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CASE REPORT

Dural Tear and Pseudomeningocele Due to Lumbar Burst Fractures: Detection by Multidetector Computed Tomography and Magnetic Resonance Imaging

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ABSTRACT

Dural tear and pseudomeningocele are reported to occur with thoracic and lumbar burst fractures. Conventional myelography, computed tomography with intrathecal metrizamide, dynamic computed tomographic myelography, magnetic resonance imaging and magnetic resonance myelography have all been used to detect consequential dural injury and cerebrospinal fluid leakage. Early diagnosis helps prevent neural entrapment, meningitis and cerebrospinal fluid leaks. We report a case of dural tear and lumbar pseudomeningocele formation secondary to multiple lumbar spine burst fractures diagnosed by multidetector computed tomography and magnetic resonance imaging.

Key Words: *Dura mater; Magnetic Resonance Imaging; Meningocele; Spinal fractures; Tomography, X-ray computed;*

中文摘要

因腰椎爆裂骨折引致的硬腦膜撕裂及假性腦膜膨出：多排螺旋CT及磁共振診斷

JC Kandathil、M George

有報導指胸和腰椎爆裂骨折會引致硬腦膜撕裂及假性腦膜膨出。傳統的脊髓造影、CT鞘內造影、動態CT脊髓造影、MRI及MRI脊髓造影都被用作診斷其誘發的硬膜損傷及腦脊液漏。及早診斷可預防神經卡壓、腦膜炎及腦脊液漏。本文報告一宗用多排螺旋CT及MRI診斷涉及多個腰椎爆裂骨折併發硬腦膜撕裂及假性腦膜膨出的病例。

INTRODUCTION

Dural lacerations with thoracolumbar burst fractures have been well described in the orthopaedic and neurosurgical literature.[1-4] The diagnosis of dural tear is however often difficult clinically or radiologically prior to surgery. A high index of clinical and radiological suspicion is necessary to make an early diagnosis and prevent complications.

CASE REPORT

A 42-year-old Chinese man was admitted to the emergency department in June 2010 after falling to

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the ground from a height of 5 m. Physical examination demonstrated stable vitals and a Glasgow Coma Scale score of 15. He had paraesthesia over the anterior aspect of both thighs in the L1, L2 distribution. Deep tendon reflexes were normal on both sides and the plantar reflexes were down going, and perianal sensation and sphincter tone were normal. Radiographs of the cervical spine, chest, and pelvis were unremarkable. Computed tomography (CT) on the day of admission revealed burst fractures of L2, L3, and L4 vertebrae (Figure 1a). Laminar fractures were present at all three levels. There was widening of interpedicular distance at L2, L3 and L4 levels, being widest at L4 (L2 - 2.9 cm, L3 - 3.0 cm, L4 - 3.2 cm), where there was a high-

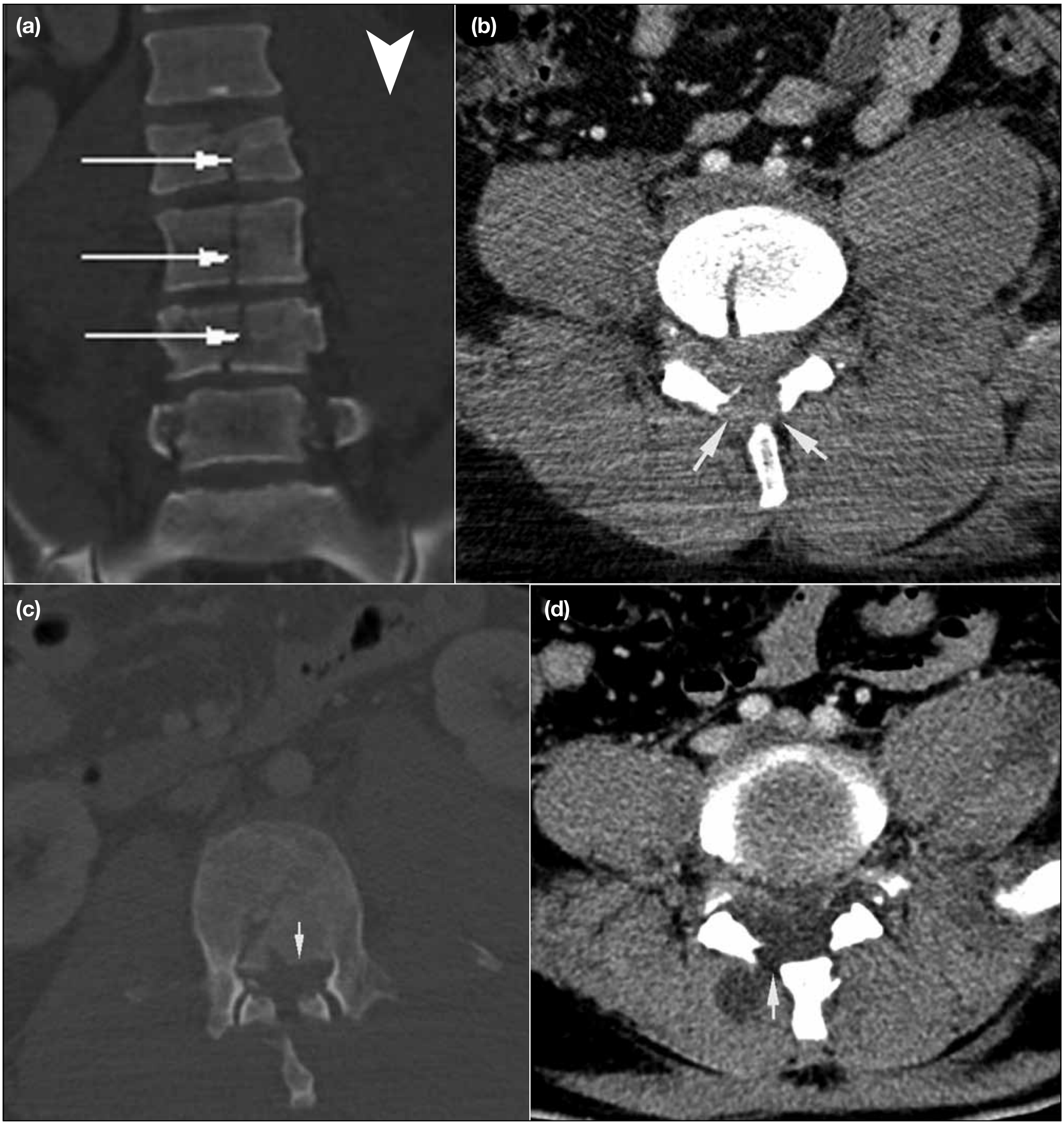

Figure 1. (a) An initial coronal reformatted computed tomographic (CT) image of the lumbar spine showing burst fractures of L2, L3, and L4 (arrows). A left psoas haematoma (arrowhead) is also seen. (b) An initial axial CT image at the level of L4 showing laminar fractures (arrows). (c) An initial axial CT image showing a retropulsed fracture fragment (arrow) at L2 causing moderate-to-severe canal stenosis. (d) A subsequent CT image at the level of L4 showing right-sided pseudomeningocele at the laminar fracture site (arrow).

degree laminar fracture (Figure 1b). A large retropulsed fracture fragment was noted at L2 causing moderate-to-severe canal stenosis (Figure 1c). Fractures were also seen involving L1 and L5 transverse processes and both pedicles of L5, though vertebral bodies were intact at these levels. A retroperitoneal haematoma was also noted extending along the left psoas muscle from T12 to L5 level (Figure 1a).

Magnetic resonance image (MRI) of the thoracic and lumbar spine done on the third day after admission revealed moderate-to-severe canal stenosis at L2 with mild compression of cauda equina roots. Moderate canal narrowing was also noted at L3 and L4 levels, compounded by an extradural haematoma extending from L2 to L4 level.

The patient was managed conservatively. Repeat CT eight days after admission (performed because of a decreasing haemoglobin concentration and tachycardia)

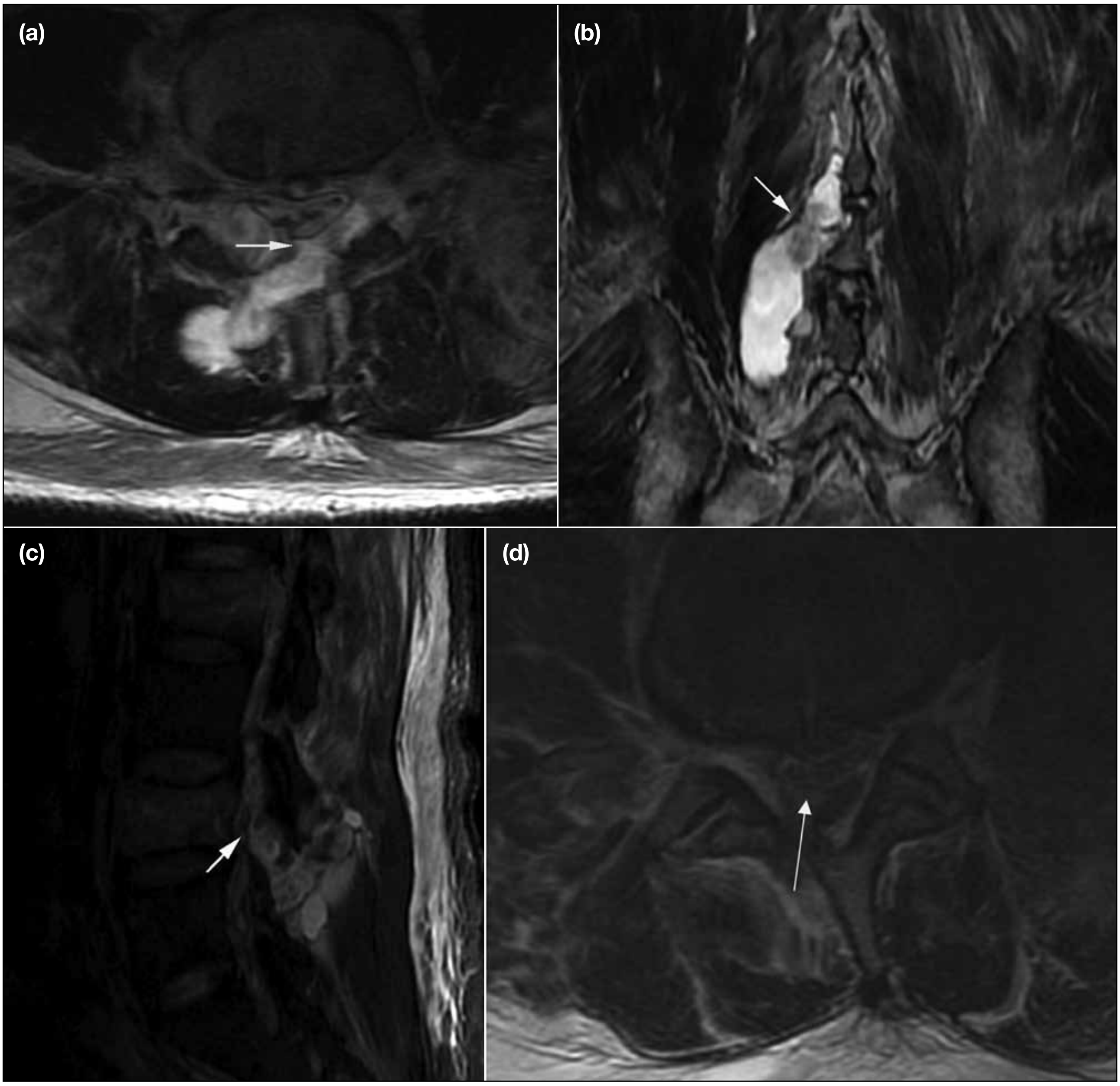

Figure 2. Follow-up magnetic resonance (MR) after a week. (a) An axial T2-weighted image at the level of the L4 lamina clearly show a dural defect and pseudomeningocele (arrow). (b, c) Coronal T2-weighted and sagittal inversion recovery images from follow-up MR show right-sided pseudomeningocele tracking inferiorly (arrow). (d) An initial axial T2-weighted MR image at the level of the L4 lamina shows irregularity of the thecal sac outline (arrow), indicating the site of dural injury (not recognised at the time).

showed a tubular, fluid-filled, out-pouching protruding from the spinal canal at the L4 level, which was next to the laminar fracture (Figure 1d). MRI of the lumbar spine revealed dural disruption at that point, with a pseudomeningocele extending inferiorly through the defect (Figures 2a, b, c). Retrospective evaluation of the initial MRI demonstrated irregularity of the thecal sac outline at this point (Figure 2d). At operation, the dural tear and pseudomeningocele were confirmed, though there were no entrapped nerve rootlets between the laminar fracture fragments; the roots appeared to be in continuity. Primary repair of the dura and T12 to S1 posterior spinal instrumentation with iliac screws was performed. The postoperative recovery was uneventful, and patient is now being followed up regularly.

DISCUSSION

Burst fractures are the result of vertical compressive and flexion forces causing failure of the anterior and middle columns of a vertebral segment.[5] Burst fractures lead to tears of the posterior aspect of the dura more commonly than the anterior aspect. Cammisa et al[3] reported 18% chance of posterior dural injuries with surgically treated burst fractures. A retrospective study of patients with spinal fractures by Keenen et al[2] revealed an 8% frequency of posterior dural tears, nearly nine out of 10 of those affected had neurological impairment. Burst fracture with associated laminar fracture is reported to be 100% sensitive and 74% specific for the presence of a dural tear.[3,4] Particularly, posterior dural lacerations are associated with laminar fractures, owing to the sharp edges of the laminar fracture cutting through the posteriorly displaced dural sac.[6]

Dural tears can result in diffusion of blood within the subdural space, cerebrospinal fluid (CSF) leaks leading to pseudomeningocele formation, trapping of herniated nerve roots and delayed scarring of neural structures.[3,4,7-10] Typically, the post-traumatic posterior dural laceration is subjected to primary repair with or without augmentation with a fascial graft or muscle plug. The knowledge that there is a dural tear is therefore important to plan optimal management. Identification of dural injury prevents further neurological problems and promotes recovery during treatment of associated spinal fractures.

Until now there have been no specific or sensitive imaging techniques to reveal small dural tears or detect CSF leakage in burst spine fractures. Contrast myelography with injection of contrast into the thecal sac has been used for this purpose with some success.[11] However the necessary patient manipulation can aggravate neurological deficits. In addition to being invasive, it also lacks the anatomical details of cross-sectional imaging and is now largely obsolete. Morris et al[12] described using CT with intrathecal metrizamide in the diagnosis of traumatic dural tears. Dynamic CT myelography has also been reported to be useful in localising high-flow spinal CSF leaks.[13] However these techniques are invasive and often difficult to perform in the context of complex spinal injury. Use of MR myelography using heavily T2-weighted fast spin echo images with fat suppression was first reported by Krudy.[14] Enhancement of CSF signal and suppression of background signal intensity makes this method ideal for demonstrating post-traumatic root avulsion. However 3-dimensional MR myelography is subject to motion artefacts, despite its short examination time.

Lee et al[15] described MRI findings which increased the likelihood of finding dural tears. They suggested there was a high possibility of dural tears on MRI when the central canal was narrowed to less than one half by displaced bone fragments with a particularly acute angle, more unstable laminar fractures, and especially wide interpedicular distance at the burst fracture level. The degree of laminar fractures was classified as follows: 0 = no fracture; 1 = fracture without a gap; 2 = fracture with a gap; and 3 = displaced fracture. Paying attention to these MR signs helped increase the sensitivity and specificity in detecting an underlying dural tear.

In summary we describe detection of a dural tear and subsequent pseudomeningocele formation by multidetector CT and MRI in a patient with multiple lumbar spine burst fractures. MR with its excellent soft tissue resolution should be used at an early stage when dural injury is suspected. Radiologists should indicate the possibility of dural tear whenever MRI findings are suggestive. Early recognition is relevant as dural defects can entrap nerve roots, increase the risk of spinal infection and lead to the development of a pseudomeningocele.

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