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Original Article

Endoluminal Shuntscope-Guided Ventricular Catheter Placement: Early Experience

Abstract

Background: Placement of ventricular catheter (VC) in an optimal position is the most important factor in determining the outcome of shunt surgery. VC obstruction due to shunt tube placement in brain parenchyma, across the septa, tangled in the choroid plexuses and clogging of VC due to brain matter or other debris are common reasons resulting in shunt complete or partial dysfunction. To resolve these hurdles, many technical advancements have been made including navigation, stereotaxy, sonography, and ventriculoscope-guided VC placement. **Objective:** To report early experience, technique, and result of placing VC with shuntscope. **Methods:** We are publishing our experience of shuntscope-guided ventriculoperitoneal shunt in 9 cases done from June 2015 to April 2016. Shuntscope is a 1 mm outer diameter semi-rigid scope from Karl Storz with 10000 pixel of magnification. It has a fiber optic lens system with camera and light source attachment away from the scope to make it light weight and easily maneuverable. **Results:** In all cases, VC was placed in the ipsilateral frontal horn away from choroid plexuses, septae, or membranes. Septum pellucidum perforation and placement to opposite side of ventricle was identified with shunt scope assistance and corrected. **Conclusion:** Although our initial results are encouraging, larger case series would be helpful. Complications and cost due to shunt dysfunction can thus be reduced to a great extent with shuntscope.

Keywords: *Endoluminal, shuntscope, ventricular catheter*

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Introduction

Ventriculoperitoneal shunt is a lifesaving procedure and is a primary treatment in hydrocephalus, especially in the communicating variety. Placement of ventricular catheter (VC) in an optimal position is the most important factor in determining the outcome of shunt surgery.[1,2] VC obstruction due to shunt tube placement in brain parenchyma, across the septa, tangled in the choroid plexuses and clogging of VC due to brain matter or other debris are most common reasons resulting in shunt complete or partial dysfunction.[1,3] To resolve these hurdles, many technical advancements have been made including navigation, stereotaxy, sonography, and ventriculoscope-guided VC placement.[4,5]

We are publishing our early experience, technique, and result of placing VC with newly devised shuntscope.

Methods

We present our experience of shuntscope-guided ventriculoperitoneal shunt in 9 cases from June 2015 to April 2016. Patients' consent and institutional approval of study and publication were taken. Shuntscope is a 1 mm outer diameter semi-rigid scope from Karl Storz with 10,000 pixel of magnification. It has a fiber optic lens system with camera and light source attachment away from the scope to make it light weight and easily maneuverable [Figure 1a and b]. This scope can be passed into VC in place of a stylet for ventricular inspection through the shunt tube [Figure 1c]. Fixed pressure or programmable shunts were used depending on the indication. Diagnosis, age, and sex distribution of patients are mentioned in Tables 1-3.

A tiny hole was made at the tip of ventricle catheter to accommodate the shuntscope for visualization of the ventricle [Figure 1c]. Ventricular puncture was done with stylet in VC. Immediately after ventricular puncture stylet was exchanged with the shuntscope [Figure 2a-c], rest of VC length was passed into the lateral ventricle under shuntscope guidance. A precalculated length of VC was placed, away from choroid plexuses, vascular, or fibrous septae without perforation of septum pellucidum [Figures 3a-f, 4a-c, and 5a, b]. Utmost

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effort was made to place the VC in the ipsilateral frontal horn near foramen Monro under direct shuntscope vision. Any brain matter or debris visualized causing clogging of the tube after placement of VC was cleaned with the help of the scope or gentle instillation of normal saline through VC [Figure 6a and 6b]. Postoperative computed tomography magnetic resonance imaging (MRI) was done to evaluate the functional state of shunt and positioning of VC in all cases.

Results

VC placement evaluation was done by two neurosurgeons. Assessment was done by Site of VC placement, size of ventricle and periventricular ooze. Along with ventricular

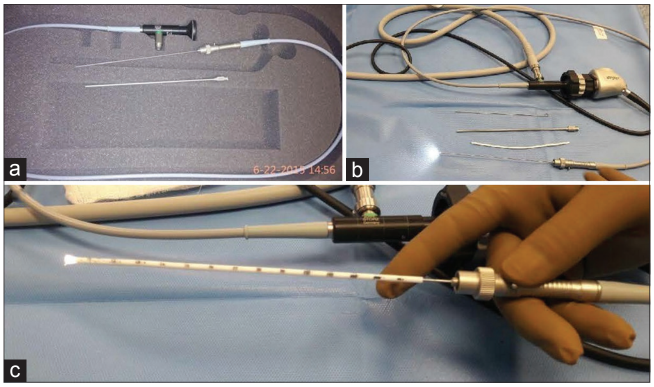

Figure 1: (a) Shuntscope (b) camera attachment (c) endoluminal placement of scope in ventricular catheter

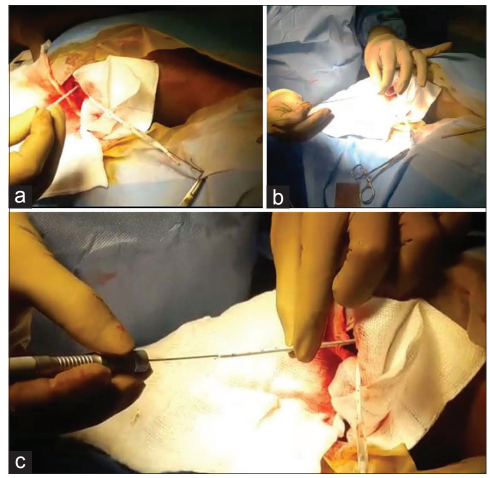

Figure 2: (a) Ventricular catheter placement (b) stylet removal (c) exchange with shuntscope

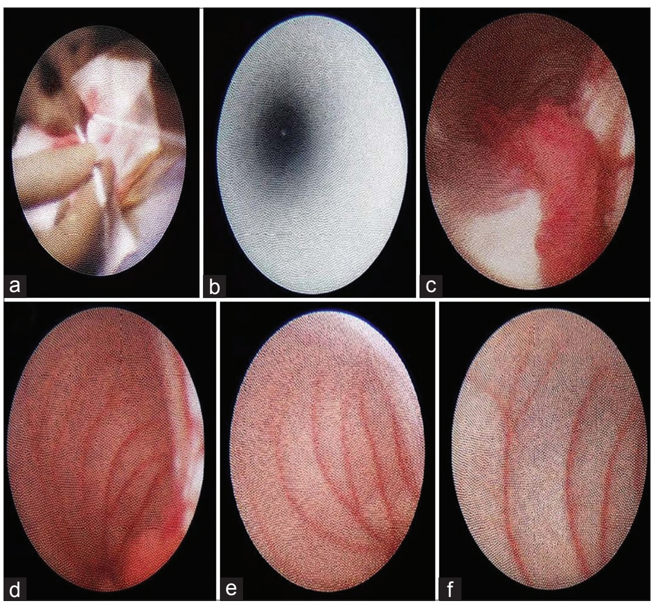

Figure 3: (a) ventricular puncture. (b) Intraluminal visualization of shunt tube while negotiating the shuntscope. (c) ventricular anatomy demonstration. (d,e and f) Placement of Ventricular catheter close to foramen monro

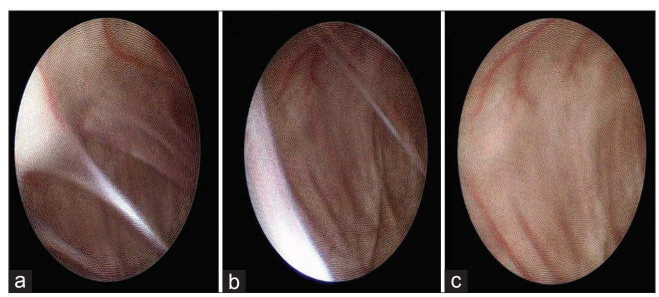

Figure 4: (a) Intraventricular visualization of multiple septae. (b and c) Placement of VC away from septae under vision

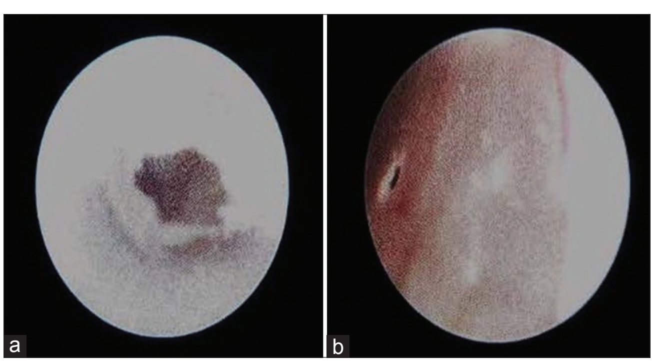

Figure 5: (a) Identifi cation of septum pellucidum perforation. (b) withdrawal of VC for optimal placement in ipsilateral ventricle

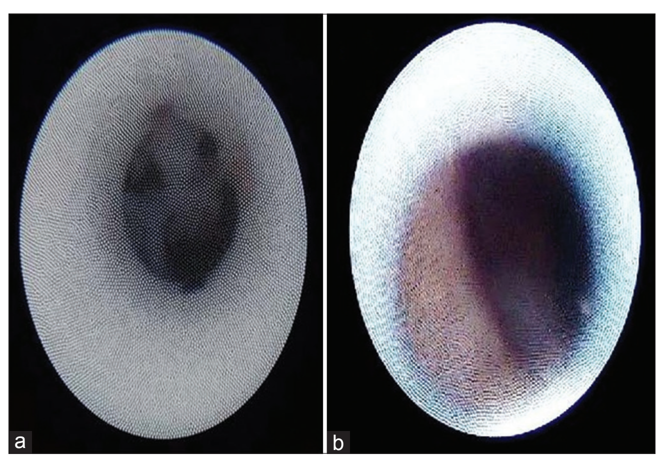

Figure 6: (a) Clogging of ventricular catheter. (b) declog of VC with shuntscope assistance

Table 1: Causes of hydrocephalus in patients

Number of cases (*n*=9)	Diagnosis
4	Postmeningitis hydrocephalus
2	Normal pressure hydrocephalus
1	Hydrocephalus postdecompressive craniotomy
1	Brain tumor

Table 2: Age distribution

Age	Number of patients
Pediatric(<16 years)	2
Adult	7

Table 3: Sex distribution

Sex	Number of patients
Male	6
Female	3

size, clinical status was taken into consideration in normal pressure hydrocephalus (NPH) cases.

In all cases, VC was placed in the ipsilateral frontal horn away from choroid plexuses, septae, or membranes. In none of the cases did the catheter perforate the septum pellucidum or cross to the opposite ventricle. In one case, the VC perforated the septum pellucidum after puncture but was recognized with the shuntscope, enabling us to adjust it to the desired position. Ventricle size reduced in all cases except in one case of NPH. Inspite of no change in ventricular size, NPH patient showed a significant clinical improvement. Shunt function status was confirmed by MRI cerebrospinal fluid flow study in this case.

Discussion

Placing VC during VP shunt is a blind procedure and results in frequent VC dysfunction. Shunt obstruction risk is approximately 17% with VC blockage being most common.[6] To improve the placement of VC, various techniques developed including navigation, stereotactic, ventriculoscope-guided shunt tube placement. These techniques have its own limitation due to excess time consumption and complexity.[5] Shunt scope is simpler and less time consuming and can be used in all surgical procedures without any technical restrictions. Furthermore, none of the endoscopic ventricle catheter placements had to be abandoned.

Intraventricular image quality was always adequate to recognize anatomical structures for orientation. Brain matter or debris partially obstructing the catheter was also recognized during procedure. As the shuntscope was covered with a catheter, no parenchymal damage or bleeding occurred in any of the cases.

Conclusion

Although our initial results are encouraging, larger case series would be helpful. Complications and cost due to shunt dysfunction can thus be reduced to a great extent with use of shuntscope.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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