Endoscopic Endonasal and Transciliary Supraorbital Approaches to Parasellar Structures: A Comparative Cadaveric Study of Surgical Working Area, Degrees of Freedom and Endoscopic Visualization

Teddy Totimeh, MD; Surya Pandey, MS; Lucy Batenant, MD; Ronke Ogunbameru, MD; Joshua Emerson, BS; Chester Griffiths, MD; Daniel Kelly, MD; Garni Barkhoudarian, MD

**Introduction**

The endoscopic endonasal transplanar approach and the transciliary (eyebrow) supraorbital craniotomy are two keyhole approaches to parasellar pathology. Both have anatomical limitations affecting surgical maneuverability to key structures. This study is designed to analyze the surgical angles of attack and degrees of freedom to shared parasellar structures as well as visualization and access with microscopic and endoscopic visualization.

**Methods and Materials**

- Dissections were performed in formalin-fixed, silicone injected cadaver heads including six extended endonasal approaches and twelve eyebrow craniotomies.
- Using frameless stereotaxy, the angle of attack and surgical degrees of freedom were calculated for all anatomical targets visualized per approach including seven selected targets common to both approaches (internal carotid artery, optic canal, crista galli, dorsum sella, middle cerebral artery, optic chiasm midpoint and pituitary infundibulum insertion).
- The surgical area accessible by both approaches was calculated.
- Qualitative assessment of the visualization and access to parasellar structures was performed with microscopy (craniotomy only) and endoscopy (0, 30 and 45 degree).

**Results – Quantitative Analysis**

Compared to the extended endonasal approach, the eyebrow craniotomy offered significantly greater surgical freedom for all the six common surgical relevant anatomical targets (p < 0.01). Mean possible angles of attack were also significantly greater for the eyebrow craniotomy than for the extended endonasal approach: axial (29.0 vs 19.4 degrees p<0.01) and sagittal (15.4 vs 11.2 degrees p<0.01) planes. The degree of freedom (product of axial and sagittal angles) was 1.9x greater in the supraorbital approach. These differences were replicated in a point by point analyses for the seven common anatomical targets for both angle of attack and degree of freedom. The gross surgically relevant area exposed was also significantly higher in the supraorbital craniotomy than for the endonasal approach (p <0.01).

**Comparison of Relevant Surgical Working Areas**

**Comparison of Degree of Freedom**

**Conclusions**

Comparing these keyhole approaches to relevant parasellar structures, there is a significantly higher surgical degree of freedom via the eyebrow craniotomy. The endoscope can improve visualization and access to additional structures, particularly with angled visualization. This data can help support surgical decisions for parasellar pathology when deciding between these two approaches.