Universe Scientific Publishing

The Follow-up Report of MRI After Transforaminal Endoscopic Surgery of Lumbar Disc Herniation with Spinal Stenosis

Limeng Sun[1], Hu Yan[2*], Xiao Jia[1]

1. Department of radiology, The Traditional Chinese Medicine hospital of Taian, Taian 271000, China.
2. Department of Spine Surgery, The Traditional Chinese Medicine hospital of Taian, Taian 271000, China.
Address correspondence and reprint requests to Hu Yan*.E-mail: Yanhu19871110@126.com

Abstract: Objective: To observe the imaging changes of MRI in the responsible disc area after modified TESSYS foraminal scopy in patients with lumbar disc herniation (LDH), and to explore the postoperative repair time of the responsible disc area, so as to provide imaging reference for the rehabilitation plan of the patients. Materials: To investigate the VAS score and MRI imaging of patients with lumbar disc herniation and spinal stenosis after transforaminal endoscopic surgery, which to lay the foundation for the rehabilitation plan. Methods: Ten patients with lumbar disc herniation (L4/5, L5/S1) with spinal stenosis were collected and followed up by MRI and the VAS score on 1 week, 1 month, 4 months and 6 months after transforaminal endoscopic surgery. Results: The VAS score were significantly lower than those before operation ($P < 0.01$) on 1 week, 1 month, 4 months and 6 months after transforaminal endoscopic surgery. There was no statistical significance in the VAS score ($P > 0.05$) on 1 month and 6 months after operation. The high signal could be seen around the intervertebral foramen and nerve roots on the operation site on 1 week, 1 month and 4 months after operation Which disappeared at 6 months after operation. Conclusion: The symptoms of low back and leg pain in patients with lumbar disc herniation and spinal canal stenosis disappeared after 1 month, while the inflammatory reaction symptoms of intervertebral foramen and nerve root were disappeared on 6 months.

Keywords: Lumbar Disc Herniation; Spinal Stenosis; Transforaminal Endoscopic Surgery; MRI

Introduction

Lumbar disc herniation (LDH) is one of the main causes of lumbar and leg pain in modern people [1]. At present, due to the gradual trend of minimally invasive spinal surgery, foraminoscopy has become one of the mainstream minimally invasive surgical methods for LDH due to its remarkable efficacy and low trauma. At present, the most widely used TESSYS technology is created by Yeung et al [2] and Hoogland[3]. The improved TESSYS technology is formed on the basis of TESSYS technology by improving the puncture point, adjusting the puncture Angle, decompression range, etc. Its advantage is to reduce the incidence of postoperative complications while taking into account the stability of the spine [4]. At present, although there are various scoring scales to evaluate the recovery of patients, there is a lack of criteria for judging the postoperative recovery of the responsible disc area [5]. Therefore, this study conducted MRI examination of the responsible disc area after lumbar disc herniation through foraminoscopy to observe the changes in the signal of the responsible disc area, so as to provide imaging data for the postoperative repair time of the responsible disc area.

1. Material and Method

Thirty patients with lumbar disc herniation accompanied with spinal stenosis hospitalized in our department from January 2019 to January 2021 were selected as the study objects, including 16 males and 14 females, with the minimum age being 30, the maximum age being 45, and the average age being 35. All patients had L5/S1 disc herniation, VAS scores and MRI examinations were performed at 1 week, 1 month, 4 months and 6 months after surgery as required.

Inclusion criteria: Reference was made to the relevant diagnostic criteria of Practical Osteology [6] and Clinical Diagnosis and Treatment Guidelines. Branch of Orthopedics [7]:

① Typical clinical manifestations: low back pain with radiative leg pain (root pain), leg numbness, waist stiffness, limited movement, and occasional changes in urination and defecation function in severe cases;

② Physical examination: lumbar tenderness with radiating pain of lower limbs, positive for straight leg elevation test or Lasegue sign or straight leg elevation enhancement test Bragard sign, abnormal neurological function (sensory, muscular, reflex).

③ Related imaging examination: The diagnosis can be confirmed according to the anterolateral and lateral lumbar spine, hyperextension and flexion film, lumbar disc CT scan and lumbar MRI scan.

Exclusion criteria [8] : ① degenerative slip or instability; ② Congenital spinal stenosis; ③ Have a history of lumbar surgery, fracture, tumor, infection, diabetes and vasculitis; ④ Pregnant women and people with mental illness.

2. Surgical methods [9]

All patients were treated with German Maxmorespine foraminal lens equipment, and modified TESSYS technology was adopted in the surgical methods.

Postoperative treatment: bed rest, wake up with waist protection after 24h, no bending, 3-7 days without any abnormal discharge. Waist circumference protection for 4 weeks after discharge, heavy physical labor is prohibited for 6 months.

Follow-up: All patients underwent MRI examination at 1 week, 1 month, 4 months and 6 months after discharge.

3. Statistical methods

Data were analyzed by SPSS 18.0 statistical software, expressed as mean ± standard deviation ($\bar{X}\pm sd$), and one-way analysis of variance was used for inter-group comparison. $P < 0.05$ would have significant statistical significance, $P < 0.01$ would have extremely significant statistical significance.

4. Results

The average operation time was 70min, the average blood loss was 20 ml, and the average postoperative hospitalization was 5 days. Follow-up was 6 months.

The VAS scores of the 30 patients were shown in Table 1.The results showed that the VAS scores of 30 patients at 1 week, 1 month, 4 months and 6 months after surgery were all lower than those before surgery, with significant statistical significance ($P < 0.01$). The VAS score at 1 month, 4 months and 6 months after the operation was significantly improved compared with that at 1 week after the operation ($P < 0.05$), while the VAS score at 1 month, 4 months after the operation and that at 6 months after the operation was not statistically significant ($P > 0.05$). None of the 30 patients had dural sac tears during the operation. There were no serious complications such as intervertebral space infection and permanent nerve root injury.

Time	Number of patients	VAS score
Pre-operation	30	6.15±0.324
1 week after surgery	30	3.20±0.041 *
1 M after surgery	30	1.43±0.021 * Δ
4 M after surgery	30	1.41±0.031 * Δ
6 M after surgery	30	1.21±0.019 * Δ ★

Table 1

Compared with pre-operation, * $p < 0.01$, which had significant statistical significance; The $\Delta p < 0.05$ was statistically significant at 1 month, 6 months and 1 week after surgery. 6 months after surgery and 1 month after surgery, ★ $p > 0.05$, no statistical significance.

MRI findings of patients (Fig. 1-Fig. 4)

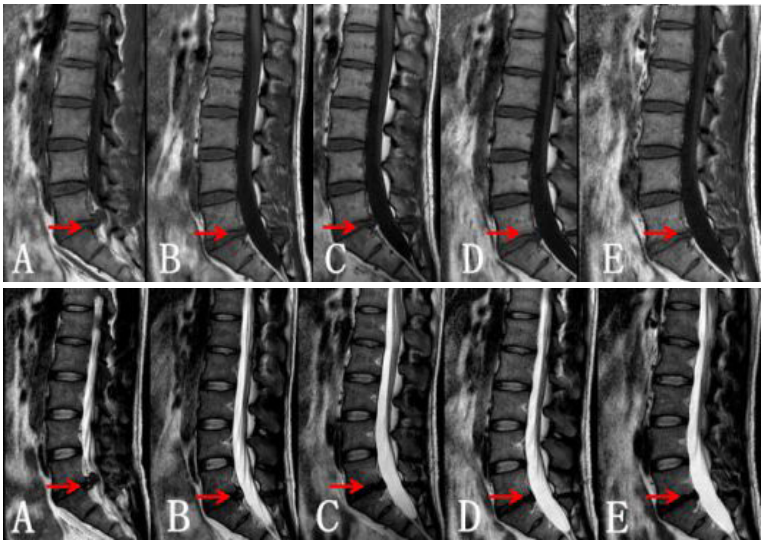

Fig. 1 MRI T1 image and Fig.2 MRI T2 imge (red arrow represents the operative area)

A: Before surgery; B: 1 week after surgery; C: 1 month after surgery; D: 4 months after surgery; E: 6 months after surgery;

A: Preoperative MRI showed that the L5/S1 intervertebral disc was prolapsed and free, and the spinal canal was obviously occupied.

B-E: From 1 week to 6 months after surgery, MRI showed that the protruded free disc with L5/S1 was removed surgically, the vertebral canal occupied disappeared, and no new disc herniation was observed.

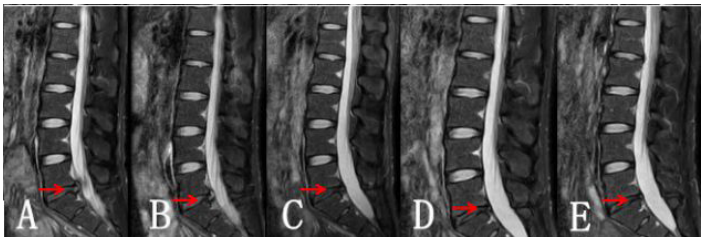

Figure 3 MRI SPAIR(red arrow indicates the operative area)

A: Before surgery; B: 1 week after surgery; C: 1 month after surgery; D: 4 months after surgery; E: 6 months after surgery;

A: Preoperative MRI showed that the L5 ~ S1 intervertebral disc was prolapsed and free, and the spinal canal was obviously occupied.

B-E: From 1 week to 6 months after surgery, MRI showed that L5-S1 prolapsed free discs were surgically removed,vertebral canal occupying disappeared, no new disc herniation, and the signal at the posterior margin of the intervertebral space was equal or low.

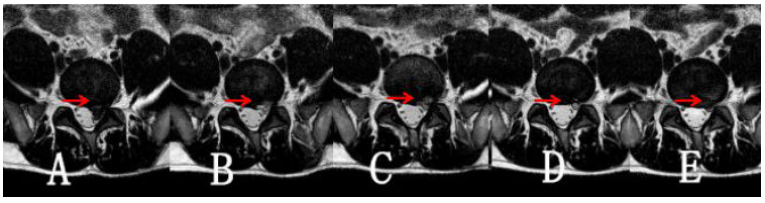

Fig. 4 MRI cross section (red arrow indicates the operative area)

A: Before surgery; B: 1 week after surgery; C: 1 month after surgery; D: 4 months after surgery; E: 6 months after surgery;

A: Preoperative MRI showed that the L5/S1 intervertebral disc was prolapsed and free, and the spinal canal was obviously occupied.

B-D: From 1 week to 4 months after surgery, high signals can still be seen in the operating area of the duty disc.

E: 6 months after surgery, the high signal in the operating area of the duty disc disappeared, presenting equal or low signal.

5. Discussion

LDH is a kind of fibrous annulus injury and rupture caused by lumbar intervertebral disc degeneration, inflammation and abnormal

stress in different degrees. As a result, the intervertebral disc, nucleus pulposus and cartilaginous endplate protrude in the spinal canal and come into contact with the blood environment, stimulating or oppressing adjacent spinal nerve roots [10] and provoking human immune response. Spinal lesions causing a range of symptoms such as back and leg pain.

In 2002, the TESSYS technology proposed by Professor Hoogland [11] in Germany expanded the surgical path from the Kambin safety triangle to the formed foramen. Zhu Kai et al. [12] summarized the steps as puncture, placement of working channels and endoscopic operation. Since then, many surgeons have improved surgical methods in terms of puncture point selection, puncture Angle, puncture needle location and other aspects based on the basic principles of TESSYS technology of predecessors. For example, Bai Yibing et al. [13,14] proposed "Broad Easy Immediate Surgery". This is to replace targeted disc removal with complete relief of nerve root compression. Among them, the modified TESSYS technology adopted in this study has significant advantages in terms of anesthesia risk, traction damage to nerve roots and dural sac, and postoperative scar tissue formation.

In order to study the repair of intraoperative wound, the VAS score and MRI findings of lumbar disc herniation were observed after foraminioscopy. The results showed that the VAS scores of all patients were lower before surgery, 1 week after surgery, 1 month after surgery, 4 months after surgery, and 6 months after surgery, with statistically significant comparison ($P < 0.01$). There was no statistical significance in VAS scores at 1 month, 4 months and 6 months after the operation ($P > 0.05$), indicating that the clinical symptoms of the patient were significantly relieved immediately after the operation, and basically disappeared 1 month after the operation. MRI sagittal T1, T2 and lipid-pressure sequences showed L5-S1 prolapse from 1 week to 6 months after surgery, free intervertebral disc disappeared, vertebral canal space disappeared, and no new intervertebral disc herniation. Transsectional MRI scan showed that T2 hypersignal was still visible in the operating area of the responsible disc from 1 week to 4 months after surgery, and the hypersignal disappeared in the operating area of the responsible disc 6 months after surgery, indicating that the inflammatory response around the foramen and nerve roots disappeared 6 months after surgery.

The study showed that the VAS score showed that the clinical symptoms of the patient tended to be stable 1 month after the operation, while MRI showed that the operative area signal of the patient was stable 6 months after the operation, and the patient avoided strenuous activities and carried out effective rehabilitation exercises within 6 months to prevent the recurrence of the disease.

However, there are some shortcomings in this study. First, there is a lack of long-term follow-up studies with large samples, which may lead to the bias of research results. Secondly, the follow-up time of this study is limited, and longer follow-up may be required to comprehensively and accurately evaluate the recovery time and intensity of patients with modified TESSYS after surgery. Finally, with the further development of spinal foraminoscopy, evidence-based medicine is also needed for the stability of postoperative spinal biomechanics.

References

[1] Tanaka M, Arataki S, Mehta R, et al. Transtubular Endoscopic Posterolateral Decompression for L5-S1 Lumbar Lateral Disc Herniation[J]. Journal of visualized experiments: JoVE. 2022.

[2] Yeung AT, Tsou PM. Posterolateral endoscopic excision for lumbar disc herniation: Surgical technique, outcome, and complications in 307 consecutive cases. Spine (Phila Pa 1976). 2002 Apr 1;27(7):722-31.

[3] Hoogland T, Schubert M, Miklitz B, Ramirez A. Transforaminal posterolateral endoscopic discectomy with or without the combination of a low-dose chymopapain: a prospective randomized study in 280 consecutive cases. Spine (Phila Pa 1976). 2006 Nov 15;31(24):E890-7.

[4] Yan H, Sun LM. Clinical study on improved TESSYS technology [J]. World Latest Medical Information Abstracts (Continuous Electronic Journal),2021,(11th issue): 48-49.(In Chinese)

[5] Ostelo RW, Costa LO, Maher CG, de Vet HC, van Tulder MW. Rehabilitation after lumbar disc surgery: an update Cochrane review. Spine (Phila Pa 1976). 2009 Aug 1;34(17):1839-48.

[6] Bredow J, Oppermann J, Scheyerer MJ, et al. Lumbar lordosis and sacral slope in lumbar spinal stenosis: standard values and measurement accuracy[J].Arch Orthop Trauma Surg, 2015,35(5):607-612

[7] Li ZF, Yan H. Clinical study of modified TESSYS technique in the treatment of lumbar spinal stenosis [J]. Massage and Rehabilitation Medicine, 2018,9(19):45-48. (In Chinese)

[8] Practical Osteology II [M]. Beijing: People's Military Medical Publishing House, 2012:2047-2050.(In Chinese)

[9] Chinese Association of Traditional Chinese Medicine. Clinical Diagnosis and Treatment Guide · Department of Orthopedics [M]. Beijing: People's Medical Publishing House.(In Chinese)

[10] Bredow J, Oppermann J, Scheyerer MJ, et al. Lumbar lordosis and sacral slope in lumbar spinal stenosis: standard values and measurement accuracy[J]. Arch Orthop Trauma Surg, 2015,35(5):607-612.

[11] Li ZF and Yan H. Clinical study of modified TESSYS technique for treatment of lumbar spinal stenosis [J]. Massage and Rehabilitation Medicine, 2018,9(19):45-48. (In Chinese)

[12] Li XJ, Tan D, Li SB. Percutaneous foraminal TESSYS technique for treatment of elderly lumbar disc herniation [J]. Chinese Journal of Bone and Joint Injury, 2019,35(7):724-726. (In Chinese)

[13] Hoogland T, Schubert M, Miklitz B, et al. Transforaminal postero-lateral endoscopic discectomy with or without the combination of a low-dose chymopapain:a prospective randomized study in 280 consecutive cases[J]. Spine,2006,31(24):E890-897.

[14] Zhu K, Tan J, Zhang YF. Progress of endoscopic decompression under percutaneous posterolateral foraminal approach in the treatment of lumbar spinal stenosis [J]. Chinese Journal of Spinal Cord, 2017, 27 (3): 268-271. (In Chinese)

Supported by Tai 'an City Science and Technology Innovation Development Project Funds(No:2021NS229)