The cost-effectiveness of reverse total shoulder arthroplasty compared with hemiarthroplasty for rotator cuff tear arthropathy

Coe MP, Greiwe RM, Joshi R, Snyder BM, Simpson L, Tosteson AN, Ahmad CS, Levine WN, Bell JE

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.

CRD summary
This study evaluated the cost-utility of reverse shoulder arthroplasty for patients with rotator cuff tear arthropathy. The authors concluded that total arthroplasty could be cost-effective, within a tight complication rate range, but the results were sensitive to changes in health utility and implant cost estimates. The method of calculating the clinical data was poor, and the utility data were uncertain due to the small sample. The authors’ conclusions do not sufficiently reflect the poor quality of the data.

Type of economic evaluation
Cost-utility analysis

Study objective
This study evaluated the cost-utility of reverse shoulder arthroplasty, for patients with rotator cuff tear arthropathy.

Interventions
Reverse shoulder arthroplasty (total replacement) was compared with hemiarthroplasty (replacing only the humeral head).

Location/setting
USA/in-patient care.

Methods
Analytical approach:
A Markov state-transition model was used to combine published clinical data to assess the costs and outcomes at different time points. Patients were modelled in annual cycles from 70 years of age, until death. The authors stated that a societal payer perspective, limited to the direct costs, was used.

Effectiveness data:
The key clinical data were the complication and revision rates following the initial procedure, and complication rates following revision. The outcomes were based on observational data. The most relevant and robust peer-reviewed articles, with similar inclusion and exclusion criteria, were selected. The number of complications and revisions from each study were converted to a rate per shoulder-year, by dividing the probability of an event by the average follow-up period. These rates were then averaged across the studies for each of the surgical procedures.

Monetary benefit and utility valuations:
Utilities were applied to five health states: well after primary surgery; well after revision; non-operative complication after primary surgery; complication after revision; and death. The utilities were from a retrospective observational study of all patients undergoing hemiarthroplasty or reverse shoulder arthroplasty, for rotator cuff tear arthropathy, at one medical centre, from 2000 to 2008. Thirteen patients undergoing total arthroplasty and 18 patients undergoing hemiarthroplasty were contacted and completed the Short Form (SF)-36 Health Survey. These data were converted to utilities using the published SF-6D algorithm. Different utilities were estimated for complications following hemiarthroplasty, and those following total arthroplasty.

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs) gained; discounted at an annual rate of 3%.

Cost data:
The costs of the implants, procedures, and revisions were included. Standard Medicare costs were used as a proxy for societal costs, with implant prices representing the direct medical costs. Implant costs were based on 2008 Deupuy list prices. The costs of procedures and revisions were based on national average Medicare reimbursement rates, using diagnosis-related group codes. The costs were in US $ and were discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way sensitivity analysis was performed on all parameters in the model.

Results
Reverse shoulder arthroplasty cost $23,000 compared with $12,000 for hemiarthroplasty. Total arthroplasty resulted in 6.454 QALYs compared with 6.334 QALYs for hemiarthroplasty. The incremental cost-effectiveness ratio of total arthroplasty, compared with hemiarthroplasty, was $94,118 per QALY gained.

The results were sensitive to the complication rates. At a total arthroplasty complication rate of more than 9.6%, total arthroplasty was dominated by hemiarthroplasty, as it was less effective and more costly. At a cost-effectiveness threshold of $100,000, total arthroplasty was cost-effective at a complication rate of less than 8.4%.

Similarly, varying the complication rate of hemiarthroplasty from 4.6% to 5.3% changed the cost-effectiveness of total arthroplasty from being dominated to being cost-effective. The same occurred when varying the utility of the hemiarthroplasty state, over a 0.01 range. The results were also sensitive to the implant price.

Authors' conclusions
The authors concluded that total arthroplasty could be cost-effective, within a tight complication rate range supported by the literature, but the results were sensitive to changes in health utility and implant cost estimates.

CRD commentary
Interventions:
There was an adequate description of the interventions. The authors stated there was no standard practice, and the two surgical interventions were both in use, so they were relevant comparators for the setting. There may be other relevant interventions for rotator cuff arthropathy.

Effectiveness/benefits:
The clinical outcomes were based on observational data, with the rates of complications and revisions averaged across the studies, for each of the surgical procedures. A weighted average might have been more appropriate. The complication rate was not calculated using the mathematical formula to convert probabilities to rates, and it is difficult to judge the impact of this error. The authors stated that the included studies had similar inclusion and exclusion criteria, but no patient characteristics were reported to compare the studies for each synthesis. Few patients provided information for the utilities, which could make these estimates uncertain. The authors appeared to estimate different utilities for complications, depending on the surgical procedure, as total arthroplasty complications were extrapolated from hemiarthroplasty data. The differences in the complications were not described.

Costs:
The authors stated that a societal perspective was adopted, but limited to the direct medical costs. A societal perspective normally includes patient, carer and productivity costs. The patient group was elderly, so there was unlikely to be much productivity lost, but there was no discussion of any patient or carer costs. The price year was not clearly stated, but the costs were from 2008 sources. The costs were adequately reported.

Analysis and results:
The model was adequately described, and the results were sufficiently reported. There were a few methodological problems that the authors did not discuss.

Concluding remarks:
The method of calculating the clinical data was poor and the utility data were uncertain, given the small sample. The authors' conclusions do not sufficiently reflect the poor quality of the data.

**Funding**
Not stated.

**Bibliographic details**

**PubMedID**
22265767

**DOI**
10.1016/j.jse.2011.10.010

**Original Paper URL**
http://www.jshoulderelbow.org/article/S1058-2746(11)00507-6/abstract

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Aged; Aged, 80 and over; Arthroplasty, Replacement /economics /methods; Cost-Benefit Analysis; Hemiarthroplasty /economics /methods; Humans; Lacerations /complications /surgery; Middle Aged; Range of Motion, Articular; Retrospective Studies; Rotator Cuff /surgery; Rupture /diagnosis /surgery; Shoulder Joint /physiopathology /surgery; Time Factors; Treatment Outcome

**AccessionNumber**
22012036111

**Date bibliographic record published**
14/01/2013

**Date abstract record published**
03/07/2013