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Ventriculopleural Shunting Used as a Temporary Diversion

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Summary

Due to the limited absorptive capacity of the pleural cavity, infants and young children are not generally ideal candidates for ventriculopleural shunts. We report using chest cavities as alternate for temporary diversion of CSF in a young child. Venous access to the cervical region could not be utilized because of scarring from previous procedures, while peritoneal access was contraindicated due to repeated pseudocyst formation. Pleural effusions were removed by thoracentesis when necessary, and the shunt catheter was changed to the opposite side of the chest when the effusions reaccumulated within one week. Utilizing the ventriculopleural shunts allowed us to temporize her non-communicating hydrocephalus for a period of one year, until a definitve CSF procedure by direct intracardiac placement of the distal catheter could be performed.

Keywords: Hydrocephalus; ventriculopleural shunt; pleural effusion.

Introduction

The standard treatment for non-communicating hydrocephalus is the ventriculoperitoneal or the ventriculoatrial shunt. Intra-abdominal infection or adhesions from abdominal or urologic procedures makes use of the peritoneal cavity for this type of shunt problematic. Use of the pleural cavity as a receptacle in the treatment of hydrocephalus was first described in 1954 by Heile[2]. In 1960, Ransohoff published a series of 83 hydrocephalic infants treated by ventriculopleural shunting[8, 9]. A small number of patients in this series were unable to absorb the fluid efficiently and developed subsequent symptomatic pleural effusions requiring thoracentesis or revision of the distal shunt catheter into the other pleural cavity, the right auricle, or the peritoneal cavity. Other reports have also well documented that respiratory compromise secondary to pleural effusion is the most common complication resulting in failure of the ventriculopleural shunt[1–8, 10, 11].

We describe a case in which the peritoneal cavity and the cervical venous system was unable to be accessed in a patient with non-communicating hydrocephalus. Use of the alternate pleural cavities enabled us to temporize her hydrocephalus for a period of one year until a definitive CSF diversion could be performed.

Case Report

This patient was a term 2500-gram female with a low lumbar myelomeningocele which was repaired within hours of birth. She developed necrotizing enterocolitis and required a partial colectomy several days later. Continued increase in head circumference as well as documented ultrasound evidence confirmed ventricular enlargement, necessitating placement of a ventriculoatrial shunt at approximately one month of age. It was felt that initial placement of a distal peritoneal catheter would not be ideal because of the recent necrotizing enterocolitis. The patient presented at one year of age for revision of the ventriculoatrial shunt, which was removed from the venous system and placed into the peritoneal cavitiy.

Several months following insertion into the peritoneal cavity, the patient began to exhibit symptoms of abdominal distention, decreased appetite, nausea, and vomiting. Shunt tap was remarkable only for increased pressure; repetitive CSF samplings could not document evidence of CSF infection. Abdominal exploration was remarkable for the presence of severe adhesions, but no evidence of infection. The catheter was placed into the right pleural cavity at that time. Four months later, the patient presented with shortness of breath and a productive cough. Chest x-ray revealed a right pleural effusion and thoracentesis was performed for 650 cc of clear fluid. The pleural effusion reaccumulated in ten days; a second thoracentesis was performed for 600 cc of fluid. The catheter was repositioned to the left chest at that time.

In four months, a symptomatic left pleural effusion developed and required draining on two occasions over a ten-day period. The right cervical region was explored by a pediatric cardiothoracic surgeon, and access into the venous system could not be obtained because of previous scarring from multiple previous intravenous catheters. The catheter was again replaced into the right chest at that time.

Two months later a right pleural effusion recurred and required thoracentesis on several occasions for between 300 and 500 cc of clear fluid.

A right thoracotomy was subsequently performed at approximately three years of age, and a ventriculoatrial shunt was performed with direct intracardiac placement of the distal catheter. The shunt remains functional at three years follow-up.

Discussion

Ventriculoperitoneal shunts are the preferred treatment for symptomatic non-communicating hydrocephalus[6]. A variety of complex abdominal problems may render the peritoneal cavity a suboptimal reservoir for CSF diversion. Abdominal pseudocyst formation surrounding the distal catheter is a well-known cause of ventriculoperitoneal malfunction, and intra-abdominal inflammatory processes are frequently a predisposing factor to pseudocyst formation[1].

Ventriculoaterial shunts have been utilized previously with some frequency, but can present a multitude of problems. The possibility of chronic renal and pulmonary emboli, as well as infection during transient bacteriemia, and the need for periodic catheter lengthening has led to the infrequent use of the shunts in recent years.

Ventriculopleural shunts were first described in 1954[2], and are recognized to have limited indications. In 1988, Jones reported a series of 29 children treated with ventriculopleural shunts in which only 7 shunts worked for more than one year[5]. In contradistinction to this series, Portnoy reported a series of 52 patients treated with ventriculopleural shunting and the addition of an antisiphon device[7]. Using this technique, only one of the 52 children required revision secondary to symptomatic pleural effusions. The mean age of this series was 8 years, with the youngest patient being 2 years old. Of interest is that 14 of the 52 (26%) had asymptomatic pleural effusions noted on chest roentgenograms.

Hoffman reviewed 1500 patients treated for hydrocephalus which included 59 patients with ventriculopleural shunts[3]. The most common indication for use of the pleural cavity in this series was pre-existing ventriculoperitoneal shunt infection. In this series, 20% were found to have symptomatic pleural effusions that requires revision, one half of those were in infants. The risk of developing symptomatic pleural effusion is felt to decrease with increasing age. Venes has recommended that ventriculopleural shunts not be utilized in children under 8 years of age because of problematic pleural effusion[10, 11].

When our patient necessitated shunt revision, the upper body venous drainage system, including the superior vena cava and the peritoneal cavity, were unable to be used. It was felt by the consultants, that due to her multiple organ system problems at the time, she was not a candidate for a direct intracardiac shunt placement. By temporarily utilizing alternate pleural cavities and treating symptomatic pleural effusions with out-patient percutaneous thoracentesis, we were able to adequately treat her hydrocephalus for a period of one year. Following this period of temporary diversion, she was then able to safely undergo open intracardiac placement of her distal catheter, and has done well with a follow-up period of three years. Although ventriculopleural shunting in a young child is not an ideal choice for the initial CSF shunting procedure, this technique is a safe, satisfactory method of temporarily controlling obstructive hydrocephalus until a definitive diversion procedure may be performed.

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