Injuries to the neck can be classified by the movement taking place at the time of impact.

1. **Extension injuries.**
   
   Here, compressive forces are applied to the posterior structures and tensile forces to the anterior structures.

   The anterior structures principally at risk are:
   
   a) Esophagus,
   b) Anterior longitudinal ligament,
   c) Anterior cervical muscles,
   d) Odontoid process,
   e) Intervertebral discs.
   
   f) Further stretching of the anterior structures beyond their limit can result in
   
   i. elastic tears of muscles,
   ii. ligaments (anterior and posterior longitudinal ligaments)
   iii. separation of disc from the end-plate can take place

   The posterior structures at risk are:
   
   a) Spinous processes,
   b) Zygaphyseal joints. This can cause cartilaginous compression and then crush fracture of the articular pillars and articular surfaces.

II **Flexion Injuries:**

   This causes compressive forces to the anterior element and tensile forces to the posterior elements of the cervical spine.

   The anterior structures resisting the flexion are:
   
   a) Intervertebral discs,
   b) Vertebral bodies.
The posterior structures stretched by flexion are:

- zygapophyseal joint capsules,
- articular pillars,
- ligamentum muchae,
- posterior neck muscles,
- flexion at the atlanto axial joint stresses the alar ligament complex.

Lateral flexion:

Movement from C2 to C7 is strictly coupled to rotation at the disc and is determined by the orientation at the cervical zygapophyseal joints. Thus, the movement may vary from the axial torque of the cervical discs to compression of the ipsilateral joint and distraction of the contralateral joint.

Shear forces:

These occur and explain much of the injuries. They would of course produce different types of damage when the impact is from the rear and when the impact is from the front.

Frontal impact to horizontal shear results in a compression at the surfaces of the zygapophyseal joints and stretching of the annular fibres at the anterior part of the disc.

Rear impact will have less impact on the zygapophyseal joint surfaces but will tense the joint capsules and stress the anterior part of the discs.

Other structures involved:

- These include structures of the brain.

  Careful animal experiments have demonstrated hemorrhage in and around the brain from acceleration injuries even without direct trauma to the head. However, there is no good experimental evidence to show damage to the brain after three months following whiplash injury. Thus, the question of how often mood, sleep, memory and concentration disturbances are due to actual brain damage remains controversial.
Other structures involved - continued

b) Temporomandibular joint disorders.
The tissues surrounding the temporomandibular joint can be damaged and some
studies have shown that the actual joint itself can be deranged. This will
be discussed by Dr. Laibovitz.
c) Horner's Syndrome:
This has been described indicating damage of the cervical sympathetic system.
d) Spinal cord injury can of course occur in severe injuries.

DIAGNOSIS:
Preamble.

Diagnosis is difficult and there are a few points that should be made before going
into diagnostic procedures.
Firstly, it should be noted that x-rays are extremely crude and may not pick up a
great deal. For instance, post-mortem studies have shown small fractures of the
zygapophyseal or other bony structures which were not picked up on x-rays. In one
study 73 lesions of the zygapophyseal joints were identified on post-mortem study
but only 4 of these lesions were evident on plain films even when studied retro-
However, x-rays may be useful if used as a baseline after the accident and then
taken at later dates for comparison.

CAT scan and MRI have similarly been shown to miss pathology which was picked up
on post-mortem. The other side of the coin also applies so that a disc or zyg-
apophyseal pathology may show up on MRI or x-ray which preceded the accident.

The gold standard is the diagnostic block. Here the idea is to prove that a
putative lesion is the cause of the patient's pain, and it requires simply that the pain be
relieved by anesthetizing the affected structure.

Diagnostic blocks therefore, are the most accurate means of pinpointing a source of pain.
**TREATMENT:**

Treatment of simple injuries which involve only muscle or ligamentous damage is fairly straightforward.

This consists of initial rest with symptomatic treatment including NSAIDs. This should be followed by gentle neck exercises, and where necessary, gentle manipulative therapy. Psychological assessment may also be required.

The difficulty in treatment arises where the patient does not recover quickly or easily. And in fact, we do not have a complete curative treatment for more complex cases.

Clearly the first priority is to get an accurate diagnosis of the physical and psychological disruptions so that treatment can be rationally approached.

Any patient who is not better after eight weeks should be considered to have chronic damage and to be seriously investigated. Time does not permit more than a listing of the techniques used in these cases.

**First let us look at diagnosis.**

This should involve careful history and physical examination. Investigations should include:

- **a)** X-rays which include flexion/extension and pillar views of the cervical vertebrae.
- **b)** MRIs of the neck.
- **c)** Diagnostic facet joint blocks.
- **d)** Discography may eventually be required.
- **e)** Psychological assessment.

Please note that I have not covered injuries which may occur to the back or other structures such as head or TMJ.
In treatment, the headings to think about include:

a) Education.
   This includes the concept of hurt vs harm.

b) Rest and cervical collar.

c) Attention to sitting, standing and sleeping postures.

d) Physical therapies.
   These include:
   i. exercises,
   ii. passive modalities such as early ice packs, and later moist heat, TENS, Codetron.
   iii. Traction.
   iv. Manipulation.
   v. Massage.
   vi. Active exercises with occupational therapy are required in the more chronic cases.

Medications:

a) NSAIDS
b) Muscle relaxants.
c) Tricyclic antidepressants, especially for sleep.

Psychological Intervention:

These include:

a) Biofeedback.
b) Hypnosis.
c) Behaviour Modification Therapy.
d) NLP as used successfully by many practitioners.
e) Family therapy.
f) Group therapy.
g) Specific therapy for minor head injury.
Nerve Blocks and Operative Procedures:

These are not widely practised. Nevertheless, in clinic where they are carried out, the anecdotal results are very good.

What is required is a form of properly designed studies to show how effective nerve block treatments may be.

I know of some clinics where this is now taking place.

Nerve Blocks:

These include:

a) Trigger point injections.
b) Occipital steroid blocks.
c) Paravertebral blocks around the cervical facet areas.
d) Blockade into the suboccipital triangle.

These blocks may be effective by virtue of placement of steroids into the inflamed areas.

Surgical treatment.

The surgeries include:

a) C2 ganglionectomy.
b) Facet joint denervation of facets after positive facet diagnostic block.
c) Cervical discotomy and fusion where discograms are positive.

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Recommended Reading:

Cervical Flexion-Extension/Whiplash Injuries, Editors: Teasell & Shapiro