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The Traction Spur

AN INDICATOR OF SEGMENTAL INSTABILITY

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Based on a study of 123 lumbar spines excised at routine necropsies, the structural changes in the lumbar intervertebral joints were described in 1954 and again in 1956. Five types of spur were recognized at that time and an attempt was made to correlate them with the observed changes in the intervertebral discs.

Continued clinical observation since that time has convinced me that the so-called traction spur is in all probability the most useful indicator of the presence of an unstable lumbar intervertebral joint. Although a joint with such a spur may not be symptomatic, it is, I believe, vulnerable to trauma.

It is the purpose of this paper to describe the morphologic and roentgenographic

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Extension and flexion of a fresh lumbar spine removed at postmortem and held in a vice applied to the sacrum. In Fig. 2-A the spine is held in extension. Note that the disc space between the fourth and fifth lumbar vertebra seems to be well maintained. In Fig. 2-B the spine has been flexed. Note how the anterior part of the disc space is narrower than the posterior part. This narrowing does not normally occur during flexion. In addition to this there is a slight forward glide of the fourth on the fifth lumbar vertebra during the flexion movement.

features of the traction spur and to present additional evidence that this spur is, in fact, an indicator of instability and, therefore, of some clinical significance.

During flexion and extension of the lumbar spine the nucleus pulposus in each interspace appears to act in a manner analogous to a ball bearing (Fig. 1), and a rolling motion takes place. This motion can be demonstrated by superimposing lateral roentgenograms of the lumbar spine made in varying degrees of flexion and extension. It can be shown that in full flexion the axis of rotation is at the anterior end of the nuclear impression in the vertebral end plate, and then as the spine extends, the axis of movement (instant center of motion) moves backward until in

Flexion-extension roentgenograms of the lumbar spine of a patient who had had a spine fusion showing disc degeneration at the level above the fusion. In Fig. 3-A the spine is held in flexion. In Fig. 3-B it can be seen that on extending the spine the vertebral body above the level of the fusion glides posteriorly to a significant degree.
Photomicrograph of a section through the cartilaginous plate and innermost portion of the annulus showing attachment of the fibers to the hyaline cartilage plate. Note how the chondrocytes follow the same lines as the annulus fibers.
ment with parallel displacement of adjacent vertebrae has been correlated with disc degeneration by several authors.\textsuperscript{1,4,6,7}

In the course of the aforementioned anatomical study, it was observed that spinal segments showing abnormal and excessive mobility tended to have osteophytes with the characteristic morphology that I called traction spurs (Fig. 9).

The traction spur can be differentiated from the common claw-type osteophyte,
in that it develops two to three millimeters away from the discal edge of the vertebral body and projects horizontally (Fig. 4). The spur owes its development to the method of attachment of the annulus fibers. These can be divided into three groups (Fig. 5). The innermost fibers pass from one cartilaginous plate to the other. The line of attachment of the hyaline cartilage plate can be demonstrated in histological sections (Fig. 6). The middle group of fibers, the epiphyseal fibers, pass from one epiphyseal plate to the other and are most numerous anteriorly and laterally. They are few in number posteriorly. The outermost fibers are attached to the vertebral body deep to the epiphyseal ring. These fibers are strongest and most numerous anteriorly, where they are reinforced by the strong anterior longitudinal ligament. They are weakest posteriorly and in this regard it is to be noted that the epiphyseal ring is frequently deficient posteriorly (Fig. 7). Abnormal movements of the vertebral bodies such as those associated with disc degeneration place traction stresses on the attachment of these outermost annular fibers, and it is at the site of the attachment of these fibers that the traction spur develops. Because few of the outer-

Figs. 11-A and 11-B: Roentgenograms made before and one year after spine fusion from the fourth lumbar vertebra to the sacrum.
Fig. 11-A: Before fusion there is a small traction spur in relation to the cranial aspect of the fifth lumbar vertebral body.
Fig. 11-B: One year after fusion, the spur is no longer apparent.

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Posterior spur. Note that its relationship to the discal surface differs from that of the traction spur (see text).

most fibers attach posteriorly, these spurs, or spondylophytes, are confined to the anterior and lateral aspects of the vertebral bodies (Fig. 8) where they project out from the vertebral bodies as thin horizontal shelves.

In the earliest stages of development, the traction spur is best demonstrated roentgenographically on the lateral projection (Fig. 11-A) where it can be recognized as a small horizontally directed excrescence of bone immediately caudal or cranial to the discal edge of the vertebral body. In the later stages of its development, the spur may become quite large (Fig. 9), but even at its maximum development, it never
curves at the tip and thereby is differentiated from the common claw or marginal osteophyte (Fig. 10). The relationship of the spur to abnormal movements is best demonstrated in patients who have undergone spine fusion. Once fusion is achieved and the segment becomes stable, the traction spur regresses (Figs. 11-A and 11-B).

Because of the anatomical disposition of the posterior portion of the epiphyseal ring, the majority of the posterior fibers of the annulus are attached to the cartilage plate. This probably accounts for the fact that the traction spur has not been observed on the posterior aspect of the vertebral bodies. A horizontally directed spur, however, is seen on occasions on the posterior aspect of the vertebral body (Fig. 12). This spur differs from a traction spur in disposition, pathogenesis, and clinical significance. It is usually small, as a rule is situated posterolaterally, rather than directly posteriorly (Fig. 13) and is related to a diffuse bulge of the intervertebral disc at this site. Roentgenographically it differs from the traction spur in that it projects from the discal edge of the vertebral body and may curve to correspond to the convexity of the protruding annulus.

**Comment**

Unfortunately, it is almost impossible to establish the clinical significance of the traction spur by a statistically valid investigation. A long-term study of comparable (with respect to age, sex, occupation, and symptoms) people, with and without traction spurs, would be required. Even if such a study were feasible, the great number of variables which would influence symptoms during the many years covered by this study would be impossible to control.

Despite these difficulties, eighteen years of clinical experience since I first recognized the traction spur as an entity has convinced me that this spur is, in fact, a manifestation of abnormal motion and that if the motion persists the traction spur will grow larger, whereas if the motion is eliminated it tends to disappear.

The shelf-like appearance of the traction spur, which always arises two millimeters or more from the discal margin, differentiates it from the common marginal osteophyte or claw-type spur, which has a broad base located at the discal margin and a claw-like configuration as it arches over the disc to interlock eventually with an opposing spur arising from the adjacent vertebra. The traction spur appears to be primarily the result of abnormal motion, whereas the marginal osteophyte seems to be related more to collapse and loss of height of the disc space.

Another type of osteophyte is the posterolateral spur which is believed to be related to posterior bulging of the disc and may initially resemble a traction spur. This type may have the same shelf-like appearance as the traction spur, but its location right at the disc margin differentiates it roentgenographically from the traction spur, whose base is always removed from the disc surface by two or more millimeters.

**Summary**

The traction spur differs from all other spondylophytes in that it is horizontally directed and arises at the site of attachment of the outermost annular fibers about two millimeters away from the discal border of the anterior and lateral surfaces of vertebral bodies. The significance of a traction spur lies in the fact that it denotes segmental instability which may or may not cause symptoms.

**References**


