

The impact of venepuncture training on the reduction of pre-analytical blood sample haemolysis rates: a systematic review

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Background

- Venepuncture is the introduction of a needle into a vein to collect a representative blood sample for laboratory testing.
- Haemolysis, the breakdown of erythrocytes into the extracellular compartment is the problem of greatest concern in the pre-analytical phase.
- Haemolysis has safety, quality and cost implications.
- Training in correct venepuncture practice has the potential to reduce rates of haemolysis.
- The evidence for the effectiveness of venepuncture training for reducing haemolysis rates has, as yet, not been synthesised.

Aim

To synthesise the literature on effectiveness of venepuncture training in the reduction of pre-analytical blood sample haemolysis, and to explore the underlying reasons for how effective/ineffective training is in each study.

Method

- A search was conducted through BNI, CINAHL, EMBASE, Medline and PubMed Databases.
- Studies that were published in 1996 to 2017 and involved investigations into training and haemolysis rate were included.
- Methodological quality and potential biases were examined using McMaster critical appraisal tool for the assessment of quantitative studies.
- The review process followed a publically available pre-registered protocol on PROSPERO ID: 42017059658.
- Study inclusions/exclusions were led by NN and verified by GA and RM.

Findings

- The review followed the Preferred Reporting Outcomes for Systematic Reviews and Meta-analysis (PRISMA) statement (2009).
- A total of 183 abstracts were identified in the database searches (including duplicates).
- Of these, 65% (n=17) were excluded at full screening stage.
- 35% (n=9) of studies met the inclusion criteria (figure 1).

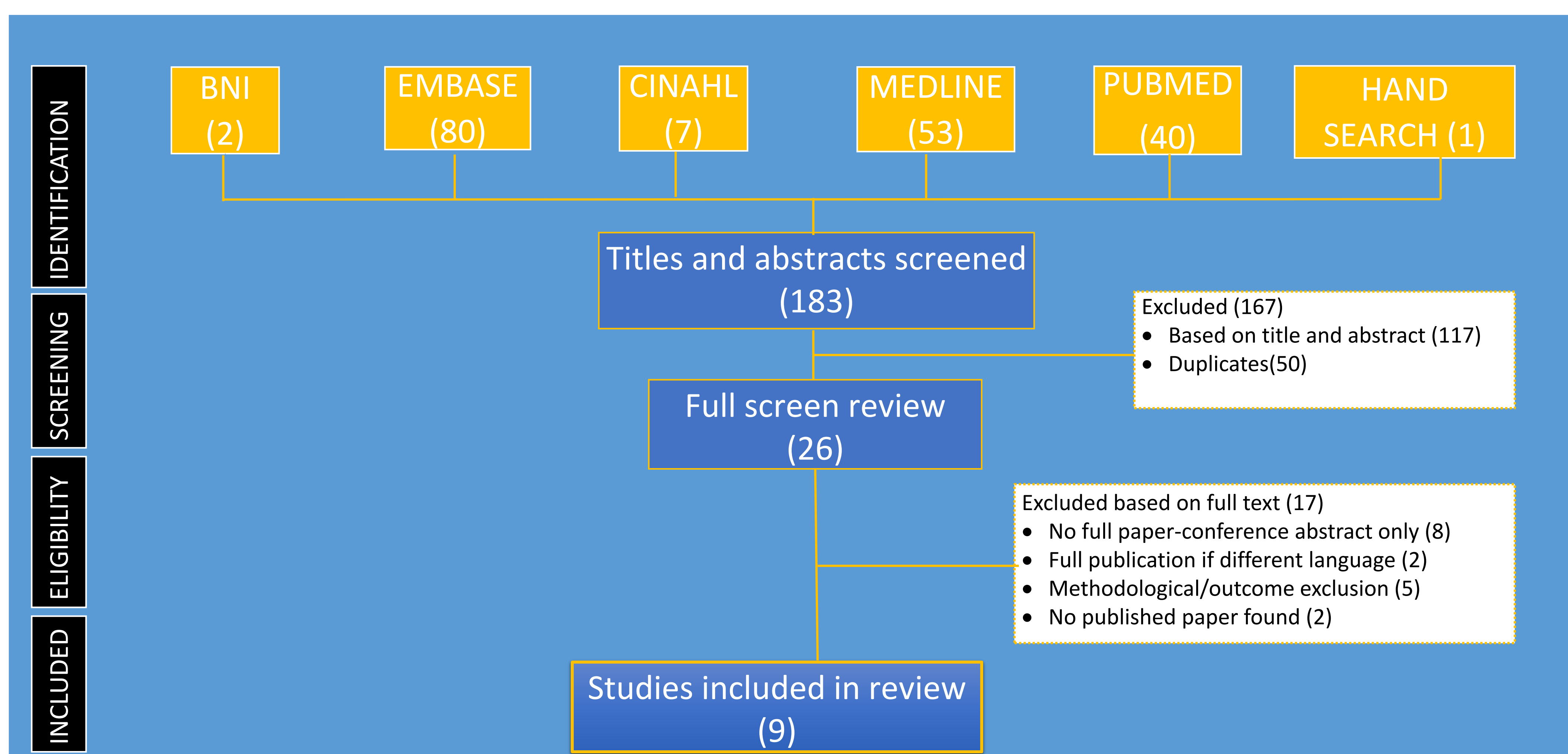


Figure 1: PRISMA flow diagram of summary of search results (PRISMA, 2009)

Results

- Heterogeneity in the study design, the characteristics of the intervention and even the biochemical threshold for haemolysis precluded a meta-analysis (**Table 1**).
- Post-training reductions in haemolysis rates (19.8 - 0.4%) were reported in four of the studies, which tended to have a clearly-reported evidence-base for their intervention, which included mentoring.
- A rise in haemolysis rate (1.3-1.9%) was reported in two studies.

Conclusion & Implications

The effects of venepuncture training on haemolysis rates are unclear at present. The main factor precluding a quantitative synthesis of evidence was the substantial variation in the biochemical threshold for haemolysis. We recommend that there is more standardisation of factors that influence venepuncture training and content in order to have positive results in the reduction of haemolysis rate. This will facilitate safe, quality and cost-effective patient care.

Table 1: Summary of included studies pre and post haemolysis rates and threshold

Author(s)	Year	Country	Haemolysed samples						Treshold
			Pre intervention			Post intervention			
			Percentage (%)	Number (n)	Total	Percentage (%)	Number (n)	Total	
Bolenius et al	2013	Sweden	10.5	698	6652	11.8	722	6121	0.15g/L
Cadamuro et al	2016	Austria	1.8	387	21512	1.6	358	22363	>0.5g/L
			0.6	129	21512	0.6	134	22363	>1g/L
Cockill	2011	Australia	Results presented statistical results only						>3*
Lillo et al	2012	Spain	0.2 ⁺	90	44896	0.013	30	15444	Not given
Ong et al	2009	Singapore	19.8	45	227	4.9	10	204	Not given
Pretlow et al	2008	USA	18.1	195	1075	Not given /stated no change			Not given
			0.7	69	9249	Not given/stated no change			
Romero et al	2012	Spain	1.97	1408	71472	3.9	2835	72692	Not given
Romero et al	2017	Spain	2.42	3592	111806	1.61	3682	132755	0.25g/L
			0.35	341	69942	0.43	955	132,235	
Yazar et al	2016	Turkey	0.27	346	129297	0.18	239	37560	Not given
			0.22	81	37549	0.07	25	129301	Not given

*No equivalence was given; +figures given per 100000, converted per 100

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