ORIGINAL ARTICLE

Spinal trauma with a complete anterior vertebral body dislocation: a report of three cases

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Study design: Retrospective review of three cases.

Objectives: Severe trauma can be responsible for a complete spinal anterior dislocation with a 100% anterior slip of the vertebral body. Three cases of this uncommon lesion are reported.

Setting: France.

Methods: The data of three cases of complete spinal anterior dislocation with a 100% anterior slip of the vertebral body were retrospectively reviewed.

Results: In all the cases, the vertebral dislocation was responsible for a severe neurological deficit and all patients had severe associated lesions. The diagnosis was made on plain radiographs. In one case of a multilevel injury, an extensive instrumented spinal fusion was necessary. In spite of the severe injury, two neurological deficits improved thanks to pedicular fractures, which widen the canal.

Conclusion: The therapeutic goal is to achieve emergent vertebral alignment, neurological decompression and solid spinal fusion. A posterior facilitates this. Reduction of vertebral dislocation can be difficult to achieve and it is therefore mandatory to perform complete arthrectomy of the injured levels before reduction. Especially in young patients, severe disc lesions secondary to the wide vertebral displacement make it necessary to perform circumferential fusion.

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Introduction

Fracture dislocations of the thoracic and lumbar spine constitute less than 3% of all spinal injuries.^{1,2} They are responsible for unstable lesions with a neurologic deficit and canal compromise. Severe trauma can be responsible for a complete spinal anterior dislocation with a 100% anterior slipping of the vertebral body. We present three cases of this very rare and severe lesion. We discuss the diagnostic imaging features and the management of these rare injuries with postoperative follow-up.

Materials and methods

The medical records of three patients presenting with a complete anterior dislocation with a 100% anterior slipping of the vertebral body were retrospectively reviewed.

Results

Patient 1 was a 32-year-old female who jumped out of a window and presented with multiple complex spinal injuries. Neurological evaluation showed a complete flaccid paraplegia with absence of rectal tone. The initial imaging work up showed a complete anterior fracture dislocation of the third lumbar vertebra (Figure 1a and b), a burst fracture of L2 and T10, a cranial end-plate fracture of L4. An open reduction and internal fixation with a posterior approach was performed 6 h after the trauma. The reduction of the lumbar dislocation was easily achieved with posterior osteosynthesis from T8 to L5, applying traction to the *trans*-pedicle screws in L3 (Figure 1c and d). Eighteen months after the trauma and completing a rehabilitation programme, the neurological recovery was partial with a severe neurological impairment of the lower limbs and severe sphincter disturbance. The global muscular strength of the lower limbs was evaluated at 3/5 with a spastic component. She was able to walk with the help of a bilateral ankle orthoses.

Patient 2 was a 19-year-old male who was admitted after a road-traffic accident. He complained of severe low-back pain and right lower limb paralysis. Neurological examination showed a complete right L5 deficit. The initial examination

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Figure 1 Lateral (a) and frontal (b) radiographs in patient 1 showing complete anterior vertebral dislocation of the third lumbar vertebra with fracture of the cranial endplate of L4. (c) Intraoperative lateral radiographs showing the initial osteosynthesis. (d) The reduction of L3 anterior displacement by means of pedicular screws.

showed a complete anterior fracture dislocation of the fourth lumbar vertebra associated with a comminuted fracture of the cranial endplate of L5 and a rupture of the left ureter. Owing to technical difficulties, a provisional osteosynthesis was carried out from L2 to S1 and a second posterior surgical procedure was performed 3 days after the trauma. The L4 reduction was then performed by applying traction to the trans-pedicle screws in L4. Eight days after the second surgical procedure, an intervertebral L3L4 and L4L5 fusion was done using a retroperitoneal approach. Eighteen months after the trauma, the patient completely recovered his neurological function. The lumbar circumferential L3L5 fusion was complete. The patient was asymptomatic and has resumed his activities.

Patient 3 was a 29-year-old soldier who was crushed by a 300 kg object. The initial examination showed a complete anterior fracture dislocation of the L4 vertebral body associated with a comminuted fracture of the cranial endplate of L5 (Figure 2). The neurological examination showed a partial bilateral L5 deficit. The global muscular

strength of the extensors muscles was evaluated at 2/5 except for the *tibialis anterior* muscle whose muscular strength was evaluated at 0/5. The sphincter examination was normal. The patient was repatriated and treated surgically 1 day after the trauma. The reduction of the lumbar dislocation was easily achieved by posterior approach. Osteosynthesis and posterior fusion was carried out from L3 to L5 and L4 reduction was then performed by applying traction to the trans-pedicle screws in L4. Eight days after the first surgical procedure, an intervertebral L4L5 fusion was done using a retroperitoneal approach (Figure 3). The patient was immobilized with a TLSO for 3 months. Twelve months after the trauma, the patient was still completing a rehabilitation programme. The neurological recovery was partial. The global muscular strength of the left extensors was measured at 3/5. The right *tibialis anterior* muscle strength was measured at 2/5.

The main data of the series are summarized in Table 1.

Discussion

Complete anterior traumatic spinal dislocations are very rare and severe lesions among the spinal fracture dislocations. In these rare and severe lesions, because of malalignment of spinal canal and a frequent neurologic deficit, immediate realignment, decompression and stabilization are required, particularly when the neurologic deficit is incomplete. In spite of the severe injury, two out of the three patients presenting with neurological impairment improved significantly, thanks to the 'floating laminae'. In such cases, the bilateral pedicular fractures at two or three levels allow the posterior elements to remain aligned while the vertebral bodies displace forward.^{3,4} With the floating arches mechanism, the spinal canal actually enlarges (Figure 1b) and, therefore, the nerve roots remain fairly intact.

Thoracic and lumbar fracture dislocations are extremely unstable and complex lesions, requiring an early diagnosis and an adequate management. In unconscious and multiple-trauma patients, CT scan with multiplanar reformatting rules out or proves any bone abnormalities with the highest precision.⁵ Although these injuries are suggested on plain films, CT is always almost preferred to confirm and further define the extent of the injury. Many characteristic signs of fracture dislocations have been described on axial CT images depending on the degree of slip:^{6,7} 'the double rim sign' represents displacement of one vertebral body over another, the 'double sun' appears in complete fracture-dislocation (Figure 4), and 'the naked facet sign' when facet dislocation is associated.

The treatment of these three cases of complete dislocation was not homogenous and this is the weak point of the study. However, we think that a posterior approach should be considered first. Reduction of vertebral dislocation can be difficult to achieve and it is mandatory to perform complete arthrectomy of the injured levels before reducing vertebral displacement. In patient 2, we had some difficulties obtaining complete reduction because of insufficient bone resection and excessive preoperative bleeding. The type and extent of instrumentation and fusion and the need for

Figure 2 Lateral (a) and frontal (b) radiographs in patient 3 showing complete anterior vertebral dislocation of the fourth lumbar vertebra with fracture of the cranial endplate of L5.

Figure 3 Postoperative frontal (a) and lateral (b) radiographs in patient 3 showing circumferential L4/L5 fusion by means of interbody bone graft. Posterolateral and anterior fusion is well-visualized on frontal (c) and lateral (d) CT-scan reformattings.

Figure 4 The 'double-rim sign' is well visualized on axial CT scan (a and b). The sagittal reformattings (c and d) allow to visualize the sagittal displacement. Note the pedicular disruption on axial and sagittal images (arrows).

Figure 5 Tri-dimensional reformattings (a and b) allow to visualize sagittal displacement and associated bone lesions. The sagittal MRI images (c and d) allow to visualize intervertebral disc disruption, especially on T2-weighted images (arrow).

Table 1 Main data of the series

Patient	Age	Gender	Mechanism	Spinal lesion	Associated lesion	Initial neurological status	Initial ASIA Score	Surgical procedure	Neurological outcome	Final ASIA score
1	32	Female	Defenestration	Complete anterior fracture dislocation of L3	Bilateral pulmonary contusion, rib fractures, fracture of the left acetabulum, fracture of the left humerus	Complete L2 flacid paraplegia	A	Open reduction and internal fixation by posterior approach	Partial neurological improvement	D
2	19	Male	Motor vehicle accident	Complete anterior fracture dislocation of L4	Rupture of the left ureter	Complete bilateral L5 radicular deficit	D	Open reduction and internal fixation by posterior approach (two consecutive procedures)/anterior interbody fusion	Complete neurological recovery	E
3	29	Male	Crushed by a 300 kg object	Complete anterior fracture dislocation of L4	None	Partial bilateral L5 radicular deficit	D	Open reduction and internal fixation by posterior approach/anterior interbody fusion	Partial neurological improvement	D

additional anterior fusion is controversial. In some cases as in case 1, multiple levels injury led to the realization of an extensive instrumentation and fusion by posterior approach. We think that, especially in young patients, severe disc lesions secondary to the wide vertebral displacement (Figure 5), make it necessary to perform circumferential fusion as we did it in patients 2 and 3.

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