Peripheral type of primitive neuroectodermal tumour arising from the left orbital floor

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ABSTRACT

Primitive neuroectodermal tumours (PNETs) are rare tumours that originate from primitive neural crest cells. They are usually found in children below ten years of age. Peripheral PNETs (pPNETs) occur in soft tissues of the body, but have the same genetic changes as Ewing's sarcoma of the bone (now called soft tissue Ewing's sarcoma). They commonly present in the thoracopulmonary region, abdomen, pelvis and the extremities. The head and neck regions may also be involved. Our case demonstrates a PNET in the peripheral tissue arising from the left orbital floor and spreading locally to involve the left maxillofacial region, cheek and gum. The incidence of pPNETs is likely to be under-reported in the literature. Recent diagnostic advances, including cytogenetic and immunohistochemical analysis, have allowed these tumours to be distinguished from other small, poorly differentiated round cell tumours such as rhabdomyosarcoma, lymphoma and poorly differentiated synovial sarcoma.

Keywords: immunohistochemical analysis, orbital floor, peripheral primitive neuroectodermal tumour, round cell tumour

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INTRODUCTION

Primitive neuroectodermal tumours (PNETs) are rare tumours originating from the cells of the primitive neural crest. They are found mainly in children below ten years of age. Peripheral PNETs (pPNETs) commonly present in the thoracopulmonary region, abdomen, pelvis and the extremities but infrequently in the head and neck regions.[1-3]

CASE REPORT

A 12-year-old Indian boy was admitted to our hospital with complaints of a large painless swelling in the left cheek region for a period of four months. The swelling also involved the left orbit, and was incidentally noticed below the lower margin of the left orbit as a bruise over the area. Initially, the swelling was small, painless, firm and smooth, causing limited disfigurement to the face and no visual impairment. It gradually became enlarged, resulting in distortion of the face and a loss of vision in the left eye (Fig. 1). There was no history of fever, nasal discharge, bone pain, gum bleeding, patechial spots or recurrent chest infections. The patient had a normal antenatal and developmental history, and his sibling was also healthy. There was no history of consanguineous marriage in the parents or any significant family history. The patient was conscious and well-oriented. Physical examination revealed a regular pulse rate of 84/min and blood pressure of 120/70 mmHg. A large, tense bosselated swelling measuring 13 cm × 11 cm was present in the left half of his face, which involved the left orbit, cheek and gum. The overlying skin was shiny, with prominent superficial veins and ulcerations over it. The mass had displaced the eye ball, nose and gum outwards, with a few teeth being uprooted. Other systemic examinations revealed no significant abnormalities.

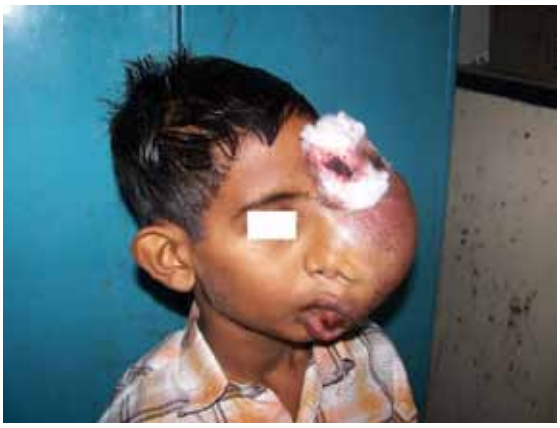

Fig. 1 Photograph shows a large tumour involving the left maxillofacial region and orbit in our patient.

Straight radiography and computed tomography (CT) imaging of the posterior nasal sinus revealed a large heterogeneously enhancing space-occupying lesion in the left inferolateral orbital region causing bony destruction and proptosis, with invasion of the extraocular muscles

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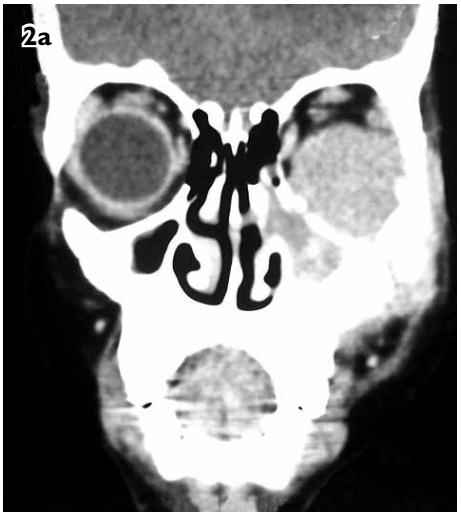

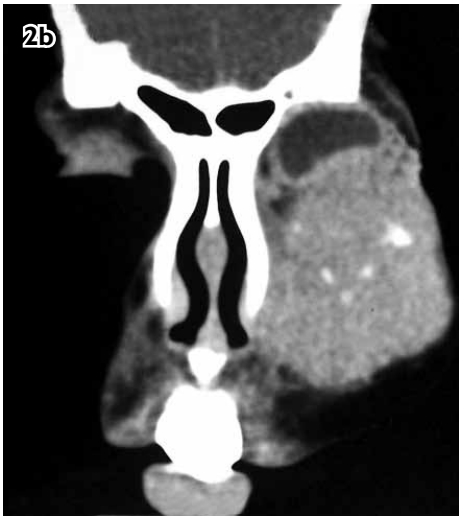

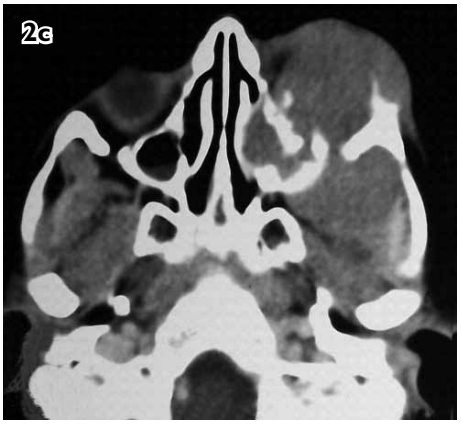

Figs. 2 Contrast-enhanced (a-b) coronal and (c) axial CT images show a large heterogeneously enhancing space-occupying lesion in the left inferolateral orbital region, causing bony destruction and proptosis with invasion of extraocular muscles and extension into the left maxillary sinus.

(Figs. 2a–c). The lesion had extended into the left maxillary sinus, causing a widening of the left osteomeatal channel. A neoplastic process was suggested. Fine-needle aspiration cytology of the mass revealed sheets of dissociated population of immature lymphoid cells, with open, immature nuclear chromatin, prominent nucleoli and few mitotic activities. The possibility of a high-grade non-Hodgkin's lymphoma (Burkitt) was suggested.

CT imaging of the chest was normal and bone marrow biopsy revealed no significant abnormality. CT imaging of the abdomen, however, revealed a few retroperitoneal lymph nodes. Biopsy from the mass showed infiltrating tumour composed of small round cells in solid sheets and clusters. In some places, the cells were arranged around eosinophilic fibrinous material in a rosette-like pattern. These cells showed scanty to moderate cytoplasm, with a high nucleocytoplasmic ratio. The nuclei had open chromatin and single-to-multiple distinct nucleoli. Occasional mitotic figures were noted. Classical lymphoglandular bodies, splaying of chromatin material or a vacuolated background were not seen. The morphological features were those of a malignant round cell tumour, with the differential diagnoses being PNET, rhabdomyosarcoma and high-grade non-Hodgkin's lymphoma (Fig. 3). Immunohistochemical study was performed. The tissue was immunoreactive to MIC2/CD 99. Cytogenetic study revealed *t*(22,11) translocations. The combination of morphology and immunochemistry was consistent with pPNET.

DISCUSSION

The majority of cells in PNET tumours are derived from neuroectoderm, but as these tumour cells have not differentiated in a similar manner as a normal neuron, they appear primitive; this is how the term PNET is derived. Based on the tumour location, it is classified into two types: (1) PNETs of the brain and central nervous system (CNS) and (2) pPNET outside the brain and nervous system. A third category arising in the autonomic nervous system, such as neuroblastoma, has also been suggested.[4]

PNETs of the CNS are supratentorial (e.g. pinealoblastoma) or infratentorial (e.g. medulloblastoma in the cerebellum), the latter being more common. pPNETs are classified as part of the Ewing family of tumours.[5] Ewing's sarcoma family of tumours includes Ewing's sarcoma, pPNET, neuroepithelioma, atypical Ewing's sarcoma and Askin's tumour (tumour of the chest wall). pPNETs occur in soft tissues of the body, resembling soft tissue sarcoma (small, round blue-cell tumours) but have identical chromosome translocation as Ewing's sarcoma of the bone (now called soft tissue Ewing's sarcoma). Immunohistochemical and cytogenetic studies suggest that these tumours have a common origin.

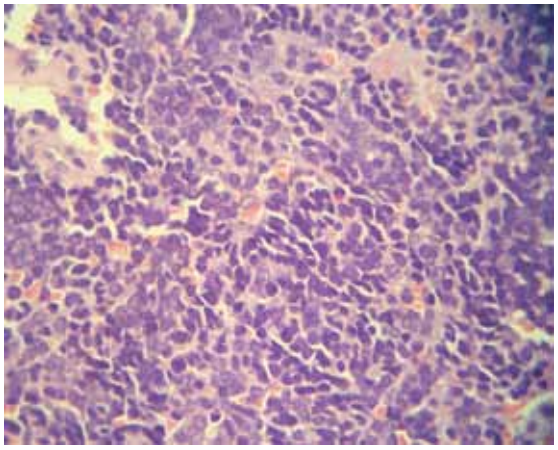

Fig. 3 Photomicrograph shows malignant round cells arranged in a rosette pattern, with hyperchromatic nuclei and scanty cytoplasm (Haematoxylin & eosin, × 100).

pPNETs commonly present in the thoracopulmonary region (Askin's tumour), abdomen, pelvis and the extremities. pPNETs that occur in the head and neck region are uncommon in most published case series.[1-3] However, Jones and McGill reported 11 cases in the head and neck region out of 26 patients with pPNETs.[6] The clinical features of pPNETs depend on the site of presentation. Symptoms commonly include pain and swelling of surrounding structures due to mass effect. pPNETs are highly aggressive, and metastatic disease may be the first presentation. The most common sites of pPNET metastases include the lung, bone and bone marrow.[7]

On histopathology, PNETs are highly cellular, showing sheets of small, round cells with hyperchromatic nuclei. PNETs differ in their degree of neuroectodermal differentiation. Tumours demonstrating neural differentiation by light microscopy, immunohistochemistry or electron microscopy are traditionally called PNETs, and tumours undifferentiated by these analyses are known as Ewing's sarcoma.[8] PNETs and Ewing's sarcomas commonly have *t*(11; 22) (q24; q12) translocation.[9] Expression of MIC2 gene produces a glycoprotein antigen MIC2 (CD99), which consistently identifies pPNETs/Ewing's sarcoma. These sarcomas typically co-express CD99 (MIC2) and vimentin,[10] but CNS PNETs (except meningeal PNET) lack the expression of CD99.[11] The treatment for pPNET usually involves a combination of surgery and chemotherapy with or without radiotherapy. The modality of treatment depends on the type, site and size of tumour, extent of metastasis as well as the age and general health status of the patient.

The incidence of pPNET is likely to be under-reported in the literature. Recent diagnostic advances like cytogenetic and immunohistochemical analysis have enabled these tumours to be distinguished from other small, poorly differentiated round cell tumours, including rhabdomyosarcoma and lymphoma.[9,12] As pPNETs exhibit aggressive clinical behaviour and worse outcomes compared to other small, round cell tumours, accurate diagnosis of these tumours is of paramount importance. By using cytogenetic and immunohistochemical analysis, better management can be facilitated.

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