

Executive summary

Antimicrobial prophylaxis in total hip replacement: a systematic review

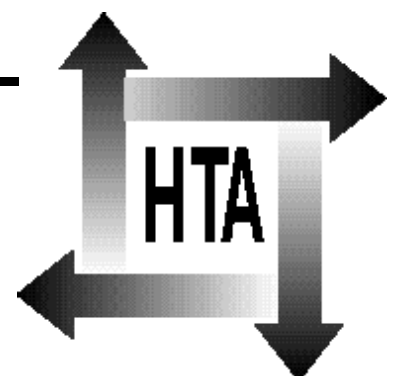
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Background

Total hip replacement (THR) has become one of the most successful and cost-effective operations ever introduced. The procedure has been practised widely in the UK for more than 25 years, with rates of THRs increasing all the time.

As with all surgery, THR has associated risks. These risks may include general risks such as vascular and/or neural injuries, thrombosis and infection. A recent survey of available data on hospital-acquired infections stated that one in 16 patients treated in hospital would develop an infection. Such hospital-acquired infections are thought to be costing the NHS in excess of £170 million in England alone.

Infection of a joint prosthesis can be devastating, increasing morbidity and hospitalisation. The role of antimicrobial prophylaxis in reducing infection rates is undisputed. However, uncertainty still remains over the choice of agent, the optimal duration, and mode of administration.

Objective

The aim of this review was to undertake a systematic review of the research evidence on the comparative efficacy and cost-effectiveness of antimicrobial prophylaxis used for patients undergoing a THR.

Methods

Data sources

Literature searches of the Cochrane Controlled Trials Register, MEDLINE and EMBASE were conducted to identify randomised controlled trials (RCTs) published between 1966 and 1998, which investigated antimicrobial prophylaxis in the prevention of postoperative wound infection following THR surgery. Reference lists of existing reviews in the area of antimicrobial prophylaxis in orthopaedic surgery were examined and experts in the field contacted to help identify further papers. Studies in all languages were considered.

Titles and abstracts of all studies identified by the searches were assessed by two reviewers to locate those that were potentially evaluations of antimicrobial prophylaxis in THR surgery.

Data extraction and validity

Data extraction and validity assessment were carried out by one reviewer and checked for accuracy by a second reviewer. Disagreements that could not be resolved through discussion were taken to a third party.

The principal outcome assessed in the review was the incidence of surgical wound infection (SWI). Data on systemic and remote infections, adverse events and resource use outcomes were also collected.

Data synthesis

Studies were grouped according to antimicrobial regimen used. Where appropriate, formal meta-analysis and investigation of heterogeneity among trials were conducted. If possible, the effect of antimicrobial prophylaxis was assessed according to the nature of the THR (i.e. primary or revision procedure) and the type of prosthesis used.

Results

A total of 25 RCTs were included in the review. The overall rate of SWI across all the included trials of antimicrobial prophylaxis for THR surgery was 1% (2.1% when total knee replacement (TKR) patients were included). *Staphylococcus aureus* and *Staphylococcus epidermidis* were the most frequently isolated pathogens in the trials included in the present review.

Trials of total joint replacement surgery have illustrated that SWI rates can be statistically significantly reduced when an antimicrobial is used prophylactically, compared with placebo or no intervention. However, trials to date provide inconclusive evidence on the optimal antimicrobial prophylaxis regimen. The comparative efficacy of antimicrobial prophylaxis for THR (and TKR) surgery was difficult to demonstrate, mainly due to the low infection rates and the small sample sizes of the trials.

Cephalosporins (first and second generation) were the most commonly studied antibiotics. There is no convincing evidence to suggest that third-generation cephalosporins are more effective than first- and second-generation cephalosporins in preventing SWIs in THR surgery.

The duration of the antimicrobial prophylactic regimen examined in the included trials varied from a single dose to a 14-day course. There is no evidence to suggest that administering antimicrobial prophylaxis for more than 1 day postoperatively reduces the number of infections following THR surgery. Extending the duration of a regimen for longer than 24 hours may not only be wasteful, but potentially hazardous in terms of toxicity, and the increased risk of developing bacterial resistance.

The antimicrobial prophylaxis examined in the review were administered parenterally, orally, or in antibiotic-loaded cement. The results of trials in this area are inconclusive. The cost and ease of administration should, therefore, be used to determine which route should be used.

Little information on the cost of the antibiotic regimens examined was provided in the RCTs included in the review.

It was not possible to carry out an assessment of the potential risk factors associated with total joint replacement surgery, due to inconsistencies in the reporting of such data within the included trials.

Conclusions

Antimicrobial prophylaxis is effective for the prevention of SWI in both TKR and THR surgery.

The efficacy of many of the regimens studied may be similar, and available data make it difficult to identify an optimal regimen. There is no convincing evidence to suggest that the new-generation cephalosporins are more effective at preventing postoperative SWI infections in THR/TKR surgery than the first-generation cephalosporins. Similarly, there is no convincing evidence to suggest that

extending the duration of a regimen beyond 24 hours postoperatively reduces the number of SWI following THR/TKR surgery. Single-dose or short-term administration is not only as effective as long-term administration, but will lower overall costs and may reduce the risk of toxicity and the development of bacterial resistance.

Implications for policy

There is evidence to support the use of antimicrobial prophylaxis in elective THR. However, the universal acceptance of a fixed antimicrobial regimen should be avoided in order to minimise the development of antibiotic resistant bacteria. Guidelines, based on available research evidence, should be developed locally by surgeons, microbiologists and pharmacists, taking into account local sensitivities to organisms commonly implicated in wound infection post THR. Cost, patient acceptability and the minimisation of adverse effects should also be taken into consideration. Such guidelines should be constantly reviewed and updated, as no definitive version can be established.

Recommendations for research

No further small, under-powered trials examining antimicrobial prophylaxis for the prevention of SWI following THR/TKR should be funded. Given the low infection rates following THR/TKR surgery, and the possible changing pattern of bacteria resistance, it may not be cost-effective to carry out mega-trials of antimicrobial prophylaxis in this area. Future research needs to examine the risk factors that determine the level of SWIs in patients undergoing THR. Risk factors could be used to identify a high-risk group on whom trials of new or additional prophylactic measures could be performed. However, if such trials were to be undertaken they must be able to recruit sufficient patients to have the power to show a statistically significant difference.

Publication

Glenny AM, Song F. Antimicrobial prophylaxis in total hip replacement: a systematic review. *Health Technol Assess* 1999;**3**(21).

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 Pharmaceutical Panel and funded as project number 94/29/01.

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 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.

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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.

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ISSN 1366-5278