Section: Anesthesia

Original Research Article

A COMPARATIVE STUDY OF USG GUIDED SCIATIC NERVE BLOCK USING 0.5% BUPIVACAINE WITH CLONIDINE VERSUS 0.75% ROPIVACAINE WITH CLONIDINE

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ABSTRACT

Background: Sciatic nerve blocks play a vital role in providing effective perioperative analgesia for lower limb surgeries. The use of ultrasound guidance has improved precision, safety, and success rates in regional anesthesia. Selecting an optimal local anesthetic combination is essential to achieve rapid onset, prolonged analgesia, and minimal adverse effects. This study compares two commonly used anesthetic combinations to determine their relative efficacy and safety profiles. **Aims and Objectives:** The study aimed to compare the onset time, duration of analgesia, overall analgesic efficacy, and safety profile of 0.5% Bupivacaine with Clonidine versus 0.75% Ropivacaine with Clonidine when used for ultrasound-guided sciatic nerve blocks in patients undergoing lower limb surgery. **Materials and Methods:** This randomized controlled trial included 60 patients scheduled for elective lower limb surgeries. Participants were randomly assigned into two equal groups: Group B (Bupivacaine + Clonidine) and Group R (Ropivacaine + Clonidine). Ultrasound-guided sciatic nerve blocks were performed under standardized conditions. Parameters assessed included onset time of sensory block, duration of analgesia, Visual Analog Scale (VAS) scores, motor block using the Modified Bromage scale, autonomic effects, and any adverse events. Data were analyzed statistically. **Results:** The Ropivacaine plus Clonidine group demonstrated a significantly faster onset of analgesia compared to the Bupivacaine group ($p < 0.05$). However, Bupivacaine with Clonidine provided a significantly longer duration of analgesia ($p = 0.0107$). VAS scores, motor block characteristics, autonomic effects, and incidence of adverse events were comparable between groups. **Conclusion:** Ropivacaine with Clonidine offers a quicker onset of analgesia, whereas Bupivacaine with Clonidine provides prolonged postoperative pain relief. Both combinations are safe, effective, and suitable for lower limb surgeries, enabling clinicians to tailor anesthetic choice according to surgical duration and patient requirements.

Keywords: Sciatic nerve block, Ultrasound-guided, Bupivacaine, Ropivacaine, Clonidine.

INTRODUCTION

Peripheral nerve blocks have become fundamental to modern regional anesthesia because they provide effective site-specific analgesia, reduce perioperative opioid requirements, and promote enhanced postoperative recovery. Among these techniques, the sciatic nerve block is particularly important due to its extensive sensory and motor innervation of the lower limb, making it highly suitable for foot, ankle, distal leg, and various orthopedic procedures, as well as certain chronic pain interventions.[1] Depending on the anatomical region involved, the sciatic nerve block may be performed alone or combined with other regional techniques such as a lumbar plexus block to achieve comprehensive anesthesia. Distal

lower limb surgeries often require only a sciatic block, whereas more proximal or extensive procedures may necessitate combined approaches to ensure adequate coverage.[2]

Despite its widespread use, careful patient selection remains essential. Absolute contraindications include patient refusal and infection at the injection site, while relative contraindications such as coagulopathy, systemic infection, or pre-existing neurological deficits require individualized risk–benefit assessment. Although generally safe, complications such as hematoma, nerve injury, local infection, or systemic local anesthetic toxicity may occur. The adoption of ultrasound guidance has significantly reduced these risks by enabling real-time visualization of neural structures, needle trajectory, and spread of anesthetic solution, thereby enhancing procedural precision and safety.[3]

A thorough understanding of sciatic nerve anatomy, originating from the L4–S3 nerve roots of the sacral plexus, is crucial for effective blockade. Various approaches—including transgluteal, subgluteal, anterior, and popliteal—allow flexibility based on surgical site, patient positioning, and perioperative considerations such as tourniquet application or anticipated motor blockade. These anatomical and technical factors influence block success and clinical outcomes.[4]

Optimizing local anesthetic selection remains central to improving analgesic quality and safety in sciatic nerve blockade. Bupivacaine and ropivacaine are long-acting amide anesthetics commonly used for lower limb blocks, yet they differ in potency, motor blockade characteristics, and cardiotoxic potential. Bupivacaine produces dense sensory and motor blockade with prolonged duration, whereas ropivacaine provides comparable analgesia with relatively less motor impairment and a more favorable safety profile. The addition of clonidine, an α2-adrenergic agonist, enhances and prolongs analgesia by modulating nociceptive transmission and inhibiting norepinephrine release, thereby improving block quality and reducing postoperative analgesic requirements.[5]

Ultrasound-guided comparison of 0.5% bupivacaine with clonidine and 0.75% ropivacaine with clonidine is clinically relevant for refining perioperative pain strategies. Ultrasound not only increases block accuracy but also allows individualized dosing and minimizes inadvertent intravascular or intraneural injection . Bupivacaine's greater potency may provide more profound anesthesia suitable for prolonged or immobilizing procedures,[6] while ropivacaine's differential sensory-motor blockade may facilitate earlier postoperative mobilization. Clonidine as an adjuvant is hypothesized to prolong block duration, stabilize hemodynamics, and reduce systemic analgesic consumption.[7]

Ambika B. 2017, evaluated these agents independently or without consistent use of adjuvants, leaving limited comparative evidence regarding their combined use under ultrasound guidance.[8] Understanding pharmacodynamic interactions between local anesthetics and clonidine is essential, particularly in high-risk patients where balancing efficacy with safety is critical. By systematically comparing onset time, duration, quality of sensory and motor block, and adverse effects, such investigations provide evidence-based guidance for anesthetic selection.[9]

Overall, ultrasound-guided sciatic nerve block represents a versatile and effective modality for lower limb anesthesia. Comparative evaluation of bupivacaine–clonidine and ropivacaine–clonidine combinations offers valuable insights into optimizing analgesic duration, onset characteristics, and safety profiles. Integrating anatomical knowledge, pharmacologic principles, and ultrasound technology strengthens clinical decision-making and enhances perioperative outcomes while minimizing opioid reliance.[10,11]

The aim of this study is to compare the efficacy, duration, and safety of ultrasound-guided sciatic nerve block using 0.5% Bupivacaine with Clonidine versus 0.75% Ropivacaine with Clonidine. The objectives are to assess the onset time of analgesia for each anesthetic combination, evaluate the effect of the block between the two combinations in lower limb surgeries, determine the duration of analgesia provided by each combination, and compare the side effects and overall safety profile of both anesthetic regimens.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Anaesthesia, Rajshree Medical Research Institute, Bareilly, U.P. from March 2024 to March 2025. Ethical approval has been obtained from the Ethical Approval Committee of Rajshree Medical Research Institute, Bareilly, U.P.

Study Population

The study population comprised 60 adult patients, with 30 allocated to each group, undergoing elective unilateral lower limb surgery to compare ultrasound-guided sciatic nerve block using 0.5% Bupivacaine with Clonidine versus 0.75% Ropivacaine with Clonidine. Eligible participants were aged ≥18 years, classified as ASA I–III, suitable for sciatic nerve block analgesia, and able to provide informed consent. Patients were excluded for drug hypersensitivity, infection, sepsis, coagulopathy, neurological deficits, chronic opioid use, significant vascular disease, pregnancy, severe psychiatric illness, BMI >40 kg/m², or communication barriers.

Data Analysis: Data were collected by a blinded research assistant using structured case report forms, recording demographic details, baseline vitals, ASA status, and surgical type. Primary outcomes included onset and duration of sensory analgesia, while secondary outcomes comprised motor and autonomic block characteristics, serial VAS scores, rescue analgesic consumption, hemodynamic parameters,

and adverse events over 24 hours. Statistical analysis was performed using SPSS v28 under intention-to-treat principles, applying appropriate parametric or nonparametric tests, repeated-measures ANOVA, correlation analysis, and significance set at $p < 0.05$, with strict data confidentiality maintained.

RESULTS

A total of 60 participants were equally randomized into two groups, with 30 patients (50%) receiving Bupivacaine + Clonidine and 30 patients (50%) receiving Ropivacaine + Clonidine, ensuring balanced allocation and minimizing bias. The mean age was 44.47 ± 9.65 years (range 24–64), with a nearly symmetrical distribution around a median of 45 years. Males comprised 58.33% (n=35) and females 41.67% (n=25). The mean weight was 66.61 ± 10.89 kg (range 45–90.7 kg), reflecting moderate variability. BMI distribution showed 43.33% normal weight, 33.33% overweight, and 11.67% each underweight and obese. Surgical procedures were predominantly Achilles tendon repair (33.33%) and calcaneal fixation (26.67%), followed by ankle ORIF (20%), forefoot surgery (10%), foot debridement (11.67%), and tibial IM nailing (8.33%), indicating a representative lower limb surgical cohort.

Drug dosing demonstrated clear variability between anesthetic agents while remaining consistent with the study protocol. Overall, Ropivacaine 0.75% had the highest mean administered dose at 158.31 ± 64.87 mg (range 0–242.6 mg), whereas Bupivacaine 0.5% showed a mean dose of 96.27 ± 49.92 mg (range 0–145.3 mg), reflecting broader clinical variation. Clonidine dosing was comparatively standardized, with a mean of 101.42 ± 19.44 µg (range 60.5–138.7 µg). Group-wise distribution confirmed protocol adherence, with the Bupivacaine + Clonidine group receiving a mean Bupivacaine dose of 130.65 ± 10.62 mg and Clonidine 103.61 ± 18.54 µg, while the Ropivacaine + Clonidine group received a mean Ropivacaine dose of 186.62 ± 20.31 mg and Clonidine 99.23 ± 20.13 µg, with no cross-administration of local anesthetics. Dose categorization showed that moderate dosing was most common across all drugs, observed in 60% of Bupivacaine cases, 50% of Ropivacaine cases, and 65% of Clonidine cases. High-dose usage remained limited (6.7% for Bupivacaine, 20% for Ropivacaine, and 15% for Clonidine), while low-dose administration was relatively uncommon except for Bupivacaine (33.3%). Overall, the dosing patterns reflected individualized anesthetic planning tailored to surgical complexity and patient characteristics while maintaining safety and protocol consistency.

Table 1: Comparison of Onset Time of Analgesia between Study Groups

Study Group	n	Mean Onset Time ± SD (minutes)
Bupivacaine + Clonidine (R)	60	13.42 ± 2.45
Ropivacaine + Clonidine (Rop)	30	12.39 ± 2.20
t-test p-value :0.048		

Ropivacaine + Clonidine showed a slightly faster onset of analgesia (12.39 ± 2.20 minutes, n=30) compared to Bupivacaine + Clonidine (13.42 ± 2.45 minutes, n=60), with the difference being statistically significant ($p = 0.048$). Although the time difference was small, Ropivacaine combination may provide a marginally earlier analgesic effect in clinical practice. Preoperative pain assessment revealed a mean VAS score of 5.22 ± 1.06 (median 5.2; range 3.1–7.7), indicating that most participants entered the study with moderate discomfort and a reasonably symmetrical distribution of baseline pain levels. Categorization showed that 76.67% of patients experienced moderate pain (VAS 4–6) and 23.33% reported severe pain (VAS 7–10), while none had mild pain, confirming a clinically significant baseline suitable for evaluating analgesic efficacy. The mean time to onset of analgesia was 13.36 ± 2.32 minutes (median 13.30; range 8.0–18.4 minutes), with 56.67% achieving onset within 10.1–14 minutes, 33.33% between 14.1–18 minutes, and only 10% within 10 minutes, demonstrating a consistent and moderately distributed onset profile. Following block administration, pain scores decreased markedly, with a mean post-block VAS of 0.86 ± 0.46 (median 0.8; range 0–2.3), reflecting rapid and uniform analgesic effectiveness. Post-block categorization showed that 88.33% experienced mild pain and 11.67% reported complete pain relief, with no cases of moderate or severe pain, confirming substantial and consistent postoperative analgesia across the cohort.

Table 2: Descriptive Statistics of Onset Time Between Study Groups

Statistic	Bupivacaine + Clonidine (R)	Ropivacaine + Clonidine (Rop)
Mean (min)	13.42	12.39
Median (min)	13.2	12.35
Standard Deviation (SD)	2.45	2.2
Range (min)	8.0 – 18.4	8.0 – 17.1

Ropivacaine + Clonidine demonstrated a slightly faster and more consistent onset of analgesia (mean 12.39 min, median 12.35, SD 2.20, range 8.0–17.1) compared to Bupivacaine + Clonidine (mean 13.42 min, median 13.2, SD 2.45, range 8.0–18.4). Overall, the Ropivacaine regimen showed a narrower variability and more predictable onset profile.

Comparison of onset time between groups demonstrated that the Ropivacaine + Clonidine group achieved significantly faster analgesia (12.39 ± 2.20 minutes; range 8–17.1) compared to the Bupivacaine + Clonidine group (14.45 ± 2.26 minutes; range 9.7–18.4), with a mean difference of 2.06 minutes that was statistically significant ($p < 0.01$). Categorical analysis further supported this finding, as more patients in the Ropivacaine group achieved onset within ≤10 minutes (16.67% vs. 3.33%), while delayed onset (>15 minutes) was more common in the Bupivacaine group (46.67% vs. 13.33%), with a significant association between anesthetic type and onset distribution ($\chi^2 = 9.22$, $p \approx 0.01$). Postoperative VAS trends showed that both groups experienced excellent early analgesia at 1 hour (0.87 vs. 0.83), with pain scores remaining low up to 6 hours and nearly identical values at 4 hours (1.56 in both groups). After 6 hours, pain gradually increased in both groups, with slightly lower scores in the Ropivacaine group at 6 hours but higher scores at 12 and 24 hours, suggesting a somewhat earlier decline in analgesic duration compared to Bupivacaine. However, comparisons of mean VAS scores at all measured time points (1, 2, 4, 6, 12, and 24 hours) showed no statistically significant differences (all $p > 0.05$). Overall, Ropivacaine with Clonidine provided a significantly faster onset of analgesia, while both combinations demonstrated comparable postoperative pain control over 24 hours, with gradual waning of effect over time.

Table 3: Frequency Distribution of Adverse Events in Each Group

Adverse Event	Group	Yes (n, %)	No (n, %)
Nausea	R	6 (20.0%)	24 (80.0%)
	Rop	5 (16.7%)	25 (83.3%)
Vomiting	R	1 (3.3%)	29 (96.7%)
	Rop	1 (3.3%)	29 (96.7%)
Hypotension	R	4 (13.3%)	26 (86.7%)
	Rop	5 (16.7%)	25 (83.3%)
Bradycardia	R	7 (23.3%)	23 (76.7%)
	Rop	6 (20.0%)	24 (80.0%)
Dizziness	R	7 (23.3%)	23 (76.7%)
	Rop	8 (26.7%)	22 (73.3%)
Headache	R	5 (16.7%)	25 (83.3%)
	Rop	2 (6.7%)	28 (93.3%)

Adverse events were comparable between groups, with similar rates of nausea (20% vs. 16.7%), vomiting (3.3% each), hypotension (13.3% vs. 16.7%), bradycardia (23.3% vs. 20%), and dizziness (23.3% vs. 26.7%) in Bupivacaine and Ropivacaine groups respectively, while headache was more frequent with Bupivacaine (16.7% vs. 6.7%). Overall, both regimens were well tolerated with mild and manageable side effects and no major safety concerns.

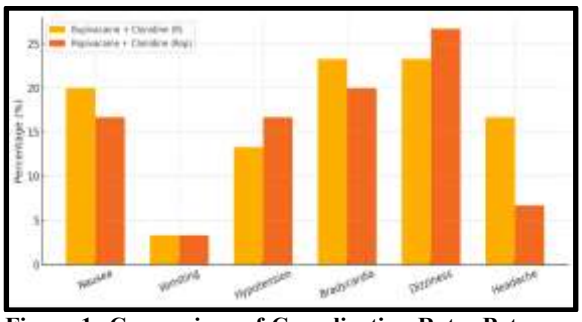

Figure 1: Comparison of Complication Rates Between Groups

Complication rates were similar between groups, with no significant differences in nausea, vomiting, hypotension, bradycardia, or dizziness (all $p = 1.00$), indicating comparable safety profiles. Although headache was more frequent with Bupivacaine (16.7% vs. 6.7%), this difference was not statistically significant ($p = 0.42$), and overall both regimens were well tolerated.

The cumulative adverse event profile was comparable between groups, with a slightly lower burden observed in the Ropivacaine + Clonidine group, where 46.7% of patients experienced no adverse events compared to 40% in the Bupivacaine + Clonidine group, while at least one adverse event occurred in 53.3% and 60% of patients, respectively; multiple symptoms (≥2) were reported in 16.7% of the Ropivacaine group versus 23.3% of the Bupivacaine group, and total recorded symptoms were marginally lower with Ropivacaine (27 vs. 30). Baseline physiological parameters including heart rate, systolic and diastolic blood pressure, mean arterial pressure, and oxygen saturation were nearly identical between groups, with negligible mean differences and no statistically significant variation (all $p > 0.05$), confirming appropriate randomization and physiological comparability prior to intervention. Clinical categorization of onset time using a 15-minute threshold further emphasized the faster action of Ropivacaine + Clonidine, with 86.7% achieving onset within 15 minutes compared to 50% in the Bupivacaine group, while delayed onset (≥15 minutes) was more frequent with Bupivacaine (50% vs. 13.3%), reinforcing the advantage of Ropivacaine in achieving earlier clinically meaningful analgesia.

Table 4: Comparison of Baseline Characteristics Between Study Groups

Variable	Bupivacaine + Clonidine (R) Mean ± SD	Ropivacaine + Clonidine (Rop) Mean ± SD	p-value
Age (years)	44.28 ± 9.39	43.93 ± 8.50	0.8639
Weight (kg)	66.21 ± 10.91	64.62 ± 10.11	0.5054
BMI (kg/m²)	24.19 ± 4.62	23.73 ± 4.64	0.6622
Baseline HR (bpm)	77.38 ± 7.75	76.23 ± 8.66	0.5252
Baseline SBP (mmHg)	126.45 ± 10.29	127.90 ± 11.50	0.5461
Baseline DBP (mmHg)	76.68 ± 7.61	75.70 ± 7.05	0.5556
Baseline MAP (mmHg)	93.38 ± 5.92	93.20 ± 6.03	0.8909

Baseline demographic and physiological characteristics, including age, weight, BMI, heart rate, blood pressure, and mean arterial pressure, were comparable between groups with no statistically significant differences (all $p > 0.05$). This confirms proper randomization and group equivalence prior to intervention, allowing outcome differences to be attributed to treatment effects.

Comparison of block effectiveness demonstrated that Ropivacaine + Clonidine produced a slightly faster onset of analgesia (12.39 ± 2.20 minutes) compared to Bupivacaine + Clonidine (13.42 ± 2.45 minutes), although this difference was not statistically significant ($p = 0.055$), and immediate post-block pain scores were nearly identical (0.83 vs. 0.86; $p = 0.773$), indicating comparable early analgesic efficacy. However, Bupivacaine + Clonidine provided a significantly longer duration of analgesia (718.75 ± 104.97 minutes) than Ropivacaine + Clonidine (663.13 ± 89.22 minutes; $p = 0.0148$), while total 24-hour rescue analgesic consumption remained similar between groups (95.00 ± 34.99 mg vs. 100.83 ± 38.55 mg; $p = 0.473$), suggesting equivalent overall postoperative pain control. VAS score trends over 24 hours showed a gradual increase in pain in both groups with no statistically significant differences at any time point (all $p > 0.05$), reflecting similar analgesic progression profiles. Postoperative complications including nausea, vomiting, hypotension, bradycardia, dizziness, and headache were mild and occurred at comparable frequencies in both groups, with no significant intergroup differences, indicating that both anesthetic combinations were well tolerated and demonstrated similar safety profiles, with Bupivacaine offering longer analgesic duration and Ropivacaine providing a marginally faster onset without compromising efficacy or safety.

The distribution of lower limb surgeries was well balanced between groups, with equal numbers for common procedures such as Achilles tendon repair (8 each), calcaneal fixation (6 each), and tibia IM nailing (3 each), and only minor variations in ankle ORIF, foot debridement, and forefoot surgeries, confirming comparable surgical case mix and procedural complexity. Drug dosing followed protocol-defined allocation, with significant differences in primary local anesthetic use ($p < 0.001$) while Clonidine dosing remained nearly identical between groups ($p = 0.9836$). The timing of block administration was also comparable ($p = 0.8435$), minimizing temporal bias. A significant difference was observed in duration of analgesia, with Bupivacaine + Clonidine providing a longer mean duration (718.75 ± 104.97 minutes; median 707.5; range 481–1004) compared to Ropivacaine + Clonidine (663.13 ± 89.22 minutes; median 682.5; range 481–833), reaching statistical significance ($p = 0.0107$). Analgesia duration did not differ significantly by sex ($p = 0.421$), and although minor variations were noted across surgical types—with slightly longer durations in ankle ORIF and tibia IM nailing and shorter duration in forefoot surgery—the block provided consistently prolonged pain relief exceeding 10 hours across all subgroups. Overall, the findings confirm comparable baseline and procedural factors between groups, with Bupivacaine + Clonidine demonstrating a significantly longer duration of postoperative analgesia while maintaining consistent effectiveness across sexes and surgical categories.

Table 5: Duration vs Type of Surgery

Surgery Type	n	Mean ± SD (min)	p-value
Achilles tendon repair	16	713.25 ± 88.40	
Ankle ORIF	11	743.73 ± 146.84	
Calcaneal fixation	12	733.25 ± 108.43	
Foot debridement	7	704.86 ± 100.89	**0.738** (NS)
Forefoot surgery	8	670.88 ± 86.96	
Tibia IM nailing	6	738.67 ± 91.69	

The duration of postoperative analgesia ranged from 670.88 ± 86.96 minutes in forefoot surgery to 743.73 ± 146.84 minutes in ankle ORIF, with consistently prolonged pain relief across all procedures. However, the differences were not statistically significant ($p = 0.738$), indicating that surgery type did not significantly affect analgesia duration.

Assessment of motor blockade using the sciatic-specific Modified Bromage score showed that complete motor block was achieved in 48 patients (80%), near-complete block in 8 patients (13.33%), and partial block in 4 patients (6.67%), resulting in 80% of patients categorized as having complete motor blockade and 20% as incomplete (scores 1–2),

indicating highly effective sciatic nerve inhibition for lower limb surgery. Autonomic (vasomotor) blockade was also consistently demonstrated, with mean scores of 2.23 ± 0.77 for skin temperature, 2.20 ± 0.55 for capillary refill and vasodilatation, 2.18 ± 0.83 for sudomotor function, and 2.03 ± 0.76 for neuropathic vasodilatation, reflecting significant sympathetic blockade characterized by peripheral vasodilatation, reduced sweating, and temperature elevation. Overall, the findings confirm that the sciatic nerve block technique produced reliable and robust motor as well as autonomic blockade in the majority of patients.

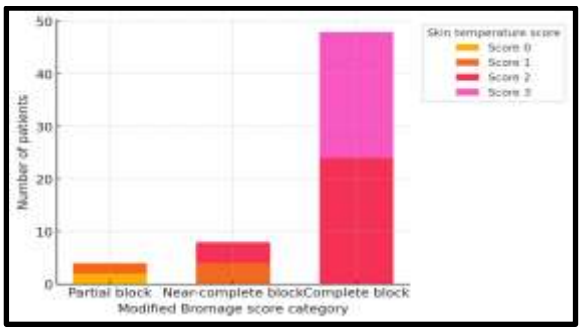

Figure 2: Association between Modified Bromage Score and Skin Temperature Changes

Skin temperature increased progressively with higher Modified Bromage scores, with minimal changes in partial block, moderate elevation in near-complete block, and consistently higher temperature scores (2 and 3) in complete block. This demonstrated a clear positive association between severity of motor block and degree of sympathetic blockade.

Group-wise comparison of motor blockade showed that complete motor block was achieved in 86.67% of patients receiving Bupivacaine + Clonidine and 73.33% of those receiving Ropivacaine + Clonidine, while incomplete block occurred in 13.33% and 26.67% respectively; however, this difference was not statistically significant ($\chi^2 = 0.94$, $p = 0.33$), indicating comparable motor block quality between groups. Autonomic (vasomotor) block parameters, including skin temperature, capillary refill with vasodilatation, sudomotor function, and neuropathic vasodilatation, demonstrated similar mean scores across both groups without clinically meaningful differences, confirming equivalent sympathetic blockade. Analysis of the relationship between Modified Bromage score and onset time of analgesia showed no significant association (ANOVA $p = 0.31$), suggesting that analgesic onset was independent of motor block severity. In contrast, correlation analysis revealed strong and statistically significant positive relationships between motor block severity and autonomic parameters, with correlation coefficients ranging from 0.60 to 0.81 (all $p < 0.001$), indicating that greater motor blockade was consistently associated with more pronounced autonomic blockade. Overall, both anesthetic combinations provided comparable motor and autonomic block quality, with motor block severity closely linked to sympathetic effects but not to onset time of analgesia.

Table 6: Mean Motor and Autonomic Block Scores by Group

Parameter	Group R (Mean ± SD)	Group Rop (Mean ± SD)
Modified Bromage score (0–3)	2.77 ± 0.50	2.70 ± 0.53
Skin temperature score	2.27 ± 0.77	2.20 ± 0.76
Capillary refill / vasodilatation score	2.23 ± 0.55	2.17 ± 0.55
Sudomotor score	2.30 ± 0.83	2.07 ± 0.81
Neuropathic vasodilatation score	2.13 ± 0.76	1.93 ± 0.75

Mean motor and autonomic block scores were comparable between groups, with similar Modified Bromage scores (2.77 ± 0.50 vs. 2.70 ± 0.53) and closely matched skin temperature, capillary refill, sudomotor, and vasodilatation scores. Overall, both anesthetic combinations produced equivalent motor and autonomic blockade without clinically significant differences.

DISCUSSION

Murphy, et. al; 2000, compared the efficacy, pharmacodynamic characteristics, and safety of 0.5% bupivacaine with clonidine and 0.75% ropivacaine with clonidine for ultrasound-guided sciatic nerve block in lower limb orthopedic surgery. Both regimens achieved effective sensory, motor, and autonomic blockade with satisfactory postoperative analgesia. However, ropivacaine combined with clonidine demonstrated a significantly faster onset of sensory block, with a greater proportion of patients attaining effective analgesia within 15 minutes, indicating a clinical advantage when rapid anesthesia is required. In contrast, bupivacaine with clonidine provided a significantly longer duration of postoperative analgesia, which may be beneficial in procedures associated with sustained postoperative pain. Despite this difference in duration, early postoperative visual analog scale (VAS) scores and total 24-hour rescue analgesic consumption were comparable, reflecting equivalent overall analgesic efficacy within a multimodal pain management strategy. Motor and autonomic blockade characteristics were similar between groups, and a positive correlation was observed between motor and sympathetic block intensity. Adverse events were mild, self-limiting, and comparable, confirming favorable safety profiles. Klein, et. al; 1998, included its single-center design, fixed drug concentrations, absence of a non-clonidine control group, subjective

pain assessment, and lack of long-term neurological follow-up.[12,13]

Brummett, et. al; 2009, aligned with prior evidence supporting α2-agonist adjuvants in regional anesthesia. Brummett, et. al; 2009, demonstrated prolonged sensory and motor blockade with α2-agonists in preclinical models without neurotoxicity.[14] McCartney, et. al; 2007, reported that clonidine enhances peripheral nerve block quality and prolongs analgesia with acceptable safety, particularly at doses below 150 µg.[15] Murphy, et. al; 2000, confirmed clonidine's ability to extend analgesia without excessive motor blockade or systemic adverse effects. Our findings extend these observations to sciatic nerve blocks, showing that clonidine enhances both long-acting anesthetics while preserving hemodynamic stability.[12]

Klein, et. al; 1998, evaluated bupivacaine and ropivacaine provides additional context. Klein, et. al; 1998, found similar onset and duration between these agents in brachial plexus blocks without adjuvants,[13] whereas our results demonstrate differentiation when clonidine is added, suggesting that drug–adjuvant interactions significantly influence block characteristics. Casati, et. al; 1999, reported faster onset with ropivacaine but comparable duration to bupivacaine in interscalene blocks,[16] in contrast, our study showed prolonged analgesia with bupivacaine when combined with clonidine, highlighting the influence of block site and adjuvant use. Eroglu, et. al; 2004, observed slightly faster onset with ropivacaine and comparable analgesic effectiveness, while Venkatesh, et. al; 2016, reported longer duration with bupivacaine in supraclavicular blocks,[17,18]

Recent investigations reinforce clonidine's value as an adjunct. Safa, et. al; 2021, demonstrated comparable efficacy between long-acting anesthetics with minimal adverse effects, and confirmed clonidine's ability to prolong analgesia in continuous blocks.[19] Chaudhary, et. al; 2016, showed that α2-agonists significantly extend femoro-sciatic block duration, while it emphasized improved analgesic quality with clonidine in neuraxial and peripheral techniques.[20] Ghose, et. al; 2024, highlighted that adjuvant-enhanced peripheral nerve blocks provide reliable, site-specific analgesia with minimal systemic complications.[21]

Jayakar, et. al; 2025, supported an individualized approach to sciatic nerve blockade. Ropivacaine with clonidine is advantageous when rapid onset is prioritized, whereas bupivacaine with clonidine offers superior analgesic longevity. Both combinations demonstrate safe, predictable, and clinically effective profiles, contributing to optimized perioperative pain management in lower limb surgery.[22]

CONCLUSION

This comparative study assessed ultrasound-guided sciatic nerve block using 0.5% Bupivacaine with Clonidine versus 0.75% Ropivacaine with Clonidine in lower limb orthopedic surgeries. Ropivacaine with Clonidine demonstrated a significantly faster onset of analgesia (12.39 ± 2.20 min vs. 13.42 ± 2.45 min; $p < 0.05$), with more patients achieving block within 15 minutes. However, Bupivacaine with Clonidine provided a longer duration of analgesia (718.75 ± 104.97 min vs. 663.13 ± 89.22 min; $p = 0.0107$). Both regimens showed comparable postoperative pain scores, motor and autonomic blockade, rescue analgesic consumption, and similarly mild, self-limiting adverse effects, confirming equivalent safety and overall efficacy.

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