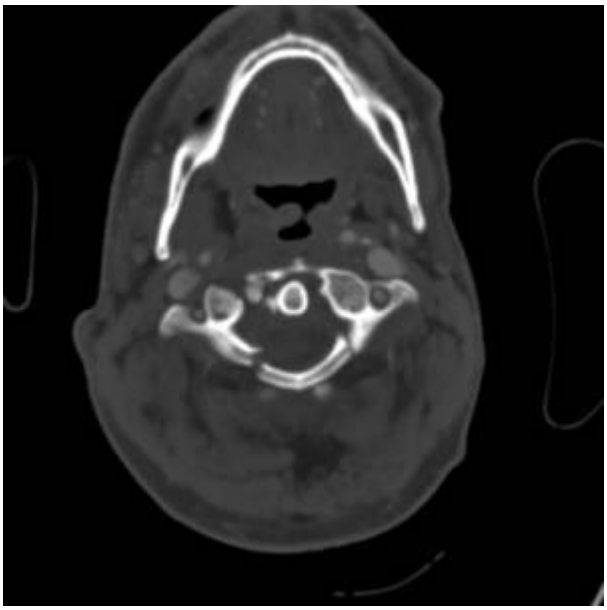
Jefferson fracture



Burst atlas fracture with bilateral fractures of anterior and posterior arch resulting from axial load. Stability determined by integrity of transverse ligament.

History and etymology

Named by Sir Geoffrey Jefferson.

Jefferson fracture is the eponymous name given to a burst atlas fracture.

It was originally described as a 4 part fracture with double fractures through the anterior and posterior arches, but 3-part and 2-part fractures have also been described.

Mechanism

A typical mechanism of injury is diving head first into shallow water. Axial loading along the axis of the cervical spine results in the occipital condyles being driven into the lateral masses of C1. The Jefferson fracture is not normally associated with neurological deficet although spinal cord injury may occur if there is a retropulsed fragment.

Associations

50% are associated with other C-spine injuries

33% are associated with a C2 fracture

25-50% of young children have concurrent head injury

vertebral artery injury

extra-cranial cranial nerve injury

Radiographic features

Plain film

Radiographs will show asymmetry in the odontoid view with displacement of the lateral mass(es) away from the odontoid peg. A distance of greater than 6 mm suggests ligamentous injury.

CT

CT demonstrates the fracture line which usually involves both the anterior and posterior arches. If there is injury to the transverse atlantal ligament, the atlantodens interval (ADI) increases. The normal ADI in the adult population is less than 3 mm; in paediatric populations, the normal distance is less than 5 mm.

MRI

The fracture will not be seen as well as with CT. However, localised soft-tissue injury will be apparent. Pre-vertebral haemorrhage or oedema will identify injury at the level of C1/2. Ligamentous injury will also be demonstrated. A fat-sat T2 sequence is useful in the trauma setting to help distinguish abnormal soft-tissue injury from normal fat.

Treatment and prognosis

Jefferson fractures are typically treated conservatively (hard collar immobilisation) provided the transverse atlantal ligament is considered intact (no widening of the atlanto-dens interval or intact ligament visualised on MRI).

In cases where the ligament is thought to be disrupted, the injury is considered unstable and more aggressive management is usually required.

This includes halo immobilisation, posterior C1-C2 lateral mass internal fixation or transoral internal fixation.