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Case Report

Massive Hemorrhage from the Posterior Ethmoidal Artery during Transsphenoidal Surgery: Report of 2 Cases

Transsfenoidal Cerrahi Sırasında Posterior Etmoidal Arter Kaynaklı Yoğun Kanama: İki Olgu Sunumu

Yasuhiko HAYASHI[1], Daisuke KITA[1], Masayuki IWATO[1], Sayaka NAKANISHI[2], Jun-ichiro HAMADA[1]

[1]Kanazawa University, Graduate School of Medical Science, Department of Neurosurgery, Kanazawa, Japan
[2]Kanazawa University, Graduate School of Medical Science, Department of Otolaryngology, Kanazawa, Japan

Corresponding Author: Yasuhiko HAYASHI / E-mail: yahayashi@med.kanazawa-u.ac.jp

ABSTRACT

Nasal bleeding is a major complication that can occur during and after transsphenoidal surgery (TSS) for intra- and suprasellar tumors. In most cases, the cause of this bleeding can be attributed to a branch of the maxillary artery called the sphenopalatine artery, injury to which can lead to life-threatening situations. Upon exposure of the suprasellar region and planum sphenoidale during surgery, it is also important to avoid damaging the posterior ethmoidal artery (PEA), a branch of the ophthalmic artery. While recent advancement in endoscopic techniques enables the performance of extended TSS, the chances of PEA injury seem to be increasing. In the current report, we present two cases that showed massive PEA bleeding during regular (not extended) TSS. The total blood loss was 2280 ml and 2150 ml, and endoscopic views disturbed by the massive hemorrhages remarkably delayed accurate stanching of the responsive artery. Therefore, anatomical recognition of the PEA is required to avoid fatal hemorrhaging during even regular TSS, especially for the beginners of this surgery.

KEYWORDS: Nasal hemorrhage, Posterior ethmoidal artery, Transsphenoidal surgery

ÖZ

İntra ve suprasellar tümörlerin transsfenoidal cerrahisi (TSC) sırasında veya sonrasında ana komplikasyon olarak nazal kanama olabilir. Çoğu olguda bu kanamanın nedeni maksiller arterin bir dalı olan sfenopalatin arter olarak kabul edilir ve hayatı tehdit eden durumlara neden olabilir. Cerrahi sırasında suprasellar bölge ve planum sfenoidale'nin ortaya konması sırasında oftalmik arterin bir dalı olan posterior etmoidal arterin (PEA) yaralanmaması önemlidir. Endoskopik teknikteki son gelişmeler genişletilmiş TSC'yi uygulanabilir hale getirmiştir. Bu da PEA hasarı riskini arttırmıştır. Burada, TSC (genişletilmiş olmayan) sırasında yoğun PEA kanaması olan iki olgu sunulmuştur. Total kan kaybı 2280 ml ve 2150 ml olmuştur ve yoğun kanamaya bağlı endoskopik görüntünün bozulması arterden kanamanın tam olarak durdurulmasını geciktirmiştir. Bu nedenle, özellikle bu cerrahiye yeni başlayanlarda, PEA'in anatomik olarak tanınması normal bir TSC sırasında fatal kanamaların önlenmesi açısından gereklidir.

ANAHTAR SÖZCÜKLER: Nazal kanama, Posterior etmoidal arter, Transsfenoidal cerrahi

ABBREVIATIONS: ACTH, adrenal corticotroph hormone; **CT,** computed tomography; **DSA,** digital subtraction angiography; **Gd,** gadolinium; **MRI,** magnetic resonance imaging; **PEA,** posterior ethmoidal artery; **SPA,** sphenopalatine artery; **TSS,** transsphenoidal surgery.

INTRODUCTION

Nasal bleeding is the most serious complication occurring both during and after transsphenoidal surgery (TSS) (7, 9). Injury of the sphenopalatine artery (SPA), a branch of the maxillary artery, could result in the massive bleeds and lead to life-threatening conditions in the most of the affected cases (3, 14). During usual TSS, the posterior ethmoidal artery (PEA), a branch of the ophthalmic artery, is rarely encountered. Moreover, massive bleeding caused by PEA injury is not paid much attention to (8).

However, some cases have shown an irregular PEA course; massive and severe nasal bleeding could happen during and after TSS, especially on first exposure of the suprasellar region and planum sphenoidale (4). Moreover, the advancement in endoscope techniques have enlarged operative targets to the supra- and parasellar region, for which extended TSS could be applied. Compared to the usual TSS, the extended approach is associated with an increased risk of PEA injury (6, 14). Thus, injuring the PEA and SPA during TSS should be avoided in order to prevent massive perioperative nasal hemorrhages.

CASE REPORTS

Case 1

A 69-year-old man presented with activity loss and visual field disturbance that had been ongoing for 6 months. The patient first consulted a local hospital where a large pituitary tumor was detected on magnetic resonance imaging (MRI); he was then referred to our department. Neurological evaluation revealed mild bitemporal hemianopsia, and endocrinological evaluation showed a decline of adrenal corticotroph hormone (ACTH) and cortisol levels from baseline. MRI showed the pituitary tumor extending into the suprasellar region, compressing the optic nerves and invading the right cavernous sinus (Figure 1A). Endoscopic TSS was performed, and a massive hemorrhage was suddenly encountered in the sphenoidal phase during mucosa dissection just above the sellar floor (Figure 1B). At first, we found it difficult to stop the PEA bleed, because the massive hemorrhage disturbed our endoscopic view, with the total amount of blood loss until hemostasis being measured as 2280 ml. When the systemic blood pressure fell down to 50-60 mmHg, the bleeding point from the PEA appeared and was controlled with the single shaft bipolar coagulator (Karl Storz Endoscopy, Tuttlingen, Germany). Partial resection of the hard adenoma was performed, and the visual field defect and decline of cortisol levels were restored. Digital subtraction angiography (DSA) performed after the operation revealed right PEA from the ophthalmic artery responsible this massive hemorrhage (Figure 1C, arrows). Retrospective inspection of computed tomography (CT) with contrast enhancement showed the PEA passing through the medial wall of the right orbit and into the posterior ethmoidal sinus (Figure 1D). The postoperative course was uneventful, and the residual tumor has been unchanged for four years.

Case 2

A 36-year-old man presented with activity loss and visual field deficits that had been ongoing for 2 months. The patient consulted another clinic where a large intra- and suprasellar cystic tumor was detected via MRI. He was referred to our department where neurological evaluation revealed bitemporal hemianopsia, and endocrinological evaluation showed reduced levels of cortisol, ACTH, and thyroid

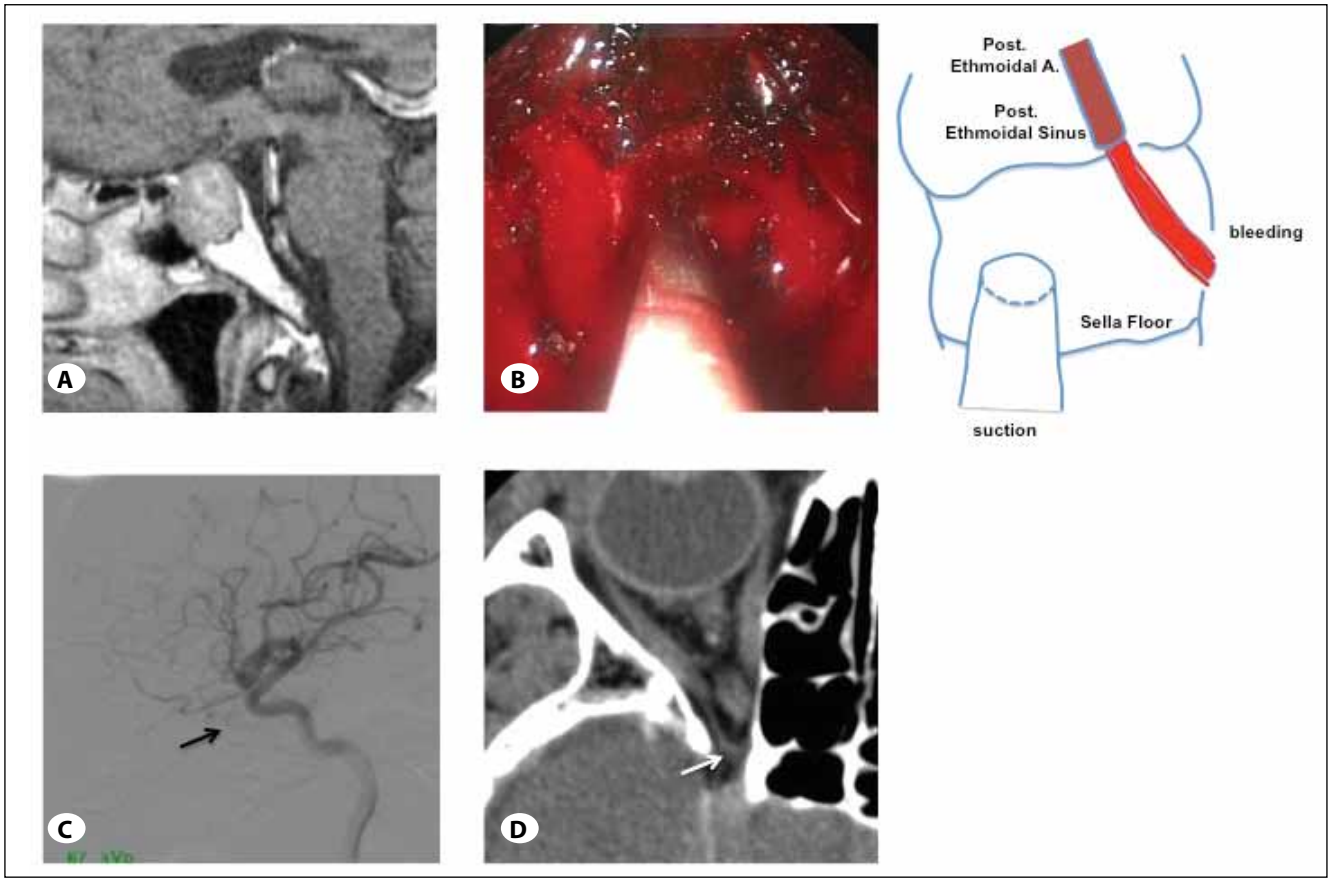

Figure 1: A) Sagittal view of gadolinium (Gd)-enhanced T1-weighted magnetic resonance images (MRI) showing an adenoma extending superior adjacent to the planum sphenoidale. **B)** Intraoperative endoscopic view showing the posterior ethmoidal artery (PEA) passing through the posterior ethmoidal sinus and actively bleeding (left). Scheme of the intraoperative endoscopic view (right). **C)** Lateral view of internal carotid artery angiography showed branching of the PEA from the ophthalmic artery and distributing to the posterior ethmoidal sinus. **D)** Axial view of computed tomography scan with contrast enhancement revealed the PEA passing through the medial wall of the orbit and into the posterior ethmoidal sinus.

hormones from baseline. MRI showed a calcified intrasellar solid mass and a suprasellar cystic lesion extending into the right frontal lobe. As an initial treatment, craniotomy was performed to remove the tumor via a trans-cortical approach and subtotal tumor removal was achieved.

Six months after the craniotomy, endoscopic TSS was performed in order to remove the residual intrasellar tumor (Figure 2A). During left-sided dissection of the superior and supreme turbinates, massive nasal bleeding was suddenly encountered. Exploration for hemostasis was carried out with continuous aspiration of the massive hemorrhage. An arterial injury adjacent to the supreme turbinate was finally encountered under endoscopic view (Figure 2B), and the bleeding was successfully managed with the single shaft bipolar coagulator (Karl Storz Endoscopy, Tuttlingen, Germany). The total amount of blood loss that had occurred until hemostasis was achieved was measured as 2150 ml. DSA performed after the operation revealed left PEA from the ophthalmic artery responsible for this massive hemorrhage (Figure 2C, arrows). Retrospective inspection of CT with contrast enhancement showed the PEA passing through the medial wall of the left orbit and into the posterior ethmoidal sinus (Figure 2D, arrows). Although the postoperative course was uneventful, the patient's endocrinological deficits persisted. Radiosurgery was performed on the residual tumor, which resulted in a good outcome.

DISCUSSION

Recent endoscopic advancement has enabled surgeons to perform extended TSS with submucosal posterior ethmoidectomy. This advancement has allowed the extension of the superior lateral wall of the nasal cavity, and has provided safer and less invasive access to lesions in the suprasellar region through the sphenoidal sinus (1, 5, 12). However, this extended transsphenoidal approach has increased opportunities to encounter postoperative complications, such as cerebrospinal fluid leakage, olfactory disturbance, and arterial injury upon exposing the posterior ethmoidal sinus and tuberculum sellae (10, 11). With this surgical approach, the risk of injuring the PEA, which passes

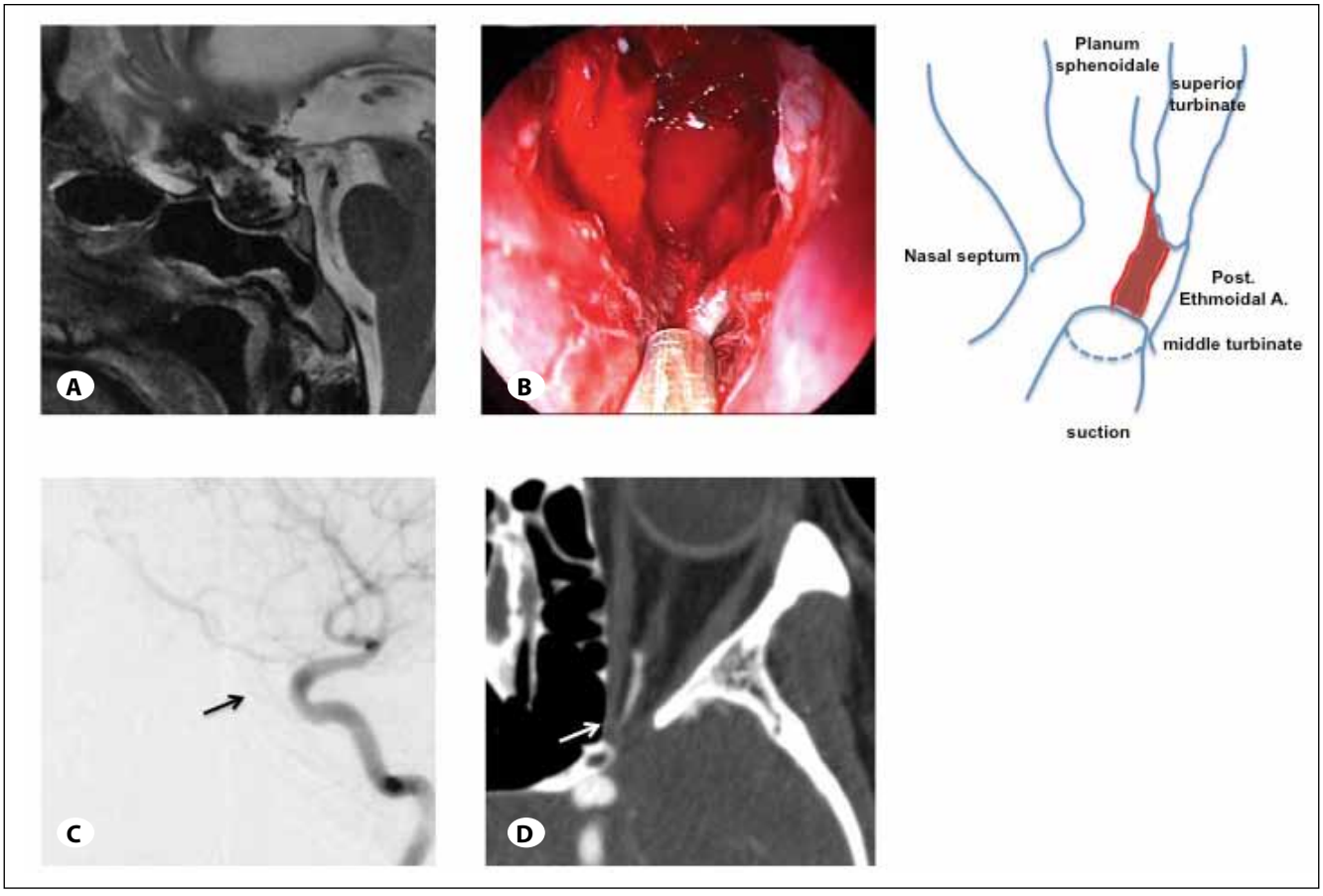

Figure 2: A) Sagittal section view of Gd-enhanced T1-weighted MRI showing a calcified craniopharyngioma located at the intrasellar and suprasellar region. **B)** Intraoperative endoscopic view showing a PEA on the left side passing along the supreme turbinate. Active bleeding was controlled under suction (left). Scheme of the intraoperative endoscopic view (right). **C)** Lateral view of internal carotid artery angiography showed branching of the PEA from the ophthalmic artery and distributing to the posterior ethmoidal sinus. **D)** Axial view of computed tomography scan with contrast enhancement revealed the PEA passing through the medial wall of the orbit and into the posterior ethmoidal sinus.

through a thin, bony channel along the ethmoidal roof, during submucosal dissection in the posterior ethmoidal sinus has also increased (6,8).

It is well known that injury of the SPA could result in the massive bleeds leading to disaster conditions among the pituitary neurosurgeons and many reports have mentioned this arterial injury should be avoided as much as possible (3,14). In our TSS series of 250 cases, we encountered these two cases of PEA injuries when the number of TSS reached 20-30. Many beginners of TSS do not acquire the skill of controlling arterial hemorrhages. Even TSS experts infrequently have difficulty in controlling the hemorrhages. As the distribution of PEA reported to be variable, surgeons can find the unexpected arterial hemorrhage from PEA if the dissection around the superior turbinate and the posterior ethmoidal sinus is carried out. Although the injury of PEA is considered as an extremely rare complication during TSS, the pituitary neurosurgeon should keep in mind the possibility of PEA injury in advance when they are still beginners of TSS.

In order to expose suprasellar lesions in the extended TSS approach, the superior and/or supreme turbinates should be removed along their base, taking care not to damage the turbinate lamina. During such maneuvers, it is important to avoid damaging the PEA, which frequently arises from the first segment of the ophthalmic artery and passes medially from the dura of the planum sphenoidale, to the posterior lamina cribrosa and on to posterior ethmoidal cells. Wide sphenoidectomy and bilateral posterior ethmoidectomy enable surgeons to clearly identify both PEAs, which are considered dangerous landmarks and usually represent the limit when opening the planum sphenoidale (2, 12, 13). As the PEA branches the proximal portion of the ophthalmic artery with high blood pressure, injury of the PEA can cause massive and severe bleeding that should be avoided as much as possible (14).

PEAs are differentially distributed; PEAs can be located near the suprasellar regions during usual TSS (4). In these two cases presented here, massive arterial bleeds were encountered during usual TSS (not extended TSS) with total blood loss of more than 2 liters. In Case 1, the bleeding was identified to be from the PEA originating at the posterior ethmoidal sinus, while in Case 2, massive bleeding was found to emerge from PEA distributing at the superior turbinate. PEAs of these two cases were detected at the DSA performed after the control of the massive hemorrhage.

For tumors located in the sellar- and suprasellar regions, use of extended endonasal approaches is increasing, resulting in elevated risks for PEA injury (13). As the PEA is a large branch stemming from the ophthalmic artery, it can be detected at the planum sphenoidale or posterior ethmoidal sinus on pre-operative examinations, such as CT angiography, as shown in our two cases. If this is the case, then, more attention should be paid during TSS in order to avoid unexpected severe arterial bleeding during submucosal dissection of the superior and lateral nasal cavity. Moreover, pituitary neurosurgeons, especially beginners of TSS, should keep in mind that injuring the PEA as well as SPA could cause massive nasal hemorrhages at the nasal and ethmoidal phase of TSS for tumors located in the sellar- and the suprasellar lesions.

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