Cost-utility of metal-on-metal hip resurfacing compared to conventional total hip replacement in young active patients with osteoarthritis


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 compared the cost-utility of metal-on-metal hip resurfacing arthroplasty with that of total hip arthroplasty, for active patients under 65 years old, with osteoarthritis. The authors concluded that resurfacing seemed more cost-effective for younger patients and men, but there was high uncertainty. The study was generally well reported, but the risk of bias in the effectiveness data was unclear. The authors’ conclusions were appropriately cautious.

Type of economic evaluation
Cost-utility analysis

Study objective
This study aimed to compare the cost-utility of metal-on-metal hip resurfacing arthroplasty (resurfacing) with total hip arthroplasty (replacement), for 50-year-old physically active patients with osteoarthritis.

Interventions
Replacement, which was the standard care, was compared with resurfacing. With replacement, the hip was replaced by a prosthesis generally consisting of an acetabular component, a femoral component, and bearing surfaces; the head of the femur was completely removed. With resurfacing the damaged surfaces of the proximal femur and the acetabulum were removed, but the femoral head was retained; the resurfacing device was the Birmingham HRA.

Location/setting
Canada/secondary care.

Methods
Analytical approach:
A 15-year Markov cost-utility model was developed for the ongoing risk of hip-replacement failure and the need for revision. The model had one-year cycles. After replacement surgery, patients could have two revision surgeries. Resurfacing patients could have a revision or a replacement; after a revision, they could have a replacement, and after replacement, they could have two revision surgeries. The authors stated that they took a health care system perspective.

Effectiveness data:
The primary effectiveness data were the time to replacement failure and the need for revision for each type of replacement. These were from the National Joint Replacement Registry of the Australian Orthopaedic Association (184,629 patients). Estimates were calculated by age group and gender. Surgery-related mortality was from a Swedish registry, and complications were from the Hip Improvement Project (HIP), in Alberta.

Monetary benefit and utility valuations:
Utility scores were applied for the first year after surgery, for each following year, and for whether or not a complication was experienced during surgery. The utilities depended on whether the surgery was primary, revision, or conversion. They were from the HIP, which used the SF-36, which was converted to SF-6D, and analysed by age group (>55 or ≤55 years) and gender. A common ratio of utilities for patients receiving replacement or resurfacing was applied. A ratio based on the HIP was applied for revision utilities. The utilities for complications were derived from a published study; they were assumed to apply for three months.
Measure of benefit:
The primary measure of benefit was quality-adjusted life-years (QALYs). Benefits were discounted at 3% annually.

Cost data:
Various Canadian or Alberta-region unit cost sources were used. The data included physician care, surgery, prosthetics, direct and indirect hospital costs, revisions, and care after surgery. Surgical costs included transfusions, cement, surgery time, and number of nurses and assistants, based on chart review. Revision and conversion costs were assumed to be identical, and were a proportion of primary surgery costs, based on a Canadian systematic review. Care after surgery included orthopaedic surgeon visits, physiotherapy, and prescription analgesics. Complications were assumed to cost the same regardless of surgery type, based on a publication. All costs were inflated to 2011 Canadian dollars (CAD) using the health care Consumer Price Index. Future costs were discounted at 3% annually.

Analysis of uncertainty:
Probabilistic sensitivity analyses were undertaken for the main analysis and seven subgroup analyses by gender and age group. The results were presented as cost-effectiveness scatter plots and cost-effectiveness acceptability curves. Deterministic threshold analyses were undertaken to assess the revision or conversion probability, and the cost of resurfacing, at which replacement was no longer less effective and more costly.

Results
In the main analysis, resurfacing was dominant, as it produced 0.079 more QALYs for CAD 583 less than replacement. It had a 58% likelihood of cost-effectiveness at a willingness-to-pay threshold of CAD 50,000 for a QALY.

In subgroup analyses, resurfacing remained dominant for males at 40 and 50 years, but not for 60-year-old men. For women, replacement dominated resurfacing, at 50 years or older. The likelihood of cost-effectiveness for resurfacing for 50-year-old women was 36%. The likelihood of cost-effectiveness remained stable at all thresholds over CAD 50,000 per QALY for all subgroup analyses.

The threshold analyses showed that an increase from a 1.5% first-year revision or conversion rate, to a 1.8% rate, removed the dominance of resurfacing. An increase to 2.5% made replacement dominant. A 2% increase in the cost of resurfacing surgery removed its dominance, as did a 44% increase in the cost of revision surgery. The results were not sensitive to changes in the conversion costs.

Authors' conclusions
The authors concluded that resurfacing seemed more cost-effective for younger patients and men, but that high uncertainty meant that it was not possible to determine the most cost-effective treatment.

CRD commentary
Interventions:
The economic evaluation included the standard care, which should be useful to local decision makers. The two treatments were only briefly described; it was unclear how the procedures were undertaken and the specific prosthesis used for replacement. The prosthesis particularly could influence the cost-effectiveness conclusions.

Effectiveness/benefits:
The primary effectiveness data (time to hip-replacement failure) were observational. It was stated that these estimates were for different age groups and gender, but there was no indication of any adjustment for confounding factors. So the difference in the time to failure between the types of surgery could be biased. The health outcomes were appropriately captured in the utility values. The authors acknowledged the uncertainty for some utilities, such as after revision surgery, where it was assumed that the ratio of primary-to-revision surgery from EQ-5D utilities would be the same for SF-6D utilities.

Costs:
In general, the costs were thoroughly described, with good justification for the included data and the choice of sources, but it was not clear if the chart review was part of the HIP or conducted elsewhere.

Analysis and results:
The analysis was reasonably well reported. There were two unclear model parameters: the proportion of cycle revision failure and proportion of cycle complication utility. The authors chose to apply triangular distributions to represent the uncertainty around these. This suggests a lack of information on their uncertainty, and one-way sensitivity analyses on these parameters would have been useful. The results were clearly presented, and the conclusion was appropriately cautious given the significant uncertainty in the results. The authors reported several appropriate subgroup analyses.

**Concluding remarks:**
The study was generally well reported, but the risk of bias in the effectiveness data was unclear. The authors’ conclusions were appropriately cautious, but uncertainty remains beyond that acknowledged by the authors.

**Funding**
Funded by the Alberta Arthroplasty Research Group, Canada.

**Bibliographic details**

**PubMedID**
24041344

**DOI**
10.1016/j.jval.2013.06.021

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adult; Alberta; Arthroplasty, Replacement, Hip /economics; Costs and Cost Analysis; Databases, Factual; Female; Health Care Costs; Health Surveys; Hip Prosthesis; Humans; Male; Markov Chains; Middle Aged; Models, Statistical; Motor Activity; Osteoarthritis, Hip /surgery; Prosthesis Failure; Quality-Adjusted Life Years

**AccessionNumber**
22013043059

**Date bibliographic record published**
22/10/2013

**Date abstract record published**
06/10/2014