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Surgical Management of a Collision Tumor: The Association of Intracranial Meningioma and Macroadenoma

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Abstract

Background: The simultaneous presence of a pituitary adenoma and a meningioma is a rare and underreported condition. The randomly encountered cases need to be reported to further allow our understanding of this collision tumors that are still not understood nor fully described. **Patients and Method:** We report a case of coexisting nonfunctioning pituitary adenoma and a left temporal lobe meningioma revealed by a 1-year history of progressive vision loss and occasional headaches in a 56-year-old woman. Her clinical condition worsened in the last 5 months with ptosis, cavernous sinus syndrome, and ophthalmoplegia of the right eye without papilledema. There was an improvement in the visual symptoms after subtotal resection of both lesions through a right frontotemporal craniotomy. Histology confirmed a collision tumor. The patient was referred for adjuvant treatment with gamma knife radiosurgery. He was doing well and back to his usual duties 6 months later. **Conclusion:** A gross total or subtotal resection with adjuvant therapy is the gold standard for the surgical management of collision tumors for a favorable patient outcome.

Keywords

Collision Tumors, Meningioma, Pituitary Adenoma

1. Introduction

A collision tumor is a rare disease in which two or more histologically distinct neoplasms are present in the same area without histological mixing or an inter-

vening cell population zone [1]. The incidence of multiple primary brain tumors with different histological types in the same patient is only 0.3% of all brain tumors or 10 cases/100,000 developing primary brain tumors [2] [3]. The simultaneous occurrence of several intracranial tumors is observed in phacomatosis, genetic syndromes, or after radiation exposure to the brain. The occurrence of several different intracranial tumors without these conditions is rather rare [4].

Nevertheless, there are fourteen reported cases showing an association between meningioma and pituitary adenoma, which had no history of radiation and/or trauma. Pathological examination usually demonstrated meningotheliomatous meningioma in the sphenoid ridge and sparsely granulated somatotroph adenoma in the pituitary fossa. Although GH-producing pituitary adenoma may stimulate adjacent dura and arachnoid cells resulting in the formation of meningioma, the possibility of coincidental occurrence of the two tumors cannot be ignored [5]. Progressive loss of vision with episodic headache was the main clinical presentation in patients with simultaneous pituitary adenoma and meningioma. Moreover, those symptoms have been described to subside following a gross total resection of the lesions [6].

Here, we report a case of cerebral collision tumors composed of 2 benign components tumors in a patient without a previous history of irradiation. This rare entity deserves serious consideration in terms of pathogenetic association, imaging, and pathological diagnosis, as well as surgical indication and approach.

2. Case Presentation

Patient information: A 56-year-old woman was admitted to our department for sudden right eye ptosis with persistent headache. She denies seizure and motor-sensory palsy. The patient reported chronic headaches with a progressive decrease in visual acuity for the past five months. Her past medical history was unremarkable.

Clinical findings: At the admission, the patient was in good general status, Glasgow Coma Scale was 15/15 with right eye ptosis, Right Eye 3/10, and Left Eye 7/10.

Diagnostic assessment: Cerebral MRI shows an extra-axial lesion centered on the cavernous lodge and encompassing the internal carotid artery. The lesion was isointense in T1-Weighted imaging, slightly hyperintense in T2-Weighted imaging, and intensively enhanced after injection of gadolinium. This process has a broad base of implantation, with mass effect on the right temporal lobe medially, fills the right cerebellar pontic angle and optochiasmatic cistern, and extends anteriorly to the right orbital cleft (**Figure 1(a)**). The MRI shows a second lesion slightly hidden by the first, located at the left-lateralized suprasellar and seems to be inserted from the sellar origin. The lesion was isointense in T1-Weighted imaging, slightly hyperintense in T2-Weighted imaging, and less intensely enhanced than the first lesion (**Figure 1(b)**).

Therapeutic intervention: The patient has undergone surgery. Simpson IV

type of excision was done after a pterional approach. This refers to a partial removal of the lesion, leaving an intradural tumor in situ. We found a huge fibrous and whitish lesion that was adherent to the skull base with a mass effect on the optic nerve and the content of the superior orbital fissure. After resection of this first lesion, a second one appears in between the optic nerves, in front of the chiasma, and originating from the sellar. This lesion has a different aspect compared to the previous one, and we were able to empty it by getting through its capsule. The lateral-superior extension of this lesion allows us to classify it as KNOP4. Partial gross resection of the lesion was done with the materials of both lesions sent to the Laboratory for analysis.

The immunohistochemistry (Figure 2) revealed two different tumors, cell type WHO grade 1 fibroblastic meningioma, and the other was a non-functioning pituitary adenoma with positive immunohistochemical staining for GH.

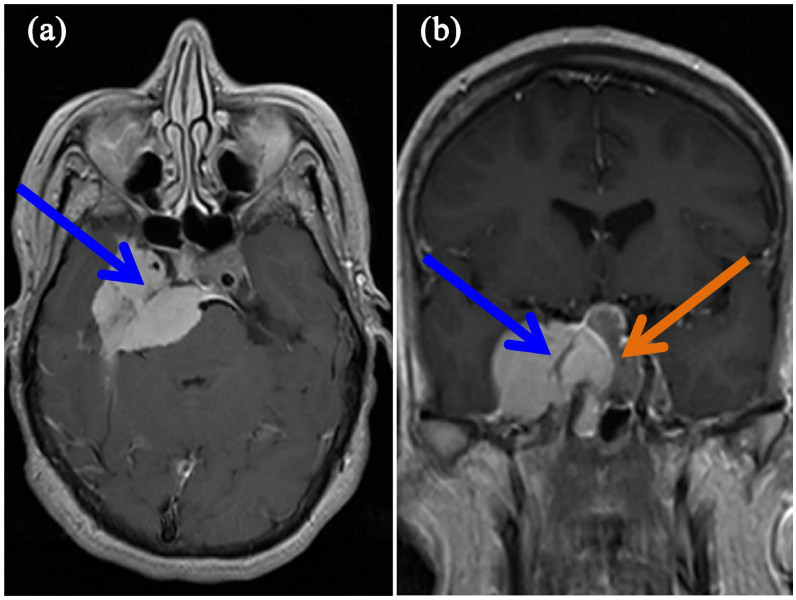

Figure 1. Cerebral MRI T1 axial with Gado (a), coronal slice (b) showing an extra-axial right temporal lesion—Meningioma (Blue arrow) extending to the cavernous lodge, with tissue signal, isointense in T1, intensified intensely after injection and a 2nd juxtaposed to a sellar-suprasellar seat lateralized to the left—Pituitary Adenoma (Red arrow).

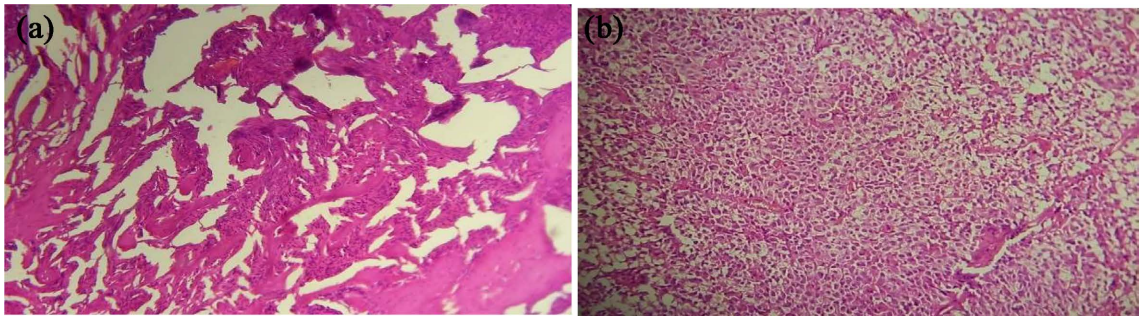

Figure 2. (a) Photomicrograph showing meningothelial proliferation arranged in short bundles within abundant fibrous stroma. HE 10× fibroblastic meningioma; (b) Photomicrograph showing a tumor proliferation of endocrine architecture in nests in a small stroma finely vascularized. HE 10× Pituitary Adenoma.

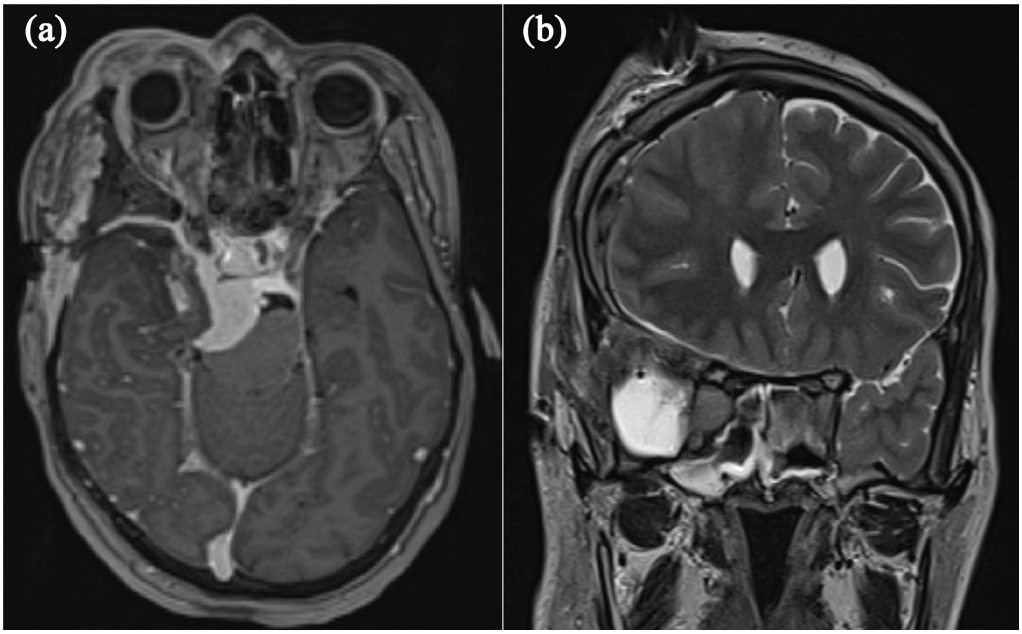

Figure 3. Postoperative cerebral MRI axial (a), coronal slice (b) revealed a remnant of the tumor, a right caverno-petrol-clival meningioma with postoperative changes.

Follow-up and Outcome:

The patient was discharged after simultaneous resection of the pituitary adenoma and pterional meningioma without a neurologic deficit. The patient was referred for adjuvant treatment with gamma knife radiosurgery. A post-op MRI **Figure 3** revealed a right caverno-petrol-clival meningioma with postoperative remodeling. An intra- and supra-sellar macroadenoma invading the cavernous cavity. The patient was doing well and back to his usual duties 6 months later.

3. Discussion

Pituitary adenomas (PAs) and meningiomas are two types of common benign tumors in the central nervous system (CNS) [6]. PA is a relatively common benign tumor (1 to 8 cases per 100,000 population) arising from the anterior pituitary gland, accounting for 10% - 15% [7] [8]. The former of all intracranial tumors, which account for 90% of sellar lesions, have their highest incidence in the third and fourth decades of life [9] [10]. **Table 1** reviews the few reported cases and found a female predominance of 78.5% (11/14) with a mean age of 57.3 ± 10.6.

Meningiomas are generally slow-growing tumors that arise from the arachnoid membrane surrounding the central nervous system and are among the most common intracranial tumors, with an overall incidence of 6 per 100,000 and a frequency of 2:1 in women compared to men [7] [19] [20]. Most case reports involve a pituitary adenoma coexisting with neoplastic, adenomatous, congenital, vascular, or inflammatory sellar lesions [14] [21]. Meningiomas can potentially be associated with numerous other lesions in the brain and are the tumor type most commonly found among several intracranial tumors of different

Table 1. Meningiomas located far away from pituitary adenoma (collision tumors) reported cases in the literature.

No.	AUTHOR	YEARS	AGE	SEX	PA	LOCATION OF MENINGIOMA	TREATMENT
01	Hyodo A.*et al.* [11]	1982	52	F	GHPA	Parietal convexity	NA
02	Irsy *et al.* [12]	1985	59	F	GHPA	centroparietal	Twice
03	Honegger J. *et al.* [13]	1989	37	F	Prolactinoma	Temporal convexity	Frontotemporal craniotomy
04	Honegger J. *et al.* [13]		74	M	NFPA	Parietal convexity	
05	Honegger J. *et al.* [13]		49	F	GHPA	Parasagital falx	
06	Uno *et al.* [14]	1991	70	F	GHPA	Sphenoidal ridge	Left temporal craniotomy
07	Mathuriya SN *et al.* [10]	2000	58	F	GHPA	Parasagittal	Right frontal craniotomy
08	Curto *et al.* [6]	2007	61	F	GHPA	Right frontal convexity Anevry intracaverneux	NA
09	Da costa *et al.* [15]	2007	45	M	Prolactinoma	4th ventricule	NA
10	Furtado *et al.* [16]	2010	53	M	NFPA	Parasagittal	NA
11	BenNsir A.*et al.* [3]	2017	61	F	NFPA	Foramen magnum	Lateral suboccipital approch, TSS, right pterional approch
12	Kumaria *et al.* [17]	2017	46	F	GHPA	Bilateral Meningioma	craniotomy of the right convexity meningioma +Left sided craniotomy + transsphenoidal PA
13	Wu Ruhong *et al.* [18]	2020	73	F	NFPA recurrent	Temporal convexity	Right-sided craniotomy PA + left frontotemporal craniotomy
14	Gosal JS.*et al.* [8]	2020	65	F	NFPA	Frontal convexity	both lesions simultaneously left frontal craniotomy for meningioma + subfrontal approach for PA
	Our Case	2022	56	F	NFPA	Temporal	Pterional approch

F= female, M = male, PA = Pituitary Adenoma, NFPA = Non Functioning Pituitary Adenoma, GH-PA = Growth Hormone secreting Pituitary Adenoma, NA = Not Available, TSS = Transsphenoidal Approach.

histology. This is due to both their frequent incidental occurrence, even as isolated intracranial tumors, and their long clinical evolution until diagnosis. Therefore, there is an increased likelihood that they simultaneously harbor another primary or secondary intracranial tumor [22] [23]. Besides meningioma, the most commonly reported tumor is neurofibroma in Von Reckling-Hausendisease, followed by glioma [24].

Nevertheless, the coexistence of PA and meningioma is an extremely rare clinical scenario with no previously known risk factors for either tumor [2]. They are rare and are located in close proximity to the sella, suprasellar and sphenoid ridge [14]. Pituitary adenomas clinically manifest by mass effect on neighboring structures due to tumor size and whether they are functional (the

cell of origin will be responsible for the affected hormone) or non-functional [22]. Both lesions can reach a large size and cause similar signs and symptoms, making difficult the diagnosis and treatment of this collision tumor [3]. Therefore, clinical awareness and recognition of such a rare disease before surgery is of great importance when surgical excision is required.

Our case is unique not only because of the location of the meningioma; It is also the first time that the two lesions were symptomatic at the same time. If a meningioma or pituitary adenoma becomes symptomatic, it is possible that a meningioma or pituitary adenoma may be discovered incidentally on MRI. Since meningiomas can become symptomatic due to chiasma compression, this could explain the higher prevalence of detected co-occurrence of these meningiomas with pituitary adenomas. It can be expected that with advances in the quality of medical imaging, the occurrence of two adjacent tumors mimicking one tumor will decrease.

However, due to their similar imaging properties, a pre-operative differential diagnosis of a collision tumor composed of both pituitary adenoma and meningioma is not possible with MRI. Therefore, a definitive diagnosis will require a postoperative pathological examination of the surgically excised material. Using imaging studies, different densities were observed in both lesions, which were later confirmed by histopathology and immunohistochemistry [24]. The coexistence of a pituitary adenoma and a meningioma in the same patient presented a surgical and treatment challenge. In most previously reported cases, the coexisting pituitary adenoma and the intracranial meningioma were treated independently, typically treating the pituitary adenoma with a transsphenoidal approach the meningioma was treated separately with conservative measures or another surgical approach. If the pituitary adenoma and meningioma are adjacent to each other, they can be removed in a one-stage operation via a single pterional approach or an endoscopically extended endonasal approach [14] [23]. Therefore, adequate knowledge of the coexisting pituitary adenoma and meningioma is a very important prerequisite for planning the appropriate surgical approach and avoiding serious surgical complications. In this case, we were able to resect the pituitary adenoma and the meningioma simultaneously. Ultimately, the patient was discharged without any significant neurological deficits.

4. Conclusion

The coexistence of a pituitary adenoma and a temporal lobe meningioma is a very rare surgical entity and the diagnosis represents a therapeutic challenge. In this case, we used a single pterional approach for both tumor removal. The results prove that the treatment is feasible. However, due to the high risk of intraoperative bleeding and its invasiveness into adjacent neurovascular structures, it should only be performed by experienced neurosurgeons. The etiology of coexisting pituitary adenoma and intracranial meningioma is unknown, and more cases and additional studies are needed to explain such unusual findings.

Ethics Approval and Consent to Participate

Informed consent was obtained from the patient prior to the submission of this article. Also, this article respects both the Consensus-based Clinical Case Reporting Guideline and the Recommendations for the Conducting, Reporting, Editing, and Publication of Scholarly Work in Medical Journals.

Consent for Publication

Informed consent was obtained from the patient to publish his case.

Availability of Data and Material

All data generated or analyzed during this study are included in this published article.

Authors' Contributions

SA: Conceptualization, writing draft, reviewing and editing, visualization, supervision, validation, methodology. **YCHD:** Conceptualization, writing draft, reviewing and editing, visualization, supervision, validation, methodology. **TJ:** Writing, review & editing, **MB:** Writing, review & editing, **NC:** Writing, review & editing. **HEO:** Writing & editing, **AEO:** Supervision, Validation, & review.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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