

ORIGINAL RESEARCH

Factors influencing blood loss and the need for transfusion following lower limb arthroplasty: An observational study

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ABSTRACT

A prospective study was done in the Department of Orthopaedics, Adesh Institute of Medical Sciences & Research, Bathinda to know the factors influencing blood loss and the need for transfusion in lower limb arthroplasty. Outcomes were assessed based on the patient's age, gender, body mass index, tranexamic acid administration, tourniquet inflation, drain placement, use of navigation, preoperative haemoglobin level and postoperative haemoglobin level, and blood transfusion. **Introduction:** Postoperative blood loss is one of the most important factors in patients undergoing lower limb arthroplasty and has a direct effect on postoperative status. With an increasing number of patients undergoing hip or knee arthroplasty for various indications and with the subsequent requirement of allogenic blood transfusion, increased attention should be given to the management of blood loss which is a modifiable outcome that affects patient satisfaction and outcome. A haemoglobin of less than 10 g/dl before total joint arthroplasty implies a nearly 90% chance of requiring transfusion, decreasing progressively to 40–60 % between 10 and 13.5 g/dl, and 15–25 % beyond 13.5 g/dl, reflecting the inverse relationship between preoperative haemoglobin and allogeneic transfusion risk. **Materials & Methods:** This is a prospective study conducted at a tertiary hospital, in which 140 patients were included who underwent lower limb arthroplasty for various indications and were followed up over a period of 1 year after satisfying inclusion and exclusion criteria. **Results:** The mean drop in haemoglobin in BTKA was 2.49 + 0.93g/dl, in bipolar hemiarthroplasty was 1.60 + 1.17g/dl and in THA was 2.10 + 1.08g/dl, the mean drop in haemoglobin in unilateral knee replacement was 1.48 + 1.17g/dl. **Conclusion:** The drop in haemoglobin levels had a positive correlation with pre-operative haemoglobin levels. The estimated blood loss was significantly higher in hip arthroplasty compared to unilateral knee arthroplasty. In our study, the use of a suction drain doesn't appear to be superior to no use of the drain.

Keywords: blood loss, total hip replacement, navigation, Arthroplasty.

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INTRODUCTION

Postoperative blood loss is one of the most important factors in patients undergoing lower limb arthroplasty and thus affecting postoperative status. With an increasing number of patients undergoing hip or knee arthroplasty for various indications and with the subsequent requirement of allogenic blood transfusion, increased attention has been given to the management of blood loss which is a modifiable outcome that affects patient satisfaction and outcome. A haemoglobin of less than 10 g/dl before total joint arthroplasty implies a nearly 90% chance of requiring transfusion, decreasing progressively to 40–60 % between 10 and 13.5 g/dl, and 15–25 % beyond 13.5 g/dl, reflecting the inverse relationship between

preoperative haemoglobin and allogeneic transfusion risk [14]. With less blood loss, the patient's rehabilitation can be improved which may be due to a reduction in blood loss around the knee resulting in less swelling and haemarthrosis, thereby increasing the range of movement and decreasing pain and stiffness. It has also become evident that transfusion, even with autologous blood, can result in complications such as fluid overload, and wound problems. Previously, it was accepted that TKA was an operation that typically resulted in significant post-operative blood loss, often requiring transfusion. This may be due to the bleeding surfaces of bone produced during the operation, the large joint cavity into which blood can accumulate, and the desire to move the knee immediately after

surgery, compromising haemostasis. Several techniques that can be used preoperatively, intraoperatively and postoperatively, such as autologous blood transfusion, intraoperative blood saving, and hypotensive anaesthesia, are now being carried out to reduce the need for allogenic blood transfusion. The clinical relevance of this study is that the findings could help identify patients at increased risk of blood loss and need for transfusion.

MATERIALS AND METHODS

This is a prospective observational study done in a tertiary care hospital in which one hundred forty patients with an average age of 61 years were selected to be included in the study. (10.9%) had femoral neck fractures, (68%) had OA, and (20.9%) had ANFH. All the patients underwent primary and revision total knee arthroplasty (TKA) surgery, total hip arthroplasty (THA), and bipolar hemiarthroplasty which was performed by the same orthopaedic surgeon at Adesh Institute of Medical Sciences and Research, Bathinda from January 2021 to June 2022. All enrolled patients had no history of haematological diseases which could affect severely blood coagulation. Variables such as gender, age, height, weight, pre-operative and post-operative haemoglobin (Hb), post-operative drain blood volume, and transfusion blood volume, were recorded. This study was reviewed and approved by the Ethics Committee of Adesh Institute of Medical Sciences and Research, Bathinda, and informed consent was received from all patients.

Sample size $[n] = z^2 p \cdot [1-p] / d^2$ Absolute precision -0.1
 p -expected proportion in population -0.5
 z -1.96 value of standard normal distribution or corresponding to a significance level of alpha hence
 $n = 1.96^2 \cdot 0.5 \cdot 0.5 / 0.1^2 = 96.4 = 100$

RESULTS

In our study, 4 patients were ≤ 40 years of age, 18 patients were 41-50 years of age, 40 patients were 51-60 years of age, 44 patients were 61-70 years of age, 29 patients were 71-80 years of age and 5 patients were 81-90 years of age. 58.5% of patients were female and 41.5% of patients were Male. In our study, 18 (12.8%) patients had 1U, 4 patients had 2U and 1 patient had 2FFP transfusion. Overall blood transfusion was required in 23 patients. In our study, 97% of patients were given Tranexamic Acid under the periosteum of the distal femur and proximal tibia (subperiosteally) in the medial and lateral collateral ligaments, pes anserine bursa, quadriceps and 1 ml as a local spray. A suction drain was used in 80 patients while in 60 patients suction drain was not used as decided by the operating surgeon. In the present study, 105 (75%) patients had a pneumatic tourniquet applied over a cotton bandage and then a tourniquet applied which was sealed at the site using a cling. The tourniquet inflated to pressure which was individualized based on the patient's systolic blood pressure and usually inflated to pressure ranges from 300 - 340 mm Hg.

The tourniquet beyond the SBP, allowed a certain amount of safety margin, which added to the SBP ranges widely, from 100 to 150 mm Hg in total knee arthroplasty. Initially, the maximum time for tourniquet inflation is 90 mins and if required for more than 2 hours, then it was deflated for 5 mins before inflating it again. The mean Pre-operative HB of patients was 13.74 ± 1.45 (g/dl) and the mean Postoperative HB (mean \pm s.d.) was 10.54 ± 1.80 .

DISCUSSION

In the present study, the mean drop in haemoglobin in BTKA was $2.49 + 0.93$ g/dl, in bipolar hemiarthroplasty was $1.60 + 1.17$ g/dl and in THA was $2.10 + 1.08$ g/dl, the mean drop in haemoglobin in unilateral knee replacement was $1.48 + 1.17$ g/dl, thus drop in haemoglobin levels had a positive correlation with pre-operative haemoglobin level, Pearson correlation coefficient 0.394 and $p < 0.0001$ which is statistically significant. In a study by Boutsiadis A [3], the drop in haemoglobin level mainly depends on preoperative haemoglobin level and tranexamic acid administration while the need for transfusion is only associated with pre-operative haemoglobin levels. The average drop in haemoglobin levels in primary knee arthroplasty in our study was $1.48 + 1.17$ g/dl, and the mean drop in the haemoglobin levels in primary total hip arthroplasty was $2.10 + 1.08$, and $p < 0.0016$. In a study by Carling MS [5], the median estimated blood loss was significantly higher in hip arthroplasty compared to knee arthroplasty and $p < 0.001$. The drop in haemoglobin levels had a positive correlation with pre-operative haemoglobin levels. The preoperative haemoglobin and blood transfusions have a strong and significant negative correlation, which signifies that blood transfusion during routine lower limb arthroplasty depends upon the patient's preoperative Hb level. There is a positive correlation between implant size and blood loss as the more the surface area of bone cuts, the more will be soft tissue dissection and more will be blood loss. The estimated blood loss was significantly higher in hip arthroplasty compared to unilateral knee arthroplasty. Although the blood loss was more in males as compared to females yet the difference was not statistically significant. In the present study, the use of a suction drain is not superior to the no-use of the drain. There was no statistical difference between the mean drop haemoglobin value for the closed suction drain group and the no-drain group since the average post-operative blood loss and length of stay were higher in patients with a suction drain in situ. But post-op soakage was more in a patient with no drain in lower limb arthroplasty and the functional recovery is more in the early rehabilitation phase as aggressive physiotherapy may be started as drain does not hinder in the patient while early mobilisation and on one month follow there is no significant difference in range of motion in a patient with a drain in situ / without drain patient.

In the present study, there was no significant difference in the drop in haemoglobin levels in patients undergoing navigated arthroplasty vs non navigated knee arthroplasty.

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