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Case Report

The "peel-away" technique for a ventriculoatrial shunt in a 6-month-old patient: A case report

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ABSTRACT

Background: A ventriculoatrial shunt (VAS) proves to be an excellent alternative in the treatment of hydrocephalus. Its usage is a viable option when ventriculoperitoneal shunt (VPS) is contraindicated in any age of patients.

Case Description: This report highlights a successful case involving a 6-month-old patient who underwent VAS catheter positioning. The child presented with hydrocephalus and biliary atresia, making him a candidate for a liver transplant. Notably, a VPS was considered a relative contraindication in this scenario.

Conclusion: The VAS emerges as a viable option for patients in whom a VPS might be contraindicated. This case demonstrates the successful application of a VAS in a pediatric patient.

Keywords: Hydrocephalus, Pediatrics, Peel-away, Ventricular shunt

INTRODUCTION

The ventriculoperitoneal shunt (VPS) is typically the primary choice for patients with hydrocephalus. In cases where this procedure is contraindicated, alternative shunts, such as the ventriculoatrial shunt (VAS), prove to be a valuable option.[3]

VAS becomes a compelling alternative when a VPS has either failed previously or is contraindicated due to abdominal pathology, such as an infectious process.[2,12] The technique for VASs was first described by Nulsen and Spitz[9] in 1951 and has since become one of the most widely utilized techniques in the pediatric population when peritoneal shunts are contraindicated. Conventionally, the placement of VAS involved an open neck dissection to access the internal jugular vein,[12] posing a considerable challenge for neurosurgeons, particularly in pediatric cases. In addition, the proper insertion of the atrial catheter presents a challenge due to the various venous anatomical variants that may lead to the misplacement of the distal catheter.[13]

In 1981, Ashker and Fox introduced a technique for the percutaneous insertion of the distal catheter into the right atrium in a VAS, known as the "peel-away" technique.[2,4] While this

less invasive procedure has been widely adopted in the adult population, there is a lack of documentation in the literature regarding its use in patients under one year of age. This case report highlights the application of the "peel-away" technique in a 6-month-old male patient with communicating hydrocephalus, demonstrating its efficacy as an alternative method in the presence of contraindications for a VPS.

CLINICAL PRESENTATION

A 6-month-old patient, born prematurely at 27 weeks, diagnosed with bile duct atresia and requiring a liver transplant, experienced intracerebral hemorrhage leading to altered cerebrospinal fluid dynamics and secondary hydrocephalus. The patient underwent multiple surgical procedures, including evacuation of intracerebral hematoma and drainage of intracranial hygromas.

During follow-up, progressive ventricular system dilation was observed, prompting the indication for a ventricular shunt to manage hydrocephalus [Figure 1]. Considering the risk of neurological repercussions and potential complications associated with VPS that could impact a future liver transplant that is a highly complicated surgery and difficult feasible in our healthcare system without knowing the possible date of liver transplant surgery, a multidisciplinary decision favored a VAS using the "peel-away" technique.

Surgical technique

Under general anesthesia, the patient was positioned supine with an interscapular roll. Subsequently, using ultrasound guidance, the internal jugular vein and the internal carotid artery on the right side were identified, and their diameters were measured [Figure 2]. This side was chosen due to the vessel's diameter and a shorter route to the right atrium, reducing the risk of misplacement and thrombosis.[3]

Following aseptic and antiseptic procedures, the internal jugular vein was punctured, and a 7 French "peel-away" catheter was inserted. The procedure was conducted with direct vision under ultrasound guidance, aided by transthoracic echography and electrocardiography wave monitoring. The distal catheter of the VAS was then advanced through the "peel-away" catheter to the right cavoatrial junction, with confirmation of the proper position achieved through intraoperative fluoroscopy [Figure 3].[2]

Finally, a right frontal ventricular access was established, connecting it to the distal system and ensuring proper fixation. Following the procedure, the patient demonstrated symptomatic improvement, and no instances of internal jugular vein thrombosis were documented where the distal catheter was lodged.

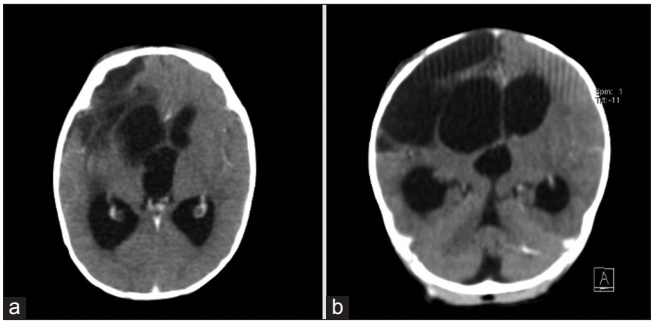

Figure 1: (a) Axial view and (b) Coronal view of a CT scan showing dilation of the ventricular system with signs of communicating hydrocephalus.

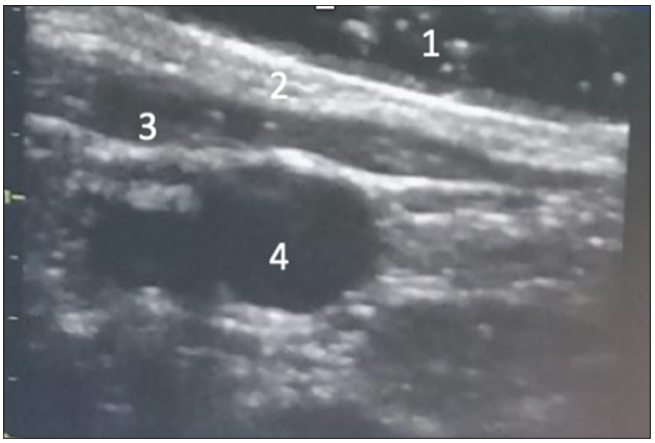

Figure 2: (1) Skin, (2) subcutaneous cellular tissue, (3) sternocleidomastoid muscle, (4) internal jugular vein.

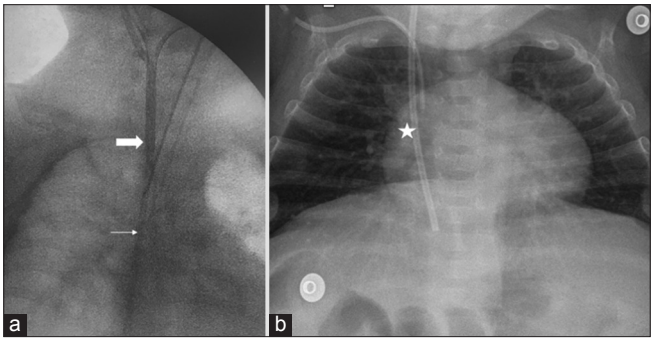

Figure 3: (a) Lateral thorax x ray view it can be observed thick arrow tip: peel away dilator, thin arrow: ventricular atrium. (b) AP x ray view that shows Star: shunt catheter in right atrium.

DISCUSSION

The VPS presents similar complications to the VAS, such as infection and malfunction, with comparable rates.[6,8] However, it introduces unique, unusual complications such as air embolism, pneumothorax, and tracheal injury.[8]

Complications, such as changes in length, have been reported in VASs in pediatric patients, ranging from 43% to 63%.[6] The alteration in length is primarily attributed to growth and can

result in retrograde migration of the distal catheter, potentially leading to thrombosis complications.[3,10] Nevertheless, elective revision of the distal catheter length can be achieved through a complete system change or extension of the distal catheter, with a recommendation for endovascular management on a migrated catheter to avoid open surgery.[1] Therefore, VPS remains a more prevalent and indicated procedure in this specific population.

In our presented case, the risk of infection and contamination of the peritoneal catheter was associated with the need for the patient to undergo surgical intervention in the abdominal cavity for a liver transplant due to bile duct atresia. While a VPS is not an absolute contraindication in liver transplant patients, it is preferable to opt for other types of shunts to mitigate potential complications[5,11] that could impact the liver transplant.

Performing the VAS procedure percutaneously, as done in our case, offers several advantages over open cervical dissection, including reduced surgical time, a smaller incision, and a lower probability of vascular lesions during surgery.[7]

The insertion of the catheter using the "peel-away" technique is more commonly performed in the adult population. However, its utilization is infrequent in the pediatric population, and to our knowledge, our case represents the youngest patient recorded in the literature.

CONCLUSION

Hydrocephalus remains one of the most prevalent challenges faced by neurosurgeons in their daily practice within the pediatric population. While VPS continues to be the preferred surgical intervention, VAS emerges as a valuable alternative for patients in whom the former is contraindicated. The utilization of minimally invasive techniques, such as distal catheter insertion through a peel-away catheter guided by ultrasonography, proves to be a swift, effective, and minimally invasive method.

In this case, we present the application of this technique in a patient under six months of age, yielding optimal short-term results. It is crucial to recognize that this type of procedure should be undertaken selectively, emphasizing the importance of thoroughly evaluating the pros and cons, especially in challenging cases like the one discussed here.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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