TECHNICAL NOTE

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Percutaneous Insertion of the Distal Catheter during Ventriculo-Atrial Shunts. A Simple and Reliable Method

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Although the ventriculo-peritoneal shunt is the treatment of choice when hydrocephalus should be corrected, the ventriculo-atrial shunt still holds strong alternative when the peritonium is precluded due to the several reasons. During the ventriculo-atrial shunt operation, it is not always easy to dissect and find the corresponding venous structures. In this technical note, the author describes a simple method of percutaneous insertion for placement of the atrial end.

KEY WORDS : Hydrocephalus · Cerebrospinal fluid · Shunt.

Introduction

The peritoneal cavity is still the most preferred site for inserting distal catheter during cerebrospinal fluid (CSF) diversion procedure in treatment of hydrocephalus. The right atrium should be alternatively selected when the peritoneum is precluded and no more available owing to the intra-abdominal adhesions, local sepsis, and scarring from previous surgery[2,3,6]. While conducting ventriculo-atrial (VA) shunt, insertion of the distal catheter, however is not always simple and straightforward. It is particularly true when relevant venous anatomy and appropriate entry point are not easily identified intraoperatively.

In the present study, the author reports a simple and safe method for insertion of distal catheter during the VA shunt. Placement involves the same technique with central venous line access familiar to all neurosurgeons. This new method has been used successfully in two adult patients.

Case Review

The author recently conducted the VA shunting procedure with the Codman Hakim progammable valve system with hydrocephalus. A 72-year-old man was brought into the emergency room following struck by a car one hour prior to admission. On admission, he was stuporous, quadriparetic (grade 3/3) and had several bruising wound all over the body. Brain computed tomography (CT) showed subdural hematoma and multiple cerebral contusions bilaterally, and decompressive bilateral craniectomies were required to control raised intracranial pressure (ICP) without hesitation. At 3 months postoperatively, he recovered motor power and regained consciousness, but had gradually progressing hydrocephalus. At that time, he had dirty abdominal wound from the initial car accident, which has been treated by the reconstructive and plastic surgeons. The abdominal muscles and fascia were also partially necrotic and a part of the peritonium was severely adhered. The VA shunt was the only surgical method we could choose.

The second patient, a 54-year-old man presented as aneurysmal subarachnoid hemorrhage 3 years ago. During 3 years after microsurgical clipping of the aneurysm, malfunctions of ventriculo-peritoneal (VP) shunt and resultant peritonitis with ileus repeatedly occurred. VA shunt was also the last resort method for the CSF diversion procedure.

Operative Technique in Two Cases

For insertion of the distal catheter, the author used the Healthport (Baxter S.A., Fromet, CA) (Fig. 1). The patients had already undergone ventriculoatrial shunt with the Codman Hakim progammable valve system (Codman; Johnson & Johnson Co, Raynham, MA) in treatment of the communicating

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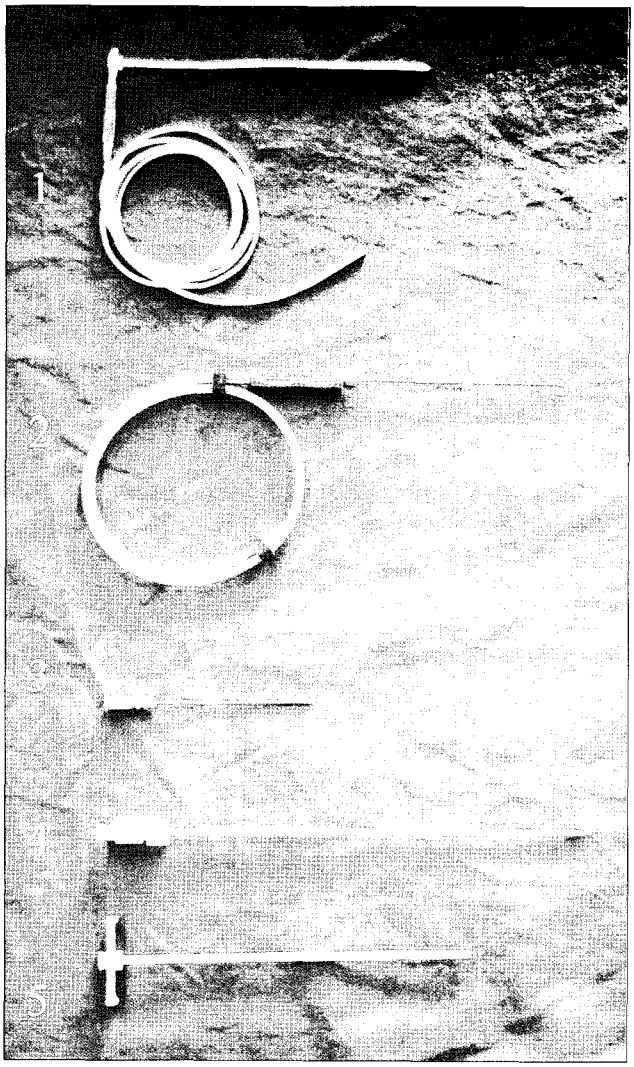

Fig. 1. Photographic demonstration of the progammable valve and percutaneous introducer set. From top to bottom. 1 programmable valve, 2 : J-guide wire, 3 : thin wall needle, 4 : dilator, 5 : split sheath introducer.

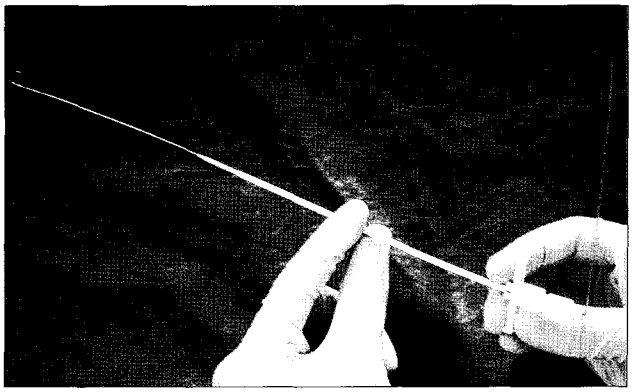

Fig. 2. After J-guide wire is advanced along the thin wall needle and thin wall needle is removed, the dilator and split sheath introducer are then passed over the wire. The bent J-guide wire is useful to measure accurate length of the distal catheter.

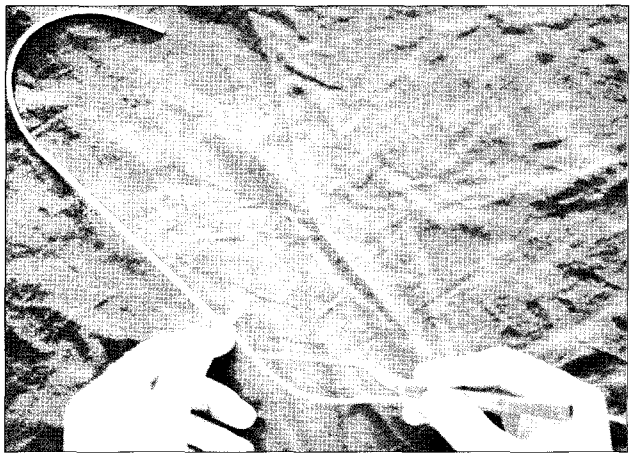

Fig. 3. After the dilator is removed, distal catheter is passed into the internal jugular vein through the introducer.

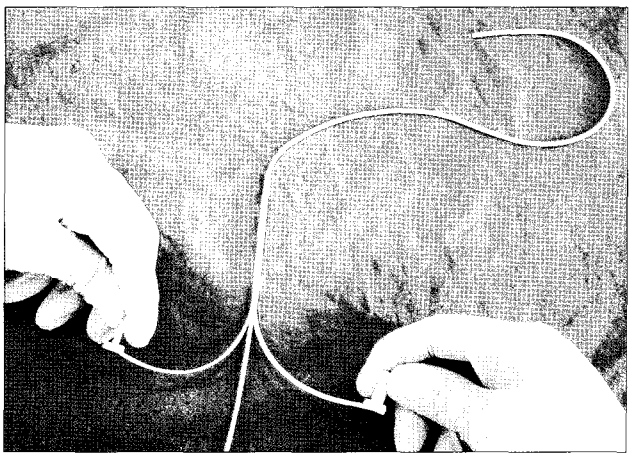

Fig. 4. The introducer is split in both directions and withdrawn.

hydrocephalus. During surgery, the proximal shunt was inserted in the usual manner. A 10mm neck skin incision was made at the anterior border of the sternomastoid muscle and then a subcutaneous tunnel was made from the scalp to the site of neck incision by using of a blunt Salmon passer. The distal catheter was passed through the subcutaneous tunnel. A thin wall needle (18 G×70 mm) was inserted into the internal jugular vein and a J-guide wire (0.89 mm×500 mm) was then advanced along the needle into the right atrium (Fig. 2, 3). At that time, fluoroscopic guidance was necessary to confirm appropriate positioning of the wire between T4 to T7 level. A No.7 French dilator and split sheath introducer were then passed over the wire. The wire was bent at the skin edge and withdrawn. The wire distal to the bending site was used to measure the desired length of distal catheter, because length of the wire has been determined fluoroscopically. The distal catheter, inserted within the atrium, was then cut into the appropriate length and threaded through the introducer after removal of dilator. When the split introducer is withdrawn, for distal catheter not to emerge from it, the surgeon must split introducer into two parts very gently (Fig. 4). If too small introducer set is utilized, there would be a difficulty when

Table 1. Outer diameter of the distal catheter of program mable valves and inner diameter of Healthport introducer

Valve type (outer diameter of distal catheter)	Healthport introducer (inner diameter)
Codman Hakim valve* (2.2 mm)	6 FR (2.00 mm)
PS Medical® Strata™ valve † (2.3 mm)	7 FR (2.33 mm)
Pro-GAB valve ‡ (2.5 mm)	9 FR (3.00 mm)

FR : French, * Codman Hakim programmable valve (Johnson & Johnson Co, Raynham, MA), † PS Medical® Strata™ valve (Medtronic Sofamor Danek, Memphis, TN), ‡ Pro-GAB programmable valve (B. Brown, Melsungen, Germany)

inserting the distal catheter. To prevent development of hematoma, manual compression is prerequisite for several minutes when distal catheter is inserted into the internal jugular vein and the introducer is removed.

Discussion

With regard to the percutaneous insertion of the VA shunt, several reports have been published[2,4-6]. Pritz[4] reported on treatment of 8 patients with hydrocephalus using a wire guide for revision of the distal end of the VA shunt in open surgery. Sorge et al.[6] also described on percutaneous insertion of the atrial catheter for VA shunt as a sufficient substitute for the open surgical preparation of neck veins in German and used a special set based on the Seldinger Technique. When the same kind of method is applied according to the Harrison's method[2], it is difficult to reproduce this new technique because the they did not exactly describe kind and size of the shunt catheter and introducer set, and the intraoperative photographs were dim black-and-white. In contrast to this, the present study demonstrate procedures of distal catheter insertion in detail and step-by-step way. Additionally, information of outer diameter of shunt distal catheter and inner diameter of introducer will be very useful to the operators (Table 1).

The advantages of using a split sheath introducer include : a greatly reduced operating time, less invasive than neck conventional dissection, and a smaller skin incision. When considering the possibility of infections from the CSF shunts, prolonged operating time is one of the most important risk factors[1]. The author were able to perform the VA shunt by the above-mentioned technique only for 45 minutes, 35 minutes respectively. Furthermore, it resulted better cosmetic results in the neck region.

The price of introducer set is not covered by the medical insurance for shunt operation because it is primarily designed for continuous or bolus infusion of chemotherapeutics, antibiotics, blood products, nutritions and solutions, nevertheless the cost is just about 50 United States dollars and is not considered expensive on cost-effectiveness point of view.

Conclusion

This technical note demonstrates a simple percutaneous approach for placement of the atrial end during the VA shunts. This method is fast, simple, efficient, and involves no tedious neck dissection. Thus, percutaneous insertion of the atrial catheter provides a reliable alternative for the open surgical preparation of neck veins.

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