Case Report

Fractured inlet connecting tube of the flat bottom flushing device of a posterior fossa cystoperitoneal shunt

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Abstract

Background: There are well-known complications for shunt procedures. Shunt fracture or disconnection is the second most frequent cause of shunt malfunction in children. Shunt disconnection is not a common cause of shunt malfunction in the early period after installation, especially in the adulthood.

Case Description: Fracture of the proximal (inlet) connector of a flat-based shunt installed for decompression of a large posterior fossa arachnoid cyst in a 31-year-old female with signs of increased intracranial pressure led to recurrence of her symptoms 6 months after surgery.

Conclusion: Awareness of the possibility of fracture site in the junction of the inlet connector of flat bottom shunt systems is warranted and can be diagnosed by three-dimensional computed tomography (3D CT) imaging without performing shunt series study.

Key Words: Cystoperitoneal shunt, hydrocephalus, shunt malfunction, shunt revision

INTRODUCTION

Placement of a ventriculo-peritoneal shunt (VPS) or cystoperitoneal shunt (CPS) is one of the most common surgeries for managing hydrocephalus and intracranial arachnoid cysts. There are well-known complications for this procedure and shunt fracture or disconnection is the second most frequent cause of shunt malfunction in children comprising up to 11% of the causes of shunt malfunction in the series with longer follow up periods.¹⁻⁴⁻⁷

Fractures of the peritoneal catheter occur most commonly in the neck, the area where the tube is subject to any kind of mechanical stress.¹⁻²⁻⁴ The typical presentation of a fractured shunt system occurs quite late after insertion.⁷

In this communication, we intend to report the first adult case of shunt malfunction that occurred within 6 months after installation with fracture of the hard inlet connector of a flat bottom flushing device, in the literature. The site of fracture could be identified in three-dimensional computed tomography (3D CT) scan just below the bulb.

CASE REPORT

A 31-year-old female was admitted complaining of chronic headache, vertigo, and blurred vision for more than 6 months. She was married and had a 4-year-old child delivered by vaginal delivery. There was no history of head trauma, meningitis, or lumbar puncture. Neurological examination was normal except for bilateral moderate papilledema with limited visual
field in all directions and decreased visual acuity to 0.7 on Snellen scaling system. Regular laboratory test and hormonal studies were all normal and she was not on any kind of medications except analgesics for headache. Magnetic resonance imaging (MRI) showed dilated supratentorial ventricular system with a dilated cisterna magna [Figure 1]. Considering: (a) The tonsils and all the gyri of the inferior part of the cerebellum were up-held, (b) the outlet of the fourth ventricle was open, and (c) there were no sign of basilar invagination, ‘a large entrapped cerebrospinal fluid (CSF) containing’ cyst such as a congenital malformative arachnoid cyst was considered to be the main pathology. The situation was explained to the family as she has suffering from a kind of congenital arrested hydrocephalus, which is aggravated. Her headache and visual impairment were refractory to medical treatments and a kind of surgical decompression became unavoidable. ‘Open exploration’ of the posterior fossa and excision of the cyst wall, ‘endoscopic decompression’ of the cavity with opening the cyst content to the adjacent subarachnoid spaces, and installation of a CPS were suggested as the different treatment modalities for such a condition for the family. They agreed with CPS for the first line of surgical treatment.

A medium pressure shunt with flat-based flushing device (Fuji System Corporation) was installed. With patient in supine position and head turned 45° to the left, a burr hole was placed in the right sub-occipital region. Tubing of the subcutaneous tissue for placement of the peritoneal tube was performed in standard manner. Dura was bluish and tight. The ventricular catheter was shortened to less than 4 cm and connected to the inlet connector of the flushing device before opening the dura. A small incision of the dura led to a gush of CSF and the shortened ventricular catheter was installed into the cyst cavity. The flushing device was fixed to the adjacent pericranium with four 40 silk sutures. The postoperative course was uneventful and her headache and vision improved remarkably the day after surgery. The device was palpable beneath the skin and could be flushed easily.

The magnetic resonance imaging (MRI) performed after 5 months showed remarkable decrease of the cyst volume, smaller ventricular system, and bilateral collection of thin layer-subdural fluid [Figure 2]. Her symptoms recurred in a month and new MRI showed disappearance of the subdural collection with moderated expansion of the ventricles and the posterior fossa cyst [Figure 3]. The catheter was visible in the cyst cavity and also could be palpated and flushed under the skin with no local fluid collection. It was planned for a shunt series imaging but 3D CT scan of the posterior fossa region disclosed disconnection of the inlet connector and ventricular tube from the bottom of the valve [Figure 4].

On exploring the shunt during the operation, the cyst catheter and the part of the connector, which was tied to it [Figure 5], were retrieved from the cyst and a new flushing device and ventricular catheter were installed. Patient has been quite well during the next 6 months after revision.

**DISCUSSION**

Complications of valve reservoirs or flushing devices are seldom reported as a cause of shunt malfunction.\(^5,7\) We report, to our knowledge, the first adult case of fracture of the proximal connector of a flushing device presenting with shunt malfunction only after 6 months after installation.

The typical presentation of a fractured shunt system is usually quite late. The most common location for a fracture is along the distal catheter segment, often near

Figure 1: Showing large CSF containing lesion pushing cerebellum up and forward

Figure 2: MRI taken 5 months after surgery showing shrunken posterior fossa cyst in T1W, and bilateral SD collection in T2W images
the clavicle or over the lower ribs. Mechanical stresses, such as lengthening during growth, manipulations, trauma, or surgery have been mentioned as the causes. The risk of shunt fracture is higher in children and this might be due to the ongoing pressure on a part of a shunt located between two fixation points in the growing child. We would like to suggest that the slope of the suboccipital bone and repeated minor trauma displacing the pump focally, for example, to detect proper shunt function with flushing, might have been the cause of disconnection in our case.

According to our review, collapse and intracranial migration of the valve reservoir, disconnection of the plastic dome from the metallic base of the reservoir, fracture in the soldered joint of the distal tube to the reservoir dome in an ‘Integral shunt,’ and fracture at the hardened plastic connector lying within the unitized portion of the ventricular catheter of a Snap shunt (2 cases) are the similar complications reported in the literature.

Accurate diagnosis of VPS malfunction is a challenging clinical task that most neurosurgeons face. A new shunt system has an expected survival time of approximately 73 months. The failure rate is reported to be 48% at 2 years and 59% at 4 years following placement. Mechanical failures in general comprise 74% of shunt malfunctions. Disconnection/fracture is reported to account for approximately 2.5–15% of all shunt failures. Radiographic assessment remains the fundamental tool for diagnosis of shunt failure. A good resolution 3D CT scan might also be included in the armamentarium for diagnosis of shunt fracture.

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