



## Case Report

# Successful endonasal transsphenoidal surgery to treat acute internal carotid artery occlusion caused by pituitary apoplexy: Usefulness of arterial spin labeling imaging for emergency decision

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## ABSTRACT

**Background:** Pituitary apoplexy (PA) is a rare clinical condition presenting with acute headache, visual disturbance, and disorientation. PA can cause strokes due to acute internal cervical artery occlusion (ICO), which is an extremely rare condition. Arterial spin labeling (ASL) on magnetic resonance imaging (MRI) is a popular technique, which is a quantitative perfusion imaging useful for the diagnosis of ischemia. We report a treatment with acute pseudo-ICO in which ASL on MRI was useful for the decision of surgery timing.

**Case Description:** A 50-year-old male presented with a sudden headache and nausea. MRI and magnetic resonance angiography revealed a large pituitary tumor and left ICO. However, the left middle cerebral and anterior cerebral arteries were depicted due to a cross-flow through the anterior communicating artery. ASL on MRI showed decreased perfusion of the left hemisphere, suggesting acute ICO. As he had no neurological deficit, we treated him conservatively, following the guidelines. Two days after admission, he presented with sensory aphasia and incomplete right paralysis. Emergency head computed tomography revealed a low-density area in his left temporal lobe. We decided on emergency tumor decompression surgery to prevent ischemic progression. We performed endonasal transsphenoidal surgery. Postoperative MRI showed recanalization of the left internal carotid artery (ICA). His incomplete right paralysis improved immediately after surgery but remains mild sensory aphasia.

**Conclusion:** ICO-related PA is a very rare occasion but there are few similar reports. Some cases of successful ICO treatment due to PA have been reported, but the question of whether emergency or elective surgery is better remains unanswered. Our case may have been no neurological deficit if we had decided to have surgery on admission. Hypoperfusion of the ICA area due to PA may be an adaptation of emergency surgery. Perfusion images like ASL could be a useful technique to decide on surgery or conservative treatment.

**Keywords:** Arterial spin labeling, Endonasal transsphenoidal surgery, Internal carotid artery occlusion, Pituitary apoplexy

## INTRODUCTION

Pituitary apoplexy (PA) is a rare clinical condition presenting with acute headache, visual disturbance, and disorientation. Emergency surgery for PA with visual disturbance and deteriorating consciousness can improve neurological dysfunction.<sup>[2]</sup>

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PA can cause strokes due to acute internal cervical artery occlusion (ICO), which is an extremely rare condition. However, although emergency surgery might prevent stroke progression due to acute ICO, the appropriate timing of surgery is still unclear. The diagnosis of acute or chronic obstruction is difficult without suggestive symptoms and is important for indicating emergency surgery.

Arterial spin labeling (ASL) on magnetic resonance imaging (MRI) is a popular and prominent technique, which is a quantitative perfusion imaging useful for the diagnosis of

ischemia. Herein, we report a treatment with acute pseudo-ICO in which ASL on MRI was useful for the decision of surgery timing.

## CASE DESCRIPTION

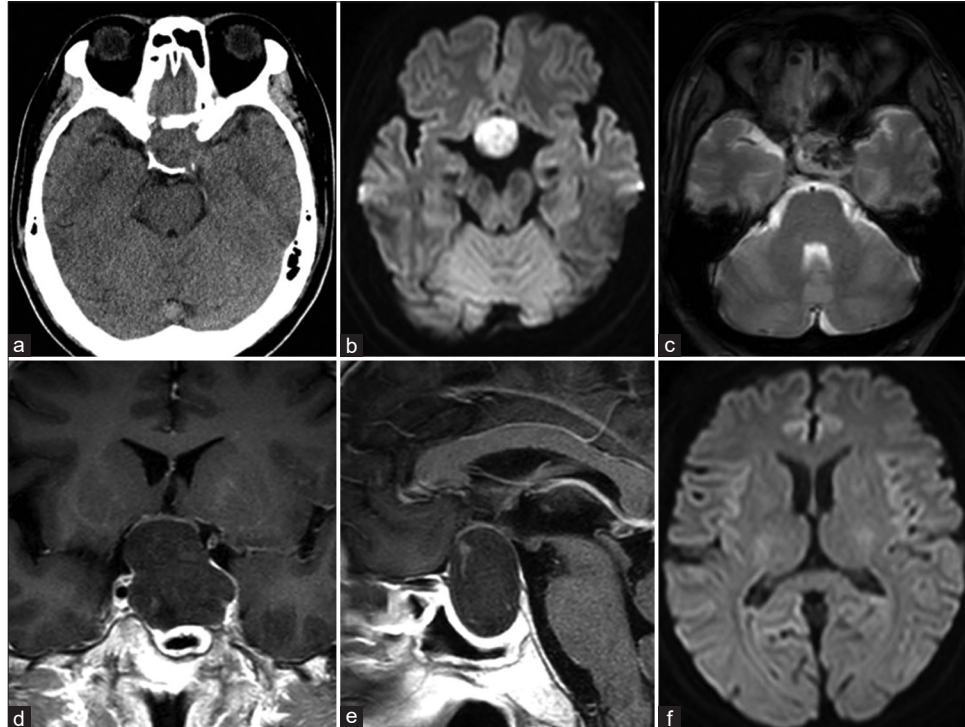
A 50-year-old male presented with a sudden headache and nausea from the past day. He had a history of asthma, hypertension, and sinusitis. His Glasgow Coma Scale (GCS) was 15 (E4V5M6). There were no neurological deficits, including visual disturbance or hemiparesis. He was started on oral betamethasone 1 week before to treat his sinusitis.

Routine blood tests revealed an elevated white blood cell count. Endocrinological blood tests showed low secretion of thyroid-stimulating hormone, adrenocorticotrophic hormone, and follicle-stimulating hormone (FSH) [Table 1]. Head computed tomography (CT) revealed an enlarged pituitary fossa [Figure 1a]. MRI showed a large pituitary tumor without enhancement, a high-intensity area with diffusion-weighted imaging (DWI) in the pituitary gland, and a low-intensity area with T2\*-weighted imaging in a large tumor [Figures 1b-e]. There had been no cortical infarction [Figure 1f]. Magnetic resonance angiography revealed pseudo-occlusion of the left internal carotid artery (ICA); however, the left middle cerebral and anterior cerebral

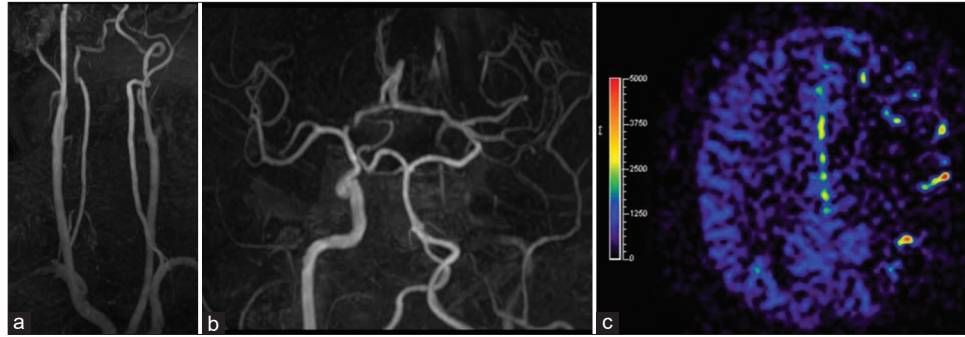
**Table 1:** Endocrinological blood tests showed low secretion of TSH and FSH under oral corticosteroid therapy.

L/D		
GH	0.03	ng/mL
IGF-1	76	ng/mL
LH	1.18	mIU/mL
FSH	1.88	mIU/mL
ACTH	1.5	pg/mL
PRL	0.72	ng/mL
TSH	0.2	μIU/mL

GH: Growth hormone, IGF-1: Insulin-like growth factor 1, LH: Luteinizing hormone, FSH: Follicle-stimulating hormone, ACTH: Adrenocorticotrophic hormone, PRL: Prolactin, TSH: thyroid-stimulating hormone



**Figure 1:** (a) Head computed tomography, (b) diffusion-weighted imaging and (c) T2\*-weighted image revealed an enlarged pituitary fossa and suggested pituitary apoplexy. Contrast-enhanced magnetic resonance imaging (d: coronal, e: sagittal) showed mass lesions without enhancement. (f) There had been no infarction on admission.



**Figure 2:** (a-b) Cervical and head magnetic resonance angiography showed left internal carotid artery occlusion but no occlusion of the intracranial artery due to cross-flow from the anterior communicating artery. (c) Arterial spin labeling imaging suggested hypoperfusion of the left hemisphere.

arteries were depicted due to a cross-flow through the anterior communicating artery. To differentiate whether it had been an acute obstruction or not, we checked the ASL on MRI. ASL on MRI showed decreased perfusion of the left hemisphere [Figures 2a-c]. We had diagnosed this occasion as PA, with acute left ICO but no ischemic stroke.

As he had no neurological deficit, we treated him conservatively with intravenous hydration and hydrocortisone infusion. Two days after admission, he presented with sudden disorientation, a GCS of 12 (E3V4M5), sensory aphasia, and incomplete right paralysis.

Emergency head CT revealed a low-density area in his left temporal lobe [Figure 3]. He was diagnosed with a stroke lacking ischemic tolerance due to ICO due to PA; thus, emergency tumor decompression was attempted to prevent ischemic progression.

Under general anesthesia, we performed endonasal transsphenoidal surgery. After the dura incision, a white tumor erupted, reflecting high intrasellar pressure (ISP).

Pathological findings showed a paucity of FSH-positive cells with immunostaining among many unstained cells. Based on pathological and physical findings, we diagnosed him with a nonfunctional adenoma.

Postoperative MRI showed recanalization of the left ICA and no fresh cerebral infarction except for a known temporal lobe stroke [Figure 4]. His incomplete right paralysis improved immediately after surgery. He was transferred to the hospital for rehabilitation for mild sensory aphasia, and his modified ranking scale was 1.

## DISCUSSION

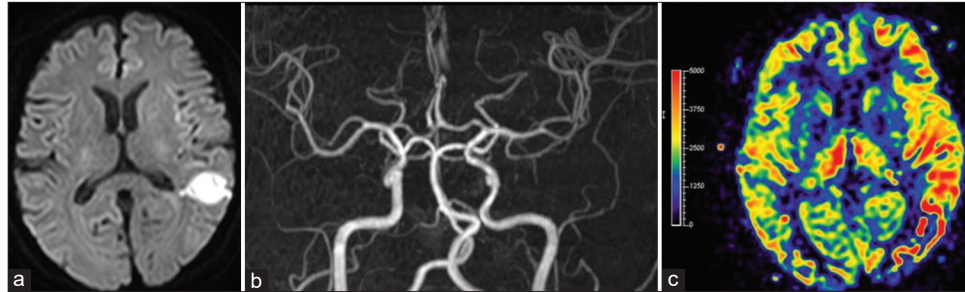
PA is a rare clinical condition, representing about 1.6–4.8% of all pituitary adenomas, and many cases present with severe headache, disorientation, and visual disturbances.<sup>[5,11]</sup> The



**Figure 3:** Preoperative head computed tomography revealed a low-density area of only the left temporal lobe.

main cause of PA is intratumoral hemorrhage or infarction; however, the mechanism of PA remains unclear. PA can also occur following minor head trauma, hormone therapy, pituitary irradiation, cerebral angiography, pregnancy, diabetes, dynamic study of the pituitary gland, and hemodialysis.

PA-induced ICO is a rare clinical condition. There have been a few similar reports in the past.<sup>[1,3,4,7,9,10]</sup> The mechanism of ICO could be related to ISP, which is similar to the normal intracranial pressure of 7–15 mmHg.<sup>[8]</sup> Hemorrhage or infarction due to PA increases anterior pituitary cell volume, leading to a rapid increase in ISP, which, in turn, can lead to ICA or ICA compression or vasospasm, increasing the risk of ischemic stroke. These reports suggested a poor prognosis of PA due to ICO; we think that it has been difficult to determine the timing to perform the surgery. As per the current guidelines, patients with PA should be pharmacologically treated with steroids, and only three neurological defects



**Figure 4:** (a) Postoperative head magnetic resonance imaging showed the known ischemic stroke of the left temporal lobe but no newly high-intensity area. (b) Head magnetic resonance angiography revealed recanalization of the left internal carotid artery, and (c) arterial spin labeling showed improvement of hypoperfusion of the left hemisphere.

indicate the need for emergency surgery for PA: severely reduced visual acuity, severe and persistent visual field defects, and deteriorating consciousness level.<sup>[2]</sup>

However, similar to mechanical thrombectomy, preventing ischemic stroke in a rare condition of major artery occlusion is important since the ISP decompression surgery can lead to ICA recanalization. Some cases of successful ICO treatment due to PA have been reported, but the question of whether emergency or elective surgery is better remains unanswered.

PA progression can invade ICA and cavernous sinus, leading to chronic ICO. When a low-perfusion area progresses to an ischemic stroke, emergency ISP decompression surgery to recanalize ICA is ineffective, leading to a large hemorrhagic infarction. Based on emergency management of PA in adult patients, emergency surgery will not be indicated in patients without focal neurological deficits, and conservative treatment, such as steroid injection, will be prioritized.

ASL is a prominent technique of MRI that can produce quantitative brain perfusion images without tracer injection. The tracer is the blood water itself created by inverting magnetization with a train of radiofrequency pulses. Thus, the ASL technique is useful to detect ischemic stroke by finding differences between DWI and ASL.<sup>[6]</sup>

In terms of preventing stroke, perfusion imaging can be useful in deciding whether elective or emergency surgery should be performed, especially for ASL, to prevent the progression of ischemic stroke.

In our case, the patient had no focal neurological deficits on admission, but ASL of the left hemisphere showed low perfusion. As a result, he was diagnosed with ischemic stroke of the temporal lobe. Therefore, the stroke could have been prevented if the decision of surgery had been made earlier due to his ischemic intolerance. In such cases of PA with ICO showing low perfusion in ASL but no high intensity in DWI, emergency surgery for PA should be considered to prevent ischemic stroke.

## CONCLUSION

We reported a case of successful treatment of ischemic stroke caused by ICO due to PA. Due to high ISP, PA could lead to ischemic stroke, such as major artery occlusion. For cases of ischemic intolerance, emergency ISP decompression surgery can prevent stroke progression and lead to a better prognosis. Perfusion imaging, like ASL on MRI is a useful imaging test to decide a strategy to treat such complicated conditions. Low perfusion indicated an urgent risk of ischemic stroke, which may warrant emergency surgery.

## Ethical approval

The Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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