

## Instability resulting from a missed Chance fracture

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Despite improvements in seat and seat-belt designs, lap-belt injuries continue to occur in children.<sup>1,2</sup> The diagnosis of abdominal and spinal injuries is often delayed or missed completely.<sup>1,3</sup> Heightened awareness, a good history and physical examination, as well as the appropriate investigations are required for the prompt diagnosis of such injuries. We present the case of a young boy with a lap-belt injury in whom an intra-abdominal injury was diagnosed immediately but a potentially unstable spine injury was missed for over a year.

### Case report

An 11-year-old boy was a lap-belted back-seat passenger involved in a high-speed head-on motor vehicle accident. At the scene the boy was alert, oriented and hemodynamically stable but complained of abdominal pain. He was flown by air ambulance to hospital where he was further assessed by the trauma team in the Emergency Department. On inspection of the abdomen, a "seat-belt sign" was evident at the level of the umbilicus. Abdominal examination revealed guarding and rebound tenderness. "Log rolling" the patient demonstrated a large hematoma in the mid-lumbar region. Initial films that included cervical spine, anteroposterior chest and anteroposterior pelvis appeared normal. Since the patient was hemodynamically stable, CT of the abdomen was performed, revealing thickened loops of bowel and free fluid within the peritoneal cavity, indicative of hollow viscus rupture. At exploratory laparotomy a small-bowel blowout was found, which was repaired without difficulty. Postoperatively, he went immediately from the recovery room for completion of cervical, thoracic and lumbar spine films (Fig. 1). These were interpreted as normal. Postoperatively, the patient slowly began to ambulate despite

severe back pain and had an otherwise uncomplicated hospital course before being discharged on postoperative day 5.

The boy was seen in the pediatric orthopedic clinic approximately 1 year later with the presenting complaint of flat feet. On examination, flexible flat feet were noted. Examination of the spine, however, revealed a large lumbar kyphotic deformity. When questioned further, the patient stated that he did suffer from occasional back pain on a weekly basis, but the pain was not severe. He continued to be active in hockey (as a goaltender) and baseball, and other than the occasional backache, was not limited in any way. Repeat radiographs, including flexion-extension lumbar spine films, were obtained (Fig. 2).

After reviewing the radiographs we determined that this patient had suffered a soft-tissue Chance fracture<sup>4</sup> at the L3-4 level. White and Punjabi<sup>5</sup> have defined instability in the lumbar spine at the L3-4 level as more than 15° of angulation in the sagittal plane. Forward bending films confirmed marked instability (approximately 25°) at the injury site. The films taken at the time of the accident were reviewed, and it was clear that widening between the disc spaces posteriorly between L3 and L4 was present. The patient underwent posterior spinal instrumentation and fusion with use of autologous bone graft (Fig. 3). Postoperatively, he did well, and to date no complications have occurred.

### Discussion

"Seat-belt syndrome" is characterized by injury to intestinal viscera and mesentery along with an associated lumbar spine injury, usually a Chance type fracture secondary to a flexion-distraction injury about a lap-type seat belt. Children presenting with a seat-belt sign have intestinal injuries in up to 78% of cases and

lumbar spine injuries in 21%.<sup>6</sup> Further, an alarming 50% of abdominal injuries are missed initially and identified more than 24 hours after presentation.<sup>3</sup> Up to 30% of spine injuries are also missed on initial presentation.<sup>2</sup> Careful history-taking, physical examination, careful scrutiny of



FIG. 1. Lateral radiograph of the thoracolumbar spine at the time of injury.

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FIG. 2. Maximum flexion view of the thoracolumbar spine 1 year after the injury.

the radiographs for subtle signs and a degree of suspicion based on the mechanism of injury are the keys to making the diagnosis. In our case, the combination of a significant ecchymosis and widening of the posterior disc space were definitive signs of an underlying spinal injury.

Children are particularly susceptible to this type of spinal injury because of the large ratio of head-to-body size, underdeveloped anterior superior iliac spines and rib cage, their tendency to be placed in the back seat, and improper placement of lap belts above the anterior iliac spine.<sup>7</sup> Booster seats and shoulder harnesses have been developed specifically to combat this problem, but injuries still persist.<sup>8</sup> Children and adolescents, as opposed to adults, are more susceptible to soft-tissue than to bony injuries; awareness of spinal injury must certainly be raised in the presence of seat-belt injuries.

In children, flexion-distraction injuries can be divided into 4 types as proposed by Rumball and Jarvis.<sup>2</sup> The present case represents a type B injury, which is defined as an avulsion of the posterior elements with facet joint disruption. In general, injuries

involving predominantly bony structures can be treated with an extension orthosis, whereas primarily soft-tissue injuries, such as the one we describe, usually require surgical intervention to prevent increasing kyphosis and instability. However, Glassman and associates,<sup>9</sup> reporting on 4 cases with pure soft-tissue injury, found that 2 required operative intervention, whereas the other 2 required only extension orthoses. As for Chance-type fractures, 2 of Glassman and associates' patients were followed up for 9 years with no severe sequelae but, unlike the present case, treatment was instituted early. The natural progression of such injuries remains to be determined. Children are thought to have a better prognosis from this injury because they lack pre-existing degenerative changes in the spine; also, increased vertical growth of the anterior column serves to restore lumbar lordosis.<sup>10</sup>

#### Conclusions

There have been few reports in the literature on the natural history of untreated soft-tissue Chance fractures in

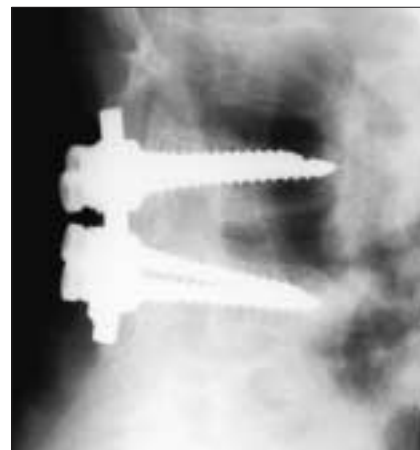


FIG. 3. Postoperative lateral view of the L3-4 region after instrumentation.

children. The diagnosis is often delayed as illustrated by the extreme delay in the case we have described. It is interesting and remarkable that this child was still able to be active and compete in sports relatively unhindered despite an alarming amount of clinical deformity and radiographic evidence of instability.

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