Pituitary apoplexy after surgery for cervical stump adenocarcinoma: A case report and literature review

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Abstract. Pituitary apoplexy (PA) is an emergency condition caused by sudden hemorrhage or infarction and characterized by sudden sella turcica compression, intracranial hypertension and meningeal stimulation. PA usually occurs secondary to pituitary adenomas and can serve as the initial manifestation of an undiagnosed pituitary adenoma in an individual. In the present study, a case of PA following surgery for cervical stump adenocarcinoma was reported. The patient experienced an abrupt onset of headache and drowsiness on postoperative day 1 (POD1), and developed blurred vision and blepharoptosis of the left eye on POD4. Pituitary MRI confirmed the diagnosis of PA, prompting the initial administration of hydrocortisone to supplement endogenous hormones, followed by trans-sphenoidal resection. At the six-week follow-up, the patient had fully recovered, with only mild residual blurring of vision. Diagnosing PA post-surgery can be a challenging task due to its symptomatic overlap with postoperative complications. The existing literature on PA after surgery was also reviewed, including the symptoms, time of onset, imageological examination, management, potential risk factors and outcome to improve on early detection and individualized treatment in the future.

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Abbreviations: ACTH, adrenocorticotropic hormone; BP, blood pressure; CT, computerized tomography; FSH, follicle-stimulating hormone; FT3, free triiodothyronine; FT4, free thyroxine; HPV, human papillomavirus; K^+, potassium ion; LH, luteinizing hormone; MRI, magnetic resonance imaging; Na^+, sodium; PA, pituitary apoplexy; PET-CT, positron emission tomography-computed tomography; POD, postoperative day; TCT, thinprep cytology test; TSH, thyroid stimulating hormone

Key words: pituitary apoplexy, cervical stump adenocarcinoma, pituitary adenoma, case report

Introduction

The term pituitary apoplexy (PA) was initially introduced by Brougham in 1950 (1), defined as an emergency condition caused by hemorrhage or infarction of the pituitary gland. However, PA can be generally neglected in 25% of pituitary tumors and there may only be radiological or histopathological evidence of infarction and/or hemorrhage without any clinical manifestation (2). In the present article, PA refers to clinically diagnosed PA with classical symptoms.

The prevalence of PA reported in different studies ranges from 0.6 to 7% (3-7), suggesting that numerous cases were undiagnosed and did not receive any clinical attention (8). While the pathophysiology of PA remains elusive, several risk factors have been identified, such as fluctuation of blood pressure (BP), use of anticoagulant drugs, major surgeries, pregnancy and pituitary function test (9-11). Clinical symptoms vary from person to person, commonly manifesting as sudden onset of headache, visual field defect, diplopia, ophthalmoplegia, decreased consciousness, increased urine volume, nausea and vomiting (12-14). Dysfunctions in the hypothalamic-pituitary hormone axis can result in a lack of various pituitary-related hormones, which may lead to physiological disorders in several ways (Fig. 1). Hypothyroidism and adrenal insufficiency secondary to PA may weaken the body's tolerance to surgical trauma. Glucocorticoid and thyroid hormones both have a role in post-operative stress. Glucocorticoids help maintain BP and blood sugar, facilitate fat mobilization, combat cellular damage and suppress inflammatory responses (15), and thyroid hormones can speed up the metabolism and increase peripheral cells' utilization of glucose (16). The choice of treatment between hormonal replacement therapy and trans-sphenoidal resection is determined based on the severity of neuro-ophthalmic symptoms and the patient's capacity to undergo a second surgery (2).

However, presenting as the initial sign of unknown pituitary tumors, it can be a challenging task to diagnose PA post-surgery due to its symptomatic overlap with postoperative complications. It is a rare postoperative complication that may have severe consequences if not treated timely and properly. Due to the lack of reviews on PA after surgery, the

current article presented a clinical case and summed up the characteristics of relevant cases published over the years.

Case report

A 64-year-old female with a history of subtotal hysterectomy 20 years prior presented with vaginal bleeding persisting for three months and was admitted in Shengjing Hospital of China Medical University (Shenyang, China) in March 2023. The patient's body mass index was 24.2 kg/m^2 (body height, 164 cm; body weight, 65 kg). The obstetric history included two pregnancies-one ending in abortion and the other in a vaginal birth. At the age of 44 years, the patient underwent a subtotal hysterectomy and left adnexectomy due to multiple uterine leiomyomas and a lateral ovarian cyst, with postoperative pathology confirming benignity. Irregular human papillomavirus (HPV) and thinprep cytology test (TCT) screening were conducted post-surgery, and the last screening was 2 years prior and the results remained negative. After undergoing minor but persistent vaginal bleeding for 3 months, the patient tested HPV-16 positive and negative for intraepithelial lesion or malignancy on TCT. The pelvic ultrasound, computerized tomography (CT) and positron emission tomography-computed tomography (PET-CT) identified a moderately hyperechoic mass in the cervical stump region, which was highly suggestive of cancer (Fig. 2). Gynecological examination revealed normal vulvar development with signs of aging and a smooth vaginal canal. An exogenous lesion with a diameter of ~2.5 cm was observed at the stump of the cervix, exhibiting lesion contact bleeding. The anterior fornix was shallow and the pelvic cavity was with no obvious abnormalities in the adnexal areas. The patient reported no comorbidities, aside from a sulfonamide allergy. General examination was unremarkable, except for admission BP of 148/96 mmHg. According to the latest guideline of hypertension in China (17), hypertension was defined as systolic BP ≥140 mmHg/or diastolic BP ≥90 mmHg. The patient's BP was monitored and a cardiologist was consulted. During hospitalization, the patient's BP was stable, ranging from 120/80 to 140/90 mmHg. The patient cooperated well in the physical examination. The bilateral pupils were equally large and round with a diameter of 3 mm and had no limitation of eye movement or visual field defect. The patient exhibited full mobility in all four limbs with normal muscle force and strength and neither had a history of pituitary adenoma nor manifested any related symptoms. The patient underwent tissue biopsy and cervical stump adenocarcinoma was diagnosed. After comprehensive pre-operative evaluations, including PET-CT, the patient underwent open extensive stump cervicectomy, pelvic lymph node dissection and transcystoscopic bilateral ureteral stenting. Pelvic drainage and vaginal drainage were used. The surgery proceeded smoothly with an intraoperative bleeding volume of 100 ml. Intraoperative anesthesia and medication details are provided in Fig. S1 [Illustrator 27.7 (Adobe, Inc.) was used to generate the translated version of this image]. The patient's BP remained stable during the operation and no hypotension was detected prior to or after the surgery. After the gynecological operation, the patient was treated with intravenous cefazolin sodium (Sinopharm CNBG Zhongnuo Pharmaceuticals Co., Ltd.) 0.5 g per 8 h, intramuscular enoxaparin sodium [Sanofi Aventis (Beijing) Pharmaceutical Co., Ltd.] 40 mg per day, intravenous methylprednisolone (Pharmacia & Upjohn Co., Ltd.) 20 mg per day and other supportive care (methylprednisolone is administered as a common treatment at the Enhanced Recovery After Surgery ward to alleviate peri-operative stress and inflammation). From postoperative day 1 (POD1), the patient complained of the sudden onset of a headache [pain visual analogue scale (VAS) score (18), 4/10] and drowsiness. Since the pre-operative PET-CT did not indicate any pituitary tumor (Fig. 3A), it was inferred that the patient's symptoms may be due to general anesthesia and the postoperative analgesia pump and the pump was turned off immediately. On POD2, the patient still reported headaches and a neurosurgery consultation was started. The neurosurgery doctor suggested recording a head CT but the patient perceived her headache to be of mild severity and signed to refuse relevant tests. On POD3, the patient's BP fluctuated between 120/70 and 145/85 mmHg. It was not until the patient's headache worsened (pain VAS 7/10) and a new complaint of blurred vision and blepharoptosis of the left eye occurred on POD4 that she consented to further examination. The patient's Glasgow coma scale score was 3-5-6 points (19). A head CT scan and an ophthalmic consultation were carried out immediately, revealing multiple lacunar infarctions and local density increases in the sella turcica and suprasellar regions (Fig. 3B). Enhanced pituitary MRI showed a 2.4x1.7x2.6 cm occupation in the sellar area with a heterogeneous signal, indicating a pituitary macroadenoma with apoplexy (Fig. 3C and D). Ophthalmic assessments showed bitemporal hemianopsia and abnormal findings in the fundus photography and visual pathway images (data not shown). Laboratory tests indicated panhypopituitarism (Table I). The patient was promptly transferred to the neurosurgery ward. Considering the visual field defect was stable, there was no indication of an emergency surgery and hydrocortisone (Tianjin Jinyao Amino Acid Co., Ltd.; 100 mg/day) replacement therapy was used to complete enhanced head CT and arterial angiography, and transsphenoidal hypophysical lesion resection through the neuroendoscope under general anesthesia was carried out successfully on POD12. After the neurosurgery operation, the patient took desmopressin acetate tablets [Huilin (Sweden) Pharmaceuticals Co., Ltd.] 0.1 mg to treat postoperative diabetes insipidus, sustained-release potassium tablets (Shenzhen Zhonglian Pharmaceutical Co., Ltd.) 1 g three times per day to treat hypokalemia and prednisolone acetate tablets (Tianjin Tianyao Pharmaceuticals Co., Ltd.) 10 mg at 8:00 a.m. and 5 mg at 4:00 p.m. each day. Postoperative pathology was performed by reticulin fiber staining with kit no. G3535 from Solarbio Science and Technology (Beijing) Co., Ltd (20), and it indicated hemorrhage of pituitary tumor (Fig. 4). The patient reported complete resolution of headaches, bitemporal hemianopia and visual field improvement the day after the operation and was discharged from the hospital a week later. The patient reported mild blurry vision during the follow-up of six weeks after the neurosurgery operation. After discharge, the patient underwent follow-up every three months, and her hormone levels completely returned to normal. The patient was advised to undergo hormone level assessments and pituitary imaging every six months, with continued lifelong follow-up.

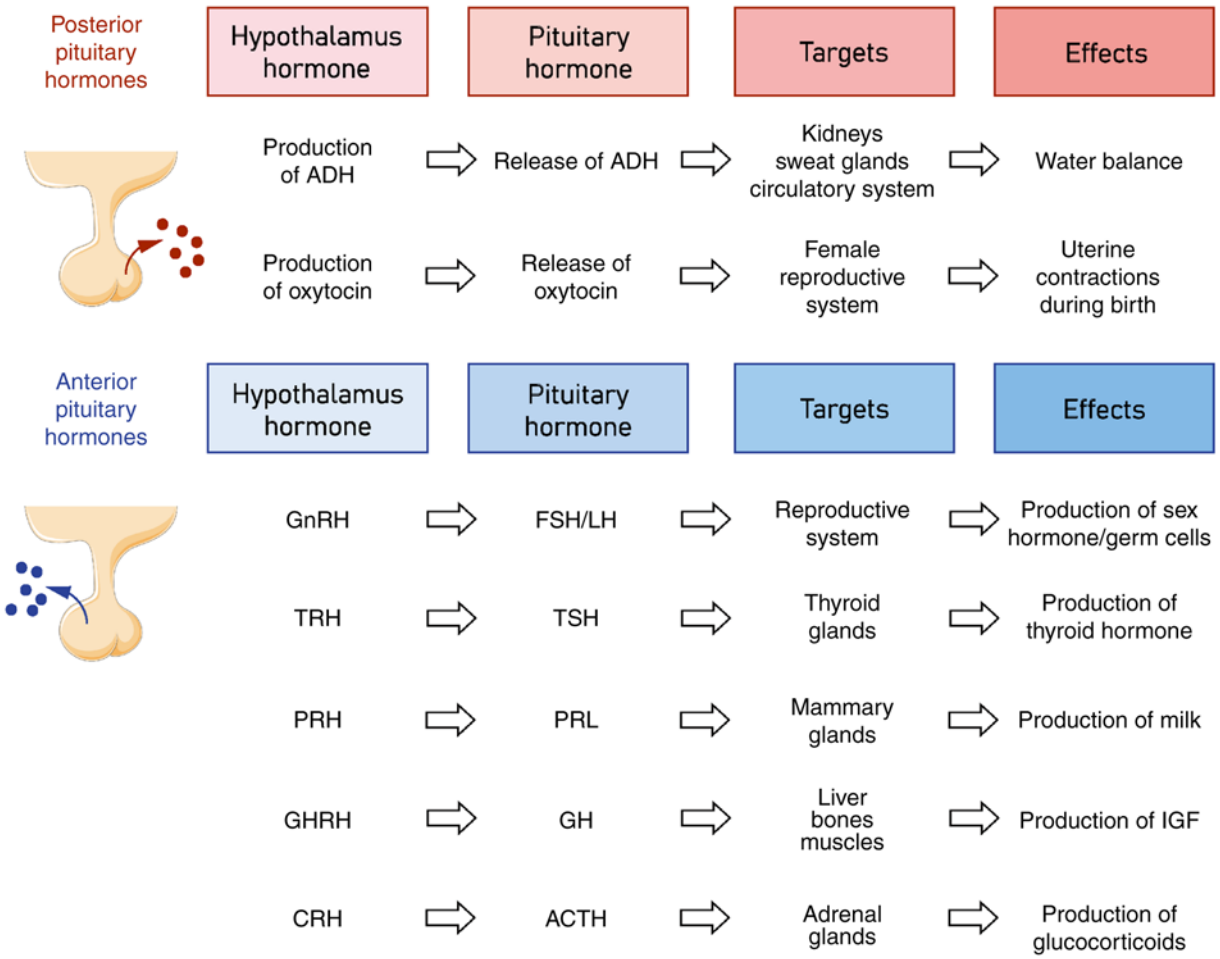

Figure 1. Hypothalamic-pituitary hormone axis and its main functions. ACTH, adrenocorticotropic hormone; ADH, antidiuretic hormone; CRH, corticotropin-releasing hormone; FSH, follicle-stimulating hormone; GH, growth hormone; GHRH, growth hormone releasing hormone; GnRH, gonadotropin-releasing hormone; LH, luteinizing hormone; PRH, prolactin releasing hormone; PRL, prolactin; TRH, thyrotropin-releasing hormone; TSH, thyroid stimulating hormone.

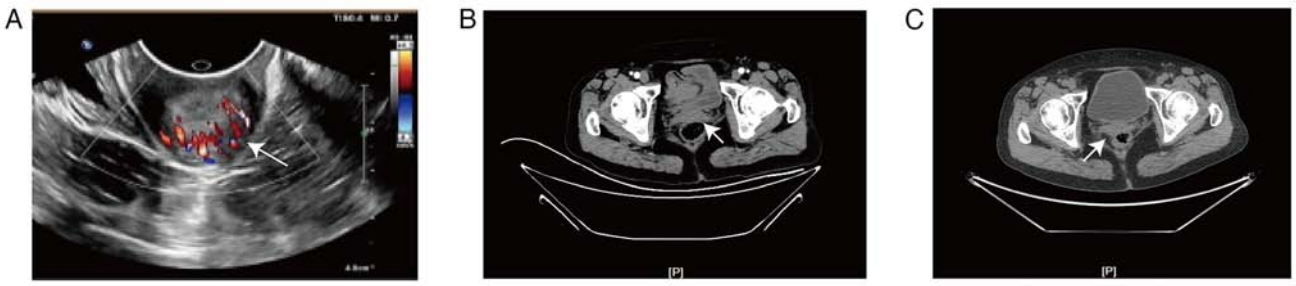

Figure 2. Preopreative imaging examination. (A) The ultrasound indicated blood flow signals visible in the cervical stump mass. (B) CT and (C) positron emission tomography-CT showed a mass in the cervical stump.

Discussion

PA is a rare postoperative complication that may be life-threatening if not diagnosed and treated properly. It is usually caused by a sudden ischemic or hemorrhagic infarction of a preexisting pituitary adenoma, while only pituitary apoplexy rarely occurs in normal pituitary glands. Bonicki *et al* (3) reported that PA occurs in 5% of patients with pituitary adenomas; however, >40% of PA cases have never been diagnosed with a pituitary tumor prior to onset (21). PA is related to a variety of inducible factors, but its exact pathogenesis remains elusive. Due to the specific features of the pituitary vascular system, pituitary tissue is more susceptible to hypoperfusion, ischemia and intraoperative embolism, particularly during pump-on surgery. During the literature review for the current study, it was found that predisposing factors of PA included not only transient hypertension or hypotension, but also diabetes, angiographic test, cardiac surgery, hemodialysis, pituitary dynamic function test, radiation therapy, positive pressure mechanical ventilation and anticoagulant therapy (22).

Table I. Hormone and ion levels of the patient at different stages.

Time-point	K^+, mmol/l	Na^+, mmol/l	FT3, pmol/l	FT4, pmol/l	TSH, μmol/l	ACTH-8:00 a.m., pg/ml	Cortisol-8:00 a.m., μg/dl	FSH, μIU/ml	LH, μIU/ml	Prolactin, ng/ml
Pre-operation	3.78	139	4	9.42	1.75	16.74	15.6	23.45	6.09	38.28
Between two operations	3.27↓	135↓	2.48	6.81↓	0.19↓	3.83↓	5.63↓	3.77↓	<0.2↓	1.13↓
Post-operation	3.24↓	137	<1.54↓	8.48↓	0.2↓	2.25↓	11.94	2.49↓	<0.2↓	1.57↓
6 weeks after the operation	4.49	141	3.24	12.22	0.9	11.9	10.11	2.41↓	0.62↓	3.75
Normal ranges	3.5-5.5	136-145	2.43-6.01	9.01-19.05	0.3-4.8	7.2-66.3	6.02-18.4	6.74-113.59	10.87-58.64	2.74-19.64

K^+, potassium ion; Na^+, sodium; FT3, free triiodothyronine; FT4, free thyroxine; TSH, thyroid stimulating hormone; ACTH, adrenocorticotropic hormone; FSH, follicle-stimulating hormone; LH, luteinizing hormone; ↓, decreased.

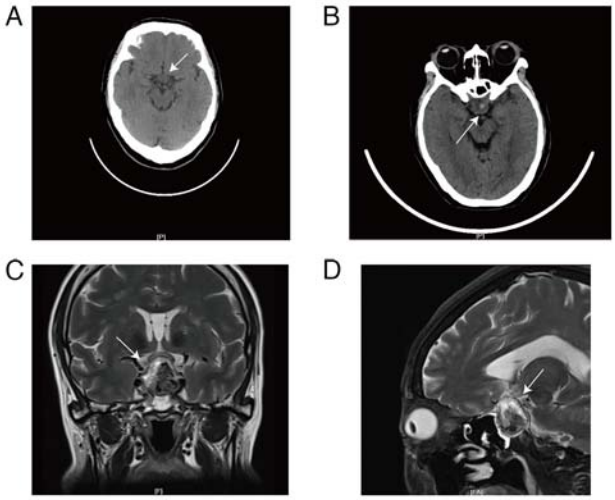

Figure 3. Imageological examination. (A) No obvious abnormalities were detected in the pituitary gland (arrow) on pre-operative positron emission tomography-CT scans. (B) Local density increase in the sella turcica and suprasellar regions (arrow) was observed in the transverse section on CT on POD4. (C and D) Contrast-enhanced sellar MRI showed a 2.4x1.7x2.6 cm-sized mixed signal (arrow) expanding from the sellar fossa and suprasellar region and compressing the optic chiasm in the (C) coronal and (D) sagittal section on POD4. POD4, postoperative day 4.

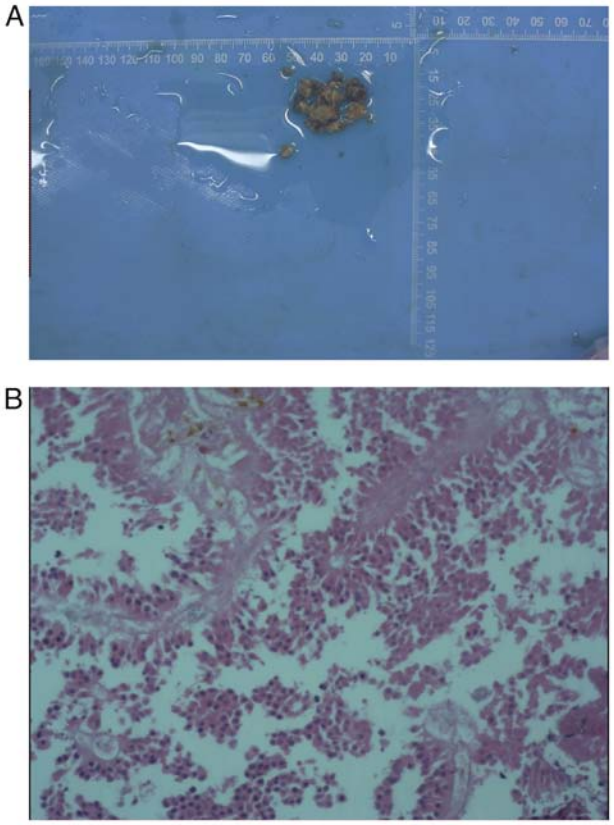

Figure 4. Postoperative paraffin pathology of pituitary tumor. (A) Gross observation: A clump of fragmented tissue measuring 3.5 cm, mostly greyish-white in color with some parts dark red. (B) Under the microscope: Massive hemorrhage and necrosis were observed and only tumor cell remnants were seen [stained for reticulin with kit no. G3535 from Solarbio Science and Technology (Beijing) Co., Ltd.; magnification, x200].

To the best of our knowledge, the present study was the first case report of PA after gynecological malignancy. Since the pre-operative PET-CT did not indicate any pituitary tumor, post-operative symptoms such as headache, visual field defect, ptosis and hypopituitarism were confused with common postoperative complications and PA was not detected in the initial stage. This may be for the following two primary reasons. First, PET-CT lacks specificity and sensitivity in the hypothalamic-pituitary region, potentially resulting in undetected pituitary microadenomas. Furthermore, the pituitary adenoma became enlarged due to hemorrhage post-surgery, thereby facilitating detection. However, headaches likely occurred due to extravasation of blood into the subarachnoid space, causing meningeal irritation (22). Bitemporal hemianopia is the most common type of visual field defect caused by a pituitary tumor, which occurs due to the PA pressing on the middle of the optic chiasma (14). Ptosis presented as a result of oculomotor nerve compression and hypopituitarism was a sign of pituitary dysfunction. Besides, severe hypoglycemia and hyponatremia may occur due to a reduced glucocorticoid effect because of low cortisol response, as well as water overload caused by adrenocorticotropic hormone deficiency.

A total of four primary factors contributing to the occurrence of PA were identified for the present case. First, general anesthesia carries a greater risk of low BP than local anesthesia. General anesthesia may also lead to reduced cerebral perfusion. Second, surgery can cause intravascular fluid to spread into the interstitial space, leading to edema and a drop in BP. Third, blood loss may also be a contributing factor. Although only 100 ml of blood loss was stated in the surgical record, the patient underwent a major resection and lymph node dissection with postoperative nausea and vomiting, which indicated the possibility of local bleeding after abdominal closure and blood loss may be difficult to estimate accurately. Fourth, anticoagulant therapy is another risk factor, as it increases the risk of bleeding from damaged pituitary tissue.

PA can also occur in various types of surgery, particularly in surgery of the circulatory system. A literature search was conducted through PubMed, using 'pituitary apoplexy' and 'surgery or operation' as key terms to identify relevant articles published between 1984 and 2023. The search was limited to articles in English and only studies with sufficient information were included in the literature review (Table II). Based on the literature review, PA after surgery mostly occurred in males (76%), with an average age of 53 years for women and 68 years for men. Only 8% of cases had known pituitary disease (23,24). Clinical symptoms usually occur on the operation day or on POD1 (72%) and headache (76%) was the main and the earliest complaint in most cases. This symptom was possibly triggered by dural stretching and meningeal irritation caused by extravasation of blood and necrotic tissue into the subarachnoid space (25). Further examination of the literature indicated that visual disturbances were mentioned in 64% (visual deterioration in 24%, diplopia in 24%, visual defects in 20% and loss of light reflex in 20%), which was caused by pressure on different parts of the optic nerve and oculomotor nerve involvement may present as ptosis (44%). In addition, adrenal insufficiency may reduce the level and the efficiency of glucocorticoids and eventually cause arterial hypotension and/or hypoglycemia, as well as varying degrees of consciousness change, which was noted in 12% of cases in the present review.

The diagnosis of PA is based on imaging evaluation, mainly by MRI, which is more sensitive than CT. Pituitary MRI is the radiological examination of choice (26). It can identify areas of bleeding and necrosis and determine the relationship between the tumor and neighboring structures, such as the optic chiasm, cavernous sinuses and hypothalamus (27). However, CT is also an examination that cannot be ignored, which can exclude headaches caused by subarachnoid hemorrhage and make a tentative diagnosis of intrasellar mass in most cases (28). In the present review, 80% of cases were detected by CT and 80% by MRI.

Endocrine deficiencies can exist at the onset and urgent evaluation of hormonal levels is suggested. According to the latest guidelines from Oxford and Royal College of Physicians (29), empirical hormonal replacement is indicated in each patient with secondary adrenal insufficiency no matter whether to perform a surgery or not. Applying hydrocortisone 100-200 mg intravenously and then applying either continuous intravenous infusion 2-4 mg/h or intramuscular injection 50-100 mg/6 h are suggested. Reviewing the series of patients with PA, 84% of cases received hormonal replacement therapy regardless of whether surgery was performed, while 72% of cases ended up receiving neurosurgical intervention. Applying exogenous hormones alone has certain inherent imperfections, as different hormones can influence the regulation of each other to a certain extent (30). The indications for surgery following hormonal replacement are as follows: i) Evidence of worsening or persistent neurological symptoms, such as visual impairment and ophthalmoplegia (paralysis or weakness of the eye muscles); ii) altered mental state; iii) patient is stable (no progressive deterioration in visual or mental state) and shows improvement with conservative treatment (26). Most cases (84%) achieved partial or complete remission in the visual field and ophthalmoplegia after prompt treatment. However, most studies demonstrate that surgical treatment, usually within 7 days of the event, leads to a higher rate of recovery from visual impairment (31). Nevertheless, certain retrospective studies confirm that there is no significant difference in the recovery of vision and endocrine function between patients with pituitary tumors treated conservatively and those undergoing surgical decompression (32,33). Currently, there is a lack of high-level evidence-based medical evidence for choosing a treatment approach. The UK guidelines for the management of pituitary tumor apoplexy recommend that the treatment plan should be determined through multidisciplinary collaboration, considering emergency surgical treatment based on the patient's pituitary apoplexy score evaluation (9).

A limitation of this study was the omission of ophthalmic assessment figures. These results were not included in our hospital's electronic medical records. Consequently, only copies of photographs of these results are available. Additionally, paper reports were not preserved, precluding the possibility of scanning them for enhanced clarity.

In conclusion, this review emphasized that even as an uncommon postoperative complication, PA is potentially life-threatening. It may occur in postoperative patients either with diagnosed or undiagnosed prior pituitary adenoma. Early diagnosis is essential for the timely treatment of hypopituitarism and prevention of serious neurological complications. In short, the wise surgeon should: i) Recognize PA after surgery in a timely manner by obtaining early neuroimaging tests and pituitary-related hormone tests and remember MRI is more sensitive than CT in observing early changes of hemorrhage or infarction. ii) Take initial action, such as applying intravenous glucocorticoids and mannitol. Transsphenoidal surgery should be considered and performed at the early stage of PA, if possible, to achieve better recovery. iii) If vision and the visual field are not affected, or vision defects are stable or temporary, hormonal replacement therapy alone may be considered, which is more appropriate for patients with surgical contraindications and may also spare patients from unnecessary surgery.

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Table II. Summary of information on PA cases during and after surgery from the literature review and the present case.

Authors, year	Age, years/sex	Prior lesion	Operation method	Clinical presentation	Onset time	Pituitary imaging MRI/CT	Potential risk factors	Treatment hormone replacement therapy	Surgery	Prognosis	(Refs.)
Mura *et al*, 2014	85/male	-	Laparoscopic colorectal resection	Left palpebral ptosis, anisocoria, divergent strabismus, mydriasis without photo-motor reflex	During the operation	CT: Pituitary gland increase; MRI: Pituitary gland increase with hematoma	Preoperative anticoagulant therapy, intraoperative BP fluctuation	Dexamethasone 4 mg x2/day	-	-	(34)
McClain *et al*, 2022	75/female	-	Elective rotator cuff repair	Headache, vomiting, diplopia, inability to open the right eye	POD1	CT: A large sellar mass; MRI: A sellar and suprasellar mass effect compressing the optic chiasm	History of essential hypertension	-	Urgent transsphenoidal endoscopic resection of the pituitary mass	Ptosis and ophthal-moplegia completely recovered and visual field deficits stabilized	(35)
Liberale *et al*, 2006	73/male	-	Subrenal aortic abdominal aneurysm repair by subcostal bilateral laparotomy	Diplopia, right palpebral ptosis, mydriasis, divergent strabism	On the operation day	MRI: A large sellar mass compressing back carotid arteries and the optical chiasma	Preoperative anticoagulant therapy	Cortisone acetate 50 mg/ morning and 25 mg/evening, sodique levothyroxin, 50 g/day	Transsphenoidal adenectomy	Partially recovered the right third oculomotor palsy and remained stable during the 4-year follow-up	(36)
Naito *et al*, 2019	14/female	-	Recurrent cardiac myxoma resection surgery	Headache and visual impairment	POD1	CT: A tumor surrounding the hypothalamopituitary lesion; MRI: An intra- and supra-sellar tumor compressing optic chiasma and bilateral optic nerves	Hemodynamic instability during surgery, use of anticoagulant	l-T4 treatment for 3 months	-	Improved visual field of both eyes before discharge	(37)
Hidiroglu *et al*, 2010	47/male	-	Coronary artery bypass grafting operation	Ptosis of both eyes, headache	POD2	CT: A solid mass compressing the optic chiasm	-	-	Transsphenoidal adenectomy	-	(38)

Table II. Continued.

Authors, year	Age, years/sex	Prior lesion	Operation method	Clinical presentation	Onset time	Pituitary imaging MRI/CT	Potential risk factors	Treatment hormone replacement therapy	Surgery	Prognosis	(Refs.)
Yakupoglu *et al*, 2010	74/male	-	Open three-vessel CABG and insertion of a saphenous vein graft	Right ophtha-lmoplegia with ptosis, right mydriasis, headache	6 h after the operation	CT: A mass on the pituitary gland; MRI: Pituitary macroadenoma with haemorrhage and infarction	Hemodynamic changes	Intravenous hydrocortisone 50 mg/day, oral levothyroxine 0.2 mg/day	Transcranial adenoma excision	Full recovery of ptosis, visual field deficits and mental changes within 2 weeks of surgery	(39)
Yoshino *et al*, 2014	78/male	-	Right upper and middle lobectomy and lymph node dissection	Headache, sudden increase in urine volume	POD6	MRI: A high-intensity area inside the pituitary gland	-	Hydrocortisone 200 mg/day	-	Complete recovery	(40)
Joo *et al*, 2018	73/male	-	Lumbar fusion surgery in prone position	Severe headache, ophthalmalgia and ptosis on right eye	POD2	CT and MRI: A mass in the sellar fossa and suprasellar region, compressing the optic chiasm	Intraoperative BP fluctuation	Hydrocortisone 300 mg/day	Transsphenoidal hypophysectomy	Improved ptosis and anisocoria	(41)
Goel *et al*, 2009	76/male	-	Elective left total hip athroplasty	Sudden headache, total left vision loss and temporal right hemianopia	POD1	CT: A mass in the left pituitary fossa; MRI: Intersellar mass with a suprasellar extension on the left side, compressing the optic chiasma and cavernous sinus	Transient episode of hypotension in the postoperative period	Dexamethasone 2 mg/6 h	Transnasal transphenoidal decompression of the pituitary tumor	Complete recovery	(42)
Goel *et al*, 2009	61/male	-	Elective left total knee athroplasty	Sudden headache, nausea, vomiting, right ptosis	POD1	CT: An intersellar tumor	Microembolism	High-dose dexamethasone intravenously	Craniotomy and decompression of pituitary adenoma	Complete recovery	(42)
Kim *et al*, 2015	69/male	-	Open heart mitral valvuloplasty	Severe headache, visual field defects, double vision	After the operation	MRI: A sellar mass with hemorrhage pituitary macroadenoma	Excessive anticoagulation, hemodynamic instability	High-dose steroids	Transsphenoidal resection of the tumor	Complete recovery	(43)

Table II. Continued.

Authors, year	Age, years/sex	Prior lesion	Operation method	Clinical presentation	Onset time	Pituitary imaging MRI/CT	Potential risk factors	Treatment hormone replacement therapy	Surgery	Prognosis	(Refs.)
Mizuno *et al*, 2011	73/male	-	Elective coronary artery bypass grafting	Right ptosis with completely dilated pupils, light reflex loss, headache	4 h after the surgery	CT and MRI: A large suprasellar mass with bleeding	Strong heparinization, BP fluctuation during CPB	-	Endonasal transsphenoidal resection of the pituitary gland	Complete recovery	(44)
Thurtell *et al*, 2008	79/male	-	Coronary artery bypass grafting	Blindness, no light perception, miosis	Following extubation	CT: A large pituitary mass; MRI: The mass extended into the suprasellar cistern and compressed the optic chiasm	Hemodilution, hypotension, anticoagulation	Intravenous dexamethasone sodium phosphate 8 mg	Transsphenoidal decompression	Remained blind with no light perception on follow-up	(45)
Thurtell *et al*, 2008	64/male	-	Coronary artery bypass grafting	Blindness, no light perception, miosis	Following extubation	CT: A large pituitary mass; MRI: The mass extended into the suprasellar cistern and compressed the optic chiasm	Hemodilution, hypotension, anticoagulation	Intravenous dexamethasone sodium phosphate 12 mg	Transsphenoidal decompression	Remained blind with no light perception on follow-up	(45)
Matsusaki *et al*, 2011	56/female	-	Living donor liver trans-plantation	Headache, thirst, frequent urination	POD10	CT: A high-density area in the pituitary gland; MRI: A suspicious area between the anterior and posterior of the pituitary gland	Intraoperative hypotension, coagulopathy, transient hypertension, dopamine agonist therapy	Prednisolone, 20 mg/days	-	Complete recovery	(46)
Telesca *et al*, 2009	70/male	-	Elective coronary bypass surgery	Headache, visual field defects, diplopia	Following extubation	CT and MRI: A sellar mass with suprasellar extension	-	High-dose steroids	-	Complete recovery	(47)
Fyrmpas *et al*, 2010	67/male	Non-secreting pituitary macro-adenoma	Bilateral endoscopic middle meatal antrostomy, ethmoidec-tomy and polypectomy	Reduced vision, diplopia, headache	POD2	CT and MRI: Haemorrhage within the pituitary tumor	Hypertension, diabetes, anticoagulation therapy, prolonged intraoperative hypotension	Corticosteroid replacement therapy	Microscopic endoscopic transsphenoidal resection	Regained vision and oculomotor nerve function partly	(23)

Table II. Continued.

Authors, year	Age, years/sex	Prior lesion	Operation method	Clinical presentation	Onset time	Pituitary imaging MRI/CT	Potential risk factors	Treatment hormone replacement therapy	Surgery	Prognosis	(Refs.)
Absalom *et al*, 1993	61/male	Non-secreting pituitary tumor	Coronary artery bypass grafting	Sudden onset of headache, nausea, vomiting	40 h after the surgery	CT: A 3-cm suprasellar mass with a large bleeding area in the pituitary	Preoperative anticoagulant therapy, sudden coronary revascularization	Mannitol 80 g and dexamethasone 10 mg iv	Craniotomy, de-compression of the optic nerves, intracapsular removal of pituitary tumor	Dead of acute myocardial infarction	(24)
Madhusudhan *et al*, 2011	62/male	-	Right total shoulder replacement	Bilateral frontal headaches, binocular diplopia, increased urinary output, confusion, drowsiness	POD5	CT: A low attenuation signal in the pituitary fossa; MRI: The pituitary stalk was markedly deviated to the right with an enhancing area in the pituitary fossa, suggesting an adenoma	Preoperative anticoagulant therapy, postoperative hypoperfusion	Hydrocortisone and thyroxine supplements, testosterone replacement therapy	-	Complete recovery	(48)
Cohen *et al*, 2004	50/female	-	Liposuction on abdomen, hips and thighs	Persistent headache, nausea, vomiting	After the surgery	MRI: An intrasellar and suprasellar mass extending into the right cavernous sinus	Large dose of local anesthetic, hypovolemia, fluid overload	-	Transsphenoidal resection of the pituitary mass	Complete recovery	(49)
Shapiro, 1990	60/female	-	Coronary artery bypass surgery	Headache, severe right ptosis, unresponsive pupil on the right side	POD1	CT: A right-sided sellar mass with extension into the sphenoid sinus; MRI: A pituitary tumor with surrounding hemorrhage	Reduced perfusion pressure during cardiopulmonary bypass, anticoagulant therapy	Hydrocortisone 50 mg every 6 h	Transsphenoidal surgery	Third nerve palsy persisted post-operatively	(50)
Tansel *et al*, 2010	60/male	-	Coronary artery bypass grafting	Unexplained episodes of hypotension, dysrhythmia, electrolyte imbalances, somnolence, agitation, respiratory distress, high fever	Following extubation	MRI: Pituitary infarction	Protamine hypersensitivity	Hydrocortisone, testosterone, thyroxin	-	In good condition except for a certain degree of visual disturbance	(51)

Table II. Continued.

Authors, year	Age, years/sex	Prior lesion	Operation method	Clinical presentation	Onset time	Pituitary imaging MRI/CT	Potential risk factors	Treatment hormone replacement therapy	Surgery	Prognosis	(Refs.)
Slavin and Budabin, 1984	57/male	-	Three-vessel coronary bypass surgery	Mild periorbital pain, unable to open right eye, headache	Awakening from anesthesia	CT: An intrasellar mass with right parasellar extension	Intraoperative or postoperative hypotension, anticoagulation, positive pressure ventilation	Corticosteroids	Transsphenoidal hypophysectomy	Complete recovery except for a mild visual field defect	(52)
Slavin and Budabin, 1984	55/male	-	Mitral valve replacement under cardio-pulmonary bypass	Bilateral blepharoptosis and partial oph-thalmoplegia on each side, bilateral confrontation visual fields disclosed nasal field defects	After the surgery	CT: An intrasellar mass with large radiolucent areas encroaching on the right cavernous sinus	Intraoperative or postoperative hypotension, anticoagulation, positive pressure ventilation	Corticosteroids	Transsphenoidal hypophysectomy	Complete recovery except for a mild right abduction defect	(52)
Present case, 2024	64/female	-	Extensive stump cervicectomy, pelvic lymph node dissection	Sudden onset of headache, drowsiness	POD1	CT: Multiple lacunar infarctions and local density increase in saddle and suprasellar region; MRI: The pituitary was enlarged and mixed signals were seen	Reduced cerebral perfusion, anticoagulant therapy	Hormone replacement therapy	Microscopic endoscopic transsphenoidal resection	Complete recovery except for a mild blurry vision	-

POD, post-operative day; BP, blood pressure; CPB, cardiopulmonary bypass.

Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

KL and XY conceived the study and revised the manuscript. CS made substantial contributions to the acquisition and analysis of the data and drafted the tables of the manuscript. LJ drafted the figures of the manuscript and interpreted the data. All authors read and approved the final manuscript. XY and KL checked and confirmed the authenticity of the raw data.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Competing interests

The authors declare that they have no competing interests.

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