

Neglected knowledge: Asymmetric features of lumbar disc disease

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ABSTRACT

Background: Lumbar disc herniations have been extensively studied in the literature. Asymmetric trunk muscle anatomy could affect the development of this entity which has never been quantitatively studied previously. The purpose of this manuscript was to analyze the operated sides of herniated lumbar disc.

Materials and Methods: Data files of patients with lumbar disc herniation operated in author's hospital between January 2007 and March 2009 were analyzed.

Results: In operated side analysis, discectomy side was 53% on the left side, 40% on the right side, the difference between two sides was statistically significant.

Conclusion: The asymmetric distribution may be a significant factor in the development and surgical treatment of lumbar disc herniations.

Key words: Asymmetry, lumbar disc disease, herniation

Introduction

Sciatica is a common health problem all over the globe.^[1] Degenerative disc disease is one of the most common diseases of the spine.^[2,3] For decades, lumbar discectomy has been one of the most common surgical practices performed by neurosurgeons.^[4] At present, neurosurgical practice is confronted by an explosion of technology.^[4-6] Despite these recent developments in neurosurgery, we still have a very limited understanding of the patho-physiology of lumbar disc disease (LDD). The reasons some people have this persistent pain after surgery remain unclear, so the surgical treatment of ruptured lumbar inter-vertebral discs is sometimes discouraging to both surgeon and patient.^[7] It has been argued that a clarification of the mechanical causes of failures of

disc surgery requires knowledge of the states of stress and strain throughout the spine and the question of whether the trunk asymmetry affects side location of disc herniation is fascinating. Any contribution to our knowledge of the cause of the operative failures of discectomy is always welcome. Since a purely experimental approach cannot provide this information, retrospective studies are called for, and studies focusing on asymmetric features of lumbar disc pathology are lacking. The aim of this study was to show the asymmetric feature of LDD in human.

Materials and Methods

From January 2007 to March 2009, the medical records of 91 consecutive patients who had undergone lumbar discectomy were analyzed. In each of the 91 patients, a detailed preoperative physical examination included; assessment of the range of motion of the spine; evaluation of the ipsilateral

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and crossed straight-leg raising tests; and neurological examination that included assessment of motor strength, deep tendon reflexes, and sensation and magnetic resonance imaging evidence of disc protrusion. The operative findings in each patient were evaluated, and each involved disc was classified as protruded, extruded, or sequestered. The patients, who had bilateral involvement, were excluded from the study. In all patients, discectomy was carried out through a standard inter-laminar approach. Operative notes, clinical documents, and radiology reports were evaluated in order to describe and determine the side of discectomy.

Results

Ninety-one discectomy were performed during study period. The two-proportions test was used to examine the relationships between the left and right sided discectomy. As the name suggests, it is used when comparing the percentages of two groups. It only works, however, when the raw data behind the percentages are available since the sample size is a determining factor of the test statistics.

In our example, the null hypothesis (H_0) and the alternative hypothesis (H_a) are:

$H_0: P_{\text{left}} = P_{\text{right}}$

$H_a: P_{\text{left}} \neq P_{\text{right}}$

The alpha level is set at 5%, that is $\alpha = 0.05$.

In this study, discectomy side was 53% on the left side, 40% on the right side. The patients with bilateral LDD (7%) were excluded from the study. The two-proportions test was showed the statistically significant difference ($P = 0.001$ and <0.05). The test statistics of the two-proportions test is the Z-value. For large sample sizes, this Z-value follows the same normal distribution as the well-known standardized Z-value for normally distributed data.

Discussion

Human body, which appears symmetrical along the midline grossly, is, in fact, asymmetrical both morphologically and physiologically. Low back pain has long been connected to postural and structural asymmetries, most commonly in the pelvis.^[8] While externally there is a difference in bilateral dimensions of various body parts and musculature, internally it is due to asymmetrical positioning of viscera as well as variations in bilateral skeletal dimensions. This asymmetry has been explained as the result of differential mechanical loadings largely due to handedness and activity pattern.^[9] More stress and strain on the dominant side may cause differences between the sides, often referred to as directional asymmetry. Wolff's law says bone formation occurs along lines of stress the bones and muscles respond

by growing more vigorously and increasing in density on exposure to repeated high levels of mechanical loading. Onset of lumbar disc in human often is associated with bipedal ambulation. Theories propose that this transformation in the mechanics of locomotion is the inciting evolutionary event that made the lumbar spine susceptible to degenerative disease. If the primary sources of disc pathology are these forces/stresses acting on the spine, why did the spine not evolve into a more rigid structure?

Recent studies confirmed that patients with lumbar degenerative disease were characterized by an anterior sagittal imbalance, a loss of lumbar lordosis, and an increase of pelvis tilt.^[10] As noted above, neurosurgical practice is confronted by an explosion of technology.^[4-6] With the time and in parallel to the technological advancement new and more complex spine procedures were performed.^[10] However, many patients with lumbar disc herniation fail to improve following a successful surgery. According to Barrey, patients with chronic lower back pain presented a minor balance defect.^[11] The surgical treatment of ruptured lumbar inter-vertebral discs is sometimes discouraging to both surgeon and patient.^[7] The treatment of discogenic pain is sometimes problematic for spine surgeons. Pain may persist or recur despite well-indicated and well-performed surgery.^[12] A major reason for recurrent disc herniations after a discectomy is that the annular rent does not seal completely, thus allowing a weakened defect to continue to be exposed to mechanical intradiscal pressure changes.^[13] Recently, it was reported that cartilage end plate degeneration is usually accompanied by loss of cellularity and this loss may be a crucial key factor in initiation and development of degenerative disc disease.^[14] These changes seem to be not symmetric at both sides of the vertebral column, because, in this study, discectomy sides of 91 patients were 53% on the left side, 40% on the right side. This result, first time, shows that this disorganization should be asymmetric fashion, low rate discectomy on the right side. Asymmetric changes occur in inter-vertebral disc under asymmetric loading. The lumbar spine and its associated soft tissues work in a coordinated manner. This study shows asymmetric feature of LDH in human, high rate incidence of left-sided discectomy. It seems to be imperative to understand this asymmetric process to better target treatments. The opening of new horizons of this kind of knowledge will help understand the complex challenge of lumbar disc herniation [Table 1].

Importance of this study

Symmetric load transmission across the spine and lumbar disc is important. Currently, lumbar fusion has increasingly used as a standard treatment for degenerative spinal disorders. This system may assist to shift abnormal load transmission, because pain sometimes is not caused by the loss of stability in the vertebral column. Instead pain may be caused by the loss of distribution of load.^[15] Disc herniation is a situation

Table 1: Sex-side cross-tabulation

Sex	Side			Total
	Bilateral	Left side discectomy	Right side discectomy	
Male				
Count	3	30	23	56
Percentage	5.4	53.6	41.1	100.0
Female				
Count	2	19	14	35
Percentage	5.7	54.3	40.0	100.0
Total				
Count	5	49	37	91
Percentage	5.5	53.8	40.7	100.0

in which the nuclear material has protruded into the radial tears in one area and has displaced surrounding anatomic structures. As a normal disc is subjected to torsion insult, circumferential tears occur in the intact annulus. These tend to accumulate centrally and form radial fissures into which nuclear disc material may protrude. This study first time showed the laterality of this process. In fact, laterality is fundamental to the vertebrate body plan. Lateralization of the vertebrate body plan is both evolutionarily conserved and developmentally rigid. According to our knowledge, asymmetric distribution of lumbar disc herniation has not been previously studied. From this study, we draw the following conclusions:

- This study demonstrates that the nucleus pulposus from an inter-vertebral disc could induce asymmetric structural and functional changes. This information can be useful for new therapeutic strategies of LDD
- We think that stabilizations procedures correct asymmetry of spine in part. So the comprehension of the asymmetric mechanisms of degeneration may be decisive and revolutionary in the understanding and treatment of the LDD. The present study also suggests that patients with LDD has a balance defect
- It has been established that facet joints are the primary components resisting loadings, distributing loadings, and guiding movements which are not symmetric.

In the present study, there is the difference in the discectomy sides, which can be interpreted by asymmetric changes in posterior spinal elements. However, unilateral facet hypertrophy is very rare conditions.^[16] We copiously stress the fact that we are the first ones to report on such asymmetric distribution of discectomy sides that the recognition of this fact is of importance because it has to do with the also asymmetrical progression of degenerative changes in the spine. If indeed one is the first to report something and that something is of value. More data is needed on this subject.

Limitation of this Study

There are several weaknesses in this study. This is a small study and is limited by the number and, therefore, in addition to the retrospective nature the results could be questioned. All of 91 discectomy were performed by a single center. In addition, our study has deficiencies that are inherent in all retrospective studies. In the patient files, we examined retrospectively, we did not take into consideration the psoas muscle size. The psoas muscle size may predispose to the asymmetric disc herniations. The calculation size of those muscles could be a great contribution to spine literature.

Conclusions

Here, in a consecutive series of patients undergoing surgery for symptomatic lumbar disc herniation, left-sided herniation was significantly more prevalent than right-sided herniation. Asymmetrical distribution of operated side of herniated lumbar disc may be attributed to asymmetric biomechanical load. Treatment of spine pathologies should consider anatomic and physiologic rules.^[15] Our study provides objective evidence that relatively subtle skeletal asymmetry, and not just pathology, influences patterns of asymmetric disc herniations. Further study to understand the physiological and biomechanical factors precipitating this asymmetry may lead to better treatments for degenerative disc disease. More information is obviously needed.

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Conflicts of interest

There are no conflicts of interest.

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