National Clinical Guideline Centre

Draft for Consultation

Transfusion

Blood transfusion

NICE guideline
Appendices O-P-Q-R
18 May 2015

Draft for consultation

Commissioned by the National Institute for Health and Care Excellence











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Funding

National Institute for Health and Care Excellence

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Appendices O-P-Q-R

Appendix O: Research recommendations

O.1 Red blood cell thresholds and targets

What is the clinical and cost effectiveness of restrictive compared with liberal red blood cell thresholds and targets for patients with chronic cardiovascular disease?

Why this is important:

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The literature suggests that there may be some evidence of harm with the use of restrictive Red Blood Cell threholds in populations with coronary ischaemia at baseline. In this guideline a level of 80–100 g/litre was used for patients with acute coronary syndrome, but further studies are needed to determine the optimal transfusion threshold for patients with chronic cardiovascular disease.

Criteria for selecting high-priority research recommendations:

PICO question	Population:
	Patients with chronic cardiovascular disease in whom a decision is made to transfuse red cells.
	Intervention and Comparison: 'Liberal' and 'restrictive' transfusion triggers for red cell transfusion based on the pre-transfusion haemoglobin concentration (possibly 10g/dl for the 'liberal transfusion strategy' and 8g/dl for 'restrictive').
	Outcomes:
	Primary outcome: RBC use from randomisation to hospital discharge (proportion of patients receiving red cell transfusion and number of units of red cells/transfused patient.
	Secondary outcomes
	 Use of non-RBC blood products post-randomisation (FFP; cryoprecipitate; platelets)
	2. Mortality (hospital; 90 days)
	3. HRQoL (90 days)
	4. ICU and hospital length of stay
Importance to patients or the population	The research could be used to formulate evidence-based guidance for clinical staff that in turn will assist in reducing donor exposure to patients by giving specific transfusion triggers for clinical staff. By promoting a consistent approach nationally this would improve patient safety and allow benchmarking of patient outcomes.
Relevance to NICE guidance	The results would ensure that implementation of specific red blood cell thresholds based on evidence allowing improved clinical and cost effectiveness.
Relevance to the NHS	The study would provide evidence to guide clinicians on use of either high or low red cell thresholds across the NHS. It would also assist in showing which threshold best supports patient safety and best outcomes. More optimum use of blood products would ensure these are available for those in whom greatest clinical benefit occurs.
	Variation in clinical practice and patient care in relation to blood product transfusion will be reduced.
National priorities	
Current evidence base	The overall quality of current clinical evidence was very low in being inconsistent

	with each paper aiming for specific haemoglobin targets. There was high risk of bias found.
Study design	Randomised Controlled Trial in patients with chronic cardiovascular disease. Patients randomised to low thresholds vs. high thresholds for red cell transfusions.
	Studies of specific patients groups such as surgical and medical should be collated and analysed, areas of research could include patients who have undergone similar surgical procedures or the same underlying medical conditions. A comparison should be undertaken by randomly selecting low/high thresholds targets and reviewing outcomes e.g. hospital stay, complications etc. Work to specific guideline for each group.
Economic considerations	If the findings show low haemoglobin thresholds and targets are effective this will mean financial savings of 1 or 2 units of red cells per patient.
Feasibility	This research should be completed within a reasonable timescale. May have to consider ethical issues if using high and low thresholds most of the research papers used specific target haemoglobins for their patient groups.
Equalities	No specific equality issues identified
Importance	None.

O.2 Electronic Decision Support

What is the clinical and cost effectiveness of electronic decision support systems compared with current practice in reducing inappropriate blood transfusions, overall rates of blood transfusion and mortality?

Why this is important:

The clinical evidence evaluating electronic decision support systems is of low quality. There is also no evidence on their cost effectiveness within the NHS, and this is particularly important because of the potentially high setup and running costs of these systems. An evaluation of the clinical and cost effectiveness of electronic decision support systems for blood transfusion is needed. Important outcomes are rates of inappropriate transfusion, overall rates of transfusion, and patient safety outcomes including mortality and transfusion errors. Secondary outcomes should include length of hospital stay and quality of life; and pre-transfusion haemoglobin levels, platelet count and coagulation results.

Picto question Population: Patients in whom a request for red cells or other blood products is made Intervention: Electronic decision support system specific to blood transfusion Comparison: Existing blood transfusion request procedures (excluding electronic decision support systems) Outcomes: inappropriate blood transfusion; overall rates of blood transfusion; mortality; hospital length of stay; quality of life; pretransfusion haemoglobin level (for red cell transfusion), pretransfusion platelet count (for platelet transfusion), coagulation results (for plasma and coagulation factor transfusion) Importance to patients or the population outcomes. Reduction in overall use of blood products will reduce costs to the NHS, and increase availability for the population. Cost-effective systems will reduce cost to the NHS as well as improve patient outcomes. Relevance to NICE guidance Relevance to the NHS The results would ensure that implementation of electronic decision support was based on evidence of clinical and cost effectiveness. The study would provide evidence to guide whether the electronic decision support systems for blood products would result in more optimum use of blood products would result in more optimum use of blood products would result in more optimum use of blood products would result in more optimum use of blood products would result in more optimum use of blood products would result in more optimum use of blood products would ensure these are available for those in whom greatest clinical benefit occurs. Variation in clinical practice and patient care in relation to blood product transfusion will be reduced. The overall quality of current clinical evidence was very low. No evidence relating to quality of life or the impact on pretransfusion haemoglobin, platelet, or coagulation tests was identified. No evidence concerning the cost effectiveness of electronic decision support systems was identified. Study design A variety of study designs may be appropriate. These could include parallel gro		
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Economic An electronic decision support system would be implemented at hospital/blood	Study design	randomised trials, cluster randomised trials, or other forms of evaluation. Studies should include all patients in whom blood transfusions occur, and may need to specifically account for important subgroups, for example urgent versus nonurgent transfusions, transfusions of red cells or platelets or plasma, and specific NHS
	Economic	An electronic decision support system would be implemented at hospital/blood

considerations	bank level. Economic evaluations need to account for an institution level perspective in addition to an individual patient perspective. Cost effectiveness analysis needs to acknowledge that subsequent implementation would require investment within multiple institutions within the NHS.
Feasibility	This research should be completed within a reasonable timescale. There are technical issues over trial design but it is unlikely there would be ethical problems. Specific consideration of the consent procedures required is relevant, as individual patient consent is unlikely to be feasible.
Equalities	No specific equality issues identified
Other comments	None.

O.3 Post-operative cell salvage following cardiac surgery

For patients having cardiac surgery with a significant risk of post-operative blood loss, is post-operative cell salvage and reinfusion clinically and cost effective in reducing red blood cell use and improving clinical outcomes, compared with existing practice?

Why this is important:

There was some evidence for benefit from post-operative cell salvage, but the quality was low. Reducing blood loss during cardiac surgery may reduce the risk of complications. However, post-operative cell salvage carries additional cost. Studies are needed to determine whether post-operative cell salvage is more clinically and cost effective than existing practice for patients having cardiac surgery with a significant risk of post-operative blood loss. Important outcomes should include the use of red blood cells and other blood products, clinical outcomes and quality of life.

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PICO

Population

Patients undergoing coronary artery bypass surgery and/or valvular surgery Patients in whom overall perioperative blood loss is expected to be >500mL Patients considered to be at risk of significant post-operative blood loss based on pre-operative and/or intraoperative factors

Intervention:

The intervention is a device, namely the use of a post-operative cell salvage system that collects shed blood from post-operative chest drains, washes, and haemoconcentrates the RBCs, and re-infuses via a venous cannula.

All patients should receive intraoperative interventions to minimise blood loss and RBC transfusion according to NICE guidance, namely the use of tranexamic acid and, for selected cases, intraoperative cell salvage.

All patients will receive RBC transfusions during the post-operative ICU period according to a protocol consistent with recommendations in the NICE guidance

The intervention groups will receive post-operative cell salvage from chest drains, with re-infusion following RBC processing until bleeding has stopped or a clinical decision to discontinue post-operative cell salvage is made

Comparator:

All patients should receive intraoperative interventions to minimise blood loss and RBC transfusion according to NICE guidance, namely the use of tranexamic acid and, for selected cases, intraoperative cell salvage.

All patients will receive RBC transfusions during the post-operative ICU period according to a protocol consistent with recommendations in the NICE guidance

The comparator group will NOT receive post-operative cell salvage from chest drains.

Outcomes:

Primary outcome:

RBC use from randomization to hospital discharge

Secondary outcomes

Haemoglobin concentration at ICU discharge

Use of non-RBC blood products post-randomization (FFP; cryoprecipitate; platelets)

	Reoperation rate Mortality (hospital; 90 days) HRQoL (90 days) ICU and hospital length of stay A cost-effectiveness analysis should be incorporated.
Study Design	To define the at risk population a systematic review of available literature to define risk factors for post-operative risk of bleeding should be undertaken
	If necessary, new research to define the at risk population, for example to develop a risk score, should inform the RCT design
	The main trial should be a randomized parallel group design, with concealment of outcome assessors for the outcomes if feasible
Timeframe	No specific timeframe
Importance to patients or the population	Cardiac surgery utilises a high proportion of the UK blood supply. Wide variation in blood use remains between individual patients, surgeons, and hospitals. RBC transfusion has been associated with adverse outcomes in cardiac surgery, but it is uncertain whether this association is causative. NICE guidance will recommend tranexamic acid is offered to all patients undergoing cardiac surgery in whom blood loss is expected to be greater than 500 mLs. The consideration of intraoperative cell salvage for cases in whom large blood losses are expected will also be recommended based on clinical judgement. Some patients continue to lose blood from chest drains post-operatively, and a small proportion has major blood losses, which may require reoperation. Post-operative cell salvage could reduce RBC requirements, and/or improve post-operative haemoglobin concentration in patients, and may reduce other complications in patients who suffer major bleeding (for example: coagulopathy, hypothermia). These benefits may reduce complications, ICU and hospital length of stay, RBC and other blood product use, and HRQoL.
Relevance to NICE guidance	The NICE systematic review suggested that post-operative cell salvage may be clinically and cost-effective. However, the GDG recognised this was based on a small number of studies, and in patients in whom other recommended therapies, for example tranexamic acid, may not have been used. Post-operative salvage is available, but evidence to guide whether and when it should be used is weak.
	This question is of medium interest and it will inform the use of an available therapy and enable future updates to provide recommendations for this technology
Relevance to the NHS	If post-operative cell salvage is clinically and cost-effective, its implementation would benefit patients and the NHS, through reduced cost and reducing use of RBCs.
	Cardiac surgery is a costly and high volume procedure in the NHS.
	High quality evidence would enable business plans to be developed to support the introduction of post-operative cell salvage in an equitable manner to patients undergoing cardiac surgery

National priorities	
Current evidence base	 The NICE systematic review found possible benefit from post-operative cell salvage, but problems with the evidence base were: The quality of the evidence was low The evidence was not obtained in patient groups in whom other NICE guidance was implemented, namely the use of tranexamic acid,
	intraoperative cell salvage, and the use of restrictive transfusion triggers
	The target population was not clearly defined
Equality	No
Feasibility	This research is feasible within the NHS; the sample size is likely to be achievable within a high volume surgery, and there are no particular ethical issues.
	If post-operative cell salvage is shown to be cost-effective the cost of a trial is likely to be justified given the volume of this type of surgery each year. If a trial finds no benefit, it will provide high quality evidence that existing use of post-operative cell salvage should be reviewed.
Other comments	It is likely that a manufacturer of post-operative cell salvage equipment would provide the excess treatment costs for a trial

Appendix P: Excluded clinical studies

2 P.1 Erythropoietin and iron

Study	Exclusion reason
Adamson 1996 ⁶	Systematic review: literature search not sufficiently rigorous. Systematic review: methods are not adequate/unclear
Andrews 1997 ¹⁹	Not review population. Non-anaemic patients
Atabek 1995 ²⁶	Incorrect study design
Beris 2008 ³⁷	Systematic review: study designs inappropriate
Bhandal 2006 ⁴¹	Non -surgical patients
Braga 1998 ⁵⁵	Letter to the editor
Breymann 1996 ⁵⁷	Includes patients with vaginal delivery and c-section.
Cherian 2013 ⁸⁸	Systematic review- checked references
Chua 2014 ⁹⁸	Abstract
Corwin 2002 ¹⁰⁹	Intensive care patients not about transfusion during surgery
Corwin 2004 ¹⁰⁷	Systematic review: study designs inappropriate
Corwin 2007 ¹⁰⁸	Intensive care patients. not about transfusion in surgery
Cuenca 2007 ¹¹⁴	Incorrect study design
Del campo 1982 ¹²³	Incorrect study design
Duh 2008 ¹³²	Systematic review is not relevant to review question or unclear PICO
Froessler 2012 ¹⁵⁴	Systematic review- checked references
Froessler 2013 ¹⁵³	Systematic review- checked references
Goodnough 1994 ¹⁷³	Incorrect population of interest- autologous blood donors
Jaspers 2014 ²²⁰	EPO after allogeneic haematopoietic cell transplantation
Jeong 2014 ²²¹	Incorrect study design
Krafft 2011 ²⁴⁷	Postpartum women. Mentions but does not stratify between spontaneous. caesarean and operative vaginal deliveries
Keating 2015 ²³³	Narrative review
Lee 2014 ²⁵⁶	Incorrect study design
Lin 2013 ²⁶⁶	Systematic review- checked references
Maclaren 2004 ²⁸¹	Systematic review is not relevant to review question or unclear PICO
Mercuriali 1994 ²⁹⁴	Incorrect population (autologous blood donation)
Monk 1999 ³⁰⁰	Inappropriate comparison. Incorrect interventions
Moonen 2008 ³⁰¹	Incorrect interventions
Mudge 2009 ³⁰⁹	Incorrect population of interest- kidney transplant patients
Mudge 2012 ³¹⁰	Incorrect population of interest- kidney transplant patients
Munoz 2006 ³¹⁵	Incorrect study design
Munoz 2008 ³¹³	Systematic review: study designs inappropriate; methods are not adequate/unclear
Pajoumand 2004 ³⁴³	Systematic review is not relevant to review question or unclear PICO
Pfeffer 2009 ³⁵⁴	No surgery patients
Pieracci 2009 ³⁵⁶	Intensive care patients. not about transfusion during surgery

Rowlands 2013 ³⁷⁶	Study protocol
Shimpo 1994 ³⁹⁵	In Japanese
Singh 2006 ⁴⁰⁰	No surgery patients
Sowade 1998 ⁴¹⁸	Systematic review is not relevant to review question or unclear PICO
Tran 2014 ⁴⁴⁹	Narrative review - checked references
Van loo 1996 ⁴⁶²	Incorrect population of interest- kidney transplant patients
Walpoth 1996 ⁴⁷³	Incorrect interventions
Watanabe 1992 ⁴⁸⁵	Autologous blood donation
Weber 2005 ⁴⁸⁸	Allogeneic and autologous blood transfusion. Unable to clearly separate results between autologous and allogeneic transfusions.
Yang 2011 ⁵⁰⁴	Systematic review: literature search not sufficiently rigorous
Yazicioglu 2001 ⁵⁰⁷	Incorrect population of interest- autologous blood donors

1 P.2 Alternatives

Study	Exclusion reason
Abdullah 2012 ⁴	Conference abstract
Adler ma 2011 ⁷	Incorrect interventions- systematic review
Aggarwal 2012 ⁸	Does not meet the inclusion criteria
Alipour 2013 ¹⁰	No outcomes of interest
Allanki 2009 ¹¹	Abstract
Almeida 2013 ¹²	Non-randomized prospective cohort study
Alshryda 2011 ¹⁴	Incorrect interventions- systematic review
Alshryda 2014 ¹⁵	Meta-analysis
Aluri 2012 ¹⁶	Abstract
Antinolfi 2010 ²⁰	Conference abstract
Antonopoulou 2013 ²¹	Abstract
Aoki 2012 ²³	Incorrect study design
Badeaux 2014 ²⁸	Systematic review of IV TXA in patients undergoing spine surgery. All references checked.
Baldus 2010 ³⁰	Incorrect study design
Barbara 2010 ³¹	Abstract
Basta 2012 ³²	Systematic review: methods are not adequate/unclear
Bhavana 2013 ⁴²	Abstract
Blatsoukas 2010 ⁴⁷	Not RCT
Boenigk 2011 ⁴⁸	Conference abstract
Borisov 2011 ⁵¹	Conference abstract
Bouali 2011 ⁵²	Conference abstract
Bracey 2009 ⁵³	Conference abstract
Briganti 2011 ⁵⁸	Conference abstract
Cacheux 2012 ⁶⁴	Conference abstract
Campbell 2012 ⁶⁷	Cell salvage plus heparin vs blood returned unprocessed

Cavolli 2011 ⁸¹	Abstract
Celebi 2006 ⁸²	Incorrect interventions
Chan 2013 ⁸³	Systematic review: methods are not adequate/unclear
Chen 2008 ⁸⁵	No relevant outcomes reported
Chen 2013 ⁸⁷	Systematic review: methods are not adequate/unclear
Chen 2013 ⁸⁶	Objective/outcomes of the study not relevant
Cheriyan 2013 ⁸⁹	Meta-analysis
Cholette 2011 ⁹²	Abstract
Cholette 2012 ⁹³	Abstract
Cholette 2013 ⁹⁴	Mean age of patients around 4 months
Christabel 2014 96	No relevant outcomes reported
Chu 2013 ⁹⁷	Non-randomised study
Crash-2 collaborators 2011 ¹⁰²	Population out of scope (trauma)
Dadure 2011 ¹¹⁶	Incorrect age group
Dalmau 2000 ¹¹⁷	Not review population
Damgaard 2010 ¹¹⁸	No relevant outcomes reported
Dhariwal 2014 ¹²⁷	Systematic review of use of ICS in caesarean section. Only one RCT was included in this review and this study is included in our evidence review.
Duran 2003 ¹³³	Not in English
Elgafy 2010 ¹³⁸	Systematic review: study designs inappropriate
Espahbod 2014 ¹³⁹	Meta-analysis
Faraoni 2011 ¹⁴³	Conference abstract
Faraoni 2012 ¹⁴⁵	Paediatric cardiac surgery - does not include all types of sur
Faraoni 2014 A ¹⁴⁴	Systematic review- does not meet our protocol criteria
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	entirely Total knee arthroplasty - does not include all types of
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Fu 2013 ¹⁵⁵ Gandhi 2013 ¹⁵⁸ Garg 2012 ¹⁵⁹ Gautam 2011 ¹⁶⁰ Gautam 2013 ¹⁶¹ Gill 2008 ¹⁶⁵ Golab 2008 ¹⁶⁸ Gomez 2012 ¹⁷⁰ Goobie 2011 ¹⁷¹ Gourlay 2013 ¹⁷⁷ Goz 2013 ¹⁷⁸	entirely Total knee arthroplasty - does not include all types of sur Total knee and hip arthroplasty -does not include all types of surgeries Conference abstract Incorrect study design Systematic review: study designs inappropriate. Incorrect study design Spine surgery -no other surgeries included Incorrect age group Conference abstract Incorrect age group Abstract Abstract

Guay 2006 ¹⁸⁶	Incorrect age group
Gurusamy 2011 ¹⁸⁹	Incorrect population
Haien 2013 ¹⁹⁰	Systematic review: methods are not adequate/unclear
Halder 2013 ¹⁹¹	Incorrect study design
Hashimoto 2007 ¹⁹³	Cell salvage compared to autologous blood transfusion
Hassani 2012 ¹⁹⁴	Paper not in English
Hoelscher 2011 ²⁰¹	Conference abstract
Hogan 2014 ²⁰²	Abstract
Huang 2014 ²⁰⁶	Meta-analysis
Huet 1999 ²⁰⁷	Systematic review: methods are not adequate/unclear
Hutton 2012 ²⁰⁹	Conference abstract
Hutton 2012 ²⁰⁸	Systematic review: methods are not adequate/unclear
Ipema 2012 ²¹³	Systematic review: study designs inappropriate
Jahanshahi 2014 ²¹⁷	No outcomes of interest
Jairath 2014 ²¹⁸	Abstract
Jimenez-yuste 2002 ²²²	Incorrect interventions
Kashefi 2012 ²³⁰	Paper not in English
Kaste 1979 ²³¹	Use of TXA subarachnoid haemorrhage -not releavant population
Kelley 2014 ²³⁴	Retrospective case control study
Kim2014A ²⁴⁰	Systematic review
Klinck 1993 ²⁴¹	Conference abstract
Konig 2013 ²⁴⁵	Non-randomised study
Kristensen 1992 ²⁴⁸	Excluded from Cochrane review for insufficient data
Kumar 2014 ²⁴⁹	Systematic review- includes non-randomised studies
Leelahanon 2002 ²⁵⁹	Conference abstract
Li 2013 ²⁶³	Meta-analysis
Li 2014 ²⁶²	Meta-analysis of autologous blood transfusion drainage vs. no drainage in patients undergoing primary THA. All references checked.
Lian 2011 ²⁶⁴	Not in English
Lin 2011 ²⁶⁸	Incorrect study design
Liu 2010 ²⁶⁹	Not in English
Lundin 2013 ²⁷⁵	Abstract
Ma 2010 ²⁷⁹	Abstract
Macgillivray 2011 ²⁸⁰	Inappropriate comparison
Maniar 2012 ²⁸⁴	Control group not part of randomisation
Markar 2012 ²⁸⁵	Systematic review: methods are not adequate/unclear
Martinez-sanz 2011 ²⁸⁷	Conference abstract
Mason 2011 ²⁸⁹	Incorrect study design
Matkovic 2010 ²⁹⁰	Abstract

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Meybohm 2013 ²⁹⁶	Systematic review: study designs inappropriate
Miao 2014 ²⁹⁷	Single-center, retrospective study
Moguilevitch 2011 ²⁹⁸	Abstract
Molloy 2007 ²⁹⁹	Incorrect interventions
Moore 2011 ³⁰²	Abstract
Morales 2013 ³⁰³	Abstract
Moret 2006 ³⁰⁴	Conference abstract
Morgenschweis 2011 ³⁰⁶	Abstract
Munoz 2013 ³¹⁶	Retrospective review
Munoz 2014 ³¹⁴	Before and after cohort study
Ngaage 2010 ³²⁶	Systematic review: study designs inappropriate. Incorrect interventions
Nicolai 2004 ³²⁸	Inappropriate comparison
Offierski 2013 ³³⁴	Conference abstract
Oishi 1997 ³³⁶	Inappropriate comparison
Ozal 2002 ³³⁹	Incorrect interventions
Panteli2013 ³⁴⁷	Systematic review- check references
Patel 2014 ³⁵¹	Incorrect interventions
Peitsidid 2014 ³⁵³	Systematic of TXA in patients with menorrhagia due to uterine fibroids (Incorrect population)
Proctor 2011 ³⁵⁷	Conference abstract
Prokopchuk-gauk 2012 ³⁵⁸	Conference abstract
Pundir 2013 ³⁵⁹	Systematic review
Risch 2000 ³⁷²	Not in English
Rybo 1972 ³⁷⁷	Not relevant surgery- conization
Sasanuma 2011 ³⁸¹	Incorrect interventions
Schouten 2009 ³⁸⁶	Inappropriate comparison
Shantikumar 2011 ³⁹¹	Systematic review: methods are not adequate/unclear
Shen 2013 ³⁹³	Abstract
Shimizu 2011 ³⁹⁴	Upto 40% of children in both groups less than 1 year of age
Shulman 1998 ³⁹⁷	Inappropriate comparison
Silva 2013 ³⁹⁸	Retrospective cross-sectional study
Sinclair 2009 ³⁹⁹	Systematic review: methods are not adequate/unclear
Singh 2010 ⁴⁰²	Incorrect study design
Song 2013 ⁴¹⁷	Craniosystosis -no other surgeries included
Song 2013 ⁴¹⁶	Orthognathic surgeries- other types of surgeries not included
So-Osman 2014 A ⁴¹³	Reports combined results for (ICS+PCS)+PCS as AUTO group; does not meet protocol
So-Osman 2014B ⁴¹⁰	Abstract
Specchiulli 2011 ⁴¹⁹	Conference abstract

Sukeik 2011 ⁴³²	Orthognathic surgery- not all surgeries included
Sun 2008 ⁴³³	Systematic review: methods are not adequate/unclear
Taj 2014 ⁴³⁴	No outcomes of interest
Tan2013 ⁴³⁵	Meta-analysis
Thomassen 2011 ⁴³⁹	Abstract
Toda 2013 ⁴⁴⁶	Conference abstract
Vacharaksa 2002 ⁴⁵⁸	Incorrect interventions
Vela 2012 ⁴⁶⁵	Conference abstract
Wang 2009 ⁴⁸⁰	Systematic review: methods are not adequate/unclear
Wardrop 2012 ⁴⁸²	Conference abstract
Washington 2009 ⁴⁸⁴	Abstract
Waters 2012 ⁴⁸⁷	Systematic review: methods are not adequate/unclear
Weltert 2013 ⁴⁹⁰	Inappropriate comparison
Williams 2009 ⁴⁹⁹	Abstract
Yagi 2012 ⁵⁰¹	Incorrect study design
Yang 2012 ⁵⁰⁵	Systematic review: methods are not adequate/unclear
Yang 2013 ⁵⁰²	Systematic review: methods are not adequate/unclear
Yassen 1993 ⁵⁰⁶	Not review population
Yutthakasemsunt2013 ⁵⁰⁹	Incorrect population- non-surgical patients with traumatic brain injury
Zaporozhan 2013 ⁵¹²	Conference abstract
Zhang 2012 ⁵¹³	Systematic review: methods are not adequate/unclear
Zhang 2014 ⁵¹⁴	Systematic review of TXA in patients undergoing TKA. Checked references.
Zhaohui 2014 ⁵¹⁶	Incorrect comparisons- TXA +epinephrine vs. Epinephrine
Zhaoyu 2014 ⁵¹⁵	Meta-analysis of TXA in patients undergoing primary TKA. All references checked.
Zheng 2000 ⁵¹⁷	Conference abstract
Zhou 2013 ⁵¹⁸	Systematic review: methods are not adequate/unclear
Zhu 2010 ⁵¹⁹	Conference abstract

2 P.3 Red blood cells RBC Targets

1100 01000 0010 1120 1018000	
Study	Exclusion reason
Alvarez 2001 ¹⁷	Review article
Bellomo 2001 ³⁵	Abstract
Berns 2010 ³⁸	Incorrect study design. Narrative review
Bracey 1999 ⁵⁴	Incorrect interventions
Carson 1998 ⁷³	Narrative review
Carson 1998 ⁷⁴	Incorrect interventions. Inappropriate comparison

Carson 2002 ⁷⁷	Contamostic annicon conducted in 2002 (all apleads afternoon acted)
	Systematic review conducted in 2002 (all relevant references noted)
Carson 2011 ⁷⁸	Incorrect interventions
Carson 2012 ⁷⁶	clinical practice guideline
Carson 2013 ⁷⁵	Incorrect interventions
Colomo 2008 ¹⁰³	Incorrect interventions
De gast-bakker 2013 ¹²²	Incorrect interventions
Foss 2009 ¹⁵⁰	Incorrect interventions
Grover 2006 ¹⁸⁴	Incorrect interventions
Hardy 2003 ¹⁹²	Narrative review
Hebert 2000 ¹⁹⁶	Review article
Hogshire 2013 ²⁰³	Literature review
Holst 2013 ²⁰⁵	Incorrect interventions
Jairath 2013 ²¹⁹	Incorrect interventions
Johnson 1992 ²²⁴	Incorrect interventions
Karam 2011 ²²⁸	Incorrect interventions
Kennedy 2002 ²³⁵	Incorrect interventions
Lum 1997 ²⁷⁴	Incorrect study design
Napolitano 2004 ³²⁴	Narrative review
Nielsen 2012 ³²⁹	Incorrect interventions
O'hara 1999 ³³³	Review of medical records. Incorrect study design
Palmieri 2007 ³⁴⁴	Incorrect study design
Parker 2013 ³⁴⁸	Incorrect interventions
Rosland 2014 ³⁷³	Cohort study
Rouette 2010 ³⁷⁵	Incorrect interventions
Shehata 2012 ³⁹²	Incorrect interventions
Singh 2008 ⁴⁰¹	Incorrect study design. Critical review
So-osman 2010 ⁴¹¹	Incorrect interventions
So-osman 2013 ⁴¹²	Incorrect interventions
Strippoli giovanni 2006 ⁴³¹	Only includes patients with chronic kidney disease
Tay 2011 ⁴³⁶	Protocol for study
Valeri 1998 ⁴⁶¹	Article
Vichinsky 1995 ⁴⁶⁸	Patients with haemoglobinopathies
Viele 1994 ⁴⁶⁹	Literature review
Wali 2003 ⁴⁷²	Patients with haemoglobinopathies
Walsh 2013 ⁴⁷⁵	Incorrect interventions
Wang 2013 ⁴⁸¹	Includes only upper GI bleeding
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Webert 2008 ⁴⁸⁹	Incorrect interventions
Whyte 2011 ⁴⁹³	Infants
Willems 2010 ⁴⁹⁷	Sub group analysis of cardiac surgery patients in TRIPICU study (Lacroix 2007 which has been included)

P.4 RBC Doses

Study	Exclusion reason
Arslan 2004 ²⁵	Incorrect interventions
Carson 2013 ⁷⁵	Incorrect interventions
Cooper 2011 ¹⁰⁵	Incorrect interventions
Lightdale 2012 ²⁶⁵	Incorrect study design
Parker 2013 ³⁴⁸	Incorrect interventions
Shehata 2012 ³⁹²	Incorrect interventions
Slight 2008 ⁴⁰⁶	Incorrect interventions
Smith 2013 ⁴⁰⁸	Review- checked references
Walsh 2013 ⁴⁷⁵	Incorrect interventions
Wang 2013 ⁴⁸¹	Incorrect interventions

2 P.5 Platelets

3 P.5.1 Platelet thresholds and targets

Study	Exclusion reason
Callow 2002 ⁶⁵	Incorrect study design
Cameron 2007 ⁶⁶	Incorrect study design
Goodnough 2002 ¹⁷²	Abstract
Heddle 2009 ¹⁹⁸	Incorrect interventions
Khan Assir 2013 ²³⁷	Incorrect interventions
Klumpp 1999 ²⁴³	Incorrect interventions
Nevo 2007 ³²⁵	Incorrect study design
Razzaghi 2012 ³⁶⁵	Only includes patients with upper GI bleeding
Rebulla 1996 ³⁶⁶	conference abstract
Sensebe 2005 ³⁸⁸	Incorrect interventions
Solomon 1978 ⁴¹⁵	Incorrect interventions
Stanworth 2004 ⁴²²	This Cochrane review has been updated in 2012
Tinmouth 2002 ⁴⁴³	Incorrect interventions
Tinmouth 2004 ⁴⁴⁴	Incorrect interventions
Wandt 1995 ⁴⁷⁷	Incorrect study design. conference abstract
Wandt 1998 ⁴⁷⁶	Incorrect study design
Wandt 2009 ⁴⁷⁸	conference abstract
Zahur-ur-rehman 2002 ⁵¹⁰	Incorrect interventions

2 Platelet targets

i latelet talgets	
Study	Exclusion reason
Callow 2002 ⁶⁵	Incorrect interventions
Cameron 2007 ⁶⁶	Incorrect interventions
Diedrich 2005 ¹²⁸	Incorrect interventions
Estcourt 2012 ¹⁴¹	Incorrect interventions
Goodnough 2002 ¹⁷²	Incorrect interventions
Heckman 1997 ¹⁹⁷	Incorrect interventions
Heddle 2009 ¹⁹⁸	Incorrect interventions
Khan Assir 2013 ²³⁷	Incorrect interventions
Klumpp 1999 ²⁴³	Incorrect interventions
Nevo 2007 ³²⁵	Incorrect interventions
Razzaghi 2012 ³⁶⁵	Incorrect interventions
Rebulla 1996 ³⁶⁶	Incorrect interventions
Rebulla 1997 ³⁶⁷	Incorrect interventions
Sensebe 2005 ³⁸⁸	Incorrect interventions
Stanworth 2004 ⁴²²	Incorrect interventions
Stanworth 2010 ⁴²⁶	Incorrect interventions
Stanworth 2013 ⁴²⁷	Incorrect interventions
Tinmouth 2002 ⁴⁴³	Incorrect interventions
Tinmouth 2004 ⁴⁴⁴	Incorrect interventions
Wandt 1995 ⁴⁷⁷	Incorrect interventions
Wandt 1998 ⁴⁷⁶	Incorrect interventions
Wandt 2009 ⁴⁷⁸	Incorrect interventions
Wandt 2012 ⁴⁷⁹	Incorrect interventions
Zahur-ur-rehman 2002 ⁵¹⁰	Incorrect interventions
Zumberg 2002 ⁵²²	Incorrect interventions

3 P.5.2 Platelet doses

L Flatelet uoses	
Study	Exclusion reason
Ackerman 2000 ⁵	Incorrect interventions
Cid 2007 ⁹⁹	Systematic review: methods are not adequate/unclear
Estcourt 2014 ¹⁴²	Protocol for Cochrane review
Herman 1995 ¹⁹⁹	Abstract
Josephson 2009 ²²⁵	Abstract
Kaufman 2015 ²³²	Secondary analysis of PLADO study. The study examined the frequency of transfusion related adverse events (TRAE) and whether the risk of TRAEs varied depending on the platelet characteristics.
Klumpp 1995 ²⁴²	Abstract
Klumpp 1999 ²⁴³	Crossover study
Lu 2011 ²⁷²	Abstract
Lu 2013 ²⁷³	Abstract

Murphy 2003 ³¹⁹	Inappropriate comparison. not randomised to compare platelet doses
Murphy 2006 ³²⁰	Inappropriate comparison. not randomised to compare platelet dose
Norol 1995 ³³¹	Abstract
Pedrazzoli 1997 ³⁵²	Abstract
Sahin 2013 ³⁷⁸	Abstract
Schiffer 1976 ³⁸³	Incorrect interventions
Schiffer 1976 ³⁸⁴	Incorrect interventions
Slichter 2005 ⁴⁰⁵	Incorrect interventions
Slichter 2006 ⁴⁰⁴	Narrative paper; background and rationale for PLADO trial
Slichter 2009 ⁴⁰³	Abstract
Stanworth 2004 ⁴²²	Systematic review; updated in 2012 (Estcourt 2012)
Steffens 2002 ⁴²⁹	Inappropriate comparison
Tinmouth 2002 ⁴⁴³	Abstract
Tinmouth 2003 ⁴⁴⁵	Systematic review: methods are not adequate/unclear
Triulzi 2009 ⁴⁵²	Abstract
Triulzi 2012 ⁴⁵³	Secondary analysis of Slichter 2010; outcomes not relevant to protocol
Van rhenen 2003 ⁴⁶³	Incorrect interventions
Wandt 2009 ⁴⁷⁸	Abstract

1 **P.6 FFP**

2 P.6.1 FFP thresholds and targets

Study	Exclusion reason
Casbard 2004 ⁷⁹	Systematic review is not relevant to review question or unclear PICO
Dara 2005 ¹¹⁹	Incorrect study design
Doussau 2014 ¹³⁰	Incorrect interventions
Levy 2011 ²⁶¹	Conference abstract
Muller 2011 ³¹²	Incorrect interventions
Stanworth 2004 ⁴²⁰	Systematic review is not relevant to review question or unclear PICO
Stanworth 2006 ⁴²¹	Narrative review
Stanworth 2007 ⁴²³	Systematic review is not relevant to review question or unclear PICO
Stanworth 2011 ⁴²⁴	Incorrect study design
Tinmouth 2008 ⁴⁴²	Conference abstract
Williamson 1999 ⁵⁰⁰	Incorrect interventions

3 P.6.2 FFP doses

Study	Exclusion reason
Abdel-wahab 2006 ³	Incorrect interventions
Anwar 2012 ²²	conference abstract

Danas dua 2012 ⁴⁰	Confirmed a shake at Full and a standard to fee
Besandre 2012 ⁴⁰	Conference abstract. Full paper not published so far.
Boldt 1989 ⁵⁰	Not in English
Carino 2009 ⁷¹	conference abstract
Casbard 2004 ⁷⁹	Systematic review is not relevant to review question or unclear PICO
Despotis 1994 ¹²⁶	Incorrect interventions
Dzik 2004 ¹³⁶	Narrative review
Khan 2007 ²³⁸	Incorrect interventions
Labarinas 2013 ²⁵¹	Literature review
Lauzier 2007 ²⁵⁴	Inappropriate comparison. Incorrect interventions
Lerner 2000 ²⁶⁰	Incorrect interventions
Levy 2011 ²⁶¹	Incorrect interventions. conference abstract
Matsumoto 2007 ²⁹¹	Incorrect interventions. Inappropriate comparison
Motta 2014 ³⁰⁸	Neonates
Muller 2011 ³¹²	Study protocol
Noddeland 2002 ³³⁰	Incorrect interventions. Inappropriate comparison
Puronen 2009 ³⁶⁰	Incorrect interventions. conference abstract
Sezik 2014 ³⁸⁹	Incorrect study design.
Stanworth 2004 ⁴²⁰	Not relevant comparisons. References noted. Incorrect interventions
Stanworth 2006 ⁴²¹	Literature review
Stanworth 2007 ⁴²³	Review article
Stanworth 2007 ⁴²⁵	Literature review
Tollofsrud 2003 ⁴⁴⁸	Inappropriate comparison. Incorrect interventions
Trimble 1964 ⁴⁵⁰	Incorrect interventions. Inappropriate comparison
Tripodi 2012 ⁴⁵¹	Incorrect study design
Urwyler 2009 ⁴⁵⁷	Study protocol
Verghese 2008 ⁴⁶⁶	Narrative review
Walsh 2011 ⁴⁷⁴	Conference abstract. Study included
White 2011 ⁴⁹²	conference abstract
Willems 2014 ⁴⁹⁸	Incorrect interventions
Williamson 1999 ⁵⁰⁰	Incorrect interventions
Yang 2012 ⁵⁰³	Not all comparisons relevant. One study reference identified.
Youssef 2003 ⁵⁰⁸	Incorrect interventions. Inappropriate comparison

1 P.7 Cryoprecipitate

2 P.7.1 Cryoprecipitate thresholds and targets

Study	Exclusion reason
Abbott 2009 ²	Inappropriate comparison
Fenger-eriksen 2009 ¹⁴⁷	Incorrect interventions
French 2003 ¹⁵¹	Incorrect interventions. Inappropriate comparison
Galas 2012 ¹⁵⁶	Inappropriate comparison. conference abstract
Goldenberg 2006 ¹⁶⁹	Review article
Hesselvik 1987 ²⁰⁰	Not review population

Hwang 1991 ²¹¹	Not review population
lyengar 2013 ²¹⁶	Incorrect interventions
Karlsson 2009 ²²⁹	Incorrect interventions
Ketchum 2006 ²³⁶	Review article
Kostousov 2012 ²⁴⁶	Incorrect interventions. conference abstract
Lang 1993 ²⁵²	Incorrect interventions. Inappropriate comparison
Lee 2014 ²⁵⁸	cohort study <1000 patients
Stevens 1986 ⁴³⁰	Not review population
Teitel 2011 ⁴³⁷	Incorrect interventions
Tinegate 2011 ⁴⁴¹	Survey
Warmuth 2012 ⁴⁸³	Systematic review is not relevant to review question or unclear PICO. Relevant papers ordered
Wikkelsø 2013 ⁴⁹⁶	Incorrect interventions
Zakout 2009 ⁵¹¹	conference abstract

1 P.7.2 Cryoprecipitate doses

Study	Exclusion reason
Abbott 2009 ²	Inappropriate comparison. Incorrect interventions
Fenger-eriksen 2009 ¹⁴⁷	Incorrect interventions
French 2003 ¹⁵¹	Incorrect interventions. Inappropriate comparison
Galas 2012 ¹⁵⁶	Incorrect interventions. Inappropriate comparison
Goldenberg 2006 ¹⁶⁹	Incorrect interventions. Inappropriate comparison
Hesselvik 1987 ²⁰⁰	Incorrect interventions. Inappropriate comparison
Holcomb 2013 ²⁰⁴	Incorrect interventions. Inappropriate comparison
Hwang 1991 ²¹¹	Incorrect interventions. Inappropriate comparison
lyengar 2013 ²¹⁶	Incorrect interventions
Karlsson 2009 ²²⁹	Incorrect interventions
Ketchum 2006 ⁶⁶	Incorrect interventions
Kostousov 2012 ²⁴⁶	Incorrect interventions. Inappropriate comparison
Lang 1993 ²⁵²	Incorrect interventions. Inappropriate comparison
Lee 2014 ²⁵⁸	Incorrect interventions
Stevens 1986 ⁴³⁰	Incorrect interventions. Inappropriate comparison
Teitel 2011 ⁴³⁷	Inappropriate comparison. conference abstract
Warmuth 2012 ⁴⁸³	Incorrect interventions. Inappropriate comparison
Wikkelsø 2013 ⁴⁹⁶	Incorrect interventions. Inappropriate comparison

2 **P.8 PCC**

3 P.8.1 PCC thresholds and targets

Study	Exclusion reason
Arshad 2013 ²⁴	Protocol for study- for follow up
Awad 2013 ²⁷	Review
Bechtel 2011 ³³	Review. Not directly relevant to review question

Cabral 2013 ⁸³ Retrospective case series review of 30 patients; not information on thresholds/targets Chong 2010 ⁹⁵ Case series of 7 patients; evaluates PCC + FFP Desmettre 2012 ¹²⁵ Paper not available Eerenberg 2011 ¹³⁷ Healthy volunteer study; comparisons not relevant Dowlatshahi 2012 ¹³¹ Canadian registry. n=141. Does not compared PCC transfusion at different thresholds/target levels Huynh 2014 ²¹⁰ n=44. Small retrospective study Johansen 2013 ²²³ Protocol for Cochrane review on PCC for peri-operative reversal of Vitamin K antagonist Junagade 2007 ²²⁶ Abstract Knight 2009 ³⁴⁴ Systematic review on efficacy of r FactorVIIa and aPCC Leal-noval 2013 ²⁴⁵ Do not report number of patients in allocated to low (15 IU/kg) and high dose groups (25 IU/kg) Lin 2013 ²⁶⁷ Systematic review of PCCs and fibrinogen concentrates (FIBCs) in combination Lusher 1980 ²⁷⁸ RCT evaluating efficacy of 2 PCC preparations with placebo; does not evaluate INR thresholds or targets-wrong comparison Lusher 1983 ²⁷⁷ Compares 2 different types of PCCs, not relevant comparison Lusher 1984 ²⁷⁶ Narrative review of PCC and Factor VIII inhibitors Mai 2013 ³⁸³ Abstract Pabinger 2008 ³⁴⁰ 44 patients, no control arm, prospective study Pabinger 2008 ³⁴⁰ 44 patients, no control arm, prospective study Pabinger 2010 ³⁴¹ Evaluates impact of speed of PCC infusion Patanwala 2011 ³⁵⁰ Systematic review- relevant papers ordered Solbeck 2012 ⁴¹⁴ Systematic review- relevant papers ordered Solbeck 2012 ⁴¹⁴ Systematic review checked references Staudinger 1999 ⁴²⁸ Cohort study, n=16. Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract Voils 2012 ⁴⁷¹ Systematic review- relevant references noted	Bershad 2010 ³⁹	Literature review
thresholds/targets Chong 2010 ²⁵ Case series of 7 patients; evaluates PCC + FFP Desmettre 2011 ¹³⁷ Healthy volunteer study; comparisons not relevant Dowlatshahi 2012 ¹³¹ Canadian registry. n=141. Does not compared PCC transfusion at different thresholds/target levels Huynh 2014 ²¹⁰ n=44. Small retrospective study Johansen 2013 ²²³ Protocol for Cochrane review on PCC for peri-operative reversal of Vitamin K antagonist Junagade 2007 ²²⁶ Abstract Knight 2003 ²⁴⁴ Systematic review on efficacy of r FactorVIIa and aPCC Leal-noval 2013 ²⁵⁵ Do not report number of patients in allocated to low (15 IU/kg) and high dose groups (25 IU/kg) Lin 2013 ²⁶⁷ Systematic review of PCCs and fibrinogen concentrates (FIBCs) in combination Lusher 1980 ²⁷⁸ RCT evaluating efficacy of 2 PCC preparations with placebo; does not evaluate INR thresholds or targets-wrong comparison Lusher 1983 ²⁷⁷ Compares 2 different types of PCCs, not relevant comparison Lusher 1984 ²⁷⁶ Narrative review of PCC and Factor VIII inhibitors Mai 2013 ³⁸⁸ Abstract Otite 2013 ³⁸⁸ Abstract Pabinger 2000 ³⁴⁰ 44 patients, no control arm, prospective study Pabinger 2010 ³⁴¹ Evaluates impact of speed of PCC infusion Patanwala 2011 ³⁵⁰ Systematic review- checked references Staudinger 1999 ⁴²⁸ Cohort study, n=16. Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract		
Desmettre 2012 ¹²⁵ Paper not available Eerenberg 2011 ¹³⁷ Healthy volunteer study; comparisons not relevant Dowlatshahi 2012 ¹³¹ Canadian registry. n=141. Does not compared PCC transfusion at different thresholds/target levels Huynh 2014 ²¹⁰ n=44. Small retrospective study Johansen 2013 ²²³ Protocol for Cochrane review on PCC for peri-operative reversal of Vitamin K antagonist Junagade 2007 ²²⁶ Abstract Knight 2009 ²⁴⁴ Systematic review on efficacy of r FactorVIII and aPCC Leal-noval 2013 ²⁵⁵ Do not report number of patients in allocated to low (15 IU/kg) and high dose groups (25 IU/kg) Lin 2013 ²⁶⁷ Systematic review of PCCs and fibrinogen concentrates (FIBCs) in combination Lusher 1980 ²⁷⁸ RCT evaluating efficacy of 2 PCC preparations with placebo; does not evaluate INR thresholds or targets-wrong comparison Lusher 1983 ²⁷⁷ Compares 2 different types of PCCs, not relevant comparison Lusher 1984 ²⁷⁶ Narrative review of PCC and Factor VIII inhibitors Mai 2013 ²⁸³ Abstract Otite 2013 ³⁸⁸ Abstract Otite 2013 ³⁸⁸ Abstract Pabinger 2008 ³⁴¹⁰ Evaluates impact of speed of PCC infusion Patanwala 2011 ²⁵⁰ Systematic review- relevant papers ordered Solbeck 2012 ⁴¹⁴ Systematic review- checked references Staudinger 1999 ⁴²⁸ Cohort study, n=16. Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract	Cabi ai 2013	· · · · · · · · · · · · · · · · · · ·
Eerenberg 2011 ¹³⁷ Healthy volunteer study; comparisons not relevant Dowlatshahi 2012 ¹³¹ Canadian registry. n=141. Does not compared PCC transfusion at different thresholds/target levels Huynh 2014 ²¹⁰ n=44. Small retrospective study Johansen 2013 ²²³ Protocol for Cochrane review on PCC for peri-operative reversal of Vitamin K antagonist Junagade 2007 ²²⁶ Abstract Knight 2009 ²⁴⁴ Systematic review on efficacy of r FactorVIIIa and aPCC Leal-noval 2013 ²⁵⁵ Do not report number of patients in allocated to low (15 IU/kg) and high dose groups (25 IU/kg) Lin 2013 ²⁶⁷ Systematic review of PCCs and fibrinogen concentrates (FIBCs) in combination Lusher 1980 ²⁷⁸ RCT evaluating efficacy of 2 PCC preparations with placebo; does not evaluate INR thresholds or targets-wrong comparison Lusher 1983 ²⁷⁷ Compares 2 different types of PCCs, not relevant comparison Lusher 1984 ²⁷⁶ Narrative review of PCC and Factor VIII inhibitors Mai 2013 ²⁸³ Abstract Otite 2013 ²⁸³ Abstract Otite 2013 ³³⁸ Abstract Pabinger 2008 ³⁴⁰ 44 patients, no control arm, prospective study Pabinger 2008 ³⁴⁰ 44 patients, no control arm, prospective study Pabinger 2010 ³⁴¹ Evaluates impact of speed of PCC infusion Patanwala 2011 ³⁵⁰ Systematic review- relevant papers ordered Solbeck 2012 ⁴¹⁴ Systematic review- checked references Staudinger 1999 ⁴²⁸ Cohort study, n=16. Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract	Chong 2010 ⁹⁵	Case series of 7 patients; evaluates PCC + FFP
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Solbeck 2012 ⁴¹⁴ Systematic review- checked references Staudinger 1999 ⁴²⁸ Cohort study, n=16. Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract	Pabinger 2010 ³⁴¹	Evaluates impact of speed of PCC infusion
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Varga 2013 ⁴⁶⁴ Retrospective case series on efficacy of PCC dose; to include if RCTs included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract	Solbeck 2012 ⁴¹⁴	Systematic review- checked references
included of every low quality/ do not provide helpful evidence; Info for other considerations Valentino 2009 ⁴⁶⁰ Abstract	Staudinger 1999 ⁴²⁸	Cohort study, n=16.
		included of every low quality/ do not provide helpful evidence; Info for
Voils 2012 ⁴⁷¹ Systematic review- relevant references noted		Abstract
	Voils 2012 ⁴⁷¹	Systematic review- relevant references noted

1 P.8.2 PCC doses

Study	Exclusion reason
Bershad 2010 ³⁹	Literature review
Cabral 2013 ⁶³	No comparison groups
Chong 2010 ⁹⁵	Case series of 7 patients; evaluates PCC + FFP
Desmettre 2012 ¹²⁵	Paper not available
Eerenberg 2011 ¹³⁷	Healthy volunteer study; comparisons not relevant
Huynh 2014 ²¹⁰	Small retrospective study, n=44.
Knight 2009 ²⁴⁴	Systematic review on efficacy of Factor VII and PCC

Leal-Noval 2013 ²⁵⁵	Does not report number of patients in allocated to low (15 IU/kg) and high dose groups (25 IU/kg)
Lusher 1980 ²⁷⁸	RCT evaluating efficacy of 2 PCC preparations with placebo; dose not evaluate INR thresholds or targets-wrong comparison
Lusher 1983 ²⁷⁷	Compares 2 different types of PCCs, not relevant comparison
Lusher 1984 ²⁷⁶	Narrative review of PCC and Factor VIII inhibitors
Pabinger 2008 ³⁴⁰	Does not report outcomes/results according to the different doses of PCC
Pabinger 2010 ³⁴¹	Evaluates impact of speed of PCC infusion
Varga 2013 ⁴⁶⁴	Retrospective case series on efficacy of PCC dose

1 P.9 Monitoring for acute reactions

2 None

3 P.10 Electronic decision support

Reference	Reason for exclusion
Choi 2014 ⁹¹	Abstract
Cotterell 2013 ¹¹⁰	Systematic review
Estcourt 2013 ¹⁴⁰	Abstract
Goodnough 2013 ¹⁷⁴	Abstract
Rao 2013 ³⁶³	Abstract
Morris 2011 ³⁰⁷	Abstract
Mascotti 2009 ²⁸⁸	Abstract
Kuo 2011 ²⁵⁰	Abstract
Gregurek 2010 ¹⁸²	Abstract
Gregurek 2009 ¹⁸¹	Abstract
Goddard 2010 ¹⁶⁷	Abstract
Rothschild 2004 ³⁷⁴	Abstract
Uriz 2011 ⁴⁵⁶	Intervention does not match protocol (for patient identification)
Alves 2002 ¹⁸	Population does not match protocol (In neonates)
Schnurr 2010 ³⁸⁵	Intervention does not match protocol
Febra 2011 ¹⁴⁶	Abstract
Guerra 2010 ¹⁸⁷	Abstract
Martinez 2011 ²⁸⁶	Abstract
McCrory 2010 ²⁹³	Abstract
Waters 2012 ⁴⁸⁶	Abstract
Zijlker 2013 ⁵²⁰	Abstract
Shojania 2009 ³⁹⁶	Review (not relevant comparisons)
Philcox 1987 ³⁵⁵	Inocrrect intervention
Palo 2006 ³⁴⁵	Intervention does not match protocol(database system to manage blood component use in hospital)
Morgan 1973 ³⁰⁵	Intervention does not match protocol(computer controlled automated transfusion, not for decision support)

1 P.11 Electronic patient identification

Study	Exclusion reason
Aandahl 2007 ¹	Incorrect interventions. Narrative review
Baele 1994 ²⁹	Incorrect interventions
Brewer 1977 ⁵⁶	Incorrect interventions. Narrative paper
Burrows 2009 ⁶⁰	Incorrect interventions. Evaluates inaccessibility of identification bands in operating theatre
Clark 1984 ¹⁰⁰	Narrative paper
Clifford 2013 ¹⁰¹	Incorrect interventions
Cottrell 2013 ¹¹⁰	Audit of transfusion practice. Incorrect interventions
Davis 2012 ¹²¹	Incorrect interventions
Dzik 2003 ¹³⁵	Review
Dzik 2007 ¹³⁴	Narrative paper
Finlay 2005 ¹⁴⁸	Incorrect interventions
Galusha 2003 ¹⁵⁷	Narrative paper
Goodnough 2009 ¹⁷⁶	Incorrect interventions
Goodnough 2012 ¹⁷⁵	Incorrect interventions. Narrative paper
Green 2008 ¹⁸⁰	Inappropriate comparison. Narrative paper
Grimm 2010 ¹⁸³	Inappropriate comparison. Survey; no co-relation presented between patient identification by electronic methods and inappropriate transfusions
Gumpeni 2006 ¹⁸⁸	Narrative paper
Ibojie 2000 ²¹²	Incorrect interventions
Mercuriali 1996 ²⁹⁵	Incorrect interventions (only non-electronic patient identification)
Murphy 2007 ³¹⁸	Incorrect interventions
Novis 2003 ³³²	Incorrect interventions
Ohsaka 2009 ³³⁵	Incorrect interventions
Pagliaro 2006 ³⁴²	narrative review
Quillen 2006 ³⁶¹	Incorrect interventions
Renner 1993 ³⁶⁹	Incorrect interventions
Rentas 1999 ³⁷⁰	Incorrect interventions
Sandler 2007 ³⁷⁹	Wrong comparison (only evaluates if RFID system can be implemented, does not evaluate prevention of errors)
Schulmeister 2008 ³⁸⁷	Narrative paper
Smith 2011 ⁴⁰⁹	Incorrect interventions
Thomas 2004 ⁴³⁸	Incorrect interventions. Narrative paper
Tiehen 1998 ⁴⁴⁰	Narrative paper
Valenstein 2004 459	Review, not systematic
Wenz 1991 ⁴⁹¹	Incorrect interventions (only non-electronic patient identification)
Wickham 2006 ⁴⁹⁵	Inappropriate comparison
Wickham 2006 ⁴⁹⁴	Abstract
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2 P.12 Patient information

Reference	Reason for exclusion
Benson 1996 ³⁶	Evaluates patients views regarding receiving home transfusions

Reference	Reason for exclusion
Bielby 2013 ⁴³	Abstract
Bishop 2009 ⁴⁵	Abstract
Bishop 2010 ⁴⁶	Does not address review question; no information on patients views regarding info
Burgess 2006 ⁵⁹	Audit results and recommendations for practice
Busby 2012 ⁶²	Abstract
Busby 2013 ⁶¹	Abstract
Cankovic 2009 ⁶⁹	Abstract
Cankovic 2011 70	Abstract
Carruther 2001 ⁷²	Audit and survey of hospital practices regarding consent; patients views not reported
Cassidy 2013 ⁸⁰	Abstract
Cong 2009 ¹⁰⁴	Abstract
Corkery2013 ¹⁰⁶	Abstract
Court2010 ¹¹²	Abstract
Court2012 ¹¹¹	Abstract
Davis2012 ¹²¹	Survey to assess patients willingness to participate in transfusion related behaviours related to identity checking and administration of blood
Friedman2011 ¹⁵²	Abstract
Islam2011 ²¹⁵	Abstract
Khan2012 ²³⁹	Evaluates use of a clinician tool to aid patient counselling before blood transfusion
Latreille2010 ²⁵³	Abstract
Lee2003 ²⁵⁷	Evaluates people's perception of the risk of blood transfusion in comparison to other hazards (for example, pesticides, caffeine); wrong objective
Lowe2001 ²⁷⁰	Evaluates perception of risk of blood transfusion with respect to receiving own blood/blood substitutes
Mahapatra2013 ²⁸²	Abstract
Mccarthy2001 ²⁹²	Abstract
Muhammad2014 ³¹¹	Abstract
Naim2011a ³²³	Abstract
Naim2011b ³²²	Abstract
Naim2012 ³²¹	Abstract
Ngo2013 ³²⁷	Qualitative Systematic review
Orme2013 ³³⁷	Evaluates experiences of patients' experience of living with anaemia and receiving transfusion at a day hospice; does not look at what information people want
Tolich2010 447	Abstract
Twiss2011 ⁴⁵⁵	Abstract
Vetter2014 ⁴⁶⁷	Survey of patients perception of risk of blood transfusion and associated patients characteristics; no reporting of what info people may want

2 P.12.1 RBC Thresholds

Study	Exclusion reason	
Carson 2012 ⁷⁶	Clinical practice guideline	
Chatterjee 2013 ⁸⁴	Systematic review: literature search not sufficiently rigorous	
Chirico 2011 ⁹⁰	Pre-term infants	
Curley 2014 ¹¹⁵	Systematic review- checked references	
Desjardins 2012 ¹²⁴	Systematic review: study designs inappropriate	
Fischer 2010 ¹⁴⁹	Incorrect interventions	
Gauvin 2010 ¹⁶²	Analytic cohort analysis	
Hearnshaw 2010 ¹⁹⁵	Incorrect study design	
Holst 2013 ²⁰⁵	Protocol- TRISS trial	
Jairath 2013 ²¹⁹	Protocol	
Kahan 2013 ²²⁷	Statistical analysis plan- TRIGGER trial	
Lightdale 2012 ²⁶⁵	Incorrect study design	
Parker 2013 ³⁴⁸	Incorrect interventions. Inappropriate comparison	
Parker 2014 ³⁴⁹	Systematic review- checked references	
Rouette 2010 ³⁷⁵	Sub group analysis of surgery patients in TRIPICU study- we are only updating the Cochrane review (that is, including studies after 2011)	
Shah 2015 ³⁹⁰	Review article	
So-Osman 2010 ⁴¹¹	Incorrect interventions	
So-Osman 2013 ⁴¹²	Post-hoc analysis	
Tay 2011 ⁴³⁶	Protocol -TRIST trial	
Wang 2013 ⁴⁸¹	Includes only upper GI bleeding	
Whyte 2011 ⁴⁹³	Low birth-weight infants	
Willems 2010 ⁴⁹⁷	Sub group analysis of cardiac surgery patients in TRIPICU study (Lacroix 2007 which has been included)	

3

4 Appendix Q: Excluded economic studies

5 Q.1 Erythropoietin and iron

Reference	Reason for exclusion
Bedair 2015 ³⁴	This US within trial (prospective cohort) cost consequence analysis of erythropoietin was assessed as partially applicable with potentially serious limitations. The GDG judged the three cost utility analyses (two UK and one USA) and one German cost consequence analysis, were of greater applicability and methodological quality, and therefore this study was selectively excluded.

Q.2 Alternatives to blood transfusion

Reference	Reason for exclusion	
Murphy 2005 ³¹⁷	This UK cost–consequence analysis of cell salvage was assessed as	
	partially applicable with potentially serious limitations. However, the GDG	

Reference	Reason for exclusion
	judged that the available UK cost-utility analysis ¹²⁰ was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Crotty 2006 ¹¹³	This UK cost–comparison of cell salvage was assessed as partially applicable with very serious limitations. The GDG judged that the available UK cost–utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Savvidou 2009 ³⁸²	This Greek cost-consequence analysis of cell salvage was assessed as partially applicable with potentially limitations. The GDG judged that the available UK cost—utility analysis ¹²⁰ was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Boese 2011 ⁴⁹	This US cost–consequence analysis of cell salvage was assessed as partially applicable with very serious limitations. The GDG judged that the available UK cost–utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Dobosz 2012 ¹²⁹	This Polish cost-consequence analysis of cell salvage was assessed as partially applicable with potentially limitations. The GDG judged that the available UK cost—utility analysis ¹²⁰ was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Rao 2012 ³⁶⁴	This US cost—comparison of cell salvage was assessed as partially applicable with very serious limitations. The GDG judged that the available UK cost—utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Canan 2013 ⁶⁸	This US cost—utility analysis of cell salvage was assessed as not applicable with very serious limitations: QALYs estimated from expert opinion, time frame and discounting unclear, patient perspective taken, and very high unit cost of allogeneic blood which is not representative of current UK unit costs. Therefore this study was excluded.
Munoz 2013 ³¹⁶	This Spanish cost-consequence analysis of cell salvage was assessed as partially applicable with potentially limitations. The GDG judged that the available UK cost—utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Albright 2014 ⁹	This US comparative cost analysis of cell salvage was assessed as partially applicable and with potentially serious limitations. The GDG judged that the available UK cost–utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Bilgili 2014 ⁴⁴	This Turkish cost-consequence analysis of cell salvage was assessed as partially applicable with very serious limitations. Health outcome not expressed as QALYs. No information provided on how the total costs were estimated. Effectiveness data from a retrospective study and therefore not included in the clinical review. Therefore this study was excluded.
Munoz 2014 ³¹⁴	This Spanish cost-consequence analysis of cell salvage was assessed as partially applicable with potentially limitations. The GDG judged that the available UK cost–utility analysis was of greater applicability and methodological quality, and therefore this study was selectively excluded.
Lozano 2008 ²⁷¹	This Spanish within trial (retrospective observational) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.

Reference	Reason for exclusion
Gill 2009 ¹⁶⁴	This US within trial (RCT) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Irisson 2012 ²¹⁴	This French within trial (retrospective cohort) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Panchmatia 2012 ³⁴⁶	This UK within trial (prospective cohort) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Gillette 2013 ¹⁶⁶	This US within trial (retrospective cohort) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Slover 2014 ⁴⁰⁷	This US cost-effectiveness analysis (decision tree) was assessed as partially applicable with very serious limitations. Relative treatment effects were not reported or referenced in this analysis. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses of, both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Vigna-Taglianti 2014 ⁴⁷⁰	This Italian within trial (before and after study with regression analysis) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses 13,362, both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
Tuttle 2014 ⁴⁵⁴	This US within trial (retrospective cohort) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.
George 2015 ¹⁶³	This UK within trial (retrospective cohort) cost consequence analysis of tranexamic acid was assessed as partially applicable with potentially serious limitations. This study was selectively excluded as it was superseded by two recent UK cost consequence analyses ^{13,362} , both of which were within-trial analyses of RCTs that are included in clinical review and therefore more applicable to the UK NHS context.

Q.3 Red blood cells

Reference	Reason for exclusion
Reference	Reason for exclusion

Reference	Reason for exclusion
Palmieri 2007 ³⁴⁴	This study was assessed as partially applicable with very serious limitations. Based on a before and after study that was excluded from the clinical review. Savings are a product of blood usage and cost of a unit of blood (US cost). Therefore this study was excluded.
Zilberberg 2007 ⁵²¹	This study was assessed as partially applicable with very serious limitations. Savings are a product of blood usage and cost of a unit of blood (US cost). Therefore this study was excluded.

1 Q.4 Platelets

2 Q.4.1 Platelet thresholds and targets

Reference	Reason for exclusion
Sarode 2010 ³⁸⁰	This study was assessed as partially applicable with very serious limitations. Based on a before and after study that was excluded from the clinical review protocol. Not all costs are included and source of unit costs unclear (appears to be based on a US hospital). Therefore this study was excluded.

3 Q.4.2 Platelet dose

Reference	Reason for exclusion
Riley 2012 ³⁷¹	This study was assessed as partially applicable with very serious limitations. Based on platelet doses that are not UK standard doses. Assumes same health outcomes for all doses and unit costs are from a US perspective. Therefore this study was excluded.

4 Q.5 Fresh frozen plasma

5 Q.5.1 Fresh frozen plasma thresholds and targets

Reference	Reason for exclusion
Sarode 2010 ³⁸⁰	This study was assessed as partially applicable with very serious limitations. Based on a before and after study that was excluded from the clinical review protocol. Not all costs are included and source of unit costs unclear (appears to be based on a US hospital). Therefore this study was excluded.

Appendix R: NICE technical team

2

1

Name	Role
Sharon Summers-Ma	Guideline Lead
Martin Allaby	Clinical Advisor
Beth Shaw	Technical Lead
Bhash Naidoo	Health Economist
Louise Shires	Guideline Commissioning Manager
Joy Carvill	Guideline Coordinator
James Hall	Editor

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