Infectious disease consultation and microbiologic surveillance for intensive care unit trauma patients: a pilot study

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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 routine use of prospective microbiologic surveillance and infectious disease (ID) consultation as part of the management of trauma patients admitted to the intensive care unit (ICU). The ID consultation was facilitated by including an ID physician with the multidisciplinary ICU team. ID consultations were performed within the first 72 hours for patients expected to spend longer than 48 hours in the ICU. The microbiologic surveillance comprised:

- obtaining sputum Gram stains on Mondays, Wednesdays and Fridays, and sputum cultures on Mondays and Fridays;
- performing urinalyses on Mondays and Thursdays, and urine cultures on Mondays; and
- obtaining blood cultures if patients displayed fever greater than or equal to 38.5 degrees C, or when there appeared to be onset of systematic inflammatory response syndrome (SIRS).

The ID consultants reviewed Gram stains and cultures, along with the patient's fever curve, vital signs, physiologic parameters and chest X-ray.

In the absence of a prospective microbiological surveillance and ID consultation, consultation from ID physicians was obtained only for circumstances deemed to be beyond the knowledge base of the treating trauma physicians. Cultures were obtained without specific protocols.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients admitted to a trauma centre who were subsequently admitted to the ICU.

Setting
The setting was secondary care. The economic study was carried out in Illinois, USA.

Dates to which data relate

Source of effectiveness data
The effectiveness data were derived from a single study.
Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample as that used in the effectiveness analysis.

Study sample
The study sample consisted of 154 patients admitted to the trauma centre before the routine use of microbiologic surveillance and ID consultation (cohort I), and 141 patients admitted after the introduction of this new management strategy (cohort II). No power calculations were carried out. The mean age was 33.7 years (standard deviation, SD=20.4) in cohort I and 31.7 years (SD=23.2) in cohort II. Seventy per cent of cohort I were male versus 66% of cohort II. Given the study type, the patient sample was suitable for the study question.

Study design
The study was a retrospective, before-and-after, cohort study that was conducted in a single hospital. The observation periods were March to August of 1990 and 1991.

Analysis of effectiveness
The primary outcomes were:

- days on a ventilator,
- days in the ICU,
- the total length of stay,
- diagnostic precision,
- days of antibiotic treatment,
- infection rates,
- disability and
- survival.

The authors stated that the cohorts were generally similar in terms of cause and type of injury. In addition, there were no statistically significant differences in terms of injury severity score, probability of survival, or Glasgow coma score. The patients were retrospectively stratified by risk of infection, but there still remained a significant difference between the cohorts. This was because of an excess of high-risk patients in cohort I (20 versus 16 patients). Thirty-eight per cent of the highest-risk patients in cohort II were male, compared with 80% of those in cohort I.

Patients at minimal risk of infection were excluded from the analysis since ID consultation was not intended for such patients. Therefore, the resulting analysis assessed 88 patients in cohort I and 87 patients in cohort II.

Generalised linear models (GLMs) were used to compare the outcome variables across cohorts. Infection-risk strata were adjusted for by including them as a covariate in the regression models used to assess differences in the outcome. Infection rates were modelled relative to days in hospital, days on a ventilator, or days in the ICU using Poisson regression. Proportions were assessed using logistic regression. Days on antibiotics were assessed using a GLM with a log link function.

Effectiveness results
There was no significant difference in days on a ventilator, days in the ICU, or total length of stay.
The distributions of infecting and colonising organisms were similar to one another across, and within cohorts.

The adjusted rate of diagnosed infections increased by 49%, \( p=0.011 \), from cohort I to cohort II.

The risk-adjusted mean days of prophylactic antibiotics per 100 days decreased by 45%, \( p=0.0016 \), from cohort I to cohort II.

No statistically significant differences were seen in the distribution of discharge levels of feeding, locomotion, or expression.

There were 13 deaths in cohort I and 14 deaths in cohort II.

**Clinical conclusions**
The introduction of prospective microbiologic surveillance and ID consultation increased the number of infections detected and reduced antibiotic use.

**Measure of benefits used in the economic analysis**
No summary measure of health benefit was used. In effect, a cost-consequences analysis was performed.

**Direct costs**
The perspective of the study was unclear, but it was likely to have been that of a hospital. The costs and the quantities were reported separately. The direct costs covered the pharmacy costs, laboratory costs and consultation charges. The costs were estimated on the basis of hospital charges. Discounting was not relevant. The costs were adjusted for inflation using the average of the reported rates for 1990 and 1991. The study reported the average costs.

**Statistical analysis of costs**
A maximum likelihood GLM with a gamma distribution was used to estimate differences in the costs. A gamma distribution is suitable for analysing cost data as it is can characterise positive and right-skewed data. Studies are typically not powered to detect differences in the costs.

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

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analyses were undertaken.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The daily cost of antibiotics was $16.84 in cohort I and $9.16 in cohort II. The reduction of 49.4% was statistically significant, \( p=0.0008 \).
The daily ID consulting charges increased in cohort II compared with cohort I from $0.03 to $1.41 in the minimal infection-risk strata, and from $2.90 to $31.06 for the highest infection-risk stratum.

The costs of adverse events or knock-on costs were not relevant.

**Synthesis of costs and benefits**
Not relevant since, in effect, the study was a cost-consequences analysis.

**Authors’ conclusions**
The authors did not draw any conclusion that combined the effectiveness and cost results. The results suggested that the use of prospective microbiological surveillance and multidisciplinary physician teams, including infectious disease (ID) physicians, as part of the management of high-risk trauma patients should be considered.

**CRD COMMENTARY - Selection of comparators**
The comparator was current care in the study setting. You must consider whether current practice is similar in your own setting.

**Validity of estimate of measure of effectiveness**
The basis of the analysis was a retrospective, before-and-after cohort study, which was suitable for a pilot study such as this. However, the authors did acknowledge that their results were less robust than those obtained from randomised controlled trials. The study sample appears to have been representative of the study population and the groups were shown to be comparable at analysis. The analysis of effectiveness was handled credibly.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. Therefore, the study was classified as a cost-consequences analysis.

**Validity of estimate of costs**
Although the study included hospital costs, the cost of length of stay was not included. This is a potentially important cost in assessing different patterns of care. However, as there was no significant difference in length of stay between the patient groups, this omission might not have affected the conclusions. The costs were reported separately from the quantities, which should aid the generalisability of the study.

The resource use data were obtained from a single study. Statistical analysis of the quantities was performed using GLM regression, which is suitable for the type of data reported. The prices were based on hospital charge data, which may limit the generalisability of the findings. A statistical analysis of the prices was not conducted. The authors made appropriate adjustments for inflation. The years to which the prices referred were reported, which will permit reflation exercises to be undertaken. Discounting was, appropriately, not undertaken since the costs were incurred during less than 2 years.

**Other issues**
The authors made appropriate comparisons of their findings with those of other studies, and noted that their results differed from those found previously. The issue of generalisability to other settings was not addressed. The authors did not present their results selectively and their conclusions reflect the scope of their analysis.

**Implications of the study**
The authors concluded that prospective microbiologic surveillance and ID consultation should be considered for high-
risk trauma patients, but acknowledged that the current study may not provide sufficient evidence for this.

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