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Case Report

A pituitary gland squeezed upward by intrasellar kissing carotid arteries: Mimicking a pituitary microadenoma

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ABSTRACT

Background: Intrasellar kissing carotid arteries are a rare variant in which bilateral internal carotid arteries run very near each other at their cavernous sinus portion. We encountered a woman with the pituitary gland mimicking a pituitary microadenoma because the pituitary gland was compressed bilaterally by intrasellar kissing carotid arteries.

Case Description: A 61-year-old woman with a chronic headache underwent magnetic resonance imaging, which revealed a sellar mass measuring 10.2 mm in height, 8.2 mm in length, and 4.0 mm in width at the mid-intercarotid level. Blood levels of all pituitary and target-organ hormones were within normal range. The height and superior convex shape of the sellar mass suggested that it was a nonfunctioning microadenoma, which was monitored over the past 16 years. A recent three-dimensional reconstruction of magnetic resonance angiography clearly showed that the pituitary gland was squeezed upward, compressed bilaterally, and extended superiorly by intrasellar kissing carotid arteries.

Conclusion: The pituitary gland can be squeezed upward by intrasellar kissing carotid arteries and mimic pituitary tumor.

Keywords: Intrasellar kissing carotid arteries, Pituitary gland, Pituitary microadenoma, Pituitary tumor

INTRODUCTION

In general, the size of human pituitary glands typically increases during childhood and adolescence, reaching its peak in the second or third decade of life.[6,8,11,12,20,22-25] The upper surface of the pituitary gland often becomes a convex shape during this period, particularly in women.[8,12,14,20,21] Then, its height gradually decreases as the upper surface changes from convex to flat or concave.[6,8,11,12,20-22,24] The maximum pituitary height in healthy men and postmenopausal women is reported to be 8 mm.[8] Therefore, the abnormal height and convex superior surface of the pituitary gland may lead to the suspicion of insidious pituitary lesions, including pituitary microadenoma.[5] On the other hand, bilateral carotid arteries often show a tortuous course and occasionally run very near each other at their cavernous sinus portion, a condition known as "intrasellar kissing carotid arteries."[1,9,10,15] Inadvertent dural incision on it during transsphenoidal surgery may cause disastrous bleeding.[13]

We hereby report a postmenopausal woman with a pituitary gland of 10.2 mm in height with a convex superior surface, which was accompanied by intrasellar kissing carotid arteries. The case has been followed for 16 years under the suspicion of micro-non-functioning pituitary adenoma.

CASE DESCRIPTION

A 61-year-old woman with a chronic headache underwent magnetic resonance imaging (MRI), which suggested the presence of a sellar mass. The mass showed an intensity similar to that of cerebral gray matter on both T1-weighted (T1W) and T2-weighted MRI [Figures 1a-c]. The posterior pituitary lobe, which appeared bright on T1W-MRI, is located behind the mass [Figures 1a and b]. The mass had a diameter of 10.2 mm in height and 8.2 mm in length. The width at the mid-intercarotid level was calculated to be 4.0 mm, considering the wall thickness of the internal carotid arteries. Gadolinium injection homogeneously enhanced the mass [Figures 1d-f]. Blood levels of all hormones of the pituitary and its target organs, including prolactin, were within normal range. The somatomedin-C level was 150 ng/mL; the standard deviation value based on age/sex-matched normal population was +0.9, which was also within the normal range.

Young neurosurgeons initially in charge of this patient suggested the mass to be the pituitary gland harboring nonfunctioning pituitary microadenoma due to the height and convex upper surface.

The patient was initially followed up annually and later every few years. However, recent MRI studies using 3T-machine (SIGNA, GE Healthcare, US) revealed that the mass remained unchanged over the 16 years [Figure 2]. It also showed bilateral tortuous internal carotid arteries ran very close to each other, so-called intrasellar kissing carotid arteries, at their cavernous portion.

Three-dimensional (3D) reconstruction of magnetic resonance angiography showed that the kissing carotid arteries at the sella turcica were squeezing the pituitary gland [Figure 3] upward. The volume of the anterior pituitary lobe, calculated using the 3D volume analyzer Synapse Vincent (Fujifilm, Tokyo, Japan), was 0.397 mL, which fell within the normal range for age- and sex-matched healthy populations. This finding rules out the possibility of a pituitary microadenoma existing in the pituitary gland. The homogeneous enhancement pattern without relative hypo-intensity area of the pituitary gland in the gadolinium-enhanced MRI study performed 16 years ago reinforces our assertion.

DISCUSSION

In this case, the height of the pituitary gland was 10.2 mm at the time of initial MRI. Table 1 shows the reported size of the pituitary gland in females aged 50 and over. Mean heights ranged from 4.4 to 6.7 mm. The maximum height is reported to be 7.8–8 mm, which is less than that

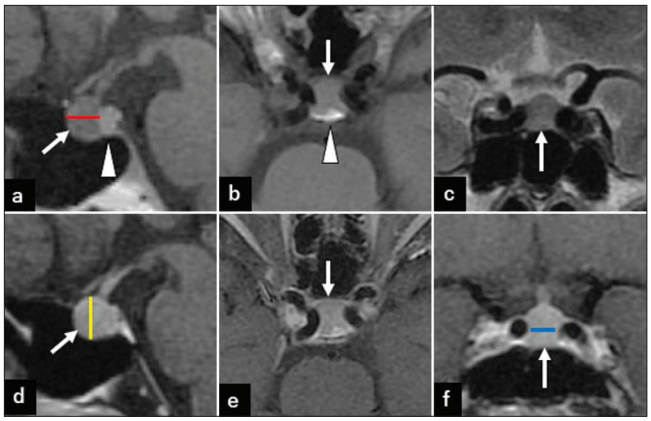

Figure 1: Magnetic resonance imaging of the pituitary mass at 61 years old. (a) T1-weighted (W) sagittal image. (b) T1W axial image. (c) T2W coronal image. (d) Gadolinium-enhanced (GE) sagittal image. (e) GE axial image. (f) GE coronal image. Red bar in 1a: Antero-posterior diameter, Yellow bar in 1d: Height, Blue bar: Transverse diameter at mid-intercarotid level. A pituitary mass (arrow, in a-c) with similar intensity to the brain parenchyma existed in front of the posterior pituitary lobe (arrowhead in a and b). The gadolinium moderately and diffusely enhanced the pituitary mass (arrow, in d-f).

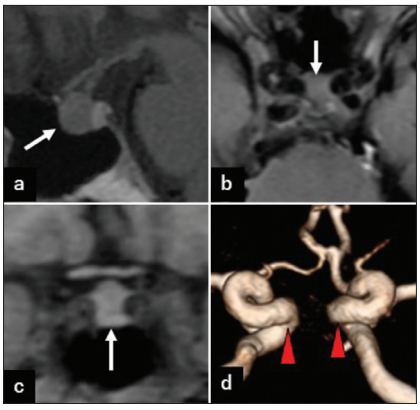

Figure 2: Magnetic resonance imaging of the pituitary mass at 77 years old. (a) T1-weighted (W) sagittal image. (b) T1W axial image. (c) T1W coronal image. (d) Three-dimensional reconstruction of time-of-flight magnetic resonance angiography. The size of the pituitary mass (arrow) did not change compared to 16 years before (a-c). Bilateral tortuous internal carotid arteries (red arrowheads) are running very near to each other (d).

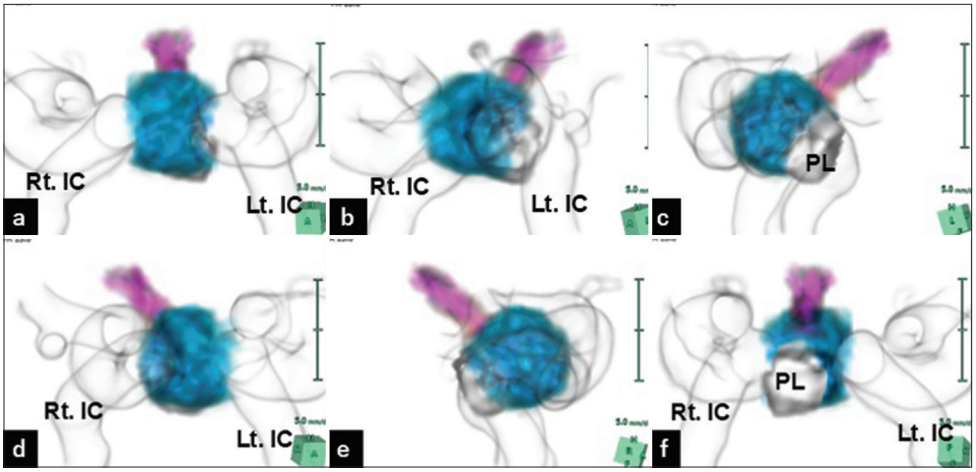

Figure 3: Magnetic resonance imaging-based three-dimensional reconstruction images of the pituitary gland and bilateral internal carotid arteries (IC). (a) Anteroposterior view, (b) left anterior oblique view, (c) left-right view, (d) right anterior oblique view, (e) right-left view, and (f) posteroanterior view. Blue: Anterior pituitary gland, Pink: Pituitary stalk, PL: Posterior pituitary lobe, Bar: 10 mm. Anterior pituitary gland is compressed by the "intrasellar kissing carotid arteries" and squeezed upward.

Table 1: Height and volume of the pituitary gland on magnetic resonance imaging (MRI) in elderly female.

Author	Ref.	Year	Country	Age	Number	Mean height (mm)	SD (mm)	Maximum height (mm)	Mean volume (mm³)	SD (mm³)
Suzuki	[23]	1990	Japan	60-69	18	4.9	1.6	7.8	ND	ND
Sato	[20]	1991	Japan	60-69	14	4.6 #	1.0 #	ND	ND	ND
Doraiswamy	[7]	1992	USA	60-69	8	5.7	1.7	ND	ND	ND
Tsunoda	[24]	1997	Japan	60-69	137	4.88	1.07	ND	ND	ND
Denk	[6]	1999	Turkey	61-	9	5.0	0.4	8	ND	ND
Kato	[12]	2002	Japan	60-69	ND	4.4 #	1.5 #	ND	ND	ND
Yadav	[25]	2017	India	51-	ND	6.7	1.9	ND	420	174
Singh	[22]	2018	India	50-	35	5.27	1.14	8	344.81	99.87
Berntsen	[2]	2021	Norway	60-66	213	4.85	1.64	ND	489	135
Shajil	[21]	2024	India	61-	ND	4.90	1.05	ND	245.01	61.07

Ref.: Reference number, SD: Standard deviation, #: Suspected based on figures, ND: Not described

observed in our case.[6,22,23] The convex shape of the upper pituitary surface is generally seen in young females aged 10–19 years old, and it becomes flat or concave later.[12,20] Sato found that only 12.1% of healthy females aged 50 or over have a convex upper pituitary surface.[20] According to Kato *et al.*'s report, the incidence in this age group was around 15%.[12] Therefore, the initial speculation by the young neurosurgeons in their training course that the patient might have a microadenoma cannot be dismissed as irrelevant, given the pituitary's abnormal height and convex upper surface.

On the other hand, the average volume of the pituitary gland in females older than 50 is reported to range from 245.1 to 489 mm³ [Table 1]. The volume, in our case, 397 mm³, appears to be within normal range.

How to explain the discrepancy between the abnormal height and convex pituitary surface and the normal volume of the pituitary gland? Reported mean intercarotid distances at the sellar region varied considerably, from 11.4 to 17.1 mm, due to the differences in research subjects, which include cadavers, autopsy specimens, and neuroimaging of healthy adults, as well as variations in measuring methods [Table 2].

However, the distance can sometimes become very narrow, 4 mm or less, due to the tortuous course of the internal carotid arteries, intrasellar kissing carotid arteries. In Renn and Rhoton's cadaveric study, the narrowest distance was 4 mm in 10% of 40 cadavers.[17] In Newman *et al.*'s MRI study, the narrowest distance was 4 mm in 1.3% of healthy adults.[15] In rare cases, pituitary glands were reported to be compressed bilaterally by these kissing carotid arteries,[1,10,18,19] causing

Table 2: The reported intercarotid distance at the sellar region.

Author	Ref.	Year	Country	Number	Subjects of study	Mean (mm)	SD (mm)	Minimum (mm)	Maximum (mm)
Bergland *et al.*	[1]	1968	USA	225	Autopsy specimens	14	ND	4	23
Renn and Rhoton	[17]	1975	USA	40	Cadavers	12	ND	4 (in 10%)	18
Fujii *et al.*	[9]	1979	USA	25	Cadavers	17.0	ND	8.0	24
Yilmazlar *et al.*	[26]	2008	Turkey	49	Cadavers	17.1	4.0	ND	ND
				22	MRI on healthy adults	15.4	1.8	ND	ND
Gupta	[10]	2009	India	26	Cadavers	13.71	ND	8.66	16.73
Zada *et al.*	[27]	2011	USA	100	MRI on healthy adults	16.2	ND	7.4	25.5
Cebula *et al.*	[4]	2014	USA	20	Cadavers	12.15	7.3	3	19
Newman *et al.*	[15]	2020	Australia	151	MRI on healthy adults	11.4	0.2 (SEM)	4.7	17.2
								4[#] (in 1.3%)	

Ref.: reference number, MRI: magnetic resonance imaging, [#]Supposition considering the thickness of the carotid artery wall, SD: Standard deviation, SEM: Standard error of the mean, ND: Not described

hypopituitarism.[18,19] Pereira Filho Ade *et al.*, reported an extreme case with intrasellar kissing carotid arteries, pushing the pituitary gland upward.[16] However, the height and contour of the pituitary gland remained normal.

In this case, a recent follow-up MRI clearly showed that the pituitary gland was bilaterally compressed by intrasellar kissing carotid arteries. Perhaps a large opening of diaphragma sellae, as observed in 40% of cadaveric specimens,[3] may have allowed the pituitary gland to extend upward without impairing pituitary function, resulting in the height >10 mm and the convex upper surface. This explains the discrepancy between the abnormally high pituitary gland with a convex superior surface and normal volume. Physicians interpreting pituitary MRIs should verify the absence of intrasellar kissing carotid arteries before diagnosing a pituitary microadenoma based on the height and shape of the pituitary gland.

CONCLUSION

The authors presented an elderly woman with intrasellar kissing carotid arteries who was suspected of having a pituitary microadenoma based on the height and shape of the pituitary gland on MRI. However, over 16 years, the lesion has not grown. We finally concluded that this is the normal pituitary gland, which is squeezed upward by the kissing carotid arteries.

Ethical approval

The Institutional Review Board has waived the ethical approval for this study.

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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