

# Intrathecal Magnesium Sulfate as an Adjunct to Prolong Motor Block in Cesarean Section

Katie Kei, BSN, RN  
Texas Christian University

## INTRODUCTION

- Breakthrough pain in cesarean sections (C/S) impairs mother-child bonding and early breastfeeding.<sup>1</sup>
- Spinal bupivacaine is the most commonly used local anesthetic (LA) in C/S due to its rapid onset and dense sensory and motor blockade.<sup>2</sup>
- Intrathecal (IT) opioids are commonly added to spinal LAs, but increase the incidence of pruritus, respiratory depression, and nausea/vomiting.<sup>1,3-6</sup>
- Other adjuncts such as IT alpha-2 agonists (clonidine, dexmedetomidine) increase the risks of hypotension and sedation.<sup>1,3-6</sup>
- Mg<sup>2+</sup> functions as an antinociceptive analgesic that blocks calcium (Ca<sup>2+</sup>) influx via N-methyl D-aspartate (NMDA) sites in the central nervous system (figure 1).<sup>3-6</sup>
- Magnesium (Mg<sup>2+</sup>) exists naturally in cerebral spinal fluid and seldom depresses respirations, suggesting it may be a safer IT adjunct.<sup>5,7</sup>
- **PICOT:** In patients age 18 to 45 years-old undergoing elective C/S, what is the effect of IT Mg<sup>2+</sup> added to bupivacaine versus no IT Mg<sup>2+</sup> added to IT bupivacaine on the duration of motor block as measured by the Bromage score?

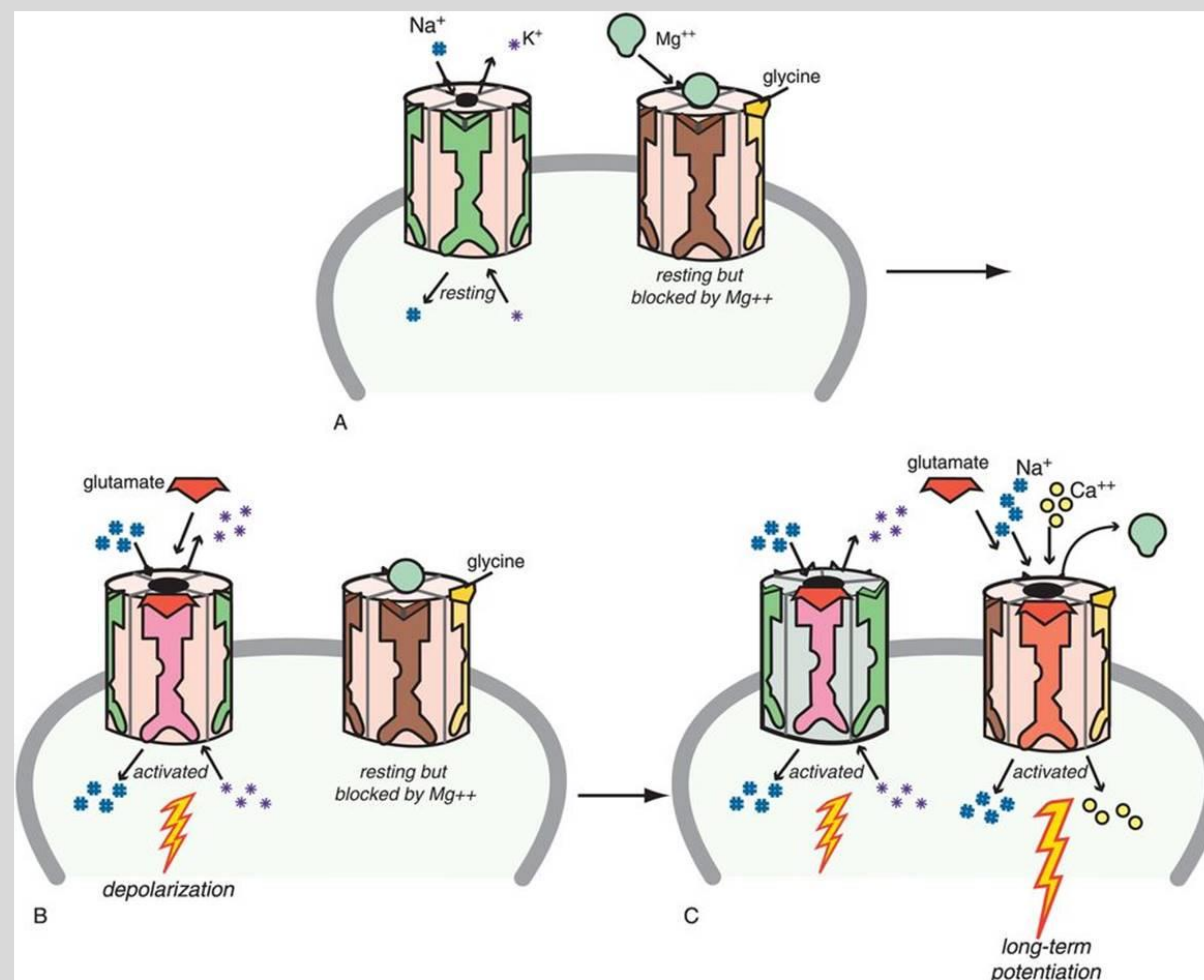
## METHODS

- Systematic search on Embase and Web of Science
- Keywords: *intrathecal, magnesium, bupivacaine, cesarean*
- Inclusion: English language, randomized controlled trial (RCT), elective C/S, age 18 to 45 years, Bromage score, 0.5% bupivacaine
- Search yielded 15 citations
- Exclusion: IT opiate in control group, alpha-2 agonists, non-bupivacaine LAs, epidural, non-C/S surgery, IV Mg<sup>2+</sup>
- Retrieved 4 prospective, double-blinded RCTs
- IRB/IACUC approval does not apply to this evidence-based project.

## REFERENCES



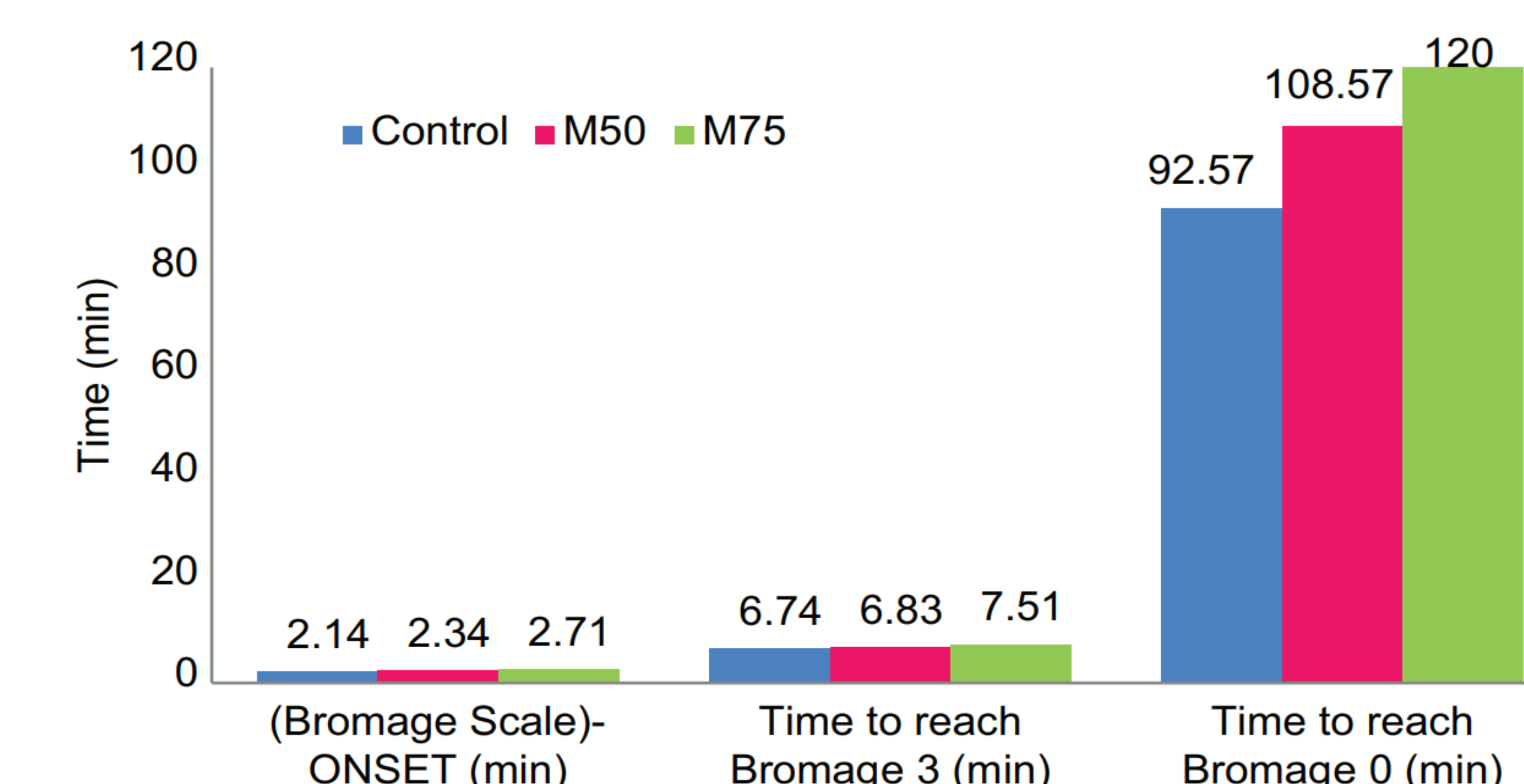
# Intrathecal magnesium sulfate added to spinal bupivacaine extends motor block duration in elective C-sections.



**Figure 1.** Antinociceptive Mechanism of Mg<sup>2+</sup> on the NMDA receptor.<sup>9</sup>  
A. α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor (AMPA) at rest, impermeable to Na<sup>+</sup> and K<sup>+</sup>. Mg<sup>2+</sup> and glycine co-antagonists block Ca<sup>2+</sup> entry to NMDA receptor.  
B. Agonist glutamate activates AMPAR via depolarization from Na<sup>+</sup> entry and K<sup>+</sup> exit. Mg<sup>2+</sup> prevents NMDA activation.  
C. Depolarization removes Mg<sup>2+</sup> from binding site. Glutamate binds to binding site on glycine-bound NMDA receptor, channel opens allowing Ca<sup>2+</sup> influx, and subsequent long-term potentiation of pain.

## REVIEW of LITERATURE / CRITICAL APPRAISAL

- All studies measured both motor and sensory block durations as primary outcomes using the same methods; trends of motor and sensory block durations corresponded with each other.<sup>3-6</sup>
- Two studies reported significantly longer motor and sensory blockade using 75 and 100 mg 50% IT Mg<sup>2+</sup> sulfate,<sup>3</sup> with 1 aimed at preeclamptic patients (figure 2).<sup>6</sup>
- One study reported no difference<sup>4</sup> and 1 reported shorter block duration, with 50 mg 5% IT Mg<sup>2+</sup> sulfate.<sup>5</sup>
- The Bromage scale allows for a more objective assessment of block regressions compared to pinprick tests. Differential blockade suggests that, since motor neurons are blocked last, sensory blockade has been achieved.<sup>8</sup>
- There is an established and predictable progression of intrathecal sensory and motor blockade, therefore, monitoring of motor blockade provides confidence in congruent sensory blockade as well.<sup>8</sup>
- Overall, these studies report consistent homogeneity in the spinal techniques, level of injection, and methods of block assessment.<sup>3,5,6</sup>



**Figure 2.** Characteristics of Motor Block in Different Doses of IT Mg<sup>2+</sup> in Preeclamptic Patients.<sup>6</sup>

## RECOMMENDATIONS for PRACTICE / CONCLUSION

- IT Mg<sup>2+</sup> sulfate is an emerging adjunct to spinal LAs that extends block duration with well-documented hemodynamic stability;<sup>2-6</sup> 75 mg of IT Mg<sup>2+</sup> is recommended as an adjunct to spinal bupivacaine in surgeries involving lengthier operating times and in patients who do not tolerate other IT adjuncts.
- Future research on a concentration of 50%, instead of 5%, and doses of 75 - 100 mg of IT Mg<sup>2+</sup> is recommended to determine the optimal dosing for extending block duration.
- Evidence of IT Mg<sup>2+</sup> effect on reducing shivering and nausea should be further investigated.<sup>3,5,6</sup>
- Delays in discharge time are possible with prolonged motor block, which could result in institutional financial burden. However, durations are comparable to other IT adjuncts and low adverse effects may be safer for some parturient.