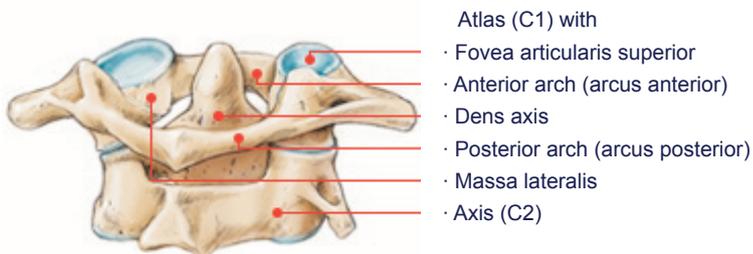


The forms of the first and second cervical vertebrae, atlas (C1) and axis (C2), differ considerably from those of the other vertebrae to ensure the fixation and mobility of the head.

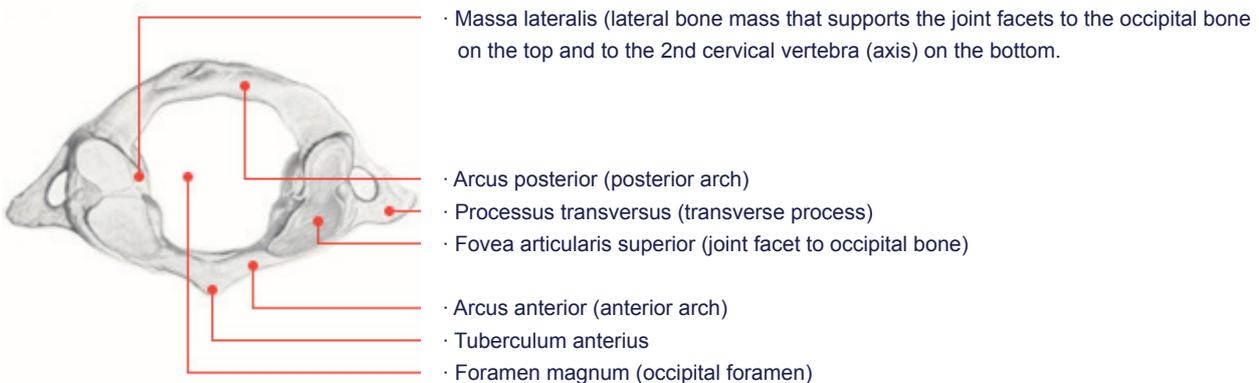
• Atlas and Axis, from the rear



The ring-shaped atlas (C1) carries the head and consists of two side pieces, massae laterales, connected by the anterior and posterior arches. The atlas is connected to the occipital bone of the skull via joint facets (fovea articularis superior) on the massae laterales, forming the atlantooccipital joint. This joint allows the head to move forward, backward and slightly to the side.

The inferior side of the atlas is connected via the inferior joint facets (fovea articularis inferior) to the 2nd cervical vertebra (axis).

• Anatomical structure of Atlas, 1st cervical vertebra, view from above



What types of fractures occur?

The fractures of the 1st cervical vertebra (atlas) are classified by Gehweiler in 5 subtypes:

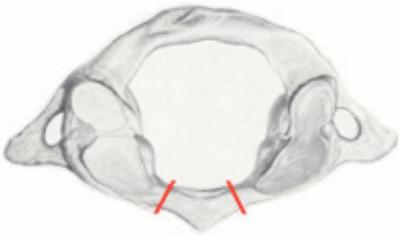
Type I: Fracture of the anterior arch of the atlas

This fracture type is an avulsion fracture of the tuberculum anterius of the anterior arch of the atlas, where a muscle belonging to the deep anterior cervical musculature (musculus longus colli) is attached.

The musculus longus colli is excessively tensed by the hyperextension of the cervical spine (massive backward overstretching), potentially resulting in a bony avulsion of the tuberculum anterius of the atlas.

An isolated avulsion of the tuberculum anterius atlantis is classified as a stable fracture.

- Fracture of the anterior arch of the atlas, Gehweiler Type I

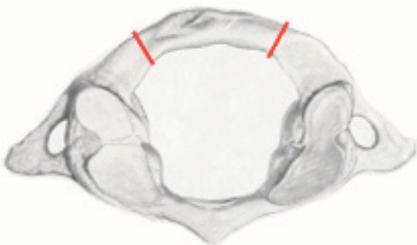


Type II: Fracture of the posterior arch of the atlas

A fracture of the posterior arch of the atlas may result from hyperextension, pronounced flexion, or axial compression of the cervical spine. Axial compression results in the wedging of the posterior arch of the atlas between the joint masses of the occipital bone and the 2nd cervical vertebra (axis), resulting in a fracture of the posterior arch of the atlas.

An isolated fracture of the posterior arch of the atlas is classified as a stable fracture.

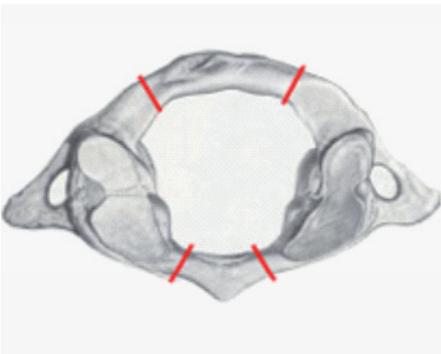
- Fracture of the posterior arch of the atlas Gehweiler Type II



Type III: Combined fractures of the anterior and posterior arches of the atlas

The combined fracture type of the anterior and posterior arches of the atlas is also known as a “Jefferson fracture”.

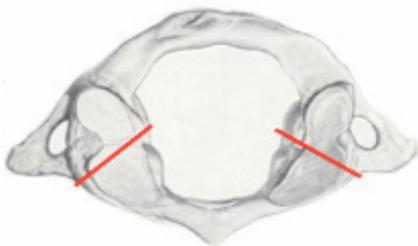
- Combined fracture of the arches of the atlas, Gehweiler Type III



Type IV: Fracture of the massa lateralis

An isolated fracture of a joint-bearing lateral mass of the atlas (massa lateralis) is classified as a stable fracture.

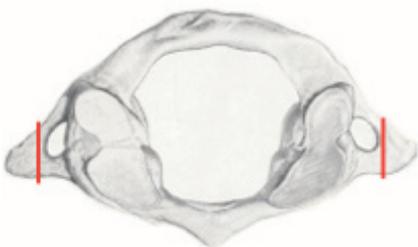
- Fracture of the massae laterales, Gehweiler Type IV



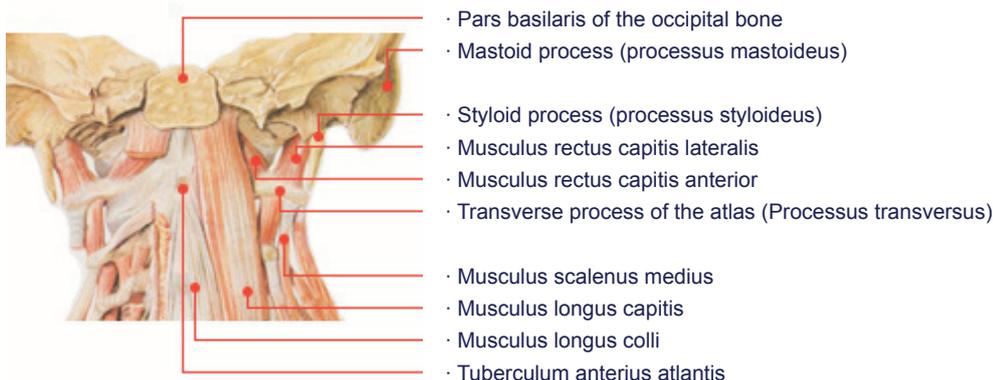
Type V: Fracture of the processus transversus

The transverse processes of the atlas (processus transversus) provide the site of insertion for several muscles from the lateral group of deep cervical muscles, such as parts of the musculus scalenus medius that descend along the spinal column, and the musculus rectus capitis lateralis that ascend. Avulsion fractures of the transverse processes of the atlas are classified as stable fractures.

- Fracture of the processus transversus Gehweiler Type V



- Parts of cervical muscles, front view



Jefferson fractures of the atlas

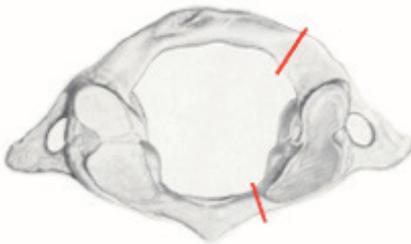
Combined fractures of the anterior and posterior arches of the atlas, Gehweiler type III, are also known as Jefferson fractures.

G. Jefferson was the first to describe these combined fractures of the 1st cervical vertebra in 1920. He classified them according to various types.

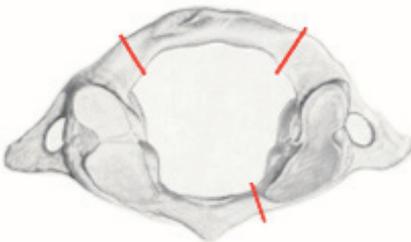
What are the different types of Jefferson fractures?

The classical Jefferson fracture is a 4-part fracture, though fracture types with 2 or 3 fracture parts also occur.

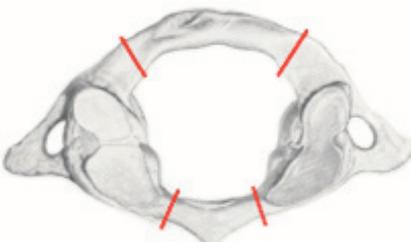
- Jefferson fracture, 2-part fracture



- Jefferson fracture, 3-part fracture



- Jefferson fracture, 4-part fracture

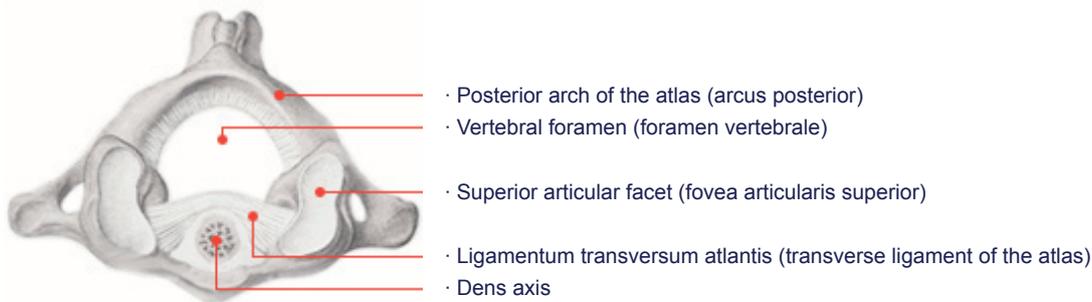


How are Jefferson fractures caused?

When forces act upon the cervical spine from above, when a person takes a header, for example, these forces are distributed via the joint masses of the occipital bone (condyli occipitales) to the atlantooccipital joints. Since there is no intervertebral disc in this area, the atlas is forced to distribute these forces with no buffering effect. The axial forces are transformed by the joint facet angle of the upper cervical joints into forces that are distributed outward. This laterally directed redirection of the applied energy causes the arches of the atlas to burst apart.

The lateral deviation of the arches of the atlas may cause the transverse ligament of the atlas (ligamentum transversum atlantis) to avulse. This is the ligament responsible for stabilizing the atlantoaxial joint between the 1st and 2nd cervical vertebrae. If it avulses, this results in instability with the possible compression of the spinal cord due to a narrowing of the spinal cord canal.

- Atlas, view from above, ligamentum transversum



What are the symptoms of Jefferson fractures?

- Painful restrictions of movement in the cervical spine
- Wryneck
- Swallowing dysfunction
- Injuries of the nervus glossopharyngeus and nervus occipitalis major
- Unstable fracture types can result in compression of the spinal cord with neurological deficits
- Injury of the arteria vertebralis in 30% of cases

How are atlas fractures diagnosed?

- X-rays of the cervical spine in 2 planes
- Computer or nuclear magnetic resonance tomography

How are atlas fractures treated?

Stable fractures with no dislocation of the atlas can often be treated conservatively by means of immobilization using special cervical braces worn for 8 weeks.

Jefferson fractures with ligamentous avulsions, and resulting lateral dislocation of C1 in relation to C2 require surgery urgently. The surgical options available are:

- Harms transoral repositioning and osteosynthesis of C1
- C0/C2 fusion