



Comparison of general vs. spinal anesthesia for direct anterior approach total hip arthroplasty in elderly patients: A retrospective study

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Abstract

ARTICLE INFO

Keywords:

Direct anterior approach
General anesthesia
Spinal anesthesia
Total hip arthroplasty

Received: Dec 06, 2022

Accepted: Jan 13, 2023

Available Online: 27.02.2023

DOI:

[10.5455/annalsmedres.2022.12.363](https://doi.org/10.5455/annalsmedres.2022.12.363)

Aim: It remains unclear whether spinal anesthesia is beneficial instead of general anesthesia in total hip arthroplasty (THA) performed via the direct anterior approach (DAA) in elderly patients. The aim of the present research was to investigate the safety and effectiveness of SA in elderly patients underwent DAA-THA.

Materials and Methods: We made a retrospective analysis of 166 elderly patients underwent DAA-THA between January 2018 and December 2021. Patients were divided into two groups: general anesthesia (group GA, n=88) and spinal anesthesia (group SA, n=78). We compared the two groups regarding to 90-day readmission rate, amount of bleeding, blood product transfusion, length of hospital stays (LOS), major adverse cardiac events (MACE), postoperative pulmonary complications (PPC), and intensive care unit (ICU) requirement. We also recorded the demographics and procedure data of the two groups.

Results: Ninety-day readmission rate, PPC, and ICU requirement in group SA were significantly lower than group GA ($p<0.05$). There was no statistical difference between the two groups in terms of amount of bleeding, blood product transfusion, MACE, and LOS.

Conclusion: Spinal anesthesia in elderly patients underwent DAA-THA may reduce 90-day readmission rate, PPC, and ICU requirement without increasing amount of bleeding, blood product transfusion, MACE, and LOS.



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Introduction

One of the most commonly performed major orthopedic surgical procedures is total hip arthroplasty (THA) [1]. With aging on a global scale, a significant increase is expected in the patient population with multiple comorbidities and requiring THA due to severe arthritis [2-4]. General anesthesia (GA) or spinal anesthesia (SA) are the main two methods in anesthesia management of THA surgery. It remains unclear whether GA or SA is associated with better outcomes in THA surgeries [5,6]. General anesthesia involves a combination of drugs administered to render a patient unresponsive to surgical stimuli and requires controlled mechanical ventilation. Spinal anesthesia obtains the injection of a local anesthetic drug into the subarachnoid space at the lumbar region.

Neuraxial anesthesia has been associated with reduced morbidity, blood loss, surgical site infections, and admission rates to critical care services in patients with total

joint arthroplasty [7-9]. However, these studies generally included THA patients with the posterior and lateral surgical approach. Direct anterior approach THA (DAA-THA) is a relatively newer and minimally invasive approach, which has become increasingly popular in recent years and been associated with significant improvements in patients' quality of life outcomes [10]. Only one study has described the effect of GA and SA on outcomes in patients undergoing DAA-THA [11]. However, this review does not include a subanalysis of elderly patients. After all, there has been no study comparing GA and SA in elderly patients aged 65 and over who underwent DAA-THA.

Considering the existing literature evaluating the type of anesthesia in DAA-THA patients, our hypothesis is that SA would reduce 90-day readmission rate, amount of bleeding, blood product transfusion, length of hospital stays (LOS), major adverse cardiac events (MACE), postoperative pulmonary complications (PPC), and intensive care unit (ICU) requirement.

The primary outcome of the present study was the impact of anesthesia type on 90-day readmission rate. Secondary outcomes were amount of bleeding, blood product transfu-

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sion, length of hospital stays (LOS), major adverse cardiac events (MACE), postoperative pulmonary complications (PPC), and intensive care unit (ICU) requirement.

Materials and Methods

This study was carried out as a retrospective, observational and single-center in a university hospital. Bezmialem Vakif University Ethics Committee approved this study (decision no: 08/155, date: 08.06.2020). Patients who underwent DAA-THA at Bezmialem Vakif University between January 2018 and December 2021 were enrolled in the study. Consent form was not obtained due to retrospective study design. Patients aged ≥ 65 , American Society of Anesthesiologists (ASA) physical status 1-3, and scheduled for DAA-THA surgery under SA or GA were included in the study. In SA group, epidural anesthesia was excluded to create a more homogeneous population and to limit confusion. Patients with lack of data, ASA physical status 4, failed spinal intervention and requiring emergency surgery were excluded from the study.

The primary outcome of this study was 90-day readmission rate. Ninety-day readmission was described as any unplanned admission that occurred within 90 days of initial hospital discharge and required hospitalization.

Secondary outcomes were amount of bleeding, blood product transfusion, LOS, MACE, PPC, and ICU requirement. Amount of bleeding is calculated in milliliters after the end of surgery. Amount of bleeding was measured as the volume of blood aspirated during surgery by subtracting the amount of saline irrigation at the end of surgery and calculation of intraoperative blood-soaked gauze. Blood product transfusion is defined as numbers of red blood cell pack given throughout in intraoperative period. Also LOS is described as the number of days that patients stay in hospital. The MACE is used to describe patients who develop acute myocardial infarction, cerebrovascular event, heart failure and arrhythmia. Atelectasis, pulmonary edema, pneumonia, prolonged mechanical ventilation requirement and pneumothorax criteria were sought for PPC. Intensive care unit requirement is defined as absent or present. Also demographic characteristics (such as age, sex, body mass index, ASA physical status, and comorbidities) were recorded.

Preoperative and postoperative initial hematocrit values were recorded and used to calculate the change in hematocrit for each patient. Anesthesia type (SA or GA) was selected based on the patient preference, anesthetist's recommendation and medical comorbidities. General anesthesia administration included intravenous induction followed by maintenance inhalation anesthetics, intravenous opioids, and controlled mechanical ventilation. A routine general anesthesia protocol was applied to all patients in the GA group. Spinal anesthesia was achieved by injecting 9-15 mg of isobaric bupivacaine into the subarachnoid space via lumbar puncture in the sitting position. SA was administered with premedication (midazolam 1-2 mg IV or/with fentanyl 25-100 mcg IV). Patients who developed any complication (failed spinal anesthesia, severe hypotension, cardiac arrest, allergy, respiratory failure, etc.) related to spinal anesthesia or sedation were excluded from

the study. In our clinic, if there are no contraindications, intraoperative restrictive fluid therapy, periarticular infiltration analgesia, intravenous tranexamic acid and hypotensive anesthesia protocol are applied as standard for patients who underwent THA.

Sample size calculation

Since the mean effect size value was 0.5 between the groups when 90-day readmission was accepted as the primary outcome with a confidence level of 95% and a power of 80%, it was calculated that a minimum of 64 participants should be enrolled into the study. The sample size was calculated by G Power software (latest ver. 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany).

Statistical analysis

In our research, descriptive statistics of quantitative variables are given as mean and standard deviation, median, minimum, maximum and descriptive statistics of qualitative variables are given as numbers and percentages. Relationships between qualitative variables were analyzed with Pearson chi-square and Fisher Freeman Exact tests. The Shapiro Wilk test was used for the conformity of quantitative variables to normal distribution. In the mean comparison of two independent groups, independent sample t test (Student T test) was used for normally distributed variables, and Mann Whitney U test was used for non-normally distributed variables. Paired t-test was used for preoperative and postoperative comparison of hematocrit values. The statistical significance level was taken as 0.05 in the calculations. The SPSS program (Statistical Package for Social Sciences Statistics for Windows, Version 26.0 Software. Armonk, NY: IBM Corp) was used for statistical analysis.

Results

A total of 166 patients who underwent DAA-THA were included in this retrospective study. The mean age of the 166 patients was 72.61 ± 5.276 years old. In total, 88 patients (53%) received GA. The mean age in group GA and group SA was 72.81 ± 4.971 and 72.40 ± 5.625 years old, respectively ($p=0.404$). The female gender ratio in group SA was significantly higher than those in group GA ($p=0.027$). Diabetes mellitus rates in group GA were significantly higher than those in group SA ($p=0.010$). The mean BMI in group SA was significantly lower than those in group GA ($p=0.043$). The demographic characteristics of the two groups are presented in Table 1.

The 90-day readmission rate in group GA was significantly higher than those in group SA ($p<0.001$). Postoperative pulmonary complications and ICU requirement in group GA were significantly higher than those in group SA ($p=0.011$ and $p=0.032$, respectively). Preoperative and postoperative mean hematocrit values in group SA were significantly higher than group GA ($p=0.043$, $p=0.012$, respectively). When the groups were compared in terms of hematocrit changes, the postoperative and preoperative difference of hematocrit was similar ($p=0.923$). There was no significant difference between the groups in terms of LOS ($p=0.125$). Clinical outcomes of both groups are presented in Table 2.

Table 1. Demographic characteristics of the patients.

	General Anesthesia (n=88)	Spinal Anesthesia (n=78)	p value
Age, years (range, mean±SD)	65-87, 72.8±4.9	65-87, 72.4±5.6	0.404
Male sex, n (%)	61 (69%)	41 (52%)	0.027
BMI (kg/m ² , mean±SD)	28.6±3.4	27.5±2.8	0.043
ASA, n (%)			0.417
I No systemic disease	5 (5.7%)	9 (11.5%)	
II Mild systemic disease	62 (70.5%)	51 (65.4%)	
III Severe systemic disease	21 (23.9%)	18 (23.1%)	
Coexisting conditions, n (%)			
Hypertension	66 (75%)	52 (66.7%)	0.304
Diabetes Mellitus	20 (22.7%)	6 (7.7%)	0.010
Chronic kidney disease	5 (5.7%)	5 (6.4%)	1.000
Congestive heart failure	32 (36.4%)	32 (41%)	0.632
Cerebrovascular disease	6 (6.8%)	3 (3.8%)	0.503
Side, n (%)			0.878
Unilateral	44 (50%)	38 (48.7%)	
Bilateral	44 (50%)	40 (51.3%)	

BMI: Body mass index, ASA: American Society of Anesthesiologists physical status, n: number, SD: Standard deviation.

Table 2. Procedure data.

	General Anesthesia (n=88)	Spinal Anesthesia (n=78)	p value
90-day readmission, n (%)	25 (28.4%)	3 (3.8%)	<0.001
Amount of bleeding (mean±SD)	676.56±522.095	612.06±499.952	0.157
Blood transfusion [unit, n (%)]			0.257
0	61 (69.3%)	62 (79.5%)	
1	14 (15.9%)	8 (10.3%)	
2	3 (3.4%)	5 (6.4%)	
3	5 (5.7%)	3 (3.8%)	
4	2 (2.3%)	0	
5	3 (3.4%)	0	
LOS (days, mean±SD)	3.55±1.49	3.080±0.701	0.125
MACE, n (%)	5 (5.7%)	1 (1.3%)	0.215
PPC, n (%)	10 (11.4%)	1 (1.3%)	0.011
ICU requirement, n (%)	12 (13.6%)	3 (3.8%)	0.032
Wound infection, n (%)	3 (3.4%)	1 (1.3%)	0.623
Pulmonary embolism, n (%)	4 (4.5%)	0 (0%)	0.123
Deep vein thrombosis, n (%)	5 (5.7%)	1 (1.3%)	0.215
Preoperative haematocrit (mean±SD)	38.14±4.448	40±4.924	0.012
Postoperative haematocrit (mean±SD)	30.35±4.175	32.26±4.295	0.004

LOS: Length of hospital stay, ICU: Intensive care unit, MACE: Major Adverse Cardiovascular Events,

PPC: Postoperative pulmonary complications, n: number, SD: Standard deviation.

Discussion

Both general and spinal anesthesia are commonly used in DAA-THA procedures. We know that there is no study analysing the differences in short-term outcomes associated with both anesthesia types in patients aged 65 years and older who underwent DAA-THA. The current study used data collected from 166 patients aged 65 years and older who had undergone DAA-THA to compare 90-day readmission, rate amount of bleeding, blood product trans-

fusion, LOS, MACE, PPC, and ICU requirement, between those undergoing GA and SA. In our study, we found that GA administration to DAA-THA patients aged 65 and over statistically increased 90-day readmission rate PPC, and ICU requirement compared to SA. We did not observe a statistically significant difference between anesthesia type and amount of bleeding, blood product transfusion, LOS and MACE.

Results of this study are compatible with previous stud-

ies demonstrating the benefit of neuraxial anesthesia over GA in terms of the risk of complications, excluding the LOS and intraoperative blood loss, in patients undergoing THA. However, the most of those previous studies comparing SA with GA included THA surgeries performed with conventional approaches, and there were a few studies comparing DAA-THA patients. However, the most of those previous studies comparing SA with GA included THA surgeries performed with conventional approaches, and there was only one study comparing DAA-THA patients in this context [11].

Some retrospective studies from the literature have indicated that SA is associated with better outcomes than GA in terms of 30-day mortality, LOS, and perioperative complications [12,13]. A multicenter retrospective study showed that SA for THA patients was related with a lower incidence of major complications and LOS, and it was reported that the greatest effect was in the elderly patients with comorbidities [14]. In contrast, a retrospective study did not find any significant difference in major or minor complications between SA and GA [15]. In a recent retrospective study, it was reported that neuraxial anesthesia was associated with a shorter LOS, less requirement for morphine in the PACU and lower pain scores compared to general anesthesia in patients with DAA-THA [11]. Spinal anesthesia has been associated with better postoperative outcomes compared to GA in patients with multiple comorbidities undergoing total joint arthroplasty [16]. In our study, all patients received controlled hypotensive anesthesia, intraoperative restrictive fluid therapy, periarticular infiltration of local anesthetics and intravenous tranexamic acid. This may be associated with similar results in the amount of bleeding, blood product transfusion and LOS in both groups.

Several studies comparing GA to SA in THA patients have demonstrated the benefits of neuraxial anesthesia, including reduced blood loss, less need for transfusions, reduction in thromboembolic events, and lower surgical site infection rates [17-19]. The results obtained from previous studies comparing the anterior with the posterior and lateral approaches in patients undergoing THA showed that muscle sparing and minimally invasive DAA-THA is associated with reduced blood loss, early functional recovery and shortened LOS [20-22]. We think that minimally invasive surgery may also have an effect on the inability to detect a statistically significant difference in the amount of bleeding, blood product transfusion, and LOS in both groups in our study.

Our study had some limitations. The main limitation was conducting a retrospective design in a single center. Another limitation of our study is that body mass index, which may affect clinical results, was not similar between the two groups. Because the sample size is small and our results may be biased, it may not be representative of a larger patient population. Nowadays the use of controlled hypotensive anesthesia and fibrinolytic drugs to reduce bleeding in THA surgeries has become very popular. Therefore, it would be beneficial to review the results of GA and SA in the light of bleeding reduction strategies in THA patients. To confirm these findings, future prospective studies that randomized elderly DAA-THA patients

to different types of anesthesia within fast-track protocols are recommended.

Conclusion

Evolving the current approach to outpatient surgery in THA and increasing number of THAs worldwide have made safe and effective perioperative care more important. The use of SA in the anesthetic management of patients undergoing DAA-THA has been associated with a reduction in PPC, ICU requirement, and 90-day readmission rate. Although our findings need to be confirmed in multicenter, prospective studies involving large patient populations, SA may be preferred in the absence of contraindications in elderly patients undergoing DAA-THA.

Ethics approval

Bezmialem Vakif University Ethics Committee approved this study (decision no: 08/155, date: 08.06.2020).

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