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Metastatic Lung Carcinoma to Skull, an Atypical Presentation with Atypical Radiologic Features: A Case Report

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Abstract A 65-year-old male patient was referred to a university hospital with a skull mass and previous history of left lung carcinoma, although a left sided pneumonectomy had been performed two years ago. The large solitary extra-axial, intra- and extra-osseous skull mass exhibited uncharacteristic radiologic features that were atypical for all of the proposed differential diagnoses, which included metastasis, atypical meningioma, and osteosarcoma. An incomplete patient history also made the radiologic diagnosis more difficult. In the end a tumour excision was performed and the tissue morphology and immunohistochemical properties examined, and the diagnosis of a metastatic lung carcinoma to the skull was confirmed.

Keywords: *skull mass, metastasis, lung carcinoma*

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1. Introduction

Masses of the skull no matter their size or clinical appearance, and despite seemingly clear-cut characteristics that might indicate one diagnosis or another, can cause a great problem during the workup process.

The range of neoplastic extra-axial masses is wide [1] and ranges from metastases to lipomas, and the tactic and, most importantly, prognosis varies accordingly. As such, it is highly important for both clinicians who encounter patients with these types of neoplasms, and radiologists whose reports clinicians rely upon for diagnosis, to be aware of the wide spectrum of differential diagnoses.

In this article we present a patient with an extra-axial, intra- and extra-osseous mass of the skull that presented diagnostic difficulties due to its uncommon radiological features (such as, among others, an atypical location and number [solitary] for metastasis, an origin from the meninges, no observable oedema of the adjacent brain tissue etc.) and hope that the case may be both illustrative and of clinical use given that a search of the literature regarding similar cases yielded few results, with some authors even presenting their cases as a world-first [2].

2. Case Report

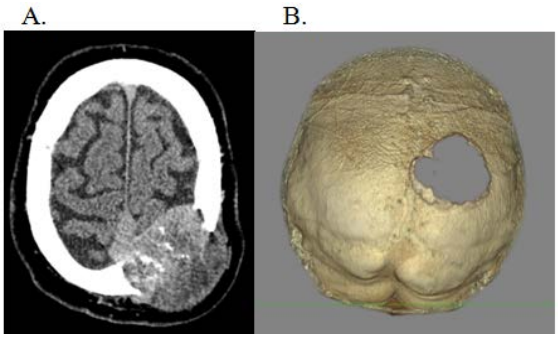

Figure 1. NE CT (A.), 3D CT (B.): A. Axial thin slice (1.25 mm) multidetector computed tomography (MDCT) image of the lesion. The reporting radiologist described 'an intracranial and extracranial inhomogeneous, massive convexital tumour of the left parietal bone with extensive calcification and destruction of the adjacent bone, main differential osteosarcoma'. B. The extent of bone damage can best be evaluated in a 3D reconstruction of the MDCT scan (internal caudocephalad view of the skull)

The patient, a 65-year-old male, presented as an outpatient due to a subcutaneous mass in the left parietal region that had gradually increased in size over the years. Due to the

cosmetic defect and threatening appearance of the large mass, a head CT scan was performed in a regional hospital (Figure 1), and 'an inhomogeneous, massive convexital tumour of the left parietal bone with extensive calcification and destruction of the adjacent bone,' was reported, with a further recommendation to consult a neurosurgeon.

As per the recommendations the patient was admitted to the neurosurgery department of Pauls Stradins Clinical University Hospital, and to ensure better evaluation of the lesion and preparation for surgery, a magnetic resonance imaging (MRI) scan was performed. For a report of the findings see Figure 2 and Figure 3.

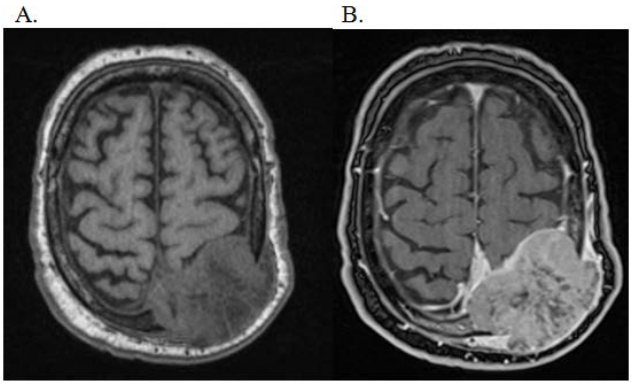

Figure 2. MRI T1 + T1c: A. T1 sequence, B. T1 sequence after i/v injection of gadolinium contrast agent (homogeneous uptake but heterogenous overall because of calcifications)

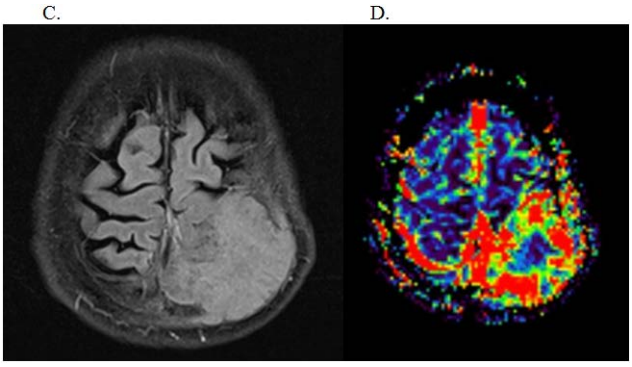

Figure 3. FLAIR + MRP CBV: C. FLAIR sequence, D. Magnetic resonance perfusion (MRP) map showing cerebral blood volume (CBV) values on a scale ranging from less volume (blue) to more (red) with yellow-green tint representing values in between

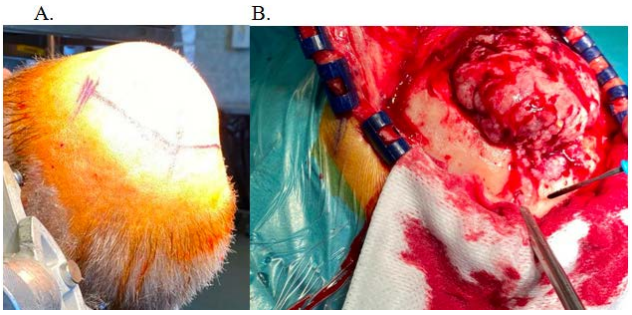

Figure 4. A. preoperative view of the lesion + B. intraoperative view of a very well perfused, partially extracranial mass*

A unilocular left-sided convexital extra-axial lesion abutting the left parietal bone can be seen, most likely originating from the meninges with both intra- and extra-osseous spread and infiltration in the superior sagittal sinus from the left side without clear evidence of penetrating the sinus. No mass effect or midline shift is visible. The lesion is inhomogeneous and slightly hypointense on T1 and exhibits high contrast uptake on the T1 post contrast sequence, whereas it is slightly hyperintense on T2 and well perfused on the MRP CBV map. The lesion is most likely an atypical meningioma; however, a strong differential diagnosis of a metastasis of the skull exists.

A tumour excision was performed, and the material sent for a morphologic study of the specimen using hematoxylin-eosin and immunohistochemical staining.

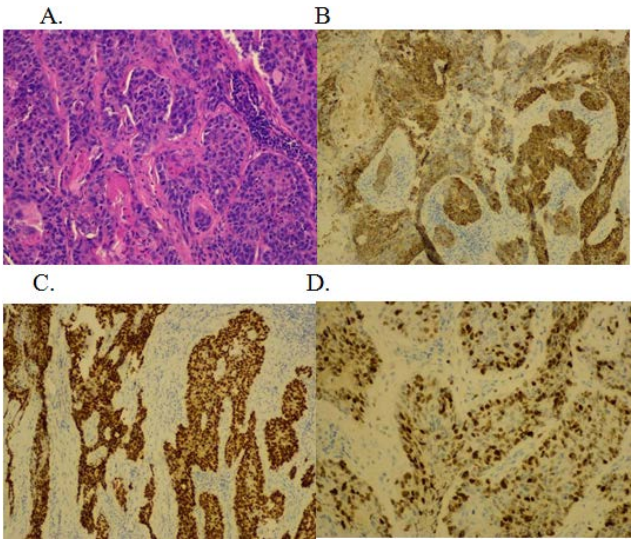

Figure 5. HE, p63+, CK20 +, Ki67: A. HE (200x), B. + p63 (100x, marker for squamous cell differentiation), C. + Cytokeratin 20 (CK20; 100x), D. Proliferation index: Ki67 (200 x; 30%)

Altogether the morphology report, especially the immunohistochemical study (see Figure 5), revealed that the lesion contained intratumoural abscesses and micronodular fibrosis with a +P63 and CK20 marker and a proliferation index (Ki67) of 30% and reported the lesion more likely being a metastasis of a primary lung carcinoma (although other cancers could also have a similar profile) [3]. A thorough patient history was gathered and a fact that had gone unknown until this point in the treatment of the patient was revealed: the patient had a history of left lung carcinoma, although a left sided pneumonectomy was performed two years previously. At the time of this report the authors are not aware of any other metastases or active primary tumours.

3. Discussion

The gradually expanding large solitary skull mass was first interpreted as a parietal bone osteosarcoma on a CT scan, due to its destruction of bony tissue and high level of calcification, despite primary bone tumours of the skull, especially the neurocranium, being very rare [4]. No periosteal reaction was also observed. A subsequent MRI scan revealed a heterogenous pattern after contrast uptake that could be characteristic for osteosarcomas [5], however, in this case can be explained by the prevalence of calcifications within the tumorous mass, with the uptake in the tissue that isn't calcified being homogenous.

The lesion being transdiploic is of no help either because both meningiomas, metastases and osteosarcomas can have this appearance [6]. Two main differentials were proposed: a meningioma and a metastasis.

The differential of atypical meningioma was proposed because of the lesion seemingly originating from the meninges and otherwise having an MRI appearance that resembles an atypical meningioma due to its inhomogeneity on T1 and T2 sequences [7,8], no oedema in the adjacent brain tissue and also high perfusion. However, lesions of the skull with a high perfusion could be both indicative of a meningioma [9] and a metastasis [10].

Skull metastases are not rare and can be found in up to 1/3 of patients with lung cancer [11]. On the other hand, skull metastases are more often multiple not singular like in this case [12], especially when they are as large as in this case, and are often surrounded by oedema [13]. Although it was known that the patient had previous history of lung carcinoma and that metastases can be slow growing and take years until diagnosis [14], the mass was radiologically interpreted as more likely being an atypical meningioma due to the more typical appearance on MRI. It is important to note, however, that the differential diagnosis of a skull metastasis was still very strong.

Only after a full pathologic examination of the mass tissue was done it was revealed that although the immunochemical profile of the sample tissue (high proliferation index, +CK 20, +p63) was not specific to metastases from the lungs, it is highly probable, especially taking into account the strong differential from the MRI.

Overall the case illustrates the difficulties encountered when diagnosing a both intra- and extra osseous solitary mass of a relatively rarely affected region, especially when the patient has a history of cancer and the lesion is uncharacteristic. In this case the authors want to emphasize the difficulty in making a radiologic diagnosis under such circumstances and accept that in some cases radiological examination is only supplementary to morphologic examination, with the final call being made by pathologists.

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