

TECHNOLOGIES OF RESTORATIVE MEDICINE AND MEDICAL REHABILITATION

ТЕХНОЛОГИИ ВОССТАНОВИТЕЛЬНОЙ МЕДИЦИНЫ И МЕДИЦИНСКОЙ РЕАБИЛИТАЦИИ

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Clinical Characteristics of Patients with Lumbar Disc Herniation: A Retrospective Comparative Study of 58 Females

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ABSTRACT

INTRODUCTION. Low back pain (LBP) is a common discomfort in young women during pregnancy and after childbirth. These female patients with lumbar disc herniation (LDH) have unique clinical manifestations, but few studies have been reported.

AIM. To investigate the clinical characteristics of female patients with LDH after childbirth and to provide basis for rehabilitation and treatment.

MATERIAL AND METHODS. We collected the clinical data of 58 female patients with LDH, analyzed the clinical characteristics. We used CT scan to determine the location and type of LDH, observed the dural sac of lumbar intervertebral disc, serum 25 hydroxyvitaminD (25 [OH] D) levels were measured and compared with healthy women and pregnant women.

RESULTS. Our results showed that according to the age distribution of patients with low back pain was the most common among 30-34 years old, accounting for 43.1% of all patients. Patients with LDH accounted for the highest proportion of patients with LBP, up to 55.2%. L4-L5 segment was the most common part of LDH, accounting for 46.9%, followed by L5-S1 segment, accounting for 31.3%. Protrusion was the most common type of LDH, accounting for 84.4%. Among 34 patients with LDH, 15 patients (46.9%) had dural sac compression. The serum 25(OH) D level of patients with LDH was 11.36 ± 5.16 ng/ml, lower than that of healthy women (first control group, 15.22 ± 3.42 ng/ml, $p=0.022$), and pregnant women (second control group, 18.95 ± 6.94 ng/ml, $p<0.011$).

CONCLUSION. LDH is one of the main causes of LBP in female patients. Female patients with LDH have their specific features in terms of age distribution, location and type of intervertebral disc herniation, especially the serum 25(OH)D level of female patients is significantly low. To clarify the clinical characteristics of female patients with LDH is very important for the rehabilitation treatment.

KEYWORDS: Low back pain, lumbar disc herniation, childbirth, 25 hydroxyvitamin D

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Клиническая характеристика пациентов с грыжей поясничного диска: ретроспективное сравнительное исследование 58 женщин

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РЕЗЮМЕ

ВВЕДЕНИЕ. Боль в пояснице часто доставляет дискомфорт молодым женщинам во время беременности и после родов. У пациентов с грыжей поясничного диска наблюдаются отличительные клинические признаки, о которых сообщалось в лишь немногочисленных исследованиях.

ЦЕЛЬ. Изучить клинические особенности молодых пациенток с грыжей поясничного диска после родов, обосновать необходимость реабилитации и лечения.

МАТЕРИАЛ И МЕТОДЫ. Были собраны клинические данные 34 молодых пациенток с поясничной болью, проанализированы клинические характеристики. Авторы применяли компьютерную томографию для определения расположения и типа поясничной боли, наблюдали за дуральным мешком поясничного межпозвоночного диска, измеряли уровень 25-гидроксивитамина D (25 [ОН] D) в сыворотке крови и сравнивали со здоровыми женщинами и беременными женщинами.

РЕЗУЛЬТАТЫ. Наши результаты показали, что согласно возрастному распределению пациентов с болью в пояснице наиболее часто встречаются пациенты в возрасте 30-34 лет, составляя 43,1% от всех пациентов. Пациентки с грыжей поясничного диска составили наибольшую долю пациентов с поясничной болью, до 55,2%. Поясничная боль чаще всего встречается в сегменте L4-L5, составляя 46,9%, за ним следует сегмент L5-S1, составляя 31,3%. Наиболее распространённым типом поясничной боли была протрузия, составляя 84,4%. Среди 34 пациентов с поясничной болью у 15 пациентов (46,9%) была компрессия дурального мешка. Уровень 25(ОН) D в сыворотке крови пациентов с болью составил $11,36 \pm 5,16$ нг/мл, что ниже, чем у здоровых женщин (первая контрольная группа, $15,22 \pm 3,42$ нг/мл, $p=0,022$) и беременных женщин (вторая контрольная группа, $18,95 \pm 6,94$ нг/мл, $p < 0,011$).

ЗАКЛЮЧЕНИЕ. Грыжа поясничного диска является одной из основных причин поясничной боли у молодых пациенток. Пациентки с грыжей поясничного диска имеют свои особенности относительно возрастного распределения, расположения и типа грыжи межпозвоночного диска, особенно уровень 25(ОН)D в сыворотке крови у пациенток значительно ниже. Выяснение клинических особенностей молодых пациенток с грыжей поясничного диска имеет большое значение для реабилитационного лечения.

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INTRODUCTION

Lumbar disc herniation (LDH) is one of the common diseases causing low back pain (LBP), radicular pain, motor weakness, and numbness. LBP was listed as the fourth leading cause of disability in the world in 2015 (DALYs) [1].

In China, the prevalence of LDH is 14%, L4/5 and L5/S1 are the most frequent involved segments for the majority of lumbar disc diseases [2]. The annual prevalence of LBP varies between different occupations, such as 40% in teachers, 74% in garment workers. Considering that the working population demonstrated 2.5 times higher persistence of LBP, than non-working population in low and middle-income regions [3].

With the increase of age, under the action of external forces such as extrusion, traction and torsion, the water and nutrition of the lumbar intervertebral disc decrease, the elasticity decreases, and the anti-load ability decreases. It is easy to cause the rupture of the fibrous ring, the protrusion of the nucleus pulposus, the compression of the spinal nerve, and the low back pain and leg pain [4].

The degenerative change of lumbar intervertebral disc is the internal cause of LDH, while the imbalance of external force is the external factor causing LDH.

In order to adapt to the increased load during pregnancy, women have evolutionarily greater lumbar lordosis than men to help with the burden of pregnancy. There are gender differences in lumbar lordosis. The Lumbar angle representative of lordotic curvature between L1 and S1, was 7.3° greater in females than males when standing [5]. Additionally, sacral slope was greater in females than males, the spine in women has a larger range of activity, and women have more degenerative intervertebral discs than men at the elderly age.

Patients with LDH classically undergo a brief course of conservative management prior to microdiscectomy surgery, in this time the gender differences identified in the selection and symptomatic response to commonly used non-operative therapies. A greater percentage of female patients relied on muscle relaxants, lumbar epidural steroid injections, and emergency department services.

Gender differences exist in the utilization of nonoperative therapies for the management of a lumbar intervertebral herniated disc prior to microdiscectomy surgery [6].

The human intervertebral disc is mainly composed of annulus fibrosus and nucleus pulposus. Apoptosis of nucleus pulposus cells can cause lumbar disc degeneration. Recent studies have shown that the severity of pain increased in patients with LBP as vitamin D deficiency increased [7]. Studies have found that the expression level of vitamin D receptor is associated with intervertebral disc degeneration, vitamin D can reduce the apoptosis of human intervertebral disc nucleus pulposus cells [8].

The objective of our study is to use the electronic medical record information and CT image data of patients with LBP, analyze the age characteristics of female patients, location and type of LDH, compare the different ratio of dural sac compression, measure the serum 25(OH) D level of female patients, and compare it with healthy controls,

so as to provide basis for the rehabilitation treatment of patients with LDH.

MATERIAL AND METHODS

We collected the electronic medical records of 58 female patients with LBP. These patients came to the rehabilitation medicine clinic of our hospital between January and September 2021, aged 20-40 years (average age 32.4±5.14 years).

These patients mainly complained of lumbar pain. All the patients underwent double-row spiral computed tomography (CT) of the whole body on a Siemens AS 128 (CT machine). The patients lay on their back on a scanning table and had regular scans of the L1-S1 intervertebral discs, with a layer thickness of 3 mm and 5 layers of each intervertebral space; a CT image of the lumbar disc herniation is shown in Figure 1.



The intervertebral disc compresses the dural sac

Fig. 1. CT image showed disc herniation at L4-L5 levels

We selected 22 female patients with LDH from 58 patients, aged between 20 and 40 (average 30.9 ± 4.2 years) as the study group. At the same time, we selected 22 female healthy person who underwent physical examination in the outpatient department of Obstetrics and Gynecology of our hospital as the first control group, average 33.0±4.7 years (aged between 20 and 40), in our hospital obstetrics clinic, we selected 22 pregnant women (6-10 weeks of pregnancy) as the second control group, average 28.55±3.75 years (aged between 20-40 years). All pregnant women took vitamin D supplements every day (400 IU/d). The levels of 25 hydroxyvitamin D in the serum of patients in the study group and healthy people in the control group were detected respectively, the serum 25(OH) D level was measured by Roche ECL method.

The statistical analysis used IBM SPSS 22.0 software, the Pearson's chi-squared test was used to test the rate, and

T test was used for significance difference test, p-value <0.05 was considered statistically significant. The results are expressed as mean ±SEM.

RESULTS AND DISCUSSION

Age distribution of female patients with LDH

Among the 58 patients, the age range was 20-40 years, the mean age was 32.4 ± 5.14 years. As shown in Figure 2, there were 5 patients between the ages of 20-24 years, accounting for 8.6% of the total number of patients. Between the ages of 25-29 years, there were 15 patients, accounting for 25.9% of the total number of patients. There were 25 patients aged between 30 and 34, accounting for 43.1% of the total number of patients. Between the ages of 35-40 years, there were 13 patients, accounting for 22.4% of the total number of patients.

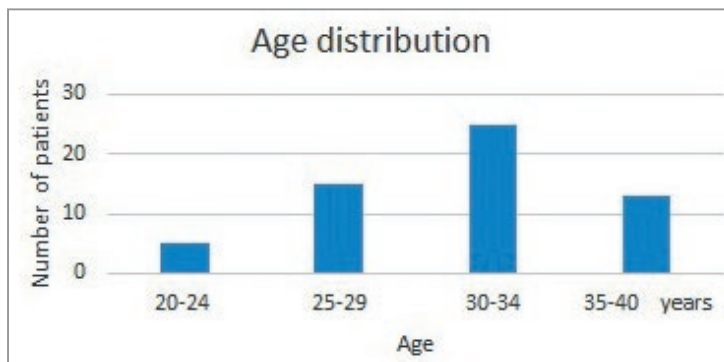


Fig. 2. The age distribution of female patients with LBP

Causes of low back pain

Among 58 patients with low back pain, 32 patients were diagnosed with lumbar disc herniation, accounting for 55.2% of all patients, 19 patients with lumbar muscle strain, accounting for 32.8% of all patients, 4 patients with lumbar bone hyperplasia, accounting for 6.9% of all

patients, 2 patients with sacral cracked, accounting for 3.5% of all patients, 1 patient with sacroiliac joint sclerosis, accounting for 1.7% of all patients. As shown in Table 1, lumbar disc herniation accounts for the highest proportion of 58 patients with low back pain.

Table 1. The causes of low back pain in female patients

| Patients diagnosis | Number of patients | Percentage |
|-----------------------------|--------------------|------------|
| Lumbar disc herniations | 32 | 55.2 % |
| Lumbar muscle strain. | 19 | 32.8 % |
| Lumbar hyperosteogeby | 4 | 6.9 % |
| Sacral vertebra fissure | 2 | 3.5 % |
| Sacroiliac joint sclerosis. | 1 | 1.7 % |

Location of lumbar disc herniation

Out of 32 patients with lumbar disc herniation there were 15 patients with L4-L5 herniation, accounting for 46.9% of all patients. There were 10 patients with L5 -S1 prominent sites, accounting for 31.3% of all patients. One patient with prominent sites in L3-L4, accounting for 3.1% of all patients. One patient with prominent part in L2-L3,

accounting for 3.1% of all patients. There were three patients with L4-L5 and L5-S1 prominent sites, accounting for 9.4% of all patients. There were two patients with prominent sites of L3-L4, L4-L5 and L5 S1, accounting for 6.2% of all patients. As shown in Table 2, LDH patients with L4-L5 lumbar disc herniation have the highest proportion.

Table 2. The location of lumbar disc herniation in young female patients

| Location | Number of patients | percentage |
|-------------------|--------------------|------------|
| L2 - L3 | 1 | 3.1 % |
| L3 - L4 | 1 | 3.1 % |
| L4 - L5 | 15 | 46.9 % |
| L5 - S1 | 10 | 31.3 % |
| L4-L5, L5-S1 | 3 | 9.3 % |
| L3-4, L4-5, L5-S1 | 2 | 6.3 % |

Types of lumbar disc herniation

We used computed tomography (CT scan) to classify patients with lumbar disc herniation, as show in Figure 3.

The three types are as follows: disc bulging, disc protrusion and disc extrusion.

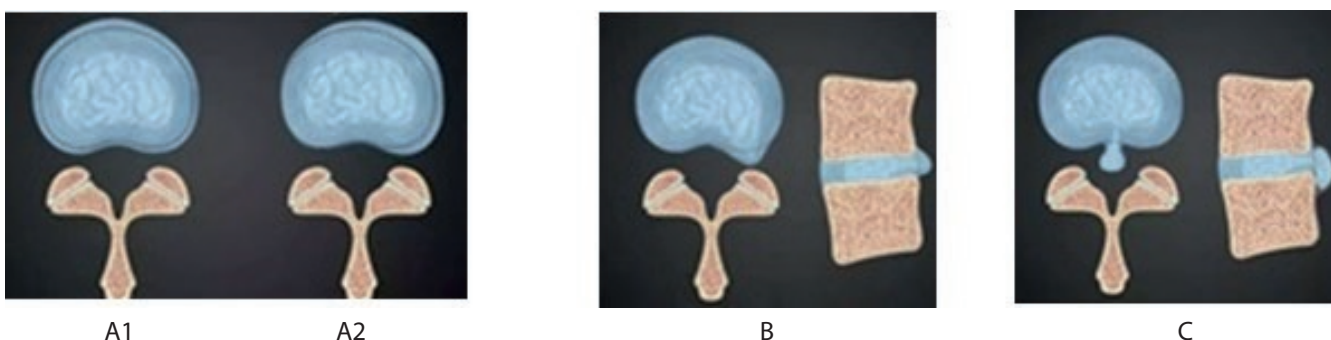


Fig. 3. Classification of lumbar disc herniation: (A1) disc bulging of circumferential, (A2) disc bulging of asymmetric, (B) disc protrusion, (C) disc extrusion

As shown in Figure 4, out of 32 patients with LDH, there were 27 patients with type of protrusion, accounting for 84.3% of all patients. The number of the patients of bulging type was 4, accounting for 12.5% of all patients.

One patient with extrusion type, accounting for 3.1% of all patients. LDH patients with type of protrusion had the highest proportion in all patients.

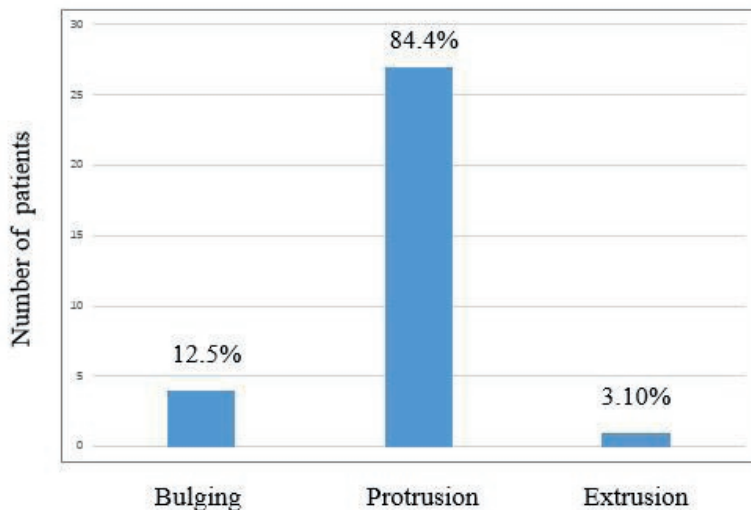


Fig. 4. The types of lumbar disc herniations in female patients

Compressed spinal dural sac

As shown in Table 3, among 32 female patients with LDH, 15 patients had dural sac compression, and the compression rate was 46.9%. Among 32 female patients,

17 patients had no dural sac compression and the rate of no compression patients was 53.1%.

Table 3. The ratio of dural sac compression in female patients

| Patients | Numer | Percentage |
|-----------------------------|-------|------------|
| Compression of dural sac. | 15 | 46.9% |
| No compression of dural sac | 17 | 53.1% |
| Total number of patients, | 32 | 100 % |

Determination of serum 25 (OH) D level

As show in Table 4 and Table 5, serum 25 (OH) D levels were observed in 22 patients with LDH, these patients are the study group as well as the patient group. While the average serum 25 (OH) D levels was 11.36 ± 5.16 ng / ml in the patients group. In the health object, that is, the first control group, the average serum 25 (OH) D levels was 15.22 ± 3.42 ng /ml. There was a significant difference

between the patients group and first control group (p<0.05). We measured that the average levels of serum 25 (OH) in the pregnant woman group was 18.95±6.94 ng / ml, as well as the second control group. Serum 25 (OH) D levels in LDH patients was significantly lower than that in pregnant women (P< 0.001).

Table 4. Comparison of 25 (OH)D levels between LDH patient and Health women

| Group | Serum 25 (OH) D levels [ng/ml] | p |
|----------------------|---------------------------------|----------|
| LDH patients [n=22] | 11.36 ± 5.16 | p= 0.022 |
| Health object [n=22] | 15.22 ± 3.42 | |

ВАН СЯО-ЦЗЮНЬ И ДР. | ОРИГИНАЛЬНАЯ СТАТЬЯ

Table 5. Comparison of 25 (OH)D levels between LDH patient and pregnant women

| Group | Serum 25 (OH) D levels [ng/ml] | p |
|---------------------|--------------------------------|-----------|
| LDH patients [n=22] | 11.36 ± 5.16 | p < 0.001 |
| Gravidas [n=22] | 18.95 ± 6.94 | |

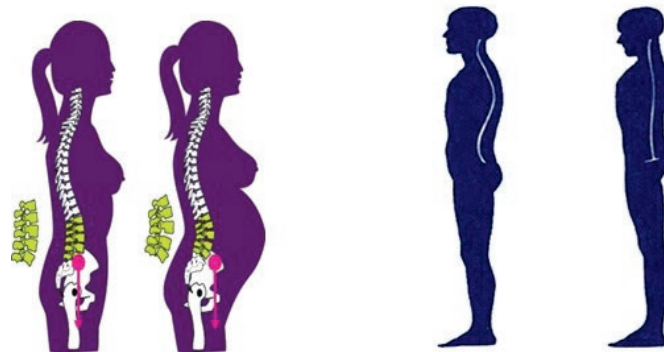
In this study, we analyzed the age distribution of female patients with LBP. Our results show that 43% of female patients with LBP are aged between 30 and 34, these patients account for nearly half of all patients. In 2015, the average age of childbearing for Chinese women was 33.73 years, the period of 30-34 years old is the peak of female fertility in China [9].

LBP is the most common skeletal muscle disease and discomfort experience for women during pregnancy. The prevalence of LBP during pregnancy is 34% in Asian countries and more than 50% in European countries [10, 11]. LBP seriously affects the quality of daily life of pregnant women, not only during the pregnancy and after the childbirth, but also for 11 years after the childbirth [12].

The prevalence of LBP increases with the progress of pregnancy, especially in the late pregnancy, due to a weight gain and a center of gravity shift, resulting in increased lumbar load, combined with the role of hormones during pregnancy, can cause ligament relaxation. Continuous work, long standing and weight lifting during pregnancy are associated with LBP [13].

We found that the main causes of low back pain in young women were lumbar disc herniation, lumbar muscle strain and lumber hyperosteogeby. In particular, LDH patients accounted for the highest proportion of all patients with LBP, reaching 55.2%. LDH is the main cause of low back pain in young women after childbirth and this finding is consistent with several previous studies [14-16].

Previous studies have shown that there are gender differences in anatomy of the lumbar spine, as shown in Figure 5. In order to adapt to the increase of lumbar load during pregnancy, women have greater lumbar lordosis angle than men. Compared to men, women's spine has a greater statistically significant curvature [17]. This means that the lumbar range of motion is different in men and women. During pregnancy, women's lumbar load increases, the body center of gravity shifts, affecting the spinal stability and increasing the mechanical compression of lumbar intervertebral disc. Studies by Jung showed that the crude incidence of LDH in young women aged 30-40 was higher than in middle-aged men [18].

**Fig. 5.** Different lumbar lordosis angles are between female and male

One surprising finding in the current study was that in female LDH patients with lumbar pain, CT images showed that more than half of the patients did not find that the dural sac was compressed by the herniated disc. This result suggests that in young female patients with LDH, in addition to lumbar pain caused by herniated disc compression nerve, there are other reasons that can cause lumbar pain. Recent studies have shown that the severity of pain increased in patients with LBP as the deficiency of Vitamin D increased [7] and Vitamin D level was a factor related to patients with chronic nonspecific low back pain [19].

Vitamin D deficiency may be associated with chronic and nonspecific musculoskeletal pain. In our study, we measured serum 25 (OH) D levels in young female patients with LDH and compared it with healthy women and pregnant women. We found that 25 (OH) D levels in young female patients with LBP were lower than those in

young healthy women, this result is statistically significant ($p < 0.05$). Also we investigated the comparison of serum 25(OH) D levels between young female patients with LDH and pregnant women, there was a significant relationship between the two group, serum 25(OH) D levels of patients with LDH had a significantly lower than in pregnant women ($P < 0.001$).

In a review study that supports our research, the relationship between LBP and 25(OH) D levels has been established, it has been reported that patients with LBP have lower serum 25(OH) D levels [20].

Vitamin D in human body is mainly derived from skin synthesis. Although, food such as egg yolk, sea fish and animal viscera can supplement vitamin D, it cannot meet the needs of the body due to the insufficient source of vitamin D in natural foods. Therefore, vitamin D is mainly synthesized in the skin, when exposed to ultraviolet radiation. 25 (OH) D is the main storage form of vitamin

D in human body. Measuring the level of serum 25 (OH) D of pregnant women can help to understand whether there is a vitamin D deficiency in pregnant women [21].

In our study, the women in the second control group were in the 6th to 10th week of pregnancy. In order to prevent vitamin D deficiency, pregnant woman took vitamin D supplements, every day 400 IU. Therefore, in our results, vitamin D levels in pregnant women were significantly higher than those in female patients with LDH.

It is common knowledge that, that women due to pregnancy increase their weight, resulting in increased sagittal diameter of the abdomen, with the center of gravity shifting forward and the load on the lower back increasing, which results in pelvic anteversion and lumbar lordosis [23].

The increase of lumbar lordosis is a biomechanical regulation of the spine, which absorbs greater vertical impact load of the spine and transmits the load to the posterior annulus fibrosus and intervertebral joints of the intervertebral disc, thereby reducing the pressure of the intervertebral disc [24].

As the pregnancy progresses, the load on the L5 to S1 segment of the lower back increases, and a change in the weight distribution increases the load by 36%. Under the influence of mechanical factors, pain increased while

standing, sitting, bending, lifting, and walking. The last lumbar segment of the lumbar vertebra L5 contributes to nearly 40% of all lordosis cases [22].

CONCLUSION

In our study of female patients with LBP, more than half of patients are with LDH (55.2%), the highest ratio of herniated disk was found at L4-L5, and the ratio of these patients reached 46.2%. Indeed, disc hernias were common at L4 – L5, which is consistent with the majority of related studies [25]. There are few studies into the types of LDH in female patients. Our results show that the protrusion type in young female patients is more common (84.4%), which is inconsistent with the results of other studies based on a built type [26].

A limitation of this study is the lack of comparison with male patients because male and female patients differ in spinal anatomy, pre-surgical pain, conservative treatment choices and postsurgical outcomes [27-29]. In the future, we need to compare the differences between female patients and male patients with LDH, because we choose different rehabilitation and traditional Chinese medical treatment methods according to different clinical characteristics of LDH [30].

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Author's contribution:

All authors confirm their authorship according to the ICMJE criteria (all authors contributed significantly to the conception, study design and preparation of the article, read and approved the final version before publication).

Special contribution:

Wang X.J. – contribute to design and development of the protocol;

Wang X.J., Yang Y., Zhang X.Y., Ni Y.Z., Zhang Y., Zhao J.L., Wang F., Li X.H., Zhang X.L. – provide to date collection;

Wang X.J., Yang Y. – complete data analysis independently.

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The authors state that all the procedures used in this paper has been approved by the Hospital Expert Committee and comply with the ethical standards of the institutions that carried out the study and comply with the Helsinki Declaration as revised in 2013.

Consent for Publication:

Consent of patients (their representatives) to the processing and publication of non-personalized data was obtained.

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