ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 02 | February - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE ANALYSIS OF LOCAL INFILTRATION USING LIGNOCAINE ALONE VERSUS LIGNOCAINE COMBINED WITH DEXAMETHASONE ALONG THE SPINAL EPIDURAL NEEDLE PATHWAY FOR PREVENTING BACK PAIN FOLLOWING NEURAXIAL BLOCK IN LOWER LIMB ORTHOPEDIC SURGERIES.

Anaesthesiology

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ABSTRACT

Anaesthetic techniques for orthopaedic surgical procedures include general and regional anaesthesia techniques. Over the past decades, regional anaesthesia has become the anaesthetic technique of choice for many orthopaedic procedures. It entails injecting a local anesthetic solution to disrupt signal transmission in peripheral nerves or spinal nerve roots, which supply sensory and motor functions to the surgical area. Regional anaesthesia can be classified into two categories: Neuraxial anaesthesia which includes spinal, epidural and combined spinal epidural (CSE) techniques, and peripheral nerve blocks which cover both upper and lower extremity blocks. Neuraxial anaesthesia (NA) involves inserting a needle or a catheter between the vertebrae to administer medication into either the epidural space (epidural anaesthesia) or the subarachnoid space (spinal anaesthesia). DL and L these both groups were comparable with regards to mean hemodynamic parameters like pulse rate, systolic and diastolic blood pressure and oxygen saturation [p value > 0.05]. incidence of post-neuraxial back pain was 51.4% in cases of group L as compared to 25.7% in group DL [p value = 0.027], which was significantly reduced in Group DL. Post-operatively mean VAS score was significantly less in group DL as compared to L at 12 hours (2.66 vs 3.2; p value = 0.02).

KEYWORDS

Local infiltration, Combined spinal Epidural, Backpain, Lower limb orthopaedic surgery

INTRODUCTION

Anaesthetic techniques for orthopaedic surgical procedures include general and regional anaesthesia techniques. Over the past decades, regional anaesthesia has become the anaesthetic technique of choice for many orthopaedic procedures. It entails injecting a local anesthetic solution to disrupt signal transmission in peripheral nerves or spinal nerve roots, which supply sensory and motor functions to the surgical area [1].

Regional anaesthesia can be classified into two categories: Neuraxial anaesthesia which includes spinal, epidural and combined spinal epidural (CSE) techniques, and peripheral nerve blocks which cover both upper and lower extremity blocks. Neuraxial anaesthesia (NA) involves inserting a needle or a catheter between the vertebrae to administer medication into either the epidural space (epidural anaesthesia) or the subarachnoid space (spinal anaesthesia) [1].

The problem with spinal anaesthesia is that it interferes with the respiratory and circulatory system. Additionally, if the anaesthesia level is insufficient, intravenous general anaesthetics are the only option to continue the surgery. Moreover, postoperative headaches and back pain can occur after spinal anaesthesia. These complications often cause concern for both anaesthesiologists and surgeons regarding the use of spinal anaesthesia [2].

Epidural anaesthesia offers benefits like minimal interference with the respiratory and circulatory systems, reduced physiological impact, quicker postoperative recovery, and fewer complications [3].

Combined spinal-epidural anaesthesia (CSEA) is a technique that combines a subarachnoid block with the placement of an epidural catheter [4,5]. This method offers the benefits of a rapid onset, effective analgesia, and excellent muscle relaxation, making it a popular choice in orthopaedic surgeries [6]. However, despite its many advantages, the complication of backpain after the block still persists. The very fear of backpain after spinal anaesthesia is one reason for the patient's refusal for neuraxial anaesthesia.

The incidence of backpain after epidural anaesthesia is over 20% [7-10] which indicates that backpain may be associated with tear of muscle fibres or local trauma and/or nerve injury [11,12] caused by the epidural needle leading to aseptic periostitis, tendonitis, ligamentous inflammation and osteochondritis etc. resulting to Lumbar Pain [13,14]. Most major orthopaedic lower limb surgeries are associated with immobilization for more than 2.5 hours [11] often in uncomfortable positions, which can contribute to backpain post spinal epidural anaesthesia. Although backpain is typically localized to lower back, a few studies show the radiation of pain to buttocks[12].

The aim of this study was to compare the efficacy of local infiltration of injection 2% lignocaine and 2% lignocaine with dexamethasone along the spinal epidural pathway, in reducing the post-operative backpain after spinal epidural anaesthesia.

METHODS:

This observational comparative study was done in Department of Anesthesiology, a tertiary health care unit, in western Maharashtra. All the patients aged between 20-60 years belonging to ASA-PS Grade I, II requiring spinal epidural anaesthesia for major orthopaedic lower limb surgeries were included in this study. Any patient with hypersensitivity to local anaesthetics, history of chronic lumbar pain, injury or surgery, use of analgesic or anticoagulant within 2 weeks before surgery, those with psychiatric and CNS disorders, and Pregnant females were excluded from the study.

70 patients were randomly allocated to receive either local 2% lignocaine infiltration (Group L), or 2% lignocaine with dexamethasone infiltration (Group DL) along the spinal epidural pathway.

The patients were then evaluated for backpain using **Visual analogue scale** (VAS), they were explained in detail about VAS where score 0 stands for 'NO PAIN' and score 10 stands for 'WORST PAIN'. They were evaluated on the basis of following question:

1. **When did the patient develop pain, at 12, 24 or 48 hours post-operatively?**

The Study was initiated after approval of institutional ethics committee and written informed consent was taken from the patient in patient's local language.A thorough preoperative evaluation for significant past history or any other related clinical history, systemic general examination and routine laboratory test were done. Patient undergoing major orthopaedic lower limb surgeries were randomly divided into two groups, 35 patients in group L receiving infiltration of injection 2% lignocaine and 35 patients in group DL receiving infiltration of injection 2% lignocaine with dexamethasone along the spinal epidural needle pathway. Lignocaine sensitivity test prior to administration of the drug was done for all the patients undergoing surgery.

Pre-op vitals of the patient were monitored, IV access (20G) established and then the patients were shifted to Operation theatre where monitors were connected to record the basal vitals of the patient.

Patients were positioned and prepared under all aseptic precautions.

In group L, patients received local infiltration with 4ml of 2% Lignocaine along the spinal epidural needle pathway while in group DL, 4mg dexamethasone (1ml) is mixed with 3ml of 2% lignocaine and the space was infiltrated with 4ml of drug. After identifying the space, combined spinal epidural needle was inserted. Epidural needle (18G) inserted at L2-L3 or L3-L4 intervertebral space via the midline approach via loss of resistance technique, the spinal needle (27G) was inserted to puncture the Dura, and 3 ml of 0.5% (Heavy) bupivacaine was injected after confirming free flow of CSF. After injecting Bupivacaine, epidural catheter was inserted into the epidural space. Catheter fixed and sterile dressing was done.

Patients were monitored throughout surgery for Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), Mean arterial pressure (MAP), respiratory rate (RR), and spo2.If the BP and HR was 30% below their baseline values, ephedrine and atropine was administered intravenously, respectively.

Patients were followed post-operatively to enquire about the post-operative backpain at 12, 24 and 48 hours. The pain score was assessed by 10-point Visual Analogue Scale [VAS] where 0 equals to 'NO pain' and 10 equals to 'Worst pain' in both groups, group L and group DL.

The study evaluated the incidence and severity of pain in both the groups L and DL after spinal epidural anaesthesia.

Statistical Analysis:

All the data was noted down in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by Chi-Square test. Quantitative data was represented using Mean ± SD. Analysis of Quantitative data between the two groups was done using unpaired t-test if data passed 'Normality test' and by Mann-Whitney Test if data failed 'Normality test'. A p-value < 0.05 was taken as level of significance. Results were graphically represented where deemed necessary. SPSS Version 26.0 was used for most analysis and Microsoft Excel 2021 for graphical representation.

RESULTS:

In the present study mean age of the cases was 42.1 years with no difference between the two groups[p value=0.45]. In group DL, there were 22 females and 13 males while in Group L, there were 18 females and 17 males. A total of 35.7% cases were in ASA grade I while 64.3% were in ASA grade II [p value = 1.0]

Table 1: Comparison of Mean hemodynamic parameters among study groups.

Hemodynamic Parameters	Group	N	Mean	SD	p-value
Pulse Rate	**DL**	35	80.00	9.01	**0.68**
	L	35	80.86	8.30	
SBP	**DL**	35	123.83	12.63	**0.21**
	L	35	121.71	8.66	
DBP	**DL**	35	82.83	5.69	**0.69**
	L	35	85.43	6.57	
SpO2	**DL**	35	99.01	0.23	**0.79**
	L	35	99.12	0.47	

Table 2: Distribution of study groups as per incidence of post-neuraxial back pain.

Post-neuraxial back pain	Group		Total
	DL	L	
No	26	17	43
	74.3%	48.6%	61.4%
Yes	9	18	27
	25.7%	51.4%	38.6%
Total	35	35	70
	100.0%	100.0%	100.0%
p- value - 0.027			

Above table shows incidence of post-neuraxial back pain was 51.4% in cases of group L as compared to 25.7% in group DL [p value = 0.027], which was significantly reduced in Group DL.

Table 3: Mean Vas Score Comparison Among Study Groups

VAS Score	Group	N	Mean	SD	p- value
12 hrs	**DL**	35	2.66	1.28	**0.02**
	L	35	3.20	1.13	
24 hrs	**DL**	35	3.26	1.07	**0.04**
	L	35	3.69	0.91	
48 hrs	**DL**	35	2.19	0.87	**0.02**
	L	35	2.63	1.16	

Above Table shows, post-operatively mean VAS score was significantly less in group DL as compared to L at 12 hours (2.66 vs 3.2; p value = 0.02). The difference remained significant at 24 hours (3.26 vs 3.69; p value = 0.04) and 48 hours follow up (2.19 vs 2.63; p value = 0.02).

DISCUSSION:

Regional anaesthesia has been the standard for orthopaedic surgeries in the recent decades. The two main types of regional anaesthesia are neuraxial (spinal, epidural, CSE) and peripheral nerve blocks, both of which are being used to provide adequate sensory and motor block during surgery.

Combined spinal epidural anaesthesia (CSEA) uses subarachnoid block with epidural catheter indwelling [4,5]. Orthopaedic surgery uses combined spinal epidural anaesthesia for its quick onset, better analgesia, and muscle relaxing properties [6]. Despite its benefits, backpain after spinal epidural may remain which accounts for patient refusal of neuraxial anaesthesia due to concern of backpain following CSEA. The epidural needle used may cause aseptic periostitis, tendonitis, ligamentous inflammation and osteochondritis resulting in lumbar pain [13,14] occurring due to muscle fibre tear, local trauma, and even nerve injury[11,12].

Local tissue trauma causes localized pain [15], tissue edema, and the release of pro-inflammatory factors, chemokines, substance P, and vasoactive intestinal peptide [16]. Furthermore, the acute nociceptive response at the puncture site triggers the release of TNF-α, IL-1β, and IL-8, which further promote the release of peripheral hyperalgesic mediators[17].

Dexamethasone is a long-acting corticosteroid that, when locally infiltrated, can inhibit inflammation and the release of inflammatory factors for over 36 hours, effectively reducing the incidence of acute postoperative back pain. The analgesic effect of dexamethasone is likely linked to its ability to directly suppress local inflammation, which is a key contributor to pain. Numerous studies have shown that inflammatory cytokines play a significant role in pain processes [18-20].

As a well-known anti-inflammatory drug, dexamethasone is widely used to combat inflammation. It works by inhibiting phospholipase A2 and the expression of cyclo-oxygenase-2, thereby reducing the synthesis of prostaglandins, which are major contributors to pain[21].

In our study, we hypothesised that prophylactic dexamethasone infiltration along the needle insertion channel would reduce backpain after spinal-epidural anaesthesia. This study compared the effectiveness of local infiltration of 2% lignocaine and 2% lignocaine with dexamethasone along the spinal epidural route in decreasing post-operative backpain.

Baseline Data

Study included 70 cases requiring spinal epidural anesthesia for major orthopaedic lower limb surgeries. We randomly allocated these patients to receive either local 2% lignocaine infiltration along the spinal epidural pathway (Group L), or 2% lignocaine with dexamethasone infiltration (Group DL). Mean age of the cases was 42.1 years with no difference between the two groups (p-0.45). Out of the total 70 cases, 57.1% were females and 42.9% were males (p-0.334). A total of 37.5% cases were in ASA grade I while 64.3% were in ASA grade II (p-1.0). Both the groups were comparable with regards to mean hemodynamic parameters like pulse rate, systolic and diastolic blood pressure and oxygen saturation (p>0.05).

Post-neuraxial Back Pain

In our study incidence of post-neuraxial back pain was reduced in both groups, group L as well as group DL. Incidence of post-neuraxial back pain was 51.4% in cases of group L as compared to 25.7% in group DL (p-0.027). Since the p-value is <0.05, the incidence of post-neuraxial back pain was significantly less is DL group. This was comparable to

the study done by Gao.et.al [22] in gynaecological surgeries where he found the incidence of acute, subacute, and chronic back pain was significantly lower in the DL group than the L group. He also studied effect of lignocaine and lignocaine with dexamethasone on chronic backpain following 6 months from surgery and found similar results.

In 2009, Muslu et al.[23] conducted a study with local administration of nonsteroidal anti-inflammatory medications with lignocaine vs lignocaine alone and found considerably reduced post-epidural low back discomfort in patients receiving NSAIDS with lignocaine infiltration.

Severity Of Backpain

In our study severity of backpain was assessed with visual analogue scale (VAS).

We found that mean VAS score was significantly less in group DL as compared to L at 12 hours (2.66 vs 3.2; p- 0.02). The difference remained significant at 24 hours (3.26 vs 3.69; p-0.04) and 48 hours follow up (2.19 vs 2.63; p – 0.02). Similar inferences were found in the study conducted by Gao.et.al. who assessed the severity of pain via VAS for 1^{st},2^{nd},3^{rd} days and 6 months post-operatively.

Girwalkar AS et al. [24] (2014) also evaluated the severity of low back pain in patients undergoing inguinal herniorrhaphy surgeries using lignocaine vs saline infiltration before spinal anaesthesia and found reduction in the severity of backpain with lignocaine infiltration assessed using a 11-point numeric rating scale (NRS) at 24, 48 and 72 hrs.

In 2009, Muslu et al. [23] conducted a study with local administration of NSAIDS with lignocaine vs lignocaine alone and found considerably reduced post-epidural low back discomfort in patients receiving NSAIDS with lignocaine infiltration assessed using VRS (Verbal rating scale) at 24, 48 and 72 hours postoperatively.

CONCLUSION:

To summarize, in our study both local infiltration of injectable 2% lignocaine and 2% lignocaine with dexamethasone along the spinal epidural pathway were shown to be helpful in decreasing post-operative backpain following spinal epidural anaesthesia. Although, the addition of dexamethasone to lignocaine, however, resulted in a substantially greater reduction in the incidence and severity of post-neuraxial back pain.

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