Neural Arch Clefts Mimic Fractures: a case report and literature review

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Neural arch cleft could be a challenge to radiologists to distinguish from acute fracture on plain radiograph or CT scan. It is important for radiologists to be familiar with the imaging appearance and types of neural arch cleft to avoid unnecessary management. Here we present a female patient with acute lumbar spine injury and several transverse process fractures, and incidental findings of two neural arch clefts which can be mistaken as acute fractures. Common locations of neural arch cleft and literatures are also reviewed.

Neural arch clefts could occur in the pedicle (retrosomatic cleft), the pars interarticularis (spondylolysis) or the lamina (retroristhmic cleft) of the vertebral arch [1]. Spondylolysis is found with an incidence of 5-7%, whereas retrosomatic and retroristhmic clefts are very rare [2]. We report a female patient suffered from acute lumbar spine injury and multiple fractures of transverse processes with incidental findings of a retrosomatic cleft and a contralateral pars interarticularis cleft which can be mistaken as acute fractures.

CASE REPORT

A 31-year-old woman was sent to our emergency department with the complaint of back pain following motor vehicle accident. Physical examination disclosed no significant neurologic deficiency. Radiographs of lumbar spine (Fig. 1) and CT scan (Fig. 2) revealed acute avulsion fractures of right transverse processes of the first through fourth lumbar vertebrae. In addition, linear radiolucent lines with sclerotic border were noted over right pars interarticularis and left pedicle of the fourth lumbar vertebra, which initially were also interpreted as coincidental acute fractures. We reported, however, these lines as retrosomatic and spondylolysis clefts because there are corticated margins around the defects and absence of displacement and surrounded soft tissue change. The patient was treated conservatively and follow-up in the orthopedics clinic with uneventful recovery.

DISCUSSION

There are six types of neural arch clefts (Fig. 3). Their origins are congenital, acquired, or a predisposition to defects based on a focal congenital osseous weakness. Such defects include retrosomatic clefts, pars interarticularis defects (spondylolysis), retroristhmic defects, synchondroses, paraspinous and spina bifida occulta [1].
It is important to differentiate these types of neural arch clefts from acute fractures. Multisliced CT scan with 2D or 3D reformation is now the imaging modality of choice in the evaluation of acute spinal injury because of its superb demonstration of osseous structures [3].

The retrosomatic cleft is a rare defect in the pedicles near its junction with the vertebral body. It is found primarily in women, who often suffer from low grade back pain. The adjacent intervertebral disc space may be narrowed [2]. In CT images the cleft usually has sclerotic margin. The origin of this defect has not been elucidated. Possible causes include neurofibroma, vertebral artery erosion, neoplastic disease, or fracture of the neural arch [2]. There are many studies suggesting that the abnormality is of congenital origin [4, 5]. The association with other vertebral anomalies supports this viewpoint. The affected pedicle may be elongated, shortened, thickened, or attenuated. Coexisting contralateral spondylolysis in the same vertebral segment has also been reported in literature [1, 5], and this is seen in our case reported here.

Spondylolysis defects in the pars interarticularis have been classified into congenital and acquired types. The acquired type, due to repeated microtrauma and overuse, is believed more common [6]. The rarity of the defects in young children suggests...
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they are more commonly acquired. The overall prevalence of spondylolysis is estimated to be 5-7% [2]. The L5 vertebral body accounts for 90% of the cases. Most spondylolysis can be detected on plain radiographs, lateral or oblique projection. Difficult cases, especially unilateral occurrence, can be determined with CT scan.

The retroisthmic cleft is the rarest of the six posterior fusion defects. This defect has been described as “laminolysis” because the defect is through the lamina [7]. Unlike spondylolysis, the defect is dorsal to the inferior articular facet. It has been reported as incidental finding, usually in women, and often associated with other defects of the neural arch. It is thought to be a congenital abnormality containing fibrous tissue that does not ossify [2].

A persistent neurocentral synchondrosis results from the failure of the vertebral body growth plate to transform into bone. As the vertebra is derived from three primary ossification centers (two in the neural arch and one in the vertebral body), the postolateral parts of the vertebral body ossify by the vertebral arch centers. Therefore, in the first few years of life there are two cartilage zones separating the ossification centers (the neurocentral synchondroses) extending vertically through the vertebral bodies. Normally, by the age of 3-6 years, these cartilaginous neurocentral joints fuse. Persistent synchondroses are usually seen in the first decade of life with incomplete ossification of these cartilage segments and are located anterior to the sites of retrostromatic clefts [8]. Their borders are sharp, straight and uniform, with no evidence of bone sclerosis.

The most common and least significant type of neural arch cleft is paraspinous cleft and the spina bifida occulta. Although most of these defects occur in the lumbar spine, they may occur anywhere along the spinal column. The defects are due to the failure of neural tube closure during development [9]. Fibrous tissue is noted in these bony defects. Differentiation from fracture usually is easy because of the midline location and the corticated margins along the border.

In conclusion, neural arch clefts can cause confusion in the evaluation of patients with trauma. It is important to both orthopedists and radiologists to be familiar with these imaging features of neural arch clefts to avoid misdiagnosis and unnecessary management.

REFERENCES

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從傳統X光與電腦斷層來區分脊椎椎弓峡裂與急性骨折對放射科醫師來說常會造成困擾。熟悉它的影像與型態分類可以讓我們避免誤認為骨折而導致不需要的臨床處置。我們報告一例女性創傷病人併有腰椎橫突骨折及一開始可能被誤認為急性骨折的兩處腰椎椎弓峡裂，並對於其常見發生位置及文獻做一回顧探討。