Section: Anaesthesia

Original Research Article

A RANDOMIZED COMPARATIVE STUDY OF DEXMEDETOMIDINE VERSUS CLONIDINE AS ADJUVANTS TO ROPIVACAINE IN ULTRASOUND-GUIDED SUPRAINGUINAL FASCIA ILIACA BLOCK FOR POSTOPERATIVE ANALGESIA IN ELECTIVE HIP SURGERIES

Nandakishore B R[1], Darshan M S[2], Manasa G[3], Nireeksha R[4]

[1]*Junior Resident, Department of Anaesthesia, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India.*
[2]*HOD, Associate Professor, Department of Anaesthesia, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India.*
[3]*Assistant Professor, Department of Anesthesiology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India.*
[4]*Senior Resident, Department of Emergency Medicine, NH, Bangalore, India.*

Received *: 01/01/2026*
Received in revised form *: 10/01/2026*
Accepted *: 28/01/2026*

Corresponding Author:
Dr. Nandakishore B R,
Junior Resident, Department of Anaesthesia, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India.
Email: nandakishore645@gmail.com

DOI:10.70034/ijmedph.2026.1.478

Source of Support: Nil,
Conflict of Interest: Nonedeclared

Int J Med Pub Health
2026; 16 (1); 2784-2788

ABSTRACT

Background: Effective postoperative analgesia is essential for early mobilization and improved outcomes following hip surgeries. Ultrasound-guided suprainguinal fascia iliaca block has emerged as a reliable regional anesthesia technique for postoperative pain control. The use of α2-adrenergic agonists such as dexmedetomidine and clonidine as adjuvants to local anesthetics has shown promise in prolonging analgesia; however, comparative evidence between these agents remains limited. **Objectives:** To compare dexmedetomidine and clonidine as adjuvants to ropivacaine in ultrasound-guided suprainguinal fascia iliaca block with respect to postoperative analgesia, hemodynamic stability, and sedation profile.

Materials and Methods: This prospective randomized comparative study included 30 patients undergoing elective hip surgeries, divided into two groups of 15 each. Group RD received ropivacaine with dexmedetomidine, while Group RC received ropivacaine with clonidine for ultrasound-guided suprainguinal fascia iliaca block. Duration of analgesia, time to first rescue analgesia, Visual Analogue Scale scores, hemodynamic parameters, and Ramsay Sedation Scores were recorded and analyzed.

Results: Group RD demonstrated a significantly longer duration of analgesia and delayed requirement for rescue analgesia compared to Group RC ($p < 0.001$). Postoperative pain scores at 6 and 12 hours were significantly lower in the dexmedetomidine group. Hemodynamic parameters remained stable and comparable in both groups. Sedation scores were significantly higher in Group RD without any incidence of excessive sedation or respiratory depression.

Conclusion: Dexmedetomidine is a more effective adjuvant than clonidine when combined with ropivacaine in ultrasound-guided suprainguinal fascia iliaca block, providing superior and prolonged postoperative analgesia with stable hemodynamics and optimal sedation in patients undergoing elective hip surgeries.

Keywords: Dexmedetomidine. Clonidine. Suprainguinal fascia iliaca block.

INTRODUCTION

Postoperative pain following hip surgeries is often severe, especially in elderly patients, and if inadequately managed, it can lead to delayed mobilization, increased morbidity, prolonged hospital stay, and higher incidence of cardiopulmonary complications. Effective perioperative analgesia is therefore a cornerstone in the anesthetic management of patients undergoing elective hip surgeries. Regional anesthesia techniques have gained prominence due to their ability to provide site-specific analgesia while minimizing systemic opioid requirements and associated adverse effects.[1]

The fascia iliaca compartment block (FICB) is a well-established regional anesthetic technique that provides analgesia by blocking the femoral nerve, lateral femoral cutaneous nerve, and, variably, the obturator nerve. With the advent of ultrasound guidance, the suprainguinal approach to FICB has been shown to offer more consistent spread of local anesthetic within the iliac fossa, resulting in superior sensory blockade of the anterior, medial, and lateral aspects of the thigh compared to the infrainguinal approach. Ultrasound guidance enhances block accuracy, improves success rates, and reduces complications by allowing real-time visualization of anatomical structures and local anesthetic spread.[2]

Ropivacaine, a long-acting amide local anesthetic and pure S-enantiomer, is commonly used for peripheral nerve blocks due to its favorable safety profile, reduced cardiotoxicity, and ability to provide effective sensory analgesia with minimal motor blockade. However, the duration of analgesia provided by local anesthetics alone may be insufficient in the postoperative period following major orthopedic procedures. To overcome this limitation, various adjuvants have been added to local anesthetics to prolong block duration and enhance analgesic quality.[3]

α2-adrenergic agonists such as clonidine and dexmedetomidine are widely used as adjuvants in regional anesthesia. These agents exert their analgesic effects through both central and peripheral mechanisms, including inhibition of nociceptive neurotransmitter release, hyperpolarization of nerve membranes, and modulation of pain pathways at the spinal and supraspinal levels. Clonidine, a partial α2-agonist, has been shown to prolong the duration of sensory blockade and postoperative analgesia when added to local anesthetics. Dexmedetomidine, a highly selective α2-agonist with greater receptor affinity than clonidine, offers additional benefits such as anxiolysis, sedation, and sympatholysis, while preserving respiratory function.[4]

Aim

To compare the efficacy of dexmedetomidine versus clonidine as adjuvants to ropivacaine in ultrasound-guided suprainguinal fascia iliaca block for postoperative analgesia in elective hip surgeries.

Objectives

1. To compare the duration and quality of postoperative analgesia between the two groups.
2. To evaluate perioperative hemodynamic changes associated with each adjuvant.
3. To assess the sedation profile in patients receiving dexmedetomidine and clonidine.

MATERIALS AND METHODS

Source of Data

The data were collected from patients posted for elective hip surgeries in the Department of Orthopaedics, in collaboration with the Department of Anaesthesiology.

Study Design

This study was conducted as a prospective, randomized, comparative clinical study.

Study Location

The study was carried out in a tertiary care teaching hospital attached to a medical college.

Study Duration

The study was conducted over a period of 12 months, from the date of approval by the Institutional Ethics Committee.

Sample Size

A total of **30 patients** were included in the study and randomly allocated into two groups:

- **Group RD (n = 15):** Ropivacaine + Dexmedetomidine
- **Group RC (n = 15):** Ropivacaine + Clonidine

Inclusion Criteria

- Patients aged 18–70 years
- ASA physical status I and II
- Patients undergoing elective hip surgeries
- Patients willing to provide written informed consent

Exclusion Criteria

- Patient refusal
- Known allergy to local anesthetics or study drugs
- Coagulopathy or bleeding disorders
- Infection at the injection site
- Severe cardiac conduction abnormalities
- Chronic opioid use or neurological disorders

Procedure and Methodology

All patients were evaluated preoperatively and standard fasting guidelines were followed. After shifting to the operating room, routine monitors were applied. Under strict aseptic precautions, ultrasound-guided suprainguinal fascia iliaca block was performed postoperatively using a high-frequency linear probe.

Patients in Group RD received 40 ml of 0.375% ropivacaine with dexmedetomidine 1 µg/kg, while patients in Group RC received 40 ml of 0.375% ropivacaine with clonidine 1 µg/kg. The local anesthetic solution was injected after confirming correct needle placement beneath the fascia iliaca.

Sample Processing

Pain scores were assessed using the Visual Analogue Scale (VAS) at predefined postoperative intervals. Duration of analgesia was defined as the time from block administration to first request for rescue analgesia. Hemodynamic parameters and sedation scores were recorded at regular intervals.

Data Collection

All observations were recorded in a predesigned case record form. Data included demographic variables, duration of analgesia, VAS scores, hemodynamic parameters, and sedation scores.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. Student's t-test and Chi-square test were used as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants (N = 30)

Parameter	Group RC (Clonidine) n = 15	Group RD (Dexmedetomidine) n = 15	Test of significance	95% CI (Mean difference)	p value
Age (years)	58.4 ± 9.6	56.9 ± 10.1	Student's t-test	-5.4 to 2.4	0.54
Gender (Male/Female)	9 / 6	8 / 7	Chi-square		0.71
Weight (kg)	63.2 ± 7.4	64.6 ± 6.9	Student's t-test	-6.1 to 3.3	0.48
Height (cm)	162.8 ± 6.5	164.1 ± 7.1	Student's t-test	-5.9 to 3.3	0.56
BMI (kg/m²)	23.9 ± 2.1	24.2 ± 2.3	Student's t-test	-1.8 to 1.2	0.67
ASA I / II	6 / 9	7 / 8	Chi-square		0.72
Duration of surgery (min)	98.6 ± 14.2	101.3 ± 13.8	Student's t-test	-9.1 to 3.7	0.39

Table 1 shows the comparison of baseline demographic and clinical characteristics between Group RC (clonidine) and Group RD (dexmedetomidine). The mean age of patients was comparable between the two groups (58.4 ± 9.6 years in Group RC vs. 56.9 ± 10.1 years in Group RD; p = 0.54). Gender distribution was similar, with a male predominance in both groups, and no statistically significant difference was observed (p = 0.71). Mean weight, height, and body mass index were also comparable between the groups, with no significant differences noted (p > 0.05 for all). The distribution of ASA physical status I and II patients was similar in both groups (p = 0.72). Additionally, the mean duration of surgery did not differ significantly between Group RC (98.6 ± 14.2 minutes) and Group RD (101.3 ± 13.8 minutes; p = 0.39).

Table 2: Comparison of Postoperative Analgesia Parameters Between Groups

Parameter	Group RC (n = 15)	Group RD (n = 15)	Test of significance	95% CI	p value
Duration of analgesia (min)	600.0 ± 33.3	786.7 ± 34.3	Student's t-test	162.4 to 211.0	<0.001*
Time to first rescue analgesia (min)	598.1 ± 35.6	784.2 ± 36.1	Student's t-test	158.2 to 214.0	<0.001*
Mean VAS at 6 hours	3.6 ± 0.7	2.4 ± 0.6	Student's t-test	-1.7 to -0.6	<0.001*
Mean VAS at 12 hours	4.8 ± 0.8	3.1 ± 0.7	Student's t-test	-2.2 to -1.0	<0.001*
Patients requiring rescue analgesia in 12 hrs n (%)	11 (73.3)	4 (26.7)	Chi-square		0.009*

Statistically significant

Table 2 compares the duration and quality of postoperative analgesia between the two groups. The mean duration of analgesia was significantly longer in Group RD (786.7 ± 34.3 minutes) compared to Group RC (600.0 ± 33.3 minutes), and this difference was statistically highly significant (p < 0.001). Similarly, the time to first request for rescue analgesia was significantly prolonged in Group RD (784.2 ± 36.1 minutes) compared to Group RC (598.1 ± 35.6 minutes; p < 0.001). Pain intensity assessed using the Visual Analogue Scale was significantly lower in Group RD at both 6 hours and 12 hours postoperatively (p < 0.001 for both comparisons). Furthermore, a significantly higher proportion of patients in Group RC required rescue analgesia within the first 12 hours postoperatively compared to Group RD (73.3% vs. 26.7%; p = 0.009).

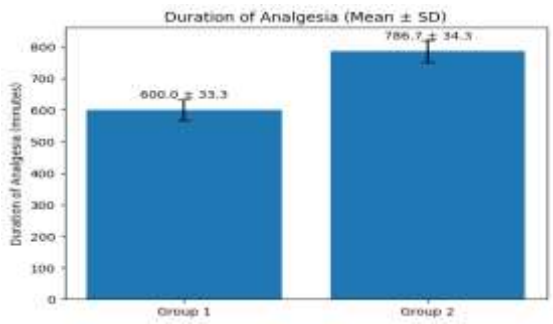

Figure 1: Duration of Analgesia

Table 3: Comparison of Perioperative Hemodynamic Parameters Between Groups

Parameter	Group RC	Group RD	Test of significance	95% CI	p value
Mean pulse rate (beats/min)	76.4 ± 6.1	74.8 ± 5.9	Student's t-test	-1.8 to 4.9	0.31
Mean systolic BP (mmHg)	124.6 ± 8.4	121.9 ± 7.6	Student's t-test	-2.5 to 7.9	0.28
Mean diastolic BP (mmHg)	78.3 ± 6.2	76.5 ± 5.8	Student's t-test	-1.9 to 5.6	0.33
Mean respiratory rate (breaths/min)	16.4 ± 1.2	16.1 ± 1.1	Student's t-test	-0.7 to 1.3	0.52
SpO_2 (%)	98.1 ± 0.7	98.3 ± 0.6	Student's t-test	-0.7 to 0.3	0.41

Table 3 presents the comparison of perioperative hemodynamic parameters between Group RC and Group RD. The mean pulse rate, systolic blood pressure, and diastolic blood pressure were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$ for all). Similarly, mean respiratory rate and oxygen saturation levels remained stable and comparable between the groups throughout the observation period. None of the hemodynamic parameters showed clinically relevant deviations or required intervention.

Table 4: Comparison of Sedation Profile Between Groups (Ramsay Sedation Score)

Parameter	Group RC	Group RD	Test of significance	95% CI	p value
Mean Ramsay score (2 hrs)	2.2 ± 0.4	3.1 ± 0.5	Student's t-test	-1.3 to -0.5	<0.001*
Mean Ramsay score (6 hrs)	2.0 ± 0.3	2.8 ± 0.4	Student's t-test	-1.1 to -0.4	<0.001*
Patients with optimal sedation (RSS ≥3) n (%)	4 (26.7)	11 (73.3)	Chi-square		0.009*
Excessive sedation (RSS >4)	0	0			

Statistically significant

Table 4 compares the sedation profile between the two groups using the Ramsay Sedation Score. Group RD demonstrated significantly higher mean sedation scores at both 2 hours and 6 hours postoperatively compared to Group RC ($p < 0.001$ for both). A significantly greater proportion of patients in Group RD achieved optimal sedation (RSS ≥ 3) compared to Group RC (73.3% vs. 26.7%; $p = 0.009$). Importantly, no patient in either group experienced excessive sedation (RSS > 4).

DISCUSSION

Table 1: Baseline Demographic and Clinical Characteristics: In the present study, baseline demographic and clinical variables such as age, gender distribution, weight, height, body mass index, ASA physical status, and duration of surgery were comparable between Group RC and Group RD, with no statistically significant differences observed. This homogeneity between the two groups ensured that postoperative outcomes could be attributed primarily to the pharmacological effects of clonidine and dexmedetomidine rather than confounding patient-related or surgical factors.

Similar baseline comparability has been reported in several studies evaluating α2-adrenergic agonists as adjuvants in peripheral nerve blocks. Staikou C et al.(2025),[5] reported no significant differences in demographic profiles between clonidine and dexmedetomidine groups in lower limb regional anesthesia. Likewise, studies by Goel C et al.(2021),[4] observed comparable ASA grading and surgical duration, supporting the methodological robustness of randomized comparative designs. The demographic profile of patients undergoing hip surgeries in the present study is also consistent with the elderly population described in orthopedic regional anesthesia literature.

Table 2: Postoperative Analgesia Parameters: The present study demonstrated a significantly longer duration of postoperative analgesia and delayed requirement for rescue analgesia in the dexmedetomidine group compared to the clonidine group. Additionally, pain scores assessed using the Visual Analogue Scale at 6 and 12 hours postoperatively were significantly lower in Group RD. A markedly lower proportion of patients in the dexmedetomidine group required rescue analgesia within the first 12 hours.

These findings are consistent with previous studies reporting superior analgesic efficacy of dexmedetomidine compared to clonidine when used as an adjuvant to local anesthetics. Staikou C et al.(2025),[5] in their meta-analysis, demonstrated that dexmedetomidine significantly prolongs sensory block duration and postoperative analgesia in peripheral nerve blocks. Dost B et al.(2025),[6] reported prolonged analgesia and reduced opioid consumption with dexmedetomidine in fascia iliaca blocks. The enhanced analgesic effect of dexmedetomidine is attributed to its higher α2:α1 selectivity, resulting in greater inhibition of nociceptive transmission at peripheral nerve endings and dorsal horn neurons.

Table 3: Perioperative Hemodynamic Parameters: In the present study, perioperative hemodynamic parameters including heart rate, systolic and diastolic blood pressure, respiratory rate, and oxygen saturation remained stable and comparable between both groups. No episodes of clinically significant bradycardia, hypotension, respiratory depression, or desaturation were observed.

These findings align with studies by Niyonkuru E et al.(2024),[7] who reported hemodynamic stability with low-dose perineural dexmedetomidine and clonidine. Although dexmedetomidine is known for its sympatholytic effects, perineural administration at low doses appears to provide analgesia without causing significant systemic hemodynamic compromise. McEvoy MD et al.(2022),[8] also

reported that perineural dexmedetomidine does not significantly increase the incidence of adverse hemodynamic events compared to clonidine when appropriate dosing is used.

Table 4: Sedation Profile: The sedation profile in the present study revealed significantly higher Ramsay Sedation Scores at 2 and 6 hours postoperatively in the dexmedetomidine group, with a greater proportion of patients achieving optimal sedation (RSS ≥3). Importantly, no patient in either group experienced excessive sedation.

These findings are in agreement with studies by Kim DH et al.(2020),[9] who reported better quality sedation with dexmedetomidine without respiratory depression. The sedative effect of dexmedetomidine is mediated via activation of α2-receptors in the locus coeruleus, producing a state of cooperative sedation resembling natural sleep. Clonidine, being a less selective α2-agonist, provides comparatively less sedation. The absence of oversedation in both groups underscores the safety of both agents when used in appropriate doses. Banks EM et al.(2023).[10]

CONCLUSION

The present randomized comparative study demonstrated that dexmedetomidine is a superior adjuvant to clonidine when combined with ropivacaine for ultrasound-guided suprainguinal fascia iliaca block in patients undergoing elective hip surgeries. Dexmedetomidine significantly prolonged the duration of postoperative analgesia, delayed the time to first rescue analgesic requirement, and provided better quality analgesia as evidenced by lower postoperative pain scores. In addition, dexmedetomidine produced a more favorable sedation profile with higher Ramsay Sedation Scores, offering calm and cooperative sedation without excessive sedation or respiratory depression. Importantly, both dexmedetomidine and clonidine maintained stable perioperative hemodynamics with no clinically significant adverse effects. Therefore, dexmedetomidine can be considered a more effective and safer adjuvant than clonidine for enhancing postoperative analgesia and patient comfort in ultrasound-guided suprainguinal fascia iliaca block for elective hip surgeries.

Limitations of the Study

1. The study was conducted with a relatively small sample size, which may limit the generalizability of the findings.
2. The study was performed at a single tertiary care center, and multicentric trials may provide broader applicability.
3. Long-term outcomes such as chronic pain development and functional recovery were not assessed.
4. Serum levels of dexmedetomidine and clonidine were not measured to correlate systemic absorption with clinical effects.
5. The study focused only on ASA physical status I and II patients; results may differ in high-risk populations.

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