Avoiding pullout complications in external ventricular drains: technical note

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This report describes a reliable and simple technique for securing external ventricular drains (EVDs) to the scalp and avoiding pullout complications. The operative technique consists of fixing the drain between 2 hydrocolloid dressings and securing it with staples. A 10-year retrospective analysis of EVD pullout complications was performed in a series of 435 consecutive patients who were treated at a single institution. The EVD pullout complication rate was 0.4%. No complications related to the fixation technique were found. The median operative time required to fix the drain was 60 seconds.

The technique presented here is a simple and reliable procedure to fix the EVD to the scalp, preventing pullout complications and thus reducing the morbidity of EVD reimplantation.

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Ventriculostomy, or external ventricular drainage, is among the most common procedures in neurosurgery practice. However, it is not exempt from complications.6,7 Since its first description, it has been improved with several technical advances and safer protocols.5,8 Additionally, complications from the procedure have been addressed in several papers, including reports on infection2,4 and misplacement3,9 as the most important.

Despite the better understanding we have about external ventricular drains (EVDs) and the technical advances, accidental pullouts have been poorly described as a complication. In our experience, this complication is not uncommon in busy neurosurgery units. Neither the morbidity nor the mortality specifically associated with a pullout complication has been addressed.

External ventricular drains are often implanted in pediatric or newborn patients in a complex environment. This implies several situations that could increase the pullout risk. Furthermore, there are several techniques for securing the EVD to the scalp, with a wide variability between hospitals and even between surgeons.10

We describe the procedure used in our pediatric unit to secure an EVD to the scalp; this is a simple and reliable technique that minimizes the pullout complication risk. We retrospectively describe the single-center experience in a large consecutive patient series.

Methods

All EVDs were placed bedside under sedation in the ICU or, more often, under general anesthesia in the operating room, depending on the patient’s clinical features. Freehand ventriculostomy was performed as traditionally described.3,9 In some cases ultrasound and navigation aids were used.

The first step, after the EVD was placed and tunneled, was to secure it with 2 staples at the point where it emerged from the scalp (Fig. 1). Precautions must be taken to avoid damaging the EVD catheter while it is being stapled. This is the most delicate step of the procedure. Then, a thick hydrocolloid dressing (Comfeel Plus, Coloplast [approximate cost €0.63]; Varihesive, ConvaTec Inc.; Hydrocoll, Hartmann; and Tegaderm, 3M, among others) was placed on the skin where the EVD was to be fixed. A lateral section in the colloid allows exit of the catheter. Size was variable and adapted individually; usually a 4 × 8–cm rectangular dressing was enough. The EVD was then placed above the dressing and it was covered by a second, similar piece of

ABBREVIATIONS EVD = external ventricular drain.


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hydrocolloid dressing. Finally, the dressing was secured with staples on both sides of the EVD catheter. In this way, the drain lies protected between the layers of hydrocolloid dressing.

This EVD placement technique has been the standard in the Pediatric Neurosurgery Unit in Hospitales Universitarios Virgen del Rocio (Seville, Spain) since 2002. A retrospective analysis of EVD pullout complications was performed in 489 consecutive EVDs, which had been placed in 435 pediatric patients between 2005 and 2015. The patients who needed EVD manipulation after primary placement were excluded because the integrity of the technique could not be assured. The main reasons for manipulation were obstruction and infection. An EVD pullout was defined as an accidental complete or incomplete explantation leading to EVD dysfunction.

Results

There were 2 EVD dislodgements in the entire series, accounting for a pullout complication rate of 0.4%. In the first case the EVD was intentionally pulled out by the patient, a 6-year-old boy with ventriculomegaly secondary to tuberculous meningitis. In the second case the pullout mechanism was unknown, but a Munchausen syndrome by proxy was suspected in a 4-year-old girl with cerebral palsy and complex hydrocephalus.

There were no cases of EVD lumen obstruction caused by the fixation material, including the staples and hydrocolloid dressing. This technique requires approximately 60 seconds, considerably less than the standard EVD technique.

Discussion

Despite the wide use of ventriculostomy or EVD placement as a common therapeutic procedure, dislodgement has not been traditionally addressed as an important complication. Nonetheless, it is a complication that should be prevented considering its potential association with morbidity and mortality, and as a hemorrhagic and infectious risk.

There is only one previous description of a technique to secure the drain to the scalp, which consisted of a box stitch around the exit site and a modified “Roman sandal” knot. Whitney and Selden recommend this technique based mainly on their own professional experience in 245 EVD placements. Furthermore, there is a great variability in the technique regularly used with regard to suture material, knot type, and length of the catheter from its exit point from the scalp and dressing.

The technique described here is reliable for securing an EVD and is associated with an extremely low risk of a pullout complication. Additionally, it does not significantly increase the cost and it is suitable for the pediatric population. Its simplicity allows a relatively short learning curve, as seen with first-year neurosurgery residents.

In our experience, this technique could prevent skin erosion and could lead to a decrease in the ventriculostomy obstruction risk. Additionally, the colloid can offer absorption of the fluids or pericatheter CSF effusions that can damage skin around the exit point of the tube and promote bacterial colonization. It can be used in cases with extensive traumatic scalp wounds and significant lost tissue because colloids are routinely used in these settings. The few disadvantages identified as the most important include the increase in the time needed for EVD explantation and the patient’s associated discomfort.

This technique would be especially indicated in pediatric patients, in whom the risk of a pullout complication may be higher, because it would assure the needed EVD fixation.

Conclusions

The technique used to secure an EVD to the scalp is of major relevance because it can prevent pullout complications. Here, a simple and reliable technique for securing the EVD to the scalp with a low pullout complication rate is presented. The main feature of this technique is that the drain lies protected by 2 layers of hydrocolloid dressing and is secured with staples.

References

1. Bauer DF, Razdan SN, Bartolucci AA, Markert JM: Meta-
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Disclosures
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Author Contributions
Conception and design: Márquez-Rivas. Acquisition of data: all authors. Analysis and interpretation of data: all authors. Drafting the article: Velásquez. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Márquez-Rivas. Statistical analysis: Velásquez, Cañizares-Méndez. Study supervision: Márquez-Rivas.

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