Post-traumatic thoracic scoliosis with rib head dislocation and intrusion into the spinal canal: a case report and review of literature

Thomas J. Kishen · Bibhudendu Mohapatra ·
Ashish D. Diwan · Greg Etherington

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Abstract The objective of the study was to report a rare occurrence of dislocation and intrusion of two rib heads into the spinal canal at the convex apex of a post-traumatic thoracic scoliosis in an adult in the absence of any neurological impairment. A 47-year-old male presented with a slowly progressive, post-traumatic thoracic scoliosis and a mild aching sensation over the posterior chest wall. The lower limb neurology and bowel and bladder function were normal. There was no clinical evidence of neurofibromatosis. CT scans showed that the 8th and 9th ribs on the convex apex of the scoliotic curve had intruded into the spinal canal and were lying adjacent to the dura and spinal cord. The MRI scan did not show any cord signal intensity changes. Although rib dislocation and intrusion into the spinal canal is uncommon, images should be carefully analysed to rule out this condition in sharp angular scoliotic curves.

Keywords Post-traumatic scoliosis · Thoracic scoliosis · Rib dislocation · Rib intrusion

Introduction

The rib–vertebrae–transverse process articulation is stable [1] and dislocation/subluxation of this joint is uncommon.

Rib head dislocation and intrusion into the spinal canal have been reported in dystrophic kyphoscoliotic deformities associated with neurofibromatosis (NF-1) [2–8]. The ribs situated at the apex of the sharp and angular dystrophic scoliotic curves can dislocate and intrude into the spinal canal. The neurological sequelae following rib intrusion into the spinal canal in neurofibromatosis are variable and some patients do not develop a neurological impairment [2–8]. However, the presence of rib intrusion into the spinal canal of a scoliotic spine can alter the treatment plan.

In this study, we report the rare occurrence of dislocation and intrusion of two ribs heads into the spinal canal in a 47-year-old male with a post-traumatic thoracic scoliosis. Most published reports of rib head intrusion into the canal are in children with neurofibromatous scoliosis. The interesting feature of this case report is the absence of any neurological impairment despite significant intrusion of two rib heads into the thoracic spinal canal. The pathomechanics of rib head dislocation and intrusion into the spinal canal are discussed.

Case report

A 47-year-old male IT architect presented to the clinic with a mild ache in the posterior and lateral aspects of the lower chest wall bilaterally. The pain was aggravated by taking deep breaths and turning on his side in bed. He had also noticed a slowly progressive deformity in the spine with a prominence on the left side of the chest. He had no neurological impairment and the bowel and bladder function and gait were normal.

He was involved in a pushbike accident at the age of 15 years and sustained a head injury and a fracture of the

T. J. Kishen (✉) · B. Mohapatra · A. D. Diwan ·
G. Etherington
Spine Service, Department of Orthopaedic Surgery, St George
Hospital and Clinical School, University of New South Wales,
53, Montgomery Street, Kogarah, NSW 2217, Australia
e-mail: t.kishen@spine-service.org

thoracic spine and sternum without any neurological impairment. Subsequently, he was admitted to hospital and underwent a burr-hole decompression of an intracranial haematoma. The fractures of the thoracic spine and sternum were managed non-operatively.

On examination, he had a well-balanced left thoracic scoliosis. The range of motion of the spine was full and painless in all directions. The upper and lower limb neurology was normal with no evidence of long tract signs. There was no clinical evidence of neurofibromatosis.

Plain radiographs (Fig. 1) of the spine revealed a 56° (Cobb's method) left thoracic scoliosis from T6 to T11 with the apex at T8. Wedging of the apical vertebral body (T8) was present and to a lesser extent at the T7 and T9 vertebral bodies (Fig. 2). The axial CT scan sections (Fig. 3a, b) showed that the 8th and 9th rib heads had intruded into the spinal canal on the convex apex of the scoliotic curve and were lying adjacent to the dura. MRI scan (Fig. 4a, b) also revealed rib intrusion into the spinal canal, but did not show cord signal intensity changes or cord compression. The spinal cord had shifted to the concavity of the scoliotic curve.

Fig. 1 Plain radiograph showing a left thoracic scoliosis and wedging of the apical vertebrae

Fig. 2 Coronal CT scan section showing a left thoracic scoliosis with wedging of the T8 vertebra and to a lesser extent the T7 and T9 vertebrae with bridging osteophytes in the curve concavity

Discussion

This report discusses the dislocation of two rib heads and intrusion into the thoracic spinal canal in a patient with a 56° post-traumatic thoracic scoliosis. The 1st, 10th, 11th and 12th ribs articulate with the corresponding vertebrae. The T2–T8 vertebrae have two demifacets per side (Fig. 5a, b) and demifacets from adjacent vertebrae form a complete articular surface for each rib. Hence, the second to ninth ribs articulate with two adjacent vertebrae. The 3rd through 9th ribs also articulate with the transverse process of the corresponding caudal vertebrae, whereas the 11th and 12th ribs do not articulate with the transverse process. The costovertebral ligament (rostral, middle and caudal portions) and costotransverse ligament (anterior, middle and posterior portions) stabilize the costovertebral and costotransverse articulation, respectively [1]. The rib–vertebrae–transverse process articulation, therefore, is a stable joint [1] and a dislocation/subluxation of this joint is uncommon.

Rib head dislocation and penetration into the spinal canal at the apex of kyphoscoliotic deformities associated with neurofibromatosis (NF-1) has been reported [2–8]. The spindling of transverse processes, foraminal enlargement, saccular dilatations and pencilling of vertebral margins and apical ribs and the acute angular dystrophic curves may contribute to costovertebral subluxation or dislocation of the rib head towards the neural foramen [2]. Post-traumatic scoliosis also has an acute angular curve and

Fig. 3 Axial CT scan sections showing intrusion of the left 8th and 9th rib heads into the spinal canal

progression of the curve is a predisposing factor for rib head dislocation. The second to ninth ribs articulate with two demifacets, which are located adjacent and anterior to the neural foramen. Progression of the scoliotic curve increases the distance between the demifacets on adjacent vertebrae in the convex apex of the curve and can potentially disrupt the rib–vertebral articulation. The apical vertebral rotation may also play a role in disrupting the rib–vertebral articulation. The dislocated rib head then intrudes into the canal through the widened foramen (convex side) as the convex apex of the curve moves laterally (towards the rib head) away from the midline. However, the 10/11th ribs that articulate with a single vertebra (not demifacets) have also been known to dislocate when they are located at the apex of the curve [4].

Due to the small size of the thoracic spinal canal relative to the spinal cord, the thoracic spinal canal has a low

Fig. 4 Axial MRI sections showing intrusion of the left 8th and 9th rib heads into the spinal canal

threshold for canal encroachment leading to cord compression and neurological impairment. The neural sparing in this patient can be attributed to two reasons. Firstly, the rib entered the canal through the convex side of a scoliotic curve with the spinal cord being displaced to the concave side. Secondly, the slow progression of the scoliotic curve has probably resulted in neural sparing so far. The reported neurological impairment following rib intrusion into the spinal canal in neurofibromatosis associated scoliosis is variable. Initial post-operative neurological recovery followed by delayed onset of neurological impairment has been reported following scoliosis correction when rib head intrusion has been missed. Delayed onset neurological deficit has been reported after corrective surgery for

Fig. 5 Line diagrams showing the position of the facets and demifacets on the thoracic vertebrae for rib head articulation

scoliosis in the presence of rib intrusion into the spinal canal [3–8]. Neural sparing has also been reported following intra-canal rib head intrusion [4]. Gkiokos et al. [2] described a “painful rib hump” as a clinical indicator of rib head intrusion into the spinal canal. Fractured ribs intruding into the spinal canal at T3–T4 and causing complete cord transection has been reported [9] following a high speed motor vehicle accident. Neurological deficits have also been reported following cord compression from an osteochondroma of the rib head [10].

Diagnosis of rib head intrusion can occasionally be made on good quality anterior–posterior radiographs of the spine. The rib head dislocates cranially over the pedicle and lies medial to the medial wall of the pedicle [4]. CT scans provide better visualisation of the bony pathology, provided the correct gantry angles are chosen and a CT myelogram further improves the visualisation of rib intrusion and spinal cord compression [4]. An MRI is also useful as the whole spine can be visualised to rule out other intraspinal lesions [4], and cord compression and signal changes can be detected.

Yalcin et al. [4] have discussed the management of rib intrusion into the canal in neurofibromatous scoliosis. In the presence of neurological impairment, rib head excision is deemed necessary. The rib head can be excised through a laminotomy prior to deformity correction, or segmental resection distal to the transverse process can be performed. In the presence of a deformity that does not require surgical correction; the management of an asymptomatic intraspinal rib intrusion is unclear and the authors state that in the absence of cord indentation, rib head excision is not always necessary. Our patient has been offered surgery in the form of rib head excision (via a laminectomy) and instrumented fusion of the scoliosis. However, at this stage the patient is still considering the option.

In summary, rib dislocation and intrusion into the spinal canal are uncommon. Images should be carefully analysed to rule out this pathology in sharp angular scoliotic curves.

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