

Microscopic Transsphenoidal Resection of Pituitary Adenomas With Conchal Sphenoid Sinus: a Report of Three Cases

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Case report

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Abstract

Object The present study aimed to investigate the methodology and characteristic of the microscopic transsphenoidal resection of pituitary adenomas with a conchal sphenoid sinus.

Method Three patients with sellar tumor and non-pneumatized sphenoid sinuses received microscopic transsphenoidal surgery with help of neuronavigation system.

Result The three conchal sphenoid sinuses were accessed safely, total resection was achieved and no serious complication occurred. we found that pituitary tumors with conchal sphenoid sinus was more smaller and soft.

Conclusion the presence of a conchal sphenoid sinus is not an absolute contraindication for employing the microscopic transsphenoidal route in the resection of pituitary adenomas with help of neuronavigation.

Introduction

The microscopic transsphenoidal route is considered the standard procedure for cure pituitary adenomas, which represent at least 10% of all intracranial tumors[[i](#)]. Transsphenoidal route needs pass through the sphenoid sinus to reach the sella. According to the commonly used classification system proposed by Hammer & Radberg (1961), the pneumatization of the SS is divided into three types: conchal, presellar, and sellar[[ii](#)]. The conchal nonpneumatized sphenoid was always considered to be a contraindication to the transsphenoid approach to the sella. It usually makes this approach less favorable[[iii](#)]. The presence of a conchal sphenoid sinus is typically considered to be one of the contraindications for the use of transsphenoidal route due to the difficulties of intraoperative localization and exposure of the sellar floor[[iv](#)]-[[v](#)]-[[vi](#)]. The current study presents three cases of resection of sellar tumors with conchal sphenoid sinus via the microscopic transsphenoidal surgery. Written informed consent was obtained from the patient's family and the patient for all three cases.

Case 1

History and clinical examination

35-year-old female, unfortunately falling at home, head hitting the floor, unbearable headache arise after injury, she was been transported urgently to the local hospital, the brain CT scan was performed quickly, found a lesion in the sellar area without intracranial hemorrhage; 4 months later for further examination and treatment she went to our department. Nervous system examination found no obvious signs of neurological deficits.

Neuroimaging and serum hormones

MR scan revealed a lesion in the sellar cavity with a conchal sphenoid sinus, tumor with height of 1.5cm, enhanced scan showed a uniform homogeneous enhancement. Serum hormone test found no significant abnormal increase in hormones, all hormones indicators are in the normal range [figure1 A-B].

Treatment

we also applied Microscopic transsphenoidal surgery on this patient with the help of neuronavigation system [figure1 C]. The position of patient was supine during procedure of surgery. The incision was in the middle of nasal septum. Using nasal dilator make a surgical corridor between mucosa and bone of septum. It's intermittently employing baton of navigation to find hole of sphenoid sinus accurately, then we gradually drill a tunnel, the diameter was about 1.6cm, through conchal sphenoid sinus to the sellar floor. When the dura of sellar floor was full exposure, we found that dura was lack of blood supply, then the dura was cut off in X-shaped without bleeding of intercavernous sinuses. The tumor tissue that is in solid, intermediate stiffness form and lack blood supply was flowed out through the dura incision. After that the tumor was Gradually removed and carefully protect the normal tissue of pituitary. The CSF leakage was not found in the procedure of surgery [Figure1 E-H].

Postoperative course

After operation the patient recovered quickly, the reexamination of head MRI showed there was no residual tumor 20 months after operation [Figure1 D]. Immunohistochemistry: FSH type pituitary adenoma.

Case 2

History and clinical examination

25-year-old male patient presented to our hospital's department of Cardiology with chest tightness and asthma for more than 2 months. They consider that this patient may have acromegaly because he has a rough face. The brain MRI examination found the sellar region had a tumor of pituitary, Then he was turned to our department for further treatment. Neurological examination: In addition to special facial changes, the patient also exists oily and thickly skin, sweating, enlargement of heart, heart rate 110 beats/min, lower extremity with moderate edema.

Neuroimaging and serum hormones

The MR image found that a lesions occupied in the seller region, with height 18mm, enhanced scanning show that tumor was moderately enhanced; skull bone was unevenly thickening, patched enhancement signal was broadly showed in the diploe of skull bone, the signal is not Uniform. Sphenoid sinus area was full of bone signals, been considered a non- pneumatolytic sphenoid sinus [Figure2 A-B]. Serum GH level was higher than 40 ng / ml, PRL level was equaled 343.99 ng / ml (reference range 2.1-17.7 ng / ml), IGF-

1 was 392 ng / ml (reference range 116-358 ng / ml), Other hormone levels were no obvious abnormalities.

Treatment

Under the guidance of neuro-navigation, we applied microscopic transsphenoidal surgery to resect the pituitary adenomas. Bilateral nasal of this patient were stenosis and the right stenosis was more significant. Removed the bilateral middle turbinate, left nasal septum before the left side of the incision. Under the guidance of the navigation, and gradually removed the skull base. Finally reached the saddle, exposure of the dura of sella, when the dura was incised by mini knife, we found that the tumor tissue , soft, milky white, blood supplying not rich, flow out from inner sella; as the tumor stopped flow the incision of dura was enlarged by scissors, then the residual tumor was removed totally. No cerebrospinal fluid leakage, there was a little bleeding in cavernous sinus, stopped by packing gelatin sponge on bleeding point. Postoperative pathological immunohistochemistry reported: polyhormonal pituitary adenoma (PRL, GH).

Postoperative course

At 6 days after surgery, serum GH levels were 12.2 ng / ml, IGF-1: 448 ng / ml and PRL53.1 ng / ml (reference range 2.1-17.7 ng / ml). Four months after surgery, serum GH was 7.34 ng / ml. Postoperative MRI examination showed that the lesion of tumor was disappeared (Figure 2 C-D).

Case 3

History and clinical examination

27-year-old female, due to dizziness, progressive obesity, with blurred vision, admitted to our department. she was concentric obesity with full moon face. Binocular vision decreased significantly.

Neuroimaging and serum hormones


Brain MRI detected an abnormal signal in the right side of the pituitary fossa and found the ossification of sphenoid sinus (Figure 2 E-F). T1WI, T2WI showed the lesion with an equal signal, height 7.5mm, the maximum diameter of 11mm, dynamic enhanced scan showed some mild enhancement in the area of lesion. Serum hormone test found that morning ACTH 252.4pg / ml (reference range 4.7-48.8 pg / ml), morning serum cortisol 35.65ug / dl (reference range 4.3-22.4ug / dl).

Treatment

This patient was applied Microscopic transsphenoidal surgery with the guidance of neuronavigation. Using high speed drill to gradually remove the sphenoid bone within the sinus region. when instruments reached the saddle floor that had a thin layer of dense bone we should be take care of that for keeping integrated dura from being drill through. The sellar floor dura was opened, then tumor was easily sucked

out. We found the tumor was with gray color, soft texture and few blood supply. Finally the tumor was totally removed.

Postoperative course

One week after surgery, patient's serum ACTH was 14.72 pg/ml (reference range 4.7-48.8 pg/ml) and morning serum cortisol was 0.82ug/dl (reference range 4.3-22.4ug/dl). Postoperative recovery was smooth, 4.5 months later after surgery the head MRI showed no tumor remnants and recurrence . Immunohistochemistry conformed that tumor was positive with ACTH.

Discussion

The presence of a conchal sphenoid sinus is typically considered to be one of the contraindications for the use of transsphenoidal route due to the difficulties of intraoperative localization and exposure of the sellar floor. With advances of the application of microscopy and the application of neural navigation technology, we are able to safely carry out transsphenoidal resection of pituitary adenomas with conchal sphenoid sinus. Compared with the non conchal sphenoid sinus pituitary adenoma, the channel of the transsphenoidal surgery will be smaller, the operation space will be limited, it is more difficult that the surgical instrument be operating in this narrow corridor. We consider that surgical resection of pituitary adenoma with conchal sphenoid sinus under microscope have more advantages than endoscopic transsphenoidal surgery due to microscope surgery need less surgical instruments than endoscopic surgery. the distance of the internal carotid artery of the cavernous segment should be carefully measured preoperatively, which determines the size of corridor of TSS surgery [i], which is the adverse aspect to excise pituitary lesion with conchal sphenoid sinus; during the procedure of drilling conchal sphenoid sinus we should be intermittently apply the probe of neuronavigation to confirm the distance of carotid arteries and to adjust the direction of surgery path to prevent injury the internal carotid arteries accidentally.

But in these four patients of pituitary adenoma with conchal sphenoid sinus, we found, during TSS procedure, that sphenoid bony tissue is relatively loose and easy to drill away, hemostasis of bone surface is not difficult, the sellar floor dura mater is smooth, few vessel, easy to open, Except one case which have very small intercavernous sinus is not caused a significant impact to operation, which may be due to bilateral cavernous sinus blood circulate through a large number of cancellous bone communication instead of the intercavernous sinus of sellar dura, so poor blood supply through sellar dura, bleeding was significantly reduced more rather than those with pneumatized well sphenoid sinus. Loose bone within the sinusoids is easy to drill, bleeding could be stop immediately by the heat and bone meal, when necessary, bone wax can also be used to stop bone bleeding easily. At the same time, we found that the size of pituitary adenoma with conchal sphenoid sinus are smaller, the average diameter is about 1.9cm, and the tissue of tumor is soft easy removal, and lesions are without rich blood supply, less bleeding. These finds need further research because there are exist same papers already published about that some pituitary adenoma with conchal sphenoid sinus have larger diameter [ii]. Therefore, we believe that pituitary adenoma with conchal sphenoid sinus can relatively safe be resected by transsphenoidal

surgery with aid of the neuronavigation and achieve satisfactory therapeutic effect, this type PA is no longer a contraindication to transsphenoidal surgery.

To study the anatomy of sphenoid sinus we will find that sphenoid sinus can be divided into conchal type, saddle type, and saddle according to the degree of pneumatolysis; There is study show that the degree of pneumatization of sphenoid sinus play an important role to safely carry out TS surgery, suggest that the circumstance of sphenoid sinus should be full evaluated preoperatively[[iii](#)]. Our experience is not only must carry on the MRI scanning preoperatively, also must carry on the thin layer CT scanning of saddle area that would give us more information to comprehensively understand degree of pneumatolysis of sphenoid sinus, and to know the relationship between the internal carotid artery and sphenoid sinus. Conchal type of sphenoid sinus occurrence rate is very low, Song Tao team found that the incidence of sphenoid sinus of nonpneumatized is 6% in Chinese population[[iv](#)], that is consistent with our center study found. Conchal type of pituitary adenoma is a taboo for transsphenoidal surgery in the past, this is due to the thickening of the sphenoid sinus bone cause obstacles to surgery corridor, making the surgeon lost and increasing the risk to injury the internal carotid artery; The application of neuronavigation can better solve this problem, with the aid of neuronavigation improve the success rate of surgery; reduce the rate of complication of operation[[v](#)]. In addition, because the bone structure of sphenoid sinus and skull base those structure scanning by MRI is less clear than CT scanning and Studies have shown that error of navigation registration base on CT image is smaller than MRI, we choose CT's neuronavigation, the accuracy is reliable. we are not machinery in accordance with the instruction of the navigation, but we should combin with the experience of surgeons and the observation of sella anatomy, at the same time, to judge the right direction of surgery.

In this study we think pituitary adenomas with conchal sphenoid sinus, the surgery corridor is narrow, so microscopic resection with the aid of neuronavigation has more certain advantages than endoscopic TSS. microscopic surgery use the surgical instruments less than endoscope TTS, so the microscopic TTS are easier to operate, less time needed for surgery; endoscopic observation Angle more wide than microscope[[vi](#)], but we found that this type of pituitary adenomas tumors are smaller, no obvious intercavernous sinus, don't need more viewing Angle in resection of pituitary adenoma with conchal sphenoid sinus. although neural endoscopic resection of pituitary adenoma surgery is more and more widely applied, according to our experience, microscopic transsphenoid surgery applying to conchal type of pituitary adenoma has some advantages. at the same time we found that between pituitary adenomas with conchal sphenoid siuns and other type pituitary adenomas exist certain differences, such as anatomical differences, tumor biological behavior characteristics and so on, it remains to be further research.

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Conclusion

the presence of a conchal sphenoid sinus is not an absolute contraindication for employing the microscopic transsphenoidal route in the resection of pituitary adenomas with help of neuronavigation. Pituitary adenomas with conchal sphenoid sinus, the surgery corridor is narrow, microscopic resection with the aid of neuronavigation may have more certain advantages than endoscopic TSS.

Abbreviations

TSS: Transsphenoidal Surgery; FSH: Follicle-stimulating Hormone; GH: Growth hormone; ACTH: Adrenocorticotropic Hormone; CT: Computed Tomography; MRI: Magnetic Resonance Imaging; T1WI: T1weighted Image; T2WI: T2weighted Image

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of 900th Hospital. Written informed consent was obtained from each patient before enrolment in the study.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no conflict of interest.

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None

Authors' contributions

HJ collected the patient data and performed the primary writing of the manuscript. SW conceived of this study and participated in its design. All authors read and approved the final manuscript.

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Figures

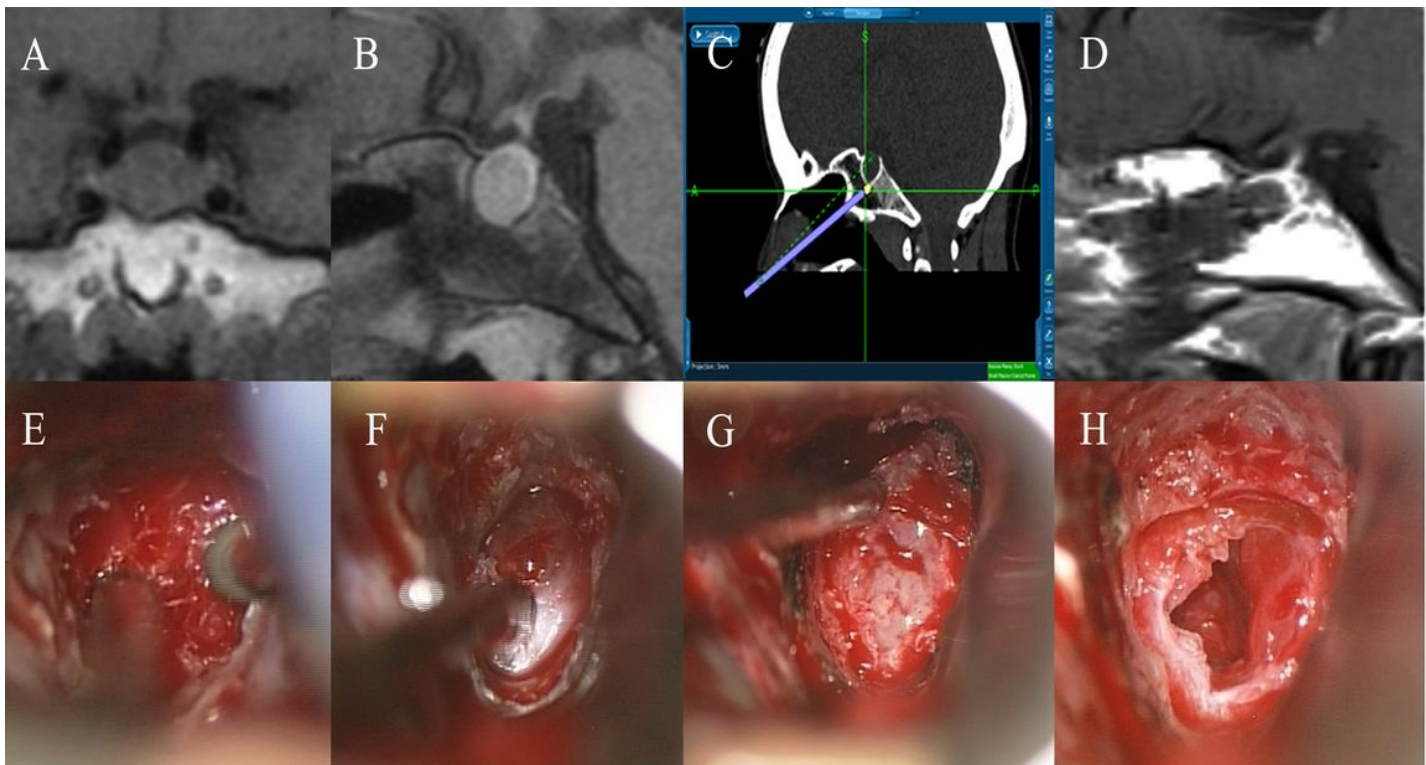


Figure 1

The preoperative MR imaging and intraoperative picture of Case one: A~B, Preoperative MR image showed that saddle area occupied by the pituitary adenomas with conchal sphenoid sinus. C, Neuronavigation guided the surgical direction. D, Postoperative MR images revealed complete tumor

resection. E, Open the anterior wall of sphenoid sinus after exposure of ossification of the sphenoid sinus. F, Open the sellar floor display dural thick, no obvious intercavernous sinus. G, Soft tumor texture, less blood supply. H, The medial wall of cavernous sinus was revealed after tumor resection.

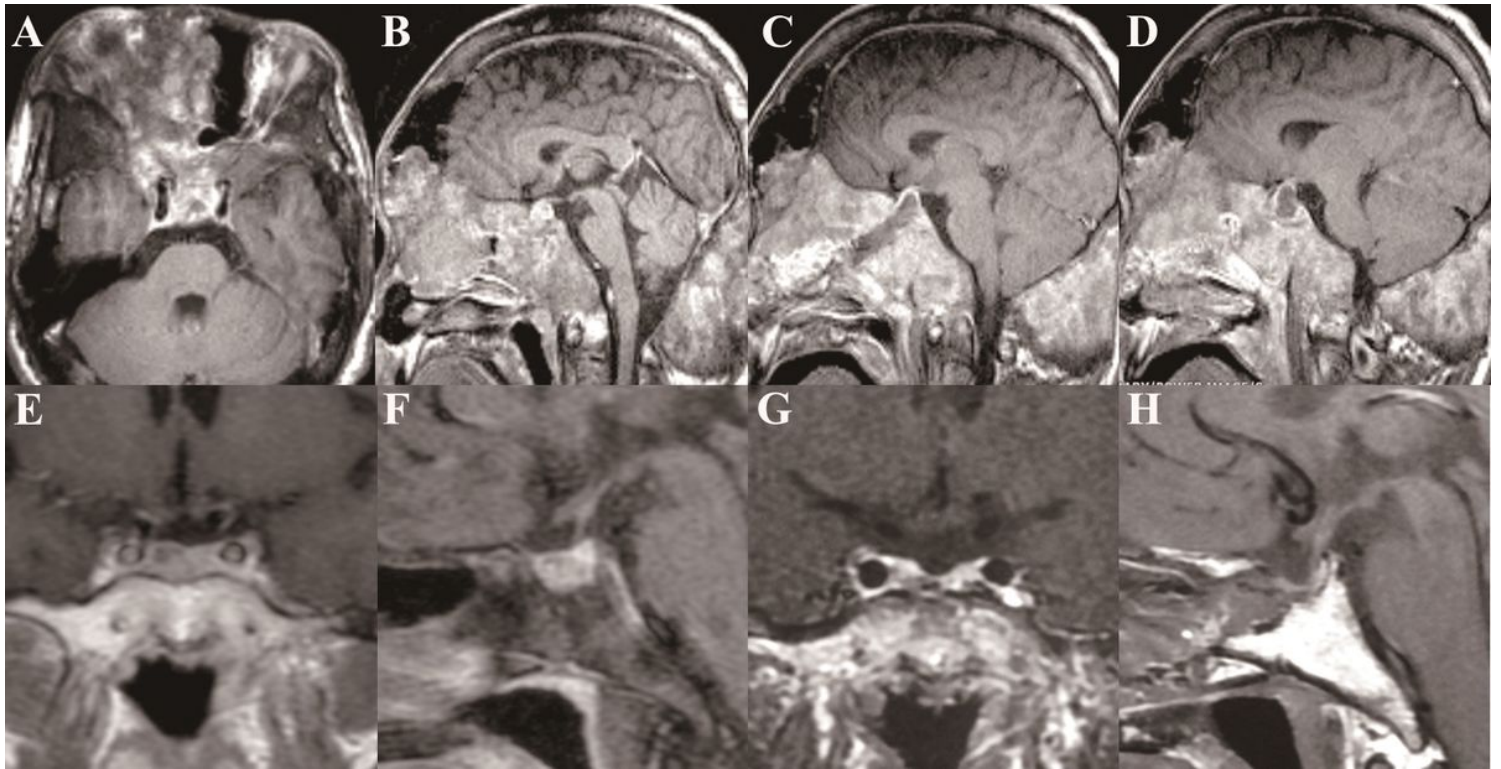


Figure 2

Preoperative and postoperative MR imaging of Case two and Case three: A-B: case 2 preoperative axial and sagittal magnetic resonance imaging, found a lesion in the saddle area, the maximum diameter of tumor was 18mm, sphenoid sinus calcification, and visible skull fibrous hyperplasia. C-D: Case 2 postoperative 2 months review of magnetic resonance imaging, there had a bony surgical pathway in the sphenoid sinus, no tumor recurrence. E-F: case 3 preoperative coronal and sagittal magnetic resonance imaging, found a microadenomas on the right side of the pituitary fossa, with conchal sphenoid sinus. G-H: Case 3 postoperative MR image after surgery of 4.5 months showed no tumor recurrence.