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Case Report

Ventricular peritoneal shunt malfunction after operative correction of scoliosis: report of three cases

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Abstract

BACKGROUND CONTEXT: Two of the most common disease processes associated with hydrocephalus in children are spina bifida and intraventricular hemorrhage of prematurity, both of which are known to be also associated with spinal deformity in later childhood. The occurrence of shunt malfunction after mechanical injury or stress to the hardware has been well documented. Newer techniques in the treatment of neuromuscular scoliosis, including anterior release with segmental fixation, have resulted in more powerful corrections of these large spinal deformities. A new potential cause of shunt malfunction is the aggressive correction of scoliosis.
PURPOSE: To report patients with neuromuscular curves averaging 100° who were subsequently recognized to have perioperative shunt malfunction.
STUDY DESIGN: Three case studies from a university hospital setting were included.
PATIENT SAMPLE: All three children were young adolescents and had-long term shunts. Two of the children had spina bifida and a third had cerebral palsy. All children underwent anterior release of their scoliosis with posterior segmental instrumentation, with unit rods and sublaminar wires. All had significant correction of their scoliosis.
OUTCOME MEASURES: Malfunctioning of the ventriculoperitoneal shunts were recorded.
METHODS: Chart reviews of three cases were analyzed.
RESULTS: Two children had shunt malfunctions within a month of their surgery, and one child had intraoperative recognition and externalization of the shunt.
CONCLUSIONS: Older children undergoing repair of neuromuscular scoliosis are often preadolescents or adolescents who have the same indwelling shunt systems originally implanted in early infancy. The shunt may be brittle and calcified, and the peritoneal catheter may be short. The correction of scoliosis often results in an almost instantaneous growth of a few inches. Because of the potential difficulty in recognizing shunt malfunction in the perioperative period, consideration should be given for elective revision of the peritoneal catheter in children at risk.

Keywords: Ventriculoperitoneal shunt; Scoliosis; Surgery; Cerebral palsy; Spina bifida; Malfunction

Introduction

Spina bifida and intraventricular hemorrhage of prematurity are two of the most common disease processes associated with hydrocephalus in infancy, a condition that may require immediate medical intervention [1,2]. One of the best treatments for hydrocephalus is to introduce a ventriculoperitoneal shunt during early infancy, in which a tube is placed from the ventricles to the peritoneum. The shunt helps to direct cerebrospinal fluid (CSF) to the peritoneum and thus, reduce the intracranial pressure. However, one of the most common complications of the procedure is shunt malfunction, which is often caused by shunt infections, obstructions, and other mechanical reasons [3–8]. Although shunt infections and obstructions have been discussed

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extensively in the literature, few articles have reported ventriculoperitoneal shunt malfunction during correction of spinal deformity later in childhood.

Both spina bifida and intraventricular hemorrhage of infancy can lead to spinal deformity. In spina bifida, abnormalities of the bony elements of the spine and neuromuscular imbalances often result in scoliosis or kyphosis [9,10]. Intraventricular hemorrhage of infancy can cause neurologic impairment, such as cerebral palsy, which in turn cause abnormalities of muscle tone and strength, another reason of spinal deformity [11,12].

These abnormal spinal curves typically progress rapidly during periods of substantial growth, such as the preadolescent and adolescent years, often exceeding 100°. Spinal deformity often significantly interferes in a child's quality of life and thus, requires surgical interventions to achieve the straightening of the spine, such as anterior release of the disc spaces, anterior longitudinal ligament, and deformed osseous elements and posterior surgery [13–15].

Recent advances in instrumentation and surgical techniques make it possible to accomplish more aggressive corrections of these deformities. Yet, as a result of the operations, we also witness more ventriculoperitoneal shunt malfunctions. In this article, we report three cases of ventriculoperitoneal shunt malfunctions during the perioperative period of correction of scoliosis.

Case reports

Case #1

A 12-year-old girl with cerebral palsy had a ventriculoperitoneal shunt implanted in infancy. She presented with progressive neuromuscular scoliosis with a thoracolumbar curve measuring 105°. Bending films showed a stiff curve. The child had difficulty sitting in a wheelchair, and pulmonary function tests revealed a significant restriction of pulmonary function from her thoracic deformity.

She underwent anterior release of her thoracolumbar spine, followed by posterior instrumentation and fusion using a unit rod construct with sublaminar wiring 1 week later. A substantial correction of the scoliosis was obtained with the postoperative curve measuring 55°. The immediate postoperative period was uneventful, and the child went home a week after the surgery.

A month later (postoperative Day 30) she was readmitted with headache, lethargy, and poor appetite. Computed tomography scan demonstrated ventricular enlargement, and a shunt series demonstrated disconnection and dislocation of her distal catheter into her pelvis. She underwent revision of the shunt with full recovery.

Case #2

A 13-year-old boy with spina bifida and a ventriculoatrial shunt placed in infancy. He developed a severe progressive scoliosis measuring 105° and had difficulty sitting in his wheelchair without pain.

We performed a multilevel anterior thoracolumbar release, followed a week later by posterior instrumentation and fusion from T2 to the sacrum. The correction was substantial, with a postoperative curve of 30°. He gained 4 inches in height. He did well in the postoperative period and was discharged to home.

Approximately 3 weeks later (postoperative Day #39), he presented to a hospital close to his home with deteriorating mental status. Evaluation eventually revealed shunt malfunction and he underwent shunt revision. His mental status did not improve, and the shunt was revised again. He lapsed into a coma, was ventilator dependent, and died 18 months later.

Case #3

JV is a 12-year-old boy with spina bifida, who had a ventriculoperitoneal shunt placed in infancy. At the age of 12 years, he presented with a progressive 100° neuromuscular thoracolumbar scoliosis that interfered with sitting in his wheelchair.

We performed a multilevel anterior release, and intraoperatively it was apparent that there was not sufficient catheter in his peritoneum to accommodate the few inches of growth that was anticipated. His shunt was externalized, and after the posterior surgery, the shunt was internalized with a full-length peritoneal catheter. He has done well and has had no signs or symptoms of shunt malfunction at the 2-year follow-up.

Discussion

Ventriculoperitoneal shunt is widely used for treatment of hydrocephalus in early infancy. Although the procedure is effective, shunt malfunction is a common complication encountered by physicians. A variety of factors may lead to shunt malfunctions. Mechanical failure and infection are the two most frequently reported reasons in literature. The general symptoms of shunt malfunction include headache, malaise, vomiting, mental status alterations, enlarged head circumference, and increase high blood pressure [16]. If caused by shunt infection, patients generally present with fever and meningeal signs. The CSF or shunt fluid culture may be positive [6,7]. Mechanical reasons for shunt malfunction are diverse, yet they can usually be diagnosed with radiographs [17]. Proximal or distal obstruction and migration are often presented in clinical medicine [3,8,18,19]. However, many shunt malfunctions occur during the first year of implantation [20]. To date, few articles have reported shunt malfunction after corrections of spinal deformity in later childhood.

In this article, we report three patients with neuromuscular scoliosis and indwelling ventricular shunts. All patients