Cost-effectiveness analysis of cefepime compared with ceftazidime in intensive care unit patients with hospital-acquired pneumonia


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 third and fourth generation cephalosporins in the treatment of hospital acquired pneumonia.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients at least 18 years of age, receiving either cefepime or ceftazidime for the treatment of hospital acquired pneumonia. Patients were excluded if the absolute neutrophil count was less than 1000 cells/mm3, a pathogen resistant to antibiotic therapy was identified within 24 hours of therapy or if patients received antibiotic therapy for less than 72 hours.

Setting
Hospital intensive care unit. The economic analysis was conducted in Hartford, Connecticut, USA.

Dates to which data relate
Effectiveness data were collected from March 1997, although the precise duration of the study is not stated. Resource data were also collected in 1997. The base price years used were not stated.

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

Link between effectiveness and cost data
Cost data were collected prospectively although the clinical endpoints were determined retrospectively.

Study sample
50 consecutive patients who received ceftazidime for HAP prior to formulary conversion to cefepime were compared with 50 consecutive patients who received cefepime for HAP immediately after the formulary conversion. 58% of patients in the ceftazidime group were male and 68% of the cefepime groups were male. The mean age of patients in the two groups was 67.0 (+/- 16.7) years and 68.2 (+/- 16.9) years. Power calculations were not used to determine the sample size.
Study design
This was a single centre retrospective before and after study (although it should be noted that different samples were used in the before and after analyses). There was no loss to follow up. The duration of follow up was 14 days after the end of drug therapy.

Analysis of effectiveness
The analysis of effectiveness was based on the intention to treat principle. The primary health outcomes used were successful treatment rates for pneumonia, microbiological eradication rates and the incidence of adverse events. At analysis both groups were similar in demographic and clinical characteristics.

Effectiveness results
At the end of the 14 day follow-up period there was a significant difference in successful treatment rates for patients in the cefepime and ceftazidime groups, 39 patients (78%) versus 30 patients (60%) respectively, (p=0.05). Bacterial eradication rates were also significantly better in the cefepime group, 77% versus 55%, (p=0.04). Adverse events were mild and the incidence of such events was similar between the two groups.

Clinical conclusions
Cefepime had favourable clinical success rates at the end of the 14 day follow up period compared with ceftazidime.

Modelling
A decision tree model was used to combine probabilities of clinical success with cost estimates for the two treatment options.

Measure of benefits used in the economic analysis
The authors did not utilise a summary health benefit measure. As such the benefits are assumed to be those of the effectiveness results reported above. A cost-consequences analysis was therefore performed.

Direct costs
Drug acquisition costs, additional antibiotics and costs of treating adverse events and clinical failures were estimated. Costs of hospitalisation were also estimated. The costs of study drugs were estimated using acquisition costs at the study hospital at the time of the clinical study, March 1997. Preparation and administration costs for other drugs were estimated using a published 1997 time and motion study at the study hospital. Hospitalisation costs were determined by multiplying the study hospital’s 1997 cost to charge ratio by all charges for patients in the clinical study. Costs were not discounted due to the short time period of the study. An institutional perspective was adopted in the economic analysis. The base price year used in the analysis was not clearly stated.

Indirect Costs
Not included.

Currency
US dollars ($).

Sensitivity analysis
Clinical efficacy rates were varied in one way sensitivity analysis.
Estimated benefits used in the economic analysis
The reader is referred to the effectiveness results reported above.

Cost results
The costs of study drugs, additional drugs and treatment for adverse events and clinical failure were significantly less for the cefepime group compared with the ceftazidime group, $266.59 (+/- $200.17) and $395.93 (+/- $355.22) respectively, (p=0.04). Costs did not differ significantly when all hospitalisation costs were included for patients $19,996.21 (+/- $13,999.77) for cefepime and $24,528.10 (+/- $16,698.54) for ceftazidime. It is not clear, however, whether costs refer to costs per patient or costs per 50 patient cohort.

Synthesis of costs and benefits
A synthesis was not undertaken by the authors since the intervention was the dominant strategy in all outcome measures analysed.

Authors' conclusions
Cefepime is a cost-effective alternative to ceftazidime in the treatment of HAP. Furthermore the results of the analysis were robust in sensitivity analysis. Overall hospital costs tended to be lower in the cefepime group although this was not significant, and randomised controlled trials are required further to compare the two interventions.

CRD COMMENTARY - Selection of comparators
A justification for the comparator was provided by the authors. Both cephalosporins are well used in the treatment of HAP and cefepime has been demonstrated in previous trials to have an advantageous microbiological profile compared with ceftazidime.

Validity of estimate of measure of benefit
Benefits were taken from a small before and after study, and as such may be subject to bias. Furthermore, power calculations do not appear to have been used to determine the sample size. Clinical data including post-treatment evaluation were taken from actual clinical practice and were shown to be robust in one-way sensitivity analysis. The authors, whilst acknowledging the weakness of the non-randomised study sample, did point out that their findings were similar to those from previously conducted randomised controlled trials.

Validity of estimate of costs
Adequate details were provided of the sources of cost data, although it was not entirely clear whether the base price year used was 1997. It was not clear whether the cost estimates reported were mean costs per patient, per cohort or some other measure. Future analyses may also wish to consider other costs such as those to the individual and society.

Other issues
The authors indicated that length of mechanical ventilation and length of stay may also favour cefepime, although this did not reach statistical significance and was not reported formally. The issue of the generalisability of results to other settings was not specifically addressed. In the sensitivity analysis the efficacy of ceftazidime would have to be 51% higher than cefepime to become more cost-effective.

Implications of the study
Further well designed randomised controlled trials alongside economic evaluations are required to examine the cost effectiveness of alternative cephalosporins used in the treatment of HAP.
Bibliographic details

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