LETTER TO EDITOR

# Endoscopic Endonasal trans-sphenoid surgery for pituitary tumours- past, present and future

Dear Editor,

Pituitary adenomas, which account for up to 20% of primary intracranial tumours, are known for their slow growth and diverse subtypes, categorized as non-functioning and functioning adenomas. They may manifest incidentally or with mass effects like visual decline or hormonal imbalances such as Cushing's disease, acromegaly, etc., potentially leading to significant health complications or mortality if left untreated. [1]

The history of pituitary surgery spans over a century. In the late 1800s and early 1900s, trans-cranial approaches to the pituitary gland were attempted, but they carried a high mortality rate. Schloffer proposed the transsphenoidal route as a safer option for accessing the sella turcica, achieving the first successful removal of a pituitary tumour using this approach in 1906. Surgeons further refined this technique, with Halstead describing a sub-labial gingival incision in 1910. Meanwhile, Norman Dott persisted with the transsphenoidal approach in Scotland, later introducing it to Gerard Guiot, who innovated further by incorporating radio fluoroscopic control and cisternal pneumography for enhanced visualization and tumour removal. Jules Hardy later refined the transsphenoidal approach by introducing the operating microscope, thereby improving its effectiveness and reducing surgical complications.[2]

The introduction of endoscopy in the early 1960s marked a significant advancement in pituitary surgery, enhancing a surgeon's visualization intraoperatively with a wider and more illuminated field of view. Gerard Guiot pioneered the use of the endoscope in transsphenoidal surgery, initially as a microscope-assisted tool for exploring the sella cavity for residual tumours. In 1997, Jho and Carrau reported the first clinical series of purely endoscopic pituitary surgery, leading many surgeons to gradually adopt the endoscopic endonasal approach for pituitary adenomas and other para-sellar tumours.[3]

Both microscopes and endoscopes are effective and safe tools to successfully treat most pituitary adenomas. In Endoscopic Endonasal trans-sphenoid surgery (EETS), there is little doubt that this technique has many clear advantages. These include a wider, more panoramic field of visualization, improved illumination and mobility of instruments, and an ability to look around anatomical corners using an angled lens. Concerns about instrument manoeuvrability during endoscopic procedures have largely been alleviated with the development of newer endoscope-specific instrumentation and the evolution of endoscopic techniques. Most meta-analysis and retrospective series converge on the superiority of endoscopic techniques in achieving gross total removal in macroadenomas, especially when these tumours are locally invasive and are not just limited to the sella[4]. In EETS, mainly two approaches are used, the uni nostril approach and the uni nostril approach. In my series of EETS of 81 patients who underwent EETS using a single single-handed approach, 38(47.06%) patients were operated on with the bi-nostril approach and the remaining 43(52.94%) were operated with the uninostril approach. The endoscope's superior visualization makes it minimally invasive and allows for complete removal of the tumour and reduces the rate of complications, shorter hospital stay, and better

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quality of life. This approach allows free air circulation in paranasal sinuses, and preservation of sinus mucosa with its mucociliary function. One or both nostrils are entered, depending on the space available and the need for exposure during surgery. Even though endonasal is an excellent surgical route to reach sella turcica, it has its limitations. The long and narrow surgical corridor creates a limited space for the movement of instruments, and limited lateral and suprasellar visibility. In the EETS technique, wide exposure of the sellar floor is done followed by intracapsular debulking and decompression of the tumour. The effectiveness of the EETS is achieved by the improved field of view, direct midline exposure without any brain or neurovascular retraction or manipulation required, and the possibility of achieving early devascularization in certain lesions of the skull base. Regarding the totality of tumour removal, sub-total resection (STR) is less than 90% of tumour removal, near-total resection (NTR) means 90-99% tumour is resected and gross total resection (GTR) is when there is no evidence of residual tumour. With an extended endoscopic approach, higher rates of gross total resection for giant pituitary adenomas can be achieved. Homeostasis from cavernous sinus bleeding could be achieved effectively using a topical hemostat or injectable homeostatic agents and gentle pressure. The two intraoperative observations can be used as criteria to determine complete removal: confirmation by the surgeon that no residual mass remained in the residual cavity by using endoscopic observations of arachnoid pulsations and fall of arachnoid in tumour bed; and no tumour cells being present in the bordering tissue by performing an intraoperative pathological examination, however, the latter is rarely used.[5]

Despite advancements in organizational and technological aspects of management, numerous studies report high rates of treatment failure and recurrence in both functioning adenomas and nonfunctioning adenomas (up to 50% on long-term follow-up).[6,7] Amongst the factors responsible for recurrence, the most important ones are tumour characteristics, such as firm consistency, large size, invasiveness into surrounding tissues, or aggressive growth patterns. In our series tumour was suckable in 62(76.47%) patients, and tumour was fibrous in 14 (17.2%) patients. Apoplexy was present in 6(7.84%) patients. One patient had a tumour soft to firm in consistency. 11 patients (13.5%) had transient DI in the post-operative period and a single patient had permanent DI. CSF rhinorrhea occurred in 18(22.2%) patients, of which two required to be re-operated for repair, rest settled with simpler measures like LP drain and acetazolamide. Meningitis was seen in 3(5.88%) patients. Mortality was seen in a single patient (due to hypothalamic dysfunction)

During the post-operative period, residual tumours were seen in 30 (37.03%) patients. Out of which 9 (11.11%) were given gamma knife therapy and 5(6.1%) were observed they have small residuals. 4(4.92%) patients had to undergo trans cranial surgery and 12(14.80%) underwent redo EETS.

**Future Prospects**

The outlook for the endoscopic approach to pituitary tumours looks optimistic, thanks to ongoing advancements in technology, surgical techniques, and interdisciplinary collaborations. Here are potential future developments for this approach: Technological Progress: Continuous improvements in endoscopic technology, such as high-definition imaging systems, robotic assistance, and navigation tools, can potentially enhance visualization, precision, and safety during pituitary tumour surgery.

- Instrumentation and Miniaturization: Further refinement of endoscopic instruments and the creation of specialized tools may enable more precise and less invasive surgery, resulting in reduced tissue trauma and better patient outcomes.
- Integration of Virtual and Augmented Reality: Incorporating virtual reality and augmented reality technologies into endoscopic pituitary surgery could offer surgeons improved visualization and spatial awareness, leading to enhanced surgical planning and navigation.
- Personalized Treatment Approaches: Advances in molecular diagnostics and imaging techniques may enable personalized treatment strategies for pituitary tumours, allowing surgeons to tailor surgical approaches based on individual tumour characteristics and patient-specific factors.
- Collaborative Care: Collaborative efforts among various medical specialties, including neurosurgery, otolaryngology, endocrinology, radiology, and others,

can optimize patient care through thorough preoperative assessment, informed intraoperative decision-making, and comprehensive postoperative management.

- Innovative Surgical Methods: The development of innovative surgical techniques, such as extended endoscopic approaches and trans orbital endoscopic surgery, could expand the range of endoscopic pituitary surgery and lead to improved outcomes for complex cases.
- Research into Surgical Outcomes: Continued investigation into long-term outcomes, recurrence rates, complication rates, and quality of life following endoscopic pituitary surgery can refine surgical techniques, identify prognostic factors, and guide postoperative care.

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