Comparison of ceftriaxone and cefuroxime for surgical prophylaxis in orthopaedic practice

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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 study examined the use of two generations of cephalosporin, ceftriaxone and cefuroxime, as antibiotic prophylaxis in orthopaedic surgery. Ceftriaxone was given at a dose of 1 g intravenously 30 minutes before operation. Cefuroxime was given at a dose of 1.5 g preoperatively, followed by 2 doses of 750 mg postoperatively at 8-hour intervals.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised orthopaedic patients with no history of recent infection. Patients with known septic focus or associated disease, such as diabetes mellitus, sickle cell disease and immuno-compromise, were excluded from the study.

Setting
The setting was secondary care. The economic study was carried out in Saudi Arabia.

Dates to which data relate
The dates to which the data referred were not reported. The price year was also not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The cost data were collected prospectively for the same patient sample as that used in the effectiveness study.

Study sample
No power calculations were reported. The study recruited consecutive patients undergoing orthopaedic surgery. One hundred and twenty patients were recruited to the study, with 60 randomised to each treatment group. The average age of the study sample was 34.65 (+/- 13.978) years for the ceftriaxone group and 35.5 (+/- 14.373) years for the cefuroxime group. Forty-three patients randomised to ceftriaxone were male, compared with 39 of those randomised to cefuroxime. The average duration of surgery was 112.16 (+/- 39.759) minutes in the ceftriaxone group and 108.5 (+/- 39.254) minutes in the cefuroxime group. The authors did not report the number of patients excluded from the study.
Study design
The study was a randomised controlled trial that was conducted in a single centre. The method of randomisation was not reported. The patients were followed up for 12 months. The authors did not report any loss to follow-up. The surgeons performing the orthopaedic procedure were blinded to the type of prophylaxis used, but no other participants were blinded.

Analysis of effectiveness
There were no data to suggest that the analysis did not include the full study sample. The primary health outcome was the incidence of postoperative infection. The secondary outcomes were side effects due to the drug and tolerance to antibiotics. The authors reported that the demographic characteristics of the two groups were well matched at baseline.

Effectiveness results
Three patients (5%) in the cefuroxime group, but none (0%) in the ceftriaxone group, developed infection. No statistical tests were reported.

There were no local or regional side effects due to the drugs in either group. The patients tolerated the antibiotics well.

Clinical conclusions
The authors concluded that single-dose ceftriaxone is a safe and effective means of prophylaxis in orthopaedic surgery.

Measure of benefits used in the economic analysis
The measure of benefits used was the incidence of postoperative infection.

Direct costs
The direct costs included in the analysis were the hospital costs of providing the study drugs. No other costs (e.g. intravenous sets, nursing time) were included in the analysis. The resource use data were derived from the same patient sample as that used in the effectiveness study, but the source of the price data was not provided. Discounting was not relevant given the short timeframe of the study. The study reported the average cost of providing prophylaxis.

Statistical analysis of costs
No statistical analysis of the costs was undertaken, possibly because of the minimal amount of cost data included in the analysis.

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

Currency
Saudi riyals (SR). The study also reported the costs in US dollars ($), but the date or source of the exchange rate used was not reported.

Sensitivity analysis
No sensitivity analyses were carried out.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section. Ceftriaxone was estimated to be superior to cefuroxime in the prevention of
postoperative infection over the course of 1 year. The side effects of treatment were not considered in the analysis.

Cost results
The cost of providing prophylaxis with ceftriaxone was SR2,460 ($656), compared with SR3,840 ($1,024) for cefuroxime.

Synthesis of costs and benefits
The costs and benefits were not combined as ceftriaxone was estimated to dominate cefuroxime, being both more effective and less costly.

Authors’ conclusions
A single dose of ceftriaxone was more effective and economically better than 3 doses of cefuroxime for prophylaxis among patients undergoing orthopaedic surgery.

CRD COMMENTARY - Selection of comparators
The authors explicitly justified their focus on cephalosporins by stating that they are part of routine practice. You should consider whether cephalosporins are routinely used for antibiotic prophylaxis in your own setting. The authors did not explicitly justify their decision to exclude a third cephalosporin, cefazolin, from the analysis even though it might have been a relevant comparator.

Validity of estimate of measure of effectiveness
The effectiveness data were derived from a single-centre randomised trial, which was an appropriate design for the study question. The study sample appears to have been representative of the study population, and there were no data to indicate that the study groups were not comparable at analysis. Although the investigators were not blinded to the treatment, the incidence of infection should be a relatively objective outcome measure. There was little information on the statistical analysis performed on the outcome measures, and no indication that the difference in outcome was statistically significant.

Validity of estimate of measure of benefit
The estimation of benefits was obtained directly from the effectiveness analysis. This choice of estimate was appropriate given the study objectives.

Validity of estimate of costs
The authors did not specify the perspective of the study. They included only the costs of the drugs used for prophylaxis. It is unlikely that the omission of other categories of costs would have affected the study conclusions, given that the less costly drug was estimated to be more effective in preventing postoperative infection. The resource use data were derived from a single study and no statistical analysis of the quantities was conducted. This might have been due to the minimal amount of cost data included in the study. The source of the price data was not stated, nor was the price year or the method of conversion from Saudi Riyals to US dollars. This may affect the generalisability of the study results in countries where ceftriaxone is not the cheaper of the two drugs compared. Discounting was unnecessary, as all the costs were incurred during one year, and was therefore not performed.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to settings outside of Saudi Arabia was not addressed. The authors do not appear to have presented their results selectively, and their conclusions reflected the scope of their analysis. The study enrolled patients undergoing orthopaedic surgery and this was reflected in the authors’ conclusions. The authors stated that the small size of their
study was a limitation, but concluded that it is still possible to derive inference from the study results.

**Implications of the study**
The authors suggested that single-dose prophylaxis may be preferable when antibiotic resistance is taken into consideration. They also suggested that single-dose ceftriaxone is safer, and that large-scale multi-centre trials at various hospitals in Saudi Arabia are needed.

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**Bibliographic details**

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