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ORIGINAL ARTICLE

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Duration of motor block with intrathecal ropivacaine versus bupivacaine for caesarean section: a meta-analysis

R. Malhotra,[a] C. Johnstone,[a] S. Halpern,[b] J. Hunter,[a] A. Banerjee[a]
[a]*Department of Anaesthesia, Royal Liverpool and Broadgreen University Hospitals NHS Trust, Liverpool, UK*
[b]*Department of Anesthesia, Sunnybrook Health Sciences Centre, Toronto, Canada*

ABSTRACT

Background: Bupivacaine is a commonly used local anaesthetic for spinal anaesthesia for caesarean section, but may produce prolonged motor block, delaying discharge from the post-anaesthesia care unit. Ropivacaine may have a shorter time to recovery of motor function compared with bupivacaine. We performed a meta-analysis to assess the time difference in duration of motor block with intrathecal ropivacaine compared with bupivacaine for caesarean section.

Methods: We searched MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials databases for randomised controlled trials comparing ropivacaine with bupivacaine in parturients undergoing elective caesarean section under spinal anaesthesia. The primary outcome was the duration of motor block. Secondary outcomes included the time to onset of sensory block, need for conversion to general anaesthesia and the incidence of hypotension.

Results: Thirteen trials comprising 743 spinal anaesthetics were included. Intrathecal ropivacaine resulted in a reduced duration of motor block, regressing 35.7 min earlier compared with intrathecal bupivacaine ($P<0.00001$). There was no difference in the time to onset of sensory block ($P=0.25$) or the incidence of hypotension ($P=0.10$). Limited data suggested no difference in the rate of conversion to general anaesthesia, but an earlier request for postoperative analgesia with ropivacaine.

Conclusions: Compared with bupivacaine, intrathecal ropivacaine is associated with more rapid recovery of motor block despite similar sensory properties and no increased rate of conversion to general anaesthesia. This may be useful in centres in which recovery of motor block is a criterion for discharge from the post-anaesthesia care unit. However, small numbers of trials and significant heterogeneity limit the interpretation of our results.

Keywords: Anaesthesia; Spinal; Ropivacaine; Bupivacaine; Sensory block; Motor block; Caesarean section

Introduction

The majority of elective caesarean sections in the UK are performed under neuraxial anaesthesia, with spinal anaesthesia accounting for over 80% of cases.[1] Currently, bupivacaine is the most commonly used local anaesthetic for spinal anaesthesia, with the advantages of a rapid onset and prolonged duration of sensory block but the disadvantage of a prolonged motor block.[2]

Ropivacaine is an amide local anaesthetic that may have a shorter duration of motor block compared with bupivacaine[3] and could represent an alternative that would allow earlier discharge from the post-anaesthesia care unit. Several randomised studies in obstetric surgery suggest that intrathecal ropivacaine results in a reduced duration of motor block compared with bupivacaine.[4–7] Therefore, ropivacaine may be a better choice of local anaesthetic, provided comparable intraoperative analgesia can be obtained.

We performed a meta-analysis investigating the difference in duration of motor block and intraoperative analgesia for intrathecal ropivacaine compared with bupivacaine for caesarean section.

Methods

We identified published randomised controlled trials (RCTs) from January 1980 to 27 July 2015 using MEDLINE, Google Scholar, EMBASE and the Clinical Trials Registry website (http://clinicaltrials.gov) without language restriction using the following text and keywords: intrathecal, subarachnoid, spinal, Cesarean, Caesarean, ropivacaine and bupivacaine. We also searched the references of relevant reviews and published

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Correspondence to: Dr A Banerjee, Department of Anaesthesia, Royal Liverpool and Broadgreen University Hospitals NHS Trust, Prescot St, Liverpool L7 8XP, UK.
E-mail address: abanerjeeuk@gmail.com

abstracts from international meetings including the American Society of Anesthesiologists (ASA), the Society for Obstetric Anesthesia and Perinatology (SOAP), the Obstetric Anaesthetists' Association (OAA), the European Society of Regional Anaesthesia (ESRA) and the European Society of Anaesthesiology (ESA). The literature search was conducted by the authors AB, RM, SH and CJ, who subsequently reviewed articles identified by the search. Study eligibility was determined by reading the title, abstract and the full article to determine the methods used. We contacted authors of included studies for further information when required. We included RCTs in patients undergoing caesarean section and included data of all patients irrespective of their American Society of Anesthesiologists (ASA) physical status classification, age, and comorbidities. All subjects received intrathecal ropivacaine or bupivacaine with or without the addition of an opioid. We excluded those groups where bupivacaine was compared with levobupivacaine, if the procedure being undertaken was not a caesarean section or if the trial was dose-finding. Trials or abstracts deemed irrelevant were excluded with the final list of eligible studies being derived by consensus.

Three authors (RM, SH and CJ) scored each trial according to the Jadad scale, a validated quality of reporting index for randomised controlled trials,[8] and assigned a final score. Where there was disagreement, a consensus was reached including discussion with a fourth author (AB). Data were recorded independently by AB, RM and CJ to avoid transcription errors, with any discrepancies resolved by consensus after revisiting the original articles. Data were then entered into the statistical program Review Manager 5.1 (http://tech.cochrane.org/Revman) and rechecked by all authors. A funnel plot was used for assessing publication bias (Fig. 1).

The primary outcome was the duration of motor block, as defined by the authors in each publication.

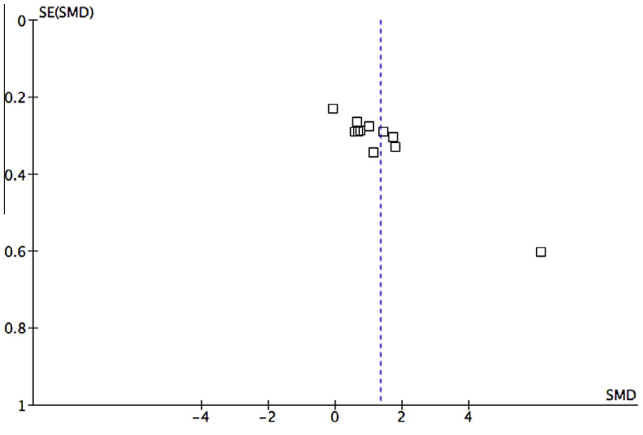

Fig. 1 Funnel plot of included studies. SMD: standardised mean difference; SE: standard error

This is described in terms of the Bromage or modified Bromage scores; both scoring systems were included in the analysis, with further subgroup analyses planned to identify any differences between the scores.

Secondary outcomes were: time to onset of sensory block, defined by the time from intrathecal injection to the onset of sensory block as defined by the authors of each of the publications; time to complete motor block; duration of sensory block; intraoperative analgesia needed; dose of vasopressors required; incidence of hypotension; time to first postoperative analgesia; and umbilical cord blood pH. Because there is no universally agreed dermatomal level at which adequate surgical anaesthesia for caesarean section can be guaranteed,[9] outcomes such as intraoperative analgesia and conversion to general anaesthesia were used as markers of adequate surgical anaesthesia. In instances where more than one dermatome level was given as the onset time, the level that would most likely allow surgical anaesthesia was chosen.[7] The variability associated with this outcome measure likely reflects the variable practices at different institutions. To reduce the impact of this, subgroup analysis was performed for all trials that used the sixth thoracic dermatomal level in their definition. With regards to the time to complete motor block and duration of motor block, all included studies used the modified Bromage score (0, no motor loss; 1, inability to flex the hip; 2, inability to flex the knee; 3, inability to flex the ankle). These scores at onset of block varied from 1 to 3, whereas motor recovery was defined as a Bromage score of 0 in all studies. Duration of sensory block was defined as the time taken for regression of the sensory block as defined by the authors.

Statistical analysis

Meta-analytic techniques were used where possible to combine the results. For dichotomous variables, the odds ratio (OR) and 95% confidence interval (CI) were calculated and combined using a random effects model. A statistically significant difference occurred when the 95% CI did not include 1.0. For continuous variables, the standardised mean difference (SMD) and 95% CI were calculated using random effects modelling. A statistically significant difference occurred when the 95% CI did not include 0. For the primary outcome, the overall mean duration of motor block (with CI) for the ropivacaine and bupivacaine groups was calculated and the mean difference (MD) was subsequently calculated. If continuous data were only reported as median with a range or interquartile range [IQR], the mean was estimated as equivalent to the median and standard deviation was computed to be approximately one-quarter of the range of data values. In the case of IQRs, the IQR was taken to represent two standard deviations.[10] Where necessary, values were rounded to one decimal place. A sensitivity analysis excluding outliers