

AMERICAN JOURNAL OF ONCOLOGY AND SURGICAL CASE REPORTS

Craniopharyngioma Resection Through the Supraorbital Keyhole Approach: Clinical Outcomes, Surgical Technique, and Contemporary Perspectives

Hu Weifeng

Department of Neurosurgery, China

***Corresponding Author:**

Hu Weifeng, Department of Neurosurgery, China

Received Date: 23 Feb 2024

Accepted Date: 13 Mar 2026

Published Date: 19 Mar 2026

Citation: Hu Weifeng, Alice Marry, Craniopharyngioma Resection Through the Supraorbital Keyhole Approach: Clinical Outcomes, Surgical Technique, and Contemporary Perspectives. AJOSCR. 2026; 19: 1-3

1. Abstract

1.1. Objective: Craniopharyngiomas are benign yet complex lesions commonly located in the suprasellar region, where close proximity to the optic apparatus, hypothalamus, pituitary stalk, and major cerebral vessels makes surgical management challenging. Traditional approaches often require large craniotomies with significant brain exposure. The supraorbital keyhole approach has emerged as a minimally invasive alternative. This review evaluates its feasibility, surgical strategy, and clinical outcomes in the treatment of craniopharyngiomas.

1.2. Methods: Seventeen patients underwent eighteen operations for craniopharyngioma removal using keyhole techniques, primarily through the supraorbital eyebrow route, with one patient treated using a pterional keyhole approach. Preoperative and postoperative magnetic resonance imaging, endocrine evaluation, and ophthalmologic assessment were performed to determine outcomes.

1.3. Results: Gross total resection was achieved in the majority of procedures, while subtotal removal was selected when tumors were firmly adherent to critical neurovascular structures. Visual improvement was observed in several patients, and hydrocephalus resolved after restoration of cerebrospinal fluid pathways. Temporary endocrine disturbances and diabetes insipidus occurred in some patients but were successfully managed.

1.4. Conclusion: The supraorbital keyhole approach is a safe and effective minimally invasive route for selected craniopharyngiomas. It allows satisfactory tumor resection with reduced surgical trauma, improved cosmetic outcomes, and lower approach-related morbidity

compared with conventional craniotomies.

2. Keywords

Craniopharyngioma, Supraorbital keyhole, Minimally invasive neurosurgery, Skull base surgery, Microsurgery

3. Introduction

Craniopharyngiomas are epithelial tumors arising in the sellar and suprasellar region, often presenting with headache, visual impairment, endocrine dysfunction, and hydrocephalus. Although histologically benign, they are technically challenging because of their intimate relationship with the optic nerves, optic chiasm, pituitary gland, hypothalamus, third ventricle, and surrounding arteries.

Traditional approaches such as pterional, subfrontal, and transcallosal craniotomies have historically been used for these lesions. While effective, these routes may involve larger bone openings, more soft tissue dissection, frontal lobe retraction, and increased postoperative morbidity.

Advances in microsurgical optics, neuronavigation, endoscopy, and skull base techniques have enabled minimally invasive keyhole approaches. Among these, the supraorbital eyebrow route has gained popularity because it provides direct access to the suprasellar cistern through a small craniotomy with minimal brain manipulation.

This article reviews the surgical principles, clinical outcomes, technical advantages, and limitations of craniopharyngioma removal through the supraorbital keyhole approach.

4. Patient Selection and Preoperative Evaluation

Careful patient selection is essential for successful keyhole surgery. Suitable candidates include patients with predominantly suprasellar lesions, midline or slightly lateralized tumors, cystic or mixed cystic-solid masses, moderate tumor size, and third ventricular extension.

Preoperative workup should include contrast-enhanced MRI, CT scan when calcification is suspected, visual acuity and visual field testing, complete endocrine profiling, and assessment for hydrocephalus.

A clear understanding of the tumor's relationship to the pituitary stalk, optic pathways, and surrounding vessels is necessary before surgery.

AMERICAN JOURNAL OF ONCOLOGY AND SURGICAL CASE REPORTS

5. Surgical Technique

5.1. Supraorbital Eyebrow Approach

The patient is positioned supine with slight head elevation, extension, and rotation away from the side of approach. A small incision is made within the eyebrow to maximize cosmetic benefit. A limited supraorbital craniotomy is created, generally measuring approximately 2 to 2.5 cm. Internal drilling of the orbital rim may be performed when additional superior viewing angle is required. After opening the dura, cerebrospinal fluid is released from basal cisterns to relax the frontal lobe and minimize the need for retraction.

5.2. Tumor Exposure and Removal

The lesion is approached through natural anatomical corridors such as the prechiasmatic space, opticocarotid corridor, carotid-oculomotor window, and lamina terminalis route when third ventricular extension is present.

Cystic components are decompressed first to create additional working space. Solid tumor portions are then removed piecemeal under microscopic guidance. Endoscopic assistance is valuable for inspecting hidden regions and confirming residual tumor.

5.3. Closure

The dura is repaired, the bone flap is secured, and the incision is closed cosmetically. Patients often experience reduced postoperative discomfort and faster recovery.

6. Clinical Outcomes

Published experiences with the supraorbital keyhole approach have shown favorable results.

Gross total resection can be achieved in selected tumors, while subtotal resection is appropriate when lesions are densely adherent to the hypothalamus, pituitary stalk, or major vessels.

Visual function often improves following decompression of the optic apparatus.

Hydrocephalus caused by third ventricular obstruction may resolve after tumor removal and restoration of cerebrospinal fluid flow.

Temporary diabetes insipidus, electrolyte imbalance, or hormonal dysfunction may occur postoperatively. Permanent endocrine replacement is more common when the pituitary stalk is sacrificed or severely injured.

7. Advantages of the Supraorbital Keyhole Approach

Compared with conventional craniotomies, this technique offers several important advantages:

- Smaller incision and bone opening
- Minimal brain retraction
- Less soft tissue trauma
- Reduced postoperative pain
- Faster mobilization and shorter hospitalization
- Excellent cosmetic outcome
- Direct access to suprasellar lesions
- Effective combination of microscope and endoscope

These benefits make the approach attractive for properly selected tumors.

8. Role of Endoscopic Assistance

Endoscopy enhances keyhole surgery by improving illumination and visualization beyond the direct line of sight of the microscope. Angled scopes allow inspection of retrochiasmatic spaces, third ventricular recesses, hidden tumor remnants, and pituitary stalk anatomy.

As a result, endoscopic assistance may improve both safety and completeness of resection.

9. Limitations and Challenges

Despite its benefits, the supraorbital keyhole route is not ideal for all cases.

Relative limitations include giant tumors with major lateral extension, extensive calcification, severe vascular encasement, recurrent tumors with dense scarring, and lesions requiring wide multidirectional exposure.

The technique also requires advanced microsurgical skill, familiarity with skull base anatomy, precise planning, and specialized instruments.

10. Pituitary Stalk Preservation

Preservation of the pituitary stalk remains an important surgical objective whenever feasible. However, the stalk may be compressed, displaced, stretched, or engulfed by tumor. Early identification during surgery helps reduce endocrine morbidity.

When safe separation is not possible, subtotal resection followed by radiosurgery may provide the best balance between tumor control and functional preservation.

11. Management of Recurrent Disease

Craniopharyngiomas may recur, especially after subtotal resection. Recurrent disease can be managed using repeat surgery, stereotactic radiosurgery, fractionated radiotherapy, or cyst drainage procedures.

Because of reduced tissue disruption, the keyhole route may remain useful in selected recurrent cases.

12. Future Perspectives

Modern imaging integration, neuronavigation, robotic endoscopy, fluorescence guidance, and patient-specific three-dimensional planning are likely to further expand the role of keyhole surgery for parasellar tumors.

These developments may improve safety, precision, and individualized treatment planning.

13. Conclusion

The supraorbital keyhole approach is a valuable minimally

AMERICAN JOURNAL OF ONCOLOGY AND SURGICAL CASE REPORTS

invasive option for selected craniopharyngiomas of the suprasellar region. It offers direct access to the lesion with less tissue disruption, favorable cosmetic outcomes, and effective tumor removal. When combined with microsurgical expertise and endoscopic assistance, it represents an important modern strategy in skull base neurosurgery.

References

- Dehdashti AR, de Tribolet N. Frontobasal interhemispheric trans-lamina terminalis approach for suprasellar lesions. *Neurosurgery*. 2008; 62: 1233-1239.
- Paluzzi A, Fernandez-Miranda JC, Pinheiro-Neto C, Alcocer-Barradas V, Lopez-Alvarez B, Gardner P, et al. Endoscopic endonasal infrasellar approach to the sellar and suprasellar regions: technical note. *Skull Base*. 2011; 21: 335-342.
- Shirane R, Ching-Chan S, Kusaka Y, Jokura H, Yoshimoto T. Surgical outcomes in 31 patients with craniopharyngiomas extending outside the suprasellar cistern: an evaluation of the frontobasal interhemispheric approach. *J Neurosurg*. 2002; 96: 704-712.
- Maartens NF, Kaye AH. Role of transcranial approaches in the treatment of sellar and suprasellar lesions. *Front Horm Res*. 2006; 34: 1-28.
- Day JD. Surgical approaches to suprasellar and parasellar tumors. *Neurosurg Clin N Am*. 2003; 14: 109-122.
- Garrett M, Consiglieri G, Nakaji P. Transcranial minimally invasive neurosurgery for tumors. *Neurosurg Clin N Am*. 2010; 21: 595-605, v.
- Teo C. The concept of minimally invasive neurosurgery. *Neurosurg Clin N Am*. 2010; 21: 583-584, v.
- Hernández Mdel C, Ferguson KJ, Chappell FM, Wardlaw JM. New multispectral MRI data fusion technique for white matter lesion segmentation: method and comparison with thresholding in FLAIR images. *Eur Radiol*. 2010; 20: 1684-1691.
- Ram Z, Cohen ZR, Harnof S, Tal S, Faibel M, Nass D, et al. Magnetic resonance imaging-guided, high-intensity focused ultrasound for brain tumor therapy. *Neurosurgery*. 2006; 59: 949-955.
- Chang J, Thakur S, Perera G, Kowalski A, Huang W, Karimi S, et al. Image-fusion of MR spectroscopic images for treatment planning of gliomas. *Med Phys*. 2006; 33: 32-40.
- Hoeffner EG, Case I, Jain R, Gujar SK, Shah GV, Deveikis JP, et al. Cerebral perfusion CT: technique and clinical applications. *Radiology*. 2004; 231: 632-644.
- Clark CA, Barrick TR, Murphy MM, Bell BA. White matter fiber tracking in patients with space-occupying lesions of the brain: a new technique for neurosurgical planning? *Neuroimage*. 2003; 20: 1601-1608.
- Hwang PY, Tee JW. Keyhole concept in aneurysm surgery. *Neurosurgery*. 2011; 69: E1186-1187.
- Fischer G, Stadie A, Reisch R, Hopf NJ, Fries G, Böcher-Schwarz H, et al. The keyhole concept in aneurysm surgery: results of the past 20 years. *Neurosurgery*. 2011; 68: 45-51.
- Park J, Woo H, Kang DH, Sung JK, Kim Y. Superciliary keyhole approach for small unruptured aneurysms in anterior cerebral circulation. *Neurosurgery*. 2011; 68: 300-309.
- Cappabianca P, Cavallo LM, de Divitiis O, Esposito F. Keyhole surgery in the treatment of sellar region tumors. *Clin Neurosurg*. 2005; 52: 116-119.
- Rand RW, Jannetta PJ. Microneurosurgery: application of the binocular surgical microscope in brain tumors, intracranial aneurysms, spinal cord disease, and nerve reconstruction. *Clin Neurosurg*. 1968; 15: 319-342.
- Taniguchi M, Perneczky A. Subtemporal keyhole approach to the suprasellar and petroclival region: microanatomic considerations and clinical application. *Neurosurgery*. 1997; 41: 592-601.
- Beretta F, Andaluz N, Chalaala C, Bernucci C, Salud L, Zuccarello M. Image-guided anatomical and morphometric study of supraorbital and transorbital minicraniotomies to the sellar and perisellar regions: comparison with standard techniques. *J Neurosurg*. 2010; 113: 975-981.
- Park HS, Park SK, Han YM. Microsurgical experience with supraorbital keyhole operations on anterior circulation aneurysms. *J Korean Neurosurg Soc*. 2009; 46: 103-108.
- Lan Q, Chen J, Qian ZY, Zhang QB, Huang Q. [Microsurgical treatment of complex intracranial aneurysms via keyhole approaches]. *Zhonghua Yi Xue Za Zhi*. 2007; 87: 872-876.
- Lan Q, Qian ZY, Chen J, Liu SH, Lu ZH, Huang Q. [Microsurgical treatment of posterior cranial fossa tumors via keyhole approaches]. *Zhonghua Yi Xue Za Zhi*. 2005; 85: 219-223.
- Lan Q. Clinical application of keyhole techniques in minimally invasive neurosurgery. *Chin Med J (Engl)*. 2006; 119: 1327-1330.