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Technical Note

Guiding Device for Subdurostomy Catheters in the Management of Chronic Subdural Hematoma: Moscote–Agrawal Subdurostomy Catheter Introducer

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Abstract

The drainage of chronic subdural hematoma is a very frequently performed neurosurgical procedure. The management often requires subdurostomy with catheter placement for hematoma drainage. Sometimes, the catheter misplacement can lead to complications that could be catastrophic. This technical note introduces the Moscote–Agrawal guiding device, a tool designed to enhance the accuracy and safety of catheter placement during subdurostomy. We hope that this concept can be adapted by neurosurgeons around the world to minimize procedural risks, improve outcomes, and ensure the safety of neurosurgical practices.

Keywords

- hematoma drainage
- Moscote–Agrawal guiding device
- chronic subdural hematoma
- neurosurgery
- neurotrauma

Introduction

Chronic subdural hematoma (CSDH) is a common neurosurgical condition, particularly in older adults, where an encapsulated collection of blood accumulates on the surface of the brain under the dura mater.[1] The hematoma's expansion is driven by a unique structure composed of an external and internal membrane.[2,3] The external membrane develops from meningeal irritation caused by hemorrhage, leading to neovascularization and the formation of fragile sinusoidal vessels, which allow plasma and red blood cells to pass into the subdural space. This process contributes to the progressive growth of the hematoma, often resulting in delayed clinical presentation. The primary treatment for CSDH is the evacuation of the hematoma, commonly through a subdurostomy. This procedure involves the placement of a catheter to drain the hematoma fluid, but the process can be challenging, with risks of catheter misplacement and iatrogenic damage to critical brain structures. This technical note introduces a guiding device designed to enhance the precision and safety of subdurostomy catheter placement in CSDH management.

Background

The pathophysiology of CSDH mainly includes the development of two membranes surrounding the hematoma, with the outer membrane being particularly problematic due to its fragility.[1] The neovascularization of the membrane creates sinusoids with thin, permeable walls that allow passage of blood and plasma into the hematoma cavity. This perpetuates hematoma growth, as described in Gardner's osmotic theory, which posits that the balance between plasma effusion and the reabsorptive capacity of

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the neomembrane promotes hematoma evolution. As the hematoma grows, especially in older patients with age-related brain atrophy, the expanded subdural space allows significant hematoma accumulation before intracranial hypertension occurs. Subdurostomy remains a common and effective treatment for this condition, but its success depends on accurate placement of the drainage catheter. This technical note presents a guiding device designed to improve the accuracy of catheter placement, reducing procedural complications, and ensuring effective hematoma evacuation.

The Moscote–Agrawal Guiding Device: Device Description

The proposed guiding device is designed to assist neurosurgeons in the accurate placement of subdurostomy catheters (see ►**Figs. 1** and **2**). The device comprises a precision-guiding mechanism that fits into the existing subdurostomy catheter system. We considered some characteristics for the proposed device:

- *Accurate catheter positioning:* The use of the guiding device ensures precise positioning of the catheter within the hematoma cavity, reducing the risk of damaging surrounding brain structures.
- *Stability control:* This device stabilizes the catheter during insertion, minimizing the risk of misalignment or dislodgement during the procedure.
- *Adjustability:* The use of this device allows adjustable depth and angle settings, ensuring adaptability to different anatomical conditions and patient-specific needs.
- *Material composition:* We propose that the device be made from lightweight, biocompatible materials, ensuring the device is both durable and easy to sterilize, making it suitable for repeated use in clinical settings.

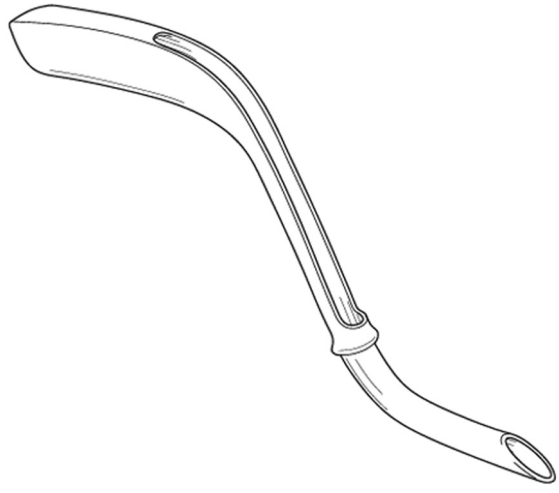

Fig. 1 Lateral view of the Moscote-Agrawal introducer, showcasing its ergonomic design and structural components optimized for safe and precise subdural access.

Surgical Technique

Briefly, the use of our guiding device follows standard subdurostomy procedures, with the addition of the device for catheter guidance.

Preparation: The patient is positioned, and a standard burr hole craniotomy is performed. The dura is opened to expose the subdural space.

Device setup: The guiding device is attached to the subdurostomy catheter, then it is adjusted to the patient's anatomy, ensuring the proper depth and angle for catheter insertion.

Insertion: The catheter is inserted into the hematoma cavity using the guiding device. This maintains the catheter's trajectory and ensures it remains in the optimal position for drainage.

Final placement: Once the catheter is correctly positioned, the device is removed, and the catheter is secured in place, followed by standard incision closure.

Discussion

A critical step in the management of CSDH is the placement of subdurostomy catheters. However, an inappropriate positioning can result in complications such as inadequate drainage, rebleeding, or injury to the brain parenchyma. The guiding device described in this technical note overcomes these challenges by providing enhanced precision during catheter placement, not only improving patient outcomes but also reducing learning curve for neurosurgeons, particularly those in training or those less experienced with subdurostomy procedures.[4–6]

Once catheter stabilizing and correct placement are achieved, the device minimizes the risk of iatrogenic injury and optimizes the drainage of the hematoma. Furthermore, the device's adjustable settings make it a versatile tool for use in a wide range of clinical scenarios.

Conclusion

The guiding device for subdurostomy catheters represents an important advance in CSDH management. Its ability to enhance the precision of catheter placement during subdurostomy procedures can lead to improved patient safety, better outcomes, and more consistent procedural success. As the device is not patented, it is freely available for adoption by neurosurgeons worldwide, with the potential to standardize and improve the efficacy of CSDH management. The proposed device offers an accessible, easy-to-use solution for the global neurosurgical community, and we encourage its integration into clinical practice to enhance the safety and precision of subdurostomy procedures.

Funding
None.

Conflict of Interest
None declared.

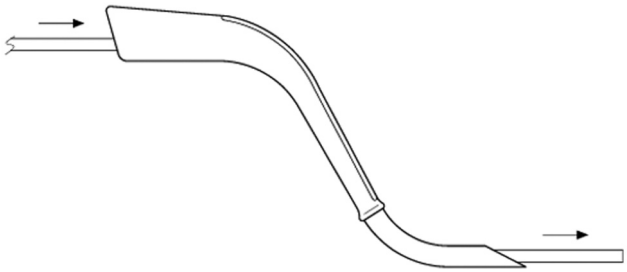

Fig. 2 Subdural catheter placement through the Moscote-Agrawal introducer, demonstrating the introducer's role in facilitating accurate insertion and stability during the procedure.

References

1 Alvis-Miranda HR, Alcalá-Cerra G, Rubiano AM, Moscote-Salazar LR. Chronic subdural hematoma: physiopathology and surgical management. Bol Asoc Med P R 2014;106(04):58–63

2 Alcalá-Cerra G, Young AM, Moscote-Salazar LR, Paternina-Caicedo A. Efficacy and safety of subdural drains after burr-hole evacuation of chronic subdural hematomas: systematic review and meta-analysis of randomized controlled trials. World Neurosurg 2014;82(06):1148–1157

3 Peng D, Zhu Y. External drains versus no drains after burr-hole evacuation for the treatment of chronic subdural haematoma in adults. Cochrane Database Syst Rev 2016; 2016(08):CD011402

4 Moscote-Salazar LR, Agrawal A. Letter: subdural pneumocephalus aspiration reduces recurrence of chronic subdural hematoma. Oper Neurosurg (Hagerstown) 2020;18(02):E62

5 Mishra R, Deora H, Florez-Perdomo WA, et al. Clinical and radiological characteristics for recurrence of chronic subdural hematoma: a systematic review and meta-analysis. Neurol Int 2022;14(03):683–695

6 Rodriguez B, Morgan I, Young T, et al. Surgical techniques for evacuation of chronic subdural hematoma: a mini-review. Front Neurol 2023;14:1086645

