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TECHNICAL NOTE

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A new technique for the treatment of lumbar far lateral disc herniation: technical note and preliminary results

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Abstract A newly designed technique for a minimally invasive approach to the laterally herniated disc is presented. Fifteen patients suffering from far lateral disc herniation (extraforaminal) were operated according to this technique. Through a small skin incision (1.5 cm), the paraspinal muscles are spread by dilators, until a working channel of 9 mm inner diameter and 11 mm outer diameter can be placed. The next steps are done through this channel using the surgical microscope. No bone resections are necessary and the facet joints are left untouched. However, partial resection of the intertransverse ligament may be necessary. The mean follow-up period for these 15 patients was 11.5 months, and they were evaluated by using the visual analogue scale (VAS) and the Oswestry Disability Index (ODI). The average surgical time was 43 min. The ODI improved from 30.6 (preoperative) to 14.3 (postoperative). The VAS of leg pain improved from 7 (preoperative) to 3.6 (postoperative), which represented a statistically significant improvement at the significance level of ($P<0.01$). No intra-operative or early postoperative complications occurred. However, one recurrence did occur, which was treated by the same technique. This technique combines the advantages of three-dimensional visual control (operating microscope) with the minimal surgical trauma of endoscopic techniques, while avoiding some of the shortcomings of both the microsurgical and endoscopic techniques.

Keywords Far lateral disc herniation · Minimally invasive approach

Introduction

Lumbar lateral (extraforaminal) disc herniation constitutes from 2.6% to 11.7% of all lumbar disc herniations [3, 17]. According to Benini [3], any disc herniation lateral to the medial wall of the pedicle is classified as lateral disc herniation. The symptoms of lateral lumbar disc herniation were first well described by Abdullah et al. [1]. They consist of minimal lumbar pain and notable lower limb pain in the area innervated by the compressed root; often there is accompanying sensorial or motor deficit. Symptoms alone do not differentiate this type of hernia from other hernias or compression syndromes. Therefore, instrumental investigation is necessary to achieve diagnostic certainty [9]. Computed tomography (CT) and magnetic resonance imaging (MRI) now allow successful demonstration of lateral disc herniation [18].

Currently, two surgical approaches commonly used for the treatment of this type of disc herniation are (1) a conventional midline approach via large laminotomy and partial facetectomy, and (2) a paramedian approach [23]. Watkins [24] described a paraspinal approach for posterior-lateral fusion, and this approach was modified by Wiltse and Spencer [25] to be used in the treatment of lateral disc herniation. Zindrick et al. [26], Reulen et al. [20] and Maroon et al. [17] modified the paraspinal approach by splitting the paraspinal muscles with preservation of the facet joints. Apart from the minimal soft tissue injury, the paraspinal approach will not damage the lamina or the

facet joints. On the other hand, when treating lateral disc herniation by the standard midline posterior approach, partial laminectomy and sometimes medial facetectomy are mandatory [1, 13, 14, 16], and this may lead to destabilization of the spine.

When a minimally invasive variant of the paraspinal approach is used to introduce a working channel, removal of the laterally herniated disc is possible, with the help of an operating microscope. The aim of this approach is to minimize surgical trauma and to maintain the stability of the spine, as the paraspinal muscles, the bony structures, and the ligaments are left relatively undamaged.

Materials and methods

This study consisted of 15 patients with lateral disc herniations admitted to our centre in the period from February 1999 to December 2001. The mean patient age was 60.3 years, 53% were female, 10 patients complained only of pain (mainly leg and to a lesser extent back pain) and the remaining 5 patients suffered from neurological deficits in addition to pain. The neurological deficits were in the form of paraesthesia at the distribution of the compressed nerve root and weakness of the quadriceps muscle (grade 3–4) [22]. The diagnosis of lateral disc herniation was confirmed by lumbar MRI (Fig. 1). The level mainly affected was L4/5 (six patients) and L3/4 (six patients). The indication for surgery was failure of conservative treatment of pain over a period of 6 weeks and/or neurological deficits. The patients were assessed preoperatively and postoperatively using the Oswestry Disability Index (ODI) [7] and the visual analogue scale (VAS) for back and leg pain [2]. The follow-up period ranged from 2 to 24 months, with a mean of 11.5 months. The results of the scoring systems were analysed statistically using the *t*-test.

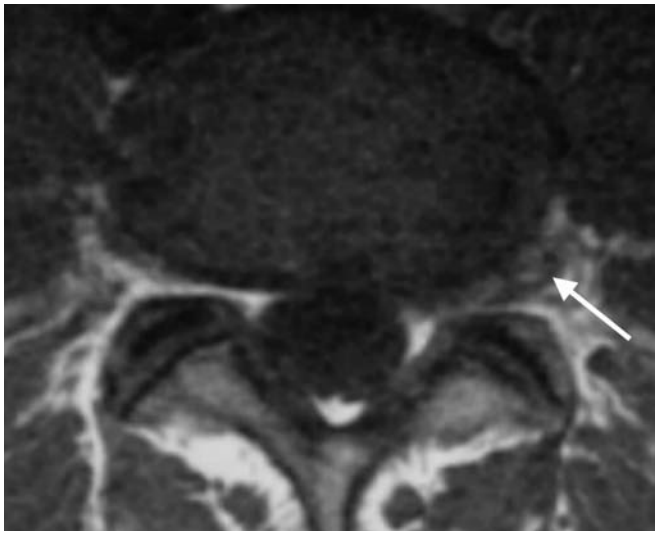

Fig. 1 Magnetic resonance imaging (MRI) axial cut at the level of L4/L5 showing right lateral disc herniation

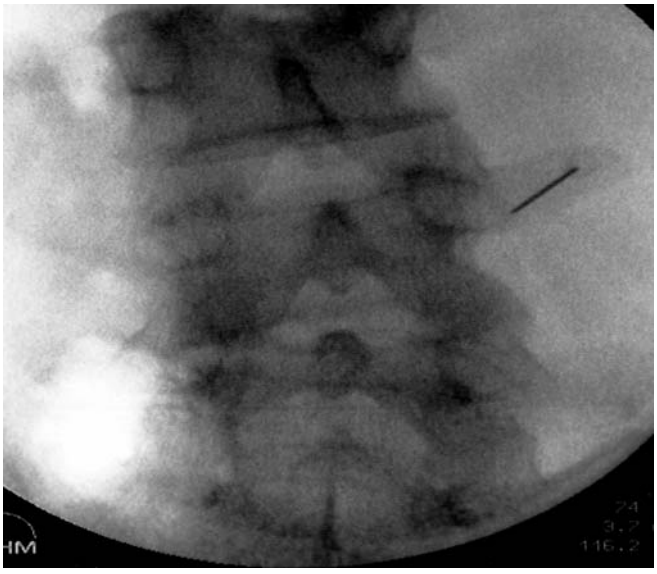

Fig. 2 Intraoperative antero-posterior view (by image intensifier) showing the position of the spinal needle in relation to the right L4 transverse process

Fig. 3 Position of the second dilator at L4/L5 level (right side) in relation to the midline and the iliac bone

Surgical technique

The operation is done under general anaesthesia, and the position of the upper transverse process at the level of the herniated disc is determined by a spinal needle under image intensifier control (anterior-posterior view) (Fig. 2). A skin incision of 1.5 cm length and about 4–5 cm lateral to the midline is made, and two soft tissue dilators are then applied in sequence (Fig. 3), in order to achieve a gentle spreading of the soft tissues and the fibres of the paraspinal muscles. The working channel is then inserted and its position is checked by the image intensifier (Fig. 4). These working channels are made of titanium with 9 mm inner and 11 mm outer diameter. There are three different lengths (45, 55, 65 mm) (Fig. 5). The han-

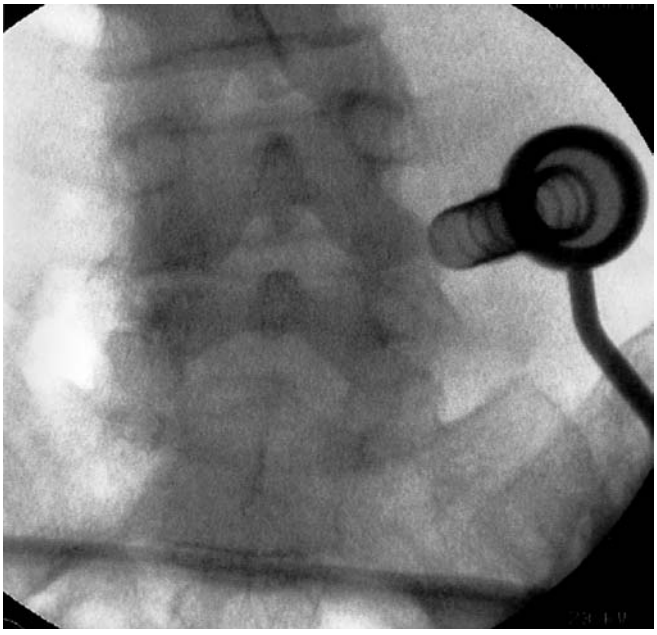

Fig. 4 Intra-operative radiograph (by image intensifier) showing the position of the working channel at L4/L5 level (right side)

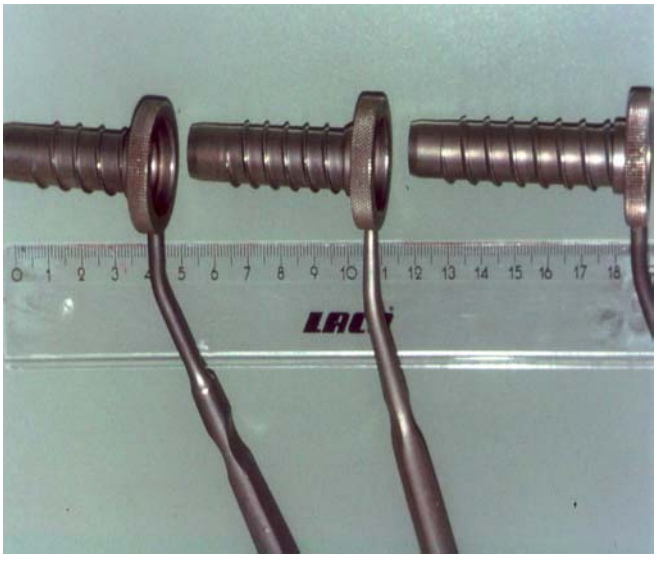

Fig. 5 Working channels in different lengths

dle of the working channel allows it to be moved in a suitable direction with good access. A smooth insertion and secure positioning of the working channel are achieved through the outer threads. An important anatomical landmark is the angle between the lower border of the transverse process and the lateral part of the isthmus region. The working channel should be inclined 10° toward the midline. After correct positioning of the working channel, the next steps are done using the surgical microscope. Dissectors and probes are used to search for the nerve root in the extraforaminal region (lateral to the pars interarticularis) [23]. After cranial mobilization of the nerve root and of the accompanying branch of the segmental lumbar artery (which could be injured), the herniated disc is found and removed. In case of partial intraforaminal disc herniation, trimming of the ligamentum flavum will be necessary.

After removal of the herniated part of the disc, the nerve root is freed all around by using ball-pointed hooks of different lengths. In case there is neural foramen stenosis as a result of facet joint hypertrophy, careful undercutting can be done from this lateral position without damaging the facet joints. A difficulty arises with this technique at the level of L5/S1, due to a high iliac bone. However, in the single patient we had with pathology at this level, we did not encounter any problems.

After making sure that the nerve root is free all around, washing with saline and removal of the working channel is performed. Closure of the fascia and the subcutaneous layer is done by one suture.

Postoperatively, there is no need for lumbar support, and mobilization of the patient can be started after 4 h. The postoperative hospital stay ranges from 3 to 4 days. There is no restriction of daily activity or duration of sitting.

Results

The average operation time was 43 min. The postoperative ODI and VAS scores for the patients are shown in (Table 1). The ODI improved from 30.6 (preoperative) to 14.3 (postoperative), and this was statistically highly significant ($P<0.01$). The VAS also showed postoperative improvement of both back and leg pain when compared with the preoperative findings, and the relation between them was also statistically highly significant ($P<0.01$). In general, both back and leg pain improved immediately postoperatively. The neurological deficits (five patients) also improved, with disappearance of paraesthesia and return of quadriceps muscle power to normal. The patients who had been employed before the operation (5 of 15) returned to work within 4–8 weeks postoperatively.

There were no intra-operative or postoperative complications. One patient (patient 14) remained symptom free for 2 months after the operation, and then the complaint started again. MRI confirmed recurrence of the disc herniation, which was treated by the same technique. Intraoperatively, there was minimal scar tissue around the nerve root. The calculated rate of re-operation was 6.7% (1 patient out of 15).

Discussion

Although lateral disc herniations constitute only 2.6–11.7% of all lumbar disc herniations [3, 17], through compression of the nerve root they can be a source of back pain, leg pain and neurological deficits as well. While central (intraspinal) disc herniations are common at the age of 30–50 years [21], lateral (extraforaminal) disc herniations predominate in older age groups (60 years) [6, 11]. This coincides with our findings, as the mean age in our group was 60.3 years.

This minimally invasive technique via the paraspinal approach is designed to avoid the hazards of open surgery,

Table 1 Clinical data of 15 patients operated for lateral disc herniation (*ODI* Oswestry Disability Index, *VAS* visual analogue scale)

Patient no.	Sex	Age	Level	Operation time (mins)	ODI preop.	ODI postop.	VAS back preop.	VAS leg preop.	VAS back postop.	VAS leg postop.	Follow-up (months)
1	F	76	L4/5	45	42	27	8	9	5	6	24
2	M	46	L3/4	65	20	10	6	8	2	6	19
3	M	37	L3/4	60	29	20	8	7	8	2	18
4	F	60	L4/5	40	34	19	6	5	3	2	15
5	M	72	L3/4	40	31	3	6	6	2	2	15
6	F	54	L4/5	50	36	20	8	6	8	1	12
7	F	74	L4/5	50	32	25	7	7	7	4	12
8	M	71	L2/3	20	25	0	5	8	1	1	10
9	F	69	L3/4	25	29	20	9	8	8	6	10
10	M	70	L4/5	60	33	16	6	6	2	6	10
11	F	65	L4/5	30	24	13	7	7	6	3	9
12	F	57	L2/3	60	31	27	7	8	6	4	7
13	M	26	L5/S1	20	27	7	5	8	2	6	5
14	M	75	L3/4	40	36	1	7	7	1	1	2
15	F	52	L3/4	40	30	7	6	6	5	4	3

especially postoperative instability. According to Panjabi et al. [19], the posterior elements are mainly responsible for the stability of the spine. Therefore, operative techniques damaging the paraspinal muscles, facet joints, and ligaments have a potential to destabilize the spine.

Casper [4] was the first to introduce microscopic surgery in the treatment of lumbar disc herniations, through a midline posterior approach. Endoscopic techniques, on the other hand, were introduced by Foley and Smith [8] and Destandeau [5]. Both innovations helped in minimizing surgical trauma when treating disc herniations. However, a very important disadvantage of the endoscopic technique is that it only allows two-dimensional visualization, and vision is often blurred by bleeding. In comparison, this new minimally invasive technique has the advantage of offering the three-dimensional vision of the operating microscope. Hood [12] also stated that a paramedian approach with endoscopic visualization could theoretically allow exploration of the far lateral space and foramen, but it risks inadequate exposure and incomplete decompression. Lew et al. [15], using percutaneous endoscopic discectomy in the treatment of far lateral disc herniations, reported poor outcomes in 11% (5 out of 47 patients), and these patients subsequently had to be revised in open procedures at the same level.

The average operative time was 43 min. We could not find similar reports in the literature to compare with. Goffin [10] reported that the operative time of microsurgical nucleotomy by a midline posterior approach ranges from 40 to 60 min. Lew et al. [15] reported an operative time that ranged from 60 to 120 min. When comparing the preoperative and postoperative clinical results, we found that patients improved significantly as regards pain and the quality of life, and these findings are similar to those of other authors [6, 9, 11, 18]. The effect of this minimally invasive technique on the late follow-up results needs further examination and assessment.

An important advantage of this new technique is rapid mobilization of the patients (after 4 h postoperatively), which is important in this elderly age (60.3 years). This helps avoid a lot of complications resulting from delayed mobilization of patients.

Conclusion

The results from this small series seem to promise that this minimally invasive microscope-assisted technique is a practical and valuable alternative to conventional techniques for the treatment of lateral disc herniation. Its main advantages include: minimal surgical trauma, lack of any effect on the stability of the spine, rapid rehabilitation, short hospital stay and excellent cosmetic outcome.

References

1. Abdullah AF, Ditto EW III, Byrd EB (1974) Extreme-lateral lumbar disc herniations: clinical syndrome and special problems of diagnosis. J Neurosurg 41:229–234
2. Beecher HK (1969) Measurement of subjective responses. Quantitative effects of drugs. Oxford University Press, Oxford
3. Benini A (1998) Der Zugang zu den lateralen lumbalen Diskushernien am Beispiel einer Hernie L4/L5. Operat Orthop Traumatol 10:103–116

4. Caspar W (1977) A new surgical procedure for lumbar disc herniation causing less tissue damage through a microsurgical approach. In: Wüllenweber R, Brock M, Hamer J (eds) Advances in neurosurgery. Spinger, Berlin, pp 74–77
5. Destandeau J (1999) A special device for endoscopic surgery of lumbar disc herniation. Neurol Res 21:39–41
6. Donaldson WF III, Star MJ, Thorne RP (1993) Surgical treatment for the far lateral herniated lumbar disc. Spine 18: 1263–1267
7. Fairbank JCT, Pynsent PB (2000) The Oswestry Disability Index. Spine 25: 2940–2953
8. Foley KT, Smith MM (1997) Microendoscopic discectomy. Tech Neurosurg 3:301–307
9. Gioia G, Mandelli D, Capaccioni B (1999) Surgical treatment of far lateral lumbar disc herniation. Spine 24:1952–1957
10. Goffin J (1994) Microdiscectomy for lumbar disc herniation. Clin Neurol Neurosurg 96:130–134
11. Hodges SD, Humphreys CS, Eck JC (1999) The surgical treatment of far lateral L3-L4 and L4-L5 disc herniation. Spine 24:1243–1246
12. Hood RS (1993) Far lateral lumbar disc herniations. Neurosurg Clin North Am 4:117–124
13. Kronberg M (1987) Extreme lateral lumbar disc herniations. Clinical syndrome and computed tomography recognition. Spine 12:586–589
14. Kurobane Y, Takahashi T, Tajima T (1986) Extraforaminal disc herniation. Spine 11:260–268
15. Lew SM, Mehalic TF, Fagone KL (2001) Transforaminal percutaneous endoscopic discectomy in the treatment of far lateral and foraminal lumbar disc herniations. J Neurosurg 94:216–220
16. Macnab I (1971) Negative disc exploration. An analysis of the causes of nerve-root involvement in sixty-eight patients. J Bone Joint Surg (Am) 53: 891–903
17. Maroon JC, Kopitnik TA, Schulhof LA, Abla A, Wilberger JE (1990) Diagnosis and microsurgical approach to far-lateral disc herniation in the lumbar spine. J Neurosurg 72:378–382
18. O'Hara LJ, Marshall RW (1997) Far lateral lumbar disc herniation. J Bone Joint Surg Br 79:943–947
19. Panjabi MM, Krag MH, Goel VK (1981) A technique for measurement and description of three dimensional six degree of freedom motion of a body joint with an application to the human spine. J Biomech 14:447–460
20. Reulen HJ, Pfaundler S, Ebeling U (1987) The lateral microsurgical approach to the "extracanalicular" lumbar disc herniation. A technical note. Acta Neurochir 84:64–67
21. Schwetlick G (1998) Mikrochirurgische lumbale Bandscheibenoperationen. Orthopade 27:457–465
22. Seddon HJ (1954) Peripheral nerve injuries. Medical Research Council special report series 282. HMSO, London
23. Viswanathan R, Swamy NK, Tobler WD, Greiner AL, Keller JT, Dunsker SB (2002) Extraforaminal lumbar disc herniations: microsurgical anatomy and surgical approach. J Neurosurg 96: 206–211
24. Watkins MB (1964) Posterolateral fusion in pseudarthrosis and posterior element defects of the lumbosacral spine. Clin Orthop 35:80–84
25. Wiltse LL, Spencer CW (1988) New uses and refinements of the paraspinal approach to the lumbar spine. Spine 13:696–706
26. Zindrick MR, Wiltse LL, Rauschning W (1987) Disc herniations lateral to the intervertebral foramen. In: White AH, Rothman RH, Ray CD (eds) Lumbar spine surgery. CV Mosby, London, pp 195–207