

# Surgeons often underestimate the amount of blood loss in replacement surgeries

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**【Abstract】 Objective:** To assess the accuracy of the clinically estimated blood loss (EBL) when compared with the actual blood loss (ABL) in replacement surgeries.

**Methods:** This prospective study was done in Sri Ramachandra Medical Centre from April 2011 to April 2013. Altogether 140 patients undergoing total hip replacement or total knee replacement were included with the inclusion criteria being patients with haemoglobin higher than 100 g/ml and coagulation profile within normal limits. Exclusion criteria were intake of anti-platelet drug or anti-coagulant, bleeding disorders, thrombotic episode, and haematological disorders. There were 65 men and 75 women. In this study, the consultants were free to use any clinical method to estimate the blood loss, including counting the blood-soaked mops and gauze pieces (estimating the volume of blood carried in all the mops and gauzes), measuring blood lost to suction bottles and blood in and around the operative field. The ABL was calculated based on a modification of the Gross's formula using haematocrit values.

**Results:** In 42 of the 140 cases, the EBL exceeded

the ABL. These cases had a negative difference in blood loss (or  $\text{DIFF-BL} < 0$ ) and were included in the overestimation group, which accounted for 30% of the study population. Of the remaining 98 cases (70%), the ABL exceeded the EBL. Therefore they were put into the underestimation group who had a positive difference in blood loss ( $\text{DIFF-BL} > 0$ ). We found that when the average blood loss was small, the accuracy of estimation was high. But when the average blood loss exceeded 500 ml, the accuracy rate decreased significantly. This suggested that clinical estimation is inaccurate with the increase of blood loss.

**Conclusion:** This study has shown that using clinical estimation alone to guide blood transfusion is inadequate. In this study, 70% of patients had their blood loss underestimated, proving that surgeons often underestimate blood loss in replacement surgeries.

**Key words:** *Hemoglobins; Blood Loss, surgical; Erythrocyte transfusion; Hematocrit*

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Total hip or knee arthroplasty is an elective surgery that is usually accompanied by substantial blood loss, which may lead to anaemia. As a result, almost half of total joint arthroplasty patients need blood transfusion to prevent postoperative anaemia.<sup>1,2</sup> For patients undergoing these surgeries, under-transfusion is associated with risks of increased perioperative morbidity and delayed recovery in the postoperative period.<sup>3</sup> Consultants often rely on clinical estimation of blood loss alone to guide transfusion of red blood cells (RBCs) in the perioperative period

because other methods of examination may be either impractical or unavailable all the time. The aim of this study was to assess whether the clinical estimation of blood loss is accurate in replacement surgeries.

## METHODS

This prospective study consisted of 140 patients undergoing total hip replacement or total knee replacement in Sri Ramachandra Medical Centre from April 2011 to April 2013. The inclusion criteria were patients with haemoglobin higher than 100 g/ml and coagulation profile within normal limits. Exclusion criteria were anti-platelet drug intake, anti-coagulant intake, bleeding disorders, thrombotic episode, and haematological disorders. There were 65 male and 75 female and their ages were between 45 and 70

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years. The body weight ranged from 38 to 79 kg and preoperative haematocrit from 23% to 47% (mean=37.10%).

The anesthetist consultant, nurse, and all theater staff were informed about the objective of this study. A proforma was prepared including patients' age, sex, body weight, preoperative haematocrit, diagnosis and surgery type, etc. The estimated blood loss (EBL) and time, as well as fluid therapy up to the time of estimation were recorded. Blood transfusion during and immediately after surgery were done based on the EBL.

Clinical methods of blood loss assessment included counting the blood-soaked mops and gauze pieces, measuring blood lost to the suction bottles and estimating blood in and around the operative field. The time from the induction of anesthesia to the estimation of blood loss was noted and the volume and types of intravenous fluid given before and after the estimation was also recorded. The total blood loss, RBCs (if) transfused and the total duration of surgery were documented in the proforma. The postoperative haematocrit was also checked. The ABL was calculated from a modification of the Gross formula<sup>4</sup> given below

$$ABL = BV [Hct (i) - Hct (f)] / Hct (m)$$

Where BV is the blood volume and equals body weight (kg) x 70 ml/kg; Hct (i), Hct (f) and Hct (m) are the initial, final and mean (of the initial and final) haematocrit respectively.<sup>4</sup> No transfusions were done according to ABL. For each patient, the numerical difference in blood loss (DIFF-BL) equals ABL-EBL. The average blood loss (AVE-BL) is also calculated, which is the mean of EBL and ABL.

## RESULTS

The clinical EBL ranged from 300 to 1 750 ml; while the ABL that was calculated from the laboratory haematocrit ranged from 380 to 2 250 ml.

In 42 of the 140 cases, the EBL exceeded the ABL (DIFF-BL < 0). In these cases the consultant's clinical judgment on blood loss was higher. All of them were grouped together as overestimation,

and accounted for 30% of the study population. Of the remaining 98 cases (70%), the ABL exceeded EBL (DIFF-BL > 0). These patients were included in the underestimation group. The DIFF-BL was between -700 ml (overestimation) and +1230 ml (underestimation).

Table 1 shows that when AVE-BL is small, the accuracy rate of blood loss estimation is high; similarly when the AVE-BL exceeds 500 ml, the accuracy decreases significantly. This suggests that clinical estimation is inaccurate as the blood loss increases. The *P* values also confirm that there is a significant difference between AVE-BL and DIFF-BL.

For all of the 140 patients, the mean ABL was 732.09 ml (SD=302.584 ml, SEM=25.573 ml) and EBL was 568.75 ml (SD=214.770 ml, SEM=18.151 ml). The difference between the two means was around 164 ml which was statistically significant.

## DISCUSSION

Total knee or hip arthroplasty is usually accompanied by substantial blood loss and regularly requires postoperative blood transfusion. Blood is a finite resource with a limited shelf life and is associated with considerable processing cost.<sup>5</sup> The blood transfusion itself is not a risk free therapeutic method either. Transfusion can lead to transmission of infectious diseases such as HIV, hepatitis, and others, as well as transfusion-related lung injury, haemolytic reactions, fluid overload and a higher rate of postoperative infection.<sup>6,7</sup> Therefore utilization of this resource needs strict examination in advance to avoid overuse and reduce the risks to patients and costs in hospital.

Perioperative transfusion triggers for RBCs include physiologic signs of inadequate oxygenation of the entire body or of a specific organ, haemoglobin concentration and logistical aspects such as experience of the anesthesiologists and surgeons, predictability of blood loss and the time required for a hemoglobin determination and RBC delivery.<sup>8</sup> Defining transfusion triggers for RBC transfusions is important to avoid unnecessary RBC transfusions and equally to avoid under-transfusion in some situations where RBC transfusions may be beneficial.<sup>9</sup>

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