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Endonasal endoscopic removal of growth-hormone–secreting pituitary adenomas

在鼻內利用內窺鏡切除分泌生長激素的垂體內的腺瘤

Trans-sphenoidal removal of pituitary tumours using the endonasal endoscopic technique, a novel application, is herein reported in five consecutive patients with growth-hormone–secreting pituitary adenomas seen at a teaching hospital in Hong Kong. All five patients demonstrated complete tumour removal on postoperative imaging and hormonal assessment following the procedure. Surgical morbidity and symptoms were minimal; postoperative obstructive nasal packing was not required with this technique, which greatly improved patient comfort. Preliminary experience suggests that the endonasal endoscopic approach is a safe and effective alternative to the conventional trans-septal microscopic method for the treatment of pituitary tumour. A randomised controlled trial comparing these two approaches is currently underway at this institution.

本文報告了在香港的一所教學醫院中，利用新穎的鼻內內窺鏡技術，把5名患者分泌生長激素的垂體內的腺瘤經蝶骨切除。根據手術後的影像術和隨後的激素評估，證明5名患者的腫瘤已完全被切除。利用這項技術，發現患者的外科病態及症狀可減至最低，而且手術後並不需要使用阻塞性鼻敷，大大提高患者的舒適程度。初步經驗顯示與傳統經隔膜處理的顯微法比較，鼻內內窺鏡對於處理垂體腫瘤是一種既安全，又有效的方法。目前，該醫院正在進行這兩種方法的隨機對照試驗的比較。

Key words:
Acromegaly;
Adenoma/surgery;
Endoscopy;
Pituitary neoplasms/surgery

關鍵詞：
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Introduction

Microsurgical trans-sphenoidal surgery, through either a sublabial or transnasal incision, has long been the standard practice for pituitary surgery.[1] The technique requires extensive dissection along the submucosal plane of the nasal septum, followed by controlled fracture of the latter in order to gain access to the sphenoidal air sinus. This artificial passage has to be maintained with a rigid speculum throughout the procedure. Visualisation of the pituitary fossa through the operating microscope, placed several inches above the patient, then allows only a narrow angle of vision with limited depth of field.

The nasal cavity, on the other hand, is a natural anatomical route to the sphenoidal sinus. Encouraged by the visualisation provided by the modern surgical endoscope, Jankowski et al[2] developed the endoscopic technique approaching the sphenoidal sinus through the nasal cavities. Since then, satisfactory results from other centres have been reported.[3-5] Trans-sphenoidal surgery is a safe and effective treatment for acromegaly and remains the first treatment choice for most acromegalic patients.[6]

Table. Patient characteristics and outcome

Patient no.	Sex	Age (years)	Presentation	Tumour size (mm)*	Operating time (mins)	Postoperative pituitary function	Follow-up period
1	F	45	Facial features	8x4x4	240	Cortisol insufficiency†	14 months
2	F	62	Facial features	5x7x5	350	Intact	15 months
3	F	40	Dental malocclusion	11x9x11	300	Intact	14 months
4	F	56	Sleep apnoea	9x8x6	240	Intact	14 months
5	F	47	Facial features	11x15x7	280	Intact	16 months

* Antero-posterior x width x height on magnetic resonance imaging
† present before surgery

In this paper, initial experience with the endonasal endoscopic technique in five patients with growth-hormone (GH)–secreting pituitary adenomas is reported.

Materials and methods

Patients

Between July 1999 and December 1999, five consecutive patients with GH–secreting pituitary adenomas underwent surgery using the endonasal endoscopic trans-sphenoidal approach (Table). The five female patients were aged between 40 and 62 years (mean, 50 years). All patients had elevated GH levels which were not suppressed below 2 μg/L (normal range, <2 μg/L) during an oral glucose tolerance test (OGTT).

Preoperative magnetic resonance imaging (MRI) revealed pituitary adenoma in all patients, with tumour size ranging from 7 to 15 mm in diameter. None of the tumours exhibited suprasellar extension; all patients had intact visual fields. Before surgery, a full endocrinological evaluation was completed and informed consent was obtained. The mean follow-up period postsurgery was 14.6 months.

Operative technique

All patients were given prophylactic antibiotics (cephazolin 2 mg and metronidazole 500 mg intravenously [IV]) and a perioperative steroid 'stress dose' (hydrocortisone 100 mg IV 6 hourly). The patient was given a general anaesthestic with orotracheal intubation and placed in the supine position. The head was held with a three-pin head-fixation system and was tilted to face the operating surgeon. The sublabial area was also prepared in case a conversion to the conventional sublabial approach was necessary (none of the five patients required conversion). Fluoroscopy was used to obtain lateral views of the sphenoidal sinus in order to determine the optimal head position and angle of approach. The operation was carried out, with assistance from an otolaryngologist, using a 4-mm rigid endoscope via the nasal cavity. Visualisation was obtained via a video camera and a closed circuit real-time television monitor. A lens-cleansing irrigation system (Endoscrub, Xomed-Treace, Jacksonville, USA) was used to eliminate the need to withdraw the endoscope for cleaning during the operation.

The middle turbinate, the key to successful use of this approach, was first pushed laterally to facilitate the introduction of instruments. Following removal of the posterior portion of the nasal septum (around 1 cm in diameter), the ostium of the sphenoidal sinus was identified and the mucosa over the anterior wall of the sphenoidal sinus was coagulated and removed. The sphenoidal sinus and the anterior wall of the sella turcica were opened by bone rongeur or pneumatic drill. The pituitary fossa dura was then exposed.

The endoscope was initially hand-held until the dura was exposed (Fig 1). Thereafter, the endoscope was maintained within the nasal cavity using a custom-made scope-holder to allow the surgeon to use both hands. During tumour removal, instruments were passed through both nasal cavities (eg suction catheter through the right cavity and curette through the left). The dura was incised in a cruciate fashion and the tumour was removed using pituitary microrongeurs and curettes. A 0°-angled lens endoscope was predominantly used, giving better anatomical orientation, whereas a 30°-angled lens was employed to examine

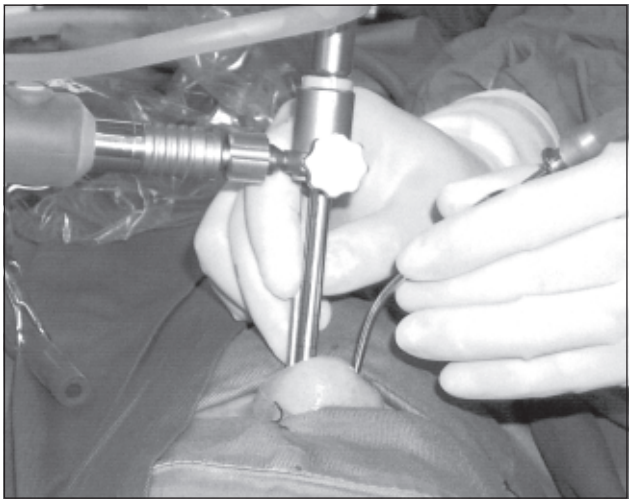

Fig 1. The rigid endoscope maintained in position with a pneumatic scope-holder

suprasellar structures. After the tumour was removed and haemostasis was achieved, Merocel (Xomed Surgical Products, Jacksonville, USA) packing was placed in the middle meatus in case of bleeding from traumatised mucosa. Obstructive nasal packing with ribbon gauze was not used.

Results

No major postoperative complications occurred. None of the patients suffered from postoperative cerebrospinal fluid leakage, meningitis, delayed haemorrhage, or visual deterioration. One patient (patient 2) had a transient period of diabetes insipidus, which resolved on postoperative day 3. Gross total removal of tumour and pathological confirmation of the diagnosis of benign pituitary adenoma was obtained for all patients. The mean operating time was 282 minutes for the procedure.

All patients reported a reduction in soft tissue swelling and body weight shortly after surgery. Patient discomfort and analgesic requirements were minimal. Four patients required soft nasal packing as previously described, which was removed the morning after surgery. None of the patients complained of postoperative nasal congestion or disturbance of smell sensation. Patients were discharged from the neurosurgical unit on day 3 postsurgery with the exception of the patient with transient diabetes insipidus, who was discharged on day 9.

All five patients demonstrated biochemical cure of their acromegaly on OGTT (growth hormone suppressed below 2 μg/L). Four patients had intact anterior and posterior pituitary functions after surgery; one patient (patient 1) had persistent cortisol insufficiency, which was present preoperatively. Postoperative MRI indicated that no residual tumour was present (Fig 2).

Discussion

Before the development of the endonasal technique, the surgical endoscope had been used as an adjunct to explore the pituitary fossa during conventional transseptal surgery.[7] The endoscope, introduced through a speculum, was shown to facilitate tumour clearance and preservation of the normal pituitary gland tissue.[8] The angled endoscopic lens was also noted to provide an extra safety margin by enabling exploration of the suprasellar region under direct vision. With the conventional microscopic technique, removal of the suprasellar portion of a macroadenoma is essentially a blind procedure, which carries the risk of damage to adjacent structures such as the internal carotid artery.[9] Another technical advantage of this new technique is that surgical instruments no longer have to work coaxially within the tunnel provided by an operative speculum. Since the endoscope is already placed distally, close to the pituitary fossa, the surgeon's line of vision is no longer blocked by the long stems of the instruments. New instruments specially designed for endoscopic pituitary surgery are currently under development.[10] For instance, the handle of instruments could be bent in the horizontal plane to avoid interference between the surgeon's hand and the endoscope.

The endonasal approach makes use of the nasal cavity as the surgical pathway.[11] In contrast with the

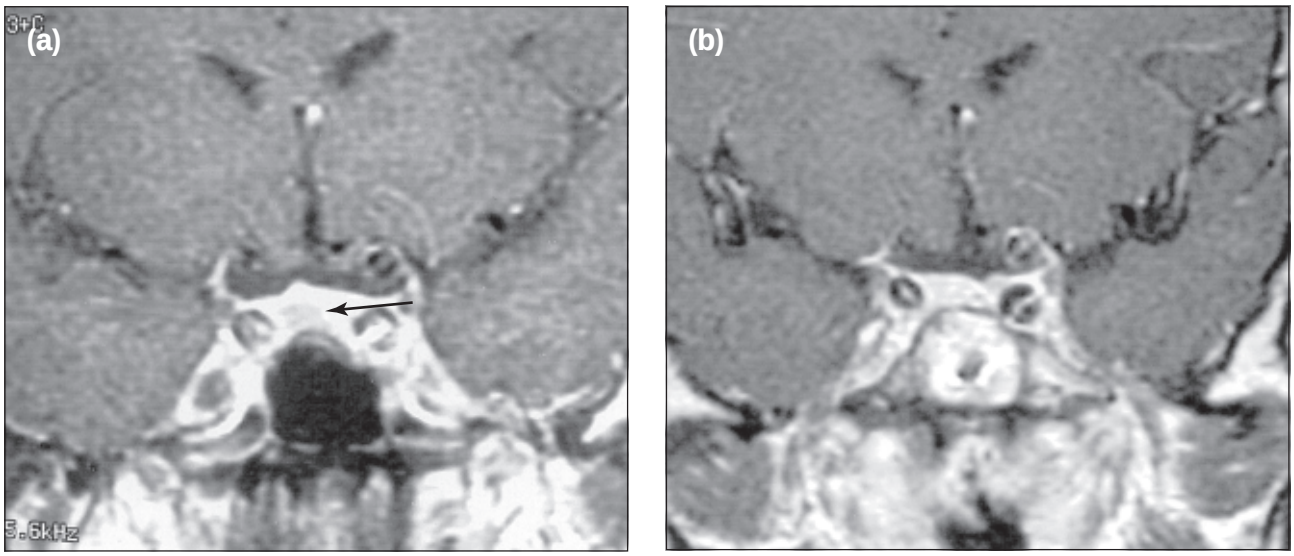

Fig 2. Magnetic resonance imaging (T1 with gadolinium)
(a) Preoperative magnetic resonance imaging showing the microadenoma (arrow) within the contrast-enhanced normal pituitary gland; (b) Postsurgery—note postoperative changes within the sphenoidal air sinus

conventional trans-septal approach, the endonasal endoscopic technique obviates the need for submucosal dissection and fracturing of the whole of the nasal septum. Only the most posterior portion of the nasal septum is excised. This has been shown to significantly reduce postoperative morbidity, such as nasal congestion, septal perforation, upper incisor numbness, haemorrhage, and pain.[3,4,11] A well-developed middle turbinate may sometimes obstruct the pathway and need to be excised.[2] Our experience, however, showed that adequate exposure can be obtained simply by fracturing and displacing the middle turbinate laterally.[12]

Following conventional trans-septal dissection, obstructive nasal packing is required postoperatively to enhance healing and minimise mucosal haemorrhage. With the endonasal technique, mucosal damage is minimal and non-obstructive packing alone is adequate. As experience was gained with the procedure, nasal packing was found to be unnecessary. In addition to greater patient comfort, this also ensures better airway patency during the postoperative period. This is an important advantage, albeit a theoretical one, in acromegalic patients who already experience sleep apnoea and who are at risk of perioperative upper airway obstruction.[13] The technique, however, is by no means confined to the treatment of acromegalic patients as occurred by chance in the initial five consecutive patients reported here.

The use of an endoscope for trans-sphenoidal surgery is technically different from conventional microsurgery. During the period of familiarisation with the technique, operating times were prolonged. The technique has been shown in one retrospective study to be associated with shorter operative times than the conventional method, however.[11] Surgical outcome for all patients in the current series has been satisfactory to date but a longer period of follow-up is indicated to monitor hormonal control. In this series, no major limitation with this technique was experienced, which is inconsistent with the literature. Occasionally however, patients may present with narrow nasal passages which do not admit endoscopic instruments or allow only very limited manipulation. A randomised controlled trial comparing the conventional and endoscopic methods of pituitary surgery is currently being conducted at Queen Mary Hospital to investigate the relative merits of these two techniques.

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