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Surgical Strategy of Young Severe Obesity Patients with Lumbar Disc Herniation

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Abstract

Background: Young patients with lumbar disc herniation(LDH) tend to use minimally invasive techniques rather than early intervertebral fusion, but the high recurrence rate and the difficulty of thorough removal of osteophytes in the spinal canal become a thorny problem. For patients with high-risk recurrence of severe obesity and spinal canal stenosis, a modified posterior lumbar interbody fusion(MPLIF) procedure that includes insertion of a unilateral cage through the symptomatic side with supplementary bilateral pedicle screws has been conducted to reduce the recurrence rate and thoroughly remove calcified intervertebral discs(CID) and posterior vertebral margin osteoplasia (PVMO).

Materials and methods: Three young patients with severe obesity and lumbar disc herniation, all with CID or PVMO, underwent a bilateral MPLIF using a single cage and bilateral pedicle screws. The postoperative clinical evaluation was based on visual analogue scale (VAS), Oswestry Disability Index (ODI) for back pain and leg pain, and Japanese Orthopaedic Association Scores (JOA) for neurological recovery at multiple time points following the surgery. Radiological assessments were performed with CT and MRI at 1-month after preoperation, and positive and lateral plain radiographs were taken at three days after operation, 1, 6 and 12 months postoperation and at the most recent follow-up.

Results: Three patients all underwent a bilateral MPLIF using a single cage and bilateral pedicle screws and the mean duration for the surgeries was 101.67 min. The mean haemorrhage volume was 175 ml, and no blood transfusion was required for any of the cases. Twelve months postoperatively, all patients had achieved an Excellent or Good outcome (Excellent in 2 patients and Good in 1). None of the patients had recurrent disc herniation or fusion cage loss. The mean pain score was 7.33 prior to surgery and decreased to 2.00 at the 1-month postoperative examination.

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There was statistical difference in the improvement of VAS, ODI and JOA score after operation compared with that before operation. ($p<0.05$). A mean decrease of protruding calcified intervertebral disc on postoperative CT cross-section was 6.97 mm from the preoperative measurement to 1-month after operation follow-up examination was determined to be statistically significant ($p<0.05$). No significant complications or neurological deterioration occurred. None of the 3 patients appeared to have any fusion failure. No broken screw, screw loosening, significant cage migration or subsidence was observed in any of the cases.

Conclusions: Modified PLIF can fully decompress osseous stenosis, less damage to the posterior column of the vertebral body, lower probability of recurrent intervertebral disc herniation, loosening internal fixation screw and prolapse of intervertebral fusion cage. It is an effective method to treat severe obese LDH with CID or PVMO.

Keywords: ***Lumbar disc herniation; Intervertebral disc calcification; Severe obesity; Young patients; Intervertebral fusion***

1. Introduction

Because of the advantages of minimal trauma, accurate operation and quick recovery, percutaneous transforaminal endoscopic discectomy (PTED) technique is widely favored by young patients with lumbar intervertebral disc herniation [1-3]. Obese patients with intervertebral disc herniation have a high recurrence rate after nucleus pulposus resection by PTED because of the influence of weight pressure on disc [4]. The difficulty of the operation with PTED will increase if the patient is accompanied by CID or PVMO.

Excessive removal of bone under PTED may result in intraspinal hematoma, which may compress the spinal nerve and cause corresponding symptoms [5]. PTED can lead to a slight deterioration in the biomechanical characteristics of adjacent segment discs [6]. Obesity is a high risk factor for adjacent segment disease(ASD), and it is more likely to occur in young people who are overweight and exercise-intensive after minimally invasive surgery [7-9]. Posterior lumbar interbody fusion (PLIF) technique was used to remove the bilateral laminae, facets and spinous ligament complexes of the lumbar spine. The operative field of vision was fully exposed. Although it was convenient for the removal and decompression of the nucleus pulposus, it destroyed the structure of the middle and posterior columns of the spine and affected the stability of it [10,11]. Modified posterior lumbar interbody fusion(MPLIF) is an operation that combines the advantages of intervertebral foramen surgery and PLIF surgery. It can remove nucleus pulposus and relieve the pressure of nerve root and maintain the stability of the structure of spinous process ligament complex [12,13]. Lumbar fusion surgery can reduce lumbar's motion and accelerate the degeneration of the adjacent lumbar intervertebral disc [14,15]. Minimally invasive treatment such as PTED and percutaneous endoscopy is effective to young patients with LDH [16-18]. Therefore, lumbar fusion surgery in young patients is recommended only for patients with severe obesity and severe degeneration or obvious spinal stenosis.

To the best of our knowledge, there is a few reported in the medical literature talking about the effect of lumbar fusion in young patients with severe obesity and decompression method of lamina and facet of intervertebral joint by modified PLIF. The purpose of our study was to explore the effect of modified PLIF method on severe obesity young patients with lumbar disc herniation, and to analyze the surgical strategies of lumbar disc herniation in obese young people with different degenerative degrees.

Between January 2015 and May 2018, 3 young severe obesity patients (age ranging from 20 to 30 and body mass index (BMI)>35) with unilateral radiculopathy who were diagnosed with LDH with IDC and PVMO underwent a MPLIF using a single cage filled with a local morselised bone graft via the symptomatic side and performing bilateral pedicle screw fixation. The clinical outcomes, fusion success and related complications were analysed. Intraoperative blood loss, operation duration and postoperative hospitalised days were also recorded. Age, sex, responsible segment of lumbar intervertebral disc herniation, operation duration, intraoperative bleeding volume, time of antibiotic prophylaxis, time of drainage tube removal, length of hospitalization, and time of suture removal were recorded. The postoperative clinical evaluation was based on visual analogue scale (VAS) [19], Oswestry Disability Index (ODI) [20] for back pain and leg pain, and Japanese Orthopaedic Association Scores (JOA) [21] for neurological recovery at multiple time points following the surgery. Radiological assessments were performed with CT and MRI at 1-month after preoperation, and positive and lateral plain radiographs were taken at three days after operation, 1, 6 and 12 months postoperation and at the most recent follow-up. The VAS, ODI, JOA scores of the patients at 3 months after operation were compared with those of the patients before operation. Successful interbody fusion was marked by no loosening or loss of internal fixation and the formation of osseous fusion at the responsible segment. The height of intervertebral space and the length of osteophyte on the horizontal plane of CT were compared before and after operation.

2. Surgical Technique

Unilateral single cage insertion and bilateral pedicle screw fixation were performed on all patients. The patients were placed in the prone position under general anaesthesia. With the muscles adjacent to the spine on the symptomatic side retraced laterally to minimize damage, the area lateral to the lamina and the posterior joint was exposed. A transpedicular screw system was placed on the bilateral sides on the guide of the X-ray. Next, bilateral facetectomy and hemilaminectomy were performed on the symptomatic segments. The symptomatic nerve root was detected and decompressed carefully. Subsequently, the disc space for unilateral cage insertion was prepared with entire endplate curettage. The end plates of the central portion of the disc space were also curetted carefully. The contralateral disc space was filled as compactly as possible with autogenous morselised bone obtained from the laminectomy and facetectomy. Accordingly, a single cage filled with morselised bone graft material was inserted into the disc space on the symptomatic side. Eventually, the surgery was performed by compressing the intervertebral space slightly with pedicle screw fixation to secure stability and improve the bony union immediately postoperation. In the procedure, the spinous process, supraspinous and interspinous ligaments remained uninjured (FIG. 1. A and B).

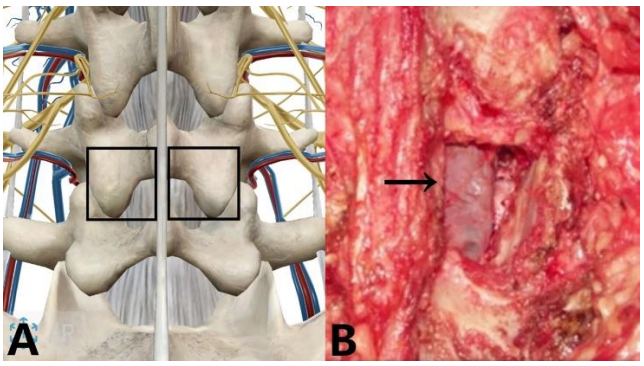

FIG. 1. **MPLIF method for reducing the extent of lumbar spinal canal.**

A: Using 3D animation model to imitate the skeletal structure of human spine, the black box represents the bilateral decompression range of the lumbar 4/5 intervertebral space. **B**: In reality, the area designated by the black arrow is consistent with the decompression range of the black box in figure A, removing the inferior articular process of the upper vertebral body, part of the lamina, hyperplastic and cohesive osteophytes and thickened ligamentum flavum.

The median lumbar incision was removed. Skin incision, subcutaneous adipose tissue, lumbar and dorsal deep fascia were performed. Longissimus thoracis and multifidus muscle were dissected layer by layer from both sides of the Supraspinal Ligament to the outer margin of the articular process without exposing the transverse process. The posterior structures such as spinous process, lamina margin, supraspinal and interspinal ligament were retained. Firstly, the contralateral small window decompression was performed, and the ligamentum flavum was removed, then the affected side decompression was performed. The lamina was removed with gun forceps from the medial margin of the inferior articular process near the midline of the spinous process (1/3 of the lamina was retained). The inferior articular process was excised to expose the articular surface of the superior articular process. The nerve dissector separated the area where the ligamentum flavum adhered to the dura mater or nerve root, then performed ligamentum flavum resection. At the same time, the articular surface of the superarticular process with proliferative cohesion was removed, and the dural sac lateral spinal canal was exposed. The nerve root canal and lateral recess were decompressed simultaneously. Elbow gun forceps were used to decompress the contralateral hyperplasia of ligamentum flavum at an angle of about 50 degrees inclined to the horizontal plane. It is not necessary to expose the superior nerve root when separating inward along the dura mater. The nerve hook gently pulls the dura mater horizontally to the other side, then obliquely removes the PVMO and CID with gun forceps and small nucleus pulposus forceps. After that the small window of intervertebral disc were opened with a sharp blade. Nucleus pulposus should be removed with nucleus pulposus forceps as far as possible. Next, the fibrocartilage and the upper and lower endplates were removed with a curette, and the endplates were smoothed with a grinder. Then the appropriate size of the interbody fusion cage was selected. Before the fusion cage was implanted into the intervertebral space, the interbody fusion cage was filled with collected fragments bitten from lamina and articular process. The iliopsoas, quadriceps femoris contractions and ankle joint exercises can begin one hour after surgery. On the third day after operation, drainage tube and catheter were pulled out and the film was taken after then. Patients can get out of bed and walk under rigid waistline protection, and wear them continuously for one month.

3. Clinical Outcome Assessment

VAS, ODI for back pain and leg pain, and JOA for neurological recovery at multiple time points following the surgery. Radiological assessments were performed with CT and MRI at 1-month after preoperation, and positive and lateral plain radiographs were taken at three days after operation, 1, 6 and 12 months postoperation and at the most recent follow-up.

Success of fusion was evaluated by filling the intervertebral space with continuous bone trabeculae and the upper and lower endplates were disappearing. Fusion cage was surrounded by bone trabeculae and mixed with surrounding bone, showing a structure similar to "reinforced concrete". The failure of fusion was judged by follow-up of more than 6 months when the intervertebral space was not filled with trabeculae or the upper and lower endplates were still clearly visible. Another indication is that the intervertebral mobility is more than 5 degrees of motion on lateral flexion-extension radiographs. The removal of osteophytes before and after surgery requires imaging evaluation. It requires calculating the length of the

intervertebral space osteophyte removed from the responsible segment of the spinal canal, i.e. the length of the intervertebral space before operation minus the length after operation. The calculation of intervertebral height recovery is equally important, namely, the height of the intervertebral space on the axis of the responsible segment after operation minus the height before operation. At the same time, the above values before and after operation are compared to evaluate whether there are statistical differences.

4. Statistical Analysis

Statistical analyses were performed using SPSS (version 22.0; SPSS, USA). Mean values (MV) and standard deviations (SD) were calculated. Differences between preoperative and postoperative group were statistically compared using paired-samples t test. All reported *p* values were two-tailed, and *p* values less than 0.05 were considered significant.

5. Results

The mean age at the time of surgery was 26 years (ranging from 21 to 29 years). The mean BMI was 35.39 (ranging from 35.08 to 35.59). The study population was all male. All of the patients were Han nationality of ethnic Chinese, and the inclusion diagnosis was limited to unilateral radiculopathy caused by LDH with CID and PVMO. The responsibility sections were as follows: 1 case with L4/5 section, 1 case with L5/S1 section and 1 case with L4/5 and L5/S1 sections. Patients with conditions requiring bilateral nerve root decompression and cage insertion were excluded from the symptomatic side. All patients were followed for more than 1 year. The mean follow-up period was 20 months (ranging from 15 to 24 months). The patients all had a single or two levels fusion, and the duration of the surgeries was 101.67 mins. The mean haemorrhage volume was 175 ml, and no blood transfusion was required for any of the cases. There are two periods when antibiotics are used to prevent infection, namely 30 mins before operation and the first day after operation. The drainage tube was removed in all cases on the 3rd day after operation. Suture of surgical area in all cases was removed 10 days after operation. The mean hospitalisation period was 11.67 days.

One month postoperatively, all patients had achieved an excellent or good outcome (Excellent in 2, general in 1). Excellent efficacy means significant improvement in pain, sensation and muscle strength. General efficacy means that the pain symptoms of the lumbar and lower limbs are obviously improved, but the muscle strength and numbness have not recovered significantly. The mean pain score was 7.33 prior to surgery and had decreased to 2.33 at the 1-month postoperative examination. No significant complication or neurological deterioration occurred during the follow-up. Comparing the VAS, ODI and JOA scores of the patients before and 1 months after the operation is shown in TABLE 1. No fusion failure or loosening or falling off of the internal fixator occurred during the follow-up.

The radiological outcomes were listed as follows. At the 12-month postoperative examination, none of the three patients appeared to have fusion failure. No screw loosening, broken screws, significant cage migration or subsidence was observed in any of the cases. The length of proliferative osteophytes in the spinal canal after operation was significantly reduced on the horizontal CT images compared with preoperation ($p<0.05$), the imaging data was also arranged in TABLE 1. CT and MRI imaging appearances before and after operation were shown in FIGURE 2.

TABLE 1. **VAS, ODI, JOA and CTL scores at different time points in patients.**

Time	n	VAS	ODI(%)	JOA	CTL
Before operation	3	7.33 ± 0.58	69.00 ± 6.56	13.00 ± 2.00	8.17 ± 0.15
1 month after operation	3	3.00 ± 1.00*	25.00 ± 5.00*	23.67 ± 3.21*	1.20 ± 0.30*

CTL means the length of proliferative osteophytes in the spinal canal.

Asterisks represent statistical differences, $p<0.05$.

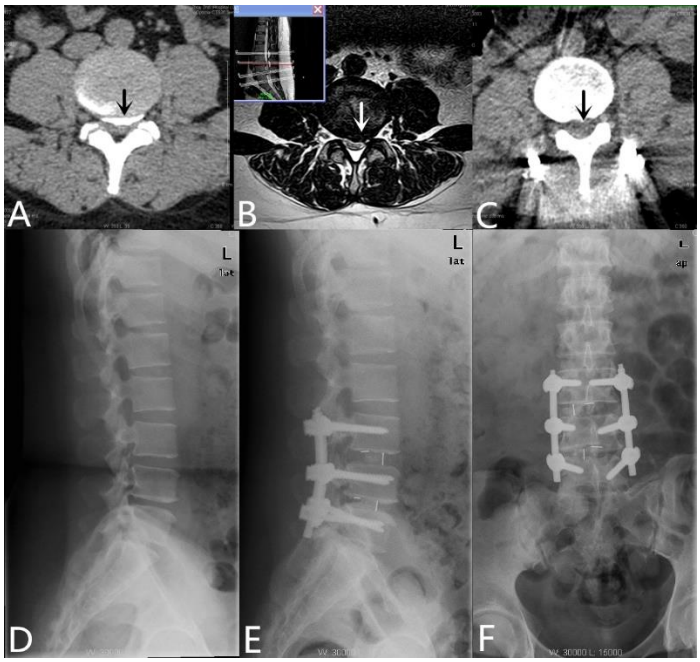

FIG. 2. **X-ray, CT and MRI imaging performance before and after surgery.**

A shows a cross-sectional CT image of the disc herniation of the preoperative segment, and a black arrow indicates the calcification of the disc. **B** is the MR image of the corresponding cross section before surgery, and the area indicated by the white arrow is equivalent to the black arrow of Figure A. **C** is a CT cross-sectional image of the disc herniation and calcification after removal of the responsible segment, and the black arrow indicates that the herniated and calcified intervertebral disc has been removed. **D** shows preoperative X-ray lateral image. **E** shows lateral X-ray image after operation. F shows positive X-ray images after operation.

6. Discussion

Degeneration of intervertebral disc is the main cause of lumbar disc herniation [22]. At present, the pathogenesis of intervertebral disc degeneration is not clear. Many scholars believe that it is related to nutritional disorders, abnormal stress, inflammatory factors, cell apoptosis and other factors [23-25]. In the latest progress, Diabetes is also an independent risk factor in the latest research [26].

Lumbar intervertebral disc herniation tends to be younger, which may be related to the acceleration of modern urban life and work rhythm, heavy physical work and long-term sitting of mental workers. Long-term lumbar fatigue reduces the contents of proteoglycan and collagen in the matrix of intervertebral disc, decreases the water content in the nucleus pulposus, weakens the function of collagen fiber scaffolds, and abnormal mechanical load easily causes traction injury caused by tearing of annulus fibrosus of intervertebral disc [27]. Mattila VM et al. conducted a study of 57408 adolescents and concluded that daily smoking in males and frequent participation in sports clubs and overweight in females measured at adolescence were statistically associated with lumbar discectomy at an 11-year follow-up [28]. The study of these common risk factors and their modifications may lead to a better understanding of the causes of lumbar disc herniation.

Considering age, young patients with disc herniation tend to be treated conservatively or minimally invasively. Kim NH et al. used radiofrequency ablation technology to treat LDH patients with good results. This method can significantly alleviate pain, rapid symptom improvement, early return to work [29], but there is the possibility of recurrence and neuroelectric injury after surgery, and high technical requirements for operators [30-31]. Intervertebral foraminoscopy technology has a huge impact on young people. Attraction, and has been popularized all over the world, the advantages are small trauma, fast recovery, moderate price. Postoperative patients can go down as soon as possible and quickly recover to daily life [32-34]. However, the residual nucleus pulposus will further degenerate the intervertebral disc tissue, and the lumbar spine stress in severe obesity patients is huge.

Under this effect, the residual nucleus pulposus is protruded again through the weak posterior longitudinal ligament and annulus fibrosus, which is the main cause of recurrence after minimally invasive surgery [35]. Minimally invasive decompression and removal of rigid structures are limited in patients with severe degenerative changes of the lumbar spine, moderate to severe spondylolisthesis, spinal stenosis or severe calcification of the intervertebral disc [36,37]. At that time, posterior lumbar spine incision and bone graft fusion were often needed.

Obesity, commonly defined as a body mass index (BMI) of >30 kg/m^2. In the United States the percentage of adolescents with obesity has reached an alarming level of 21% [38]. And Obesity affects one-third of the adult U.S. population, accounts for 10% of all U.S. healthcare expenditures, and is associated with numerous clinical sequelae [39]. Chronic disease reports in China show that the rates of overweight and obesity in adults are 30.6% and 12.0% respectively [40]. Previous studies have suggested that obese patients have a stronger tendency to have an LDH [41,42] and further an elevated risk of recurrence and revision procedures [43-45].

Rihn JA et al. and Mirtz TA et al. analyzed the mechanism of intervertebral disc herniation in obese patients, pointed out that overweight body mass index increased abnormal stress of lumbar spine, increased pressure of intervertebral disc, accelerated the degeneration of intervertebral disc, and then led to intervertebral disc herniation [46-49]. At the molecular level, high levels of adipokines and growth factors in obese patients accelerate intervertebral disc degeneration through physiological responses [50,51]. A retrospective case-control series at a university-based level-1 trauma center was carried out, the result shows that obesity is a risk factor for cauda equina syndrome(CES) from disc herniation. The CES cases also had a greater amount of herniated material, focally narrower canal, and larger epidural fat deposits. The latter may be the mechanism

linking obesity with CES [52]. Vigorous exercise is also highly correlated with the probability of surgical removal of disc herniation in adolescents [28].

Degenerative changes of the lumbar spine, PVMO and CID were not serious in most young patients with normal BMI or mild obesity. Minimally invasive spinal techniques such as coblation nucleoplasty (CN), microendoscopic discectomy(MED), PTED or percutaneous endoscopic interlaminar discectomy (PEID) can achieve good results [53-56]. And they have less soft tissue damage, destruction of spinal bone structure and bleeding during operation, which are conducive to maintaining the stability of the lumbar posterior column. Young patients with L5/S1 herniated disc and high iliac crest were often obstructed by iliac crest during the operation of PTED. The problem can be easily solved by using surgical strategy of PEID. Minimally invasive treatment of lumbar spine can be regarded as a kind of excessive operation before lumbar fusion for young obese people with less severe degeneration. If the patients have recurrent lumbar disc herniation with severe lumbar degeneration or lumbar spondylolisthesis in the future, posterior lumbar fusion is feasible. Mattis and Madsbu et al. conducted a multicenter study on lumbar microdiscectomy in obese patients. Their findings lead to the conclusion that although they had more minor complications, obese individuals experienced improvement after lumbar microdiscectomy for lumbar disc herniation similar to that of nonobese individuals [57]. Cole and Jackson evaluated the use of minimally invasive techniques to treat lumbar disc herniation in obese patients and concluded that this minimally invasive approach is the preferred technique to manage these patients because of favorable results and a trend toward reduced infectious complications [58].

Although minimally invasive is popular in treatments of young patients with lumbar disc herniation, it is not the "golden oil" for obese ones, and some studies indicated that patients with severe obesity have little benefit from minimally invasive treatment [59]. To make matters worse, the risk of recurrence of intervertebral disc herniation is positively correlated with body BMI [59-62]. When LDH accompanied by PVMO, severe CID, and serious stenosis or spondylolisthesis of the spinal canal, minimally invasive laminectomy has a very limited vision and physical space to manipulate surgical equipment, which may be disorienting and prevent totally complete decompression of nerve roots or dura mater [63]. The operator is required to have rich experience in endoscopy and strong imagination of three-dimensional structure when using the foramen technique to decompress patients with lumbar disc herniation accompanied by mild spinal stenosis or spondylolisthesis. There is no big data to support its effectiveness and safety [64].

Severe obesity is a high risk factor for recurrence after endoscopic nucleus pulposus removal. The disc, which seems to have good elasticity, is actually undergoing degenerative changes of the lumbar spine at an incredible rate due to the pressure of excessive BMI, manifested by PVMO, CID, hyperosteogeny of the upper and lower articular processes, and even spondylolisthesis of the lumbar spine. Vertebral spondylolisthesis, which often occurs in middle-aged and elderly patients, can also occur in these young patients with severe obesity. Degeneration will increase the difficulty of endoscopic surgery, even make the operation unable to decompress sufficiently, affecting the effect of surgery. Therefore, it is questionable whether all young patients with severe obesity with lumbar disc herniation can be treated by minimally invasive non-fusion surgery. Open lumbar fusion is an ideal surgical method for young patients with lumbar disc herniation and severe obesity accompanied by degeneration. Transforaminal lumbar interbody fusion was an alternative to posterior lumbar interbody fusion for decompression surgeries. Intervertebral fusion technology provides a secure fixation of the spinal segments while

maintaining load carrying capacity and restoring intervertebral height, in addition to traditional lumbar posterior fusion surgery, transforaminal lumbar interbody fusion was an alternative to posterior lumbar interbody fusion for decompression surgeries [65,66]. Even the most common adjacent spondylosis after lumbar fusion can be solved by lumbar fusion technology [67]. In addition, the ability to reconstruct the anterior column after removal is very important because 80% of the compression, torsion and shear forces are transferred through the anterior column [68,69]. PLIF can relieves the pain resulting from nerve compression by neural decompression of the symptomatic side, and it can restores disc height, maintains vertebral alignment, restores weight bearing and reconstructs stability of the segment [70,71].

In this paper, the MPLIF operation method is used to decompress the spinal canal and release the lumbar lateral crypt, retaining the spinous process and interspinous ligament, and protecting the stability of the lumbar posterior column. The same method as Bingqian C et al. is the use of oblique decompression techniques to reduce the risk of nerve root damage [12]. We believe that the decompression of the healthy side of the spinal canal first, and then the affected side can reduce the secondary damage of edema and adhesion nerve root bulging. Ingenious application of nerve strippers in the operation to detect and push the hyperplastic epiphysis in the spinal canal can effectively reduce the compression of the dura mater by the osseous structure of the posterior margin of the vertebral body. De la et al. studied the effect of obesity on lumbar fusion surgery and found that the probability of recurrence of intervertebral disc after lumbar fusion is low and can achieve a high rate of pain relief [72].

Considering the activity and movement range of young patients, non-fusion lumbar dynamic fixation is also an effective method to treat young patients with lumbar disc herniation. Elastic peek rod and matching screw are used to fix the lumbar vertebrae to maintain a certain range of intervertebral height, while allowing the lumbar vertebrae to have a certain flexion, displacement and torsion function [73]. This method can reduce the incidence of adjacent segment degeneration by retaining a small amount of lumbar motion [74].

We also used a dynamic nail stick system to treat a 29-year-old man with a body mass index of 35 who had lumbar disc herniation. Initially, the patient was considered young, and the posterior small window nucleus pulposus removal surgery was performed. After 2 years later, the lumbar disc herniation recurred. The surgical procedure for re-operation is dynamic nail stick system fixation and nucleus pulposus removal. The postoperative x-ray is shown in Figure 2. The symptoms of the patient recovered well after operation. The vas, odi scores were significantly improved in the 2 years during the follow-up, and there were no symptoms of recurrence and significant motor dysfunction.

Early lumbar fusion surgery is not necessarily reliable for young patients with a body mass index greater than 40 according to our experience because of the risk of postoperative intervertebral bone graft nonunion and intervertebral cage dislocation is high. It is recommended to avoid sedentary, heavy lifting, and severe exercise and over-extension and flexion within 3-6 months after lumbar fusion surgery. The buoyancy of water can lower its body weight and thus reduce the pressure on the intervertebral disc. Therefore, swimming as a way of exercising is a good choice. Of course, in order to reduce the adverse effects of obesity itself on the patients, such as diabetes, high blood pressure, and high blood lipids [75], weight loss surgery is a good choice [76].

7. Conclusions

Individualized surgical strategy should be formulated according to the comprehensive consideration of BMI value and degeneration degree of young obese patients with LDH. Foraminoscopy such as CN, MED, PTED or PEID is preferred in young patients with mild degeneration or low BMI index (less than 35). In patients with moderate or severe PVMO or CID, the bilateral MPLIF and responsible segment fusion may be a better choice than minimal invasive. However, the number of cases in this study is small with less experience in surgery. High-quality randomized controlled trials are required to further study the efficacy and safety of MPLIF in treating young obese patients with LDH.

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