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Case Report

Olfactory groove meningioma: A case report with typical clinical and radiologic features in a 74-year-old Nigerian male ☆,☆☆

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ABSTRACT

Olfactory groove meningiomas (OGMs) are rare, intracranial tumors located in the anterior cranial fossa that grow along the nerves between the brain and the nose. This report highlights a case in which a 74-year-old Nigerian male presented with clinical features of anosmia and headache as well as pertinent CT and MRI findings that typically occur in female patients. The study reviews the importance of imaging as a means of achieving a timely diagnosis and accurately measuring the size and magnitude of the disease as it serves as a guide to surgeons when planning for intervention.

Introduction

Meningiomas are the most common intracranial tumors, accounting for about 20%-36% of primary brain tumors [1,2]. Meningiomas constitute approximately 20%-30% of primary intracranial neoplasms in Africa and are more common in females [3]. Olfactory groove meningiomas (OGMs) are rare types of meningiomas that are benign and slow growing, accounting for 2% of all primary brain tumors, 4%-18% of all intracranial meningiomas, and 34% of anterior cranial fossa meningiomas: OGMs affect roughly 0.008% of US females and 0.003% US males per year [2,4–6]. OGMs arise from the arachnoid cap cells of the dura, located in the anterior cranial fossa over the cribriform plate. They remain clinically latent during the early phases of tumor growth, leading to a large tumor size at the time of diagnosis [2,4].

Clinical presentation and diagnosis often occur in the late stage as many are asymptomatic until the tumor grows to a considerable size of > 4 cm, at which the tumor may compress the adjoining structures including the frontal lobe, optic nerve, and optic chiasm [5,7]. OGMs have a mean age

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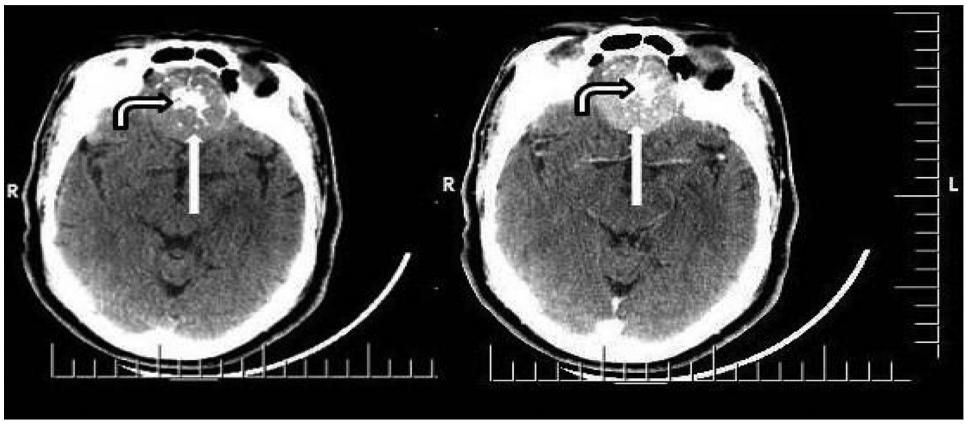
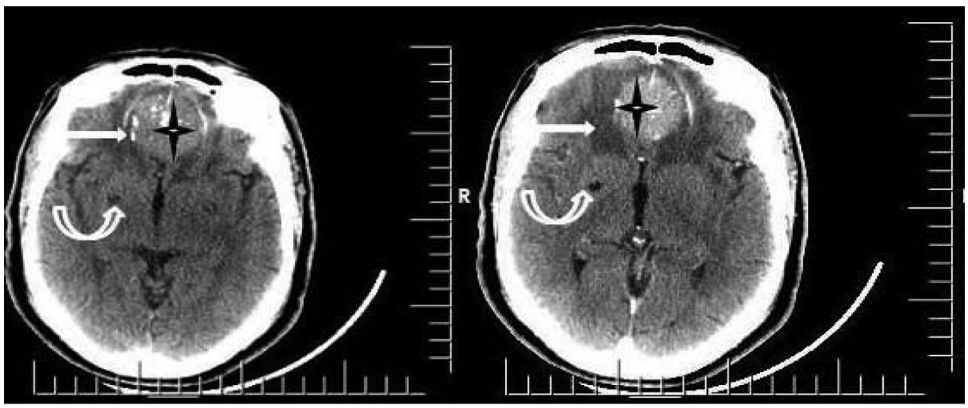


A. Axial Pre-contrast B. Axial Post-contrast

Fig. 1 – Axial pre-contrast (A) and post-contrast (B) cranial CT scan (brain window) at the level of the midbrain, showing a well-defined, oval shaped isodense to hyperdense, brilliantly enhancing mass (block arrow) located in the floor of the anterior cranial fossa with central areas of calcification within it (bent arrow).



A. Axial Pre-contrast B. Axial Post-contrast

Fig. 2 – Axial pre-contrast (A) and post-contrast (B) cranial CT scan (brain window) showing the oval shaped isodense to hyperdense mass (star) with surrounding hypodensity seen in the adjoining frontal lobes indicative of perilesional edema. There is also a sub-centimeter area of hypodensity (curved arrow) seen in the right basal ganglia consistent with a chronic lacunar infarct.

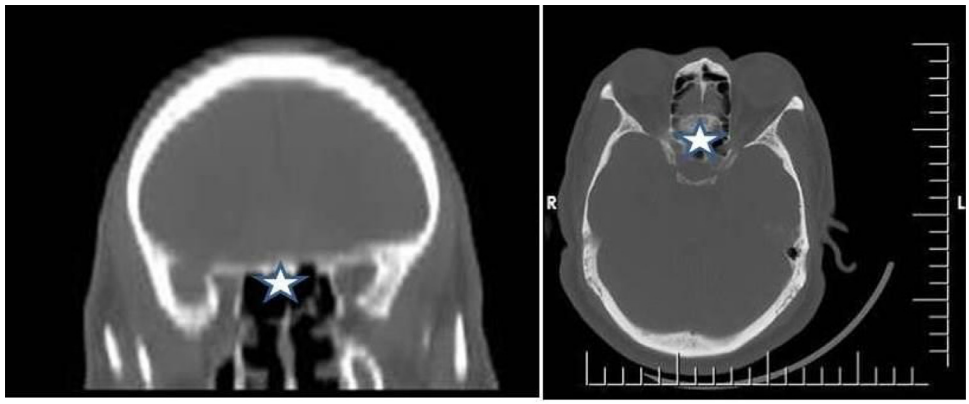
of onset at 54 years and display a strong female predominance. Headache (31%-86%), anosmia (57%-78%) and personality changes (48%-72%) are the most common presenting symptoms. Other symptoms can include visual impairment (24%-61%), seizures (17%-35%), or intracranial hypertension (50.8%). Roughly 3%-12% of patients with OGM are diagnosed by an incidental finding detected on imaging performed for an unrelated symptom [4,6].

Imaging plays an essential role in the diagnosis and management of OGMs. Computed tomography (CT) and magnetic resonance imaging (MRI) are the imaging modalities that are typically employed in the management of OGMs, with MRI being the imaging modality of choice [1,4].

Here, we report a rare case of OGM as an atypical presentation in a 74-year-old Nigerian male patient with clinical and radiological features of the disease. The case highlights the manifestation of OGM in a male patient and the contribution of imaging in the diagnosis and management of the condition.

Case report

A 74-year-old Nigerian male presented with a history of bilateral vision loss and anosmia of 7 months duration. He also complained of occasional headaches that were generalized and not associated with vomiting. His past medical history included chronic hypertension. Neurological examination revealed an impaired sense of smell with decreased visual acuity of 20/40 OU. Aside from an elevated blood pressure (150/100 mmHg) at the time of the visit, all other findings were unremarkable.



A. Coronal Bone window B. Axial Bone window

Fig. 3 – Coronal (A) and axial (B) bone window images showing a lack of bone erosion (star) or expansion of the mass into the ethmoidal sinuses.

Biochemical laboratory testing revealed normal complete blood count (CBC), fasting blood glucose, blood urea nitrogen (BUN), and creatinine levels. In view of his age and clinical features, an intracranial space occupying lesion was suspected. He was then requested to undergo a cranial CT scan and a brain MRI. The cranial CT scan depicted a well-defined, oval shaped isodense to hyperdense, brilliantly enhancing mass located in the floor of the anterior cranial fossa related to the cribriform plate (Fig. 1). The mass appeared to contain central areas of calcification (Fig. 1) and was measured to be 2.7 cm x 4.5 cm x 3.9 cm (LS X AP X TS) with an approximate volume of 24.6 cm^3. There was also an associated surrounding hypodensity seen in the adjoining frontal lobes that was indicative of perilesional edema (Fig.2). Features of mass effect, as evidenced by the compression and splaying of the frontal horns of both lateral ventricles, was noted. There were no signs of mass extension into the sinuses or bone erosion. An incidental finding of a right basal ganglia chronic lacunar infarct (Fig. 2) was also noted (Fig. 3).

MRI showed a well-defined, large oval shaped mass, depicting isointense to grey matter, with central areas of signal void seen on Fluid attenuated inversion recovery (FLAIR), T_1weighted (T_1W) and T_2 weighted (T_2W) images (Fig. 4) in the inferior aspect of the anterior cranial fossa and straddling the midline (Fig. 4). A cerebrospinal fluid (CSF) cleft sign, or a rim of CSF signal intensity, was seen surrounding the mass (Fig. 4), indicating the extra-axial location of the mass. There was also a surrounding irregular area in the adjoining frontal lobes with hypointense signals on T_1W and hyperintense signals on T_2W and FLAIR, indicating perilesional edema (Fig. 5). Compression and splaying of the frontal horns of both lateral ventricles were also seen (Fig. 6). In addition, the mass showed avid enhancement on post-contrast images except for the central signal void area.

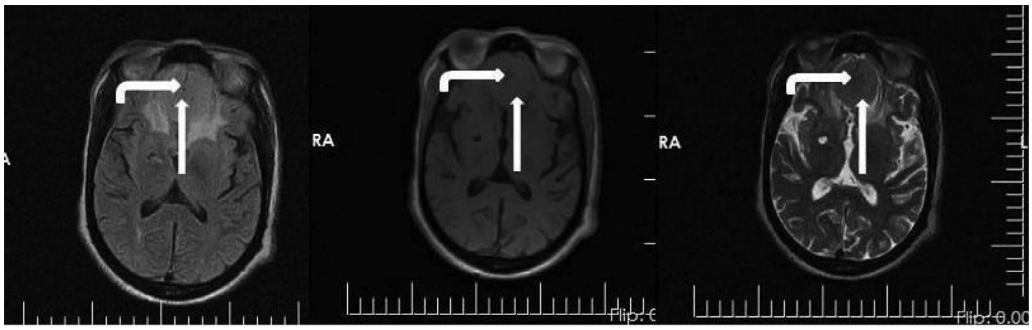
A radiological diagnosis of an olfactory groove meningioma was made. The patient was subsequently worked up for a craniotomy with gross total excision but eventually did not undergo any further procedure due to financial constraints.

Discussion

Interestingly, this patient who was diagnosed with an OGM, presented with generalized headaches, anosmia, and visual impairment but did not have other defining symptoms such as seizures, intracranial hypertension, or personality changes.

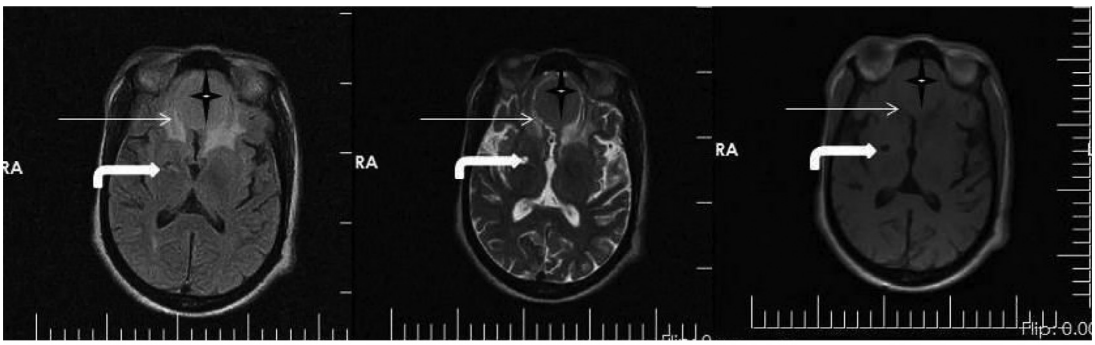
Imaging is paramount in achieving an early diagnosis of OGMs. Because of their slow growth and delayed onset of obvious neurological deficits, they are one of the largest intracranial tumors seen [4]. The first reported radiological diagnosis of a meningioma was in 1902 from a radiograph [1]. Other imaging modalities have since been used in the diagnosis, from ventriculography, pneumoencephalography and angiography, to the modern-day modalities of CT and MRI, which are now the primary method of diagnosis [1]. This patient underwent both a cranial CT scan and a brain MRI. The appearance of OGMs on CT and MRI is comparable to those of other subtypes of meningiomas; however, OGMs, as seen in this case, can have a strategic location as they arise from the dura mater overlying the ethmoid cribriform plate located in the midline of the anterior cranial fossa [8]. Typical features such as gradual growth with an asymmetric extension across the midline and progressive compression of both frontal lobes were able to be visualized in this patient. However, while CT would be useful in defining the osseous anatomy, including areas of hyperostosis or erosion that may assist in the diagnosis or planning of a surgical approach to resecting these lesions, the images of this patient did not show such features. Even though some of the key signs, symptoms, or radiographic imaging features did not appear during the clinical workup or management, it is crucial to understand the variation of OGMs in both its clinical presentation and manifestation on radiographic imaging.

As seen in other meningiomas, the OGM appeared to be slightly hyperdense relative to the brain parenchyma on non-contrast CT scans and enhanced homogeneously and brightly after administration of contrast. CT showed the presence of intratumoral calcification, which can be seen in up to 15%-20%



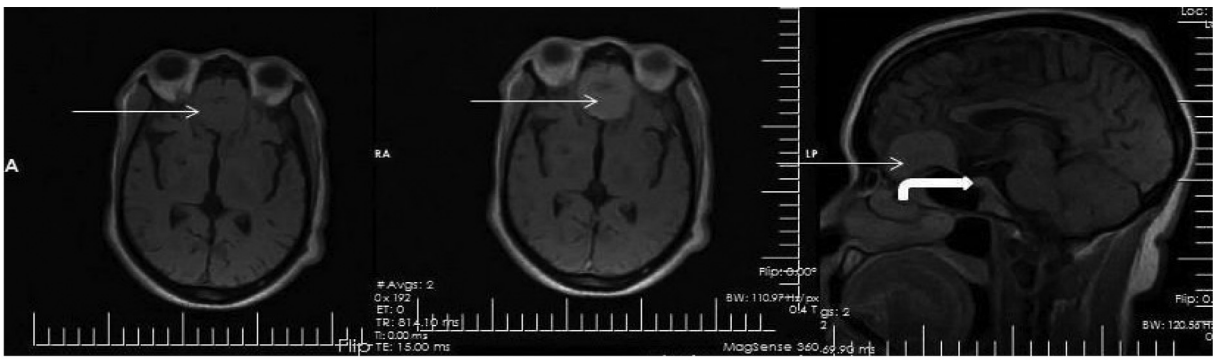
A. Axial Flair B. Axial T1W C. Axial T2W

Fig. 4 – Axial FLAIR (A), T_1W (B) and T_2W (C) MRI images at the level of the globes showing a well-defined, large oval shaped mass, which is mainly isointense to grey matter on all the sequences (block arrow), in the inferior aspect of the anterior cranial fossa and straddling the mid line. It also shows central signal void areas (bent arrow) corresponding to the areas of calcification seen on the CT images (Fig. 2). A rim of CSF intensity (C.S.F. cleft sign) is seen around the mass most notably on the T_2W image.



A. Axial Flair B. T2W C.T1W

Fig. 5 – Axial FLAIR (A), T_2W (B) and T_1W (C) MRI images at the level of the 3RD ventricle showing the mass (star) with surrounding irregular areas of T_1W hypointensity seen in the adjoining frontal lobes; which appear hyperintense on T_2W and FLAIR images—indicative of perilesional edema (block arrows). There is also compression and splaying of the frontal horns. A sub-centimeter area of T_1W and FLAIR hypointensity and T_2W hyperintensity (curved arrow) is seen in the right basal ganglia consistent with a chronic lacunar infarct.



A. Axial T1 Pre-contrast B. Axial T1 Post-contrast C. Sagittal T1 Post-contrast

Fig. 6 – Axial pre- (A) and post-contrast (B) T_1W and sagittal (C) post-contrast T_1W images showing avid enhancement of the mass (arrow) on post-contrast images except for the central signal void area. The sagittal images also exhibit enhancement of the dura posterior to the mass and the dural tail sign (bent arrow).

of OGM. However, in this patient, paranasal sinus extension through the floor of the anterior cranial fossa, which would otherwise be visible on CT scans, was not seen [1,4].

MRI is the imaging modality of choice. Both MRI and MR angiography (MRA) define the relationship of the tumor to the optic nerves and chiasm as well as the anterior cerebral arteries and anterior communicating arteries. MRA has thus replaced conventional angiography, though it can be used to also define the vascularity of the tumor and predominant feeders [4]. As seen with this patient, OGMs can appear on MRI as isointense to gray matter on T_1-weighted sequences and isointense or hyperintense on T_2-weighted sequences with avid enhancement after administration of Gadolinium [8].

The mainstay of treatment for OGMs is surgical resection. This is commonplace in many OGMs that appear to be quite large on imaging studies and cause behavioral changes, anosmia, or reduction in visual acuity on clinical presentation. This patient was planned for surgical resection but did not undergo any further procedure due to financial constraints. Aside from surgical treatments, continued observation may play a role in asymptomatic patients who are very elderly, unable to withstand surgery, or who have small incidental tumors [8]. Following surgery, imaging is also important in follow up either by CT or MRI [1].

In addition, surgical resection is not the only viable treatment option when dealing with patients with OGMs. One alternate treatment option is radiotherapy: radiotherapy should be considered as an upfront treatment approach if subtotal resection or operative morbidity is likely outcomes [9]. Furthermore, radiotherapy is also used as an adjuvant therapy (postresection) and in the setting of recurrence for previously resected meningiomas [9]. However, this treatment modality does not come without its own downsides, risks and morbidities. For instance, many meningiomas treated with radiotherapy do not undergo biopsy, which prevents histological confirmation of grade or molecular features [9]. This downside drastically decreases the clinician's ability to determine the pathological markers of the meningioma, thus favoring surgical resection as the more direct treatment. Furthermore, long-term toxicities of cranial radiotherapy are dependent on the field size and location and may include endocrinopathies, cognitive effects, increased cerebrovascular events and/or secondary malignancy risks [9].

It is worthwhile to note that OGMs do not affect all patient population equally. In fact, the prevalence of pathologically confirmed meningioma's in the USA is 97.5/100,000, with an incidence rate of 8.36 for females and 3.61 for males out of 100 ,000 person-years [10]. Because of this, it is important for clinicians to consider all relevant patient factors when evaluating patients for OGMs. While most meningiomas are sporadic in origin, some have been associated with certain conditions and risk factors [11]. These factors include obesity, alcoholism, exposure to ionizing radiation, radiotherapy, hormonal factors such as exposure to exogenous hormones, hormonal replacement therapy, use of oral contraceptive pills, and breast cancer [11]. Other risk factors in already affected patients that show a suboptimal prognosis and a high recurrence of OGM include obvious edema ($\geq$20 mm), soft tumor texture, hyperostosis and dural tail sign [12].

This case study highlights the challenges radiologists face with diagnosing OGMs. The presence or lack of various typical constitutional symptoms and exam findings can be nonspecific or misleading, and subsequently lead to significant delays in diagnosis. The study reviews the importance of imaging as a means of achieving a timely diagnosis and accurately measuring the size and magnitude of the disease as it serves as a guide to surgeons when planning for intervention. Additionally, as OGMs manifest more commonly in women, it is important to note from this case presentation that both radiologists and general medical providers should be mindful of the variation and constellation of signs, symptoms, and typical radiographic images found in OGMs regardless of the demographic characteristics or sex of the patient.

Patient consent

Written informed consent for publication was obtained from the patient described in the OGM case.

Ethical approval

This case report was conducted in accordance with the Declaration of Helsinki. The collection and evaluation of all protected patient health information was performed in a Health Insurance Portability and Accountability Act (HIPAA) compliant manner.

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All authors attest that they meet the current ICMJE criteria for authorship

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