Antibiotic prophylaxis for wound infections in total joint arthroplasty: a systematic review

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CRD summary
The authors concluded that antibiotic prophylaxis was effective in reducing wound infection following total joint replacement. There was no evidence to suggest the superiority of one group of antibiotics or route of administration over any others. In light of methodological weaknesses in the review process and limitations in the available studies, the reliability of the authors' conclusions is unclear.

Authors' objectives
To update a previous systematic review (see Other Publications of Related Interest) on the efficacy of antibiotic prophylaxis in reducing wound infections in patients who underwent total joint replacement.

Searching
MEDLINE, EMBASE, CINAHL and The Cochrane library were searched. Search terms were reported. Search dates varied across sources and spanned 1966 to July 2007. Google Scholar search engine and AMEDEO Medical Literature Guide were also searched. Reference lists of retrieved articles were handsearched. Primary authors of selected articles were contacted to identify further unpublished clinical trials. Only English-language trials were eligible for inclusion.

Study selection
Randomised controlled trials (RCT) of antibiotics administered preoperatively in any dose and by any route of administration to patients who underwent primary or revision total hip replacement or total knee replacement and which measured wound infection rates were eligible for inclusion. Studies that compared different doses of the same drug were excluded.

Included studies were of the following intervention comparison groups: cephalosporins, lincomycin or penicillin derivatives compared to placebo, no antibiotic cement or no treatment; a variety of systemic antibiotics compared to antibiotic cements; cephalosporins compared to teicoplanin; cephalosporins compared to penicillin derivatives; and first generation cephalosporins compared to second generation cephalosporins. Dosage used and route and timing of administration varied between studies; intravenous administration was the most common route. The duration of treatment ranged from one to 14 days. Included studies were of patients with total hip replacement or total knee replacement. One study was of total joint replacement and other arthroplasties. The definition of wound infection varied between included studies and ranged from early or superficial infection to late or deep infection. The follow-up ranged from 10 days to 10 years. The studies included for review were single and multi-centre trials conducted in North America, Europe and Asia.

The authors stated neither how the studies were selected for the review nor how many reviewers performed the selection.

Assessment of study quality
Validity was assessed using criteria described in the Delphi list measuring randomisation, allocation concealment, blinding, baseline comparability, description of eligibility criteria, sample size, intention-to-treat analysis and excluded data. Methodological quality was assessed by one reviewer.

Data extraction
Data were extracted on the number of wound infections in each group and used to calculate relative risks (RR) with corresponding 95% confidence intervals (CI) for individual studies. Where data were available on the number of joints, these were used rather than the number of patients. When the rates of wound infection in all randomised joints was not available, an available case analysis was used.

The authors stated neither how the data were extracted for the review nor how many reviewers performed the data extraction.
Methods of synthesis
A pooled relative risk with 95% CI was calculated for each intervention comparison group using the Mantel-Haenszel model. Statistical heterogeneity was assessed using the I² statistic.

Results of the review
Twenty six RCTs were included for review (n=11,343). Randomisation was unclear in 21 studies. Allocation concealment was unclear in 22 studies. Eight studies had double or triple blinding. Seventeen studies had adequate baseline comparability. All but one study defined eligibility criteria. Sample size calculation was not reported or was unclear and intention-to-treat analysis was unclear or inadequate for 22 studies.

Prophylactic antibiotics significantly reduced the risk of wound infection compared to no antibiotics or placebo (RR 0.19, 95% CI 0.12 to 0.31, p<0.00001; seven studies, n=3,065). There was no evidence of significant statistical heterogeneity. There was no significant difference between systemic antibiotics and antibiotic impregnated cement (three studies, n=2,388), between cephalosporins and teicoplanin (five studies, n=2,625), between cephalosporins and penicillin derivatives (three studies, n=386) and between first and second generation cephalosporins (eight studies n=2,879) in the rate of wound infection. Statistical heterogeneity for these analyses was low or absent.

Authors’ conclusions
Antibiotic prophylaxis was effective in reducing wound infection following total joint replacement, but there was no evidence to suggest superiority of one group of antibiotics or route of administration over any others.

CRD commentary
The review addressed a clear question with well-defined inclusion criteria. Several relevant databases were searched and attempts were made to identify unpublished data, thereby minimising the risk of publication bias. The review was restricted to English language articles, which introduced a risk of language bias. The review methods for study selection and data extraction were unclear and the validity assessment was conducted by only one reviewer, therefore, the possibility of error and bias in the review process could not be ruled out. A suitable validity assessment was carried out, but methodological weaknesses were evident in several studies and this may have affected the reliability of the data. The results of the validity assessment were not fully used to inform the results. The decision to combine the results in a meta-analysis was appropriate, statistical heterogeneity was assessed and no evidence of significant statistical heterogeneity was found. In light of methodological weaknesses in the review process and limitations in the available studies, the reliability of the authors’ conclusions is unclear.

Implications of the review for practice and research
Practice: The authors stated that patients who underwent joint arthroplasty should be offered antibiotic prophylaxis with type and route determined by cost and local availability.

Research: The authors stated that further rigorous RCTs of antibiotics in joint arthroplasty were needed. These should be conducted in accordance with the Consort Standards and with clear outcome measures and internationally accepted definitions.

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