Use of ultrasound to place central lines
Keenan S P

Authors' objectives
To determine the relative effectiveness of the use of real time ultrasound and landmarks alone to place central venous catheters (CVCs)

Searching
MEDLINE was searched from 1966 to 2001 using 'central venous catheter', 'internal jugular vein', 'subclavian vein' or 'femoral vein' as the search terms with the restriction 'controlled clinical trial'. Two previous systematic reviews and the references from these plus other selected studies were checked.

Study selection
Study designs of evaluations included in the review
Only randomised controlled trials (RCTs) and quasi-RCTs were considered for the review.

Specific interventions included in the review
Comparisons of the use of real time ultrasound (using an external probe or Doppler ultrasound) with the use of traditional landmark techniques alone to place CVCs were considered in this review. Eleven of the included studies used Doppler ultrasound and 13 used external ultrasound.

Participants included in the review
Any patient group that required placement of a CVC was eligible. The included studies were of medical-surgical patients, intensive care unit patients, adult cardiothoracic surgery patients, paediatric cardiac surgery patients, dialysis, apheresis or total parenteral nutrition patients, cardiac catheterisation patients, chemotherapy patients, post-cardiac arrest patients, and an unspecified population in one study.

Outcomes assessed in the review
The outcomes specified in the inclusion criteria were time to catheter placement, number of attempts, number of successes at first attempt and failure to place catheter. Complications were also recorded.

How were decisions on the relevance of primary studies made?
The author does not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
The quality of the studies was assessed according to concealment of allocation, blinding, whether patient characteristics were stated, standard method of catheter insertion, explicit descriptions of outcomes, post-randomisation exclusions and intention-to-treat analysis. The author does not state how the papers were assessed for quality, or how many of the reviewers performed the quality assessment.

Data extraction
The author does not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. Failure rate for catheter placement, successful placement at first attempt and rate of arterial puncture were all reported by using individual study risk differences and their 95% confidence intervals (CIs).

Methods of synthesis
How were the studies combined?
The studies were combined in a meta-analysis using a random-effects model to calculate a summary risk difference, with 95% CI, for failure rate for catheter placement, successful placement at first attempt and rate of arterial puncture. For time to catheter placement and number of attempts at catheter placement, the results were reported as mean and standard deviation. The weighted mean differences were also calculated. Trials reporting only median values were not pooled with the others.

How were differences between studies investigated?
Heterogeneity was assessed visually and by means of the chi-squared test. Pre-specified subgroup analyses were also reported.

Results of the review
Eighteen trials (17 RCTs and 1 quasi-RCT) were included. The number of participants was not specified.

The pooled estimates resulting from the meta-analyses showed a statistically-significant reduction in the failure rate, number of attempts and arterial puncture rate with ultrasound in comparison with landmarks. However, the results of the heterogeneity test were highly significant for all of these outcomes. This heterogeneity persisted when the results were analysed by vein type. Some of the heterogeneity may be explained by differences between the types of ultrasound, but these analyses were not presented in the review.

Authors’ conclusions
'Adoption of real-time ultrasound to guide CVC placement has the potential to improve successful line placement and minimise complications.'

CRD commentary
This review addressed an appropriate question using adequate inclusion and exclusion criteria. This review was an update of previous systematic reviews, but by restricting the searches to MEDLINE it risked omitting some recent studies. The review appears to have been conducted by a single author and thereby risked being susceptible to a high degree of reviewer bias. The details of the primary studies included in the review were presented, but details of the review methods were not. The meta-analysis was appropriate, but given the high degree of heterogeneity found, the reporting of the pooled estimates was not. Further investigation of the sources of heterogeneity was required. It appears that the inclusion criteria of the review were too broad and narrower criteria should have been specified for populations. Given these reservations with the review, the author's conclusions appear too general. Further research is required to identify the conditions under which real-time ultrasound is truly beneficial.

Implications of the review for practice and research
Practice: The author states that the adoption of real-time ultrasound to guide CVC placement has the potential to improve successful line placement and minimise complications.

Research: Further clinical trials and cost-effectiveness studies are required.

Bibliographic details
Keenan S P. Use of ultrasound to place central lines. Journal of Critical Care 2002; 17(2): 126-137

PubMedID
12096376

Indexing Status
Subject indexing assigned by NLM

MeSH
Catheterization, Central Venous /adverse effects /economics /methods; Critical Care /economics /methods; Hospital Costs; Humans; Intensive Care Units; Randomized Controlled Trials as Topic; Ultrasonography; United States

AccessionNumber
12002001573

Date bibliographic record published
30/11/2003

Date abstract record published
30/11/2003

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.