

Case Report

Joo Pyung Kim, M.D.

Bong Jin Park, M.D.

Sung Bum Kim, M.D.

Young Jin Lim, M.D.

Department of Neurosurgery,
Kyung Hee University Hospital
Seoul, Korea

Pituitary Apoplexy due to Pituitary Adenoma Infarction

Cause of pituitary apoplexy has been known as hemorrhage, hemorrhagic infarction or infarction of pituitary adenoma or adjacent tissues of pituitary gland. However, pituitary apoplexy caused by pure infarction of pituitary adenoma has been rarely reported. Here, we present the two cases pituitary apoplexies caused by pituitary adenoma infarction that were confirmed by transsphenoidal approach (TSA) and pathologic reports. Pathologic report of first case revealed total tumor infarction of a nonfunctioning pituitary macroadenoma and second case partial tumor infarction of ACTH secreting pituitary macroadenoma. Patients with pituitary apoplexy which was caused by pituitary adenoma infarction unrelated to hemorrhage or hemorrhagic infarction showed good response to TSA treatment. Further study on the predisposing factors of pituitary apoplexy and the mechanism of infarction in pituitary adenoma is necessary.

KEY WORDS : Pituitary apoplexy · Pituitary adenoma infarction.

INTRODUCTION

Pituitary apoplexy is a life-threatening clinical syndrome which is caused by the fulminant expansion of pituitary mass due to hemorrhage, hemorrhagic infarction or infarction of pituitary adenoma or the adjacent tissues of pituitary gland. Since first introduced by Bailey in 1898, the incidence of pituitary apoplexy varies from 0.6% to 22.8%^{7,11,12,17}. However, pituitary apoplexy due to tumor infarction is very rare. We report two cases of pituitary apoplexies, caused by pituitary tumor infarction after surgery by transsphenoidal approach (TSA) for pituitary macroadenomas. These cases showed pathologic findings of tumor infarction without any signs of related hemorrhage or hemorrhagic infarction.

CASE REPORT

Case 1

A 44-year-old male patient was admitted via emergency room due to sudden onset of severe headache, nausea, vomiting and visual disturbance. These symptoms were developed 5 days prior to admission. He had no specific previous medical history. Subarachnoid hemorrhage (SAH) was ruled out on brain computed tomography (CT), however sella magnetic resonance imaging (MRI) showed a mass lesion in the sella and suprasellar area which was measured about $3.1 \times 2.3 \times 2.2$ cm. On T1 weighted images, there was hyperintense peripheral portion and an isointense central portion. With gadolinium (Gd) enhancement, the mass showed peripheral rim enhancement but there was no enhancement in the hypointense central portion (Fig. 1). Diffusion MR images were not obtained due to emergency operation. The optic chiasm was compressed by the mass which resulted in bitemporal hemianopsia and the worsening of the visual acuity of the right eye to 0.4 and maintaining that of the left, 1.1. There was a decrease in the levels of free T4 (4 µg/dl), TSH (0.28 µU) and cortisol (2 µg/dl). Steroid was administered before the operation. The mass was totally resected by TSA and there was no evidence of remaining enhancing tumor or hemorrhage seen in the postoperative first day follow-up sella MRI (Fig. 2). Microscopic examination of the resected mass showed total infarction without viable tumor cells (Fig. 2). The cells showed pale appearance and maintained cellular architecture. These findings led to the diagnosis of pituitary apoplexy due to total tumor infarction of a nonfunctioning pituitary macroadenoma. Clinical symptoms and

• Received : March 4, 2008
• Accepted : May 7, 2008
• Address for reprints :
Bong Jin Park, M.D.
Department of Neurosurgery
Kyung Hee University Hospital
1 Hoegi-dong, Dongdaemun-gu
Seoul 130-702, Korea
Tel : +82-2-958-8408
Fax : +82-2-958-8380
E-mail : hyunsong@khmc.or.kr

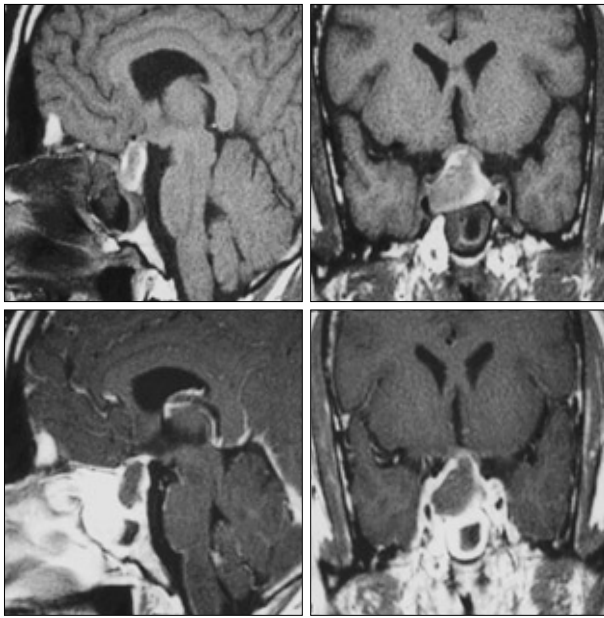


Fig. 1. The preoperative sella magnetic resonance findings, the 3.1x2.3x2.2 cm-sized mass lesion is observed in sella and suprasella. The mass showing iso-signal intensity and peripheral high signal intensity in T1 weighted image that is compressing optic chiasm. Low signal intensity and peripheral rim enhancement without contrast enhancement in the central part are shown in Gadolinium enhancement (Gd-enhancement).

visual disturbance showed improvement soon after the surgery, while the hormone levels of the pituitary gland, except for the free T4, all returned to normal 3 months after the surgery. Without undergoing hormone replacement therapy, free T4 hormone level (10 µg/dl) returned to normal value one year after the surgery.

Case 2

A 66-year-old female patient visited to the hospital complaining of sudden onset of headache, right proptosis and total ophthalmoplegia which occurred two days prior to admission. Her previous medical history revealed of cardiomyopathy. The patient showed a Cushing's appearance, moon face, buffalo hump, truncal obesity, wide abdominal purple striae, proximal myopathy and dorsal fat pad. Sella MRI showed a mass lesion in the sella and suprasellar area which was measured about $2.9 \times 2.5 \times 2.0$ cm. On T1 weighted images, there was a hyperintense peripheral portion and an isointense central portion. With Gd enhancement, the mass showed peripheral rim enhancement without hypointense central portion (Fig. 3). Diffusion MR images were not obtained due to emergency operation. The optic chiasm and the right cavernous sinus were compressed by the mass, which lead to the bitemporal hemianopsia and the worsening of the visual acuity of the right eye to 0.2 and maintaining that of the left, 0.9. The patient was being treated for heart failure caused by

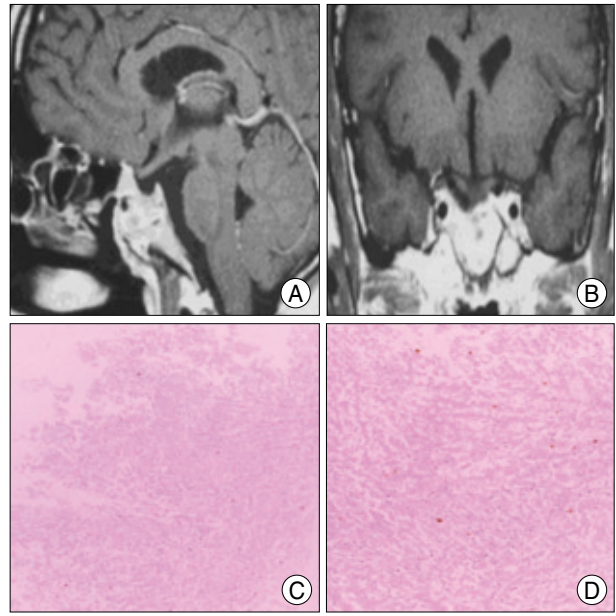


Fig. 2. No evidence of remaining enhancing tumor or hemorrhage seen in postoperative first day follow up sella MRI. The microscopic examination shows total infarction without viable tumor cell. The cells are demonstrated as pale appearance maintaining a cell architecture (H&E, x40)(A,C) (x200)(B,D).

ischemic cardiomyopathy. Endocrine study showed decrease in T3 (70 ng/dl) and TSH (0.24 µU/dl) while there was an increase in ACTH (73 ng/ml) and cortisol (26 µg/dl). The mass was removed totally by TSA and pathologic findings revealed focal ischemic necrosis of a pituitary adenoma. We concluded the diagnosis as pituitary apoplexy caused by partial tumor infarction of a ACTH secreting pituitary macroadenoma (Fig. 4). Sella MRI taken 2 months after the surgery showed no evidence of remaining enhancing tumor (Fig. 4). Headache and visual symptoms were relieved after the surgery and endocrine study showed normalization of ACTH and cortisol. Hormone replacement therapy was not required because all the hormone levels, except for TSH, were returned to normal value.

DISCUSSION

There have been numerous reports on the prevalence of pituitary apoplexy and various predisposing factors of pituitary apoplexy have been reported, such as pituitary irradiation, alternation of intracranial pressure gradients, minor head trauma, hormone therapy, pregnancy, diabetes mellitus, diabetic ketoacidosis, cerebral angiography, anticoagulants medication, dynamic study of pituitary gland, hemodialysis and surgeries including cardiac surgery, lumbar laminectomy, thyroidectomy, appendectomy. However, many of the causes are still unknown. Wakai et al¹⁶⁾ reported that there was no difference in the prevalence rates according to

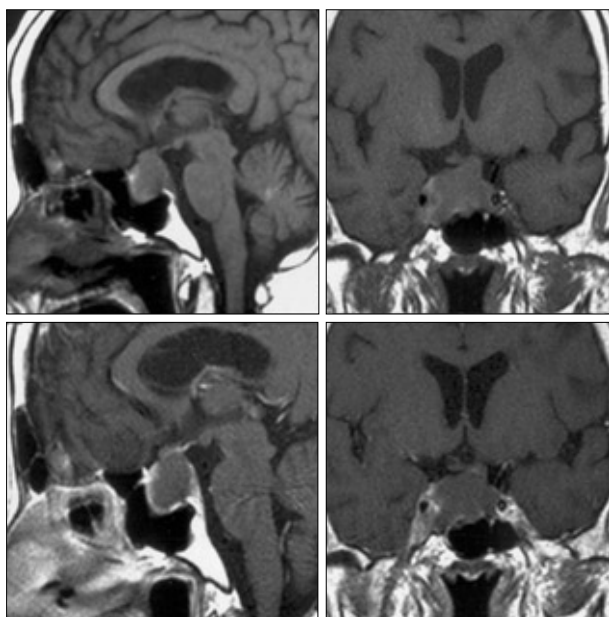


Fig. 3. According to Sella magnetic resonance findings, the 2.9x2.5x2.0 cm-size mass lesion is observed in sella and suprasella. Tumor infarction shows as isosignal intensity and peripheral high signal intensity in T1 weighted image that is compressing the optic chiasm and right cavernous sinus. Also, low signal intensity and peripheral rim enhancement without contrast enhancement in the central part are shown in Gd-enhancement.

the patients' sex. Intratumoral hemorrhage and hemorrhagic infarction have been known as the main causes of pituitary apoplexy, and tumoral infarction is very rare^{2,5,8,10-13}. However, Semple PL^{11,12} reported that the cause of pituitary apoplexy in 22 cases out of 55 patients was the infarction of the pituitary gland though most of the other studies reported the infarction as a cause to be infrequent. We found the 2 cases (6.9%) of pituitary apoplexy caused by tumor infarction among our 29 cases. Pure infarction of pituitary gland or the adjacent tissues without tumorous conditions can occur occasionally, though their symptoms of were not severe. But, the severity of symptoms may increase for a large infarction, venous congestion and edema, which affect the increase of intracranial pressure^{7,11,12,19}. The mechanism of the infarction is still not clearly verified. Brougham et al³ suggested that it was due to a sudden spurt in tumor growth which outstripped its blood supply. Other suggested precipitating causes include radiotherapy and head injury which may provoke massive infarction in patients described by van Wagenen¹⁵. Ischemia due to hypotension or circulatory collapse can cause infarction of non-tumorous pituitary tissues and Cardoso et al⁴ mentioned that intrinsic vasculopathy can also be another cause. In our first case, even though the existence of pituitary adenoma was uncertain due to total infarction of the mass, we presumed that pure vascular infarction resulting

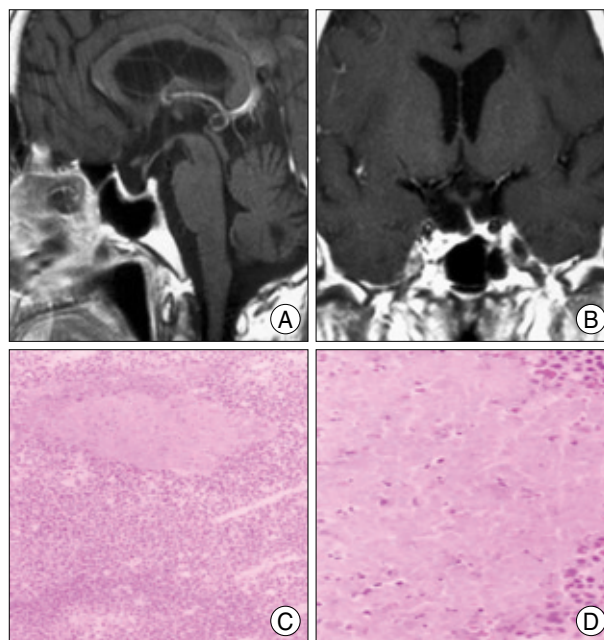


Fig. 4. No evidence of remaining enhancing tumor or hemorrhage seen in postoperative 2 months follow up sella MRI. Histologic appearance of focal ischemic necrosis within the pituitary adenoma (H&E, x40)(A,C) (x200)(B,D).

from the reduced pituitary blood flow, compressed by the expanding tumor the mass would be more closely related with the cause of infarction than vasculopathy of the unusual vessels in the pituitary gland and its adjacent tissues. In the second case, histopathology of the resected mass revealed pituitary adenoma with coagulation necrosis and the endocrine study also showed an increase in ACTH and cortisol. According to these results, confirmative diagnosis of pituitary apoplexy due to partial infarction of ACTH-secreting pituitary macroadenoma could were made. Similar reports of pituitary apoplexy caused by tumor infarction in a Cushing's disease have been mentioned, however their incidences were extremely rare¹. Clinical manifestations of pituitary apoplexy are very diverse. In subclinical pituitary apoplexy cases, not all cases showed symptoms^{4,11,12}. Clinical features of an infarcted pituitary adenoma would be dependant upon the size and direction of spread of the tumor before the infarction occurs. The most common symptom is sudden severe headache and this is caused by the increased intracranial pressure or the retraction of the dura⁴. Next common symptom is visual impairment which is usually caused by the rapid enlargement of the tumor growing towards the optic chiasm. Rapid enlargement of the tumor is closely related with infarction and this causes impaired vision or visual field defects. However, hypothalamic damage is rare.

Sella MRI has been reported the choice of neuroimaging method and diffusion weighted MRI may assist in early

detection of acute pituitary tumor infarction^{10,14}. Our cases showed that pituitary apoplexy caused by pituitary adenoma infarction must be suspected in patients who have clinical symptoms and signs or peripheral rim enhancement without hemorrhage on sella MRI. In current cases, early surgical decompression of pituitary adenoma infarction in pituitary apoplexy showed good clinical results. Clinical outcomes of pituitary adenoma infarction in pituitary apoplexy were similar to that caused by hemorrhage. Further studies on predisposing factors of pituitary apoplexy and mechanism of pituitary tumor infarction is essential.

CONCLUSION

TSA showed good results in patients with pituitary apoplexy caused by pituitary tumor infarction with no relation to hemorrhage. Further study on predisposing factors of pituitary apoplexy and mechanism of pituitary tumor infarction is essential.

References

1. Alarifi A, Alzahrani AS, Salam SA, Ahmed M, Kanaan I : Repeated remissions of cushing disease due to recurrent infarctions of an ACTH producing pituitary macroadenoma. *Pituitary* 8 : 81-87, 2005
2. Biousse V, Newman NJ, Oyesiku NM : Precipitating factors in pituitary apoplexy. *J Neurol Neurosurg Psychiatry* 71 : 542-545, 2001
3. Brougham M, Heusner AP, Adams RD : Acute degeneration changes in adenomas of pituitary body with special reference to pituitary apoplexy. *J Neurosurg* 7 : 421-439, 1950
4. Cardoso ER, Peterson EW : Pituitary apoplexy : a review. *Neurosurgery* 14 : 363-373, 1984
5. Elsasser Imboden PN, De Tribolet N, Lobrinus A, Gaillard RC, Portmann L, Pralong F, et al : Apoplexy in pituitary macroadenoma : eight patients presenting in 12 months. *Medicine (Baltimore)* 84 : 188-196, 2005
6. Imaki T, Yamada S, Harada S, Tsuchiya M, Sano T, Demura H : Amelioration of acromegaly after pituitary infarction due to gastrointestinal hemorrhage from gastric ulcer. *Endocr J* 46 : 147-151, 1999
7. Kim JT, Park BJ, Sung JN, Kim YJ, Cho MK : Clinical analysis of pituitary apoplexy. *J Korean Neurosurg Soc* 30 : 724-728, 2001
8. Liu JK, Couldwell WT : Pituitary apoplexy in the magnetic resonance imaging era. clinical significance of sphenoid sinus mucosal thickening. *J Neurosurg* 104 : 892-898, 2006
9. Matsuura I, Sacki N, Kubota M, Murai H, Yamaura A : Infarction followed by hemorrhage in pituitary adenoma due to endocrine stimulation test. *Endocr J* 48 : 493-498, 2001
10. Rogg JM, Tung GA, Anderson G, Cortez S : Pituitary apoplexy : early detection with diffusion weighted MR imaging. *AJNR Am J Neuroradiol* 23 : 1240-1245, 2002
11. Semple PL, De Villiers JC, Bowen RM, Lopes MB, Laws ER Jr : Pituitary apoplexy : do histological features influence the clinical presentation and outcome. *J Neurosurg* 104 : 931-937, 2006
12. Semple PL, Webb MK, De Villiers JC, Laws ER Jr : Pituitary apoplexy. *Neurosurgery* 56 : 65-72; discussion 71-73, 2005
13. Shahlaie K, Olaya JE, Hartman J, Watson JC : Pituitary apoplexy associated with anterior communicating artery aneurysm and aberrant blood supply. *J Clin Neurosci* 13 : 1057-1062, 2006
14. Tosaka M, Sato N, Hirato J, Fujimaki H, Yamaguchi R, Kohga H, et al : Assessment of hemorrhage in pituitary macroadenoma by T2 weighted gradient echo MR imaging. *AJNR Am J Neuroradiol* 28 : 2023-2029, 2007
15. van Wagenen WP : Hemorrhage into a pituitary tumor following trauma. *Ann Surg* 95 : 625-628, 1932
16. Wakai S, Fukushima T, Teramoto A, Sano K : Pituitary apoplexy : its incidence and clinical significance. *J neurosurg* 55 : 187-193, 1981
17. Walker AB, Eldridge PR, MacFarlane IA : Clomiphene-induced pituitary apoplexy in a patient with acromegaly. *Postgrad Med J* 72 : 172-3, 1996
18. Wiesmann M, Gliemroth J, Kehler U, Missler U : Pituitary apoplexy after cardiac surgery presenting as deep coma with dilated pupils. *Acta Anaesthesiol Scand* 43 : 236-238, 1999
19. Zayour DH, Selman WR, Arafah BM : Extreme elevation of intrasellar pressure in patients with pituitary tumor apoplexy : relation to pituitary function. *J Clin Endocrinol Metab* 89 : 5649-5654, 2004