Ropivacaine versus Bupivacaine for Spinal Anesthesia in Elective Caesarean Deliveries

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Spinal anesthesia, referred to as "cocainization of the spinal cord" in early 1900s [1] has now become one of the most commonly used techniques for regional anesthesia in obstetric surgeries worldwide. It is preferred over general anesthesia as it is associated with reduced maternal mortality, more direct experience of childbirth, and faster neonatal-maternal bonding. [2] In England, for example, regional anesthesia was used for caesarean section in about 40% of cases in 2008/9 compared to 5% using general anesthesia [3].

Bupivacaine is an amide type local anesthetic, a racemic (50:50) mixture of S and R enantiomers [4]. Since its introduction in 1956, it has been used as the drug of choice for spinal anesthesia due to its longer duration of action (3-7 hours), limited placental transfer, and minimal neonatal effects compared to other local anesthetics [4]. In 1979, attention was drawn towards the cardiotoxic and neurotoxic effects of bupivacaine, linked to its R-enantiomer [5]. As a result, another amide type local anesthetic, ropivacaine, the S-enantiomer of propyl derivative of pipecoloxylidide was first introduced in 1996 and approved for spinal anesthesia in the European Union in 2004 [6]. Ropivacaine, being a pure S-enantiomer, has low lipid solubility and blocks nerve fibres involved in pain transmission to a greater degree than those involved in motor function [7].

The report by Singh et al [8] in this issue of JPMS adds to the overall evidence that there is a greater degree of sensory-motor separation with ropivacaine as compared to bupivacaine. Singh et al compared the efficacy of intrathecal 0.75% isobaric ropivacaine (24 mg) with 0.5% heavy bupivacaine (12.5 mg) for elective caesarean section. Safety of these two drugs was also assessed as a secondary outcome. A total of 46 parturients were enrolled in this single-blind, randomized controlled trial.

The main findings were that bupivacaine had a shorter time to achieve sensory block at T10 (2.5±1.3 min) compared to ropivacaine (3.2±1.5 min) ($p < 0.05$). The time taken for maximal block was also significantly lower ($p < 0.05$) in bupivacaine group (7.9±2.3 min) in comparison to ropivacaine group (9.8±3.1 min). However, the duration of motor block was significantly shorter ($p < 0.01$) in ropivacaine group (112.5±45) as compared to bupivacaine group (165.3±26). This finding is consistent with previous literature that ropivacaine provides spinal anesthesia of similar quality to that of bupivacaine with shorter duration of motor block [7].

However, there are concerns regarding the adverse clinical outcome evaluated in this study. The authors also reported significantly fewer side-effects ($p < 0.05$) such as hypotension, nausea, shivering and bradycardia in the ropivacaine group than bupivacaine group. Since the trial was not double-blinded, there is a high potential for observer bias. Therefore, due to the nature of blinding in the trial and a very small number of events in both the groups, it is difficult to conclude that the safety profile of ropivacaine is superior to bupivacaine. Additionally, the study also concludes that there was no statistical difference between APGAR scores in the two groups. This seems an encouraging finding; however, it may be confounded by vasopressor administration and hypotension episodes, which were significantly different in both drug groups and may have altered the true association between the drugs and APGAR scores.

When comparing drugs for spinal anesthesia, three factors are essential to assess – the speed of onset, quality of block and the cost. In this particular study, the onset of block was shorter in bupivacaine than ropivacaine. However, in context of elective caesarean delivery, this may not be clinically important. It may be more important in emergency cases, where there is urgency to deliver the fetus. Nevertheless, the magnitude of difference found in the study is so small that it is difficult to say that one is better than the other. Likewise, none of the parturients required conversion to general anesthesia and adequate level of sensory analgesia and complete motor block was achieved in all patients. Therefore, the quality of block was comparable between both groups. The only important difference between both groups was the duration

Conflicting Interest: None declared

This article has been peer reviewed.

Article Submitted on: 28th February 2012

Article Accepted on: 27th March 2012

Funding Sources: None declared

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of motor block. This finding favors the use of ropivacaine, as shorter motor block would mean early mobilization, shorter time to first micturation and earlier recovery from respiratory disturbance caused by spinal anesthesia [9]. Therefore, from a clinical perspective, both the drugs are comparable and can be used for spinal anesthesia.

Lastly, cost-effectiveness of the drug is another practical issue to be considered. In the UK, for example, the cost of the chosen dose of ropivacaine is 3 times higher than the cost of bupivacaine [10]. This may be an important factor in the clinical applicability and use of ropivacaine especially in developing countries. Therefore, from an economic perspective, it is difficult to justify the use of ropivacaine in place of bupivacaine when both the drugs have very similar clinical effects. It is well established now that ropivacaine has very similar sensory effects but offers a shorter motor block than bupivacaine. What is needed now is an economic analysis to investigate which drug is more cost-effective in elective obstetric and other surgeries.

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