



ORIGINAL RESEARCH PAPER

Anaesthesiology

A DESTINED INQUISITIVE STUDY OF INTRAOPERATIVE BLOOD LOSS ASSESSMENT IN A SOUTH INDIAN TERTIARY CARE HOSPITAL

KEY WORDS: Assessment, Accuracy, haematocrit, Intraoperative Blood Loss, blood transfusion

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ABSTRACT

Background: There is no clear concise method of measuring intra-operative estimated blood loss. Many clinicians often estimate blood on simple observation, which can offer wide-ranging values. This often leads to poor management with the transfusion of blood products in the intraoperative patient. The aim of this study was to assess the accuracy of intraoperative blood loss estimation.

Objectives: Access the accuracy of clinical blood loss estimation, find the better alternative method to assess the intraoperative blood loss.

Methodology: Fifty patients undergoing major elective surgeries for various indications were enrolled in this study. Baseline characteristics, preoperative haematocrit, post-operative haematocrit, clinically estimated blood loss (EBL) was noted. Blood was transfused after the sample was drawn for haematocrit estimation. Modification of the Gross formula is used to calculate actual blood loss (ABL). The number of cases where the blood loss was clinically underestimated and overestimated; and the relationship between the difference in actual and estimated blood loss and accuracy of clinical assessment of blood loss was determined. The data obtained was analyzed using descriptive statistics and Bland Altman plot

Results: 50 cases of which we studied, there was overestimation of blood loss in 26 (52%) cases. However, there was underestimation of blood loss in 24 (48%) cases. The Bland and Altman plot suggests that as the average blood loss increases (p<0.001) the clinical estimation of blood loss is more inaccurate

Conclusion: We conclude that clinical estimation of blood loss is inaccurate in the intraoperative period and should not be used as a sole for estimation of blood loss and as need to determine for red blood cell transfusions.

INTRODUCTION

Intraoperative blood loss is one of the worrying causes of death during most of surgical procedures. Moreover acute anaemia can also result from excessive blood loss and this can affect healing of tissues after surgery.⁽¹⁾ In patient undergoing surgery with significant blood loss, under transfusion has been associated with risks of increased perioperative morbidity and delayed recovery in the postoperative period.⁽²⁾

Patients may be required to donate varying number of units of blood prior to surgery which may or may not be used. The potential blood loss and estimated number of blood products required should therefore be predetermined using many factors.⁽³⁾ Intraoperative transfusion practices and its implications on morbidity and mortality have depended on the accuracy of clinical estimated blood loss. Though these clinical methods are simple to perform and can be performed repeatedly; at no additional cost or complication to the patient, they may largely depend on the Anaesthesiologist's experience and expertise in estimating blood loss. Since the above constellation of factors are dynamic, evolving and in a sense "real time", Anaesthesiologists should repeatedly estimate the blood loss. These clinical estimations and changes in the monitored hemodynamic variables should be interpreted by the Anaesthesiologist and used to determine the time of testing the hematocrit.⁽⁴⁾

MATERIALS AND METHODS

This study was carried out at Department of anaesthesiology, K.S. Hegde Hospital after obtaining hospital ethical committee approval and informed written consent from the patients from March 2016 to August 2017. Fifty patients aged 18 to 65 years of either sex scheduled for major elective surgical procedure for which blood was cross matched were included in the study. Exclusion criteria included surgeries where estimation of clinical blood loss not routinely performed including cardiac surgeries, Patients with BMI>25 Kg/m², severely anaemia patients (i.e haematocrit <21%), Patients with massive and sudden blood loss (as they require blood transfusion immediately) and who refused to consent to be part of study A

day prior to surgery, pre anaesthetic evaluation of the patient was done and necessary investigation was sent and reviewed airway assessment was done. Those satisfying the above study criteria were enrolled in study. Concerned anaesthesiologist were informed about the study. Proforma containing age, sex, body weight, preoperative haematocrit was made available to anaesthesiologist. Assuming normovolemia was maintained anaesthesiologist clinically estimated the blood loss. Simultaneously, blood sample was sent to the laboratory for haematocrit estimation. Blood was transfused after the sample was drawn for haematocrit estimation. In this study, for estimation of blood loss anaesthesiologist was free to use any clinical method. The total duration of surgery, total blood loss, blood (if) transfused were noted and haematocrit (Post Op) was also recorded.

Actual blood loss will be measured using the formula⁵: $ABL = BV [Hct(i) - Hct(f)] / Hct(m)$ Where, ABL = Actual blood loss, BV = Blood volume, Blood Volume = Body wt in Kgs x 70 ml/kg, Hct (i) = initial Haematocrit, Hct(f) = final Haematocrit and Hct(m) = mean Haematocrit Difference in blood loss (DIFF-BL) is difference between the actual (calculated) blood loss and estimated blood loss was calculated. Similarly, Average blood loss (AVG-BL) is mean of actual (calculated) blood loss (ABL) and estimated blood loss (EBL) was calculated.

RESULTS:

The 50 patient's age between 18 to 63 years of either sex 29 men and 21 women was included in the study. The body weight and height was 40 to 78 kgs and 135 to 175cms respectively (table 1). The hematocrit (preoperative) was between 33% and 55% (mean = 41.45% and SD of 4.91%).

Table 1: Demographic data

	Mean	Median	Standard deviation
Age (yrs)	42.82	47.5	15.24
Weight (Kgs)	60.34	60	8.28

The blood loss estimated clinically was designated as estimated blood loss (EBL), which range between 250 ml to

1600 ml. The Actual Blood Loss (ABL) calculated from the laboratory hematocrit which range between 199 ml and 2139 ml.

In 26 (52%) cases of estimated blood loss exceeded the actual blood loss. The clinical judgment in these cases estimated blood loss was more than actual blood loss. The difference in blood loss (or DIFF-BL<0) being negative which reflected overestimation of blood loss. The actual blood loss (ABL) exceeded 24 (48%) cases in estimated blood loss. The difference in Blood Loss (or DIFF-BL>0) being positive which reflected underestimation of blood loss.

The difference in blood loss ranged between - 507 ml (overestimation) and +738 ml (underestimation) in EBL.

The average blood loss between calculated and estimated blood loss was 225 ml and 1769 ml with a mean of 739.72 ml and a standard deviation of 378.45 ml.

To compare the two samples non parametric Wilcoxon's sign rank test was done which shows the mean and median values of difference in the anaesthetist blood loss is 34.56 and -10.9. Which is statically highly significant (p < 0.001)

Table 2: Difference in anaesthetist blood loss

	Mean	Median	P value
Difference in anaesthetist blood loss	34.56	- 10.9	<0.001

The Bland and Altman plot was used to assess the agreement between clinical measurements between the difference in blood loss and the average blood loss in this study. Three groups were made on Average Blood Loss (i.e anaesthetist and actual blood loss) into groups with blood loss < 500 ml, 500 to 1000 ml and > 1000ml Average blood loss was compared to the Difference in Blood Loss.

Table 3: Difference in anaesthetist blood loss and average blood loss

Average blood loss	Difference in anaesthetist blood loss			Total
	<0 ml	0 to 500 ml	>500 ml	
< 500 ml	7	11	0	18
500 to 1000 ml	15	8	0	23
> 1000 ml	4	2	3	9
	26	21	3	

We found that difference or inaccuracy in blood loss estimation is less when average blood loss is low. However as average blood loss increases the difference in blood loss (or inaccuracy of estimation) increases. We suggest as the blood loss increases the accuracy of clinical estimation decreases.

Bland and Altman plot

Bland and Altman plot is plotted taking Average Blood Loss on the X-axis and difference in blood loss on the Y-axis. We observed as the Average Blood Loss increases, the values on Y-axis scattered further away from the "0" point. This signifies as the average blood loss increases there is an increase in disagreement between the actual and estimated blood loss.

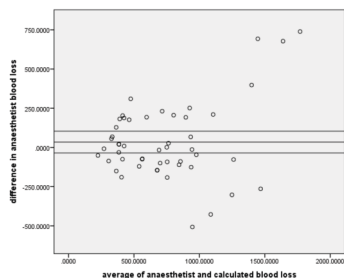


Figure 1: Bland and Altman plot comparing average and difference in anaesthetist and actual blood loss

DISCUSSION

The main aim of the study was to assess the accuracy of intraoperative blood loss estimation. There are not many studies regarding accurate estimation of blood loss in major elective surgery. To avoid unnecessary massive blood transfusion and also under transfusion were blood transfusion would be beneficial. It is important to define the transfusion trigger for blood transfusion.

Blood loss can be measured by various methods. Which includes subjective and objective method of blood loss estimation. Though subjective method is common method of blood estimation its highly unreliable and objective method includes automated blood loss meter its based on electrolyte conductivity, gravimetric method, measuring radioactivity of blood and calorimetric method. Currently there is no clear concise method for measuring intraoperative blood loss.³

Many clinicians based on simple clinical observation often estimates blood loss. Which often leading to wide range in values. Thus unnecessary transfusion of blood products leading to poor management of patient. The American college of physicians recommended transfusion of blood should be unit by unit and patient should be evaluated between each transfusion.⁴

Tarter and Barron conducted a study on patients undergoing potential curative resection for colorectal malignancies they found 90% unnecessary blood transfusion because of practice of administrating blood without reevaluating the haematocrit between transfusions. They recommended 25% reduction in consumption of blood if haematocrit is determined before transfusion of each unit of blood.⁵

Lee et al conducted a prospective clinical study for quantification of surgical blood loss they concluded that quantifying amount of intra-operative blood loss was accurately assessed using spectrophotometric haemoglobin analysis but it was applicable as research tool as the procedure was time consuming. They recommended gravimetric method of evaluation of intra-operative blood loss for use in a clinical setting as it was found to be accurate method.⁶

In our study estimated blood loss (EBL) there was overestimation of blood loss in 48% of cases and overestimation in 52% of cases. In comparison to our study, Ganesan ram et al⁷ conducted a study on blood loss in hip or knee replacement surgeries found that 70% of patients had their blood loss underestimated. Similarly, Naveen Eipe et al⁸ found in their study on pre-operative blood loss that there was underestimation of blood loss in 64% of cases.

Also, we found that as the intraoperative blood loss increases there is tendency to underestimate blood loss. In comparison to our study, study conducted by Naveen Eipe et al⁸ found that as the blood loss increase the clinical estimation of blood loss is inaccurate. Similarly study conducted by Ganesan et al⁷ also found similar result as the blood loss increases clinical estimation of blood loss becomes inaccurate.

In 15 cases there is requirement of blood transfusion of which 7 cases blood was transfused when haematocrit was above 38% and 3 cases blood was transfused when haematocrit was below 22%. In all above transfusion clinical estimation of blood loss was used to asses the blood loss.

The limitation of our study includes the fact that there was no standardization in blood loss estimation as it's an observational study

CONCLUSION

In conclusion, the patient's well-being in intraoperative care will be adversely affected if surgical blood loss is

inaccurately estimated. Most anaesthetist continue to measure surgical blood by clinical judgment, which though convenient is inaccurate. Modified gross formula using haematocrit can be used as an economical and accurate method to estimate blood loss in operative procedures.

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