New choices for central venous catheters: potential financial implications
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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
Uncoated central venous catheters (CVCs) and two types of newer antiseptic and antibiotic-impregnated CVCs were evaluated. The newer CVCs were coated with either chlorhexidine silver sulfadiazine (CSS) or rifampin-minocycline (RM).

Type of intervention
Device.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of critically ill patients who required a CVC, which was expected to be in place for at least 48 hours. CVCs placed routinely in the operating room, during acute resuscitations and during ‘code’ situations were not considered.

Setting
The setting was a hospital. The economic analysis was performed in the USA.

Dates to which data relate
The effectiveness data were gathered from studies published between 1999 and 2001. No dates were reported for resource use data. The price year was 2002.

Source of effectiveness data
The effectiveness data were derived from a review of completed studies.

Modelling
A decision tree model was used to estimate the total costs and expected health-related effects in a hypothetical cohort of 1,000 patients receiving CVCs. There was only one decision node, which represented the decision to choose one of the three CVCs. Only the probability of developing or not developing a CRBSI was modelled.

Outcomes assessed in the review
The outcomes assessed in the review were the incidence of CRBSIs with standard CVC, and the relative risk reduction (RRR) for CRBSIs with CCS-CVC versus standard CVC, and with RM-CVC versus standard CVC.
Study designs and other criteria for inclusion in the review
The incidence of CRBSI with uncoated CVC was derived from the results of a meta-analysis that reviewed 61 prospective trials. Data on RM-CVC were retrieved from a randomised trial, while data on CSS-CVC came from the abstract of a randomised trial.

Sources searched to identify primary studies
MEDLINE was searched for relevant primary studies on coated CVCs. The search was not restricted to English language publications. The keywords used were “bacteremia”, “bloodstream”, “catheter”, “central line”, “colonization”, “nosocomial” and “sepsis”. Each keyword was exploded.

Criteria used to ensure the validity of primary studies
The authors did not report any explicit criteria for ensuring the validity of the primary studies. However, only evidence from randomised trials was used, thus implying that the primary studies had high internal validity.

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

Number of primary studies included
Only 3 studies were included in the review.

Methods of combining primary studies
When the authors had to combine the primary study estimates, conservative values (disfavouring coated CVCs) were selected.

Investigation of differences between primary studies
Not stated.

Results of the review
The incidence of CRBSIs with standard CVC was 3.3% (range: 1.65 - 4.95).

The RRR for CRBSIs with CCS-CVC versus standard CVC was 60% (range: 30 - 90).

The RRR for CRBSIs with RM-CVC versus standard CVC was 85% (range: 42.5 - 92.5).

Measure of benefits used in the economic analysis
The measure of benefits used in the economic analysis was the number of cases of CRBSIs prevented with each CVC. This measure was obtained from the decision model.

Direct costs
The costs were incurred in the short term and, appropriately, no discounting was applied. The unit costs were reported separately from the quantities of resources used. The cost categories included in the analysis were devices and CRBSI (diagnosis, treatment and prolonged hospitalisation). The perspective of the study was that of a large third-party payer (or institution). The source of the cost data was the average prices of CVC devices and institutional charges for CRBSI. Such charges were then converted into actual costs using a department-specific cost-to-charge ratio. The authors made assumptions, supported with published data, to estimate resource use. Whenever possible, conservative assumptions were made. All the costs were reported in 2002 values.
Statistical analysis of costs
Statistical tests of the costs were not conducted.

Indirect Costs
The indirect costs were not considered.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were carried out to deal with uncertainty and to assess the robustness of the estimated cost-effectiveness ratios. One-way sensitivity analyses were performed, varying each parameter by 50%. Best- and worst-case scenarios were assessed by varying all model inputs simultaneously by 50% (multivariate analysis). Finally, threshold analyses were performed to identify the critical value of each model input at which the conclusions of the analysis changed. The ranges used in the analysis were derived from the literature.

Estimated benefits used in the economic analysis
In a cohort of 1,000 patients, there were 33 CRBSI cases with standard CVC, 13.6 with CSS-CVC and 5.1 with RM-CVC. Thus, RM-CVC was more effective than the other devices in reducing the incidence of CRBSIs.

Cost results
The total cost in the overall cohort was $414,280 with standard CVC, $218,512 with CSS-CVC and $136,692 with RM-CVC.

The lower costs observed with coated devices were due to there being fewer cases of CRBSIs.

The use of CSS-CVC in place of standard CVC would lead to cost-savings of $165.88. The cost-savings would be $277.59 if RM-CVC was used in place of standard CVC, and $81.82 if RM-CVC was used instead of CSS-CVC.

Synthesis of costs and benefits
An incremental analysis was conducted to combine the costs and benefits of the three devices.

The incremental cost per CRBSI prevented was $9,596.47 with CSS-CVC versus standard CVC, $9,605.12 with RM-CVC versus standard CVC, and $9,625.88 with RM-CVC versus CSS-CVC.

The sensitivity analyses revealed that the estimated cost-effectiveness ratios were sensitive to the costs of CRBSIs. However, the base-case results did not change even in the worst-case scenario.

The estimated threshold values, which made the standard CVC more cost-effective than the new devices, were unrealistically low.

Authors’ conclusions
The new antiseptic and antibiotic-impregnated central venous catheters (CVCs) were cost-effective in comparison with the standard uncoated CVC in critically ill patients. The rifampin-minocycline (RM)-CVC was economically more advantageous than the chlorhexidine silver sulfadiazine (CSS)-CVC. These conclusions were robust to a range of variations explored in the sensitivity analyses.
CRD COMMENTARY - Selection of comparators

The rationale for the choice of the comparator was clear. The uncoated CVC represented the standard device used for critically ill patients. CSS- and RM-CVCs are two newer commercially available antiseptic and antibiotic-impregnated CVCs. You should decide whether they represent valid comparators in your own setting.

Validity of estimate of measure of effectiveness

The effectiveness evidence was derived from published studies, which were identified through a review of the literature. The authors reported the methods and conduct of the review, and the design of the primary studies. Conservative assumptions were made when combining the primary estimates. The ranges observed in the literature were used in the sensitivity analysis. The authors selected randomised trials as sources of effectiveness data, to ensure the validity of the data used in the model.

Validity of estimate of measure of benefit

The benefit measure was disease-specific and this could represent a problem when comparing the benefits of the interventions evaluated in this analysis with those obtained with other health care technologies.

Validity of estimate of costs

The authors reported the perspective adopted in the study and the items included in the analysis. The unit costs and the price year were given. This simplifies the transferability of the results. Statistical tests were not conducted in the base-case. The source of the cost data was reported. The quantities of resource use were based on assumptions, but sensitivity analyses were conducted to deal with uncertainty.

Other issues

The authors compared their findings with those from other studies. They addressed the issue of the generalisability of the study results to other settings by performing sensitivity analyses. The authors stated that the costs might vary in different institutions. However, their conclusions were robust to wide ranges of cost estimates. Some limitations of the analysis were noted. First, the model did not consider the duration of catheterisation as a risk factor for development of CRBSIs, and the possibility of organism resistance. Second, the relative efficacy of CSS- versus RM-CVCs was estimated indirectly as no direct comparison existed. Finally, the cost of a CRBSI remains uncertain. Most of these issues were addressed in the multivariate sensitivity analysis and by making conservative assumptions.

Implications of the study

The main implication of the analysis was that newer antiseptic and antibiotic-impregnated CVCs lead to cost-savings in comparison with standard CVCs, despite their high initial acquisition costs.

Source of funding

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