

SHORT TECHNICAL REPORT

A cylindrical endoport and self-retaining port-holder: technical advances in Neurosurgery (a brief technical report)

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Tubular ports are commonly used in endoscopic neurosurgical procedures. Studies have shown that by splitting and not disrupting fiber tracts, the neuroports can cause much less damage to the brain as compared to the one caused by blades of the conventional retraction systems. We describe here a transparent, soft, and flexible silastic tube that can be used as a neuroendoport successfully for removal of deep-seated brain tumors and hematomas. The self-retaining retractor system described in this report is safe and efficient to hold the endoport in position and is used in our department without any complication. More importantly, the system is indigenous and cheaper and is available in all neurosurgery departments.

Keywords: endoport, endoscope, deep-brain lesions, brain tumor, intracerebral hematoma, self-retaining retractor**Key message:** The neuroport and self-retaining retractor system that we described here are available in all neurosurgery departments and can be used without any problems in all endoscopic neurosurgical procedures.

Introduction

Endoscopic ports are meant to provide a stable passage within the brain for unrestricted movements of the endoscope and operative instruments during surgery. Endoporters are generally safer for brain surgery because the brain retraction pressure is lower (1–3). The pressure is exerted radially and diffusely because of the cylindrical configuration of the tubes and is tolerated better by the brain (4). The port insertion is atraumatic, as it mainly causes splitting and not disruption of the brain fibers (2, 3). The tubular port provides a panoramic vision of the deep-seated intracranial lesions and the surrounding brain parenchyma.

Objectives

One of the major problems in the presently available port system is the instability of the port, because of which the endoport tends to move during the procedure, making the operation inaccurate and hazardous. Various methods used in the past to stabilize these undesirable movements of the ports, such as ports of different sizes and shapes, ports with a handle, or an assistant physically holding the port with hands, failed to prevent this complication in most surgical procedures.

In this report, we describe our modification of the tubular endoport (**Figure 1**), which is indigenous and can be safely used in neurosurgery.

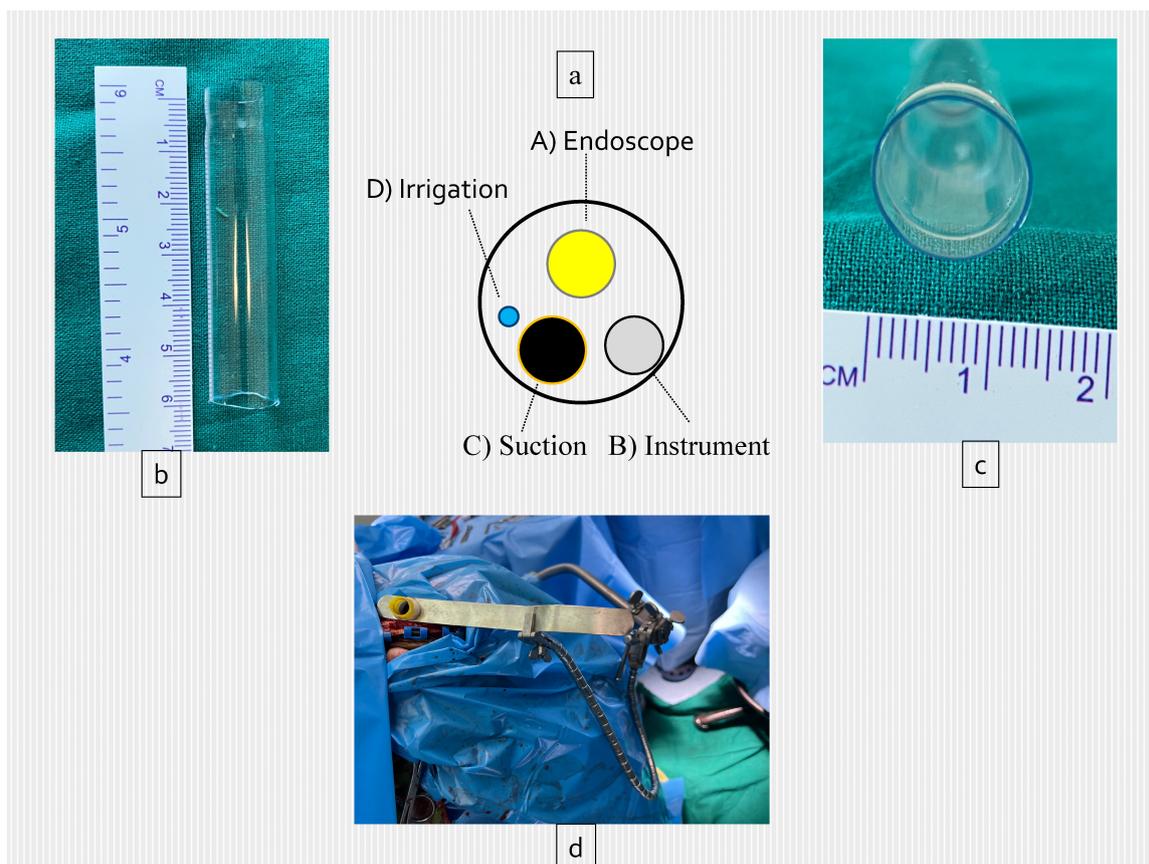


FIGURE 1 | (a) Neuroendoport. (b) 6.0 cm long. (c) 11.0 mm wide transparent silicon tube (Neuroendoport). (d) A Neuroendoport is fixed in a hole at one end of the spatula, and the other end of the spatula is connected to a Leyla self-retaining retractor system at the distal end. A, neuroendoscope; B, instrument; C, suction; D, irrigation.

Port design

Our endoport is a plastic tube that is cylindrical in shape and is 11 mm in diameter, which is sufficient for four instruments at a time, including a neuroendoscope, a dissecting instrument or tumor forceps, a suction cannula, and a small fluid irrigation cannula (Figure 1). The length of the port can be decided preoperatively on the Computed Tomography/Magnetic Resonance Imaging (CT/MRI) scan and is usually 6–6.5 cm long from the skin level to the deepest portion of the tumor along the planned trajectory. A regular self-retaining retractor system is used, when required, to hold the endoport in place (5).

Port insertion

A burr hole is placed at a safer area of entry, and tract disposition is used with the MRI tractography and neuronavigation. A small craniotomy (2.0 cm) allows angulation of the port intraoperatively and provides enough dura and soft tissue for a watertight closure. The dura is opened in such a way that it comfortably allows insertion of an 11 mm tube and helps to perform a watertight dural

closure. Finally, the arachnoid and pia mater are coagulated and cut after ensuring the avoidance of any cortical vessels.

A tubular port with its obturator (a test tube) is fixed on a previously made hole on a retractor spatula. The self-retaining retractor arm of the port holder is then unlocked, and the port is inserted in the brain as per the previously determined trajectory or with navigation until it reaches the center of the hematoma, tumor, or cerebral ventricle. The endoport has round and smooth margins at one end and is atraumatic to insert in the brain. The surgeon introduces the neuroendoscope at the 12 o'clock position in the port for visualization, and the port-holder retractor is locked. The brain lesion is then removed gradually using suction, biopsy forceps, or a cavitron ultrasonic aspirator (CUSA). Once tumor removal has been accomplished, the areas around the tumor bed and tubular retractor are inspected carefully for hemostasis.

Results

We have used the above-mentioned tubular retractor system in 75 patients of intracranial tumors and cysts (parenchymal, thalamic, and intraventricular) and 54 cases of primary

intracerebral hematomas till today. Total removal of the hematomas was observed in 90% of cases. In 65.5% and 38.5% of cases, respectively, there was a gross-total resection of the lesser invasive and highly invasive parenchymal brain tumors. Total removal of the intraventricular tumors was performed in about 70% of cases. In less than 6.5% of patients, we encountered complications related to endoport or self-retaining retractors, like inaccurate trajectory, poor illumination, higher vascularity, calcification, new brain edema, brain contusions, hematoma formation, etc.

Discussion

Brain retractors were introduced first by Greenberg (6) in 1981 and subsequently by Rosenørn and Diemer (7) in 1985 and Yokoh et al. (8) in 1987. However, Kelly et al. (9) were the first ones to introduce stereotactic cylindrical retractors for excision of deep-seated intraparenchymal and intraventricular lesions in 1988. In 2000, Nishihara et al. (3) used a transparent plastic sheath as a retractor for the first time for endoscopic evacuation of intracerebral hematomas.

The endoport system was introduced to aid in the effective endoscopic resection of intraparenchymal and intraventricular tumors and hematomas (10–15) in 2005. Since then, several multiple tubular retractor systems have been employed to address deep-seated intracranial pathologies, including a plastic sheath (3, 10, 11, 16), syringe port system (12, 13, 17), ViewSite Brain Access System (Vycor Medical, Boca Raton, Florida, USA) (15, 18), BrainPath (NICO Corp., Indianapolis, Indiana, USA) (19), and others (3, 14, 20, 21). We have been using a soft, transparent, and 11-mm-diameter plastic tube for removal of the deep-seated hematomas and tumors/cysts from the brain for last 15 years (10). We also studied the ease of application of our tubular retractors and the other commonly used retractors in endoscopic brain surgery.

Mechanical and electric endoscope holders (Storez, Germany) and pneumatic arms (Mitaka, Japan) are available to hold the endoscope in various procedures, but steady endoport holders are not well recognized in neurosurgery. We apply a Leyla self-retaining retractor (5) to the tubular port to stabilize it in the brain. Yasargil and Fox (5) first introduced the same retractor in 1974. It was further refined by Greenberg (6) in 1981.

Our experience shows that our endoport is efficient and is more comfortable to use for removal of the primary intracerebral hematoma or brain tumor/cyst (10). The transparent, soft, and tubular endoscopic ports cause much lesser brain injury when the lesions are at the depth of the brain. We have also observed that the self-retaining retractors hold the endoport firmly and avoid all unnecessary movements of the endoport. There were less than 6.5% of cases of complications of endoport surgery in our study. We feel that larger randomized studies are required to compare

various individual endoport systems with other more dedicated and commercially available port systems.

Conclusions

The plastic and transparent endoport systems are very useful for removal of the hematomas and tumors or cysts that are located at the depth of the brain. The efficacy and safety of tubular ports have been described in our paper and other publications.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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