

Transumbilical approach for ventriculoperitoneal shunt placement in infants and small children: a 6-year experience

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Abstract

Introduction Improved cosmesis has been demonstrated using a transumbilical incision for placement of the peritoneal end of a ventriculoperitoneal shunt. We now present our experience with this technique.

Patients and methods From January 2005 until present, a prospective cohort of 25 children underwent placement of a ventriculoperitoneal shunt with the peritoneal shunt catheter being introduced into the peritoneum via an incision into the umbilicus. There were 17 boys and 8 girls. The age range at insertion was 6 days to 5 years (mean 1.2 years). **Results** The mean follow-up for this group was 3.2 years (range 2 months to 6 years). Of all patients, only one complication (4%) has occurred, although this did not lead to long-term issues. The infection rate for this small group was 0%.

Conclusions Placement of the peritoneal end of a ventriculoperitoneal shunt via an umbilical incision is effective, cosmetically appealing, and not more prone to complications than other standard incisions used on the anterior abdominal wall. Additionally, and based on our experience,

this approach is quicker and almost bloodless with no long-term complications.

Keywords Pediatric neurosurgery · Shunt · Hydrocephalus · Treatment · Umbilicus

Introduction

Historically, the umbilicus has been avoided as an entry point for shunt insertion likely secondary to concerns centered on the umbilicus serving as a source of infection further complicating shunt insertion. However, studies conducted in abdominal surgery fail to show an increased risk of infection, wound dehiscence, or incisional hernia associated with use of an umbilical incision when compared with avoidance of the umbilicus [1]. Transumbilical single-port laparoscopic cholecystectomy utilizing only a transumbilical incision has been employed in general surgery thus eliminating any visible abdominal scars with improved cosmesis [2]. Our interest in using the umbilicus as a source of entry for shunt insertion stems from the anatomy of the umbilicus in particular the easy access into the peritoneal cavity in that entry from the umbilicus offers with its close proximity to skin, aponeurosis, and peritoneum [3].

A ventriculoperitoneal (VP) shunt is the gold standard for the treatment of nonobstructive hydrocephalus with the peritoneal cavity serving as the best site for diversion of cerebrospinal fluid (CSF). Treatment of communicating hydrocephalus typically requires multiple interventions. There are increased risks that are associated with shunt insertion for diversion of CSF including the risk of repeated surgery, and malaligned incisional scars as well as abdominal wall-related complications especially applicable in high-risk patients with obesity and diabetes or in children.

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In 2005, in *Child's Nervous System*, Breaud et al. [4] first reported a transumbilical approach for shunt insertion in a pediatric population and found better cosmetic results. These authors found that the transumbilical approach compared to the traditional transrectus approach was not more difficult and was not shown to be associated with an increased risk of infection (12.5%) [4]. We report the use of a transumbilical approach for shunt insertion as an alternative to the traditional modality of shunt insertion including transrectus approaches and laparoscopically assisted peritoneal shunt insertions.

Patients and methods

From January 2005 until present, a prospective cohort of 25 children underwent placement of a ventriculoperitoneal shunt with the peritoneal shunt catheter being introduced into the peritoneum via the umbilicus. There were 17 boys and 8 girls. The age range at insertion was 6 days to 5 years (mean 1.2 years). All children presented with signs/symptoms of hydrocephalus, and none had previous treatment. The etiologies for the hydrocephalus included postintracranial hemorrhage, meningitis, and aqueductal stenosis. Patients were chosen due to their small size and lack of significant anterior abdominal wall fat. Patients with previous abdominal surgery including gastrostomy were not considered for this procedure. Surgically, the umbilicus was thoroughly prepped with alcohol and chlorhexidine as was the remaining operative field.

The technique used was to make a curvilinear incision in the upper aspect of the umbilicus and within its confines. While pulling up on the surrounding skin, the linea alba was dissected with hemostats using a spreading motion until the peritoneal cavity was entered. After passing the peritoneal catheter from the head to the incision made in the umbilicus, the tubing was then placed into the peritoneal cavity. The midline fascia and linea alba were sutured together and the skin closed in a routine fashion. Absorbable skin sutures were used on all patients. All patients received a dose of intravenous cefazolin (30 mg/kg) perioperatively and 8 h postoperatively. All patients underwent postoperative radiographs of the entire implanted shunt system to verify positioning.

Results

The mean follow-up for this group is 3.2 years (range 2 months to 6 years). Of all patients, only one complication (4%) has occurred, although this did not lead to long-term issues. This was a 3-year-old boy in whom postoperative radiographs noted that the peritoneal shunt tubing was

tightly coiled in the midline. Although asymptomatic, the patient was returned to the operating room where a standard paraumbilical transrectus incision was performed and the peritoneal catheter repositioned. Postoperative radiographs of this second procedure noted that the peritoneal catheter was loosely uncoiled in the peritoneal catheter. From this cohort, no shunt revision due to infection or shunt malfunction has been performed. No patient has presented with midline herniation at the entrance site into the linea alba. At the last follow-up, all patients were well with no complaints related to the umbilical incision. Cosmetically, all umbilical incisions were well healed. Anecdotally, this method is faster due to no muscle dissection and is relatively bloodless due to entering the midline at the linea alba.

Discussion

Breaud et al. [4] first performed the transumbilical approach for shunt insertion with eight children aged 6 weeks to 47 months with an average age of 15 months. These authors did not show any perioperative or long-term complications and demonstrated good cosmetic results associated with this approach [4]. Of the eight children in their study, only one (12.5%) developed a postoperative infection at 1-month postsurgery with *Staphylococcus aureus*, and this was treated with externalization and antibiotics and required a second shunt [4]. In our series, no patient experienced a shunt infection. In a study conducted in 2003 with 42 infants undergoing 44 transumbilical laparotomies, it was shown that the transumbilical approach is safe, and cosmetically superior to an open operation for a broad array of surgeries in children [5].

We initially determined that our umbilical incision would be performed in the upper portion of this structure in order to avoid a patent urachus. This complication was never encountered. However, one case, the only complication in our series, was found on postoperative radiographs to have a coiled peritoneal catheter in the midline and just deep to the anterior abdominal wall. This was theorized to be due to placement into a large falciform ligament. The patient was taken back to the operating room the next day and the catheter repositioned with no long-term consequences. Interestingly, and although rare, development of an abscess in the falciform ligament secondary to the anatomical proximity of the umbilicus to the falciform has been reported in a child with a ventriculoperitoneal shunt [6].

Based on our experience, placement of the peritoneal end of a ventriculoperitoneal shunt via an umbilical incision is effective, cosmetically appealing, and not more prone to complications than other standard incisions used on the anterior abdominal wall. Additionally, this approach is

appears to be quicker and almost bloodless with no long-term complications. Our findings support those of Breaud et al. [4].

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