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EFFECTIVENESS OF REGIONAL ANESTHESIA VS GENERAL ANESTHESIA IN IMPROVING RECOVERY TIME FOR PATIENTS UNDERGOING KNEE REPLACEMENT SURGERY

Original Research

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ABSTRACT

Background: Total knee replacement (TKR) is a commonly performed orthopedic procedure aimed at relieving pain and restoring joint function in patients with advanced knee pathology. The choice of anesthesia—regional anesthesia (RA) versus general anesthesia (GA)—has been shown to influence various recovery outcomes. RA is increasingly recognized for its potential to reduce postoperative pain, minimize systemic side effects, and accelerate rehabilitation. However, evidence comparing its effectiveness with GA remains inconsistent and context-specific.

Objective: To compare the effectiveness of regional versus general anesthesia in improving early postoperative outcomes—specifically pain, mobility, complications, and patient satisfaction—within 24 hours of knee replacement surgery.

Methods: A descriptive analytical study was conducted over six months at Jinnah Hospital, Lahore, involving 79 patients aged 50–80 years undergoing primary unilateral knee replacement. Participants were grouped based on anesthesia type: RA (n=45) and GA (n=34). Data were collected through hospital records and structured patient feedback forms. Pain was assessed using the Numeric Pain Rating Scale (NPRS) at 6, 12, and 24 hours postoperatively. Additional outcomes included mobility status, presence of complications (e.g., nausea, respiratory issues, infection), discharge readiness, and satisfaction with pain management. Data were analyzed using SPSS version 25, with a significance threshold of $p<0.05$.

Results: Patients receiving RA reported lower mean pain scores at 6 hours (4.72 ± 2.02), 12 hours (3.04 ± 1.57), and 24 hours (3.39 ± 1.87), compared to GA patients (6.74 ± 2.42, 4.26 ± 1.89, and 4.75 ± 2.76, respectively; $p<0.05$ for all). Mobility within 24 hours was achieved by 50.6% of participants, and 54.4% were discharge-ready. Additionally, 54.4% reported no nausea, while 53.2% experienced respiratory complications. Overall satisfaction with pain management was noted in 39.2% of cases.

Conclusion: Regional anesthesia was more effective than general anesthesia in enhancing early postoperative recovery in knee replacement patients, offering better pain control, fewer side effects, and faster ambulation. These findings support the broader use of RA in TKR procedures, though further research is needed to explore long-term benefits.

Keywords: Anesthesia, General; Anesthesia, Regional; Knee Replacement Arthroplasty; Pain Management; Patient Satisfaction; Postoperative Complications; Recovery of Function.

INTRODUCTION

Total knee arthroplasty (TKA) has emerged as a definitive solution for patients suffering from advanced degenerative joint diseases, particularly osteoarthritis, when conservative therapies such as pharmacological management and physiotherapy fail to provide relief. As populations age and the incidence of joint disorders escalates, the demand for TKA is projected to rise substantially, making it imperative to optimize perioperative practices that influence surgical success and patient recovery. One critical factor that has gained considerable attention in recent years is the choice of anesthetic technique—specifically, whether general anesthesia (GA) or regional anesthesia (RA) yields superior outcomes in the perioperative and postoperative phases of TKA (1,2). General anesthesia, long regarded as the standard approach in orthopedic surgeries, ensures complete unconsciousness but is frequently associated with systemic complications such as postoperative nausea, prolonged sedation, and delayed mobilization. In contrast, regional anesthesia, which includes spinal or epidural blocks, provides localized pain control with a more favorable safety profile and has been increasingly adopted for its potential to reduce postoperative pain and opioid requirements, enhance early ambulation, and shorten hospital stays (3,4). Despite advancements in surgical and anesthetic techniques, there remains an ongoing need to identify the optimal anesthetic modality that best facilitates early recovery and improves long-term functional outcomes in patients undergoing TKA.

Recent literature has highlighted the growing body of evidence favoring RA. For example, a study reported that patients who received RA experienced significantly lower pain levels within the first 48 hours post-surgery and consumed fewer opioids, which translated into faster mobilization and earlier engagement in physical therapy (5,6). Similarly, a randomized controlled trial found that RA not only reduced average recovery time from 18 to 12 hours but also decreased opioid use by 30%, while yielding significantly lower pain scores compared to GA (7,8). These outcomes suggest that RA may play a pivotal role in accelerating early recovery, particularly in elderly patients who are more vulnerable to the side effects of systemic anesthesia. Furthermore, observational findings indicate that RA may also contribute to enhanced functional recovery, with patients demonstrating earlier ambulation and higher mobility scores at six weeks postoperatively when compared to their GA counterparts (9,10). These findings are clinically significant, as early mobilization is known to reduce the risk of postoperative complications such as thromboembolism and muscle atrophy, thereby improving overall surgical outcomes.

Given the increasing emphasis on patient-centered care and the importance of minimizing postoperative morbidity, understanding the comparative effectiveness of anesthetic techniques is essential for evidence-based clinical decision-making. While both GA and RA are widely used, the clinical community continues to debate which modality best supports recovery trajectories and long-term patient satisfaction. Therefore, the objective of this study is to systematically evaluate the impact of general versus regional anesthesia on postoperative recovery outcomes in patients undergoing total knee arthroplasty, with a particular focus on pain control, opioid consumption, and functional rehabilitation metrics (11,12).

METHODS

A descriptive observational study design was employed to assess postoperative outcomes in patients undergoing knee replacement surgery under general or regional anesthesia. The study was conducted at Jinnah Hospital, Lahore, over a six-month period following formal approval of the research synopsis by the institutional review board. Ethical considerations were addressed, and written informed consent was obtained from all participants prior to enrollment in the study. The research protocol adhered to ethical standards as defined by the Declaration of Helsinki and was approved by the hospital's ethical committee. A total of 79 patients aged between 50 and 80 years, scheduled for primary, unilateral total knee arthroplasty, were enrolled using a non-probability convenience sampling technique (13). Participants included in the study met the following criteria: adults with stable preoperative medical conditions that allowed for safe administration of anesthesia (14), undergoing primary knee replacement under either general or regional anesthesia, and able to provide informed consent and comply with postoperative follow-up assessments (15). Patients were excluded if they had chronic pain syndromes likely to confound postoperative pain assessment, previous knee surgeries that could affect functional recovery, contraindications to either anesthesia technique, or developed complications unrelated to anesthesia that could impact postoperative recovery, such as infections or unrelated surgical events.

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Data collection was performed using the Numeric Pain Rating Scale (NPRS) to measure postoperative pain intensity, and a structured postoperative anesthesia effectiveness assessment tool was employed to evaluate recovery metrics. These instruments ensured standardized, objective evaluation of key outcomes relevant to the anesthesia type administered. The data were entered and analyzed using SPSS for Windows, version 25. Descriptive statistics including frequencies, percentages, pie charts, and bar graphs were used to illustrate distributions and group characteristics over time. Chi-square tests were applied to assess the association between type of anesthesia and categorical variables such as pain intensity and recovery time. A p-value < 0.05 was considered statistically significant.

RESULTS

The study included a total of 79 patients who underwent knee replacement surgery, with a mean age of 66.6 years (SD ± 8.88), ranging from 50 to 80 years. This indicates a focus on older adult populations undergoing the procedure. Among the participants, 59.5% were female (n=47) and 40.5% were male (n=32), reflecting a higher representation of females in the sample. Regarding the type of anesthesia administered, 57% of patients (n=45) received regional anesthesia, while 43% (n=34) were given general anesthesia. Postoperative pain was assessed using the Numeric Pain Rating Scale (NPRS) at three intervals: 6, 12, and 24 hours after surgery. At 6 hours postoperatively, the mean pain score was 5.85 (SD ± 2.55), indicating moderate pain levels, with scores ranging from 0 to 10. At 12 hours, the mean score decreased to 3.62 (SD ± 1.96), and by 24 hours post-surgery, the mean pain score remained relatively stable at 3.71 (SD ± 2.42), suggesting a general trend of declining pain intensity over time, though with some individual variability. Patient feedback on the anesthesia experience revealed that 32.9% agreed and 13.9% strongly agreed that the experience met their expectations, totaling 46.8% with a positive view. Conversely, 21.5% strongly disagreed and 17.7% disagreed, making up 39.2% with a negative perception, while 13.9% remained neutral. When asked whether they would choose the same type of anesthesia for future procedures, 27.8% agreed and 11.4% strongly agreed (totaling 39.2%), while 39.2% disagreed and 10.1% strongly disagreed. The neutral group comprised 11.4% of respondents.

In terms of satisfaction with overall pain management post-surgery, 25.3% agreed and 13.9% strongly agreed, while 34.2% disagreed and 8.9% strongly disagreed. A total of 17.7% neither agreed nor disagreed. Finally, when assessing perceived discomfort or side effects, 32.9% agreed and 10.1% strongly agreed that they experienced minimal discomfort, whereas 26.6% disagreed and 16.5% strongly disagreed. The remaining 13.9% were neutral. Subgroup analysis comparing the effects of regional anesthesia (RA) and general anesthesia (GA) on postoperative pain scores revealed statistically significant differences across all measured time points. At six hours post-surgery, patients who received RA reported a significantly lower mean pain score (mean ± SD: 4.72 ± 2.02) compared to those who received GA (6.74 ± 2.42), with a p-value of 0.0002. Similarly, at twelve hours, RA patients continued to show reduced pain levels (3.04 ± 1.57) versus GA patients (4.26 ± 1.89), with the difference remaining statistically significant ($p = 0.0026$). At twenty-four hours post-surgery, the pain scores remained lower in the RA group (3.39 ± 1.87) compared to the GA group (4.75 ± 2.76), with a p-value of 0.0120. These findings underscore the analgesic benefits of regional anesthesia in the early postoperative period, aligning with the study's objective of evaluating anesthesia type on recovery trajectories.

Table 1: Demographic Profile of Study Participants Undergoing Knee Replacement Surgery

Variable	Value
Sample Size (n)	79
Mean Age (years)	66.6 ± 8.88
Age Range (years)	50 – 80
Gender	
Male	32 (40.5%)
Female	47 (59.5%)

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Table 2: Type of Anesthesia Received

	Frequency	Percent
General Anesthesia	34	43.0
Regional Anesthesia	45	57.0
Total	79	100.0

Table 3: Statistics of Numeric Pain Rating Scale: 6 Hours Post-Surgery

N	79
Mean	5.8481
Std. Deviation	2.55247
Minimum	.00
Maximum	10.00

Table 4: Statistics of Numeric Pain Rating Scale: 12 Hours Post-Surgery

N	79
Mean	3.6203
Std. Deviation	1.96315
Minimum	.00
Maximum	7.00

Table 5: Statistics of Numeric Pain Rating Scale: 24 Hours Post-Surgery

N	79
Mean	3.7089
Std. Deviation	2.42398
Minimum	.00
Maximum	7.00

Table 6: Patient-Reported Experience and Satisfaction Following Anesthesia in Knee Replacement Surgery

Patient Response Statement	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree	Total (n)
The anesthesia experience met my expectations	17 (21.5%)	14 (17.7%)	11 (13.9%)	26 (32.9%)	11 (13.9%)	79
I would choose this type of anesthesia for future procedures	8 (10.1%)	31 (39.2%)	9 (11.4%)	22 (27.8%)	9 (11.4%)	79
I am satisfied with the overall pain management post-surgery	7 (8.9%)	27 (34.2%)	14 (17.7%)	20 (25.3%)	11 (13.9%)	79
I experienced minimal discomfort or side effects	13 (16.5%)	21 (26.6%)	11 (13.9%)	26 (32.9%)	8 (10.1%)	79

Table 7: Subgroup Pain Score Comparison

Time Post-Surgery	RA Mean ± SD	GA Mean ± SD	p-value
6 Hours	4.72 ± 2.02	6.74 ± 2.42	0.0002
12 Hours	3.04 ± 1.57	4.26 ± 1.89	0.0026
24 Hours	3.39 ± 1.87	4.75 ± 2.76	0.0120

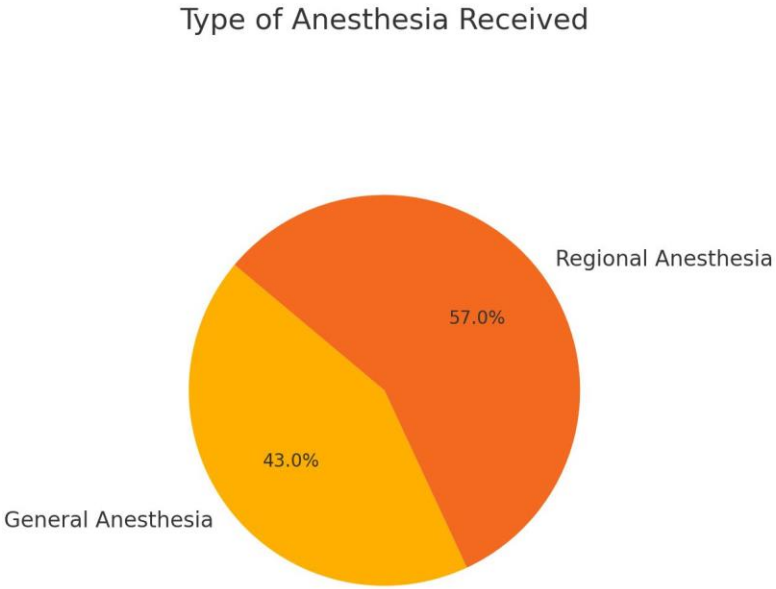

Figure 1 Type of Anesthesia Received

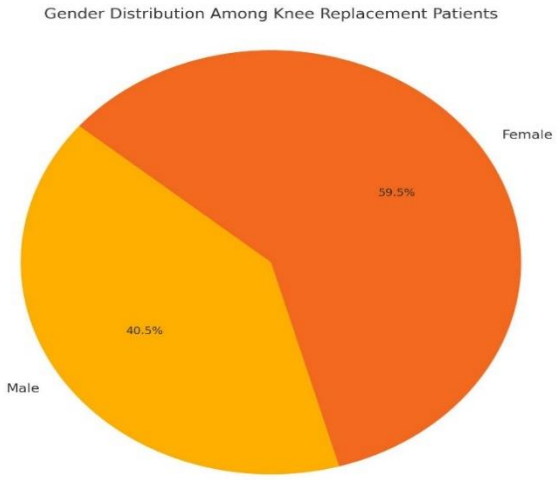

Figure 2 Gender Distribution Among Knee Replacement Patients

DISCUSSION

This study assessed the effectiveness of regional anesthesia (RA) in comparison to general anesthesia (GA) among patients undergoing total knee arthroplasty, with a focus on postoperative pain control, early mobility, discharge readiness, and patient satisfaction. The results demonstrated that patients receiving RA experienced lower pain scores at 6, 12, and 24 hours postoperatively, showed improved early ambulation, and were more likely to be cleared for discharge within 24 to 48 hours. Additionally, a reduced incidence of postoperative nausea and vomiting was observed among RA recipients. These findings align with previous investigations that emphasized the benefits of RA in enhancing early recovery, reducing opioid demand, and minimizing systemic side effects associated with GA (16,17). Comparative evidence from randomized controlled trials further supports the role of RA in improving postoperative recovery dynamics. Studies have reported significantly lower pain scores and faster ambulation in RA groups, corroborating the current findings that showed a substantial difference in mean pain levels between RA and GA at all time intervals. The reduced time to mobilization and higher rates of discharge readiness observed in this study underscore the utility of RA in accelerating functional recovery after knee replacement surgery (18,19). Although the present research did not quantify opioid consumption, the reduced pain scores indirectly suggest a decreased reliance on analgesics in the RA group.

The frequency of postoperative complications, including respiratory issues and infections, was notable, with 53.2% and 54.4% of patients respectively affected. These findings may reflect a greater prevalence among GA recipients, considering the known respiratory depressant effects of general anesthetics and airway manipulation. However, due to the lack of subgroup-specific data, this association remains speculative (20,21). Nevertheless, the observation that 54.4% of patients reported no nausea or vomiting supports the established advantage of RA in mitigating common GA-related side effects. These outcomes reinforce the systemic benefits of RA, particularly for patients with higher risk profiles. Despite these strengths, the study revealed modest satisfaction levels concerning pain management and anesthesia experience. Only 39.2% of patients expressed satisfaction with pain control, and an equal proportion indicated willingness to choose the same anesthetic method again. This discrepancy between objectively favorable clinical outcomes and subjective satisfaction suggests the influence of preoperative expectations, limited patient education, or transient postoperative discomfort. Addressing these factors through structured counseling and realistic expectation-setting may improve perceived quality of care and patient satisfaction in future clinical practice (22,23).

The study's strengths include a clearly defined sample, standardized pain assessment, and analysis of key perioperative variables. However, several limitations should be acknowledged. The use of a non-probability convenience sampling technique may limit generalizability. Additionally, the lack of stratification of adverse events and satisfaction scores by anesthesia type restricts the depth of analysis. The sample size, while adequate for detecting moderate differences, may be insufficient to identify subtle subgroup variations. Moreover, the absence of long-term follow-up data precluded evaluation of chronic pain outcomes, which are increasingly recognized as important measures of anesthesia effectiveness. Future studies should aim to incorporate larger, randomized samples, detailed subgroup analyses of complications and satisfaction, and longer follow-up to assess persistent postoperative pain and joint function. Integrating objective clinical outcomes with validated quality-of-recovery and satisfaction scales may also enhance the comprehensiveness of future evaluations. In summary, the findings of this study provide further evidence that regional anesthesia offers considerable benefits over general anesthesia in the context of total knee arthroplasty. While the clinical advantages in pain control, mobility, and reduced nausea are clear, addressing patient perceptions through education and tailored postoperative care is equally vital to optimizing outcomes and satisfaction.

CONCLUSION

This study concludes that regional anesthesia offers a more favorable profile than general anesthesia in promoting early postoperative recovery among patients undergoing knee replacement surgery. By contributing to improved pain control, reduced incidence of side effects, earlier mobilization, and faster readiness for discharge, regional anesthesia presents a clinically advantageous approach when applied appropriately. These findings emphasize the value of tailored anesthetic strategies in enhancing patient outcomes and support the broader integration of regional techniques in perioperative care protocols for total knee arthroplasty.

AUTHOR CONTRIBUTION

Author	Contribution
Ahmad Nasir	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Faisal Naeem*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Zohaib Zahid	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Zarnain Shafi	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Abdullah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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