

Analysis of Hemodynamic Stability and Complications of Using Dexmedetomidine Versus Fentanyl with Bupivacaine in Epidural Anesthesia for Orthopedic Lower Limb Surgeries

Jeetendra Gupta

Associate Professor, Department of Anaesthesiology,
RKDF Medical College Hospital & Research Center, Bhopal, Madhya Pradesh, India.

ABSTRACT

Aim: Regional anesthesia presents notable benefits compared to general anesthesia for surgical procedures involving the lower abdomen and lower extremities, with intrathecal and epidural methods being the most frequently employed. This study aims to analyze hemodynamic stability and complications of using dexmedetomidine versus fentanyl with bupivacaine in epidural anesthesia for orthopedic lower limb surgeries.

Materials and Methods: The study involved 80 participants, divided into two groups of 40. Group A received a combination of hyperbaric bupivacaine and fentanyl, while Group B received hyperbaric bupivacaine and dexmedetomidine. Before surgery, patients underwent a thorough pre-anesthetic evaluation, including a physical examination and standard tests. They also provided informed consent and followed specific pre-surgery instructions, including fasting from midnight and taking prescribed medications. The study compared the intraoperative hemodynamic profiles of the two groups, using SPSS software for statistical analysis, with p-values under 0.05 considered significant.

Results: The average age of patients in Group A was 41.7 years, and in Group B, it was 43.9 years. Hemodynamic changes in Group B were gradual, stabilizing throughout the surgery. In contrast, Group A experienced more significant fluctuations, which were statistically notable. Complications

occurred in 20% of Group A patients and 40% of Group B patients.

Conclusion: Combining dexmedetomidine with intrathecal bupivacaine accelerated the onset and prolonged the duration of the block compared to using fentanyl with bupivacaine. Both combinations had minimal side effects, although fentanyl caused temporary hemodynamic instability. The dexmedetomidine group had fewer postoperative complications, suggesting a more favourable profile.

Keywords: Bupivacaine, Fentanyl, Dexmedetomidine.

*Correspondence to:

Dr. Jeetendra Gupta,
Associate Professor,
Department of Anaesthesiology,
RKDF Medical College Hospital & Research Center, Bhopal,
Madhya Pradesh, India.

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INTRODUCTION

Neuraxial anesthesia refers to central blocks that target the spinal, epidural, and caudal regions. Although it has become an essential complement to, and at times a substitute for, general anesthesia, its application is not a recent development. As early as 1885, physicians like Corning published research demonstrating the effectiveness of neuraxial blocks. Additionally, pioneering physician-scientists such as Bier gained insights into spinal anesthesia through personal experimentation, which, regrettably, also led him to experience postdural puncture headaches. Despite its initial implementation, significant advancements in neuraxial blocks did not materialize until the early 20th century.¹

The limitations in this field of anesthesia were primarily due to a restricted range of available drugs and insufficient equipment.

Before 1904, cocaine was the sole drug permitted for neuraxial applications, and the development of epidural technology was still in its infancy. The expansion of the drug repertoire and improvements in equipment subsequently broadened the application of neuraxial anesthesia within clinical practice. While it is evident that the nature of surgical procedures largely determines the choice of anesthesia, most surgeries performed below the neck can be conducted using neuraxial anesthesia. Research has indicated a reduction in postoperative morbidity and even mortality when neuraxial anesthesia is utilized, either in conjunction with general anesthesia or as a standalone option. In epidural anaesthesia, the anaesthetist injects one or more drugs into the epidural space bordering on the spinal dura mater to

achieve a "central" and/or "neuraxial" block.^{2, 3} It is one of the earliest techniques in anaesthesia, originally performed exclusively with local anaesthetic agents. Continuous epidural analgesia is an important tool in postoperative pain management. More and more often, the increasing proportion of patients who have comorbidities or are permanently taking medication that modulates the clotting system demands that the anaesthesiologist balance the individual risks and benefits before inducing epidural anaesthesia.⁴⁻⁶

Present study aims to analyze hemodynamic stability and complications of using dexmedetomidine versus fentanyl with bupivacaine in epidural anesthesia for orthopedic lower limb surgeries.

MATERIALS AND METHODS

This study involved 80 participants, divided into two groups of 40. Group A received a combination of hyperbaric bupivacaine and fentanyl, while Group B received hyperbaric bupivacaine and dexmedetomidine. Before surgery, patients underwent a thorough pre-anesthetic evaluation, including a physical examination and

standard tests. They also provided informed consent and followed specific pre-surgery instructions, including fasting from midnight and taking prescribed medications. The study compared the intraoperative hemodynamic profiles of the two groups, using SPSS software for statistical analysis, with p-values under 0.05 considered significant.

RESULTS

The average age of patients in Group A was 41.7 years, and in Group B, it was 43.9 years. Hemodynamic changes in Group B were gradual, stabilizing throughout the surgery. In contrast, Group A experienced more significant fluctuations, which were statistically notable. Complications occurred in 20% of Group A patients and 40% of Group B patients. Time from injection to onset of sensory block was 4.6 mins in group A and 2.1 minutes in group B. Significant results were obtained while comparing Time from injection to onset of sensory block among two study groups. Onset of motor block was 5.1 mins in group A and 3.3 minutes in group B. Significant results were obtained while comparing onset of motor block among two study groups.

Table 1: Demographic and anaesthetic variables

Variable	Group A	Group B	p-value
Mean age (years)	41.7	43.9	0.25
Males	33	31	0.28
Females	7	9	
Time from injection to onset of sensory block (mins)	4.6	2.1	0.000 (Significant)
Onset of motor block (mins)	5.1	3.3	0.000 (Significant)

Table 2: Heart rate

Mean Heart rate	Group A	Group B	p-value
Baseline	72.5	75.3	0.28
15 mins intraop	68.1	75.9	0.00*
30 mins intraop	66.9	76.1	0.00*
45 mins intraop	67.2	75.9	0.00*
60 mins introp	68.9	75.8	0.00*

DISCUSSION

Epidural anesthesia is a versatile technique used both for providing anesthesia and postoperative analgesia. It contributes to intra operative hemodynamic stability and has shown to reduce perioperative stress response thereby causing a decrease in complications and improving patient outcome. It helps in early mobilization by relieving postoperative pain, which decreases the incidence of thromboembolic events.⁷⁻¹⁰ Present study aims to analyze hemodynamic stability and complications of using dexmedetomidine versus fentanyl with bupivacaine in epidural anesthesia for orthopedic lower limb surgeries.

The average age of patients in Group A was 41.7 years, and in Group B, it was 43.9 years. Hemodynamic changes in Group B were gradual, stabilizing throughout the surgery. In contrast,

Group A experienced more significant fluctuations, which were statistically notable. Complications occurred in 20% of Group A patients and 40% of Group B patients. Time from injection to onset of sensory block was 4.6 mins in group A and 2.1 minutes in group B. Significant results were obtained while comparing Time from injection to onset of sensory block among two study groups. Onset of motor block was 5.1 mins in group A and 3.3 minutes in group B. Significant results were obtained while comparing onset of motor block among two study groups. Bajwa SJ et al compared the hemodynamic, sedative, and analgesia potentiating effects of epidurally administered fentanyl and dexmedetomidine when combined with ropivacaine. The demographic profile of patients was comparable in both the groups. Onset of sensory analgesia at T10 (7.12 ± 2.44 vs 9.14 ± 2.94) and establishment of complete

motor blockade (18.16 ± 4.52 vs 22.98 ± 4.78) was significantly earlier in the RD group. Postoperative analgesia was prolonged significantly in the RD group (366.62 ± 24.42) and consequently low dose consumption of local anaesthetic LA (76.82 ± 14.28 vs 104.35 ± 18.96) during epidural top-ups postoperatively. Sedation scores were much better in the RD group and highly significant on statistical comparison ($P < 0.001$). Incidence of nausea and vomiting was significantly high in the RF group (26% and 12%), while incidence of dry mouth was significantly higher in the RD group (14%) ($P < 0.05$). Dexmedetomidine seems to be a better alternative to fentanyl as an epidural adjuvant as it provides comparable stable hemodynamics, early onset, and establishment of sensory anesthesia, prolonged post-op analgesia, lower consumption of post-op LA for epidural analgesia, and much better sedation levels.¹¹ S. Fyreface-Ogan et al determined the effect of adding dexmedetomidine to hyperbaric bupivacaine for neuraxial analgesia for labor. Ninety laboring multiparous women were allocated to have single shot intrathecal bupivacaine alone (B), bupivacaine with fentanyl (BF), or bupivacaine with dexmedetomidine (BD). Sensory and motor block characteristics; time from injection to two dermatome sensory regression, sensory regression to S1 dermatome, and motor block regression to Bromage 1 were recorded. Labor pain was assessed with a 10 cm verbal pain scale. Peak sensory block levels in the three groups were essentially the same. The time for sensory and motor blocks to reach T10 dermatome and Bromage 1, respectively, was faster in group BD than in the other groups. The time for sensory regression to S1 was significantly prolonged in the group BD. Motor block regression time to Bromage 1 was also prolonged in the group BD. Neonatal outcome was normal in all groups. Single shot intrathecal bupivacaine/dexmedetomidine significantly prolonged sensory block in laboring women.¹²

CONCLUSION

Combining dexmedetomidine with intrathecal bupivacaine accelerated the onset and prolonged the duration of the block compared to using fentanyl with bupivacaine. Both combinations had minimal side effects, although fentanyl caused temporary hemodynamic instability. The dexmedetomidine group had fewer postoperative complications, suggesting a more favourable profile.

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