



## **Dexmedetomidine Combined with Local Anaesthetics for Enhanced Recovery after Anaesthesia in Spine Surgeries :A Review Article**

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### **Abstract**

Lumbar spine surgery is a common surgery .This procedure leads to mechanical and thermal trauma causing damage to nerves which supply the paraspinal muscles as well as muscular ischemia. This is experienced as severe and diffuse pain in the postoperative period [1]. Currently, opioids are the mainstay of treatment for postoperative pain in spine patients. Excessive reliance on opioids leads to side effects including sedation, nausea and vomiting, respiratory complications, delayed hospital discharge and even potential long-term addiction. Enhanced recovery after anaesthesia is an approach to improve postoperative outcomes in surgical patients.This is done using several evidence –based actions[2].Regional anaesthesia is rarely used in spine surgeries despite evidence that shows superiority of nerve block to other pain management strategies. Erector spinae block is an interfascial plane[3] block which can be used as part of multimodal analgesia in spine surgery. It has several advantages including ultrasound guidance ,easy technique , low complications rate .Demand for opioids is significantly reduced after ESP block.In single shot ESP block with local anaesthetic alone,sensory block usually lasts 6-8 hours[2] .However , adding dexmedetomidine can prolong the sensory effect of the block for upto 18-24 hours[2]. Dexmedetomidine [4]is a highly selective alpha 2 agonist which is short-acting and has sedative and anti-anxiety effect.[5]

### **Keywords**

Lumbar spine surgery,Enhanced recovery after anaesthesia,erector spinae plane block, opioids, dexmedetomidine.

### **Abbreviations**

ERAS :enhanced recovery after anaesthesia, ESPB :erector spinae plane block.

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## Introduction

Surgeries for lumbar spine are increasing worldwide. There are several indications for these, including disc herniation, spinal canal stenosis and degenerative spondylolisthesis. Postoperative course in most of these patients is outlined by pain that is severe and diffuse [1]. The usual management of postoperative pain relies primarily on opioids. Excessive reliance on opioids leads to side effects including sedation, nausea and vomiting, respiratory complications, constipation, delayed hospital discharge and even potential long-term addiction. Neuraxial anaesthesia is rarely utilized due to the motor and sensory anatomy and function of the spine [1]. When deployed, these comprise of epidural analgesia and intrathecal opioids. Regional anaesthesia in spine surgeries offers a safe and effective method of pain management [6]. Erector spinae plane block (ESPB) is an interfascial plane block [1] that targets ventral and dorsal rami and rami communicants of spinal nerves. It is increasingly utilized in several surgeries including breast, abdominal and spine surgeries. When used with other modalities of analgesia it would be an important component of enhanced recovery after anaesthesia (ERAS) protocol. This would prevent the side effects of excessive opioid use, potential harm from neuraxial block and prevent development of chronic pain. ESPB, usually given prior to skin incision suppresses chronic sensitization process and prevents chronic pain which is observed after spine surgery. Single shot ESPB given with local anaesthetic alone leads to postoperative analgesia that usually lasts only 6-8 hours. This is not adequate for the postoperative pain in these patients. However, adding dexmedetomidine in a dose of 1 mcg per kg can prolong the block for up to 18-24 hours. [2]

## Article

Lumbar spine surgery results in both mechanical and thermal trauma which leads to ischemia of muscles and nerve damage. Posterior spine surgery procedures are extremely painful with the median VAS pain score ranging from five for spinal decompression to seven for spinal fusion on an average. Adequate pain relief is essential postoperatively for enabling early mobilization, reducing the incidence of respiratory complications [2] and reduced risk of chronic pain syndrome. Many of these patients have a history of chronic pain and long-term analgesia use preoperatively [2]. ERAs is an approach to improve postoperative outcomes. This is done using several evidence-based actions. While many interventions are being utilized, pain management utilizing a multimodal approach is still not adequately practiced for spine surgeries. So far these have been primarily limited to neuraxial techniques namely epidural analgesia and intrathecal opioids. These have certain limitations as well as side effects and are very rarely used. Local anesthetic

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wound infiltration is usually performed but has short term benefits . Low concentrations of local anesthetic applied by nerve blocks have been shown to preferentially inhibit pain generation and transmission compared to motor and sensory function. Ultrasound- guided nerve blocks have become an integral part of this approach.

ESPB is an interfascial plane block that targets the ventral and dorsal branches of the spinal nerve[2]. Demand for opioids is significantly reduced after ESPB. ESPB is applied before the incision as preemptive analgesia to suppress the chronic sensitization process .It thus abolishes the stress response, Dexmedetomidine [4] is a highly selective alpha 2 agonist which is short-acting and has sedative and anti anxiety effect. It also causes inhibition of sympathetic excitation and has hypnotic effects as well. Dexmedetomidine has been known to cause faster onset of block and prolong the duration of analgesia leading to a significant reduction postoperatively in opioid consumption.

Addition of one microgram per kg dexmedetomidine has a better analgesic effect at 12,24 and 48 hours after surgery[2] compared to 0.5 mcg per kg body weight dexmedetomidine. It provided analgesia and sleep improvement for the first post operative night enabling early mobilization of the patient resulting in reduced risk of pulmonary complications and reduced hospital stay. As for the complications are concerned postoperative nausea and vomiting as well as was reduced in the group with dexmedetomidine however the differences were statistically significant only in nausea primary reason for this is the reduced opioid requirement in this group .Hypotension and bradycardia which are the most common adverse effects of dexmedetomidine were increased in group with 1 mcg per kg body weight especially when total dose was 100 mcg or more. Also these were seen more in elderly patients.

## **Discussion**

Lumbar spine surgery is performed to reduce or relieve pain and provide functional improvement in patients. Posterior lumbar spinal surgery is characterized by severe pain. This occurs due to structural damage in the surgical area, which generates a huge amount of inflammatory mediators in the surgical area and continuously stimulates peripheral receptors, leading to the exacerbation of pain. Additionally, central pain is induced by irritation of nerve roots. Posterior spine surgery procedures are extremely painful with the median VAS pain score (VAS consists of a 10 cms line with two end points representing 0 indicating no pain and 10 indicating the worst possible pain ) ranging from five for spinal decompression to seven for

spinal fusion. Traditionally, opioids have been the mainstay for perioperative pain therapy. However, they are not adequate to control pain and at high doses have several significant adverse effects including sedation, cognitive impairment, constipation. In addition, there is risk of long-term dependence. Currently, ERAS protocols are increasingly applied to ensure optimal patient outcome. Multimodal analgesia forms an integral part of ERAS. There has been much research done demonstrating the superiority of perioperative analgesia of nerve block to other drugs.

ESPB is an interfascial plane block that affects the ventral and dorsal branches of spinal nerves. First, it is an easy technique to perform as the visualization of the target by ultrasound is very simple and it is not difficult to direct the needle towards it. Second, the technique has a low risk of complications. Important structures (such as main vessels, pleura, or medulla) whose injury can cause serious complications, are far from the target of blockage. ESPB when applied before skin incision as preemptive analgesia suppresses the stress response, reducing release of catecholamines and thereby causing better blood pressure control intraoperatively and prevention of chronic pain postoperatively. The drawback however, of this technique is that the duration of analgesia is only 6 to 8 hours after surgery using medium and long acting local anesthetics. If we can prolong the duration of analgesia after single dose ESPB, it would greatly enhance patient satisfaction and reduce opioid requirement without increasing risks related to a catheter placement for infusion of local anaesthetic. Dexmedetomidine is a selective and specific alpha 2 adrenoceptor agonist that has action selective to central nervous system.[1].

The main mechanisms which are hypothesized to be responsible for improve ESPB effect due to addition of dexmedetomidine include vasoconstriction resulting in delayed absorption of the local anesthetic. Secondly dexmedetomidine blocks hyperpolarization activated cationic currents and decreases acute local anesthetic induced perineural inflammation. Additionally, dexmedetomidine itself has analgesic effects and analgesic retention properties and peripheral alpha 2- adrenoceptors are the mechanism of action for peripheral nerve block pain relief [4]. Adding dexmedetomidine to ropivacaine or bupivacaine in ESPB reduces tissue injury, prolongs duration of block and reduces pain postoperatively.[1]

Addition of one microgram per kg weight dexmedetomidine has a better analgesic effect at 12, 24 and 48 hours after surgery compared to 0.5 mcg dexmedetomidine per kg weight. Also, sensory block is prolonged by 11 hours compared to 4.86 hours in lower dose group. However, adding one microgram per kg of dexmedetomidine for ESPB caused fluctuations in blood pressure and heart rate when the total dose is more than 100 microgram [5] it is important to note that bradycardia and hypotension which are the most common

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adverse effects of this drug occur mainly in elderly individuals.

## Conclusion

ESPB as preemptive analgesia to suppress chronic sensitization as well as significantly reduce opioid requirement perioperatively can be an integral part of the multimodal analgesia management. This multipronged analgesia approach would be an important component of ERAS. This technique has the unique advantage to abolish neuroendocrine stress response by reducing counter regulatory hormones like catecholamines which may enhance controlled hypotensive anesthesia intraoperatively. It would also reduce incidence of chronic pain postoperatively. Adding dexmedetomidine to ropivacaine in ESB causes highly effective sedative and analgesic effect after surgery [2]. Addition of one microgram per kg dexmedetomidine has a better analgesic effect at 12, 24 and 48 hours after surgery compared to 0.5 mcg per kg dexmedetomidine.

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