Systematic review of spinal anaesthesia using bupivacaine for ambulatory knee arthroscopy

Nair GS, Abrishami A, Lermitte J, Chung F

CRD summary
The authors concluded that findings suggested that 4 to 5 mg of hyperbaric bupivacaine could produce effective spinal anaesthesia for outpatient knee arthroscopy with unilateral positioning. The specific doses mentioned in the conclusion appeared to be based on limited evidence, so the authors' conclusion should be interpreted with caution.

Authors' objectives
To evaluate the effects of bupivacaine for spinal anaesthesia in ambulatory knee arthroscopy.

Searching
MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (CENTRAL) and DARE were searched over periods ranging from 1950 to December 2007. Search terms were reported. No language restrictions were applied. Reference lists of retrieved studies were handsearched. Principal authors and experts contacted for additional published or unpublished studies.

Study selection
Parallel-group, randomised controlled trials (RCTs) that evaluated bupivacaine for spinal anaesthesia during elective knee arthroscopic surgery in an ambulatory setting were eligible for inclusion. Quasi-randomised studies were excluded.

All but one of the included trials evaluated hyperbaric bupivacaine. The review evaluated different doses of bupivacaine (doses ranged from 3 mg to 15 mg), the effect of adjuvants (fentanyl and morphine), bupivacaine versus ropivacaine, and unilateral versus bilateral positioning during spinal anaesthesia. The mean age of included patients was 41 years (range 18 to 83). The review assessed time to onset of spinal block, time to recovery, voiding and home discharge, and complications and failures.

Three reviewers independently selected studies. Discrepancies were resolved by a fourth reviewer.

Assessment of study quality
Three reviewers independently assessed validity using method of randomisation, allocation concealment, blinding and completeness of follow-up. Disagreements were resolved by a fourth reviewer.

Data extraction
For each trial, where possible, times until events of interest and mean differences and standard deviations were extracted.

Two reviewers independently extracted data which were then verified and checked. Authors were contacted for missing data if required.

Methods of synthesis
Where possible, pooled weighted mean differences (WMD) with 95% confidence intervals (CI) were calculated using fixed-effect and random-effects models; where results were similar for both models and only results from fixed-effect models were presented. Heterogeneity was assessed using the $I^2$ statistic, with values of greater than 50% to indicate substantial heterogeneity.

Meta-analysis was used to pool data on time to discharge time for bupivacaine plus adjuvant versus plain bupivacaine, and for unilateral versus bilateral positioning. Trials reporting other outcomes were combined in a narrative synthesis. Trials comparing different doses of bupivacaine were grouped by the position of the patient during spinal anaesthesia.
Results of the review

Fifteen RCTs were included (one trial included two types of comparison and was counted as two trials in the review). The number of patients was unclear; it appeared to be approximately 1,117. Eleven trials met all the quality criteria (adequate methods of randomisation, allocation concealment, blinding and completeness of follow-up). The other five trials were considered to be at moderate risk of bias.

**Unilateral position during spinal anaesthesia** (four RCTs): Studies using the same bupivacaine dose reported varying times to recovery. Results on time to home discharge were inconsistent. Failure rates were low (0% in 3 studies and 1.9% and 6.2% in one study).

**Supine position during spinal anaesthesia** (one RCT): Higher bupivacaine doses (10 and 15 mg) were associated with a significantly increased time to voiding and discharge compared to lower doses (5 and 7.5 mg); the 5 mg dose was associated with higher failure rate (26%).

**Opioid adjuvants** (fentanyl and morphine) (four RCTs, n=260 patients): There was no statistically significant difference in time to discharge for adjunctive fentanyl compared with no fentanyl (three studies, n=190 patients). Adding morphine increased recovery time compared with adjunctive fentanyl or no adjunctive agents. The authors stated that adding opioids was associated with reduced pain scores and decreased requirement for analgesia, but no supporting data were presented. All studies reported increased side effects associated with adjunctive fentanyl. The most common side effect was pruritus (in 48% to 75% of patients in the fentanyl group).

**Bupivacaine versus ropivacaine** (five RCTs): Studies reported no significant difference between bupivacaine or levobupivacaine plus ropivacaine for time to voiding and discharge and side effects.

**Unilateral and bilateral spinal anaesthesia** (two RCTs): The authors stated that unilateral spinal anaesthesia was associated with a reduced time to discharge, but it was not clear from tables which group in one study received the unilateral anaesthesia. Both studies reported that unilateral spinal anaesthesia was associated with a significant reduction in side effects and bradycardia; there was no significant difference in the risk of urinary retention.

Authors' conclusions

Findings suggested that 4 to 5 mg of hyperbaric bupivacaine could produce effective spinal anaesthesia for outpatient knee arthroscopy with unilateral positioning.

CRD commentary

The review question was clearly stated. Inclusion criteria were appropriately defined for study design, intervention and participants. Several relevant sources were searched and attempts were made to minimise publication and language bias. Appropriate methods were used to minimise reviewer error and bias during the review process. Only RCTs were included, validity was assessed and results were reported.

Little information was provided about patients and no details were reported of the surgical interventions, so the generalisability of findings was unknown. Meta-analysis was appropriately used to pool only homogeneous data. Clinically diverse studies that reported different outcomes were appropriately combined in a narrative synthesis. It was not possible to verify some review findings since no supporting data were presented. Much of the review was well-conducted. The conclusion about the optimal bupivacaine dose appeared to be based on a small number of RCTs that found inconsistent results for some outcomes, and were inadequately described with respect to patient characteristics and surgical intervention. This means that the authors' conclusion should be interpreted with caution.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that larger studies that directly compare low doses of bupivacaine in the unilateral position are required to determine the optimal dose of bupivacaine for outpatient knee arthroscopy. Studies are also required to compare plain and hyperbaric bupivacaine. Future studies should use standardised doses and concentrations of local anaesthetic, more consistent patient positioning and more consistent outcome measures.
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