CLINICAL ARTICLE

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Validity of Paramedian Tangential Approach to L5-S1 Far-Lateral Lesions

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Objective : There are various surgical approaches to far-lateral lesions in the L5-S1 intervertebral space. Of these is the validity of a paramedian tangential approach is being investigated in this study.

Methods : A retrospective study was conducted on 25 patients who had been diagnosed as having a far-lateral L5-S1 disc herniations, osteophyte, costal process hypertrophy, and had undergone a paramedian tangential approach from November 1999 through December 2003. The degree of symptoms and improvement were compared via the visual analog pain scale, before and after surgery.

Results : This study included 4 males and 21 females with a mean age of 62±11.8 years old. The average follow-up period after surgery was 8.2±2.7 months. The visual analog pain scale taken before surgery was 6.7±1.1 points, while the post-surgical scale was 2.4±0.9 points showing a significant decrease ($p < 0.05$). There were no complications that developed during surgery.

Conclusion : A paramedian tangential approach is less invasive in the soft tissue than that of the median approach. This approach may effectively reduce nerve root compression and expand intervertebral foramens, and is devoid of the risk of spinal instability after surgery. The authors suppose that a paramedian tangential approach is quite an effective technique to relieve compression in the far-lateral L5-S1 intervertebral space.

KEY WORDS : Paramedian tangential approach · L5-S1 lesions · Far-lateral disc herniations.

Introduction

With far-lateral lumbar disc herniations, compression dose not occur at the lower nerve root as in case of classical herniations, but at the upper root which leaves the spinal canal just above the herniated disc[1,6,16,17,19].

Macnab et al. had suggested the 'Hidden Zone', in lumbar disc herniations cases which causes radiating pain in the lower extremities and the negative findings in the contrast media test. Now this zone is no longer anatomical hidden zone owing to exact anatomical definition of the offending lesion by properly performed imaging techniques, computerized tomography(CT) or magnetic resonance imaging(MRI) scan, or both[6,9,12,13,18,19].

Far-lateral lumbar disc herniations take up 2.6~11.3% of the total number of lumbar disc herniations cases[2,3,16,18,19]. It occurs the most in the L4-L5 level[18]. Particularly, the surgical approach to L5-S1 far-lateral disc herniations is difficult due to its anatomical peculiarity. However, many surgical methods have been attempted[3,7,8,10,11,14,16,18].

The purpose of this study is to investigate the validity of a paramedian tagential approach to L5-S1 far-lateral lesions.

Materials and Methods

A retrospective study was conducted on 25 patients of far-lateral L5-S1 lesions who had undergone a parmedian tangential approach, from November 1999 through December 2003 (Table 1). This study included 4 males (16%) and 21 females (84%) with a mean age of 62±11.8 years old. The age distribution ranged from 46 to 82 years old.

All lesions occurred unilaterally in a single segment. Eighteen patients had far-lateral lumbar disc herniations, while four showed nerve root compression secondary to bone fragmentation. Three showed nerve root compression due to costal process hypertrophy. The mean follow-up period was 8.2±2.7 months. The visual pain analogue scale and Macnab's criteria were used

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Table 1. Characteristics and results of 25 patient with L5-S1 far-lateral lesions

Lesion	Case no	Age	Sex	Side	BP	RP	SP	SD	MS	SLRT	Duration	Complication	F/U	Pre vaps	Post vaps	Outcome
Disc herniations	1	46	F	Lt	+	+	+	+	G5	60	60	none	6	6	3	excellent
	2	74	F	Rt	+	+	+	+	G4	45	1	none	10	7	2	excellent
	3	74	F	Rt	+	+	+	+	G4	60	5	none	6	8	1	excellent
	4	63	F	Lt	+	+	−	+	G5	60	36	none	12	5	2	excellent
	5	64	F	Lt	−	+	+	+	G4	60	24	none	6	5	3	good
	6	51	F	Lt	+	+	−	+	G5	45	6	none	6	6	3	good
	7	50	F	Lt	+	+	−	+	G4	45	2	none	7	6	2	excellent
	8	75	F	Lt	+	+	+	+	G4	30	12	none	12	7	2	excellent
	9	57	M	Lt	−	+	+	+	G5	60	48	none	10	7	1	excellent
	10	82	F	Lt	+	+	+	+	G5	60	2	none	6	8	4	excellent
	11	68	F	Rt	+	+	−	+	G5	60	4	none	6	8	3	excellent
	12	47	F	Rt	+	+	−	+	G4	45	1	none	12	6	2	excellent
	13	70	F	Lt	+	+	+	+	G4	45	2	none	12	6	3	good
	14	59	F	Lt	+	+	+	+	G2	30	1	dysesthesia	12	5	4	fair→good
	15	61	F	Lt	+	+	+	+	G5	60	30	none	10	6	2	excellent
	16	59	F	Rt	+	+	+	+	G5	60	36	none	12	7	2	excellent
	17	60	F	Lt	+	+	+	+	G5	60	12	none	6	7	3	excellent
	18	72	M	Lt	+	+	−	+	G5	45	24	none	6	6	2	excellent
	19	65	F	Lt	+	+	−	+	G5	45	12	none	6	6	1	excellent
Osteophyte	20	67	M	Rt	−	+	+	+	G4	60	6	none	12	6	2	excellent
	21	55	F	Rt	+	+	+	+	G4	60	8	none	6	7	2	excellent
	22	57	F	Lt	−	+	+	+	G5	60	12	none	6	9	4	excellent
Costal process hypertrophy	23	59	F	Lt	+	+	+	+	G4	45	6	none	6	8	2	excellent
	24	60	M	Rt	+	+	+	+	G5	60	6	none	6	8	3	excellent
	25	62	F	Lt	+	+	+	+	G5	60	12	none	6	8	3	excellent

* BP=low back pain, RP=radicular pain, SP=sciatic pain, SD=sensory dysesthesia, MS=motor status, Duration, F/U : months

for the evaluation of outcome and therapeutic effect. Utilizing the SPSS ver 11.5, the student t-test was used for the statistical analysis. P values of 0.05 or less was regarded as being statistically significant.

Surgical Approach

A paramedian tangential approach, which had been suggested by Muller et al., was used in this investigation[14,18]. First, a transverse skin incision was made and myo-fascia was removed in the area approximately 3cm away from the median line toward the lesion along the dorsal curvature of the ilium. Then, the mutlifidus muscle and the longissimus muscle was separated with a finger tips and the area was exposed for operation.

By pulling muscles with a caspar retractor, the intertransverse ligament of the 5th lumbar vertebra, upper part of the sacrum and the posterior joint of L5-S1 were exposed. After verifying the cephalic, medial and caudal aspects of the L5-S1 far-lateral lesions, the lateral portion of the facet joint and coastal process were removed under a surgical microscope. Once the L5-S1 far-lateral lesion was exposed, the herniated disc material was removed by using pituitary forceps and curettes. The bone fragment compressing the nerve root was removed by using a high-speed drill and curettes.

Results

Main complaints of these 25 subjects were radiating pain in the lower extremities and dysesthesia (Table 1). Twenty-one subjects (84%) had lumbago but 4 (16%) showed only radiating pain in the lower extremities. Eleven subjects (44%) had various levels of weakness in the lower limbs. The mean period from symptomatic onset to the time of surgery was 14.7 months.

Table 2. Macnab's criteria for the classification of outcome in patients treated for lumbar herniations

Classification	Criteria
Excellent	No pain; no restrictions of activity
Good	Occasional back or leg pain of sufficient severity to interfere with the patient's ability to do normal work or capacity to enjoy leisure hours
Fair	Improved functional capacity,but handicapped by intermittent pain of sufficient severity to curtail or modify work or leisure activities
Poor	No improvement or insufficient improvement to enable increase in activities; further operative intervention required

Fig. 1. Nerve root compression due to far lateral lumbar disc herniations.

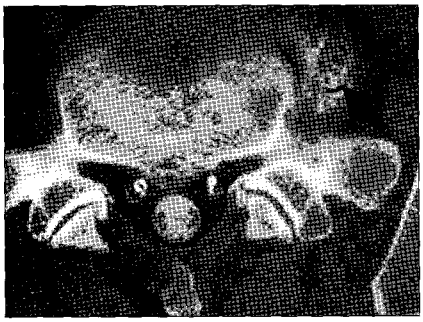

Fig. 2. Nerve root compression due to a osteophyte.

Fig. 3. Preoperative 3D reconstruction computed tomography shows narrowing of L5–S1 foramen.

The visual pain analogue scale was 6.7±1.1 before surgery, and 2.4±0.9 after surgery showing a significant reduction. ($p<0.05$) Outcome set forth by Macnab's criteria (Table 2) for 18 (72%) and 6 patients (24%) were excellent and good, respectively, during the mean follow-up period. The remaining 1 patient showed transitory symptomatic remission after surgery. However, the patient's radiating pain in the lower extremities worsened during the follow-up period due to a new L4-L5 lumber central disc herniations discovered. This patient showed remission (fair →good) after surgery, but continuous dysesthesia remained. Radiating pain in the lower extremities, the main chief complaint before surgery, showed symptomatic improvement within 4 weeks after surgery in all cases. All 25 patients had complaint of dysesthesia before surgery. Nineteen patients improved in 2 weeks, while 6 improved in 4 weeks. Nineteen out of 21 patients who had a complaint of lumbago improved within 1 week after surgery, but two showed improvement within 2 weeks partially. Ten out of 11 patients who had a complaint of weakness in the lower extremities improved within 6 weeks after surgery, but one patient continued to have weakness. Four patients with sciatic pain improved within 2 weeks. There were no significant complications that developed during surgery. The paramedian tangential approach was used for those 18 patients with symptoms of far-lateral lumbar disc herniations (Fig. 1). The bone fragment was removed, thus relieving nerve root compression, through the paramedian tangential approach for those 4 patients who showed nerve root compression secondary to bone fragmentation (Fig. 2, 3, 4).

Fig. 4. Postoperative 3D reconstruction computed tomography shows widening of L5–S1 foramen.

Only decompression was performed through a simple paramedian tangential approach for those 3 patients (12%) who showed costal process hypertrophy.

Discussion

Unlike clinical findings of common lumbar disc herniations, far-lateral lumbar disc herniations display nerve root compression one level above the corresponding lumbar disc.

Compression of a nerve root and dorsal root ganglion by ruptured disc materials, fixation of a nerve root to the lateral zone by the ligament and entraptment of a nerve root between the pedicle and ruptured disc materials lead to decrease in nerve root mobility. These elements cause severe radiating pain in the lower extremities[8,15,18].

Particularly, there is an anatomical narrowing consisting of (1) the pedicle of L5 and the lower edge of the L5 transverse process in the upper part of the L5-S1 level, (2) pedicle of the sacrum in the lower part, (3) the posterior lumbaosacral ligaments and costal process laterally, and (4) the anterior lumbosacral ligament medially. Thus, an surgical approach would not be easy[5,14].

Various surgical methods have been developed. Even total facetectomy, extended medial facetectomy, percutaneous endoscopic discectomy, percutaneous laser discectomy and chemonucleolysis have been attempted[3,7,8,10,11,14,16,18].

Total facetectomy and extended medial facetectomy allow relatively easy access to the lesion, but there is a risk of causing vertebral instability after surgery, due to damage to the pars interarticularis[8,17]. Percutaneous techniques, such as percutaneous endoscopic discectomy or percutaneous laser discectomy, have advantage of reducing pain after surgery owing to a short operating time and less manipulation, but a relatively narrow surgical view which may lead to inadequate removal of the

herniated part. Thus, excessive manipulations of the dorsal root ganglion may cause complications such as dysesthesia after surgery[10,11]. Chemonucleolysis has an advantage of using local anesthesia which is less burdensome to patients while shortening operating time. However, since far-lateral lumbar disc herniations may often contain a rupture or lead to a separation in the herniated disc, a surgical target may be limited[7]. On the other hand, the paramedian tangential approach has advantage of not affecting spinal instability owing to wide surgical view permitting minimal facet joint damage and least nerve root manipulation. Especially, this approach also has a benefit of easy removal of various lesions that may cause L5 radiculopathy including lumbar disc herniations, osteophyte, costal process hypertrophy safely.

In this study, seven out of 25 cases (28%) also had various separation from lumbar disc herniations. Owing to securing of a wide surgical view and having less manipulations of the dorsal root ganglion, it also had advantage of reducing dysesthesia, which may develop after surgery[4,14,18]. Twenty-four out of 25 patients (96%) who had a complaint of dysesthesia before surgery in this investigation showed improvement, but one patient had dysesthesia continuously. This may be due to a scar formation following L4-5 level lumbar disc herniations, which might have developed after surgery.

Conclusion

Factors that cause L5 radiculopathy include far-lateral lumbosacral lesions, such as L5-S1 far-lateral disc herniations, osteophyte and costal process hypertrophy. As a surgical approach to these factors, though we have diverse possible approaching techniques to L5-S1 far-lateral lesions, paramedian tangential approach may be a one of the most effective procedure since it permits a complete removal of the lesion, and can be applied to various lesions with relatively less risk of having elements that may induce spinal instability after surgery and minimum complication such as dysesthesia. In spite of its validity, the postoperative sensory dysesthsia should be avoided through less manipulation which may be caused by thermal or mechanical trauma.

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Commentary

The authors describe a excellent surgical approach and results.

Although this approach is less familiar to many spinal surgeons, the authors would recommend this approach safe and effective method than the midline approaches, percutaneous endoscopic discectomy, total facetectomy or chemonucleolysis for the treatment of these unique pathologies such as L5-S1 far lateral disc herniations, osteophyte, and costal process hypertrophy. Of the 25 patients reported by the authors, 24 had shown improvement of dysesthesia.

The authors present this excellent manipulations of the ganglion and results. Their paper provide us with significant insight into this difficult to approach region of the spine.

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