

WHEN SHOULD YOU TRANSFUSE BLOOD PERIOPERATIVELY?

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ABSTRACT

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The excellent outcome with increasingly complex surgeries performed in more and more older individuals have made orthopaedic surgeons the role model for other surgical specialities. Besides the “cold work” performed on such persons, the significance of hot orthopaedics in dealing with several trauma cases can never be underestimated. One of the key components of the tremendous success of the latter is blood transfusions. In the same manner, adequately preparing an anaemic patient for the joint/limb surgeries and dealing with unexpected bleeding and blood loss perioperatively is crucial in elective surgeries as well. In this article, several practical points are considered which may assist the specialist in safely prescribing blood and blood component transfusions.

WHY IS PREOPERATIVE ANAEMIA IMPORTANT?

One of the commonest laboratory abnormalities in the perioperative period is anaemia. Although the symptoms of anaemia are well-known, the fact that anaemia can cause poor oxygen supply to the muscles and thus longer time to full mobilisation postoperatively is often forgotten. In those with cardiac illnesses, pre-existing anaemia and further reduction in haemoglobin from surgical bleeding can have adverse outcomes including development of respiratory

and cardiac failure. One beneficial aspect of red blood cells which is not well-known is its haemostatic function (explained in the figure 1). Red cells, being the largest cells tend to travel in the middle of the blood vessels pushing platelets and white cells to the periphery. However, in patients with anaemia, the reduction in the central red cell concentration will lead to the platelets, the key cells important in controlling bleeding to drift towards the middle and thus allowing the patient to bleed more from the surgery. Thus, for several reasons, optimisation of haemoglobin prior to surgery is important for good surgical outcome.

THE PROBLEM OF PREOPERATIVE ANAEMIA

In the published literature, studies from well-resourced countries has found that about almost one-third of patients presenting for major surgery are anaemic. This figure is likely to be higher in a middle income country like India, where poor nutrition and unidentified chronic blood loss from intestinal parasites could lead to higher degrees of anaemia. Although severe anaemia is often noticeable from the symptoms, mild anaemia is often overlooked but is not without risk of peri-operative complications.

In non-emergency cases, it is useful to assess a patients’ anaemic status prior to proceeding for surgery. This



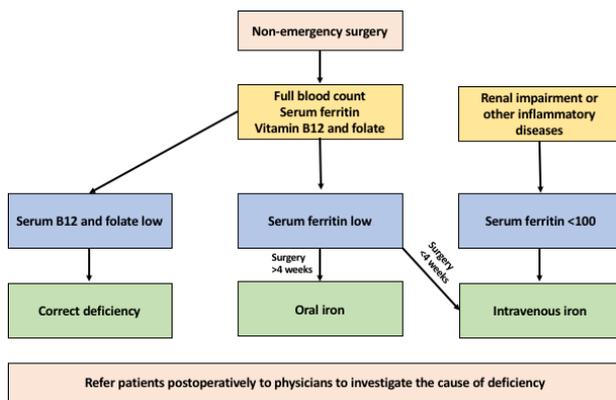


FIGURE 1.

is especially useful and important if the surgery is likely to be associated with moderate to severe blood loss since the development of significant anaemia can lead to longer hospital stay and postoperative complications. It may be considered that blood transfusions in the postoperative period is an easy answer to this not so important but common issue. However, several studies in the recent times have highlighted the negative effects of blood transfusions in the perioperative period.

ARE BLOOD TRANSFUSIONS SAFE?

Red cell transfusion has long been the mainstay of anaemia management in the perioperative setting. It may be considered a quick-fix of the anaemia problem and obviously has an immediate effect. However, the adverse effects of blood transfusions in any surgical setting is being increasingly recognised. One study showed blood transfusions had to be stopped prematurely in one in 100 cases because of an adverse event. These include among many others allergic and rarely anaphylactic reactions, and haemolytic problems, which can occur commonly if the blood is not leucodepleted (not prepared to remove the small number of white cells which can cause these reactions). There is also an increasing understanding of the complication of TACO or transfusion-associated cardiac overload which is cardiac embarrassment caused by blood transfusions. This may be prevented by transfusing only when necessary and to transfuse one unit of blood at a time and checking the increment in haemoglobin to assess the need for more.

Blood transfusions have been linked to higher risk of infections. Although the transmission of infectious agents like hepatitis B & C and HIV may be considered rare (but not absent), emerging infections like zika virus have been recently observed to be passed on through blood. Other infections like malaria have also anecdotally been reported to be transmitted through blood. There are also situations where blood transfusions can suppress the immune system of the recipient through the mechanism of transfusion-related

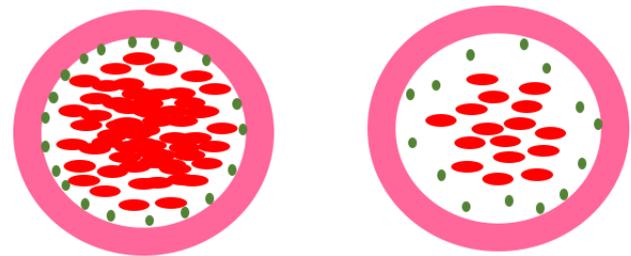


FIGURE 2

immunomodulation (TRIM). This is one of the causes of higher infection rates postoperatively in surgical patients who have received transfusions. Orthopaedic surgeons may attribute the postoperative infections to wound or surgical site infections and may not think of the significant contribution from blood transfusions.

HOW TO DEAL WITH PREOPERATIVE ANAEMIA

A simple algorithm for the management of anaemia in the preoperative setting is given in figure 2. In the preoperative assessment period, it is considered good practice to perform tests to identify anaemia and look for the common causes for the same. Worldwide, iron deficiency is the commonest cause of anaemia. This can be easily corrected with replacement of iron via oral or parenteral route. In patients who require elective surgery which can wait for 6-8 weeks, oral iron is adequate. More recent data shows high doses of iron stimulate the release of the iron regulatory protein, hepcidin. This can cause lower iron absorption from the next dose. Thus, alternate day oral iron may be better in these circumstances and can also help in reducing gastro-intestinal side effects from unabsorbed iron. In one study in people over the age of 80 years with iron deficiency anaemia, a lower dose of 50 mg or a higher dose of 150 mg Ferrous sulphate both improved haemoglobin equally (Rimon et al, 2005).

Although oral iron is easily administered, it may not be effective in patients with functional iron deficiency (those patients with chronic diseases like renal problems) or poor gastrointestinal absorption. In such cases, parenteral iron is recommended. The maximal effect from the intravenous iron is obtained at three weeks, although an increase in haemoglobin is noted in a week. Although this time limit may not be acceptable to some patients, an explanation that the best outcome from surgery does depend on correcting preoperative anaemia may encourage patients to wait for the short period. Interestingly, intravenous iron treatment within two weeks of the surgery has also been shown to be successful in decreasing the incidence of renal impairment and infections in orthopaedic surgery. It needs to be stressed in this context that most of the studies in this area have not been

large randomised controlled trials although these are underway.

WHO SHOULD BE TRANSFUSED?

If possible, red cell transfusions should be avoided especially preoperatively unless there is persistent bleeding, or the surgery is urgent and cannot be delayed. In the postoperative period, the need for transfusions may be reduced if vigorous attempts at correcting preoperative anaemia have been successful. If transfusions have been decided upon, one unit of blood should be transfused at a time and response checked to assess the effectiveness and the need for more. Many surgeons use a transfusion threshold and haemoglobin target in this context.

THE TRANSFUSION THRESHOLD

The World Health Organization defines anaemia as haemoglobin less than 13 g/l in men and less than 12 g/l in women. Most surgeons would use a transfusion threshold to trigger the need for blood transfusion. Although the values should be considered patient and procedure-specific, NICE in the UK recommends a transfusion threshold of haemoglobin drops to less than 7.0 g/dL and aim for a haemoglobin of 9.0 g/dL after transfusion. The exceptions to these are major haemorrhage, acute coronary syndrome and chronic anaemia needing regular blood transfusions. Patients with a history of ischaemic heart disease would benefit from maintaining a haemoglobin of 9.0–10.0 g/dL. Consider setting individual thresholds and haemoglobin concentration targets for each patient who needs regular blood transfusions for chronic anaemia. Although these transfusion trigger values are a good guide, it needs to be borne in mind that this 'normal' value can vary depending on different individuals and different underlying co-morbidities. For example, someone with chronic respiratory illness like chronic bronchitis (COPD) can have a higher haemoglobin as normal for them and a value of 13 g/dl may be inadequate. Since women tend to have lesser plasma volume than men but may bleed the same amount as men after similar surgeries, threshold required for women should not be different to that of men. Erythropoietin may be offered in patients who meet the criteria for pre-op transfusion if either they decline it for religious/cultural reasons or if the appropriate blood type is not available because of the presence of red cell antibodies. Intra-operative cell salvage method is well-known to anaesthetists and may be considered for patients, who are expected to lose a very high volume of blood (pelvic reconstruction and scoliosis surgery) but the authors limited experience makes it difficult to suggest the definite advantages of this method. In all cases, an individualised approach

to assess each patients' preoperative status, cardiac status and risk of bleeding with the surgery should be followed.

MEASURES TO REDUCE SURGICAL BLEEDING RISK

As mentioned previously, optimising the haemoglobin and reducing anaemia can help reduce the risk of bleeding. It is useful to check if the patient is taking drugs which can have an impact on the blood clotting system. There are an increasing number of patients who are taking antiplatelet agents for cardiac stents which can increase the risk of bleeding if not discontinued preoperatively. This may pose a dilemma in patients who recently had a coronary ischaemic event since discontinuation of the antiplatelet agents may trigger a recurrent event. It is crucial to discuss with cardiologists about this aspect in the preoperative period. It is also useful to check if the patients may be taking herbal medications, some of which may increase the risk of bleeding.

One of the preoperative measures which can be helpful in this regard is an assessment of the patient's inherent bleeding risk. Although there are no published data, the author is aware of a number of patients with inherited bleeding disorders who remain undiagnosed in various parts of India. Operating on these individuals can cause heavy bleeding perioperatively which can seriously increase the postoperative morbidity. A good personal and family history of bleeding is imperative in this context. A patient who had uncontrollable bleeding after a tooth extraction or previous surgery, a female patient with heavy periods with no gynaecological reasons to account for it or significant postpartum haemorrhage without an explanation will belong to this category of high-risk bleeding patients. In such patients, a clotting screen (PT and APTT) and Von Willebrands screen needs to be performed and may need a specialist consultation for clearance before surgery. More details on this topic has recently been reviewed (see Borges and Thachil in reference section).

There are several operative techniques which can help in reducing surgical bleeding including the use of minimally invasive techniques like arthroscopic, or endovascular approaches, liberal use of tourniquets, topical fibrin glues and the more fashionable tranexamic acid.

TRANEXAMIC ACID

Tranexamic acid is the wonder drug in relation to the concept of haemostasis. One of the biggest advantages of this drug is it being extremely cheap. It works by reversibly binding plasmin and plasminogen and acts as an antifibrinolytic. In simple terms, it stops a

blood clot which has already formed from breaking down by the endogenous fibrinolytics. Although its effectiveness is beyond doubt, especially after the results from the multi-national CRASH-2 trial of trauma patients, there is controversy on which is the best route of administration, the timing and frequency of this drug in the orthopaedic surgery setting. The Association of Anaesthetists of Great Britain and Northern Ireland recommend the use of tranexamic acid in all in whom a blood loss more than 500 ml may be expected. The dose if given intravenously is 10 mg/kg body weight as bolus followed by 1 mg/kg/h infusion, if patient continues to bleed. Intuitively, the intravenous formulation may seem more effective compared than oral or topical administration, but the latter has much less risk of thromboembolic events. A recent meta-analysis showed no statistically significant difference in total blood loss, drain output, transfusion requirements and thromboembolic complications between topical tranexamic acid and intravenous tranexamic acid in patients who underwent total knee arthroplasty (Meena et al, 2017). There is also interest for the use of intra-articular tranexamic acid in combination with the intravenous form. Some orthopaedic surgeons use tranexamic acid 1g iv given just before tourniquet release, and just before incision when no tourniquet is used, combined with post-op intraarticular injection of similar dose (typically intraarticular knee). More studies are underway on identifying the correct timing and duration in addition to the best way of administration in orthopaedic setting.

CONCLUSION

The most important step in blood transfusion management in orthopaedic surgery is a thorough pre-operative evaluation of each patient. Any degree of anaemia should be addressed and optimised prior to proceeding with elective surgery if possible. Iron and haematinic replacement should take priority over blood transfusion, which has several negative consequences in addition to practical difficulties. Careful consideration should also be given to ensure adequate time has elapsed after stopping antiplatelet

or anticoagulants, which can increase the risk of perioperative bleeding. It is also useful to have hospital policies drafted by senior staff in consultation with anaesthetists and physicians on appropriate transfusion methods. In the absence of any contraindications, the use of tranexamic acid perioperatively should be widespread for the simple fact that it is a cheap drug which is safe and very effective.

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