CASE REPORT

Late-diagnosed seat-belt syndrome: A second Chance?

Michael Dodds*, Rehan Gul, Noelle Cassidy

Department of Orthopaedic Surgery, Paediatric Orthopaedic Unit,
The Children’s University Hospital, Temple Street, Dublin 1, Ireland

Accepted 22 June 2005

Case report

A 7-year-old male, rear seat passenger restrained by a 2-point seat-belt, was involved in a head on road traffic accident. The driver, also restrained, collapsed and died at the scene. The child was taken to the nearest accident and emergency department where primary survey found him to be conscious and haemodynamically stable. The trauma series of radiographs consisted of lateral cervical spine, AP chest, abdomen and pelvic films. A CT scan of his head was requested for reasons of headache and vomiting, and this was extended to include thoracic, abdominal and pelvic regions, to rule-out other injuries. The only abnormality noted was cerebral oedema. The patient was transferred to the intensive care unit of our hospital for monitoring of his head injury. Three days post-injury, he developed signs of an acute abdomen and underwent emergency laparotomy. This revealed a mesenteric vessel injury and ischaemic segment of jejunum. A resection and primary anastamosis was performed. Ten days post-operatively the patient was reluctant to mobilize complaining of back pain and left leg pain. Examination revealed abdominal wall ecchymoses at the level of the umbilicus (Fig. 1), tenderness localized to the L2 vertebra and symptoms of pain radiating down the distribution of the left L2 dermatome. Neurological examination was otherwise normal. Plain AP and lateral radiography of the lumbar spine revealed a Chance fracture of the L2 vertebra (Fig. 2). MRI scan of the lumbar spine ruled-out any significant spinal cord lesion. The patient was treated with a hyper-extension Risser jacket. This was removed after 6 weeks where clinical and radiographic examination suggested fracture union. Long-term follow-up has confirmed full recovery from his cerebral, abdominal and spinal injuries, though the patient has a traumatic hernia through his oblique abdominal wall musculature caused by the seat-belt injury.

Discussion

Chance first described the flexion-distraction injury to which his name was given in 1948,2 17 years later the first report of such a fracture due to a 2-point lap restraint in a motor vehicle was described by Howland et al.8 Since then, Chance fractures due to seat-belt use have been well reported along with the associated abdominal injuries, the so-called “seat-belt syndrome”.1,5,7,9,12 The implementation of seat-belt laws in many countries while decreasing the mortality from road traffic accidents have
undoubtedly increased the incidence of this type of injury, with the 2-point lap-restraints being chiefly implicated.\(^5,6,13\)

**Mechanics of injury**

The resting position of the 2-point restraint has been implicated in the aetiology of these injuries. Correctly positioned over the thighs, the seatbelt restrains the pelvis under rapid decelerations. The reduced size of the paediatric skeleton is such that a restraint over the lap can easily ride above the iliac wings, resting above the pelvis.

The mechanism of spinal injury is one of forced flexion and distraction of the torso over the immobilized lower lumbar spine resulting in a tensile force being produced across the posterior elements of the vertebrae. Tissue failure may occur through the posterior elements of the vertebral body (bony Chance) or through the ligamentous tissue and inter-vertebral disc (soft-tissue Chance). Compression by the restraint itself results in a zone of injury, which may involve one or more of the structures listed in Table 1.

**Diagnosis of injuries**

The key in diagnosing occult injuries is to suspect the seat-belt syndrome. Therefore, an adequate history of the mechanism of injury must be obtained. When this is unavailable, the syndrome should always be considered. If suspected, appropriate investigations should be performed to rule out these injuries. Plain AP and lateral radiography of the spine is essential along with appropriate clinical examination and investigation for abdominal injuries. A study by Glass et al. showed that thick-cut CT missed 57% of spinal injuries, whereas plain radiography of the spine diagnosed 100% of injuries.\(^4\)

Abdominal wall ecchymosis (AWE) is associated with abdominal injury in up to 65% of cases (compared to 8% in the absence of AWE).\(^3\) Beaunoyer et al. in a retrospective study of 48 patients with thoracolumbar fractures following RTA found that 38% of patients with thoracolumbar fracture required therapeutic laparotomy for abdominal injuries. This figure was increased to 72% when both lumbar fracture and abdominal wall ecchymosis were present together.\(^1\) Sivit et al., looked at 61 patients with AWE and found that 21% had a lumbar spine injury, 23% had hollow viscus injury and 8% had both spinal and hollow viscus injury.\(^10\)

**Conclusions**

In cases, such as the one we describe, a broad range of blunt trauma may occur due to seat-belt use. It is essential to suspect the possibility of intra-abdominal, retroperitoneal and spinal injuries in these patients, especially when the ‘seat-belt mark’ sign

---

Table 1  Injuries associated with the seat-belt syndrome

<table>
<thead>
<tr>
<th>Sites involved</th>
<th>Injuries sustained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal wall</td>
<td>Abdominal wall ecchymosis (seat-belt mark)</td>
</tr>
<tr>
<td></td>
<td>Anterior abdominal wall herniation</td>
</tr>
<tr>
<td></td>
<td>Anterior abdominal wall disruption</td>
</tr>
<tr>
<td>Intraperitoneal</td>
<td>Hollow viscus perforation</td>
</tr>
<tr>
<td></td>
<td>Mesenteric vessel injury</td>
</tr>
<tr>
<td>Retroperitoneal</td>
<td>Renal, splenic, hepatic injury</td>
</tr>
<tr>
<td></td>
<td>Aortic disruption(^8)</td>
</tr>
<tr>
<td></td>
<td>Bladder rupture</td>
</tr>
<tr>
<td>Spinal</td>
<td>Chance’s fracture</td>
</tr>
<tr>
<td></td>
<td>‘Ligamentous’ Chance injury</td>
</tr>
<tr>
<td></td>
<td>Compression fractures(^11)</td>
</tr>
</tbody>
</table>
is present. Abdominal wall ecchymosis may represent a seven-fold increase in the risk of associated abdominal injury. Where any one injury is identified, we recommend systematic investigation to rule out other possible injuries in both the primary and secondary surveys. We feel it is also important to reiterate the limitations of CT scanning in diagnosing Chance’s fracture in the trauma setting. Computer tomography is proven to be no substitute for plain radiography of the spine.

References


Figure 2  AP and lateral radiographs of the lumbar spine showing L2 bony Chance fracture.