Case Report

Absent C6 Cervical Pedicle in a Collegiate Football Player

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Abstract Congenital absence of a cervical pedicle is a rare clinical finding with only 70 reported cases in the literature from 1946 until present. The congenitally absent pedicle has clinical importance owing to the frequency of misdiagnosis and inappropriate invasive treatments. We present the case of a 21-year-old college football player who experienced neck and shoulder pain after violent twisting of his neck by the face mask. The player walked off the field under his own power. He was sent to the locker room, where he underwent right shoulder and cervical spine radiographs. Initial review of the radiographs raised concern for a jumped right C6 facet. The patient then underwent CT and MRI of the cervical spine, confirming the diagnosis of an absent cervical pedicle. He was treated nonoperatively for a short time and completed the season. He had no symptoms at last followup at 8 months. The most frequent location of the absent cervical pedicle is at the C6 level, and the next most common is at the C5 level. Neural compression or instability is uncommon and nonsurgical treatment is the mainstay of treatment. Misdiagnosis can lead to inappropriate treatment such as halo

or tong application with traction, which occurred in seven of 57 cases in one series, and exploratory surgery, which occurred in four of 57 cases.

Introduction

Congenital absence of a cervical pedicle is a rare clinical finding. There have been only 70 reported cases in the literature from 1946 until present [2, 3, 6, 9]. The congenitally absent pedicle has clinical importance owing to the frequency of misdiagnosis and inappropriate invasive treatments. We present the case of a college football player who experienced neck and shoulder pain after violent twisting of his neck by the face mask during a college football game. Congenital absence of a cervical pedicle must be considered in the differential diagnosis in patients who have abnormal plain radiographs after trauma to prevent morbidity from unnecessary surgical intervention.

Case Report

A 21-year-old college football varsity player was running straight ahead when an opposing player grabbed his face mask and violently pulled him to the ground from behind. He immediately experienced right shoulder pain and had difficulty turning his head from side to side. The neuromuscular examination was normal with the exception of weakness with shoulder abduction secondary to pain. The player walked off the field under his own power. He was sent to the locker room, where he underwent right shoulder and cervical spine radiographs. Initial review of the radiographs raised concern for a jumped right C6 facet.

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Each author certifies that his or her institution approved or waived approval for the reporting of this case and that all investigations were conducted in conformity with ethical principles of research.

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Fig. 1 An axial cut from the CT of the cervical spine reveals the absent C6 pedicle on the right.

Fig. 3 A coronal view at the level of C6 shows the obviously absent right C6 pedicle.

Fig. 2 A CT sagittal image reveals the large space where the pedicle normally sits.

Fig. 4 A three-dimensional reconstruction of the CT again shows the absent C6 pedicle on the right.

The patient then underwent CT (Figs. 1–4) and MRI (Fig. 5) of the cervical spine. The imaging studies confirmed the diagnosis of congenitally absent cervical pedicle. The patient was treated for a cervical sprain with collar immobilization for 3 days. The immobilization was followed by 1 week of supervised physical therapy, including ROM and stretching. The player returned to play

the following week and completed the remainder of the season with no additional symptoms. The patient was followed daily by the athletic trainers and biweekly by the senior author (RAM) for the remainder of the season. His most recent followup was 8 months after the initial injury, and he reported he is pain free and without limitations in his activities. IRB approval was obtained before initiation

Fig. 5 A T2-weighted MR image shows no canal narrowing or neurologic compromise at the C6 level.

of data collection for this case report and received exempt status. The player gave verbal permission for his case to be presented and published.

Discussion

The skeletal system develops from paraxial and lateral plate mesoderm, and from the neural crest. The paraxial mesoderm forms somites on either side of the neural tube. The ventromedial aspect of the somite differentiates into sclerotomes and the dorsolateral aspect differentiates into dermomyotomes. By the end of the fourth week of gestation, the sclerotome cells become the mesenchyme, or embryonic connective tissue. The sclerotomes shift their position to surround the developing spinal cord and notochord. The caudal portion of each sclerotome then proliferates and condenses, binding the caudal cephalic half of the sclerotome below it. This process is regulated by HOX genes. Mesenchymal cells between the cephalic and caudal parts of the original sclerotome contribute to formation of the intervertebral discs [4]. Each vertebral segment develops from six (three paired) chondrification centers appearing at approximately the seventh week of gestation: two for the vertebral body, one for each side for the transverse processes, and one for each side of the neural arch. Outgrowths from the neural arch center become the pedicle, superior and inferior articular processes, lamina, and spinous processes [1, 2]. Full neural closure does not

occur until the third month. Failure of development of a vertebral chondrification center of a particular sclerotome or failure of ossification could lead to the absence of a pedicle [6].

The most frequent location of the absent cervical pedicle is at the C6 level, and the next most common is at the C5 level. The most common presenting symptom in these cases is neck pain radiating to the back and shoulders. The next most common symptom is sensory findings in the upper extremities. Neural compression or instability is uncommon and nonsurgical management is the most common treatment [3]. White et al. [8] proposed the functional spinal unit, defined as two adjacent vertebrae and their intervening soft tissues, is stable if all anterior structures (vertebral body and/or disc) are intact and one posterior structure (facet joints, laminae, spinous processes, and/or posterior intervertebral ligaments) is intact. The reverse is also true: the spine is stable if one anterior structure is intact with all posterior structures intact [8]. The congenitally absent cervical pedicle is therefore a stable injury pattern in most cases. Proper radiographic evaluation including CT and MRI should be done to rule out injuries to the aforementioned structures that would contribute to instability, as many absent pedicles are found after traumatic episodes and in association with other abnormalities of the spine that could lead to instability [5].

The dominant radiographic features are a triad: (1) false appearance of an enlarged ipsilateral neural foramen because of the absent pedicle; (2) a dysplastic, dorsally displaced ipsilateral articular pillar and lamina; and (3) dysplastic ipsilateral transverse process [3, 7]. Initial evaluation with conventional radiographs frequently leads to misdiagnosis and misguided intervention [9]. Other osseous abnormalities often are associated with absent cervical pedicles and include spina bifida occulta, vertebral body or arch fusion, and additional pedicles [3]. An absent pedicle has a smooth cortical margin without soft tissue swelling. The differential diagnoses should include fracture, spinal tumor, bone tumor, vascular anomaly, and a spondylolytic lesion [6].

Misdiagnosis can lead to inappropriate treatment such as halo or tong application with traction, which occurred in seven of 57 cases in one series, and exploratory surgery, which occurred in four of 57 cases [6]. An absent cervical pedicle must be considered in patients with trauma and abnormal plain radiographs. We recommend additional radiographic evaluation before surgical intervention to prevent unnecessary morbidity. Although absence of a cervical pedicle apparently has not been reported previously in football players, our case shows an absent cervical pedicle is consistent with safe return to play if the conditions for spinal stability outlined by White et al. [8] have been met.

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