Metal on metal hip resurfacing 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
The use of metal-on-metal hip resurfacing arthroplasty (MOM) as the initial hip replacement procedure was studied. MOM was compared with total hip replacement (THR) and watchful waiting. Watchful waiting involves patient monitoring, drug-based treatments and other supportive activities such as physiotherapy.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised hypothetical cohorts of adults with advanced hip disease. Separate models were estimated for younger persons (e.g. aged 45 - 50 on entry) and more active elderly persons (e.g. aged 65 - 70 on entry).

Setting
The setting was secondary care. The economic analysis was carried out in the University of Aberdeen, UK.

Dates to which data relate
The authors used a structured literature search published in 2002 to identify evidence on the clinical effectiveness of the three interventions for the treatment of hip disease. The dates of the sources included in the review ranged from 1991 to 2001. The resource use data were collected from one study published in 1998 and through discussions with local medical staff. The price year was 2000.

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

Modelling
A Markov model was used to estimate a typical patient's costs and outcomes for the treatment alternatives for 20 cycles, with each cycle lasting one year. The model for MOM assumed that an initial decision to use MOM was ultimately followed by a decision to use THR, unless deaths occurred before the need for other treatment. The THR model assumed that the initial decision to use THR was followed by a decision to use revision THR, unless death occurred first. The model for watchful waiting assumed that an initial decision to use watchful waiting was ultimately followed by a decision to use THR, unless death occurred beforehand.

Outcomes assessed in the review
The outcomes assessed included:

the mortality rates,

the complication rates,

the revision rates, and

health-related quality of life.

**Study designs and other criteria for inclusion in the review**
The objective of the search strategy was to identify any randomised or comparative observational studies, or systematic reviews, comparing MOM with THR or watchful waiting.

**Sources searched to identify primary studies**
The strategy to identify relevant research included an electronic search of databases and websites.

**Criteria used to ensure the validity of primary studies**
The criteria of Vale et al. (see Other Publications of Related Interest) were used.

**Methods used to judge relevance and validity, and for extracting data**
The methods of Vale et al. (see Other Publications of Related Interest) were used.

**Number of primary studies included**
Approximately 10 studies, along with data from the Office for National Statistics, were included in the review.

**Methods of combining primary studies**
Three studies on MOM revision rates were found. However, the data were derived from only one study since the other two had a very small sample size, or included a particularly young patient group who had had many operations and presented considerable deformity.

**Investigation of differences between primary studies**
The methods of Vale et al. (see Other Publications of Related Interest) were used.

**Results of the review**
The estimated annual equivalent revision rate for THR among younger and more active elderly patients was 1.36%.

The MOM revision rate was 1.52%. This was derived by taking the weighted average of the annual equivalent revision rates from the four sub-groups in a study by McMinn et al. (see Other Publications of Related Interest).

The annual probability of THR for watchful waiting patients was 8.33%.

The models used annual rates of mortality, derived from the Office for National Statistics, in 5-year bands over the 20-year time horizon of the model, with the addition of a 1% operative mortality risk.

The quality of life score was 0.964 for patients receiving MOM, 0.964 for those receiving THR and 0.503 for those treated by watchful watching. The quality of life for a dead person was 0.
Measure of benefits used in the economic analysis
The measure of benefit used was the number of quality-adjusted life-years (QALYs) gained. Quality of life scores for MOM and THR were obtained from a study where a group of patients with osteoarthritis of the hip were asked to consider hypothetical scenarios that were designed to reflect patients having mild, moderate and severe osteoarthritis of the hip. These patients were then asked to state how many years in each of these hypothetical states they would give up to achieve a certain number of years in perfect health (i.e. the time trade-off approach). Quality of life scores for watchful waiting were based on a similar study, which also used the time trade-off approach to utility scores. The health benefit was discounted at an annual rate of 1.5%, in accordance with the UK Treasury recommended rates at the time of the study.

Direct costs
Resource use and costs were reported separately. The direct costs included in the analysis were costs to the health service. These comprised operation costs, hospital ward costs and follow-up costs. The unit costs and resource use were obtained from the British National Formulary, while the unit costs of health care and social care were obtained from the Personal Social Services Research Unit, and from company submissions to the National Institute for Clinical Excellence (Midland Medical Technologies Ltd.). As the costs were incurred during 20 years, discounting was relevant and was appropriately performed at a rate of 6% per annum. All the costs were inflated to 2000 prices using the NHS price index. The average costs were reported in the analysis.

Statistical analysis of costs
The costs and resource use and were treated as point estimates (i.e. the data were deterministic).

Indirect Costs
The indirect costs were not included in the analysis.

Currency
UK pounds sterling ().}

Sensitivity analysis
The models were run using alternative key parameter values as part of a sensitivity analysis. The parameters varied in the analysis were the relative revision rates for MOM and primary THR, and the costs of treating a patient. The impact of the time horizon was also assessed, running the model for 5, 10 and 15 cycles. A further analysis considered the sensitivity of the incremental cost per QALY of MOM compared with watchful waiting, using alternative quality of life estimates for patients treated by watchful waiting.

Estimated benefits used in the economic analysis
The estimated QALYs gained by the different interventions were:
in the younger cohort, 16.20 with MOM, 12.46 with watchful waiting followed by THR, and 16.22 with THR;
in the active elderly cohort, 12.31 with MOM and 12.33 with THR.

Cost results
The costs of the different interventions were:
in the younger cohort, 6,297 for MOM, 6,476 for watchful waiting followed by THR, and 4,940 for THR; and
in the active elderly cohort, 6,180 for MOM and 4,818 for THR.
Synthesis of costs and benefits
The costs and benefits were combined using an incremental cost-utility ratio (i.e. the incremental cost required to gain an extra QALY). In the young persons cohort, when MOM was compared with watchful waiting followed by THR, MOM was found to dominate (i.e. it was both more effective and less costly than watchful waiting). However, when MOM was compared with THR, MOM was found to be both more costly and less effective than THR. In the active elderly cohort, when MOM was compared with THR, MOM was again found to be more costly and less effective than THR.

In the sensitivity analysis, MOM was found to become cost-effective as the revision rate of THR increased, or as the revision rate of MOM decreased. If the annual cost of watchful waiting fell below 620 per patient per annum, MOM would no longer dominate. The authors also found that even with THR prosthesis costs at 300% higher than the baseline prosthesis cost, THR continued to dominate MOM. MOM dominated MOM at each of the time horizons. The incremental cost per QALY gained for MOM compared with watchful waiting diminished until approximately 14.5 years after MOM, beyond which MOM dominated watchful waiting. MOM continued to dominate watchful waiting even at watchful waiting quality of life values of up to 0.963.

Authors’ conclusions
All data and modelling results indicated that metal-on-metal hip resurfacing arthroplasty (MOM) merited further scientific investigation.

CRD COMMENTARY - Selection of comparators
The choice of THR as a comparator was justified on the grounds that it represented the current standard practice in the authors’ setting. You should decide if the comparator represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The authors made use of a systematic review of the literature presented in a Health Technology Assessment report, commissioned by the National Health Service, investigating the effectiveness and cost-effectiveness of MOM for the treatment of hip disease. It is therefore very likely that all relevant research was identified. When combining estimates of effectiveness from the primary studies, the authors appropriately reported why MOM revision rates were only obtained from one study, and not from the three they originally identified. However, for THR revision rates, the authors did not mention why they had not used all their evidence and had only used the effectiveness data from a single study. The authors also failed to provide the all-cause mortality estimates that they used in the review, although they did report where these estimates were obtained from. All key parameters were appropriately varied in the sensitivity analysis.

Validity of estimate of measure of benefit
The estimation of benefits was modelled. The instrument used to derive a measure of health benefit, a Markov model, was appropriate. All future QALYs gained were discounted at a rate of 1.5% per annum, following recommendations from the Treasury.

Validity of estimate of costs
The resource use and costs were reported separately, which will enhance the generalisability of the authors’ results. All the categories of cost relevant to the health care service perspective adopted were included in the analysis, and no important costs appear to have been omitted from the analysis. The resource use and costs were obtained from a variety of sources, and appropriate sensitivity analyses were performed. All the costs were appropriately inflated from 1996 to 2000 using the NHS price index. Discounting was necessary, as some costs were incurred over 20 years, and was appropriately performed. The price year was reported, which will aid any future inflation exercises.

Other issues
The authors did not compare their findings with those from other studies. The issue of generalisability to other settings was addressed in the sensitivity analysis. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis. The authors reported as a limitation to their study that the model was constrained substantially by the lack of data.

**Implications of the study**
The authors reported that more controlled studies comparing MOM with THR and watchful waiting are needed, ideally through studies with long-term follow-up.

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None stated.

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**Other publications of related interest**


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