

## To Compare Perioperative Outcomes Between Anaesthetic Types for Patients Undergoing Primary Elective Total Hip Arthroplasty

Santosh Kumar Mishra<sup>1</sup>, T. Suresh Kumar Gupta<sup>2</sup>, Debasis Sahoo<sup>3</sup>, Saroj Kumar Parida<sup>4</sup>, Amit Das<sup>5</sup>, Sambit Kumar Panda<sup>6</sup>

<sup>1</sup>Associate Professor, Department of Anaesthesia, B. B. Medical College & Hospital, Balangir, Odisha, India.

<sup>2</sup>Associate Professor, Department of Orthopaedics, FM Medical College & Hospital, Balasore, Odisha, India.

<sup>3</sup>Assistant Professor, Department of Anaesthesia, B. B. Medical College & Hospital, Balangir, Odisha, India

<sup>4</sup>Assistant Professor, Department of Orthopaedics, S.C.B. Medical College, Cuttack, Odisha, India

<sup>5</sup>Assistant Professor, Department of Orthopaedics, B. B. Medical College & Hospital, Balangir, Odisha, India

<sup>6</sup>Associate Professor, Department of Orthopaedics, B. B. Medical College, Balangir, Odisha, India

---

Received: 12-03-2023 / Revised: 05-04-2023 / Accepted: 25-04-2023

Corresponding author: Dr. Sambit Kumar Panda

Conflict of interest: Nil

---

### Abstract

**Background:** Total hip arthroplasty is being used for offering the orthopaedic procedures. There are more than one million operations are done using this procedure to perform the hip surgery. To perform such surgery, general anaesthesia is considered as the gold standard for major hip surgery. There are many clinical studies have conducted and showing the relative benefits of applying the spinal anaesthesia beyond the general anaesthesia. This kind of anaesthesia is helping to decreased blood loss and required the transfusion to decrease the rate of thromboembolic events. This study's main hypothesis was that, even after accounting for patient characteristics, there would still be disparities in the rates of adverse events between patients who had primary elective total hip arthroplasty under general anaesthesia and those who had it done under spinal anaesthetic.

**Aim:** The study aims to compare perioperative outcomes between anaesthetic types for patients undergoing primary elective total hip arthroplasty.

**Method:** An exemption for this study was granted by our institutional review board. A retrospective cohort study was conducted with use of the database, which collects data of 234 for general anaesthesia and 372 spinal anaesthesia patients participating in BB MCH, Balangir, Odisha, FM MCH, Balasore, Odisha and SCB MCH, Cuttack, Odisha. The database considered from December 2019 to December 2022 was queried to identify patients who had undergone total hip arthroplasty. We identified all patients who had undergone primary total hip arthroplasty. Bivariate logistic regression was used to compare age, sex, BMI, and modified Charlson Comorbidity Index between patients who had undergone total hip arthroplasty with general anaesthesia and those who had undergone total hip arthroplasty with spinal anaesthesia.

**Results:** surgical approach of the general anaesthesia group for posterior and lateral was 91.9% and 8.1%. Operative side of these patients involves 40.9% left and 59.1% right. Fixation methods involve 4.7% cemented, 46.2% hybrid and 49.1% uncommented

respectively. Apart from this, surgical approach of the spinal anaesthesia group for posterior and lateral was also 91.9% and 8.1%. Operative side of these patients involves 46.5% left and 53.5% right. Fixation methods involve 7% cemented, 64.2% hybrid and 28.8% uncommented respectively. GA patients' mean preoperative Hb level, 12.5 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.2g/dL (SD, 1.3 g/dL). SA patients' mean preoperative Hb level, 12.6 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.1 g/dL (SD, 1.5 g/dL).

**Conclusion:** General anaesthesia was associated with an increased rate of adverse events and mildly increased operating room times.

**Keywords:** General Anaesthetics, Spinal Anaesthesia, Blood Loss and Transfusion.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

## Background

There are many people facing many issues related to health and looking for proper treatment that could help to manage the daily operations properly. Total hip arthroplasty is being used for offering the orthopaedic procedures [1]. There are more than one million operations are done using this procedure to perform the hip surgery. To perform such surgery, general anaesthesia is considered as the gold standard for major hip surgery. However, the clinical experts are using the spinal anaesthesia for total hip arthroplasty, but the optimal anaesthetic techniques are debatable [2,3].

There are many clinical studies have conducted and showing the relative benefits of applying the spinal anaesthesia beyond the general anaesthesia [4]. This kind of anaesthesia is helping to decreased blood loss and required the transfusion to decrease the rate of thromboembolic events [5]. Moreover, it is helping to minimize the rate of surgical site infections. However, there is need of multicentre studies to compare the outcome of the total hip arthroplasty using the spinal and general anaesthesia [6].

This kind of treatment approach is useful for offering the better care and recovery for the patients. Moreover, use of this anaesthesia is helping to minimize the blood loss during the surgery and for

patient's safety [7,8]. Second, despite the fact that intrathecal anaesthetic treatments are frequently carried out, they come with a number of hazards, such as postoperative nausea and vomiting, itching, subdural hygroma and cardiac abnormalities [9]. General anaesthesia is still often employed despite multiple research projects demonstrating that spinal anaesthesia has advantages over general anaesthesia for individuals receiving total hip surgery [10]. Less blood transfusions, fewer thromboembolic events, and fewer surgical site infections are all said benefits of spinal anaesthetic [11]. As some issues linked to surgery can manifest up to 90 days following the procedure, it is unfortunate that many of these studies do not report on rates of morbidity and mortality after 30 days [12].

This study's main hypothesis was that, even after accounting for patient characteristics, there would still be disparities in the rates of adverse events between patients who had primary elective total hip arthroplasty under general anaesthesia and those who had it done under spinal anaesthetic. Generalizable findings may direct clinical management for this common procedure by using high-quality, prospectively gathered data from a large, national cohort of patients who had undergone hip arthroplasty.

## Aim

The study aims to compare perioperative outcomes between anaesthetic types for patients undergoing primary elective total hip arthroplasty.

## Method and material

An exemption for this study was granted by our institutional review board. A retrospective cohort study was conducted with use of the database, which collects data of 234 for general anaesthesia and 372 spinal anaesthesia patients participating in BB MCH, Balangir, Odisha, FM MCH, Balasore, Odisha and SCB MCH, Cuttack, Odisha. Patients are identified prospectively at eligible hospitals and more than 110 variables are recorded by trained clinical reviewers, using a combination of chart abstraction and patient interviews. Data are collected until the thirtieth postoperative day and including after discharge.

The database considered from December 2019 to December 2022 was queried to identify patients who had undergone total hip arthroplasty. We identified all patients who had undergone primary total hip arthroplasty. For this study, general anaesthesia had been performed with either tracheal intubation or laryngeal mask airway. Spinal anaesthesia did not include cases that had been performed

under epidural anaesthesia. Patients who had received any form of anaesthesia other than general or spinal were excluded from this study. Patients who had undergone nonelective surgery, those with previous evidence of infection, and those with missing perioperative data were also excluded from the analysis.

Bivariate logistic regression was used to compare age, sex, BMI, and modified Charlson Comorbidity Index between patients who had undergone total hip arthroplasty with general anaesthesia and those who had undergone total hip arthroplasty with spinal anaesthesia. To control for selection bias between the nonrandomized spinal and general anaesthesia groups, propensity scores were used, with the propensity score defined as the conditional probability of receiving general anaesthesia based on the observed patient demographic characteristics and comorbidities. The propensity score has been extensively used in the literature for this purpose. Propensity-adjusted p values for preoperative patient demographic characteristics were reported. The model successfully reduced selection bias by eliminating significant differences in preoperative variables (the adjusted p value was  $>0.05$  for all patient).

## Results

**Table 1: Demographic**

Particulars	General anaesthesia	%	Spinal anaesthesia	%
Total	234		372	
Male	107	45.7%	169	45.4%
Female	127	54.3%	203	54.6%
	<b>Mean</b>	<b>(SD)</b>	<b>Mean</b>	<b>(SD)</b>
Age (Years)	54.7	16.0	63.3	13.7
Height (Inches)	65.9	4.4	65.3	4.1
Weight	62.4	47.4	63.4	40.3
BMI (Kg/m <sup>2</sup> )	29.1	6.4	28.9	6.0
ASA operative risk	2.3	0.9	2.5	0.9

Table 1 has provided the information related to demographics of the patients involved in both groups. The total number

of patients who had the general anaesthesia was 234 in which 107 were male and 127 were female. The mean age,

height, weight, and BMI of these patients was 54.7, 65.9, 62.4 and 29.1 respectively. Moreover, the ASA operative risk was 2.3. Apart from this, the total number of patients who had the spinal anaesthesia

was 372 in which 169 were male and 203 were female. The mean age, height, weight, and BMI of these patients was 63.3, 65.9, 63.4 and 28.9 respectively. Moreover, the ASA operative risk was 2.5.

**Table 2: Operative data**

Particulars	General anaesthesia	%	Spinal anaesthesia	%
<b>Surgical approach</b>				
Posterior	215	91.9%	342	91.9%
Lateral	19	8.1%	30	8.1%
<b>Operative side</b>				
Left	97	40.9%	173	46.5%
Right	137	59.1%	199	53.5%
<b>Fixation method</b>				
Cemented	11	4.7%	26	7%
Hybrid	108	46.2%	239	64.2%
Uncommented	115	49.1%	107	28.8%

Table 2 has provided information about the operative data of the patients of both groups. According to analysis, surgical approach of the general anaesthesia group for posterior and lateral was 91.9% and 8.1%. Operative side of these patients involves 40.9% left and 59.1% right. Fixation methods involve 4.7% cemented, 46.2% hybrid and 49.1% uncommented

respectively. Apart from this, surgical approach of the spinal anaesthesia group for posterior and lateral was also 91.9% and 8.1%. Operative side of these patients involves 46.5% left and 53.5% right. Fixation methods involve 7% cemented, 64.2% hybrid and 28.8% uncommented respectively.

**Table 3: Operative indications**

Condition	General anaesthesia	%	Spinal anaesthesia	%
Osteoarthritis	157	67.1%	287	77.1%
Avascular necrosis	32	13.7%	31	8.3%
Rheumatoid arthritis (RA)	11	4.7%	21	5.6%
Inflammatory arthritis (excluding RA)	7	2.9%	13	3.5%
Posttraumatic arthritis	15	6.4%	11	2.9%
Developmental dysplasia	8	3.4%	6	1.6%
S/P arthrodesis	2	<1%	2	<1%
Tumor	2	<1%	1	<1%

Table 3 has analyzed the operative indication for the patients and frondmost of the patients from general group were facing the condition of Osteoarthritis (157), Avascular necrosis (32) and

Posttraumatic arthritis (15). The highest number of patients who had spinal anaesthesia was facing the condition of Osteoarthritis (287), Avascular necrosis (31) and Rheumatoid arthritis (RA) (21).

**Table 4: Estimated Rate of Blood Losses a Function of Factors**

Factors	Relative risk	Standard errors	t	P	95% CI	
					Lower	Upper
Operative time	2.62	0.32	8.16	0.001	1.99	3.25
BMI	3.47	0.89	3.90	0.001	1.72	5.22
Male	0.45	0.13	3.49	0.001	0.20	0.70
<b>Cemented femur +</b>						
acetabular prostheses	-0.02	0.27	-0.08	0.936	-0.05	0.51
<b>Cemented femur +</b>						
<b>uncemented</b>						
acetabular prostheses	0.33	0.14	2.39	2.39	0.06	0.61
General anesthesia	0.62	0.13	4.69	4.69	0.36	0.89

Table 4 has provided the analysis of blood losses and function of factor. According to analysis differences between the groups' complication rates were not statistically significant.

**Table 5: Haemoglobin Data, Mean (SD) g/dL**

Condition	General anesthesia		Spinal anesthesia	
	Mean	SD	Mean	SD
Preoperative	12.5	1.6	12.6	1.6
Immediate postoperative	11.2	1.4	11.1	1.5
<b>Postoperative day</b>				
1	9.5	1.2	9.8	1.2
2	9.3	1.1	9.7	1.2
3	9.4	1.1	9.7	1.1
4	9.5	1.0	9.7	1.1
5	9.6	1.1	9.8	1.1

Table 5 displays preoperative, immediate postoperative and serial postoperative daily Hb levels. GA patients' mean preoperative Hb level, 12.5 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.2g/dL (SD, 1.3 g/dL). SA patients' mean preoperative Hb level, 12.6 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.1 g/dL (SD, 1.5 g/dL). There were no statistical differences between the groups' preoperative or immediate postoperative Hb levels.

### Discussion

The study has analyzed various aspects to compare the significance of general and spinal anaesthesia in total hip surgery. According to analysis, it is helping to minimize the rate of surgical site

infections. However, there is need of multicentre studies to compare the outcome of the total hip arthroplasty using the neuraxial and general anaesthesia. As per the outcome of the study, surgical approach of the general anaesthesia group for posterior and lateral was 91.9% and 8.1%. Operative side of these patients involves 40.9% left and 59.1% right. Fixation methods involve 4.7% cemented, 46.2% hybrid and 49.1% uncommented respectively. Apart from this, surgical approach of the spinal anaesthesia group for posterior and lateral was also 91.9% and 8.1%. Operative side of these patients involves 46.5% left and 53.5% right. Fixation methods involve 7% cemented, 64.2% hybrid and 28.8% uncommented respectively.

Moreover, the analysis has identified that most of the patients from general group

were facing the condition of Osteoarthritis (157), Avascular necrosis (32) and Posttraumatic arthritis (15). The highest number of patients who had spinal anesthesia was facing the condition of Osteoarthritis (287), Avascular necrosis (31) and Rheumatoid arthritis (RA) (21). Apart from this, the study of Pflüger, Frömel and Meurer (2021) [13] identified through the bivariate analyses, general anaesthesia was associated with increased operative time and postoperative room time. On multivariate analyses, general anaesthesia continued to be associated with increased operative time (+12 minutes [95% confidence interval (95% CI), +11 to +13];  $p < 0.001$ ) and postoperative room time (+5 minutes [95% CI, +4 to +6 minutes];  $p < 0.001$ ). Bivariate and multivariate analyses found no association between anaesthesia type and preoperative room time or postoperative length of stay [14].

According to outcome of current study, the preoperative, immediate postoperative and serial postoperative daily Hb levels. GA patients' mean preoperative Hb level, 12.5 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.2g/dL (SD, 1.3 g/dL). SA patients' mean preoperative Hb level, 12.6 g/dL (SD, 1.6 g/dL), dropped to a mean immediate postoperative Hb level of 11.1 g/dL (SD, 1.5 g/dL).

Moreover, the study of Mercier et al., (2021) [15] has also founded through the multivariate analyses, any adverse event (odds ratio, 1.31 [95% CI, 1.23 to 1.41];  $p < 0.001$ ), prolonged postoperative ventilator use (odds ratio, 5.81 [95% CI, 1.35 to 25.06];  $p = 0.018$ ), unplanned intubation (odds ratio, 2.17 [95% CI, 1.11 to 4.29];  $p = 0.024$ ), stroke (odds ratio, 2.51 [95% CI, 1.02 to 6.20];  $p = 0.046$ ), cardiac arrest (odds ratio, 5.04 [95% CI, 1.15 to 22.07];  $p = 0.032$ ), any minor adverse event (odds ratio, 1.35 [95% CI, 1.25 to 1.45];  $p = 0.001$ ), and blood transfusion (odds ratio, 1.34 [95% CI, 1.25

to 1.45];  $p < 0.001$ ) were associated with general anaesthesia. [16]

### Conclusion

From the analysis, it has been concluded that less blood transfusions, fewer thromboembolic events, and fewer surgical site infections are all said benefits of spinal anaesthetic. As some issues linked to surgery can manifest up to 90 days following the procedure, it is unfortunate that many of these studies do not report on rates of morbidity and mortality after 30 days. Moreover, general anaesthesia was associated with an increased rate of adverse events and mildly increased operating room times.

### References

1. Memtsoudis SG, Cozowicz C, Bekeris J, Bekere D, Liu J, Soffin EM, Mariano ER, Johnson RL, Hargett MJ, Lee BH, Wendel P. Anaesthetic care of patients undergoing primary hip and knee arthroplasty: consensus recommendations from the International Consensus on Anaesthesia-Related Outcomes after Surgery group (ICAROS) based on a systematic review and meta-analysis. *British journal of anaesthesia*. 2019 Sep 1;123(3):269-87.
2. Abdullah HR, Sim YE, Hao Y, Lin GY, Liew GH, Lamoureux EL, Tan MH. Association between preoperative anaemia with length of hospital stay among patients undergoing primary total knee arthroplasty in Singapore: a single-centre retrospective study. *BMJ open*. 2017 Jun 1;7(6):e016403.
3. Long H, Zeng C, Xiong Y, Shi Y, Wang H, Lei G. Neuraxial versus general anesthesia for perioperative outcomes and resource utilization following knee arthroplasty: experience from a large national database. *Archives of Orthopaedic and Trauma Surgery*. 2022 Jun 13:1-1.
4. Curtis GL, Newman JM, George J, Klika AK, Barsoum WK, Higuera CA.

- Perioperative outcomes and complications in patients with heart failure following total knee arthroplasty. *The Journal of Arthroplasty*. 2018 Jan 1;33(1):36-40.
5. Viramontes O, Erfe BM, Erfe JM, Brovman EY, Boehme J, Bader AM, Urman RD. Cognitive impairment and postoperative outcomes in patients undergoing primary total hip arthroplasty: a systematic review. *Journal of Clinical Anesthesia*. 2019 Sep 1; 56:65-76.
  6. Lu Y, Cregar WM, Goodloe JB, Khazi Z, Forsythe B, Gerlinger TL. General anesthesia leads to increased adverse events compared with spinal anesthesia in patients undergoing unicompartmental knee arthroplasty. *The Journal of Arthroplasty*. 2020 Aug 1;35(8):2002-8.
  7. Bovonratwet P, Shen TS, Islam W, Sculco PK, Padgett DE, Su EP. Is there an association between negative patient-experience comments and perioperative outcomes after primary total hip arthroplasty? *The Journal of Arthroplasty*. 2021 Jun 1;36(6):2016-23.
  8. Memtsoudis SG, Poeran J, Cozowicz C, Zubizarreta N, Ozbek U, Mazumdar M. The impact of peripheral nerve blocks on perioperative outcome in hip and knee arthroplasty—a population-based study. *Pain*. 2016 Oct 1;157(10):2341-9.
  9. Memtsoudis, S.G., Cozowicz, C., Bekkeris, J., Bekere, D., Liu, J., Soffin, E.M., Mariano, E.R., Johnson, R.L., Go, G., Hargett, M.J. and Lee, B.H., 2021. Peripheral nerve block anesthesia/analgesia for patients undergoing primary hip and knee arthroplasty: recommendations from the International Consensus on Anesthesia-Related Outcomes after Surgery (ICAROS) group based on a systematic review and meta-analysis of current literature. *Regional Anesthesia & Pain Medicine*, 46(11), pp.971-985.
  10. Bourget-Murray J, Halpenny D, Mahdavi S, Piroozfar SG, Sharma R. Perioperative outcomes associated with general and spinal anesthesia after total joint arthroplasty for osteoarthritis: a large, Canadian, retrospective cohort study. *Canadian Journal of Surgery*. 2022 Jul;65(4): E460.
  11. Johnson RL, Kopp SL, Burkle CM, Duncan CM, Jacob AK, Erwin PJ, Murad MH, Mantilla CB. Neuraxial vs general anaesthesia for total hip and total knee arthroplasty: a systematic review of comparative-effectiveness research. *BJA: British Journal of Anaesthesia*. 2016 Feb 1;116(2):163-76.
  12. Herndon CL, Levitsky MM, Ezuma C, Sarpong NO, Shah RP, Cooper HJ. Lower dosing of bupivacaine spinal anesthesia is not associated with improved perioperative outcomes after total joint arthroplasty. *Arthroplasty Today*. 2021 Oct 1; 11:6-9.
  13. Pflüger MJ, Frömel DE, Meurer A. Total hip arthroplasty revision surgery: Impact of morbidity on perioperative outcomes. *The Journal of Arthroplasty*. 2021 Feb 1;36(2):676-81.
  14. Amundson AW, Johnson RL, Abdel MP, Mantilla CB, Panchamia JK, Taunton MJ, Kralovec ME, Hebl JR, Schroeder DR, Pagnano MW, Kopp SL. A three-arm randomized clinical trial comparing continuous femoral plus single-injection sciatic peripheral nerve blocks versus periarticular injection with ropivacaine or liposomal bupivacaine for patients undergoing total knee arthroplasty. *Anesthesiology*. 2017 Jun;126(6):1139-50.
  15. Mercier MR, Pathak N, Adrados M, Galivanche AR, Malpani R, Hilibrand AS, Rubin LE, Grauer JN. Patient factors and perioperative outcomes affect hospital consumer assessment of healthcare providers and systems survey response rates after primary total hip replacement. *JAAOS Global*

Research & Reviews. 2021 Apr 1;5(4):  
e21.  
16. M.O O., T.P O., & I.A., S.O.  
Malacological Survey of Intermediate  
Hosts of Public Health Importance in

Akure South and Owo Local  
Government Areas of Ondo State,  
Nigeria. Journal of Medical Research  
and Health Sciences, 2023; 6(2):  
2414–2423.