

Reducing hospital infections: which catheter?

Key Findings

- Nitrofurazone-impregnated catheters may be cost-effective for use in the UK NHS. The cost savings were modest but given the volume of catheterisation and the high likelihood of this situation occurring, even this small difference may lead to substantial savings overall.
- 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.

What problem was this research addressing?

Catheter-associated urinary tract infection (CAUTI) is the second most common cause of hospital-acquired infection and its prevention is an important part of patient safety initiatives in many countries. In the United Kingdom (UK), approximately 15-25% of patients admitted to National Health Service (NHS) hospitals each year will require urethral catheterisation with a risk of developing bacteriuria of approximately 5% per day. Development of CAUTI is likely to prolong a patient's hospital stay by an estimated 0.5 days to 5 days, and suffering CAUTI adversely affects quality of life (QoL). A potential way to reduce CAUTI risk is to use catheters containing antimicrobial agents designed to reduce bacterial colonisation. Available options include a nitrofurazone-impregnated catheter or a silver alloy-coated catheter.

What this research adds

This study was a multi-centre, randomised controlled trial testing three urinary catheters in a range of high-volume clinical settings. The study aimed to establish whether use of either silver alloy-coated or nitrofurazone-impregnated catheters reduced the rate of symptomatic CAUTI, and was cost-effective, compared to a standard catheter amongst patients who required short-term catheterisation as part of their routine hospital care.

Methods

We used data from a three arm randomised controlled trial (RCT) comparing nitrofurazone-impregnated (n=2153) and silver alloy-coated (n=2097) catheters with standard polytetrafluoroethylene-coated (PTFE; n=2144) catheters for patients requiring short-term urethral catheterisation in hospital to populate a decision analytic model. The model was then used to predict the likelihood of antimicrobial catheters being cost-effective. The analysis used health status measurements derived from the EQ-5D (3 level) and costs reported in 2012 Sterling (£).

To determine whether the results were influenced by those who suffered CAUTI being more likely to incur extra costs or having a worse health state for reasons unconnected to CAUTI (such as a more severe underlying illness or worse general health), we performed a series of alternative analyses on selected subgroups: those admitted to an obstetrics and gynaecology specialty ward only; those with an EQ-5D score of 1 at 3 days after catheter removal; and participants recorded as having a symptomatic CAUTI treated with antibiotics at 3 days post catheter removal.

Research Findings

Routine use of nitrofurazone catheters is, on average over the six weeks of trial participation, associated with the least total healthcare cost - £3595; followed by standard PTFE - £3602; and then silver alloy - £3608 (Table 1). Participants randomised to nitrofurazone catheter had the highest QALY (Quality adjusted life year) value over six weeks, followed by silver alloy, then standard PTFE. Overall, there is a 70% chance that nitrofurazone would be the least costly option, and an over 80% probability that it would be cost-effective when society is willing to pay £30,000 per QALY (Table 1). Silver alloy has virtually no chance of being cost-effective when compared with the other two catheters.

Sensitivity analyses using trial participant sub-groups that were homogeneous in terms of severity of underlying ill health in comparison to the whole trial population (Table 1) showed low and statistically insignificant differences in health care costs. Again, differences in QALYs were very small and not statistically significant.

Discussion

We measured QoL changes using EQ-5D at selected time points: during catheterisation, three days following catheter removal, one and two weeks after catheter removal and six weeks after randomisation. However, the number of factors influencing each participant's score at each time point makes determining the impact of a particular catheter on the risk of CAUTI, and on QoL, difficult. Our analysis suggested that nitrofurazone-impregnated catheters may be cost-effective. 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 standard PTFE. However, cost savings were modest and the confidence interval included zero, suggesting borderline clinical and statistical significance. Nevertheless, given the high volume of catheterisation within well-resourced healthcare organisations, and the high likelihood of this occurring, even this small difference may lead to substantial NHS budget 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 unlikely to be cost-effective. It was likely 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 increased expenditure. This is an important conclusion as some healthcare organisations have deployed this catheter for routine use.

Table 1 Results of the model analysis and the sub-group analysis

Intervention	Cost (£)	Incremental cost (£)	QALY	Incremental QALY	ICER
Base case analysis					
Nitrofurazone	3595		0.0823		
PTFE	3602	7	0.0822	-0.0001	Dominated
Silver alloy	3608	12.67	0.0822	0	Dominated
Participants admitted into the obstetric specialty ward					
PTFE	1905.40		0.0874		
Nitrofurazone	1907.23	1.82	0.0876	0.00015	£11,497
Silver alloy	1911.12	3.87	0.0874	-0.00014	Dominated
Participants who at 3 days had an EQ-5D score = 1 (full health)					
Nitrofurazone	2678.43		0.10106		
PTFE	2695.51	17.08	0.10098	-0.00008	Dominated
Silver alloy	2700.33	21.9	0.10098	-0.00007	Dominated
Three-day symptomatic antibiotic-treated CAUTI outcome					
Nitrofurazone	3644.58		0.08118		
PTFE	3671.06	26.48	0.08108	-0.00010	Dominated
Silver alloy	3675.43	30.85	0.08109	-0.00009	Dominated
Probability (%) of being cost-effective at different threshold values for society's willingness to pay for an additional QALY (Base case analysis)					
Threshold	£0	£10,000	£20,000	£30,000	£50,000
Nitrofurazone	72	77	80	83	88
PTFE	28	23	20	17	12
Silver alloy	0	0	0	0	0

QALY = Quality adjusted life year; ICER = Incremental cost effectiveness ratio;

PTFE = Polytetrafluoroethylene-coated; Dominated = Costs more and is less effective

Research and policy implications

- Although the results of the economic analysis for the nitrofurazone-impregnated catheter were favourable, there was a high degree of uncertainty.
- Accurate, but feasible, methods of capturing any changes in benefits and costs specific to catheterisation are required.
- Silver alloy-coated catheters were highly unlikely to be cost-effective. It was unlikely that the reduction in cost caused by the observed reduction in risk of CAUTI could compensate for the higher unit cost of the catheter.
- Further, any gain in QALYs from the very small observed reduction in CAUTI rate was unlikely to be large enough to justify increased expenditure.

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For further information see:

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