

OSTEOTOMIES OF SPINE

ESSAY SUBMITTED FOR
PARTIAL FULFILMENT OF
MASTER DEGREE OF
ORTHOPAEDIC SURGERY

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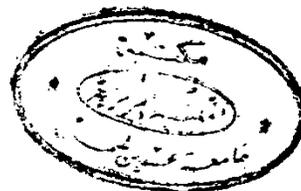
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1989



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Introduction and historical review

He found that the integrity of posterior longitudinal ligament and locking of the opposing surfaces of osteotomy, were adequate to provide good stabilization. He also reported osteotomy of spine on flexion deformity produced by osteomalacia.

Adams (1952) advised lateral position to prevent brain anoxia produced by dependant head in prone position.

He also designed a special extending apparatus which gave advantage of perfect control during extension of the spine to close the gap made by osteotomy.

Paul McMaster has performed more than 40 spinal osteotomies dating from 1947 to 1972.

In 1965, Hodgson described his first case of anterior opening wedge osteotomy for congenital kyphosis. The result was satisfactory, with 25 degrees of final correction. Since that time, the anterior approach for spine deformities has become increasingly recognised as a necessary procedure for most patients with sharply angulated kyphosis or kyphoscoliosis and for release of cord impingement paraplegia.

Excision of hemivertebra has been attempted by Compere (1932); Von Lackum and Smith (1933) and Wiles (1951), but in most instances the result have been poor, possibly due to inadequate removal of bone anteriorly and posteriorly.

Leathermann (1973) reported the two stage technique of hemivertebra excision, and this technique was strongly recommended

Single stage anterior and posterior resection is not recommended, owing to the high percentage of paralysis reported from such procedures.

Sharrad(1968)pioneered resection of the kyphosis in myelomeningocele particularly in the newborn in order to obtain skin closure.

Sharrad(1972)perform osteotomy excision of spine for lumbar kyphosis in older children with myelomeningocele.

Similar procedures were reported by Eskstein and Vora in 1972.

Winter et all(1973)reported the short time correction of such osteotomies. Although the osteotomy level was fused, the deformity recurred owing to the lack of surgical stabilization of the whole curvature.

Poitars and Hall(1974)stated the problem well:"Correction can be accomplished only by excision of bony elements of the kyphosis , but maintainance of correction can be obtained only by solid interbody and posterior fusion of the entire length of the deformity`

Normal curvatures of spine

Normal curvature of spine.

The neonatal back bone is C shaped because it is flexed in whole extent. There are two types of curves, the first is a primary or accommodation curve, and the second is a secondary or compensation curve. They are convex forward in cervical and lumbar regions.

The dorsal and sacral curves are primary, persisting from the embryonic state. These help accommodation of thoracic and pelvic viscerae. The cervical and lumbar curves are convex ventrally and represent secondary curves that appear when the upright posture is attained. They develop by changes in the intervertebral discs.

The cervical curve appears in infancy when the face is tripped upwards associated with muscular support of the head. This occurs about the third month, and with ability to sit about the sixth month. This cervical curve is not fixed, presented in upright posture and obliterated in the horizontal position.

The lumbar curve appears between the ages 9 and 12 months, when the child begins to stand and walk. When the infant's hips are extended, the lumbar vertebrae are pulled forward by the psoas muscles and hip ligaments, forming the lumbar curve. This curve becomes relatively fixed in adult life.

The alternating curves of the vertebral column are largely responsible for the strength of the spine. Which is estimated as 16 times that of a straight alignment.

However the actual shock absorbing factors in the spinal column are the intervertebral disc (Last, 1979).

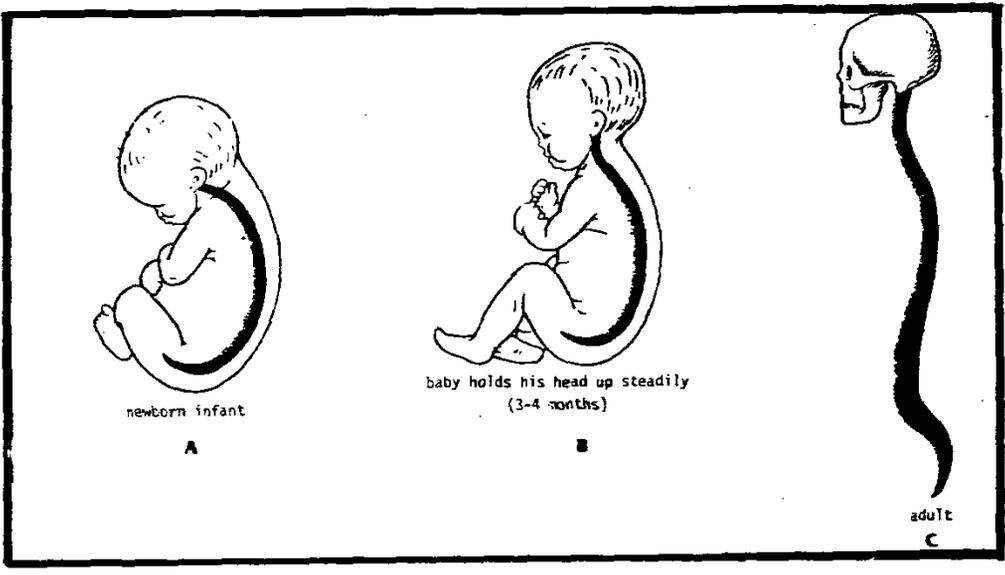


Fig.1:-Curves of the vertebral column at different ages.
(Last,1979)

Indications

Indications of spinal osteotomy

Osteotomies are performed to regain the normal alignment of the vertebral column. Osteotomy of spine is done when all forms of treatment fail to obtain an acceptable correction.

Two types of spinal osteotomies are known. The first is posterior osteotomy or osteotomy of the neural arch, the second is anterior osteotomy of the vertebral body.

Osteotomy is always accompanied by spinal fusion with or without internal fixation to provide stability.

The main indications of spinal osteotomy are:-

1_Anyklosing spondylitis (Marie-Strumpell arthritis).

11_Rheumatoid spondylitis.

111_Congenital kyphosis in myelomeningocele and kyphoscoliosis associated with unsegmented bar and hemivertebrae.

1V_Failed fusion mass in scoliosis.

1&11_Anyklosing spondylitis and rheumatoid spondylitis:-

Smith-Petersen et al. (1945), La Chapelle (1946), Law (1959), Urist (1958), Herbert (1959), McMaster (1962), Goel (1968), Simmons (1983), McMaster (1985), and Styblo et al. (1987).

Ankylosing spondylitis

Is a disease of spine occurring in late adolescent or early adulthood, characterised pathologically by progressive inflammation of the spine, sacroiliac joint and the large joint of the extremities, particularly the hips and leading to fibrous or bony ankylosis and deformity.

The changes in the diarthrodial joints in ankylosing spondylitis are very similar to those seen in patients with rheumatoid spondylitis disease.

Ankylosing spondylitis may be regarded as being neither constructive nor destructive, but transformative.

The lesion and deformities concerned in ankylosing process are as follow:

Anteriorly:

The intervertebral discs ossify; This ossification is centripetal starting at the periphery of the anterolateral portions of the disc, but never extends to the centre of the disc

In the early stages, ossification is confined to narrow strips at the anterior or posterior margin or both, replacing part or all of the depth of the disc.

In the later stages, the greater part of the disc becomes replaced by bone. Ossification of the lateral region of the disc, accounting for the radiographic appearance of "bamboo spine" or "syndesmophytis", occurs at a late stage in the process of bony replacement (Herbert, 1959).

Posteriorly:

The flaval ligament, the capsular ligaments and, less often the interspinal ligaments ossify. It seemed necessary for successful correction that both the anterior and posterior elements of the vertebral column be freed, since each is involved in the ankylosing process (La Chapelle, 1946).

Changes in joints:

There is villous hyperplasia of synovial tissue with proliferation of synovial cells. The synovial tissue proliferates to a granulation tissue "pannus" over the surface

of articular cartilage. The underlying articular cartilage gradually disappears and the granulation tissue penetrates the underlying bone. As the disease progresses and the opposing articular cartilage is destroyed, the joint surfaces are ankylosed by a mixture of fibrous tissue and bone. Later on, the joint space becomes progressively more narrowed, and the ultimate picture is that of bony ankylosis with disappearance of all vestiges of the joint. The ligamentous insertion into the bone is considered the primary location of inflammation in ankylosing spondylitis and the resulting pathological changes (enthesopathy) correlate well with the clinical picture (Clain and Fries, 1978).

The morphological aspect of the individual intervertebral disc is altered only slightly or not at all.

In elderly persons, the disc may be flattened, but in young adults the ossified disc preserves its normal height and appears to undergo osseous metaplasia. Areas of destruction on a level with the disc are rare, and if present, they are probably other associated lesions. Bone adjacent to involved joints are markedly atrophied (Herbert, 1959).

Pathological changes appear first in the sacroiliac joints and in the lower intervertebral discs, and tend to progress upward. Parallel with the evolution of these lesions, the vertebral column as a whole becomes distorted, assuming typical deformity. In the majority of the patients, a severe kyphosis develops, associated with lateral deviation and starting at the thoracolumbar region. As a rule the abdomen becomes prominent, but in exceptional cases, it is

concave, with a deep sulcus separating the xiphoid process from the pubis (Herbert, 1959).

The kyphos itself has a variable point of origin. The initial site may be the lumbar, thoracic, thoracolumbar, or cervical region, in most instances the kyphos originate in the lumbar region. The lordotic curve disappears and the pelvis tilts, causing the sacrum to become vertical. The thoracic and cervical column project forward, creating the kyphos (Herbert, 1959).

When the thoracic region (about the sixth and seventh thoracic vertebrae) is the site of origin, the lordotic lumbar curve is unaltered and the upper thoracic column is flexed sharply forward, becoming nearly horizontal, the examiner has the impression that he is dealing with cervical kyphosis; actually, the lordotic cervical curve is preserved and all the deformity stems from the high thoracic column (Herbert, 1959)

In cases of thoracolumbar origin, the lumbar lordotic curve partly disappears, and the normal thoracic curve is increased from the point of its deviation forward at times, there is associated lateral list of the trunk and, more rarely, a torsion of the vertebral column.

The cervical region is seldom the site of origin of the kyphos. In such cases, the normal lumbar and thoracic curves remain unaltered, it is the uppermost part of the vertebral column that is flexed sharply forward, with a concomitant torsion and lateral deviation. The cervical column and, occasionally, the upper thoracic vertebrae are involved in the deformity (Herbert, 1959).

Rheumatoid spondylitis

In typical rheumatoid arthritis, the peripheral small joints of the extremities are first involved, and spread to the spine occurs as a late manifestation.

Either the sacroiliac joints or cervical spine may be the initial site of the disease, spreading to other parts of the spine is slower, occurring only during exacerbations, and crippling is not extensive. The differential diagnosis from Marie-Strumpell disease is shown in table 1:-

Table 1:- Differential diagnosis between rheumatoid spondylitis and ankylosing spondylitis. (Calin and Fries, 1978).

	Rheumatoid	Ankylosing
_History	Date from 19th century Man only	Date from 3000 BC crocodiles, Monkeys & horses
_Prevalence	1:2%	1:2%
_Etiology	unknown	unknown
_Family history	slight increase	increased familial prevalence
_Sex distribution	♀ > ♂	♂ ≥ ♀
_Age	all ages (peak 30-50Y.)	young (peak 20-30)
_Joint distribution	polyarthropathy symmetrical upper > lower limb	oligoarthropathy asymmetrical large > small
_Sacro iliac joint involvement	-	+
_Spine involvement	cervical	total ascending
_Nodules	+	-
_Eye	scleritis, scleromalacia	conjunctivitis, uveitis
_Aortic regurgitation	-	+
_Pathology	inflammatory synovitis	Enthesopathy (inflammation starts in ligamentous insertion in the bone.)
_Serology (RH. Factor)	+	-
HLAB27	-	+
_Radiology	symmetrical erosive arthropathy	asymmetrical erosive arthropathy with new bone formation. ankylosis and sacroilitis