Ventriculoperitoneal Shunt Complications in a Developing Country: a Single Institution Experience

Qamile Morina1, Fatos Kelmendi2, Arsim Morina2, Dukagjin Morina3, Doruntina Bunjaku1
Clinic of Anaesthesiology, University Clinical Center of Kosova, Prishtina, Kosovo1
Clinic of Neurosurgery, University clinical center of Kosovo, Prishtina, Kosovo2
Stadtische Kliniken Duisburg. Klinikum Kalkweg – Neurochirurgische Klinik, Duisburg, Germany3

Introduction: Shunting a hydrocephalus is among the most commonly performed neurosurgical procedures. Hydrocephalus constitute a significant medical problem in terms of urgency and treatment. Shunting of cerebrospinal fluid has dramatically reduced the morbidity and mortality of hydrocephalus, but they have potential complications that may need multiple surgical procedures during a patient’s lifespan. Materials and methods: We evaluated the following individual characteristics in relation to shunt complication rates: sex, ethnicity, age at the time of the first shunt placement (1 month [neonate], 1 to 12 months [infant], 1 to 18 years [child], 18 years [adult]), hydrocephalus type (spina bifida, congenital excluding spina bifida, communicating, obstructive) and socioeconomic status. In this retrospective study 193 patients were analyzed, unfortunately 27 where lost in the procedure of follow up and 12 died this patients were excluded from studies. Results: Obstructive hydrocephalus (47.9%) was the most common diagnosis followed by communicating hydrocephalus (13.3%). Patients with ventriculoperitoneal shunt that were followed over time in 37% of cases experienced at least one surgical shunt complication during the study period and 13% of patients had multiple shunt complications. Discussion: The causes for shunt malfunction include shunt infection, obstruction, distal catheter migration, shunt disconnection etc. Neonates and children experienced the highest complication rates. By 5 years of follow—up almost half of the children required a repeat surgical procedure. Children with obstructive hydrocephalus experienced the greatest risk of needing an initial shunt revision. Conclusion: Ventriculoperitoneal shunts constitute a significant medical problem, in terms of both urgency of treatment and economic costs. In conclusion, young infants are at highest risk for CSF shunt revision. Key words: hydrocephalus, shunt infection, shunt complication.

Corresponding author: Qamile Morina, MD. Rruga e spitalit p.n. 10 000 Prishtina, Kosova

1. INTRODUCTION

Shunting a hydrocephalus is among the most commonly performed neurosurgical procedures (1, 2). Hydrocephalus constitute a significant medical problem in terms of urgency and treatment. Hydrocephalus characterizes a heterogeneous group of disorders that span a wide range of ages from newborn to adult, with varying degrees of chronicity and severity. Shunting of cerebrospinal fluid has dramatically reduced the morbidity and mortality of hydrocephalus, but they have potential complications that may need multiple surgical procedures during a patient’s lifespan. Despite the introduction of new shunt materials and insertion techniques, CSF shunts have a higher risk of failure than most currently approved medical devices (3, 4, 5, 6).

In pediatric surgical series, shunt failures occur in 14% of patients just within the first month after shunt placement (7), and 40 to 50% of shunts will fail within the first year (5, 8, 9). Adults also experience a relatively high (29%) shunt failure rate within the first year (2). Long-term studies suggest that 45 to 59% of all patients, regardless of age, will require a shunt revision (1, 7).

The reasons of shunt failure include obstruction (proximal part and distal part), infection, mechanical disconnection or breakage. Earlier studies evaluated shunt-associated complications and shunt survival predominantly in the pediatric hydrocephalus population; only limited data are published in adult patients (2, 6, 8, 10).

Previous studies have shown that an increasing number of previous revisions and shorter time to first revision increase the risk of shunt complications (4, 9, 10).

In neurosurgery treatment of hydrocephalus patients with multiple ventriculoperitoneal shunt failures is a very challenging issue.

Regardless of the significant advances in shunt technology and treatment approaches in neurosurgery, the ideal management of hydrocephalus in both pediatric and adult patients is yet to be established.
We have evaluated in University Clinical Center of Kosova, Clinic of Neurosurgery hospital data over an 10 year period (June 1999 - December 2010) to study rates of ventriculoperitoneal shunt complications also to determine factors that may be associated with increased risk of shunt complications. We really hope that outcomes of this study may help to improve the surgical management of hydrocephalus in pediatric and adult patients.

2. PATIENTS AND METHODS

The Clinic of Neurosurgery in University Clinical Center of Kosova is the only Clinic for the state of Kosova. Clinical follow-up evaluations were reviewed retrospectively for all hydrocephalus patients with surgical VP shunts. We evaluated the following individual characteristics in relation to shunt complication rates: sex, ethnicity, age at the time of the first shunt placement (1 month [neonate], 1 to 12 months [infant], 1 to 18 years [child], 18 years [adult]), hydrocephalus type (spina bifida, congenital excluding spina bifida, communicating, obstructive) and socioeconomic status. In this retrospective study 193 patients were analyzed, unfortunately 27 where lost in the procedure of follow up and 12 died, this patients were excluded from studies.

3. RESULTS

The remaining analyses are restricted to the 154 patients and the mean length of follow-up was 55 months and children were followed on average longer than adults (58.2 versus 52.3 mo). Children represented one-third of all patients who received a ventriculoperitoneal shunt during the study period and Adults represent 2/3 (Table 1).

Obstructive hydrocephalus (47.9%) was the most common diagnosis followed by communicating hydrocephalus (13.3%). Patients with ventriculoperitoneal shunt that were followed over time in 37% of cases experienced at least one surgical shunt complication during the study period and 13% of patients had multiple shunt complications. Shunt replacement and removal happened in most cases with shunt complications, whereas distal shunt complications and shunt exploration were less common (Table 2).

All types of shunt complication (except shunt exploration) were with significantly difference more common in children than in adults (P <0.05). In children all kinds of shunt complications were significantly more frequent. Children were less likely to die in a hospital during the study period than were adults (5.9 versus 17.1%, P=0.253).

Patients with obstructive hydrocephalus have a higher shunt complication rate than patients with communicating hydrocephalus. The shunt failure rates did not differ significantly between patients with congenital hydrocephalus and those with spina bifida. Roma, Ashkaeli and Egyptian together experienced an increased risk of VP shunt complications when compared with Albanians and Gorans.

Table 1. Characteristics of 193 patients who received a ventriculoperitoneal shunt in Kosova between 1999 and 2010

<table>
<thead>
<tr>
<th>Shunt replacement</th>
<th>Adults N (%)</th>
<th>Children N (%)</th>
<th>All patients N (%)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=128</td>
<td>n=26</td>
<td>n=154</td>
<td></td>
</tr>
<tr>
<td>Shunt replacement</td>
<td>22 (17.5%)</td>
<td>10 (36.8%)</td>
<td>32 (20.8%)</td>
<td>P=0.03</td>
</tr>
<tr>
<td>Shunt removal</td>
<td>10 (8.1%)</td>
<td>6 (21.4%)</td>
<td>16 (10.6%)</td>
<td>P=0.048</td>
</tr>
<tr>
<td>Distal shunt complication</td>
<td>7 (5.2%)</td>
<td>7 (8.6%)</td>
<td>14 (9.1%)</td>
<td>P=0.002</td>
</tr>
<tr>
<td>Shunt exploration</td>
<td>1 (0.8%)</td>
<td>1 (3.8%)</td>
<td>2 (1.3%)</td>
<td>P=0.310</td>
</tr>
<tr>
<td>Any shunt complication</td>
<td>31 (23.9%)</td>
<td>12 (45.3%)</td>
<td>43 (28.0%)</td>
<td>P=0.042</td>
</tr>
</tbody>
</table>

*Complication rate in adults and children

Table 2. Surgical shunt complication rates among 154 children and adults who received a ventriculoperitoneal shunt in Kosova between 1999 and 2010

4. DISCUSSION

The treatment of hydrocephalus primarily involves the drainage of CSF through shunts. CSF shunting provides an improved neurological outcome. The causes for shunt malfunction include shunt infection, obstruction, distal catheter migration, shunt disconnection etc. Neonates and children experienced the highest complication rates. By 5 years of follow-up almost half of the children required a repeat surgical procedure. Children with obstructive hydrocephalus experienced the greatest risk of needing an initial shunt revision. Children with spina bifida experienced the greatest risk of undergoing multiple shunt revisions (Figure 1 and 2).
Mechanical factors may be responsible for the higher shunt complications rates in patients with obstructive hydrocephalus, future studies are needed to confirm this hypothesis. Lower socioeconomic status was associated with a 21.3% increased ratio for VP shunt complications. A uniform technique for VP shunt placement was used, the overall treatment was chosen by a number of 7 neurosurgeons and 4 residents. Many of these variables included in the retrospective study are dependent on the decisions of individual neurosurgeons and surgical procedures involved for the shunt placement. Theoretically it is possible that the study results could be affected by the different criteria of different neurosurgeons for performing shunt placement or shunt reoperation. We still believe that our retrospective analysis is valuable and has several strengths. The shunt revision incidence observed in the present study could be explained in the different ways. Obstruction, infection, overdrainage and mechanical shunt complications are the major contributors to shunt revision in hydrocephalus patients. Moreover, shunt design, valve type, and shunt material may play a role in shunt survival in these patients. Patients who underwent shunt insertion for other etiologies, including SAH, posttraumatic, tumor/cysts, and postcraniotomy, had a lower incidence of shunt revision and a relatively longer median time to shunt failure.

5. CONCLUSION

Ventriculoperitoneal shunts constitute a significant medical problem, in terms of both urgency of treatment and economic costs. In conclusion, young infants are at highest risk for CSF shunt revision. There is also ethnic variation in the risk of ventricular shunt revision.

Children with a shorter time from initial shunt placement to failure are at risk for a shorter duration of survival for the subsequent shunt.

REFERENCES