A systematic review of randomized controlled trials that evaluate strategies to avoid epidural vein cannulation during obstetric epidural catheter placement

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CRD summary
This review concluded that use of lateral patient position, fluid predistention, single-orifice catheters, wire-embedded polyurethane epidural catheters and limiting the depth of catheter insertion to 6cm or less may reduce the risk of intravascular placement of the lumbar epidural catheter in pregnant women. This review was generally well conducted and these conclusions are likely to be reliable.

Authors' objectives
To evaluate the evidence for seven strategies that have been proposed to minimise epidural vein cannulation during lumbar epidural catheter placement in pregnant women.

Searching
MEDLINE, EMBASE, CINAHL and Cochrane Central Register of Controlled Trials (CENTRAL) were searched without language restriction from 1968 to 2007. ISI Web of Knowledge was searched for additional studies. Search terms were reported. Reference lists of relevant publications were screened. Study authors were contacted for clarifying any specific techniques of epidural catheter insertion not reported in the published paper.

Study selection
Randomised controlled trials (RCTs) that evaluated strategies to minimise epidural vein cannulation during lumbar epidural catheter placement in pregnant women were eligible for inclusion. The review outcome was the incidence of epidural vein or intravascular cannulation. Only the results from primary placement attempts were included in the analyses.

The included studies evaluated the following strategies: positioning the patient in the lateral as opposed to sitting posture; using the paramedian as opposed to the midline approach to the epidural space; using a smaller epidural needle or catheter as opposed to a larger one; injecting fluid through the epidural needle before inserting the catheter (fluid predistension) compared with inserting the catheter without fluid injection; using a single catheter versus a multi-orifice catheter; using a wire embedded polyurethane catheter versus alternative designs; and limiting the depth of catheter insertion. All the included studies were published between 1984 and 2007.

Two reviewers independently assessed studies for inclusion. Any disagreements were resolved by discussion.

Assessment of study quality
The quality of studies was assessed using a modified version of Chalmers weighted quality assessment tool (a scale evaluating randomisation, comparability of groups, loss to follow-up, adequate description of the interventions and controls, adequate description of outcome measures and blinding, intention-to-treat analysis and adequate presentation of main outcome measures). The criteria of patient blinding and testing compliance were considered not applicable in this review. The possible quality score ranged from 0% (lowest) to 100% (highest).

Three reviewers performed the validity assessment. Any disagreements were resolved by discussion.

Data extraction
Data were extracted on the number of patients who experienced an event. Odds ratios (ORs), with 95% confidence intervals (CIs), were calculated.

Two reviewers independently performed the data extraction. Any disagreements were resolved by discussion.
Methods of synthesis
Where appropriate, studies were combined in meta-analyses using a random-effects model (DerSimonian and Laird method). Pooled ORs with 95% CIs were calculated. Statistical heterogeneity was investigated using X² statistic. Where there was significant heterogeneity between studies, metaregression was used to detect potential explanatory variables.

Results of the review
Thirty RCTs (n=12,923) were included in meta-analyses, four of which were unpublished studies. The mean quality score of studies was 35% (range 19% to 79%).

Patient position: Compared with the sitting position, placement of epidural catheter in the lateral position was associated with a significant reduction in epidural vein cannulation (OR 0.53, 95% CI 0.32 to 0.86; six RCTs).

Fluid injection before catheter insertion: Compared with no predistension, predistension of the epidural space with fluid was associated with a significant reduction in epidural vein cannulation (OR 0.49, 95% CI 0.25 to 0.97; eight RCTs).

Multi-orifice catheters: Compared with multi-orifice catheters, single-orifice catheters were significantly associated with a reduction in epidural vein cannulation (OR 0.64, 95% CI 0.45 to 0.91; five RCTs).

Wire-Embedded Polyurethane Catheter Design: Compared with conventional nylon catheters, wire-embedded polyurethane design was associated with a significant reduction in intravascular catheter placement (OR 0.14, 95% CI 0.06 to 0.30; five RCTs).

Epidural catheter insertion depth: Compared with insertion depths of 7cm or more, insertion depths of 6cm or less were significantly associated with a reduction in intravascular cannulation (OR 0.27, 95% CI 0.10 to 0.74; two RCTs).

Anatomic approach (midline or paramedian) (one RCT) and needle or catheter gauge (one RCT) did not lead to a significant effect.

Significant heterogeneity was only observed for the outcome for fluid injection before catheter insertion (p=0.04). Metaregression showed that more recent trials were more likely to show favourable results for fluid predistention (p=0.008).

Authors' conclusions
Use of lateral patient position, fluid predistention, single orifice catheters, wire-embedded polyurethane epidural catheters and limiting the depth of catheter insertion to 6cm or less may reduce the risk of intravascular placement of the lumbar epidural catheter in pregnant women. The strength of the conclusions was limited by the low quality of included studies.

CRD commentary
This review's inclusion criteria were clear. Several relevant databases were searched. Efforts were made to find both published and unpublished studies without language restriction, which minimised the potential for language and publication biases. Sufficient attempts were made to minimise the errors and biases in the review process. Relevant criteria were used to examine the study quality. Statistical heterogeneity was assessed and appropriate methods were used to pool the results. This review was generally well conducted. In view of the limited quality of included studies, the authors' cautious conclusions reflected the evidence presented and are likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that there was insufficient evidence to support the use of paramedian versus midline approach or smaller needle or epidural catheter sizes.

Research: The authors stated that further high-quality studies should test the interaction between patient position, predistention and alternative catheter designs to prevent epidural vein cannulation during lumbar epidural catheter placement in pregnant women.
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