Ventriculo-cholecystic Shunt in the Management of Hydrocephalus

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Ventriculo peritoneal shunt is the preferred surgical management for hydrocephalus. Various sites namely cardiac atrium, pleural cavity, ureter, fallopian tubes, bladder and gastric lumen have been used as alternative for distal CSF flow. Gallbladder has been used sparingly in the past as a reservoir of CSF diversion. We report our experience with ventriculo-cholecystic (VC) shunt in 2 cases and recommend it as a simple and safe alternative .for CSF drainage particularly in the situations where serosal surface of abdomen is unfit or unavailable for absorption.

Keywords: *Gallbladder, Hydrocephalus, Ventriculo-cholecystic Shunt (VC shunt).*

Ventriculoperitoneal shunting is the preferred surgical treatment for hydrocephalus in children. A shunt may become dysfunctional and additional reservoirs for CSF reabsorbtion may have to be used which include the cardiac atrium, pleural cavity, stomach and fallopian tubes. Shunts may become malfunctional because of several mechanisms including infections, intraabdominal adhesions, peritonitis, CSF cysts and other mechanical causes. The ventriculocholecystic shunt (VC shunt) remains an attractive alternative for selected and difficult to manage patients with hydrocephalus in whom intraperitoneal and intravascular shunts are no longer feasible.

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We report our experience with 2 cases of ventriculocholecystic shunt.

Case Reports

Case 1

A ventriculoperitoneal shunt was placed in a 3½-year-old male child at one month of age for congenital hydrocephalus due to aqueductal stenosis. The patient had repeated headache and ascites, which were treated with two courses of oral antibiotics and abdominocentesis elsewhere.

He presented to us with headache, intractable ascites and distal shunt block. Computerized tomography of head showed features suggestive of severe hydrocephalus. USG abdomen showed giant pseudocyst where gut was found to form a clump in the posterior aspect of cyst. Shunt tap showed CSF protein of 180 mg% and CSF culture was negative for pyogenic organism.

A diagnosis of CSF pseudocyst with distal shunt block was made and patient was taken up for exploratory laparotomy. A huge pseudocyst involving whole of abdomen was excised and adhesiolysis of bowel was done. No peritoneal surface was available for absorption of CSF. We had few options of putting the distal end into the right atrium as Ventriculo Atrial Shunt or into pleural cavity or into one of the intraabdominal sites such as ureter, pelvis of the kidney, stomach or the gallbladder. Since none of the above mentioned options are free from complications and we had opened the abdomen for excision of pseudocyst and adhesiolysis, gallbladder seemed a simple and easily accessable option for distal end placement. Endoscopic third ventriculostomy was an option but was not available in our setup. The lower end of VP shunt was changed, ventricular patency was confirmed and the terminal end was inserted into gall bladder by the technique described earlier(3). Postoperative CT head showed decompressed ventricles. Shuntogram showed free flow of dye into duodenum (*Fig.1*).

Case 2

A 6-month-old girl was referred to us with a diagnosis of communicating hydrocephalus (post meningitis). On conservative management baby

Fig. 1. Shuntogram showing patent ventriculo-cholecystic shunt and functioning gallbladder emptying into duodenum.

showed progressive increase in hydrocephalus, irritability, constipation and delayed milestones at maximum tolerable dosage of oral acetazolamide. There was history of necrotizing enterocolitis, sepsis and bacterial meningitis being managed conservatively in the neonatal age for which baby was admitted in neonatal ICU for 2 months. CT scan showed enlargement of lateral, 3rd and 4th ventricles and thinning of cortex. There were no space occupying lesions or any evidence of ventriculitis. Patient was taken up for elective standard VP shunt. On exploration, there were extensive intraperitoneal adhesions, which excluded the possibility of VP shunt, and so ventriculocholecystic shunt was done as an alternative site of intraabdominal distal CSF diversion.

Both the patients are on regular follow up and doing well at 2½ years and 3 years post operatively respectively.

Discussion

Smith, *et al.*(1) were the first to employ reported using biliary tree as the site for distal ventricular shunt placement in 1959. They demonstrated that gallbladder could act as a suitable receptor organ for cerebrospinal fluid because bile is relatively sterile, water and electrolytes could be reabsorbed in the intestinal tract, intracranial pressure could be adequately maintained and gallbladder is not essential for overall patient's survival. Intrinsic pressure of 10-20 cm of water would maintain intracranial pressure and that essential electrolytes and fluid could be salvaged. Formations of fibrinous adhesions about the distal shunt tip were prevented by the lytic action of the bile. Some dynamic role of gallbladder in the maintenance of ventriculo-cholecystic shunt has been reported by Novelli, *et al.*(2).

Technique of VC shunt placement, differs technically little from ventriculoperitoneal shunt. Intraventricular portion of shunt was placed using a standard technique. Right subcostal incision was placed and gallbladder fundus was isolated. Desired length of catheter was cut, allowing linear growth of child and excess length coiled over the dome of the right lobe of liver. Cholecystotomy was created, bile cultured and catheter placed into position within gallbladder for a length of 5 cm. Purse string was secured over the connector to prevent compromise of lumen. Low pressure one-way valve was used, as intrinsic biliary tree resist-ance maintained adequate intracranial pressure.

Contraindications to VC shunt include cholelithiasis, past cholecystectomy, and disease likelihood of gallstone formation such as sickle cell anemia and hereditary spherocytosis. Various complications as reported in literature include biliary tract infection, gallbladder atony, proximal shunt obstruction, disseminated intravascular coagulation, shunt tract infection, wound infection, small bowel fistulas(3) are not specific to VC shunt except for former two. Bernstein and Hsueh(4) have reported bile pigments in the ventricular system in the autopsy finding of a 5-year-old child who died on total parenteral nutrition (TPN); cholestatic jaundice and VC shunt. Although, some apprehension regarding retrograde reflux of bile into ventricle was made, use of a competent one-

way valve precludes the back diffusion of bile.

There are other reports(5,6), which have found gallbladder as an effective receptacle for distal CSF drainage.

The gallbladder remains functional and revision free. However, the nature of distal shunt placement should be clearly highlighted in any ventriculo abdominal shunt so that in the event of future shunt revision the surgeon would be alerted to the possibility of distal terminus of a shunt to be other than the peritoneal cavity, as revision surgery in patients with VC shunt requires exposure of the connector on the gallbladder wall to prevent biliary leakage(7).

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