

Factors associated with an increased risk of postoperative blood transfusions in patients undergoing total hip arthroplasty – A mini-review

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Abstract

Introduction: Elective total hip arthroplasty is a common surgery performed around the world. Many patients undergoing elective total hip arthroplasty are elderly, with a large proportion being anaemic preoperatively. The aim of this mini-review is to discuss the numerous factors associated with blood transfusions after total hip arthroplasty, with particular emphasis on preoperative anaemia.

Methods: This is a mini-review of the literature regarding factors associated with increased rates of postoperative blood transfusions and methods and strategies to reduce the incidence of postoperative blood transfusions after elective total hip arthroplasty.

Results: Preoperative anaemia is a common condition in patients undergoing elective total hip arthroplasty. Preoperative anaemia, age, and increasing ASA score are all associated with increased rates of postoperative blood transfusions.

Conclusion: Preoperative anaemia, increased age and ASA score are all associated statistically with increased rates of postoperative blood transfusions in patients undergoing elective total hip arthroplasty.

Background

Total hip arthroplasty (THA) is one of the most common surgeries performed in the world, with over 700,000 projected to be performed in the US in 2040¹. It is a crucial surgical practice, that greatly improves the quality of life of patients who undergo the procedure, as shown by its quality-adjusted life year (QALY) of 0.25². Whilst it is associated with a great financial burden, with an episode of care cost of approximately \$10,000³, it is considered to be very cost-effective with regard to improvements in quality of life⁴. The cohort who undergo elective total joint arthroplasty are largely elderly patients, with knee and hip replacement being the most common¹. Elderly patients, who are the predominant demographic undergoing elective THA, often suffer from a variety of comorbidities which can complicate their recovery, and lead to an increased length of stay (LOS)⁵. One comorbidity, anaemia, was the main focus of this mini-review. Previous studies have demonstrated that the demographic undergoing elective THA are primarily over 65⁵, and 25% suffer from preoperative anaemia⁶. The aim of this mini-review is to discuss the numerous factors associated with blood transfusions after total hip arthroplasty, with particular emphasis on preoperative anaemia, and the management of this condition.

Analysis of Current Literature

Preoperative anaemia

Preoperative anaemia is a key factor associated with postoperative

blood transfusions after THA⁷. The epidemiology of patients undergoing elective THA internationally is important to know, for the production of local and international guidelines. The incidence of preoperative anaemia in patients undergoing THA ranges depending on location, but a recent meta-analysis has found that the average prevalence of preoperative anaemia is 15.2%, but this is not entirely specific to primary THA and includes revision surgeries⁸. Studies which highlight the incidence of factors such as preoperative anaemia in patients undergoing THA are useful benchmarks which institutions can use to judge their own practice. The incidence of preoperative anaemia in recent years is an important statistic to measure for a variety of reasons. Many papers have previously investigated the incidence of preoperative anaemia in patients undergoing THA, but these studies were performed almost a decade ago. In the space of 10 years since many of these studies were performed, the awareness of clinicians of the incidence of preoperative anaemia in an elderly cohort has grown significantly. Previous studies have found that up to 25% of patients over the age of 65 who are undergoing elective THA are anaemic preoperatively⁶. As a result of the greater awareness created by the published literature, clinicians are more aware of the condition, and are therefore able to manage it to a greater degree.

Preoperative anaemia management

The management of anaemia is complex. The mainstay of management includes accurate diagnosis of the type of anaemia, such as microcytic, normocytic and macrocytic, and investigations to find the cause of the anaemia⁹. Causes of anaemia are numerous, and include but are not limited to vitamin deficiencies such as B12, mineral deficiencies such as iron, anaemia secondary to blood loss, malignancy, anaemia due to kidney disease, or anaemia due to a haematological disorder⁹. Patients diagnosed with anaemia may require investigations, such as iron studies, blood tests for B12 deficiency, or a bone marrow biopsy¹⁰. Other methods of diagnosis can include endoscopy or CT scans to find the underlying pathology¹¹. Accurate diagnosis is required for accurate treatment, and therefore management of the underlying pathology causing the anaemia.

Postoperative blood transfusion rates

The rates of postoperative blood transfusion after THA in patients undergoing elective THA in an orthopaedic centre are important to clinicians nationally and internationally. Rates of postoperative blood transfusion vary after THA in the literature, from approximately 1.2 - 3.1%^{7,12}. What is most important about the incidence of postoperative blood transfusion, is the relationship with preoperative anaemia. Preoperative anaemia is a key risk factor for postoperative blood transfusion. Specifically, it has been found that 19.2%

of patients who are anaemic preoperatively will receive a postoperative blood transfusion, which is in stark contrast to the transfusion rate of 1.5% in those who are not anaemic preoperatively⁷. These findings provide important, up-to-date information on the incidence of postoperative blood transfusions in the patient cohort undergoing THA. It also quantifies the association and risk of postoperative blood transfusions that being anaemic preoperatively pre-disposes a patient to. The collection of this data has a number of benefits. Firstly, it can be shared with the relevant blood banks to provide recent and relevant data on the number of units of blood that they can expect to be required for patients undergoing THA. It can be used to develop protocols and procedures, to monitor the incidence of preoperative anaemia, and develop pathways to treat this condition, reducing the rates of postoperative blood transfusion. Finally, it can be used measure the current practice in an elective orthopaedic hospital, and provide information to similar units both nationally and internationally regarding the demographic of patients undergoing elective THA surgery, to further develop their own specific protocols. By developing local protocols, it can aid to ensure that sufficient blood supplies are available for transfusion, and a comprehensive preoperative assessment clinic is established to optimise these patients. Other factors found to be associated with preoperative anaemia and postoperative blood transfusion include increasing age, with higher ASA scores having mixed findings in the literature in support of their association^{7,12}.

Blood transfusion risks

The incidence of blood transfusion is an important variable to be measured for numerous reasons. Blood transfusions are costly to administer¹³. Significant funding is required to collect, analyse, store and distribute blood products. Costs are also associated with maintaining the quality and safety of the product. Blood products are often in short supply, with public campaigns ongoing to recruit new donors¹⁴. Approximately 120 million units of blood are donated annually around the world to meet the demand¹⁵, with each unit costing hundreds of euro to transfuse. Blood transfusions have a number of potentially significant consequences. They are associated with a variety of complications, such as graft versus host disease, acute lung injury, blood group mismatches, and contaminated blood products such as by HIV¹⁶⁻¹⁸. They are independent risk factors for increased morbidity and mortality. They have long been associated with increased length of stay in hospitals of approximately 2 days^{7,19,20}. Therefore methods to reduce the incidence of postoperative blood transfusions would lead to decreased risks to the patient, decreased pressure on the blood banks globally, decreased cost to the relevant medical service, decreased length of stay in hospital, and greater patient satisfaction.

ASA grade and postoperative blood transfusions

The American Society of Anesthesiologists (ASA) grade is a popular system used to quantify patients according to their anaesthesia risk and comorbidities²¹. It is a grading system that can be used preoperatively, using the available information, to risk stratify patients before surgery. It is a useful scoring system with respect to postoperative blood transfusions, as higher ASA scores have been shown to be associated with increased risks of postoperative blood transfusions^{7,21}. It has been documented that 19.2% of patients who are anaemic preoperatively will require a postoperative blood transfusion after elective THA, compared to 1.5% of those with a normal haemoglobin level⁷. Similarly, patients who are ASA 1 are unlikely to require a blood transfusion postoperatively, with ASA 2 patients having transfusion rates of 1.82%, increasing to 13.89% in patients who are ASA 3⁷. This information can be used to risk stratify patients, and lead to closer monitoring and follow-up of patients who have been shown to be at an increased risk of requiring a postoperative blood transfusion. This information leads to increased vigilance of the relevant surgical and anaesthesiology team caring for the patient, and can ultimately lead to better patient outcomes.

Preoperative anaemia management

With this information in mind regarding the prevalence of preoperative anaemia, the incidence of postoperative blood transfusions, along with the morbidity, mortality and increased LOS associated with them, it is important to look to the future, and see what can be improved. If we know that a significant proportion of patients who are undergoing elective THA are anaemic preoperatively, and we know that this significantly increases the risk of requiring a postoperative blood transfusion²¹, with all of the relevant complications that can be associated with such an intervention, then can we perform an intervention to decrease the incidence of preoperative anaemia? This is a topic that has been researched by other institutions in the past. As stated previously, finding the underlying cause of the anaemia is paramount. Patients can have undiagnosed comorbidities, which may first manifest as anaemia²². Consultation with the patient's general practitioner on diagnosis of anaemia in the preoperative assessment clinic may be appropriate, to further investigate the cause of the anaemia. Iron deficiency anaemia is the most common cause of anaemia in the elderly population, and its treatment is iron supplementation²³. This can occur by a variety of means, such as increased dietary iron from eating red meat, by oral iron supplementation, or even intravenous iron therapy. Intravenous iron therapy is invasive, and has a variety of complication such as iron extravasation, hypophosphataemia and iron-induced

gastric mucosal injury^{24,25}. Oral iron therapy can also have deleterious consequences. Oral iron tablets can be irritant to the stomach, and predispose patients to peptic ulcer disease²⁶. They can also be constipating, particularly in the elderly population²⁷. Previous studies have investigated the routine use of preoperative iron supplementation, and found no difference in blood transfusion rates²⁸. Patients suffering from a macrocytic anaemia may have folate or vitamin B12 deficiency which can be treated by diet or oral supplementation²⁹.

Blood transfusion guidelines

Haemoglobin targets are a topic that have been investigated extensively in the literature internationally. Current guidelines recommend a haemoglobin target of greater than 7g/dl in asymptomatic patients undergoing elective THA without cardiovascular disease³⁰⁻³². International guidelines would recommend a higher haemoglobin target of greater than 8g/dl in specific circumstances, such as patients with acute myocardial infarction or unstable myocardial ischaemia³³, with a value of 7-9 being favoured during active bleeding³⁴, but these are the exception. Underlying all of these international guidelines however is that clinical decision making is the most important factor in deciding whether or not to administer a unit of blood to a patient. If the clinician assesses a patient and determines that they are unstable and requiring a blood transfusion, this should be administered regardless of the haemoglobin value in the laboratory.

Summary

In conclusion, preoperative anaemia is a common comorbidity in patients undergoing elective THA. Preoperative anaemia is a strong risk factor for requiring a postoperative blood transfusion. Postoperative blood transfusions are associated with increased morbidity, mortality, and LOS. Preoperative haemoglobin status, increasing ASA grade, and increasing age have all been associated with increased rates of postoperative blood transfusion after elective THA. Measures to reduce the incidence of preoperative anaemia may be beneficial to decrease the risk and cost associated with transfusions in the future.

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