Misdiagnosing absent pedicle of cervical spine in the acute trauma setting

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Abstract

Congenital absence of cervical spine pedicle can be easily misdiagnosed as facet dislocation on plain radiographs especially in the acute trauma setting. Additional imaging, including computed tomography (CT)-scan with careful interpretation is required in order to not misdiagnose cervical posterior arch malformation with subsequent inappropriate management. A 39-year-old patient presented to the emergency unit of our university hospital after being trampled by a cow over her back and head followed by loss of consciousness, retrograde amnesia and neck pain. Her initial cervical CT-scan showed possible C5-C6 dislocation, then, it became clear that her problem was a misdiagnosed congenital cervical abnormality. Patient was treated symptomatically without consequences. The congenital absence of a cervical pedicle is a very unusual condition that is easily misdiagnosed. Diagnosis can be accurately confirmed with a CT-scan of the cervical spine. Symptomatic conservative treatment will result in resolution of the symptoms.

Introduction

Abnormalities of the cervical spine posterior arch are very rare and found incidentally on neck radiographs requested to rule out other pathology. Their radiographic findings may mimic more serious entities such as fractures, locked facets, and tumor-induced bony erosions.[1] It is crucial to differentiate between these congenital absent pedicles and other pathologies since congenital lesions do not require treatment, while the other lesions might require urgent care. Since Hadley firstly reported three cases of this rare clinical finding in 1946, less than one hundred cases of absent pedicle syndrome have been reported.[1-7] Recognition of this syndrome is important not just in the cervical spine, as it has also been reported to occur in the thoracic, lumbar, and sacral spine.[8,9]

Case Report

A 39-year-old female patient presented to the emergency department at our hospital after she was trampled by a cow injuring her back, neck and head. She sustained a loss of consciousness with retrograde amnesia, neck pain and stiffness. Initial Glasgow Coma Scale was 14 and vital signs showed mild increase in the pulse at a rate of 110. Blood pressure was maintained at 107/65 mmHg. Primary and secondary survey revealed a mild tenderness over the parietal bone, mid-line neck tenderness, bruises over the right upper quadrant of the abdomen, right chest wall and right buttock. Her chest auscultation and initial neurological exam were unremarkable. Based on her history and physical examination a hard cervical collar was applied with full cervical spine precautions and a computed tomography (CT)-head, cervical spine, chest and abdomen were obtained and reported by the radiologist on call with these findings: grade II liver laceration, right 10th rib fracture and C5-C6 right facet dislocation based on the radiology report (Figure 1). Her brain CT-scan was unremarkable and her loss of consciousness was most likely secondary to a concussion. Patient was admitted to intensive care unit for hemodynamic monitoring. Prior to Gardner Wells application for a trial of reduction, the senior author PJ reviewed the CT scan and he diagnosed her with C6 absent pedicle. For that reason, a magnetic resonance imaging (MRI) was performed 1 day after her injury to asses her persistent neck pain which did not show any soft tissue injuries. A 3-D reconstruction of the native images of the CT Scan was performed and it was found out that she had a congenital absence of the C6 cervical pedicle that was misinterpreted on the initial images (Figure 2). The patient was discharged the next day after obtaining normal flexion/extension X-rays of the cervical spine.

Discussion

Congenitally absent pedicle has been described as occurring between C4 and C7 with C6 being the most common site of occurrence (39%) followed by C5 (27%).[10] The defect may occur on either side and is almost always unilateral. The sex distribution is equal.[1,9,10] In general, congenital abnormalities of the posterior arch result from the failure of development of a vertebral chondrification center for the posterior arch of a particular sclerotome, or failure of appropriate ossification of that chondral center.[3] These abnormalities may lead to absence of a pedicle or spondylolysis. In general, these anomalies likely develop between gestational age of sixth and ninth weeks.

Absent pedicle syndrome involves the failure of development of the ventral chondrification centers during the sixth week of gestation leading to absence of the pedicle and lateral mass. This in turn leads causes a dysplasia of the inferior articulating facet of the adjacent level which displaces anteriorly causing the characteristic unilateral subluxed appearance of the vertebrae.[1,11]

Symptoms and clinical presentation

Most patients with absent pedicle are asymptomatic and diagnosed incidentally on imaging. 59% of these had cervical pain or headache, appearing most often after trauma, radiating to one or both upper extremities. Several patients (17%) have had isolated upper extremity symptoms.[1] However, neurological examination is normal in the majority (65%).[12] One author reported the development of premature degenerative changes and narrowing of the contralateral neural exit foramen.[13] Clinical entities that may mimic absent cervical pedicle which include: a spinal tumor, a bone tumor, vascular anomaly or a fracture-dislocation (Table 1).

Radiological findings and treatment

Absent cervical pedicle is commonly misdiagnosed as a facet dislocation, fracture dislo-

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cation or spondylolysis/spondylolisthesis. Antero-posterior and lateral-view X-rays of the cervical spine as a screening test give general information on the anatomy and the alignment of the vertebral bodies, although subtle pathologies such as fracture of the vertebral pedicles cannot always be ruled out.[14] The presence of a prevertebral soft tissue swelling could indicate a cervical traumatic injury.[15] However, in the acute trauma setting, absent cervical pedicle can be misdiagnosed on plain radiography. Holmes et al. found a pooled sensitivity for cervical spine injuries on plain radiography of 52% and 98% for CT scan.[16] Evidence exists that CT significantly outperforms plain radiography as a screening test for patients at very high risk of cervical spine injury,[17] and should be used in all cases where congenital absent pedicle is suspected. Magnetic resonance imaging will not provide any further information unless there are neurological symptoms, but is useful for eliminating soft tissue injury that is usually associated with acute trauma, especially in traumatic subluxations.[6] In addition, MRI is helpful with soft tissue tumor or vascular anomalies.[18] The typical triad of radiological findings associated with absent pedicle was described by Wiener *et al.*[9] which includes: i) an enlarged neural foramen secondary to the absence of a pedicle and posterior displacement of the articular mass of this vertebra; ii) a dysplastic, posteriorly displaced articular facet and lamina ipsilateral to the anomaly; and iii) an ipsilateral dysplastic transverse process. Additional abnormalities that may be seen are: spina bifida occulta, additional hypoplastic pedicles, and vertebral body fusions.[1] On the other hand, the distinctive features of cervical spondylolysis are: i) bilateral spondylolysis of the articular masses; ii) incomplete fusion or spina bifida of the spinous process; iii) bilateral hypoplastic pedicles; iv) Grade I spondylolisthesis of the superior vertebral body; and v) elongation of the neural foramina.[19] To prevent subsequent improper management, it is important not to misinterpret the radiographic features of absent pedicle syndrome for a fracture or cervical spondylolysis (Table 2). Despite the radi-

Table 1. Differential diagnosis of absent cervical pedicle.

Differential diagnosis	
Spinal tumor	Neurofibroma, meningioma, schwannoma, fibroma, ganglioglioma, chondroma, metastasis, or plasmacytoma
Bone tumor	An aneurysmal bone cyst, osteogenic sarcoma, osteoblastoma, osteochondroma or osteofibroma
Vascular anomaly	A tortuous vertebral artery, angioma or aneurysm
Spondylolytic lesion	Uni- or bilateral spondylolysis
Fracture-dislocation	Uni- or bilateral Facet fracture dislocation

Table 2. Radiographic distinctions between absent cervical pedicle and cervical spondylolysis.

	Absent pedicle	Unilateral spondylolysis	Bilateral spondylolysis
Pedicle	Always absent on ipsilateral side; contralateral side is normal	Hypoplastic on ipsilateral side; contralateral side is normal	Hypoplastic on both sides
Transvere process	Dysplastic on ipsilateral side	Normal	Normal
Spinous process	Could have spina bifida	Spina bifida commonly present	Spina bifida commonly present
Lateral mass	Dysplastic on ipsilateral side	Ipsilateral well corticated cleft in pars interarticularis	Bilateral well articulated cleft in pars interarticulares
Articular facets	Superior articular facet is hypoplastic or absent	Dysplastic and displaced but present	Dysplastic and displaced but present on both sides
Spondylo-listhesis	Absent	Sometimes present	Always present
Neural foramina	Always widened on ipsilateral side	Commonly widened on ipsilateral side	Commonly widened bilaterally

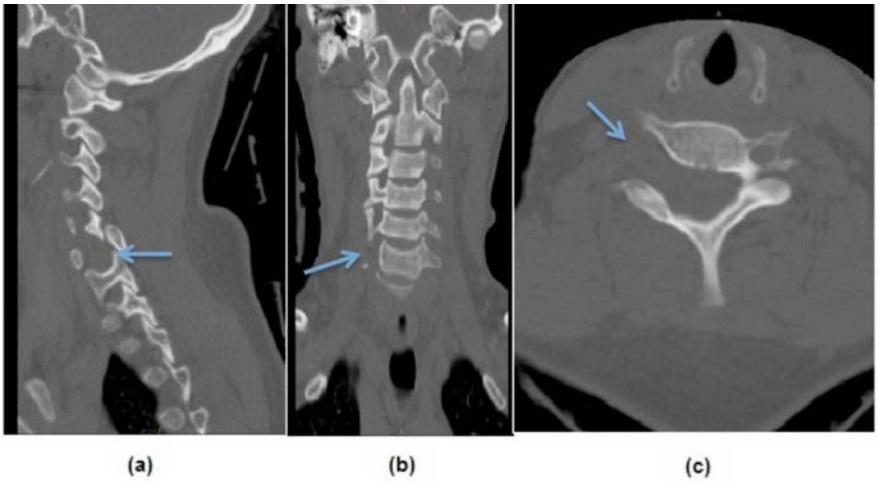

Figure 1. a) A sagittal cut of the cervical spine CT scan of our patient showing a large space where the pedicle normally sits at the level of C6. b) A coronal view showing an absent right C6 pedicle with hypoplastic pillar above it on the ipsilateral side. c) An axial cut showing an absent C6 pedicle on the right side.

Figure 2. A three-dimensional reconstruction of the cervical spine computed tomograsphy scan demonstrating the absent C6 pedicle on the right side. 3D reconstruction provides clear evidence of the congenital abnormality.

ographic appearance of absent pedicle syndrome, is still a stable condition according to Punjabi and White's definition which states that a functional spinal unit of *two adjacent vertebrae and their intervening soft tissues* is stable if all anterior structures (disc and vertebral body) are intact and one posterior structure (facet joints, laminae, pedicles, spinous processes, and/or posterior ligaments) is intact.[20] Treatment for this congenital condition is usually conservative and doesn't require intervention. The present case is one in which the condition was not initially diagnosed until more senior staff examined the CT and MRI scans. Halo or tong traction has occurred in the literature at a rate of seven of 57 cases in one series, and exploratory surgery, which occurred in 4 of 57 cases.[21] Our case was about to receive cervical traction, but fortunately did not, and serves as a reminder to search for the classic triad of i) an enlarged neural foramen, ii) a dysplastic, posteriorly displaced articular facet, and iii) an ipsilateral dysplastic transverse process, any time a facet dislocation is seen in a trauma patient. If there is doubt, a 3D reconstruction of a CT image will usually be diagnostic for congenital absence of the pedicle, particularly if close attention is paid to the presence or absence of the pedicle that is suspect.

Conclusions

Congenital absence of a cervical spine pedicle is a rare finding and because of its rarity, it can be readily confused with more clinically significant pathologies, such as facet dislocation or lytic tumors. As a result, the presence of this malformation can result in unnecessary surgical intervention, if the problem is uncovered in the setting of trauma or metastatic tumor. Initial evaluation with conventional X-rays frequently leads to misinterpretation. The routine use of CT-scan with or without three-dimensional reconstruction can help to confirm the diagnosis. Appropriate knowledge and awareness of this rare anomaly can prevent inappropriate invasive mistreatment.

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