Cost-effectiveness analysis of total ankle 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
Total ankle arthroplasty was compared with ankle fusion in the treatment of end-stage ankle arthritis.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of 55-year-old patients seeking an operation for ankle osteoarthritis.

Setting
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were taken from papers published from 1979 to 2003. The price year for the costs was 1998.

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
The authors used a decision tree model to estimate the costs and quality-adjusted life-years (QALYs) in the treatment of end-stage ankle arthritis.

Outcomes assessed in the review
The outcomes assessed in the review were:

the percentage of successful fusions;
the percentage of nonunions;
the percentage of amputations after ankle fusion;
the percentage with hindfoot arthritis;
the percentage of successful arthroplasties;
the mean follow-up after ankle replacement;
the revision rate; and
the percentage of amputations after ankle replacement.

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
Fourteen primary studies were included in the review.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The percentage of successful fusions was 75%.

The percentage of nonunions was 20%.

The percentage of amputations after ankle fusion was 5%.

The percentage with hindfoot arthritis was 50%.

The percentage of successful arthroplasties was 80%.

The mean follow-up after ankle replacement was 10 years.

The revision rate was 18%.

The percentage of amputations after ankle replacement was 2%.

Methods used to derive estimates of effectiveness
The authors made assumptions, on the basis of a review of clinical studies, to derive estimates of utility.

**Estimates of effectiveness and key assumptions**

The estimates of utility were:

- ankle fusion, 0.8;
- ankle replacement, 0.9;
- revision ankle replacement, 0.8;
- hindfoot arthritis, 0.7;
- non-union, 0.75;
- surgery and postoperative recovery, 0.5;
- below-the-knee amputation, 0.6; and
- revision fusion after replacement, 0.75.

**Measure of benefits used in the economic analysis**

The outcome measure used was the QALYs.

**Direct costs**

The costs were discounted at a rate of 3% per year. The costs were estimated for mean hospital charges for the Diagnosis-Related Groups associated with each intervention. These charges were based on data from the Centers for Medicare and Medicaid Services, reported in 1998.

**Statistical analysis of costs**

No statistical analysis was undertaken.

**Indirect Costs**

The indirect costs were not included in the analysis.

**Currency**

US dollars ($).

**Sensitivity analysis**

Both univariate and multivariate sensitivity analyses were conducted. Several key variables were investigated, including the duration of prosthetic function, QALYs following ankle replacement and fusion, the probability of surgical complications, the discount rate and the cost of surgical procedures.

**Estimated benefits used in the economic analysis**

The benefits were discounted at a rate of 3%. Total ankle replacement resulted in 14.23 QALYs, whereas ankle fusion resulted in 13.71 QALYs. This represented an incremental gain of 0.52 QALYs.
Cost results
The total expected cost was $16,568 for ankle replacement versus $6,990 for ankle fusion. This represented an incremental cost of $9,578.

Synthesis of costs and benefits
The costs and benefits were combined to give a cost per QALY.

The cost per QALY for the base-case was $18,419.

Sensitivity analyses showed that the functional life of prosthesis had the largest effect on the cost per QALY.

The cost of the surgical procedure, complications and discount rates had little effect on the cost per QALY.

Authors’ conclusions
Total ankle arthroplasty represents a potential technological advance in the treatment of ankle arthritis. Despite a lack of long-term data, the interest in implementing this new technology is growing. The dissemination of total ankle arthroplasty will be more justified if long-term clinical trials document levels of prosthetic survival and function that meet or exceed thresholds identified in this study.

CRD COMMENTARY - Selection of comparators
The rationale for the selection of the comparators was clear. Ankle arthroplasty has been used to overcome the limitations of ankle fusion. Early implant designs had a high failure rate. However, the new designs introduced have shown improved results.

Validity of estimate of measure of effectiveness
The authors did not state that they carried out a systematic review of the literature. They made assumptions for the model based on the results in the literature. The differences between the studies were discussed in the paper, and a sensitivity analysis was performed on all parameters to explore the impact of uncertainty in parameter values.

Validity of estimate of measure of benefit
The economic benefit was measured by QALYs, which were estimated using a decision model. The model considered the health status that the patients could enter and the probability of moving between the states.

Validity of estimate of costs
The authors reported that the costs were estimated from a payer’s perspective. The source of the cost data was appropriately given, and the reporting of the price year would aid reflation exercises in other settings. Sensitivity analyses were performed on the costs of the surgical procedures, which enhances the validity of the results.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. In addition, sensitivity analyses were undertaken which helps validate the findings. The authors acknowledged a number of limitations in the study. For example, several variables in the model had unknown values, such as the durability of ankle prosthesis and the long-term utility of ankle fusion and replacement. However, sensitivity analyses performed on these variables did not change the results of the study.

Implications of the study
The authors stated that the analysis would benefit from empirical studies that more directly measure the long-term
utility of ankle fusion and ankle replacement.

**Source of funding**
None stated.

**Bibliographic details**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
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