Outcome of Carotid-Cavernous Fistula Embolization with Onyx Via Transvenous, Transarterial & Direct Approaches

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Introduction

Carotid-Cavernous Fistula (CCF) is an abnormal communication between the internal (ICA) or external carotid artery (ECA) and the cavernous sinus (CS). Even though spontaneous regression of CCFs has been documented and expectant management has been described, more symptomatic and urgent fistulas prompt interventional approach. Endovascular therapy is currently considered the safest and most effective management. Recently Onyx, a non-adhesive liquid embolic copolymer dissolved in dimethyl-sulfoxide, has been used to treat CCF. Although most of the CCF can be treated transvenously via the inferior petrosal sinus (IPS), patients’ condition or anatomy may require alternative approaches.

Objectives

We aim to evaluate the outcome of using Onyx to treat CCF via 3 different approaches: transvenous (TV), transarterial (TA) and direct transorbital puncture. Illustrative cases are shown.

Methods

• 13 cases (5 men, 8 women, age 24-88 yrs, mean, 55 yrs.) with diagnosis of CCF were examined and followed prospectively. Preembolization angiograms were performed in all patients and pertinent data was collected, including the type of fistula and intervention. Additional use of coils at the superior ophthalmic vein (SOV) or CS was implemented in high-flow fistulas to avoid migration of embolic material. Patients were followed to determine surgical outcome and complications.

• 8 cases were performed via TV embolization (Case #1):
  - Femoral vein and contralateral femoral artery were accessed. Preembolization angiogram was acquired (Figure 1).
  - A 4 Fr catheter was maneuvered to the IPS or facial vein. A microcatheter was advanced into the CS under road map guidance.
  - A coil was deployed at the SOV (Figure 2).
  - Onyx was slowly injected into the CS. Post embolization angiogram was done to confirm occlusion of the fistula (Figure 3).

• 4 cases were performed via TA embolization (Case #2):
  - Femoral artery was accessed. A 6 Fr guide catheter was maneuvered to the CS with selective microcatheterization of the feeding vessels (Figure 5).
  - Onyx was slowly injected in the cavernous carotid using a subtracted roadmap (Figure 6 & 7) while simultaneously infating a balloon to avoid reflux of Onyx.

• One case was performed via Direct Transorbital approach (Case #3):
  - Patient with 5 month history of ocular chemosis and periorbital swelling. Preembolization angiogram is shown (Figure 8). Despite multiple attempts, the IPS was not accessed, and the contralateral IPS, ipsilateral facial vein and superior petrosal sinuses were not visualized. Her superior ophthalmic vein was small and deep, making cut-down unsuitable. Given the limited access, a direct transorbital approach was attempted.
  - The femoral artery was accessed and a catheter was maneuvered to the ICA.
  - A 3-D CT reconstruction of the skull was obtained for better localization (Figure 9).
  - A spinal needle was inserted percutaneously at the inferior orbital rim and advanced towards the superior orbital fissure under fluoroscopic guidance with overlay of the CT. The needle was advanced until arterial blood was obtained.
  - Onyx was injected in the CS once adequate positioning was confirmed (Figure 10).

Results

• Immediate complete fistula obliteration was achieved in all patients confirmed by angiogram (Figures 3, 6 and 10).
• There was 100% resolution of presenting symptoms within 2 months.

Complications:
- 3 patients had complications:
  1. permanent complete facial nerve palsy via TA approach
  2. transient complete CN III palsy and CN V numbness via TA approach
  3. transient Horner syndrome with partial CN VI palsy via TV embolization.

Conclusions

Non-surgical radiologic approaches to treat CCF using Onyx via transvenous, transarterial and percutaneous embolization are effective methods but complications may occur.

Illustrative Cases

Case 1 – TV Embolization

Illustrative Cases

Case 2 – TA embolization

Illustrative Cases

Case 3 – Direct Transorbital Embolization

References


*Cases were previously published and are shown with permission of participating authors.