Ultrasound guided internal jugular vein access in children and infant: a meta-analysis of published studies

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CRD summary
This review concluded that ultrasound guidance during internal jugular vein access has no effect on failure rate and complications in infants and children. Given the small number of included trials of uncertain quality and small sample sizes, and the potential for missing studies, the authors’ conclusions should be interpreted with caution.

Authors' objectives
To assess the advantages of ultrasound pre-location and/or guidance over anatomical landmarks during internal jugular vein access in children and infants.

Searching
PubMed and EMBASE were searched for studies published in English to April 2009; search terms were reported. Reference lists of identified relevant reviews, meta-analyses and studies were manually searched.

Study selection
Randomised controlled trials (RCTs) that compared ultrasound pre-location and/or guidance versus anatomical landmarks techniques during internal jugular vein access in children and infants were eligible for inclusion. The outcomes were rate of internal jugular vein access failure, carotid artery puncture, haematoma at puncture site, and pneumothorax and/or haemothorax.

In the included trials, children's age ranged from one day to eight years; their mean weight ranged from 5 to 8.9 kg. Cardiac surgery patients comprised the patient group (where reported). The ultrasound technique used was pre-location or intraoperative ultrasound guidance. Failure rates for ultrasound ranged from 0 to 20%; failures rates for skin landmark ranged from 10.8 to 23.1%.

Two reviewers independently assessed the studies for inclusion; disagreements were resolved through consultation with two other reviewers.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Two reviewers independently extracted data to calculate odds ratios (ORs), mean differences (MDs) or standardised mean differences (SMDs) and their 95% confidence intervals (CIs). In trials that reported outcomes as medians and ranges, the means and variances were estimated by the methods of Hozo. Disagreements were resolved through consultation with two other reviewers.

Methods of synthesis
Outcomes were pooled using fixed-effects meta-analysis; when significant heterogeneity was present random-effects models were used. Heterogeneity was assessed using the $X^2$ and I$^2$ statistic; $p<0.10$ or I$^2>40%$ was considered to be significant. A value of one was assigned to all cells if any of the cells contained zero.

Subgroup analysis was used to clarify the effects of the ultrasound techniques used (pre-location or guidance), and the experience of practitioners.

Results of the review
Five RCTs (n=359 children) were included in the review.

In comparison with anatomical landmarks, ultrasound pre-location and/or guidance decreased the number of punctures required (MD -0.81, 95% CI -1.10 to -0.52; three RCTs; $I^2=0\%$), but had no effect on internal jugular vein access failure rate (five RCTs), the rate of carotid artery puncture (five RCTs), haematoma, haemothorax, or pneumothorax occurrence (three RCTs).

When the analysis was restricted to the two trials that used pre-location guided ultrasound, there were significant decreases in both internal jugular vein access failure rate (OR 0.13, 95% CI 0.03 to 0.61; $I^2=0\%$) and inadvertent carotid artery puncture (OR 0.16, 95% CI 0.03 to 0.77; $I^2=2\%$) compared with anatomical landmarks. When intraoperative ultrasound guidance was used, there were no significant differences compared with anatomical landmarks for either failure rate or inadvertent carotid artery puncture.

When the analysis was restricted to the two trials where internal jugular vein access was performed by novice practitioners, there were significant decreases in both internal jugular vein access failure rate (OR 0.11, 95% CI 0.02 to 0.52; $I^2=0\%$) and inadvertent carotid artery puncture (OR 0.11, 95% CI 0.02 to 0.48; $I^2=0\%$); there were no significant advantages of ultrasound in experienced practitioners.

**Authors’ conclusions**
Ultrasound guidance during internal jugular vein access had no effect on failure rate and complications in infants and children.

**CRD commentary**
The review question was supported by appropriate inclusion criteria. Two databases were searched. Only English-language studies were sought, which introduced the potential for language bias. The review was restricted to published studies, so some studies may have been missed. Two authors performed study selection and data extraction, which minimised risks of reviewer error and bias in the analysis.

The absence of any formal quality assessment of included trials limited interpretation of the reliability of the findings; there were a small number of included trials with small sample sizes. Appropriate methods were used to combine the trials and to assess heterogeneity.

Given the small number of included trials of uncertain quality and small sample sizes, and the potential for missing studies, the authors’ conclusions should be interpreted with caution.

**Implications of the review for practice and research**
The authors did not state any implications for practice or further research.

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