

Late neurologic deterioration after nonoperative treatment of a Chance fracture in an adolescent

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Injuries to the spine in children and adolescents are uncommon,¹ and few reports on Chance-type fractures in this population exist.² Differences between pediatric and adult spinal injuries have been noted,¹ and the need for separate classification and treatment strategies for flexion-distraction injuries in children have been recognized.^{2,3} Still, there is little evidence to guide treatment and minimal data on long-term follow-up. We present the case of an adult in whom neurologic symptoms developed many years after nonoperative treatment of a Chance fracture.

Case report

A 37-year-old woman complained of back pain radiating into both legs, associated with leg weakness and numbness bilaterally, which had progressed slowly over several years to the point of significant disability and the need for narcotic analgesia. At 15 years of age, she had sustained a back injury in a motor vehicle collision. At that time she had hypoesthesia in the L4 nerve root distribution in her left leg that gradually resolved during her hospitalization. There was no motor deficit. Radiographs were reported as showing “a compression fracture of the anterior portion of the L3 vertebral body with a horizontal fracture line and separation of the posterior rim of the body

and shattering of the pedicles, complete disruption of the lamina of L3 with no connection of the inferior articulation facets and the body.” The documented original diagnosis was that of an “L2–3 Chance fracture.” Treatment consisted of hyperextension on a Stryker frame for 3 weeks with reported good correction of the deformity on the radiograph. This was followed by immobilization for 3 months in extension in a plaster body cast with reported maintenance of the corrected alignment with slight kyphosis at the fracture site on the radiographs. At 2-year follow-up she was stated to be asymptomatic, fully active with no neurologic symptoms and radiographs that were essentially unchanged.

On examination at the time of her current presentation, she had a bilateral high-stepping drop-foot gait. She was unsteady while walking and could only travel 15 m before having to rest because of claudicant leg pain. Radiographs demonstrated anterior wedging of L3 with retrolisthesis of L3 on L4 (Fig. 1). The kyphosis angle was 36° and horizontal displacement was 44% as measured by the method of Denis and colleagues⁴ and Dupuis and associates,⁵ respectively. Computed tomography showed a split in the L3 spinous process and pars interarticularis (Fig. 2), as well as severe central spinal stenosis (Fig. 3).

A diagnosis was made of a remote

Chance fracture with late neurologic deterioration possibly due to progression deformity. We carried out an L3 laminectomy, posterior segmental instrumentation and fusion using cancellous iliac crest bone grafting from L1–4, as well as an anterior release and fusion with iliac



FIG. 1. Radiograph demonstrates anterior wedging of L3 with retrolisthesis of L3 on L4.

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crest strut bone graft and instrumentation from L2–3 (Fig. 4). The radiographic findings were confirmed at surgery, together with the discovery of a fracture of the left transverse process. Three months postoperatively, the posterior instrumentation from L1 was removed to provide better motion and the previous bone graft was augmented. There were no surgical complications.

At 9 months, the patient had significant improvement in her back-specific health status as measured by her score on the Roland–Morris Disability Questionnaire⁶ (4 v. 21 preoperatively). She no longer required narcotic analgesia and had returned to horseback riding. Although her walking and exercise tolerance had improved considerably, she still had a slow, unsteady drop-foot gait.

Discussion

In 1948, Chance⁷ reported 3 cases of spinal fractures in which the fracture line extended transversely through the spinous process and neural arch to exit in the posterior-superior vertebral end plate. These were believed to be flexion-type injuries, although the author could not explain why the vertebral body was only

slightly wedged anteriorly.⁷ Later, Howland and associates⁸ described a similar “Chance fracture” that exited in the anterior vertebral body and was associated with the use of a lap belt. In 1968, Smith and Kaufer⁹ better defined the relationship between lap belts and spinal injury and postulated tension, created by forced extension about the belt as the mechanism of injury.

With increased use of lap belts, associated lumbar spinal injuries become more common. Subsequent research elucidated various patterns of lumbar flexion-distraction injuries and their pathomechanics.^{9–12} Further, the occurrence of “Chance-type” fractures among children and adolescents as well as the characteristics that distinguish them from those of the adults were reported.^{13–16}

The literature on flexion-distraction injuries in children and adolescents is restricted to a few small series and case reports. Although a few reports have described surgical treatment of these injuries^{1,9} and operative management was recommended for adolescent patients in a recent review article,¹⁷ the majority of reported cases have been managed conservatively with generally good results. A review of 42 children and adolescents with various spinal fractures noted that the natural history of spinal injury in this

population was “characteristically benign” and that late morbidity was not generally seen.¹ Of the 7 “Chance-type” fractures reported by Reid and colleagues,¹⁶ 6 were treated with bedrest and postural reduction followed by application of a body cast. Only 1 patient required operative treatment for progressive refractory kyphosis. Six fractures demonstrated satisfactory healing. In 1 patient, a paraplegic, a slight kyphosis developed at the fracture site. Average progression in the kyphosis angle was 3°.

Similarly, Rumball and Jarvis³ reviewed 10 cases of pediatric “Chance fracture.” Nine of these were treated conservatively. One patient underwent laminectomy for persistent paraplegia and eventually required fusion 5 years after the original injury. Although they noted the uniqueness of these injuries in the pediatric population and developed a classification system for these injuries, the authors did not comment on how such classification should guide treatment.

In reviewing 12 cases of flexion-distraction injuries in patients younger than 16 years, Glassman and associates²

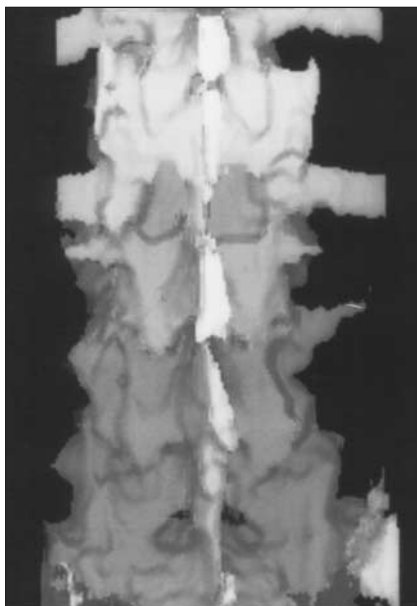


FIG. 2. Computed tomography coronal reconstruction demonstrating a split in the L3 spinous process and pars interarticularis.



FIG. 3. Axial computed tomography shows severe central spinal stenosis.

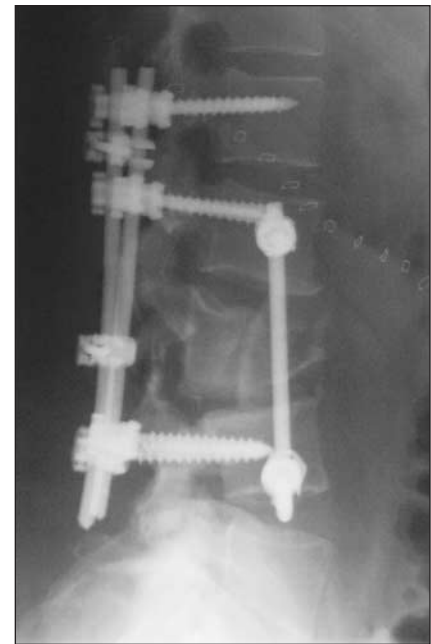


FIG. 4. Surgery consisted of an L3 laminectomy, posterior segmental instrumentation and fusion with insertion of cancellous iliac crest bone graft from L1–4, plus an anterior release and fusion from L2–3.

compared the outcomes of surgical versus nonsurgical therapy. Injuries were classified as bony, ligamentous or combined, and this classification together with the patient's overall status determined treatment. Bracing was determined to be a viable treatment option not only for bony injuries but also for some ligamentous and combined injuries. An initial kyphosis angle of less than 20° was considered to be a predictor of good outcome with bracing.

To date there is little published evidence to guide the treatment of flexion-distraction injuries of the lumbar spine in children and adolescents. Although some authors believe the principles of adult management can be applied to children and adolescents,¹⁸ others have advocated specific injury classification systems³ and treatment strategies for the pediatric population.² The literature consists of only isolated case reports and a few small studies with limited follow-up. One case of late instability after a missed diagnosis has been reported.¹⁹ To our knowledge, no cases of late neurologic deterioration or instability after treatment of a "Chance-type" injury has been reported. Given the paucity of published outcomes, we wish to contribute this case to the literature as an example in which

neurologic deterioration and possibly late instability followed initially successful nonoperative treatment.

Competing interests: None declared.

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