Controlling antimicrobial use and decreasing microbiological laboratory tests for urinary tract infections in spinal-cord-injury patients with chronic indwelling catheters


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 effect of replacing the indwelling catheter of patients suspected of having a urinary tract infection (UTI) before collecting a urine sample on the number of organisms isolated in cultures and on the drug and microbiology laboratory costs.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
Data were collected for all patients hospitalised in the two SCI units of the authors' institution who had an indwelling catheter or suprapubic catheter, and who were suspected of having a UTI. Patients with condom catheters or those receiving intermittent catheterisation were excluded. Only those patients who were diagnosed with a UTI by their primary care providers and treated with antimicrobials were included in the study.

Setting
The setting was secondary care (two SCI units). The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence and resource use data were collected between October 2001 and March 2002. The authors stated that data were collected on intravenous (i.v.) and oral antimicrobial therapy administered within the year before study enrolment, but these were not incorporated into the economic analysis. The price year was not reported.

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

Link between effectiveness and cost data
The costing was carried out prospectively on the same sample of patients as that used in the effectiveness analysis.

Study sample
Patients who met the exclusion and inclusion criteria were selected as they attended the SCI unit of the authors' institution. During a 6-month period, the authors collected data on 85 patients in all. There were 41 patients in the control group and 44 in the intervention group. The mean age was 55.6 (+/- 15.5) years in the control group and 64.1
(+/- 14.0) years in the intervention group. Thirty-nine patients in the control group and 35 in the intervention group had Foley catheters; the remaining had suprapubic catheters.

**Study design**
This was a prospective cohort study that was based at a single centre containing two SCI units. The routine practice of obtaining urine specimens from the port of the indwelling catheter was continued in one SCI unit, while in the other unit, nurses replaced the catheter immediately before obtaining a urine specimen. The patients were not randomly assigned to the groups. Instead, patients admitted to the SCI service were admitted to either of the two units depending on bed availability. The length of follow-up was not reported, although the study duration was 6 months. There were no losses to follow-up in the study. The authors noted that different SCI physicians, using the urine culture results and clinical information, freely made their own choice of antimicrobials to treat the UTIs.

**Analysis of effectiveness**
The analysis of the clinical study was based on only those patients who went on to have a confirmed diagnosis of a UTI and received antimicrobial treatment from their primary care provider. Patients who, following urine cultures, were not diagnosed with a UTI were excluded from the study sample. The clinical end point of the study was the number of organisms isolated and the susceptibility profile of the organisms isolated. The clinical outcomes were not directly assessed to determine whether changing the urinary catheter had a positive clinical impact on patient care. Patients in the control group were significantly younger than those in the intervention group, (p=0.032), but no adjustment was made for this. The length of hospital stay (from date of admission to SCI unit to date of first urine culture), duration of i.v. and oral antimicrobials used one year before enrolment, and type of catheter (Foley versus suprapubic) were similar between groups.

**Effectiveness results**
The total number of significant (>/= 10^5 colony-forming units per mL, CFU/mL) organisms isolated per urine specimen was 89 in the control group and 60 in the intervention group, (p<0.01).

An average of 2 isolates (Range: 0 to 4) per patient in the control group and 1 per patient (Range: 0 to 5) in the intervention group were found.

The total number of non significant (< 10^5 CFU/mL) organisms isolated per urine specimen was 4 in the control group and 19 in the intervention group.

Seventy-two of the 93 organisms in the control group were identified, compared with 53 of the 79 in the intervention group.

The patients in the control group had significantly more multidrug-resistant organisms (34 isolated from 26 patients; 63%) than patients in the intervention group (8 isolated from 8 patients; 18%), (p<0.001).

The use of potentially toxic antimicrobials that required monitoring was significantly greater in the control group than in the intervention group (24.4% versus 4.6%; p=0.012).

**Clinical conclusions**
Patients without urinary catheter replacement had twice as many bacterial isolates as those who had the replacement, as well as more isolates of multidrug-resistant organisms. The significantly higher rate of bacteriuria before the catheter change can be explained by the presence of the bio-film laden catheter, which gives false-positive results for UTIs. The authors found that, in their study, fewer and less-resistant organisms were more precisely isolated in the intervention group, allowing less toxic drugs to be prescribed and resulting in more targeted therapy.

**Measure of benefits used in the economic analysis**
No summary measure of benefits was included in the analysis. The costs and effects were left disaggregated and the study was, therefore, a cost-consequences analysis.

Direct costs
Discounting was not carried out because of the short duration of the study. The costs and the quantities were analysed separately but were not presented separately. The costing was conducted from the point of view of the SCI unit or hospital. The cost of antimicrobial therapy was calculated using the dosage, interval and duration of antimicrobial therapy used to treat the UTI for each patient. Estimations of the quantities and costs were derived using actual data. The unit drug cost was based on the cost set by the Federal Supply Schedule. The microbiology laboratory workload was calculated by summing estimated technician time (at a wage of $20 per hour) and the cost of materials (petri dish and media) required to isolate one organism for identification and susceptibility testing. The cost of the urinary catheter was an additional expense of the intervention. Several cost components were not included. Specifically, the costs of monitoring drug levels, nursing time for hanging i.v. antimicrobials or drawing drug levels, pharmacists’ time spent on pharmacokinetic calculations, and length of hospital stay. The price year was not reported.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analyses were conducted.

Estimated benefits used in the economic analysis
Not relevant in a cost-consequences analysis.

Cost results
The total cost of antimicrobial therapy was $1,726.92 in the control group, compared with $1,552.76 in the intervention group.

The total costs to the microbiology laboratory were $2,320.19 in the control group and $1,860.32 in the intervention group. These accounted for 80 and 69 hours plus supplies in the control and intervention groups, respectively.

Combining antimicrobial and microbiology laboratory costs resulted in an average saving of $21.14 per patient due to the intervention. After including the cost of the replacement catheter, a cost-reduction of $15.64 per patient due to the intervention was realised. The authors estimated that this would translate to a cost-saving of $2,700 per year in their institution. The costs of adverse effects or knock-on costs were not considered.

Synthesis of costs and benefits
The costs and benefits were not combined.

Authors' conclusions
The authors stated that, traditionally, all identified isolates were treated with antimicrobials and that some organisms may be resistant to multiple drugs. In their study, the ability to provide the prescriber with a more relevant urine analysis, by replacing the indwelling urinary catheter before collecting a urine sample for culture and conducting susceptibility testing, resulted in more targeted and less toxic therapy, reduced the laboratory workload, and was cost-saving for patients in the intervention group.

**CRD COMMENTARY - Selection of comparators**
The comparator was justified as representing current practice in the authors' setting. You should decide if this is true in your own setting.

**Validity of measure of effectiveness:**
A randomised controlled trial would have been more appropriate for the study question. Instead, the patients were assigned to groups on the basis of bed availability, which may have been correlated with the study outcomes or the distribution of confirmed UTIs. The study sample, although a convenience sample, appears to have been representative of the study population as it was limited to SCI patients with UTIs. With the exception of age, the patient groups were comparable at baseline. No investigation was conducted into the potential of age to confound the results. The outcomes were analysed only for those patients who had UTI diagnoses confirmed and treated, though an intention to treat analysis should have been undertaken.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The analysis was, in effect, a cost-consequences study. Linking costs with health outcomes would have resulted in a more complete, and hence more informative, economic evaluation of the new process. However, the authors described their study as a "quality assurance" study, indicating that their main interest did not lie in establishing final health outcomes in patients.

**Validity of estimate of costs**
The authors did not state explicitly which perspective was adopted in the study, although it appears that costs relevant to the health care provider have been included in the analysis. Some relevant costs were omitted from the analysis (the costs of monitoring drug levels, nursing time for hanging i.v. antimicrobials or drawing drug levels, pharmacists’ time spent on pharmacokinetic calculations and length of hospital stay). These omissions are likely to have affected the authors' results by underestimating the costs for each group, highlighting the regrettable incompleteness of the economic evaluation. The unit costs and the resource quantities were generally not reported separately. However, it would be possible to replicate the costing for another setting by applying local resource use pertaining to the analysis of urine (based on the reported number of organisms isolated) and the treatment usually given for the organisms identified. Resource use and prices were collected alongside the effectiveness study at the authors' setting. However, the basis for the estimate of technician time per organism isolated was not reported. No statistical analysis of the costs or quantities was conducted. The authors did not acknowledge the uncertain reliability of their conclusions. Since all costs were incurred within 6 months, discounting was unnecessary.

**Other issues**
The authors made some comparisons of the results of their effectiveness study with those from other studies. The issue of generalisability to other settings was not addressed. The authors did not present their results selectively. However, more detail around the costing would have been explanatory as they appeared only scattered in the text. The authors' conclusions reflected the scope of the study. The authors recognised a number of limitations to their study. For example, the incomplete costing, the lack of randomisation, the non-exclusion of patients with other sites of infection (perhaps confounding the results), the variability stemming from individual physician discretion in diagnosis and treatment, and the lack of an assessment of clinical outcomes to determine if changing the catheter had a positive impact on patient care.
Implications of the study
The authors described their study as a "quality assurance" study. They believed that their results would promote the benefits to both patients and providers of replacing indwelling catheters before collecting urine samples for culture.

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