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Original research article

Different origins of hydrocephalus lead to different shunt revision rates

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ABSTRACT

Introduction: Hydrocephalus (HC) occurs due to multiple origins. Time course and dynamic of HC and its therapies differ between underlying pathologies. Different revision rates due to the type of HC are expected. Though hydrocephalus is known to be a life time condition, the lack of shunt malfunction years or decades after initial shunt insertion raises the hope of a superfluous shunt.

Methods: We conducted a retrospective survey of our OR-database during a 10 year period. All newly inserted shunt systems and subsequent shunt revisions are recorded according to quantity and time point. All patients were subdivided according their aetiology of HC.

Results: 260 patients were eligible with a follow-up of 4.5 years. Subgroups were: 90 patients with NPH, 76 patients with posthaemorrhagic and 16 patients had posttraumatic HC. 22 received a shunt as a consequence of a tumour, 41 were children and 15 for other causes. Overall revision rate was 39.5%. During the first 6 months 55.6%, 57.9% and 75% of patients with NPH, posthaemorrhagic and posttraumatic HC had revisions. In contrast only 38.1% of children and 20% of tumour cases required early revision.

Conclusion: Two different patterns of revision are evident: mainly early revisions in morphologically stable diseases such as posthaemorrhagic, posttraumatic and NPH and predominantly late revisions in changing organisms such as children and tumour patients. The conception HC may be transient because of a lack of late revisions cannot be supported by this data.

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1. Introduction

Hydrocephalus (HC) is a frequent entity in daily neurosurgical practice. In addition to endoscopic third ventriculostomie (ETV) CSF shunting is still the most common therapy for HC of different aetiologies. Shunt failure presents a significant medical burden. Studies have shown an overall shunt failure rate up to 45% within the first year [1–3].

Because of this major problem, the concept HC could be transient because of a lack of late revisions is tempting and advocated by O'Kelly et al. especially in the case of post-haemorrhagic HC [4].

This study was undertaken to compare different hydrocephalus types with the revision rates and their time course to give a hint to the question if HC could be a temporary condition especially in the case of posthaemorrhagic HC.

2. Patients and methods

2.1. Study design

This study was approved by the local ethic committee. We conducted a retrospective cohort study of all CSF shunts that were placed in a 10-year period between 1st January 2004 and 31st December 2013. Only patients who had their initial shunt insertion within the 10-year study period were included. Follow-up was extended up to August 2014. For each patient the following was recorded: age at initial shunt insertion, date of initial shunt insertion and all subsequent revisions with date of surgery. Shunt revisions were defined as all surgical procedures related to the shunt system. In case of a shunt infection, removal and replacement were counted as one procedure. All revisions were dichotomised to within the first six month or later.

Patients with a follow-up of less than one year were excluded. Patients were categorised according to their aetiology of HC in: normal pressure HC, posthaemorrhagic HC following subarachnoid or intraventricular haemorrhage, HC following traumatic brain injury, HC in the consequence of an intracranial tumour and miscellaneous. Children were counted as a separate group up to the age of 14 years regardless of their underlying aetiology.

Revision rates were calculated as the percentage of patients needing at least one shunt revision. Furthermore we calculated the average number of shunt revisions per patient as the ratio of all initial shunt insertions divided by the number of revisions.

2.2. Data sources

Data were derived from administrative and surgical databases maintained at . . . Patients were identified via ICD-9, ICD-10 for Q3 hydrocephalus and OPS-codes for shunt insertion and revisions. All subsequent patient charts were reviewed. Contemporary follow-up was accomplished by yearly routine follow-up or by telephone interview.

2.3. Statistical analysis

Statistical analyses were performed using SSPS statistical software (version 19). *T*-test was used to calculate the mean time to first revision. For comparison of revision rates between the groups Chi-square test was used. Correlation between revisions and age was done with Spearman Rank test. Survival curves were constructed using the Kaplan–Meier method.

2.4. Surgical technique and shunt hardware

Ventriculo-atrial shunting was the standard procedure in adults up to June 2005. After June 2005 ventriculo-peritoneal shunting was the most common procedure. Whenever possible a right frontal burrhole was used for insertion of the ventricular catheter.

The following valves were used: Pro-GAV, Miethke, Germany in 106 patients (40.8%), Hakim Medos programmable valve, Codman, USA in 92 patients (35.4%), GAV, Miethke, Germany in 36 patients (13.8%), Hakim Precision medium–low, Codman, USA in 22 patients (8.5%) and Certas, Codman, USA in 4 patients (1.5%).

3. Results

333 patients received a newly inserted shunt system within the 10 year period. 56 patients died in the first year after shunt insertion. 17 patients were lost to follow-up. According to the inclusion criteria 260 had at least one year follow-up and were eligible for this study with a mean follow-up period of 1656 days = 4.5 years (range 366–4369 days).

122 patients were men, 134 women. 75.7% had ventriculo-peritoneal shunts. 23.5% had ventriculo-atrial shunts. Two patients (0.8%) received a cystoperitoneal shunt.

Table 1 – Complications and revisions in itemised subgroups.

Subgroup	No. of patients	Operations performed	Follow up (years)	At least 1 revision	Infection rate	Revisions first 6 months
NPH	90	120	3.6	24.4%	5.6%	55.6%
Posthaemorrhagic HC	76	122	4.9	40.5%	17.8%	57.9%
Posttraumatic HC	16	29	4.8	60%	26.7%	83.3%
Tumour-HC	22	35	4.3	40%	5%	20.0%
Children	41	105	5.9	59.5%	14.3%	38.1%
Miscellaneous	15	34	4.4			
All	260	448	4.5	39.5%	12.2%	56.0%

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