Economic Value Of Antibiotic-Impregnated External Ventricular Drain Catheters In Cerebrospinal Fluid Diversion Procedures

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Objectives
• An external ventricular drain (EVD) is the first-line, interim intervention in a variety of acute brain injuries requiring cerebrospinal fluid (CSF) diversion.
• EVD catheters pose a considerable risk of CSF infection, forcing replacement of the contaminated catheter, systemic antibiotics treatment, and prolonged hospitalisation.1,2
• Reducing systemic antibiotics use and the emergence of antibiotic-resistant bacteria is a focus of many healthcare systems.3
• Antibiotic-impregnated EVDs can be used to reduce the duration of systemic antibiotics use (1 vs 10.6 days1) and reduce the infection risk.
• The present model estimated the cost impact of transitioning to antibiotic-impregnated EVDs in France, Germany, Italy, and the United Kingdom (UK).

Methods
• A decision-tree model compared treatment with either conventional or antibiotic-impregnated catheters (Figure 1).
• The input costs were detailed for the index procedure, consumables, antibiotic use, and revision due to infections to simulate the hospital resource consumption.
• Cost data were sourced from both official reimbursement documentation and published literature for each country.
• Clinical inputs included only EVD-related adverse events and the use of systemic antibiotics (Table 1).
• The model estimated a 1-year time horizon from the local hospital documentation and published literature for each country.
• Clinical outcomes included only EVD-related adverse events and the use of systemic antibiotics (Table 1).
• The model estimated a 1-year time horizon from the local hospital purchasers’ perspective.
• Cost drivers were evaluated using one-way sensitivity analysis.

Results
• In regard to clinical outcomes and costs the antibiotic-impregnated EVD system appears advantageous for the four examined European countries.
• Costs per patient were reduced in all countries (Figure 2), with savings ranging from 1.8% (France) to 3.1% (UK).
• In monetary terms, savings per patient were estimated to be:
  • €405 (France)
  • €469 (Italy)
  • €497 (Germany)
  • £839 (UK)
• Savings from reduced use of systemic, intravenous antibiotics accounted for up to 55% (France) of savings accrued.
• Cutbacks in infection-related management expenses from improved antibiotic prophylaxis effectively offset the higher procurement the antibiotic-impregnated catheters.
• One-way sensitivity showed that the length of stay was the largest driver of total costs of care, followed by the incidence of CNS infections.

Limitations
• The model was developed using the best clinical data available, but data is scarce and further investigations would be recommendable.
• Systemic antibiotics resource costs were modelled, but no consequences and side effects of antibiotics utilization were included.
• This is the first economic evaluation on antibiotic-impregnated EVDs and no comparison against other approaches could be made.

CONCLUSION
Antibiotic-impregnated EVD catheters are expected to offer a cost-saving alternative to systemic antibiotic use in the four European countries examined.

Figure 2 Cost difference per patient. EVD: External ventricular drain

<table>
<thead>
<tr>
<th>Country</th>
<th>Antibiotic-impregnated EVD</th>
<th>Conventional EVD</th>
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<tbody>
<tr>
<td>France</td>
<td>£22,104</td>
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</tr>
<tr>
<td>Germany</td>
<td>€22,204</td>
<td>£22,201</td>
</tr>
<tr>
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<tr>
<td>UK</td>
<td>£26,039</td>
<td>£26,878</td>
</tr>
</tbody>
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Table 1 Key clinical parameters used in the model. EVD: External ventricular drain; CNS: Central nervous system