Infantile hemangioendothelioma of the pericranium presenting as an occipital mass lesion

Case report

CARLOS G. CARLOTTI, JR., M.D., VENITA JAY, M.D., AND JAMES T. RUTKA, M.D., PH.D., F.R.C.S.(C)

Divisions of Neurosurgery and Neuropathology, The Hospital for Sick Children, The University of Toronto, Toronto, Ontario, Canada

The case of a newborn infant with a large midline mass in the occipital region is presented. Skull x-ray films demonstrated multiple radiolucent defects in the occipital bone. A computerized tomography scan revealed an extracranial mass lesion with marked contrast enhancement. A magnetic resonance image demonstrated that the venous drainage of the lesion passed through the occipital bone into the dural venous sinuses. The anatomy of the hindbrain was normal. The neonate was treated by complete surgical removal of the mass. The histopathological diagnosis was infantile hemangioendothelioma, a tumor commonly found in the liver but rarely in this location. The classification, histopathological characteristics, imaging studies, and treatment of this tumor are discussed.

KEY WORDS • infantile hemangioendothelioma • vascular tumor • congenital tumor • cranial tumor • neonate

Infantile hemangioendotheliomas are rare vascular tumors that occur in infants. Fully 85% of these lesions are identified during the patient’s first 6 months of life.21 These lesions are found frequently in the liver10,14,22 but can affect other sites such as the ovaries,19 heart,9 head,17 soft tissues,13,26 and adrenal gland.24 In approximately 10% of cases, hemangiomatous involvement of the skin is found, and in 15% of cases, congestive heart failure may develop because of the rich vascularity of these lesions.22 In the present article, we describe an IHE of the occiput that was successfully managed by surgery alone. The differential diagnosis, clinicopathological features, and management issues regarding these rare vascular lesions are discussed.

Case Report

History. A full-term male neonate, who had been delivered by cesarean section, presented in 1993 with a large midline mass in the occipital region. Prenatal ultrasonography performed at another institution was reported to show an occipital encephalocele, but the images were unavailable for review.

Examination. On clinical examination, a 14 × 10–cm² lesion was found (Fig. 1). The mass was firm, nonpulsatile, and completely covered by skin. No bruit could be detected over the lesion. The rest of the examination was unremarkable. Specifically, there were no signs of congestive heart failure. The hematological results showed a hemoglobin level of 161 g/L, a white blood cell count of 11.4 × 10⁹/L, and a platelet count of 218 × 10⁹/L.

Skull x-ray films revealed a large soft-tissue mass overlaying the occiput with multiple radiolucent defects in the occipital bone (Fig. 2). The lesion crossed the midline. Skull sutures were normal and, elsewhere, ossification of the skull was within normal limits. A CT scan revealed a solid extracranial mass that appeared hyperdense compared with the brain tissue (Fig. 3). There were several well-developed vascular channels noted within the inferior aspect of the mass lesion, which were associated with enlargement of the superior sagittal sinus and the torcular herophili. Small lucencies within the occipital bone were reported to represent bony canals through which venous blood drained from the mass lesion into the dural venous sinuses. The brain was normal in appearance, revealing normal sulci, cisterns, and ventricles. An MR image revealed an enhancing, vascular lesion with large venous channels that coursed toward the transverse venous sinuses bilaterally (Fig. 4). Magnetic resonance venography confirmed venous drainage of the lesion into the dural venous sinuses of the posterior fossa (Fig. 5). Cerebral angiography was attempted but was unsuccessful because of the small size of the infant’s femoral arteries. The differential diagnosis of this large, midline occipital lesion in-
cluded encephalocele, vascular malformation, and vascular tumor of the scalp.

**Operation.** The infant was taken to surgery for excision of the mass lesion (Fig. 6). A midline, occipital incision was made, and dissection of the mass lesion from surrounding soft tissues revealed large vessels with both arterial and venous characteristics. During dissection of the mass lesion from the external occipital protuberance, vigorous venous bleeding occurred; this was controlled by coagulation of venous channels found to be coursing through the occipital bone and by bone wax applied to the bony defects. Large vascular pedicles feeding the mass were identified bilaterally as they arose from the occipital arteries. Ligation of these feeding vessels facilitated exposure of the lesion and diminished the blood loss from within. At the end of the surgery, total resection was achieved. One hundred fifty milliliters of packed red blood cells was transfused throughout the procedure to prevent intraoperative hypotension from occurring.

**Pathological Findings.** The histopathological diagnosis was IHE. The lesion was composed of lobules, which consisted of vascular spaces of varying sizes surrounded by layers of endothelial cells. In some areas, cellular nodules were present; these were devoid of vascular spaces or contained only pinpoint ones (Fig. 7 upper). The cellular nodules were present in a background of dense fibrous tissue that contained scattered foci of microcalcification. Using immunohistochemical analysis, we found that the lesion showed positive immunoreactivity to *Ulex europeus* (Fig. 7 lower), confirming the vascular origin of the tumor. The MIB-1 index was 15%, reflecting the lesion’s proliferative potential.

**Postoperative Course.** After surgery, the patient did well without any complications. It is now 6 years since surgery, and no adjuvant therapy has been required; there has been no recurrence of the lesion, and the child is neurologically normal.

**Discussion**

Vascular tumors are recognized for their tendency to form angiomatous structures. These lesions have a multitude of synonyms, which has led to confusion in their classification and in case reporting. The biological behavior of vascular tumors varies from benign, as in the case of IHE, cavernous hemangioma, and angiomatosis; to intermediate aggressivity, as with epithelioid hemangioendothelioma, spindle-cell hemangioendothelioma, kaposiform hemangioendothelioma, and endovascular papillary hemangioendothelioma; to frankly malignant forms as in the case of angiosarcoma, Kaposi sarcoma, and epithelioid hemangioendothelial sarcoma. In the past few years, a few new vascular tumors have been described, and some of the tumors just listed will probably undergo reclassification.

Infantile hemangioendothelioma can be found in the literature to bear several names such as infantile hemangioendothelioma Types 1 and 2, cellular angioma of infancy, benign hemangioendothelioma, infantile (juvenile) capillary hemangioma, and nonmalignant hemangioen-
This confusing nosology of IHE obviously leads to difficulty in providing adequate evaluation of the treatment and prognosis of these lesions.

Histopathological diagnosis of IHE was classified into two types by Dehner and Ishak. Type 1 IHE is characterized by both irregularly dilated and small compressed vascular spaces lined by a single layer or, less often, by several layers of plump endothelial cells with an innocuous cytological appearance. Type 2 IHE is more aggressive in appearance, with tortuous vascular spaces and endothelial cells that demonstrate larger and more hyperchromatic and pleomorphic nuclei than the endothelial cells found in Type 1 lesions. Immunohistochemical analysis has been useful in defining the vascular origin of IHE. Infantile hemangioendotheliomas are positively identified by antibodies to endothelial markers such as CD34, CD31, factor VIII–related antigen, and U. europaeus. However, immunohistochemical analysis cannot be used to differentiate benign forms from malignant ones. In the present case, the histopathological findings were compatible with those of the Type 1 lesion described by Dehner and Ishak, and the immunohistochemical studies confirmed the lesion’s vascular origin. This tumor should be differentiated from the more aggressive vascular tumors that can affect the brain and skull, such as angiosarcoma and epithelioid hemangioendothelioma.

Imaging studies have been useful in the diagnosis of IHE. These lesions may be detected prenatally by using ultrasonography, as in our case in which the lesion simulated the appearance of a conventional occipital encephalocele. In the case described by Pearl, et al., and in our case, imaging studies demonstrated defects in the occipital bone in proximity to the transverse sinuses. Typically, angiograms reveal richly vascularized lesions. It is indeed unfortunate that we were unable to perform cerebral angiography in our patient, for both diagnostic and potentially therapeutic purposes. Although performing this imaging study may be particularly challenging during the neonatal period because of the small size of the access vessels, our experience at The Hospital for Sick Children.
over the past three decades suggests that cerebral angiography can be successfully performed in 90% of neonates with acceptable rates (<1%) of morbidity. By using CT scanning, an IHE usually appears as a low-attenuation mass lesion and is accompanied by calcification in 50% of cases. Infantile hemangioendotheliomas have been described as heterogeneous on both T1- and T2-weighted MR images. On dynamic contrast-enhanced CT and MR imaging, IHEs display early peripheral enhancement followed by centripetal filling of the lesion. Most of the imaging features described previously are based on findings from hepatic IHEs. In our case, both CT and MR images illustrated communication of the tumor vasculature with the dural venous sinuses of the brain.

We have found only three cases in which vascular tumors of the cranium occurred during the newborn period. The first was described by Pearl, et al., and the child died during attempted surgical removal of the IHE. The second case was described by Tokuda and colleagues, and the diagnosis was capillary hemangioma. In the third case, described by Boulot and associates, the diagnosis was nonmalignant hemangioendothelioma, and the patient was doing well 9 months after surgery. Interestingly, there have been two previous reports of primary cerebral IHEs in children. Taratuto, et al., reported a good outcome following partial resection of an IHE in the parietal lobe of a 4-year-old boy; and Chow, et al., reported a poor neurological outcome following the attempted removal of a primary cerebral IHE in a 4-month-old boy.

The differential diagnosis of the lesion in our case of a subtorcular occipital encephalocele was excluded on the basis of the imaging studies, which did not demonstrate a large defect in the occipital bone, a hindbrain dysgenesis, or an anomaly of the major venous sinuses.

An examination of the literature shows that the treatment of IHE is not uniform. For tumors arising in the liver, a multitude of treatments have been recommended, such as partial or complete surgical excision, surgery and steroid therapy, surgery and chemotherapy, liver transplantation, radiation therapy, and steroid therapy. For cranial IHEs, the case described by Pearl and colleagues illustrates the potential hazards of surgery and the need for understanding the vascular supply and venous drainage of these lesions before surgical resection is attempted. In our case, early ligation of arterial feeding vessels from the occipital arteries and skillful administration of pediatric neuroanesthesia with appropriately anticipated volume resuscitation led to the successful removal of the lesion. In a case in which the lesion had its origins in the ovary, the patient underwent surgery, with a good result. In a case of cardiac IHE, the patient underwent a biopsy followed by steroid treatment, and the lesion subsequently regressed in size.

Regression of IHEs, occurring either spontaneously or in response to therapy such as steroid medications, is intriguing. In the present case, because of the age of the neonate, the large size of the lesion, and its location in the occipital region, we did not believe that we could await spontaneous regression or attempt trials of steroids or other chemotherapy. Radiation therapy was not considered an option because of the young age of the patient. Whether a novel class of antiangiogenic factors will be of value in the future has yet to be determined. In our opinion, the best method for treating a neonate with a similar
lesion is by complete surgical extirpation. Whether surgery could have been aided by preoperative embolization is an interesting but unanswered question in our case.

In summary, we have presented the only case of a well-defined large IHE of the pericranium for which there is long-term survival and follow-up review. This case reinforces the benign course of these lesions in newborns following complete surgical excision.

References