Journal of Surgical Techniques and Procedures

Case Report
Published: 24 Mar, 2022

Balloon-Assisted Gluing of Ultra High-Flow Vein of Galen Aneurysmal Malformation

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Abstract

The treatment of choice of Vein of Galen Aneurysmal Malformation (VGAM) involves endovascular procedures that can be technically challenging to perform in ultra high-flow fistulas. We describe the use of a balloon-assisted technique to safely treat an ultra high-flow fistula in an infant with VGAM.

Keywords: Galen aneurysmal malformation; Vein; Congestive heart failure; Balloon inflation

Introduction

Vein of Galen Aneurysmal Malformations (VGAMs) are rare congenital diseases of cerebral vasculature, characterized by abnormal arterio-venous connections within the wall of the Median Prosencephalic Vein (MProsV) [1].

Two main types of angioarchitecture are recognized [2]. The mural type with one or more direct arteriovenous shunts; the choroidal type with multiple arterial feeders creating a nidus-like structure that drains into the dilated venous pouch [3].

Congestive Heart Failure (CHF), hydrocephalus, seizures and mental retardation can occur in the neonatal period and during infancy depending on the velocity of the vascular malformation [1]. Clinical symptoms are determinant for the treatment timing [2].

Endovascular treatment is the first-line treatment and it is possible *via* transarterial or transvenous route [1]. Numerous endovascular techniques exist, each one with their particularities. Flow control is the key issue during treatment of VGAM to avoid venous thrombosis.

The aim of this case-report is to show the possibility of a transarterial balloon-assisted glue injection technique for the treatment of an ultra-high-flow VGAM.

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Received Date: *09 Feb 2022*
Accepted Date: *11 Mar 2022*
Published Date: *24 Mar 2022*

Citation:
Elens S, Bonnet T, Mine B, Guenego A, Lubicz B. Balloon-Assisted Gluing of Ultra High-Flow Vein of Galen Aneurysmal Malformation. J Surg Tech Proced. 2022; 6(1): 1051.

Case Presentation

The patient is a 4.5 year-old boy from Algeria, send to our hospital for hydrocephalus and a possible diagnosis of VGAM.

The diagnostic cerebral angiography shows a direct ultra-high-flow shunt between the right Posterior Cerebral Artery (PCA) and an aneurysmal dilatation of the Ampulla of Galen measured at 92 mm (Figure 1).

First procedure

Under general anesthesia and a bolus of intravenous heparin (20 IU/kg to 30 IU/kg), a bilateral femoral artery puncture was performed with placement of two 5-French (F) sheaths. Two 5-F Envoy catheters (Codmann, United Kingdom) were placed in the vertebral arteries. In coaxial, a single-lumen balloon (Hyperglyde balloon, EV3, USA) was placed at the origin of the right PCA; then, a Prowler Select Plus microcatheter (Codmann, United Kingdom) was placed in the PCA, just ahead of the balloon (Figure 2).

After balloon inflation, the controlled injection of 3 ml of pure 100% glue (Histoacryl opacified with tantalum powder) was facilitated by the flow reduction within the arteriovenous shunt.

On successive controls, the glue cast was located at the shunt-zone with very slight distal migration into the aneurysmal dilatation.

The venous drainage wasn't significantly reduced on controls and the patient was kept sedated during 24 h. The child woke up with a normal examination. Three days later, a CT-scan was performed

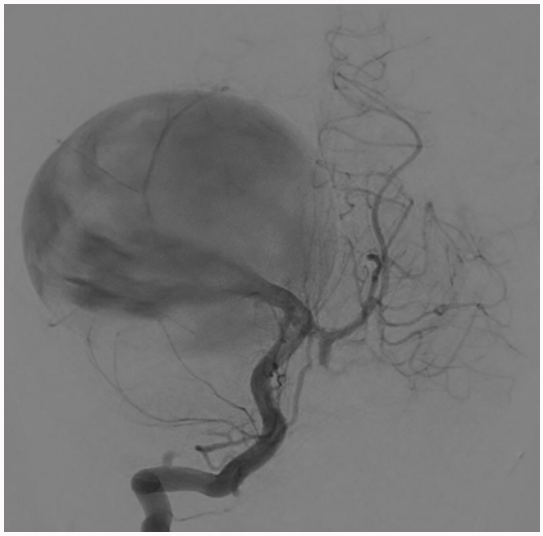

Figure 1: The diagnostic angiography of the right vertebral artery shows the ultra high-flow fistula between the segment P1 of the posterior cerebral artery and the aneurysmal dilatation of the ampulla of Galen in a vein of Galen malformation.

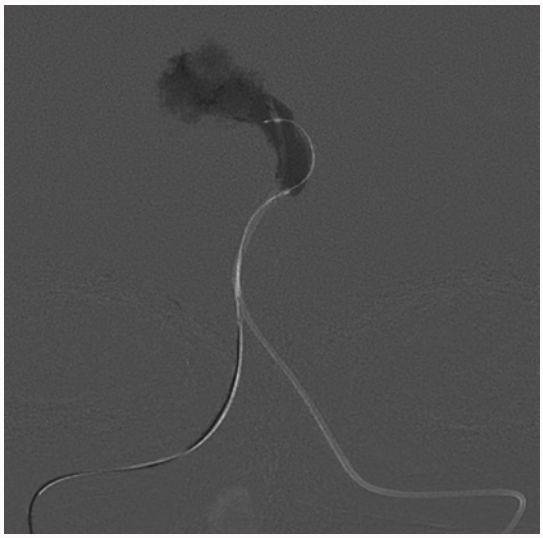

Figure 2: Through the right vertebral artery, the balloon-catheter is placed just proximally from the fistula at the junction of the posterior cerebral artery and the basilar artery. Through the left vertebral artery, the Prowler Select plus catheter is placed just distally from the balloon-catheter for injection of the contrast agent and the glue. On this figure the glue-cast is well located at the origin of the venous component of the arteriovenous fistula without distal migration and the inflated balloon prevent reflux of glue in the basilar artery.

because of worsening of headaches and vomiting. It showed a partial migration of the glue cast and a partial thrombosis of the aneurysmal dilatation. It was decided to perform a second embolization.

Second procedure

The same technique was used and 10 ml of pure 100% glue was injected through the microcatheter that formed a very stable cast within the PCA. The balloon was left inflated for a few seconds to allow adequate glue polymerization and to prevent distal embolization. By doing so, the balloon-microcatheter was intentionally left in place with the balloon deflated and the microcatheter cut at the groin. Angiographic controls showed a complete occlusion of the malformation (Figure 3).

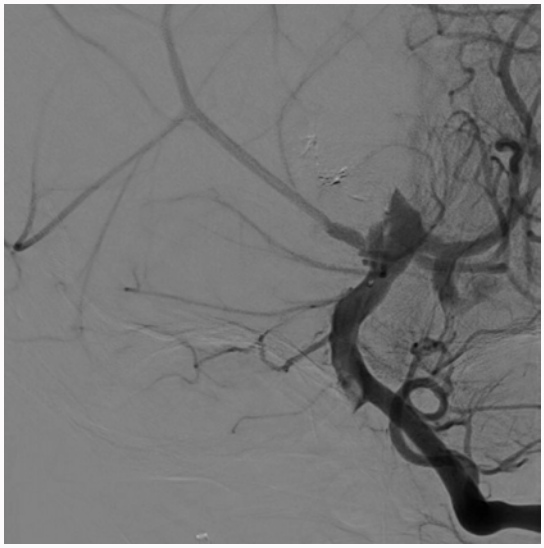

Figure 3: The control arteriography of the right vertebral artery post-embolization shows a total occlusion of the ultra high flow fistula.

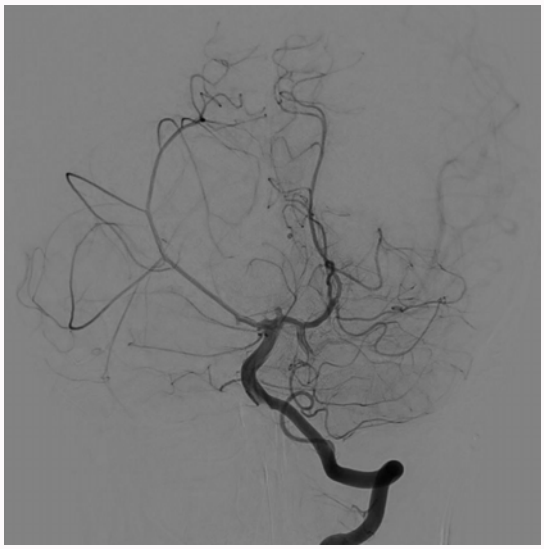

Figure 4: Shows a persistent occlusion of the ultra high-flow fistula of the VGAM without permeability of the aneurysmal dilatation of the ampulla of Galen on the control arteriography 9 months after the embolization.

After the procedure, IV heparin was maintained for 12 h and clopidogrel was started to prevent thromboembolic complication from the trapped microcatheter. The patient was kept sedated during 24 h; he woke up with a normal examination.

Follow-up

Nine-month post-procedure DSA showed complete occlusion of the VAGM (Figure 4). On MRI, the aneurysmal dilatation was completely thrombosed.

Discussion

This case illustrates how glue can be safely injected in an ultra high-flow fistula by using a single balloon-assisted endovascular technique.

In the following discussion, coiling of the arterial feeder before injections of embolic agent is not taken into account because of very high risk of distal embolization in ultra-high flow fistulas.

Different techniques of managing high-flow fistulas in VGAM have been described before; hereby we compare 2 of them with our technique.

Andreou et al. [4] described an embolization technique for high-flow Arteriovenous Fistula (AVF) with a transarterial balloon-assisted glue injection. One of the 5 patients had a VGAM in which 2 balloons were inflated, one into the internal carotid artery and one into the posterior cerebral artery. Like our technique, the disadvantages of the described technique is the double arterial access, the risk of vessel rupture when inflating the balloon and/or insufficient flow arrest due to inability of correct balloon-inflation. However, our technique shows that flow control can be achieved by using only one well-placed balloon more distally. By doing so, the flow is controlled at the origin of the arteriovenous shunt and it allows the glue to form a cast at the desired location and prevents distal migration into the vein.

One case of single balloon-assisted embolization of mural-type VGAM has been published before, although in that case, Onyx™ was used. The use of Onyx is limited due to his tendency of distal diffusion into the venous system and the prolonged procedure time. The main advantage of glue, compared to Onyx, is the good penetration and the immediate thrombosis with permanent occlusion of the fistula [4]. However, the properties of the biological glue make the risk of catheter gluing higher than Onyx. The delivery-technique of the glue is highly practitioner-dependent and demands practice as adaptive skills but once acquired, injection of glue is faster and more controlled than other embolic adhesive materials.

Conclusion

In conclusion, this case illustrates the possibility of curing ultra high-flow VGAM with a single balloon-assisted endovascular technique.

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