Syringe Port: A Convenient, Safe, and Cost-Effective Tubular Retractor for Transportal Removal of Deep-Seated Lesions of the Brain

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■ OBJECTIVE: **Minimally invasive transportal resection of deep intracranial lesions has become a widely accepted surgical technique. Many disposable, mountable port systems are available in the market for this purpose, like the ViewSite Brain Access System. The objective of this study was to find a cost-effective substitute for these systems.**

■ METHODS: **Deep-seated brain lesions were treated with a port system made from disposable syringes. The syringe port could be inserted through minicraniotomies placed and planned with navigation. All deep-seated lesions like ventricular tumours, colloid cysts, deep-seated gliomas, and basal ganglia hemorrhages were treated with this syringe port system and evaluated for safety, operative site hematomas, and blood loss.**

■ RESULTS: **62 patients were operated on during the study period from January 2015 to July 2017, using this innovative syringe port system for deep-seated lesions of the brain. No operative site hematoma or contusions were seen along the port entry site and tract.**

■ CONCLUSIONS: **Syringe port is a cost-effective and safe alternative to the costly disposable brain port systems, especially for neurosurgical setups in developing countries for minimally invasive transportal resection of deep brain lesions.**

Key words
- Deep-seated brain lesions
- Intraventricular tumor surgery
- Keyhole craniotomy
- Minimally invasive brain surgery
- Transportal brain surgery
- Tubular brain retractor

Abbreviations and Acronyms
ICP: Intracranial pressure
OD: Outer diameter

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Supplementary digital content available online.

Citation: World Neurosurg. (2018) 114:117-120.
https://doi.org/10.1016/j.wneu.2018.03.019

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

1878-8750/$ - see front matter

INTRODUCTION

Deep-seated brain lesions have been a technically challenging surgical entity. Surgery for deep intraparenchymal and intraventricular lesions is associated with higher risks of complications like surgical bed hematomas and retraction-induced contusions. A great deal of attention has focused lately on improving the efficacy and safety of removing such lesions.

The keyhole concept of minimally invasive brain surgeries has been gaining widespread acceptance. Advancements in neuroimaging, operative microscopes, cranial endoscopes, and navigation have made it possible to make tailored smaller craniotomies to achieve satisfactory surgical exposure.[1]

Circular retractors or dilators have become a cornerstone in keyhole brain surgeries. The tubular retractors introduced the concept of creating a surgical corridor using progressive dilators to safely dilate the brain tract during the approach to a deep-seated lesion.[2] The use of such dilators leads to splitting of the neural tissue en route to the lesion and avoids direct damage to the parenchyma, in a fashion similar to the keel of a ship. A wide number of such retractors are now commercially available for use in neurosurgery.

We present our experience with an indigenously designed brain port system using common syringes to provide a cost-effective alternative to the commercially available brain ports.

METHODS AND MATERIALS

Perioperative Evaluation

The diagnostic work up for patients planned for transportal surgery includes 3-dimensional contrast-enhanced magnetic resonance imaging. In emergency conditions, like intraparenchymal hemorrhages, thin-slice computed tomography is appropriate. Planning a tailored craniotomy for lesions in close proximity to the eloquent brain areas requires functional mapping and tractography.

The procedure is performed with the patient under general anesthesia and guided by neuronavigation. The patient is positioned in a Mayfield 3-pin head holder. The head is positioned in such a way that the planned cortical site is the highest and the surgical tract will be nearly vertical to the floor.

Craniotomy, Corticectomy, and Trajectory

Craniotomy, corticectomy, and trajectory are guided by neuronavigation. These are planned based on known safe areas of entry and on knowledge of tract disposition on magnetic resonance tractography.

The craniotomy is roughly 3 cm in diameter. This allows adequate margins for angulation of the port intraoperatively. The craniotomy is made with a high-speed craniotome. The dura mater is hitched and opened in a cruciate fashion. The arachnoid and pia mater are coagulated and cut.

Port Design and Preparation

The syringe port can be tailored as needed before the dural incision. The length of the syringe port can be judged by the depth of the tumor from the skin level. The port needs to be long enough to reach the deepest portion of the tumor along the planned trajectory. A long port can be slightly withdrawn if required, but a shorter port will need to be replaced in case of intraoperative problems. A shorter port will also hamper angulation of the port while accessing the margins of tumor after initial decompression.

The size of the port is determined by the nature of the lesion to be dealt with and its expected vascularity. The plastic 5-mL syringe (BD, Becton Dickinson, Gurugram, Haryana, India) has an outer diameter (OD) of 2.06 mm, the 10-mL syringe has an OD of 14.5 mm, and the 20-mL syringe has an OD of 19.13 mm. A 5-mL syringe port is used for relatively avascular lesions like colloid cysts and hematomas, and a 20-mL syringe is used for highly vascular tumors like central neurocytomas. For intermediate lesions, a syringe port made from a 10-ml syringe provides adequate visualization.

The hub and front end of the barrel of a syringe are cut. The length of the port is measured from the barrel flange of the syringe to the cut end of the barrel. The cut end of barrel is smoothed.

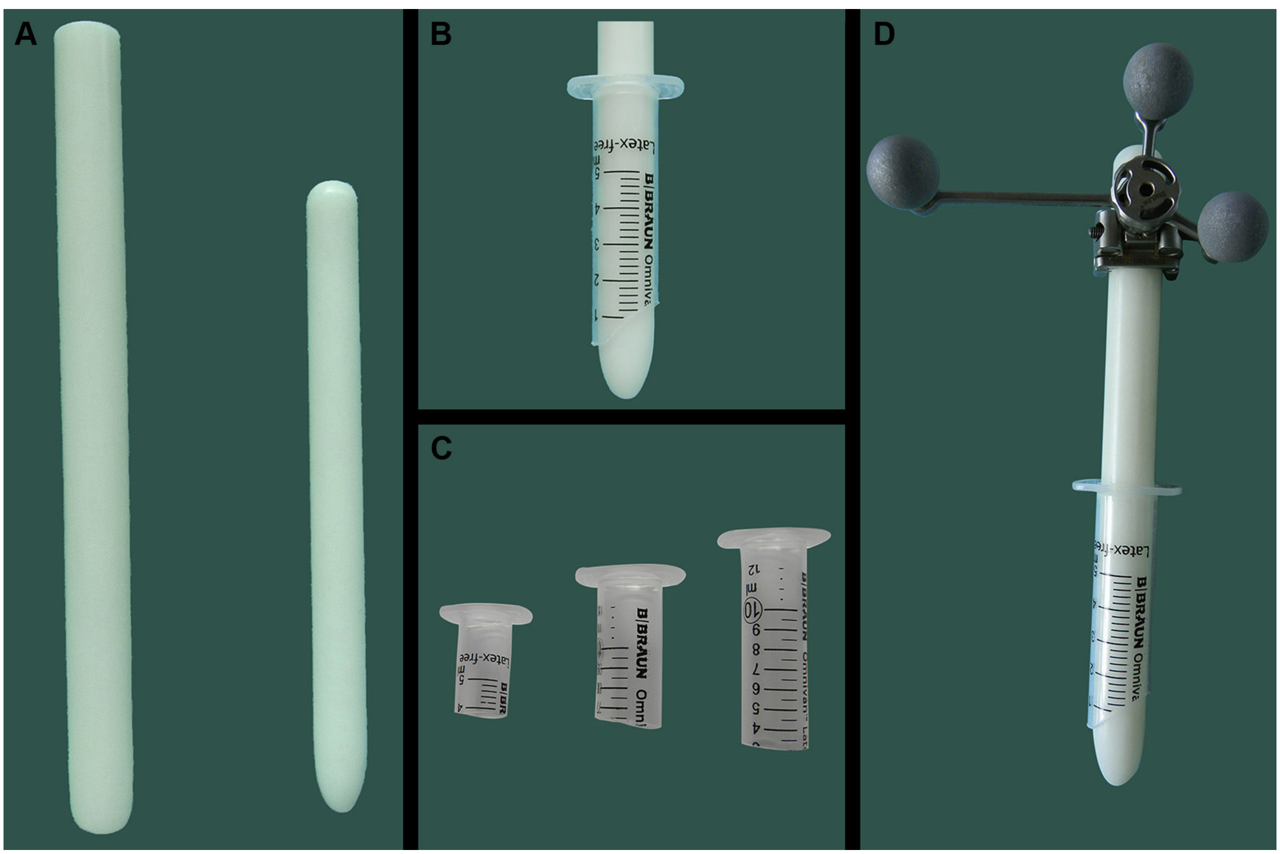

Figure 1. Basic design of the port. (**A**) Trocar designed from medical-grade plastic dilators, which will fit into syringes of various diameters. (**B**) Design of the port from 5-mL and 10-mL plastic syringes. (**C**) Syringe port with plastic trocar. (**D**) Use of neuronavigation adaptors with syringe ports for intraoperative navigation.