



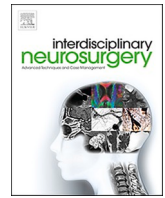
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Interdisciplinary Neurosurgery: Advanced Techniques and Case Management

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Case Reports & Case Series

Transcranial approach as surgical treatment for giant pituitary adenoma during COVID 19 pandemic – What can we learn?: A case report

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ARTICLE INFO

Keywords

Giant pituitary adenoma
Transcranial surgery
COVID-19 pandemic

ABSTRACT

Introduction: In the COVID 19 pandemic, pituitary surgery is one of challenging surgical treatment, especially the involving transsphenoid approach. It was reported that the aerosolisation and mucosal involvement increase the risk of viral transmission during operation. Therefore, transcranial is a safer surgical approach during COVID-19 pandemic. This study aimed to reported transcranial approach to treat giant pituitary adenoma with aggressive visual disturbance which require urgent surgical management.

Case presentation: We reported a 21-year old male, who required urgent surgery because of progressive visual disturbance due to giant pituitary adenoma. On brain MRI with contrast, it was revealed an extraaxial tumor extending anteriorly over planum sphenoidal with the greatest diameter was 5.34 cm. Transcranial approach was chosen to resect the tumor. Near total removal of the tumor was achieved without damaging vital neurovascular structure. The visual acuity was improved and no significant postoperative complication. Pathology examination revealed pituitary adenoma.

Conclusion: Transcranial surgery for pituitary adenoma is still an armamentarium in neurosurgical practice, especially in the COVID 19 pandemic to provide safer surgical approach.

1. Introduction

A giant pituitary adenoma is defined as an adenoma with more than 4 cm in diameter, with prevalence around 6–10% of all pituitary adenomas [1]. Pituitary adenomas could be secreting hormone or non-functioning depends on the hormone profile of the patients [2]. However, the non-functioning giant pituitary adenoma is the most common histological type of this tumor [1]. Surgical management is considered the treatment of choice for pituitary adenoma except for prolactinoma, which can be managed initially with a dopamine agonist [3]. The surgical approach can be transsphenoidal, which can be performed microscopically or endoscopically, and transcranial approach [4].

Surgical management for a patient with intracranial tumors during this pandemic era had been a significant concern [5]. Patients with skull base lesions often require an endonasal approach via transnasal, paranasal sinus, or mastoid [5]. In this era, the development of endoscopic surgery becomes widely used for many surgeries especially for midline skull base lesions such as pituitary adenoma [6–9]. Endoscopic surgery will provide a panoramic, close-up, multi-angled view with excellent

illumination and magnification, permitting complete excision of the tumor with preservation of normal pituitary [10,11]. However, this approach involves the nasal mucosa and has a risk of aerosol generation for virus spreading [12]. Zhu et al., in their case report, mentioned a patient operated on through endonasal endoscopic approach developed COVID-19 one week after the surgery, and later on, 14 of their staff were confirmed for SARS-CoV-2 [13]. During pandemic COVID-19, pituitary tumors with an urgent indication for surgical treatment should be done through an open transcranial approach [5,14]. In this article, we reported a giant pituitary adenoma with an aggressive visual disturbance that requires urgent surgical management. We decide to perform the surgery with the transcranial approach.

2. Case presentation

This is a case report of pituitary adenoma and we have the consent from the patient to include any information of his condition in this article. A 21-year-old male presented at Sanglah General Hospital Bali Indonesia with a 10-month history of headache and visual disturbance,

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<https://doi.org/10.1016/j.inat.2021.101153>

Received 11 October 2020; Received in revised form 13 February 2021; Accepted 15 February 2021

Available online 25 February 2021

2214-7519/© 2021 The Author(s).

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which was getting worse in the past 4 months. On the first week of March 2020, he experienced progressive visual acuity declining. The ophthalmologist reported his visual acuities were light perception and 1/300 on the right and left eyes, respectively. Other physical examinations did not show any sign of hormonal disturbance, such as a sign of Cushing syndrome, acromegaly, or palpitation. And it was confirmed by a normal hormone profile study with normal FT4 and TSHS (1.07 and 0.94, respectively).

On further diagnostic workup of axial, coronal, and sagittal plane of brain MRI with contrast, an extra-axial tumor extending anteriorly over planum sphenoidal was revealed with the greatest diameter 5.34 cm (Fig. 1). Non-secreting of giant pituitary adenoma was diagnosed. In the early pandemic, swab test (PCR test) for COVID 19 was not yet become preoperative standard in our center. Therefore, we rely on a chest x-ray and physical examination to rule out the possibility of COVID 19 infection. To minimize the risk of aerosol spreading of virus from nasal sinus, we selected transcranial surgery (right pterional approach) to remove this tumor. We opt to approach the tumor from the right side because the visual symptoms are much worse on the right eye. Pterional craniotomy on the right side was performed with an additional bone drill on the sphenoid bone to minimize brain retraction. Subarachnoid dissection was performed to drain the cerebrospinal fluid. The tumor was identified surrounding the brain tissue, blood vessels (internal carotid artery {ICA} and anterior cerebral artery {ACA}), and nerves (optic nerve, chiasm, pituitary stalk). During surgery, we achieve near-total removal and preserve all of the vital structures. All neurovascular structures, including the optic nerve, chiasm, stalk, ICA and ACA were well exposed and preserved (Fig. 2). After the removal, the patient

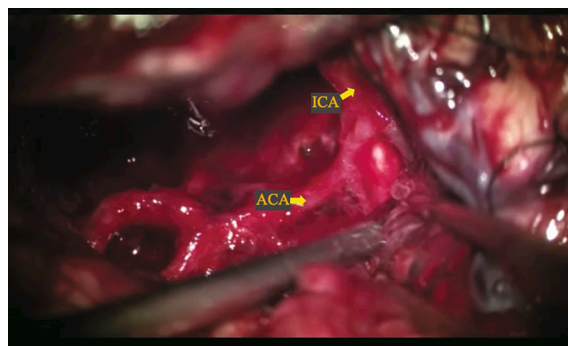


Fig. 2. Transcranial pterional approach operative field view after resection of pituitary tumor. ICA: Internal carotid artery; ACA: anterior cerebral artery.

showed increasing urine output (up to 4400 cc per 24 h) and increasing serum sodium (149 mmol/L), which was diagnosed as diabetes insipidus. The patient was treated with vasopressin 5 IU TID, and within one week the urine output and serum sodium were back to normal limit (from 149 mmol/L to 137 mmol/L). One week following surgery, the patient showed significant visual improvement with 1/60 for the left eye and 1/300 for the right eye. There were no other significant post-operative complications observed. Pathology examination revealed an oval cell with granulated eosinophilic cytoplasm, an ovoid nucleus with granular chromatin, which concluded as adenoma (Fig. 3). Post-operative MRI taken three months following surgery showed a small residual tumor (Fig. 1). The patient has been informed regarding the use

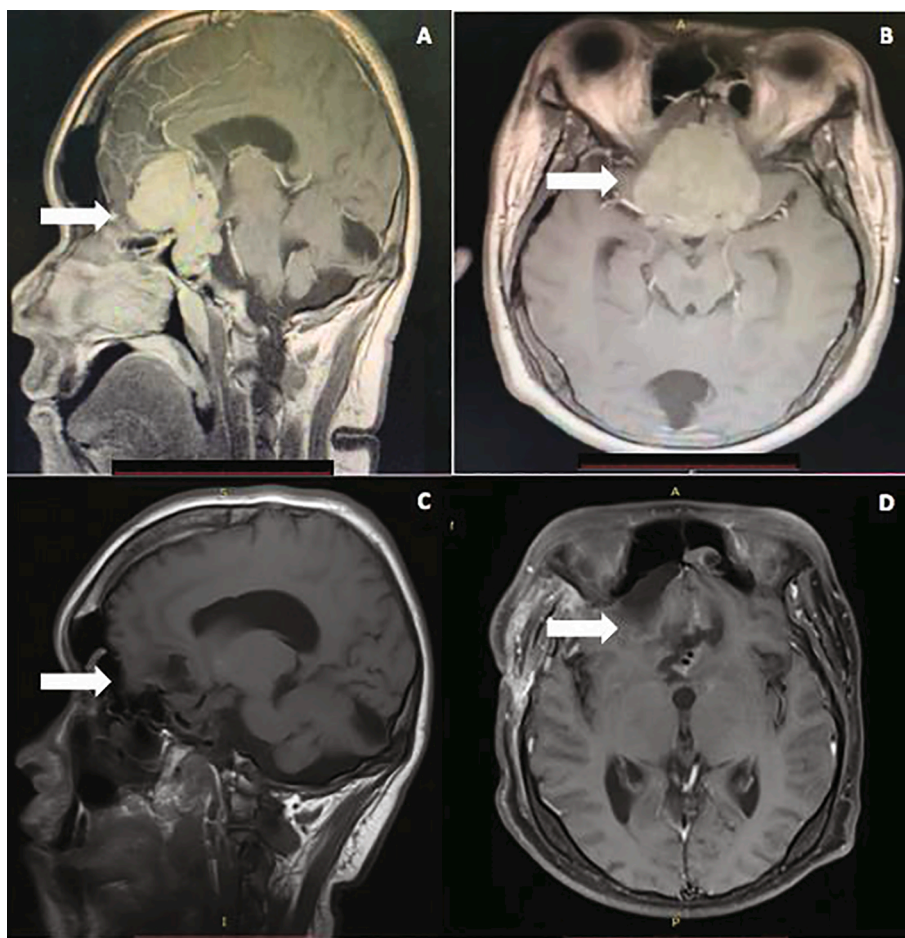


Fig. 1. T1W brain magnetic resonance imaging in A) Sagittal view and B) Axial view showing a tumor in sellar region indicating giant pituitary adenoma with 5.34 cm in diameter. (white arrow) and post-operative MR C) Sagittal and D) Axial view without contrast showing a small residual tumor (white arrow).

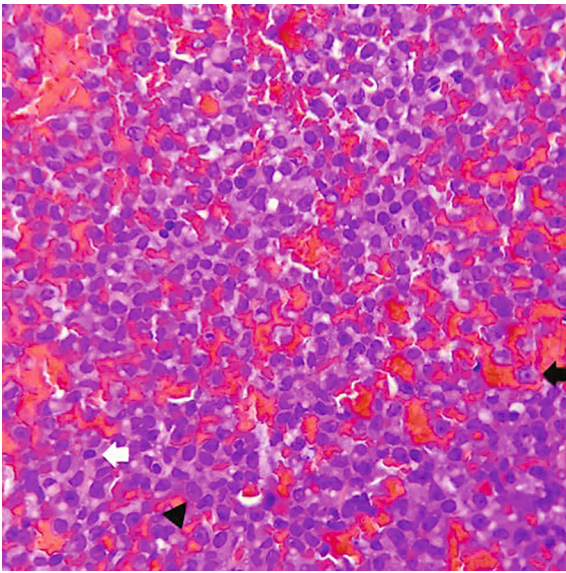


Fig. 3. Tumor mass consist of round shaped proliferated cell with partially granulate eosinophilic cytoplasm (black arrow), rounded nucleus (black arrowhead), and granulated chromatin (white arrow). Hardly any evidence of mitotic activity.

of their information in making this case report.

3. Discussion

A giant pituitary adenoma is defined as adenoma with the largest diameter >4 cm [1]. Goet et al. and Nakao et al. defined this entity as pituitary tumors with an extension more than 40 mm from the midline in any direction or within 6 mm of the foramina [15,16]. Iglesias et al. and Garibi et al. also defined it as a pituitary tumor with vertical diameter >30 mm above the tuberculum or superior margin >20 mm above the jugum sphenoidale [1,17]. In this case, the tumor's greatest diameter was 5.34 cm; so, based on Hardy classification, this tumor was classified as giant pituitary adenoma [15].

The clinical presentation of giant pituitary adenoma could be the mass effect, hypopituitary, or hypersecretion of the hormone [1]. The mass effect, including visual disturbance, is the most common presentation; hydrocephalus due to an obstruction of the ventricular system; and cranial nerve palsy, mainly third, fourth, and sixth nerve [1]. In this case, the visual disturbance was the main problem of the patient. Based on the literature, pituitary tumor with suprasellar and anterior extension are the most common cause of visual impairment [1,15,17].

Surgical management is considered the treatment for pituitary adenoma except for prolactinoma, which can be managed initially with medication [3]. The goals of pituitary adenoma surgical treatment are optic decompression with safe maximal resection while preserving pituitary function [18]. The surgical approach can be transsphenoidal, which can be performed microscopically or endoscopically, and transcranial approach [15].

Transsphenoidal endoscopic procedure is more commonly practiced and recommended for pituitary adenoma for it is viewed as a safer and more effective approach with lesser complication [11]. The disadvantage of transsphenoidal approach is due to deep and narrow working space [4,19]. The transcranial approach is usually used in a more complicated case with lateral or anterior extension of the tumor because it can provide more radical resection, which is one of the suggested reason as to why this approach is associated with more complications and higher risk of damaging surrounding structures than the transsphenoidal approach [4,20].

Elshazly et al. reported in their study that they achieved gross-total

removal in 44%, near-total removal in 47%, and subtotal resection in 9% of patients undergoing endoscopic endonasal resection of giant pituitary adenoma [21]. Leung et al. combined transcranial and transsphenoidal approaches to resect giant pituitary adenoma, and they achieved Gross Total Resection (GTR) in 41.7% and Subtotal Resection (STR) in 58.3% of patients [22]. D'Ambrosio et al. also reported GTR in 55%, Near Total Resection (NTR) in 9%, and subtotal resection in 36% of giant pituitary adenoma patients using combined transcranial and transsphenoidal approach [23]. However, Kuga et al. reported only near-total and subtotal removal using a combined endoscopic endonasal and transcranial approach to resect giant pituitary tumors [24]. Komotar et al. reported that GTR was higher in endoscopic endonasal (47.2%) compared to transsphenoidal microscopic (30.9%) or open transcranial (9.6%). However, tumors with frontal and temporal lobe extension should be treated with an open approach [25].

The transcranial approach is still used approximately 1 to 4% and requires a specific indication [26]. However, it is used in general practice when the transsphenoidal approach fails to remove the desired result. Therefore, there is a continuation of using transcranial surgery for pituitary adenoma, and neurosurgeons should maintain their expertise with this approach [26,27]. In our case, it may need a combined approach, especially to remove the anterior part of the tumor over the planum sphenoidal. With the extended endonasal technique, the anterior part of the tumor could be reached.

Particular attention should be concerned, particularly for procedures performed involving the nasal mucosa, such as a transsphenoidal approach for pituitary adenoma, considering the tremendous level of viral shedding [12]. It is not the endoscopic procedure is risky, but the nasal and pharyngeal areas are hazardous because they may act as reservoirs with a high viral load [12]. Therefore, all endoscopic, microscopic, and open surgical procedures involving nasal or paranasal sinus and pharyngeal regions must be considered at risk [28,29]. In those circumstances, transcranial surgery should be preferred rather than through the skull base via the transsphenoidal approach [30].

In this pandemic state, with the limitation of swab testing preoperatively, we intentionally used a transcranial approach for this tumor. Despite of the possibility of the virus infiltrating the brain, going through nasal mucosa still pose a greater risk in dealing with the tumor [31]. In our opinion, in urgent cases, especially with COVID 19 testing limitation, transcranial surgery should be considered to rescue the vision. With meticulous technique and gentle brain tissue manipulation, transcranial surgery is still safe and provides good surgical outcomes [32]. Regarding the extent of resection, Nishioka et al. concluded that regardless of surgical approach, factors that limit adequate resection were a massive intracranial extension, irregular configuration, and marked cavernous sinus invasion [33]. The lateral extension of pituitary adenoma should be treated with an open approach because endoscopic endonasal limits the visualization during surgery [34].

In our case, a near-total resection of the tumor was done, the visual disturbance is significantly improved without significant clinical complication. When transcranial approaches are used, it must be tailored according to the direction of tumor extension, the goal of surgery, the skill of the surgical team, and surgeon preference. The traditional pterional approach provides a clear surgical view and allows almost complete tumor removal with good preservation of neurovascular structures. Even though this approach is not preferred for the surgery on the sellar region, our consideration to select transcranial surgery is due to pandemic and the tumor extension over planum sphenoidal, in which, in our opinion, it needs combined approaches. Limitation of this study is unable to performing RT-PCR to detect COVID-19 due to limitation in our hospital.

4. Conclusion

Transcranial surgery for pituitary adenoma is still an armamentarium in neurosurgical practice to minimize the spreading of the virus

through aerosolization, and especially when RT-PCR testing for COVID 19 is not yet become a standard preoperative test.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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