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Measurement and Analysis of Lumbosacral Parameters in Patients with Low Back Pain in Shaanxi Area

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Abstract: Objective: To measure the lumbosacral parameters of patients with low back pain in Shaanxi, and analyze the measured results, to provide a reference for clinical diagnosis and treatment of low back pain patients. Methods: CT data of 120 cases of lumbago patients diagnosed with lumbar disc herniation or bulging disc in Shaanxi Provincial People's Hospital from January to December in 2019 were collected retrospectively, divided into different groups based on age, and related parameters were measured and analyzed respectively. Results: The angle between the L5-S1 disc was larger in old females than old males, the difference was statistically significant (*P<0.001)*; The Lumbosacral angle was larger in middle females than young males, the difference was statistically significant (*P*<0.05); The Lumbosacral angle was larger in old males than young males, the difference was statistically significant (*P*<0.05). Conclusion: The Lumbosacral angle and the angle between the L5-S1 disc will change larger along with the growth of age, especially in females, which should raise concern in clinics.

1. Introduction

Low back pain has always been prevalent in different ages of people, especially in middle-aged and elderly people [1], the intervertebral disc bulge is one of the most common causes to affect people's quality of life. With the rapid development of medical imaging examination technology, digital CT examination has gradually replaced ordinary X-ray plain film as one of the main modalities to assist diagnosis.

In this study, retrospective measurement, and analysis of related parameters in people with lower back pain confirmed by CT, including lumbosacral angle, lumbar 4-5, lumbar 5-sacral 1 disc angle and sacral inclination, in order to provide a reference for clinical diagnosis and treatment.

2. Materials and Methods

2.1. General Information

120 cases of patients with low back pain in Shaanxi province between January and December in 2019 were collected retrospectively, diagnosed with lumbar herniation by digital CT technology, the

number of males and females were 60 respectively, ages from 14 to 65 years, and the median age was 41 years. Informed consent was obtained from the patients and approved by the Medical Ethics Committee of Shaanxi Provincial People's Hospital.

2.2. Inclusion and Exclusion Criteria

Inclusion criteria for cases: 1) pain in the lower back, with or without lower limb radiation pain; 2) CT intervertebral disc scan confirmed swelling; 3) no history of surgery or trauma; 4) no obvious degenerative changes or developmental abnormalities in the intervertebral disc, vertebral body, or vertebral facet joints.

Exclusion criteria: 1) lumbar vertebral body or accessory obvious lesions; 2) lumbar surgery patients; 3) Disc degeneration; 4) lumbar spinal canal lesions or bony stenosis.

2.3. Methods

2.3.1. CT Parameter Measurement Methods

Figure 1: Lumbosacral angle measurement method

Figure 2: Measurement method of intervertebral disc clip angle

Figure 3: Measurement method of sacral inclination

Lumbosacral angle measurement: refer to Ghasemi et al measurement method [2], select the median level of the sagittal position of the bone window, the upper edge plane of the extended sacral 1 vertebral body as the tangent AB, and the Angle formed by point B as the horizontal line and AB is defined as the lumbosacral angle **(Figure 1)**.Lumbar 4-sacral 1 disc Angle measurement: The literature measurements were performed by Benlidayi et al[3] , selected the median sagittal level of the bone window, the lower edge of lumbar 4 vertebrae, the upper and lower edge of lumbar 5 vertebrae, and the upper edge of sacral 1 vertebra. Angle 1 and 2 were defined as the disc Angle **(Figure 2)**. Sacral inclination: The literature measurements were performed by Benlidayi et al [3], the angle between the posterior upper edge of the 1 and 2 vertebrae **(Figure 3)**.

2.3.2. Study Protocol

The collected cases were divided into three groups: 14-30,31-50, and 51-65, with 20 men and women in each group. The measurement results of the corresponding parameters were measured and analyzed.

2.4. Statistical Methods

Data analysis was performed using SPSS 24.0 statistical software, all data were expressed as mean ± standard deviation, statistical methods using t-tests with independent samples within and between group statistical tests. P <0.05 was considered statistically significant.

3. Results

Results of Lumbosacral Angle, Lumbar 4-5, Lumbar 5-Sacral 1 Disc Angle, and Sacral Inclination Measurements in the Three Groups, The mean lumbosacral angle in middle and elderly groups was greater than that in the young men (P<0.05); that in middle and elderly women (P<0.05); the mean in the lumbar 5-sacral disc was greater than that in the elderly group (P<0.001), and the same gender (P>0.05). (Table 1)

Table 1: Results of lumbosacral angle, intervertebral disc angle, and sacral inclination measurements ($\bar{x} \pm s$)

age group (years)	gender	lumbosacral angle (°)	lumbar 4-5 angle (°)	lumbar 5-sacral 1 clip angle (°)	Sacral inclination angle (°)
14-30	M	30.92 ±5.86	7.46 ±2.41	11.82 ±3.87	47.21 ±7.73
	F	30.99 ±6.72	7.23 ±2.71	12.22 ±4.70	47.98 ±9.11
	Total	30.96 ±6.29	7.35 ±2.56	12.02 ±4.29	47.59 ±8.42
31-50	M	35.55 ±6.15*	6.99 ±2.11	12.68 ±4.30	49.15 ±7.99
	F	35.91 ±6.70#	7.23 ±1.97	13.32 ±4.22	50.43 ±8.76
	Total	35.73 ±6.43	7.11 ±2.04	13.00 ±4.27	49.79 ±8.38
51-65	M	35.85 ±7.44*	6.78 ±2.41	12.68 ±3.98	48.41 ±6.82
	F	35.92 ±6.52#	7.35 ±2.40	15.17 ±5.73**	46.19 ±8.81
	Total	35.88 ±6.98	7.07 ±2.40	13.93 ±4.85	47.30 ±7.81

M: male; F: female; *Compared with men in the youth group, P<0.05; #Compared with the women in the youth group, P<0.05; **In contrast to men in the older group, P<0.001.

4. Discussion

Lower back pain is a common symptom in patients of different ages. The main causes include lumbar joint degeneration, lumbosacral muscle strain, intervertebral disc bulge, vertebral compression fractures, and other acute or chronic traumatic injuries [4]. As reported in the literature, patients with low back pain worldwide can account for about 23% of the population, with some patients with recurrent history [5,6]. Due to the complexity and biomechanics of the spine, only about 20% of cases of patients can be diagnosed accurately [7].

Disc bulge is one of the common causes, among which disc herniation mainly occurs in lumbar 4-5 and lumbar 5-sacral 1 discs. Some literature suggests that the total incidence of lumbar 5-sacral 1 discs is the highest [8], one of the main discs under spinal pressure, prone to degeneration and herniation. Some scholars through studying the related causes of lumbar instability, [9-11] believe that the changes in the lumbosacral horn and instability of the spine. Qu Guolin et al. studied the relationship between spondylolisthesis and lumbosacral angle and suggested that lumbosacral angle enlargement is one of the main causes of spondylolisthesis, and can even aggravate the degree of spondylolisthesis [12]. Shi Ningwen et al. proposed the relationship between lower back pain and lumbosacral pain between the lower back pain and the lumbosacral horn [13]. After studying the relationship between disc herniation and the lumbosacral horn, Duan Yumei et al. believed that lumbosacral angle enlargement can be used as an index of disc suspicion [14]. But some previous studies mainly with X-ray lumbar tablet as the research object, with the rapid development of medical imaging technology, CT, and MRI examination gradually become the main means of auxiliary diagnosis of disc bulge, can from the axial, sagittal, and coronal multiple positions detailed assessment of disc condition, and can clearly assess near nerve compression, spinal stenosis, etc., the disc examination can confirm patients for about 50% of all patients with low back pain [15].In recent years, more and more literature reports that CT and MRI have gradually replaced ordinary X-ray lumbar examination as a necessary and reliable examination method [16,17] for the clinical treatment of patients with low back pain. The current focus on the elderly, especially aged> 50 years of literature, but lumbar disc bulge in young people has a trend of increasing year by year, some young patients due to new symptoms failed to cause enough attention, failed to timely diagnosis and early clinical treatment, lead to late treatment effect is not ideal, bring adverse effects on work and quality of life

[18-21].

In this study, the author selected patients of different ages with obvious low back pain and CT diagnosis as intervertebral disc bulge as the research subjects, Measure and analyze the relevant parameters, Significance of measurement indicators and the selection of methods: 1) Disdisc bulge directly reflects the relationship between intervertebral disc and spinal stenosis and nerve root compression after the lesion, The condition of sagittal process was determined using CT axis and sagittal position, Large disc bulging towards the posterior edge of the vertebral body, Diagnosing the swelling out; Limited disc herniation to the posterior margin of the vertebral body, The diagnosis was prominent, It is divided into central, paracamal, foraminal, foraminal and other[22]; 2) Lumbosacral angle mainly reflects the size of the sacral vertebra and lumbar spine, The larger the angle, The less the sacrum bears pressure in the biomechanics, The smaller the angle, The greater the pressure on the sacrum, In association with spine stability, There are several different methods for measuring lumbosacral angle[23-27], Most of the references mainly refer to Ghasemi and other literature measures [2], The specific method is to select the central sagittal plane of the bone window, The upper margin plane of the extended sacral 1 vertebral body serves as the tangent AB, The angle formed by point B as the horizontal line and AB is defined as the lumbosacral angle; 3) lumbar 4-sacral 1 disc angle mainly reflects the disc compression, Indirectly reflecting the changes in the lumbar spine curvature, The smaller the angle, The lighter the disc compression condition, As the angle increases, The more severe the intervertebral disc compression condition is, Specific measurements were measured by Benlidayi[3], Select the sagittal bone window, The lower edge of lumbar 4 vertebra, the upper and lower margin of lumbar 5 vertebra, and the upper edge of sacral 1 vertebra each make a straight line, Angle 1 and 2 are defined as disc angles; 4) Sacral inclination reflects the degree of sacral physiological curvature, The smaller the angle, The smaller the sacral physiological curvature, The larger the angle, The greater the sacral physiological curvature, In relation with spondylolisthesis, Specific measurements were measured by Benlidayi such as[3], The angle between the posterior upper edge and vertical lines of the 1 and 2 vertebrae is defined as the sacral inclination.

The measured results were all smaller than in bulge patients reported in the literature. By making a summary of the literature, The finding that this difference may be related to different human race constitution and growth and development in different regions, besides, The results of this study found that the lumbosacral horn and lumbar 5-sacral 1 horn will increase with age, Lumbar 4-5 Angle, sacral inclination change and age size did not increase or decrease the trend; By using a within-group t-test, We further found that the, Women in the elderly group had a greater lumbar 5-sacral 1 disc angle than men of the same group, Women than the youth group, Middle-aged women were larger than those in the youth group, Men in the older group were greater than men in the younger group, The difference was also statistically significant, There were no differences between the parameters within and between the remaining groups, Note that with increasing age, Lumbosacral horn changes are even more pronounced in female patients, The gradual enlargement of the lumbosacral angle due to the influence of long-term biomechanics, Increasing the pressure on the lumbar spine, As the physiological curvature changes, Then aggravating the incidence of lumbar 5-sacral 1 intervertebral disc bulge disease, The disc herniation will be even more pronounced, Clinical symptoms were even more severe. This phenomenon should be paid attention to in the clinical diagnosis and treatment of lumbar process patients, especially when encountering female patients.

5. Conclusion

The Lumbosacral angle and the angle between the L5-S1 disc will change larger along with the growth of age, especially in females, which should raise concern in clinics. The limitation of this study is the lack of data from healthy controls and the relatively small sample size, so further in-depth

studies are necessary.

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