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GRAND ROUNDS

Floating lumbar spine: proposed mechanism with review of literature

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Abstract

Hyperextension injuries of lumbar spine resulting in lumbosacral dislocation are a rare entity. We report a case of a 60-year-old male who presented to us in outpatient department with history of trivial fall from bicycle with fracture through the pedicles extending from L2 to L5 with lumbosacral dislocation with free floating posterior elements with intact neurology. This is the first case report of 4 level extension compression injury with lumbosacral dislocation leading to floating lumbar spine to the best of author's knowledge. Treatment consists of reduction of the lumbosacral dislocation first and fusion of the disc space followed by reduction of the other fractures proximally. These injuries may present with a trivial trauma in spondylotic spine in elderly patients. MRI and CT scan should be done early to identify it, reduce and fix it, as in many cases with trivial trauma there may be no neural deficit.

Keywords Hyperextension · Floating · Lumbar spine · Lumbosacral dislocation

Case presentation

A 60-year-old man with no history of any comorbidity except hypertension presented with history of fall from bicycle after colliding with another bicycle. He had pain in the back, but he got up and was able to cycle down his home after injury. He showed up in outpatient department to us with severe pain in the back 2 days after injury. On examination patient had spasm in the back. Step was palpable in the lower back, but neurology was normal.

Diagnostic imaging

X-rays were done which showed lumbosacral dislocation with fracture of pedicles from L2 to L5 (Fig. 1). CT scan was done which showed multi level fractures through the pedicles from L2 to L5 with lumbosacral dislocation (Figs. 2, 3). There was no evidence of any preexisting spondylolysis. Dexa scan was also done to rule out osteoporosis. Patient had no preexisting comorbidities.

Historical review

Hyperextension injuries of lumbar spine resulting in lumbosacral dislocation are reported in literature. These injuries were originally classified earlier as B3.2 in the original

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Fig. 1 Lateral view of the spine

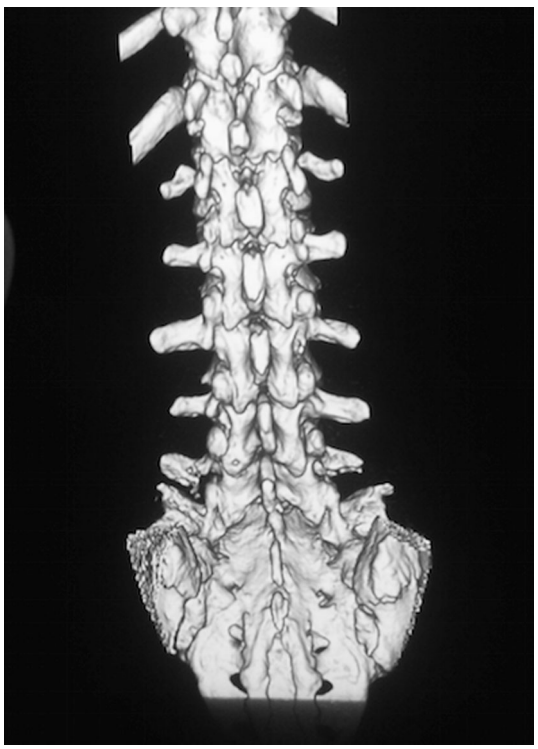

Fig. 2 CT scan posterior view with floating lamina

Magerl classification [1]. Most of the injuries reported are anterior dislocations only. Very rarely posterior spinopelvic dissociation can also occur. Around ten posterior

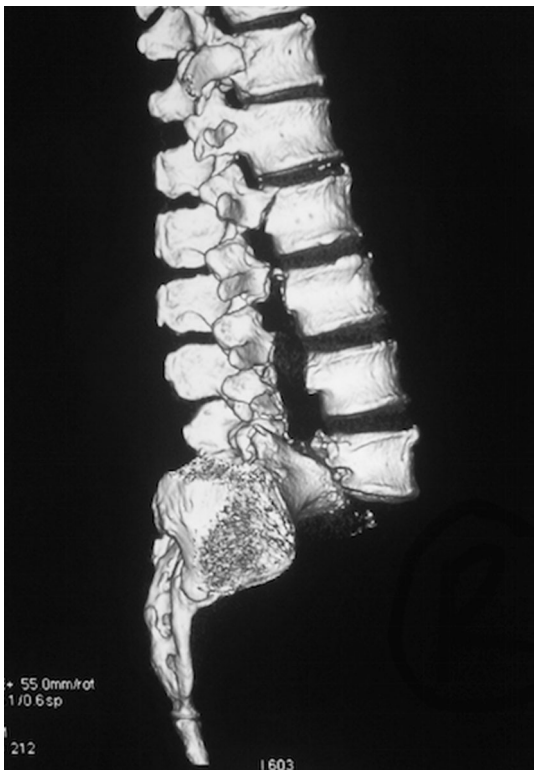

Fig. 3 CT scan with lumbosacral dislocation with fractured pedicles

dislocations have been described till now. In anterior spinopelvic dissociation injuries fracture line extends from anterior to posterior with disc failing first followed by failure of posterior column. Fracture of pedicles of lumbar spine from L2 to L5 with lumbosacral dislocation has never been reported in literature to the best of author's knowledge. All case reports and series, which have been described in literature, describe only lumbosacral dislocation. Management of these complex fractures with no neurological deficit is challenging considering the potential unstable spine with lumbosacral dislocation and freely floating posterior elements.

Rationale for treatment and evidence based literature

Watson-Jones first described lumbosacral dislocation in 1940 [2]. In this fracture fifth lumbar vertebra translates over the sacrum resulting in lumbosacral dislocation. Aihara et al. had classified lumbosacral dislocation into five types [3]. This type of injury has not been classified before. There are more than 100 cases of lumbosacral dislocation reported till date but none has reported this kind of injury after a trivial trauma. It is important to identify these three column injuries early by CT scan and MRI. Pathomechanics of this injury are controversial [4]. Authors

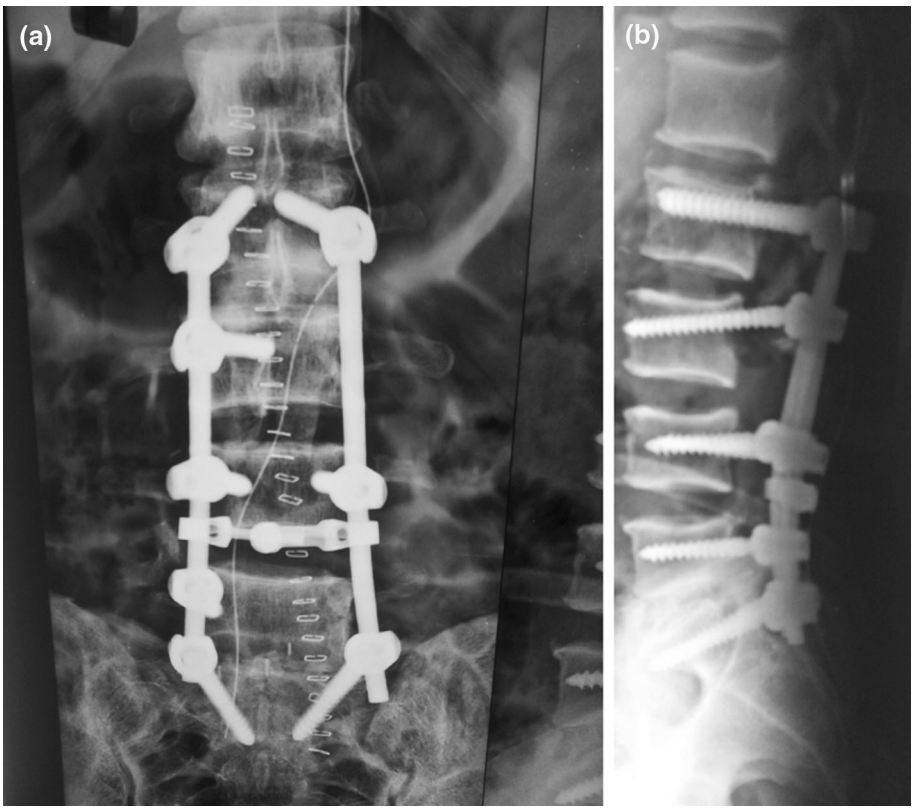

Fig. 4 **a** Immediate post op AP and **b** immediate post op lateral

hypothesize hyperextension injury to the lumbar spine can result in fracture of the pedicle with dislocation at lumbosacral region. Although some authors consider hyperflexion with compression can result in anterior spinopelvic dissociation. Injuries with fracture of other proximal pedicles along with lumbosacral dislocation are not described before. It is rare as once the fracture occurs at L5 the force is dissipated and further hyperextension does not cause any other injury. In this patient fracture progressed further resulting in fracture of L5, L4, L3 and L2 pedicles also. The failure of pedicles and neural arch extended from below upwards can also be appreciated, as there is a partial break in the neural arch of L2, while all arches below are completely disrupted. Authors hypothesize that this injury can occur if continuous compression force is applied in extension position. No mechanism has been described in literature before for these injuries. All cases reported in literature had severe trauma and most of them had neural deficit also. In our patient it was not a high velocity trauma and there were no comorbidities also like osteoporosis or other inflammatory disorders. There was no neural deficit as the auto decompression occurred because of the failure of posterior elements also. Transverse process fracture if seen can act as sentinel signs, which can suggest lumbosacral dislocation [5]. Little is written about hyperextension injuries of lumbar spine. They may be seen more commonly in cervical spine but is rare in lumbar spine. It also explains the scanty literature available for management of these injuries. In the present era there is no role for conservative management of these injuries and all such injuries require operative intervention. Authors have coined the term floating lumbar spine to describe this fracture with fractured pedicles of lumbar spine with lumbosacral dislocation with floating posterior elements.

Operative procedure

Patient was placed prone on the operating table and hips were flexed to avoid hyperextension of spine. Bolsters were used to position the patient. After positioning of the patient only slight reduction could be achieved. Keeping in view of the good bone density fixation to pelvis was not considered and authors decided to stop distally at S1. L5/S1 was reduced and fixed first. S1 pedicle screws were put first and were directed towards sacral promontory to gain bicortical purchase in sacrum. Image intensifier was used for putting pedicle screws. L5 pedicle reduction screws (extended threaded tabs on polyaxial screws) were put next and were inserted two to three threads deep into the L5 body. It helped in pulling L5 body to rod for reduction of L5/S1 listhesis. L5 was reduced gradually over S1.

Fig. 5 Maintained reduction at 2-year follow-up

Distraction maneuver was used while reducing spondylolisthesis. One has to be very careful while reducing listhesis as L5 screws can pull out if the bone density is not adequate. Chances of stretch to L5 nerve root also exist. Author had used neuromonitoring during the reduction maneuver. L5/S1 was stabilized by a small straight temporary rod. Disc was prepared and TLIF was done at L5/S1 after placing a temporary rod. Once L5/S1 was stabilized, partial reduction occurred at proximal levels from L2 to L4, as discoligamentous complex was intact from L5 to L2 proximally. Fixation was then extended to L2 sequentially capturing pedicles by inserting reduction screws into the remaining vertebral bodies and pedicle anteriorly. A longer contoured rod connecting L2 to S1 on both sides replaced a temporary rod connecting L5/S1 one by one. Biopsy was sent from the vertebral body and affected pedicles, which was reported as normal.

Procedure imaging

X-rays were done in the operation theatre at the completion of surgery, which showed adequate reduction (Fig. 4a, b).

Outcome and follow-up

Patient was mobilized next day and was discharged on fourth postoperative day. He was followed at 2-week, 3-month, 1- and 2-year follow-up. X-rays were repeated at 2-year follow-up which shows good maintenance of reduction (Fig. 5). He is doing his agricultural work as before and has no complaints. Authors suggest "floating lumbar spine" is a clinical entity, which should be suspected in patients even with history of mild trauma especially in elderly patients. Extension compression of spine is the most common mechanism resulting in this kind of injury. Management consists of reduction of fracture from distal to proximal with fixation and bone grafting. Author suggests reduction of L5 over sacrum first by reduction screws and fusion at the base of construct followed by other proximal screw fixation with posterior or posterolateral grafting. If the bone is osteopenic then fixation to pelvis may be considered.

Compliance with ethical standards

Conflict of interest None of the authors have any potential conflict of interest.

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