

# Perioperative Anaesthetic Management in Revision Total Hip Arthroplasties in a Tertiary Care Hospital

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## Abstract

**Background:** The revision total hip arthroplasties are associated with significant perioperative mortality and morbidity which can be due to patient factors, surgical factors, and anaesthetic factors. The objective of this study is to audit the common anaesthesia practices in the revision total hip arthroplasties in the perioperative period.

**Materials and Methods:** A total of 39 patients who underwent revision total hip arthroplasty in a period of 2 years participated in the prospective observational study. The pre-operative, intraoperative, and post-operative data were assessed using a case record form and analyzed using a statistical software.

**Results:** There were 26 males (66.7%) and 13 females (33.33%). The mean age was 56.12 years (Range 23–81, SD = 15.21). Hypertension was the most common comorbidity among the study subjects. Regional anaesthesia was preferred to general anaesthesia (15.38%). The mean blood loss during the surgery was 778.2 mL. Twenty patients (51%) required blood transfusion. The patients who received tranexamic acid had lesser blood loss compared to those who had not received tranexamic acid. Thirty-seven patients (94.87%) recovered uneventfully.

**Conclusion:** The role of tranexamic acid in the improvement of perioperative outcome and reduction of the need for allogeneic blood transfusion is again confirmed by the study. The usage of neuraxial techniques over general anaesthesia is associated with almost similar perioperative outcomes. These findings suggest that the decision of anaesthetic technique should depend on the patient, surgical and anaesthetic risks of morbidity and mortality.

**Key words:** Blood loss, Blood transfusion, Regional anaesthesia, Total hip arthroplasties, Tranexamic acid

## INTRODUCTION

The first recorded hip replacement surgery was attempted as early as in 1891 by Themistocles Gluck (1853–1942) in Germany.<sup>[1]</sup> With the advancements in both the surgical as well as the anaesthetic techniques, the joint arthroplasties have come a long way to improve the quality of life especially in elderly population. With the increasing count

of primary hip arthroplasties happening, the number of revision surgeries tend to increase in manifold.

The revision total hip arthroplasties are associated with significant perioperative mortality and morbidity which can be due to patient factors, surgical factors, and anaesthetic factors. The identification of such factors can help in optimizing the perioperative outcome and might help in reducing the impact on the cost of medical care.<sup>[2]</sup>

The aim of this study was to identify the common anaesthesia practices in the revision total hip arthroplasties. The primary objectives were to study the common anaesthesia techniques, associated blood loss, blood and blood products used, haemodynamic stability, and post-operative recovery of the patient. The secondary

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objectives were to study the common pain relief practices, demographic and statistical data affecting the outcomes, and any anaesthesia-related complications.

## MATERIALS AND METHODS

### Study Design

This study was prospective observational study.

### Inclusion Criteria

The following criteria were included in the study:

1. All the patients who underwent revision total hip joint replacement surgery during the period of study.
2. All the patients above 18 years of age and were willing to participate in the study.

### Exclusion Criteria

The following criteria were excluded from the study:

1. All the patients who were not willing to participate in the study.

### Study Procedure

This study was conducted in the elective orthopedic operation theaters in a tertiary care hospital for 2 years after the Institutional Ethics Committee approval. Universal sampling method was used and all patients fulfilling the inclusion and exclusion criteria were included in the study and the informed consent was taken after doing the pre-operative assessment.

### Data Collection

The pre-operative, intraoperative, and post-operative records of all patients undergoing the revision total hip arthroplasties were collected and an appropriate case record form was developed. The following details were collected from each patient's form.

1. Demographic data: Name, age, sex, weight, height, body mass index, diagnosis, medical history, previous surgery history, medications, addictions, relevant pre-operative investigations, and American Society of Anaesthesiologists (ASA) status of the patient.
2. Anaesthesia techniques: General anaesthesia (GA), regional anaesthesia (RA – spinal/epidural/block), combined GA and RA.
3. Intraoperative haemodynamics: Pulse rate, blood pressure, SpO<sub>2</sub>, EtCO<sub>2</sub>, and Respiratory rate.
4. Fluid, blood and blood products:
  - a) Intraoperative usage of crystalloids, colloids, and blood and blood products.
  - b) Need for inotropic supports.
    - Inj. Noradrenaline 0.01–0.02 µ/kg/min was started as first choice as a routine practice.

- c) Blood loss.
  - d) Use of Inj. Tranexamic acid.
5. Pain management
    - Type of technique used – IV drugs/Epidural boluses/Continuous epidural infusions/Blocks/Local Infiltration/other method
    - As per institutional protocol, Inj. Paracetamol 1g 6 h was given to all patients. Inj. Tramadol 50–100 mg 8 h was given on demand basis in the first 24 h postoperatively.
    - Epidural boluses of Inj. Bupivacaine 0.125–0.25% 5cc are given with or without Inj. Buprenorphine 30–90µ if epidural catheter *in situ*.
    - Local infiltration Analgesia given by surgeons' intraoperatively. The routine practice was to give Inj. Bupivacaine 0.5% 2 mg/kg + Inj. Clonidine 1 µ/kg + Inj. Fentanyl 1–2 µ/kg.
  6. Post-operative recovery.

### Statistical Analysis

- The data were entered in Microsoft Excel sheet and analyzed using SPSS version 25 and EPI Info version 7.3.
- Chi-square test was used to assess the association between categorical variables.
- Comparison of categorical variables was done using counts and percentages.
- Mean and standard variations was used for continuous variables.
- $P < 0.05$  was considered to be statistically significant.

## RESULTS

A total of 39 patients were assessed and included in the study. The data were sorted manually and entered into a Microsoft Excel Sheet and analyzed using statistical software.

### Patient Demographics

- There were 26 (66.67%) males and 13 (33.33%) females. The mean age was  $56.12 \pm 15.21$  years (range 23–81, standard deviation = 15.21). The majority of the patients were ASA II followed by ASA I [Table 1].
- Fifteen patients had no comorbidities. Fourteen had hypertension, followed by stroke in four patients. There were three patients of diabetes mellitus, ischemic heart disease, and old pulmonary koch's each.
- Eighteen (46.15%) patients had one previous surgery followed by 13 (33.33%) patients with two previous hip surgeries. Three previous hip surgeries were done in 5 (12.82%) patients.
- [Table 2] 15 (38.46%) patients were given Subarachnoid Block (SAB) followed by combined spinal epidural

**Table 1: Patient demographics and pre-operative data**

Demographic	Variable	Number (%)
Gender, n (%)	Female	13 (33.33)
	Male	26 (66.67)
Age (years)	Mean	56.12 years
	Range	23–81
	Standard deviation	15.21
ASA grading, n (%)	I	14 (35.90)
	II	23 (58.97)
	III	2 (5.13)
	IV	0 (0)
Co-morbidities, n	No comorbidities	15
	Hypertension	14
	Stroke	4
	Diabetes mellitus	3
	Ischemic heart disease	3
	Old Pulmonary Koch's	3
	Ankylosing spondylosis	2
	Retroviral disease	2
	Pre-operative anaemia (as per WHO classification)	Males
	Females	12 (92.31)
Number of previous hip surgeries, n (%)	1	18 (46.15)
	2	13 (33.33)
	3	5 (12.82)
	4	1 (2.56)
	5	1 (2.56)
	6	1 (2.56)

**Table 2: Type of anaesthesia technique employed**

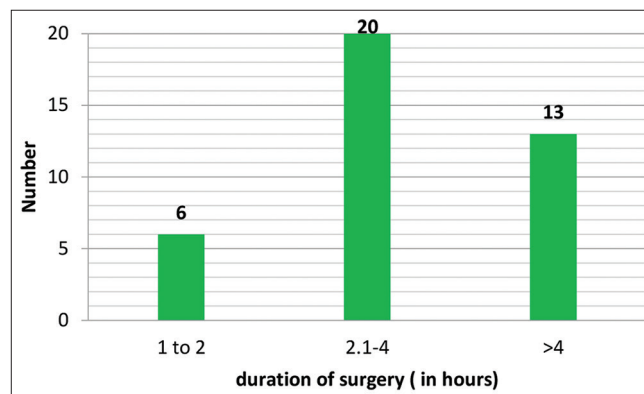
Type of anaesthesia	Number	Percentage
CSE	10	25.64
GA	05	12.82
SAB	15	38.46
SAB+EA	08	20.51
GA+EA	01	2.56
Total	39	100

anaesthesia (CSE) given to 10 (25.64%) patients. Subarachnoid block and epidural anaesthesia (SAB + EA) was given at different levels in 8 (20.51%) patients. General anaesthesia (GA) was given in 06 (15.38%) patients [Table 3].

- [Figure 1] 20 (51.28%) patients were operated within 2.1–4 h followed by 13 (33.33%) patients in more than 4 h. Only 6 (15.38%) patients were operated between 1 and 2 h.
- Among 39 patients, 25 (64.10%) patients lost blood between 501 and 1000 mL during surgery followed by 8 (20.51%) patients who lost 1001–1500 mL blood during surgery.
- [Figure 2] 19 (49%) patients were not transfused during surgery followed by 9 (23%) patients that were transfused 1–250 mL blood and 9 (23%) patients were transfused 251–500 mL blood during surgery. Only 2 (5%) patients were given more than 500 mL.

**Table 3: Intraoperative data**

Data	Variable	Number (%)
Duration of surgery (hours)	1–2 h	06 (15.38)
	2.1–4 h	20 (51.28)
	>4 h	13 (33.33)
	Mean duration	212.5 min
Invasive monitoring during surgery (arterial/central venous line)	Yes	02 (5.13)
	No	37 (94.87)
Blood loss during surgery (mL)	≤500 mL	06 (15.38)
	501–1000 mL	25 (64.10)
	1001–1500 mL	08 (20.51)
	Mean blood loss	778.2 mL
Blood transfusion during surgery (mL)	No Transfusion	19 (49)
	1–250 mL	09 (23)
	251–500 mL	09 (23)
	>500 mL	02 (5)
	Mean blood transfusion	163.4 mL
Crystalloids given during surgery (mL)	<1000 mL	09 (23.08)
	1000–1500 mL	27 (69.23)
	>1500 mL	03 (7.69)
	Mean crystalloids given	1139.2 mL
Colloids given during surgery (ml)	Not given	16 (41.02)
	1–250 mL	04 (10.26)
	251–500 mL	19 (48.72)
	Mean colloids given	252.2 mL
Inotropes used during surgery	Yes	06 (15.38)
	No	33 (84.62)



**Figure 1: The distribution of study subjects according to the duration of surgery**

- [Table 4] When the association of blood loss and tranexamic acid usage during surgery was seen using Chi-square test, it was found to be statistically significant ( $P = 0.04$ ). Out of six patients having blood loss of <500 mL, all 6 (100%) patients were given tranexamic acid. Out of 25 patients having blood loss of 501–1000 mL, majority 17 (68%) patients were given tranexamic acid. Out of eight patients having blood loss of 1001–1500 mL, 5 (62.50%) patients were not given tranexamic acid.
- [Table 5] For the post-operative analgesia, 22 (56.41%) patients were given intravenous analgesia postoperatively followed by 17 (43.59%) were given

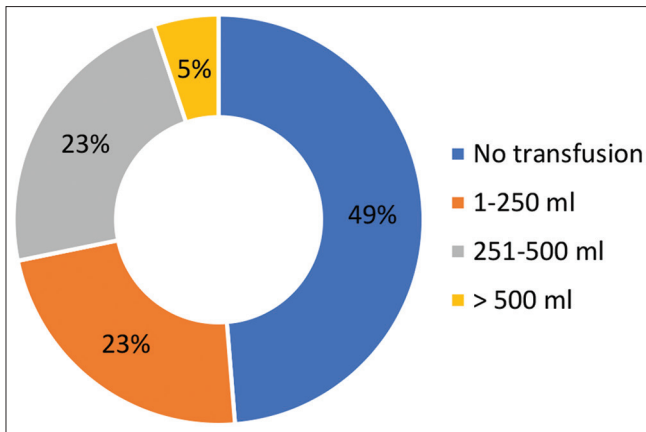


Figure 2: The distribution of study subjects according to blood transfusion during surgery

Table 4: The distribution of study subjects according to blood loss and tranexamic acid given during surgery

Tranexamic acid given	Blood loss during surgery			P value
	≤500 mL Number (%)	501-1000 mL Number (%)	1001-1500 mL Number (%)	
Yes	06 (100)	17 (68.00)	03 (37.50)	0.04*
No	00 (00)	08 (32.00)	05 (62.50)	
Total	06 (100)	25 (100)	08 (100)	

Table 5: Post-operative data

Data	Variable	Number (%)
Recovery after surgery	Recovery uneventful	37 (94.87)
	Intensive care unit	02 (5.13)
Pain management	Local Infiltration Analgesia	28 (71.79)
	Intravenous route	22 (56.41)
	Epidural+Intravenous route	17 (43.59)

both epidural analgesia and intravenous analgesia for pain management. Local infiltration analgesia was given by surgeons' in 28 patients (71.79%).

- 37 (94.87%) patients recovered uneventfully and only 2 (5.13%) patients were in ICU for recovery. When Chi-square test was applied to see the association between age and recovery during surgery, it was not found to be statistically significant ( $P = 0.8$ ) [Table 6].
- [Table 7] Multivariate analyses of general anaesthesia versus neuraxial anaesthesia.
- When the association was established between age of the patient and the blood loss during surgery using the Chi-square test, it was not found to be statistically significant.

## DISCUSSION

Anaesthesia management in the revision total hip arthroplasties has always been associated with significant

perioperative mortality and morbidity due to elderly population and related comorbidities, prolonged surgical time, positioning, significant hemodynamic changes, perioperative blood loss, blood transfusion, postoperative complications, extended hospital stay, and anaesthetic alterations for the same.<sup>[3,4]</sup> Proper pre-operative assessment, risk stratification, and necessary pre-operative optimization with proper anaesthetic planning for stable intraoperative management and post-operative monitoring form the major components in the management of these patients.

- In our study, among the 39 patients, majority 10 (25.64%) patients were in age group of 51–60 years followed by 9 (23.08%) in age group of 61–70 years. The mean age was  $56.12 \pm 15.21$  years (range 23–81). As per hospital episode statistics (HES) for England,<sup>[5]</sup> mean age of the patients undergoing revision surgeries was 71.8 years, whereas for the primary surgeries was 68.6 years. As per Australian National Registry,<sup>[6]</sup> the mean age of first revision is 71.4 years.
- It was found that there were 26 (66.67%) males and 13 (33.33%) females in the study. As per HES for England<sup>5</sup>, the female rates were higher than males in the age group of 50 years and above. Traven *et al.* found that there were 54.6% females and 45.4% males who underwent revision total hip arthroplasties.<sup>[4]</sup>
- The majority of the patients were ASA II (58.97%) followed by ASA I (35.90%). Begun *et al.* found that more than 80% of the patients were healthy or had mild systemic disease (ASA 1-2) at the date of surgery.<sup>[7]</sup> Traven *et al.* found that 1.8% belonged to ASA 1, 39.7% to ASA 2, 53% to ASA 3, and 5.5% to ASA 4 among 13,948 patients who underwent revision total hip arthroplasties.<sup>[4]</sup>
- In our study, Central Neuraxial Blockade (CNB) was preferred to general anaesthesia (15.38%). Awake fiberoptic intubation was done in two patients with ankylosing spondylosis. Memtsoudis *et al.* found that in a large study of total arthroplasties from 2006 to 2010, 74.8% surgeries were performed under general anaesthesia.<sup>[8]</sup> O'Hara DA *et al.* found in a study of 9425 elderly patients for hip surgeries, General anaesthesia was used in 6206 (65%) patients and regional anaesthesia in 3219 patients.<sup>[9]</sup> Although GA was preferred in many Western literature, CNB was preferred in our institute in view of multiple factors like most of the study population undergoing arthroplasties were elderly patients and their age related comorbidities, to avoid multi-drug therapy, to reduce the opioids usage, to reduce post-operative nausea and vomiting, to encourage early feeding, early mobilization, and early recovery, and to avoid post-anaesthesia care unit stay, better post-operative pain management, and better compliability of the Indian patients.<sup>[8,10-14]</sup>
- GA was preferred in patients with active cardiac conditions, difficult spine, anticipated higher blood

**Table 6: The distribution of study subjects according to age and recovery after surgery**

Recovery	Age group( in years)						P value
	21–30 years Number (%)	31–40 years Number (%)	41–50 years Number (%)	51–60 years Number (%)	61–70 years Number (%)	>70 years Number (%)	
ICU	0 (00)	0 (00)	0 (00)	01 (10.00)	0 (00)	01 (14.25)	0.8
Recovery uneventful	03 (100)	05 (100)	05 (100)	09 (90.00)	09 (100)	06 (86.75)	
Total	03 (100)	05 (100)	05 (100)	10 (100)	09 (100)	07 (100)	

ICU: Intensive care unit

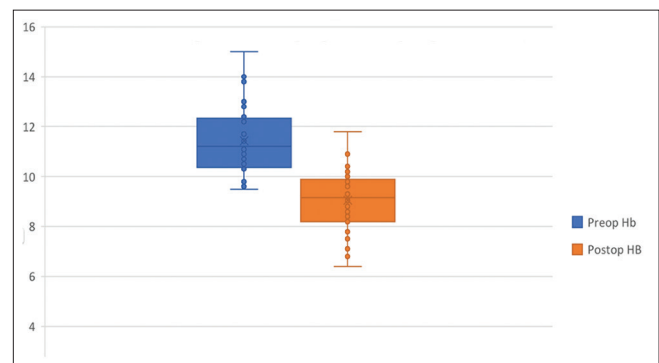
loss, expected surgical difficulties, and longer duration of surgery. The informed decision was taken after discussion with the patient and the surgeon.

- Hypertension was the commonest comorbidity in 14 patients followed by stroke in four patients. There were three patients with diabetes mellitus, ischemic heart diseases and Old Pulmonary Koch's each. Memtsoudis *et al.* found that in a large study of total arthroplasties from 2006 to 2010 in US, 16.9% patients had uncomplicated diabetes, 14.1% had chronic obstructive pulmonary disease (COPD), 3.7% had previous myocardial infarction, and 3.6% had rheumatic disease.<sup>[8]</sup> Wei *et al.* found in a retrospective study of 5759 patients, that common comorbidities were hypertension (59.84%), diabetes mellitus (13.63%), and COPD (5.70%).<sup>[10]</sup>
- The mean duration of the surgery in the study was 212.5 min. Habicher *et al.* found that in a study of 130 patients, the duration of surgery was 135 min (107–171 min) in the goal directed fluid therapy group and 125 min (99–159 min) in the control group.<sup>[15]</sup>
- The mean pre-operative hemoglobin was 11.43 g/dL and the mean post-operative hemoglobin was 9.05 g/dL. There was a difference of 2.38 g/dL. The mean blood loss in the study was 778.2 mL. Singh *et al.* found that the mean intraoperative blood loss was 489 mL (without tranexamic acid) and 339 mL (with tranexamic acid).<sup>[6]</sup> Peck *et al.* found that the estimated intraoperative blood loss was 845 mL (with tranexamic acid) and 1095 mL (without tranexamic acid) [Figure 3].<sup>[17]</sup>
- Singh *et al.*,<sup>[6]</sup> Peck *et al.*,<sup>[17]</sup> and Park *et al.*<sup>[18]</sup> found that the blood loss was lesser with tranexamic acid. It was found to be similar in our study, as seen in Table 4.
- Out of 26 males, 23 (88.46%) were anemic preoperatively and out of 13 females, 12 (92.31%) were anaemic preoperatively as per World Health Organization (WHO) classification for anaemia. Saleh *et al.* found that the prevalence of anaemia in elective major orthopedic surgeries is 20% and perioperative transfusions could be avoided.<sup>[19]</sup>
- The mean blood transfusion during the procedure was 163.4 mL. Twenty patients (51%) required blood transfusion during surgery. Only one patient (2.56%)

**Table 7: General anaesthesia versus neuraxial anaesthesia**

Outcome	General anaesthesia n (%)	Neuraxial anaesthesia n (%)
Number of patients	6 (15.38)	33 (84.61)
Duration of surgery	170 min	220.3 min
Blood loss	650 mL	801.51 mL
Blood transfusion	151.66 mL	165.63 mL
Inotropic needs	1 (16.66)	5 (15.15)
Postop ICU stay	0 (0)	2 (6.06)

ICU: Intensive care unit



**Figure 3: Comparison between pre-operative and post-operative haemoglobin**

was given fresh frozen plasma in the study. Saleh *et al.* found that 12 out of the 16 patients who underwent revision hip surgeries required blood transfusion.<sup>[19]</sup> Mahadevan *et al.* found that 73 patients (50%) out of 146 patients who underwent revision hip arthroplasties required blood transfusion.<sup>[19]</sup>

- The mean crystalloids given during the procedure was 1139.2 mL. Habicher *et al.* found that in a study of 130 patients, average of 725 mL crystalloids (500–100 mL) was given in the goal directed fluid therapy group and average 1500 mL was given in the control group.<sup>[15]</sup>
- The mean colloids given during the procedure was 252.5 ml. Twenty-three patients (58.97%) were given colloids in the study. Habicher *et al.* found that in a study of 130 patients, average of 1250 mL (1000–1750 mL) colloids was given in the goal directed fluid therapy group and average of 500 mL (500–1000 mL) was given in the control group.<sup>[15]</sup>

- 06 (15.38%) patients needed the requirement of inotropes during the surgery. The inotropes were started in view of major blood loss and non-maintenance of haemodynamics. Out of six patients, four were weaned off of inotropic supports in the immediate post-operative management. Habicher *et al.* found that in a study of 130 patients, 28 patients in the goal directed fluid therapy group and one patient in the control group required inotropes during the surgery.<sup>[15]</sup>
- Two patients (5.12%) were shifted to PACU for post-operative monitoring in view of major blood loss, non-maintenance of haemodynamics, and need for inotropic supports. Both of them were induced under CNB and had a drop of post-operative hemoglobin by around 3 g/dL.
- The limitations of this study include the single center study, lack of randomization and the lack of information about the type of implants and their influence on the perioperative outcome.<sup>[3,7]</sup>

## CONCLUSION

The role of tranexamic acid in the improvement of perioperative outcome and reduction of the need for allogeneic blood transfusion is again confirmed by the study. The usage of neuraxial techniques over general anaesthesia is associated with almost similar perioperative outcomes. These findings suggest that the decision of anaesthetic technique should depend on the patient, surgical and anaesthetic risks of morbidity and mortality.

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