

An Evaluation of Intra- and Post-operative Blood Loss in Total Hip Arthroplasty at the National Orthopaedic Hospital, Lagos

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ABSTRACT

Background: Severe hip pain with associated significant functional limitation is the major indication for total hip replacement, a rewarding and gratifying procedure. However, significant blood loss can occur in the intra- and post-operative periods, posing a major challenge and necessitating prompt restoration of circulating blood volume to minimize morbidity and mortality. The aim of this study was to evaluate blood loss after primary total hip replacement, and to determine the effect of surgical time on blood loss. **Patients and Methods:** A prospective study of blood loss after total hip arthroplasty in 41 patients. All cases were primary total hip arthroplasty done by one surgeon. Intra- and post-operative blood losses were recorded in two groups of patients (surgical time <2 h and surgical time >2 h), and the effect of these on blood loss was evaluated. **Results:** The mean intra- and post-operative blood losses were 1222.7 ml and 574.3 ml, respectively. These showed a strong positive correlation with total blood loss ($r = 0.790$, $P < 0.001$ and $r = 0.517$, $P < 0.001$). Higher intra- and post-operative blood losses were recorded in patients with surgical time >2 h, with a significant difference on postoperative days 2 and 3 ($P = 0.003$ and $P = 0.014$, respectively). **Conclusion:** Blood loss in total hip replacement is an important factor and may be influenced by a shorter surgical time.

KEYWORDS: Blood loss, primary total hip arthroplasty, surgical time

INTRODUCTION

Total hip replacement is a rewarding and reliable procedure in patients with severe hip pain associated with functional limitation. The benefits of the procedure are gratifying in the elderly and young patient, particularly if patient selection is appropriate and ideal. The procedure, however, may be associated with significant blood loss, especially in revision and complex cases, necessitating prompt restoration of circulating blood volume. This in itself poses a danger, as the risks of homologous blood transfusion cannot be over emphasized.^[1-4] Measures to minimize intra-operative blood loss including optimal preoperative physiological status, use of appropriate surgical approach, gentle and delicate tissue dissection, surgical expertise, rational use of electrocautery, and others should be employed during this procedure.

Studies have shown a reduction in blood loss after the use of a posterior approach in total hip replacement.^[5-7] Others

have emphasized the benefits of surgical time <90 min in reducing blood loss;^[7] however, speed should not substitute good surgical acumen and gentle tissue dissection. The role of autologous blood transfusion, deliberate hypotension, and administration of fibrinolytic inhalators in reducing blood loss was emphasized by Bannister *et al.*^[8] Other researchers have investigated the role of tranexamic acid in minimizing intra- and post-operative blood loss.^[9-12]

The hypothesis of this study is that reduced surgical time has no significant benefit in minimizing blood loss, if surgical principles are strictly followed.

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How to cite this article: Ugbeye ME, Lawal WO, Ayodabo OJ, Adadevoh IP, Akpan JJ, Nwose U. An evaluation of intra- and post-operative blood loss in total hip arthroplasty at the national orthopaedic hospital, Lagos. Niger J Surg 2017;23:42-6.

Access this article online	
Quick Response Code: 	Website: www.nigerianjsurg.com
	DOI: 10.4103/1117-6806.205750

Objectives

1. To evaluate blood loss after total hip replacement
2. To evaluate the effect of surgical time on blood loss.

PATIENTS AND METHODS

Study design

A prospective study of blood loss after total hip arthroplasty in 41 patients in the National Orthopaedic Hospital, Lagos, between January 2013 and December 2014.

Inclusion criteria

- Patients with no previous thromboembolic phenomenon
- Patients with no renal pathology
- Patients with no hepatic pathology
- Patients that gave consent for inclusion in the study.

Exclusion criteria

- History of bleeding disorder
- Patients on anticoagulants for established venous thromboembolism
- Patients with renal pathology
- Patients with hepatic pathology
- Patients that do not give consent for inclusion in the study
- Revision and complex primary total hip replacement.

Study technique

Approval for the study was obtained from the Ethics and Research Committee of the Hospital, following development of a study protocol. Consecutive patients with established indications, presenting for total hip arthroplasty were recruited into the study after obtaining their consent.

Patients' demographic parameters, complaints, and associations, diagnosis, surgical approach, type of anesthesia, pre- and post-operative hemoglobin concentration, duration of surgery, intra- and post-operative blood loss, and a number of blood units transfused were recorded on the designed pro forma.

As part of the study protocol, preliminary estimation of blood volume in a partially and fully soaked gauze pack (abdominal pack) and swab was done by weighing the wet and dry gauze pack and swabs and subtracting the values of dry weight from wet weight as shown in Table 1.

Surgery was done under regional or general anesthesia using either the direct lateral or posterior approach. All procedures were done under strict asepsis by the same surgeon; while ensuring dissection along surgical planes, judicious use of electrocautery and gentle soft tissue dissection. A Redivac suction drain was used for all patients.

Table 1: Volume of blood loss into swabs and gauze

	packs	
	Volume in gauze pack (ml)	Volume in swab (ml)
Partially soaked	50	10
Fully soaked	100	20
Fully soaked and dripping	150	40

Intraoperative blood loss was calculated by counting the number of swabs and gauze packs and estimating the volume of blood as shown in Table 1. Blood loss was also measured by calculating the amount of blood in the suction, after subtracting the volume of irrigation fluid used; blood loss on the drapes was also estimated. The total intraoperative blood loss is obtained by summation of blood loss to all these points. Postoperative blood loss was calculated by measuring the blood volume within the closed suction reservoir bottle within the first 72 h.

The effect of surgical time on blood loss was evaluated by dividing patients into two groups, based on the surgical time. Group 1 patients had surgical time <2 h, whereas Group 2 patients had surgical time >2 h.

Statistical analysis

Data were collected and summarized on a spreadsheet and analyzed using the Statistical Package for the Social Sciences version 17 (SPSS Inc., Chicago, IL). Statistical significance of tested variables was assessed using the independent *t*-test and Levene's test for equality of variances. *P* =0.05 or less was taken as significant, at 95% confidence interval.

Outcome measure

The outcome measures were intra- and post-operative blood loss after total hip replacement.

RESULTS

A total of 41 patients who had total hip arthroplasty were studied. Age range was between 18 and 81 years, with a mean age of 45.6 ± 15.8 years. Male patients accounted for 36.6% of cases and females 63.4%, giving a male: female ratio of 1:1.7. The average duration of symptoms was 3.8 years, with bilateral pathology in 27.9% of patients. Twenty-one patients (51.2%) had a right total hip arthroplasty, whereas twenty patients (48.8%) had left total hip arthroplasty. Fourteen patients (32.6%) had associated hemoglobinopathy.

All patients had a primary total hip replacement. The direct lateral approach was used in 23 (56.1%) patients, whereas 18 (43.9%) patients had a posterior approach. The average duration of surgery was 2.3 ± 0.5 h,

with 18 (43.9%) of procedures done within 2 h and 23 (56.1%) lasting over 2 h.

The results of pre- and post-operative parameters and blood loss are shown in the charts and tables below. The average pre- and post-operative hemoglobin concentrations were 11.4 ± 1.9 g/dl and 9.4 ± 1.4 g/dl, respectively [Figures 1 and 2]. The mean hemoglobin loss was 2.1 ± 1.1 g/dl ($r = 0.82, P < 0.001$).

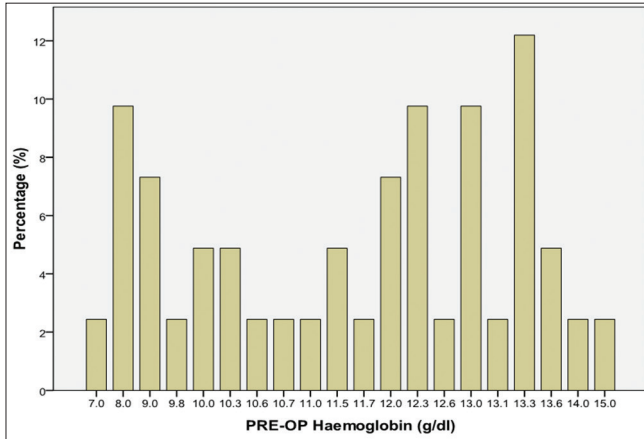


Figure 1: Pre-operative Hemoglobin Concentration

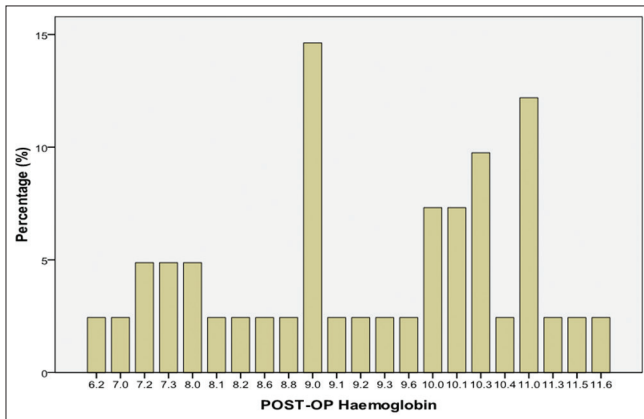


Figure 2: Post-operative Hemoglobin Concentration

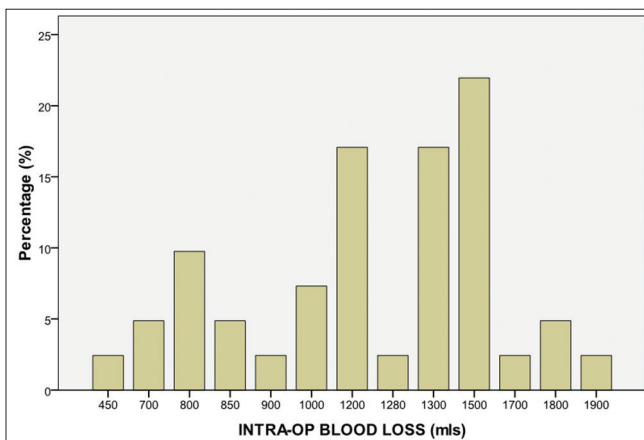


Figure 3: Intra-operative Blood loss

The mean intraoperative blood loss was 1222.7 ± 334.7 ml, with a range of 450–1900 ml [Figure 3]. Thirty-seven patients (90.2%) had intraoperative blood transfusion, with 80.5% of patients receiving at least two pints of blood [Table 2]. The mean postoperative blood loss and total blood loss were 574.3 ml and 1786.2 ml, respectively, showing a strong positive correlation ($r = 0.517, P < 0.01$). Intraoperative blood loss also showed a strong positive correlation with total blood loss ($r = 0.790, P < 0.01$).

The postoperative blood loss measured as drain effluent volume within the first 72 h, is shown in Table 3; the average duration of drain use is also shown. The results of intra- and post-operative blood loss in the two groups of patients are shown in Tables 4 and 5, as assessed by the independent *t*-test.

Table 2: Volume of blood transfused intraoperatively (pints)

	Frequency (%)	Cumulative percentage
0.0	4 (9.8)	9.8
1.0	4 (9.8)	19.5
2.0	20 (48.8)	63.3
3.0	12 (29.3)	97.6
4.0	1 (2.4)	100.0
Total	41 (100.0)	

Table 3: Postoperative blood loss as measured by drain effluent within first 72 h

	Redivac effluent day 1 (ml)	Redivac effluent day 2 (ml)	Redivac effluent day 3 (ml)	Redivac duration (days)
Mean	407.1	143.1	21.4	2.5
SEM	26.2	12.3	4.2	0.1
Median	400.0	150.0	20.0	3.0
Mode	400.0	100.0	0.0	3.0
SD	156.9	73.7	25.4	0.5
Range	700.0	330.0	100.0	1.0
Minimum	100.0	20.0	0.0	2.0
Maximum	800.0	350.0	100.0	3.0

SEM: Standard error of mean, SD: Standard deviation

Table 4: Independent *t*-test for two groups

	Duration of surgery group	Mean	SD	SEM
Blood loss (ml)	Group A (<2 h)	12204.4	332.6	78.4
	Group B (>2 h)	1236.9	343.2	71.6
Redivac effluent day 1 (ml)	Group A (<2 h)	358.0	145.9	37.7
	Group B (>2 h)	442.1	158.5	34.6
Redivac effluent day 2 (ml)	Group A (<2 h)	103.3	57.9	14.9
	Group B (>2 h)	171.4	71.7	15.9
Redivac effluent day 3 (ml)	Group A (<2 h)	10.0	18.5	4.8
	Group B (>2 h)	29.5	26.9	5.9

SEM: Standard error of mean, SD: Standard deviation

Table 5: Independent samples *t*-test for equality of means

	Levene's test for equality of variances		<i>t</i> -test for equality of means			
	<i>F</i>	Significant	<i>t</i>	Significant (two-tailed)	Mean difference	SE difference
Blood loss (ml)	0.05	0.83	-0.31	0.76	-32.50	106.57
Redivac effluent day 1 (ml)	0.16	0.69	-1.60	0.11	-84.10	57.1
Redivac effluent day 2 (ml)	1.37	0.25	-3.10	0.003	-68.1	21.6
Redivac effluent day 3 (ml)	0.90	0.35	-2.50	0.014	-19.5	7.5

SE: Standard error

DISCUSSION

Blood loss in total hip arthroplasty remains a challenge, as efforts are constantly being made to minimize the rate of loss, rate of replacement, and the associated morbidity and mortality that follow blood loss and blood transfusion.^[1-4]

This study evaluates blood loss following total hip arthroplasty and considers the effect of surgical time on intra- and post-operative blood loss.

The mean surgical time was 2.3 ± 0.5 h, which was higher than that described by Flordal and Neander,^[7] (89 min) and Miao *et al.*^[13] (88 ± 26 min). However, 43.9% of patients in this study had surgical time <2 h.

The mean intraoperative blood loss was 1222.7 ml, which is 12.2% and 197.3% higher than that described by Flordal and Neander^[7] (1090 ml) and Miao *et al.*^[13] (411 ml), respectively. This is also reflected in the mean total blood loss of 1155 ml reported by Miao *et al.*, as opposed to 1786.2 ml in this study; other authors have reported a mean total blood loss ranging from 1023 to 1785 ml.^[4,14,15]

The mean postoperative blood loss reduced steadily from day 1 to day 3, with an average of 407.1 ml on day 1 and 21.4 ml on day 3. The average duration of drain use was 2.5 ± 0.5 days. The intra- and post-operative blood loss both showed a positive correlation with the total blood loss in this series and is also a reflection of the significant decline in hemoglobin concentration postoperatively with an average of 2.1 ± 1.1 g/dl ($r = 0.82$, $P < 0.001$).

Surgical time >2 h showed a higher intra- and post-operative blood loss, compared to surgical time <2 h. This difference was significant in postoperative blood loss on days 2 and 3, when equal variances are assumed ($P = 0.003$ and $P = 0.014$), with lower values in surgical time <2 h.

CONCLUSION

A reduction in surgical time <2 h has a role in minimizing blood loss, especially in the postoperative period. The tested hypothesis is, therefore, rejected.

Limitations

1. Limited number of cases done yearly, which was also the basis of our sample size calculation
2. No Control group was used in this study to determine other factors that may affect blood loss. However, the authors are currently evaluating the effect of tranexamic acid on blood loss in total hip replacement with this study as a control.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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