

Cerebrospinal fluid draining devices infection in pediatric neurosurgery

G. Felici (1,2), P. Liby (1), A. Ricciardi (2), S. Necozone (3), A. Grimaldi (2), M. Tichy (1)

1) Dept. of Neurosurgery, Motol University Hospital, Prague 2) Dept. of Infectious diseases, University of L'Aquila 3) Dept. of Life, Health & Environmental Sciences University of L'Aquila

Introduction

Hydrocephalus is a common but complex condition caused by physical or functional obstruction of cerebrospinal fluid (CSF) flow that leads to progressive ventricular dilatation. Treatment is usually surgical and consists of implanting a ventriculo-peritoneal shunt (VPS) or an external ventricular drainage (EVD) in most cases. The insertion of foreign materials into the body may be accompanied by many potential problems.



Fig. 1 – Implantation of ommaya reservoir

One of the most frequent is a CSF-draining device, with a rate of about 5-15% [1]. The CDD infections are caused by Staphylococcus species but not uncommon are P. acnes (9%), and polymicrobial infections (15%), including gram-negative bacilli [2]. We present a retrospectively study performed in pediatric neurosurgery department of Motol hospital (Prague), on patients aged <18 years who underwent CDD surgery from January 2013 and May 2018.

Methods

A CDD-associated infection was defined using 2 or more criterias: fever, rash over the CDD, the presence of the pathogen(s) in the CSF or in the blood, fever, CRP > 8mg/l, neutrophils > 0.700 x 10⁹ and leucocytes in CSF > 12/3 ul. We collected the resistances of pathogens based on one or more antibiogram(s). Axetine was the prophylactic antibiotic, administered approx. 30 minutes before the incision.

Results

The study included 191 pediatric patients (M/F ratio 1.62) with a median age of 10 years. Hydrocephalus was caused by a non-tumoral etiology in 122 patients (64%) and 69 (36%) patients had a tumoral etiology. The total number of surgeries was 552: 155 in tumoral etiologies and 397 in non-tumoral etiologies. The overall rate of infection of total surgeries was 8%. The total number of device related infections was 71, in 43 (23%) patients. The infection rate after 90 days was 39% in children <6 year and 12% in children ≥6 years (Fig. 2), with an increased probability of infections in children <6 year (3.18 times – p=0.0001, CI = 1.6176 to 6.2640).

Chi-squared test showed that among non-infected patients, those ≥6 years were 76.2%, compared to younger (23.8%) (p=0.0001). The probability of infections in non tumoral etiology was 2.15 times higher than tumoral etiology (2.1573 times).

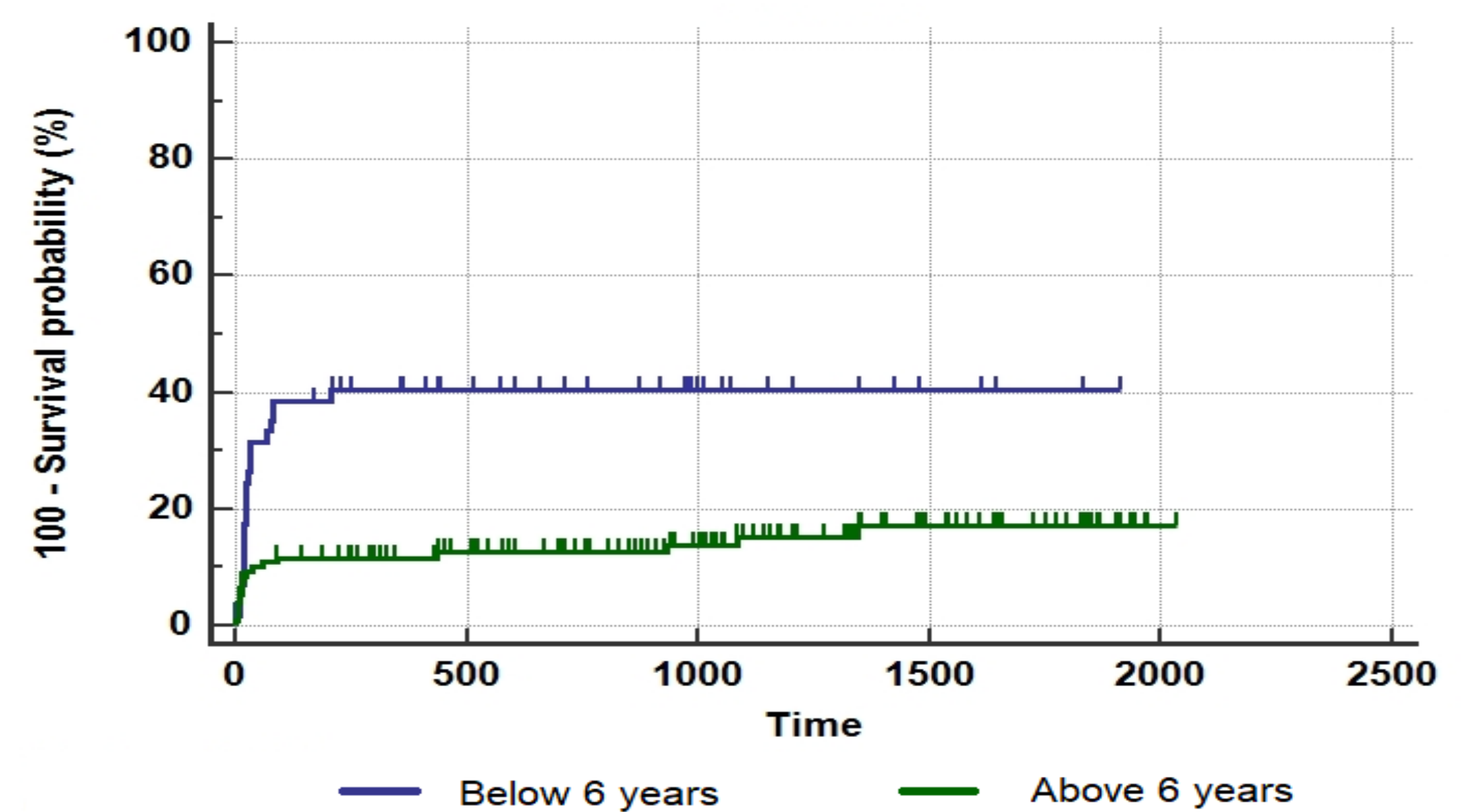


Fig. 2 – Probability of infection in patients <6 years (logrank test P = 0.0001)

This hazard ratio had a significant CI = 1.1532 to 4.0354. The infection probability after 90 days since the surgery was 11% in tumors and 25% in non-tumoral etiology, significant (p=0.0358). There was a strong association between >1 infective episode in patient's history and the chance of a new infection (Fig. 3). After 90 days, patients ≤1 infection had 5.5% chances to have a new one, while patients >1 infection had 40% chances. Overall, patients with >1 infections had 10.42 times higher risk (p<0.0001). The main pathogens were S. epidermidis (38%), E. Coli (8%) and E. Faecalis (8%); among these infections were observed respectively 23 (85%), 2 (33%) and 1 (17%) cases of MDR.

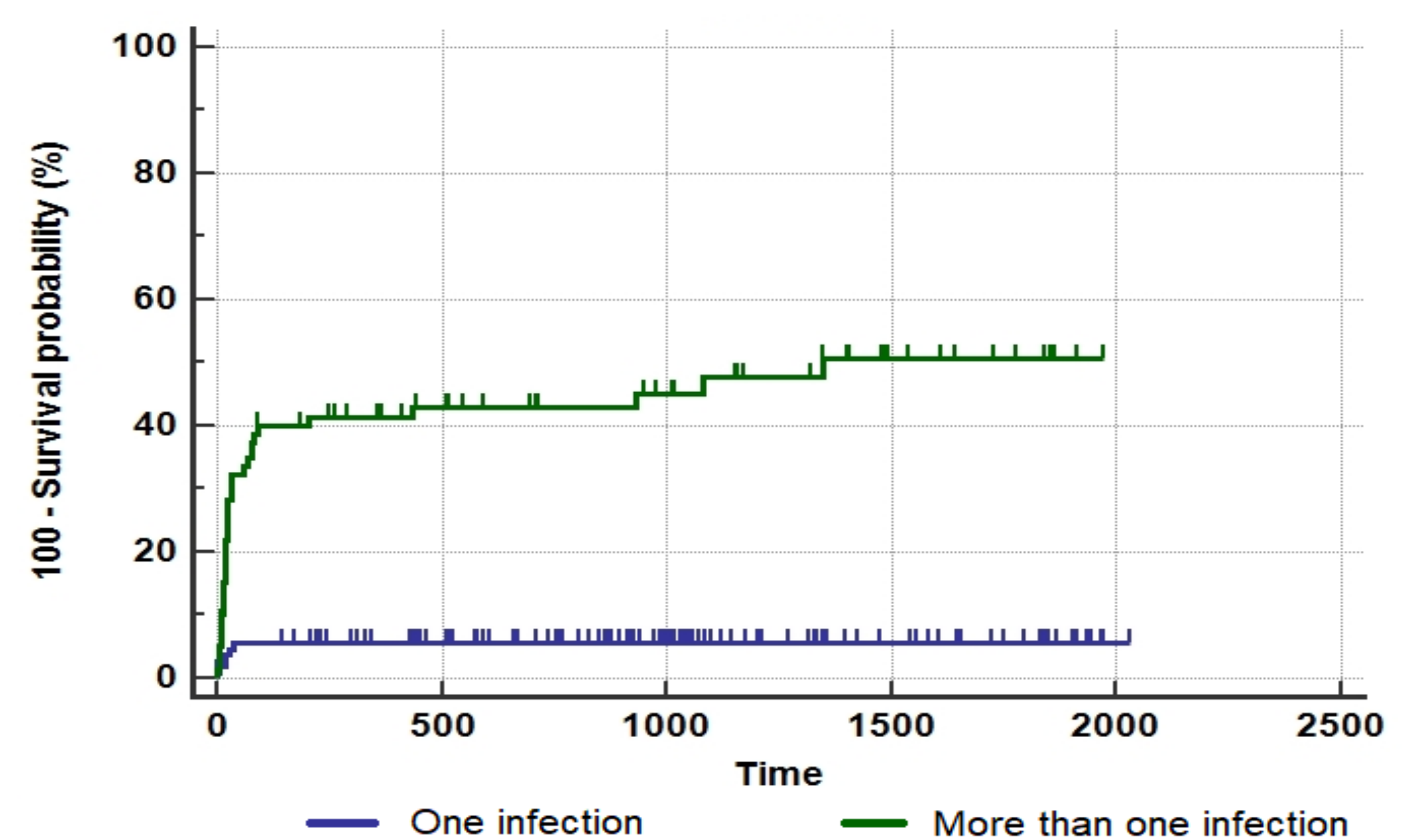


Fig. 3 – Probability of infection in patients < 1 infection and ≥1 infection (P < 0.0001)

Conclusion

According to our results, we consider non-tumoral etiology of hydrocephalus, age < 6 years, implantation of shunt, ≥ 1 infection in the patient's history, perioperative antibiotic different from vancomycin or cefuroxime, as risk factors for device infections. Thus we would prefer neuroendoscopy and ETV to solve the hydrocephalus whenever possible. Moreover, we consider presence of gram negative and MDR bacteria in malignant tumors as bad prognostic factors.

Reference

- 1) Infections of cerebrospinal fluid shunts and other devices, Larry M Baddour, MD, FIDSA, FAHAPatricia M Flynn, MDThomas Fekete, MD; uptodate.com
- 2) Conen A, Walti LN, Merlo A, et al. Characteristics and treatment outcome of cerebrospinal fluid shunt-associated infections in adults: a retrospective analysis over an 11-year period. Clin Infect Dis. 2008;47:73–82.