NICE National Institute for Health and Care Excellence

NICE guideline

Blood transfusion

NICE guideline
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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

This guideline is the basis of QS138.

Overview

This guideline covers the assessment for and management of blood transfusions in adults, young people and children over 1 year old. It covers the general principles of blood transfusion, but does not make recommendations relating to specific conditions.

Who is it for?

- Healthcare professionals who assess for and manage blood transfusions and their alternatives
- Commissioners and providers of transfusion services
- People over 1 year old who may need a blood transfusion, their families and carers

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

This guideline contains recommendations about general principles of blood transfusion, and applies to a range of conditions and different settings. It does not make recommendations relating to specific conditions. For more information on what the guideline covers, see the context section.

Some people have religious beliefs that do not allow the transfusion of blood. Specific issues relating to these people have been addressed when reviewing the evidence and writing the recommendations.

Blood transfusion algorithm

A blood transfusion algorithm (PDF only) is also available.

1.1 Alternatives to blood transfusion for patients having surgery

Erythropoietin

1.1.1 Do not offer erythropoietin to reduce the need for blood transfusion in patients having surgery, unless:

- the patient has anaemia and meets the criteria for blood transfusion, but declines it because of religious beliefs or other reasons or

- the appropriate blood type is not available because of the patient's red cell antibodies.

Intravenous and oral iron

1.1.2 Offer oral iron before and after surgery to patients with iron-deficiency anaemia.

1.1.3 Consider intravenous iron before or after surgery for patients who:

- have iron-deficiency anaemia and cannot tolerate or absorb oral iron, or are unable to adhere to oral iron treatment (see the NICE guideline on medicines adherence)
- are diagnosed with functional iron deficiency
- are diagnosed with iron-deficiency anaemia, and the interval between the diagnosis of anaemia and surgery is predicted to be too short for oral iron to be effective.

1.1.4 For guidance on managing anaemia in patients with chronic kidney disease, see the NICE guideline on chronic kidney disease: assessment and management.

Cell salvage and tranexamic acid

1.1.5 Offer tranexamic acid to adults undergoing surgery who are expected to have at least moderate blood loss (greater than 500 ml). For advice on using tranexamic acid in primary hip, knee and shoulder replacement, see the NICE guideline on joint replacement (primary).

1.1.6 Consider tranexamic acid for children undergoing surgery who are expected to have at least moderate blood loss (greater than 10% blood volume).

1.1.7 Do not routinely use cell salvage without tranexamic acid.

1.1.8 Consider intra-operative cell salvage with tranexamic acid for patients who are

expected to lose a very high volume of blood (for example in cardiac and complex vascular surgery, major obstetric procedures, and pelvic reconstruction and scoliosis surgery).

1.2 Red blood cells

Thresholds and targets

1.2.1 Use restrictive red blood cell transfusion thresholds for patients who need red blood cell transfusions and who do not:

- have major haemorrhage or
- have acute coronary syndrome or
- need regular blood transfusions for chronic anaemia.

1.2.2 When using a restrictive red blood cell transfusion threshold, consider a threshold of 70 g/litre and a haemoglobin concentration target of 70–90 g/litre after transfusion.

1.2.3 Consider a red blood cell transfusion threshold of 80 g/litre and a haemoglobin concentration target of 80–100 g/litre after transfusion for patients with acute coronary syndrome.

1.2.4 Consider setting individual thresholds and haemoglobin concentration targets for each patient who needs regular blood transfusions for chronic anaemia.

Doses

1.2.5 Consider single-unit red blood cell transfusions for adults (or equivalent volumes calculated based on body weight for children or adults with low body weight) who do not have active bleeding.

1.2.6 After each single-unit red blood cell transfusion (or equivalent volumes calculated

based on body weight for children or adults with low body weight), clinically reassess and check haemoglobin levels, and give further transfusions if needed.

1.3 Platelets

Thresholds and targets

Patients with thrombocytopenia who are bleeding

1.3.1 Offer platelet transfusions to patients with thrombocytopenia who have clinically significant bleeding (grade 2; see the table on World Health Organization [WHO] Bleeding Grades) – and a platelet count below 30×10^9 per litre.

1.3.2 Use higher platelet thresholds (up to a maximum of 100×10^9 per litre) for patients with thrombocytopenia and either of the following:

- severe bleeding (WHO grades 3 and 4)
- bleeding in critical sites, such as the central nervous system (including eyes).

Patients who are not bleeding or having invasive procedures or surgery

1.3.3 Offer prophylactic platelet transfusions to patients with a platelet count below 10×10^9 per litre who are not bleeding or having invasive procedures or surgery, and who do not have any of the following conditions:

- chronic bone marrow failure
- autoimmune thrombocytopenia
- heparin-induced thrombocytopenia
- thrombotic thrombocytopenic purpura.

Patients who are having invasive procedures or surgery

1.3.4 Consider prophylactic platelet transfusions to raise the platelet count above 50×10^9 per litre in patients who are having invasive procedures or surgery.

1.3.5 Consider a higher threshold (for example $50–75\times10^9$ per litre) for patients with a high risk of bleeding who are having invasive procedures or surgery, after taking into account:

- the specific procedure the patient is having
- the cause of the thrombocytopenia
- whether the patient's platelet count is falling
- any coexisting causes of abnormal haemostasis.

1.3.6 Consider prophylactic platelet transfusions to raise the platelet count above 100×10^9 per litre in patients having surgery in critical sites, such as the central nervous system (including the posterior segment of the eyes).

When prophylactic platelet transfusions are not indicated

1.3.7 Do not routinely offer prophylactic platelet transfusions to patients with any of the following:

- chronic bone marrow failure
- autoimmune thrombocytopenia
- heparin-induced thrombocytopenia
- thrombotic thrombocytopenic purpura.

1.3.8 Do not offer prophylactic platelet transfusions to patients having procedures with a low risk of bleeding, such as adults having central venous cannulation or any patients having bone marrow aspiration and trephine biopsy.

Doses

1.3.9 Do not routinely transfuse more than a single dose of platelets.

1.3.10 Only consider giving more than a single dose of platelets in a transfusion for patients with severe thrombocytopenia and bleeding in a critical site, such as the central nervous system (including eyes).

1.3.11 Reassess the patient's clinical condition and check their platelet count after each platelet transfusion, and give further doses if needed.

1.4 Fresh frozen plasma

Thresholds and targets

1.4.1 Only consider fresh frozen plasma transfusion for patients with clinically significant bleeding but without major haemorrhage if they have abnormal coagulation test results (for example, prothrombin time ratio or activated partial thromboplastin time ratio above 1.5).

1.4.2 Do not offer fresh frozen plasma transfusions to correct abnormal coagulation in patients who:

- are not bleeding (unless they are having invasive procedures or surgery with a risk of clinically significant bleeding)
- need reversal of a vitamin K antagonist.

1.4.3 Consider prophylactic fresh frozen plasma transfusions for patients with abnormal coagulation who are having invasive procedures or surgery with a risk of clinically significant bleeding.

Doses

1.4.4 Reassess the patient's clinical condition and repeat the coagulation tests after

fresh frozen plasma transfusion to ensure that they are getting an adequate dose, and give further doses if needed.

1.5 Cryoprecipitate

Thresholds and targets

1.5.1 Consider cryoprecipitate transfusions for patients without major haemorrhage who have:

- clinically significant bleeding **and**
- a fibrinogen level below 1.5 g/litre.

1.5.2 Do not offer cryoprecipitate transfusions to correct the fibrinogen level in patients who:

- are not bleeding **and**
- are not having invasive procedures or surgery with a risk of clinically significant bleeding.

1.5.3 Consider prophylactic cryoprecipitate transfusions for patients with a fibrinogen level below 1.0 g/litre who are having invasive procedures or surgery with a risk of clinically significant bleeding.

Doses

1.5.4 Use an adult dose of 2 pools when giving cryoprecipitate transfusions (for children, use 5–10 ml/kg up to a maximum of 2 pools).

1.5.5 Reassess the patient's clinical condition, repeat the fibrinogen level measurement and give further doses if needed.

1.6 Prothrombin complex concentrate

1.6.1 Offer immediate prothrombin complex concentrate transfusions for the emergency reversal of warfarin anticoagulation in patients with either:

- severe bleeding **or**
- head injury with suspected intracerebral haemorrhage.

1.6.2 For guidance on reversing anticoagulation treatment in people who have a stroke and a primary intracerebral haemorrhage, see the section on reversal of anticoagulation treatment in people with haemorrhagic stroke in the NICE guideline on stroke and transient ischaemic attack in over 16s.

1.6.3 Consider immediate prothrombin complex concentrate transfusions to reverse warfarin anticoagulation in patients having emergency surgery, depending on the level of anticoagulation and the bleeding risk.

1.6.4 Monitor the international normalised ratio (INR) to confirm that warfarin anticoagulation has been adequately reversed, and consider further prothrombin complex concentrate.

For advice on reversing direct-acting oral anticoagulants (DOACs), see the MHRA safety advice on DOACs for a list of reversal agents, and NICE's technology appraisal guidance on andexanet alfa for reversing anticoagulation from apixaban or rivaroxaban.

1.7 Patient safety

Monitoring for acute blood transfusion reactions

1.7.1 Monitor the patient's condition and vital signs before, during and after blood transfusions, to detect acute transfusion reactions that may need immediate investigation and treatment.

1.7.2 Observe patients who are having or have had a blood transfusion in a suitable environment with staff who are able to monitor and manage acute reactions.

Electronic patient identification systems

1.7.3 Consider using a system that electronically identifies patients to improve the safety and efficiency of the blood transfusion process.

1.8 Patient information

1.8.1 Provide verbal and written information to patients who may have or who have had a transfusion, and their family members or carers (as appropriate), explaining:

- the reason for the transfusion
- the risks and benefits
- the transfusion process
- any transfusion needs specific to them
- any alternatives that are available, and how they might reduce their need for a transfusion
- that they are no longer eligible to donate blood
- that they are encouraged to ask questions.

1.8.2 Document discussions in the patient's notes.

1.8.3 Provide the patient and their GP with copies of the discharge summary or other written communication that explains:

- the details of any transfusions they had
- the reasons for the transfusion
- any adverse events
- that they are no longer eligible to donate blood.

1.8.4 For guidance on communication and patient-centred care for adults, see the NICE guideline on patient experience in adult NHS services.

1.9 Blood transfusions for patients with acute upper gastrointestinal bleeding

1.9.1 For guidance on blood transfusions for people with acute upper gastrointestinal bleeding, see the section on resuscitation and initial management in the NICE guideline on acute upper gastrointestinal bleeding in over 16s.

Terms used in this guideline

Adults, children and young people

These are defined as:

- Children: over 1 year to under 16 years.
- Young people: 16 years to under 18 years. No evidence was found on transfusions specifically for young people. Recommendations for adults in this guideline will generally apply to young people as well, but healthcare professionals should use their clinical judgement on when this is not appropriate for individual patients.
- Adults: 18 years or older.

Major haemorrhage

This can be defined as any of the following:

- The loss of more than 1 blood volume within 24 hours (around 70 ml/kg, or more than 5 litres in a 70 kg adult).
- A loss of 50% of total blood volume in under 3 hours.
- Bleeding in excess of 150 ml/minute in adults.
- As a practical clinical definition, bleeding which leads to:
  - a systolic blood pressure of less than 90 mm/Hg or
  - a heart rate of more than 110 beats per minute in adults.

The modified World Health Organization (WHO) bleeding scale

This was used to assess bleeding in trials of platelet transfusions. Examples of bleeding at each grade are listed below:

WHO bleeding scale

World Health Organization Bleeding Grade	Examples
1	• Oropharyngeal bleeding, with the total duration of all episodes no more than 30 minutes in the last 24 hours. • Epistaxis, with the total duration of all episodes no more than 30 minutes in the last 24 hours. • Petechiae of oral mucosa or skin. • Purpura up to 2.5 cm (1 inch) in diameter. • Spontaneous haematoma in soft tissue or muscle. • Positive stool occult blood test. • Microscopic haematuria or haemoglobinuria. • Abnormal vaginal bleeding (spotting).

World Health Organization Bleeding Grade	Examples
2	• Epistaxis, with the total duration of all episodes over 30 minutes in 24 hours. • Purpura over 2.5 cm (1 inch) in diameter. • Joint bleeding. • Melanotic stool. • Haematemesis. • Gross/visible haematuria. • Abnormal vaginal bleeding (more than spotting). • Haemoptysis. • Visible blood in body cavity fluid. • Retinal bleeding without visual impairment. • Bleeding at invasive sites.
3	• Bleeding needing red blood cell transfusion over routine transfusion needs. • Bleeding associated with moderate haemodynamic instability.
4	• Bleeding associated with severe haemodynamic instability. • Fatal bleeding. • Central nervous system bleeding on imaging study with or without dysfunction.

Recommendations for research

The guideline committee has made the following recommendations for research. The committee's full set of research recommendations is detailed in the full guideline.

1 Red blood cell transfusion thresholds for patients with chronic cardiovascular disease

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

The literature suggests that there may be some evidence of harm with the use of restrictive red blood cell thresholds 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.

2 Electronic Decision Support

What is the clinical and cost effectiveness of an electronic decision support system 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.

3 Post-operative cell salvage for patients having cardiac surgery with a significant risk of post-operative blood loss

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 components, clinical outcomes and quality of life.

4 Fresh frozen plasma for patients with abnormal haemostasis who are having invasive procedures or surgery

What dose of fresh frozen plasma is most clinically effective at preventing bleeding in patients with abnormal haemostasis who are having invasive procedures or surgery?

Why this is important

Audits have shown that fresh frozen plasma is widely used for non-bleeding patients in the intensive care unit (ICU) and many other clinical settings. There is a large variation in dose and no real evidence base to guide practice. Fresh frozen plasma transfusions may cause adverse outcomes in people who are critically ill, including transfusion-related acute lung injury, transfusion-related circulatory overload, multi-organ failure and an increased risk of infections.

A multicentre study (2011) of ICUs in the UK showed that 12.7% of patients admitted to the ICU received fresh frozen plasma. The median dose was 10.8 ml/kg, but doses varied widely (range 2.4–41.1 ml/kg). This study showed that a high proportion of fresh frozen plasma transfusions had unproven clinical benefit.

Better evidence from clinical trials could significantly alter how fresh frozen plasma is used, and in particular ensure that clinically effective doses are given to patients.

Implementation: getting started

This section highlights 2 areas of the blood transfusion guideline that could have a big impact on practice and be challenging to implement, along with the reasons why these areas are important (given in the box at the start of each area). We identified these with the help of stakeholders and guideline committee members (see section 10 of developing NICE guidelines: the manual). NICE has also produced tools and resources to help you put this guideline into practice.

The challenge: Using tranexamic acid as an alternative to transfusion

See recommendation 1.1.5.

Hospitals may improve clinical outcomes and cut costs (see the guideline tools and resources) by reducing the need for blood transfusions (with their associated risks) whenever possible. Tranexamic acid is an an inexpensive antifibrinolytic pharmacological agent that can be administered before and during surgery to reduce bleeding and therefore the need for blood transfusions. There is strong evidence that this is clinically effective and that its use will reduce mortality and costs.

Reducing variation in practice

Clinicians are not consistently offering tranexamic acid to adults undergoing surgery who are expected to have at least moderate blood loss (greater than 500 ml). Clinical opinion is that current usage may be as low as 10–20%. This may be due to a lack of awareness and of inclusion in local clinical protocols.

To promote its use, medical directors and hospital transfusion committees could:

- Use the NICE baseline assessment tool for this guideline, and consider carrying out a clinical audit to establish current practice. Awareness-raising and training initiatives can then be targeted at areas of most need.
- Use the NICE guideline algorithm (PDF only) to include using tranexamic acid as part of the hospital protocol for adults undergoing surgery who are expected to have at

least moderate blood loss.

- Use the NICE costing statement to estimate possible cost savings. Depending on the reduction in the number of units of blood transfused, there may be a saving in the range of £146–£689 per person. Use of tranexamic acid may also reduce length of hospital stay, which will result in efficiency savings.

The challenge: using electronic patient identification systems

See recommendation 1.7.3.

Human error is the main cause of adverse events related to transfusion. The most serious of these are the wrong patient being given a transfusion or the incorrect blood product being given. These errors are caused by misidentification during pre-transfusion sampling or when giving a transfusion. Electronic patient identification systems prompt staff to carry out key steps in the correct order, and ensure that transfusions are given to the right patients through scanning of compatible wristbands and blood component containers.

Making the case for investment

Many hospitals do not have such a system in place, and for these hospitals implementation will involve a redesign of hospital blood transfusion services to incorporate patient identification and bedside handheld computers that prompt staff through each step and verify that the correct transfusions are given. There will be an initial cost to implementing these systems, as well as annual maintenance costs. However, the systems will provide substantial efficiency gains, including savings in nursing and laboratory staff time and reduced blood product wastage.

To develop a business case, hospital managers could:

- Refer to resources such as the NHS right patient, right blood safer practice notice.
- Use the NICE costing statement to assess potential costs, including ongoing costs for maintenance and administrative support. In addition, consider efficiency savings such as improved traceability and availability of data.
- Use published data (such as SHOT) to demonstrate the patient safety benefits of

implementing such a system and provide examples of where the system would have prevented errors, in particular where a potential NHS England Never Event would be avoided.

- Gain high-level support from influential patient safety representatives and the Hospital Transfusion Committee.
- Use examples from practice in other NHS hospitals to learn about how such a system has been implemented.

Need more help?

- Further guideline resources are available from NICE to help support implementation.
- Uptake data about guideline recommendations and quality standard measures are available on the NICE website.
- NICE is developing a quality standard on blood transfusion. More information is available from the quality standards topic library on the NICE website.
- There is a suite of information leaflets that hospitals can order free of charge or download, including leaflets written for children and in languages other than English. Use good-quality information leaflets such as the NICE information for the public and those developed by NHS Blood and Transplant, the Royal College of Obstetricians and Gynaecologists, and Macmillan Cancer Support.
- Information is also available online. The NHS website and NHS Blood and Transplant provide reliable information on blood transfusion.

Context

Blood transfusions are common in clinical practice. In 2014/15 NHS Blood and Transplant issued 1.7 million units of red blood cells, 275,000 units of platelets, 215,000 units of fresh frozen plasma and 165,000 units of cryoprecipitate to hospitals in England and North Wales. An estimated 430,000 patients received a red blood cell transfusion in 2002; a further study has not been conducted, but given the reduction in blood use since 2002 the number of patients who have had a transfusion is likely to be 10% to 20% lower than this figure.

Despite considerable efforts to ensure the safety of blood transfusions, they are associated with significant risks. The Serious Hazards of Transfusion (SHOT) scheme estimated that in 2014 the risk of transfusion-related death was 5.6 per million blood components issued, and the risk of transfusion-related major morbidity was 63.5 per million blood components issued, although it was not always certain that transfusion was the direct cause of death or major morbidity. Removing cases where patient harm was caused by delayed transfusion rather than transfusion itself reduces the risk of transfusion-related death to 4.5 per million blood components issued, and the risk of transfusion-related major morbidity was 61.9 per million blood components issued. The most common cause of death associated with transfusion was transfusion associated circulatory overload.

There is evidence from the SHOT scheme and national audits of transfusion practice that:

- some patients are receiving the wrong blood components
- the choice of blood component is not always based on clinical findings and laboratory test values
- patients are not always monitored for the adverse effects of transfusion, and these effects are not always managed correctly
- some patients are transfused unnecessarily, which is wasteful of a scare and costly resource and put patients at unnecessary risk.

Accurate patient identification is a crucial step. Giving a patient the wrong blood transfusion is an avoidable serious hazard, and can result from errors made anywhere in the transfusion process.

There has been an approximate 25% decline in the transfusion of red blood cells in England in the last 15 years. The red blood cell transfusion rate declined from 45.5 to 36 units per 1,000 people between 1999 and 2009, and since then has dropped further to around 31.5 units per 1,000 people. This rate is a little higher than in Northern Ireland, the Netherlands and Canada, but is considerably lower than in the United States. In contrast, the use of platelets and fresh frozen plasma has been increasing. The proportion of red blood cells used between 1999 and 2009 in surgical patients has declined from 41% to 29% of all red cells transfused, and in medical patients has increased from 52% to 64% of all red cells transfused. Use in obstetrics and gynaecology has remained stable at 6%. A national audit of blood transfusion in 2014 showed that the proportion of red cell transfusions used in surgical patients continues to decline and was 27% of all red cells transfused with a corresponding increase in medical patients to 67%.

This guideline contains recommendations about general principles of blood transfusion, and applies to a range of conditions and different settings. It does not include recommendations relating to specific conditions.

The guideline covers:

- the appropriate use of blood components
- alternatives to transfusion for surgical patients
- ensuring patient safety, including monitoring for transfusion reactions
- providing patients with information about transfusion.

This guideline focuses on the general principles of transfusion. To do this, it was necessary to limit the scope by excluding:

- patient groups with special transfusion needs, such as fetuses, neonates and children under 1 year old, pregnant women, and patients with haemoglobinopathies.
- specialist areas already covered by NICE guidelines, for example, anaemia in chronic kidney disease, upper gastrointestinal bleeding and trauma and massive haemorrhage.
- the use and administration of blood products, such as intravenous immunoglobulin, anti-D and recombinant activated factor VII.
- near-patient testing for haemoglobin concentration and haemostasis.

- laboratory procedures relating to the safety and quality of blood, including pre-transfusion compatibility testing.
- the diagnosis of anaemia.
- the management of anaemia in medical patients is out of the scope of this guidance, but it is important to note that the correct approach for managing anaemia in medical patients is important for avoiding unnecessary use of blood.

Despite the lack of specific evidence in the paediatric population, a number of the recommendations have been considered applicable to children following extrapolation from evidence in adults. This was considered to be a reasonable approach to provide some guidance for this age group. However, it should be noted that the guidelines do not cover transfusion for neonates and infants less than a year of age due to the difficulties in extrapolating adult evidence to very young children.

Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on injuries, accidents and wounds.

For full details of the evidence and the guideline committee's discussions, see the full guideline. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting our guidelines into practice, see resources to help you put NICE guidance into practice.

Update information

Minor changes since publication

August 2023: We added links to the MHRA safety advice on DOACs and NICE's technology appraisal guidance on andexanet alfa for reversing anticoagulation from apixaban or rivaroxaban (TA697) to the section on prothrombin complex concentrate.

March 2022: A link to MHRA advice on intravenous iron was removed from recommendation 1.1.3.

July 2020: A link to MHRA advice on intravenous iron was added to recommendation 1.1.3. A link to the NICE guideline on joint replacement (primary) was added to recommendation 1.1.5 to give advice on tranexamic acid in primary hip, knee and shoulder replacement.

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