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Editorial

# Neuroendoscopy: Pearls and Pitfalls

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Neuroendoscopy is being increasingly used in recent times in cranial [1-4], spinal [5-7] and in skull base lesions [8-10]. Although it has many advantages, endoscopic procedures are also associated with many limitations [11-13]. It is indicated both as an independent treatment modality and as an adjunct to micro-neurosurgery for various neurologic disorders. Endoscopic surgeon needs to acquire microsurgical skills in addition to endoscopic skill.

**Advantages of Neuroendoscopy:** Some of the advantages of endoscopic techniques are better results, decreased pain, small incision, less hospital stay, and low cost.

**Limitations of endoscopy and steps to deal such limitations:** Although principle advantage of an endoscope is its ability to place light and view sources as close to the area of interest as possible, it also has a dangerous feature of blind area (inability to visualize the pathway between the skin and the endoscope tip). This creates the potential for instruments and the endoscope to unknowingly injure structures in this area [11]. Endoscopic surgeons must consciously train themselves to overcome this limitation by removal of the endoscope with insertion of instrument, and by directly visualization of instrument with naked eyes in blind area.

Bimanual dissection may not be possible in some of the endoscopic techniques when one hand of the surgeon is being used for holding the scope and also because of availability of a single working channel in majority of systems. Use of telescope holder or assistant holding scope allows the surgeon to employ both hands for dissection.

Endoscopic neurosurgery is usually associated with a steep learning curve [11]. It is because of difficulty in controlling bleeding, blind area, requirement of unique skills for endoscopy which are different than microscopic skills, 2D images, limited space in which extra space is required for placement of scope etc. Simpler case selection in the beginning, multidisciplinary team approach, practice on models, cadaveric dissection and attending live operative workshops can shorten the learning curve.

Scope occupies some area in an already limited space and the telescope may obstruct movements of instruments, proper placement of the telescope is important to overcome these limitations. In Neuroendoscopy extra space is needed to station scope in addition to the area required for two instruments usually. It should be placed as much away as possible from the surgical target and at the same time allowing proper visualization. The telescope, instrument and the surgical target should be in triangular position and not in a straight line otherwise the surgical object wouldn't be visualized. Rotation of instrument or the scope allows visualization of instrument tip. Visual obscuration in endoscopic surgeries can be due to staining lens tip secondary to the presence of blood, bone dust, drop of fluid or brain tissue on scope tip. Excessive moisture content in the air medium, telescope out of focus and the breakage of lens, etc. can also degrade image quality. Anti-fogging agents, manual irrigation of scope using saline and removal of drop off liquid from lens tip by suction, suction of air containing excessive humidity, and proper focusing of scope help improve image quality. Scope can be soiled by bone dust which can be avoided by using longer focal length scope which can be positioned as much away as possible, using intermittent irrigation in between the short period of drilling, and lower revolutions per min (RPM) drill.

Bleeding, even if minor, during endoscopic surgery especially when procedure is done under fluid media obscure visualization and subsequent surgery. It should be prevented. Inflating the balloon catheter or gently keeping instrument, already in the field, on the bleeding point can stop the hemorrhage at the site of fenestration in the floor of the third ventricle. It is not desirable to remove instrument used for perforation of third ventricle floor and to bring in cautery to stop bleeding, it is usually difficult to see anything by the time cautery forceps is brought in. Intermittent careful closure of outflow can also produce tamponade effect, which could decrease bleeding and also help in locating the bleeding point. Maintaining ventricular access is important in severe bleeding. Telescope must be maintained within the field, rather than pulling it out. The telescope should be placed in large size ventricle cavity (lateral ventricle rather than third ventricle) as any movement in the smaller ventricle could be dangerous [11]. Endoscope may be removed, but the sheath should be in place. Fluid can be replaced by air and coagulation of the bleeding point can be done if it is difficult to manage bleeding in fluid media. Rapid conversion to open surgery is recommended when significant bleeding is not controlled by any other technique.

**Training in Neuroendoscopic procedures:** Instrument tip should be slightly curved for better visualization. Single shaft slender instruments are preferred over double shaft and bulky because of the less space occupied by such equipment. Straight instruments are preferred over bayonet shape. Gentle support of the hand on the endoscopic sheath or surrounding structures can prevent fatigue and improve precision where as unsupported hand can give rise to early tiredness. Pen type grip is better than the power grip [12]. If power grip is needed because of the required function or due to poor instrument design, pen grip should be added to improve precision. For dissection or other surgical manipulation the tissue should not be pulled towards the scope, it can be moved to the side or away from scope.

Sufficient case volume may not be available for neuroendoscopic training for young neurosurgeon. Surgeon should spend more time in labs using indigenously made inexpensive models such as capsicum, papaya etc. Neuroendoscopic training can be learnt by performing surgeries in deep and superficial operative area. Suturing using surgical gloves, silastic tubes and dissection using papaya, and or capsicum can be learnt in laboratories. Like wise hemostasis, drilling and cutting technique can also be learnt. Neuroendoscopic training using high and low magnification should be practiced. High magnification is preferred in most part of the procedure for better visualization; where as low magnification may be needed sometime for overview of large operative area.

Low-cost, commercially available USB camera and LED light source can be used. 0° and 30° view can be obtained, 30° angulation can be obtained by displacing the optical axis of the USB camera by 30°. Spatial adaptation, depth adaptation, cutting, hemostasis, suturing and dissection can be learnt using this low cost system. Neuroendoscopic skill can be learnt by observation alone or by observation accompanied by verbal guidance. Attending live operative workshops, watching operative video, visiting other departments where large number of endoscopic procedures are performed, observing skillful endoscopic neurosurgeon and use of simulators can help in improving endoscopic skill.

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