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Impact of postoperative pain management on mortality and morbidity in hip arthroplasty: a retrospective study

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ABSTRACT

Aims: Total hip arthroplasty (THA) is one of the most common operations performed today and is associated with significant postoperative pain. Inadequate pain control causes delayed mobilization and prolonged hospital stay, which is associated with increased morbidity and mortality. Our aim was to compare the length of hospital stay, postoperative infection, mortality and morbidity in patients with and without regional analgesia technique in the postoperative period.

Methods: Patients with missing records were excluded. 444 patients were included in the study and divided into two groups according to postoperative analgesia management. Patients who received peripheral block for postoperative analgesia (group block+) and patients who received IV analgesics for postoperative analgesia (group block-). Gender, American Society of Anesthesiologists (ASA) scores, laboratory data, postoperative blood component transfusion surgical site infection, length of hospital stay (days) and mortality data of the patients were analyzed.

Results: There was no significant difference between the groups with and without block in terms of gender, age and ASA classification ($p>0.05$). A significant positive correlation was found between the white blood cell (WBC) count difference and discharge rate ($p<0.05$). This finding showed that the effect of WBC change on discharge was significant, although at a low level. A significant positive correlation was found between the length of stay in the intensive care unit and C-reactive protein changes ($p<0.05$). There was no significant difference in infection and mortality rates between the groups with and without block ($p>0.05$).

Conclusion: Short-term mortality, length of hospital stay, and infection parameters were similar after hip replacement surgery with or without regional analgesia techniques. Block application was effective in reducing the postoperative inflammatory response but did not significantly improve infection, mortality, or other clinical outcomes.

Keywords: Total hip arthroplasty, mortality, morbidity, infection, peripheral nerve block, retrospective analysis

INTRODUCTION

Total hip arthroplasty (THA) is one of the most common operations performed today and is associated with significant postoperative pain. Inadequate pain control causes delayed mobilization and prolonged hospital stay, which is associated with increased morbidity and mortality. These patients are usually elderly and have multiple comorbidities. In this vulnerable population, early and appropriate analgesic treatment can have a strong positive impact on the course of postoperative recovery.[1]

Paracetamol, NSAIDs, and opioids are traditionally used for postoperative pain relief in THA. The most commonly used opioids are morphine, hydromorphone, oxycodone, hydrocodone and fentanyl.[2] However, the use of opioids also have side effects such as nausea, vomiting, itching, sedation and constipation. It has been reported that it can cause more serious complications such as ileus and respiratory depression.[3] In addition, it has been reported that patients using opioids have higher pain scores during hospitalization, need more postoperative rehabilitation and have more postoperative complications.[2]

Multimodal pain management is "the administration of two or more drugs that act by different mechanisms to provide analgesia to patients by the same or different routes. Recently, multimodal pain management has become increasingly popular due to the reduction in opioid use and improved recovery.[4]

Regional techniques such as epidural block, femoral nerve block, lumbar plexus block, psoas compartment block, fascia iliaca block, lateral femoral cutaneous nerve block and anterior quadratus lumborum block are frequently applied

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for postoperative analgesia in total hip arthroplasty surgeries. There are many studies in the literature showing that these techniques reduce pain scores and opioid consumption.[5]

In this retrospective article, we analyzed the patients who underwent THA surgery with under spinal anesthesia between 01.01.2022 and 31.12.2023 in our hospital. We examined the hospital stay, postoperative infection, mortality and morbidity records of these patients. Our aim was to compare clinical progress in patients with and without regional analgesia technique in the postoperative period.

METHODS

Approval for the study was obtained from the Bursa City Hospital Clinical Researches Ethics Committee (Date: 06.12.2023, Decision No: 2023-20/9). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The data of 654 patients who underwent THA with spinal anesthesia between 01.01.2022 and 31.12.2023 were retrospectively analyzed. Patients with missing records were excluded. 444 patients were included in the study and divided into two groups according to postoperative analgesia management. Patients who received peripheral block for postoperative analgesia (group block+) and patients who received IV analgesics for postoperative analgesia (group block-). Gender, American Society of Anesthesiologists (ASA) scores, preoperative white blood cell (WBC) count, hemoglobin (Hb), C-reactive protein (CRP) values, neutrophil-to-lymphocyte ratio (NLR), duration of procedure (min), intraoperative blood components (RBC, plasma, platelet), transfusion postoperative transfer location and postoperative WBC, Hb, CRP, NLR, postoperative blood component transfusion surgical site infection, length of hospital stay (days) and mortality data of the patients were analyzed.

Statistical Analysis

Data analysis of the data in our study was performed using the "statistical package for social sciences (SPSS) for Windows 20.0 (SPSS, Inc., Chicago, IL, USA)". The conformity of the data to normal distribution was evaluated by Kolmogorov-Smirnov test. Continuous data in the perioperative period in patients with and without block were evaluated using Mann-Whitney U test and categorical data were evaluated using Chi-square test. The effect of pre-postoperative differences in laboratory parameters on postoperative outcome parameters was evaluated by Spearman correlation test. A p-values <0.05 were considered statistically significant.

RESULTS

There was no significant difference between the groups in terms of gender, age and ASA classification (p>0.05). Duration of procedure was similar between the groups (p>0.05) (**Table 1**). Postoperative WBC and neutrophil levels were significantly higher in the non-block group (p<0.05). In other laboratory parameters, no significant difference was found between the groups in terms of pre- and postoperative hemoglobin, lymphocyte, CRP and NLR values (**Table 2**).

There was no significant difference between block and non-block groups in terms of infection rates and mortality rates (p>0.05). Although the discharge rate was higher in the non-block group, this difference was not statistically significant (p>0.05) (**Table 3**).

Table 1. Demographics, duration of procedure and length of hospital stay

		Group block- (n: 261)	Group block+ (n: 183)	p
Gender (F/M)		111/150	74/109	0.660
ASA	I-II	133	104	0.222
	III-IV	128	79	
		Med (min-max)	**Med (min-max)**	
Age		63 (17-93)	62 (30-83)	0.514
Duration of procedure (min)		115 (60-170)	110 (55-175)	0.367
Length of hospital stay (day)		5 (2-56)	5 (2-22)	0.164

Datas were expressed as a med (min-max), chi-square tests, Mann-Whitney U, F: Female, M: Male, ASA: American Society of Anesthesiologists, Med: Median, Min: Minimum, Max: Maximum

Table 2. Preoperative and postoperative laboratory results

	Group block- (n: 261)	Group block+ (n: 183)	
	Med (min-max)	**Med (min-max)**	**p**
Preoperative WBC	7.7 (3.78-20.7)	7.3 (2-23.9)	0.243
Preoperative Hb	13.1 (8.1-17)	13.1 (6.2-17.2)	0.753
Preoperative neutrophil	4.8 (1-17.1)	4.4 (1.3-21.45)	0.364
Preoperative lymphocyte	2.1 (0.25-4.74)	1.9 (0.41-8.42)	0.336
preoperative CRP	4.9 (0.50-236)	4.4 (0-268)	0.660
Preoperative NLR	2.34 (0.49-44.80)	2.26 (0.68-32.8)	0.640
Postoperative WBC	107 (3.85-26.5)	9.43 (2.6-26.76)	0.001
Postoperative Hb	10.25 (6.3-17.6)	10.3 (6.4-15.5)	0.386
Postoperative neutrophil	8.53 (2.29-22.3)	7.34 (1.5-23.32)	0.001
Postoperative lymphocyte	1.2 (0.34-8.7)	1.17 (0.3-5.1)	0.501
postoperative CRP	105.6 (0.90-322)	128.1 (2.9-325.3)	0.738
Postoperative NLR	6.99 (0.70-49.21)	6.33 (0.94-40)	0.248

Datas were expressed as a med (min-max), Mann-Whitney U test, WBC: Leukocyte, Hb: Hemoglobin, CRP: C-reactive protein, NLR: Neutrophil lymphocyte ratio, Med: Median, Min: Minimum, Max: Maximum

Table 3. Pre-postoperative blood transfusion, infection, intensive care admission and mortality

		Group block- (n: 261)	Group block+ (n: 183)	p
Peroperative RBC transfusion	No	217	159	0.281
	Yes	44	24	
Peroperative FFP transfusion	No	259	183	0.235
	Yes	2	0	
Postoperative RBC transfusion	No	195	143	0.404
	Yes	66	40	
Postoperative FFP transfusion	No	250	177	0.613
	Yes	11	6	
Surgical site infection	No	247	176	0.452
	Yes	14	7	
Mortality	No	259	181	0.168
	Yes	2	2	
ICU		81	44	0.290

Chi-square tests, RBC: Red blood cell, FFP: Fresh frozen plazma, ICU: Intensive care unit

A significant positive correlation was found between WBC difference and discharge rate (p<0.05). Lymphocyte difference had a significant negative correlation with length of stay in

intensive care unit (p<0.05). A significant positive correlation was found between the duration of intensive care unit stay and CRP changes (p<0.05) (**Table 4**).

Table 4. Correlation of laboratory values with length of hospital stay, intensive care unit stay, infection, and discharge

		LHS	ICU	Infection	Discharge
WBC difference	r s	-0.053	-0.017	0.043	0.105
	p	0.270	0.719	0.365	0.028
Neutrophil difference	r s	-0.087	0.030	0.036	0.086
	p	0.067	0.535	0.454	0.072
Lymphocyte difference	r s	0.020	-0.116	-0.038	0.061
	p	0.669	0.015	0.430	0.199
NLR difference	r s	-0.075	0.090	0.018	0.017
	p	0.115	0.057	0.699	0.724
CRP difference	r s	0.019	0.202	-0.076	n/A
	p	0.800	0.008	0.322	n/A

Spearman correlation test, WBC: White blood cell, CRP: C-reactive protein, NLR: Neutrophil to lymphocyte ratio, LHS: Length of hospital stay, ICU: Intensive care unit

DISCUSSION

After analyzing the results of 444 patients included in our study, no statistically significant difference was found regarding infection, intensive care unit requirement and hospital discharge.

There are studies reporting that the in-hospital mortality rate in patients undergoing surgical intervention due to hip fracture varies between 1.2% and 12.1%.[6-9] In our study, in hospital mortality rate was 0.9%. This rate is compatible with the literature. The use of only data from patients who underwent hip surgery under spinal anesthesia in our study may have affected the results. However, a recently published study revealed that there was no difference in in-hospital mortality rates between regional and general anesthesia techniques in patients undergoing hip surgery.[10] Studies have reported that 2.1% to 2.4% of patients with hip fracture die during hospitalisation, which is comparable to the results of the present study.[11,12]

Atay et al.[13] analyzed the data of patients who underwent THA and found the mean age of the patients to be 76.01±8.24 and reported that they found no correlation between mortality and age. Similar results were obtained in our study and no statistically significant difference was found between the mean age of the patients and mortality. Jiang et al.[14] reported that male gender had a higher mortality risk when the annual mortality of patients with hip fracture was evaluated. We found that the number of deaths was low and the mortality rate was similar between genders, which makes it difficult to interpret the effect of gender on mortality. No statistical effect of age and gender on mortality was found in our study.

Anemia is quite common in patients with hip fracture.[15] According to the World Health Organization (WHO), anemia is defined as a hemoglobin (Hb) level below 12 g/dl in women and below 13 g/dl in men.[16] Many studies have demonstrated that anemia increases the risk of 90-day and 180-day mortality in patients with hip fracture.[17] However Elmas et al.,[18] could not find a significant relationship between preoperative hemoglobin values and mortality rates within one year in patients with hip fracture.

Perioperative anemia is mostly treated with RBC transfusion to prevent postoperative morbidity and mortality. However, there are conflicting data regarding the effect of RBC transfusion on morbidity and mortality in patients with acute hip fracture. Engören et al.[19] found that allogeneic RBC transfusions were associated with an increase in long-term (>90 days to 2 years) mortality after THA. In our study, no significant relationship was found between intraoperative and postoperative blood transfusions and mortality. In addition, it has been reported that the risk of postoperative infections such as pneumonia, delirium, short-term mortality, length of hospital stay and systemic inflammatory response syndrome increases in patients receiving blood component transfusions.[20] Therefore, careful preoperative planning and a multidisciplinary approach are necessary to reduce postoperative transfusion rates.[21]

Systemic inflammation is characterized by neutrophilia, lymphopenia and thrombocytosis. Leukocytes generate a physiologic response to stress, characterized by an increase in neutrophils and a decrease in lymphocytes. NLR as a new risk factor for mortality in patients with hip fracture was first reported by Forget et al.[22] In this study, they reported that mortality may be high if NLR >5 on the 5th postoperative day, but preoperative NLR was not predictive of postoperative mortality. In acute inflammation, serum inflammation markers such as elevated C-reactive protein (CRP) may also be an indicator of mortality.[23] In our study, although surgical site infection was proportionally less in patients who underwent block, there was no statistically significant difference between the groups.

Conditions such as malignancy, rheumatologic diseases and steroid use may affect inflammatory markers, which is a disadvantage of our study in terms of generalizability. When the length of hospital stay was evaluated in our study, there was no statistically significant difference between the groups, although there were lower values in the block group.

Severe pain increases complications associated with hip fracture. Hung et al.[24] emphasized the importance of optimal pain control after hip fracture to minimize complications such as delirium, loss of function and death due to pain and immobility.

There are some suggestions that the use of nerve blocks may reduce in-hospital mortality after hip fracture, but the evidence is not yet conclusive. Pederson et al.[25] found that a comprehensive hip fracture program including the use of continuous femoral nerve block catheters reduced 12-month mortality from 29% to 23%. Abou-Setta at al.[26] meta-analysis failed to detect a statistically significant reduction in mortality with nerve blocks based on the limited evidence available, suggesting the need for further research. We did not find a statistically significant difference in mortality between patients with and without nerve block. We think that the evaluation of the 12-month period in the study by Pederson et al.[25] may be the reason for this difference.

Limitations

There are some limitations in our study. Firstly, short-term follow-up of the patients was performed, long-term results could have been examined. Secondly, the patients' ASA classes were evaluated, their comorbidities could have been evaluated in detail. Thirdly, the sample size could have been expanded. Finally, the study could have been planned prospectively.

CONCLUSION

In conclusion, short-term mortality, length of hospital stay and infection parameters were similar after hip replacement operations with or without regional analgesia techniques. Block application was effective in reducing the postoperative inflammatory response, but had no significant effects on conditions such as infection, mortality rates and other clinical outcomes. The significant effect of CRP on the requirement for ICU suggests that the inflammatory response should be considered as an important marker. Further studies with a larger scope and number of patients may better elucidate the effect of regional analgesia applications on clinical outcomes.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Bursa City Hospital Clinical Researches Ethics Committee (Date: 06.12.2023, Decision No: 2023-20/9).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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