TITLE: Antibiotic-impregnated Shunts for Patients with Hydrocephalus: Clinical Effectiveness

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RESEARCH QUESTION:

What is the clinical effectiveness of antibiotic-impregnated shunts for use in patients with hydrocephalus for the prevention of infection?

METHODS:

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 4, 2009), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between 2004 and December 2009. No filters were applied to limit the retrieval by study type. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

RESULTS:

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, controlled clinical trials, and observational studies.

One systematic review, one controlled clinical trial, and 12 observational studies were identified pertaining to the clinical effectiveness of antibiotic-impregnated shunts for use in patients with hydrocephalus for the prevention of infection. No relevant health technology assessment reports
or randomized controlled trials were identified. Additional information that may be of interest has been included in the appendix.

OVERALL SUMMARY OF FINDINGS:

The identified systematic review\(^1\) and non-randomized controlled clinical trial\(^2\) both concluded that AIS systems reduced the incidence of shunt infections compared to systemic antibiotics\(^1\) and non-antibiotic shunts.\(^2\) Both studies also reported that more high quality studies were needed. The non-randomized controlled clinical trial studied children and the systematic review did not report age, but the review was published in a pediatric journal.

Of the 12 observational studies identified, seven were conducted in a pediatric population.\(^5,7-9,12-14\) One observational study was conducted in adults,\(^4\) three were conducted in a mixed child and adult population,\(^6,10,11\) and one study did not specify the patient population, though it was published in a pediatric journal.\(^3\)

Of the seven studies that included pediatric populations, six\(^5,7,8,12-14\) found AIS to be beneficial. In one study, AIS use reduced the rate of shunt infections in children, such as premature neonates, at highest risk for infections.\(^5\) One study concluded that antibiotic impregnated shunts are safe for use in infants\(^7\) while another found AIS to be safe, well tolerated, and associated with low incidence of infection in children between six months and 17 years of age (mean 4.5 years).\(^13\) In a study of both children and neonates, a reduction in shunt infections was observed when AIS systems were introduced.\(^6\) One study concluded that there was more than a two-fold decrease in the likelihood of shunt infection in patients with AIS systems within the first six months of shunt placement\(^14\) and another study concluded that AIS systems do not significantly increase the incidence of shunt infections later than six months after shunt placement.\(^12\) The one study to conclude that AIS systems did not prevent infection found an infection rate of 5.0% in the AIS group compared to a rate of 8.8% in the control group as well as a similar average time to infection.\(^9\)

With respect to mixed adult and pediatric populations, two of the three studies found AIS systems to be effective in reducing shunt infections.\(^6,10\) In one study, the rates of shunt infection decreased in both adults and children after AIS systems were introduced.\(^6\) In the second study, it was found that AIS systems significantly reduced the rate of shunt infections.\(^10\) The study that concluded that AIS systems did not offer an advantage compared to conventional shunts noted a “remarkably low infection rate” in the entire study population and recommended further investigation of the systems.\(^11\)

The one study that exclusively included adults concluded that AIS systems could be effective in a high-risk adult population.\(^4\) Although it was published in a pediatric journal, one study did not clearly state the patient population; the authors concluded that AIS systems have the potential to significantly reduce the rates of shunt infections.\(^3\)

Overall, AIS systems have been shown to be effective in reducing infection rates in patients with hydrocephalus,\(^5,6,8,10,13\) even those at high risk for infection.\(^2,4,5\) AIS systems have been shown to be safe for infants and neonates\(^7,8\) and effective in preventing both early\(^14\) and late\(^12\) shunt infections. Although not all included studies found AIS systems to be superior to non-antibiotic impregnated shunts,\(^9,11\) the need for large, well designed clinical trials to determine the
effectiveness of AIS systems for the prevention of infections in patients with hydrocephalus was recommended by many of the study authors.\textsuperscript{1,2,4,9,11,13}
REFERENCES SUMMARIZED:

Health technology assessments
No literature identified.

Systematic reviews and meta-analyses

Randomized controlled trials
No literature identified.

Controlled clinical trials

Observational studies


PREPARED BY:
Kristen Moulton, BA, Research Assistant
Jessie Cunningham, MIST Information Specialist
Health Technology Inquiry Service
Email: htis@cadth.ca
Tel: 1-866-898-8439
APPENDIX – FURTHER INFORMATION:

Economic studies and cost information


Guidelines and recommendations

See 6.5.4 Antibiotic-impregnated devices in neurosurgery, p.34