Systematic review and meta-analysis of ultrasound in the diagnosis of deep vein thrombosis

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Background
The role of ultrasound has been evaluated by numerous research studies. We aimed to systematically review the literature to determine the diagnostic accuracy of ultrasound in the diagnosis of deep vein thrombosis (DVT).

Methods
We sought to identify all diagnostic cohort studies of patients with suspected DVT that compared the results of ultrasound to a reference standard of venography. We searched the following electronic databases (1986-2004): Medline, EMBASE, CINAHL, Web of Science, Cochrane Database of Systematic Reviews, Cochrane Controlled Trials Register, Database of Reviews of Effectiveness, and the ACP Journal Club. The bibliographies of all retrieved articles were scanned for potentially relevant articles that were not identified by the original search.

Titles and abstracts were screened by two independent reviewers (FS and SG). Full copies of all selected articles were retrieved and reviewed by the same two reviewers. We included studies published in English, French, Spanish or Italian, but excluded studies published in other languages. Two independent reviewers (SG and EVB) extracted data and assessed study quality against validated criteria.

Results

Pooled estimates of sensitivity (proximal and distal DVT) and specificity were calculated using a random effects model. Meta-regression was used in order to explore the influence of study level covariates on diagnostic performance. All analyses were undertaken using MetaDiSc statistical software.

Statistical Analysis
Pooled estimates of sensitivity (proximal and distal DVT) and specificity were calculated using a random effects model. Meta-regression was used in order to explore the influence of study level covariates on diagnostic performance. All analyses were undertaken using MetaDiSc statistical software.

Table: Sensitivity and specificity

<table>
<thead>
<tr>
<th>Author &amp; date</th>
<th>N (%) of positive scans confirmed by venography</th>
<th>N (%) of repeat ultrasound scans positive</th>
<th>N (%) of repeat ultrasound scans confirmed by venography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heijboer, 1993</td>
<td>93/80 (19%)</td>
<td>17/93 (18.5%)</td>
<td>72/85 (84.7%)</td>
</tr>
<tr>
<td>Cogn, 1996</td>
<td>85/175 (48%)</td>
<td>12/85 (14%)</td>
<td>45/89 (51.8%)</td>
</tr>
<tr>
<td>Szorczynski, 1991</td>
<td>70/171 (41%)</td>
<td>0/58 (0%)</td>
<td>-</td>
</tr>
<tr>
<td>Birdwell, 1998</td>
<td>69/405 (17%)</td>
<td>7/94 (2,0%)</td>
<td>8/38 (2,0%)</td>
</tr>
<tr>
<td>Birdwell, 2000</td>
<td>95/700 (14%)</td>
<td>9/32 (1,7%)</td>
<td>8/3 (0,2%)</td>
</tr>
</tbody>
</table>

Overall, our best estimate of the positive yield of repeat scanning is 35/2610 = 1.34% (95% CI 0.97 to 1.86%).

Conclusions
Ultrasound has sensitivity of 95% for proximal DVT, sensitivity of 65% for distal DVT, and specificity of 94%. Our estimates of sensitivity are slightly lower, and specificity slightly higher, than previous meta-analyses. This may be because we were less selective and included more studies than previous meta-analyses.

The best diagnostic performance is achieved using a compression ultrasound and colour doppler, although compression ultrasound alone has almost the same accuracy. Even after accounting for different techniques used, there is substantial heterogeneity among the results of individual studies. This is probably explained by differences among operators and populations studied.

Repeat ultrasound in unslected patients with a negative initial scan is positive in 1.34% of cases.

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