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CASE REPORT
Craniofacial/Pediatric

Deep Infantile Hemangioma in the Involuting Phase That Was Difficult to Diagnose before Surgery

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Summary: Infantile hemangioma (IH) is a common pediatric vascular tumor and is easily diagnosed in most cases based on the clinical course and appearance, but deep IHs are difficult to diagnose based on external appearance alone. Clinical and imaging findings are therefore important clues to the diagnosis of soft tissue tumors; however, a definitive diagnosis is decided based on the pathological examination of biopsy or resection specimens. A 1-year-old girl with a subcutaneous mass on her glabella was referred to our hospital. At 3 months of age, her mother noticed a tumor that swelled when she cried. It gradually enlarged, and ultrasonography and magnetic resonance imaging were performed at 12 months of age. Doppler ultrasonography showed a hypo-vascular mass. Magnetic resonance imaging revealed a subcutaneous mass with low-intensity on T1-weighted image and slightly high-intensity on T2-weighted image, with tiny flow voids. Computed tomography showed no frontal bone defect. The soft tissue tumor could not be diagnosed based on these imaging findings; thus, we decided to perform total resection under general anesthesia. A histopathological examination showed a highly cellular tumor with capillaries with opened small vascular channels and glucose transporter 1 positivity. Thus, it was diagnosed as deep IH transitioning from the proliferative phase to the involuting phase. Deep IHs are difficult to diagnose because characteristic imaging findings disappear during the involuting phase. We emphasize the importance of performing Doppler ultrasonography in the early phase (eg, at 6 months of age) for soft tissue tumors of infancy. *(Plast Reconstr Surg Glob Open 2023; 11:e4975; doi: 10.1097/GOX.0000000000004975; Published online 10 May 2023.)*

Infantile hemangioma (IH) is the most common pediatric vascular tumor. IHs are diagnosed clinically in most cases; however, the diagnosis of deep-type IH is known to be difficult, and imaging examinations such as ultrasonography (US) and MRI are useful.[1] Clinical and imaging findings are important clues for the diagnosis of soft tissue tumors; however, we sometimes encounter difficulties in obtaining definite findings to decide the treatment plan. Although a biopsy provides a diagnosis, both needle biopsy and excisional biopsy require general anesthesia for infants and children.[2] We report an infantile case of subcutaneous tumor in glabellar area, which was difficult to diagnose by US and MRI. We decided to perform total excision biopsy under general anesthesia; however, the pathological diagnosis showed a deep IH.

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CASE

A girl with a mass on her glabella was first seen at our hospital when she was 12 months old. A 2-cm, elastic-soft mass was palpable, and became remarkable when she cried. Her mother noticed the tumor at 3 months of age. A pediatrician and a plastic surgeon in another hospital just observed without any imaging from 3 months to 12 months, but gradual enlargement was observed. At the age of 12 months, US and MRI were performed before admission to our hospital. US showed a flat hypoechoic mass of 1 cm in diameter in the periosteal layer. The tumor showed hypovascularity by power Doppler US, which has excellent blood flow detection sensitivity and less angle

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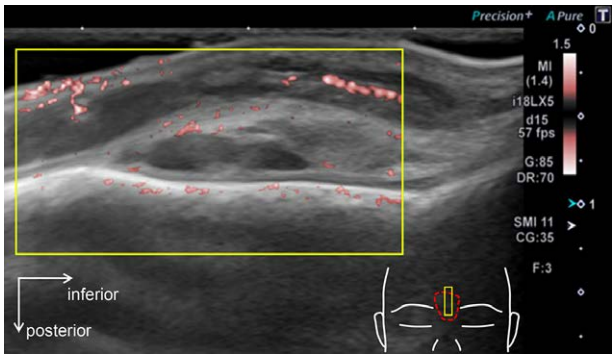

Fig. 1. Power Doppler ultrasound findings at 12 months of age. A 1-cm flat mass in the glabellar area showed poor blood flow.

dependence (Fig. 1). MRI revealed a mass lesion on the periosteum with low-intensity on T1-weighted image and slightly high-intensity on T2-weighted image (Fig. 2). (**See figure, Supplemental Digital Content 1,** which shows the sagittal view of T2-weighted image. **http://links.lww.com/PRSGO/C544**.) Tiny flow void pattern was detected by MRI; however, it was difficult to characterize the tumor as IH, and further investigation was needed, including biopsy. Tufted angioma, vascular malformations, infantile myofibromatosis, and other tumors could be cited as differential diagnosis, and also, rhabdomyosarcoma could not be excluded. At 13 months of age, she was referred to our hospital. Computed tomography (CT) showed no obvious defects in the frontal bone. We performed total excision of the mass under general anesthesia to make a histological diagnosis. A clearly demarcated tumor was found in the procerus muscle layer with a transverse incision on the tumor. (**See figure, Supplemental Digital Content 2,** which shows the resected tumor. **http://links.lww.com/PRSGO/C545**.) The tumor was mobile with no adhesions to the surrounding tissues or periosteum. After the excision of the tumor on the periosteum, the muscle layer and dermis were sutured with absorbable suture (4-0 PDS; Johnson & Johnson, N.J.). Dermabond (Johnson & Johnson) was applied for the adhesion of the skin surface. Hematoxylin-eosin staining showed the highly cellular clump of the tumor with capillaries and opened small vascular channels with adipose tissue, which indicated that the IH was in the transitional phase from the proliferative phase to the involuting phase (Fig. 3). Histopathological immunostaining of glucose transporter 1 was positive, which supported the diagnosis of IH. At 6 months after the operation, a transverse incisional scar was observed in the glabella.

DISCUSSION

IHs are clinically classified according to their depth, as superficial, deep, and mixed. In most cases, the diagnosis is based on clinical characteristics; however, deep IHs are known to be difficult to diagnose, and several imaging methods (eg, US, CT, and MRI) are used to distinguish them from other benign or malignant tumors.[2] The natural history of IHs consists of a proliferative phase, an involuting phase, and an involuted phase. The imaging findings of IHs depend on the phase. In the proliferative phase, IHs seem as a well-circumscribed mass of variable echogenicity. The use of color Doppler US substantially facilitates the diagnosis of IHs by showing characteristic patterns of high-flow vessels and high vascular density. In the involuting phase, US shows decrease in size and vascular density.[3] MRI during the proliferative phase presents a well-defined mass, hypointense on T1-weighted images and hyperintense on T2-weighted images, often with the presence of internal flow voids. Following contrast administration, strong diffuse enhancement is observed. In the involuting phase, a hyperintense area on T1 imaging appears with replacement of fibro-fatty tissue, flow voids decrease gradually, and the enhancement effect decreases.[4] GLUT-1 staining of the endothelium is a sensitive marker for IH. In the proliferative phase, histological analyses show highly cellular clumps and small vascular channels with barely discernable vessel lumens. Going into the involution phase, the vascular walls become thinner

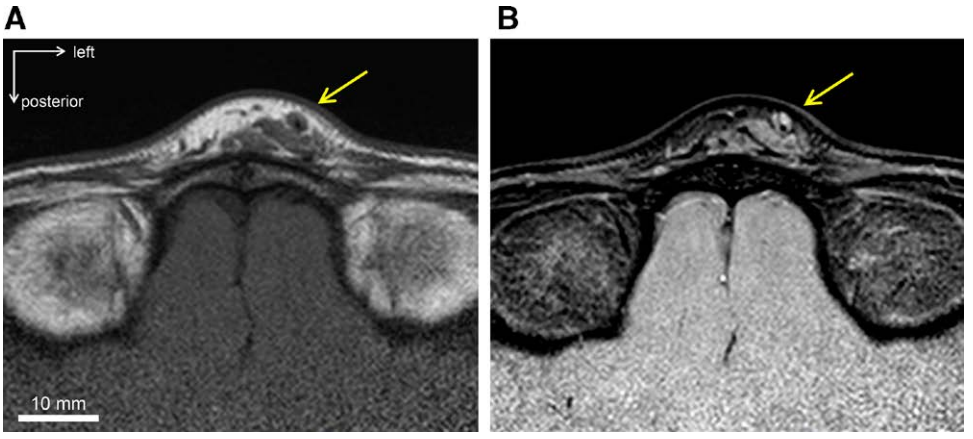

Fig. 2. MRI findings (axial view) at 12 months of age. A subcutaneous mass at the glabellar area demonstrated low signal intensity on T1-weighted image (A) and slightly high signal intensity on T2-weighted image (B) with tiny flow voids inside the tumor (yellow arrows).

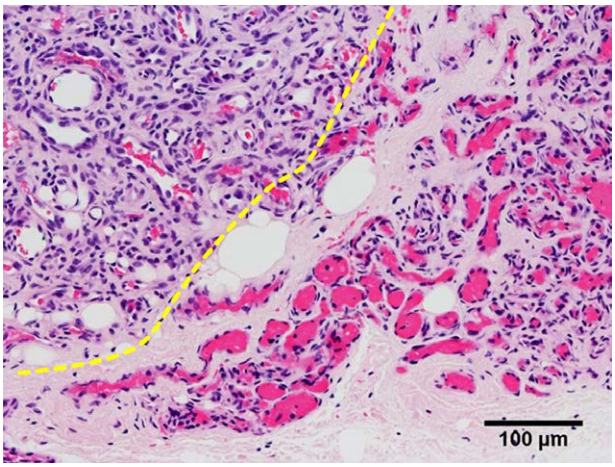

Fig. 3. Histopathological findings (hematoxylin-eosin staining). The left side of the yellow dashed line shows tumorous proliferation in the proliferative phase. The right side of the yellow border shows blood vessels intermingled with open lumens with adipose tissue as the involuting phase.

with flattened endothelial cells, and vascular channels become more prominent. In the involuted phase, residual tissue composed of adipocytes and connective tissue may be seen.[5] In our case, a histopathological examination confirmed that it was transitioning from the proliferation phase to the involuting phase. At this time, characteristic image findings gradually disappear, which made the diagnosis difficult.

There were two factors that made the diagnosis of IH difficult in this case. First, the glabellar region is not a common location. Kawaguchi et al reported that IHs in the glabellar region accounted for less than 5% of IHs on the head and face. Furthermore, they reported that the root of the nose was spared from the distribution of lesions.[6] Second, transitioning from the proliferating phase to the involuting phase caused the characteristic US finding of blood flow inside the tumor to be lost. Imaging should have been performed during the proliferating phase, when characteristic findings could be obtained.

Treatment options for IHs include laser therapy, surgical excision, and drug therapy.[7] Propranolol had been the drug of choice because its effectiveness was reported in 2008, and it became the first line therapy in many institutions.[8] However, IHs on the central facial area were reported to be associated with a relatively higher risk of volumetric sequelae[9]; thus, resection of the residual lesion may be needed, even after oral propranolol treatment, if the bulge remains. Deep IHs are difficult to diagnose because characteristic findings on imaging disappear during the involuting phase. We insist on the importance of performing US examination during the proliferating phase.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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