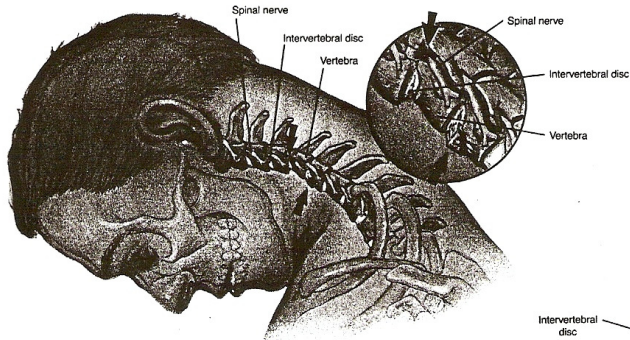


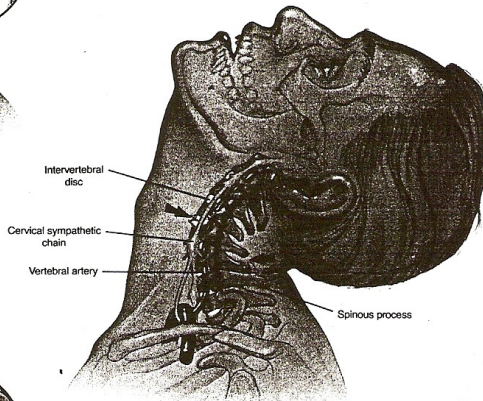
WHIPLASH INJURIES OF THE HEAD AND NECK



HYPERFLEXION

The head is propelled in a forward and downward motion in hyperflexion. A wedge-shaped deformity of the bone may be created if the anterior portion of the vertebrae are crushed. Intervertebral disks may be damaged. The disks may bulge or herniate, irritating spinal nerves.

Whiplash injury of the head and neck is caused by a sudden exaggerated thrust of the head backward, forward, and sometimes sideways. Abnormal forces are applied to muscles, ligaments, nerves, bones, intervertebral discs, blood vessels, and eyes as the weighty head moves beyond normal physiological limits. There may be no visible bruises or abrasions from this type of injury yet victims report classic symptoms. The symptoms are due to injuries of vertebrae and of soft tissues of the head and neck.

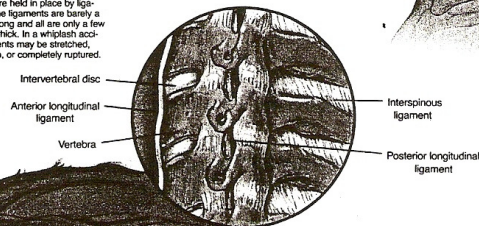


HYPEREXTENSION

The head is forced backward in hyperextension. Pieces of bone may be pulled from cervical vertebrae by a tear of the anterior longitudinal ligament. Spinous processes of the vertebrae may be fractured. Intervertebral disks may be compressed posteriorly and torn anteriorly. Vertebral arteries may be stretched, pinched, or torn, causing an impediment to blood flow to the brain. Nerves of the cervical sympathetic chain may also be injured.

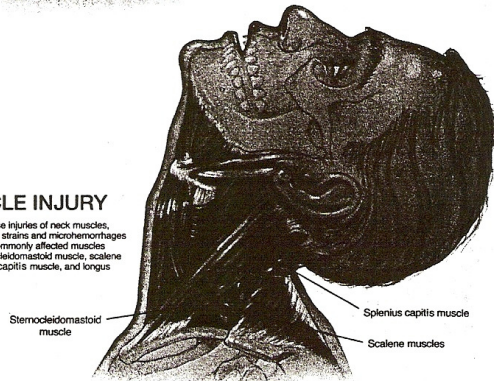
SPINAL LIGAMENTS

Vertebrae are held in place by ligaments. Some ligaments are barely a centimeter long and all are only a few millimeters thick. In a whiplash accident, ligaments may be stretched, partially torn, or completely ruptured.



MUSCLE INJURY

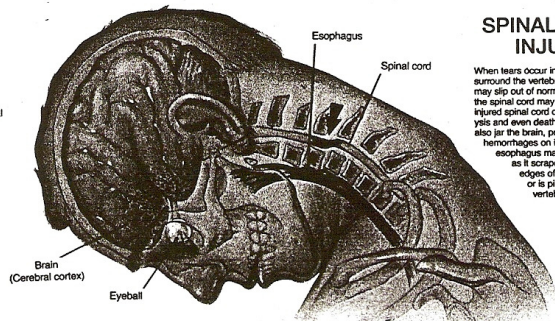
Whiplash can cause injuries of neck muscles, ranging from minor strains and microhemorrhages to severe tears. Commonly affected muscles include the sternocleidomastoid muscle, scalene muscles, splenius capitis muscle, and longus colli muscle.



LIGAMENT DAMAGE

The anterior longitudinal ligament, running vertically along the anterior face of the vertebrae, may be stretched during hyperextension. The posterior longitudinal ligament running parallel to the anterior longitudinal ligament, on the posterior surface of vertebral bodies, may be injured in hyperflexion. The broad ligamentum nuchae may also be stretched or torn.

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SPINAL CORD INJURY

When tears occur in ligaments that surround the vertebrae, the vertebrae may slip out of normal alignment and the spinal cord may be injured. An injured spinal cord can cause paralysis and even death. Whiplash may also jar the brain, producing minute hemorrhages on its surface. The esophagus may even be injured as it scrapes against sharp edges of articular bone or is pinched between vertebrae.