

Introduction to the Cervical Spine

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A. Basic Anatomy

The spine is composed of four main areas, cervical (C1-C7), thoracic (T1-T12), lumbar (L1-L5), the sacrum, and the coccyx. Each spinal vertebra can be divided into an anterior part called the vertebral body, which provides much of the structural support (and is separated from its neighboring vertebral body by a disc), and a posterior portion called the spinous process and lamina. The posterior and anterior parts of the vertebral body are connected by pedicles. Posteriorly the area where two vertebrae touch and form a joint is called the facet joint. Inside the spinal canal, formed by the arch of the laminae and contained by the pedicles, is the dura and within the dura are the spinal cord and nerve roots. From the cord the nerve roots exit through the foramen to the individual muscles which the root controls. There are ligamentous attachments both anteriorly and posteriorly. The disc is composed of a fibrous outer portion called the annulus and a softer inner portion called the nucleus pulposus, which may herniate through the annulus and put pressure on either the nerve root or the spinal cord.

B. Function

The purpose of the spine is to allow for flexibility of the body and protection of the neural elements. The most mobile portion of the spine is the occipitocervical area or the junction of the head with the upper cervical spine. This includes flexion, extension, rotation, and lateral bending. The thoracic spine is less mobile due to the connections to the rib cage. The lumbar spine is also more mobile and is able to perform flexion, extension, rotation, and lateral bending. The sacrum and coccyx are relatively fixed.

C. Degenerative Processes

a. Mechanical Problems

b. Nerve Root Problems

When a disc herniation, bone spur, or tumor press on a nerve root, it produces what is called a radiculopathy. Since each nerve root supplies a specific muscle group and sensory area, a physician can often interpret the patient's symptoms and physical findings and determine which nerve root is irritated. Irritation of a nerve root (radiculopathy) typically produces pain, weakness, numbness, tingling and possibly decreased reflexes, depending on which nerve root is irritated.

c. Spinal Cord Problems

If disc or bone push on the spinal cord, the symptoms are called myelopathy. The signs of myelopathy are variable, but typically are also associated with decreased motor and sensory functions, sometimes involving arms and legs, and sometimes altering bowel and bladder control. There may also be increased reflexes or potentially absent reflexes if the cord injury is severe.

II. Treatment for Neck Pain

A. Home Remedies

- a. Rest
- b. Home Exercises
Stretching and range of motion
- c. Over-the-Counter Medications
Anti-inflammatory medications

B. Medical Care

- a. Physical Therapy
A prescription is required for physical therapy, and physical therapists can treat any area of the spine. Physical therapy entails instruction of proper exercise and technique, spine education, and hands-on therapy such as heat, ice, ultrasound, massage (myofascial release), and perhaps trials of traction.
- b. Chiropractic Treatment
Chiropractic care involves diagnosis and treatment using manipulative techniques and potentially additional physical therapy.
- c. Prescription Medication
Most spinal disorders respond to anti-inflammatory medications, muscle relaxants and pain medications such as narcotics. Low-dose steroids may be prescribed over a short course to also decrease pain and inflammation.

C. Diagnostic Testing

- a. X-rays
Plain x-rays of the cervical spine are not painful and provide good information regarding the bony anatomy of the spine and the overall alignment. Flexion-extension x-rays may be useful to determine changes in alignment with bending.
- b. MRI's
MRI's are not painful. They do not involve radiation. MRI images show both bony detail and soft tissue detail such as spinal cord, nerve roots, and ligamentous structures. MRI's are not recommended for people who have pacemakers or metal within their body that could potentially be attracted by the large magnet that runs the MRI.
- c. CT's
CT's show excellent bony detail. They are not painful and are based on x-ray. CT may be combined with myelogram to show bony details and details within the spinal canal.
- d. Discography
Discography is an invasive technique, which requires a needle to be entered through the skin and into the disc. A contrast material is then injected. The

pressures might be measured and, in conjunction with CT's, may reveal internal disruption of the disc or if the disc is herniated.

e. Myelogram

Myelography is an invasive technique in which a needle is introduced into the spinal canal and contrast is injected into the spinal fluid. This allows for details within the spinal canal, and when combined with CT, shows the relationship of the bone to the contents of the spinal canal.

f. EMG/Nerve Conduction Velocity

Electrodiagnostic testing is a minimally invasive procedure in which very tiny needles are placed along the spine and along certain muscles. The electrical response between the nerves and the muscles can determine which nerves are not functioning properly.

D. Surgery

a. Indications

i. Absolute

Progressive neurologic compression and spinal instability are the main absolute indication for surgery in patients where functional loss may occur. The spine may need to be stabilized with internal fixation (screws, hooks, rods, cages, and plates) and fused.

ii. Relative

Relative indications for surgery include pain and/or loss of function due to pressure on a nerve or the spinal cord. These procedures typically involve decompression including either removal of bone and/or removal of disc or tumor, and may also require stabilization and fusion

b. Anterior Surgery

Surgery on the vertebral body from the front or side of the patient.

i. Discectomy with or without fusion

ii. Discectomy with fusion

1. Autograft

Bone from the patient's body, typically the hip or bone removed from the patient's spine.

2. Allograft

Bone from cadavers, which has been processed.

3. Cages

A metallic or synthetic support, which provides structure and provides a container to hold bone graft substances.

4. Internal Fixation

Internal fixation includes plates, screws or rods.

c. Posterior Surgery

Surgery on the posterior (spinous processes, lamina, or facet joints).

- i. Laminectomy
 - 1. Decompression
Removal of bone to decompress the spinal canal or nerve roots.
 - 2. Discectomy
Removal of disc.
 - 3. Fusion
Placement of bone (autograft or allograft) to allow for stabilization of the spine, often with some type of internal fixation.

- E. Postoperative Rehabilitation
Following surgery a brace or orthosis may be needed, depending on the particular procedure. Postoperative rehabilitation may include either a home exercise program, physical therapy in conjunction with a home exercise program, or perhaps aquatic therapy.

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