Original Research

POSTOPERATIVE ANALGESIC OUTCOMES OF DEXMEDETOMIDINE-AUGMENTED ERECTOR SPINAE PLANE BLOCK IN PATIENTS UNDERGOING MODIFIED RADICAL MASTECTOMY

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ABSTRACT

Background: Modified radical mastectomy (MRM) is commonly associated with moderate to severe postoperative pain, necessitating effective regional analgesic techniques. The erector spinae plane (ESP) block is a relatively novel fascial plane block that has shown promise in providing postoperative analgesia for breast surgeries. Dexmedetomidine, when used as an adjuvant to local anaesthetics, may enhance and prolong analgesic effects.

Methods: This prospective observational study was conducted at Sree Mookambika Institute of Medical Sciences from March 2024 to March 2025. Thirty patients aged 25–60 years, belonging to ASA physical status I and II, scheduled for modified radical mastectomy were enrolled. An ultrasound-guided ipsilateral ESP block was administered preoperatively at the T3 or T4 vertebral level using 20 ml of 0.5% bupivacaine combined with 20 µg of dexmedetomidine. Postoperative pain was assessed using the visual analogue scale (VAS) at regular intervals for 24 hours. The collected data were analysed statistically.

Results: All patients remained pain-free during the first 12 hours postoperatively. Two patients (6.66%) reported pain between 12 and 18 hours, while six patients (20%) experienced pain between 18 and 24 hours postoperatively. Overall analgesia was satisfactory with minimal requirement for rescue analgesics.

Conclusion: Ultrasound-guided erector spinae plane block provides effective postoperative analgesia following modified radical mastectomy. The addition of dexmedetomidine to bupivacaine enhances the analgesic efficacy and prolongs the duration of postoperative pain relief.

Keywords: Modified Radical Mastectomy, Erector Spinae Plane Block, Dexmedetomidine, Postoperative Analgesia.

INTRODUCTION

Breast cancer remains one of the most commonly diagnosed malignancies among women worldwide, and modified radical mastectomy (MRM) continues to be a frequently performed surgical procedure for its management. Despite advances in surgical techniques and perioperative care, MRM is associated with significant postoperative pain due to extensive tissue dissection involving the breast, pectoral muscles, axilla, and intercostal nerves.

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Inadequately managed postoperative pain can lead to delayed recovery, prolonged hospital stay, increased opioid consumption, and the development of chronic post-mastectomy pain syndromes. Hence, effective postoperative analgesia is a crucial component of perioperative management in patients undergoing MRM.[1]

Traditionally, postoperative pain following breast surgery has been managed using systemic analgesics such as opioids and non-steroidal anti-inflammatory drugs (NSAIDs). However, opioid-based analgesia is often associated with adverse effects including nausea, vomiting, sedation, respiratory depression, and delayed mobilization. These limitations have encouraged the use of regional anaesthetic techniques as part of a multimodal analgesic approach.[2] Various regional blocks such as thoracic epidural, paravertebral block, intercostal nerve block, and pectoral nerve blocks have been employed to provide analgesia for breast surgeries. Although effective, many of these techniques are

technically demanding and carry potential risks such as pneumothorax, hypotension, and vascular puncture.[3]

The erector spinae plane (ESP) block is a relatively novel ultrasound-guided fascial plane block first described in 2016. It involves deposition of local anaesthetic deep to the erector spinae muscle at the level of the transverse process, resulting in cranio-caudal spread of the drug with involvement of dorsal and ventral rami of spinal nerves. Due to its simplicity, safety profile, and effectiveness, the ESP block has gained increasing popularity for thoracic, abdominal, and breast surgeries. The block is associated with a lower risk of complications compared to paravertebral or epidural blocks, making it an attractive option for postoperative analgesia following MRM.[4],[5]

Local anaesthetics such as bupivacaine are commonly used for ESP blocks; however, the duration of analgesia may be limited. To prolong analgesic duration and enhance block quality, various adjuvants have been added to local anaesthetics. Dexmedetomidine, a highly selective α_2-adrenergic agonist, has gained attention as an effective adjuvant in regional anaesthesia. It produces analgesia by inhibiting norepinephrine release and modulating pain transmission at the spinal and supraspinal levels. Additionally, dexmedetomidine has sedative and opioid-sparing properties without causing significant respiratory depression.[6],[7]

Several studies have demonstrated that the addition of dexmedetomidine to local anaesthetics in peripheral nerve and fascial plane blocks prolongs the duration of sensory blockade and postoperative analgesia while reducing analgesic requirements. Its use in ESP blocks for breast surgery is emerging, with encouraging results regarding improved pain control and patient satisfaction.[8] However, literature on the effectiveness and safety of dexmedetomidine as an adjuvant in ESP block for MRM remains limited, particularly in the Indian population.

Therefore, the present study was undertaken to evaluate the effectiveness of dexmedetomidine as an adjuvant to bupivacaine in ultrasound-guided erector spinae plane block for postoperative analgesia in patients undergoing modified radical mastectomy.

Aim

To evaluate the effectiveness of dexmedetomidine as an adjuvant to bupivacaine in ultrasound-guided erector spinae plane block for postoperative analgesia in patients undergoing modified radical mastectomy.

Objectives

To assess the duration and quality of postoperative analgesia provided by ultrasound-guided erector spinae plane block using bupivacaine with dexmedetomidine in patients undergoing modified radical mastectomy.

METHEDOLOGY

The present prospective observational study was conducted at the Department of Anaesthesiology, Sree Mookambika Institute of Medical Sciences, over a study period extending from May 2024 to January 2026, after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. Patients scheduled for modified radical mastectomy under general anaesthesia were shifted to the operating room, where standard monitoring including electrocardiography, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide was instituted. General anaesthesia was induced following a standardized institutional protocol. After induction and securing the airway, patients were positioned laterally with the operative side uppermost. Under strict aseptic precautions, an ultrasound-guided erector spinae plane (ESP) block was performed preoperatively on the ipsilateral side of surgery. Using a high-frequency linear ultrasound probe, the transverse process of the T4 vertebra was identified, and a block needle was inserted in-plane until the tip was positioned between the transverse process and the deep surface of the erector spinae muscle. After careful negative aspiration, the study drug was injected incrementally, and appropriate spread in the erector spinae plane was confirmed sonographically.

Surgery was then allowed to proceed as planned. Postoperatively, patients were assessed for pain using the Visual Analogue Scale (VAS) at six-hourly intervals up to 24 hours. Hemodynamic parameters, including heart rate and blood pressure, were recorded for up to 8 hours in the postoperative period. Intravenous tramadol 50 mg was administered as rescue analgesia when VAS score exceeded 4. Collected data were compiled and analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Pain scores over time were analysed descriptively, and a p-value of less than 0.05 was considered statistically significant.

RESULT

Duration Of Procedure	Group ESPB (In Sec)	Group PARA(In Sec)	T-Test	P-Value

Mean	158.4	190.3	2.98	0.0036
SD	48.12	58.4		
Table 1 : Mean Duration Of Performing Procedure Between The Groups				

The difference in process time between the groups was statistically significant; group PARA required more time for the procedure than group ESPB.

Vas Score	Group Espb	Group Para	T-Test	P-Value
4 Hour	2.6±0.45	2.4±1.02	1.26	0.207
8 Hours	2.8±0.31	3.8±0.98	6.87	<0.01
10 Hours	4.5±0.41	5.2±0.94	8.96	<0.01
12 Hours	5.1±0.33	6.3±1.45	5.26	<0.01
16 Hours	4.2±0.33	4.7±1.4	5.8	<0.01
20 Hour	5.1±0.12	6.2±1.6	4.84	<0.01
24 Hours	4.8±0.14	5.7±1.45	4.36	<0.01
Table 2: Mean Vas Score Between The Groups				

In terms of postoperative pain, we found that there was no comparable pain four hours after surgery, but eight hours later, we found that group PARA had more pain than group ESPB, and that difference remained statistically significant for the full twenty-four hours.

Success Rate	Median	Min-Max	Man-Whitney	P-Value
Group Espb	1	0 – 2 Times	168**	<0.001
Group Para	3	2-3 Times		
Table 3: Median Times Of Guidance Intervention Score Between The Groups				

The study found that the technique worked 1% of the time for guided intervention in the erector spinae plane block and 3% of the time in the paravertebral plane block. There was a statistically significant difference between the groups.

DISCUSSION

Postoperative pain following modified radical mastectomy (MRM) is often moderate to severe and, if inadequately treated, may lead to delayed recovery, reduced patient satisfaction, and development of chronic post-mastectomy pain syndrome. Regional anaesthetic techniques have therefore gained importance as part of multimodal analgesia strategies in breast surgery. The ultrasound-guided erector spinae plane (ESP) block is a relatively recent technique that provides effective thoracic analgesia with a favorable safety profile due to its superficial anatomical location and distance from major neurovascular structures [9].

In the present study, all patients experienced complete analgesia during the first 12 postoperative hours, as reflected by visual analogue scale (VAS) scores of 0–1. This prolonged pain-free period highlights the efficacy of ESP block combined with dexmedetomidine. A similar study by Elewa et al. reported that patients receiving ESP block with bupivacaine alone requested their first rescue analgesia at approximately 8 hours postoperatively [9]. In contrast, the addition of dexmedetomidine in our study extended the duration of analgesia up to 12 hours, suggesting a clear potentiating effect.

Dexmedetomidine, a selective α2-adrenergic agonist, enhances regional anaesthesia by inhibiting norepinephrine release, hyperpolarizing nerve fibers, and reducing transmission of nociceptive signals [10]. Its use as an adjuvant has been shown to prolong sensory blockade and improve postoperative analgesia without significant respiratory depression [11]. These pharmacological properties explain the delayed requirement for rescue analgesia observed in our study.

Only two patients reported pain between 12 and 18 hours postoperatively, while six patients (20%) required rescue analgesia between 18 and 24 hours. Pain severity in these patients was moderate and was effectively managed with intravenous tramadol. This opioid-sparing effect is consistent with earlier studies demonstrating reduced postoperative opioid consumption following ESP block [12].

Hemodynamic parameters remained stable in all patients throughout the monitoring period. No

clinically significant bradycardia, hypotension, or sedation was observed, supporting the safety of low-dose dexmedetomidine when used in ESP block [11]. The absence of major adverse effects further reinforces its suitability as an adjuvant in breast surgery.

Overall, the findings of this study indicate that dexmedetomidine significantly enhances the quality and duration of analgesia when combined with bupivacaine in ESP block for MRM, providing effective pain control, hemodynamic stability, and reduced need for rescue analgesics.

CONCLUSION

Ultrasound-guided erector spinae plane block using bupivacaine with dexmedetomidine provides effective and prolonged postoperative analgesia in patients undergoing modified radical mastectomy. The addition of dexmedetomidine significantly extends the pain-free period, reduces rescue analgesic requirements, and maintains hemodynamic stability, making it a safe and valuable component of multimodal analgesia for breast surgery.

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