Systematic review of ventriculo-peritoneal shunt infections in children

Aim: The purpose of this review is to provide an overview of the risk factors, diagnosis and clinical management of children with ventriculo-peritoneal (VP) shunt infections. It will also highlight gaps in the literature where more research is required.

Background: VP shunt infections are very challenging infections in children due to the difficulty in diagnosing them, and also the lack of evidence base that there is to the management of these cases. Often the infections can occur in infants, where there is a particular paucity of research in how best to manage these infections. Management can vary considerably between different centres and also even the definition of infection can vary also. This can make it very difficult to compare infection rates between different centres and countries.

Contributors

- Richard John Drew, Consultant Microbiologist
- Andrew Riordan, Consultant in Paediatric Infectious Diseases
- Stéphane Paulus, Consultant in Paediatric Infectious Diseases
- Conor Mallucci, Consultant Neurosurgeon
- Theresa Cole, Specialist registrar in Paediatric Infectious Disease
- Nigel A. Cunliffe, Consultant Microbiologist

Method: The full study protocol will be registered with the Prospero network at the Centre for Reviews and Dissemination in the University of York. The inclusion and exclusion criteria are specified below. PubMed, Scopus and Cochrane databases will be reviewed. The searches will be written so as to capture all of the relevant studies. Duplicates will then be reviewed. Two researchers (T Cole and RJ Drew) will then review all of the extracted items using the inclusion and exclusion criteria that have been stipulated. The list of screened papers will then be reviewed by RJ Drew to eliminate studies that do not pertain to children or do not give clinical details of treatment given.

The final list of papers to be fully reviewed will then be identified. All papers will be obtained in full. English language papers will be reviewed in duplicate by RJ Drew and T Cole and data extracted as outlined below. Non-english papers will be reviewed by a native speaker who is a healthcare professional (doctor, nurse or pharmacist) and RJ Drew to extract the necessary information. Finally the extracted data performed independently by RJ Drew and T Cole will be compared. Any discrepancies will be resolved with third author and if necessary put to all authors.

Data to be extracted is:

- Study name, Author, Year of publication
- Journal and full reference details
• Children aged 0-18 years included (yes/no)
• Antimicrobial used
• Dose of antimicrobial used
• Route of antimicrobial used
• Was shunt removed and EVD placed?
• Microbiology results and causative organism of infection
• Microbiological cure
• Clinical cure
• Survival
• Adverse effects related to antimicrobial treatment
• Bias

Inclusion criteria

• Types of studies
  o Retrospective or prospective study
  o Cohort studies
  o Randomised controlled trials
  o Observational studies
  o No language restriction
  o Published between 1993 and 2012
    o Study must concern cerebrospinal fluid shunt infections
• Types of participants
  o Humans
  o Children aged 0-18 years
• Types of interventions
  o Antimicrobial treatment, including both antifungals and antibacterials
• Types of outcome measures
  o Microbiological cure
  o Clinical cure
  o Survival

Exclusion criteria

• Types of studies
  o Studies which lack any specific detail on antimicrobial treatment given
  o Surgical prophylaxis trials
  o Antimicrobial shunt trials
  o Published before 1993 or after 2012
    o Studies regarding other types of shunts such as cardiac shunts
• Types of participants
  o Non-Human trials
  o Adults
    o In-vitro studies
- Types of interventions
  - Any non-antimicrobial intervention

**Expertise:** I am currently employed as the Head of Department of Clinical Microbiology at Alder Hey Children’s Hospital in Liverpool, United Kingdom. Alder Hey is a supra-regional centre for paediatric neurosurgery and craniofacial for the North West of England and North Wales. Last year over 300 operations were performed, many of which involve the placement of VP shunts. I have also been involved in the investigation and management of children who presented with suspected VP shunt infections. My colleagues in Neurosurgery and Paediatric Infectious Diseases, who have also published on this area and on paediatric meningitis, will participate in the review and help to ensure all possible papers are included.

**Timeline:** 4-5 months and to commence in May 2013.

**Potential impact:** This study will clearly show clinicians what areas have an evidence base, and also those that require further research and evaluation. This may provoke other research groups into carrying out trials and studies on this complex and challenging area.