

A Preemptive Incision Infiltration with 0.5% Ropivacaine in Patient undergoing Lumbar Laminectomy

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Abstract:

Background: Lumbar laminectomy is a commonly performed procedure in neurosurgical and orthopedic practice. Postoperative pain relief helps in early mobilization, initiation of physiotherapy, provides satisfaction to the patients and plays an important role in reducing the morbidity and mortality. This prospective study investigated the simple technique of instillation of wound with bupivacaine and leaving a contact time of 60 seconds on postoperative pain following lumbar laminectomy.

Methods: 32 ASA I and II patients scheduled for laminectomy were randomly allocated to receive either 20 ml of normal saline (group I) or 0.25% of bupivacaine (group II) into the wound after securing hemostasis. After a dwell time of 60sec the wound was closed in layers without mopping or suctioning. After extubation, the pain scores were evaluated by visual analog scale at every 4 hrs. For 24hrs and also the time for first demand of analgesia, number of analgesic demands and the total amount of analgesia consumed were noted by an independent observer.

Results: The median duration of analgesia in group I was 8.8 [5-11] and in group II 13 [8.5- 16] hrs. with a p=0.04. The number of demands and the amount of analgesia consumed was also statistically significant.

Conclusion: Wound instillation technique is simple, safe and effective in management of acute pain management after lumbar laminectomy and can be used as one among the multimodal armamentarium in pain management.

Keywords: Lumbar Laminectomy, Bupivacaine, Postoperative Pain, Wound Instillation.

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Introduction

Lumbar laminectomy is a widely performed surgical procedure in neurosurgery and orthopedic practice aimed at relieving pressure on the spinal cord or nerves caused by conditions such as spinal stenosis, herniated discs, or tumors. Despite the benefits of the procedure, patients often experience significant postoperative pain, which can impede early mobilization, delay the initiation of physiotherapy, and affect overall patient satisfaction.[1] Effective postoperative pain management is crucial, as it not only improves patient comfort but also plays a vital role in reducing morbidity and mortality. [2]

Recent advancements in understanding the pathophysiology of acute pain have led to the development of various analgesic modalities. Current postoperative pain management strategies include the use of intravenous opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), and the administration of opioids and local anesthetics intrathecally.[3] Additionally, the continuous

infusion of analgesics through epidural or paravertebral catheters has been explored. Regional anesthesia techniques are particularly advantageous as they target pain at or near the site of tissue damage, and when local anesthetics are used, they significantly reduce the need for opioids, thereby minimizing the associated side effects. [4,5] However, these techniques are not without limitations. They may have high failure rates, be costly, technically challenging, and labor-intensive. Moreover, they carry the risk of adverse or toxic effects and procedure-related complications.

An alternative method that has shown promise in managing acute postoperative pain is wound site infiltration with local anesthetics. This technique, though efficient, carries a theoretical risk of wound site infection. Previous studies have demonstrated that the instillation of local anesthetics into the wound can provide effective postoperative analgesia in surgeries such as hernia repair and laparoscopic cholecystectomy. [6,7] Despite its

potential benefits, the role of wound instillation with local anesthetics in lumbar laminectomy has not been extensively studied. The proposed study aims to fill this gap by evaluating the duration and analgesic efficacy of 0.5% Ropivacaine when used for wound instillation following lumbar laminectomy. The hypothesis is that a simple technique of instilling 0.5% Ropivacaine into the wound and allowing a contact time of 60 seconds could significantly alleviate postoperative pain, thereby enhancing patient recovery and satisfaction. [8,9]

Aim and Objectives

To systematically assess the duration of analgesia provided by 0.5% Ropivacaine and to determine its efficacy in managing postoperative pain following lumbar laminectomy.

Material and Methods

The study was conducted at Mamata Medical College in Khammam, Telangana, from March 2023 to March 2024. It was a prospective, randomized, double-blind study, approved by the institutional ethics committee, with informed consent obtained from all participants. A total of 32 patients with ASA physical status I and II, scheduled for single-level lumbar laminectomy, were enrolled. Exclusion criteria included patients requiring instrumentation due to spondylolisthesis or spinal stenosis, those scheduled for multiple or double-site laminectomy, previous lumbar disc surgery, ASA status III-IV, prior neurological deficits, preoperative opioid use, history of substance abuse or steroid use, infection, known allergies to local anesthetics, and patients with

bleeding, cerebrospinal fluid leaks, or needing drain placement after initial recruitment. Patients were randomly assigned to one of two groups of 16 each using computer-generated random numbers. All patients received standard general anesthesia with an appropriately sized endotracheal tube and 1 gram of intravenous paracetamol for intraoperative analgesia. After the surgical procedure was completed and hemostasis was secured, patients in group I received a 20 ml instillation of normal saline in the wound for 60 seconds, while patients in group II received 20 ml of 0.5% Ropivacaine for the same duration. The wound was then closed in layers without mopping or suctioning. Postoperative pain was assessed using a visual analog scale (VAS), ranging from 0 (no pain) to 10 (maximum pain). An independent observer, blinded to the study, recorded pain scores immediately after extubation and every 4 hours for 24 hours. The duration of analgesia was defined as the time from drug instillation to the first request for analgesia. When the pain score exceeded 3, rescue analgesia with diclofenac 75 mg IM was administered, with a lock-out period of 8 hours and a maximum dose of 225 mg in 24 hours. The number of analgesic demands and the total amount of analgesia administered were also recorded.

Result

Demographic data was comparable between the groups. Two patients (one from each group) were excluded due to surgical complications. The median duration of analgesia in group I was 8.8 [5-11] hrs. and in group II 13 [8.5-16] hrs. This was statistically significant with a p 0.04.

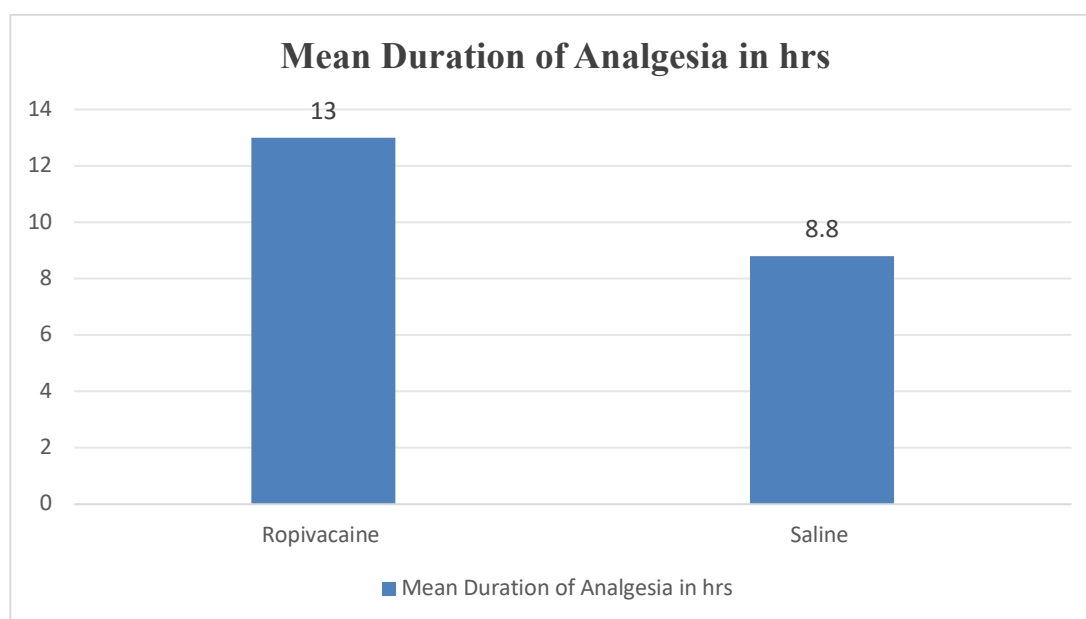


Figure 1: Mean duration of analgesia in both the group

The number of demands and the amount of analgesia consumed was also significantly lower in the group II as compared to group 1 ($p=0.05$). The pain scores were significantly lower in group II at all-time intervals.

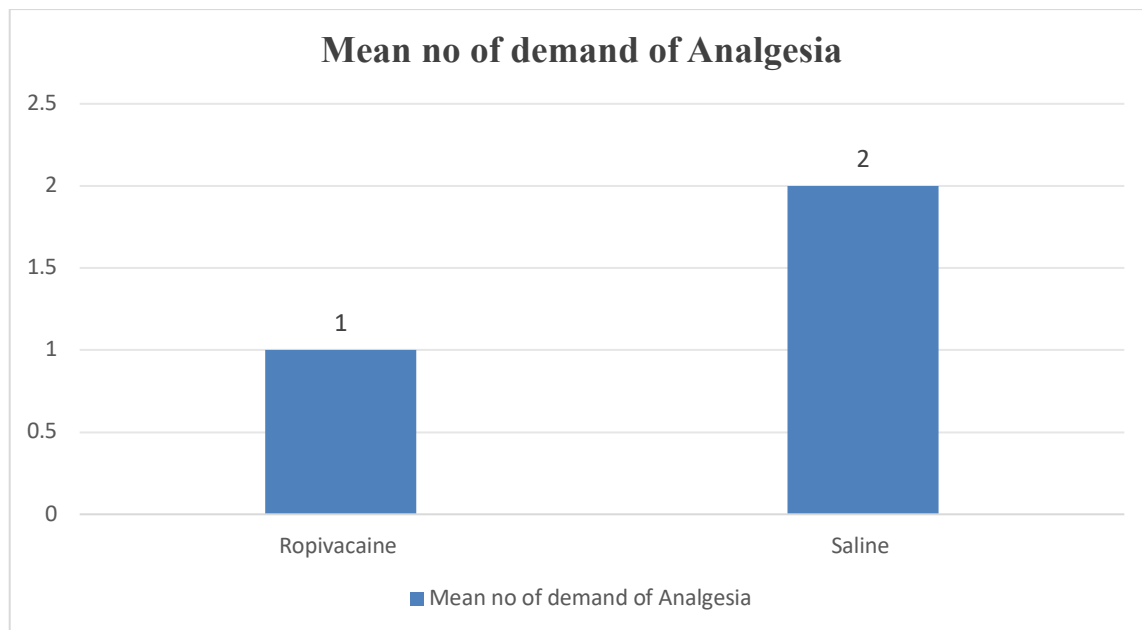


Figure 2: Mean no of Analgesics demand in both the study group

Table 1: Patient characteristics in both the study group

Variable	Group I	Group II	P-value
Age (Years)	40 [30-53]	43.5 [38.2-48.3]	0.579
Weight (Kg)	60 [57-70]	50 [50-60]	0.143
Gender (M/F)	10/5	9/6	
Duration of surgery(Min)	120 [120-187]	90 [60-120]	0.796
Duration of Analgesia(Hrs)	8.8 [5-11]	13 [8.5-16]	0.04*
Number of Demands	2 [1.75-3]	1 [1-1]	0.05*
Amount of Analgesia(mg)	150 [131.5-225]	75	0.05*

Discussion

In this prospective study, results indicated that patients who received a wound instillation of 20 ml of 0.5% Ropivacaine experienced superior postoperative analgesia compared to those who received saline. The study drug was instilled with a dwell time of 60 seconds, and the likely mechanism of pain relief is attributed to the anesthetic effect of Ropivacaine on the pain receptors located in the soft tissues and nerve endings exposed in the wound, from the skin to the dura mater. This includes areas such as the skin, paraspinal muscles, posterior longitudinal ligament, dorsal annulus, facet joint capsule, compressed nerve root, and spinal meninges, all of which are supplied by the recurrent nerve of Von Luschka.

Patients in the Ropivacaine group consistently reported lower pain scores at all measured time points. The duration before the first request for analgesia was significantly longer in the Ropivacaine group, and both the cumulative consumption of rescue analgesics and the number

of analgesic demands within the first 24 hours were notably lower compared to the saline group. The use of wound infiltration with local anesthetics, with or without adjunct drugs, has long been recognized for its effectiveness in providing postoperative analgesia. For instance, a study by Cherian and colleagues [10] demonstrated significant analgesic benefits with bupivacaine wound infiltration following lumbar laminectomy compared to a placebo. The average time before the first analgesic dose was required was substantially longer for the bupivacaine group (807.7 ± 567.6 minutes) compared to the placebo group (181.4 ± 110.1 minutes). Similarly, Milligan et al [11]. Found that patients who received a 10 ml injection of 0.5% bupivacaine into the wound reported lower pain scores and enjoyed a longer duration of analgesia after lumbar discectomy. Furthermore, Hernández-Palazón and colleagues [12] also studied wound infusion of 0.25% bupivacaine, supporting the efficacy of local anesthetics in postoperative pain management. Hernández-Palazón and colleagues [12] conducted a study comparing the effects of 0.25%

bupivacaine and 0.25% ropivacaine instilled into the paraspinal muscle and skin before wound closure following lumbar laminectomy. They found that the mean time until the first request for analgesia was significantly longer in the bupivacaine group (164 ± 53 minutes) compared to the ropivacaine (68 ± 31 minutes) and control groups (38 ± 14 minutes). Continuous wound infusion with ropivacaine has also proven effective following various surgeries, such as spinal instrumentation, iliac crest bone grafts, and shoulder surgery. However, unlike these studies, which typically involve injection, infiltration, or infusion of the local anesthetic, the present study focused on a single-time instillation of Ropivacaine into the laminectomy wound, allowing a dwell time of 60 seconds. This novel approach yielded remarkable analgesia.

Local tissue instillation of Ropivacaine is a straightforward, safe, and cost-effective technique. Peripheral tissue injury triggers both peripheral and central sensitization in the CNS. Central sensitization increases the excitability of spinal cord neurons due to nociceptive afferent inputs, amplifying pain responses. Local anesthetic infiltration blocks C-fiber input to the dorsal horn, potentially inhibiting central sensitization. It also offers additional benefits, such as inhibiting the early inflammatory response (edema, fibrin formation, capillary dilation, leukocyte aggregation) and the late effects (capillary and fibroblast proliferation, collagen formation, and scarring). Effective acute postoperative pain relief has been shown to improve long-term outcomes.

Conclusion

In this study, the median duration of analgesia with ropivacaine instillation was 13 hours, providing high-quality pain relief without side effects typically associated with the spread of local anesthetic to nerve roots or the intrathecal space, which could impact mobility and wound infection rates. The concentration of ropivacaine used (0.5%) primarily caused sensory blockade. Overall, the wound instillation technique proved to be a simple, safe, and effective method for managing acute pain after lumbar laminectomy and could be a valuable addition to the multimodal approach to pain management.

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