

# The Role of Trauma in Low Back Pain: A Review

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Trauma plays an important role in the production of low back pain. This review emphasizes how the forces to which the spine is subjected are modified by many factors. Attention is directed to the role of mechanical stress in the etiology of spondylolisthesis, subtle spinal fractures, as well as the relevance of stress to the degenerative process. It is suggested that trauma plays a very major role in low back pain but, at present, the problems in diagnostic technology create difficulty in establishing the precise degree of that role. The drawbacks of over-reliance on plane radiography are emphasized. It is suggested that improved diagnostic techniques may result in more accurate treatment and perhaps less disability resultant from the ubiquitous problem of low back pain.

One of the significant problems which tax the diagnostic and therapeutic acumen of medical practitioners is low back disorders. A traumatic etiology is implied in the majority of diagnoses given for these disorders such as "acute back strain," ligamentous sprain, "sprung back," and acute herniated nucleus pulposus (7). The implications of these diagnoses are threefold: 1) mechanical stresses presumably are causative; 2) a specific structural abnormality should be identifiable, for example, a torn ligament; 3) the person has had an injury which, if it occurs in relation to work, is compensable.

In this article, the role of trauma in low back diseases will be reviewed. Although more questions will be raised than answered, an understanding of these mechanical principles may aid the responsible medical practitioner to deal more critically with this ubiquitous and often frustrating group of disorders.

## MECHANICAL EPIDEMIOLOGY

Sixty to eighty per cent of the world's adult population experiences back pain at some time (23, 25, 26). Such complaints reach a peak during the third, fourth, and fifth decades which corresponds to the peak incidence of surgical procedures in those age groups (50). Although twice as many males as females undergo spine surgery, the frequency of low back complaints is similar for the two sexes (23, 25, 50).

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Comparative analyses of individuals with and without low back pain reveals few distinct differences or mechanical risk factors. Truck and tractor drivers, those who drive more than ten miles per day, and multiple pregnancies are definable risk factors for herniated nucleus pulposus (30). Such athletic activities as golf, tennis, and baseball may be of relevance to herniated nucleus pulposus, while gymnastics, and interior football lineman positions are associated with an increased risk of spondylolisthesis (19, 27, 57). Heavy lifting, or occupations which involve significant physical stress, are not associated with any more severe back problems (26, 42). Farmers are one group, however, who appear to be at somewhat greater risk for low back difficulties.

## MECHANICAL FORCES ACTING UPON THE SPINE

The lumbar spine is subject to forces of varying magnitudes and varying rates and directions of application. As a general principle, a force applied to any structure results in either motion and/or deformation. In the spine, significant loads are generated by the weight of body segments, externally applied loads, and the muscle and ligamentous forces reacting to those loads.

Figure 1 illustrates the various types of loading experienced by the lumbar spine, including compression, tension, bending, torsional, and shearing stresses. Each of these loading configurations may be static, cyclic, or dynamic (impact).

**Compression.** The effects of compression have been studied extensively in vivo and in vitro. Figure 2 demonstrates the results of the typical compression experiment in vitro where two vertebrae and their intervening disc are subjected to a compressive load. The initial rapid deflection results in loss of disc space height, accompanied by radial bulging of the annulus fibrosus. If this load is continued, gradual and less significant deflection occurs

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