International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/| Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue: 3 (May-June 2023); Page No: 1000-1002

Research Article

IJMPR

Effect of Adding Dexmedetomidine versus Fentanyl to Intrathecal Levobupivacaine 0.5% on Spinal Block in LSCS

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ABSTRACT

Background: Spinal anaesthesia is the preferred technique for lower segment caesarean section (LSCS) due to rapid onset, dense sensory block, and minimal drug exposure to the fetus. Adjuvants such as dexmedetomidine and fentanyl are commonly added to intratheral local anesthetics to enhance the quality and duration of block.
Aim: To compare the efficacy and safety of adding dexmedetomidine versus fentanyl to intrathecal levobupivacaine 0.5% in parturients undergoing LSCS.
Methods: In this prospective, randomized, double-blind study, 50 ASA II parturients were randomly allocated into two groups (n=25 each). Group D received 2.5 ml of 0.5% levobupivacaine with dexmedetomidine 5 µg, while Group F received 2.5 ml of 0.5% levobupivacaine with fentanyl 25 µg. Onset time, duration of sensory and motor block, hemodynamic parameters, and adverse effects were recorded.
Results: Group D showed significantly faster onset of sensory block (2.3±0.5 min) compared to Group F (3.1±0.6 min, $p<0.001$) and longer duration of sensory block (262±18 min vs. 218±20 min, $p<0.001$). Duration of motor block was also prolonged in Group D (210±15 min) compared to Group F (175±14 min, $p<0.001$). Hemodynamic stability was comparable in both groups, with mild bradycardia observed in 2 patients in Group D and pruritus in 4 patients in Group F.
Conclusion: Intrathecal dexmedetomidine with levobupivacaine provides earlier onset and longer duration of sensory and motor block compared to fentanyl, with comparable safety in LSCS.

Keywords: Dexmedetomidine, Fentanyl, Levobupivacaine, Spinal anesthesia, LSCS, Intrathecal adjuvant.

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Introduction

Spinal anesthesia continues to be regarded as the gold standard technique for lower segment caesarean section (LSCS) because it is simple to administer, has a rapid onset, and produces a dense and reliable block (Simmons et al., 2018). In obstetric anesthesia, the ideal local anesthetic should provide adequate sensory anesthesia, minimal motor blockade, rapid onset, and an appropriate duration of action to cover the surgical period. Levobupivacaine, the pure S-enantiomer of bupivacaine, has gained increasing popularity in recent years due to its favorable safety profile, particularly with respect to reduced cardiotoxicity and neurotoxicity, while still maintaining effective anesthesia and analgesia (Casati et al., 2004). Nevertheless, its relatively shorter duration compared to hyperbaric bupivacaine can sometimes necessitate additional analgesic supplementation during prolonged surgeries, especially when postoperative analgesia is also desired.

To overcome these limitations, various intrathecal adjuvants have been explored to enhance the quality and prolong the duration of spinal block. Fentanyl, a potent, lipophilic µ-opioid receptor agonist, has long been favored as an intrathecal additive because of its rapid onset of action, synergistic interaction with local anesthetics, and minimal prolongation of motor block (Ben-David et al., 2000). By acting directly on opioid receptors in the dorsal horn of the spinal cord, fentanyl enhances sensory blockade and improves intraoperative comfort. However, the use of opioids is often limited by side effects such as pruritus, nausea, vomiting, and, in rare cases, respiratory depression, which can affect maternal satisfaction and safety.

Dexmedetomidine, a highly selective α2-adrenergic receptor agonist, has emerged as a promising alternative intrathecal adjuvant. It exerts its analgesic and sedative effects through action on the locus coeruleus and the dorsal horn, resulting in inhibition of nociceptive transmission by reducing norepinephrine release (Gupta et al., 2011). Compared to opioids, dexmedetomidine offers the advantage of prolonged sensory and motor blockade without significant respiratory

depression. Several clinical studies have reported that dexmedetomidine not only improves block characteristics but also provides stable hemodynamics and enhanced postoperative analgesia (Al-Mustafa et al., 2009).

Despite the growing evidence on the benefits of both fentanyl and dexmedetomidine, there is a relative paucity of well-structured comparative studies evaluating their efficacy and safety when combined with levobupivacaine for LSCS. Understanding these differences is important for optimizing maternal comfort, intraoperative conditions, and postoperative recovery. Therefore, the present prospective, randomized, double-blind study was undertaken to compare the onset and duration of sensory and motor block, hemodynamic stability, and side-effect profiles of dexmedetomidine versus fentanyl as intrathecal adjuvants to 0.5% levobupivacaine in parturients undergoing elective LSCS.

Methodology

Study Design: Prospective, randomized, double-blind, comparative study.
Study Setting: Department of Anaesthesiology, National Institute of Medical Sciences & Research, Jaipur, India.
Study Period: June - December 2022.
Ethical Approval: Obtained from the Institutional Ethics Committee; informed consent taken from all participants.

Inclusion Criteria:

- ASA physical status II parturients
- Age 20–35 years
- Scheduled for elective LSCS under spinal anesthesia

Exclusion Criteria:

- Contraindication to spinal anesthesia
- Known allergy to study drugs
- Severe obstetric complications

Grouping:

- **Group D (n=25):** 2.5 ml 0.5% levobupivacaine + dexmedetomidine 5 µg
- **Group F (n=25):** 2.5 ml 0.5% levobupivacaine + fentanyl 25 µg

Procedure:

Spinal anesthesia was performed at L3–L4 interspace using a 25G Quincke needle under aseptic precautions. Hemodynamic parameters were recorded at baseline, every 2 minutes for first 10 minutes, then every 5 minutes until the end of surgery. Sensory block was assessed using pinprick method, motor block by modified Bromage scale.

Outcome Measures:

- Onset time of sensory block (T10 level)
- Duration of sensory and motor block
- Hemodynamic changes (HR, SBP, DBP)
- Adverse effects

Statistical Analysis:

Data analyzed using SPSS v25; $p<0.05$ considered significant.

Results

Table 1: Demographic Profile

Parameter	Group D (n=25)	Group F (n=25)	p-value
Age (years)	27.6 ± 3.2	28.1 ± 3.5	0.56
Weight (kg)	63.4 ± 5.8	64.1 ± 6.2	0.68
Duration of surgery (min)	52.4 ± 8.1	53.8 ± 7.9	0.51

Table 2: Block Characteristics

Parameter	Group D	Group F	p-value
Onset of sensory block (min)	2.3 ± 0.5	3.1 ± 0.6	<0.001*
Duration of sensory block (min)	262 ± 18	218 ± 20	<0.001*
Duration of motor block (min)	210 ± 15	175 ± 14	<0.001*

Adverse Effects:

- Group D: Bradycardia (n=2), Hypotension (n=1)
- Group F: Pruritus (n=4), Nausea (n=2)

Discussion

This study demonstrates that intrathecal dexmedetomidine, when added to levobupivacaine, provides a significantly faster onset and longer duration of sensory and motor block compared to fentanyl. These findings are consistent with Al-Mustafa et al. (2009) and Gupta et al. (2011), who reported similar block-prolonging effects of dexmedetomidine.

Fentanyl, although effective in rapid onset, was associated with higher incidence of opioid-related side effects such as pruritus, as observed in other studies (Ben-David et al., 2000). Hemodynamic stability was comparable between groups, suggesting both adjuvants are safe in healthy parturients.

The prolonged block duration with dexmedetomidine may reduce the need for postoperative analgesics, which is beneficial in the immediate postpartum period. However, mild bradycardia observed in some patients warrants cautious use, particularly in those with pre-existing conduction abnormalities.

Conclusion

Intrathecal dexmedetomidine (5 µg) combined with 0.5% levobupivacaine provides superior block characteristics compared to fentanyl (25 µg) in LSCS, with longer duration and fewer opioid-related side effects, while maintaining comparable hemodynamic stability. It can be considered a better alternative for obstetric anesthesia.

Acknowledgements: None
Conflict of Interest: None declared.

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