Spontaneous Regression of Pineal Lesions: Ghost Tumor or Pineal Apoplexy?

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BACKGROUND: **Pineal apoplexy (either hemorrhagic or ischemic) may complicate the course of a tumor at this site. This event usually is characterized by an acute clinical onset and requires emergency surgical management whereas the regression of the lesion is a much rarer outcome.**

MATERIAL AND METHODS: **Three cases of pineal vanishing tumors in the pediatric population are reported and the pertinent literature is reviewed.**

RESULTS: **In one case, radiologic findings were consistent with a diagnosis of pineal cyst, which became symptomatic after a spontaneous hemorrhage. This event may also explain its regression after the treatment of associated hydrocephalus. In the remaining 2 cases, neuroimaging examinations disclosed a solid tumor. One of them regressed after a surgical biopsy, probably because of an ischemic evolution, whereas the last one disappeared without any medical or surgical manipulation. Neither hemorrhage nor ischemia were noticed, thus the mechanism of regression remains controversial.**

CONCLUSIONS: **Vanishing tumors of the pineal region may occur in different circumstances, resulting from absence of any medical and surgical action to minor manipulation of the tumor to obtain a biopsy. This variety may reflect different underlying mechanisms, leading to hemorrhagic or ischemic change of the tumor and its subsequent regression, although radiological imaging may fail to document hemorrhage or ischemia.**

INTRODUCTION

A vanishing tumor may be defined as a space-occupying lesion that shows radiologic features consistent with tumor but that unexpectedly disappears or shrinks down during the radiologic follow-up, thereby behaving like a "ghost."[1] Only few cases are reported in the literature, although their incidence, which has been estimated at approximately 1%,[2] is greater in the clinical practice. Physiopathologic explanation of this phenomenon is still controversial, although clinical and therapeutic implications are strikingly important. In the pineal region, the occurrence of apoplexy may play a pivotal role. Herein, we report on 3 different cases of pineal lesions that regressed spontaneously, prompting us to review and discuss the main hypotheses reported by the pertinent literature to explain this event at this particular site.

ILLUSTRATIVE CASES

Case 1

This 15-year-old girl, who has been complaining of diplopia and photophobia for 3 months, finally presented at our institution with acute onset of intense headache, vomiting, and dizziness. An emergency computed tomography (CT) scan showed obstructive triventricular hydrocephalus secondary to a pineal mass, which appeared as a tumor at the follow-up magnetic resonance imaging (MRI; Figure 1A–B). Blood and cerebrospinal fluid markers of germinal tumors were negative; however, lymphoid elements (97% CD3+ T cells, 3% CD20+ B cells) were detected. Surgery was scheduled, but the patient's clinical symptoms disappeared progressively in the meantime, without steroid or antiedema therapy or any treatments for hydrocephalus. Brain MRI performed after 1 month showed the spontaneous regression of the tumor and the resolution of the

Key words
- Ghost tumor
- Pineal apoplexy
- Pineal cyst
- Pineal gland
- Pineal gland degeneration
- Vanishing tumor

Abbreviations and Acronyms
CT: Computed tomography
MRI: Magnetic resonance imaging

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Citation: World Neurosurg. (2016) 88:64-69.
http://dx.doi.org/10.1016/j.wneu.2015.12.080

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

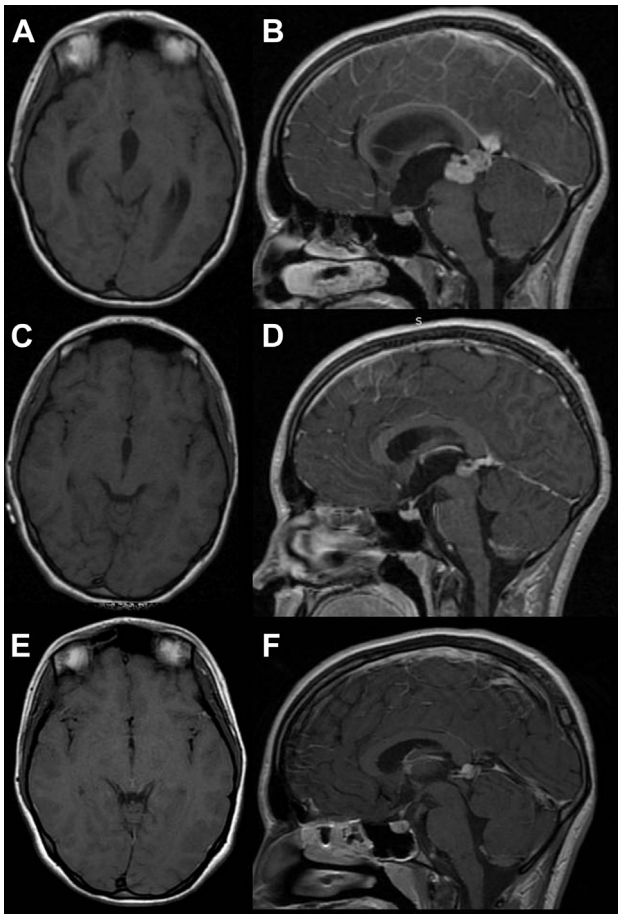

Figure 1. Case 1. Axial and sagittal T1-weighted images magnetic resonance imaging (MRI), respectively, before and after gadolinium administration showing a contrast-enhancing solid tumor mass of the pineal region, with aqueduct compression and obstructive hydrocephalus (**A**–**B**). MRI after 1 month (**C**–**D**) and after 6 months (**E**–**F**) demonstrating the spontaneous regression of the tumor, the progressive decrease in size of the third ventricle, and the patency of the aqueduct.

hydrocephalus (Figure 1C–D). Therefore, a wait-and-see policy was adopted and, at 1-year follow-up, no recurrent tumor or other complications occurred (Figure 1E–F).

Case 2

This 12-year-old girl complained of nucal headache followed by nausea and vomiting, starting 2 months before she came to our attention. Findings of her neurologic examination at the admission disclosed no deficits. Head CT scan showed a hyperdense lesion of the quadrigeminal plate causing obstructive hydrocephalus. MRI confirmed a round mass, isointense on T1-weighted and T2-weighted images, with thin ring enhancement, consistent with a pineal cyst (Figure 2A–D).

The patient underwent endoscopic third ventriculostomy for the treatment of hydrocephalus. An endoscopic biopsy was not attempted because of the normal appearance of the ependymal layer of the posterior aspect of the third ventricle. Early postoperative CT scan demonstrated the resolution of the hydrocephalus without changes of the cyst. The young girl had a complete resolution of preoperative symptoms. MRI performed 3 months later showed the complete disappearance of the cysts, which persists after a 5-year follow-up (Figure 2E–H).

Case 3

This 3-month-old boy was admitted for macrocrania. Findings of the neurologic examination were normal. Brain ultrasonograpy performed at admission showed a supratentorial hydrocephalus. MRI of the brain disclosed a pineal solid tumor with homogeneous enhancement after gadolinium administration as the cause of hydrocephalus (Figure 3A–C). Endoscopic third ventriculostomy with concomitant biopsy of the tumor was then performed. The histologic findings were consistent with a low-grade glio-neuronal tumor (Figure 4A–D). The postoperative course was uneventful. According to the benign nature of the tumor, the child was managed with a wait-and-see policy. Brain MRI performed 3 months after endoscopy showed the complete disappearance of the tumor, without recurrence at 10-year follow-up (Figure 3D–F).

DISCUSSION

The pineal gland or epiphysis is a small anatomical structure of great fascination to scientists and surgeons as well as mystics and philosophers.[3] Although the pineal gland is an evolutionary remnant of a dorsal third eye or an endocrine gland, little is known about its function; however, its anatomy and vascularization have been well elucidated.[4] In this context, the similarity with the pituitary gland is not limited to an anatomical standpoint and hormonal production, because both glands are located at the end of a diverticulum of the third ventricle and show a terminal blood supply. Interestingly, the 2 glands have a different fate and evolution through postnatal life, because the volume of the hypophysis increases throughout the pubertal growth according to its growing role in the hypothalamus-pituitary axis, whereas the volume and structure of epiphysis is subjected to spontaneous regression, although its significance is still far from being completely understood.

On these grounds, it is not surprising that vanishing tumors of both the pineal and the pituitary gland have been reported in the literature.[5-8] Apoplexy, that is, an ischemia or hemorrhage occurring into an organ, may be advocated to explain this phenomenon, based on the vascular and anatomical similarities of the 2 glands. Pineal apoplexy, however, is a controversial issue, because only 1 case has been described in a normal gland occurring in the context of anticoagulation therapy.[9] On the other hand, almost all cases described so far are associated with a "lesion."[10,11] In this context, pineal apoplexy can be related to hemorrhage into a pineal cyst, bleeding of a tumor, or rupture of a vascular malformation.[12] Several neoplasms have been found to occasionally lead to a pineal apoplexy, including ganglioglioma,[13] pineocytoma,[14,15] choriocarcinoma,[16,17] meningioma, and hemangiopericytoma.[18,19] Sometimes, however, apoplexy may ensue an ischemic event in the context of a tumor. Indeed, large tumors may compress or outgrow the feeding vessels, especially those coming from the lateral pineal