

CHANCE FRACTURE



“Garden Court” , (from Briar Rose series), oil on canvas, Edward Burne-Jones, 1893, Bristol Museum.



“Study for Garden Court” , Edward Burne-Jones, 1893.

The Nineteenth century British painter Edward Burne-Jones was one of the pre-eminent members of the Pre-Raphaelite brotherhood, a movement that aimed to return to the chivalrous values of the middle ages, before the time of Raphael. Their works included many scenes from the Arthurian legends that had their origin possibly in Wales, as early as the late Fifth and early Sixth century AD.

One of the most striking works of Burne-Jones, was the stunning four major panels of his series entitled the “The Legend of Briar Rose”. The intricate vine roses that decorate each of the works give a virtual medieval illuminated manuscripts quality, in keeping with the age of chivalry.

In one of the four works, “Garden Court”, we see six beautiful female weavers who have fallen asleep exhausted, at their looms.

Under the work is an inscription by the leader of the brotherhood, William Morris, which reads:

*“The maiden plaisance of the land
Knoweth no stir of voice or hand
No cup the sleeping waters fill
The restless shuttle lieth still.”*

To produce such beautiful and intricate works, Burne-Jones spent many hours in careful preparation, which would include numerous “rough” preliminary sketches. Some of these have survived the years, including one for the “Garden Court” . We see the figure that appears on the far right of the work. The woman has slumped forward over her loom, the edge of which appears as if it has bend her in two. To the medical eye this reminds us of the seatbelt mechanism of the Chance fracture.

CHANCE FRACTURE

Introduction

Chance fractures occur as a result of an acute hyperflexion and distraction injury of the spine around the thoracolumbar junction at T12-L2.

These are unstable fractures when they involve all 3 elements of the spinal column.²

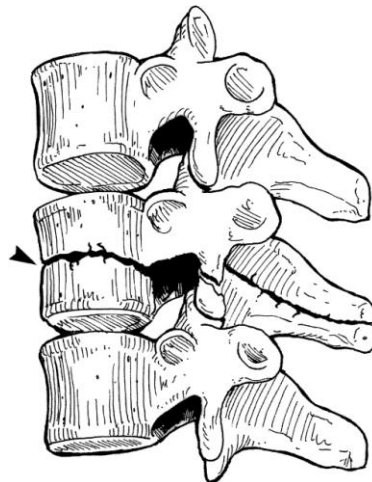
There is a high association with retroperitoneal and intra-abdominal injuries.

History

Chance fractures were first described by G.Q Chance (a radiologist from Manchester) in 1948.

With the introduction of seat belts the injury also became known as the “seatbelt” or more particularly the “lap-belt” fracture

Mechanism



Chance fracture showing involvement all 3 columns of the spine.

Chance fractures occur as a result of a violent acute forward hyperflexion and distraction injury of the spine around the thoracolumbar junction at T12-L2.

The flexion occurs about an axis anterior to the vertebral column.

The injury involves a horizontal fracture of the vertebra that begins with the posterior elements extending to the middle elements and then extending again anteriorly through the anterior elements.

As described by Denis⁴, the anterior column is represented by the anterior half of the vertebral body, disc, and anterior longitudinal ligament. The middle column consists of the posterior half of the vertebral body, its associated disc, and posterior longitudinal ligament. The posterior column includes the pedicles, facet joints, lamina, and spinous

and transverse processes, as well as the ligamentous complex, including the ligamentum flavum.

Chance fractures are usually defined as those that involve all 3 elements.

The vertebral body tends to have a wedge type compression fracture pattern, whilst the posterior elements of the vertebra (spinous processes) are typically distracted.

Alternatively the injury may primarily be ligamentous in nature, running through the inter-vertebral disc and then through the interspinous ligament, ligamentum flavum, facet capsule, posterior annulus, and thoracodorsal fascia.³

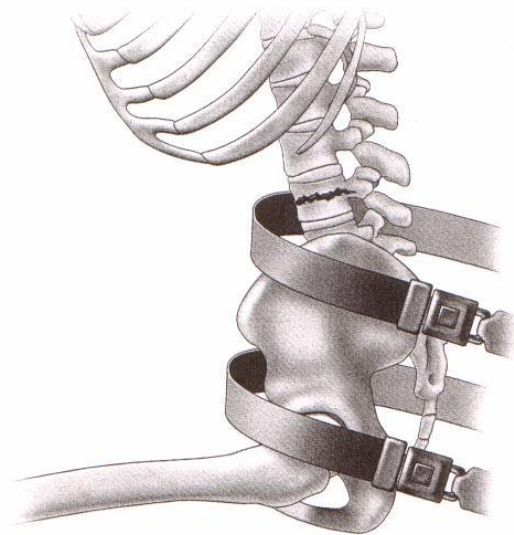
Fractures at the level of the thoraco-lumbar junction are due to the relative immobility of the thoracic spine as compared with the lumbar spine.²

Most commonly this injury is seen in **rapid deceleration automobile accidents**. It was particularly prevalent in the pre-seat belt era.

In the post seat-belt era, Chance fractures occur less commonly, but may still be seen if seat belts are incorrectly applied.

This is where the lap belt only is being used without the use of a shoulder restraint, (to provide 3 point restraint) or where a lap belt is worn incorrectly, (ie placed across the abdomen *above* the anterior superior iliac spines).

Lap belts should be worn below the level of the anterior superior iliac spine²).



Less commonly Chance fractures may be produced by falls from a height or other mechanisms that result in forceful hyperflexion at the mid-spine.

Complications

1. Unstable:
 - True Chance fractures are unstable fractures, hence there is potential for neurological injury or secondary neurological injury with careless handling.
 - Neurological injury is surprisingly uncommon however.
2. Associated injuries:

Chance fractures have a high association with retroperitoneal and intra-abdominal injuries (up to 50-60 %).

In particular these may include:

- Pancreatic injury.
 - Duodenal injury.
 - Mesenteric injury.
 - Liver injury.
 - Splenic injury.
 - Retroperitoneal bleeding/ renal injury
3. Long term:
- Unrecognized Chance injuries may result in progressive kyphosis with ensuing pain and deformity.

Clinical Features

Important points of history include:

1. The mechanism of injury should be noted
2. The type of restraint used in cases of motor vehicle accidents and whether this was correctly applied.

Important points of examination include:

1. A full primary and secondary survey needs to be done
 - Chance fractures result from violent high-energy mechanisms with high risk of multiple trauma.
2. Careful neurological assessment.
 - Patients with thoracolumbar fractures are especially vulnerable to rotational movements.
 - Logrolling should therefore be done with extreme care.
3. Careful assessment of the abdomen, due to the high risk of associated intra-abdominal injury.

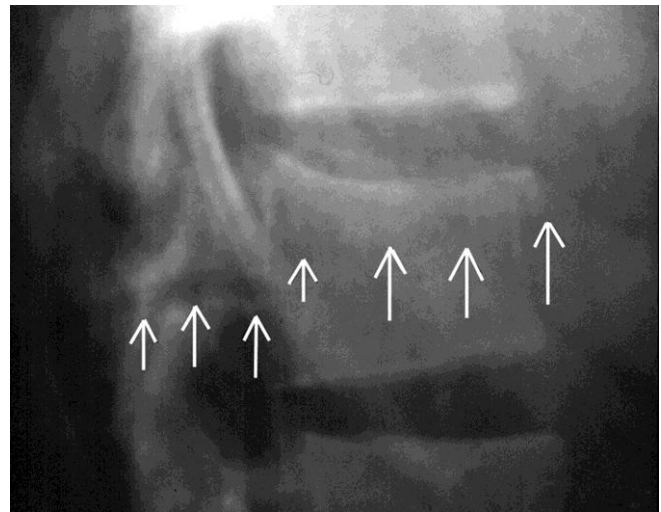
- An abrasion across the lower abdomen can suggest a significant lap seatbelt injury.

Investigation

Note that these fractures may be mistaken for simple compression wedge fractures. The true Chance fracture however is a far more serious injury.

The occurrence of a traumatic compression fracture in a young patient (following an MVA) should raise the index of suspicion for a Chance fracture.

Plain radiography



Chance fracture (arrowheads), involving all three columns of the spine making the injury unstable. The fracture may also occur through the disk as well as the vertebral body.

Lateral radiograph of lumbar spine Chance fracture showing fanning of spinous processes (double-headed arrow) and a fracture line extending through pedicle (between arrowheads) and into the L2 vertebral body (single-headed arrow).

Plain radiographs taken as A-P and lateral will usually make the diagnosis.

CT scan

When a Chance fracture is diagnosed a CT scan should be then be done of:

- The fractured region:

- ♥ To further define the extent of the injury and to evaluate the spinal canal.
- The abdomen:
 - ♥ Because of the high incidence of associated intra-abdominal or retroperitoneal injury.

MRI

This may further define the extent of ligamentous damage to the spinal column, and the extent of injury to the spinal cord, especially where neurological injury is apparent on examination.

MRI will be the best investigation when a primarily ligamentous type injury is suspected.

Blood tests

These are done as clinically indicated, as for any multi-trauma patient

1. FBE
2. U&Es/ glucose
3. Group cross match blood as required.
4. Lipase:
 - This may be useful in the detection of pancreatic injury.

Management

1. Attention to any associated immediate ABC issues.
2. Spinal immobilization:
 - Patients with thoracolumbar fractures are especially vulnerable to rotational movements.
 - Spinal precautions are therefore very important in these cases.
 - Logrolling should be done with extreme care.
 - Patients should be kept in **full** spinal immobilization.
3. Analgesia:
 - IV narcotic analgesia titrated to clinical effect.
4. Other associated injuries are common, and are treated on their merits.

5. Orthopaedic referral:

- Chance fractures may generally be managed by closed reduction and immobilization in hyperextension in a thoracolumbosacral orthosis.
- Those with multiple injuries or more severe injuries may require ORIF.

ORIF may also be necessary when conservative methods are impracticable.

References

1. Chance GQ. Note on a flexion fracture of the spine. *Br J Radiol.* 1948, 21:452-3.
2. ATLS Manual 8th ed 2008.
3. Chance Fracture of the Spine. Wheeless' Textbook of Orthopaedics, Website, www.wheelessonline.com/
4. Denis F. The three-column spine and its significance in the classification of acute thoracolumbar spinal injuries. *Spine.* Nov-Dec 1983;8(8): 817-31.

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