Spontaneous resolution of an infantile hemangioma in a dorsal root ganglion

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Infantile hemangiomas are tumors commonly seen in children. Few authors have reported infantile hemangiomas affecting the CNS, and there are no prior reports detailing spontaneous resolution of a histologically proven juvenile hemangioma within a dorsal root ganglion. The authors report the case of a newborn boy with a large cutaneous hemangioma in the midline of his back. Spinal MR images were obtained to rule out associated spinal cord tethering, and an intradural spinal lesion was unexpectedly discovered. Biopsy revealed an intradural infantile hemangioma within the dorsal root ganglion, and, based on this diagnosis, no resection was performed. Sixteen months following the biopsy, the cutaneous hemangioma had become involuted and the intradural hemangioma had completely resolved. The behavior of the intradural component in this case follows the natural history of many cutaneous infantile hemangiomas. (DOI: 10.3171/2011.9.FOCUS11203)

KEY WORDS • infantile hemangioma • natural history • vascular tumor

VASCULAR tumors in childhood represent a number of distinct clinicopathological entities. Based on recommendations of the International Society for the Study of Vascular Anomalies, a biologically based classification system was adopted in 1996 that divided vascular anomalies into either malformations or tumors based on the presence of either endothelial cell mitotic activity or errors in vascular morphogenesis.6,18 The vascular tumors that may present in children include infantile hemangiomas, congenital hemangiomas, hepatic hemangiomas, and Kasabach-Merritt lesions. Infantile hemangiomas are further classified into superficial, deep, or compound categories.19 Although cutaneous hemangiomas are the most common tumor of infancy, affecting 3%–10% of all children,20 intradural hemangiomas are much less common. There are multiple reports of spinal extradural10,12 and intradural8,9,14,15,17,22,23,26 hemangiomas in adults. We report the case of a newborn with a cutaneous hemangioma, as well as hemangiomas in the extradural space and a intradural space involving the DRG. Intradural infantile hemangiomas of the spine are very rare.13 To the best of our knowledge, this is the first reported case documenting spontaneous resolution of a histologically proven infantile spinal hemangioma. The natural history mirrors the resolution that is often seen with cutaneous infantile type hemangiomas. This is also the first reported case of an infantile hemangioma infiltrating the DRG.

Case Report

Presentation and Examination. This newborn boy presented to his pediatrician with a large cutaneous hemangioma on the midline of his lower back, from the level of the lumbosacral junction to the lower sacral levels (Fig. 1). Ultrasonography of the spine showed a low-lying conus medullaris, and MR imaging was recommended to determine if a tethered cord was present. Magnetic resonance images confirmed that the conus terminated below the L-3 level. Unexpectedly, a contrast-enhancing mass lesion was also seen within the spinal canal at the L5–S1 level (Fig. 2). Although the lesion was most obvious within the spinal canal, it extended through the neural foramen on the left and also had a paraspinal component extending to the psoas muscle (Fig. 2). The patient was referred for neurosurgical evaluation. At our initial examination of the patient, we observed a 7-cm, red, raised cutaneous hemangioma in the inferior midline portion of

Abbreviation used in this paper: DRG = dorsal root ganglion.
the patient's back. His neurological examination results were normal. In view of the imaging characteristics of the lesion, the differential diagnosis was thought to include neuroblastoma or, less likely, teratoma, lymphoma, or sarcoma.

**Operation.** A biopsy was performed. We made a midline incision 2 cm superior to the back hemangioma and extending less than 1 cm into the hemangioma itself. The spinal lesion was exposed via a 2-level laminoplasty. An epidural vascular mass was identified, removed, and sent for pathological analysis. The frozen section was thought to be consistent with a possible vascular tumor. We explored the left side of the spinal canal in the epidural space and found an enlarged L-5 nerve root sleeve. The dura mater was opened, and multiple samples of the red vascular tissue within the nerve root sleeve were sent for pathological analysis. The frozen-section analysis of this tissue sample was thought to be consistent with dorsal root ganglia without tumoral tissue, although we noted hypercellularity. Given the uncertain diagnosis, no resection of the mass lesion was carried out. The patient awoke from surgery in stable neurological condition and was dismissed from the hospital on the 3rd postoperative day.

**Pathological Findings.** On histological examination of the specimens, lobules of capillary-sized vessels were seen lined with flattened epithelium. Sheets of cells infiltrating the DRG were noted (Fig. 3). High-magnification microscopy of the epidural component showed endothelial cells with vacuolated cytoplasm, radially lined and resembling vascular lumens consistent with hemangioma. Immunohistochemistry for endothelial antigen CD31 was positive for both the epidural tumor and cells within the DRG. Cells positive for vimentin, CD31, CD34, factor VIII, muscle-specific actin, and smooth muscle actin were seen within the DRG, creating cellular density and swelling of the DRG. Type 4 collagen surrounded both the infiltrating cells and the DRG elements, but the collagen was noted to be much denser around the infiltrating cells. There were no mitoses, and the nuclei were bland with light chromatin. The MIB-1 proliferation index varied and was as high as 30% in some regions. Ganglion cells and satellite Schwann cells stained for neuron-specific enolase, CD57 and S100 protein; ganglion cells also stained for neurofilament and synaptophysin. A diagnosis of hemangioma infiltrating a DRG was made.

**Postoperative Course.** Given this diagnosis, the decision was made to follow the patient with serial MR imaging. On the first postoperative MR image, a significant amount of residual enhancing mass was seen, especially along the left L5–S1 foramen. Magnetic resonance images obtained 3 months later revealed further regression of the enhancing tissue with residual hemangioma along the cauda equina and nerve root sheaths. Sixteen months postoperatively, MR images showed no sign of a persistent spinal mass lesion (Fig. 4). The patient remains neurologically intact.

**Discussion**

Based on the International Society for the Study of Vascular Anomalies classification recommendations, this infant's lesion may be categorized as a vascular tumor of the subtype infantile hemangioma. Infantile hemangiomas are benign tumors occurring in up to 10% of all infants. Thirty percent of these hemangiomas are evident at birth. A small number of them may pose a risk by compressing vital structures. The vast majority, however, are solitary cutaneous lesions that have no serious consequences for the patient. Hemangiomas involving the head and neck area account for 40%–60% of cases, but the inferior portion of the back is also a common location. Superficial hemangiomas are red and have well-defined borders. Deep hemangiomas, however, involve the dermal layer and appear as a red, purple, or blue subcutaneous mass. Those lesions displaying combined features of superficial and deep lesions are called compound hemangiomas. Infants with hemangiomas in the midline of the lower back are frequently referred for spinal imaging to rule out a tethered spinal cord and neural tube defect.

In our patient, spinal imaging led to the incidental discovery of an asymptomatic enhancing mass within the spinal canal.

Infantile hemangiomas involving the intradural spinal compartment in children are extremely rare. Fewer than 20 such cases have been reported. Intradural hemangiomas in children are even less common, and there are no published reports reviewing the natural history of this lesion. Infantile hemangiomas of the CNS have been associated with both PHACE syndrome (Posterior fossa abnormalities and other structural brain abnormalities; Hemangioma(s) of the cervical facial region; Arterial cerebrovascular anomalies; Cardiac defects, aortic coarctation, and other aortic abnormalities; and Eye abnormalities) and tethered cord. Our patient did not have any other features of PHACE syndrome, but the spinal cord...
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was tethered. Tethered cord has also been associated with cutaneous hemangioma of the lower back, even in the absence of an intradural lesion.1 Our patient had a cutaneous hemangioma associated with hemangiomas in the DRG and the paraspinal musculature. To our knowledge, this is the first reported case of infantile hemangioma infiltrating a DRG and the first report detailing the spontaneous resolution of a histologically proven intradural hemangioma in an infant.

Infantile hemangiomas comprise a group of tumors exhibiting cellular proliferation with features including abnormal vascular lesions and extensive accumulations of blood vessels. Infantile hemangiomas may be distinguished from other types of hemangioma on the basis of their distinctive presentation and natural history. Infantile cutaneous hemangiomas characteristically appear within 2 weeks of birth, enlarge rapidly, stop growing before 1 year of age, and spontaneously involute over the next several years.3,11,27 The natural history of cutaneous infantile hemangiomas is determined by 2 active clinical stages: proliferation and involution.27 Proliferation occurs during the first 12 months of life, with periods of rapid growth within the first few weeks, and later between Months 4 and 6.27,32,33 Cutaneous hemangioma involution is marked by a change in color from bright red to a darker red with a grayish hue. During this phase the lesion ceases growing and becomes soft, lobular, and compressible. During involution, infantile hemangiomas gradually flatten as inactive cells replace plump proliferating endothelial cells and vascular channels become more pronounced.

Given the usual clinical course, many cutaneous hemangiomas require no treatment. More severe cases of cutaneous hemangioma can be treated with corticosteroids, interferon, or vincristine.31 In our case, the intradural component exhibited the natural history typical of cutaneous infantile hemangiomas. After 14 months of follow-up, the patient had near-complete resolution of the cutaneous portion and no evidence of residual intradural tumor. This parallel behavior should be remembered when determining the treatment for children with infantile hemangiomas that are associated with enhancing mass lesions within the intradural compartment. In cases with associated tethering of the spinal cord, the decision

Fig. 3. Photomicrographs of tissue samples.  A: Sheets of cells infiltrating the DRG containing nerve and ganglion cells. H & E, original magnification × 20.  B: High magnification of a juvenile hemangioma showing plump endothelial cells resembling cells lining vascular lumens. The cytoplasm of the hemangioma cells is vacuolated. H & E, original magnification × 60.  C: A classic immunohistochemical endothelial antigen stain, CD31, reveals juvenile hemangioma within DRG. Original magnification × 20.  D: Neurofilament protein stain highlighting the long peripheral nerve axons and large round ganglion cells, spread apart by neurofilament-negative juvenile hemangioma cells. Original magnification × 20.

Fig. 4. At 16 months following the biopsy, sagittal (left) and axial (right) MR images show essentially complete resolution of the mass.
to untether the spinal cord should be made according to the usual criteria for spinal cord untethering.

Infantile hemangiomas within the CNS are very rare. Most previously reported cases of infantile hemangioma in the CNS have been intracranial, including lesions found in the fourth ventricle, cerebellopontine angle, pineal region, hypothalamus, and hippocampus.17,19-24,27,28,30,31 Balaci et al.2 recently reported on a case that diffusely involved both the brain and the cervical spinal cord. Herman et al.3 reviewed a single infant with extradural extension of a mediastinal hemangioma. Karikari et al.4 reported on 2 infantile cases involving the lumbar spine. Both patients underwent resection, precluding any analysis of the natural history.19 In 2008 Viswanathan et al.5 reviewed the literature and found 15 previously reported cases of true “infantile” hemangiomas that involved the neural axis, to which they added 15 of their own cases. Of their 15 new cases, 6 involved solitary intraspinal hemangiomas, and 9 were intracranial; 1 tumor involved both intracranial and intraspinal regions. Only 2 of the patients in the intraspinal cohort presented with neurological deficits and another 2 had cutaneous hemangiomas on the back. Viswanathan et al. found that none of their cases had spinal cord parenchymal involvement, in contrast to involvement of the DRG in our patient. While Viswanathan et al. reviewed the treatment, imaging, and histological features of infantile hemangiomas involving the neural axis, they did not report on natural history of the lesion in the absence of corticosteroid and interferon therapy. Nahed et al.6 recently reported on a patient with a scalp hemangioma associated with an intracranial hemangioma that caused hydrocephalus and venous sinus thrombosis. The patient had a documented decrease in lesion size following treatment with prednisolone and low-molecular weight heparin. Although the lesion in their case was cranial rather than spinal, its behavior mimics that of our own case and reinforces our conclusion regarding the behavior of these lesions.

An important feature of most reported cases of infantile hemangioma involving the CNS is the overlying cutaneous hemangioma. Furthermore, many previously reported cases had continuity between the superficial lesions and the lesions in the CNS.31 In our patient, hemangiomas were present in the skin and epidural space, as well as the DRG, but the lesions did not appear continuous on either imaging or on surgical inspection.

The molecular analysis and histological observation of vascular tumors and malformations has been significantly clarified in recent years. Older reports frequently used identical terminology for lesions that are now considered to be different.11 Capillary hemangiomas were once considered a subtype of infantile hemangiomas but are now considered a separate diagnostic entity, often renamed congenital nonprogressive hemangiomas.7,20,21 These tumors typically display capillary lobules separated by fibrous tissue instead of the normal tissue that is seen in infantile hemangioma. In addition, these are not GLUT1-positive. Another subtype of hemangioma, the congenital hemangioma, is usually present and fully formed at birth, and variable periods of involution follow, further distinguishing it from classic infantile hemangioma.20 Although pathological analysis will allow for the proper classification of a vascular lesion, we do not recommend biopsy sampling of a lesion that is considered likely to be an intramedullary hemangioma in an asymptomatic child. In cases that are not biopsied, follow-up MR imaging is necessary to document involution of the lesion.

Conclusions

Cutaneous vascular lesions are commonly found in infants and may very rarely be associated with enhancing lesions in the CNS. Although rare, infantile hemangioma should be included in the differential diagnosis of children with intradural extramedullary lesions, particularly when associated with an overlying cutaneous hemangioma. For CNS lesions with characteristics of infantile hemangioma of the CNS in neurologically intact children, close clinical observation rather than resection should be considered.

Acknowledgment

The authors thank Holly Wagner for providing editorial assistance.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Maher. Acquisition of data: Maher, Hervey-Jumper, McKeever, Gebarski. Analysis and interpretation of data: all authors. Drafting the article: Maher, Hervey-Jumper. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Maher. Study supervision: Maher.

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Manuscript submitted August 10, 2011.
Accepted September 12, 2011.

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