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Case Report

Traumatic L4 –L5 Spondylolisthesis with Vertical Shear Fracture of Pelvis

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Abstract

We report a case of traumatic listhesis of L4 over L5 vertebra with vertical shear fracture of pelvis in a 45 year old male. The patient was treated surgically immediately after the injury. His radiological and operative findings showed anterior listhesis of L4 over L5 vertebra with dislocation of bilateral facet joints at L3-L4 and L4-L5 level and fracture of spinous processes of L4-L5 vertebra with fracture of right lamina of L4 vertebra. There was also evidence of diastasis of pubic symphysis with displaced communited fracture of right iliac bone. Surgically he was treated by decompression and reduction, L3-L5 pedicular screw fixation along with L3 to L4 laminectomy, L3-L4 and L4-L5 discectomy and reconstruction plating for pubic diastasis and right iliac bone fracture.

Key-words: Traumatic Spondylolisthesis, Pubic Diastasis, Vertical Shear fracture

Introduction

Traumatic spondylolisthesis is an uncommon entity reported in the literature. Watson-Jones described the first case in 1940 and about hundred cases are reported since then.[1] All reported cases are traumatic lumbosacral dislocations, which represents a dislocation on L5–S1 level. Diastasis of the pubic symphyseal joint has been reported to occur in 13 to 16% of pelvic ring injuries and it typically follows a very high velocity force with predominant external rotatory vector trying to split open one or both the hemipelvis. These injuries have been also been associated with various other situations like pregnancy, inflammatory arthritis following long-term corticosteroid intake, horse riding injuries etc. which carry higher rates of complications and mortalities.[2,4] Fractures of the ilium occur infrequently in direct trauma.[22] and usually are the result of a force to the lateral aspect of the pelvis. The iliac wing fracture usually arises from the sacroiliac joint, or just anterior to it, and exits through the iliac crest. This injury pattern results in a hemipelvis that is unstable to rotational stress. Several methods of stabilizing these fractures have been reported in the literature.[23,26] For the best of our knowledge, we present a unique case of L4–L5 traumatic anterolisthesis with pelvic fracture and discuss the surgical management.

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Case report

A 45 year old man was driving a tractor that over turned and fell on his back following which he had severe pain in his back and was unable to move both his lower limbs. He was shifted to a nearby hospital where first aid was given and a plain radiography taken showed anterior listhesis of L4 over L5 vertebra with pubic diastasis and communited displaced fracture of right iliac bone. He was referred to our institute for further management. On neurological examination, paraplegia was noticed. Abdomen was soft and there was no evidence of bladder or urethral injury. Additional preoperative computed tomography and plain radiography images showed anterior listhesis of L4 over L5 vertebra with dislocation of bilateral facet joints at L3-L4 and L4-L5 level and fracture of spinous processes of L4-L5 vertebra with fracture of right lamina of L4 vertebra. There was also evidence of diastasis of pubic symphysis with displaced communited fracture of right iliac bone (Fig 1 & 2). Ultrasonography of the abdomen did not show any abdominal organ injury.

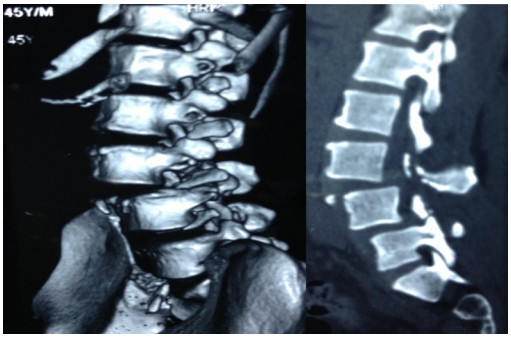

Fig 1. Traumatic lumbar spondylolisthesis

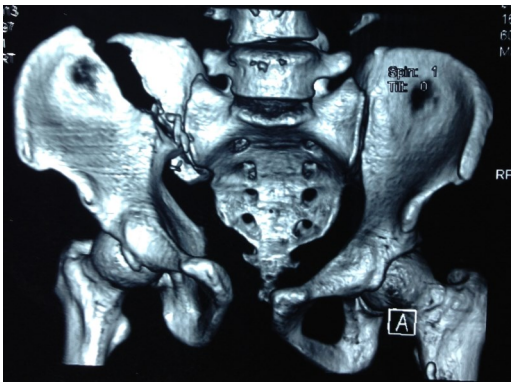

Fig 2. Fracture of Iliac bones

Surgical technique

Patient underwent surgery for pelvic fracture the next day in supine position. Pfannensteil incision was made followed by careful soft tissue dissection and the pubic diastasis was identified. Which was fixed with two reconstruction plates anteriorly and superiorly. Incision was closed in layers and the patient was turned to left lateral position and a curved postero-lateral incision was taken along the iliac crest. Careful soft tissue dissection was done and iliac bone was fixed with two reconstruction plates. Pedicular screw fixation was done two days later. Decompression and reduction, L3-L5 pedicular screw fixation using six pedicular screws and two rods, L3 to L4 laminectomy and L3-L4 and L4-L5 discectomy was done (Fig 3).

Post-operative management

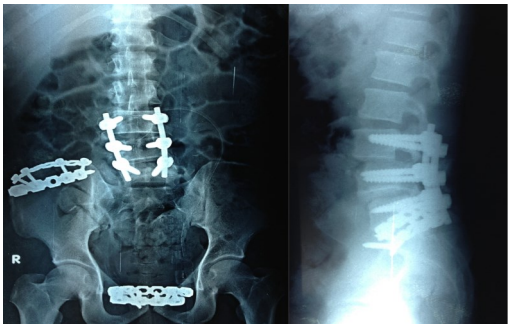

Fig 3. Reconstruction of pelvic and lumbar spine

The patient was maintained on post-operative prophylactic intravenous antibiotics for the first 24 hours and on absolute bed rest for 15 days. Static and dynamic exercises for hip, knee and ankle were started on the bed and was mobilised after 30 days with a soft lumbosacral corset and a walker. He initially complained of low back pain, numbness and weakness in both lower extremities which gradually reduced following ambulation Patient now has a motor power of 4/5 in L2-S1 on right side and motor power of 3/5 in L2-S1 on the left side.

Discussion

Spondylolisthesis was classified by Wiltse et al. into dysplastic, isthmic, degenerative, pathologic and traumatic types.[5] Acute traumatic type is very rare and should be distinguished from acute isthmic spondylolisthesis, in which acute pars interarticularis fracture occurs probably due to a predisposed spondylolysis. Different treatment modalities are proposed to treat the dislocation. Although there are some reports of successful conservative treatment, open decompression and to a certain site reduction with internal segmental fixation and fusion are the most accepted treatment modalities.[6,7] There are no reported neurological worsened case after the operation and have they remained same or improved clinically. In the event of a traumatic disruption of the disc material, it should be excised for decompression, preferably with interbody fusion. Interbody fusion allows higher degree of stability and fusion rate. The anterior support reduces the risk of implant failure.[8] It may be performed anteriorly, especially if the disc height is needed to be restored, otherwise it may be done posteriorly. In grade 2 or more, listhesis reduction should be achieved before interbody placements. If the disc material is intact, especially with ligamentous structures, at grade 1 or 2 spondylolisthesis, the necessity of the interbody fusion may be controversial, but it is mandatory to search neural canal and bilateral foraminal compression due to a disc protrusion especially after reduction. Fracture dislocation of L5 –S1 is a rare and severe lesion of the lumbosacral junction usually secondary to violent trauma of the lumbosacral area.

Many physiopathologic hypotheses have been proposed concerning the mechanism. Watson-Jones pointed hyperextension stress as an efficient traumatic vector in the first reported case of lumbosacral dislocation.[1] Roaf suggested that hyperflexion axial rotation and compression forces were responsible for anterior lumbosacral dislocation.[9] Most of the authors considered that the main

mechanism responsible for anterior or anterolateral lumbosacral dislocation is hyperflexion with compression.[7,9] There are also reports of direct traumatic vectors that act as a tangential force applied to the L5–S1 apophyseal joints and cause the dislocation to occur and also hyperextension with compression and anterior translation is reported.[6,9] Interestingly in our case, there was no single transverse process fracture. Transverse process fracture is mostly attributed as a sign of the severity of the trauma and is thought to be a warning finding for physician to search for traumatic spondylolisthesis.[6,9,10] Facet dislocations occur frequently in the cervical region, less frequently in the upper thoracic region and rare in the lumbar region. Their more common occurrence in the cervical and thoracic spine is caused by the relatively coronal orientation of the facet joints in these regions. An exaggerated flexion is the mechanism of the injury in bilateral facet dislocation and a flexion moment combined with a rotational component most commonly results in unilateral facet dislocation.

Also hyperextension type injury if combined with an axial load may result in facet fracture, laminar fracture may accompany to that kind of injury. In the lumbar region, the facet joints are able to slide past each other during extension, thus minimizing the chance for facet fracture by this mechanism.[11] In the lumbar region, the facet joints are oriented in a sagittal plane and hence their ability to resist flexion or translation is minimal, whereas their ability to resist rotation is substantial. The nearly coronal facet orientation at L5–S1 is a factor in the relatively decreased incidence of subluxation in the presence of intact facet joints; that is, in degenerative spondylolisthesis, subluxation is more common at L4–L5 than at L5–S1 despite the relative vertical orientation of the L5–S1 disc interspace.[12] The coronal facet orientation of L5–S1 and lumbosacral joint angle explains the reason why traumatic spondylolisthesis occurs mostly on L5–S1 level. It may be speculated that the weakness of the tip of this patient's inferior articular process is the reason of L4–L5 traumatic spondylolisthesis. We believe that traumatic spondylolisthesis with laminar fracture may probably be caused by an extension and axial load combination type injury, however, without laminar fracture hyperflexion type injury is the most likely cause, asymmetric lesions includes rotational component. But its occurrence mechanism in each particular case will be challenging to be exactly defined as both type of injury patterns with their subtypes, may cause to similar radiological findings.

Olson has described stable pelvis injury as one that withstands the physiological forces incurred with protected weight bearing or bed to chair mobilization without abnormal deformation of the pelvis, until bony or soft tissue healing occurs.[13] The unstable pelvic fractures are fraught with a number of complications and demand timely interventions including adequate resuscitation and appropriate, stable fixation to ameliorate the morbidity and mortality associated with these injuries.[14] Pelvic fractures predominantly involve the young male population and typically follow high energy road traffic accidents. As already emphasised, the earliest interventions that can save lives in these situations are resuscitation and control and management of haemorrhage.[15]

The importance of the radiological investigations especially CT scan in the surgical planning cannot be understated, although resuscitation and patient stabilisation must take precedence over these diagnostic procedures. Although the surgical management of the antero-posterior/lateral compression injuries has not been straight-forward.[16,18] and fraught with a number of controversies, there is a general consensus on the need for adequate surgical fixation and stabilisation when the symphyseal gap exceeds 2.5 cm. Early non-invasive stabilisation using a pelvic binder or pelvic sling to provide circumferential compression, or emergent, mini-invasive, compression techniques using the external fixators or C-Clamp (Ganz et al) may be necessary to arrest life threatening bleeding. The ideal management is, however, provided by stable, internal fixation only. There again, the controversy arises on the adequacy of single symphyseal plating, the need for double symphyseal plates, the ideal placement site of the plates (superior or anterior symphyseal surfaces), the types of plates used (reconstruction or low contact dynamic compression plates), the situations that need additional posterior pelvic stabilization, and so on. Although approach to the pubic symphysis using Pfannensteil incision is well-established and universally employed, a few authors have suggested the feasibility of minimally invasive techniques with indirect reduction and percutaneous fixation using multiple screws.[19,21] Multiple forms of symphyseal plate fixations have been tried. Single, anteriorly placed symphyseal plate provides a greater resistance to external rotation forces than superiorly placed plates in antero-posterior compression injuries and is biomechanically, a more rigid fixation.[4] The symphyseal double plate fixation (combination of anterior and superior symphyseal plates) provides the most rigid fixation of all; however, the procedure requires considerable dissection, expertise and

time and may be associated with significant blood loss. Bladder/urethral injuries are also known rare surgical complications that occur during operative fixation of the symphyseal diastasis following inadvertent invasion of the viscus by inexperienced surgeons.

Many authors have described open methods of stabilizing the iliac wing fracture seen with fracture– dislocations of the sacro-iliac joint.[23,17] Anterior and posterior approaches to the sacroiliac region have been advocated. Recommended methods of fixation range from plates and screws to threaded sacral bars. Open reduction techniques can yield excellent results.[26] Practically every author who has discussed this fracture pattern has reported good results.

Conclusions

Decompression, reduction with L3-L5 pedicular screw fixation, L3-L4 and L4–L5 disc excision and laminectomy for traumatic anterior listhesis of lumbar vertebra and reconstruction plating for pubic diastasis and iliac bone fracture is a very good method of fixation.

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