

Original Article

Blood Loss and Influencing Factors in Primary Total Hip Arthroplasties

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Abstract

Introduction: Orthopaedic surgery results in significant blood loss. There are no studies that can aid the surgeon in the African region estimate the expected blood loss after total hip replacement. We conducted a study to quantify the blood loss following total hip arthroplasty and to determine the factors associated with this blood loss. **Methods:** We conducted a cohort study of primary total hip arthroplasties and estimated the mean blood loss using a predetermined formula.

Results: The mean blood loss was estimated to be 4.3g/dl and was associated with higher pre operative haemoglobin concentration and increasing duration of surgery. **Conclusion:** Total hip arthroplasty is associated with high levels of blood loss. The reduction of surgical time and pre operative autologous blood donation may reduce this loss and potentially reduce the need for post operative allogeneic blood transfusion.

Key Words: Total hip arthroplasty, Blood loss, Blood transfusion

Introduction

Major orthopaedic surgery including Total Hip Arthroplasty (THRA) is associated with substantial blood loss (1, 2). Knowing the expected levels of blood loss for a particular procedure aids the surgeon to pre determine which patients are more likely to require transfusion (3). Alternative methods for mitigating the need for allogeneic transfusion can also be sought. Knowing the risk factors associated with increased blood loss would also identify potential areas of intervention to mitigate this loss. Though there are similar studies in western literature, surgery in the African setting is conducted in essentially different circumstances, making studies conducted in the region more relevant. There are no studies in our region that have quantified the amount of blood loss after THRA or determined the factors associated with this blood loss. Implementing the results of such studies has led to better outcomes (4).

There are two main methods of estimating blood loss after surgery, direct and indirect methods. Various indirect methods of estimating blood loss have been described (1, 5-7). Indirect methods have been found to be more accurate and can detect hidden blood loss post operatively (8).

We conducted a study first to quantify the blood loss after primary total hip replacement arthroplasty and second to determine the factors associated with this blood loss using an indirect method of measurement.

Methods

A retrospective cohort study was conducted of all total hip arthroplasties conducted at the PCEA Kikuyu Hospital Orthopaedic unit since 1998. Our unit serves as a teaching hospital for the orthopaedic residency program of the University of Nairobi and is an accredited centre for the college of surgeons of East Central and Southern Africa (COSECSA). We reviewed the charts of the patients and abstracted data on demographics, haemoglobin concentration (Hb), the use of drains and duration of surgery. At our institution patients undergoing a primary total hip arthroplasty have their Hb measured on the day prior to surgery and on the third day post operatively. The surgeries were conducted by several surgeons of varying levels of expertise in the procedure but there was no fellowship trained arthroplasty surgeon. Drains were used at the discretion of the surgeon and both cemented and non-cemented implants were used as per the individual patient's requirements. We excluded cases of revision arthroplasty and hemi arthroplasties. We also excluded from analysis any patients who had missing data. The study was approved by the hospital ethics committee. The amount of blood lost during the operation was estimated using the decline in haemoglobin concentration using the following formula;

Blood loss = pre-operative haemoglobin - post-operative haemoglobin (1).

In patients who received blood transfusion intra or post operatively the following formula was used

Blood loss = pre-operative haemoglobin - post-operative haemoglobin + units of blood transfused (1).

Several factors were investigated to see if they influenced blood loss after primary total hip replacement arthroplasty including the use of drains, length of surgery, pre operative Hb.

For the purposes of analysis, the continuous variable pre-operative haemoglobin concentration was categorized into two groups < 13 or ≥ 13 g/dl based on the average pre operative Hb expected for the cohort. The duration of surgery was grouped as up to 90 minutes and more than 90 minutes based on the expected average operating time.

The student T test was used to detect differences between continuous variables and a p value of <0.05 was considered significant.

Results

There were 666 participants in the study, 214 Males and 452 Females giving a male to female ratio of 1:2. The mean age of the participants was 63.12 years (SD 10.4). The mean pre operative haemoglobin level was 13.9g/dl(SD 1.84). The mean blood loss was 4.3 g/dl (SD 1.8). Table 1 shows the descriptive details of the basic data.

Insert Table 1 here

The average blood loss in patients whose surgery lasted 90 minutes or less was 4.1 g/dl while in patients whose surgery lasted over 90 minutes the blood loss was 4.6g/dl ($p=0.004$). The mean blood loss in patients who had a pre-operative Hb of less than 13g/dl was 3.4g/dl and 4.7g/dl in those with 13g/dl ($p<0.0001$). The use of post operative drains and a body weight above 80kgs were found not to be associated with increased blood loss. The details of the risk factors for transfusion are detailed in Table 2.

Insert Table 2 here

Discussion

The mean blood loss after total hip replacement arthroplasty is 4.3g/dl. A pre-operative Hb of 13g/dl or more and duration of surgery longer than ninety minutes are associated with higher blood loss.

The levels of blood loss are higher than the levels reported by Kajja et al (mean 3.31g/dl)in Uganda that concentrated on open reduction and internal fixation of femoral shaft fractures(1). They are also higher than the levels (mean 3.7g/dl) reported in the US by Nuttall et.al but lower than the 4.8g/dl reported for revision arthroplasty (2). Our reported blood loss was also higher than those seen in a study in Hong Kong (9). We contend that the levels of blood loss in arthroplasty are expected to be higher than in fracture surgery mainly due to the large number of

raw bleeding bone surfaces present in joint replacement. The higher level of blood loss in our study when compared to the study in the US and Hong Kong is probably due the longer operating time in our setting. This may be explained by the fact that our centre is not a specialized Arthroplasty centre and none of the surgeons were dedicated arthroplasty surgeons as is common in American centers. It has been shown that surgery that is performed by inexperienced and non specialised surgeons may result in longer operating times (10).

Our study also found that a high pre-operative haemoglobin level is associated with increased blood loss. We could not identify any other studies that have a similar finding. We postulate that this may be due to the fact that for each ml of blood lost in a patient with a higher haemoglobin concentration, there is a higher content of haemoglobin. This will result in a larger drop in post operative haemoglobin concentration. We contend that is an issue that will require more investigation in future studies.

Our results are in tandem with other studies that show there is no difference in estimated blood loss in hip arthroplasty in patients who have drains and those that don't (11). The fear of increased blood loss should therefore not be a consideration when deciding whether to use drains or not.

While blood loss is expected after major surgery, this study identifies the factors that are associated with blood loss and hence provides clinicians with strategies to reduce blood loss. The reduction in the duration of surgery will possibly result in lower blood loss. Another strategy that can be adopted is the use of autologous blood donation pre operatively and transfusion of this blood in the post-operative period. We contend that this may also reduce the preoperative Hb and this may also reduce the blood loss after surgery. The reduction of blood loss and having autologous blood has been shown to reduce the need for allogeneic blood transfusion (12).

Our study has several limitations mainly related to the study design. The retrospective nature exposes the study to missing data and the lack of standardised procedures. The large number of patients however is a major strength of the study.

Conclusion

Total hip arthroplasty is associated with high levels of blood loss. The reduction of surgical time and pre operative autologous blood donation may reduce this and potentially reduce the need for post operative allogeneic blood transfusion.

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Table 1 Description of Basic Data

Variable (N)	Minimum	Maximum	Mean	SD
Age(666)	24	94	63.12	10.4
Pre Operative Hb (659)	6.2	20	13.88	1.84
Post Operative Hb (600)	5.0	15.1	9.7	1.8
Blood Loss (600)	0.9	10.9	4.31	1.82

Table 2 Risk Factors for increased blood loss

Risk Factor	1 st Category	2 nd Category	P Value
Duration of Surgery	Upto 90 min(4.1g/dl)	>90 min (4.6g/dl)	0.004
Preop Hb	<13g/dl (3.4g/dl)	>=13g/dl (4.7g/dl)	0.0001
Drains	Drains (4.34g/dl)	No Drains (4.27g/dl)	0.7
Weight	Upto 80kgs (4.4g/dl)	>80 kgs (4.4g/dl)	0.98