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European Association of Urology

Brief Correspondence

Cost Effectiveness of Antimicrobial Catheters for Adults Requiring Short-term Catheterisation in Hospital

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Article info

Article history:
Accepted May 27, 2014

Keywords:
Randomised controlled trial
Antimicrobial catheters
Catheter-associated symptomatic urinary tract infection
Costs
Cost effectiveness
Decision-analytic model

Abstract

Catheter-associated urinary tract infection (CAUTI) is the second most common cause of hospital-acquired infection. A number of strategies have been put forward to prevent CAUTI, including the use of antimicrobial catheters. We aimed to assess whether the use of either a nitrofurazone-impregnated or a silver alloy–coated catheter was cost-effective compared with standard polytetrafluoroethylene (PTFE)–coated catheters. A decision-analytic model using data from a clinical trial conducted in the United Kingdom was used to calculate the incremental cost per quality-adjusted life-year (QALY). We assumed that differences in costs and QALYs were driven by difference in risk of acquiring a CAUTI. Routine use of nitrofurazone-impregnated catheters was, on average, £7 (€9) less costly than use of the standard catheter over 6 wk. There was a >70% chance that use of nitrofurazone catheters would be cost saving and an 84% chance that the incremental cost per QALY would be less than £30 000 (€36 851; a commonly used threshold for society's willingness to pay). Silver alloy–coated catheters were very unlikely to be cost-effective. The model's prediction, although associated with uncertainty, was that nitrofurazone-impregnated catheters may be cost-effective in the UK National Health System or a similar setting.

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The prevention of catheter-associated urinary tract infection (CAUTI) is an important part of patient safety initiatives in many countries. The development of a CAUTI is likely to prolong a patient's hospital stay by an estimated 0.5 d [1] to 5 d [2], and CAUTI adversely affects quality of life [1,3]. A potential way to reduce CAUTI risk is to use catheters containing antimicrobial agents designed to reduce bacterial colonisation [4]; available options include a nitrofurazone-impregnated catheter and a silver alloy–coated catheter.

Study methods are described in Supplement 1. We used data from a three-arm randomised controlled trial comparing nitrofurazone-impregnated catheters ($n = 2153$) and silver alloy–coated catheters ($n = 2097$) with standard polytetrafluoroethylene (PTFE)–coated catheters ($n = 2144$) for patients requiring short-term urethral catheterisation in hospital [5] to populate a decision-analytic model. The model was then used to predict the likelihood of antimicrobial catheters being cost-effective for short-term routine use in the setting of the UK National Health Service (NHS). The

http://dx.doi.org/10.1016/j.eururo.2014.05.035
0302-2838/

Table 1 – Values for variables used in the base-case economic model

Variable	Value	Source and distribution
Risk of infection for standard catheter	0.126	Based on the value from the trial analysis. β distribution* [10]; α (number of events in group) = 271; β (number of people without the event in the group) = 1873.
Risk of infection for nitrofurazone catheter	–0.021	Based on the estimated absolute risk difference between nitrofurazone and standard catheters. Normal distribution (SD: 0.01).
Risk of infection for silver alloy catheter	–0.001	Based on the estimated absolute risk difference between silver alloy and standard catheters. Normal distribution (SD = 0.01).
Utility** of a CAUTI over 6 wk	0.075	Based on trial data. β distribution: α and β derived from mean (0.075369) and SD (0.02454) of QALYs for a CAUTI.
Additional utility associated with not acquiring a CAUTI over 6 wk	+0.006	Based on the RCT adjusted analysis difference in QALYs. Assumed normal distribution (SD = 0.001).
Health care costs for patients without a CAUTI (2012 pounds sterling)	£3529.08	The cost estimate was based on all participants without CAUTI (n = 5630). Log-normal distribution derived from mean costs (£3529.08) and median costs (£2466.39) derived from trial data.
Additional health care costs for patients with a CAUTI	£572.56	Based on the adjusted analysis results cost difference estimate from trial data. Normal distribution (mean = £572.56; SD = £445).
Cost of nitrofurazone catheter	£5.53	Manufacturer: Rochester Medical Ltd., Lancing, UK. Point estimate, no distribution attached.
Cost of silver alloy catheter	£6.75	Manufacturer: Bard Medical, Crawley, UK. Point estimate, no distribution attached.
Cost of standard catheter	£0.90	NHS Supplies.† Point estimate, no distribution attached.

CAUTI = catheter-associated urinary tract infection; NHS = National Health Service; QALY = quality-adjusted life-year; RCT = randomised controlled trial; SD = standard deviation.

* The β distribution is constrained on the interval 0–1 and is characterised by two parameters, α and β.

** *Utility* is the benefit from the intervention derived using the EQ-5D-3L.

† NHS catalogue product categories [9].

analysis used health status measurements derived from the EQ-5D (3 level) and costs reported in 2012 pounds sterling. No discounting was performed, as the events for each participant took place over <1 yr.

Details of the parameters used in the model are presented in Table 1. Data on the risk of infection for standard catheters and the absolute risk differences between nitrofurazone or silver alloy and standard PTFE catheters were based on trial outcomes [5]. For each intervention, we calculated the extra cost incurred per quality-adjusted life-year (QALY) gained—the incremental cost effectiveness ratio. The probability of each intervention's being cost-effective was calculated using different willingness-to-pay thresholds, including £30 000 (€36 851) per QALY suggested by the UK National Institute for Health and Clinical Excellence [6]. Sensitivity analysis examined the effect of uncertainty in cost and QALY estimates [7] by sampling values from an assigned distribution for each variable using Monte Carlo simulation.

Further sensitivity analyses were performed to determine whether patients who had CAUTI were more likely to incur extra costs or have a worse health state for reasons unconnected to CAUTI, such as a more severe underlying illness or worse general health. For these analyses, we used trial participant subgroups that we considered to represent more homogeneous populations; the subgroups comprised admissions to obstetrics and gynaecology speciality wards, patients with an EQ-5D-3L score of 1 (perfect health) at 3 d after catheter removal, and participants who were recorded as having a symptomatic CAUTI treated with antibiotics at 3 d following catheter removal.

Model predictions were that routine use of nitrofurazone catheters was, on average over the 6 wk of trial participation, associated with the lowest cost (£3595 [€4416]), followed by standard catheters (£3602 [€4425]) and silver alloy catheters (£3608 [€4432]) (Table 2). On average, participants allocated to the nitrofurazone catheter had the highest QALYs over 6 wk, followed by the silver alloy and then the standard catheter. There is a 70% chance that nitrofurazone would be the least costly option and a >80% probability that it would be considered cost-effective when society is willing to pay a maximum of £30 000 (€36 851) per QALY (Table 2). Silver alloy had virtually no chance of being considered cost-effective.

Our modelled analysis using data from a robust randomised controlled trial suggested that nitrofurazone-impregnated catheters may be cost-effective for use in the UK NHS. The principal driver for this result was that cost savings from avoiding an infection would compensate for the increased unit cost of the nitrofurazone catheter compared with the standard catheter. However, cost savings were modest, and the confidence interval included zero, suggesting borderline clinical and statistical significance. Nevertheless, given the volume of catheterisation within well-resourced health care organisations and the high likelihood of this situation's occurring, even this small difference may lead to substantial savings. This finding should be treated cautiously, given the limitations of the analysis and the uncertainty, particularly regarding estimates of key parameters such as length of hospital stay.

Silver alloy–coated catheters were highly unlikely to be considered cost-effective for the UK NHS. The main driver was that it was unlikely that the observed reduction in risk of CAUTI was minimal, and any cost saving would not be sufficient to compensate for higher catheter cost. Similarly, any gain in QALYs was unlikely to be large enough to justify any increased expenditure. This conclusion is important, as some health care organisations have deployed this catheter for routine use [8]. In summary, we found no health–economic evidence to support the use of sliver alloy–coated urethral catheters. The conclusion is grounded in a trial encompassing a large, representative sample of the NHS