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Surgical outcome of endonasal transsphenoidal approach for pituitary macroadenoma involving cavernous sinus

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ABSTRACT

Background: Pituitary macroadenomas with cavernous sinus (CS) invasion pose significant surgical challenges due to anatomical complexity and high risk of complications. The endonasal transsphenoidal approach (ETSA) is a minimally invasive technique that offers direct access to the sellar and parasellar regions.

Objective: This study evaluates the surgical outcomes of ETSA for pituitary macroadenomas with cavernous sinus invasion based on a cohort of 36 patients.

Methods: A retrospective review of 36 patients who underwent ETSA for pituitary macroadenomas with radiological evidence of CS invasion (Knosp grades 2–4) was conducted. Surgical outcomes were assessed in terms of gross total resection (GTR) rates, hormonal remission, and postoperative complications.

Results: GTR was achieved in 61% of patients, with higher rates in Knosp grade 2 tumours (80%). Hormonal remission occurred in 67% of patients with functioning adenomas. Complications included cerebrospinal fluid (CSF) leaks (6%), transient cranial nerve deficits (8%), and diabetes insipidus (5%). No mortality was reported. Table: Clinical Characteristics of Patients Undergoing ETSA for Pituitary Macroadenomas.

Conclusion: The ETSA is a safe and effective approach for managing pituitary macroadenomas involving the CS, particularly for lower-grade tumours. Advanced intraoperative tools and multidisciplinary care improve outcomes.

INTRODUCTION

Pituitary macroadenomas account for approximately 10–15% of intracranial tumors, and 6–10% extend into the cavernous sinus (CS). Tumors invading the CS pose significant challenges, including difficulty achieving gross total resection (GTR) and an increased risk of complications such as cranial nerve deficits and cerebrospinal fluid (CSF) leaks [1-3].

The endonasal transsphenoidal approach (ETSA) has become the preferred surgical technique for pituitary tumors due to its minimally invasive nature, allowing direct access to the sellar and parasellar

Keywords

endonasal transsphenoidal,
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regions. However, the role of ETSA in cases of CS invasion remains debated [4,5].

This study evaluates the surgical outcomes of ETSA for pituitary macroadenomas involving the CS, with a focus on GTR rates, hormonal remission, and complication profiles in a cohort of 36 patients.

METHODS

Study Design

A retrospective cohort study conducted from 2015 to 2023 at private setup where endoscopic set up is there.

Patient Selection

Inclusion criteria:

- Patients with pituitary macroadenomas (>10 mm in size).
- MRI evidence of CS invasion (Knosp grades 2–4).

Exclusion criteria:

- Microadenomas (<10 mm).
- Recurrent tumors.
- Cases treated with a transcranial approach.

Surgical Technique

All surgeries were performed using a binostril endoscopic ETSA with intraoperative neuronavigation. Cavernous sinus exploration was attempted only in tumors with radiological evidence of accessible tumor portions.

Outcomes

1. Primary Outcome: Gross total resection (GTR) rate, as confirmed by postoperative MRI.
2. Secondary Outcomes: Hormonal remission in functioning adenomas, postoperative complications (e.g., CSF leaks, cranial nerve deficits), and recurrence rates.

RESULTS

Demographics and Tumor Characteristics (Table 1):

- Sample size: 36 patients (20 male, 16 female).
- Mean age: 47.3 ± 12.1 years.
- Tumor type: Functioning adenomas (56%), non-functioning (44%).
- Knosp grades: Grade 2 (30%), Grade 3 (45%), Grade 4 (25%).

Surgical Outcomes:

- GTR Rates (Figure 1): Overall: 61%; Knosp grade 2: 80%; grade 3: 65%; grade 4: 30%.

- Hormonal Remission: Achieved in 67% of functioning adenomas, highest in prolactinomas.

Complications:

- CSF leaks: 6% (resolved with lumbar drainage).
- Transient cranial nerve deficits: 8%.
- Diabetes insipidus: 5%.
- No mortality.

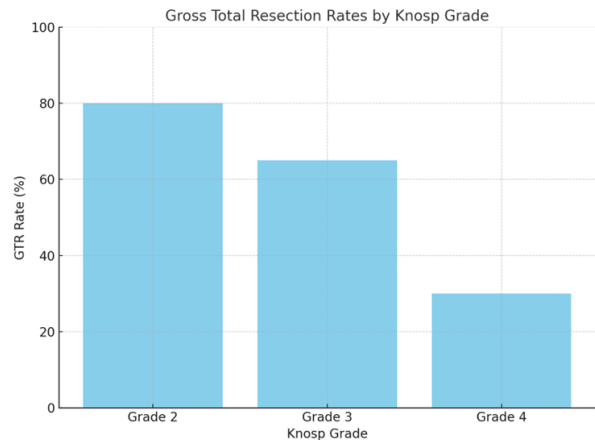


Figure 1. Gross Total Resection Rates by Knosp Grade

Table 1. Patient characteristics with tumor types, grading, resection rate and complications.

Characteristic	Value
Total Patients	36
Gender Distribution	Male: 20 (56%), Female: 16 (44%)
Mean Age (± SD)	47.3 ± 12.1 years
Tumor Type	Functioning: 20 (56%) Non-functioning: 16 (44%)
Knosp Grade Distribution	Grade 2: 11 (30%) Grade 3: 16 (45%) Grade 4: 9 (25%)
Gross Total Resection Rate	Overall: 61% Knosp Grade 2: 80% Knosp Grade 3: 65% Knosp Grade 4: 30%
Hormonal Remission Rate	67% (in functioning adenomas)
Complications	CSF Leaks: 6% Transient Cranial Nerve Deficits: 8% Diabetes Insipidus: 5%
Mortality	0%

DISCUSSION

This study demonstrates that ETSA is a viable surgical option for pituitary macroadenomas with CS invasion, particularly for lower-grade tumors (Knosp grades 2–3). The GTR rate of 61% aligns with prior

studies, while Knosp grade remains a significant predictor of resection success^[6-8].

The hormonal remission rate of 67% in functioning adenomas is consistent with expectations, with the highest success in prolactinomas^[9-12]. Complication rates, including CSF leaks (6%) and cranial nerve deficits (8%), were comparable to those in larger series, emphasizing the importance of surgical expertise and intraoperative tools^[13-18].

Advanced techniques such as neuronavigation, Doppler ultrasound, and intraoperative imaging have contributed to improved outcomes and reduced morbidity^[19-21]. Despite these advances, tumors with Knosp grade 4 invasion remain difficult to manage due to their extensive involvement of the CS^[22-24].

Future studies should explore adjunct therapies, such as stereotactic radiosurgery, for residual or recurrent tumors^[25,26].

CONCLUSION

The ETSA provides a safe and effective approach for managing pituitary macroadenomas involving the CS, particularly for Knosp grade 2–3 tumors. Multidisciplinary care and advanced intraoperative techniques are essential to optimizing outcomes.

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