Pharmacoeconomic analysis of cefmenoxime dual individualization in the treatment of nosocomial pneumonia

Paladino J A, Fell R A

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
Dual individualisation of cefmenoxime dosing in the treatment of nosocomial pneumonia.

Type of intervention
Treatment

Economic study type
Cost-effectiveness analysis

Study population
Patients with documented gram-negative nosocomial pneumonia, aged on average 70.

Setting
Hospital. The economic study was carried out in the USA.

Dates to which data relate
Effectiveness data and resource data were taken from two studies published in 1984. Price date was not specified.

Source of effectiveness data
Single study.

Link between effectiveness and cost data
Cost data were collected prospectively on the same patient. Populations used in the effectiveness analysis.

Study sample
61 patients were considered overall, out of which 33 received cefmenoxime at standard dosing and 28 received doses according to dual individualisation methodology. No power calculations were reported.

Study design
Two consecutively conducted prospective clinical studies involving patients with documented gram negative nosocomial pneumonia were used to estimate effectiveness of intervention and comparator respectively.

Analysis of effectiveness
Analysis was intention to treat based. Main outcomes were successful therapy rates and adverse events. The homogeneity in the severity of the illness between the standard and dual individualized dose groups is retrospectively determined by APACHE II scores. Differences in APACHE II scores and patient ages were tested for statistical significance. Differences in the location of patients: intensive care unit, intermediate care unit and ward are displayed graphically but not tested for significance.

**Effectiveness results**
Probability of treatment success was 73% for standard dosing and 69% for dual individualisation (p>0.05) - Adverse effects were experienced in the standard dosing group and considered not relevant.

**Modelling**
Decision tree analysis was used to estimate costs and effectiveness.

**Methods used to judge relevance and validity, and for extracting data**
Not stated.

**Measure of benefits used in the economic analysis**
Successful therapy rates. These outcomes were proxied by the median duration of antibiotic treatment while hospitalised.

**Direct costs**
All treatments, services, tests and medications used in the 2 clinical studies were recorded and costed retrospectively. It was not stated for what items actual costs were used. Other items costs were estimated from 1992 hospital charges e.g. for bed cost, radiology and laboratory costs, medical supplies, respiratory therapy etc. Generally costs and quantities were not reported separately except for the antibiotic length of stay (ALOS). Only hospital direct costs were included. Final mean costs and median antibiotic (ALOS) were derived using a decision tree.

**Statistical analysis of costs**
The 95% confidence intervals were calculated for the mean costs of the standard and DI regimes. The difference between the standard and DI dosing mean costs was tested at the 5% significance level. The median duration of antibiotic therapy for standard and DI dosing was calculated and the difference in medians between the standard and DI dosing was tested at the 5% significance level.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analysis was conducted for the generalisability of results for: cefmenoxime costs; daily hospital bed costs. Multi-way sensitivity analysis was conducted for: probabilities of success and cefmenoxime cost; hospital bed cost and probabilities of success; cefmenoxime cost and hospital bed cost.

**Estimated benefits used in the economic analysis**
Not statistically different between the two regimes. Median duration of antibiotic therapy while hospitalized was 15.2 and 12.7 for standard and DI dosing respectively (p>0.05).
Cost results
Antibiotic and infection related costs per patient (mean +/- SEM) were $848 +/- 78 for standard dosing and $1123 +/- 128 for DI dosing (p < 0.05). Inclusive of hospital bed costs this becomes $10660 +/- 1432 and $11709 +/- 1900 respectively (p>0.05). Improving the probability of DI success by a minimum of 11.2% or reducing the probability of success in the standard group by a minimum of 14.5% would change the decision to favour DI throughout the range of hospital costs. A calculation is also made which assumes an equal distribution of ICU patients. This presents the incremental costs of antibiotic and infection related costs of $275 per patient (1123 for DI - 848 for standard) as reducing the duration of antibiotic therapy while hospitalized by 2.5 (15.2 for standard - 12.7 for DI) days per patient. Applied to the 259 patients at the institution per year with a primary diagnosis of bacterial pneumonia, a total incremental cost of $71225 (259x275) averts 647.5 days of hospitalization (2.5x259) and a cost of $393033 (calculation not given), giving a net benefit of $321808.

Synthesis of costs and benefits
Not applicable.

Authors' conclusions
DI costs $1049 (11709-10660) more per patient on average than standard dosing, even though a median 2.5 day reduction in duration of antibiotic therapy while hospitalized is achieved. It is argued that this may be due to the disproportionate number of intensive care patients in the DI group with a consequent higher cost. A prospective randomised, cost-effectiveness study of DI is warranted.

CRD Commentary
a) There are no reasons given by the author why the two studies of cefmenoxime, on which this analysis was based, were selected. b) Effectiveness data were derived from two studies, reporting results for intervention from and comparator respectively. This method is of doubtful validity. c) The author claims that the distribution of intensive care unit patients between the groups receiving the standard and dual individualized dose may explain why DI appears to cost more per patient even though it reduces the median duration of antibiotic therapy. This may be so, but this fact must also seriously question the comparability of the groups and therefore all of the subsequent analysis. d) The author's method for calculating the cost savings of DI over standard dosing, assuming an equal distribution of intensive care unit patients between groups, is unclear. e) To calculate the benefits in the economic analysis, the median antibiotic length of stay was used as a proxy of the successful rate. This was not necessary since the clinical outcomes could have been used. Nevertheless, since the difference in clinical outcomes and their proxies was not statistically significant, no calculation of the (incremental) cost-effectiveness ratio was necessary. Conclusions could have been based on the difference of costs only.

Implications of the study
A properly designed prospective trial and economic evaluation of standard and dual individualized dosing of cefmenoxime is required.

Bibliographic details

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