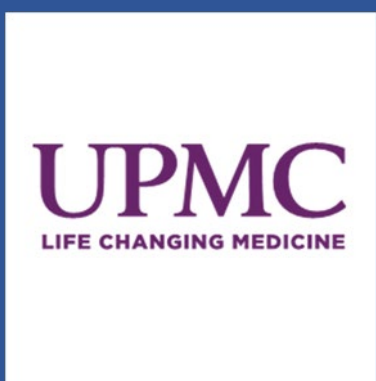




Robotic Exoscope Facilitates Improved Visualization and Ergonomics for Two-Surgeon Eyebrow Approaches to Orbital Lesions



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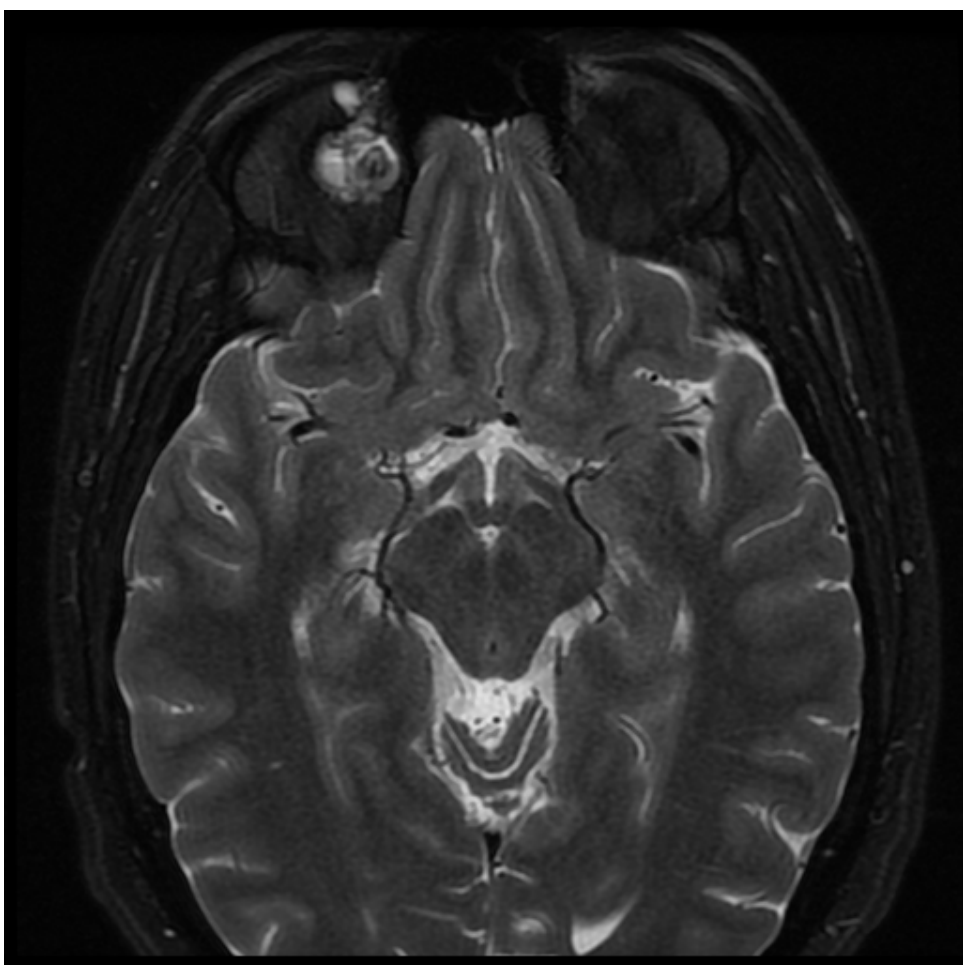
Introduction

- Minimally invasive orbital surgery requires excellent visualization due to deep, narrow surgical corridors and proximity to neurovascular and visual structures.
- Complex, deep, or dural-adjacent orbital tumors are best managed with a team approach involving ocular and neurosurgeons.
- The robotic exoscope has recently emerged as an exciting alternative to conventional operating microscopes. It provides high definition, three-dimensional imaging with a panoramic view of the surgical field on a large monitor.
- Early experience with brain and spine surgery has suggested that the exoscope may provide improved optics, ergonomics, and surgical workflows compared to the traditional operating microscope.
- Despite these advantages, there are very few reports on use of the exoscope for surgical approaches to the orbit.

Methods

- We retrospectively reviewed five patients who underwent eyebrow transorbital approaches to orbital lesions using the robotic exoscope.
- All cases were performed using a collaborative two-surgeon technique with neurosurgery and oculoplastics.
- Presenting symptoms, pathology, and clinical outcomes were recorded. Operative workflow and ergonomics were qualitatively assessed.

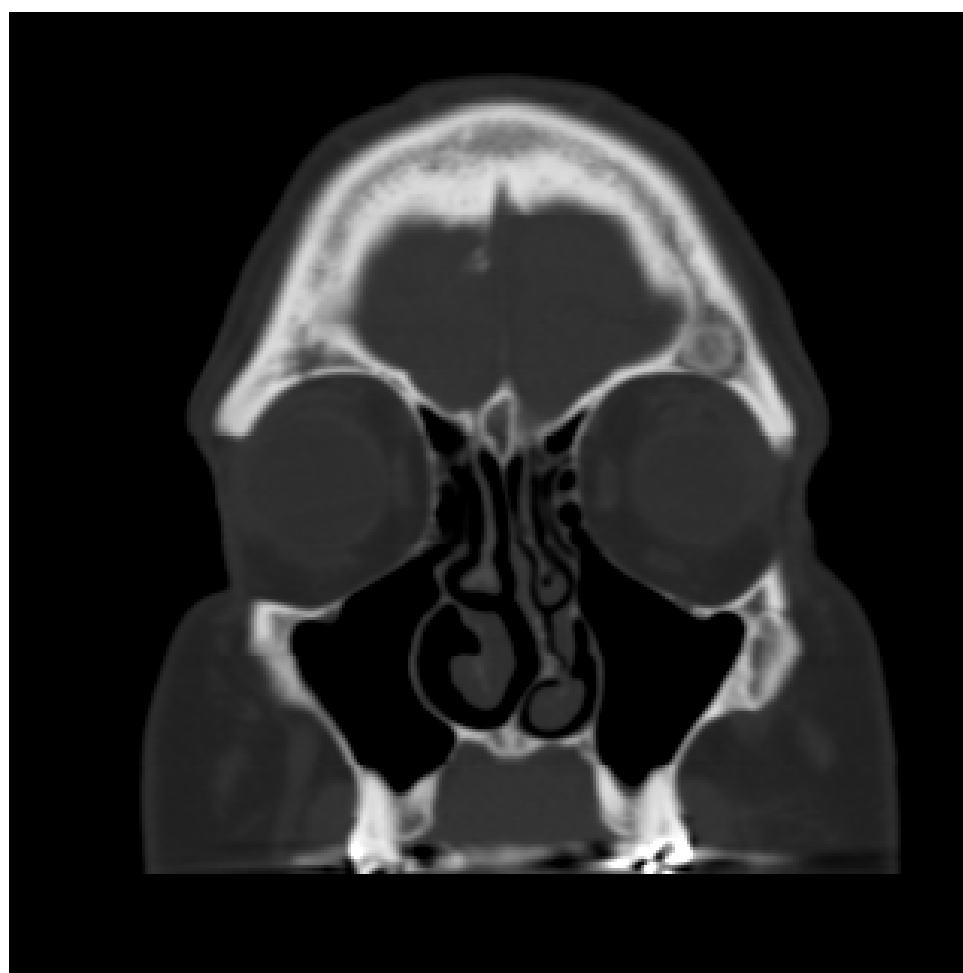
Orbital Pathologies Treated



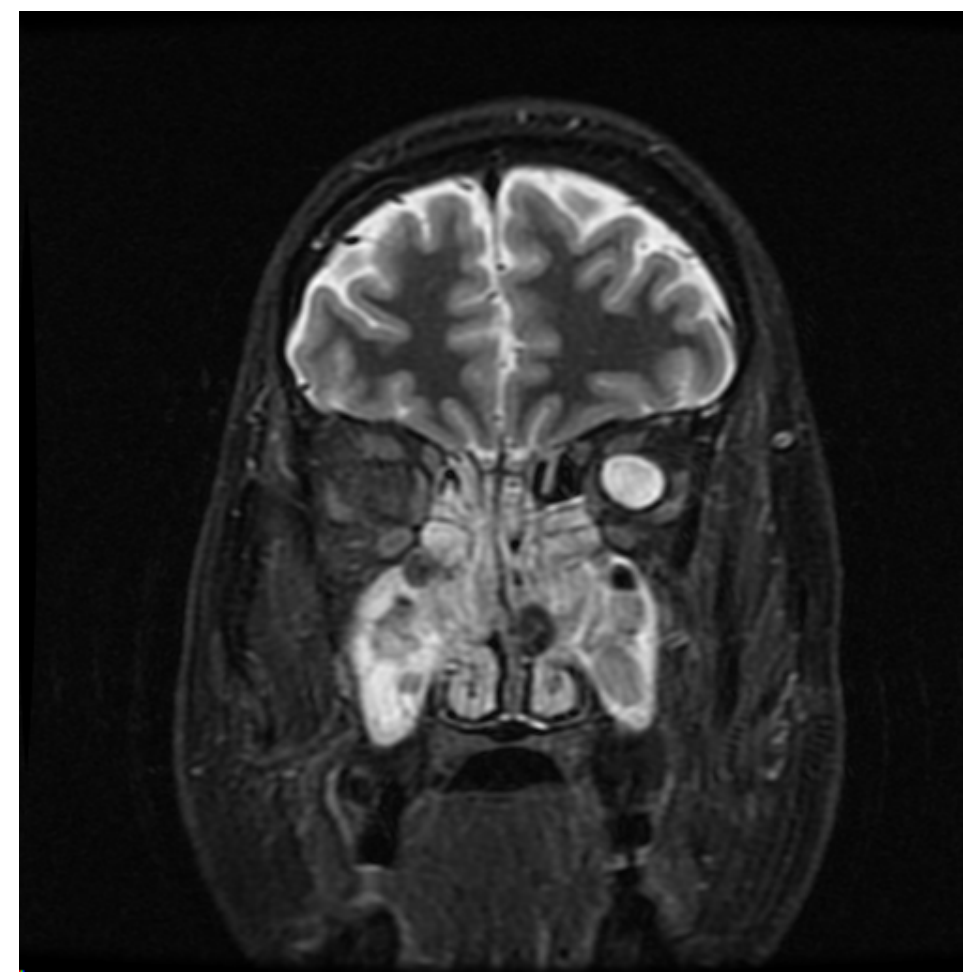
1. Cavernous lymphangioma



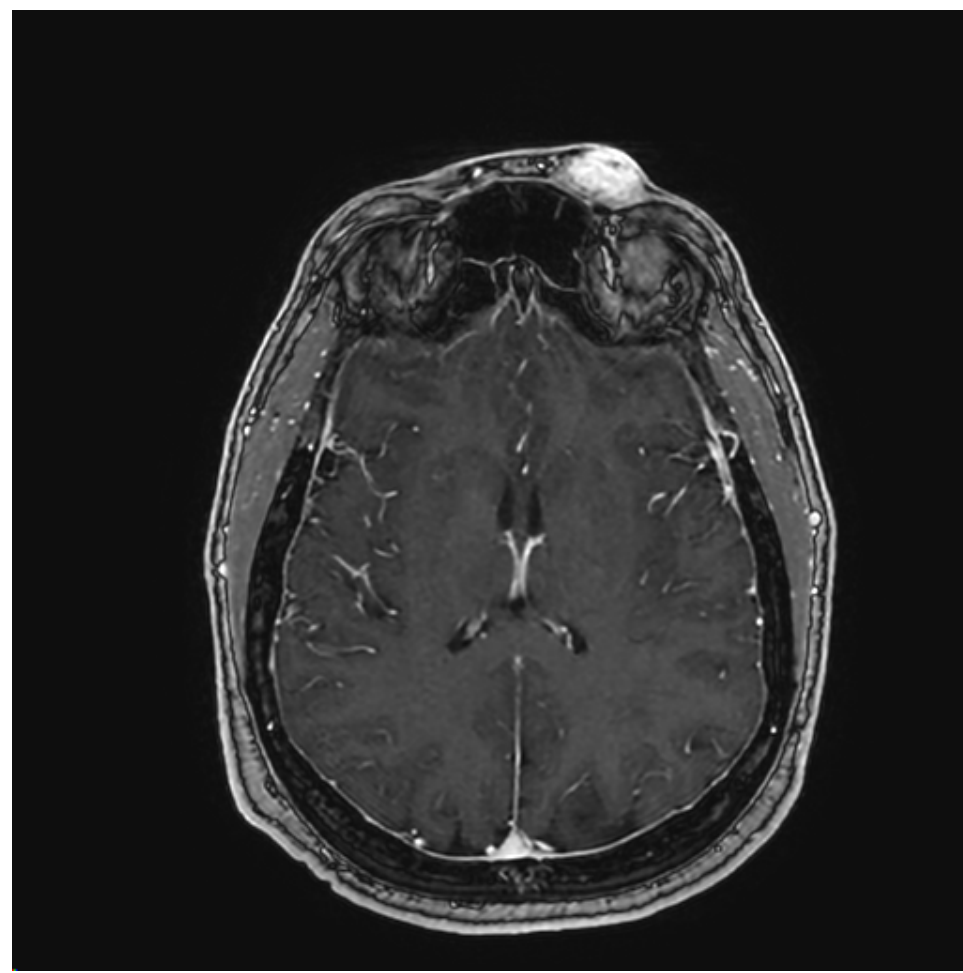
2. Orbital roof epidermoid cyst



3. Benign fibro-osseous lesion



4. Hybrid nerve sheath tumor



5. Arteriovenous malformation

Figure 1. Orbital lesions treated with exoscope-based, two-surgeon eyebrow approaches

Patient Presentations

Case	Age	Sex	Presenting symptoms	Pathology
1	21	M	Retroorbital pain, blurry vision, intermittent diplopia	Orbital cavernous lymphangioma
2	43	F	Diplopia, ptosis, blurry vision, headaches	Orbital roof epidermoid cyst
3	50	M	Retroorbital pain and swelling	Fibrous dysplasia
4	59	M	Retroorbital pain, intermittent diplopia, and blurry vision	Hybrid nerve sheath tumor
5	31	M	Growing pulsatile mass on brow and forehead	Orbital AVM

Table 1. Characteristics of patients who underwent eyebrow approaches to orbital lesions

Outcomes and Intraoperative Visualization

- Gross total resection was achieved in all cases with no complications.
- All patients had preserved visual acuity and function with excellent cosmetic outcomes.

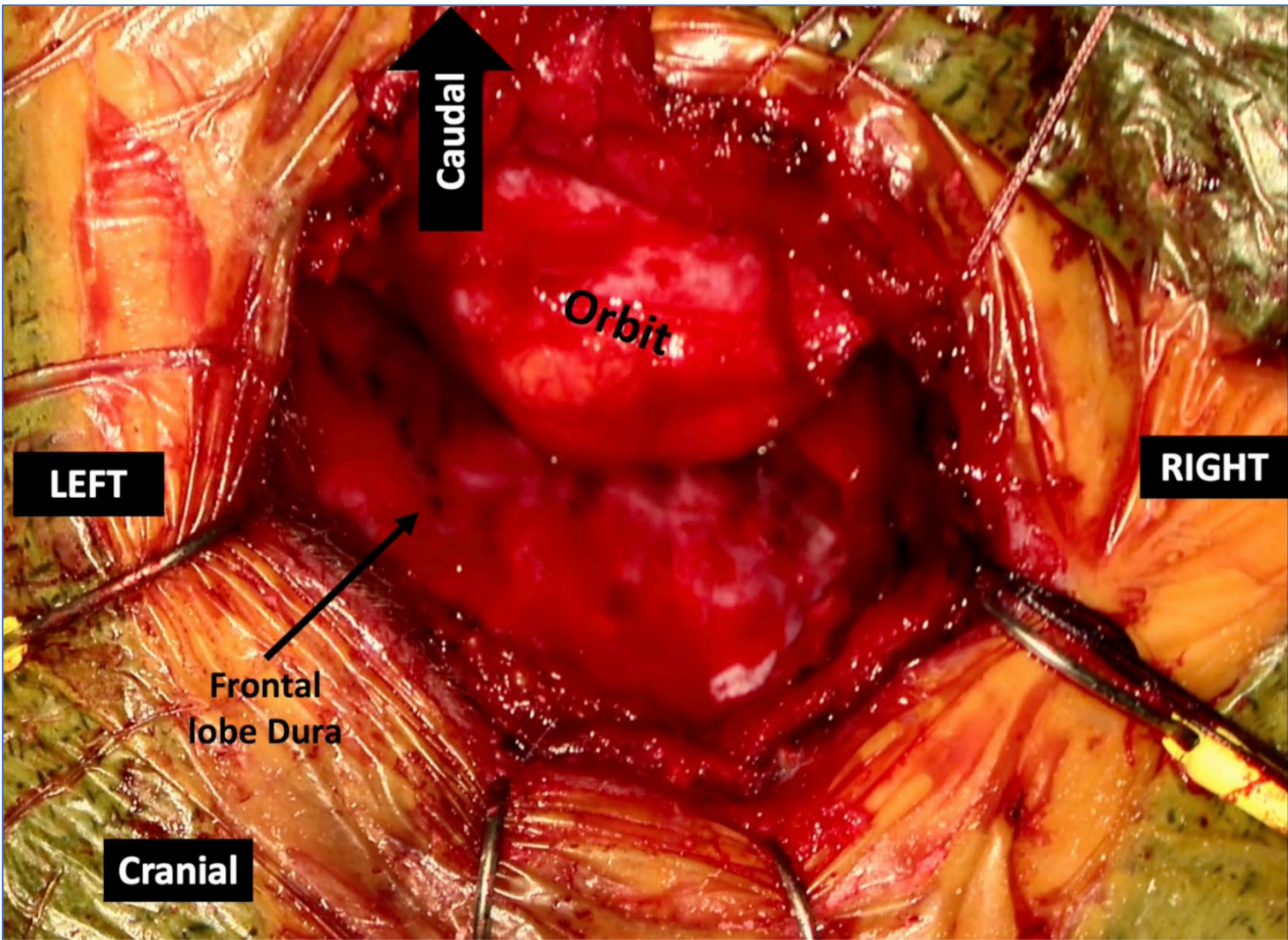


Figure 2. Exposure of orbital contents after eyebrow transorbital approach

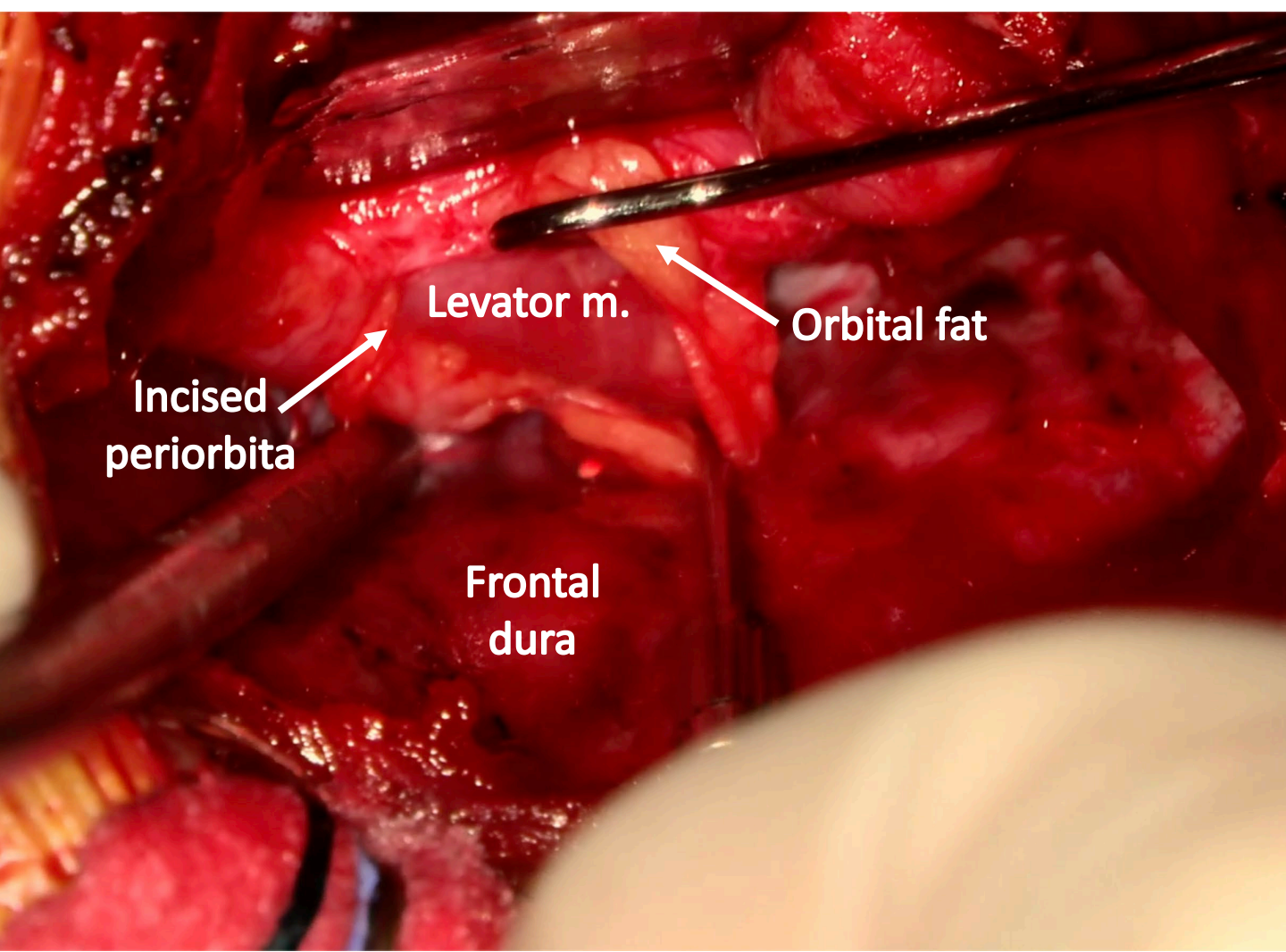


Figure 3. Intraoperative view of two-surgeon dissection of orbital contents

Discussion

- All patients had excellent clinical outcomes.
- The exoscope offered favorable ergonomics for two surgeons operating simultaneously in parallel, with the same field and angle of view for both, despite different surgeon heights.
- The exoscope provided excellent illumination in the narrow, deep space of the orbit with the ability to maintain focus on both superficial and deep structures simultaneously.
- The large screen enabled three-dimensional visualization for the entire operative team, including the scrub tech, circulating nurse, anesthesiologist, neurophysiology technician, and trainees.

Conclusions

- The robotic exoscope is a safe and effective visualization platform for eyebrow transorbital approaches.
- It offers significant potential advantages for two-surgeon approaches to the orbit, including improved ergonomics, enhanced deep illumination, and shared three-dimensional visualization.

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Surgical Video

