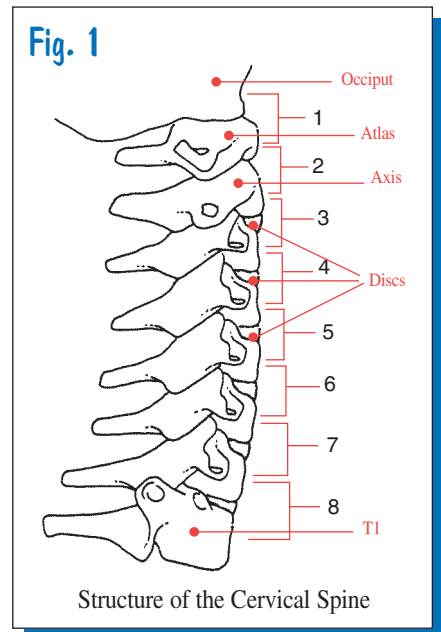


The Cervical Spine: Part I

INTRODUCTION

Neck pain with or without associated upper extremity symptoms is a common malady for which individuals often seek treatment. There are not only numerous sources of cervical pain and related symptoms, but also many causes of these symptoms.

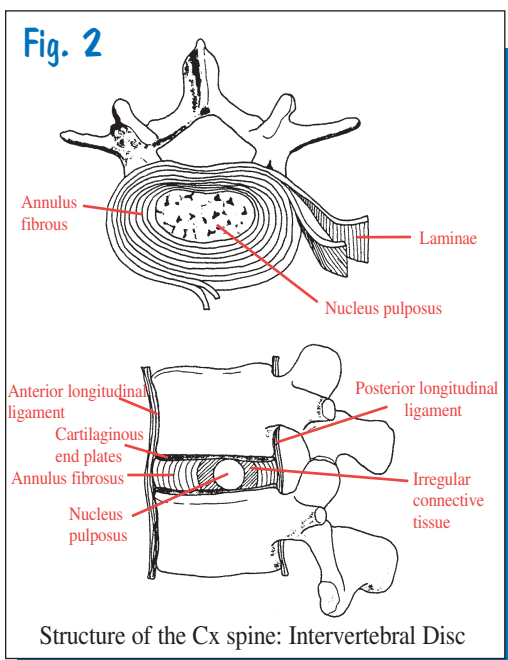
In order to offer some relief from these symptoms, an individual must first have a detailed knowledge of the structure (anatomy) and function (physiology/pathophysiology) of the region. This allows for a determination to be made as to the source of the symptoms, and the functional relevance of the damaged structures. A thorough understanding of pathology is essential so that an appropriate evaluation is conducted, and the subsequent treatment administered is safe, effective, and efficient.



THE STRUCTURE OF THE CERVICAL SPINE

The cervical (Cx) spine consists of seven vertebrae arranged into a semi-flexible pillar (Figure 1). In adulthood, the normal Cx column has an anterior convexity. The function of the Cx spine is to provide support and allow movement of the head and neck. In addition, the Cx spine offers protection to the spinal cord. The first, second, and seventh Cx vertebrae are known as atypical vertebrae based upon the structural and functional differences of these vertebrae.

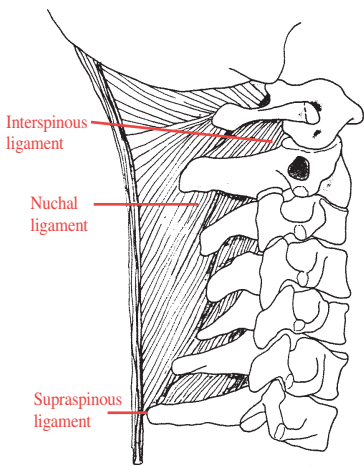
Lying between each adjacent vertebra from the second through the seventh Cx vertebral bodies are the intervertebral discs. These fibrocartilaginous discs are composed of an outer fibrous ring, the annulus fibrosus, and the centrally located gelatinous nucleus, the nucleus pulposus (Figure 2). The intervertebral discs function primarily to provide support against compressive loads, and to allow normal movement of



the vertebrae.

LIGAMENTS OF THE NECK

figure 3



Ligaments of the Cx Spine

Various ligaments provide for structural connection between the adjacent vertebrae, while also helping to restrain movements. The most important of these are the anterior longitudinal ligament, the posterior longitudinal ligament, the ligamentum flavum, the supraspinous ligament, and the interspinous ligaments (Figure 3).

The specialized region of the upper Cx spine (i.e. the occipitoatlantal and atlantoaxial joints) has its own specialized ligaments: the apical ligament of the dens, the transverse ligament of the atlas, the alar ligaments, the tectorial membrane, as well as, the anterior and posterior atlanto-occipital membrane. The specific location of each of these ligaments dictates the role provided in affording support and restraining movements.

MUSCLES OF THE CERVICAL SPINE

The more superficially located muscles of the neck are the platysma, trapezius, sternocleidomastoid, and levator scapulae. Deep to these muscles are the paravertebral muscles: the splenius, iliocostalis, longissimus, and the spinalis muscle groups. The deepest muscles include the shorter muscles: semispinalis, multifidus, and rotatores (Figure 4). The specialized suboccipital region has its own group of four small muscles, the suboccipital muscles.

NERVES OF THE CERVICAL SPINE

Nerve roots in the neck exiting between the vertebrae (intervertebral foraminae) form complex networks of nerves known as plexuses. There is a cervical plexus and a brachial plexus. The brachial plexus includes the nerves which innervate the upper extremities (Figure 5).

BLOOD SUPPLY

Unique to the cervical spine and of clinical significance is the fact that the vertebral arteries traverse the transverse foramen of the upper six cervical vertebrae. The arteries eventually join into the basilar artery and help to supply the brain.

PATHOLOGICAL CONDITIONS OF THE CERVICAL SPINE

Two broad categories may be delineated: non-traumatic conditions and traumatic conditions. The type of condition present relates possible structures involved and its implications for both evaluation and treatment.

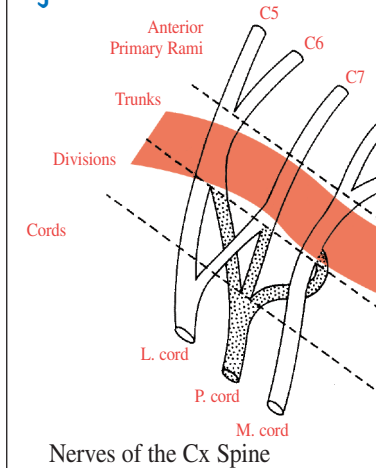
NON-TRAUMATIC CONDITIONS

Non-traumatic conditions of childhood include congenital muscular torticollis, which is a contracture of one of the sternocleidomastoid muscles, and Klippel-Fell syndrome, a congenital fusion of two or more cervical vertebrae.

Non-traumatic conditions in adulthood include disc herniation, degenerative disc disease, osteoarthritis or degenerative joint disease, rheumatoid arthritis, cervical myalgia, and osteoporosis.

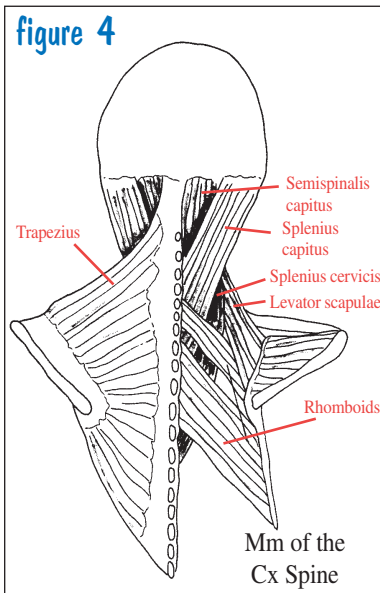
Disc herniation may be triggered by an acute injury to the disc with or without underlying degenerative changes; however, it may also present with little or

figure 5

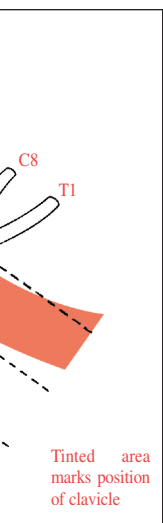


Nerves of the Cx Spine

figure 4



Mn of the Cx Spine



no remembered trauma, and is frequently associated with degenerative changes of the intervertebral disc. Sometimes, in association with herniation of the disc, there may be irritation of an associated nerve root or other nerve endings in the disc complex. Therefore, disc herniation may cause true radicular pain or non-radicular referred pain to the upper extremity. In true radicular pain, signs and symptoms are dependent upon the specific level of nerve root irritation.

Degenerative disc disease involves changes in the physical constitution of the disc, which often results in poor mechanical function. Disc degeneration is often associated with degenerative arthritic processes of the vertebral bodies and/or intervertebral joints.

Rheumatoid arthritis is classified as an autoimmune disease, and it also produces destructive changes of the spinal joints. Additionally, rheumatoid arthritis can be associated with Cx instability due to severe erosion of bone and joint surfaces.

Cervical myalgia is a non-distinct term, which is sometimes used to refer to muscular pains in the region of the neck. In these cases, pain is often accompanied by muscle spasm. Cx myalgia can develop from postural influences.

Finally, osteoporosis is a metabolic disorder affecting bone density, which may include the vertebrae of the cervical spine. Changes in the Cx vertebrae, as well as lower level vertebrae may lead to pain, especially in more advanced stages.

TRAUMATIC CONDITIONS

Traumatic conditions of childhood include rotary subluxation of C1 and C2 and birth injuries to the brachial plexus.

Rotary subluxation of the atlantoaxial joint is a relatively common problem in children. It may result from a traumatic injury, but may also be present without a history of significant trauma.

Birth injuries to the brachial plexus

are commonly known as Erb's palsy or Klumpke's palsy depending upon the exact mechanism of injury, and the specific site afflicted. Erb's palsy results from a strong lateral flexion of the infant's head and neck producing traction on the upper trunk (C5/C6) of the brachial plexus. Klumpke's palsy results from a severe over-stretching of the upper extremity, and it involves the lower trunk (C8/T1) of the brachial plexus.

Traumatic conditions of adulthood include cervical strains/sprains, Cx fracture/dislocation/subluxation, and Cx disc injuries. Most cervical injuries represent a combination of sprain and strain. Sprain refers to injury of connective tissue including ligaments and joint capsules, while strain refers to injury of muscular and tendinous soft tissue. Such injuries are very common in motor vehicle accidents, and are part of the whip-lash syndrome.

Cervical fractures/dislocations/subluxations are very serious injuries, as these types of injuries to the vertebrae and joints of the cervical spine may result in death or neurologic deficits including paralysis.

Cervical disc injuries may occur by several mechanisms (e.g. excessive torsion, combined torsion and lateral bending, or sudden axial compression, while in a hyperflexed posture). These stresses to the disc may result in strains of the annular fibers and/or bulging of the nucleus with possible irritation of the nerve root (Figure 6). In any traumatic incident, various other structures are often affected including ligaments, joint capsules, and muscles.

A thorough knowledge of anatomy, physiology, and pathophysiology is essential in attempting to properly evaluate and eventually treat any mechanical dysfunction. A brief overview of anatomy and pathophysiology has been presented.

Treatment decisions are based upon a complete assessment formulated after a comprehensive evaluation.

The next newsletter, *The Cervical Spine Part II: Evaluation and Treatment*, will address these issues.

figure 6 Traumatic Conditions

