Endoscopic Procedures for Management of Ventriculo-Peritoneal Shunt Malfunction and Malposition: Preliminary Results in 12 Consecutive Cases

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ABSTRACT

Background: Shunt Malfunction is still a challenging problem for neurosurgeons despite the advances in shunt technologies and techniques. Objective: The aim of this study is to evaluate efficacy, safety, and possible complications of endoscopic intervention in treating shunt malfunction. Methods: Retrospective study of prospectively collected data of 12 consecutive patients between January 2006 and December 2008 presenting with V-P shunt malfunction. 7 patients (58%) were operated upon by Endoscopic Third Ventriculostomy (ETV), 3 patients (25%) had shunt malposition and the shunts were redirected under endoscopic guidance, and 2 patients (17%) had endoscopic lysis of catheter tip adhesions and ETV. Results: Clinically, all patients (100%) had marked improvement of symptoms during the first postoperative week. Radiologically, 7 patients (58%) had reduced ventricular size, 12 patients (100%) had restoration of lax subarachnoid space, and 3 patients with shunt tip malposition showed good postoperative tip site. Complications were encountered in 3 patients (25%), 2 of them had postoperative ventriculitis and were treated by shunt removal and External Ventricular Drain (EVD) placement, while the third patient presented with shunt malfunction 9 months postoperative and had resurgery (ETV). No procedure related complications were reported. Conclusion: Endoscopic procedures in experienced hands are safe and effective alternatives in treating V-P shunt malfunction and malposition with high success rate and few reported complications. [Egypt J Neurol Psychiat Neurosurg. 2010; 47(3): 367-371]

Key Words: shunt malfunction, third ventriculostomy, septostomy.

INTRODUCTION

Shunt malfunction is still an existing problem for neurosurgeons and remains challenging despite the great progress in shunt technologies in the past decades. Shunt dysfunction may be caused by several factors most commonly obstruction of the ventricular catheter by choroid plexus. The repeated shunt malfunction after surgical revision provided a problem that led neurosurgeons to search alternative ways trying to avoid multiple shunt revisions which is associated with high incidence of complications like infection. Since the early 1990s, fiberoptic endoscopes became available for use in treating shunt related problems providing a safe and effective tool to reach the ventricular catheter and handle the problem in cases of shunt malfunction as well as providing a guide for shunt placement.

Several endoscopic procedures had been postulated for dealing with shunt malfunction; ETV was reported to be an effective method in such cases with good outcome data. In addition, the endoscope provides efficient visualization of the ventricular system allowing cautery or lysis of choroid or ependymal adhesions that may partially obstruct the tip of the ventricular catheter, as well as repositioning of the catheter’s tip in a proper site or passing it through a septostomy performed for unilateral ventricular dilatation.

The aim of this study is to evaluate the efficacy, safety, and possible complications with endoscopic procedures in treating different types of shunt malfunction.

PATIENTS AND METHODS

This study is a retrospective study of prospectively collected data of 12 patients admitted to Department of Neurosurgery, Cairo University Hospitals between January 2006 and December 2008 was done.
Patient selection was based on; 1) all had posterior parietal V-P shunt placement for different causes of hydrocephalus, 2) all patients suffered shunt malfunction +/- malposition and had undergone shunt revision at least once with recurrence of symptoms, 3) all patients had CSF sampling via shunt tap, confirming them infection-free before endoscopic intervention.

Patients included 5 males, 7 females (M:F ratio 1:1.4) with age ranging from 9 to 25 years (mean age 18 years). The time interval between shunt revision and endoscopic intervention ranged from 2-30 days (mean of 16 days).

All patients were assessed clinically and radiologically by CT and/or MRI of the brain, in addition to abdominal CT scan excluding any causes of distal shunt malfunction.

**Surgical Technique:**

All 12 patients were operated upon in Cairo University Hospitals by the author.

Seven patients (58%) were operated upon by ETV alone without dealing with the ventricular catheter. Under general anesthesia, the patient was placed in a supine position with the head flexed 10-15°. A burr hole was created on the coronal suture, 3 cm off the midline. A rigid 0° endoscope lens (Karl Storz, Gaab System, Germany) was introduced through its sheath after ventricular cannulation.

The floor of the 3rd ventricle was reached via the foramen of Monro, fenestration of the floor between the infundibulum and mamillary bodies was performed using gentle blunt pressure by the diathermy probe and Fogarty balloon dilatation. The prepontine cistern is then inspected ensuring clear CSF pathway.

Three patients (25%) were suffering from shunt malposition causing univentricular drainage. These patients were operated upon through a contralateral coronal burr hole performing septostomy by blunt and/or diathermy cauteryization then the tip of the ventricular catheter was identified, grasped with a forceps and brought into the contralateral ventricle.

Two patients (17%) were shown to have proximal shunt occlusion by choroid and ependymal tissues. These patients had endoscopic identification of the occluded catheter’s tip, lysis of the obstructing tissues by diathermy coagulation and scissors until the catheter’s tip is completely free. Then, ETV was performed to help in CSF drainage in case of recurrence of adhesions.

### RESULTS

Demographic data of patients, cause of hydrocephalus, procedure and complications are illustrated in Table (1). Patients were assessed both clinically and radiologically with 2nd day postoperative CT scans. Clinically, all 12 patients (100%) had marked improvement of symptoms of increased intracranial pressure within the first postoperative week.

Radiologically, ventricular size, position of the ventricular catheter and laxity of the subarachnoid spaces were assessed as follows; 7 patients (58%) had reduction of the ventricular size as measured by the largest width of both frontal horns in postoperative CT scan. All patients (100%) showed laxity of the preoperative effaced subarachnoid spaces, while good shunt position was confirmed in the 3 patients having catheter repositioning through septostomy.

Patients were followed up both clinically and radiologically in 3 months intervals for a period ranging from 12-48 months (mean of 24 months). Two patients (17%) had recurrence of symptoms within 2 and 3 weeks postoperative, shunt tap and CSF analysis proved ventriculitis. Both patients had shunt removal and EVD placement for 7 days and 12 days respectively until CSF infection cleared then shunt placement was reperformed.

One patient (8%) presented with recurrence of shunt malfunction 9 months after ETV, and was reoperated upon by endoscopic exploration showing adhesions partially obstructing the ostium of the 3rd ventricle, endoscopic fenestration of the ostium was performed. No procedure-related complications were encountered.

Figures (1) and (2) show illustrations of surgical procedures and neuroradiology of two of the patients included in the study.
Table 1. Demographic data, cause of hydrocephalus, procedure and complications of patients with Ventriculo-peritoneal Shunt Malfunction and Malposition.

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Etiology of Hydrocephalus</th>
<th>Interval between shunt revision and endoscopy</th>
<th>Procedure</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>M</td>
<td>Vermian astrocytoma</td>
<td>30 days</td>
<td>ETV</td>
<td>None</td>
</tr>
<tr>
<td>15</td>
<td>M</td>
<td>Aqueductal stenosis</td>
<td>20 days</td>
<td>ETV</td>
<td>Ventriculitis</td>
</tr>
<tr>
<td>22</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>4 days</td>
<td>Septosomy, repositioning</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>7 days</td>
<td>ETV</td>
<td>Recurrence and resurgery</td>
</tr>
<tr>
<td>25</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>2 days</td>
<td>ETV</td>
<td>None</td>
</tr>
<tr>
<td>16</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>15 days</td>
<td>ETV</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>4th ventricular medulloblastoma</td>
<td>24 days</td>
<td>Septosomy, repositioning</td>
<td>None</td>
</tr>
<tr>
<td>24</td>
<td>M</td>
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<td>9 days</td>
<td>Septosomy, repositioning</td>
<td>None</td>
</tr>
<tr>
<td>21</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>18 days</td>
<td>ETV</td>
<td>Ventriculitis</td>
</tr>
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<td>18</td>
<td>M</td>
<td>Lateral ventricular ependymoma</td>
<td>25 days</td>
<td>Lysis of adhesions, ETV</td>
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</tr>
<tr>
<td>22</td>
<td>F</td>
<td>Aqueductal stenosis</td>
<td>2 days</td>
<td>ETV</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>Tectal Glioma</td>
<td>14 days</td>
<td>Lysis of adhesions, ETV</td>
<td>None</td>
</tr>
</tbody>
</table>

Figure 1. Case 7: 9 yrs old male, preoperative CT (left) showing undrained left lateral ventricle, septostomy and repositioning of shunt (middle two), postoperative CT showing proper placement and drainage (right).

Figure 2. Case 11: 22 yrs old female, preoperative CT (left) showing shunt malfunction, ETV performed (middle), postoperative CT showing proper ventricular drainage (right).
DISCUSSION

Despite the great advances in shunt technologies, shunt malfunction remains to be a challenging problem to neurosurgeons. The risk of V-P shunt malfunction was reported to be 25-40% in the 1st year and 4-5% per year thereafter. Some authors postulated that 81% of shunts require revision after 12 years. Many factors may cause shunt malfunction most commonly the position of the ventricular catheter and choroid plexus adhesions occurring around its tip.

Nowadays, the use of endoscopic techniques offered an excellent route for visualization of the ventricular system and the ventricular catheter facilitating management of shunt malfunction by various techniques.

Endoscopic third ventriculostomy (ETV) was reported to be an effective treatment in patients with obstructive hydrocephalus who had undergone previous shunt procedures. High success rates were published by many authors ranging from 42-100%. Boschert and coworkers in 2003 and Buxton et al. in 2001 reported 82% success rate in 17 patients each. Murshid in 2000 had 88.8% success rate in 9 patients while Cinnali and colleagues in 1998 reported 76.7% success rate in 30 patients all with long term follow up. All reported no complications associated with ETV and failure was often attributed to ventriculitis.

Other endoscopic procedures can be performed either alone or in combination with ETV, like lysis of adhesions around the ventricular catheter, fenestration of entrapped compartment, septostomy and shunt repositioning.

In our study, ETV, lysis of adhesions, repositioning of shunt through septostomy were performed with comparable success rate in 9 patients (75%) to the previously mentioned publications. No procedure related complications were encountered and failure was established in 3 patients (25%), 2 of them suffered from ventriculitis and the 3rd had partial obliteration of the ETV 9 months later and the ostium was refenestrated. Failure rate was coinciding with published results in literature review as well as low rate of complications when performed by experienced hands.

Conclusion

Endoscopic procedures in experienced hands are safe and effective alternatives in treating V-P shunt malfunction and malposition with high success rate and few reported complications.

[Disclosure: Author reports no conflict of interest]
Kamal: VP shunt malfunction & malposition


المنصوص العربي

تمثل المشاكل الإصابية للصماع المخا – البريتوني في بعض المرضى استفادة المخ تحديا لجراحات الأعصاب أهمها انسداد أو تغير وضع القسطرة المخية للصماع

يدعم هذا البحث لدراسة وتشيع نتائج الجراحات المنطورية بالمخ لعلاج مشاكل الجراحات الساق تكرها من خلال دراسة 12 حالة مريض يعانون من خلل ووظائف صمام المخ لأسباب مختلفة وتم إجراء جراحات منطورية لهم بمستشفيات جامعة القاهرة خلال الفترة من يناير 2006 وحتى ديسمبر 2008.

وقد تم إجراء ثلاثة ألوان من الجراحات المنطورية للجراح المرضي: 7 حالات (58%) تم عمل بلب من البطين المخا الثالث لتصور السقال المخا الشوكي إلى الصهريج القاعدي لتدعم عمل صمام المخ، 3 حالات (25%) تم إجراء عمل بلب من الحمام الشفاف بين البطينين الجانبيين بالمخ وتعمل وضع صمام المخ من خلا الوصزان في حين تم إجراء فك التخصصات حول طرف القسطرة المخية بواسطة المنظار الجراحي مع عمل بلب بالأبين المخا الثالث في خالتين (17%).

أظهرت النتائج تحسن ملحوظ بالأعراض في جميع المرضى (100%) مع تعديل النشاط التشريحي لبطينات المخ في 7 حالات (58%).

وتغير وضع القسطرة المخية في 3 حالات وقد حلت مشاكل الجراحات في 3 حالات: ألتيم منهم أصيبوا بالتهاب بسديل المخا الشوكي وتم علاجهم ببضع الجراحات وتركيب صمام خارجي مع إعادة تركيب صمام مخا بريتوني جديد بعدها انقضاء على الالتهاب، أما الحالات الأخرى فقد عانى من ارجاع الإنسداد المخا بعد 9 أشهر وتم إجراء جراحة منطورية أخرى لعلاجها ولا توجد مشاكل مبشرة للجراحات المنطورية في جميع الحالات.

نتيجة هذا البحث تؤكد مدى فاعلية وأمان الجراحات المنطورية في علاج حالات الإنسداد المخا البريتوني مع قلة معدل المضاعفات.