Is duplex venous surveillance worthwhile after arthroplasty?
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Routine post-operative duplex ultrasound surveillance for the detection of deep venous thrombosis (DVT) following arthroplasty.

Type of intervention
Secondary prevention.

Economic study type
Cost-utility analysis.

Study population
Patients undergoing knee and hip arthroplasties.

Setting
Hospital setting. The study was carried out at the Medical University of South Carolina and the Ralph Henry Johnson Department of Veterans Affairs Medical Center, South Carolina, USA.

Dates to which data relate
The effectiveness data were collected over the period 1991-1994 and from a review of studies published between 1959 and 1995. The price year was 1995.

Source of effectiveness data
Effectiveness data were derived from a single study and a review of previously published studies.

Link between effectiveness and cost data
The costing was undertaken on the same patient sample as that used in the effectiveness study. The costing was carried out prospectively alongside the effectiveness study.

Study sample
A total of 628 patients underwent 738 arthroplasty procedures. DVT was clinically suspected after 95 procedures. Duplex scans were performed for 371 of the 643 procedures. No scans were performed in the 272 procedures for asymptomatic patients.58% of patients were male and 69% were white. Patient age ranged from 15 to 92 years, with a mean age of 61 (+/- 14) years. A minimum of 612 patients would be required in each of the DVT and the no DVT group to detect a 1% difference in rate of pulmonary embolism with a power of 0.80 at the p<0.05 significance level. The possibility of a type II error could not be excluded due to the very low incidence of DVT detected.
Study design
This was a retrospective cohort study carried out at a single centre. Patient follow-up averaged 162 (+/- 285) days. No patients were lost to follow-up.

Analysis of effectiveness
The analysis of the clinical study was based on the intention to treat principle. The primary health outcome studied was the incidence rate of DVT. No explicit analysis was undertaken to assess the comparability of the groups. This may be justified by the observation that the incidence of DVT was not correlated to the type or timing of prophylaxis, type or location of operation, or patient age, race or gender.

Effectiveness results
Ten DVTs were identified after 738 procedures. 2 of 371 surveillance examinations in asymptomatic patients were positive. 4 of 37 duplex scans performed in symptomatic patients were positive (OR: 22 versus duplex screening, 95% CI: 4-130, p<0.001). 5 of 62 phlebograms performed in symptomatic patients were positive. Phlebography and duplex scanning agreed in 14 of 15 patients who underwent both tests. 8 of 95 patients with symptoms of DVT had the diagnosis confirmed by duplex or contrast phlebography.

Clinical conclusions
The value of post-operative surveillance depends on the incidence of DVT as well as the LRP and LRN for duplex. The low incidence of clinically significant DVT and pulmonary embolism with current prophylaxis does not justify an aggressive screening program.

Modelling
A decision tree was generated to describe the three alternatives for follow-up.

Outcomes assessed in the review
The outcomes assessed in the review included the probabilities for the various potential outcomes, the sensitivity and specificity of duplex ultrasound in symptomatic and asymptomatic patients.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Approximately 16 studies were included in the review.
Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
DVT was expected to be present in 0.11 symptomatic patients and 0.012 asymptomatic patients. Duplex ultrasound was expected to yield a positive result in 0.11 symptomatic patients and 0.01 asymptomatic patients. Duplex ultrasound displayed a sensitivity of 0.97 and a specificity of 0.97 in symptomatic patients. The sensitivity and specificity of duplex ultrasound performed in asymptomatic patients was assumed to be 0.51 and 0.96, respectively. Phlebography was assumed to be 100% accurate for the presence of DVT.

Measure of benefits used in the economic analysis
The measure of benefit used was quality adjusted life years (QALYs). Utility scores were derived by consensus of the vascular surgeon authors. Expected utility scores for each alternative screening program were extrapolated over a 5-year period and discounted at an annual rate of 5%.

Direct costs
Costs were not discounted. Quantities and costs were not reported separately. Only costs for bilateral venous duplex study and for bilateral contrast phlebogram were included. The quantity/cost boundary adopted was that of the hospital. The estimation of quantities and costs was based on actual data. Costs were retrieved from the Medicare reimbursement schedule. The price year was 1995.

Statistical analysis of costs
Statistical analysis included the post hoc Scheffe F-test for discontinuous variables and stepwise regression for continuous variables. Comparisons between groups were performed using the Chi-square test. P<0.05 was considered to be statistically significant.

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
The sensitivity analysis varied the incidence of DVT or the true positive rate of duplex screening in asymptomatic patients.

Estimated benefits used in the economic analysis
Utility values of 0.95 and 1 were used for DVT and no DVT, respectively. The expected utility with duplex surveillance improved by less than 1 day.

Cost results
A charge of $163 for bilateral venous duplex study and $96 for bilateral contrast phlebogram was used. Compared with
no surveillance, the incremental cost of detection of one additional DVT in asymptomatic patients was $35,000.

**Synthesis of costs and benefits**

Duplex surveillance had an incremental cost of $110,000 per QALY. Sensitivity analysis on the incidence of DVT in asymptomatic patients and on the sensitivity of duplex scanning revealed that the incremental cost per DVT detected would not fall below $10,000 per DVT detected or $33,000 per QALY unless the incidence of DVT in asymptomatic patients exceeded 5%. If duplex had been 100% sensitive, then the incremental cost would have been $17,000 per DVT detected or $52,000 per QALY. The incremental cost for mandatory phlebographic screening was $5,500 per DVT detected.

**Authors’ conclusions**

Surveillance has not been found to be incrementally cost-effective and has not provided an effective strategy to reduce the incidence of fatal pulmonary embolism following knee or hip arthroplasty with appropriate perioperative prophylaxis.

**CRD COMMENTARY - Selection of comparators**

The rationale for the choice of the comparators was clear.

**Validity of estimate of measure of benefit**

The measure of benefit would appear to be valid. However, the utility scores represent the views of 3 surgeons, and not those of the patients who underwent the procedure. The literature also suggests that if benefits are discounted, then costs should be discounted at the same rate. This rationale was not followed by the authors.

**Validity of estimate of costs**

Only direct charges associated with the screening programme have been included. The authors used charges, which do not represent true opportunity costs. The impact of the screening programme on treatment costs for DVT and pulmonary embolism have not been included. No sensitivity analysis on costs was carried out. Hence, it is difficult to assess the robustness of the cost results.

**Other issues**

The impact of multiple examinations was not considered. The study may suffer from a small sample size in each group. Hence, the possibility of a type II error is present. The results are not readily generalisable to other settings or countries since the sensitivity and specificity of duplex ultrasound may differ across institutions.

**Implications of the study**

These results should be validated by further research. In particular, the accuracy of the screening test should be varied and a more extensive cost analysis undertaken.

**Source of funding**

None stated.

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Other publications of related interest


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