

# Primary Ewing's sarcoma of the anterior fontanelle in a neonate

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## ABSTRACT

يعتبر غرن يوينغ الأولي القحفي شديد الندرة. نقدم حالة غرن يوينغ الأولي القحفي عند طفل وليد يشمل اليافوخ الأمامي والذي كان عدواني جدا في طبيعته حتى مع الجراحة الجذرية. تراجعت حالة المريض خلال شهرين من اجراء العملية وتوفي في نهاية المطاف. وقد تم عرض نتائج التفاصيل الشعاعية والتشريحية المرضية.

Primary cranial Ewing's sarcoma is extremely rare. We present a case of primary Ewing's sarcoma of the skull in a neonate that involved the anterior fontanelle and was very aggressive in nature. Even with radical surgery, the patient had early recurrence within 2 months of surgery and ultimately died. Detailed radiological and pathological findings are described.

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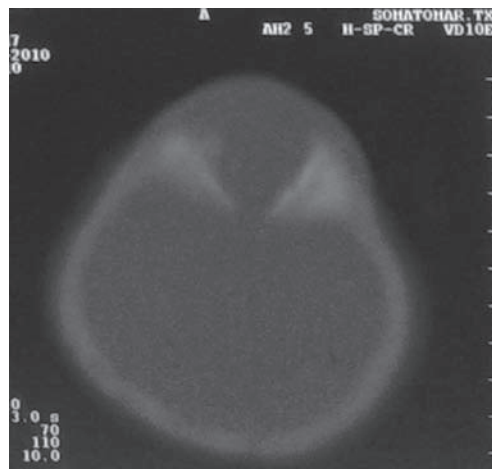
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Primary Ewing's sarcoma arising from the skull is an extremely rare lesion. We report a case of Ewing's sarcoma that arose in the anterior fontanelle of a one-month-old neonate. We searched PubMed using the following keywords: primary, Ewing, sarcoma, fontanelle, but were unable to source previous publications with this location, and only one published report of Ewing's sarcoma at birth.<sup>1</sup> The second youngest case was a one-year-old girl.<sup>2</sup> We present this case to shed light on the radiographical and histopathological features of this entity, and to stress the importance of early and aggressive radical surgery.

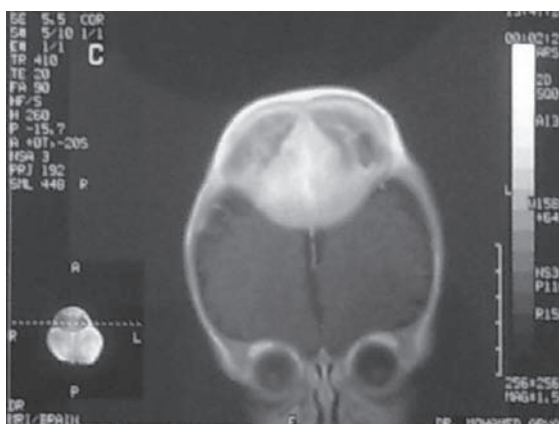
**Case Report.** A one-month-old male neonate was brought by his parents for an increasingly enlarging head swelling. According to the parents, the mass was first noticed when he was around 10 days old when it was very small and hence ignored. However, it increasingly became larger and firmer. There was no history of fever, vomiting, or seizures. On examination, he was alert, and calm. Local examination revealed a hard giant mass measuring approximately 9 cm in diameter based at the anterior fontanelle. The overlying skin was normal-looking with marked dilatation of surrounding scalp veins (Figure 1). General physical and neurological examination was normal. Laboratory investigations including complete blood count, and a chemistry panel were all within normal limits. On brain CT scan the lesion appeared slightly hyperdense with bony spicule formation bilaterally (Figure 2). The T1-weighted MRI revealed the tumor as an extra-axial, well-demarcated, oval mass that was isodense with heterogeneous enhancement along with areas of hemorrhage and necrosis. The enhancement was especially noted at the center (Figure 3). On T2 weighted MRI, the tumor was heterogeneously hypointense. To assure this tumor was a primary; he underwent a full body scan, which did not reveal other lesions. Considering the giant skull vault mass, he underwent decompressive surgery using a bicoronal incision. The tumor appeared mushroom-



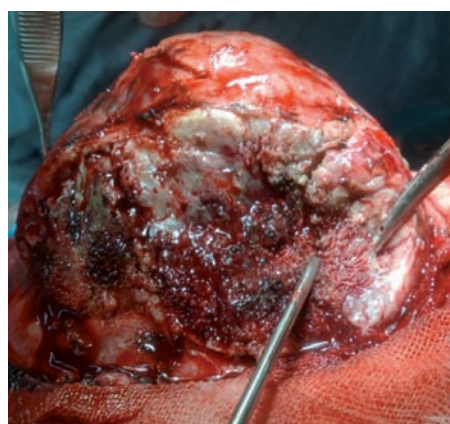
**Figure 1** - External appearance of the giant mass in the anterior fontanelle (patient is positioned supine on the operating table).



**Figure 2** - Axial CT scan (bony window) shows bony spicule formation bilaterally.



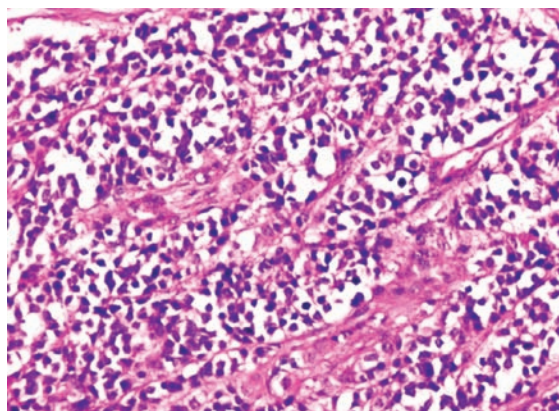
**Figure 3** - Coronal T1W MRI with contrast: Tumor enhances strongly, especially at the center.



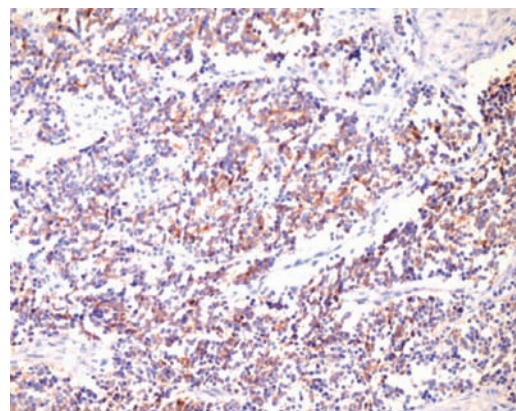
**Figure 4** - Intra-operative view: Tumor appears mushroom-like, with the fleshy part at the periphery and a necrotic hemorrhagic center.

like, with the fleshy part at the periphery and a necrotic hemorrhagic center (Figure 4). The dura was dissected free from the tumor and gross total resection was achieved. The postoperative period was uneventful, and he was discharged in good status. Histopathological examination showed a solid growth pattern of sheets of small round cells divided into irregular masses by fibrous strands. Individual cells were small and uniform. The cell outlines were indistinct, resulting in a 'syncytial' appearance. The nuclei were round, with frequent indentations, small nucleoli, with brisk mitotic activity. In small areas, we found a fair degree of histologic heterogeneity, some cells were larger and more pleomorphic exhibiting conspicuous nucleoli. There was a well-developed vascular network (Figure 5).

The differential diagnosis included: Ewing's sarcoma, malignant lymphoma, embryonal rhabdomyosarcoma, and small cell osteosarcoma. We performed a panel of antibodies (Vimentin, CD99, neuron-specific enolase, synaptophysin, desmin, and leukocyte common antigen) using Dako Chem Mate reagents (Dako Company, Glostrup, Denmark) and agents as described in the manufacturer's operating manual. Immunostaining was positive for vimentin, CD99, neuron-specific enolase, and synaptophysin (Figure 6). Immunostaining for desmin and leukocyte common antigen was negative. We also performed Periodic Acid Schiff stain, which stained the neoplastic cells. After completing these stains, the diagnosis was confirmed as Ewing's sarcoma. Unfortunately, a cytogenetic analysis



**Figure 5** - Microscopic appearance shows small round cells with indistinct outlines and fair degree of histologic heterogeneity.



**Figure 6** - Microscopic appearance of tumor with immunostaining positive for synaptophysin.

of the current case could not be performed because no fresh tumor was preserved. Due to his very young age, the patient received multidrug chemotherapy, but not radiation therapy. The tumor recurred 2 months later at the same site, possibly because of microscopic residuals. We re-admitted him, preparing for a second surgery. However, he succumbed to nosocomial pneumonia and died.

**Discussion.** Ewing's sarcoma usually occurs in children and young adolescents. While common in the long bones, primary skull involvement is estimated as less than 1% of cases.<sup>3,4</sup> Ewing's sarcoma constitutes less than 1% of all the brain tumors. As in the present case, calvarial Ewing's sarcoma usually present as a rapidly enlarging swelling<sup>3-5</sup> without apparent signs of raised intracranial pressure. Neurological symptoms occur in cases where the tumor extends intracranially to compress the adjacent cerebral cortex.<sup>4,5</sup> The CT scan usually shows an isodense mass that may extend intra- or extracranially. The enhancement is usually strong and heterogeneous. On bony window, there may be bony destruction and/or new bone formation, with a speculation pattern distinctive of Ewing's sarcoma.<sup>5,6</sup> The MRI imaging shows heterogeneous signal intensity, along with scattered areas of hemorrhage and necrosis. As with other brain tumors, the MRI is essential before surgery, not only for the coronal and sagittal views it provides, but also because it can identify the relationship between tumor, dura, and dural sinuses.

Histopathologically, Ewing's sarcoma consists of massively clustered small and uniform round cells that are packed side by side with profound mitotic activity. The differential diagnosis primarily includes neuroblastoma,

**Table 1** - Immunohistochemical positivity to differentiate Ewing's sarcoma from malignant lymphoma, embryonal rhabdomyosarcoma, and small cell osteosarcoma.

| Tumor                      | Vim | Des | CD99 | NSE | LCA | Syn |
|----------------------------|-----|-----|------|-----|-----|-----|
| Ewing sarcoma/ PNET        | +   | -   | +    | +   | -   | +   |
| Malignant lymphoma         | +   | -   | +    | -   | +   | -   |
| Embryonal rhabdomyosarcoma | +   | +   | -    | +   | -   | -   |
| Small cell osteosarcoma    | +   | -   | -    | -   | -   | -   |

Vim - Vimentin, Des - Desmin, NSE - neuron-specific enolase,  
LCA - leukocyte common antigen, Syn - synaptophysin,  
CD - cluster of differentiation

lymphoma, and rhabdomyosarcoma. Immunostaining is the cornerstone to reaching the diagnosis as illustrated in Table 1. Gross total resection is particularly possible with skull base tumors, in contrary to skull base tumors, which may be very difficult to eradicate. Except in very young patients (<3 years), radiotherapy to the residual tumor is recommended especially in case of incomplete resection.<sup>7-9</sup> Chemotherapy has developed many options, and best of them is the 4-drug regimen consisting of vincristine, Adriamycin, cyclophosphamide, and actinomycin-D.<sup>1-3,7</sup> Early recurrence correlates with poorer outcome.<sup>10</sup>

In conclusion, primary Ewing's sarcoma of the calvarium in a neonate is an exceedingly rare lesion. The patients present merely with scalp swelling. The CT scan and MRI (with MR venography when necessary) define the intracranial extension and/or dural sinus involvement. Histopathology and immunostaining differentiate it from similar lesions. Surgical excision followed by chemotherapy is the recommended treatment. Early recurrence bears a poor prognosis.

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