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Review

Executive summary

Primary total hip replacement surgery: a systematic review of outcomes and modelling of cost-effectiveness associated with different prostheses

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Health Technology Assessment
NHS R&D HTA Programme

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Objectives

- To identify the literature on primary total hip replacement (THR) surgery that is relevant to the question of whether prostheses differ in their medium to longer term outcomes, and to synthesise this evidence.
- To use evidence regarding both costs and outcomes of primary THR to model how much more effective newer prostheses must be to justify higher costs.

Methods

Data sources

- Electronic searches of MEDLINE and EMBASE (1980–1995).
- Hand-searches (1980–1995) of the 11 journals with the highest yield of relevant articles in the electronic searches.

Study selection

- Randomised controlled trials (RCTs) of any kind that compared prostheses for primary THR.
- Observational cohort studies that included concurrent controls.
- Observational studies of single prostheses with at least 5 years of follow-up and reporting outcomes in terms of revision rate or semi-standardised clinical assessment.

Data extraction and synthesis

It was not possible to carry out meta-analysis of the evidence from RCTs because each trial compared a unique pair of prostheses. A more informal form of meta-analysis was performed in which all data (randomised and observational) were combined for any prosthesis for which at least five independent studies reporting revision surgical rates were obtained. The meta-analysis was termed 'informal' because of the impossibility of controlling for numerous biases in the data and the poor quality of reporting of much of the evidence. Revision rates for eligible prostheses were calculated, adjusted for person-years at risk. Data were also combined for meta-analysis for other outcomes (i.e. hip scores, global ratings of success, and proportion of patients pain-free). However, studies lacked evidence of patient-based outcomes, and clinicians' views of outcome required substantial modification of diverse clinical ratings to produce a standardised score.

Costs and benefits of primary THR were assessed using Markov modelling, and calculation of costs per quality adjusted life-year, with sensitivity analysis of the results. Outcomes data were taken from a prospective study of a series of patients followed up for 14 years after THR. Costs were estimated from cost-generating events for THR and unit costs from a single centre (Nuffield Orthopaedic Centre, Oxford).

Results

Eleven RCTs were found that compared outcomes of prostheses. The trials followed up patients for short time periods (mean, 3.9 years) and had quite small sample sizes (mean, 168 patients). A significant difference between prostheses in terms of revision rate was observed in only one RCT.

When results of all reports that included a revision rate were combined, ten prostheses met the criterion set for a meta-analysis that at least five independent studies should be available for a prosthesis to be included. Adjusted THR revision rates (revision rate per 100 person-years at risk) were calculated for each of the ten prostheses to take account of different lengths of observation. The most favourable adjusted revision rates were found for the Exeter, Lubinus and Charnley prostheses. Intermediate results were found for the Müller, McKee-Farrar and Stanmore prostheses. The least favourable adjusted revision rates were observed for the Ring, Harris-Galante, PCA and Charnley-Müller prostheses.

Economic modelling indicated that to be cost-effective the following improvements in THR outcome and revision rates would be needed.

- For a new prosthesis costing three times more than the standard Charnley (i.e. typical cost of a new cementless prosthesis): ≥ 35–44% improvement in patients aged 50–70 years; ≥ 21–27% improvement in patients aged < 50 years.
- For a new prosthesis costing 1.5 times more than the standard Charnley (i.e. typical cost of a new

cemented prosthesis): 9–12% improvement in patients aged 50–70 years; 6–7% improvement in patients aged < 50 years.

From the available evidence, the extent of the improvement required of new and more expensive prostheses is particularly implausible for older patients. However the new cheaper prostheses may be cost-effective because the improvements required are more likely to be achievable.

Conclusions

There is a striking paucity of clear and relevant evidence on which to make well-informed choices about prostheses for primary THR. Although basic scientific innovation continues in relation to THR, the knowledge base to inform selection of prostheses is unlikely to improve in the foreseeable future.

Of prostheses commonly used in the NHS by far the greatest volume of evidence is available for the Charnley and on the basis of that evidence the Charnley appears to perform relatively well. However, the Charnley design has changed, and it is not clear how much of the evidence is relevant to the current design.

Of other prostheses currently used in the NHS, positive evidence (but no data from RCTs) was found in support of the Exeter prosthesis, and some positive evidence was found for the Stanmore (for example, evidence that it performed as well as the Charnley in an RCT). Positive evidence for the Lubinus IP (less widely used in the NHS) was also found. The quality of the evidence for other prostheses was either poor or non-existent. No substantial evidence could be found for cementless prostheses in terms of independent observation of results from five or more studies.

None of the analyses used in this review, such as meta-analysis of evidence, could overcome the fundamental weaknesses of the available evidence. The poor quality of evidence overall does not provide a basis clearly and authoritatively to identify prostheses that could be – or should not be – recommended for use by the NHS. However, it is clear that the more expensive the prosthesis, the more difficult it is to provide justification for its selection on the basis of the current evidence. On the basis of the economic analysis it seems that the use of the more expensive (i.e. cementless) prostheses is hard to justify on current evidence.

Recommendations for future research

As a substantial proportion of the evidence on outcomes of THR comes from healthcare systems quite different from the NHS (i.e. the Swedish and Norwegian national registers) it is recommended that the case for a UK register should be evaluated.

Least biased assessments would be from RCTs, but to detect the small but important differences that may exist between prostheses such trials must be more adequately designed and powered than those carried out previously, and should involve multicentre participation and long-term follow-up. Economic modelling in this review indicates that such trials might identify differences in cost-effectiveness between cemented prostheses.

Patient-based outcomes provide relevant and feasible methods to conduct large multicentre studies. To obtain unbiased assessments of outcome, the focus should be on outcomes of concern to patients, particularly pain and function, and not solely on revision surgery.

Publication

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NHS R&D HTA Programme

The overall aim of the NHS R&D Health Technology Assessment (HTA) programme is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and work in the NHS. Research is undertaken in those areas where the evidence will lead to the greatest benefits to patients, either through improved patient outcomes or the most efficient use of NHS resources.

The Standing Group on Health Technology advises on national priorities for health technology assessment. Six advisory panels assist the Standing Group in identifying and prioritising projects. These priorities are then considered by the HTA Commissioning Board supported by the National Coordinating Centre for HTA (NCCHTA).

This report is one of a series covering acute care, diagnostics and imaging, methodology, pharmaceuticals, population screening, and primary and community care. It was identified as a priority by the Acute Sector Panel and funded as project number 93/11/08.

The views expressed in this publication are those of the authors and not necessarily those of the Standing Group, the Commissioning Board, the Panel members or the Department of Health. The editors wish to emphasise that funding and publication of this research by the NHS should not be taken as implicit support for the recommendations for policy contained herein. In particular, policy options in the area of screening will, in England, be considered by the National Screening Committee. This Committee, chaired by the Chief Medical Officer, will take into account the views expressed here, further available evidence and other relevant considerations.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The editors have tried to ensure the accuracy of this report but cannot accept responsibility for any errors or omissions. They would like to thank the referees for their constructive comments on the draft document.

Copies of this report can be obtained from:

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