EDITORIAL

Endoscopic third Ventriculostomy: Surgical technique and outcome prediction

Hydrocephalus management with its different etiologies remains an ongoing challenge to neurosurgeon especially in young children. Management of hydrocephalus is not only about how to deal with it initially, but it also involves how to prevent and deal with the complications of the disease before and after management. Hydrocephalus can be either congenital or acquired. It can also be classified into communicating (non-obstructive) and non-communicating (obstructive).

Endoscopic third ventriculostomy (ETV) is a minimal invasive approach to treat obstructive (non-communicating) hydrocephalus whereby the neurosurgeon will make an opening in the floor of the 3rd ventricle to make intraventricular cerebrospinal fluid (CSF) directly communicating with the subarachnoid space by passing the 4th ventricle. However, the choice between ETV and ventriculo-perotineal (VP) shunting is subjective to so many factors including the type of hydrocephalus, the age of the patient, the etiology of hydrocephalus, the condition of the baby, any associated co-morbidities and the patients or parents preference.

ETV in children is a procedure preferred by many neuro-surgeons and patients upon counseling even if the success rate was theoretically low. Although the efficiency of ETV below the age of one year remains uncertain, but it is still a valid treatment option.[1] It is suggested to check for third ventricle floor bowing to select best ETV candidates pre-operatively.[2] This will increase the success rate for ETV even if the ETV success score was low.[3] In patients with posterior fossa tumors, ETV does not seem to be a good option and it is mostly going to fail especially in patients with ependymoma.[4]

In 2009, Kulkarni et al suggested an ETV success score model to predict the success rate of the procedure pre-operatively. The score has 3-components; the age, the etiology of hydrocephalus and the presence or absence of a previous VP shunt. The summation of the score for these 3-components will give you the estimated success rate of the procedure pre-operatively.[5] This score now is becoming familiar and is being used by most neurosurgeons up to the moment and we found it useful even in pre-operative counseling for patients and their families.[6-8] The best candidates for ETV should be those with a score of 80 or more.[9]

ETV is an early procedure that has been described even before VP shunt by many years. Ventriculostomy was first made by Walter E Dandy in the early 1900s when he tried to treat communicating hydrocephalus through performing choroid plexectomy. Then he tried to perform a third ventriculostomy through a subfrontal approach. In 1910 an urologist tried to cauterize the choroid plexus using a cystoscope. In 1923, the first successful ETV was done by an urologist using a urethroscope. However, the high rates of complications and the advent of the VP shunt had reduced the favor for this procedure for many years.[10] Recently, after the new researches came on how to select the best candidates for the procedure and how to predict the success rate pre-operatively, the neurosurgeons started again to prefer this procedure on the classic VP shunting.

The commonest site for approaching the lateral ventricle in ETV is Kocher's point which is situated approximately 2 cm anterior to the coronal suture and 4 cm lateral to the sagittal suture at the mid-pupillary line. A burr hole can be made at this point or through the anterior fontanelle if the baby has large widely opened anterior fontalelle. The neuro-surgeon performing this procedure must have sound knowledge on the endoscopic anatomy of the ventricles besides adequate training on the endoscope use. Once you are inside the lateral ventricle, first make sure you are in the right lateral ventricle by looking for 2 landmarks; the choroid plexus (CP) and the thalamostriate vein which should not be confused with the thinner septal vien. The thalamostiate vein should be to the right of CP in the right ventricle and to the left

of CP in the left ventricle. If the anatomy is distorted and not clear, the CP can be followed as it will lead you to the foramen of Monoro which should be dilated to avoid injury to the Fornix. A careful navigation through the foramen of Monoro into the 3rd ventricle should be done. Once you are inside the 3rd ventricle, if your assistant is familiar with the procedure you can use the free-hand technique, otherwise you can use the articulating arm. Some neuro-surgeons prefer the later technique as once you have reached the optimum location, you can fix the endoscope and complete the ETV steps without worrying about the navigation. The 2-important landmarks in the 3rd ventricle is the infundibular recess and the 2-mammillary bodies. ETV opening is made in between these 2-landmarks in the blackest translucent part. The opening is made by first slightly coagulating the area without perforating it, then opening the floor with the tip of Fogerty catheter. In patients with a thick floor (like in cases of post-meningitic hydrocephalus) this can be made with the grasping forceps. After the opening is made, it should be dilated carefully with the balloon of the Fogerty catheter and the biopsy forceps. A careful navigation through the ETV opening can then be done through the endoscope after releasing the lock of the articulating arm until you see the naked pulsating basilar artery and the prepontine cistern structures.[11]

Some neuro-surgeons advise combining this procedure with CP coagulation specially in children younger than 1-year of age to increase the success rate.[12]

Throughout the procedure, irrigation with normal saline or ringer lactate warmed to the body temperature should continue to maintain a clear view, to secure hemostasis and to prevent the collapse of the ventricles.[11]

Conclusion:

ETV success depends on many factors including the patient age, hydrocephalus etiology, presence or absence of a previous VP shunt, patient selection, the neuro-surgeon experience and training on endoscopy use.

Careful pre-operative planning and study of the MRI can help in increasing the success rates of the procedure. Further multi-center studies are required to avoid ETV related complications and to increase ETV success rates. Endoscopy use and minimally invasive approaches represent the future of neuro-surgery and the preferred kind of surgeries for most patients and their families now-a-days.

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