



Royal College  
of Nursing

# Standards for infusion therapy

*Fourth edition*

Under review, use with caution





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# Standards for infusion therapy

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# Introduction

Welcome to the fourth edition of the RCN's *Standards for Infusion Therapy*, sections of which have been updated to reflect changes in the delivery or commissioning of care since this guidance was last published in 2010.

This edition features a dedicated section on patient safety and quality ([Section 2](#)) and one on patient experiences and infusion therapy. There is also a new section on service development ([Section 10](#)), reflecting the role of commissioning in IV therapy and the continued development of outpatient/home parenteral antimicrobial therapy (OPHAT) services.

Certain specialist areas are now considered beyond the scope of this document; for example specific infusion devices such as the 'Ommaya reservoir' and apheresis (see Section 8.9 of this publication). Where available or appropriate, the reader is signposted to local policies/guidelines and/or websites for further information.

## Document scope

This document has been developed to support the care of adult patients undergoing infusion therapies. The scope of infusion therapies includes, but is not limited to, intravenous (IV) sub-cutaneous, intra-osseous and epidural infusions. Therapies may include fluids, medications, blood and blood components and parenteral nutrition.

The document has been written to support nursing practice for infusion therapies and is relevant to nurses and health care assistants/assistant practitioners where this forms part of the sphere of practice. It will also be of relevance to other health care professionals and health care students involved in infusion therapy. For continuity, the term health care professional (HCP) is used throughout.

This publication should be read in conjunction with local and national policies for all aspects of infusion therapy.

Where possible the document provides a UK-wide approach in terms of guidance and guidelines. However, it is recognised that devolved health care systems may have specific national guidance or policies which the reader should be aware of and comply with.

## Abbreviations

The following organisations are referred to by abbreviations throughout this document:

AAGBI	Association of Anaesthetists of Great Britain and Ireland
BCSH	British Committee for Standards in Haematology
CDC	Centre for Disease Control and Prevention
DH	Department of Health
HPS	Health Protection Scotland
HSE	Health and Safety Executive
INS	Infusion Nurses Society
IPS	Infection Prevention Society
MHRA	Medicines and Healthcare products Regulatory Agency
NICE	National Institute for Health and Care Excellence
NPSA	National Patient Safety Agency
ONS	Oncology Nursing Society
RCN	Royal College of Nursing
UKPIN	UK Primary Immunodeficiency Network

## How to use this publication

Each topic covered within this document includes a standard statement and supporting guidance on how to implement this.

- The standard provides criteria for accountability and expectations regarding the delivery of elements of infusion therapy and are measurable. Standards are based on evidence from published papers and graded as in table 1 below, from regulatory requirement or based on expert consensus when evidence or regulation is not currently in place.
- Guidance set out under the standards support the implementation of the standard and can be incorporated into local infusion related policies and procedures, quality assurance and performance/ quality improvement programmes, HCP competency assessment and educational programmes.
- Both standards and guidance include references to relevant supporting evidence or literature and where relevant further reading/information.
- Where no reference exists expert consensus has agreed the standard or guidance statement.

In order that the reader may evaluate the strength of the evidence base, the supporting literature, where it exists, has been graded using criteria based on INS (2016) (see Table 1).

Where evidence has been identified to support guidance statements this has been included and referenced throughout the document. Expert consensus has been agreed for all guidance statements where references are not included.

**Table 1: Strength of evidence (adapted from INS 2016)**

Strength of evidence	Evidence description*
I	Meta-analysis, systematic literature review, guideline based on randomised controlled trials (RCTs), or at least three well-designed RCTs.
II	Two well-designed RCTs, two or more multi-centre, well-designed clinical trials without randomisation, or systematic literature review of varied prospective study designs.
III	One well-designed RCT, several well-designed clinical trials without randomisation, or several studies with quasi-experimental designs focused on the same question. Includes two or more well-designed laboratory studies.
IV	Well-designed quasi-experimental study, case-control study, cohort study, correlational study, time series study, systematic literature review of descriptive and qualitative studies, or narrative literature review, psychometric study. Includes one well-designed laboratory study.
V	Clinical article, clinical/professional book, consensus report, case report, guideline based on consensus, descriptive study, well-designed quality improvement project, theoretical basis, recommendations by accrediting bodies and professional organisations, or manufacturer directions for use for products or services. Includes standard of practice that is generally accepted but does not have a research basis (for example, patient identification). May also be noted as 'Committee consensus', although rarely used. NICE.
Regulatory	Regulatory regulations and other criteria set by agencies with the ability to impose consequences, such as the; GMC; GPhC; HCPC; HPS; NMC; PHE; organisational policies.

\*Sufficient sample size is required with preference for power analysis adding to the strength of the evidence

Note: infusion therapy practice processes and standards should be established in local organisational policies, procedures and guidelines (INS, 2016). All HCPs should be aware of and comply with these.

## Background

Many patients admitted to hospital or in receipt of health care in the other settings, including their own homes, will become recipients of one or more infusion therapies at some stage (NICE, 2013; NHS Scotland, 2002). Total parenteral nutrition (TPN), cancer chemotherapy and other infusion therapies are increasingly delivered in community settings, reflecting the changing approach to care delivery/ commissioning and patient choice. These initiatives, alongside the development of outpatient and home delivered parenteral antimicrobial therapy (OHPAT), has led to the need for greater flexibility to meet patients, clinical and lifestyle needs. Intravenous (IV) therapy forms a large component of infusion therapy practice and this is reflected in the document.

However, the diversity of care delivery and its commissioning, equipment, therapies, access devices and environments for infusion therapy, can have implications for patient care and safety. Health care professionals must ensure that each patient receives the most appropriate infusion therapy via the most appropriate device and site, in the most appropriate environment, and at the right time (Hallam et al., 2016; Loveday et al., 2014).

This updated version of the *RCN Standards for Infusion Therapy* acknowledges the increasing importance of the use of evidence in informing standards of nursing care for patients receiving infusion therapies. It also acknowledges the role of the health care professional (HCP) in contributing to the body of evidence to enable sustainable improvements in quality and safety of patient care.

It should be noted that these standards are not intended to be exhaustive, and HCPs will be required to refer to other guidance, policies and procedures (local and national) in addition to this document.

## Scope of practice and evidence-based care

Infusion therapy is now an integral part of professional practice for many HCPs. Involvement ranges from caring for an individual with a peripheral cannula (vascular access device) in situ, to caring for a patient with multiple parenteral and haemodynamic therapies in the critical care environment. Whatever the route or device used, infusion therapy is not without risk (NICE, 2013). Infusion management however, is not limited just to the care of the patient and the device. HCPs may also be responsible for procurement of the consumables associated with infusion therapy, implementation of quality improvement/safety initiatives and evidence/research activities. Consequently, the range and depth of professional involvement related to infusion therapy will depend on the extent of an individual health care professional's scope of practice.

The regulatory body for nursing and midwifery, the Nursing and Midwifery Council (NMC) code of professional conduct *The Code* (NMC, 2015a) emphasises the need to base care on the best available evidence and both the NMC(2015a) and the Health and Care Professionals Council's (HCPC) *Standards of Performance, Conduct and Ethics* (HCPC, 2016) maintain that health care professionals should maintain their skills and knowledge relevant to their scope of practice. The NMC has also recently introduced *Revalidation* (NMC, 2015b) whereby nurses must demonstrate their continued ability to practise safely and effectively on a continual basis throughout their nursing careers. Revalidation is covered in more detail in Section 1 (Education and training) and at <http://revalidation.nmc.org.uk>

## The role of support workers

The person in overall charge of the nursing care of the patient is usually the registered nurse. However, the nurse cannot perform every task for every patient and therefore s/he will need to delegate aspects of that care to colleagues. Support workers, such as health care assistants (HCAs) and assistant practitioners (APs), are members of the health care team delivering care to patients in all settings. They undertake essential care activities but are increasingly also undertaking clinical



tasks such as phlebotomy, cannulation and the management of infusion therapies.

Registered nurses have a duty of care and a legal liability with regard to the patient. If they have delegated a task they must ensure that the task has been appropriately delegated. This means that:

- the task is necessary and delegation is in the patient's best interest
- the support worker understands the task and how it is to be performed
- the support worker has the skills and abilities to perform the task competently
- the support worker accepts the responsibility to perform the task competently.

All of the above apply to the delivery of infusion therapies.

## Principles of delegation

The principles of delegation (RCN, 2015) are outlined below:

- delegation must always be in the best interest of the patient and not performed simply in an effort to save time or money
- the support worker must be suitably trained to perform the task
- the support worker should always keep full records of training given, including dates
- there should be written evidence of competence assessment, preferably against recognised standards such as National Occupational Standards
- there should be clear guidelines and protocols in place so that the support worker is not required to make a clinical judgement that they are not competent to make
- the role should be within the support worker's job description
- the team and any support staff need to be informed that the task has been delegated (for example, a receptionist in a GP surgery or ward clerk in a hospital setting)

- the person who delegates the task must ensure that an appropriate level of supervision is available and that the support worker has the opportunity for mentorship
- the level of supervision and feedback provided must be appropriate to the task being delegated; this will be based on the recorded knowledge and competence of the support worker, the needs of the patient/client, the service setting and the tasks assigned (RCN et al., 2006)
- ongoing development to ensure that competency is maintained is essential
- the whole process must be assessed for the degree of risk.

For more information on accountability and delegation, please go to: [www.rcn.org.uk/professional-development/publications/pub-004852](http://www.rcn.org.uk/professional-development/publications/pub-004852)

## Patient experience

Infusion therapies may be required as a result of emergency or planned episodes of care and will be dependent upon a patient's clinical needs. Therapies may be required in the short or longer term in both hospital and non-hospital settings and patients may be too unwell to contribute to discussions on the choice or therapy or devices used to deliver these. Where infusion therapy is considered for use in the longer term, many patients and their carers will be well enough to participate in decisions to support or deliver their care.

Patients should be able to make informed decisions in partnership with HCPs and the HCP must obtain their consent (The Supreme Court, 2015). When patients do not have the capacity to make informed decisions, health care professionals should follow the guidance/code of practice in relation to the *Mental Capacity Act 2005* and the supplementary information on the deprivation of liberty safeguards or the corresponding guidance for Scotland, Wales and Northern Ireland (NICE, 2013).

Despite the move towards increased patient involvement in decisions affecting their care, there is little published evidence to support user involvement in

the selection of vascular access devices. There is, however, increasing evidence of patients' experiences linked with vascular access and infusion therapies. This relates mainly to treatments linked to dialysis (peritoneal and haemodialysis) (Baillie and Lankshear, 2015; Combes et al., 2015; Monaro et al., 2014; Bayhakki and Hatthakit, 2012; Jansen et al., 2010) and cancer treatments (Nicholson and Davies, 2013; Ream et al., 2013). Important principles linked to patients' experiences with vascular access and infusion therapy within these studies are explored further in Section 1.2 of this document. Specific studies involving patients' experiences of infusion therapy in the community (Stephens, 2013) and patients receiving blood transfusions (Weiss and Tolich, 2011) are also explored.

When selecting vascular access devices and treatment regimens, it is important to consider the patient's lifestyle as well as their individual infusion therapy and other clinical care needs. Younger patients may have differing considerations to older patients. Some individuals will have access to supportive carers, while others may be socially isolated. Some individuals will have the mental capacity and manual dexterity to be involved in their infusion therapy, while others may not. Infusion therapy may only be one element of a patient's health care needs. All such factors therefore need to be taken into consideration when assessing each patient for infusion therapy.

### Patient assessment

Patient assessment should commence with patient needs, including the identification of any medications/therapies required. A thorough assessment of suitable route(s) to administer therapies is required.

### Infection prevention and control

The importance of using effective infection prevention and control measures are integral to all aspects of infusion therapy (Loveday et al., 2014).

### Consent

"It is a general legal and ethical principle that valid consent must be obtained before starting treatment or physical investigation, or providing personal care, for a person" (DH, 2009; DHSSPS, 2016a). All patients have a

right to receive accurate information about their condition and intended treatment. It is the responsibility of the individual health care professional proposing to carry out the treatment to ensure that the patient understands what is proposed (The Supreme Court, 2015; NMC, 2015a).

Consent can be given orally, in writing or by co-operation (NMC, 2015a). It is important that treatment and care take into account the patient's needs and preferences. Individuals who require infusion therapy should have the opportunity to make informed decisions about their care and treatment in partnership with the health professional looking after them.

When the patient does not have the capacity to make decisions, health care professionals should follow the DH guidelines on consent and the Code of Practice that accompanies the *Mental Capacity Act 2005* (DH, 2005). In Wales, health care professionals should follow the advice on consent from the Welsh Government (NICE, 2012). In Scotland, health care professionals should adhere to the requirements of the *Adults with Incapacity (Scotland) Act 2000* (UKEN, 2016). At the time of writing, a government bill linked to consent and mental capacity was in process in Northern Ireland.

With regards to consent for blood transfusion, the HCP should be directed to the Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (JPAC) website (2016) and should also refer to the Department of Health (2016b) Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) (2011). See [www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs#publications](http://www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs#publications). Local policy and procedures should also be followed.

# 1 Education and training

## 1.1 Staff education

### Standard

The HCP responsible for the management (including device insertion and ongoing management) of infusion therapy should be competent in all clinical aspects of infusion care which they carry out and have the skills and knowledge pertinent to their role. The HCP in addition should have validated clinical competence in accordance with the NMC's Code (NMC, 2015a) or other relevant health professional *Standards of conduct performance and ethics* in order to maintain their knowledge and skills (HCPC, 2016; NMC, 2015a; 2015c).

### [Regulatory]

### Guidance

Registered HCPs undertaking the insertion of vascular access devices, the care and management of these, and the administration of infusion therapy will have undergone theoretical and practical training in the following as part of a competency assessment. This will be dependent on the roles and responsibilities of the HCP with regards to infusion therapy – local policy procedures and guidelines should be followed for what specific initial and ongoing training and education each HCP requires:

1. Anatomy and physiology of the circulatory system, in particular, the anatomy of the location in which the device is placed including veins, arteries and nerves and the underlying tissue structures.
2. Assessment of patients' vascular access needs, nature and duration of therapy, risks and quality of life needs for the setting in which their therapy is delivered.
3. Improving venous access, for example the use of pharmacological and non-pharmacological methods.
4. Selection of vascular access insertion site and problems associated with venous access due to thrombosed, inflamed or fragile veins, the effects of ageing on veins, disease process, previous treatment, lymphoedema or presence of infection.
5. Selection of appropriate vascular access device and other supportive equipment (such as dressings and pumps, for example).
6. Infection prevention and control issues related to vascular access and infusion therapy.
7. Pharmacological issues (use of local anaesthetics, management of anxious patients, management of haematoma, phlebitis, pharmacology and pharmaceuticals related to reconstitution and administration and drug administration).
8. Fluid balance and blood/blood component administration.
9. Mathematical calculations related to medications and administration.
10. Use and maintenance infusion related equipment.
11. Local and systemic complications of vascular access device insertion and maintenance and infusion therapies.
12. Risk management/health and safety.
13. Care and management of vascular access devices.
14. Patients' perspective on living with a vascular access device.
15. Professional, legal and ethical aspects (consent, professional guidance, knowledge and skill maintenance, and documentation).
16. Prevention and management of complications during insertion and ongoing infusion therapy (nerve injury, haematoma, and so forth).
17. Monitoring and care of the device insertion site (flushing, dressing, removal, and so forth).
18. Product/consumables evaluation.

19. Patient/caregiver information and education.
20. Specific training for insertion of vascular access devices and associated infusion therapy in specialist areas, for example oncology patients, transfusion therapy and parenteral nutrition where appropriate.

In addition, HCPs must recognise and meet their obligations to maintain their knowledge and skills (HCPC, 2016; NMC, 2015a). For nurses this will also include NMC revalidation requirements (NMC, 2015b).

Health care organisations must support and provide staff with training and education both on Induction to the organisation and in fulfilment of their ongoing training needs and education to maintain their competency.

## 1.2 Patient/caregiver education and involvement in decision making

### Standard

The patient, caregiver or legal representative must receive instruction and education related to the vascular access device, prescribed infusion therapy, infection prevention and control and plan of care (NICE, 2012). [V]

The patient, caregiver or legally authorised representative must be informed of any potential complications, risks and any alternatives available for the treatment or therapy (NICE, 2012). [V]

The HCP should document the information given and the patient's, caregiver's, or legally authorised representative's response in the patient's records (NMC, 2015a). [Regulatory]

Education and training of patients or caregivers should be in accordance with The Code (NMC, 2015a) or other health care professional *Standards of conduct performance and ethics* (HCPC, 2016) and *Standards for medicines management* (NMC, 2015c). [Regulatory]

The health care professional responsible for educating and training patients and caregivers to administer intravenous therapy should ensure that reasonable foreseeable harm does not befall a person as a consequence of their instructions and delegation (of care) (HCPC, 2016; NMC, 2015a). [Regulatory]

### Guidance

- The patient/caregiver should be involved in decision making in infusion therapy as with any other therapy (The Supreme Court, 2015).
- The patient/caregivers should be given the option of undertaking treatment at their local hospital or at home if appropriate. This should be based on patient/clinical need and not on cost (UKPIN, 2015).
- The patient/caregiver should be assessed for ability and willingness to undertake administration of infusion therapy (UKPIN, 2015).
- The patient, caregiver and/or legal representative should be informed in clear and appropriate terminology about all aspects of the therapy, including the physical and psychological effects, side-effects, risks, benefits and alternatives (INS, 2016; NICE, 2013; NICE, 2012).
- The patient, caregiver and/or legal representative should be given a set of verbal and written instructions about all aspects of the therapy, including the physical and psychological effects, side-effects, risks, benefits and alternatives, to support any practical care tasks they may undertake. These should be tailored to his or her cognitive, psychomotor and behavioural abilities (INS, 2016; NICE, 2012).
- The patient, caregiver or legal guardian should demonstrate understanding and the ability to perform procedures and care (NICE, 2012).
- An assessment as to the appropriateness of the home setting for the preparation, administration and storage of intravenous therapy and equipment should be undertaken (Chapman, 2013). This

assessment should be in conjunction with the patient/caregiver (Combes et al., 2015). The HCP should liaise with the relevant personnel including the patient/caregiver if the home setting is unsuitable and appropriate action taken.

- Education, training and written information should be provided that includes the storage of the drug and equipment, aseptic technique and hand hygiene, preparation and administration of the drug and infusion delivery equipment, care and maintenance of the vascular access device, side-effects of therapy, prevention of spillage of hazardous waste, and management and recognition of allergic/anaphylactic reactions (NICE, 2012).
- Ongoing support and education/training should be provided to the patient/caregiver (Combes et al., 2015).
- Recognition of the benefits and constraints of home infusion therapy should be acknowledged and discussed with the patient (Stephens, 2013).

## 2 Patient safety and quality

### 2.1 Patient care

#### Standard

Infusion therapy standards are applicable to any patient care setting in which vascular access devices (VADs) are placed and/or managed and where infusion therapies are administered (INS, 2016). [V]

Infusion therapy is provided in accordance with legal, ethical and cultural principles (INS, 2016) [V]

Local organisational policies, procedures, protocols and guidelines for infusion therapy are available and provide the health care professional with an acceptable course of action including performance, accountability and clinical decision making (INS, 2016). [V]

The HCP ensures that infusion therapy is patient-specific and is tailored towards the needs of the patient, their personal circumstances, co-existing conditions and personal choices (NICE, 2013). [V]

The HCP maintains patient confidentiality, safety, and security; and respects, promotes, and preserves patient autonomy, dignity, rights, and diversity (INS, 2016; NICE, 2013). [V]

### 2.2 Documentation

#### Standard

The requirements for documentation should be set out in organisational policies, procedures and practice guidelines for all **vascular access devices (VAD)**, site, insertion, therapy and ongoing care and maintenance. [Expert Consensus V]

Documentation in patient records must contain complete information regarding any/all infusion therapies, vascular access, and adverse drug reactions

(INS, 2016; NMC, 2015a). **[V/Regulatory]**

Documentation must comply with the guidelines for records and record-keeping within the health care professional's code (HCPC, 2016; NMC 2015a).

**[Regulatory]**

### Guidelines

Documentation/record of the insertion and the VAD should include the following, dependant on the specific VAD and local policies and procedures.

1. Evidence of informed consent (HCPC, 2016; NMC, 2015a).
2. The date and time of insertion of the VAD and the HCP inserting the device.
3. The reason for insertion of the VAD (Loveday et al., 2014).
4. Details of site preparation (Loveday et al., 2014).
5. The number and location of insertion attempts; details of the insertion technique utilised – for example, use of ultrasound or micro-introducer and any problems encountered during insertion.
6. The insertion site including vein(s) used (Loveday et al., 2014).
7. Type of VAD size/gauge/length, number of lumens and manufacturer, lot/batch and number, and expiry date (Loveday et al., 2014)
8. Local anaesthetic and details of prefilled flush solutions used including amount.
9. The functionality of the VAD immediately post-insertion; for example, presence of blood return and ability to flush device easily (INS, 2016).
10. Actual length of catheter inserted.
11. Method of verifying catheter tip location - radiographic or other locally agreed method of confirmation of the location of catheter tip is required, for example ECG (Bodenham et al., 2016 Clinical Guidance; INS, 2016).
12. The patient's tolerance of the insertion procedure (Bodenham et al., 2016).
13. The appearance of the catheter site after insertion; for example, any bruising or bleeding, type of dressing and securement device utilised (Bodenham et al., 2016).
14. Length of exposed central line should be recorded.

Documentation of ongoing care and maintenance should include the following dependant on the specific VAD and local policies and procedures:

1. Details of catheter care, including specific safety or infection prevention and control precautions taken (Loveday et al., 2014).
2. Site and device care and condition/appearance using local assessment scales for phlebitis and/or infiltration/extravasation and so forth (see Section 9 for guidelines on complications of vascular access devices and infusion therapy).
3. Flush solution(s) used – in other words, type, volume, frequency, any difficulties encountered.
4. Any changes to any of the infusion equipment (Bodenham et al., 2016).
5. Dressing changes
6. Changes of any add on devices eg, needle-free connectors
7. Methods to evaluate proper functioning of the VAD prior to use (Bodenham et al., 2016).
8. Continued documentation of the external/exposed length of the central venous line in order to observe for migration.
9. Patient or caregiver participation in, and understanding of, therapy and procedures including education and any written information given to the patient/caregiver about ongoing care and maintenance (see [Section 10](#) for further information on community and OPHAT infusion therapy).
10. Information relating to the VAD for patient and health care professionals involved in the care and management of the VAD – for example, IV passport, community and OPHAT contact numbers in case of problems/queries for community and OPHAT patients (see [Section 10](#) for further

information on community and OPHAT infusion therapy).

#### 11. Any catheter replacements (Loveday et al., 2014).

Documentation of infusion therapy should include the following:

1. clear, accurate and detailed record of intravenous medicines administered, as soon as possible after the event (NMC 2015c)
2. type of therapy administered: drug, dose, rate, route, time and method of administration (INS, 2016)
3. assessment and monitoring of patient's vital signs (INS, 2016)
4. patient's tolerance/response to therapy, symptoms and/or appropriate laboratory tests taken and results documented (INS, 2016)
5. record any adverse drug reactions/adverse reactions to blood and blood components in the patient record (NMC, 2015c) and report as per local and national requirements (MHRA, 2016b)
6. any adverse events, complications of therapy or VAD use should be documented in patient records and reported as per local and national requirements (MHRA, 2016b)
7. record the results of any monitoring; for example, insertion site assessment in the patient record, prescription chart or monitoring chart according to local policy.

Documentation of complications of VAD use should include the following (see also Section 9):

1. document any complications and side-effects of infusion therapy alongside the date, time and situation when the complication was noted. Include any strategies used to manage complications and evaluation of effectiveness.

Documentation of removal of VAD/end of therapy should include the following:

1. date and time of removal, procedures used to remove VAD, the catheter length and integrity of the VAD on removal, appearance of the site, skin

cleansing used at site prior to removal, and type of dressing applied after removal (INS, 2016)

2. reason for removal of the VAD and any samples sent for microbiology (central venous catheter tip) (INS, 2016)
3. any complications during removal of VAD and if any advice from vascular surgery or intervention radiology required (Bodenham et al., 2016)
4. discontinuation of therapy.

## 2.3 Expiry dates

### Standard

Medications and blood/blood components must be administered, and products and equipment must be used before their expiry dates (INS, 2016). [V]

### Guidance

- Manufacturers' guidelines for proper storage of medication should be followed to ensure the validity of the expiry date (NMC, 2015c).
- Expiry dates should be verified prior to initiation or administration of therapy (NMC, 2015c).
- Expiry dates should be verified by the health care professional by checking supplementary information received from the manufacturer, or by checking labels attached to the medication, product or equipment.
- The maximum expiry date for any injection/infusion prepared in a clinical area is 24 hours or less in accordance with the manufacturer's specification of product characteristics (NPSA, 2007d).

## 2.4 Labelling

### Standard

Clear, accurate labelling should be used for product and drug identification (EU, 2003). [Regulatory]

## Guidance

European Directive 92/27/EEC (EU, 2003) specifies the requirements for the labelling of medicines (see [www.ema.europa.eu/docs/en\\_GB/document\\_library/Scientific\\_guideline/2009/09/WC500003412.pdf](http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003412.pdf)).

- Labelling for drugs should include the brand name and the generic name, with prominence given to the generic name. Other information that should be included when labelling medicines includes the name of the drug, its strength (amount per unit volume) and total amount in volume, route of administration, dosage and warnings (EU, 2003).
- Use injections that are prepared or used in closed, not open, systems. Injections must be drawn up from the source bottle or ampoule directly into syringes that are labelled and checked prior to administration (NHS England, 2015a; NPSA, 2007d).
- Consider providing pre-printed prescriptions or stickers that makes the prescribing, preparing and administering of high-risk products clearer (NPSA, 2007d).
- It is preferable that only licensed ready-to-administer or ready-to-use injectable medicines are procured and supplied (NPSA, 2007d).
- Infusion bags, syringes and administration sets for epidural therapy should be clearly labelled with “For Epidural Use Only” in a large font. Storage should be in separate areas. Epidural administration sets and catheters distinct from those used for intravenous and other routes should be used (NPSA, 2007c).
- Organisational policies and procedures should reflect guidance to minimise risks associated with ‘wrong route errors’ (NHS England 2015b).

## 2.5 Product requirements

### Standard

All medical devices used in the UK must have a CE marking. The CE mark certifies that a product has met the requirements of the Medical Devices Directive

93/42/EEC as amended by 2007/47/EC. CE stands for ‘Conformité Européene’, which means European Conformity (MHRA, 2012a). **[Regulatory]**

All infusion medicines including blood and blood components must conform to ‘medicinal products’ as determined by the MHRA (MHRA, 2016a). **[Regulatory]**

### Guidance

- Any product including medicine, blood and blood components not meeting the CE marking requirements and MHRA requirements for medicinal products should be withdrawn from use and reported to the MHRA (MHRA, 2016a; MRHA 2016b).

## 2.6 Product defect reporting

### Standard

All product defects must be reported in writing to the appropriate department within the HCP’s organisation and national regulatory agencies such as the MHRA (MHRA, 2016b). The supplier may also be informed depending on local policies and procedures.

**[Regulatory]**

### Guidance

- All organisations should have a policy for reporting product complaints.
- Product complaints/incident reports should include any suspected damage, incorrect labelling, packaging damage or tampering.
- Any contaminated product must be dealt with according to the organisation’s policy.
- Product reports should include details of the complaint, the effect of the defect on the procedure, if any, and the lot number of the product.
- Product complaints should be reported to the MHRA (MHRA, 2016b).
- All adverse incidents must be reported as soon as possible and where appropriate to the MHRA via



the most appropriate method and should contain as much relevant detail as available (MHRA, 2016b). See the MHRA website (<https://yellowcard.mhra.gov.uk>) for details of the criteria for reporting adverse incidents as well as local policy and procedures.

## 2.7 Patient safety incidents

### Standard

All patient safety incidents that have the potential to, or actually result in, harm should be reported to ensure that any necessary action can be taken to prevent similar incidents from occurring in the future and in order for learning to take place and be shared (NHS England, 2016). **[Regulatory]**

All organisations should have in place a local incident reporting system which should be in line with the National Reporting and Learning System (NRLS) in England (NHS England, 2016); Health Facilities Scotland (HFS, 2016) and the Northern Ireland Adverse Incident Centre (DHSSPS, 2016b). **[Regulatory]**

### Guidance

- Patient safety incident reporting must be managed and reported in accordance with local and national organisational policies and procedures (NHS England, 2016).
- Patient safety incidents should be reported locally using a centralised risk management system and nationally via the National Reporting and Learning System (NHS England, 2016).
- All reported incidents must be graded, investigated and analysed in accordance with local and national organisational policies and procedures.
- Any adverse incident involving a medical device must be reported to the MHRA using the adverse incident reporting system/yellow card scheme (MHRA, 2016b).
- Improvement strategies that aim to reduce risk to future patients should be implemented and monitored by the health care provider (NHS England, 2016).

- Adverse drug reactions and defects with medicine products should be reported directly to the MHRA (MHRA, 2016b).
- Adverse blood/blood component reactions should be reported to the hospital transfusion team. Serious adverse blood reactions and events (SABRE) and near-miss events should be reported to the appropriate haemovigilance and regulatory organisations (Serious Hazards of Transfusion [SHOT], see [www.shotuk.org](http://www.shotuk.org) and the MHRA, <https://aic.mhra.gov.uk/mda/sabresystem.nsf/Login?Open>

Health care professionals are signposted to the following resources and websites:

*Never Events Policy and Framework* (NHS England, 2015b), available at [www.england.nhs.uk/patientsafety/wp-content/uploads/sites/32/2015/04/never-evnts-pol-framwrk-apr2.pdf](http://www.england.nhs.uk/patientsafety/wp-content/uploads/sites/32/2015/04/never-evnts-pol-framwrk-apr2.pdf)

Serious untoward incidents should be reported to the appropriate Commissioners and Stakeholders (NHS, England, 2015c). See the NHS England Serious Incident Framework, available at <https://www.england.nhs.uk/patientsafety/serious-incident/>

Resources outlining how to report incidents to SHOT and the MHRA are provided at [www.shotuk.org/reporting/sabre](http://www.shotuk.org/reporting/sabre)

## 2.8 Research, audit and assurance

### Standard

Health care professionals have a responsibility to deliver safe and effective care based on current evidence, best practice, and where applicable, validated research (HCPC, 2016; NMC, 2015a). **[Regulatory]**

Research and assurance processes such as audit should be used to expand the base of health care professional knowledge, to validate and improve practice, to advance professional accountability, and to enhance evidence-based decision-making (INS, 2016). **[V]**

Health care professionals should ensure that patients are treated and cared for in a safe environment that protects them from avoidable harm (NHS England, 2016) (DH, 2015). **[Regulatory]**

### Guidance

- Any research, audit and assurance linked to infusion therapy should be in line with national guidelines, available research and professional standards of practice (Loveday et al., 2014).
  - Audit should be an ongoing process in order to monitor, maintain and improve clinical practice in infusion therapy (Bodenham et al., 2016; NICE 2013). Identified deficiencies should be documented and evaluated, and form the basis of an action plan for improvement (Loveday et al., 2014). Examples of audit tools include:
    - NICE *Clinical guideline CG174 on Intravenous fluid therapy in adults in hospital* (2013) with up to date audit tools is available at [www.nice.org.uk/guidance/cg174/resources](http://www.nice.org.uk/guidance/cg174/resources)
    - *One Million Global (OMG) Peripheral Intravenous Catheter Study*, available at: [www.avatargroup.org.au/omg-pivc.html](http://www.avatargroup.org.au/omg-pivc.html)
    - *Saving Lives: reducing infection, delivering clean and safe care* (DH, 2007) high impact interventions, available at [http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_078134](http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_078134)
    - *1000 Lives: reducing health care associated infections, appropriate and timely use of invasive devices*, available at [www.1000livesplus.wales.nhs.uk/sitesplus/documents/1011/How%20to%20%2821%29%20Invasive%20Devices%20%28March\\_12%29%20Web.pdf](http://www.1000livesplus.wales.nhs.uk/sitesplus/documents/1011/How%20to%20%2821%29%20Invasive%20Devices%20%28March_12%29%20Web.pdf)
  - Local audit should include specific data, including patient details, diagnosis, date of insertion of device and site, number of previous devices and sites, health care professional who inserted the device and department where the device was inserted. Any complications associated with the device, date of and reason for removal should also be included.
- Infective episodes and other adverse events should also be included and the data used to develop improvement measures.
- Each area should monitor their infection rates per 1,000 catheter days to observe any changes or trends in infection rates.
  - Information obtained as a result of audits should be disseminated promptly and evaluated by practitioners in order to develop a culture of learning and quality improvement (Flottorp et al., 2010).
  - Research should be conducted in accordance with the UK-wide NHS Research Authority (see [www.hra.nhs.uk/resources/research-legislation-and-governance/research-governance-frameworks/](http://www.hra.nhs.uk/resources/research-legislation-and-governance/research-governance-frameworks/)) and must be approved by a Research Ethics Committee (REC).

# 3 Infection prevention and control

## 3.1 General infection prevention and control principles and practices

### Standard

All infusion-related procedures (site preparation, insertion of peripheral or central venous access devices, management of infusion related equipment such as administration sets, add on devices and dressings as well as ongoing maintenance and care) require the use of an aseptic technique, observation of standard precautions and use of sterile products (Loveday et al., 2014). [V]

Maximal sterile barrier precautions must be used when performing specific infusion procedures such as insertion of central venous access devices, as per local policies and procedures (Loveday et al., 2014). [V]

All disposable blood-contaminated and/or sharp items, must be disposed of in sharps containers. The management of sharps should conform with *The Health and Safety (Sharp Instruments in Healthcare) Regulations 2013* (HSE, 2013a; RCN, 2012a) and *Health Technical Memorandum 07-01: Safe Management of Healthcare Waste* (DH, 2013a). This incorporates information from the European Council Directive 2010/32/EU (the Sharps Directive) (European Agency for Health and Safety at Work, 2010). [Regulatory]

Non-disposable equipment such as surgical instruments requiring decontamination should be handled according to manufacturers' guidelines for sterilisation. However, disposable equipment should be used wherever possible. [Expert consensus]

All products requiring disposal must be managed in

line with the DH guidance *Health Technical Memorandum 07-01: Safe management of healthcare waste* (DH, 2013a; RCN, 2014) and local policy.

[Regulatory/V]

A quality assurance and performance improvement programme, incorporating infection prevention and control practices, should be implemented to minimise potential for development of health care associated infection and to enable corrective action, when necessary (Loveday et al., 2014). [V]

Morbidity and mortality rates associated with vascular access device related infections should be monitored, reviewed, evaluated and reported on a regular basis (Loveday et al., 2014). [V]

### Guidance – general

- The elements of, and protocol for, aseptic technique should be established in organisational policies and procedures (NICE, 2012; RCN, 2012a).
- A protocol for ascertaining any infusion therapy related device/product integrity and sterility should be established in organisational policies and procedures.
- Practitioners performing procedures that result in the generation of aerosols, droplets or splashing of blood and/or body fluids should ensure that they are undertaking the appropriate transmission based precautions and using appropriate personal protective equipment including well-fitting gloves, appropriate mask, gown, protective eyewear and drapes in line with local policy (INS, 2016; HPS, 2015; Loveday et al., 2014). Please refer to transmission based precautions (TBPs) in HPS (2015), available at: [www.nipcm.hps.scot.nhs.uk/chapter-2-transmission-based-precautions-tbps](http://www.nipcm.hps.scot.nhs.uk/chapter-2-transmission-based-precautions-tbps)
- Regulation sharps containers should be placed at multiple convenient and safe locations. They should be easily accessible, assembled correctly, labelled with the name of the patient/ward/area and date of assembly and temporary closure mechanisms in place. When filled to the fill line, they should be sealed shut and the date of closure included on the label. They should then be disposed of in line with the DH guideline *Health Technical Memorandum*

07-01: *Safe Management of Healthcare Waste* (DH, 2013a) and local policy. See also *The Management of Waste from Health, Social and Personal Care* (RCN, 2014).

- Where it is **not reasonably practicable** to avoid the use of a medical sharp, 'safer sharps' incorporating protection mechanisms should be used (Sharps Regulations: Regulation 5(1)(b)). Risk assessments should be undertaken in situations where the above is not practicable; (HSE, 2013a; RCN, 2013a). The use of these devices should be considered in line with local policies.
- Performance improvement measures, including site rotation and administration set changes, should be implemented in accordance with the standards incorporated in this document.
- A robust system for learning from incidents, including infection, should be in place – see [Section 2.7](#) of this document.
- Organisations should have surveillance systems in place to monitor infections associated with VAD – for example, catheter related blood stream infections (CRBSIs). The standard calculation for CRBSI is: number of IV device related infections divided by total number of catheter days x 1,000 = number of IV device-related infections per 1,000 catheter days.

### 3.2 Hand hygiene

#### Standard

Gloves should not be used as an alternative to hand hygiene. [Expert consensus]

There are numerous indications relating to when to perform hand hygiene, including before and after patient contact and whenever contact with a vulnerable site is anticipated (Loveday et al., 2014; HPS, 2015; RCN, 2012a). [V]

#### Guidance

- The use of gloves is not a substitute for hand hygiene. Hand hygiene should be performed before

and immediately after procedures, and before putting on and after removing gloves (Loveday et al., 2014).

- Hand-hygiene should be a routine practice that is established in organisational policies and procedures (Loveday et al., 2014; RCN, 2012a; HPS, 2015).
- Hand hygiene should be performed in line with local policies and procedures.
- Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material should be washed with liquid soap and water (HPS, 2015; Loveday et al., 2014; NICE, 2012).
- All wrist and hand jewellery should be removed at the beginning of each clinical shift to facilitate hand hygiene. A plain metal band can be worn and should be in line with local organisational policy and procedures (RCN, 2012a). Cuts and abrasions should be covered with a waterproof dressing. Fingernails should be kept short and clean; the wearing of nail varnish, false nails and nail art are inappropriate as they are a potential reservoir for micro-organisms (HPS, 2015; Loveday et al., 2014, RCN, 2012a).
- Clinical staff should not wear any clothing below the elbow as per local policies and procedures.
- Hand hygiene should be performed after removal of PPE (HPS, 2015; Loveday et al., 2014). See [Appendix 3](#) for hand washing with soap and water and alcohol based rub application (HPS, 2015).
- Care should be taken to prevent contamination of liquid soap or antiseptic dispensers. These containers should be discarded and replaced according to organisational policies and procedures in hospital and organisational settings (NICE, 2012).
- Liquid soap should be used (in other words, not bar soap for community based staff).
- Paper hand towels should be used to dry the hands (Loveday et al., 2014).
- Alcohol hand rub should be used when hands are clean or when running water is compromised or

unavailable. The alcohol hand rub should be rubbed over all areas of the hands and wrists vigorously until the solution has evaporated and the hands are dry (Loveday et al., 2014). This should include using similar step by step approach to cover the hands as with hand washing (HPS, 2015).

### 3.3 Personal protective equipment (PPE)

#### 3.3.1 Gloves

##### Standard

Gloves should be used with discretion when performing infusion-related procedures. The use of non-sterile or sterile gloves will depend on the procedure being undertaken, contact with susceptible sites or clinical devices, the risks involved and the local organisational policies and procedures in place (Loveday et al., 2014).  
[V]

##### Guidance

- The use of gloves should follow a risk assessment that identifies exposure to blood/bodily fluids as a risk to the HCP. Where this risk is not identified hand hygiene before and after contact with the device/patient is required
- The use of gloves is not a substitute for hand hygiene. Hand hygiene should be performed before and immediately after procedures, and before putting on and after removing gloves (Loveday et al., 2014).
- Gloves use should be timely and applied immediately before and removed immediately after procedures (HPS, 2015).
- Gloves should be worn to protect hands from contamination from blood, body fluids, secretions and excretions and to reduce the risk of cross-contamination to both patient and staff (HPS, 2015; Loveday et al., 2014).
- Gloves must conform to European Community standards (CE) and must be of a suitable quality (Loveday et al., 2014).
- There is no requirement to avoid latex gloves, however for practitioners and patients who are sensitive to specific latex free gloves, alternative latex free gloves must be made available and their use should be supported in the local policies and procedures (Loveday et al., 2014; RCN, 2012b). In areas where natural rubber latex gloves are in general use alternatives must be made available and risk assessments undertaken. Any sensitivity to natural rubber latex in staff and patients must be documented (Loveday et al., 2014).
- Powdered and polythene gloves should **not be used** for infusion procedures (HPS, 2015; Loveday et al., 2014).
- Gloves must be available in all clinical areas and community settings where required (HPS, 2015; Loveday et al., 2014).
- Gloves should be well fitting; gloves which are too small may be punctured by the wearer's fingernails, while gloves which are too large may impede manual dexterity (HPE, 2015; Loveday et al., 2014).
- Following removal, gloves must be discarded in an appropriate health care waste stream according to infection risk and local policies and procedures (RCN, 2014).
- The choice of sterile or non-sterile gloves should be made based on an assessment of the technical difficulty/risks of the procedure and not the diagnosis of the patient.
- Gloves are not required for the preparation of antibiotic infusions to prevent exposure to the drug. Concerns regarding sensitivity to antibiotics should be discussed with local occupational health advisers.

#### 3.3.2 Plastic aprons and gowns

##### Standard

Disposable plastic aprons should be worn whilst carrying out all infusion procedures due to the risk of contact with blood/body fluids or contamination of uniform (Loveday et al., 2014) (unless the nature of the procedure warrants the use of a disposable sterile gown

– see below for when disposable sterile gowns should be used instead of a disposable plastic apron. [V]

Plastic aprons are single use items and must be disposed of after use and before the next task is initiated (HPS, 2015; Loveday et al., 2014).

[Regulatory/V]

The wearing of a disposable sterile gown should be part of the maximal sterile barrier precautions during central venous access device insertion (Loveday et al., 2014). [V]

### Guidance

- Where there is a risk of contamination by pathogenic micro-organisms, blood or bodily fluids, a disposable plastic apron should be worn to prevent contamination and protect uniform or clothing (Loveday et al., 2014).
- The disposable apron should be worn for a single procedure and then discarded and disposed of in the appropriate health care waste stream according to infection risk and local policies and procedures (HPS, 2015; Loveday et al., 2014; RCN, 2014).
- The apron should be changed between patients and/or following completion of a procedure or task (HPS, 2015; Loveday et al., 2014).
- Full body fluid repellent gowns should be worn if there is risk of extensive splashing of blood and bodily fluids for any procedure/care episode and should be changed between patients and/or following completion of a procedure or task (HPS, 2015; Loveday et al., 2014).
- Full body fluid repellent gowns should be worn if required during transmission based precautions for specific infections/viruses and advised by local and or national infection prevention and control policies and should be changed between patients and/or following completion of a procedure or task (INS, 2016; HPS, 2015).
- Sterile gowns should be worn during the insertion of central vascular access devices due to the significantly higher risk of infection than for short peripheral cannulae and wearing a sterile gown will reduce this risk (Loveday et al., 2014).

### 3.3.3 Face masks, caps and eye protection

#### Standard

The wearing of a face mask, cap and eye protection is essential during the performance of certain infusion procedures; for example, insertion of central venous access devices. Local policy and guidance should be present as to when maximal sterile barrier precautions should be used for infusion procedures (INS, 2016; Loveday et al., 2014). [V]

The appropriate protective clothing should be worn when the practitioner is at risk from splashes of substances or body fluids and/or aerosols for ALL infusion procedures (HPS, 2015; Loveday et al., 2014).

[Regulatory/V]

#### Guidance

- The wearing of face mask (surgical mask), cap and eye protection should be part of the maximal sterile barrier precautions during central venous access device insertion (Loveday et al., 2014).
- To prevent possible infection of staff, face masks (surgical mask), caps and eye protection should be worn when there is a risk that the procedure could cause hazardous substances or body fluids to splash into the face, eyes or mouth (HSE, 2013b; Loveday et al., 2014).
- When delivering infusion therapy to a patient with a respiratory infection with airborne transmission a correctly fitted particulate filter mask (FFP3) must be worn (Loveday et al., 2014) alongside appropriate eye protection (HPS, 2015).

### 3.4 Reconstitution

#### Standard

Where possible, all drugs should be available in a ready-to-use form that is either pre-prepared by pharmacy or purchased pre-prepared from a pharmaceutical company (NPSA, 2007d). [V]

Chemical, physical, and therapeutic properties and compatibilities must be ascertained prior to

reconstituting medications using an aseptic technique (Injectable Medicine Guide, 2013; NPSA, 2007d). [V]

A laminar flow hood or isolator must be used for reconstitution of medicines which are hazardous to health, for example cytotoxic drugs, in accordance with national guidance (HSE, 2013b; HSE, 2015).

### [Regulatory]

### Guidance

- A protocol for reconstitution should be established by and conducted under the direction of the pharmacy.
- Local policies and guidelines should be followed (Injectable Medicine Guide, 2013).
- The list of medications that the HCP **may not** reconstitute should be set out in organisational policies.
- Where possible, injections/infusions that are in a ready-to-use form should be used. If not available, a pharmacy unit should make up the injection/infusion. All cytotoxic and TPN preparations and additions to total parenteral nutrition (TPN) should be prepared in the pharmacy department. A risk assessment should be completed to determine the most appropriate location for preparation and any action required to minimise the hazards (NPSA, 2007d).
- The HCP should have a thorough knowledge of the principles of reconstituting, including, but not limited to, aseptic technique, compatibility (physical, chemical and therapeutic), stability, storage, labelling, interactions, dosage and calculations and appropriate equipment (NMC, 2015c).
- Reconstituting procedures and safeguards should be congruent with standards set by the HSE (2015), NMC (2015c), NPSA (2007d) and HSE (2013b).
- Infusions should be given an expiry time of 24 hours (or less if pharmaceutically required) if prepared in a clinical area (NPSA, 2007d).
- Aseptic technique should be used throughout reconstitution (NPSA, 2007d). This includes adequate cleaning of additive ports of infusion bags

and the tops of medicine vials and ampoules). Cleaning should be undertaken using 2% chlorhexidine gluconate in 70% alcohol or locally determined alternative if chlorhexidine allergy (Loveday et al., 2014).

- Where used, the health care professional should be trained and know the general operating procedures for the use of a laminar flow hood/isolator (HSE, 2015).
- Blunt fill and blunt filter needles should be used for medication preparation from vials and glass ampoules.

## 3.5 Compatibility

### Standard

Chemical, physical and therapeutic compatibilities must be ascertained prior to the reconstitution and administration of prescribed infusion medications.

[Expert consensus/V]

Compatibility between medications and delivery systems must also be ascertained prior to the administration of prescribed infusion medications.

[Expert consensus/V]

### Guidance

- Manufacturers' guidelines should be followed for reconstituting and administration of a specific medication (Injectable Medicine Guide, 2013).
- A registered pharmacist should be consulted on issues of compatibility (Injectable Medicine Guide, 2013).
- Adequate flushing should be performed between the administration of each drug to prevent incompatibilities from occurring (Injectable medicine Guide, 2013).
- An IV injection should NEVER be administered via a running infusion that also contains a medicine additive. Any infusion containing a medicine should be stopped temporarily with the line being flushed both before and after the injection is given (Injectable Medicine Guide, 2013).

- Infusions containing a medicine must be infused separately wherever possible. If it is absolutely necessary to administer two infusions via the same vascular access device, mixing should occur as close to the vascular access device as possible (Injectable Medicine Guide, 2013). See also Section 4 of this document and the MHRA publication *Administration Sets and Backtracking* (MHRA, 2010).
- All medicine mixtures should be checked for signs of incompatibility; for example, cloudiness, change in colour, haze or formation of precipitate (Injectable Medicine Guide, 2013).
- The cannula insertion site should be regularly checked for signs of local inflammation. Chemical phlebitis may be attributable to a medicine incompatibility (Injectable Medicine Guide, 2013). See Section 9 of this document for information and guidance relating to complications.

If there are any uncertainties regarding compatibility, refer to the Injectable Medicine Guide website at <http://medusa.wales.nhs.uk/?ID=d35b35c8fe4ec8a03486cced2a2680fe700> for further information and consult with your local pharmacist: <http://medusa.wales.nhs.uk>

### 3.6 Safe use and disposal of sharps and hazardous material

#### Standard

Organisations should assess the risk of sharps injuries and, where risks exist, avoid unnecessary use of medical sharps if practicable. Where medical sharps need to be used, organisations should use safe sharps (incorporating protection mechanisms) where reasonably practicable (HSE, 2013a; RCN, 2013a).

#### [Regulatory/V]

All used disposable sharp items, including but not limited to needles or stylets and surgical blades, should be disposed of in a non-permeable, puncture-resistant, tamper-proof container that complies with UN 3921 and BS7320 standards and is located in a safe environment in the ward or department or a near-

patient location or a patient's home (Loveday et al., 2014). [V]

Sharps must not be re-sheathed, broken or bent (Loveday et al., 2014; HSE, 2013a; NICE, 2012). [V/Regulatory]

Needles and syringes must not be taken apart by hand prior to disposal (HSE, 2013a). [Regulatory]

All hazardous materials (cytotoxic drugs for example) and wastes should be discarded in the appropriate manner and appropriate container, according to national guidelines and organisational policies and procedures (HSE, 2013b; DH, 2013a; RCN, 2012a). [Regulatory/V]

#### Guidance

- Protocols for training and safe handling of hazardous materials and hazardous waste as well as prevention and reporting of sharps and inoculation injuries should be set out in organisational policies and procedures (Loveday et al., 2014; PHE, 2014; DH, 2013a; HSE, 2013a; RCN, 2012a).
- The manufacturer's guidelines, standards of practice, and national regulations should be adhered to when developing organisational policies and procedures pertaining to the safe handling of hazardous materials, hazardous and paper waste (DH, 2013a).
- Because of the potentially serious consequences of exposure to blood borne pathogens and the potential for permanent and disabling injury, ideally all needles should have a safety device with engineered sharps injury protection (HSE, 2013a).
- Needle-free equipment is available for certain procedures and should be used, where it is reasonably practicable to do so (HSE, 2013a).
- Wherever practicable use of sharps such as sutures for fixation of lines should be replaced with sutureless devices to reduce risks of sharps injury. (HSE, 2013a).
- Exposure to potentially infectious materials or injury from sharps should be identified, reported, tracked and analysed for trends and corrective action should be taken (HSE, 2013a).



- All sharps must be accounted for before, during and immediately upon completion of a procedure (AfPP, 2012).
- Cleaning, disinfection or sterilisation should not cause damage that could alter the integrity or performance of the equipment (DH, 2016a; DH, 2013b). Cleaning should be in accordance with manufacturer's guidance (MHRA, 2015b).

### 3.7 Cleaning and disinfection of reusable equipment

#### Standard

All medical equipment used for insertion, dressings and administration of solutions used during invasive procedures must be sterile. [Expert consensus/V]

Supplementary equipment such as drip stands, mechanical and electronic infusion devices and so forth must be cleaned routinely prior to and following patient use (INS, 2016). Evidence should be available to support that the cleaning of equipment is taking place, for example cleaning checklists, audit and labelling of items. [Expert consensus/V]

Cleaning/disinfection/sterilisation processes should be in line with local policy and in accordance with manufacturers' guidelines (RCN, 2012). [Expert consensus]

Single-use devices are meant for single use only and must not be re-used (MHRA, 2013a). [Regulatory]

#### Guidance

- Protocols for the cleaning, disinfection and sterilisation of all medical equipment should be set out in organisational policies and procedures (MHRA, 2015b; DH, 2016a).
- To prevent cross-infection, cleaning of reusable medical equipment should be performed prior to patient use, between different patient use, and after patient use, and at established intervals during long-term single-patient use. Cleaning documentation such as checklists and labels should be used to support this.
- Cleaning of medical equipment should include drip stands, electronic infusion devices, splints and other non-disposable infusion-related equipment used in providing patient care (DH, 2016a; DH, 2013b).

## 4 Infusion equipment

### 4.1 Administration sets

Also known as ‘giving sets’, these include primary and secondary infusion sets.

#### Standard

Administration sets used for a continuous infusion must be changed every 96 hours unless indicated otherwise by the manufacturer, they become disconnected, or the integrity of the product or system has been compromised (Ullman et al., 2013). [I]

Administration sets in continuous use for blood and blood components should be changed at least every 12 hours, or when the transfusion is complete (Loveday et al., 2014). Platelet components should be transfused through new giving sets and not through giving sets that have previously been used to administer other blood components (BCSH, 2009). [V]

Administration sets in continuous use for parenteral nutrition and containing lipids and non-lipids should be changed every 24 hours. [Expert consensus/V]

Administration sets must be changed using aseptic technique, observing standard precautions and following manufacturers’ recommendations (Loveday et al., 2014). [V]

Only recommended or designated administration sets should be used in electronic infusion devices (MHRA, 2013b). [Regulatory]

Date and time labels must be applied to ensure administration sets are changed at the correct interval (Injectable Medicines Guide, 2013). [V]

#### Guidance

- Protocols for primary and secondary continuous administration set changes must be set out in organisational policies and procedures.

- Product integrity must be determined prior to use of the administration set (MHRA, 2013b).
- The primary administration set change should coincide with the intravascular access device change and/or initiation of a new container of solution (Loveday et al., 2014).
- The type of solution administered via a primary or secondary continuous administration set (for example, lipids, blood and blood components) should dictate whether the administration set is changed more frequently (Loveday et al., 2014).
- The secondary administration set change should coincide with change of the primary administration set and/or initiation of a new container of solution (Loveday et al., 2014).
- Once a secondary administration set is detached from the primary administration set it should be discarded (Loveday et al., 2014).
- Changing of add-on devices such as, but not limited to, extension sets, filters, stopcocks, and needle-less devices where possible should coincide with the changing of the administration set (INS, 2016).
- Care must be taken to avoid backtracking when more than one IV set is connected through multiple ports. Backtracking is where fluid flows away from the intended delivery point and can result in interruption of treatment and/or accidental bolus. The latter can lead to overdose, speed shock and ultimately may result in death. If appropriate, consider alternatives (MHRA, 2010).

#### 4.1.1 Primary intermittent solution sets

##### Standard

Primary intermittent administration sets should be changed every 24 hours if remaining connected to a device or discarded after each use if disconnected. [Expert consensus/V]

The set should be disconnected immediately upon suspected contamination and discarded when the integrity of the product or system has been compromised. [Expert consensus/V]

Primary intermittent administration sets must be

changed using aseptic technique and observing standard precautions (Loveday et al., 2014). [V]

Date and time labels must be applied to ensure administration sets are changed at the correct interval (*Injectable Medicines Guide*, 2013). [V]

### Guidance

- Protocols for primary intermittent administration set changes should be set out in organisational policies and procedures.
- Product integrity should be ascertained prior to use of the administration set (MHRA, 2013b).
- The change of add-on devices, such as but not limited to, extension sets, filters, stopcocks and needleless devices wherever possible should coincide with the changing of the administration set.

## 4.1.2 Administration sets – parenteral nutrition

### Standard

Administration sets used for parenteral nutrition (PN) should be changed every 24 hours (unless the solution contain lipids, or immediately upon suspected contamination, or when the integrity of the product or system has been compromised) (Loveday et al., 2014). [V]

PN administration sets should be changed using aseptic technique and observing standard precautions (Loveday et al., 2014). [V]

### Guidance

- Protocols for PN administration set changes should be set out in organisational policies and procedures.
- Product integrity should be ascertained prior to use of the administration set (MHRA, 2013b).
- Change of add-on devices, such as but not limited to extension sets, filters, stopcocks and needleless devices wherever possible should coincide with the changing of the administration set.

For guidance on filters, please refer to [Section 4.7](#) of this document.

## 4.1.3 Administration sets for blood and blood components

### Standard

A sterile blood administration set should be used with a 170–200µm integral mesh filter (JPAC, 2016). It must be changed when a transfusion episode is complete or every 12 hours (whichever is sooner) or according to manufacturers' recommendations (Loveday et al., 2014; Norfolk, 2013; BCSH, 2009). [V]

Platelet components should not be transfused through giving sets which have already been used to administer other blood components (BCSH, 2009). [V]

A new administration set should be used if another fluid has been or is to be infused prior/following the blood components (Norfolk, 2013). [V]

Administration sets used for blood components must be changed immediately upon suspected contamination or when the integrity of the product or system has been compromised (INS, 2016). [V]

Administration sets used for blood components must be changed using aseptic technique and observing standard precautions, in line with manufacturers' instructions (Loveday et al., 2014). [V]

Blood sets are not interchangeable with solution sets. Specific blood sets should be used as recommended by the manufacturer (MHRA, 2013b). [Regulatory]

### Guidance

- Protocols for blood and blood component administration set changes should be set out in organisational policies and procedures.
- Product integrity should be ascertained prior to use of the administration set (MHRA, 2013a).
- In-line blood and blood component filters appropriate to the therapy and device should be used (MHRA, 2013b).
- Blood sets and solution sets are not interchangeable. Specific blood administration sets with a 170–200 µm integral mesh filter should be used (Norfolk, 2013).

## 4.2 Flow control devices

### 4.2.1 Manual flow control devices

#### Standard

The rate of infusions can be regulated by manual flow control devices to ensure timely delivery of the prescribed therapy for example in theatre and resuscitation situations. **[Expert consensus/V]**

The HCP responsible for the care and management of the patient is accountable for the use of manual flow control infusion devices, if deemed competent in the use of manual flow infusion devices and supported by local and other policy, guidance or protocol. **[Expert consensus/V]**

#### Guidance

- Protocols for the use of manual flow control devices should be set out in organisational policies and procedures.
- When selecting an infusion device, consideration should be given to the patient's age and condition, prescribed therapy and the care setting in which the therapy is delivered (MHRA, 2013b).
- Use of manual flow control devices should adhere to manufacturers' guidelines; these devices include, but are not limited to slide, roller clamps and drop controllers (MHRA, 2013b).
- A manual flow control device should achieve accurate delivery of the prescribed therapy with minimal deviation from manufacturers' guidelines. If this cannot be achieved then alternatives should be sought (MHRA, 2013b).
- The HCP should demonstrate knowledge and competency related to manual flow control devices, including indications for use and ability to calculate flow rates (NMC, 2015b).
- Manual flow control devices should be considered as an adjunct to patient care and are not intended to alleviate the HCPs responsibility for regularly monitoring and documenting the infusion rate of the prescribed therapy.

- Frequency of flow rate monitoring should be performed depending on the patient's clinical requirements and the flow rate required (MHRA, 2013b).
- Manual flow control devices may not be suitable for all environments where infusion therapy is being delivered, especially when there is limited opportunity for monitoring.
- HCAs/HCSWs/HPs must demonstrate competence in the use of manual control infusion devices before they can be delegated the task. They are then accountable for the sphere of practice associated with the device in which they have been deemed competent; for example, identifying extravasation and stopping an infusion by closing the wheel clamp on the infusion and informing the registered nurse (see the *Role of support workers* heading in the Introduction section of this document).

### 4.2.2 Electronic flow control devices

#### Standard

Electronic infusion devices should be used in accordance with the MHRA risk classification system (MHRA, 2014) that includes patient condition, care setting, prescribed therapy and rate of infusion. **[Regulatory]**

The HCP should demonstrate knowledge and competency which has been assessed relative to electronic infusion devices, and is responsible for monitoring the patient and is accountable for the use of electronic flow control infusion devices (NMC, 2015a; NMC, 2015b; MHRA, 2014). **[Regulatory]**

Electronic flow control infusion devices used in any organisation should be part of an agreed and documented procurement policy (MHRA, 2013b). **[Regulatory]**

#### Guidance

- Protocols for the use of electronic infusion devices should be set out in organisational policies and procedures (MHRA, 2013b).
- Electronic infusion devices should be used for central venous access device infusions wherever possible (INS, 2016).

- Manufacturer's guidelines should be adhered to in the use of electronic infusion devices; consideration should be given to electrical safety in the use of these devices (MHRA, 2015b; MHRA, 2014; MHRA, 2013b).
- Other safety features of the equipment should be of prime consideration in the selection of electronic infusion devices. Safety features include, but are not limited to, audible alarms, battery life and operation indicators, anti-free-flow protection, adjustable occlusion pressure levels, accuracy of delivery indicator, drug dosage calculation, in-line pressure monitoring and anti-tampering mechanisms (MHRA, 2013b).
- All infusion pumps must be configured correctly for their required application. Configuring means selecting the appropriate mode for the intended application (MHRA, 2013b).
- Electronic infusion devices should generate flow under positive pressure. These devices include, but are not limited to, powered volumetric infusion pumps (these may employ a linear peristaltic pumping mechanism applied to the infusion tubing ('giving set') or use a special cassette within the set and powered syringe pumps (these work by pushing the plunger of a disposable syringe along at a predetermined rate) (MHRA, 2013b).
- Administration sets should be compatible with the infusion pump. The correct pump should be specified on the administration set's packaging (MHRA, 2013b).
- When using electronic devices, an administration set fitted with an anti-free-flow device should be used (MHRA, 2013b).
- Roller clamps should always be used to occlude the line when removing the administration set, regardless of whether the set has an anti-free-flow device (MHRA, 2013b).
- The frequency of preventive maintenance of electronic infusion devices should be established in organisational policies and procedures, and should adhere to the manufacturer's guidelines and those established by the MHRA. The establishment of an equipment library is also recommended (MHRA, 2013b).
- Information on how to decontaminate infusion devices before, during and after use and prior to return to equipment libraries must be available and adhered to (MHRA, 2014).
- It is recommended that the following information is recorded: date, time infusion started, expected completion time, route, device serial number, rate setting, volume to be infused, total volume infused, volume remaining, checks of infusion site and rationale for any alterations as per local guidance (MHRA, 2014).
- Training should be provided to health care user and patient/carer where applicable on the safe use management and decontamination of the electronic device. In the case of patients and carers, printed guidance combining manufacturers and local guidance should also be provided where possible (MHRA, 2013b).
- The HCP should demonstrate knowledge and competency which has been assessed relative to electronic infusion device, including indications for use, programming the device to deliver the prescribed therapy, mechanical operation, the use of lock-out safety devices, troubleshooting, pounds per square inch (PSI) rating, the recommended height of the device, monitoring and safe use (INS 2016; MHRA, 2014; MHRA, 2013b).
- When using syringe pumps always check that the syringe used is compatible with the pump and the syringe pump is used in line with local and national guidelines, with attention to positioning and securement of syringe barrel; syringe barrel clamp, syringe plunger clamp and syringe finger grips. (MHRA, 2013b).
- Use the prime or purge facility on the syringe pump to reduce mechanical backlash. **NEVER** prime or purge the line with the extension set still attached to the patient (MHRA, 2013b).
- **NEVER** use a damaged or defective electronic infusion devices and/or equipment used in those devices (MHRA, 2013b).

- Electronic infusion devices should be considered an adjunct to patient care and are not intended to alleviate the HCP's responsibility for regularly monitoring and documenting the infusion rate of the prescribed therapy (MHRA, 2014).

Further guidance can be obtained from *Infusion Systems* (MHRA, 2013b) which is available online at: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/403420/Infusion\\_systems.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/403420/Infusion_systems.pdf)

In addition, you should also refer to the MHRA guidance *Devices in Practice: Checklists for Using Medical Devices* (MHRA, 2014) which is available online at: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/403401/Devices\\_in\\_practice.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/403401/Devices_in_practice.pdf)

### 4.3 Add-on devices

Add-on devices include three-way taps/stopcocks, ramping 'traffic light' systems, extension sets, blind hub caps, injectable caps/connectors, needleless systems and filters.

#### Standard

All add-on devices should be of closed Luer-Lok™ design (Mustafa et al., 2013). [II]

Aseptic technique must be used and standard precautions must be observed for all add-on device changes (INS, 2016; Loveday et al., 2014). [V]

All add on devices must be decontaminated using aseptic technique prior to accessing (Moureau and Flynn 2015). [II]

#### Guidance

- Protocols for the use of add-on devices should be established in organisational policies and procedures (INS, 2016).
- Protocols for the use, decontamination and frequency of change of add-on devices and junction securement devices should be in accordance with local policy and procedures and in line with manufacturer's guidelines. [Expert consensus]

- When add-on devices are used, they should be changed with each cannula or administration set replacement, or whenever the integrity of either product is compromised, and according to manufacturer's recommendations (Loveday et al., 2014).
- All add on devices should be compatible with the administration system to prevent misconnections, disconnections and leaks (NICE, 2013).

### 4.4 Injection and access devices

Injection and access devices include caps, needle-free caps, catheter hubs, ports, (portacaths); open ports; total implanted vascular access device (TIVAD) and administration ports integral to an administration set.

#### Standard

Injection and access devices must be decontaminated using aseptic technique prior to accessing the device (NICE, 2012). [Regulatory]

All injection and access sites should be decontaminated with 2% chlorhexidine gluconate in 70% alcohol. Consider the use of aqueous solution of chlorhexidine gluconate if the manufacturer's recommendation prohibits use of alcohol with their device (Loveday et al., 2014; NICE 2012). [V/Regulatory]

All health care professionals must be aware of potential sensitivity to chlorhexidine and alternatives must be available (Loveday et al., 2014; MHRA, 2012b). [V/Regulatory]

Safer sharps devices should be compatible with all of the components of the vascular access devices and administration systems (Loveday, 2014; NICE, 2012). [V/Regulatory]

Any new safety device system, for example a needle-free system, should be monitored for increase in infection rates and any suspected increases should be reported to the MHRA (Loveday et al., 2014). [V]

Injection and access caps/ports which are not integral to the device should be changed at established intervals according to manufacturers' instructions, or

immediately if the integrity of the access site is compromised (INS, 2016). [V]

Injection and access caps/ports that are not integral to the device should be of closed Luer-Lok™ design (Mustafa et al., 2013). [II]

### Guidance

- Protocols for disinfecting, accessing and changing of injection and access caps/ports should be set out in organisational policies and procedures and should be in accordance with the manufacturer's guidelines (Loveday et al., 2014; NICE, 2012).
- To prevent the entry of micro-organisms into the vascular system, the injection access site should be decontaminated with an approved single-use antimicrobial solution, such as 2% chlorhexidine gluconate in 70% alcohol (unless contraindicated by manufacturers' recommendations) (Loveday et al., 2014; NICE 2012). The solution should be applied with friction and allowed to dry, immediately before and after use (Loveday et al., 2014).
- Organisations must have systems in place to ensure that staff recognise, document and report any allergies to chlorhexidine (Loveday et al., 2014; MHRA, 2012b). An alternative solution, such as povidone iodine, should be used if the patient is allergic to chlorhexidine; seek advice from local pharmacist. See MHRA (2012b) guidance: [www.gov.uk/drug-device-alerts/medical-device-alert-all-medical-devices-and-medicinal-products-containing-chlorhexidine-risk-of-anaphylactic-reaction-due-to-chlorhexidine-allergy](http://www.gov.uk/drug-device-alerts/medical-device-alert-all-medical-devices-and-medicinal-products-containing-chlorhexidine-risk-of-anaphylactic-reaction-due-to-chlorhexidine-allergy)
- If a needle must be used, it should be between 25 and 21 gauge and not exceed one inch (2.5cm) in length. A needle smaller than 25 gauge should not be used.
- The integrity of the injection and access caps should be confirmed before and immediately after each use. If the integrity of the injection or access cap is compromised, it should be replaced immediately, and consideration should be given to changing the device and/or administration set.
- Under no circumstances should devices be left with caps open or exposed.
- The optimal interval for changing injection and access caps/ports on central, peripherally inserted central and midline catheters should be in accordance with manufacturers' recommendations (INS, 2016).
- Any time an injection access site is removed from a vascular access device, it should be discarded and a new sterile injection access site should be attached (INS, 2016).
- Disinfect needleless connectors prior to each use of the device by scrubbing the access port with an appropriate antiseptic (O'Grady et al., 2011).
- Use of passive disinfection caps containing disinfecting agents (such as isopropyl alcohol) should be in line with local policies

## 4.5 Haemodynamic and arterial pressure monitoring

### Standard

The disposable or reusable transducer and/or dome and other components of the system, including the administration set, continuous flush device and the flush solution used for invasive haemodynamic pressure monitoring, are considered a closed system and must be changed every 96 hours or sooner if contamination is suspected or when the integrity of the product or system has been compromised (O'Grady et al., 2011). [V]

The equipment should be changed using aseptic technique and observing standard precautions (Loveday et al., 2014). [V]

All administration sets should be of closed Luer-Lok™ design (INS, 2016; Mustafa et al, 2013). [II]

Date and time labels must be applied to ensure administration sets are changed at the correct interval. [Expert consensus/V]

### Guidance

- Protocols for haemodynamic and arterial pressure monitoring set changes should be set out in organisational policies and procedures (INS, 2016).

- Product integrity should be ascertained prior to use of the haemodynamic monitoring system.
- Arterial administration sets must be labelled to prevent inadvertent drug administration. **[Expert consensus]**
- Haemodynamic monitoring set changes should coincide with the initiation of a new container of solution or catheter.
- Changing of add-on devices such as, but not limited to, extension sets, filters, stopcocks and needle-less devices where possible should coincide with the changing of the haemodynamic monitoring set.
- Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit (O'Grady et al., 2011).
- All patients undergoing elective or emergency surgery, 'intravenous fluids (500 mL or more) and blood components should be warmed to 37°C' (Norfolk, 2013).
- Transfusing a patient who has clinically significant cold antibodies-check with a transfusion medicine specialist (Norfolk, 2013).
- Blood/fluid warmers must be correctly used and maintained in accordance with the manufacturer's instructions. They should undergo routine quality control inspections and be equipped with warning systems including an audible alarm and visual temperature gauges (INS, 2016).
- Blood/blood components **must not** be warmed by any other method, for example microwave oven, radiator, or immersion of pack in hot water (Norfolk, 2013).

## 4.6 Blood/fluid warmers

### Standard

Devices used for blood/fluid warming must be specifically designed and CE marked for that purpose (INS, 2016; JPAC, 2016). **[V]**

All patients undergoing elective or emergency surgery, 'intravenous fluids (500 mL or more) and blood products should be warmed to 37°C' (Norfolk, 2013). **[V]**

### Guidance

- Protocols for the use of blood/fluid warmers must be set out in organisational policies and procedures and in accordance with the standards for administration of blood (JPAC, 2016).
- The HCP should demonstrate knowledge of appropriate use and operation of specifically designed blood/fluid warmers.
- Blood/fluid warmers must be used when warranted by patient history and/or prescribed therapy (RCN, 2013).
- Blood warmers should be used in the following situations: adults receiving infusion of blood at rates >50 ml/kg/hour (Norfolk, 2013).

## 4.7 Filters

### Standard

Infusion sets should contain in-line filtration **appropriate to the solution being administered**. Clear fluids require 15 micron filtration (or less) which is usually provided by a standard clear fluid set. **[Expert consensus/V]**

For non-lipid-containing solutions that require filtration, additional filters containing a membrane that is both bacteria/particulate-retentive and air-eliminating may be required – see local policies and procedures. **[Expert consensus/V]**

For lipid infusions or total nutrient preparations that require filtration, a 1.2 micron filter containing a membrane that is both bacteria/particulate-retentive and air-eliminating should be used (INS, 2016). **[V]**

For blood components an integral mesh filter 170-200µm should be used to reduce particulate matter and micro aggregates in infusions of blood components (JPAC, 2016). **[V]**



### Guidance

- Indications and protocol for the use of bacteria/particulate-retentive, air-eliminating, and blood and blood component filters should be set out in local organisational policies and procedures (INS, 2016).
- Use of filters should adhere to the manufacturer's guidelines and the filtration requirements of the therapy (JPAC, 2016).
- Bacteria/particulate-retentive and air-eliminating membrane filter changes should coincide with administration set changes.
- Blood and blood component filters should be changed at least every 12 hours and after completion of the blood transfusion (Norfolk, 2013).
- Add-on filters should not be used routinely for infection prevention purposes (Loveday et al., 2014).
- In-line bacteria/particulate-retentive, air eliminating membrane filters should be located as close to the catheter insertion site as possible.
- Where glass ampules/vials are still in use blunt fill and blunt filter needles should be used for drawing up medications from these containers (INS, 2016).
- The tourniquet must not be applied for an extended period of time in order to prevent circulatory impairment. Ideally tourniquet time should be a maximum of 60 seconds to prevent 'haemoconcentration' (blood pooling at venepuncture site) and false blood chemistry results (Asirvatham et al., 2013).
- The tourniquet material should be cleanable and latex free (WHO, 2010).
- The tourniquet should be single patient use where possible, but always when there is the potential for microbial cross contamination between patients.
- If reusable tourniquets are used, organisations should ensure that the tourniquet can be decontaminated as per manufacturers guidelines between patient use. Fabric tourniquets which cannot be cleaned should not be used (WHO, 2010).
- The tourniquet should be a quick-release model which allows one-handed release.

## 4.8 Tourniquets

### Standard

Tourniquets should be properly applied to promote venous distention and to impede venous but not arterial blood flow. [Expert consensus/V]

Tourniquet material should provide minimal risk of contamination and transmission of infection (WHO, 2010). [V]

### Guidance

- The tourniquet should be applied at an appropriate location proximal to the selected insertion site.
- A pulse should be easily palpable distal to the tourniquet location.

# 5 Site and device selection and placement

## 5.1 Site and device selection

### Standards relating to all sites and devices

Initial assessment should include whether or not infusion therapy is required and have other routes been considered and excluded (Hallam et al., 2016). [V]

If infusion therapy is required, site and device selection for vascular access should then include assessment of the patient's condition, age and diagnosis; vascular condition; infusion device history; and the type and duration of the therapy as well as the potential complications associated with vascular access devices (Hallam et al., 2016). [V]

The vein/vessel/artery should accommodate the gauge and length of the device required by the prescribed therapy (INS, 2016). Patient's lifestyle, body image, any known abnormalities, relevant past medical history (PMH) patient preference, and therapy duration and setting should all be considered for site and device selection (Hallam, et al., 2016). [V]

Using the same criteria, any device initially placed should be reviewed after 48 hours (Hallam et al., 2016). [V]

Placement of any vascular access device, particularly central vascular access devices, is an aseptic procedure that should only be undertaken by staff who have had appropriate training (Loveday et al., 2014; NMC, 2015a). [V/Regulatory]

Prior to making a peripherally inserted central catheter (PICC) insertion, anatomical measurements should be taken to determine the length of the catheter required to ensure full advancement of the catheter to achieve catheter tip placement in the superior vena cava/right atrium. [Expert consensus]

The length of the central vascular access catheter will be selected in order to ensure that the distal tip of the catheter lies in the lower third of the superior vena cava or right atrium. (Bodenham et al., 2016). [V]

A multiple-lumen device **will not be routinely placed** unless the patient's condition/intended treatment necessitates one (Loveday et al., 2014). [V]

All catheters must be radiopaque. [Expert consensus/V]

### General guidance for all sites and devices

- Criteria for site and device selection should be set out in organisation policies and procedures and in line with the manufacturer's guidelines for insertion (MHRA, 2013a).
- Use of an organisation-wide *Vessel Health and Preservation Framework* should be considered to support staff in assessing and selecting the best vascular access device to meet each patient's needs and preserve patent blood vessels (Hallam et al., 2016).
- The HCP should have the necessary knowledge and competence to select the most appropriate site and device for the patient and the intended therapy. This should include: knowledge of the patient and environment, knowledge of the product in regard to insertion technique, potential complications, appropriateness linked to prescribed therapy and medication and manufacturers' guidelines (INS, 2016). See [Appendix 5](#) for vein diagrams.
- Central venous catheters should be of single lumen configuration unless additional therapies are required (Loveday et al., 2014).

## 5.2 Peripheral devices: cannulae and midline catheters

A **peripheral cannula** is defined as one that is less than or equal to 3 inches (7.5cm) in length. Peripheral cannulae should be selected for short term therapy of 3–5 days and for bolus injections or short infusions in the outpatient/day unit setting.

**A midline catheter for adults** is defined as one that is between 3 and 8 inches (7.5cm–20cm) in length. Midline catheters are used for the administration of blood, fluid and medication when the therapy is expected to last between 1-4 weeks. They may be used where patients present with poor peripheral venous access and when the use of a central venous catheter is contraindicated. The midline catheter provides venous accessibility along with an easy, less hazardous insertion at the antecubital fossa.

### Specific guidance relating to peripheral devices:

- Veins that should be considered for peripheral cannulation are those found in the forearm or hands (O’Grady et al., 2011).
- Site selection should be routinely initiated in the distal areas of the upper extremities; subsequent cannulation should be made proximal to the previously cannulated site.
- Where possible, use non dominant forearm for peripheral cannulation following policy and procedure.
- Veins in the lower extremities should not be used routinely in adults due to the risk of thrombosis, thrombophlebitis and increased infection risk.
- Patients with diabetes should not generally be cannulated in their feet.
- Site selection should involve assessment for previous venepuncture and subsequent damage to the vein. Aids to assist in cannulation including ultrasound and infrared imaging should be considered (Hallam et al., 2016).
- Choice of an alternative site due to infiltration/extravasation of solutions into the extremity should require assessment of the type of solution, its pH, osmolarity, the estimated volume of the infusate/duration of infusion and the condition of the vein (Hallam et al., 2016).
- Site selection should avoid areas of flexion although this may not always be possible in an emergency situation.
- Arterial flow should not be compromised when pressure is applied to produce venous distension.
- Blood pressure cuffs and tourniquets should be avoided if possible on an extremity where a peripheral device has been placed.
- Cannulation of fistulae and grafts for infusion therapy requires specialist approval and organisational policies and procedures must be followed.
- Peripheral devices should not be routinely used for blood sampling but blood can be taken immediately following insertion (WHO, 2010).
- Do not take blood from an existing peripheral venous access site because this may give false results. (WHO, 2010).
- Consider the use of an extension set between the peripheral catheter and needleless connector to reduce catheter manipulation (INS, 2016)
- A relevant HCP should be consulted, and the decision documented, prior to cannulation of the arm of a patient who has undergone axillary node dissection/radiotherapy with risk of lymphoedema (for example, following a mastectomy) or who may have existing AV fistula access or other contraindications; for example, they require future fistula formation (RA, 2015b).
- The basilic, cephalic or brachial veins of the patient’s arm are used for the insertion of a midline catheter, with the basilic vein generally being the vein of choice due to its diameter and position away from artery and median nerve (Alexandrou et al., 2011).
- Placement of the midline should be just above or below the fold of the antecubital area so as to aid the patient’s comfort when flexing their arm. This will also minimise the potential for catheter kinking. Ultrasound should be used to assist with location (Alexandrou et al., 2011).
- As the tip of the midline catheter does not extend beyond the axillary vein, X-ray confirmation of tip placement is not required prior to use (INS, 2016).

- Use vascular visualisation technology to aid vein identification for midlines (INS, 2016).
  - Midline catheters can be used as an alternative to peripheral cannula for longer term IV infusion therapy (up to <4 weeks) dependant on type of infusate, duration and individual risk assessment and following local policies (Alexandrou et al., 2011).
  - Midline catheters can be considered as an alternative to subcutaneous infusion in palliative care depending on the infusate/medicine to be infused, volume and duration of infusion therapy and individual patient needs and dependant on local policy and procedure (Bortolussi et al., 2015).
  - Therapies which are not appropriate for certain peripheral cannulae and midlines include continuous vesicant chemotherapy, parenteral nutrition solutions and/or medications with osmolarity greater than 900 Osm/L (INS, 2016). These aspects should not be considered in isolation and a risk assessment that includes vein assessment, duration and environment of therapy as well as pH and osmolarity is important prior to any site and device selection (Hallam et al., 2016; Gorski et al., 2015).
  - Ideally, peripheral devices should be equipped with a safety device with engineered sharps injury protection. Local risk assessments should be undertaken concerning the use of these devices to reduce needlestick injuries and to monitor infection rates (Loveday et al., 2014; DH, 2013a).
- medically contraindicated, use the subclavian site in preference to the jugular site for non-tunnelled catheter placement (Parianti et al., 2015) except for haemodialysis catheters (see [Section 7.3](#) of this document). Local policies and procedures should be followed.
- Use of 2D ultrasound imaging is recommended for all routine placements of all central venous access devices (Bodenham et al., 2016; Lamperti et al., 2012).
  - Central catheters should have the distal tip dwelling in the lower third of the superior vena cava or the upper right atrium (Bodenham et al., 2016; Frykholm et al., 2014).
  - The femoral vein should be avoided where possible due to the higher risk of infection. If used in an emergency situation, then it should be replaced as soon as is practically possible (Loveday et al., 2014).

**A peripherally inserted central catheter (PICC)** is a catheter that is inserted via the upper arm veins and is advanced into the central veins, with the tip located in the superior vena cava (usually the lower third) (INS, 2016). The cephalic, basilic or median cubital veins of the adult patient's arm can be used for the insertion of a PICC.

**A short-term central venous catheter** is a device that typically enters the vein from a skin puncture site over the vein.

- Antimicrobial central venous catheters should be considered in high-risk patients to minimise the risk of catheter-related bloodstream infection (Loveday et al., 2014).

**A skin-tunnelled catheter** is a long-term catheter that lies in a subcutaneous tunnel before entering a central vein. These catheters have a cuff which is surgically implanted. The cuff embeds into the tissue of the patient providing additional protection against central line infection.

**An implanted port** is a totally implanted vascular access device made of two components; a reservoir with a self-sealing septum, which is attached to a catheter.

## 5.3 Central venous access devices

### Specific guidance relating to central venous access devices:

- The choice of veins for non-tunnelled, tunnelled or implantable device should balance the risks for infection against the risks of mechanical complications and include the internal jugular and subclavian veins (Loveday et al., 2014). Unless

## 5.4 Arterial catheters

The most appropriate arteries for cannulation are those which have a collateral circulation to preserve blood flow to the distal limb: this includes the radial artery (collateral flow from the ulnar artery) and the dorsalis pedis (collateral flow from the posterior tibial artery). The brachial and femoral arteries are used in practice but, as neither has collateral flow, assessment of limb perfusion is essential in all cases as thrombosis is unpredictable and damage can occur at all sites.

[Expert consensus/V]

### Arterial access device

- Arterial access devices may be purpose-designed with end and side holes to maximise blood flow to the organ or limb in which the device is situated.
- Short venous catheters are often placed in the radial artery to facilitate short-term arterial catheterisation for haemodynamic monitoring – these are often seen in ICU and theatres.
- Specialised and larger perfusion catheters used for chemotherapy, cardiopulmonary bypass, ECMO and so forth are less frequently used and are beyond the scope of this document. [Expert consensus/V]

## 5.5 Hair removal

### Standard

Hair removal around the insertion site and area for adhesive dressing should be accomplished using clippers (NICE, 2013). [V]

### Guidance

- Clippers should be used if hair removal is required and should have disposable heads for single-patient use (NICE, 2013).
- Shaving with a razor **should not** be performed because of the increased risk of infection (NICE, 2013).

## 5.6 Local anaesthesia

### Standard

An injectable or topical local anaesthetic drug should be administered according to a patient-specific direction (prescription) or under a patient group direction (NMC, 2015c). [Regulatory]

When local anaesthesia is ordered or required, the agent which is least toxic and/or carries least risk for allergic reaction should be considered first. Consideration should also be given to the desired duration of effects and any requirement for adrenalin in the solution. [Expert consensus/V]

### Guidance

- A protocol for the use of local anaesthesia should be established in organisational policies and procedures.
- The HCP administering the local anaesthesia should have demonstrated competency and knowledge of the drug, method of administration used and management of complications (NMC, 2015c).
- Use of injectable anaesthetic should be monitored because of the potential for allergic reaction, tissue damage and inadvertent injection of the drug into the vascular system (EMC, 2015).
- Local anaesthetics should not be injected into inflamed or infected tissues.
- Other types of local anaesthesia, such as iontophoresis or topical transdermal agents, should be considered and used according to organisational policies and procedures, and manufacturers' guidelines. [Expert consensus]

## 5.7 Insertion site preparation

### Standard

Prior to peripheral, midline, arterial, central and peripherally inserted central catheter placement insertion, the intended site should be decontaminated

with the appropriate antimicrobial solution using aseptic technique (INS, 2016; Loveday et al., 2014). [V]

### Guidance

- Protocols for site preparation should be set out in organisational policies and procedures.
- 2% chlorhexidine gluconate in 70% alcohol should be used with awareness of potential chlorhexidine allergy and an alternative used (for example povidone iodine in alcohol) where this is the case (Loveday et al., 2014).
- Application technique should be as per manufacturer's instructions and local policy and procedures, allowing for appropriate cleaning and drying time.

#### 5.7.1 Peripheral cannulae

- Decontaminate the skin as per guidance in 5.7 with emphasis on cleaning and drying time. [Consensus]
- Wear clean non-sterile gloves for insertion of the cannula (Loveday et al., 2014).

#### 5.7.2 Midlines and central venous access devices

- Maximal barrier precautions including sterile gown, sterile gloves and large sterile drapes should be used for arterial, central and peripherally inserted central catheter insertions and midlines in order to minimise the risk of infection to the patient (Loveday et al., 2014). [V]
- Decontaminate the skin as per guidance in [Section 5.7](#), with emphasis on cleaning and drying time. [Consensus]
- After initial site preparation, unless the skin decontamination process involves a non-touch technique, sterile gloves should be changed prior to midline, arterial, central and peripherally inserted central catheter placement (INS, 2016). [V]

## 5.8 Intravascular device placement

### Standard

All vascular access device placements should be for definitive therapeutic and/or diagnostic purposes (Hallam et al., 2016). [V]

HCPs should be assessed as competent in specific device placement in line with local policies and procedures (NMC, 2015a). [Regulatory]

Aseptic technique must be used and standard precautions should be observed during vascular access device placement. This includes the appropriate use of hand hygiene and PPE selection/use (Loveday et al., 2014). [V]

A device designated as 'single-use' must not be reused. Only one vascular access device should be used for each insertion attempt for that particular device and patient (MHRA, 2013a). [Regulatory]

The distal tip of a central venous access device should dwell in the lower third of the superior vena cava or upper right atrium. Catheter tip location should be determined radiographically or use of ECG guidance for some devices; for example PICCs, depending on local protocols and included in the patient's medical record prior to initiation of the prescribed therapy. [V]

### Guidance

- Protocols for the placement of vascular access devices should be set out in organisational policies and procedures.
- The HCP placing any vascular access device should have a comprehensive understanding of anatomy and physiology, vascular assessment techniques and insertion techniques appropriate to the specific device.
- The HCP should be aware of the manufacturers advice relating to the particular vascular access device, preparation and placement, connections and administration set dwell time and compatibility with other fluids to ensure safe use of the device (Loveday et al., 2014).

- Caution should be employed when stylets, needles and/or wires are used to facilitate vascular access device placement because of the risk of needlestick injury.
- Stylets, which are part of the catheter product, should never be reinserted due to the risk of severing and/or puncturing the catheter (INS, 2016).
- Peripheral and central vascular access device placement, including gauge and length, product name, batch and lot number, number of attempts, anatomical location and patient's response to the placement, should be included in the patient's nursing and medical records (INS, 2016).
- Radiological confirmation of the tip location or a recognised alternative procedure (for example, ECG guidance for PICCs) should be obtained in the following clinical situations: prior to use of the central vascular access device; difficulty with catheter advancement; pain or discomfort after catheter advancement; inability to obtain positive aspiration of blood; inability to flush the catheter easily; difficulty in removing guidewire or guidewire bent on removal. (Bodenham et al., 2016; Frykholm et al., 2014). Local policies and procedures should be followed.

## 5.9 Device stabilisation

### Standard

Devices should be stabilised in a manner that does not interfere with assessment and monitoring of the access site, that does not impede delivery of the prescribed therapy, and that is acceptable to the patient (INS, 2016). [V]

Device stabilisation should be performed using an aseptic technique (Loveday et al., 2014). [V]

Stabilising devices should be placed so as not to impede circulation or impede infusion through the access device (INS, 2016). [V]

### Guidance

- Protocols for stabilisation of the catheter should be set out in organisational policies and procedures.
- Products employed to stabilise peripheral cannulae, midlines or central venous catheters include transparent film dressings, sutures, engineered stabilisation devices and sterile wound closure strips.
- For stabilisation of CVCs, and particularly midlines and PICCs, consider use of an engineered stabilisation device (INS, 2016).
- As use of sutures is associated with needlestick injury, where practicable their use should be avoided for VAD securement.
- When a specific securement device is used for stabilisation, placement should be in accordance with manufacturers' guidelines (INS, 2016).
- A catheter which has migrated externally should not be re-advanced prior to re-stabilisation.

## 5.10 Dressings

### Standard

A sterile transparent film dressing must be applied and maintained on vascular and non-vascular access devices. All dressings must be changed at established intervals in accordance with organisational policies/procedures and manufacturers guidelines, and immediately if the integrity of the dressing is compromised (Loveday et al., 2014). [V]

Criteria for the choice of securement dressing should include the type of VAD, its site of placement, expected duration, the opportunity it provides for site assessment and patient characteristics including skin condition. [Expert consensus/V]

Removal of site protection material should be done at established intervals, if a transparent dressing cannot be used, to allow visual inspection of the access site and monitoring of skin integrity in order to minimise the potential for infection (Loveday et al., 2014). [V]

An aseptic technique should be used for each dressing change and any contact with the insertion site or catheter (for manipulation of the device for access/administration of fluids/blood/blood components/medications and so forth) (Loveday et al., 2014). [V]

### Guidance

- Protocols for the use of sterile gauze and/or transparent semi-permeable polyurethane dressings should be set out in organisational policies and procedures.
- Transparent film dressings should be used to cover intravascular insertion sites where possible (Loveday et al., 2014; NICE, 2012).
- In some circumstances a sterile gauze dressing may have to be used; for example, if the patient has profuse perspiration or the insertion site is leaking or bleeding. In these instances the intravascular site should be checked regularly and the gauze dressing replaced as soon as possible with a transparent film dressing (Loveday et al., 2014; NICE, 2012).
- Transparent film dressings should be changed every seven days, or sooner if the integrity of the dressing is compromised or moisture collects under the dressing (Loveday et al., 2014).
- Dressings used on tunnelled implantable ports should be changed every seven days until the insertion site has healed, unless there is a clinical indication to change earlier. Once the insertion site has healed there may no longer be a requirement for a dressing to be in place (Loveday et al., 2014).
- For central venous access devices, the optimal time interval for changing transparent film dressings will depend on the dressing material, age and condition of the patient, environmental conditions and manufacturer's guidelines, but these should be assessed at least on a daily basis, not remain in place longer than seven days (after initial 24 hour post-insertion dressing) and should be changed if the integrity of the dressing has been compromised (Loveday et al., 2014; NICE, 2012).
- Consider the use of chlorhexidine gluconate impregnated dressings in adult patients with a central venous access device unless the patient has a chlorhexidine allergy (NICE 2015; Ullman et al., 2015; Timsit et al., 2012; Loveday et al., 2014).
- The insertion site should be visually inspected at a minimum during each shift and, in the case of peripheral vascular catheters, a visual infusion phlebitis (VIP) score (Jackson, 1998) should be recorded (Loveday et al., 2014). VIP scores may also be recorded on central vascular access devices, in line with local policy.
- All documentation related to insertion, assessment, dressing care and maintenance should be recorded in the patient's records.



## 6 Site care and maintenance

### 6.1 Care/access of vascular access device sites

#### Standard

Vascular access device site access/care, alongside add on devices, must be performed using aseptic technique and observing standard precautions (Loveday et al., 2014). [V]

When performing site care, observation and evaluation of the device and surrounding tissue, the integrity of the device and security of the connections/add on devices should be checked and documented at least every shift (Loveday et al., 2014). [V]

#### Guidance

- Protocols for vascular access device site care should be set out in organisational policies and procedures.
- Following hand hygiene, appropriate PPE should be used as per local policy (see [Section 3](#) of this document), an aseptic technique should be used when performing site care for central venous access devices including sterile gloves (Loveday et al., 2014).
- Cleansing of the peripheral venous access site should be carried out at dressing change using a single application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for those with an allergy to chlorhexidine) and allowed to air dry (Loveday et al., 2014).
- Cleansing of the central venous access site should be carried out at dressing change using a single application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for those with an allergy to chlorhexidine) and allowed to air dry (Loveday et al., 2014).

- Antimicrobial solutions should be used in accordance with manufacturer's guidelines and ensure allergy status of the patient has been established (Loveday et al., 2014).
- Consider daily cleansing of the patient with chlorhexidine wash solution for patients with a central venous access device as a measure to reduce catheter related blood stream infections (Loveday et al., 2014; O'Horo et al., 2014).
- Documentation of catheter site care should reflect the condition of the catheter site, any specific actions/interventions taken to resolve or prevent adverse reactions should be documented in the patient's medical records.

### 6.2 Maintaining patency of vascular access devices

#### Standard

The patency of the vascular access device will be checked prior to administration of medications and/or solutions. [Expert consensus/V]

The device should be flushed at established intervals to promote and maintain patency and to prevent the mixing of incompatible medications and/or solutions. [Expert consensus/V]

The patency of the device should be maintained using the correct techniques such as pulsatile flush and positive pressure. [Expert consensus/V]

#### Guidance

- The HCP should follow local policies and procedures when checking patency of any device.
- For peripheral cannulae, it may be necessary to remove the device if patency cannot be established. Local policies and procedures should always be adhered to.
- The HCP should aspirate midlines and central venous access devices to check blood return to confirm patency, assess catheter function and prevent complications prior to administration of medications and/or solutions (INS, 2016).

- In the absence of a blood return for midlines and central venous access devices, an attempt should be made to flush the device; if resistance is met **force should not be applied**. For midlines and all central venous access devices, the HCP should take further steps to assess patency of the device prior to administration of medications and/or solutions, for example diagnostic tests (INS, 2016). The relevant algorithm should be followed for checking blood return from a central venous access device (see [Appendix 4](#)).
- Sterile 0.9% sodium chloride should be used to flush and lock catheter lumens that are accessed frequently (Loveday et al., 2014; NICE, 2012).
- The volume of the flush solution can vary depending on the patient, device, catheter size and nature and type of infusion/medication. A minimum is at least twice the volume of the catheter (INS, 2016).
- Flushing with 0.9% sodium chloride solution to ensure and maintain patency should be performed before, between and after the administration of incompatible medications and/or solutions (INS, 2016).
- Where any risk of incompatibility to saline is identified local policies should be followed.
- 0.9% saline flushes should be prescribed unless provided in a pre-filled syringe and classed as a medical device.
- Follow **manufacturer's guidance on the flushing** of open-ended catheter lumens and implanted ports.
- Systemic anticoagulants **should not be used** routinely to prevent catheter-related blood stream infections (Loveday et al., 2014; NICE, 2012).
- If heparin is used refer to local policies and procedures for the concentration of heparin to be used for specific vascular access devices.

Positive pressure within the lumen of the device should be maintained by a specifically designed injection caps or positive displacement caps or by the HCP using a pulsated push pause method.

## 6.3 Catheter clearance

### Standard

The HCP should understand the predisposing factors and preventative strategies and be able to assess the catheter for suspected occlusion (INS, 2016). [V]

The HCP should assess the catheter for a potential cause of the occlusion – thrombotic, non-thrombotic or mechanical – and report/manage this in line with local policies and procedures. [Expert consensus]

### 6.3.1 Thrombotic occlusions

Thrombolytic agents specifically indicated for dissolving clots must be prescribed and administered in line with local policies. [expert consensus/V]

The instilled volume of thrombolytic agents should not exceed the volume capacity of the catheter. [Expert consensus/V]

### 6.3.2 Non-thrombotic occlusions

Agents specifically indicated for dissolving medication and/or solution precipitate should be administered and must be prescribed in line with local policies. [Expert consensus/V]

The instilled volume of precipitate clearance agents should not exceed the volume capacity of the catheter. [Expert consensus]

### 6.3.3 Mechanical causes of occlusion

Kinking or pinch-off syndrome can impair the patency of the device and the HCP must have the knowledge to recognise early signs and act accordingly. This may involve the patient undergoing a chest X-ray or consideration of device removal, in line with local policies and procedures. [Expert consensus/V]

### Guidance

- Protocols for the use and contraindications of thrombolytic agents and precipitate clearance agents to restore catheter patency should be set out in organisational policies and procedures.
- The HCP using a thrombolytic agent or precipitate clearance agent should have knowledge of dosage,

contraindications, side effects and mechanism of instillation (NMC, 2015c).

- Thrombolytic agents specifically indicated for catheter clearance should be administered; use of these agents should adhere to manufacturer's guidelines.
- The HCP's responsibilities should include assessment for appropriateness of use, documentation of outcome and continued surveillance of the patient.
- Instillation, aspiration and flushing of vascular access devices should be performed using a method that is within the catheter manufacturer's maximum pressure limits in pounds per square inch (PSI).
- The syringe size used for this procedure should be in accordance with the catheter manufacturer's guidelines, as excessive pressure may cause complications such as catheter separation and/or rupture, resulting in loss of catheter integrity. It is recommended that a syringe smaller than 10ml is not used.
- Should the procedure using these thrombolytic agents or precipitate clearance agents not restore catheter patency, the appropriate HCP should be notified.
- The procedure should be documented in the patient's records (NMC, 2015a).

## 6.4 Vascular access device removal

### Standard

The HCP removing any vascular access device must have been assessed as competent for the procedure (NMC, 2015c). [V]

### General guidance

- Any vascular access device may be removed by a HCP in accordance with established organisational policies and procedures, provided that they have the

appropriate experience, knowledge and skills and have been assessed as competent to undertake the procedure.

- If removal is related to actual or suspected catheter-related blood stream infection the catheter tip should be sent to the microbiology laboratory for culture and antimicrobial sensitivity. This action should be documented in the patient's records (INS, 2016).
- When the device is removed the tip should be checked to ensure it is intact. If the tip is not complete it should be reported and the appropriate patient observation and actions taken. It should also be documented in the patient's medical and nursing records.
- Any device defect should be reported to the organisation's risk management department, the manufacturer, and the MHRA (MHRA, 2015a).

### 6.4.1 Peripheral devices

- Peripheral cannula should be re-sited when clinically indicated and not routinely, unless device-specific recommendations provided by the manufacturer indicate otherwise (Loveday et al., 2014; Rickard et al., 2012). [III]
- Document the reason for the removal and condition of the site, for example by using a scoring system such as the Visual Infusion Phlebitis (VIP) score (Jackson, 1998), to record evidence of phlebitis; see Appendix 1 (Loveday et al., 2014). [V]
- A peripheral cannula inserted in an emergency situation, where aseptic technique has been compromised, should be replaced within 24 hours. [Expert consensus/V]
- The optimal dwell time for the removal of midline catheters is unknown; ongoing and frequent monitoring of the access site should be performed (O'Grady et al., 2011) alongside manufacturer's guidelines. [Expert consensus/V]
- A midline catheter should be removed if the tip location is no longer appropriate for the prescribed therapy (Hallam et al., 2016);. [V]

- Removal of a midline to insert another peripheral vascular access device may increase the risk of infection, therefore risk assessment and clinical indications for the need for a further peripheral vascular access device should be used when removing midlines (Loveday et al., 2014). [V]

### 6.4.2 Central vascular access devices

- Protocols for ongoing assessment, removal and post-removal site assessment should be set out in organisational policies and procedures. [Expert consensus/V]
- Central venous access devices should not be routinely changed; instead they should be monitored at least every shift and catheter assessed if any signs of inflammation, infiltration or blockage (Loveday et al., 2014). [V]
- Caution should be used in the removal of central venous catheters, including precautions to prevent air embolism (Bodenham et al., 2016). [V]
- Following removal of the catheter and application of digital pressure, the CVC site wound should be covered with an occlusive dressing and assessed regularly until healed. The condition of the site should be documented in the patient's notes with the relevant HCP informed of adverse concerns. [Expert consensus/V]
- If resistance is encountered when the catheter is being removed, the catheter should not be removed and the relevant HCP should be notified immediately and/or local policies followed. [Expert consensus/V]

### 6.4.3 Arterial catheters

- An arterial catheter inserted in an emergency situation where aseptic technique has been compromised should be replaced within 24 hours wherever possible. [Expert consensus/V]
- When a peripheral arterial catheter is removed, digital pressure should be applied until haemostasis is achieved (5 to 15 minutes), then a dry, sterile, pressure dressing should be applied to the access site. [Expert consensus/V]

- After the removal of the arterial catheter the peripheral circulatory status distal to the access site should be assessed and documented in the patient's records. [Expert consensus/V]

## 6.5 Catheter malposition

### Standard

External catheters should be secured appropriately to prevent catheter malposition and associated complications. [Expert consensus/V]

If catheter malposition is suspected, the catheter should not be used for the administration of medication, solutions or chemotherapy until the catheter tip position has been confirmed. [Expert consensus/V]

### Guidance

- HCPs should be aware that catheter malposition may occur during insertion or days to months after insertion; possible causes include vigorous upper extremity use, forceful flushing of the catheter, changes in intrathoracic pressure associated with coughing, sneezing, vomiting or constipation, congestive cardiac failure (INS, 2016).
- Protocols for securing external catheters should be set out in organisational policies, procedures and practice guidelines.
- Whenever feasible, the use of a manufactured catheter securement device is preferable.
- When any catheter securement device is used for stabilisation, placement should be in accordance with manufacturer's guidelines (INS, 2016).
- If any securement device becomes loose or is no longer intact, other measures should be implemented to prevent catheter migration or dislodgement (INS, 2016).
- A catheter which has migrated externally should not be re-advanced prior to re-stabilisation.
- The patient and/or caregiver should be instructed in ways of avoiding catheter dislodgement (Loveday et al., 2014).

- The practitioner caring for the patient with a central venous access device should be knowledgeable about the complications of catheter dislodgement and malposition. These include occlusion, thrombosis, fibrin sheath, extravasation and vessel perforation if catheter tip is outside the intended location.
- To accurately confirm catheter dislodgement and catheter tip position a chest x-ray should be performed with an AP and lateral view. A linogram may also be undertaken to confirm catheter malposition.
- If the catheter tip is outside the SVC or upper right atrium the catheter should be repositioned, replaced or removed. Seek specialist advice before removal (Bodenham et al., 2016).

## 6.6 Catheter exchange

### Standard

Exchange should only be performed if there is **no evidence of infection** at the catheter site or proven bloodstream infection (Loveday et al., 2014). [V]

Exchange should only be performed by those who have been trained and are assessed as competent to undertake the procedure in line with local policy and procedures. [Expert consensus/V]

Exchange of midline catheters or PICCs should be performed in line with local policies. [Expert consensus/V]

A non-tunnelled central catheter can be exchanged over a guidewire and **only if there is no infection** (Loveday et al., 2014). [V]

Maximal barrier precautions to aid asepsis should be observed during the exchange of the catheter following manufacturer's instructions (INS, 2016). Gloves should be changed after removing the old catheter and before touching the new catheter (O'Grady et al., 2012). [V]

### Guidance

- Protocols for exchanging midlines, PICCs and non-tunnelled central vascular access devices should be set out in organisational policies and procedures.
- The HCP undertaking the exchange of a catheter should have a comprehensive understanding experience and skill of the technique involved for the particular device (INS, 2016).
- The patient should be positioned as for catheter insertion to prevent air embolism (INS, 2016).
- The HCP should inspect the catheter for product integrity prior to placement.
- The manufacturer's guidelines for product use should be considered in the preparation and placement of the device.
- When the device is removed it should be checked to ensure it is intact; if it is not, it should be reported and the appropriate patient observation and actions taken.
- Any defect in the retrieved catheter should be reported via the organisation's risk management system, the manufacturer, as well as the MHRA (MHRA, 2016b).
- Radiographic confirmation of the correct tip location should be performed prior to using the catheter (INS, 2016).
- A record of the procedure and any complications and or actions should be documented in the patient's records (NMC, 2015a).

## 6.7 Catheter repair

**This can only be undertaken on certain catheters – refer to local policies and procedures. Arterial catheters cannot be repaired.**

## 7 Specific devices

### 7.1 Subcutaneous injection/infusion (hypodermoclysis)

Subcutaneous fluid/drug administration offers an alternative to vascular access for correcting mild to moderate dehydration (when rapid fluid resuscitation is not required) in the elderly or those receiving palliative care, particularly in non-hospital settings.

#### Standard

The HCP must assess the patient for appropriateness and duration of the prescribed therapy (Hypodermoclysis Working Group, 1998; INS, 2016). [V]

Drug dose, volume, concentration and rate should be appropriate with regard to clinical need and the integrity and condition of the patient's subcutaneous tissue (Hypodermoclysis Working Group, 1998; INS, 2016). [V]

#### Guidance

- Specific criteria should be set out in organisational policies and procedures regarding patient and condition suitability for subcutaneous fluid replacement or drug administration. This should include site selection and management, prescribed medication, rate of administration, required therapy, diagnosis, anticipated length of therapy and maintenance of the integrity of the subcutaneous tissue.
- The HCP should be educated and competent in the use of medications, solutions and subcutaneous administration procedures (INS, 2016).
- The subcutaneous device should be inserted in line with manufacturer's guidance (INS, 2016).
- The skin should be decontaminated in line with local policies and procedures
- An electronic device, for example a syringe driver,

should be used when administering medications via the subcutaneous infusion route.

- The infusion device selected should be of the smallest gauge and shortest length necessary to establish subcutaneous access (INS, 2016).
- Smaller needles should be considered as these may cause less pain for subcutaneous injections.
- The access site should be prepared using aseptic technique and observing standard precautions (Loveday et al., 2014).
- The selected access site should have intact skin and be located away from bony prominences, areas of infection, inflamed or broken skin, the patient's waistline, previously irradiated skin, sites near a joint and lymphoedematous limbs (Farrand and Campbell, 2006).
- A sterile transparent occlusive dressing should be used to cover the administration site (INS, 2016).
- To reduce the risk of complications, the subcutaneous access site should be observed at least every shift and condition of site documented in the patient's records (Loveday et al., 2014).
- The site should be rotated every 2-7 days, depending on whether site used for medications or fluids for hydration or both or if clinically indicated. Sites should be rotated when there is erythema, pain, swelling, bruising, burning or pain (INS, 2016). Local policy and procedures should be followed.
- Consideration should be given to the use of additives that enhance absorption and diffusion of the medication or solution, such as hyaluronidase, in line with local policies (BNF, 2016b; INS, 2016).
- The medication or solution should be as near to isotonic as possible (INS, 2016) with local policies and procedures outlining which fluids/medications can be administered through the subcutaneous route.
- Documentation in the patient's records should include evaluation of the need for subcutaneous infusion, patient response to therapy, and the established intervals of monitoring the infusion site.

For further information see the General Medical Council's *Treatment and Care Towards the End of Life: Good Practice in Decision Making*, which is available online at: [www.gmc-uk.org/End\\_of\\_life.pdf\\_32486688.pdf](http://www.gmc-uk.org/End_of_life.pdf_32486688.pdf)

## 7.2 Intraosseous access

Intraosseous access (IO) should be obtained for emergency or short-term treatment when access by the vascular route is difficult or cannot be achieved and the patient's condition is considered life-threatening (INS, 2016; ERC, 2015; Ker et al., 2015; Weiser, et al., 2012; Leidel et al., 2012). [V/IV]

### Standard

IO access by health care professionals should be initiated by a HCP with the experience, knowledge and skills to undertake this procedure and who has been assessed as competent (ERC, 2015). [V]

An aseptic technique and standard precautions should be implemented for IO access and manipulation of the administration set. [Expert consensus/V]

### Guidance

- Indications and protocols for the use of IO access should be set out in organisational policies and procedures and practice guidelines.
- The HCP initiating IO access should be educated and competent in IO access and should have knowledge of the principles involved in fluid resuscitation; anatomy and physiology of the intraosseous route; potential complications (INS, 2016; ERC, 2015).
- The HCP's responsibilities should include site assessment, care and maintenance, discontinuation of access and documentation in the patient's records.
- The IO access device placement is a temporary, emergency procedure, and the device should be removed as per manufacturer's recommendations, after alternative appropriate access has been obtained (INS, 2016).
- IO access should not be attempted on sites where intra-osseous access has been previously attempted. Adhere to local guidance and manufacturer's guidance
- IO access should not be attempted on the site of a fractured bone or traumatised limb and should be avoided over areas of infection or cellulitis.
- The use of I/O with patients known/suspected to have osteoporosis, osteopetrosis or osteogenesis imperfecta should be considered with caution and local policies/guidelines referred to.
- Aseptic technique should be performed for all IO access. Antisepsis of the site should be performed with chlorhexidine gluconate 2% in 70% alcohol with caution to chlorhexidine allergy. Manufacturer's guidelines should be followed (INS, 2016.)
- If the intraosseous access method is indicated, potential insertion sites include humerus, proximal or distal tibia and sternum. Choice of site and device should be determined locally and as per manufacturer's guidance, patient requirements and the HCP's training in the use of the specific IO device (ERC, 2015).
- Access devices used to obtain IO access should be considered based on local policies and procedures, individual patient need, availability of devices and the HCP's experience, knowledge and skills in undertaking the procedure with specific devices (ERC, 2015). This should include manual needle devices and semi-automatic IO devices (Weiser et al., 2012).
- Prior to infusion, IO access device placement should be confirmed by flushing 5–10ml of preservative free 0.9% sodium chloride solution (INS, 2016).
- The IO access device should be secured and the insertion site protected with a sterile dressing.
- Patients complaining of pain should be treated in line with local policies regarding the use of a slow lignocaine infusion.
- The site should be observed for complications such as extravasation/infiltration, compartment syndrome, skin necrosis and infection (INS, 2016).

- The IO needle should be removed by a practitioner with a demonstrated competency in IO management, using aseptic technique and standard precautions.
- Precautions to prevent air embolism should be employed when removing the IO needle. After removal, digital pressure should be applied and a sterile occlusive dressing. The site should be inspected regularly, as per local policy, to assess healing.
- The condition of the site and integrity of the IO needle should be determined on removal. This should be documented in the patient's records).
- If resistance is encountered on IO needle removal, the device should not be removed and the relevant HCP informed.

### 7.3 Arteriovenous fistulae, grafts and haemodialysis catheters

#### Standard

The construction or removal of an arteriovenous (AV) fistula (AVF) or AV graft (AVG) is considered to be a surgical procedure and should be undertaken by those with the necessary experience knowledge and skills to undertake the procedure (INS, 2016). [V]

The insertion of a haemodialysis catheter should be performed by a HCP, with the necessary experience knowledge and skills to undertake the procedure (INS, 2016). [V]

Administration of medicines and/or solutions through an AV fistula, graft or haemodialysis catheter will be in accordance with local policy and a valid prescription by a doctor/non-medical prescriber or via patient group direction. This however is not preferred practice due to risks of infection, sclerosis and impeded flow rates and should only be undertaken by specifically-trained personnel (RA, 2015b). [V]

Local policies and procedures should be in place for the placement and selection of AVGs (RA, 2015a). [V]

#### Guidance

- The insertion care and management of AVFs, AVGs and haemodialysis catheters should be in accordance with local policies and procedures and the HCP should have the necessary experience, knowledge and skills to insert, care for and maintain an AV fistula, graft or haemodialysis catheter and have been assessed as competent (INS, 2016).
- AV fistulae are generally the preferred form of vascular access device for adults receiving haemodialysis (NICE, 2014) due to longevity and reduced complications. An AV fistula should be first choice, AV synthetic graft second choice, tunnelled central venous catheter third choice and a non-tunnelled temporary catheter as an emergency measure (RA, 2015a).
- Catheters should only be placed as a last resort or in an emergency when other alternatives are not available (RA, 2015a).
- AV fistulae, shunts and haemodialysis catheters should not be used for routine administration of parenteral medication and/or solutions (INS, 2016).
- Aseptic technique, standard precautions and appropriate PPE should be used for all procedures relating to haemodialysis access devices in line with organisational policies and procedures (Loveday et al., 2014).
- Clinical assessment and where necessary imaging of the upper arms for potential vessel suitability should be performed (RA, 2015a).
- The AVF should be placed as distally as possible and radiocephalic and brachiocephalic AVF are preferential to brachio basilic AVF (RA, 2015a).
- Haemodynamic monitoring and venepuncture should not be performed on the extremity containing an AV fistula or graft except in an emergency and where there is no alternative.
- Tunnelled and non-tunnelled catheters should be inserted with ultra-sonographic guidance. The right internal jugular vein is recommended for catheter placement due to lower risk of complications such as venous stenosis; catheter related infection;



catheter related thrombosis and other perioperative complications. Subclavian external jugular and femoral veins should be avoided due to high risk of stenosis (RA, 2015a).

- All vascular access devices used in long-term haemodialysis should have their device monitored and maintained to minimise failure, detect complications and allow for the planning of replacement with definitive vascular access and avoid need for emergency access (RA, 2015a).
- To minimise the potential for catheter-related complications, consideration should be given to the gauge and length of the haemodialysis catheter.
- In **haemodialysis catheters** an antibiotic or antimicrobial lock solution should be considered (RA, 2015a) **but this should be in line with local policy and procedures.**
- When removing the guidewire from the catheter, or removing the needle from the fistula, techniques should be employed to reduce the potential for bleeding and promote haemostasis.
- Protocols for the removal of haemodialysis catheters should be set out in organisational policies and procedures and should be in accordance with manufacturer's guidelines.
- The optimal dwell time for a haemodialysis catheter is unknown; ongoing and frequent monitoring of the access site should be performed. Depending on the type of catheter, it will usually be removed at seven days. If it is not, it should be assessed every 24 hours thereafter until it is removed.
- The optimal dwell time for the removal of a non-tunnelled haemodialysis catheter is unknown; ongoing and frequent monitoring of the access site should be performed. Depending on the type of catheter and the clinical risk factors it will usually be removed at seven days. If it is not, it should be assessed every 24 hours thereafter until it is removed.
- The haemodialysis catheter will be removed immediately when contamination or a complication is suspected, or when therapy is discontinued (RA, 2015b).
- Radiographic confirmation should be obtained prior to the initiation of therapy.
- Caution should be used in the removal of a haemodialysis catheter, including precautions to prevent air embolism; digital pressure should be applied until haemostasis is achieved; then a sterile, occlusive dressing should be applied to the access site.
- The occlusive dressing should remain in situ for 72 hours to prevent delayed air embolism. The dressing should be assessed regularly during this time to ensure that it remains intact and effective.

Further information may be found on the Renal Association website at: [www.renal.org/guidelines/modules/vascular-access-for-haemodialysis](http://www.renal.org/guidelines/modules/vascular-access-for-haemodialysis)

# 8 Infusion therapies

## 8.1 Medication and solution administration

### Standard

The administration of medicines via a vascular access device should only be undertaken when no other route is suitable (Hallam et al., 2016). [V]

The administration of medications and solutions should be in accordance with a prescription from an authorised prescriber (NMC, 2015c; BNF, 2015).

[Regulatory/V]

Aseptic technique must be used and standard precautions adhered to in the administration of injectable medications and solutions (NPSA, 2007d; NHS Scotland, 2002). [V/Regulatory]

Where possible, the registered authorised HCP should check any medication to be given via a vascular access device with another registered authorised professional prior to administration. It should also be the registered health care professional who then administers the IV medication (NMC, 2015b). [Regulatory]

### Guidance

- A list of approved medications and solutions for each type of administration (continuous, intermittent or bolus) should be set out in organisational policies and procedures (NMC 2015b).
- The HCP should review the prescription for appropriateness for the patient's age and condition, access device, medication, dose, route of administration and rate of infusion/speed of the bolus injection (NMC, 2015b; NPSA, 2007b).
- The HCP administering medications and solutions should have knowledge of indications for therapy,

side-effects, potential adverse reactions, and the appropriate interventions required to prevent, minimise and respond to any side effects/adverse reactions (NMC, 2015b; NPSA, 2007b; NHS Scotland, 2002).

- Prior to administration of medications and solutions, the HCP should appropriately label all containers, vials and syringes; identify the patient; ensure correct date and time, verify contents, dose, rate, route, expiration date, and integrity of the medications or solution being used (NMC, 2015b).
- The HCP should explain and discuss the procedure with the patient prior to administration of medication and gain informed consent (NMC, 2015a; NMC, 2015b; The Supreme Court, 2015).
- The HCP must be certain of the identification (positive patient identification) (SHOT, 2013) and the allergy status of the patient to whom the medication/solution is to be administered and aware of the mode of action of the medication/solution, side effects and contraindications (NMC, 2015b; NPSA, 2007b).
- The HCP should make a clear accurate and immediate record of medications administered, withheld or declined (NMC, 2015b). Batch numbers should be recorded for specific medications, for example immunoglobulins. The HCP should refer to local policies and procedures.
- The HCP is accountable for evaluating and monitoring the effectiveness of prescribed therapy; documenting patient response, adverse events, and interventions; and achieving effective delivery of the prescribed therapy (NMC, 2015b).
- The HCP should report specific adverse events to the MHRA via the yellow card system as per organisational policies and procedures (MHRA, 2016b). Further advice on what should be reported can be found on the website <https://yellowcard.mhra.gov.uk> (MHRA, 2016b).
- Medicines on the consensus list of *High Risk Injectable Medicines* (IMG, 2013) should be made up in a pharmacy aseptic unit and as per local policies and procedures for high risk medicines (IMG, 2013).

- Any medications/solutions prepared in near patient areas should be infused or discarded within 24 hours (IMG, 2013; NHS Scotland, 2002).

## 8.2 Oncology and chemotherapy

### Standard

Cytotoxic drug management and administration should be provided by a multidisciplinary team in which doctors, specialist nurses and pharmacists work together to approved written protocols and provide integrated care both between hospital and community settings (including out-patient settings). [Expert consensus/V]

Administration of cytotoxic agents should be initiated upon a prescription by an appropriately qualified clinician. [Expert consensus/V]

The patient's informed consent should be obtained prior to the administration of these agents and should be documented in the patient's records (The Supreme Court, 2015). [Regulatory]

The HCP administering cytotoxic agents should have knowledge of, and technical expertise in, the administration of, specific interventions associated with cytotoxic agents, side effects and adverse reactions and safe disposal of waste and have received education and training in this area. [Consensus/V]

Aseptic technique must be used and standard precautions must be observed in the administration of injectable medications and solutions (NPSA, 2007d; NHS Scotland, 2002). [Regulatory/V]

### Guidance

- Protocols for the administration of cytotoxic agents should be set out in organisational policies and procedures (INS, 2016).
- The patient and/or caregiver should be informed of all aspects of chemotherapy including the physical and psychological effects, side-effects, risks and benefits (The Supreme Court, 2015).
- Prior to administration of chemotherapeutic agents, laboratory data and other relevant investigations should be reviewed and the patient assessed for appropriateness of the prescribed therapy by the multidisciplinary team responsible for their care.
- The HCP administering chemotherapeutic agents should have knowledge of disease processes, drug classifications, pharmacological indications, actions, side-effects, adverse reactions, method of administration (that is, intravenous bolus, intravenous infusion, and so forth), rate of delivery, treatment aim (that is, palliative or curative), drug properties (that is, vesicant, non-vesicant or irritant), mode of action of the drug and any side effects or contraindications and specific drug calculations of dose and volume relative to age, height and weight, or body surface area (NMC, 2015b; NHS Scotland, 2002).
- Handling of cytotoxic of drugs in the workplace must be in line with local policies and requires safe practice and risk assessment – for further information, please read guidance provided by the Health and Safety Executive (HSE, 2015), which is available online at [www.hse.gov.uk/healthservices/safe-use-cytotoxic-drugs.htm](http://www.hse.gov.uk/healthservices/safe-use-cytotoxic-drugs.htm)
- Electronic infusion devices should be considered for specific types of chemotherapeutic administration and for all continuous administrations.
- Where possible, a new access site/device should be initiated prior to any peripheral vesicant.
- Device, site and administration should be based on a holistic assessment of the patient's needs, clinical condition, co-morbidity, medication to be infused and patient and lifestyle preference (Hallam et al., 2016).
- Access device patency should be verified prior to the administration of each chemotherapeutic agent by aspirating the device for confirmation of blood return.
- Extravasation protocols should be set out in organisational policies and procedures and implemented when a vesicant extravasates.

- When extravasation of a vesicant agent occurs, the extremity should not be used for subsequent vascular access device placement, and alternative interventions should be explored such as discontinuation of therapy, use of the other arm, or use of a central vascular access device.
- Organisational policies and procedures for the protection of personnel and the patient should be in accordance with the Control of Substances Hazardous to Health (COSHH) 2002 guidelines (HSE, 2013b).
- All chemotherapy should preferably be prepared in a pharmacy setting (NMC, 2015b; MHRA, 2013b; NPSA, 2007b; NHS Scotland, 2002; HSE, 2013b).
- The HCP handling and mixing chemotherapeutic agents should strictly adhere to protective protocols, such as mixing under totally enclosed systems where reasonably practicable or vertical laminar flow hoods or biological safety cabinets and the wearing of appropriate PPE.
- Any medications/solutions prepared in near patient areas should be infused or discarded within 24 hours (IMG, 2013; NHS Scotland, 2002). Local guidelines and policies should be followed.
- Aseptic technique, appropriate PPE and segregation of waste should be in line with organisational policies and procedures for the administration of any cytotoxic medication.
- Pregnant women or staff planning a pregnancy should be advised of the potential risks associated with handling chemotherapeutic agents and given the opportunity to refrain from preparing or administering these agents.
- Handling of spilled products and equipment used for chemotherapeutic agents should be in line with the guidelines for hazardous waste materials (HSE, 2013b).

## 8.3 Transfusion therapy

### Standard

Organisational policies and procedures regarding all aspects of transfusion therapy should be established in accordance with national guidelines and websites for the safe, effective and appropriate use of blood (NBTC, 2014; JPAC, 2016). [V]

Informed consent of the patient or a responsible person legally authorised to act on the patient's behalf must be obtained before administering any transfusion therapy (The Supreme Court, 2015; JPAC, 2016).

[Regulatory/V]

It should be documented in the patient's medical records that the rationale, risks, benefits and any alternatives have been explained to the patient (or to the responsible person) (The Supreme Court, 2015).

[Regulatory]

Initial clinical and risk assessment should be undertaken by a suitable health care professional – to determine if a blood transfusion required for the patient is in line with NHS Patient Blood Management recommendations (JPAC, 2016). [Expert consensus/V]

If a blood transfusion is required, the HCP's checks should include assessment of the right blood, the right patient, the right time and the right place for the blood transfusion (RCN, 2013b). [V]

Positive patient identification, appropriateness of therapy and administration setting for blood and/or blood component compatibility must be verified at different stages – such as blood sampling, collection of blood from storage, delivery to the clinical area and on administration to the patient (JPAC, 2016; RCN, 2013b; BCSH, 2009). [V]

Appropriately trained, competent HCPs such as registered nurses and midwives can authorise blood component transfusions – in other words, make the clinical decision and provide the written instruction. All transfusion 'prescriptions' (written authorisation to transfuse) must include patient minimum identifiers, specify the component, dose/volume, rate of transfusion and any special requirements (JPAC, 2016; Pirie and Green, 2009). [V]

Blood components should only be administered by a registered HCP trained and competent in line with local policies and procedures (BCSH, 2009). [V]

### Guidance

- Organisations should have policies and procedures in place for the safe assessment of clinical need for blood or blood components and the administration of blood and blood components including simplification of procedures with key steps in particular patient identification (JPAC, 2016; BCSH, 2009).
- The HCP administering blood or blood components should be aware of the importance of positive patient identification at every stage of the transfusion process (BCSH, 2009).
- The HCP administering blood or blood components should have an in-depth knowledge and understanding of all aspects of transfusion therapy to ensure safe and effective delivery of care (INS, 2016; BCSH 2009) immunohaematology, blood and its components, blood grouping, administration equipment and techniques appropriate for each component, transfusion reactions, and the risks to the patient and the HCP (BCSH, 2009).
- All HCPs involved in the transfusion process should receive appropriate education and be competency assessed (RCN, 2013b).
- All HCPs involved in transfusion therapy should be aware of the dangers of transfusion-associated circulatory overload (TACO). This should involve pre-transfusion clinical assessment of the patient with particular attention to older patients (over 70 years of age) and vulnerable patients (cardiac failure, renal impairment fluid overload and hypoalbuminemia), rate of transfusion, fluid balance, regular monitoring of haemoglobin levels and prescription of diuretics (BCSH, 2012). See the BCSH website for further information, available at: [www.bcsghguidelines.com/documents/BCSH\\_Blood\\_Admin\\_-\\_addendum\\_August\\_2012.pdf](http://www.bcsghguidelines.com/documents/BCSH_Blood_Admin_-_addendum_August_2012.pdf)
- All HCPs involved in transfusion therapy should ensure that patients have an identification band or risk-assessed alternative with at least minimum identifiers (last name, first name, date of birth and unique patient number) and should be legible preferably using a computerised printed ID badge from the patient administration system (PAS). The unique identifier where possible should be the NHS number in England and Wales, the CHI number in Scotland and the HSC number in Northern Ireland. Wherever possible the patient should be asked to state their full name and date of birth (BCSH, 2009).
- All blood components have the white cells removed to minimise the potential risk of transmission of variant Creutzfeldt-Jakob disease (vCJD) (NHS Choices, 2016).
- There is no minimum or maximum size of cannula for administration of blood/blood components. The cannula size used should depend on the size of the vein and the speed at which the transfusion is to be infused (BCSH, 2009).
- Blood components must be transfused through a blood administration set with an integral mesh filter (170-200 micron pore size) (JPAC, 2016).
- Blood and blood components should be transfused using a sterile administration set designed for this procedure. For platelet concentrates a standard blood or platelet administration set should be used. Platelets must not be transfused through administration sets that have been used for other blood components. Change the administration set at least every 12 hours for a continuing transfusion and on completion of the transfusion (Norfolk, 2013).
- Blood warmers should be used as per protocol. NICE (2008) recommend that for adults undergoing elective or emergency surgery including surgery for trauma blood components should be warmed to 37°C. Information on the use of blood warmers can be found in Section 4.6 of this document.
- Infusion devices may be either gravity or electronic. These should only be used if they are safe for the purpose of blood transfusion and the manufacturer has deemed them safe and they are CE marked. The volume delivered should be monitored throughout the infusion to ensure that the expected volume is delivered and at the required rate (JPAC, 2014).

- External pressure devices can be used if there is a need to administer a unit of red cells within a few minutes. They should only be used in emergency situations alongside a large gauge venous access cannula or device. External pressure devices should ensure that pressure is exerted evenly over the entire bag; have a gauge to measure the pressure with pressure NOT exceeding 300mm Hg of pressure. External pressure devices should be monitored constantly when in use (BCSH, 2009).
- Temperature, pulse, respiratory rate and blood pressure as a minimum set of recordings should be measured and recorded before the start of each unit of blood/blood component. Temperature, pulse, respiratory rate and blood pressure (as a minimum) should be measured 15 minutes after the start of each unit of blood/blood component and when the unit is completed. The patient should be observed throughout the transfusion and additional observations – in other words, observations that form part of the national early warning score (NEWS); for example, oxygen saturation, urine output should be also recorded if indicated by the patient's condition, or according to local policy (RCN, 2013b). Further observations would also be taken if the patient becomes unwell or shows signs of a transfusion reaction (conscious patient). If the patient is unconscious, their NEWS should be taken at regular intervals during the transfusion. Transfusions should only be administered in clinical areas where patients can be readily observed by clinical staff (BCSH, 2009; RCN, 2013b).
- Document the start and finish times of each unit of blood. Record the volume of blood transfused on the patient's fluid balance record or 24 hour record. Document the fate of the blood or blood component and if it was returned to the laboratory untransfused (JPAC, 2014).
- Transfusion reactions require immediate HCP intervention. If a transfusion reaction is suspected stop the transfusion and immediately inform the doctor. If the reaction appears life-threatening, call the resuscitation team. Record the adverse event in the patient's records. Report the adverse event in accordance with local hospital policy and national reporting procedures (RCN, 2013b; BCSH, 2012). The blood and the administration set should be retained for analysis by the blood transfusion laboratory.
- Organisations should have a policy for the management and reporting of adverse events (including 'near misses') following transfusion of blood components. All adverse events related to transfusion reactions should be reported to the hospital transfusion team. Serious adverse blood reactions and events (SABRE) and near miss events should be reported to the appropriate regulatory and haemovigilance organisations (Serious Hazards of Transfusion [SHOT], see [www.shotuk.org](http://www.shotuk.org)) and the MHRA, see [www.mhra.gov.uk](http://www.mhra.gov.uk). (BCSH, 2012). Adverse events associated with licensed plasma derivatives or blood products should be reported to the UK Medicines Control Agency (BCSH, 2009).
- Red cell transfusions should be transfused over 90-120 minutes unless the patient is unable to tolerate increased blood volume and then it should be undertaken more slowly with haemodynamic monitoring. The transfusion should be completed within four hours of removal from a controlled temperature environment (BCSH, 2009).
- Fresh frozen plasma (FFP) once thawed must not be re-frozen and should be transfused as soon as possible in line with local policy. A unit of FFP is usually administered over approximately 30 minutes (equivalent to 10-20ml/kg/h) but more rapid transfusion may be appropriate in major haemorrhage situations (JPAC, 2014).
- Platelets should be administered using a standard blood administration set or a designated platelet containing a 170-200 micron filter. Platelets administration sets have a smaller priming capacity than standard blood administration sets. Platelets should not be transfused through sets that have been used for other blood components. Usual transfusion time for adults is 30-60 minutes (JPAC, 2014).
- For the administration of transfusion therapy outside a hospital, the *Framework for the Provision*

of *Blood Transfusion out of the Acute Hospital Setting* should be followed (Norfolk, 2013; BCSH, 2009).

- Drugs should not be added to any blood component pack. Whenever possible drugs should be administered between transfusions via an alternative venous access route or a separate lumen of a multi-lumen central venous catheter. If this is not possible then the transfusion should be stopped and the line flushed with 0.9% sodium chloride prior to and after administration of the drug (BCSH, 2009). Dextrose solution (5%) can cause haemolysis and must not be mixed with blood components. Calcium solutions may cause a clotting of citrated blood (Norfolk, 2013).
- On completion of the transfusion, it is not necessary to flush the remaining blood or blood component through. However, if this is done, only 0.9% sodium chloride should be used. If the patient requires another infusion then a new administration set should be used. The blood component pack and the administration set should be discarded in line with local policies and procedures as long as the transfusion was uneventful (Norfolk, 2013).
- All trusts/health care organisations involved in blood transfusion are required to ensure that *Patient Blood Management: Better Blood Transfusion* is an integral part of NHS care, to make blood transfusion safer as part of clinical governance responsibilities, avoid unnecessary use of blood and provide better information to patients and the public about blood transfusion (NBTC, 2014).
- Patient information is essential to ensure informed consent. Information sheets that outline the risks and benefits of blood transfusion can be helpful to patients. NHS information leaflets for example *Will I need a Blood Transfusion?* (NHSBT, 2016) can be obtained from the NHS Blood and Transplant website at: <http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets>

### Useful websites/further reading

Guidelines for the Blood Transfusion Services in the United Kingdom: [www.transfusionguidelines.org.uk](http://www.transfusionguidelines.org.uk)

British Blood Transfusion Society: [www.bbts.org.uk](http://www.bbts.org.uk)

British Committee for Standards in Haematology guidelines: [www.bcsbguidelines.com](http://www.bcsbguidelines.com)

Learn Blood Transfusion: [www.learnbloodtransfusion.org.uk](http://www.learnbloodtransfusion.org.uk)

NHS leaflet *Will I need a Blood Transfusion?*: <http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets>

## 8.4 Patient-controlled analgesia

### Standard

Patient-controlled analgesia (PCA) should be initiated upon the order of a clinician. **[Expert consensus/V]**

The HCP is competent in the care of patients receiving PCA. The patient and/or caregiver should be educated in the use of PCA therapy and the patient's and/or caregiver's ability to comply with procedures should be evaluated prior to, and at regular intervals during, therapy (INS, 2016). **[V]**

Medications should be obtained, administered, discarded and documented in accordance with legal requirement for controlled substances. **[Expert consensus/V]**

### Guidance

- A protocol for the use of PCA should be established in organisational policies and procedures (NPSA, 2007b), together with a protocol for 'step-down' analgesia (NHS QIS, 2004).
- The measurement of pain management outcomes should be defined in the organisational performance improvement programme. Pain should be included alongside NEWS on a regular basis in line with patient assessment (RCOA, 2016).
- The patient should be involved in the decision making process (NHS QIS, 2004).

- Patient and/or caregiver information should be clear and understandable, and appropriate to the duration of therapy (short or long term) and care setting (NHS QIS, 2004).
- This information should include the purpose of the PCA therapy, operating instructions for the device, expected outcomes, precautions and potential side-effects (RCOA, 2016).
- The appropriateness of therapy and patient's comprehension of the intended therapy should be assessed prior to initiation of therapy; whenever possible, patients should be offered the opportunity to self-manage pain by using PCA.
- Baseline data should be obtained prior to initiation of therapy and should include patient health status and pain history.
- The HCP must have knowledge of analgesic pharmacokinetics and equianalgesic dosing, contraindications, side-effects, appropriate administration modalities and anticipated outcome, and should document this information in the patient's records (NPSA, 2007b).
- Health care interventions should include continued monitoring and surveillance, evaluating the efficacy of therapy, assessing the need for changing treatment methods, monitoring for potential or actual side-effects and ongoing assessment of patient self-report of pain using a consistent pain scale. This should be documented in the patient's record (NPSA, 2007b).
- A standard drug solution should be administered via a designated single device in order to reduce the risk of user error (NPSA, 2007a). The drugs should be supplied in clearly identifiable, aseptically prepared containers (RCOA, 2016).
- Standard infection prevention precautions and an aseptic technique should be undertaken when administering any drug in line with local policies and procedures (Loveday et al., 2014).
- In order to minimise the risk of adverse outcomes, clearly defined checking procedures reflecting the competency of the HCP should be employed prior to administration of analgesia and when the syringe, solution container, or rate is changed, with special attention paid to the concentration of medication and rate of infusion (NMC, 2015c; NPSA, 2007a; NPSA, 2007b).
- An anti-siphon valve or anti-reflux valve should be used on all extension sets to reduce the risk of the drug solution siphoning into the patient (NHS QIS, 2004).
- The use of PCA infusion devices should adhere to manufacturer's guidelines.
- The HCP should be educated and competent in the preparation and use of the electronic infusion device (EID), including programming the device to deliver the prescribed therapy, administration and maintenance procedures, and the use of lock-out safety devices (MHRA, 2013b). All device users should have mandatory device training on a regular basis (RCOA, 2016).
- PCA therapy and its outcomes should be documented in the patient's records (NHS QIS, 2004).

## 8.5 Parenteral nutrition

### Standard

Patients who require parenteral nutrition should have their nutritional requirements determined by a HCP with the relevant skills and training in the prescription of parenteral nutritional support (NICE, 2006).

#### [Regulatory]

Patients should be assessed and screened for malnutrition or the risk malnutrition in both hospital and community settings by a health care professional with the appropriate skills and training (NICE, 2006).

#### [Regulatory]

Consent should be obtained prior to commencement of the administration of parenteral nutrition and should be documented in the patient's medical record. **[Expert consensus/V]**

Infusion specific filtration and an electronic infusion device only should be used during the administration of this therapy. **[Expert consensus/V]**



Administration sets used for PN should be changed when the PN has finished or 24 hours after commencement and immediately upon suspected contamination or when integrity of the product or system has been compromised (Loveday et al., 2014).

[V]

PN administration sets should be connected using an aseptic technique. [Expert consensus/V]

### Guidance

- All acute hospital trusts should have a designated inter-professional nutritional support team (NICE, 2006).
- The HCP should liaise with the designated nutritional support team on the development and implementation of the nutrition care plan (NICE, 2006).
- Patients and carers in community settings in receipt of parenteral nutrition should have a care plan in place and should have relevant training and information on the management and continued care of the regime. They should receive an instruction manual and routine and emergency contact details of an HCP with the relevant competences to assist (NICE, 2006).
- The nutritional status of the patient should be assessed prior to the commencement of parenteral nutrition and the rationale for its use identified (NICE, 2006).
- Consideration should be given to the timing of the introduction of parenteral nutrition and the duration of parenteral nutrition, due to risk factors associated with catheter related blood stream infection (CRBSI) (Casaer et al., 2011). Parenteral nutrition should only be given when enteral/oral routes are unavailable. Enteral nutrition should be commenced as soon as gut function allows (Luzzati et al., 2013).
- Parenteral nutrition should be introduced gradually and be closely monitored and should commence with no more than 50% of estimated needs for the first 24–48 hours (NICE, 2006).
- Nutritional solutions containing final concentrations exceeding 10% dextrose and/or 5% protein should be administered via a central venous catheter with tip placement in the superior vena cava (Hallam et al., 2016).
- Parenteral nutrition solutions in final concentrations of 10% dextrose or lower and/or 5% protein (nitrogen) or lower, can be administered peripherally but no longer than 1-2 days (usually 24 hours) unless concurrent supplementation with oral or enteral feeding is provided to ensure adequate nutrition and or there are no other contraindications for peripheral use.
- Product integrity should be established before using the administration set.
- The administration sets used for lipid and non-lipid containing parenteral nutrition should be replaced every 24 hours (Loveday et al., 2014).
- Parenteral nutrition solutions should be infused or discarded within 24 hours, once the administration set is attached (Medicines Complete, 2016a).
- The changing of add-on devices such as, but not limited to, extension sets, filters, stopcocks, and needle-less devices should coincide with the changing of the administration set (Loveday et al., 2014).
- Parenteral nutrition solutions should be removed from refrigeration one hour prior to infusion in order to reach approximate room temperature.
- Parenteral nutrition solutions and additives should be prepared in the pharmacy using aseptic technique under a horizontal laminar flow hood (NICE, 2006).
- Medications added to parenteral nutrition prior to administration of the solution should be assessed for compatibility (Medicines Complete, 2016a).
- Medications added to parenteral nutrition should be documented on the label that is affixed to the infusate container.
- Medications **should not** be added to the parenteral nutrition solution once it is actively infusing.

- Parenteral nutrition should be covered during administration to protect light sensitive components.
- Parenteral nutrition administration systems, whether central or peripheral, should be dedicated to those solutions (Loveday et al., 2014).
- A single lumen catheter is preferable for the administration of parenteral nutrition (Loveday et al., 2014).
- Push or piggy-back medications should not be added to these infusion systems, with the exception of lipid emulsions with verified compatibility due to risk of infection (NICE, 2006).
- The HCP should monitor the patient for signs and symptoms of metabolic-related complications and electrolyte imbalances (NICE, 2006). Specific blood tests include magnesium, phosphate and glucose. These should be undertaken daily initially and then according to clinical need. The patient requires daily fluid balance and weekly weight measurements.
- The HCP should monitor the patient for signs and symptoms of catheter-related complications, for example infection (see Section 9 of this document) (Loveday et al., 2014).
- The HCP should assess, monitor and document the patient's response to therapy in the patient's medical records (NMC, 2015a; NMC, 2015c).
- Parenteral nutrition should be withdrawn once the patient is tolerating oral or enteral nutrition and nutritional status is stable. Withdrawal should be planned and gradual, with a daily review of the patient's progress (NICE, 2006).

## 8.6 Epidural analgesia infusion

This may include continuous epidural analgesia or patient-controlled epidural analgesia.

### Standard

The epidural analgesia infusion should be initiated upon the order of a clinician. **[Expert consensus/V]**

The patient and/or caregiver should be informed of the benefits and risks of the use of epidural infusion and the patient's and/or caregiver's ability to comply with advice on the device management should be evaluated prior to, and at regular intervals during, therapy.

**[Expert consensus/V]**

Medications should be obtained, administered, discarded and documented in accordance with legal requirements for controlled substances. Special precautions should be taken in order to minimise the risk of epidural medication being incorrectly administered.

### Guidance

- A protocol for the use and management of epidural analgesia should be established in organisational policies and procedures (RCOA, 2010), together with a protocol for 'stepdown' analgesia (NHS QIS, 2004). Guidelines on the management of potential problems and adverse outcomes should also be available (NHS QIS, 2004).
- Continuous epidural analgesia should only be used in environments where this method of analgesia is frequently employed, in order to optimise expertise and safety (RCOA, 2010).
- An acute pain service should be available for advice which includes a consultant anaesthetist, pain nurse and pharmacy support. The service should ensure that appropriate documentation, regimes and audits are in place (RCOA, 2010).
- There must be 24-hour access to medical staff who are trained and competent in the management of epidurals and are immediately available to attend patients; senior anaesthetic advice and availability and a resuscitation team with a resident doctor with appropriate competencies (RCOA, 2010).
- The patient should be involved in the decision making process (RCOA, 2016).
- Patient and/or caregiver information should be appropriate to the duration of therapy (short or long term) and care setting. This information should include the purpose of the therapy, operating instructions for the device, expected outcomes,

precautions and potential side-effects (RCOA, 2010).

- The appropriateness of epidural analgesia, the environment and patient's comprehension of the intended therapy should be assessed prior to initiation of therapy; whenever possible, patients should be offered the opportunity to self manage pain by using patient-controlled epidural analgesia (PCEA).
- Baseline data should be obtained prior to initiation of therapy and should include patient health status and pain history.
- The patient must have a patent venous access device *in situ* during epidural analgesia (NHS QIS, 2004).
- The HCP must have knowledge of analgesic pharmacokinetics and equianalgesic dosing, contraindications, side-effects, appropriate administration modalities and anticipated outcome, and should document this information in the patient's medical and nursing notes.
- The practitioner should maintain continued surveillance of the patient and should document assessment and monitoring in the patient's records.
- Health care interventions should include evaluating the efficacy of therapy, assessing the need for changing treatment methods, monitoring for potential or actual side-effects and ongoing assessment of patient self-report of pain using a consistent pain scale.
- Aseptic technique should be observed during the insertion of the epidural catheter as per local policies and procedures (Loveday et al., 2014).
- The patient should be monitored for infective complications and the presence of neurological sequelae.
- Epidural analgesia catheters should be colour coded and easily identifiable (NPSA, 2007c); these should not include injection ports (NHS QIS, 2004); and an antibacterial filter should always be used (RCOA, 2004).
- The catheter should be secured so that movement of the catheter in and out of the epidural space is minimised and the dressing should facilitate inspection of the insertion site (RCOA, 2004).
- There should be protocols or guidelines that identify a restricted list of drugs and their concentrations, which can be used for epidural infusion (NPSA, 2007c). Clear labels should permit the practitioner to easily distinguish epidural infusions from other infusions (NPSA, 2007c). Specific storage for epidural solutions should be provided to separate them from other infusions (NPSA, 2007c).
- A standard drug solution should be administered via a designated single device in order to reduce the risk of user error (NPSA, 2007c).
- In order to minimise the risk of adverse outcomes, clearly defined checking procedures reflecting the competency of the practitioner/clinician should be employed prior to administration of analgesia and when the syringe, solution container, or rate is changed, with special attention paid to the concentration of medication and rate of infusion (NMC, 2015c; NPSA, 2007a; 2007c).
- The use of epidural infusion devices should adhere to manufacturer's guidelines.
- Epidural pumps should be clearly identified (NPSA, 2007c) and specifically set up for continuous epidural infusion with pre-set limits for maximum infusion rate and bolus size (RCOA, 2004). The practitioner should be educated and competent in the preparation and use of the electronic infusion device including programming the device to deliver the prescribed therapy, administration and maintenance procedures, and the use of lock-out safety devices. All device users should have mandatory device training on a regular basis (NHS QIS, 2004).
- Patients having epidural analgesia should have deep Venous Thrombus Embolism (VTE) prophylaxis adjusted, as appropriate, to minimise the risk of epidural haematoma (NHS QIS, 2004).
- Patients who have had orthopaedic or vascular surgery should be observed in order to detect the development of compartment syndromes (RCOA, 2004).

- Epidural analgesia therapy, together with any complications, should be documented in the patient's record (NPSA, 2007b) together with observations of the patency of the VAD and integrity of pressure areas.
- The epidural insertion site must be checked regularly for signs and symptoms of infection and the condition of the site documented on removal of the epidural catheter. Should any signs and symptoms of infection be present the relevant clinician should be informed.

## 8.7 Blood sampling

### Standard

Blood sampling (venepuncture, blood cultures, capillary blood sampling or via vascular access devices) should only be performed when necessary and on the request of a HCP according to established protocols.

[Expert consensus/V]

The HCP should have undertaken training and education relevant to undertaking venepuncture as per local policies and procedures and must be assessed as competent in undertaking venepuncture (NMC, 2015b).

[Regulatory]

Blood sampling should be undertaken using an aseptic technique and observing standard precautions and as per local policy and procedures.

All hazardous materials and waste must be discarded in the appropriate containers and disposed of safely according to national regulatory requirements (see also [Section 3.6](#) of this document) (RCN, 2014; DH, 2013a).

[V/Regulatory]

The patient should be positively identified and consent obtained before obtaining a blood sample (RCN, 2013b).

Blood collection tubes should be clearly labelled with patient identifiers only once the blood samples have been obtained (SHOT, 2015; RCN, 2013b; WHO, 2010a).

[V]

Safety blood collection devices, which reduce the risk of accidental sharps injury, should be used (EU Directive

Health and Safety (Sharps Instruments in Healthcare) Regulations 2013 WHO, 2010; RCN, 2013a).

[Regulatory/V]

### General guidance

- Blood collection tubes should be checked for expiration date.
- Samples should be taken in the sampling order recommended by the manufacturer.
- The amount of blood obtained for discard should be sufficient to avoid laboratory error without compromising the patient.
- Blood samples should be transported in an accepted biohazard container.
- Where appropriate, samples should be identified with a biohazard label prior to sending them to the laboratory.

### Blood sampling via direct venepuncture

- Patient consent should be obtained (The Supreme Court, 2015).
- The venepuncture site should be cleaned in line with organisational policies and procedures (for blood cultures, see [Section 8.8](#) of this document).
- Patient education, assessment and monitoring should be ongoing during the phlebotomy procedure.
- The practitioner performing venepuncture should minimise discomfort to the patient and utilise measures to reduce the fear, pain and anxiety associated with venepuncture (WHO, 2010).
- The practitioner performing venepuncture should be knowledgeable about the relevant anatomy and physiology, skin preparation and asepsis, measures to improve venous access, and be aware of the contraindications of venepuncture sites (WHO, 2010).
- The smallest possible gauge needle should be used to meet patient needs.
- Appropriate PPE should be available to all practitioners and worn during the venepuncture

procedure (see [Section 3](#) of this document) (Loveday et al., 2014; WHO, 2010).

- Blood samples should be obtained from the non-cannulated extremity; when this is not possible, the peripheral infusion should be stopped and flushed to prevent device occlusion and the venepuncture made distal to the cannula location.
- Haemostasis should be maintained at the venepuncture site after removal of the needle, and instructions should be given to the patient to report any bleeding.

### Blood sampling via access devices

- Patient consent should be obtained (The Supreme Court, 2015).
- Peripheral cannulae should not be used routinely for blood sampling due to haemolysis of the sample which may give false results (WHO, 2010). Samples can be taken at initial placement of the peripheral cannula (Dietrich, 2014; Hambleton et al., 2014).
- The access device should be cleaned according to organisational policies and procedures.
- Blood should not be drawn through an infusion administration set, as per manufacturer's guidelines.
- If the patient has an infusion in progress, the infusion should be stopped and the device flushed with 0.9% saline prior to blood sampling (INS, 2016).
- All venous access devices should be flushed with a sufficient volume of 0.9 per cent sodium chloride solution (injectable) to clear the catheter of all residual blood after blood sampling.
- Central venous access routes can be used for sampling as per local protocols and guidelines, especially if a central vascular access device bacteraemia is suspected (see also [Section 8.8](#) below). In the case of a suspected bacteraemia where a blood culture sample is required, the sample should be taken in conjunction with blood taken from a peripheral site.
- Blood samples, for example coagulation tests and

drug levels obtained from access devices, may be inaccurate.

- Samples obtained from an arterial access device should be labelled as 'arterial blood' to ensure correct reference ranges are used when interpreting blood results (Raurell-Torredà et al., 2014).

## 8.8 Blood culture

### Standard

HCPs should be aware of the signs and symptoms of bacteraemia or sepsis and act on any suspicion immediately by informing the relevant HCP in line with local policies (NICE, 2016; PHE, 2015). **[Regulatory]**

Collection of blood cultures should be taken based on clinical need (NICE, 2016; PHE, 2014; HPS, 2014; PHE, 2015) and should be taken to confirm bacteraemia and guide appropriate antimicrobial therapy (HPS, 2014). **[Regulatory]**

Blood cultures should be taken by HCPs who have been trained in the collection of blood cultures and competence has been assessed and maintained (HPS, 2014; PHE, 2015). **[Regulatory]**

HCPs should be aware of the correct policies and procedures for the indications for and the guidelines on taking of blood cultures (HPS, 2014; PHE, 2014). **[Regulatory]**

### Guidance

- Assess patient for signs and symptoms of sepsis and bacteraemia – this includes temperature, heart rate, respiratory rate, blood pressure, level of consciousness/confusion, oxygen saturation in adults with suspected sepsis or bacteraemia. Observe for any ashen or mottled appearance, cyanosis, non-blanching rash or any other breaches/rashes of the skin that could indicate sepsis or bacteraemia (NICE, 2016).
- The patient should be positively identified prior to taking blood cultures.
- All blood cultures taken should be documented in the patient's records (PHE, 2015).

- Blood cultures should be taken prior to the patient commencing antibiotics if not already started, and before the next dose if the patient is already on antibiotics (PHE, 2015).
- Blood cultures should ideally be taken from peripheral veins (PHE, 2014) but if bacteraemia is suspected, avoid existing peripheral cannulae or sites immediately above the peripheral line (PHE, 2015). If suspecting that a potential infection is linked to a central venous access device, then blood may be taken from both the central line and peripheral site with the peripheral vein sample being taken first (PHE, 2014; PHE, 2015).
- Blood culture collection should be performed after hand hygiene using an aseptic technique and the wearing of appropriate PPE (Loveday et al., 2014; HPS, 2014; PHE, 2014).
- Cleaning of the venepuncture site with chlorhexidine gluconate 2% and 70 % alcohol providing the patient has no chlorhexidine allergy (Loveday et al., 2014) should be performed and allowed to dry before blood is collected (HPS, 2014). The skin should not be re-palpated prior to needle insertion (HPS, 2014; PHE, 2014; PHE, 2015).
- Disinfect the blood culture bottle cap prior to using (ideally just before collecting the sample) with 2% chlorhexidine 70% alcohol and ensure that the cap is dry before blood is added to the bottle (HPE, 2014; PHS, 2014; PHE, 2015).
- Ideally a winged blood collection set method should be employed for blood culture collection and if other tests are required, the sample blood culture should be collected first. If a winged blood collection set not available use needle and syringe method (PHS, 2011). For more information, see *Taking Blood Cultures: Summary Best Practice* which is available at: [http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document\\_Blood\\_culture\\_FINAL\\_100826.pdf](http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document_Blood_culture_FINAL_100826.pdf)
- 20-30ml of blood should be taken for each blood culture set but see manufacturer's guidelines for maximum recommended volume for each bottle (PHE, 2014).
- Safe disposal of sharps, PPE and hand hygiene following the procedure should be undertaken as per local guidance (HPS, 2014; RCN 2013a).
- The number and frequency of blood cultures should be based on the patient's clinical condition and local policy and procedures (PHE, 2014).
- Samples should be processed as soon as possible and not refrigerated (PHE, 2014).
- Details of the rationale for taking the blood culture, date, time and the person undertaking the procedure alongside batch numbers and other blood culture set details in line with local policy and procedures should be recorded (HPS, 2014; PHE, 2014; PHE, 2015).
- Details of relevant patient history including infection and antimicrobial history and any recent foreign travel, hospitalisation or residence should be recorded on the microbiology request form.

**For further guidance and information, please see:**

NICE 2016 *Sepsis: recognition, diagnosis and early management*. Available at: [www.nice.org.uk/guidance/ng51](http://www.nice.org.uk/guidance/ng51)

*Taking blood cultures: summary of best practice*. Available at: [http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document\\_Blood\\_culture\\_FINAL\\_100826.pdf](http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document_Blood_culture_FINAL_100826.pdf)

Public Health England's *UK Standards for Microbiology Investigations*. Available at: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/372070/B\\_37i8.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/372070/B_37i8.pdf)

Health Protection Scotland's *Targeted literature review: What are the key infection prevention and control recommendations to inform a prevention of blood culture contamination quality improvement tool?* Available at: [www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/blood-culture-review-v2.pdf](http://www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/blood-culture-review-v2.pdf)

## 8.9 Other infusion therapies

Other infusion therapies included below are beyond the scope of this document. Readers should refer to local policies and guidelines for information on the use and management of other infusion therapies, which include:

- **Intravenous immunoglobulin therapy** – refer to the Primary Immunodeficiency Association’s website at [www.pia.org.uk](http://www.pia.org.uk); and the UK Primary Immunodeficiency Network (UKPIN) website at [www.ukpin.org.uk](http://www.ukpin.org.uk)
- **Intrathecal chemotherapy administration**
- **Apheresis procedures (donor/therapeutic)**
- **Intravenous conscious sedation**
- Intraventricular catheter systems such as the **Ommaya reservoir**.

# 9 Infusion-related complications

## 9.1 Phlebitis

### Standard

The HCP must be competent to assess the access site and determine the need for treatment and/or intervention in the event of phlebitis (INS, 2016). [V]

Peripheral vascular catheter insertion sites should be monitored at a minimum of each shift using a recognised Visual Infusion Phlebitis (VIP) scale for measuring degrees or severity of phlebitis (Loveday et al., 2014). [V]

Statistics on incidence, degree, cause and corrective action taken for phlebitis should be maintained and readily retrievable (Ray-Barruel et al., 2014). [II]

### Guidance

- The phlebitis scale used should be in line with local policies and procedures and should be standardised (Ray-Barruel et al., 2014) and/or adapted across the organisation depending on the device used - for example, midline/PICC. Phlebitis should be graded according to the most severe presenting indicator. An example of a VIP scale (Jackson 1998) is shown in Appendix 1.
- Each organisation should have guidelines regarding the definition, prevention and management of phlebitis. These should include appropriate device, site and vein selection, dilution of drugs and pharmacological methods.
- All vascular access sites should be routinely assessed for signs and symptoms of phlebitis (Loveday et al., 2014).
- Any incident of phlebitis should be investigated by the appropriate HCP to identify the cause and possible steps for future prevention. Removal of the

device should be in line with the phlebitis scale in use and local policy and procedures (INS, 2016).

- Any incident of phlebitis along with the intervention, treatment and corrective action, should be documented in the patient's records (NMC, 2015a).
- Organisational policies and procedures should consider calculation of phlebitis rates as a means of outcome assessment and performance improvement. The peripheral phlebitis incidence rate can be calculated according to the following formula:  $\text{number of phlebitis \% incidents} \div \text{total number of IV peripheral devices} \times 100 = \text{\% peripheral phlebitis}$ .
- The most suitable device, site and vein should be chosen to prevent phlebitis; for example, for PICC lines a proximal valve polyurethane (PVP) PICC should be used as opposed to a distal valve silicone (DVS) PICC (Ong et al., 2010).
- For peripheral catheters, closed system peripheral intravenous catheters are less likely to cause phlebitis than open system peripheral intravenous catheters (Gonzalez-Lopez et al., 2014).
- The infiltration scale should be standardised and used in documenting the infiltration; infiltration should be graded according to the most severe presenting indicator (INS, 2016; refer to [Appendix 2](#)).
- Observation of an infiltration occurrence should prompt immediate discontinuation of the infusion.
- Treatment should be dependent upon the severity of the infiltration (INS, 2016).
- Ongoing observation and assessment of the infiltrated site and any clinical outcomes should be performed as well as the presence and severity of the infiltration, and any actions performed and documented (INS, 2016).
- Organisations should monitor infiltration rates and initiate quality improvement programmes if necessary.

## 9.2 Infiltration

Infiltration is defined as the inadvertent administration of **non-vesicant** medication or solution into the surrounding subcutaneous or subdermal tissue instead of in to the intended vascular pathway.

### Standard

Any infiltration should be identified and assessed by the HCP, and appropriate interventions implemented immediately to minimise the effects of the infiltration.

[Expert consensus]

All information related to the event should be reported and documented in the patient's records (NMC, 2015a).

[Regulatory]

### Guidance

- An infiltration scale should be used to support staff to recognise and report its occurrence accurately.

## 9.3 Extravasation

Extravasation should be defined as the inadvertent administration of **vesicant** medication or solution into the surrounding subcutaneous or subdermal tissue instead of into the intended vascular pathway.

### Standard

All organisations must have a policy relating to the recognition, prevention, management and reporting of extravasation (Fidalgo et al., 2012). [V]

Precautions should be taken to avoid extravasation. Medication likely to cause extravasation injury should be given through a central line. Attention should also be given to the manufacturer's recommendations for administration of the medication (BNF, 2016a). [V]

An extravasation should be identified and assessed by the HCP and appropriate interventions/actions should be implemented to minimise the effects of the extravasation (Fidalgo et al., 2012). [V]

Extravasation should prompt immediate discontinuation of the infusion and should require immediate intervention (BNF, 2016a; MHRA, 2013b).

[Regulatory]



All information related to the event should be documented in the patient's medical and nursing records and on a clinical incident reporting system (Fidalgo et al., 2012). [V]

### Guidance

- Treatment should be dependent on the pharmaceutical manufacturer's guidelines, the properties of the extravasated agent and the severity of the extravasation (BNF, 2016a).
- If a vesicant medication has extravasated, treatment should be determined prior to catheter removal, as this may be used to remove some of the drug (BNF, 2016a).
- Ongoing observation and assessment of the extravasated site should be performed and documented in the patient's medical records (MHRA, 2013b).
- An extremity should not be used for subsequent vascular access device placement when extravasation of a vesicant agent has occurred.
- The doctor should be notified when an extravasation occurs. Specialist treatment may be required depending on the drug and the extent of the extravasation injury (BNF, 2016a).
- A critical incident form and specific extravasation documentation should be completed.
- Extravasation statistics (to include frequency, severity, and type of infusate) should be maintained within the trust and nationally using the NRLS reporting system in England (NHS England, 2016); Health Facilities Scotland (HFS, 2016); and the Northern Ireland Adverse Incident Centre (DHSSPS, 2016b).

## 9.4 Prevention and management of infusion/ device-related bloodstream infections

Catheter-related blood stream infections (CR-BSIs) are 'potentially the most dangerous complications associated with health care' (Loveday et al, 2014,). These are frequently associated with the use of IV devices and can result in secondary infections such as osteomyelitis and endocarditis.

Readers are advised to also review [Section 3](#) of this document.

### Standard

HCPs and, where appropriate, patients/carers should be educated and aware of the risks of infusion related bloodstream infections and how to prevent them occurring (Loveday et al., 2014). [V]

Organisations should have surveillance in place to monitor local rates of infusion/device related bloodstream infections. [Expert consensus/V]

HCPs and patients/carers should be aware of the signs and symptoms of blood stream infections in order to prompt investigation and action if required. [Expert consensus]

When a CR-BSI infection is suspected, blood samples, the catheter tip, the access site and the infusate (if it is suspected as a source of sepsis) should be cultured using aseptic technique and observing standard precautions (INS, 2016; Loveday et al, 2014). [V]

### Guidance

- Protocols for the prevention and management of CR-BSI and septicaemia should be set out in organisational policies and procedures (Loveday et al., 2014).
- HCPs should use recognised pre-insertion bundles/ quality improvement interventions for the insertion and maintenance of any vascular access device. This should include education of the HCP, patient and carer; general asepsis including hand hygiene and standard precautions; selection of appropriate

- device and site avoiding femoral site; maximum sterile barrier precautions during insertion; cutaneous antiseptics; catheter and catheter site care as well as general principles of replacement strategies and prompt removal (Dumyati et al., 2014; Hsu et al., 2014; Loveday et al., 2014; Marsteller et al., 2012; Munoz-Price et al., 2012).
- Consideration of the introduction of a dedicated lead nurse to standardise and facilitate good practice linked to CVADs and the prevention of CR-BSI (Thom et al., 2014; O'Connor et al., 2012).
  - When selecting the most appropriate intravascular insertion site, HCPs should assess risk of infection against the risk of mechanical complication and patient comfort (Loveday et al., 2014).
  - Avoiding the femoral site can assist in the reduction of CR-BSIs (Hsu et al., 2014).
  - Routine intranasal and or prophylactic systemic antimicrobials before or during the use of an intravascular device **should not be used** to prevent catheter colonisation or blood stream infections (Loveday et al., 2014).
  - Routine antimicrobial lock solutions **should not be used** to prevent CR-BSI (Loveday et al., 2014; NICE, 2012).
  - Routine systemic anticoagulants **should not be used** to prevent CR-BSIs. Sterile sodium chloride 0.9% should be used to flush and lock catheter lumens that are accessed on a frequent basis (Loveday et al., 2014).
  - Antimicrobial impregnated central venous access devices **should be used** for all patients whose catheter is expected to remain in place for >5 days if CR-BSI rates remain above the locally agreed benchmark despite implementation strategies to reduce CR-BSI (Loveday et al., 2014; Lai et al., 2013).
  - Consideration should be given to new intravascular devices and components and these should be monitored for any adverse reaction and increase in device related infections (Loveday et al., 2014). Any increase should be reported to the MHRA (MHRA, 2016b; MHRA, 2015a).
  - When safer sharps devices are used, HCPs should ensure that all components are compatible and secured to minimise any leaks or breaks in the system (Loveday et al., 2014; Jacob et al., 2015).
  - Standard precautions and aseptic technique should be adopted when accessing any component of the device, site or line (Loveday et al., 2014).
  - Consider the use of silver coated needless connector to reduce infection rates in CVADs (Jacob et al., 2015).
  - The use of a chlorhexidine impregnated dressing should be considered for patients with a CVAD to assist in the reduction of CR-BSI; consideration should be given to chlorhexidine allergy (Loveday et al., 2014).
  - When accessing the vascular access device, add on devices and vascular access sites aseptic technique and standard precautions should be undertaken and the device/ add on devices and site cleaned with 2% chlorhexidine gluconate in 70% alcohol, providing that the patient is not sensitive to chlorhexidine and/or the manufacturer's guidelines do not preclude the use of alcohol (advice should be sought from pharmacy/manufacturers for alternatives in these instances) (Loveday et al., 2014; NICE, 2012). The hub should be cleaned for a minimum of 15 seconds and allowed to dry (Loveday et al., 2014).
  - Consideration should be given to obtaining blood cultures through the suspected device as well as via peripheral venepuncture) (see Section 8.8 of this document for guidance on blood culture procedure).
  - When intrinsic contamination is suspected, the pharmacy, the manufacturer and the MHRA should be notified via the yellow card scheme (MHRA, 2016b; MHRA, 2015a).

## 9.5 Thrombosis

### Standard

Statistics on incidence, degree, cause and corrective action taken for thrombosis associated with vascular access should be maintained and readily retrievable.

[Expert consensus/V]

The HCP must be competent in venepuncture insertion procedures in order to prevent the risk of thrombosis (INS, 2016). [V]

The HCP must be competent to identify peripheral venous thrombosis secondary to peripheral cannulation or drug administration and the risk factors associated with this (INS, 2016). [V]

The HCP must be competent to identify central venous thrombosis secondary to central venous catheter insertion or treatments related to the access device (INS, 2016). [V]

All information relating to the event and any actions should be documented in the patient's records (NMC, 2015a). [Regulatory]

### Guidance

- Protocols for the management of thrombosis should be set out in organisational policies and procedures.
- The HCP should demonstrate knowledge of the anatomy associated with peripheral and central venous access devices (INS, 2016).
- The HCP should demonstrate knowledge of the causative factors related to the development of a thrombosis such as underlying disease, obesity, hypertension, previous history of DVT, catheter material, tip location and vesicancy and osmolarity of the medication (Maneval and Clemence, 2014).
- The HCP should be aware of the strategies to minimise the risk of peripheral and central venous thrombosis and treatment options.
- The HCP should observe for secondary effects of thrombosis; for example, pulmonary embolism, limb perfusion and report and signs symptoms immediately.

- The HCP should be aware of the increased risk of thrombosis in patients with peripherally inserted central catheters (PICCs) and give consideration to other risk factors as discussed above (causative factors) and consider alternatives if there is a high risk (Chopra et al., 2013; Maneval and Clemence, 2014). Femoral insertion of PICCs are also at higher risk of thrombosis compared to centrally inserted central venous catheters (Mitchell et al., 2013).

## 9.6 Haematoma

### Standard

Statistics on incidence, degree, cause and corrective action taken for haematoma should be maintained and readily retrievable. The HCP should be competent to assess the access site and determine the need for treatment and/or intervention in the event of haematoma. [Expert consensus/V]

### Guidance

- The organisation should have guidelines regarding the prevention of haematoma in place.
- The HCP should perform a risk assessment in order to identify individuals who may be particularly susceptible to haematoma formation, including older people and those having anticoagulation therapy.
- Strategies to minimise the risk of haematoma should be employed. These should include the use of optimal pressure to the puncture site following a failed procedure or removal of a vascular access device. The HCP should have the appropriate level of expertise for insertion of the device.
- The HCP should have knowledge of the management of haematoma including the use of pharmacological methods such as heparinoid cream (Medicines Complete, 2016b) and observing limb perfusion to avoid perfusion injury following an arterial haematoma.
- Incidence of haematoma, together with cause and its treatment, should be noted in the patient's records (NMC, 2015a), so that possible steps for future prevention can be identified.

## 9.7 Haemorrhage

### Standard

An incidence of haemorrhage should be reported as an adverse patient outcome. The practitioner must be competent to identify haemorrhage and employ appropriate strategies to minimise blood loss/arrest bleeding (Bodenham et al., 2016; Frykholm et al., 2014).

All information relating to the event should be documented in the patient's records (NMC, 2015a).

[Regulatory]

### Guidance

- All organisations must have a policy relating to the recognition, prevention, management and reporting of haemorrhage (Hunt et al., 2015).
- Assessment of the risk of haemorrhage should be made. Risk factors include, but are not limited to, the patient's health status, anticoagulant therapy and the chosen access site (Hunt et al., 2015).
- Observation of haemorrhage occurrence should prompt immediate treatment to arrest bleeding/minimise blood loss whilst adhering to standard precautions. Treatment should be dependent on the cause/site of the bleeding.
- Ongoing observation and assessment of the haemorrhage site should be performed and documented, and details of the cause and action taken should be documented in the patient's records (NMC, 2015a).

## 9.8 Air embolus

### Standard

Organisations must include clear guidance on measures to avoid air embolus when inserting, accessing, managing and removing vascular access devices in their local policies and procedures. [Expert consensus/V]

The insertion, access, management and removal of vascular access devices must be performed by a trained

HCP with the experience, knowledge and skills to perform this procedure. [Expert consensus/V]

### Guidance

- A protocol for the insertion, removal and use/access of vascular access devices should be established in organisational policies and procedures.
- An HCP with the appropriate training, experience, knowledge and skills should be responsible for the insertion and removal of venous access devices.
- HCPs caring for patients with vascular access devices should be aware of the potentially lethal complications of air embolus associated with the use of central venous catheters.
- HCPs should know how to recognise an air embolism and the action to be taken to manage air embolism.
- To avoid air embolism during PICC insertion, the patient's arm should be kept below the level of the heart.
- Central venous access devices placed in the large veins in the upper part of the body should be removed with the patient supine or in the Trendelenburg position. The catheter should be removed while the patient performs the Valsalva manoeuvre (forced expiration with the mouth closed) or following inspiration if the patient is unable to perform this technique.
- Caution should be used in the removal of vascular access devices, including precautions to prevent air embolism; gentle digital pressure should be applied to the exit site and vein entry site until haemostasis is achieved (INS, 2016) and a sterile occlusive, airtight (air-impermeable) dressing should be applied to the access site immediately on catheter removal. The dressing should be managed in line with local policies.
- Air-in-line detectors should be used to monitor for air bubbles in administration sets when delivered via an electronic infusion device.
- Air should be 'purged' from administration sets and extension tubing prior to attachment to a vascular access device.

- All equipment used with vascular access devices should have luer-locking connections, equipment with safety features designed to detect and or prevent air embolism, for example electronic infusion devices with air sensors/alarms and administration sets with eliminating filters (INS, 2016).
- The in-line clamp or an external clamp should be used to close the catheter when changing equipment; for example, end caps and administration sets (INS, 2016).
- Infusion bags and containers should not be allowed to run dry/empty during an infusion (INS, 2016).

## 9.9 Pneumothorax and haemothorax

### Standard

An incident of pneumothorax/haemothorax associated with vascular access should be reported as an adverse patient outcome (MHRA, 2015a). **[Regulatory]**

The HCP should be competent in insertion, access, management and removal of all vascular access devices, depending on their specific involvement in a specific device at a specific time (NMC 2015a).

### **[Regulatory]**

The HCP should be competent to identify pneumothorax/haemothorax and determine the need for treatment and/or intervention. **[Expert consensus/V]**

All information relating to the event should be documented in the patient's records (NMC, 2015).

### **[Regulatory]**

### Guidance

- The HCP should demonstrate knowledge of the relevant anatomy for the insertion of central venous catheters.
- Strategies to minimise the risk of pneumothorax/haemothorax should be employed including, but not limited to, choice of venous access site, optimal

patient positioning and respiratory pause and use of ultrasound imaging to aide insertion (NICE, 2002).

- Radiological determination or other recognised determination as per local guidelines of the catheter placement, following insertion, should be made and documented.
- Treatment should be dependent on the needs of the individual patient.
- Information relating to the cause, action taken and outcome of the event should be documented in the patient's record (NMC, 2015a).

## 9.10 Speed shock/fluid overload and electrolyte imbalance

### Standard

The administration of medication and/or infusion should be performed in accordance with manufacturer's recommendations and the organisation's policy/procedure in order to prevent the development of speed shock and fluid overload (NICE, 2013). **[V]**

### Guidance

- The HCP administering the medication and/or infusion should have the knowledge of the speed or rate over which to perform administration of infusions to prevent fluid overload and/or electrolyte imbalance (NICE, 2013).
- The HCP should be able to prevent the occurrence of fluid overload and/or electrolyte imbalance by following local policy and protocols and individualised patient requirements using care plans and algorithms for the administration of IV fluids – see NICE (2013) guidance, available online at: [www.nice.org.uk/guidance/cg174/chapter/1-Recommendations](http://www.nice.org.uk/guidance/cg174/chapter/1-Recommendations)
- The HCP should be able to recognise and detect the signs and symptoms of speed shock and overloading and electrolyte imbalance (NICE, 2013).

- Should either occur, the HCP must be able to act accordingly and seek medical advice immediately.

## 9.11 Cardiac tamponade

### Standard

An incidence of cardiac tamponade associated with vascular access should be reported as an adverse patient outcome. The HCP should be competent to identify the acutely ill patient following a possible tamponade and take appropriate action (NICE, 2007).

#### [Regulatory]

All information relating to the event should be documented in the patient's nursing and medical notes (NMC 2015a). **[Regulatory]**

### Guidance

- Assessment of the risk of tamponade should be carried out by a skilled professional. Risk factors include, but are not limited to, the patient's health status, anticoagulant therapy, and the procedure being performed. Tamponade is associated with central venous catheters and can occur on insertion or subsequently, particularly if the catheter is placed in the heart chambers.
- The practitioner should demonstrate knowledge of the signs and symptoms of tamponade.
- Observation of the signs and symptoms of tamponade occurrence should prompt immediate treatment to relieve cardiac compression.
- Ongoing observation and assessment of the patient should be performed and documented.
- Information relating to the cause, action taken and outcome of the event should be documented in the patient's records (NMC, 2015a).
- Incidence of tamponade, together with the cause, should be recorded so that possible steps for future prevention can be identified.

# 10 Service development

## 10.1 Commissioning

Commissioning is the process of planning, agreeing and monitoring NHS health and social care services. The planning and funding of NHS services varies across the four UK countries, with England using local commissioning to ensure services meet the needs of local populations.

The use of infusion therapies to support care delivery is integral to services provided by most NHS acute and integrated trusts. Variability occurs in community settings, however the ambition to provide more care outside of traditional hospital settings will mean that the ability to provide infusion therapy will need to be considered as part of planning future services.

The provision of specialist VAS teams to support the delivery of infusion therapy is varied across the NHS in England and devolved administrations, with inconsistency across acute and community settings. This can lead to variability in patient experience and choice, should the ability to insert and manage PICC and central lines in a timely way be constrained.

### Standard

All NHS acute service providers should consider the establishment of a Vascular Access Service (VAS) to enable health care providers to meet the requirements of national standards of care associated with VAD and patient needs. **[Expert consensus/V]**

Commissioners should work with care providers and GPs to consider the needs of local populations and the benefits of VAS services in both acute and community settings in regard to enabling the delivery of infusion therapies (such as blood transfusion, chemotherapy, OPHAT, fluid and medication administration) in a safe and cost effective way. (RCN, 2016) **[V]**

### Guidance

- The delivery of infusion therapies must consider the IPC quality requirements in order to protect patients from the risk of infection and enable care providers to meet national ambitions for mandatory indicators such as MRSA and MSSA (RCN, 2016).
- Care providers should work together to share experience, expertise and skills in infusion therapy delivery as part of planning services for local populations.
- The need for VAS in non-hospital settings should be considered and presented where required as a business case to local commissioners. An example of a business case to support development of a nurse led IV services can be found in [Appendix 6](#).

## 10.2 Outpatient and home parenteral antimicrobial therapy (OHPAT) development

OHPAT has become increasingly used as a method of outpatient or community antimicrobial therapy. Its benefits include decreased inpatient stay, reduced inpatient admissions, increased patient choice and satisfaction, and reduced health care associated infections (Chapman et al., 2012).

### Standard

The HCP should adhere to local policies and procedures for patients requiring OHPAT (Chapman et al., 2012). [V]

Patients should be able to make informed decisions in partnership with HCPs and the HCP must obtain consent (The Supreme Court, 2015; UKSC 11) when undertaking OHPAT. [Regulatory]

The HCP responsible for OHPAT should have the appropriate skills and knowledge and have undergone relevant education and training and assessed as competent in parenteral drug administration and intravascular access device selection, placement and management (Chapman et al., 2012). [V]

### Guidance

- Local policies and procedures should be followed for the development, introduction and management of OHPAT for patients. This should involve a multidisciplinary team including a medically qualified lead clinician, a antimicrobial pharmacist and a specialist HCP with expertise in parenteral drug administration and intravascular access device selection and placement.
- A clear management plan should be in place and should include **clear and robust** communication lines between the OHPAT team, GP, referring clinician and community team where appropriate.
- A specific infection related inclusion and exclusion criteria should be in place for OHPAT.
- An agreed documented OHPAT patient suitability criteria incorporating physical, social and logistic criteria should be in place and recorded for each patient.
- Initial assessment for OHPAT should be performed by a competent member of the OHPAT team.
- Patients and carers should be fully informed about the nature of OHPAT and should be given the opportunity to decline or accept.
- Risk assessment of venous thrombosis should have been undertaken and, if considered a risk in inpatient setting, should be considered for further prophylaxis during OHPAT if assessed as having ongoing risk.
- The patient's treatment plan should be agreed between the OHPAT team and the referring clinician before commencement of OHPAT.
- Treatment regimens and continuous prescription of antimicrobials should be according to local OHPAT policies and procedures.
- The HCP responsible for device, site, insertion, care and management and the reconstitution and administration of therapy must be assessed as competent in all relevant areas that they are responsible for undertaking.
- Choice of vascular access device, site, insertion, ongoing care and management should follow local

- policies and procedures and should be in line with these standards and guidance (see Sections 1-9 of this document).
- Reconstitution and administration of antimicrobials must comply with local policies and procedures standards and guidance (see Sections 1-9 of this document).
  - Training of patients or carers in the administration of intravenous medicines must comply with local policies and procedures.
  - All administered doses of intravenous antimicrobial therapy should be recorded in the patient's medical/nursing records.
  - The first dose of a new antimicrobial should be administered in a supervised setting. This may be the patient's own home, if the antimicrobial is administered by a person competent and equipped to identify and manage anaphylaxis.
  - Patients receiving in excess of one week of antimicrobial therapy should be regularly reviewed by the OHPAT team in line with local policies and procedures, Frequency and type of review determined locally.
  - Patients should have blood tests performed at least weekly if OHPAT 1 <1 month or at least twice monthly if OPAT >1 month. These should include full blood count, renal and liver function, C-reactive protein (CRP) and therapeutic drug monitoring where appropriate and as per local policies and procedures. Other tests may be required for specific indications or therapies.
  - Local policies and procedures should be in place for monitoring of clinical response to antimicrobial management, with an outline of when reviews should take place and action plans in the event of emergencies and/or urgent discussion and review of emergent clinical problems during therapy according to clinical need. There should be a clear pathway for 24 hour immediate access to advice/review/admission for OHPAT patients agreed with the referring clinician, and this should be communicated to the patient both verbally and in writing.
  - There should be audit and surveillance mechanisms in place to monitor standard outcome criteria on completion of intravenous therapy. This should include specific data on adverse drug reactions, vascular access complications, clostridium difficile-associated diarrhoea and staphylococcus aureus bacteraemia. Regular surveys of patient experience should be undertaken for OHPAT therapy.
  - OHPAT teams should be responsible for maintaining their skills knowledge and competence (Chapman et al., 2012).

### 10.3 Infusion therapy teams

Infusion therapy teams co-ordinate the assessment, insertion and maintenance of vascular access devices in line with local policies and service agreements.

#### Standard

Local service agreements, policy, procedures should be in place where infusion therapy teams exist. **[Expert consensus/V]**

Patient benefits, including patient experience, reduced waiting times and standardisation of practice, should be the drivers for the introduction of infusion therapy teams. **[Expert consensus/V]**

Where infusion therapy teams exist, the skill mix of infusion therapy teams in relation to HCPs and support workers should be locally determined, dependant on local needs and resources. **[Expert consensus/V]**

Patients should be able to make informed decisions in partnership with HCPs and the HCP must obtain consent (The Supreme Court, 2015). **[Regulatory]**

The HCP responsible for undertaking any aspect of infusion therapy – including assessment, site and device selection, insertion and maintenance – should have the appropriate skills and knowledge and have undergone relevant education and training and assessed as competent relevant to their specific area practice in infusion therapy (Chapman et al., 2012). **[V]**



## Guidance

- There should be local policy and procedures in line with safe practice for infusion therapy teams.
- Clear guidelines on the roles and responsibilities of individuals within the team as well as appropriate skill mix should be in place and based on local needs, policy and procedures.
- Infusion therapy teams should facilitate prompt, expert insertion of the most appropriate vascular access device/site by a HCP trained and competent in the procedure. Patient safety, quality and efficiency of care should be paramount.
- There should be local agreement for ongoing care and management of vascular access devices, equipment and site where infusion therapy teams are in place.
- Device and site selection, insertion, equipment, infusion therapy and care and maintenance should be undertaken in accordance with previous standards and guidance listed in previous sections of this document, and should adhere to local policies and procedures.
- All insertions and ongoing care and maintenance should be documented in the patient's records.
- Communication between HCPs involved in the patient's infusion therapy should be documented in the patient's records. This includes ongoing care and maintenance as well as insertion related communications.
- Where infusion therapy teams are in place they should liaise with local OHPAT teams, if not already part of that service.
- Where infusion therapy teams are in place, they should liaise with wards and departments to ensure that HCPs in those areas remain competent to provide appropriate infusion therapy (site/device selection, insertion and ongoing care and maintenance) in a safe and competent manner when/if the infusion therapy team are not available or not within the remit of the infusion therapy team. This will depend on local agreements and the scope, availability and practice of the infusion therapy team. Appropriate education and training should be provided and maintained in these instances, as per local policy and procedures.
- Patient feedback alongside benefits and any constraints should be recorded and used for audit and monitoring purposes, in line with local policy.
- In line with previous point, audit and surveillance should also include waiting times for appropriate line insertions, catheter related blood stream infections, inpatient stay, OHPAT numbers (where applicable) and other locally determined data.

# References

- Alexandrou E, Ramjan LM, Spencer T, Frost SA, Salamonsen Y, Davidson PM and Hillman KM (2011) The use of midline catheters in the adult acute care setting – clinical implications and recommendations for practice, *Journal of the Association for Vascular Access*, 16(1), pp.35-41. (IV)
- Asirvatham J, Moses V and Bjornson L (2013) Errors in potassium measurement: A laboratory perspective for the clinician. *N Am J med Science* Apr: 5 (4) 255-259 (V)
- Association for Perioperative Practice (2012) Accountable items, swab, instruments and needle count [online], available: [www.afpp.org.uk/filegrab/1swab-count-poster-oct-2012-a2-final-.pdf?ref=1571](http://www.afpp.org.uk/filegrab/1swab-count-poster-oct-2012-a2-final-.pdf?ref=1571) [accessed: 28 August 2016]. (V)
- Baillie J and Lankshear A (2015) Patient and family perspectives on peritoneal dialysis at home: findings from an ethnographic study, *Journal Clinical Nursing*, 24(1-2), pp.222-234. (V)
- Bayhakki A and Hatthakit U (2012) Lived experiences of patients on hemodialysis: A meta-synthesis, *Nephrology Nursing Journal*, 39 (4), pp.295-305. (IV)
- Bodenham A, Babu S, . Bennett J, Binks R, . Fee P, Fox B, Johnston A J, Klein A A, Langton JA, Mclure H and Tighe S Q M. (2016) Association of Anaesthetists of Great Britain and Ireland Safe vascular access 2016. *Anaesthesia*, 2016, 71, 573–585 (V) available: [www.aagbi.org/sites/default/files/Safe%20vascular%20access%202016.pdf](http://www.aagbi.org/sites/default/files/Safe%20vascular%20access%202016.pdf) [accessed 03 Nov 2016] (V)
- Bortolussi R, Zotti P, Conte M, Marson R, Polesel J, Colussi A, Piazza D, Tabaro G and Spazzapan S (2015) Quality of life, pain perception, and distress correlated to ultrasound-guided peripherally inserted central venous catheters in palliative care patients in a home or hospice setting, *Journal of Pain and Symptom Management*, 50(1), pp.118-123. (IV)
- British Committee for Standards in Haematology (2009) *Guideline on the administration of blood components* [online], available: [www.bcshguidelines.com/documents/Admin\\_blood\\_components\\_bcsh\\_05012010.pdf](http://www.bcshguidelines.com/documents/Admin_blood_components_bcsh_05012010.pdf) [accessed: 28 August 2016]. (V)
- British Committee for Standards in Haematology (2012) *Guideline on the administration of blood components addendum – avoidance of transfusion associated circulatory overload (TACO) and problems associated with over-transfusion* [online], available: [www.bcshguidelines.com/documents/BCSH\\_Blood\\_Admin\\_-\\_addendum\\_August\\_2012.pdf](http://www.bcshguidelines.com/documents/BCSH_Blood_Admin_-_addendum_August_2012.pdf) [accessed: 28 August 2016]. (V)
- British National Formulary (2015) *Non-medical prescribing* [online], available: [www.evidence.nhs.uk/formulary/bnf/current/non-medical-prescribing](http://www.evidence.nhs.uk/formulary/bnf/current/non-medical-prescribing) [accessed: 29 August 2016]. (V)
- British National Formulary (2016a) *Extravasation* [online], available: [www.evidence.nhs.uk/formulary/bnf/current/10-musculoskeletal-and-joint-diseases/103-drugs-for-the-treatment-of-soft-tissue-disorders-and-topical-pain-relief/extravasation](http://www.evidence.nhs.uk/formulary/bnf/current/10-musculoskeletal-and-joint-diseases/103-drugs-for-the-treatment-of-soft-tissue-disorders-and-topical-pain-relief/extravasation) [accessed: 28 August 2016]. (V)
- British National Formulary (2016b) *Hyaluronidase* [online], available: [www.evidence.nhs.uk/formulary/bnf/current/10-musculoskeletal-and-joint-diseases/103-drugs-for-the-treatment-of-soft-tissue-disorders-and-topical-pain-relief/1031-enzymes/hyaluronidase](http://www.evidence.nhs.uk/formulary/bnf/current/10-musculoskeletal-and-joint-diseases/103-drugs-for-the-treatment-of-soft-tissue-disorders-and-topical-pain-relief/1031-enzymes/hyaluronidase) [accessed: 28 August 2016]. (V)
- Casaer, M., Mesotten, D., Hermans, G., Wouters, P., Schetz, M., Meyfroidt, G., Cromphaut, S., Ingels, C., Meersseman, P., Muller, J., Vlasselaers, D., Debaveye, Y., Desmet, L., Dubois, J., Assche, A., Vanderheyden, S., Wilmer, A and Van den Berghe, G (2011) Early versus Late Parenteral Nutrition in Critically Ill Adults, *The New England Journal of Medicine*, 365(6), 506-517 (III)
- Chapman AL (2013) Outpatient parenteral antimicrobial therapy, *BMJ* (346), doi: 10.1136/bmj.f1585 [online], available: [www.bmj.com/content/346/bmj.f1585](http://www.bmj.com/content/346/bmj.f1585) [accessed: 29 August 2016]. (V)

- Chapman AL, Seaton RA, Cooper MA, Hedderwick S, Goodall V, Reed C, Sanderson F and Nathwani D (2012) Good practice recommendations for outpatient parenteral antimicrobial therapy (OPAT) in adults in the UK: a consensus statement, *Journal of Antimicrobial Chemotherapy*, 67, pp.1053-1062. (V)
- Chopra V, Anand S, Hickner A, Buist M, Rogers MA, Saint S and Flanders SA (2013) Risk of venous thromboembolism associated with peripherally inserted central catheters: A systematic review and meta-analysis, *The Lancet*, 382(9889), pp.311-325. (II)
- Combes G, Allen K, Sein K, Girling A and Lilford A (2015) Taking hospital treatments home: a mixed methods case study looking at the barriers and success factors for home dialysis treatment and the influence of a target on uptake rates. *Implementation Science*, 10(148), doi: 10.1186/s13012-015-0344-8. (IV)
- Department of Health (2005) *Mental Capacity Act 2005*, London: The Stationery Office. (Regulatory)
- Department of Health (2009) *Reference guide to consent for examination or treatment 2e*. [online], available: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/138296/dh\\_103653\\_1.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/138296/dh_103653_1.pdf) [accessed: 30 August 2016]. (Regulatory)
- Department of Health (2010) *High Impact Interventions; Taking Blood Cultures*, [online], available: [http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document\\_Blood\\_culture\\_FINAL\\_100826.pdf](http://webarchive.nationalarchives.gov.uk/20120118164404/hcai.dh.gov.uk/files/2011/03/Document_Blood_culture_FINAL_100826.pdf) [accessed 04 November 2016] (V)
- Department of Health (2013a) *Environment and Sustainability: Health Technical Memorandum 07-01 – Safe Management of Healthcare Waste* [online], available: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/167976/HTM\\_07-01\\_Final.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/167976/HTM_07-01_Final.pdf) [accessed: 30 August 2016]. (Regulatory)
- Department of Health (2016a) *Health Technical Memorandum 01-01: Management and decontamination of surgical instruments (medical devices) used in acute care Part A: Management and provision* [online], available: [www.thenbs.com/PublicationIndex/documents/details?Pub=DHEFD&DocID=315284](http://www.thenbs.com/PublicationIndex/documents/details?Pub=DHEFD&DocID=315284) [accessed: 03 November 2016]. (Regulatory)
- Department of Health (2016b) Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) [online], available: [www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs#publications](http://www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs#publications) [accessed 04 November 2016] (Regulatory)
- Department of Health (2013b) *Decontamination: Health technical memorandum 01-05: Decontamination in primary care dental practices* [online], available: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/170689/HTM\\_01-05\\_2013.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/170689/HTM_01-05_2013.pdf) [accessed: 30 August 2016]. (Regulatory)
- Department of Health Social Services and Public Safety (2016a) *Consent for examination treatment or care* [online], available: [www.dhsspsni.gov.uk/articles/consent-examination-treatment-or-care](http://www.dhsspsni.gov.uk/articles/consent-examination-treatment-or-care) [accessed: 30 August 2016]. (Regulatory)
- Department of Health (2015) *The Health and Social Care Act 2008: code of practice on the prevention and control of infections and related guidance* [online], available: [www.gov.uk/government/publications/the-health-and-social-care-act-2008-code-of-practice-on-the-prevention-and-control-of-infections-and-related-guidance](http://www.gov.uk/government/publications/the-health-and-social-care-act-2008-code-of-practice-on-the-prevention-and-control-of-infections-and-related-guidance) [accessed 04 November 2016] (Regulatory)
- Department of Health Social Services and Public Safety (2016b) Northern Ireland Adverse Incident Centre (NIAIC) [online], available: [www.health-ni.gov.uk/topics/safety-and-quality-standards/northern-ireland-adverse-incident-centre-niaic](http://www.health-ni.gov.uk/topics/safety-and-quality-standards/northern-ireland-adverse-incident-centre-niaic) [accessed: 1 September 2016]. (Regulatory)
- Dietrich H (2014) One poke or two: can intravenous catheters provide an acceptable blood sample? A data set presentation, review of previous data sets, and discussion, *Journal of Emergency Nursing*, 40(6), pp.575-578. (IV)
- Dumyati G, Concannon C, van Wijngaarden E, Love TM, Graman P, Pettis AM, Greene L, El-Daher N, Farnsworth D, Quinlan G, Karr G, Ward L, Knab R and Shelly M (2014) Sustained reduction of central line-associated bloodstream infections outside the intensive care unit with a multimodal intervention focusing on central line maintenance, *American Journal of Infection Control*, 42(7), pp.723-730. (IV)

- Electronic Medicines Compendium (2015) Lidocaine Chloride Injection BP Minijet 1% [online], available: [www.medicines.org.uk/emc/medicine/4888](http://www.medicines.org.uk/emc/medicine/4888) [accessed: 30 August 2016]. (V)
- European Agency for Safety and Health at Work (2010) *Directive 2010/32/EU – Prevention from sharp injuries in the hospital and healthcare sector* [online], available: <https://osha.europa.eu/en/legislation/directives/council-directive-2010-32-eu-prevention-from-sharp-injuries-in-the-hospital-and-healthcare-sector> [accessed: 30 August 2016]. (Regulatory)
- European Commission (2003) *Medicinal products for human use, safety, environment and information: Excipients in the label and package leaflet of medicinal products for human use* [online], available: [www.ema.europa.eu/docs/en\\_GB/document\\_library/Scientific\\_guideline/2009/09/WC500003412.pdf](http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003412.pdf) [accessed: 30 August 2016]. (Regulatory)
- European Resuscitation Council (2015) *ERC Guidelines for Resuscitation 2015* [online], available: <https://cprguidelines.eu/> [accessed: 1 September 2016]. (V)
- Farrand S and Campbell AJ (2006) Safe, simple subcutaneous fluid administration, *British Journal of Hospital Medicine*, 55(11), pp.690-692. (V)
- Fidalgo JA, Fabregat LG, Cervantes A, Marguiles A, Vidall C and Roila F (2012) Management of chemotherapy extravasion: ESMO clinical practice guidelines, *Annals of Oncology*, 23(supp. 7), pp. vii167-vii173. (V)
- Flottorp SA, Jantvedt G, Gibis B and McKee M (2010) *Using audit and feedback to health professionals to improve the quality and safety of health care*, Copenhagen: WHO. (V)
- Frykholm P, Pikwer A, Hammarskjöld F, Larsson AT, Lindgren S, Lindwall R, Taxbro K, Oberg F, Acosta S, Akesson J (2014) Clinical guidelines on central venous catheterisation. Swedish Society of Anaesthesiology and Intensive Care Medicine, *Acta Anaesthesiol Scand*, 58(5):508-24. doi: 10.1111/aas.12295. Epub 2014 Mar 5. (V)
- González López JL, Arribi Vilela A, Fernández del Palacio E, Olivares Corral J, Benedicto Marti C and Herrera Portal P (2014) Indwell times, complications and costs of open vs closed safety peripheral intravenous catheters: A randomized study, *Journal of Hospital Infection*, 86(2), pp.117-26. (III)
- Gorski LA, Hagle ME and Bierman S (2015) Intermittently delivered IV medication and pH: Reevaluating the evidence, *Journal of Infusion Nursing*, 38(1), pp. 27-46. (IV)
- Hallam, Ce, Weston, V, Denton, A, Hill, S, Bodenham, A, Dunn, H, Jackson, T (2016) Development of the UK Vessel Health and Preservation (VHP) framework: a multi-organisational collaborative. *Journal of Infection Prevention*. ISSN 1757-1774 (V)
- Hambleton VL, Gamez IA and Andreu FA (2014) Venipuncture versus peripheral catheter: Do infusions alter laboratory results? *Journal of Emergency Nursing*, 40(1), pp.20-26. (IV)
- Health and Care Professions Council (2016) *Standards of conduct, performance and ethics* [online], available: [www.hcpc-uk.org/aboutregistration/standards/standardsofconductperformanceandethics/](http://www.hcpc-uk.org/aboutregistration/standards/standardsofconductperformanceandethics/) [accessed: 1 September 2016]. (Regulatory)
- Health and Safety Executive (2013a) *Health and Safety (Sharp Instruments in Healthcare) Regulations 2013: Guidance for employers and employees* [online], available: [www.hse.gov.uk/pubns/hsis7.pdf](http://www.hse.gov.uk/pubns/hsis7.pdf) [accessed: 1 September 2016]. (Regulatory)
- Health and Safety Executive (2013b) *Control of Substances Hazardous to Health Regulations 2002. Approved code of practice and guidance (2013)*, 6th ed [online], available at [www.hse.gov.uk/pubns/books/l15.htm](http://www.hse.gov.uk/pubns/books/l15.htm) [accessed 03 Nov 2016] (Regulatory)
- Health and Safety Executive (2015) *Safe handling of cytotoxic drugs in the workplace* [online], available: [www.hse.gov.uk/healthservices/safe-use-cytotoxic-drugs.htm](http://www.hse.gov.uk/healthservices/safe-use-cytotoxic-drugs.htm) [accessed: 1 September 2016]. (Regulatory)
- Health Facilities Scotland (2016) *How to report an adverse incident* [online], available: [www.hfs.scot.nhs.uk/services/incident-reporting-and-investigation-centre-iric/how-to-report-an-adverse-incident/](http://www.hfs.scot.nhs.uk/services/incident-reporting-and-investigation-centre-iric/how-to-report-an-adverse-incident/) [accessed: 1 September 2016]. (Regulatory)

- Heath Protection Scotland (2014) *Targeted literature review: What are the key infection prevention and control recommendations to inform a prevention of blood culture contamination quality improvement tool?* [online], available: [www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/blood-culture-review-v2.pdf](http://www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/blood-culture-review-v2.pdf) [accessed: 1 September 2016]. (IV)
- Health Protection Scotland (2015) *National Infection Prevention and Control manual* [online], available: [www.nipcm.hps.scot.nhs.uk](http://www.nipcm.hps.scot.nhs.uk) [accessed: 1 September 2016]. (Regulatory)
- Heckmann JG, Lang CJG, Kindler K, Huk W, Erbguth FJ and Neundorfer B (2000) Neurologic manifestations of cerebral air embolism as a complication of central venous catheterisation, *Critical Care Medicine*, 28(5), pp.1621-1625. (III)
- Hsu Y, Weeks K, Yang T, Sawyer MD and Marsteller JA (2014) Impact of self-reported guideline compliance: Bloodstream infection prevention in a national collaborative, *American Journal of Infection Control*, 42(Supplement), pp.S191-S196. (IV)
- Hunt BJ, Allard S, Keeling D, Norfolk D, Stanworth SJ and Pendry K (2015) A practical guideline for the haematological management of major haemorrhage, *British Journal of Haematology*, (170), pp.788-803. (V)
- Hypodermoclysis Working Group (1998) *Hypodermoclysis Guidelines on the technique*, CP Pharmaceuticals Ltd, Wrexham.
- Injectable Medicine Guide (2013) *Use of the Injectable Medicine Guide website in clinical areas – IntraVENOUS medicine monographs* [online], available: <http://medusa.wales.nhs.uk/docs/Use%20of%20IV%20monographs%20in%20clinical%20areas%20January%202013.pdf> [accessed: 1 September 2016]. (V)
- Infusion Nurses Society (2016) Infusion therapy standards of practice, *Journal of Infusion Nursing*, 39(1S), available: INS Digital Press. (V)
- Jacob JT, Tejedor SC, Reyes MD, Lu X, Easley KA, Aurand WL, Garrett G, Graham K, Holder C, Robichaux C and Steinberg JP (2015) Comparison of a silver-coated needleless connector and a standard needleless connector for the prevention of central line-associated bloodstream infections, *Infection Control & Hospital Epidemiology*, 36 (3), pp.294-301. (IV)
- Jackson A (1998) Infection control: a battle in vein infusion phlebitis, *Nursing Times*, 94(4), pp.68-71. (V)
- Jansen D, Rijken M, Heijmans M and Boeschoten EW (2010) Perceived autonomy and self-esteem in Dutch dialysis patients: The importance of illness and treatment perceptions, *Psychology & Health*, 25(6), pp.733-749. (V)
- Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (JPAC) (2014) *Transfusion Handbook*, [online], available: [www.transfusionguidelines.org/transfusion-handbook](http://www.transfusionguidelines.org/transfusion-handbook) [accessed 08 November 2016] (V)
- Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (JPAC) (2016) *Safe transfusion: Right blood, right patient, right time and right place* [online], available: <http://transfusionguidelines.org.uk/transfusion-handbook/4-safe-transfusion-right-blood-right-patient-right-time-and-right-place/4-10-administration-to-the-patient> [accessed: 1 September 2016]. (V)
- Ker K, Tansley G, Beecher D, Perner A, Shakur H, Harris T and Roberts I (2015) Comparison of routes for achieving parenteral access with a focus on the management of patients with Ebola virus disease, *The Cochrane Database Of Systematic Reviews*, (2) CD011386, doi: 10.1002/14651858. (I)
- Lai NM, Chaiyakunapruk N, Lai NA, O’Riordan E, Pau WS and Saint S (2013) Catheter impregnation, coating or bonding for reducing central venous catheter-related infections in adults, *The Cochrane database of systematic reviews*, (6) CD007878, doi: 10.1002/14651858. (I)

- Lamperti, M., Bodenham, A. R., Pittiruti, M., Blaivas, M., Augoustides, J. G., Elbarbary, M., Pirotte, T., Karakitsos, D., LeDonne, J., & Doniger, S. (2012). International evidence-based recommendations on ultrasound-guided vascular access, *Intensive care medicine* 38(7), 1105–1117. (V)
- Leidel M, Bodenham AR, Pittiruti M, Blaivas M, Augoustides JG, Elbarbary M, Pirotte T, Karakitsos D, Ledonne J, Doniger S, Scoppettuolo G, Feller-Kopman D, Schummer W, Biffi R, Desruennes E, Melniker LA and Verghese ST (2012) International evidence-based recommendations on ultrasound-guided vascular access, *Intensive Care Medicine*, 38(7), pp.1105-1117. (IV)
- Loveday HP, Wilson JA, Pratt RJ, Golsorkhi M, Tingle A, Bak A, Browne J, Prieto J and Wilcox M (2014) Epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England, *Journal of Hospital Infection*, 86(Supp.1), pp. S1-S70. (V)
- Luzzati R, Cavinato S, Giangreco M, Granà G, Centonze S, Deiana, ML, Biolo G and Barbone F (2013) Peripheral and total parenteral nutrition as the strongest risk factors for nosocomial candidemia in elderly patients: A matched case-control study, *Mycoses*, 56(6), pp.664-671. (IV)
- Maneval RE and Clemence BJ (2014) Risk factors associated with catheter-related upper extremity deep vein thrombosis in patients with peripherally inserted central venous catheters: A prospective observational cohort study: Part 2, *Journal of Infusion Nursing*, 37(4), pp.260-268. (IV)
- Marsteller JA, Bryan Sexton J, Hsu YJ, Hsiao CJ, Holzmueller CG, Pronovost PJ and Thompson DA (2012) A multicenter, phased, clusterrandomized controlled trial to reduce central line-associated bloodstream infections in intensive care units, *Critical Care Medicine*, 40(11), pp.2933-2939. (III)
- Medicines and Healthcare Products Regulatory Agency (2010) *Medical Device Alert: MDA/2010/073* [online], available: <https://assets.digital.cabinet-office.gov.uk/media/5485ac2eed915d4c1000029b/con094007.pdf> [accessed: 1 September 2016]. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2012a) *Medicines and medical devices regulation: what you need to know*, London: MHRA. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2012b) *All medical devices and medicinal products containing chlorhexidine – Risk of anaphylactic reaction due to chlorhexidine allergy* [online], available: [www.gov.uk/drug-device-alerts/medical-device-alert-all-medical-devices-and-medicinal-products-containing-chlorhexidine-risk-of-anaphylactic-reaction-due-to-chlorhexidine-allergy](http://www.gov.uk/drug-device-alerts/medical-device-alert-all-medical-devices-and-medicinal-products-containing-chlorhexidine-risk-of-anaphylactic-reaction-due-to-chlorhexidine-allergy) [accessed: 1 September 2016]. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2013a) *Single-use medical devices: implications and consequences of reuse*, London: MHRA. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2013b) *Infusion systems*, London: MHRA. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2014) *Devices in practice: Checklists for using medical devices*, London: MHRA. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2015a) *Adverse drug reporting* [online], available: <https://yellowcard.mhra.gov.uk/> [accessed: 1 September 2016]. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2015b) *Managing medical devices: Guidance for healthcare and social services organisations*, London: MHRA. (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2016a) *A guide to what is a medical product*, London: MHRA (Regulatory)
- Medicines and Healthcare Products Regulatory Agency (2016b) *Yellow card* [online], available: <https://yellowcard.mhra.gov.uk/> [accessed: 1 September 2016]. (Regulatory)
- Medicines Complete (2016a) *Guidance on intravenous additives* [online], available: [www.medicinescomplete.com/mc/bnf/current/PHP107736-guidance-on-intravenous-infusions.htm](http://www.medicinescomplete.com/mc/bnf/current/PHP107736-guidance-on-intravenous-infusions.htm) [accessed: 1 September 2016]. (V)

- Medicines Complete (2016 b) *Heparinoid cream* [online], available: [www.medicinescomplete.com/mc/bnf/current/DMD3158411000001101.htm?q=Hirudoid&t=search&ss=text&p=1#DMD3158411000001101](http://www.medicinescomplete.com/mc/bnf/current/DMD3158411000001101.htm?q=Hirudoid&t=search&ss=text&p=1#DMD3158411000001101) [accessed: 1 September 2016]. (V)
- Mitchell MD, Agarwal R, Hecht TE and Umscheid CE (2013) Nonpharmacologic interventions for prevention of catheter-related thrombosis: A systematic review, *Journal of Critical Care*, 28(3), pp.316.e9-.e16. (I)
- Monaro S, Steward G and Gullick J (2014) A 'lost life': coming to terms with haemodialysis, *Journal of Clinical Nursing*, 23(21-22), pp.3262-3273. (V)
- Moureau N and Flynn J (2015) Disinfection of needleless connector hubs: Clinical evidence systematic review, *Nursing Research in Practice* [online], available: [www.hindawi.com/journals/nrp/2015/796762/](http://www.hindawi.com/journals/nrp/2015/796762/) [accessed: 4 June 2016]. (II)
- Munoz-Price LS, Dezfulian C, Wyckoff M, Lenchus JD, Rosalsky M, Birnbach DJ and Arheart KL (2012) Effectiveness of stepwise interventions targeted to decrease central catheter-associated bloodstream infections, *Critical Care Medicine*, 40(5), pp.1464-1469. (IV)
- Mustafa RA, Zimmerman D, Rioux JP, Suri RS, Gangji A, Steele A, MacRae J, Pauly RP, Perkins DN, Chan CT, Copland M, Comenda P, MacFarlane PA, Lindsay R, Pierratos A and Nesrallah GE (2013) Vascular access for intensive maintenance hemodialysis: a systematic review for a Canadian Society of Nephrology clinical practice guideline, *American Journal Of Kidney Diseases: The Official Journal Of The National Kidney Foundation*, 62(1), pp.112-131. (II)
- National Blood Transfusion Committee (2014) *Patient blood management: An evidence-based approach to patient care* [online], available: [www.transfusionguidelines.org/uk-transfusion-committees/national-blood-transfusion-committee/patient-blood-management](http://www.transfusionguidelines.org/uk-transfusion-committees/national-blood-transfusion-committee/patient-blood-management) [accessed: 1 September 2016]. (V)
- National Institute for Health and Care Excellence (2006) *Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition*, CG32, London: NICE (Regulatory)
- National Institute for Health and Care Excellence (2007) *Quick reference guide. Acutely ill patients in hospital: recognition of and response to acute illness in adults in hospital*, CG50, London: NICE. (Regulatory)
- National Institute for Health and Care Excellence (2012) *Healthcare-associated infections: prevention and control in primary and community care* [online], available: [www.nice.org.uk/guidance/cg139/chapter/1-Guidance#vascular-access-devices](http://www.nice.org.uk/guidance/cg139/chapter/1-Guidance#vascular-access-devices) [accessed: 1 September 2016]. (Regulatory)
- National Institute for Health and Care Excellence (2013) *CG174: Intravenous fluid therapy in adults in hospital* [online], available: [www.nice.org.uk/guidance/cg174?unlid=7240841622016876654](http://www.nice.org.uk/guidance/cg174?unlid=7240841622016876654) [accessed: 1 September 2016]. (Regulatory)
- National Institute for Health and Care Excellence (2014) *Renal replacement therapy services for adults* [online], available: [www.nice.org.uk/guidance/qs72/chapter/quality-statement-4-dialysis-access-preparation](http://www.nice.org.uk/guidance/qs72/chapter/quality-statement-4-dialysis-access-preparation) [accessed: 1 September 2016]. (Regulatory).
- National Institute for Health and Care Excellence (2016) *Sepsis: recognition, diagnosis and early management* [online], available: [www.nice.org.uk/guidance/ng51](http://www.nice.org.uk/guidance/ng51) [accessed: 1 September 2016]. (Regulatory)
- National Patient Safety Agency (2007a) *Improving infusion device safety*, London: NPSA. (V)
- National Patient Safety Agency (2007b) *Injectable medicines competence 4: Monitoring the administration of injectable medicines*, London: NPSA. (V)
- National Patient Safety Agency (2007c) *Safer practice with epidural injections and infusions*, London: NPSA. (V) available: [www.nrls.npsa.nhs.uk/resources/?EntryId45=59807](http://www.nrls.npsa.nhs.uk/resources/?EntryId45=59807)
- National Patient Safety Agency (2007d) *Promoting safer use of injectable medicines*, London: NPSA. (V)
- NHS Blood and Transplant (2016) *Patient information leaflets* [online] available: <http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/> [accessed: 1 September 2016]. (V)
- NHS Choices (2016) *Preventing Creutzfeldt-Jakob disease (CJD)* [online], available: [www.nhs.uk/conditions/creutzfeldt-jakob-disease/Pages/Prevention.aspx](http://www.nhs.uk/conditions/creutzfeldt-jakob-disease/Pages/Prevention.aspx) [accessed: 1 September 2016]. (V)

- NHS England (2015a) *Patient Safety Alert – Stage One: Warning Risk of death or severe harm due to inadvertent injection of skin preparation solution* [online], available: [www.england.nhs.uk/wp-content/uploads/2015/05/psa-skin-prep-solutions-may15.pdf](http://www.england.nhs.uk/wp-content/uploads/2015/05/psa-skin-prep-solutions-may15.pdf) [accessed: 1 September 2016]. (Regulatory)
- NHS England (2015b) *Revised never events policy and framework* [online], available: [www.england.nhs.uk/patientsafety/wp-content/uploads/sites/32/2015/04/never-evnts-pol-framwrk-apr2.pdf](http://www.england.nhs.uk/patientsafety/wp-content/uploads/sites/32/2015/04/never-evnts-pol-framwrk-apr2.pdf) [accessed: 1 September 2016]. (Regulatory)
- NHS England (2016) *NHS Outcomes Framework – Domain 5: Treating and caring for people in a safe environment and protecting them from avoidable harm* [online], available: [www.england.nhs.uk/resources/resources-for-ccgs/out-frwrk/dom-5/](http://www.england.nhs.uk/resources/resources-for-ccgs/out-frwrk/dom-5/) [accessed: 2 September 2016]. (Regulatory)
- NHS Quality Improvement Scotland (2004) *Postoperative pain management – best practice statement*, Edinburgh: NHS QIS. (III)
- NHS Scotland (2002) *Good practice statement for the preparation of injections in near-patient areas, including clinical and home environments*, Edinburgh: The Stationery Office. (Regulatory)
- Nicholson J and Davies L (2013) Patients' experiences of the PICC insertion procedure, *British Journal of Nursing* 22(14): S16-S23. (V)
- Norfolk D (Ed.) (2013) *Handbook of Transfusion Medicine* [online], available: [www.transfusionguidelines.org.uk/transfusion-handbook](http://www.transfusionguidelines.org.uk/transfusion-handbook) [accessed: 1 September 2016]. (V)
- Nursing and Midwifery Council (2015a) *The Code: Professional standards of practice and behaviour for nurses and midwives*, London: NMC. (Regulatory)
- Nursing and Midwifery Council (2015b) *Revalidation*, London: NMC. (Regulatory)
- Nursing and Midwifery Council (2015c) *Standards for medicines management*, London, NMC. (Regulatory)
- O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, Lipsett PA, Masur H, Mermel LA, Pearson ML, Raad II, Randolph AG, Rupp ME and Saint S (2011) *Guidelines for the prevention of intravascular catheter-related infections*, Centers for Disease Control and Prevention [online], available: [www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf](http://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf) [accessed: 1 September 2016]. (V)
- O'Horo JC, Maki DG, Krupp AE and Safdar N (2014) Arterial catheters as a source of bloodstream infection: A systematic review and meta-analysis, *Critical Care Medicine*, 42(6), pp.1334-1339. (II)
- Ong CK, Venkatesh SK, Lau GB and Wang SC (2010) Prospective randomized comparative evaluation of proximal valve polyurethane and distal valve silicone peripherally inserted central catheters, *Journal of Vascular and Interventional Radiology*, 21(8), pp.1191-1196. (III)
- Pirie E and Green J (2009) *A framework to support nurses and midwives making the clinical decision and providing the written instruction for blood component transfusion* [online]. Available: [www.transfusionguidelines.org.uk](http://www.transfusionguidelines.org.uk) [accessed 03 November 2016] (v)
- Parianti J, Mongardon N, BMégarbane B, Mira J, Kalfon P, Gros A, Marqué S, Thuong M, Pottier V, Ramakers M, Savary B, Seguin A, Valette X, Terzi N, Sauneuf B, Cattoir V, Mermel LA, and du Cheyron D (2015) Intravascular Complications of Central Venous Catheterization by Insertion Site, *New England Journal of Medicine*, (373), pp.1220-1229.
- Public Health England (2014) *Eye of the needle: United Kingdom surveillance of significant occupational exposures to blood borne viruses in healthcare workers* [online], available: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/385300/EoN\\_2014\\_-\\_FINAL\\_CT\\_3\\_sig\\_occ.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/385300/EoN_2014_-_FINAL_CT_3_sig_occ.pdf) [accessed: 1 September 2016]. (Regulatory)
- Public Health England (2015) *Start Smart – Then Focus Antimicrobial Stewardship Toolkit for English Hospitals*, [online], available: [www.gov.uk/government/publications/antimicrobial-stewardship-start-smart-then-focus](http://www.gov.uk/government/publications/antimicrobial-stewardship-start-smart-then-focus) [accessed 07 November 2016] (Regulatory)



- Raurell-Torreda, M., del Llano- Serrano, C., Almirall-Solsona, D and Nicolas-Asfelis, J (2014) Arterial Catheter setup for glucose control in critically ill patients: A randomised controlled trial, *American Journal of Critical Care*, 23(2), p.150-9. (III)
- Ray-Barruel G, Polit DF, Murfield JE and Rickard CM (2014) Infusion phlebitis assessment measures: A systematic review, *Journal of Evaluation in Clinical Practice*, 20(2), pp.191- 202. (II)
- Ream, E., Tsianakas, V., Verity, R., Oakley, C., Murrells, T., Robert, G and Richardson, A (2013) *Enhancing the role of carers in the outpatient chemotherapy setting: a participatory action research project*, [online], available: [www.dimblebycancer.org/wp-content/uploads/2013/09/Dimbleby](http://www.dimblebycancer.org/wp-content/uploads/2013/09/Dimbleby) [accessed 04 November 2016] (V)
- Renal Association (2015a) *Summary of audit measures recommended for dialysis access for adults with end stage kidney disease* [online], available: [www.renal.org/guidelines/modules/vascular-access-for-haemodialysis#sthash.MsYoKEmh.dpbsicaotion](http://www.renal.org/guidelines/modules/vascular-access-for-haemodialysis#sthash.MsYoKEmh.dpbsicaotion) [accessed: 2 September 2016]. (V)
- Renal Association (2015b) *Vascular Access for Haemodialysis*, [online], available: [www.renal.org/guidelines/modules/vascular-access-for-haemodialysis#sthash.aVJF7o3D.dpbs](http://www.renal.org/guidelines/modules/vascular-access-for-haemodialysis#sthash.aVJF7o3D.dpbs) [accessed 8 November 2016] (V)
- Rickard CM, Webster J, Wallis MC, Marsh N, McGrail MR, French V, Foster L, Gallagher P, Gowardman JR, Zhang L, McClymont A and Whitby M (2012) Routine versus clinically indicated replacement of peripheral intravenous catheters: A randomised controlled equivalence trial, *The Lancet*, 380(9847), pp.1066-1074. (III)
- Royal College of Anaesthetists (2004) *Good practice in the management of continuous epidural analgesia in the hospital setting*, London: RCA. (III)
- Royal College of Anaesthetists (2010) *Best Practice in the management of epidural analgesia in the hospital setting*, London: RCOA. (V)
- Royal College of Anaesthetists (2016) *Anaesthesia services for acute pain management*, [online], available: [www.rcoa.ac.uk/document-store/guidance-the-provision-of-anaesthesia-services-acute-pain-services-2016](http://www.rcoa.ac.uk/document-store/guidance-the-provision-of-anaesthesia-services-acute-pain-services-2016) [accessed 04 November 2011] (V)
- Royal College of Nursing (2012a) *Essential practice for infection prevention and control: Guidance for nursing staff*, London: RCN. (V)
- Royal College of Nursing (2012b) *Tools of the Trade*, RCN, London (V)
- Royal College of Nursing (2013a) *Sharps Safety*, London: RCN. (V)
- Royal College of Nursing (2013b) *Right blood, right patient, right time*, London: RCN. (V)
- Royal College of Nursing (2014) *The management of waste from health, social and personal care*, London: RCN. (V)
- Royal College of Nursing (2015) *Accountability and delegation*, London: RCN. (V)
- Royal College of Nursing (2016) *Infection prevention and Control Commissioning Toolkit*, London ; RCN. (V)
- Serious Hazards of Transfusion (2013) *Lessons for Clinical Transfusion Staff*, London: SHOT. (V)
- Serious Hazards of Transfusion (2015) *Annual SHOT report 2015*, Manchester: SHOT. (V)
- Stephens B (2013) Patients' experiences of community IV therapy, *British Journal of Nursing*, 22(19), pp. S24-S29. (V)
- The Supreme Court (2015) *Judgement: Montgomery (Appellant) v Lanarkshire Health Board (Respondent) (Scotland)* [online], available: [www.supremecourt.uk/cases/docs/uksc-2013-0136-judgment.pdf](http://www.supremecourt.uk/cases/docs/uksc-2013-0136-judgment.pdf) [accessed: 1 September 2016]. (Regulatory)
- Thom KA, Li S, Custer M, Preas MA, Rew CD, Cafeo C, Leekha S, Caffo BS, Scalea TM and Lissauer ME (2014) Successful implementation of a unit-based quality nurse to reduce central line-associated bloodstream infections, *American Journal of Infection Control*, 42(2), pp.139-143. (IV)

Timsit JF, Mimos O, Mourvillier B, Souweine B, Garrouste-Orgeas M, Alfandari S, Plantefeve G, Bronchard R, Troche G, Gauzit R, Antona M, Canet E, Bohe J, Lepape A, Vesin A, Arrault X, Schwebel C, Adrie C, Zahar JR, Ruckly S, Tournegros C and Lucet JC (2012) Randomized controlled trial of chlorhexidine dressing and highly adhesive dressing for preventing catheter-related infections in critically ill adults, *American Journal of Respiratory and Critical Care Medicine*, 186(12), pp.1272-1278. (III)

UK Primary Immunodeficiency Network (2015) *Immunoglobulin product choice for patients with primary immunodeficiency* [online], available: [www.ukpin.org.uk/resources](http://www.ukpin.org.uk/resources) [accessed: 1 September 2016]. (V)

Ullman AJ, Cooke ML, Gillies D, Marsh NM, Daud A, McGrail MR, O’Riordan E and Rickard CM (2013) Optimal timing for intravascular administration set replacement, *The Cochrane database of Systematic Reviews*, 9:CD003588. (I)

Ullman AJ, Cooke ML, Mitchell M, Lin F, New K, Long DA, Mihala G and Rickard CM (2015) Dressings and securement devices for central venous catheters (CVC) (Review), *The Cochrane Database of Systematic Reviews*, (9) CD010367, doi: 10.1002/14651858. (I)

Weiser G, Hoffmann Y, Galbraith R and Shavit I (2012) Current advances in intraosseous infusion – A systematic review, *Resuscitation*, 83(1), pp.20-26. (II)

Weiss K and Tofich D (2011) Blood transfusion: The patient’s experience, *American Journal of Nursing*, 111(9), pp.24-30. (V)

World Health Organization (2010) *WHO Guidelines on drawing blood: best practices in phlebotomy*, Geneva: WHO. (V)

# Appendix 1: Phlebitis scale

## Policy statement

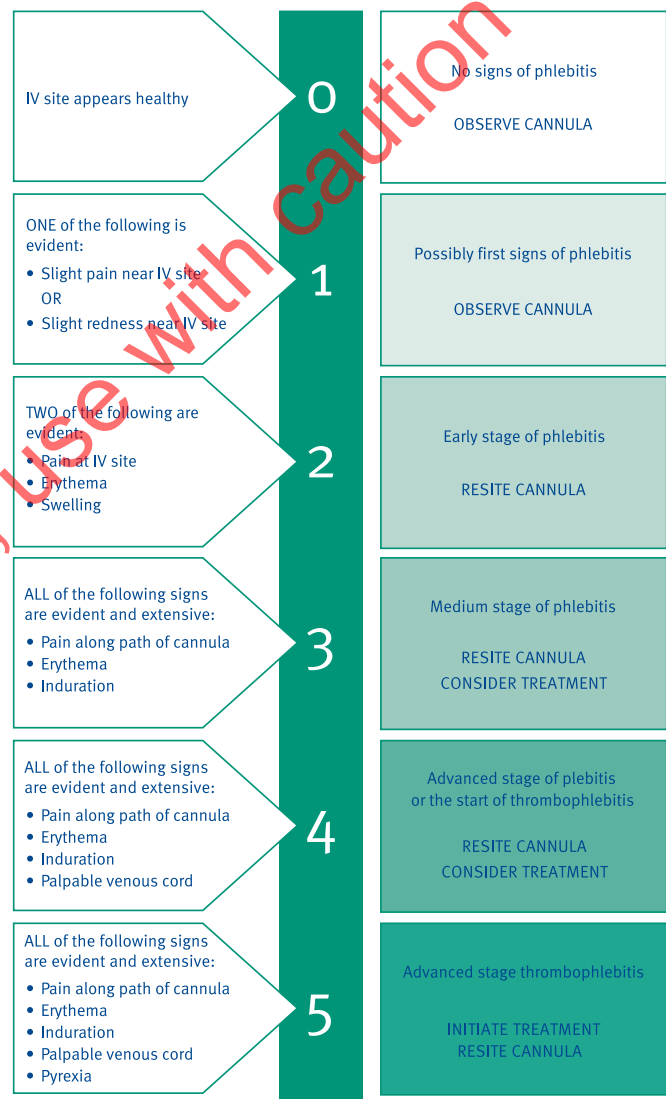
All patients with an intravenous peripheral access device in place, must have the IV site checked at least daily for signs of infusion phlebitis. The subsequent score and action(s) taken (if any) must be documented.

The cannula site must also be observed when:

- bolus injections are administered
- IV flow rates are checked or altered
- solution containers are changed.

The incidence of infusion phlebitis varies, the following good practice points may assist in reducing the incidence of infusion phlebitis:

- observe cannula site at least daily
- secure cannula with a proven intravenous dressing
- replace loose, contaminated dressings
- cannula must be inserted away from joints whenever possible
- aseptic technique must be followed
- plan and document continuing care
- use the smallest gauge cannula most suitable for the patient's need
- replace the cannula at the first indication of infusion phlebitis (stage 2 on the VIP Score).



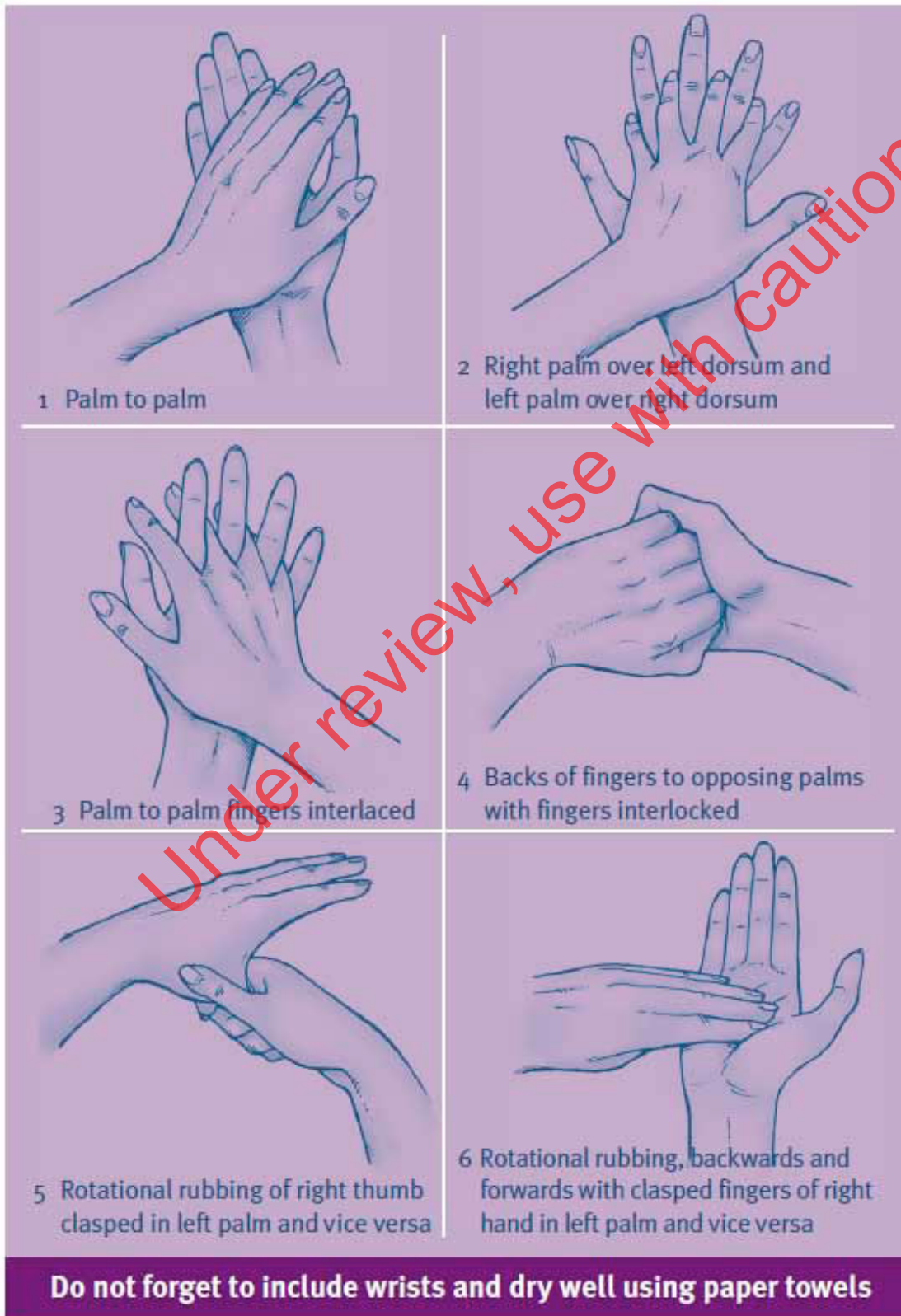
(Jackson, 1998)

## Appendix 2: Infiltration scale

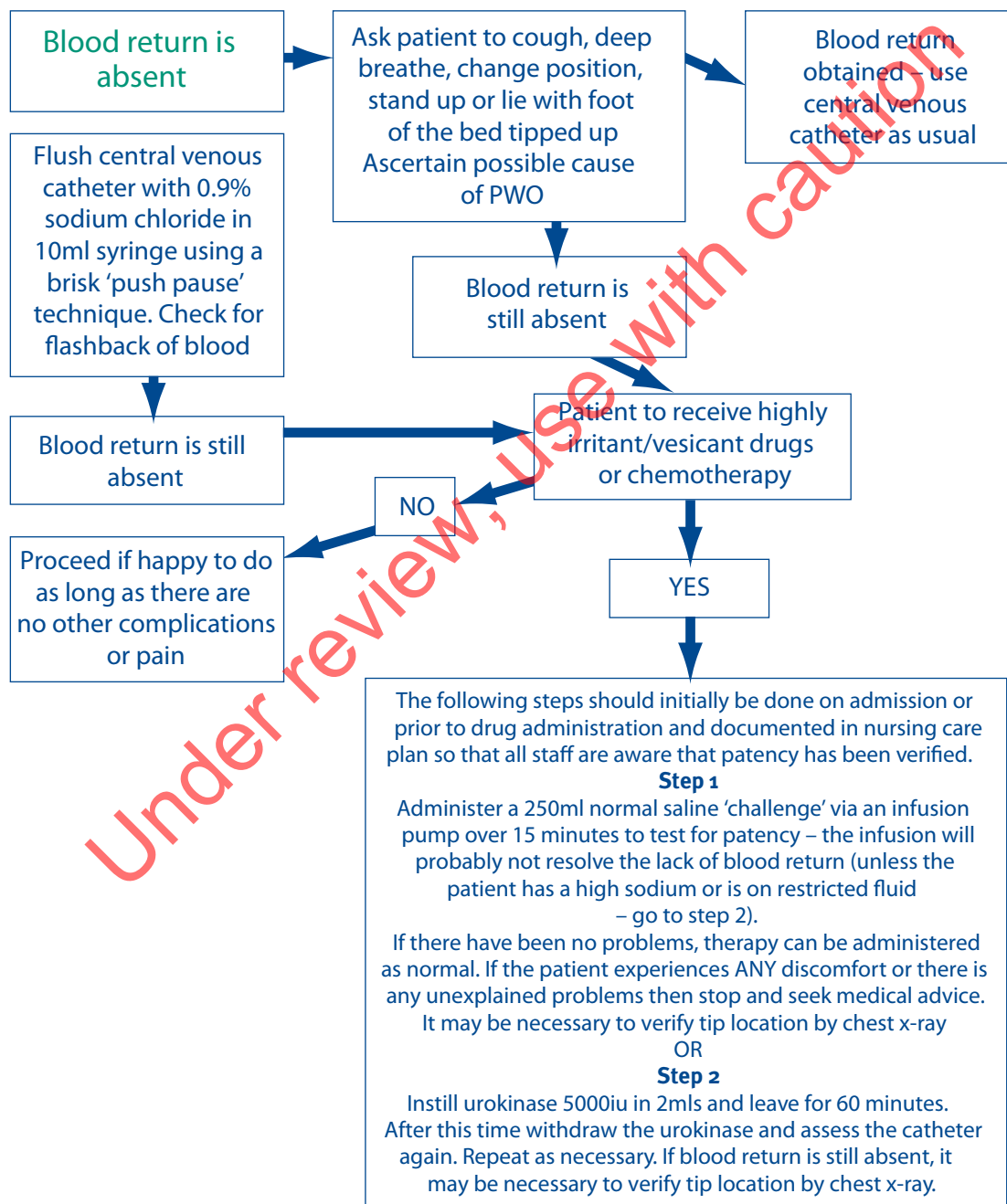
Grade	Clinical criteria
0	<ul style="list-style-type: none"> <li>No symptoms</li> </ul>
1	<ul style="list-style-type: none"> <li>Skin blanched</li> <li>Oedema &lt;1 inch (2.5cm) in any direction</li> <li>Cool to touch</li> <li>With or without pain</li> </ul>
2	<ul style="list-style-type: none"> <li>Skin blanched</li> <li>Oedema 1-6 inches (2.5cm-15cm) in any direction</li> <li>Cool to touch</li> <li>With or without pain</li> </ul>
3	<ul style="list-style-type: none"> <li>Skin blanched, translucent</li> <li>Gross oedema &gt;6 inches (15cm) in any direction</li> <li>Cool to touch</li> <li>Mild to moderate pain</li> <li>Possible numbness</li> </ul>
4	<ul style="list-style-type: none"> <li>Skin blanched, translucent</li> <li>Skin tight, leaking</li> <li>Skin discoloured, bruised, swollen</li> <li>Gross oedema &gt;6 inches (15 cm) in any direction</li> <li>Deep pitting tissue oedema</li> <li>Circulatory impairment</li> <li>Moderate to severe pain</li> <li>Infiltration of any amount of blood product, irritant, or vesicant</li> </ul>

(INS, 2006)

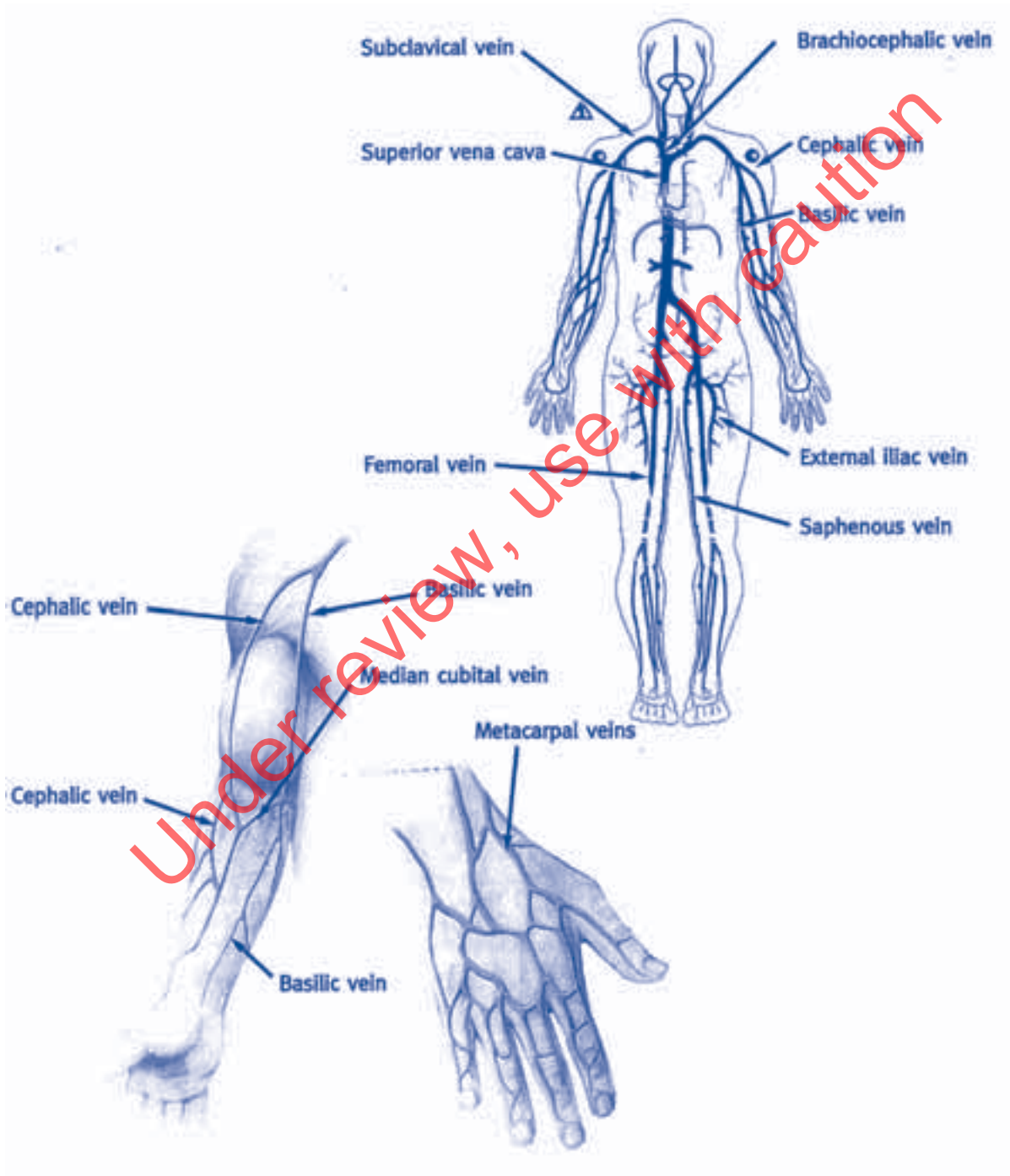
## Appendix 3: Hand washing



## Appendix 4: Algorithm for persistent withdrawal occlusion



# Appendix 5: Vein diagrams



## Appendix 6: Example business case for nurse-led service

<b>Vascular Access Service University Hospitals Coventry and Warwickshire NHS Trust</b>	
<b>1. WTE posts</b>	<ul style="list-style-type: none"> <li>• 1WTE Band 8a Lead Vascular Access CNS Mon-Fri</li> <li>• 1WTE Band 7 Vascular Access Specialist Practitioner (ODP) Mon-Fri</li> <li>• 1WTE Band 6 Vascular Access Specialist Practitioner (ODP) Mon-Fri</li> <li>• 1 Anaesthetic clinical lead- 1PA session per week</li> </ul> <p><b>Support from:</b></p> <ul style="list-style-type: none"> <li>• 2 anaesthetists 2 theatre lists per week</li> <li>• 2 Interventional Radiologists 3 slots per week – mostly used by Haematology service</li> </ul>
<b>2. Service summary</b>	<ul style="list-style-type: none"> <li>• The Vascular Access Service co-ordinates the assessment, insertion and follow up of Vascular Access Devices indicated for at least one week of intravenous therapy or specific therapy regimes such as chemotherapy and parenteral nutrition. The service provides an efficient nurse led bedside PICC line insertion service and provides the facility for the insertion of vascular access devices ranging from peripheral midlines to implanted vascular ports.</li> </ul>
<b>3. Patient experience</b>	<ul style="list-style-type: none"> <li>• During 2014 over 400 vascular access devices were placed, reducing the number of peripheral cannulas patients received for long term IV therapy. During this time at least 65 discharges to community IV therapy teams were facilitated with the insertion of longer term Vascular Access Devices. Anecdotal evidence from patients indicates positive feedback on the facilities of the service and the difference it has made to their experience. The current service has reduced the waiting time for patients to receive vascular access devices from 6 days to 2-3 on average improving the patients experience by reducing the needlesticks from repeated venepunctures.</li> </ul>



#### 4. Current SWOT analysis

##### Strengths:

- The service provides an efficient service through placement of a range of devices allowing for appropriate line choice based on treatment.
- Bedside placement of PICC lines
- Pre-insertion assessment to ensure appropriate line insertion and assessment of risks.
- Service provision for both outpatients and inpatients.
- Collaboration with local trusts for line insertion.
- Ability to follow up of patients post line insertion to monitor compliance with national standards in line care and maintenance and management of post insertion complications such as blocked lines.
- Ability to facilitate discharge through placement of vascular access devices prior to referral to community services for IV therapy.
- Placing of ports under local anaesthetic.
- Practitioner-led Hickman line removal service.
- Specialist insertion team which standardises practice and allows for professional competence and efficiency.

##### Weaknesses:

- Only able to deliver VAD service for specific patient groups. Lack of capacity prevents wider patient groups such as difficult access greater than 1 week of therapy from receiving lines.
- No capacity to undertake detailed surveillance on complication rates, namely infection rates.
- Unable to deliver comprehensive educational programme for trust due to small team size.
- No specific administration support for the service with responsibility shared with Day surgery.
- Ability to only follow up patients who are inpatients at one site, therefore second hospital site is not supported by the current service.
- Limited communication with the vascular access team from specialities and trusts using the service leading to lack of information on referral and poor communication of line complications.

##### Opportunities:

- Enhanced patient experience
- Expansion of line insertion facilities to other neighbouring trusts across the cancer network.
- Delivery of a structured educational programme for trust staff in the care and maintenance of all vascular access devices including completion of competencies.
- Accurate surveillance of infection rates trust wide and implementation of measures to reduce rates in line with national guidelines.
- Effective audit of insertion and removal practices leading to standardisation of practice.
- Innovation of services to include review clinics and pre/peri-operative vascular access options.
- Delivery of a vascular access assessment tool to encourage appropriate decision making around vascular access for referrers.
- Development of a vascular access forum for all practitioners inserting lines.
- Development of collaborative forum for anaesthetists and practitioners from the service to discuss current practice to improve quality and safety while improving standards of practice.

	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• Without the current vascular access service patients would have limited choice in terms of vascular access options and could receive inappropriate devices, which increase risks such as infection and thrombosis in comparison to those that are placed by the vascular access team.</li> <li>• Patients would not be assessed pre-line insertion and would receive limited information relating to their vascular access options.</li> <li>• Limited knowledge regarding line removal and complication rates would prevent adequate governance and not allow for an adequate feedback mechanism or audit trail for those inserting lines.</li> <li>• The current team structure only accommodates one insertion team at any one time, this limits the number of lines that can be placed in one day and has a direct affect during times of leave and sickness.</li> </ul>
<p><b>5. GAP analysis</b></p>	<p><b>Educational:</b></p> <ul style="list-style-type: none"> <li>• There is currently no structured training programme available on care and maintenance of devices. A competency programme exists, but is not widely used. Support is required to allow for theoretical underpinning of knowledge and follow up assessment. Education for junior and senior medical staff regarding choice of device and risks vs benefits to change way of thinking for those referring</li> </ul> <p><b>Organisational:</b></p> <ul style="list-style-type: none"> <li>• With only one insertion team available, line insertion takes up the majority of the time. Organisational tasks such as guideline development and efficiency improvements are often placed on hold or last priority. Annual leave/ sickness reduce the capacity of the team to deliver and manage. Organisational policies on catheter related blood stream infection diagnosis and management can make decision making regarding line infections difficult and often results in lines being removed unnecessarily. Inconsistency from microbiology on antibiotic choice and course length can also make decision making on device type difficult for the practitioners inserting lines. Lack of policies on line infection definitions also makes surveillance unachievable.</li> </ul> <p><b>Other:</b></p> <ul style="list-style-type: none"> <li>• A lack of communication channels between the vascular access team and specialties prevents patients readmitted to hospital with lines being picked up and reviewed by the team. The longer term nature of the service also prevents the opportunity for short term central lines to be monitored due to the specific remit of this team and the lack of allocated responsibility from other teams.</li> </ul>

<b>Long-Term Vascular Access Service</b>	
<b>6. Caseload and evidence of activity</b>	<ul style="list-style-type: none"> <li>• Overall line insertion activity average 40-50 lines per month.</li> <li>• 2 theatre sessions per week- 3/4 lines each</li> <li>• 3 Radiology slots per week</li> <li>• Use of treatment room for PICC line insertion/ Hickman line removal- access 3 days per week (shared with pain clinic).</li> <li>• Bedside placement of PICC/ midlines</li> <li>• Average activity</li> <li>• PICC/midlines lines 20-30 per month</li> <li>• Ports 8-12 per month</li> <li>• Hickman lines 3- 12 per month</li> <li>• Inpatient/ Outpatient 55- 45% split respectively</li> <li>• Highest indication for line requirement is long term intravenous antibiotic use, chemotherapy second, total parenteral nutrition third.</li> <li>• Over 100 patient discharges to the community facilitated through vascular access devices</li> <li>• 24hr and weekly follow up reviews average 20-30 per week</li> <li>• Complication management and ward based support 5-10 patients per week. This takes varying time from minutes to hours depending on number of patients and complications encountered.</li> </ul>
<b>7. Trust wide Leadership Activities</b>	<ul style="list-style-type: none"> <li>• Feedback monthly to Modern Matrons and Associate Directors of Nursing regarding data collection against Saving Lives Care Bundles for care and maintenance.</li> <li>• Feedback monthly to Nutrition Steering group regarding progress of Line service</li> <li>• Feedback weekly/ fortnightly to Theatre group manager/ modern matron regarding service activity</li> <li>• Produce monthly data on line insertion including type of line, indication, specialty referring, date inserted, operator, location of insertion, date removed and reason for removal if known.</li> <li>• Formulate quarterly reports based on the data collected and report to clinical Director for Surgery, Theatre Group Manager. Report is shared with planning committee.</li> <li>• Coordinate and deliver training programme for nursing staff on care and maintenance of long term vascular access devices</li> <li>• Present service development at Grand round presentation.</li> <li>• Identification and assessment of risks surrounding service delivery</li> <li>• Attend West Midlands IV forum and national forums for network opportunities with surrounding trust services.</li> <li>• Collaborating with infection prevention and control team to explore monitoring of national standards in relation to catheter- related blood stream infection.</li> <li>• Collaborating with nutrition team to maintain standards of care for patients receiving TPN via long term lines.</li> </ul>
<b>8. Nursing Service Key Performance</b>	<ul style="list-style-type: none"> <li>• Waiting time for patients to receive device from referral to insertion is reduced and maintained to below 3 days.</li> <li>• Patients require fewer cannulations and needle stabs for the duration of treatment via a reliable venous access device.</li> <li>• Patients who are fit may be discharged home sooner by receiving their IV medications at home via a reliable longer term device.</li> </ul>

### 9. Best practice guidance

- Ability to meet EPIC 3 guidelines (2014) for following criteria:
  - Insertion of Central Venous Catheters using full maximal sterile precautions, full body drape and 2%CHG 70% Isopropyl alcohol skin prep.
  - Care and maintenance of devices and measurement of standards against care bundle for central venous catheters
- Ability to meet NICE guidelines (2003) for the use of 2D Ultrasound for the insertion of central venous catheters
- Meeting NICE guidelines (2015) for the use of ECG tip location technology for the insertion of PICC lines
- Collecting data on line insertion in accordance with EPIC 3 guidelines
- Standardisation of documentation for line insertion in accordance with EPIC 3 and INS guidelines (2011).

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Author : Sharron Oulds Lead CNS Vascular Access Service- University Hospitals Coventry and Warwickshire NHS Trust Aug 2016

Acknowledgements Alison Leary Apollo Nursing Resource

Under review, use with caution

# Appendix 7: Outline business case

## Title of proposal

**Expansion and Sustainability of the Nurse Led Intravenous Access And Resource Team – including Outpatient Parenteral Antimicrobial Therapy Service (OPAT).**

**Directorate Nursing and Quality**

**Project lead (accountable officer)**

## Background information

In April 2012 the initial one year's funding of a Nurse Led Intravenous Access and Resource Team (IVRT) including Outpatient Parenteral Antimicrobial Therapy Service (OPAT) was agreed by the Trust Management Team. Following successful evaluation of the first year the service was made substantive in June 2013. Since then the demand has continued to rise for the two key functions of the team. These are:

- To improve safety, quality and efficiency of care to patients requiring prolonged or complex IV access by providing prompt, appropriate and expert line insertion and care.
- To facilitate the safe, early discharge of patients remaining in hospital only due to their requirement for the administration of IV antimicrobial therapy and ensuring they are safely monitored until the end of the antimicrobial therapy.

During 2014/15 the IRT has flexed to incorporate some admission avoidance through the Ambulatory Assessment Area of AMU to include

- Admission avoidance of  
 Otherwise well patients requiring admission for IV antimicrobial therapy as a part of the urgent and ambulatory care work streams from November 2015.

This would be strengthened with the new focus on ambulatory medicine with the opening of the Urgent Care Centre in November 2015. In addition

- Admission avoidance of  
 Otherwise well residents of nursing homes requiring admission for IV antimicrobial therapy working with the HIT from November 2015.

As part of the patient productivity work stream in 2013/14 the IVRT committed to save at least four beds through the discharge of patients on OPAT. Increasingly the IVRT save in excess of seven beds and could achieve more through further funding.

### Operational performance and utilisation

Key achievements of the IVRT and OPAT service to date include:

- Average 6.91 beds saved with current service
- 1,870 lines inserted by the IVRT (to 15th June 2015).
- 94% of lines inserted within 48 hours of receiving request (previously up to two week wait).
- The Device-Related Bacteraemia (DRB) rate for the lines inserted by the IVRT is currently 0.5 bacteraemias per 1,000 device days. There is currently no national accepted standard for a line-related infection rate, but a rate of three per 1,000 device days is widely quoted as a desirable target.
- The DRB rate (including all devices) per 10,000 bed days for 2012/13 was 4.10. This has fallen for the last financial year to 2.50. The latest national estimate on the cost for each blood stream infection was calculated to be £5,200 (DH, 2011).
- Over 15,000 line observations were undertaken between January 2013 and May 2014.
- 316 patients discharged on OPAT since October 2012 (to 15th June 2015).
- Over 6,694 bed days saved since the introduction of the OPAT service in 2012. The IVRT was a key contributor to the Patient Productivity Programme work stream.
- A 45% reduction in reduction in line associated DRB in the hospital from 6.1 per month in 2012/13 to 3.3 per month in 2013/14 and 3.08 in 2014/15.
- Timely, safer parenteral nutrition (PN) in patients with a non-functioning gut (a 60% increase in the patients receiving PN appropriately)
- The provision of education and resources on long line access and care.

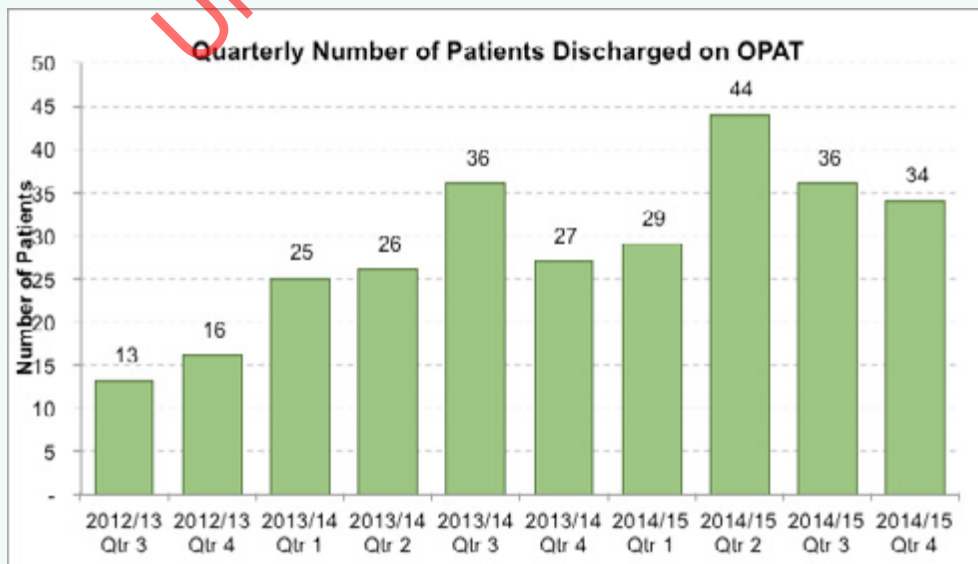
The service has been widely used across the Trust (see Table 1 below). (NB although the service was designed to complement the existing Oncology service, where line access was already considered sufficient, there has still been a demand for intravenous line insertion within the Haematology/ Oncology Directorate where 155 lines have been inserted by the IVRT).

Directorate	n	%
<b>Division One</b>		
General Surgery	340	18.2%
Cardiac	170	9.1%
Critical Care	177	9.5%
Trauma & Orthopaedics	159	8.5%
Gynaecology	24	1.3%
Head and Neck	43	2.3%
Maternity	5	0.3%
<b>Division Two</b>		
Emergency Services & Extra Capacity	289	15.4%
Respiratory & Gastroenterology	223	11.9%
Renal & Diabetes Services	154	8.2%
Haematology/Oncology/Radiotherapy Services	155	8.3%
Care of Elderly and Stroke	91	4.9%
Rheumatology	40	2.1%
Other	2	0.1%
<b>Total</b>	<b>1,872</b>	<b>100.0%</b>

There has been a significant rise in the number of patients discharged on OPAT (most of whom have specialist lines inserted by the IVRT due to duration/toxicity of treatment). Prior to discharge patients referred to the service are safely assessed in conjunction with the clinical team. Following discharge treatment and line care is usually administered by the Community Nursing Hospital at Home Team; the patients are reviewed weekly by an expert group during a 'virtual' clinic and treatment changed/stopped/adapted accordingly. The outcome is communicated to the patient's consultant by letter.

Diagram 1 displays the increase in number of patients discharged on OPAT on a quarterly basis.

**Diagram 1**

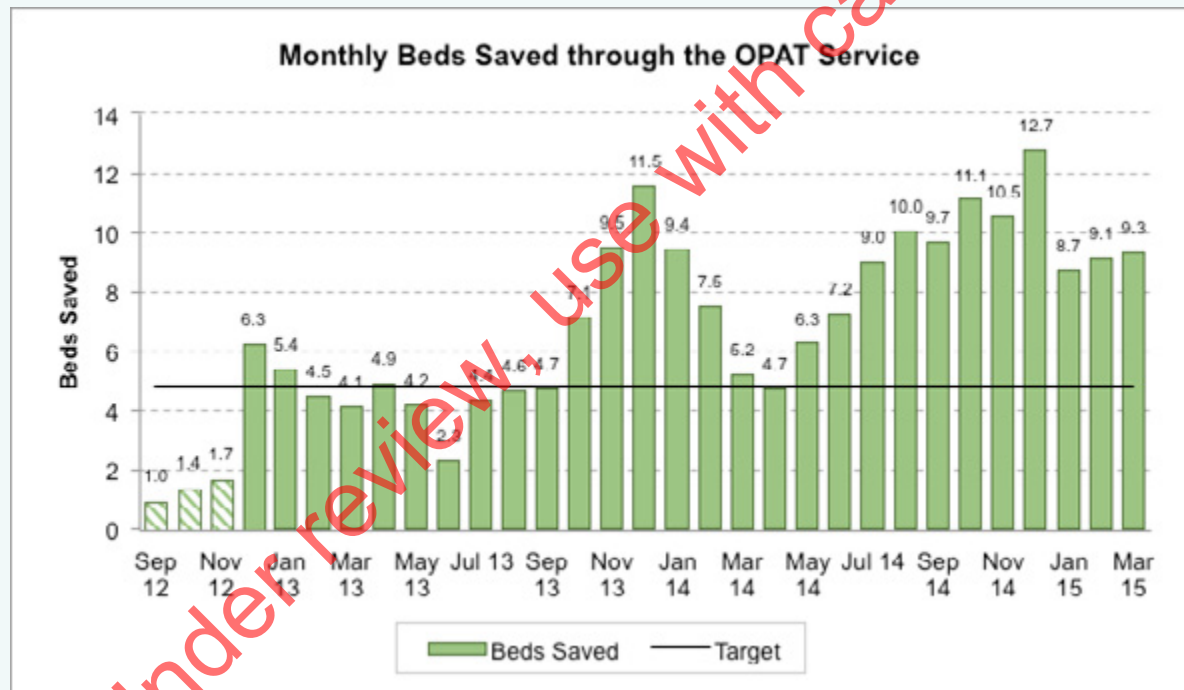


As a result of the OPAT efficiencies, the organisation has seen patients discharged earlier than anticipated releasing bed capacity across the Trust. This equates to the savings outlined in Table 2 and considers costs for both Divisions.

Assumed savings of a five day service for line insertion and OPAT referral, and a seven day service for line audit (supported by HCA's) were estimated as 4.83 beds per day (based on historical OPAT performance). However, since the introduction of the substantive service the number of beds saved in the previous 12 months (Aug-13 to Jul-14) has increased to 7.34 potentially saving £312,337; this is an increase in net savings on bed days of £108,577 per annum beyond that predicted in the substantive business case. See

Diagram 2 demonstrates the monthly beds saved through the utilisation of the OPAT Service.

**Diagram 2**



There was a saving of 11.0 beds during December 2013 and July 2014 (342 bed days) and 12 beds in December 2014 (394); with as many as 14 patients receiving OPAT on certain days. **It must be noted that during these busy periods the IV Resource Team, pharmacy and community nursing services have been stretched beyond capacity.**

This requires a renewed approach to sustaining this service, in particularly for OPAT.

### **Case for improvement** (where do we want to get to – include quantitative data showing the performance gap and how the proposal fits with Trust Strategy)

In order to safely meet the current and growing demand for this service and the Trust's strategic objectives

- Create a culture of compassion, safety and quality
- Proactively seek opportunities to develop our services.
- To have an effective and well integrated organisation that operates efficiently.



It is proposed that the current IVRT expands to further reduce the waiting time for line insertion, incorporate a greater number of patients who could avoid admission, and increase training and education provided to ensure a higher level of competence amongst clinical staff caring for the lines in order to reduce troubleshooting referrals and increase their ability to focus on line insertion and OPAT.

The IVRT would link directly to the Community Hospital at Home Service which would expand to create a triage system of OPAT patients for those housebound requiring nursing administration, ambulant and able to attend a clinic and those able to self-administer with weekly clinic checks. Clinic space has been identified at the Phoenix centre morning and evening. Antimicrobials would be administered by the flexible hospital at home team who would work where the demand was (home visits/clinic), appropriate patients would be taught to self-administer with weekly assurance visits to the clinic to support the patient and feed information to the OPAT virtual clinic. On current estimates at least 50% of current patients could be seen in a clinic setting or be self-administering. However, in practice other services have found that in practice much higher numbers of patients are able to achieve this. A clinic running 7 days a week 8-10am and 4-6pm would therefore provide scope to expand the number of patients in the community. Referral would be through a proven electronic referral system similar such as that already in place for podiatry and diabetes. This approach has full support from the Community Services Management Team and would require the hospital at home team increasing by 2 whole time equivalent band 5 staff. This has been reduced due to economies of scale arising from the joint management of the HIT and Hospital at home teams in the community.

In order to ensure that patient safety is maintained for patients on OPAT the weekly OPAT virtual clinic requires expansion to handle additional activity. Recognition of services which contribute consistently and form an essential function in preventing readmission such as pharmacy and microbiology is also required. This unique ward round reviews antibiotic regimes ensures prompt change of route from IV to oral risk assessed patient's weekly preventing readmission. Key to this is weekly monitoring of bloods, vital signs and patient condition by the Community Hospital at Home Team and subsequent consultant to consultant update of patients. This approach has fostered confidence and a great deal of positive feedback from hospital consultants evidenced by clinical teams and the consultant body having seen, first-hand, the positive impact that the Team can have on the overall experience and outcomes during a patient's episode of care.

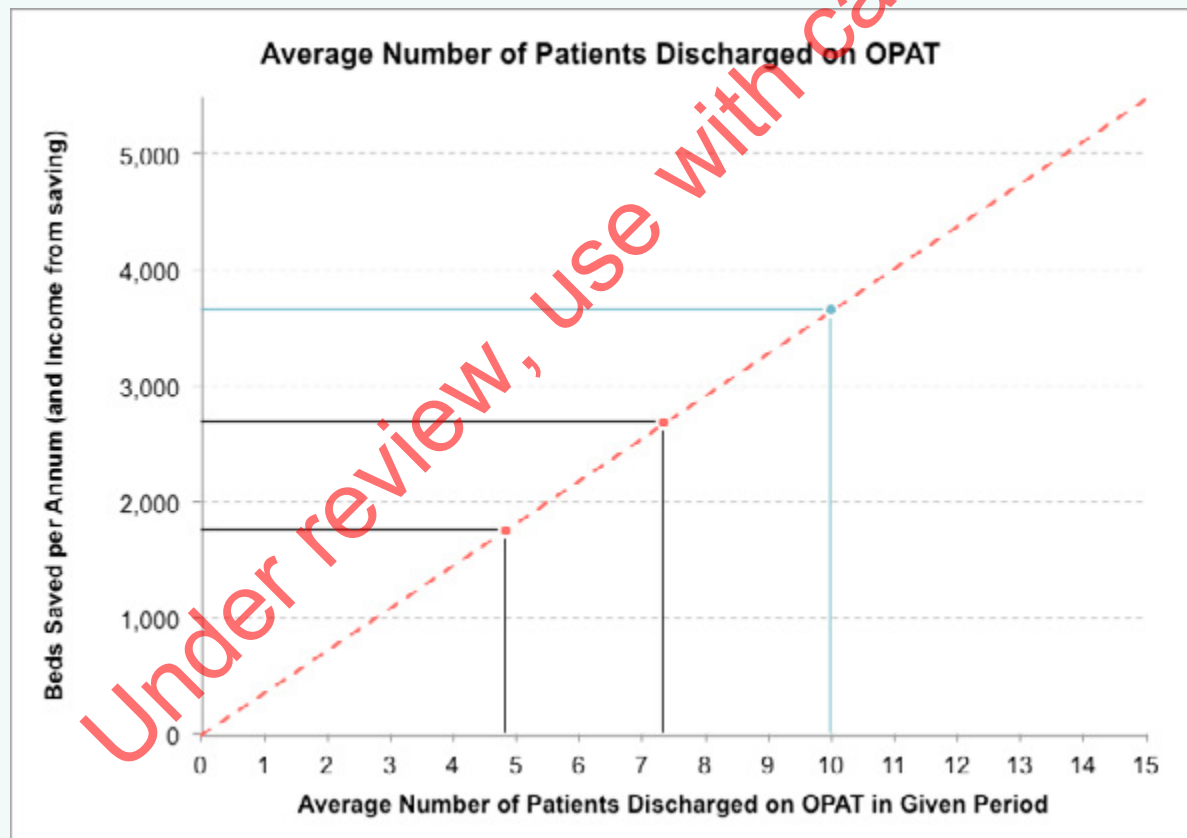
Currently the discharging ward is liable for the costs of antimicrobials once the patient is on OPAT. We propose that this money is top-sliced from Ward pharmaceutical budgets and the IVRT will be responsible for this budget from here on. This would enable accurate and fairer drug costs.

The following benefits would be provided:

- The line placement would be available 7 days/week
- There would be a standardised approach to PICC/Mid line/Leaderflex placement
- A more flexible approach to the numbers of patients on OPAT bettering current performance (as per diagram 3) with additional bed savings of up to 10 beds saved (see Diagram 3 below). This would require 14/15 patients a month being put onto OPAT with suitable capacity to treat them in the community.
- Reduction of delays in treatment
- OPAT discharges would occur at weekends in line with the IVRT governance process
- The waiting time for line insertion would reduce further towards within 24 hours for inpatients and same day for OPAT patients due to seven day working
- A greater number of patients could be put on OPAT as they are currently but with fewer delays

- Several new groups of patients could be put on OPAT, self-administering with education and competency assessment undertaken in the community, nursing home residents, admission avoidance, and further increasing capacity.
- Maintain the current excellent safety record of the IVRT
- Speed up the transfer of patients to OPAT and reduce the information governance risk through electronic referral eliminating the use of facsimile
- Further new groups of patients could be considered, such as those requiring infusions.
- Accurate drug costs.

Diagram 3



The IVRT has managed to achieve a high compliance with line insertion within 48 hours of referral during 2013; however this was achieved by staff working unpaid hours during times of high pressure on operational services. Whilst improvements in quality of care and patient experience have resulted since inception of the team, the increased demand and current teams' capacity have led to clinicians expressing concerns at delays in line insertion and delays in the OPAT discharge process.

In conjunction with the development of the service from an acute perspective, as the request for OPAT services increases the ability to support the on-going care of OPAT patients following referral to the community must also be increased in line with demand.

A consistent increase in demand for clinical line insertion and OPAT since the substantive service was agreed has delayed the commencement of planned patient education and training programmes (including self-administration) and income generation from external line insertion training. Supporting self-administration by suitably trained patients would enable the discharge of patients, who need to continue receiving antibiotics more than once a day, as the current criteria for OPAT discharge is a maximum once a day administration due to community nursing capacity.

The IVRT/OPAT initiative supports several local and national objectives including supporting the “Care Closer to Home” through discharging the patient back into their home in the community to continue treatment thus avoiding an unnecessarily extended stay in or admission to hospital (see outline pathway in Appendix 1). It also supports the facilitating discharge and preventing unnecessary admissions/ readmissions within the organisation. Through additional investment the IVRT could sustain a higher number of discharges on OPAT and meet current demand of approximately 11 patients a month across seven days (as set out in NHS England’s 10 Clinical Standards within the Trusts Service Delivery Plan).

In accordance with the Department of Health Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) – *Antimicrobial Stewardship: “Start Smart – Then Focus”* (18.11.2011), “The five Antimicrobial Prescribing Decision options are Stop, Switch, Change, Continue and OPAT” (p.12).

“The benefits of OPAT include; admission avoidance and reduced length of stay in hospital, with resulting increases in inpatient capacity, significant cost savings compared with inpatient care, reduction in risk of healthcare-associated infection and improved patient choice and satisfaction” Good Practice Recommendations for OPAT in Adults in the UK, *Journal of Antimicrobial Chemotherapy* (January 2012), p.1.

## Staffing Requirements for IVRT Business Case 2015

Good Practice Recommendations for OPAT in Adults in the UK, *Journal of Antimicrobial Chemotherapy* (January 2012), p.3 outlines using a “team approach, with the team led by a clinician/ infection specialist with experience in OPAT” and outline the following requirements:

- 1.2 The OPAT Team should have an identifiable medically qualified lead clinician who has identified time for OPAT in their job plan.
- 1.3 The OPAT multidisciplinary team should include, as a minimum, a medically qualified clinician (eg an infectious diseases physician, internal medicine specialist or a surgeon with an infection interest), a medically qualified infection specialist (infectious diseases physician or clinical microbiologist), a specialist nurse with expertise in parenteral drug administration and intravascular access device selection and placement, and a clinical antimicrobial pharmacist”.

Figure 3, Good Practice Recommendations for OPAT in Adults in the UK, *Journal of Antimicrobial Chemotherapy* (January 2012), p.3

Local experience has proven that the time required to support OPAT exceeds the original estimate and that microbiology and pharmacy input are essential to safe management of patients. Funding is now required to sustain this in line with increased patient numbers.

### Consultant microbiologist

In line with the National OPAT Good Practice Recommendations the Trust must dedicate time for this

important function to ensure that there is always a consultant microbiologist available for prescribing advice. The regular work amounts to at least 1 PA per week of time.

### Antimicrobial pharmacist

In line with the National OPAT Good Practice Recommendations; “an important principle of OPAT is that pharmaceutical care should be equivalent to that expected for hospitalized patients. This is supported throughout literature where the clinical pharmacist was identified as a key member of the OPAT team” Good Practice Recommendations for OPAT in Adults in the UK, *Journal of Antimicrobial Chemotherapy* (January 2012), p.3. Therefore, the Trust must dedicate time for this important function to ensure that there is always a suitably trained pharmacist available for prescribing advice. The regular work amounts to at least 1 PA per week of time.

### IVRT nursing staff

To provide seven day clinical cover of two qualified and 2 non-qualified staff for 11.5 hour shifts (0730-2000) from Monday to Friday, and 0800-1400 Saturday, Sunday and Bank Holidays, the IVRT require 4.8 qualified and four non-qualified staff. This allows Band 7 identified management time of 18 hours, and includes annual leave entitlements. It does not allow for any additional cover during periods of sickness.

This would require an additional two qualified nurses (band 6), and one Healthcare assistant (Band 3) to current staffing levels.

### Community clinic nursing team

The Community IV Clinic would operate seven days a week from 8am-10am and 4pm-6pm to ensure suitable access and those returning to their employment while on OPAT can access the facility.

Two band 5 nurses in the Community Hospital at Home Team would be required to develop this function.

### Administration function

No additional staffing costs are required, suitable office equipment to support the administration duties of the team have been acquired elsewhere in the Trust.

### Capital

An additional Naultus machine (for line confirmation) will enable 2 nurses to placing a line at the same time.

### Additional Non-Pay

- Some additional travel/education is anticipated
- The IT costs of developing an electronic referral system
- Consumables
- Equipment warranty/servicing

Future priorities of this team not included in this business case which would further increase productivity are:

- Development of community IV Centre
- Dedicated accommodation for the IV Resource Team with line insertion space in which ‘lists’ can be run and outpatient facility adjacent/within to New Cross Hospital

Expansion of the current service is supported by the Infection Prevention and Control Group (IPCG) and has been discussed at Division 1 and 2 management meetings.

### Income generation

The IVRT is committed to sharing the excellent practice they have developed over the last 32 months. It is proposed that the team will offer competency based assessment to staff at other trusts. This is particularly relevant due to the 3-line option the RWT IVRT uses. Income is anticipated to be around £5,000 per year.

The Infection Prevention Team will fund £12,000 non-substantively toward the business case from research monies to assist with the purchase of equipment.

## Options (Brief description of alternative ways to achieve the improvement)

### OPTION 1 – Do nothing

#### Option 1 – Quantitative Analysis: Deliver the original specification approved in June 2013

##### Outline

The IVRT/community nursing team will deliver original proposal for service delivery as efficiently as possible without additional unpaid activity at the level being undertaken as this is unsustainable.

##### Finance

Implications with bed savings as there will be fewer people seen by the OPAT Team and some patients will not be discharged who could otherwise be.

##### Activity implications

Increased bed days as IVRT will be unable to cope with current demand

##### Constraints

- Lines will be prioritised leading to poorer patient and staff experience
- No ability for service to expand to meet current demand and drivers for change
- Team does not have the referral system to support functionality and best practice in information governance.

##### Benefits

Some patients will still get the service.

##### Dis-benefits

- Planned clinical audit of devices will continue to be reduced or deferred due to meeting clinical demands.
- Withdraw service from Oncology Haematology & Critical care (as explained in original business case)

- Reduced clinical activity and therefore less lines inserted.
- Poor staff satisfaction/ low morale.
- Low perception of the service as patients will have to be turned down for OPAT due to capacity.
- Poor quality for patients who could be cared for in the community
- The service will remain 5 days for line insertion and discharge on OPAT.
- A proportion of patients missed who could be educated to self-administer treatment.

### Risks

- Potential increase in avoidable device-related bacteraemia cases (DRB).
- Less ability to undertake audit
- Demand continues to increase whilst capacity remains the same.
- Staff become stressed and unhappy at work increase in sickness levels and impact on staff retention as the team seek alternative employment.
- Patients discharged with OPAT referral and action plan – however, capacity is not allocated.

### Conclusion

This is not a sustainable option for the organisation, activity will not be sustained, current levels of service delivery will be reduced in order to enable the team to focus on delivery of training to external sources and opportunities to improve profile and facilitate income generation for the Trust will be lost.

**OPTION 2 – Expand the existing IVRT and OPAT function to provide 7 day line insertion, audit and monitoring service. To provide an education and training programme including income generation, and teaching patients in self-administration. Includes the purchase of a Nautilus Machine to assist with precision line positioning.**

**Option 2 – Quantitative Analysis: Expansion of the Current Service to meet current demand by offering a 7 day service, and facilitate delivery of a training resource for external sources whilst promoting the benefits of self-administration.**

### Outline

The current service will be expanded to include additional members of clinical staff to allow the current demand for the service to be met seven days per week, a training programme to be established and delivered to both patients and external sources (offering income for the organisation).

### Finance

- This will theoretically deliver increased savings to the organisation on marginal bed day costs. However, directorates will need to take advantage of these.

- Training and Education programme to facilitate self-administration teaching to external sources creating income for the Trust.
- Purchase of a Nautilus Machine.

### Activity implications

- The IVRT will have the ability to respond to the additional requests for line insertion across the hospital that is currently experienced on a daily basis.
- Supports commitment to work towards 7 day working.
- Enable the IVRT to comprehensively respond to clinical issues.
- Provision of the education and training programme
- Enable completion of regular audits to ensure clinical effectiveness and low infection rates are sustained.

### Constraints

- No dedicated area to see admission avoidance/returning patients – in discussion regarding urgent care centre use.
- Difficulty in managing OPAT patients who live out of Wolverhampton due to variability in obtaining weekly observations, updates and blood results – solution is discussion.

### Benefits

- Ability to respond to requests as will have the capacity to meet demand.
- Offer a programme of self-administration training for patients.
- Improved patient experience and outcomes
- Supports the “Care Closer to Home” initiative
- Supports principles of 7 Day Working and Discharge
- Improved patient safety with capacity to meet the OPAT referral demand
- Admission avoidance increased to include nursing homes and A&E referrals.
- Potential to become a showcase service for other organisations developing the Trusts profile.

### Dis-benefits

There is currently no tariff associated with OPAT intervention.

### Risks

- Clinical Space required, current negotiations with the urgent care centre to place lines and se eout of area patients on OPAT to ensure safety.
- Requirements to improve supporting services – i.e. Pharmacy, Microbiology and Community Nursing.
- There is currently no tariff associated with OPAT intervention.

## Conclusion

This is the preferred option for the Trust to enable delivery of all elements of service delivery.

**Benefits of preferred option (What will this do for Performance (targets, payment, costs), Commissioners (GP, PCTs), Patients (quality, time, perception, environment – including impact on space utilisation), Process (productivity, legal, innovation) and Staff (release potential, involvement, learning & development, environment) i.e. quantifiable measures so that we will know when the benefits have been delivered)**

## Preferred option – OPTION 2

Benefit	Measure and approach	Date benefit will be realised
A seven day service would be provided (reduced hours at weekend) for clinical line insertions by increasing current capacity, this will allow the demand for OPAT to be met.	<ul style="list-style-type: none"> <li>Monitor OPAT uptake and beds saved</li> <li>Develop system for self-administration of medicines for those that can.</li> </ul>	Immediately staff are recruited 01/10/15
The increase in demand for line insertions will be safely managed by increasing the IVRT, resulting in fewer delays.	<ul style="list-style-type: none"> <li>Recruit additional staff to IVRT/ Community nursing team and train</li> </ul>	01/10/15 (or sooner depending on skills of applicants)
Expansion will allow the IVRT to confidently develop monitoring in relation to a target that; lines will be inserted, wherever practical, within 24 hours of request.	<ul style="list-style-type: none"> <li>Monitor referral to insertion times</li> </ul>	Immediately staff are recruited 01/10/15
A continued decrease in line related infection DRB's (Hospital and Community)	<ul style="list-style-type: none"> <li>Recruit staff.</li> <li>Improve system of communication of Community DRBs</li> <li>Develop system for acting on community DRBs</li> </ul>	01/11/15
Support the IVRT to pilot nationally driven initiatives in particular line insertion choice tools, and become a showcase hospital for Nurse-Lead Vascular Access involving the potential for training external candidates in the practicalities of line insertion and the associated income generation.	<ul style="list-style-type: none"> <li>Identify tools to pilot</li> <li>Develop networks with other services regionally</li> <li>Promote service as an exemplarily service</li> </ul>	01/11/15
Supports Parenteral Nutrition with Dietetics Team	<ul style="list-style-type: none"> <li>Increase or sustain numbers of lines placed for PN</li> </ul>	01/10/15
Sustain increased beds saved through OPAT	<ul style="list-style-type: none"> <li>Monthly data monitoring of referrals and beds saved.</li> </ul>	01/10/15



The aim is for lines to be inserted within 24 hours of referral seven days a week where clinically assessed as safe to do so and where ward based pre-assessment clinical samples/ results have been completed.	<ul style="list-style-type: none"> <li>Time from referral to insertion monitored and reported monthly via intranet.</li> </ul>	Immediately staff are recruited 01/10/15
Patient self-administration of treatment Delivery of planned education and training programme to include training for patients in self-administration of antibiotics and line care.	<ul style="list-style-type: none"> <li>Creation of education and training programme, governance systems and monitoring.</li> </ul>	01/10/15

**Resource impact** (Staffing, time, costs – capital and revenue, source of funding).  
Attach financial proforma (Add hyper-link for Financial Proforma)

**Risks and dependencies** (Partners, other projects in progress, availability of resource/people, Service Improvement capability within team, contingency plans & mechanism to stop the improvement if benefits cannot be delivered i.e. exit strategy, Risk Register implications)

Risk	Grade (R,A,G)
Patients remaining in hospital who could be discharged on OPAT	A
Patients discharged on OPAT with full Community nursing support who could be self-administering with appropriate education requiring fewer DN visits.	A
No additional impact on bed day saved	A
No dedicated area for line insertion causing potential delays	A
Competition for Hospital at Home resource.	A
Admission avoidance opportunity lost	A

**Public consultation** (determine which level of consultation, if any, is appropriate)

Not Required.

## Equality impact assessment

### High level implementation plan

Key Actions	Person responsible	Timescale
Recruit staff IVRT		
Recruit staff Community nursing Hospital at Home Team		
Develop/review safe systems for self-medication and discharge of higher numbers		
Allocate resource to OPAT – Pharmacy		
Allocate Resource to OPAT – Microbiology		

### Submitted by:

Clinical Director	Matron	Dir. Mgr
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Date

### Approved by:

Divisional Director	Divisional Manager	
Divisional Accountant	Head of Nursing	

Date

### For capital investment only

Director of Estates Development

Date

(On behalf of Capital Review Group)

## Appendix 8: Glossary

**Air embolism:** presence of air in the vascular system. Venous air embolism may occur during insertion, use or maintenance of a central venous catheter and after catheter disconnection and removal (Heckmann et al., 2000). Symptoms of air embolism include shortness of breath, altered consciousness, visual disturbance, hemiparesis, chest pain and a low cardiac output state.

**Allen's test:** test performed on radial artery prior to arterial puncture to ascertain adequate arterial perfusion.

**Ambulatory infusion device:** electronic infusion device specifically designed to be worn on the body to promote patient mobility and independence.

**Amino acids:** organic components of protein.

**Ampoule:** hermetically sealed glass medication container which must be broken at the neck to access the medication.

**Anastomosis:** surgical formation of a passage between two normally distant structures, for example two blood vessels.

**Anti-free-flow administration set:** an administration set that stops when removed from the infusion device, yet allows gravity flow when the user manipulates the regulatory mechanism.

**Antimicrobial:** preventing or destroying the growth and development of micro-organisms.

**Apheresis:** involves the separation and subsequent collection of one or more blood components. Apheresis procedures include platelet depletion, therapeutic plasma exchange, red cell exchange, rapid red cell transfusion, white blood cell (mononuclear cell or polymorphonuclear cell) procedures and peripheral blood stem cell procedures.

**Arterial pressure monitoring:** monitoring of arterial pressure through an in-dwelling arterial catheter connected to an electronic monitor.

**Arteriovenous (AV) fistula:** surgical procedure to join an artery to a vein in order to create an internal site for haemodialysis access. Over time the pressure from the arterial blood entering the vein will cause the vein to enlarge in order to accommodate fistula needles.

**Aseptic technique:** mechanisms employed to reduce potential contamination of a 'vulnerable' body site.

**Bacteria:** micro-organisms that may be non-pathogenic (normal flora) or pathogenic (disease causing).

**Body surface area:** surface area of the body expressed in square metres. Used in calculating paediatric dosage, managing burn patients and determining radiation and chemotherapy dosage.

**Bolus:** concentrated medication and/or solution given rapidly over a short period of time.

**Cannula:** hollow tube made of silastic, rubber, plastic or metal, used for accessing the body.

**Cardiac tamponade:** the effusion of blood, air or pus into the pericardial sac, causing compression of the heart.

**Catheter:** tube for injecting or evacuating fluids.

**Catheter dislodgement:** movement of the catheter into and out of the insertion site. Causes of catheter dislodgement include inappropriate securing of the catheter, and motion of the extremity, neck or shoulder. Catheter dislodgement may cause occlusion of the catheter and lead to a change in the catheter tip location. Signs and symptoms of catheter dislodgement include changes in the external length of the catheter, clinical signs of local catheter infection, and inability to flush or infuse via the catheter.

**Central venous catheter:** catheter inserted into a centrally located vein with the tip residing in the vena cava; permits intermittent or continuous infusion and/or access into the venous system.

**Chemical incompatibility:** change in the molecular structure or pharmacological properties of a substance that may or may not be visually observed.

**Closed system:** administration system with no mechanism for external entry after initial set-up and assembly.

**Colour coding:** system developed by manufacturers that identifies products and medications by the use of a colour system. Colour code systems are not standardised. Each manufacturer uses different colour code systems.

**Compatibility:** capability to be mixed and administered without undergoing undesirable chemical and/or physical changes or loss of therapeutic action.

**Conscious sedation:** minimally depressed level of consciousness in which the patient retains the ability to maintain a patent airway independently and continuously, and to respond appropriately to physical stimulation and verbal commands. The drugs, doses and techniques used are not intended to produce loss of consciousness.

**Contamination:** introduction or transference of pathogens or infectious material from one source to another.

**Criteria:** relevant, measurable indicators.

**Critical or adverse incident:** an event or omission arising during clinical care and causing physical or psychological injury to a patient.

**Cross-contamination:** movement of pathogens from one source to another.

**Curative:** having healing or remedial properties.

**Cytotoxic:** any agent that may be genotoxic, oncogenic, mutagenic or teratogenic.

**Disinfectant:** agent that eliminates all microorganisms except spores.

**Distal:** furthest from the centre or midline of the body or trunk, or furthest from the point of attachment; the opposite of proximal.

**Distention:** an increase in size because of pressure from within; stretching or inflation.

**Document:** written or printed record containing original, official or legal information.

**Documentation:** record in written or printed form, containing original, official or legal information.

**Dome:** plastic component used in haemodynamic monitoring.

**Electronic infusion device (EID):** electronic instrument, either a pump (that is, positive pressure) or controller (that is, gravity-fed), used to regulate the flow rate of the prescribed therapy; often referred to as an electronic flow-control device.

**Embolus:** mass of undissolved matter present in blood or lymphatic vessel. Embolus may be solid, liquid or gaseous.

**Epidemiology:** study of the distribution and determinants of health-related states and events in populations; defines and explains the relationship between host, agent and environment.

**Epidural space:** space superior to the dura mater of the brain and the spinal cord and inferior to the ligamentum flavum.

**Epithelialised:** grown over with epithelial cells; said of a wound or catheter site.

**Erythema:** redness of skin along vein track that results from vascular irritation or capillary congestion in response to irritation; may be a precursor to phlebitis.

**Extravasation:** inadvertent infiltration of vesicant solution or medication into surrounding tissue; rated by a standard scale.

**Extrinsic contamination:** contamination that occurs after the manufacturing process of a product.

**Fat emulsion (lipid emulsion):** combination of liquid, lipid and an emulsifying system suitable for intravenous use.

**Filter:** special porous device used to prevent the passage of air or other undesired substances; product design determines size of substances retained.

**Fluid overload:** a fluid and electrolyte imbalance caused by the volume of fluid infusion into a patient.

**Free flow:** non-regulated, inadvertent administration of fluid.

**Grade:** degree of standing or value.

**Haemodynamic pressure monitoring:** general term for determining the functional status of the cardiovascular system as it responds to acute stress such as myocardial infarction and cardiogenic or septic shock. A pulmonary artery catheter is used to directly

measure intracardiac pressure changes, cardiac output, blood pressure and heart rate.

**Haemolysis:** destruction of the membrane of the red blood cells resulting in the liberation of haemoglobin, which diffuses into the surrounding fluid.

**Haemostasis:** arrest of bleeding or of circulation.

**Haemothorax:** the presence of blood in the pleural space.

**HCP:** health care professional and includes doctors, registered nurses and other professions such as radiographers.

**HCA/HCSW/HPs:** refers to members of the nursing profession such as health care assistants, assistant practitioners and health practitioners that work under the direction of a registered nurse.

**Hypertonic:** solution of higher osmotic concentration than that of a reference solution or of an isonic solution; having a concentration greater than the normal tonicity of plasma.

**Hypodermoclysis:** injection of fluids into the subcutaneous tissues to supply the body with liquids quickly.

**Hypotonic:** solution of lower osmotic concentration than that of a reference solution or of an isotonic solution; having a concentration less than the normal tonicity of plasma.

**Immunocompromised:** having an immune system with reduced capability to react to pathogens or tissue damage.

**Immunoglobulin therapy:** intravenous immunoglobulin (IVIG) has been used in the treatment of primary and secondary antibody deficiencies for more than 20 years. IVIG has also been used to treat a variety of autoimmune or allergic diseases. IVIG is produced from human blood plasma pooled from many individual donations. Both the plasma donor and the donation are screened for clinically significant viruses. During production of IVIG, steps are taken to inactivate or remove any infectious agents (Lee et al., 2000). The mechanism of IVIG action is unknown. IVIG is usually administered on a monthly basis but can be given every two to three weeks. **Implanted port:** A catheter

surgically placed into a vessel or body cavity and attached to a reservoir located under the skin.

**Immunohaematology:** an aspect of haematology relating to antibody-antigen reactions.

**Implanted pump:** a catheter that is surgically placed into a vessel or body cavity and attached to a reservoir located under the skin that contains a pumping mechanism for continuous medication administration.

**Incompatible:** incapable of being mixed or used simultaneously without undergoing chemical or physical changes or producing undesirable effects.

**Infection:** presence and growth of a pathogenic micro-organism.

**Infiltration:** inadvertent administration of a non-vesicant solution or medication into surrounding tissue; rated by a standard scale.

**Infusate:** parenteral solution administered into the vascular or non-vascular systems; infusion.

**Injection access site:** resealable cap or other configuration designed to accommodate needles or needle-less devices for administration of solutions into the vascular system.

**Intact system:** a closed infusion system. **Intermittent intravenous therapy:** Intravenous therapy administered at prescribed intervals with periods of infusion cessation.

**Intraosseous:** within the bone substance. The intraosseous route is an alternative for intravenous access in the critically ill or injured patient. This route is used for emergency drug administration, fluid resuscitation and access to the vascular system in situations where conventional routes cannot be utilised or would cause delays in treatment. The intraosseous access needle consists of a needle and stylet, such as a standard bone marrow needle.

**Intrathecal:** within the spinal canal.

**Intrathecal chemotherapy:** the administration of cytotoxic drugs into the central nervous system via the cerebrospinal fluid by means of a lumbar puncture.

**Intrinsic contamination:** contamination that occurs during the manufacturing process of a product.

**Investigational drug:** drug undergoing investigation for a specific use via a clinical trial to determine its safety and effectiveness in humans.

**Irritant:** agent capable of producing discomfort or pain at the venepuncture site or along the internal lumen of the vein.

**Isolation:** separation of potentially infectious individuals for the period of communicability to prevent or limit direct or indirect transmission of the infectious agent.

**Isotonic:** having the same osmotic concentration as the solution with which it is compared (that is, plasma).

**Laminar flow hood:** contained workstation with filtered air flow; assists in preventing bacterial contamination and collection of hazardous chemical fumes in the work area.

**Lipid emulsion:** see fat emulsion.

**Linogram:** a procedure conducted in a radiology department to check the position and/or functioning of a VAD such as CVC, PICC or implantable port.

**Lumen:** interior space of a tubular structure, such as a blood vessel or catheter.

**Lymphoedema:** swelling caused by obstruction of the lymphatic vessel(s).

**Manual flow-control device:** manually operated device to control the flow rate of the infusion.

**Maximal barrier protection:** equipment and clothing used to avoid exposure to pathogens, including mask, gown, protection eyewear, cap, sterile gloves, sterile drapes and towels.

**Medical act:** procedure performed by a licensed physician.

**Microabrasion:** superficial break in skin integrity that may predispose the patient to infection.

**Microaggregate:** microscopic collection of particles such as platelets, leukocytes and fibrin that occurs in stored blood.

**Microaggregate blood filter:** filter that removes microaggregates and reduces the occurrence of nonhaemolytic febrile reactions.

**Micron ( $\mu$ ):** unit of length equal to one-millionth of a metre, or one-thousandth of a millimetre.

**Micro-organism:** minute living body not perceptible to the naked eye.

**Midline catheter:** a midline catheter is a device that is inserted via the antecubital veins and advanced into the veins of the upper arm but not extending past the axilla (usually about 20cm in length).

**Milliosmole (mOsm):** one-thousandth of an osmole; osmotic pressure equal to one-thousandth of the molecular weight of a substance divided by the number of ions that the substance forms in a litre of solution.

**Morbidity rate:** number of infected individuals or cases of disease in relation to a specific population.

**Mortality rate:** death rate; ratio of number of deaths in a population to number of individuals in that population.

**Multiple-dose vial:** medication bottle that is hermetically sealed with a rubber stopper and is designed to be used more than once.

**Needle-less system:** substitute for a needle or a sharp access catheter, available in various designs, for example blunt, recessed and valve.

**Needlestick injury:** needlestick injuries are wounds caused by needles that accidentally puncture the skin.

**Non-permeable:** able to maintain integrity.

**Non-vesicant:** intravenous medication that generally does not cause tissue damage or sloughing if injected outside a vein.

**Occlusion:** blockage due to precipitation of infusate, clot formation, or anatomic compression.

**Occlusive dressing:** a dressing that excludes air and moisture.

**Ommaya reservoir:** (also known as a ventricular access device) – an intraventricular catheter system placed under the scalp that can be used for the delivery of drugs or aspiration of CSF.

**Osmolality:** characteristic of a solution determined by the ionic concentration of the dissolved substances per unit of solvent; measured in milliosmoles per kilogram.

**Osmolarity:** number of osmotically active particles in a solution.

**Palliative:** relieving or alleviating without curing.

**Palpable cord:** vein that is rigid and hard to the touch.

**Palpation:** examination by application of the hands or fingers to the external surface of the body.

**Parenteral:** administered by any route other than the alimentary canal, for example by the intravenous, subcutaneous, intramuscular or mucosal routes.

**Parenteral nutrition:** intravenous provision of total nutritional needs for a patient who is unable to take appropriate amounts of food enterally; typical components include carbohydrates, proteins and/or fats, as well as additives such as electrolytes, vitamins and trace elements.

**Particulate matter:** matter relating to or composed of fine particles.

**Pathogen:** a micro-organism or substance capable of producing disease.

**Peripherally inserted central catheter (PICC):** soft, flexible, central venous catheter inserted into an extremity and advanced until the tip is positioned in the lower third of the superior vena cava.

**pH:** degree of acidity or alkalinity of a substance.

**Pharmacology:** concerns the actions of medicines in the body.

**Pharmaceutics:** concerns the formulation, manufacture/preparation, stability and packaging of medicines.

**Phlebitis:** inflammation of a vein; may be accompanied by pain, erythema, oedema, streak formation and/or palpable cord; rated by a standard scale.

**Phlebotomy:** withdrawal of blood from a vein.

**Physical incompatibility:** undesirable change that is visually observed within a solution.

**PICC:** see Peripherally inserted central catheter.

**Pneumothorax:** the presence of air between the pleura.

**Policy:** written statement describing a course of action; intended to guide decision-making.

**Positive pressure:** constant, even force within a catheter lumen that prevents reflux of blood; achieved by clamping while injecting or by withdrawing the needle from the catheter while injecting.

**Post-infusion phlebitis:** inflammation of the vein occurring after the infusion has been terminated and the catheter removed, usually identified within 48 hours after removal.

**Pounds per square inch (PSI):** measurement of pressure; one PSI equals 50mmHg or 68cm H<sub>2</sub>O.

**Preservative-free:** containing no added substance capable of inhibiting bacterial contamination.

**Primary infusion set:** the main administrations set used to carry out an infusion to the patient.

**Procedure:** written statement of steps required to complete an action.

**Process:** actual performance and observation of performance based on compliance with policies, procedures and professional standards.

**Product integrity:** condition of an intact, uncompromised product suitable for intended use.

**Proximal:** closest to the centre or midline of the body or trunk, or nearer to the point of attachment; the opposite of distal.

**Psychomotor:** characterising behaviours that place primary emphasis on the various degrees of physical skills and dexterity as they relate to the thought process.

**Purulent:** containing or producing pus.

**Push:** manual administration of medication under pressure.

**Quality assurance/performance improvement:** an ongoing, systematic process for monitoring, evaluating and problem solving.

**Radiopaque:** impenetrable to x-rays or other forms of radiation; detectable by radiographic examination.

**Risk management:** process that centres on identification, analysis, treatment and evaluation of real and potential hazards.

**Safety device system:** engineered physical attribute of a device that effectively reduces the risk of sharps injury and subsequent blood borne virus exposure.

**Scale:** tool to measure gradations.

**Sclerosis:** thickening and hardening of the layers in the wall of the vessel.

**Secondary infusion set:** commonly used to deliver single or intermittent doses of IV medication, followed by a return to a single separate continuous infusion when complete.

**Semi-quantitative culture technique:** laboratory protocol for isolating and identifying microorganisms.

**Sepsis:** presence of infectious micro-organisms or their toxins in the bloodstream.

**Sharps:** objects in the health care setting that can be reasonably anticipated to penetrate the skin and to result in an exposure incident, including but not limited to needle devices, scalpels, lancets, broken glass or broken capillary tubes.

**Single-use vial:** medication bottle that is hermetically sealed with a rubber stopper and is intended for onetime use.

**Site protection material:** material used to protect an infusion catheter insertion site.

**Skin-tunnelled catheter:** vascular access device whose proximal end is tunnelled subcutaneously from the insertion site and brought out through the skin at an exit site.

**Speedshock:** the rapid uncontrolled administration of a drug, where symptoms occur as a result of the speed with which medication is administered rather than the volume of drug/fluid. This can therefore occur even with small volumes.

**Standard:** authoritative statement enunciated and promulgated by the profession by which the quality of practice, service or education can be judged.

**Standard precautions:** guidelines designed to protect workers with occupational exposure to blood borne pathogens.

**Statistics:** systematic collection, organisation, analysis and interpretation of numerical data. Sterile: Free from living organisms.

**Stylet:** rigid metal object within a catheter designed to facilitate insertion.

**Surfactant:** surface-active agent that lowers the surface tension of fluid.

**Surveillance:** active, systematic, ongoing observation of the occurrence and distribution of disease within a population and the events or conditions that alter the risk of such occurrence.

**Tamper-proof:** unable to be altered.

**Thrombolytic agent:** pharmacological agent capable of dissolving blood clots.

**Thrombophlebitis:** inflammation of the vein in conjunction with formation of a blood clot (thrombus).

**Thrombosis:** formation, development or existence of a blood clot within the vascular system.

**Transfusion therapy:** a transfusion consists of the administration of whole blood or any of its components to correct or treat a clinical abnormality.

**Transducer:** device that converts one form of energy to another.

**Transparent semi-permeable membrane (TSM):** sterile, air-permeable dressing that allows visual inspection of the skin surface beneath it; water resistant.

**Vesicant:** agent capable of causing injury when it escapes from the intended vascular pathway into surrounding tissue.





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