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The Cervical Syndrome

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The term *cervical syndrome* is used to embrace most of the other syndromes concerned with head, neck, shoulder, arm and chest pains and disabilities. It is a diagnostic term only insofar as it implies irritation of the cervical nerve roots.

ANATOMIC CONSIDERATIONS

Certain anatomic characteristics of the cervical spine must be understood for adequate interpretation and treatment of the symptoms and the clinical findings attending irritation of the cervical nerve roots.

The upper 2 vertebrae have only lateral articulations, which leaves the first and the second nerve roots without intervertebral foramina but, nonetheless, subject to irritation or compression. They are in a vulnerable position because of their close proximity to the posterior arches and to the lateral articulations of the first 2 vertebrae.

The lower 5 vertebrae have 5 articulations—2 posterior or apophyseal joints, the secondary cartilaginous joint or the intervertebral disk and 2 lateral synovial joints which are formed by the upward lateral projections of the superior surface of the distal vertebra and the beveled lateral areas of the inferior surface of the adjacent proximal vertebra (Fig. 1). Because of these lateral intervertebral joints between the bodies of the vertebrae, the annulus fibrosus of the intervertebral disk is seen or exposed anteriorly and posteriorly only between the vertebral bodies, and not at the lateral sides.

The lateral articulations of the upper 2 cervical vertebrae and the posterior articulations of the other cervical vertebrae are not in complete apposition when the head faces straight ahead, so that the position of greatest ease and stability is obtained by slight lateral bending of the neck and slight rotation of the head to the opposite side.

The posterior longitudinal ligament in the cervical spine is a very dense, strong structure which is composed of 2 distinct layers —superficial and deep. The superficial layer extends from the base of the skull to the dorsal spine vertically and covers the posterior surface of the vertebrae entirely from side to side. It can be separated from the deep layer and from the capsular ligaments of the lateral intervertebral joints. The deep layer is narrow and is tightly adherent to the bodies of the vertebrae and to the intervening annulus fibrosus of the intervertebral disks. The capsular ligaments of the lateral intervertebral joints seem to take some origin from this deep layer, as well as the adjacent bone, and they pass diagonally across the lateral intervertebral joints to attach to the lateral upward projections on the superior surfaces of the bodies of the vertebrae (Fig. 2). This gives a somewhat denticulated appearance to the deep layer of the posterior longitudinal ligament. This deep layer resembles the entire posterior longitudinal ligament of the lumbar area. These capsular ligaments are relatively short. They lack the usual laxness of the other capsular ligaments in the spine, which makes them unusually subject to sprain.

The intervertebral foramina in the cervical spine are actual bony canals. The floors

and the roofs are formed by the grooves in the vertebral arches. The anterior walls are formed by the posterolateral portion of the adjacent vertebral bodies with the intervening lateral synovial joints. The posterior walls are formed by the posterior articulations, but mainly by the anterior surface of the superior facet of the distal vertebra (Fig. 3). Mechanical changes in these canals result in more anteroposterior narrowing than vertical narrowing. The anterior and the posterior walls are potential pinchers of the nerve roots which are in intimate contact with them.

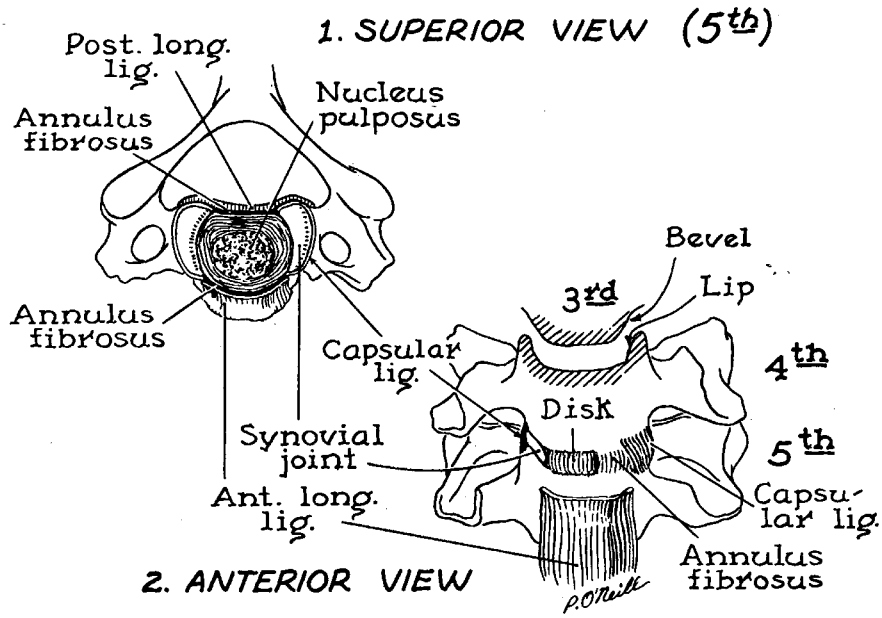

FIG. 1. The lateral intervertebral synovial joints and the cartilaginous disk at the C4 and 5 level.

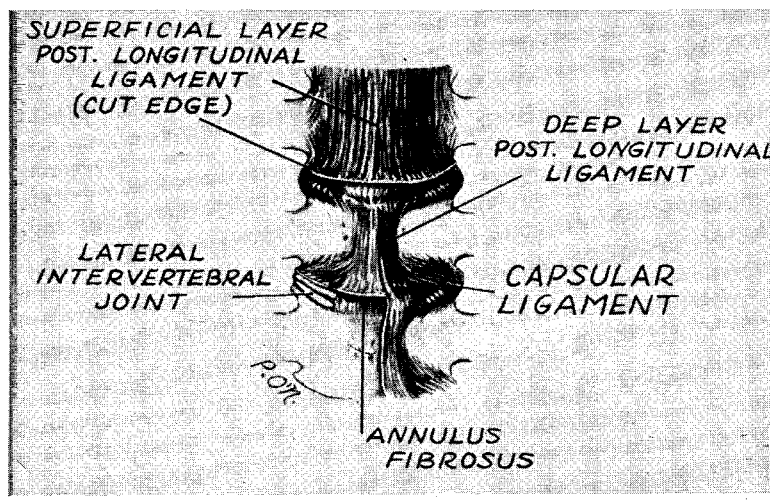

FIG. 2. The superficial and the deep layers of the posterior longitudinal ligament and the capsular ligaments of the lateral intervertebral joints.

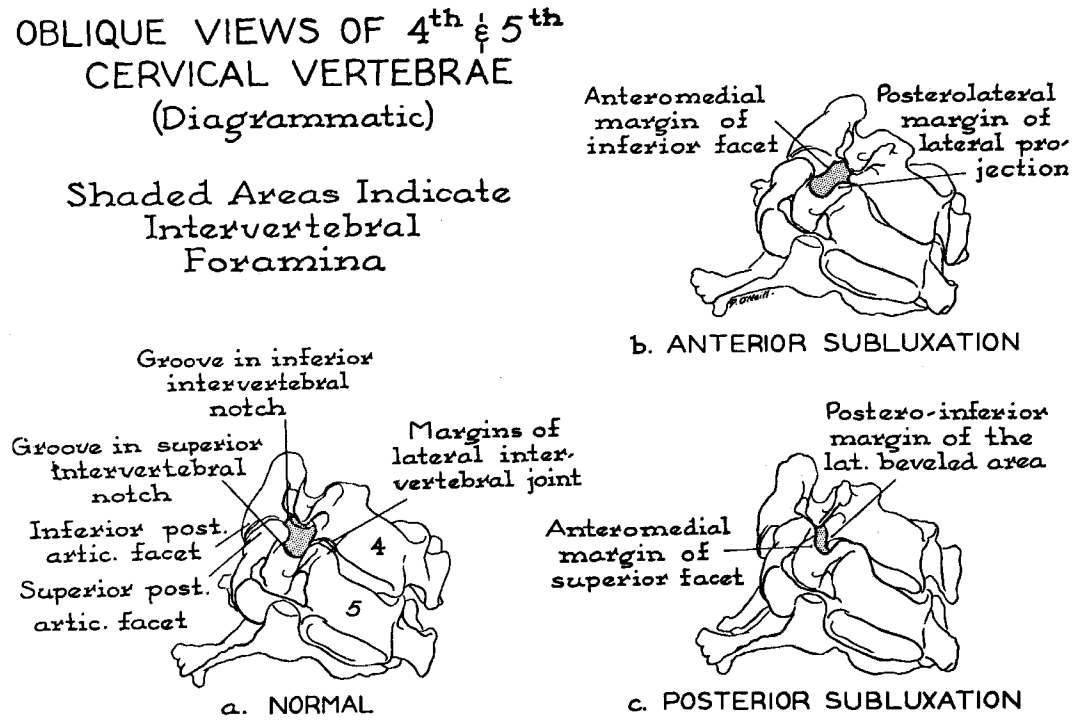

FIG. 3. Oblique views of C4 and 5 showing the boundaries of the foramina and their pincher effect upon the nerve root when mechanical derangements occur.

The cervical nerve roots, which consist of the ventral and the dorsal fibers from the corresponding surfaces of the spinal cord, arise from the cord on a level with the bodies of the vertebrae. Their fibers pass obliquely downward with a decreasing degree of obliquity to leave the spinal canal at right angles to the cord (Fig. 4). Not infrequently a fiber from one nerve root descends to join the immediate distal nerve root and leaves the spinal canal with that nerve root. The ventral and the dorsal nerve roots pierce the dura separately and become invested with a common dural sheath. They join within the intervertebral canal to form the nerve trunk.

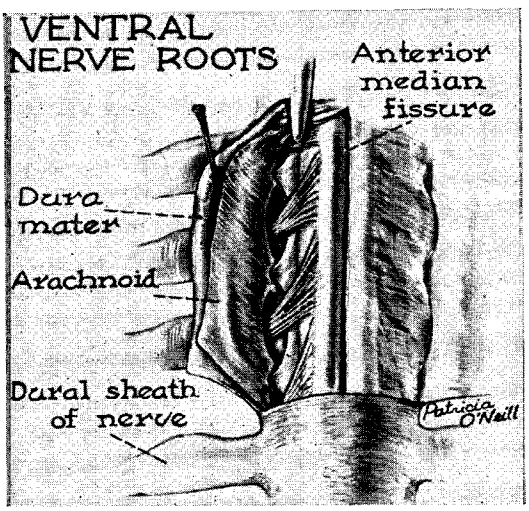

FIG. 4. Drawing of a portion of the cervical spinal cord showing the nerve roots (ventral view).

The cervical spinal nerves are composed of motor and sensory fibers only, and do not contain white rami communicantes of the sympathetic system, as do the dorsal and the upper 2 lumbar nerves. They communicate with the sympathetic nervous system through the white rami communicantes of the first and the second dorsal nerves, which join the cervical sympathetic ganglia by way of the anterior primary rami. From these ganglia, postganglionic fibers reach the an-

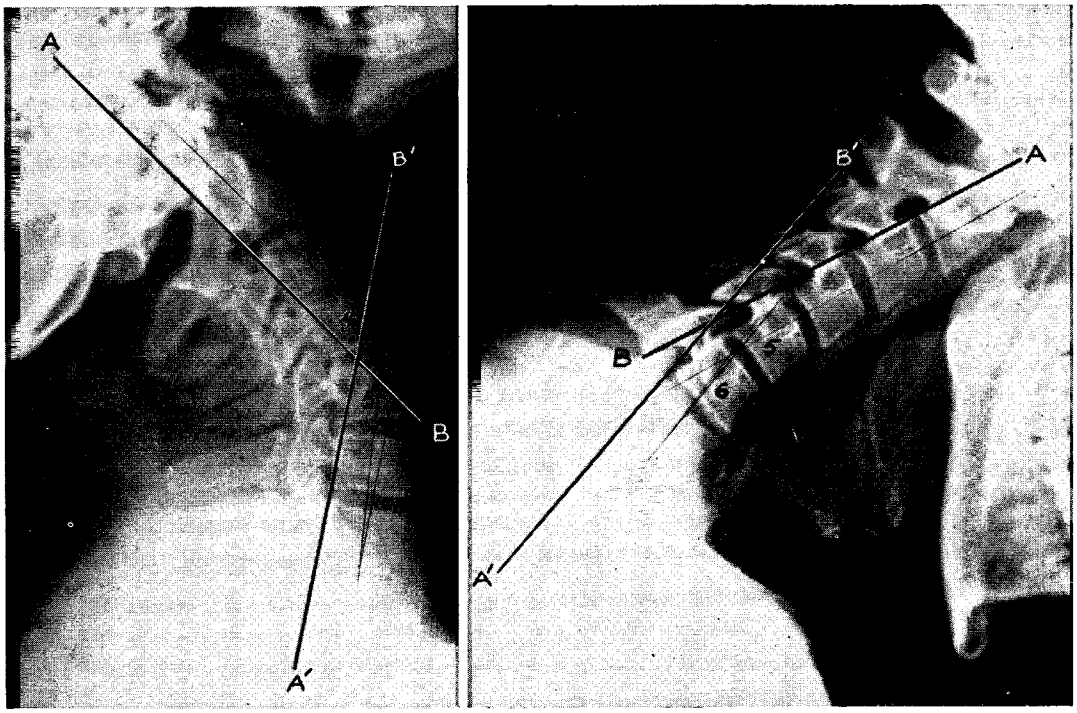

FIG. 5. Roentgen films of a cervical spine in hyperextension (*left*) and flexion (*right*). Point of intersection of lines AB and A'B' indicates level of maximum stress and strain.

terior rami of the cervical nerves and are distributed with their branches. Other postganglionic fibers communicate with most of the cranial nerves, and peripheral branches reach the pharynx, the heart and the arteries of the head, the neck and the arms. The fibers which invest the internal cartoid give branches eventually to the back of the orbit, the dilator muscle of the pupil and the smooth muscles of the upper eyelid. Other fibers which surround the vertebral arteries give branches to the inner ear eventually. Communicating branches are given to the recurrent spinal meningeal nerves which leave the trunks and pass back through the intervertebral foramina to supply the dura mater and the posterior ligamentous and capsular structures of the neck. Reflex stimulation of the cervical sympathetics may give rise to symptoms such as blurring of vision, loss of balance, swelling of the fingers, etc., which may confuse the picture of irritation of the cervical nerve roots inasmuch as these signs and symptoms occur secondarily to irritation of the nerve roots.

It should be remembered, also, that pain-conducting afferent spinal nerve fibers from the blood vessels of the head, the neck and the upper extremities traverse the sympathetic trunk and communicating rami. Reflex stimulation of the sympathetics may cause vasoconstriction and, therefore, aggravation of pain. Interruption or paralysis of the sympathetics may relieve pain by paralyzing the afferent pain-conducting spinal nerve fibers which traverse the sympathetic trunk and communicating rami or by alleviating vasoconstriction.

Because of its position between a relatively immobile dorsal spine and the head which is a weight that must be balanced and supported upon it, and because of the demands of mobility made upon it, the cervical spine is more vulnerable to injury and, therefore,

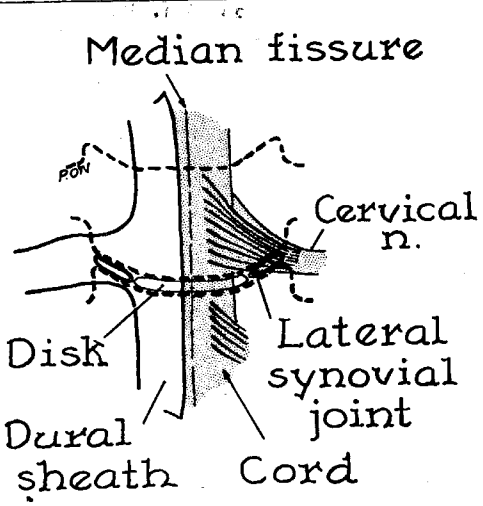

FIG. 6. Diagram showing the relationship of the cervical nerve roots to the lateral intervertebral joints and the intervertebral disk. The body of the vertebra is the "safety zone" for the nerve roots.

to the changes initiated by trauma than is any other area of the spine.

The greatest amount of stress and strain in the cervical spine occurs at the fourth and the fifth and at the fifth and the sixth articulations, as shown in Figure 5. However, with localized fixation from muscle spasm or from hypertrophic and degenerative changes, the points of stress and strain may shift to lower or higher levels.

ETIOLOGY

Approximately 90 per cent of all cases of cervical nerve root irritation are a result, either directly or indirectly, of sprain of the ligamentous and the capsular structures, which permits subluxations and, therefore, anteroposterior narrowing of the intervertebral canals and subsequent irritation of the nerve roots. In 60 per cent of these injuries there are some immediate symptoms, whereas in the other 40 per cent symptoms may be delayed for months or years. The delayed symptoms are due to the anteroposterior narrowing of the intervertebral canals which was initiated by the original trauma and by repeated stress and strain. Swelling and thickening of the capsular structures occur in the early stages. Adhesions about the nerve roots may develop, so that their dural sheaths become tightly and firmly adherent to the adjacent structures of the intervertebral canals.

As time goes on, osteophyte formations or hypertrophic spurring occurs about the margins of the lateral intervertebral joints and the posterior articulations. Chrondromalacic changes occur within these joints, and degeneration of one or more intervertebral disks is inevitable.

These changes take place over a long period of time, and the nerve roots may become adjusted to, or tolerant of, the progressive decrease in the anteroposterior diameters of their foramina. However, eventually they may become intolerant of their narrowed habitats and rebel, with resulting pain and disability. Some trivial added stress or strain may set off a similar response. The extent and the degree of irritation vary. Some fibers within a nerve root may escape involvement, while others may sustain variable degrees of irritation. There may be individual differences of susceptibility of nerve fibers to trauma, and some may be better protected than others. The symptoms and the clinical findings will, therefore, vary with the location and the extent of the irritation.

Automobile accidents are responsible for the greatest number of neck sprains. The neck-lash injury, which is a sudden forceful movement of the neck with a spontaneous recoil in the opposite direction, often occurs. The lashing effect is greatest when the muscles are caught off guard. Many times multiple lashings occur. However, sprains may occur from strenuous sports, falls, sudden thrusting forces against the arms, sudden forceful pulls on the arms and blows on the head or the chin.

Not infrequently these sprain injuries with nerve root irritation are diagnosed as "cervical disks," which is meant to imply pressure on a nerve root from a posterolateral extrusion of disk material as occurs in the lumbar spine. However, if disk material is extruded posteriorly in the cervical spine, it

will cause compression of the spinal cord itself rather than compression of the nerve roots, inasmuch as the nerve roots are protected by "safety zones," that is, the bodies of the vertebrae. The nerve roots do not pass over the intervertebral disks in the cervical spine (Fig. 6). A severe injury which causes a tear of the posterior longitudinal ligament may cause extrusion of disk material. A trivial injury superimposed upon an already weakened or degenerated posterior longitudinal ligament may cause extrusion of disk material. In either event, the extruded disk material would press upon the cord rather than upon the nerve roots. Thickening of the capsular ligaments of the lateral intervertebral joints and hypertrophic marginal lipping give the appearance of a bulging disk anterior to the nerve root.

Any sudden movement of the neck when the supporting structures are relaxed may result in a unilateral subluxation with apparent locking of the facets. This is the typical "crick" in the neck. Synovial impingement may give a similar picture.

Inflammatory joint changes, congenital anomalies and fractures of the articular processes and of the vertebral arches account for approximately 10 per cent of these cases of cervical nerve root irritation.

Fatigue and emotional tension aggravate the symptoms. Poor postural attitudes, habits and activities which cause sudden or prolonged hyperextension or flexion of the neck may be responsible factors.

In general, it can be said that any anteroposterior narrowing of the intervertebral canals from mechanical derangements or from inflammatory changes may cause cervical nerve root irritation. The extent of the mechanical derangement, as evidenced by roentgen films, is no indication of the severity of the symptoms, however.

EFFECTS OF CERVICAL NERVE ROOT IRRITATION

Irritation of the nerve roots gives rise to pain and/or sensory, motor and trophic changes anywhere along their segmental distribution. Areas of localized deep tenderness and muscle spasm will be found at the painful sites. The reflexes may be normal, diminished or absent. Reflex irritation of the cervical sympathetics may give rise to dilatation of a pupil, loss of balance, circulatory changes, palpitations, nausea, tendinitis, etc.

Cervical nerve root irritation may give rise to variable degrees of limitation of neck motion. Glenohumeral motion may be limited due to voluntary immobilization because of pain, or to reflex sympathetic dystrophy which gives rise to inflammatory and degenerative changes and to adhesive capsulitis and tendinitis. Calcareous deposits in a cuff tendon occur in 8 per cent of the cases. Humeral epicondylitis may occur, as well as fibrotic changes in the palmar fascia, as a result of reflex sympathetic dystrophy.

A knowledge of the segmental distribution of the cervical nerve roots is of importance in making a diagnosis. The fifth and the sixth nerve roots are irritated most frequently, but any or all may be involved.

Pain, which is reflexly referred from visceral and somatic structures which have the same segmental nerve root supply, may be accompanied by superficial tenderness or hyperalgesia, but not by deep tenderness and muscle spasm. Sensory, motor and trophic changes do not involve the region of reflexly referred pain, and the reflexes are normal. Pain which results from lesions of the cervical spinal cord and of the brain follows no definite nerve root pattern, and is ill defined and indistinctly demarcated. Hypertonia and hyperactive reflexes are the rule.

ROENTGEN STUDIES

Treatment should never be instituted until roentgen studies have been made. The 3 upright lateral views, as suggested by Davis, give valuable information. In 78 per cent of the cases the straight lateral film will show a loss of the normal forward curve. This is caused by contraction or spasm of the prevertebral and the lateral vertebral muscles.

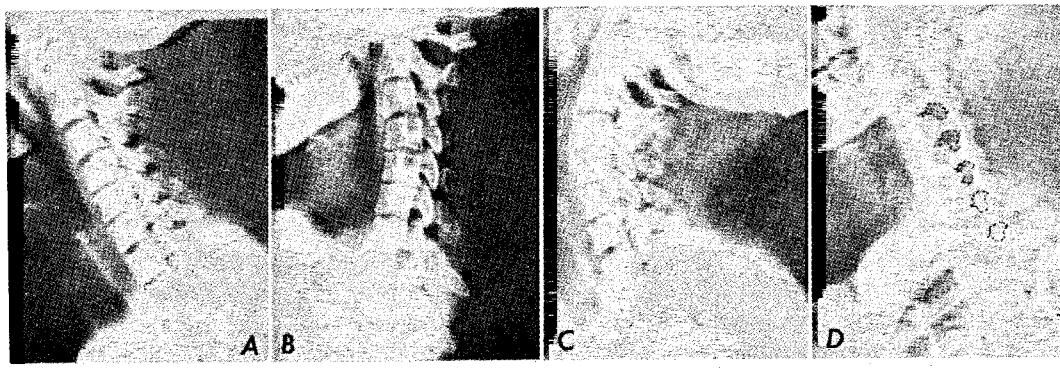

FIG. 7. The Davis series of lateral roentgen films and an oblique view showing the intervertebral foramina. The straight lateral view (A) shows a loss of the forward curve and a narrowing of the intervertebral disks between C4 and 5 and C5 and 6. Flexion view (B) shows anterior subluxation of C3 on 4. Hyperextension view shows posterior subluxation of C3 on 4. The fourth, the fifth and the sixth vertebrae are fairly well fixed, so that very little motion occurs in this area. Oblique view (D) shows narrowing of the intervertebral foramina between C4 and 5 and C5 and 6.

The forward flexion view shows the extent of motion and forward subluxations, whereas the hyperextension view shows the extent of backward motion and posterior subluxations (Fig. 7). All views should show the presence or the absence of narrowed disks and hypertrophic changes.

Oblique views are helpful in making a diagnosis. They show the intervertebral foramina, and may reveal anteroposterior narrowing due to subluxations or to hypertrophic changes about the margins of the lateral intervertebral joints and the posterior articulations. Fractures of the articular processes and of the vertebral arches may be visualized best in oblique flexion views.

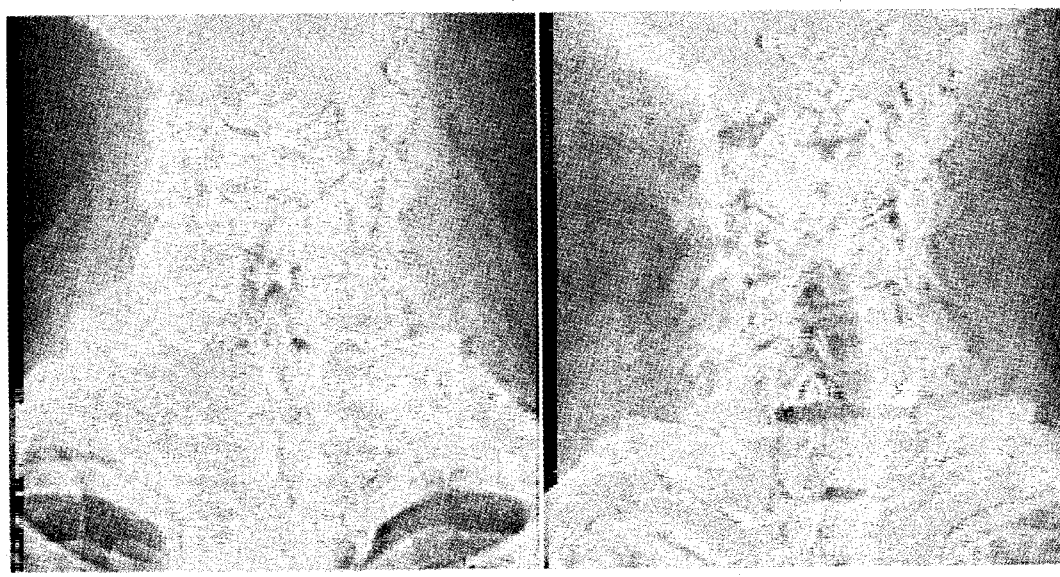

FIG. 8. Anteroposterior views showing changes about the lateral intervertebral joints. (*Left*) Made in 1947, shows early changes about the joints at C5 and 6 and minimal changes at C4 and 5. (*Right*) Made in 1953, shows marked changes at both levels.

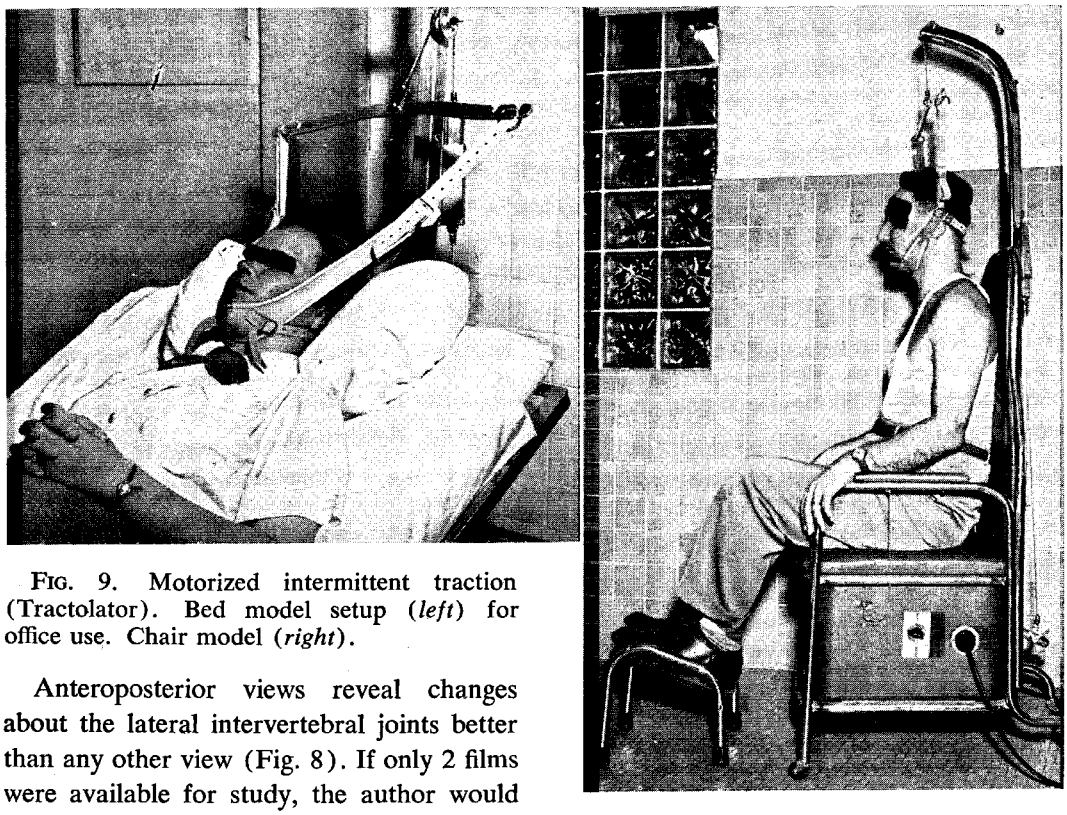

FIG. 9. Motorized intermittent traction (Tractolator). Bed model setup (*left*) for office use. Chair model (*right*).

Anteroposterior views reveal changes about the lateral intervertebral joints better than any other view (Fig. 8). If only 2 films were available for study, the author would prefer the straight lateral and the anteroposterior views.

It should be remembered that the presence of narrowed disks per se does not necessarily preclude nerve root irritation at that level. Many times the nerve root irritation occurs above or below that level. If there is marked narrowing of a disk, one usually will find fixation of the adjacent vertebrae with subluxations above that area.

If there is clinical evidence of a space-occupying lesion or of cord compression, myelographic studies should be made. However, interpretation of these studies is very important. A defect in the column of radiopaque material does not necessarily signify extruded disk material, inasmuch as flexion and hyperextension of the neck may produce actual defects in the column of oil. Therefore, the effect of neck position on blockage of the subarachnoid space must always be considered.

If shoulder pain and limitation of motion are present, anteroposterior and lateral films of the shoulder should be made. From 8 to 10 per cent of the patients will show evidence of pathology in the shoulder joint.

If symptoms of blurring of vision and dizziness or blacking-out are present, films of the upper 2 cervical vertebrae should be made. These may show joint discrepancies, fractures of the odontoid and fractures of the lateral articulations.

TREATMENT

Treatment must be designed for the relief of pain and the restoration of function. Because of the differences in pain tolerance, and because of the emotional and the constitutional variations in people, such treatment must be suited to the needs of each individual. The patient must be taught to live with the altered mechanics of his neck. These are treatment cases and call for great

FIG. 10. Collars for immobilization. (*Left*) Felt collar covered with stockinet. (*Right*) The celastic collar. Collars should be designed to prevent hyperextension.

patience and understanding on the part of the physician.

Heat usually is gratifying to the patient and does relieve ischemia to a certain extent. Hot moist packs or diathermy gives the best results.

Patients with severe localized pain and muscle spasm obtain dramatic relief of pain from injection of a local anesthetic into the myalgic areas or about the nerve roots. Paralysis of the pain receptors and conductors breaks the pain reflex and gives relief for days, weeks or months. To avoid reactions from a local anesthetic, it is wise to use a ½ per cent solution and to sedate the patient prior to the injection.

Traction is indicated in most cases. Motorized intermittent traction, which can be given in the office or the physical-therapy department, gives the best results (Fig. 9). This traction can be controlled in amount and duration, and gives the maximum pull with the minimum amount of discomfort to the patient's chin.

If one does not have access to this method of traction application, hospitalization may be necessary for continuous or bed traction. This type of traction requires repeated supervision. The direction of the pull should be in a straight line with the neck in order to straighten the cervical spine. The patient should be placed in a jackknife position for relaxation of the abdominal muscles. A small roll or a round pillow placed beneath the neck adds greatly to the patient's comfort. The amount and the duration of traction will vary with each individual.

Immobilization of the cervical spine may be necessary. The wraparound felt collar may be sufficient, but, if more rigid support is indicated, the celastic collar is a good one. In any event, the support should be designed

to keep the neck straight and to prevent hyperextension (Fig. 10).

Correction of poor posture and of poor postural attitudes or habits is of the utmost importance. Shoulder braces to prevent or to correct drooping shoulders and to straighten the cervical spine may be necessary. The avoidance of activities which require hyperextension or hyperflexion of the neck is important.

The correction of poor sleeping posture by the use of a cervical contour pillow, as designed by the author, may give relief in some instances without any other therapy (Fig. 11).

Drug therapy, too, has its place. Any muscle-relaxant drug may help. The injection intramuscularly of 1 cc. of Phyatromine H gives good relaxation.

Cortisone, Butazolidin, Thorazine, androgens and/or estrogens may be indicated.

Attention to the patient's general health is important. Adequate rest and relief of emotional tension are essential.

Limitation of gleno-humeral motion can be relieved by injection of a local anesthetic into the suprascapular muscles if the symptoms are of short duration and there is no adhesive capsulitis. If a calcium deposit is present in the cuff tendon, it should be aspirated under a local anesthetic and 25 mg. of Hydrocortone Acetate injected through the same needle. Within 3 days all pain will be relieved and a full range of motion restored. Epicondylitis can be relieved with a local anesthetic and ½ cc. Hydrocortone injected about the epicondyle.

Good results can be obtained by conservative treatment measures. Surgery should be avoided unless there are absolute and definite indications for it. These cases are treatment cases which require time, patience and understanding. In most instances the results will be most gratifying.

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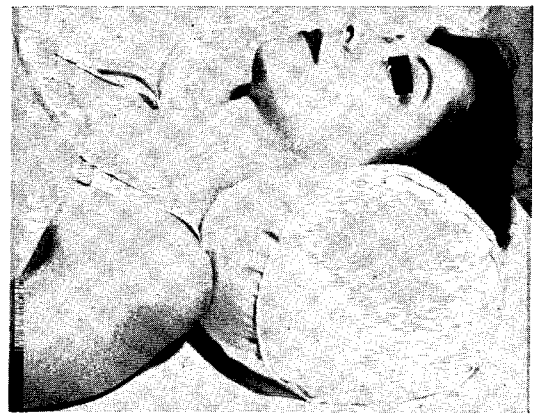

FIG. 11. The cervical contour pillow designed by the author for correct sleeping posture.

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SUMMARIO IN INTERLINGUA

Numerose casos de irritation del radice de nervos cervical parada camouflagiate como varie syndromes pertinente a dolores e invaliditates del capite, del collo, del spatulas, del thorace, e del bracios.

Le duo prime radices nerval non ha foramines durante que le radices del altere nervos cervical passa a transverso definite canales ossee. Iste canales o foramines es potentialmente pinciatores o compressores del radices nerval in caso de mesmo le plus minime disrangiamento mechanic.

Le irritation del radices nerval pote resultar in dolor e/o alterationes sensorial