Case of the Month

Title: Microsurgical Clipping of a Ruptured Supraclinoid Communicating segment Internal Carotid Artery Aneurysm with Anterior Clinoidectomy and Decompressive Craniectomy in the Setting of Diffuse Cerebral Vasospasm: An Operative Case Study

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Clinical Presentation

Q– A 38-year-old woman presented with recurrent sudden, severe headaches followed by loss of consciousness and abnormal tonic posturing. Imaging showed thick right sylvian and basal cisternal subarachnoid hemorrhage with intraventricular extension. DSA revealed a small, wide-necked, ruptured right supraclinoid ICA aneurysm with moderate-to-severe diffuse vasospasm of the bilateral ACA, MCA, PCA and basilar artery territories.

Given the ruptured aneurysm, heavy clot burden, diffuse vasospasm and intraoperative brain bulge, what is the most appropriate surgical strategy?

- Endovascular coiling
- Stent-assisted coiling
- Microsurgical clipping through a standard pterional approach
- **Microsurgical clipping with anterior clinoidectomy, proximal cervical ICA control and decompressive craniectomy**

Abstract

Background

Ruptured supraclinoid internal carotid artery (ICA) aneurysms are especially challenging in the presence of thick subarachnoid hemorrhage, vasospasm, raised intracranial pressure and a tense brain. Secure proximal and distal control is critical for safe clipping. Anterior clinoidectomy improves exposure of the supraclinoid ICA and aneurysm neck, while decompressive craniectomy may be needed when brain bulge limits safe exposure.

Observations

A 38-year-old woman presented with recurrent severe headache, loss of consciousness and tonic posturing. Imaging showed thick right sylvian and basal cisternal SAH with thin intraventricular hemorrhage. DSA revealed a wide-necked, ruptured right supraclinoid ICA aneurysm (4.23 × 3.57 × 2.47 mm; neck 3.26 mm) with moderate diffuse vasospasm of the bilateral ACA, MCA, PCA and basilar artery.

Through a right frontotemporal craniotomy with extradural anterior clinoidectomy and cervical ICA exposure, the aneurysm was clipped under temporary occlusion of the supraclinoid ICA and the A1 and M1

segments. Significant brain bulge necessitated a right frontotemporoparietal decompressive craniectomy with lax duraplasty. ICG angiography confirmed complete exclusion with patent parent and branch vessels. Monitored in the ICU with serial neurological examinations and transcranial Doppler (TCD) studies, she remained stable, was extubated, and was discharged with GCS E4V5M6 and no significant neurological deficit.

Lessons

These aneurysms demand meticulous planning of proximal and distal control. Anterior clinoidectomy improves visualization and mobilization of the supraclinoid ICA and aneurysm neck, and decompressive craniectomy relieves brain bulge that compromises safe access. Tailoring these techniques permits safe exclusion while minimizing ischemic and retraction-related complications.

Introduction

Ruptured communicating-segment ICA aneurysms are challenging because of their close relationship with the optic apparatus, posterior communicating artery (PCOM), anterior choroidal artery, anterior cerebral artery (ACA), middle cerebral artery (MCA) and perforators. Thick cisternal clot, vasospasm, edema and raised intracranial pressure after aneurysmal SAH add further complexity: a tense brain narrows the operative corridor, raises the risk of vascular injury and hampers proximal control.

In such cases, **adequate proximal control is a fundamental prerequisite for safe aneurysm dissection**. Cervical carotid exposure provides an alternative when intracranial temporary clipping is difficult or hazardous, and extradural anterior clinoidectomy widens the working space around the aneurysm neck. Decompressive craniectomy may be added when swelling persists despite CSF drainage and skull-base relaxation techniques.

We present a ruptured right supraclinoid ICA aneurysm with thick SAH and diffuse vasospasm, managed with all three adjuncts.

Case Presentation

A 38-year-old woman had a two-week history of intermittent headaches, followed by an acute severe headache with loss of consciousness and tonic posturing suggestive of a seizure. She was intubated at an outside hospital for gasping respiration and airway protection. Non-contrast CT (NCCT) (Fig 1a) showed thick SAH in the right sylvian fissure and basal cisterns with thin intraventricular extension (modified Fisher grade 3), and she was referred to our institution.

On admission, she was intubated with a GCS of E4VTM6, normal reactive pupils, power of at least 4+/5 in all limbs and no gross cranial nerve deficit (Hunt and Hess grade III). DSA (Fig 1b) showed a wide-necked right supraclinoid ICA aneurysm (approximately 4.23 × 3.57 × 2.47 mm; neck 3.26 mm) with a medially directed dome, and moderate diffuse vasospasm of the bilateral ACA, MCA, posterior cerebral arteries (PCA) and basilar artery. Given these findings and the need for secure proximal and distal control, urgent microsurgical clipping was planned.

Surgical Technique

Under general anaesthesia, the patient was positioned supine with the head elevated and rotated for a right pterional approach (Fig 1c).

1. Cervical ICA exposure for proximal control

Through a linear incision anterior to the right sternocleidomastoid (approximately C3–C6), the common carotid artery was isolated and slung for **proximal control of the ICA** if needed — a valuable safeguard given the aneurysm's location and the anticipated need for temporary occlusion.

2. Right frontotemporal craniotomy

A right frontotemporal craniotomy was performed, and the sphenoid ridge and temporal skull base were drilled to flatten the anterior and middle fossae and optimize the subfrontal and pretemporal corridors. An **extradural anterior clinoidectomy** then improved exposure and mobilization of the supraclinoid ICA. C-shaped dural opening revealed significant **brain bulge** (Fig 1d).

3. Cisternal and Sylvian dissection (Fig 1e, f)

Working through combined **subfrontal and pretemporal corridors**, thick suprasellar clot was evacuated to expose the right optic nerve and the communicating segment of the ICA. Circumferential distal dissection identified the **posterior communicating artery, anterior choroidal artery, A1, M1 and the aneurysm dome** (Fig 1g). The aneurysm pointed **anteromedially**, its neck densely adherent to the clot.

4. Proximal and distal vascular control (Fig 1h)

After the neck was freed from clot and adjacent structures, temporary clips were placed on the **supraclinoid ICA proximal to the aneurysm** and on the **A1 and M1 segments**, allowing controlled manipulation and minimizing the risk of uncontrolled rupture.

5. Permanent aneurysm clipping (Fig 1i)

A permanent clip was applied across the neck and the temporary clips removed. **Total temporary clipping time was approximately 7 minutes.** The ICA and its major branches were preserved.

6. Intraoperative ICG confirmation (Fig 1j)

Indocyanine green videoangiography confirmed satisfactory exclusion, showing:

- Patent ICA
- Patent A1 and M1 branches
- Preserved filling of the major ICA branches
- **No residual filling of the aneurysm**

7. Decompressive craniectomy

Because **brain bulge** persisted despite skull-base drilling and cisternal decompression, and postoperative swelling was anticipated with thick SAH and diffuse vasospasm, the bone flap was not replaced. The craniotomy was extended into a **right frontotemporoparietal decompressive craniectomy** with lax duraplasty to allow unrestricted brain expansion.

Postoperative Course

In the ICU, the patient was closely monitored for delayed cerebral ischemia and progression of vasospasm. Postoperative NCCT showed the **craniectomy defect with the aneurysm clip in situ** in the medial sylvian fissure (Fig 1k). Serial transcranial Doppler (TCD) studies tracked cerebral blood flow velocities. She

remained neurologically stable, was extubated, and was discharged with GCS E4V5M6 and no significant neurological deficit.

Discussion

Supraclinoid ICA aneurysms lie close to the optic nerve, PCOM, anterior choroidal artery and ICA bifurcation, and SAH and vasospasm can distort this anatomy. Here, the difficulty was compounded by **thick SAH, multi-territory vasospasm and significant brain bulge**.

Importance of proximal control

Reliable proximal control is a cornerstone of complex ICA aneurysm surgery. Cervical carotid exposure before intracranial dissection provided a safety net against intraoperative rupture or failed intracranial temporary control, and is especially useful when the skull base, aneurysm anatomy or brain swelling restricts proximal intracranial exposure.

Role of anterior clinoidectomy

Anterior clinoidectomy exposes the distal dural ring and supraclinoid ICA, widens the working corridor and aids proximal control and visualization of the neck. Here, it was performed extradurally and early to facilitate safe dissection.

Proximal and distal temporary clipping

Combined proximal ICA and distal A1/M1 temporary clipping allowed controlled handling of a ruptured aneurysm embedded in thick clot, where unprotected dissection may precipitate rupture. Occlusion lasted approximately **7 minutes**.

Vasospasm and cerebral perfusion

Vasospasm after aneurysmal SAH significantly increases the risk of delayed cerebral ischemia. With multi-territory vasospasm, preserving the parent and branch vessels was paramount; temporary occlusion was kept brief, and ICG confirmed adequate perfusion after clipping.

Role of decompressive craniectomy

Brain bulge persisted despite clot evacuation and extensive skull-base drilling. Replacing the bone flap could have raised intracranial pressure as edema and vasospasm evolved; **decompressive craniectomy with lax duraplasty** provided additional volume during the vulnerable postoperative period. Importantly, decompression was an adjunct for refractory swelling, not a substitute for adequate microsurgical exposure.

Conclusion

Ruptured supraclinoid ICA aneurysms with thick SAH, diffuse vasospasm and cerebral edema pose formidable challenges. A **tailored strategy combining cervical ICA exposure, extradural anterior clinoidectomy, meticulous proximal and distal control, definitive clipping and decompressive craniectomy** can achieve safe exclusion while preserving critical vessels, with ICG angiography confirming occlusion and perfusion in real time.

This case underscores the importance of **anticipating difficult proximal control, optimizing skull-base exposure, minimizing temporary occlusion time and addressing brain swelling early**. The favorable

outcome shows that an individualized approach can succeed without compromising cerebral perfusion, even with diffuse vasospasm and marked brain bulge.

References

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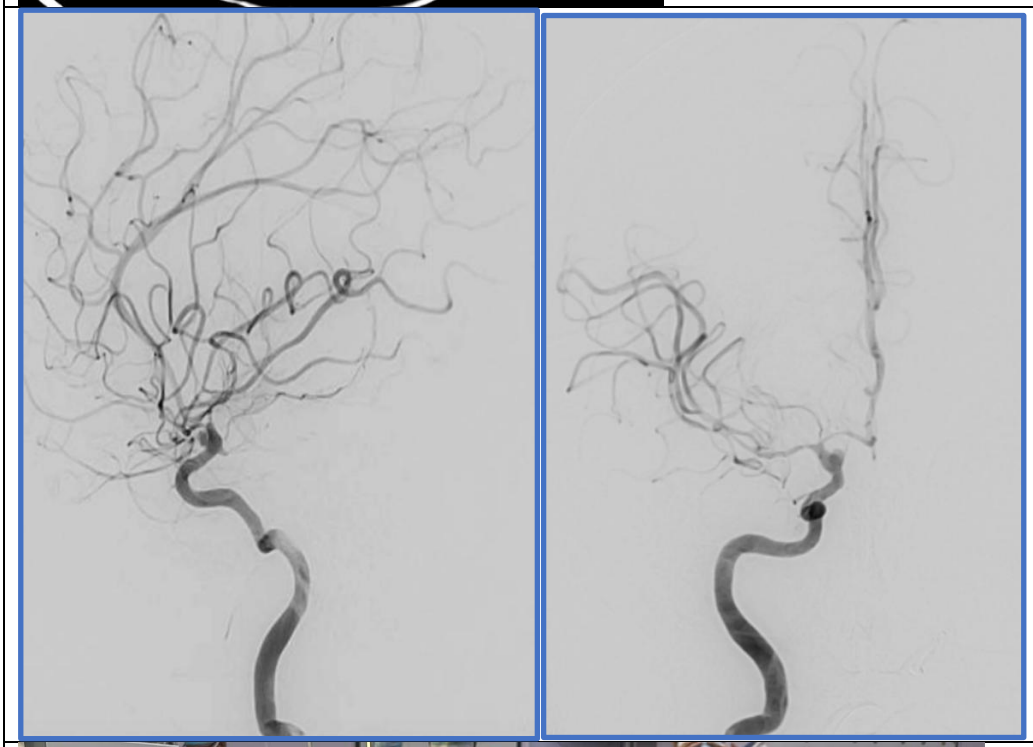
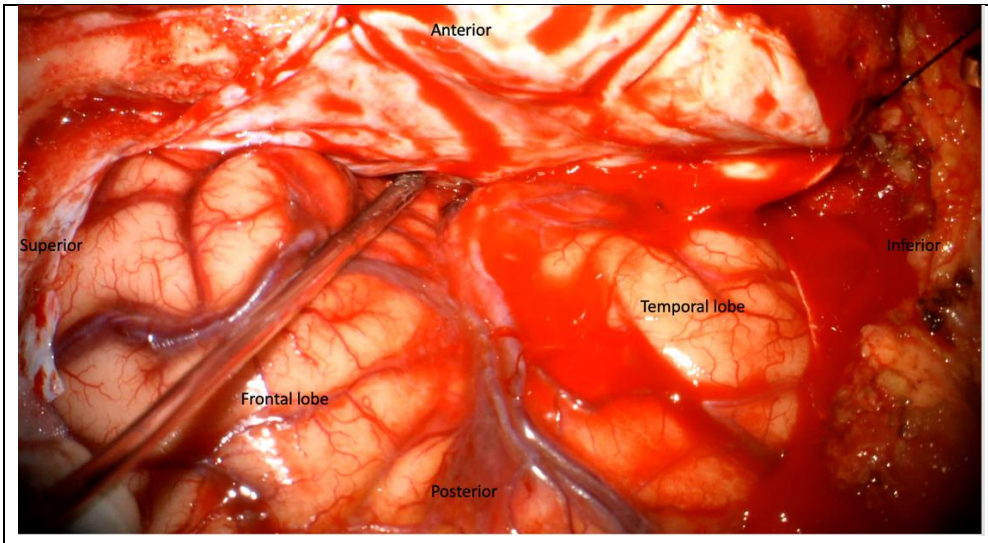
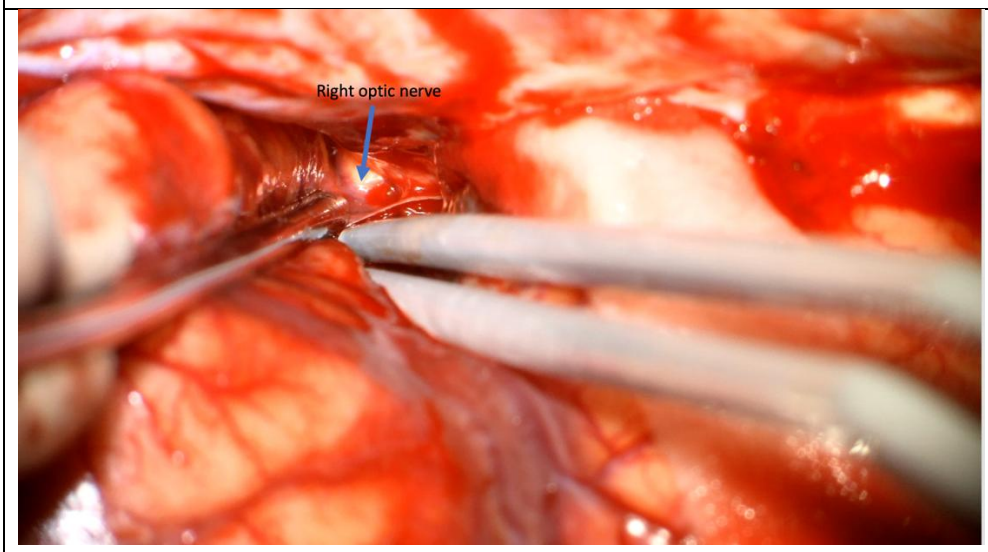
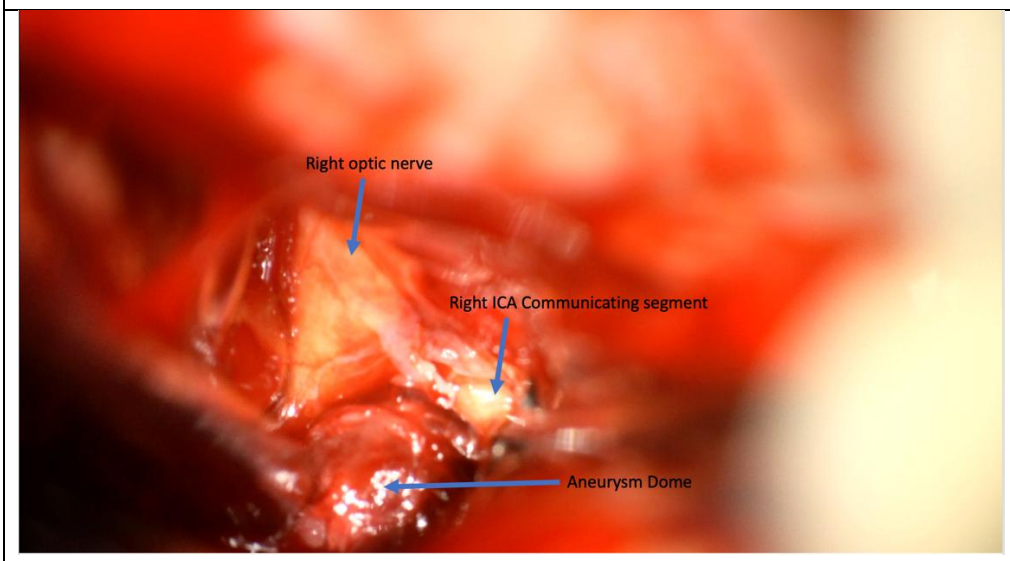
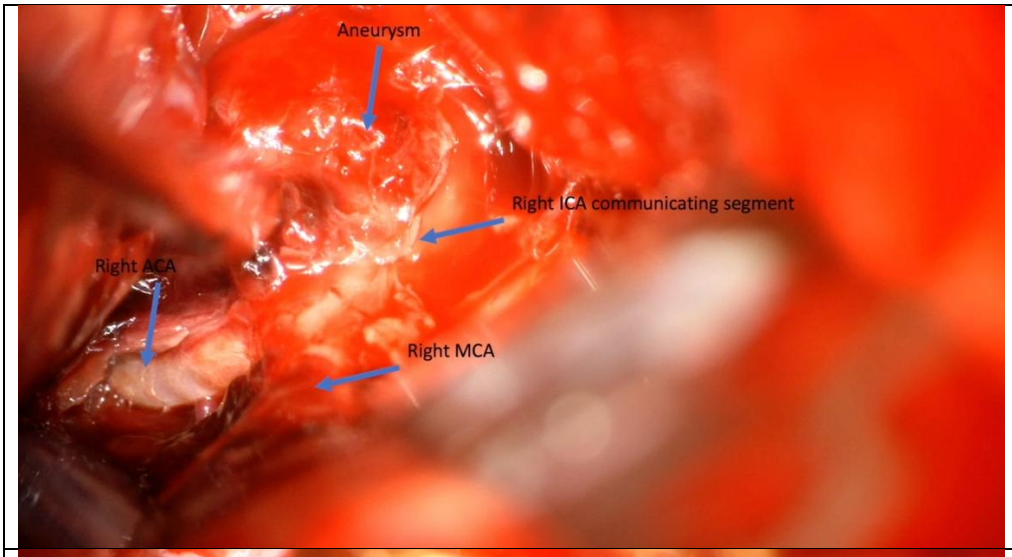
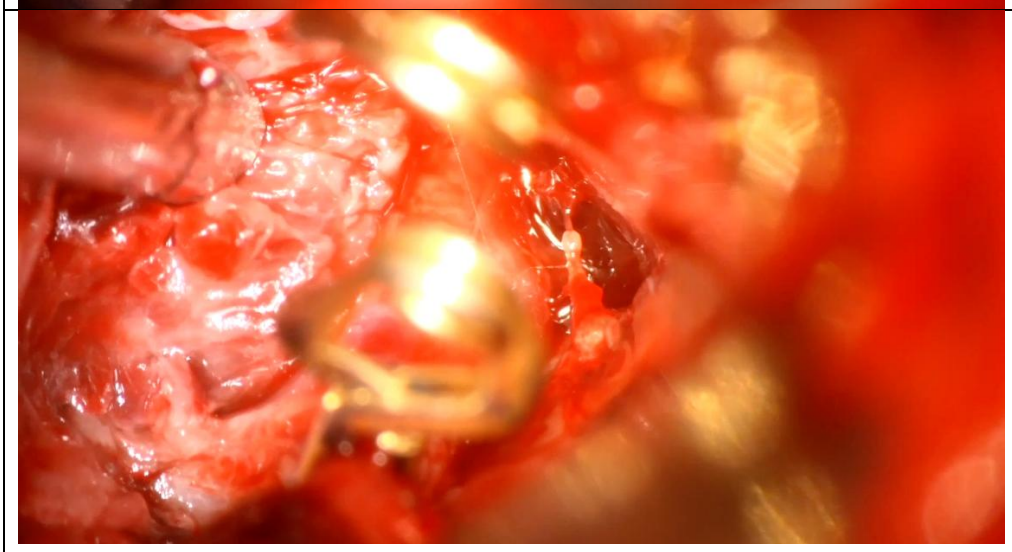
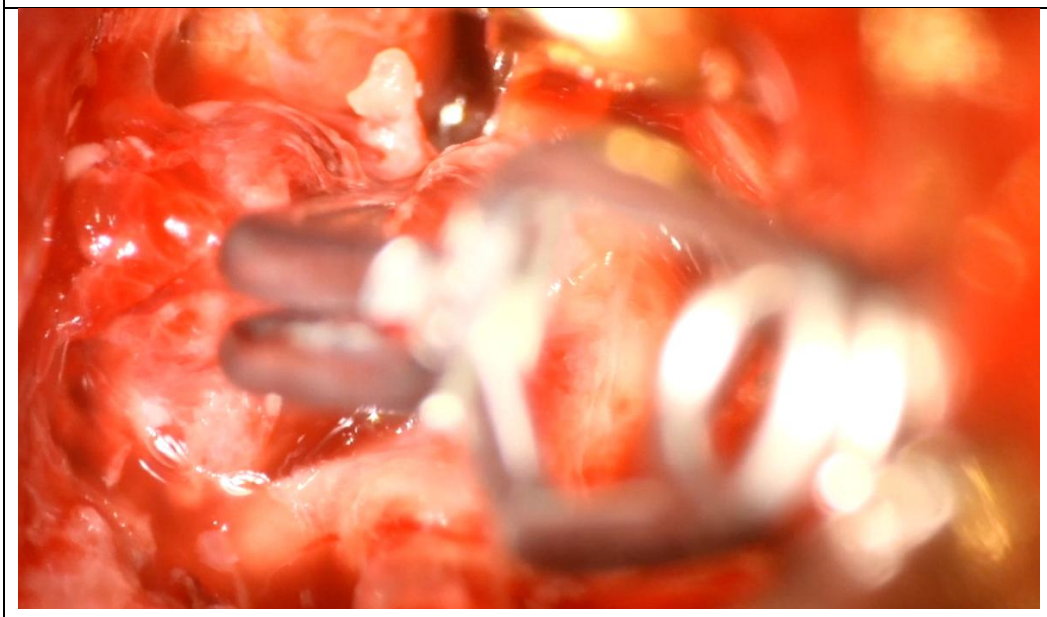
Figure 1. Preoperative Imaging and Intraoperative Surgical Steps

	**(A)** Preoperative NCCT showing thick SAH in the right sylvian fissure and basal cisterns with thin intraventricular hemorrhage (modified Fisher grade 3).
	**(B)** Preoperative DSA showing the right supraclinoid ICA aneurysm in **anteroposterior (AP) and lateral views**.
	**(C)** Patient positioning for the right frontotemporal surgical approach.

	**(D)** Significant **brain bulge** after dural opening.
	**(E)** Subfrontal exposure of the **right optic nerve**.
	**(F)** Exposure of the **right communicating segment of the ICA and the aneurysm**.

	**(G)** Further dissection exposing the **right ICA, A1 and M1 segments, and the aneurysm** and surrounding neurovascular structures.
	**(H)** Temporary clips on the **right ICA and M1 segment**.
	**(I)** Permanent clipping of the right ICA aneurysm after proximal and distal control.

	**(J)** ICG videoangiography showing **patent flow through the ICA and its branches with complete exclusion of the aneurysm**.
	**(K)** Postoperative CT showing the **right frontotemporoparietal decompressive craniectomy defect with the aneurysm clip in situ**.