

Efficacy of Regional Anesthesia Techniques for Lower Limb Orthopedic Surgeries

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Abstract

Background: Lower limb orthopedic surgeries are commonly associated with significant perioperative pain and physiological stress. Regional anesthesia techniques are widely used for these procedures due to their advantages in providing effective anesthesia, stable hemodynamics and prolonged postoperative analgesia. However, local evidence regarding their efficacy and safety in Bangladeshi patients remains limited.

Methods: This prospective observational study was conducted in the Department of Anesthesia at Dhaka Community Medical College and Hospital, Dhaka, Bangladesh, from February to December 2025. A total of 200 adult patients undergoing elective or emergency lower limb orthopedic surgeries under regional anesthesia were included. Various regional anesthesia techniques, including spinal, epidural, combined spinal-epidural and peripheral nerve blocks, were administered according to institutional practice. Data on socio-demographic characteristics, type of surgery, anesthesia technique, efficacy outcomes and anesthesia-related complications were collected.

Results: The majority of patients were aged 31–45 years (34%), with a male predominance (64%). Most participants belonged to ASA physical status II (46%). Spinal anesthesia was the most commonly used technique (72%). Adequate sensory and motor blockade was achieved in 92% and 88% of patients, respectively. Hemodynamic stability was maintained in 84% of cases, while only 4% required conversion to general anesthesia. Hypotension (18%) was the most frequent complication. Prolonged postoperative analgesia lasting more than six hours was observed in 73% of patients.

Conclusion: Regional anesthesia techniques demonstrated high efficacy and an acceptable safety profile for lower limb orthopedic surgeries in this tertiary care setting, supporting their continued use as a primary anesthetic modality.

Keywords: General anaesthesia, Hemodynamic stability, Laparoscopic cholecystectomy, Postoperative pain, Spinal anaesthesia.

1. INTRODUCTION

Lower limb orthopedic surgeries are among the most commonly performed surgical procedures worldwide and are frequently associated with

significant intraoperative and postoperative pain [1].

Effective anesthetic management plays a crucial role in ensuring optimal surgical conditions,

patient comfort, early mobilization and reduced postoperative morbidity. Regional anesthesia techniques have gained increasing popularity in lower limb orthopedic surgeries due to their ability to provide targeted anesthesia and analgesia while minimizing systemic effects associated with general anesthesia [2, 3].

Regional anesthesia, including spinal anesthesia, epidural anesthesia, combined spinal-epidural anesthesia and peripheral nerve blocks, offers several advantages such as superior pain control, reduced blood loss, stable hemodynamic profile, decreased incidence of thromboembolic events and lower rates of postoperative nausea and vomiting [4]. Additionally, regional techniques allow patients to remain conscious during surgery, facilitate early ambulation, shorten hospital stay and reduce the requirement for systemic opioids, thereby lowering the risk of opioid-related adverse effects [5].

Despite these benefits, the efficacy of regional anesthesia techniques can vary depending on factors such as patient characteristics, type and duration of surgery, anesthetic drugs used and the expertise of the anesthesiologist. Inadequate sensory or motor blockade, hemodynamic instability, need for supplemental analgesia, or conversion to general anesthesia may compromise surgical outcomes and patient satisfaction [6]. Furthermore, regional anesthesia is not entirely free from complications, with issues such as hypotension, bradycardia, post-dural puncture headache and nerve-related symptoms still being reported in clinical practice [7]. In developing countries, where resource optimization and cost-effective healthcare delivery are essential, regional anesthesia plays a vital role in orthopedic surgical care [8, 9]. However, local data evaluating the effectiveness and safety of different regional anesthesia techniques in lower limb orthopedic surgeries remain limited [10]. Understanding the real-world efficacy and complication profile of these techniques is important for guiding anesthetic decision-making, improving patient outcomes and developing institutional protocols tailored to local settings [11].

Therefore, this study was designed to evaluate the efficacy of regional anesthesia techniques in patients undergoing lower limb orthopedic surgeries at a tertiary care teaching hospital in Dhaka, Bangladesh. The findings of this study aimed to provide evidence-based insight into the effectiveness, safety and postoperative analgesic

outcomes of regional anesthesia, thereby contributing to improved anesthetic practice and patient care in orthopedic surgery.

2. METHODOLOGY & MATERIALS

This prospective observational study was conducted in the Department of Anesthesia at Dhaka Community Medical College and Hospital, Wireless Railgate, Bara Moghbazar, Dhaka, Bangladesh, from February 2025 to December 2025. A total of 200 patients undergoing lower limb orthopedic surgeries under regional anesthesia were included in the study. Adult patients of either sex aged 18 years and above, classified as American Society of Anesthesiologists physical status I to III and scheduled for elective or emergency lower limb orthopedic procedures were enrolled using a purposive sampling technique. Patients who refused to participate, had contraindications to regional anesthesia, bleeding disorders, local infection at the site of injection, known allergy to local anesthetic drugs, severe systemic illness, or neurological deficits involving the lower limbs were excluded from the study.

Regional anesthesia techniques including spinal anesthesia, epidural anesthesia, combined spinal-epidural anesthesia and peripheral nerve blocks were administered according to standard institutional protocols and patient suitability. The choice of anesthesia technique, local anesthetic agents and adjuvants was determined by the attending anesthesiologist. Standard monitoring was applied to all patients throughout the perioperative period, including heart rate, non-invasive blood pressure, oxygen saturation and electrocardiography.

The efficacy of regional anesthesia was assessed by the adequacy of sensory and motor blockade, intraoperative hemodynamic stability, need for supplemental analgesia and requirement for conversion to general anesthesia. Postoperative outcomes including duration of analgesia and anesthesia-related complications such as hypotension, bradycardia, nausea, vomiting, post-dural puncture headache and nerve-related symptoms were recorded using a structured data collection sheet.

Data were analyzed using Statistical Package for the Social Sciences version 25. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequency and percentage.

3. RESULTS

Table 1. Socio-Demographic and Clinical Characteristics of the Study Population (n = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–30	41	20.5
	31–45	68	34
	46–60	56	28
	>60	35	17.5
Sex	Male	128	64
	Female	72	36
ASA Physical Status	ASA I	78	39
	ASA II	92	46
	ASA III	30	15
Comorbidities	None	96	48
	Hypertension	58	29
	Diabetes Mellitus	34	17
	Others	12	6

Table 1 shows the socio-demographic and clinical characteristics of the study population comprising 200 patients undergoing lower limb orthopedic surgeries under regional anesthesia. The majority of patients were aged between 31–45 years (34%), followed by the 46–60 years age group (28%), while patients aged over 60 years constituted 17.5% of the study population. Male patients predominated, accounting for 64% of cases.

Most participants belonged to ASA physical status II (46%), followed by ASA I (39%), indicating that a large proportion had mild systemic disease. Nearly half of the patients (48%) had no associated comorbidities, whereas hypertension (29%) and diabetes mellitus (17%) were the most common existing medical conditions observed among the study population.

Table 2. Distribution of Lower Limb Orthopedic Procedures and Regional Anesthesia Techniques Used (n = 200)

Variable	Category	Frequency (n)	Percentage (%)
Type of Surgery	Femur fracture fixation	61	30.5
	Tibial fracture fixation	54	27
	Knee procedures	49	24.5
	Ankle/foot surgery	36	18
Regional Anesthesia Technique	Spinal anesthesia	144	72
	Epidural anesthesia	18	9
	Combined spinal-epidural	12	6
	Peripheral nerve block	26	13

Table 2 presents the distribution of lower limb orthopedic procedures performed and the regional anesthesia techniques used in the study. Femur fracture fixation was the most frequently performed surgery, accounting for 30.5% of cases, followed by tibial fracture fixation (27%) and knee procedures (24.5%). Spinal anesthesia was the most commonly utilized regional

anesthesia technique, used in 72% of patients, while epidural anesthesia and combined spinal-epidural anesthesia were employed in 9% and 6% of cases, respectively. Peripheral nerve blocks were administered in 13% of patients, reflecting a selective use of nerve block techniques based on surgical requirements and patient suitability.

Table 3. Efficacy of Regional Anesthesia Techniques (n = 200)

Parameter	Outcome	Frequency (n)	Percentage (%)
Adequate sensory block	Yes	184	92
	No	16	8
Adequate motor block	Yes	176	88
	No	24	12
Hemodynamic stability	Maintained	168	84
	Unstable	32	16
Supplemental analgesia required	Yes	38	19
	No	162	81
Conversion to GA	Yes	8	4
	No	192	96

Table 3 illustrates the efficacy outcomes of regional anesthesia techniques among the 200 patients included in the study. Adequate sensory block was achieved in the majority of cases (92%), while adequate motor block was observed in 88% of patients. Hemodynamic stability was

maintained intraoperatively in 84% of the study population, whereas 16% experienced some degree of instability. Supplemental analgesia was required in 19% of patients and conversion to general anesthesia was necessary in only 4% of cases.

Table 4. Anesthesia-Related Complications and Postoperative Analgesic Outcomes (n = 200)

Variable	Outcome	Frequency (n)	Percentage (%)
Hypotension	Present	36	18
	Absent	164	82
Bradycardia	Present	22	11
	Absent	178	89
Nausea/Vomiting	Present	28	14
	Absent	172	86
Post-dural puncture headache	Present	14	7
	Absent	186	93
Prolonged postoperative analgesia (>6 hrs)	Yes	146	73
	No	54	27

Table 4 summarizes the anesthesia-related complications and postoperative analgesic outcomes observed in the study population. Hypotension was the most common complication, occurring in 18% of patients, followed by nausea and vomiting in 14% and bradycardia in 11% of cases. Post-dural puncture headache was reported in a relatively small proportion of patients (7%). Notably, prolonged postoperative analgesia lasting more than six hours was achieved in 73% of patients, while only 27% required additional analgesia within six hours.

4. DISCUSSION

The present study evaluated the efficacy and safety of regional anesthesia techniques in lower limb orthopedic surgeries among Bangladeshi patients and demonstrated a high overall success rate with acceptable complication profiles. The predominance of middle-aged adults and male patients in our study reflects the demographic pattern commonly observed in orthopedic trauma in South Asia, which is largely attributed to road traffic accidents and occupational injuries. Similar demographic trends have been reported by Kamel et al., who highlighted the high utilization of regional anesthesia in working-age male populations undergoing orthopedic procedures [1]. Spinal anesthesia was the most frequently used regional technique in our study (72%), which is consistent with routine practice in resource-limited settings due to its cost-effectiveness, rapid onset and reliable block characteristics. Sachdeva et al. emphasized that spinal anesthesia remains the backbone of regional anesthesia for lower limb surgeries in

many developing countries, particularly where infrastructure and ultrasound availability may be limited [12]. The selective use of epidural, combined spinal-epidural (CSE) and peripheral nerve blocks in our cohort aligns with recommendations that technique choice should be guided by surgical duration, patient comorbidities and anesthesiologist expertise.

The efficacy outcomes observed in our study were notably favorable, with adequate sensory block achieved in 92% and adequate motor block in 88% of patients. These findings are comparable to those reported by Mahajan et al., who demonstrated high block success rates with commonly used intrathecal local anesthetics for lower limb surgeries [13]. The low rate of conversion to general anesthesia (4%) in our study further supports the reliability of regional anesthesia techniques when appropriately selected and administered. Ciudad et al. similarly reported low conversion rates and high satisfaction with combined spinal-epidural anesthesia in lower extremity surgeries, emphasizing its role in maintaining surgical conditions over prolonged procedures [14].

Hemodynamic stability was maintained in 84% of our patients, while 16% experienced some degree of instability, primarily hypotension and bradycardia. These findings are in line with established physiological effects of neuraxial anesthesia. Ramdev et al. reported comparable rates of hypotension in patients receiving epidural-based techniques for lower limb orthopedic surgeries [15]. The hypotension rate of 18% observed in our study is considered

acceptable and was effectively managed with standard intraoperative measures, supporting the overall safety of these techniques.

Postoperative analgesic outcomes were particularly encouraging, with 73% of patients experiencing prolonged analgesia lasting more than six hours. Hussain et al., in their network meta-analysis, emphasized the superior postoperative analgesic benefits of regional anesthesia techniques compared to systemic analgesia, especially in knee and ligament surgeries [16]. Our findings reinforce the role of regional anesthesia in reducing early postoperative pain and minimizing opioid requirements, which is particularly relevant in settings where postoperative pain services may be limited.

The incidence of anesthesia-related complications in our study was relatively low. Post-dural puncture headache occurred in only 7% of patients, which is comparable to rates reported in similar studies from low- and middle-income countries. Bajuri et al. highlighted that careful patient selection and adherence to standard techniques significantly reduce complication rates, even when advanced equipment is not universally available [17]. Importantly, no serious neurological complications were observed in our cohort, underscoring the safety of regional anesthesia when practiced by trained personnel.

Overall, the findings of this study are consistent with current international literature and demonstrate that regional anesthesia techniques are highly effective and safe for lower limb orthopedic surgeries in the Bangladeshi context. As noted by Çakmakkaya et al., strengthening training and standardization in orthopedic anesthesia can further improve outcomes [18]. The results of our study provide locally relevant evidence supporting wider adoption and optimization of regional anesthesia techniques in tertiary care hospitals across Bangladesh.

5. LIMITATIONS OF THE STUDY

This study has several limitations that should be considered when interpreting the findings. Being a single-center observational study, the results may not be generalizable to all healthcare settings in Bangladesh, particularly rural or resource-limited hospitals. The choice of regional anesthesia technique and anesthetic drugs was based on individual anesthesiologist preference rather than randomization, which may have introduced selection bias. Additionally, long-

term postoperative outcomes, patient satisfaction scores and functional recovery were not assessed, which could have provided a more comprehensive evaluation of the efficacy of regional anesthesia techniques.

6. CONCLUSION

Regional anesthesia techniques demonstrated high efficacy and an acceptable safety profile in patients undergoing lower limb orthopedic surgeries at a tertiary care hospital in Bangladesh. The high rates of adequate sensory and motor blockade, low conversion to general anesthesia and prolonged postoperative analgesia highlight the effectiveness of these techniques in routine clinical practice. Regional anesthesia should be encouraged as a primary anesthetic approach for lower limb orthopedic surgeries, particularly in resource-constrained settings, with appropriate patient selection and skilled anesthetic management.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

- [1] Kamel I, Ahmed MF, Sethi A. Regional anesthesia for orthopedic procedures: What orthopedic surgeons need to know. *World journal of orthopedics*. 2022 Jan 18;13(1):11.
- [2] Hasoon J, Nguyen A. Regional Anesthesia for Orthopedic Surgeries: A Guide for Upper and Lower Extremity Procedures. *Orthopedic Reviews*. 2025 Mar 31;17:133570.
- [3] Singh A, Boparai M, Singh+ A. Anesthetic Approaches for Postoperative Pain Management in Lower Extremity Orthopedic Surgery: A Comprehensive Review. *Extremitas Journal of Lower Limb Medicine*.:51.
- [4] Stinson Z, Ghattas YS, Crepeau A, Oei BM, Gammerman S, Finkel K, Mathew E, Vander Have K. Regional and local anesthesia in pediatric orthopaedic surgery. *Journal of the Pediatric Orthopaedic Society of North America*. 2022 Nov 1;4(4):579.
- [5] Albaqami MS, Alqarni AA. Efficacy of regional anesthesia using ankle block in ankle and foot surgeries: a systematic review. *European Review for Medical & Pharmacological Sciences*. 2022 Jan 15;26(2).
- [6] Fisher ND, Bi AS, Umeh UO, Vaz AM, Egol KA. Regional anesthesia for acute and subacute orthopedic trauma: a review. *Health Sciences Review*. 2022 Sep 1;4:100031.
- [7] Douleh DG, Chambers L, Parry JA. The effect of regional anesthesia blocks on post-operative

- pain after ambulatory orthopedic trauma surgery. *European Journal of Orthopaedic Surgery & Traumatology*. 2022 Aug; 32 (6) : 1201-6.
- [8] McLennan L, Haines M, Graham D, Sullivan T, Lawson R, Sivakumar B. Regional Anesthesia in Upper-Limb Surgery. *Annals of Plastic Surgery*. 2023 Jul 1;91(1):187-93.
- [9] Deemer AR, Ganta A, Leucht P, Konda S, Egol KA. Regional anesthesia is safe and effective for low-energy tibial plateau fractures. *Orthopedics*. 2023 Nov 1;46(6):358-64.
- [10] Aytolign HA, Mersha AT, Ferede YA. Analgesic efficacy of posterior and anterior psoas compartment block: Lumbar plexus versus three-in-one nerve block after lower limb orthopedic surgery under spinal anesthesia: A prospective cohort study. *Annals of Medicine and Surgery*. 2022 Jan 1;73:103160.
- [11] Martineau J, Guillier D, Maruccia M, Guiotto M, Borens O, Raffoul W, di Summa PG. Locoregional anesthesia for post-operative pain management in microsurgical reconstruction of the lower extremities: a retrospective study. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2022 Sep 1;75(9):3190-6.
- [12] Sachdeva A, Ahmed N. Advances in Regional Anesthesia: Techniques, Efficacy and Postoperative Pain Management. *Medical Letter*. 2025 Jun 28;2:11-6.
- [13] Mahajan HM, Patel SJ. To compare the efficacy of intrathecal 0.75% heavy ropivacaine and 0.5% heavy bupivacaine for lower abdominal and lower limb surgery. *Asian Journal of Medical Sciences*. 2023 Sep 1;14(9):58-63.
- [14] Ciudad P, Escandón JM, Manrique OJ, Escobar H, Mago BP, Malca AA. Efficacy of Combined Spinal–Epidural Anesthesia for Lower Extremity Microvascular Reconstruction. *Journal of Surgical Research*. 2023 Nov 1;291:700-10.
- [15] Ramdev B, Gopal T, Sharma DK. Safety and efficacy of patient controlled epidural analgesia versus conventional epidural analgesia in lower limb orthopedic surgeries: a prospective randomized study. *Ain-Shams Journal of Anesthesiology*. 2023 Jun 16;15(1).
- [16] Hussain N, Brull R, Vannabouathong C, Speer J, Lagnese C, McCartney CJ, Abdallah FW. Network meta-analysis of the analgesic effectiveness of regional anaesthesia techniques for anterior cruciate ligament reconstruction. *Anaesthesia*. 2023 Feb;78(2):207-24.
- [17] Bajuri MY, Saidfudin NS, Mazli N, Azriq NA, Azemi AF. Safety of wide-awake local anesthesia with no tourniquet (WALANT) in for lower limb surgery: A potential alternative in times of emergency. *Frontiers in Surgery*. 2022 Sep 9;9:848422.
- [18] Çakmakkaya ÖS, Jaremko KM, Kitapçioğlu D, Wolpaw J. Orthopedic Anesthesia Training: A Narrative Review on Program Development. *Current Anesthesiology Reports*. 2024 Dec 26;15(1):4.

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