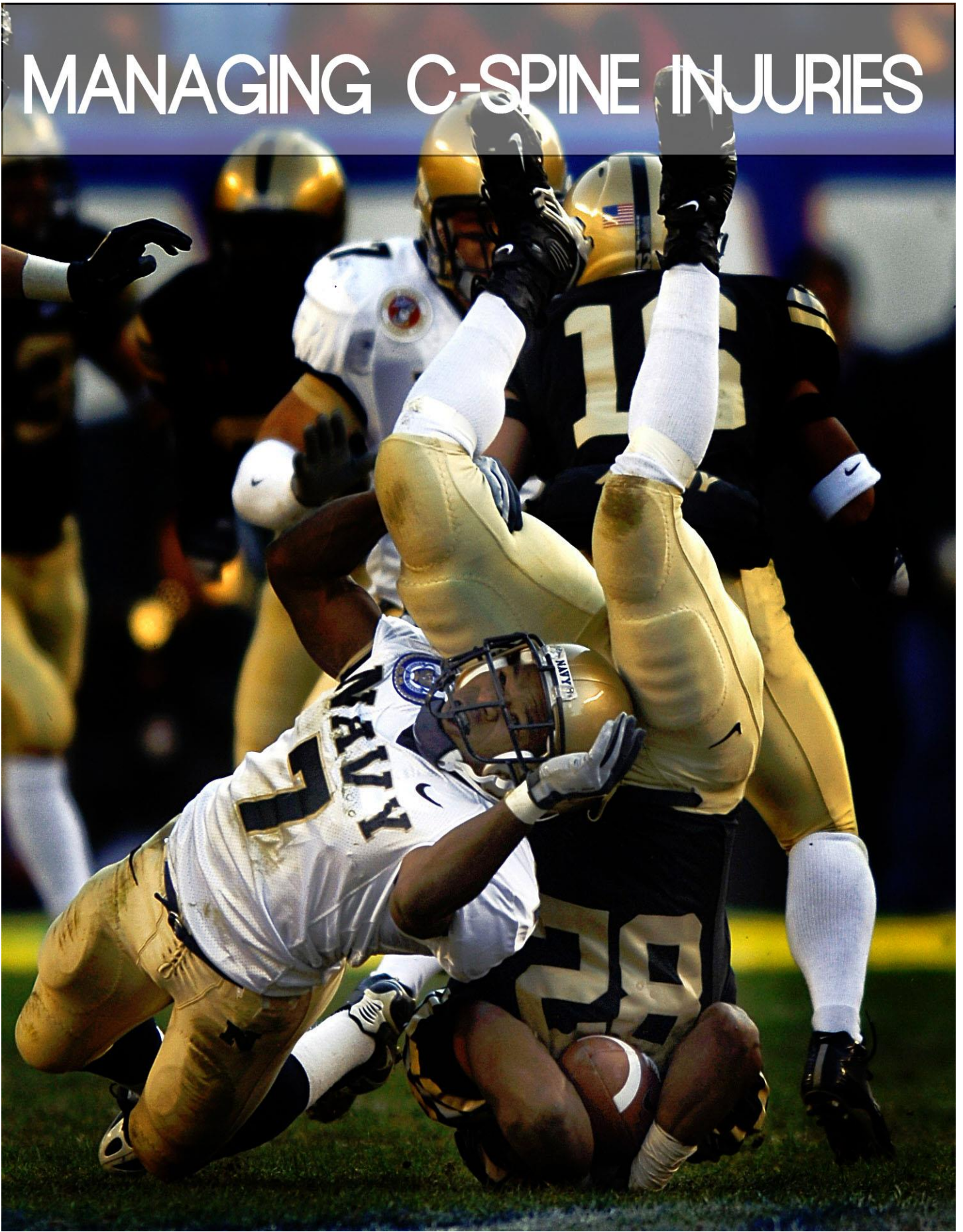
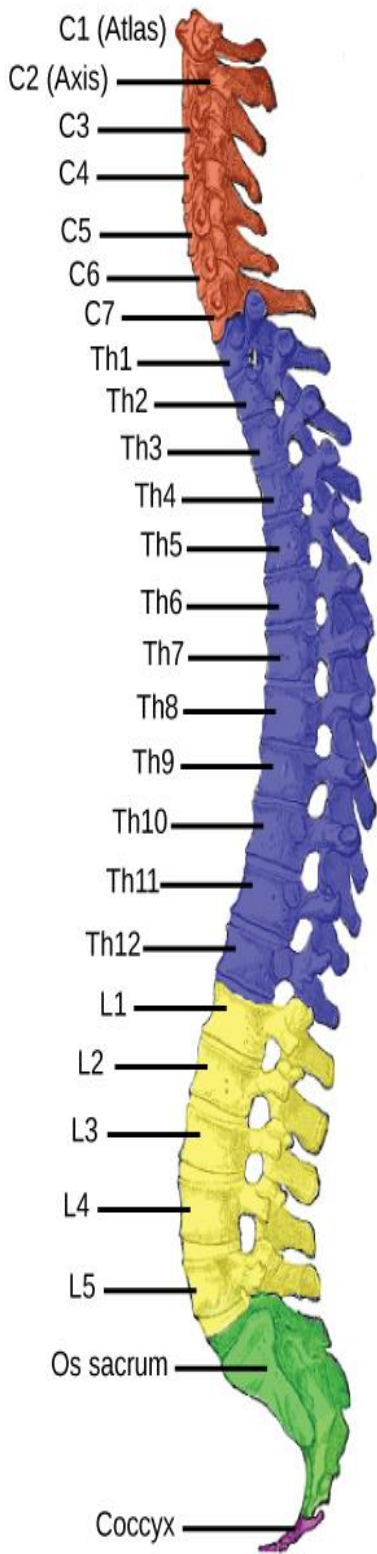
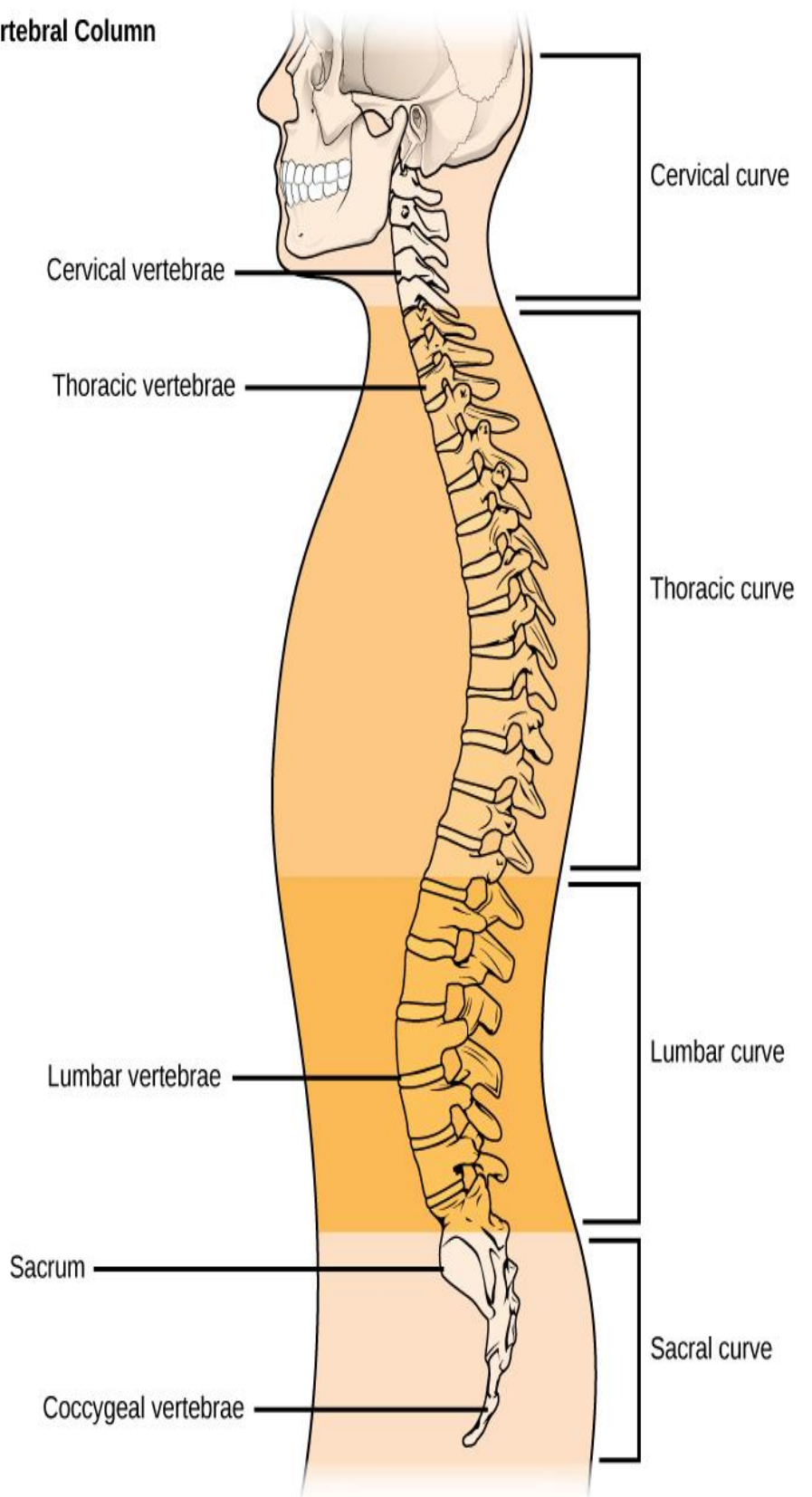


MANAGING C-SPINE INJURIES





Vertebral Column



Revised by: Jason Carney CNS 2014 – Version 3

Revised by: Catherine Foster CNS & Paul Spicer, 2003

Originally Compiled by: Gai Stratton CNS & Christine Williams CNS

Spinal Cord Injury Infographic

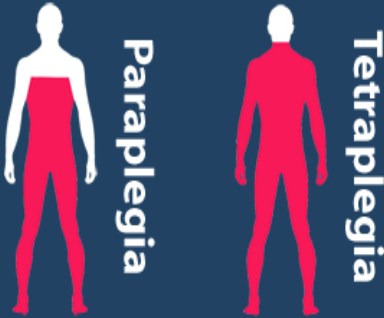
Types of Spinal Cord Injury

Prepared and designed by

www.apparelyzed.com
spinal cord injury peer support

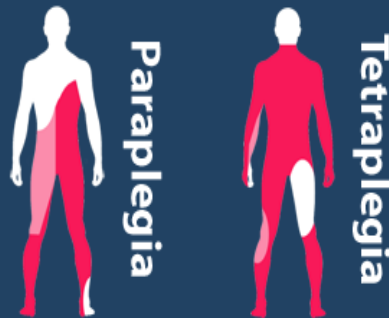
Complete Spinal Cord Injury

Complete loss of motor and sensory function below the spinal cord injury.



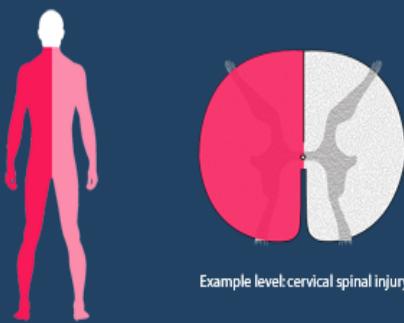
Incomplete Spinal Cord Injury

Partial random preservation of motor or sensory function below the spinal cord injury.



Common Types of Incomplete Spinal Cord Injuries

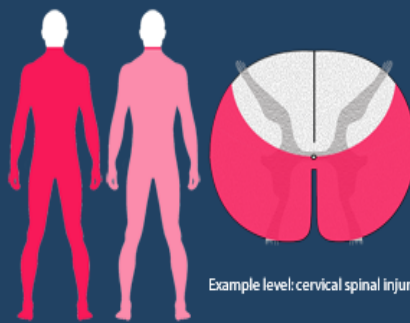
Brown-Séquard Syndrome



Example level: cervical spinal injury

Below injury level, motor weakness or paralysis on one side of the body (hemiparaplegia). Loss of sensation on the opposite side (hemianesthesia).

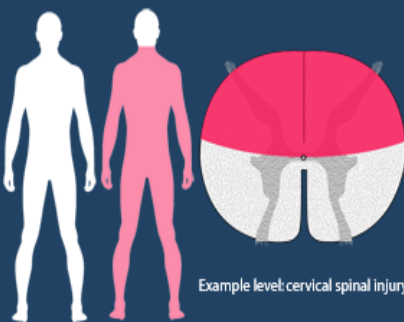
Anterior Cord Syndrome



Example level: cervical spinal injury

Below injury level, motor paralysis and loss of pain and temperature sensation. Proprioception (position sense), touch and vibratory sensation preserved.

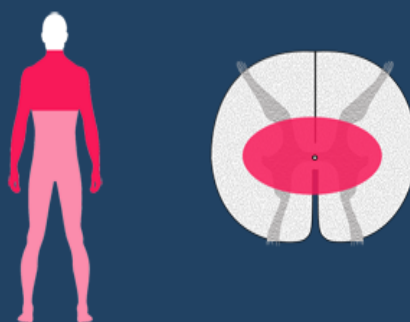
Posterior Cord Syndrome



Example level: cervical spinal injury

Below injury level, motor function preserved. Loss of sensory function: pressure, stretch, and proprioception (position sense).

Central Cord Syndrome



Results from cervical spinal injuries. Greater motor impairment in upper body compared to lower body. Variable sensory loss below the level of injury.

Cervical Nerves:

Diaphragm
Deltoids
Biceps
Wrist extensors
Rotates arm
Triceps
Bends fingers



Cervical

Thoracic Nerves:

Spread fingers
Chest muscles
Abdominal muscles
Muscles in the back



Thoracic

Lumbar Nerves:

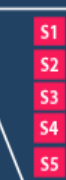
Hip muscles
Thigh muscles
Knee Muscles
Foot muscles



Lumbar

Sacral Nerves:

Bladder and bowel
Sexual function



Sacral

Sources: www.apparelyzed.com
www.wikipedia.org
sci.rutgers.edu

Key: Normal Function
 Impaired Motor Function
 Impaired Sensory Function

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spinal cord injury peer support

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All patients with diagnosed or suspected spine injury must be ~~managed as per the Emergency Departments policy on C spine management~~ (there never has been a policy). This is to ensure that the patients neck is stabilised, the current level of spinal cord functioning is maintained and further injury to the spinal cord is prevented.

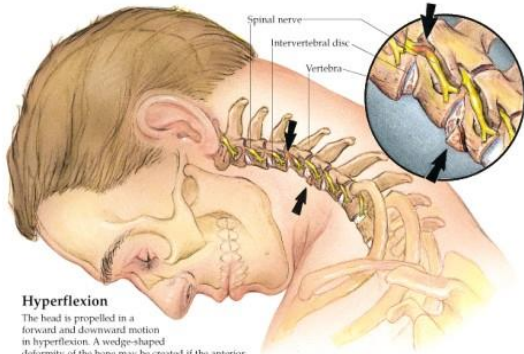
COMMON CAUSES OF INJURY

Motor Vehicle Accidents	Skiing
Motor Bike Accidents	Surfing
Falls	Wrestling
Gunshots	Fall from horse
Football	Fall from trampoline
Diving	Hanging

MECHANISMS OF INJURY

- Hyperflexion
- Hyperextension
- Compression

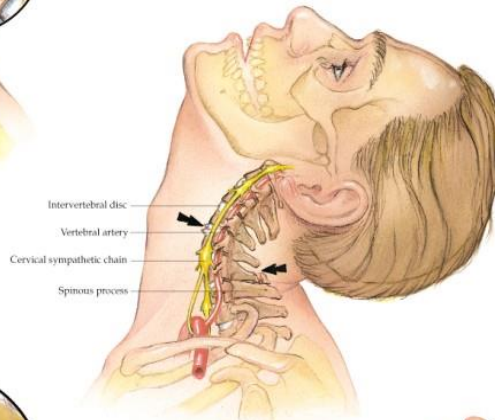
WHIPLASH INJURIES OF THE HEAD AND NECK



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 portions of the vertebrae are crushed. Intervertebral discs may be damaged. The discs may bulge or rupture, 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 head moves beyond normal physiological limits. There may be no visible bruises or abrasions from this type of injury, yet victims report classic symptoms. These symptoms result from injuries to vertebrae and to soft tissues of the head and neck.

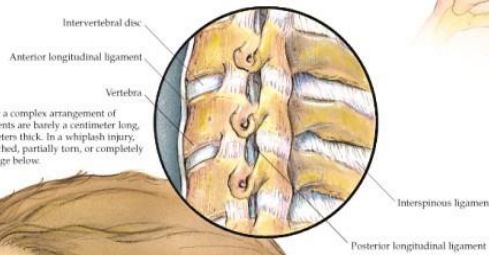


Hyperextension

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 discs may be compressed posteriorly and torn anteriorly. Vertebral arteries may be stretched, pinched, or torn, causing reduced blood flow to the brain. Nerves of the cervical sympathetic chain may also be injured.

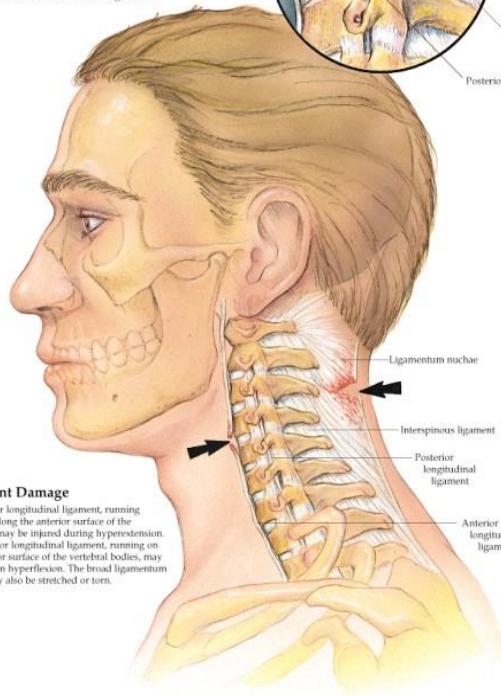
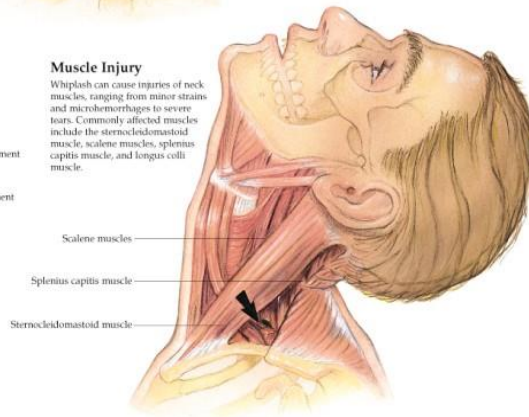
Spinal Ligaments

Vertebrae are held in place by a complex arrangement of ligaments. Some of the ligaments are barely a centimeter long, and all are only a few millimeters thick. In a whiplash injury, ligaments may be badly stretched, partially torn, or completely ruptured as shown in the image below.



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.

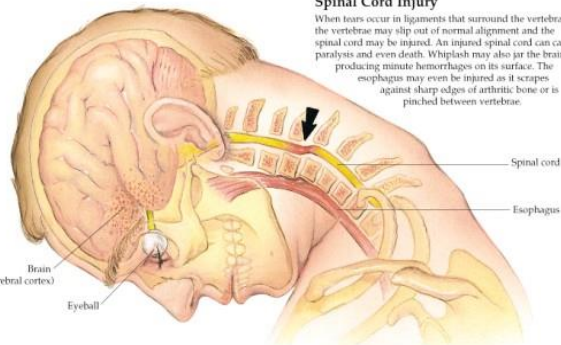


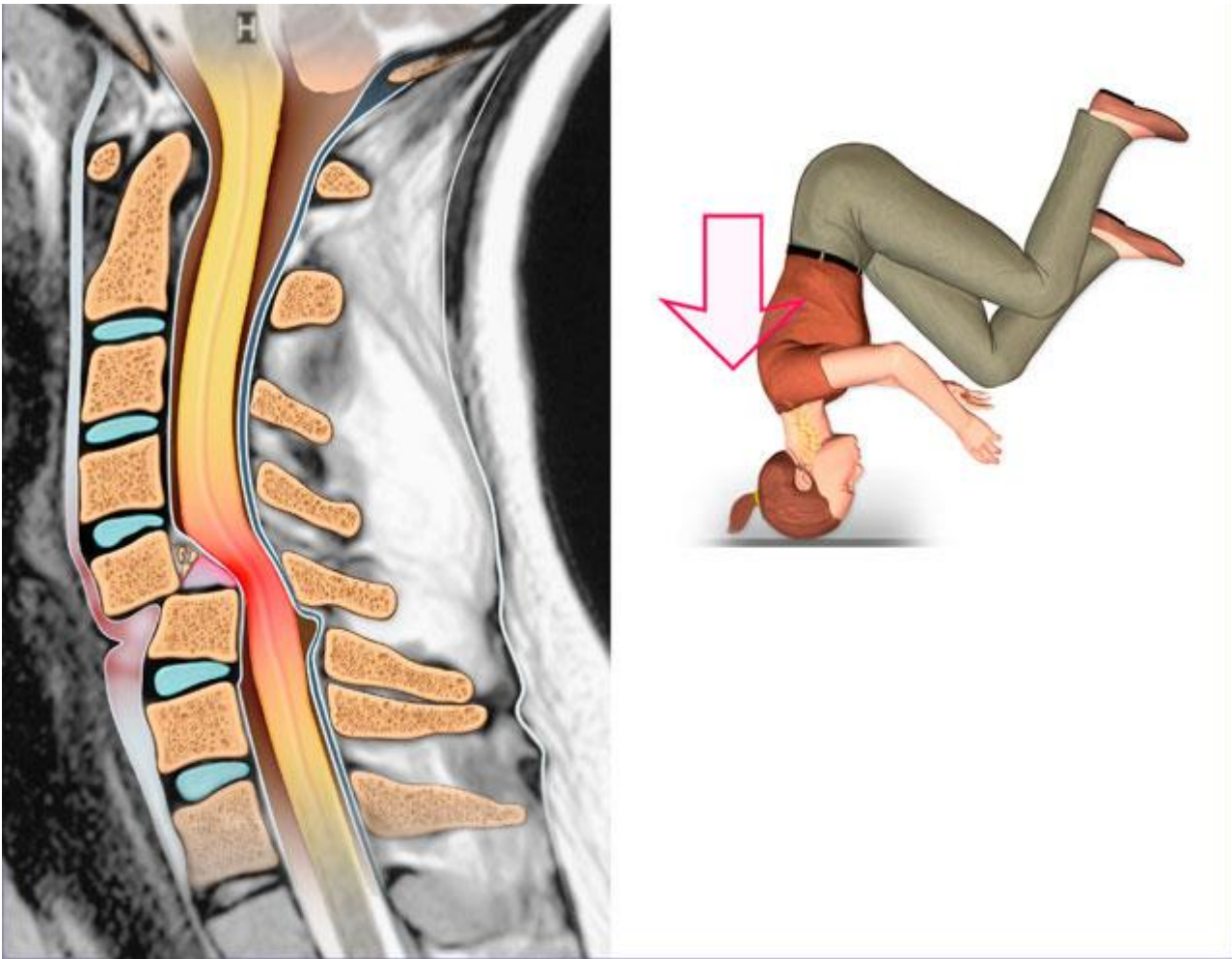
Ligament Damage

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

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.





PRESENTATION

Patients may present immediately after injury, or presentation may be delayed. (It has been known for a patient to present to the department 2 weeks after their initial injury).

Spinal injury may result in:

- Injury to bones and the joints between them
- and/or
- Injury to the spinal cord (by directly crushing the spinal cord fibres or by damage to blood vessels resulting in cell death).
- It is possible to injure the bones without injury to the spinal cord and vice versa.

ASSESSMENT

Prior to the commencement of any treatment, listen to the history and ascertain the mechanism of injury and likely severity. Briefly assess the patient for any sensory or motor deficit.

The correct sized Philadelphia cervical collar must be applied to the patient (if not already in place) prior to movement or further treatment. This applies to a patient who is supine as well as those patients who walk into the department.

The majority of patients present to the department via ambulance. More often than not a cervical spine collar is already insitu. However if one is not, the following procedure should be followed.

Firstly, **explain to the patient not to move their head.**

Placement of the cervical collar requires assistance. A nurse or medical officer experienced in cervical spine immobilisation takes charge of the procedure.

All necklaces and earrings must be removed prior to application of the collar as these may precipitate pressure areas and impede x-ray viewing (these items should be stored as per Emergency Department Specific Policy - Patient Valuables).

Explain the procedure and its rationale to the patient in order to give them an understanding and to gain their cooperation.

COMPLICATIONS

Be aware that the patient has the potential to develop the following complications:

- Further damage to the spine and spinal cord as a result of movement.
- Respiratory compromise secondary to aspiration of vomitus.
- Tissue breakdown on bony prominences secondary to prolonged contact with hard surfaces, keys/coins in back pockets etc.
- Supine Hypotension in pregnant patients (secondary to the pressure of the gravid uterus on the inferior vena cava). This can be minimised by tilting the backboard to the patients left 15-20 degrees, or pushing the patient's abdomen to the left.
- Neurogenic shock

-No sensation below level of injury

-bradycardia

-Unstable hypotension

-loss of sweating and shivering

-Poikilothermy

-bowel and bladder dysfunction

-priapism

DOCUMENTATION

It is important to document if the patient had been ambulant post injury, any sensory or motor deficit and any loss of consciousness associated with the injury.

ONGOING CARE

- Maintain patent airway
- Frequently reassess sensory and motor function
- Monitor temperature to avoid hypothermia
- Use log rolling techniques/ spinal lift to move the patient.
- Keep linen clean and dry beneath the patient
- Protect bony prominences
- Reassure patient. Do not give false hope regarding outcome

CERVICAL SPINE IMMOBILIZATION

Currently in the emergency department we immobilize the cervical spine by applying Adjustable Philadelphia collars. These are a "one size fits all approach". The adjustable collar accustoms to the following:

Neck Height

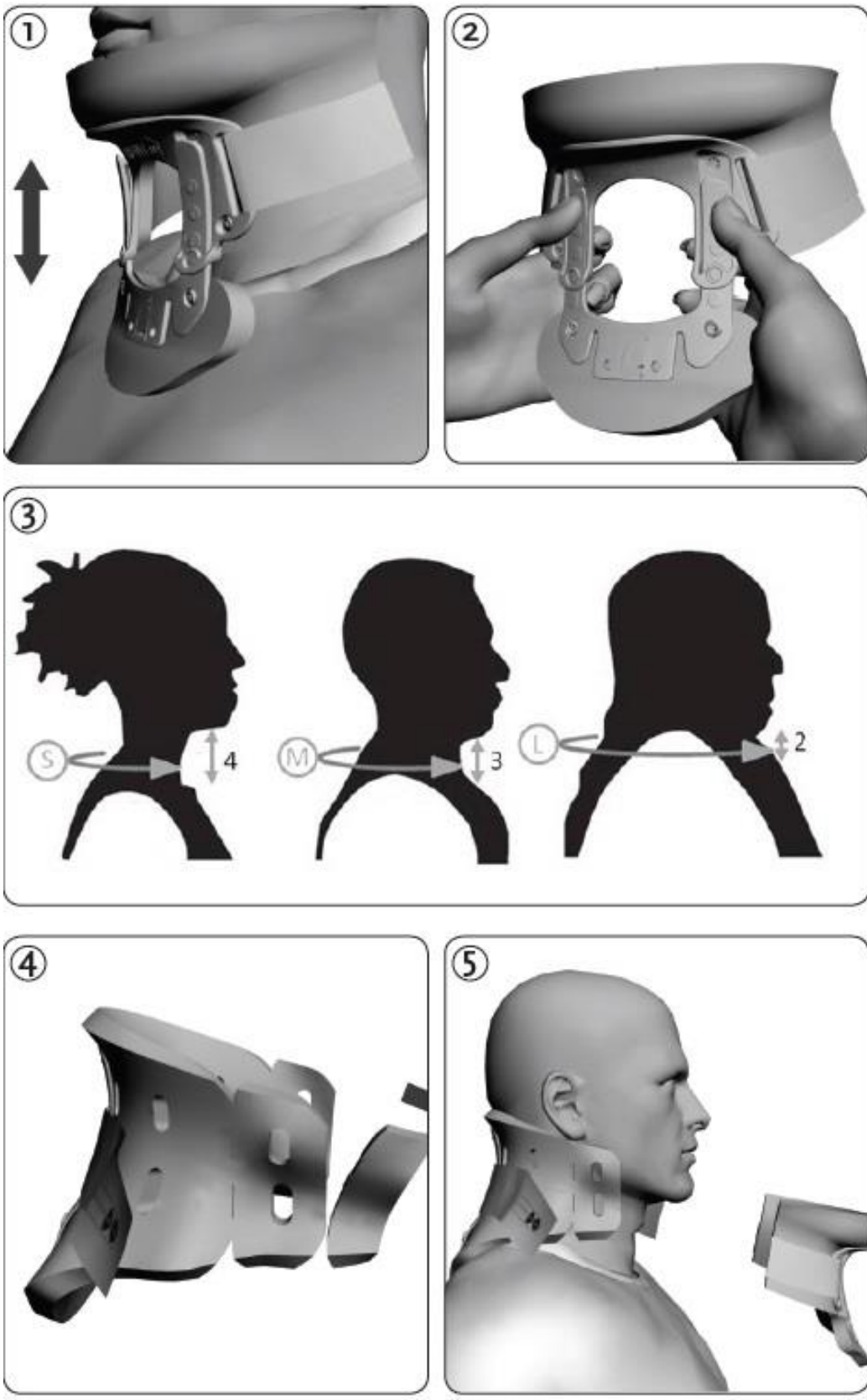
- The Neck height adjustment accommodates 2 ¼" (6 cm), 3 ¼" (8 cm) and 4 ¼" (11 cm)

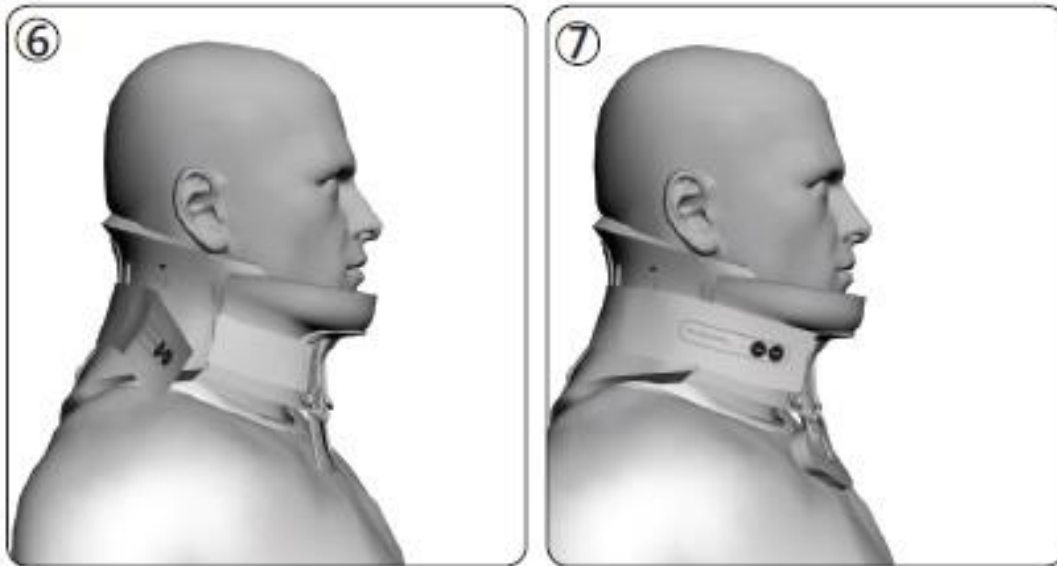
Circumference size / Range

- Small (2 tears) / 10"-13" (25.4-33.0 cm)
- Medium (1 tear) / 13"-16" (33.0-40.6 cm)
- Large (no tear) / 16"-19" (40.6-48.3 cm)



SIZING METHOD





Proper sizing is important for patient immobilization and comfort. Always maintain the patient's head in neutral alignment.

Neck Height

- Place the chin-cup of the front to the patient's chin and slide the lower front down to the patient's sternum (**Figure 1**). Lift the front away from the patient and push the two tabs to lock the size (**Figure 2**).
- Warning:** This collar is designed to be sized and locked into a single position only once; it is not intended to be resized.
- Note:** If you are familiar with the previous Philadelphia sizes you can use the size numbers marked on the front parts where 2 refers to 2 1/4", 3 refers to 3 1/4", etc. Simply slide the lower front down until the correct size number appears in the size window and lock.

Circumference

- Identify your patient's profile type according to the chart in (**Figure 3**).
- Adjust the circumference by tearing away sections of the back piece foam to change to a smaller circumference (**Figure 4**).

Collar Sizing Guide (Neck height and circumferential adjustment):

- The table below represents common sizing for the illustrated patient types (**Figure 3**). Actual sizing must be verified by the healthcare provider for each patient individually.

APPLICATION

1. Proper application of the collar is as important as proper sizing. The two-piece design consists of a FRONT piece and a BACK piece which are packaged as a set. After adjusting the size of the collar, apply the back piece of the collar to the back of the patient's neck. Center the collar (**Figure 5**). The arrow on the back should point upward.
2. Apply the FRONT piece of the collar with the chin secured in the recess. Center the collar to secure neutral alignment. The front piece OVERLAPS the back piece to ensure effective immobilization and comfort (**Figure 6**). The arrow on the front should point upward.
3. With hook and loop fasteners, tighten the collar with a bilateral adjustment (**Figure 7**). This will secure the patient's cervical region in neutral alignment.

Ambulant Patient

- The principle is the same for those patients who walk into the department. The technique is slightly different.
- Apply an adjustable Philadelphia collar while the patient is sitting.
- Before placing the patient onto the bed place the bed into 'High Fowlers position'.
- The patient can either sit themselves onto the bed or can be lifted - depending on what method is appropriate.
- Rest the patient in the high fowlers' position, and then slowly lower the back of the bed to the full supine position.

Application- Supine Patient

- Apply the adjustable Philadelphia collar to the spine patient as previous demonstrated.
- Be sure to maintain neutral alignment throughout this procedure.
- When applying the collar the leader takes a firm but gentle hold of the patients head. They place their thumbs along the patient's mandible with their fingers behind the head at the occipital ridge.

DO NOT APPLY TRACTION



LOG ROLLING TECHNIQUE

A minimum of 4 staff members are required to perform a coordinated log roll. This is to ensure the spinal column remains in alignment throughout the procedure.

Log Rolling Technique:

- The Leader remains at the patients head and directs the others.
- 1 staff member at the patients shoulders/chest
- 1 staff member at the patients abdomen/pelvis
- 1 staff member at the patients lower limbs



On the count of three the leader issues instructions to roll the patient onto their side. The patient's nose should remain in line with their umbilicus at all times (see photo 2)

Prior to the leader removing their hold on the patients head and neck, place a sandbag either side of the patients head. To further stabilise the patient it may be necessary to apply 3 inch adhesive tape directly on the skin across the patient's forehead and onto the bed/spine board.



Instruct the patient

- Not to move until spinal injury has been ruled out.
- To immediately report difficulty breathing, Increased pain, numbness or tingling.

PRECAUTIONS

- Patients with suspected spinal injury should not be left unattended.
- Suction equipment must be functioning and next to the patient ready to use in case they vomit.
- If the patient does vomit immediately call for assistance and use log rolling to position the patient on their side.
- If the patient is to be transferred to another department a nurse escort from the Emergency Department must accompany them. This includes Medical Imaging Department. Your assistance will be required to help transfer the patient onto the x-ray table.

NO LIFT

- The spinal lift is now considered to be an illegal move according to the Occupational Health and Safety Act 2000.
- A patient requiring a spinal lift, must be manoeuvred in a Jordan Frame
- The frame consists of two pieces which are connected above and below the supine patient, the thin plastic straps are slid under the patient and attached either side. The frame is then lifted with the Henry Lifter. The frame is kept in the Orthopaedic storeroom.

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FURTHER READING

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- <http://academiclifeinem.com/paucis-verbis-card-cervical-spine-imaging-rules/>
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- <http://www.intensivecarenetwork.com/index.php/icn-activities/icn-podcasts/707-96-clearing-the-c-spine>
- <http://www.resusme.em.extrememember.com/wp-content/uploads/2011/02/CEM5718-cervical-spine-full-guideline.pdf>
- [Motion within the unstable cervical spine during patient maneuvering: the neck pivot-shift phenomenon](#)

FOAM#C-SPINE

For those who use foam: #C-SPINE