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Original Investigation

Clinical Comparison Between Patients Operated for Unilateral Radiculopathy via a Contralateral (Facet-Sparing) and Ipsilateral Side Approach

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ABSTRACT

AIM: To compare clinical outcomes of the patients operated from the contralateral or ipsilateral side for unilateral radiculopathy in spinal stenosis.

MATERIAL and METHODS: This was a retrospective study. Twenty patients were listed as Group 1 (Contralateral) with unilateral radiculopathy and spinal stenosis with/without lateral recess syndrome or foraminal stenosis. Decompression from opposite side of radiculopathy was performed to Group 1 patients. Decompression from the radiculopathy side was performed to the patients in Group 2 (Ipsilateral). Twenty eight patients were listed as Group 2. Back pain visual analogue scale (VAS) score and leg pain VAS score were assessed at preoperative, postoperative 1st month and postoperative 12th month. The results were compared statistically.

RESULTS: Two patients were excluded because of reoperation at the 2nd month from the Group 2 to assessment 12th month VAS score. There was no significant difference between two groups at 1st month back pain VAS and leg pain VAS scores. There was no significant difference between two groups at 12th month back pain VAS and leg pain VAS scores. Dynamic stabilization was performed at 2nd month to two patients after the first operations for instability. So, there was no difference in clinical outcomes between the patients treated by contralateral approach and ipsilateral approach when instability did not occur. However, there is a risk of instability of the same side approach and surgery owing to shaving of the facet joint.

CONCLUSION: In the contralateral approach, the recess of the contralateral side and foramen can be better seen than in the ipsilateral approach. So, this is a facet-sparing approach to spinal stenosis with/without lateral recess syndrome or foraminal stenosis with unilateral radiculopathy. The contralateral approach to unilateral radicular complaints is quite effective. With this approach, facet joints are protected from possible instability.

KEYWORDS: Contralateral approach, Facet-sparing, Ipsilateral approach, Spinal stenosis

INTRODUCTION

Various surgical approaches are used for spinal canal stenosis. Some of these are partial laminectomy, total laminectomy, total laminectomy plus instrumentation, and bilateral decompression via a unilateral approach. Bilateral decompression via a unilateral approach is still frequently performed.

Some patients have spinal canal stenosis or bilateral lateral recess syndrome, but unilateral radiculopathy symptoms. In these patients, spinal canal decompression is usually performed by approaching from the same side, and contralateral decompression is added to most of them.

Decompression from the same side requires facet joint trimming. However, facet joints of both sides are protected

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by decompression from the opposite side below the spinous process.

In our article, we discuss decompression via the contralateral side by preserving the facet joint of the opening side with a partial laminotomy (standard or less than standard) for unilateral radiculopathy and compare the clinical outcomes in patients operated by same side decompression.

MATERIAL and METHODS

This was a retrospective study. Patients who had spinal stenosis with/without lateral recess syndrome or foraminal stenosis with unilateral radiculopathy, and were treated by two different surgical methods were assessed. All the cases were treated with single level surgery.

Group 1 (Contralateral group) (20 patients) included patients who underwent partial hemilaminectomy at the opposide side of the complaint, and flavectomy and foraminotomy of the radiculopathy side from the opposite side.

Group 2 (Ipsilateral group)(28 patients) included patients with decompression, foraminotomy and partial facetectomy from the same side.

A number of criteria were used in the selection of patients:

1) Having no spinal surgery
2) Having unilateral radicular symptoms
3) Having spinal stenosis with/without narrowing of the lateral recess or foraminal stenosis
4) No instability in preoperative graphs
5) No need for discectomy and no significant disc herniation at the same level

All of these patients were evaluated with preoperative, postoperative 1st month, and postoperative 12th month visual analogue scale (VAS) scores. Two patients were excluded from the 12th month assessment in Group 2. These 2 patients were re-operated at the 2nd month because of instability secondary to the surgical treatment.

First month and 12th month VAS scores were evaluated statistically. The groups were evaluated in terms of preoperative-postoperative VAS scores in themselves.

After partial mini-open laminotomy, the ligamentum flavum was excised partially at the medial side and then, the operation table was tilted. The contralateral ligamentum flavum was removed below the spinous process, and foraminotomy was performed in Group 1 patients. Flavectomy, foraminotomy and partial (medial) facetectomy was performed in Group 2 patients.

Statistical Analysis

The analyses were performed using the R Foundation for Statistical Computing (3.2.3). Analysis of normality was performed with the Kolmogorov-Smirnov test. Continuous variables were expressed as mean±SD. Differences in parametric continuous variables were analyzed by the Independent t test for two groups. Differences in non-parametric continuous variables were analyzed by the Mann Whitney U test for two groups. Analysis of variation in continuous variables between time periods was performed with Repeated Measures ANOVA after Mauchly's Test of Sphericity. Statistical significance tested for the level of alpha was 0.05.

RESULTS

There were 12 female, 8 male patients in Group 1 and the mean age was 57.2 years. There were 18 female and 10 male patients in Group 2 and the mean age was 56.8 years. The mean follow-up period was 12.6 months.

The VAS scores were compared statistically for both preoperative and postoperative periods in each group and between the groups in the same time periods (Table I).

Accordingly, the patients were improved after surgery. There was a significant difference between the preoperative-postoperative 1st month and preoperative-postoperative 12th month VAS scores.

There was no significant difference between Group 1 and 2 for the 1th month VAS scores after surgery. There was no significant difference between Group 1 and 2 for the 12th month VAS scores after surgery.

The changes in VAS scores of back pain and leg pain at preoperative 1st month and the 12th month of the group were investigated (Table II). The differences between preoperative-postoperative 1st month, and preoperative-postoperative 12th month for each group were statistically significant. The complaints of back pain and leg pain of the patients had therefore improved after the surgeries, but 2 patients were not assessed at the 12th month because of the re-operation due to instability in the ipsilateral group.

The decrease of VAS score in leg pain and back pain within 1 year was compared between the contralateral and ipsilateral methods (Table III).

Pv1 critical values were as shown in Table II. The pv2 critical value indicates whether the type of surgery is effective in reducing VAS scores in back pain or leg pain. Decrease of VAS score in leg pain and back pain within 1 year did not differ significantly between contralateral and ipsilateral methods.

The values for comparison with postoperative 12th month on postoperative 1st month in every line and values for comparison with postoperative 12th month on postoperative 1st month between contralateral and ipsilateral surgeries were assessed (Table IV). There were no significant values in the results.

DISCUSSION

Spinal stenosis is a problem that emerges at the end of a degenerative process. The process that is initiated with the disc degeneration causes growth in facet joints and hypertrophy of the ligamentum flavum, which then results in posterior longitudinal ligament thickening (9). Lumbar spinal stenosis is the most common indication of lumbar surgery in patients older than 65 years (2).

Table I: The Assessment of VAS Scores of Preop and Postop in Each Group and Between the Groups in the Same Periods

	Group		Total	SS
	Contralateral	Ipsilateral		
	M±SD	M±SD	M±SD	
Back Pain Preop – VAS	6.63±2.07	6.10±2.90	6.34±2.56	NS
Leg Pain Preop – VAS	5.36±3.16	5.31±3.17	5.34±3.13	NS
Back Pain Postop 1st month – VAS	1.02±1.04	1.60±1.63	1.35±1.42	NS
Leg Pain Postop 1st month – VAS	1.14±0.84	1.22±1.43	1.18±1.19	NS
Back Pain Postop 12th month – VAS	0.4±0.61	0.35±0.54	0.37±0.56	NS
Leg Pain Postop 12th month - VAS	0.23±0.43	0.63±0.74	0.45±0.65	NS

**Mann: Whitney U test, **Independent t test,*
***NS:** not significant, **Preop:** preoperative, **Postop:** postoperative, **VAS:** Visual analogue Scale score, **M:** mean, **SD:** Standard deviation.*

Table II: The Changes in VAS Values of Back Pain and Leg Pain Between Preop, Postop 1st Month and Postop 12th Month Intervals of the Groups

			M±SD	SS
Contralateral	Back Pain	Preop	6.64±2.08	<0.0001
		Postop 1st month	1.02±1.04	
		Postop 12th month	0.40±0.61	
	Leg Pain	Preop	5.36±3.16	<0.0001
		Postop 1st month	1.14±0.84	
		Postop 12th month	0.24±0.43	
Ipsilateral	Back Pain	Preop	6.10±2.90	<0.0001
		Postop 1st month	1.60±1.63	
		Postop 12th month	0.35±0.54	
	Leg Pain	Preop	5.31±3.17	<0.0001
		Postop 1st month	1.22±1.43	
		Postop 12th month	0.63±0.74	

Repeated measures ANOVA, **Preop: Preoperative, **Postop:** Postoperative, **VAS:** Visual analogue Scale score, **M:** Mean, **SD:** Standard deviation*

Table III: The Decrease of VAS Value in Leg Pain and Back Pain within 1 Year Between the Contralateral and Ipsilateral Methods

		Preop	Postop 1st month	Postop 12th month	Pv1	Pv2
Back Pain	Contralateral	6.64±2.08	1.02±1.04	0.40±0.61	<0.0001	NS
	Ipsilateral	6.10±2.90	1.60±1.63	0.35±0.54	<0.0001	
Leg Pain	Contralateral	5.36±3.16	1.141±0.84	0.24±0.43	<0.0001	NS
	Ipsilateral	5.31±3.17	1.218±1.43	0.63±0.74	<0.0001	

**Repeated measures ANOVA*
**Pv1; Values for comparison with postop 12th month and postop 1st month on preop in every line.*
**Pv2; Values for comparison at postop 12th month and postop 1st month on preop between contralateral and ipsilateral surgeries.*
Pv1 critical values are the same as those shown in Table II. The pv2 critical value indicates whether the type of surgery is effective in reducing VAS values in Back Pain or Leg Pain operations.

Table IV: Values for Comparison with Postop 12th Month on Postop 1st Month in every Line and Values for Comparison with Postop 12th Month on Postop 1st Month Between Contralateral and Ipsilateral Surgeries

		Postop 1st month	Postop 12th month	Pv1	Pv2
Back Pain	Contralateral	1.02±1.04	0.40±0.61	<0.0001	NS
	Ipsilateral	1.60±1.63	0.35±0.54	<0.05	
Leg Pain	Contralateral	1.141±0.84	0.24±0.43	<0.0001	NS
	Ipsilateral	1.218±1.43	0.63±0.74	<0.05	

**Repeated measures ANOVA*

**Pv1; Values for comparison with postop 12th month on postop 1st month in every line.*

**Pv2; Values for comparison with postop 12th month on postop 1st month between contralateral and ipsilateral surgeries.*

The surgical procedures performed for radicular symptoms associated with spinal stenosis are usually laminectomy with or without fusion, laminoplasty, laminotomy with medial facetectomy, minimally invasive decompression and placement of an interspinous device. Laminectomy has remained the mainstay of surgical treatment for many years and has reportedly resulted in good outcomes (3,4,11).

After laminotomy and medial facetectomy of the approach side, contralateral decompression can also be added if opposite side symptoms are present. Removal of the facet joint at this point can create instability in the patient and may cause problems related to instability in the postoperative period (10).

In many centers, surgery is planned as bilateral laminotomy and decompression or bilateral decompression via a unilateral approach even if there is an unilateral radicular pain. Some surgeons perform the surgery as total laminectomy and instrumentation. In all of such surgery, the facet joint is trimmed and instability may occur after the surgery if instrumentation is not performed.

Many minimally invasive methods have been developed with rapidly increasing use to overcome this condition (7,14). The most important of these methods is bilateral decompression with a unilateral approach (15). However, in order to perform decompression on the side with facet joint hypertrophy, the facet joints must still be shaved. This can lead to iatrogenic instability.

Many patients may have unilateral symptoms. Although symptoms are usually bilateral leg pain and neurogenic claudication, unilateral leg pain can be seen in spinal stenosis with/without the lateral recess syndrome or foraminal stenosis.

Radiological images do not always support the neurological symptoms. We also need to improve the neurological symptoms of the patients, not radiological signs. It is controversial whether bilateral decompression should be performed in these patients. If unilateral decompression is performed, it is possible to do this technique without damaging the facet joint by decompression from the other side. It is also possible to obtain better surgical exposure from the opposite side with less bone removal in spinal stenosis (Figure 1) (1,8,12). Even if the patient has bilateral symptoms, decompression from the opposite side on both sides will be rational in terms of better exposure. The contralateral approach to unilateral radiculopathy is even more reasonable for the lateral recess syndrome which is not accompanied by spinal stenosis.

Alimi et al. performed surgery with a tubular retractor via a contralateral approach through the dominant radiculopathy side. There was no significant difference when compared to the other side. They obtained excellent results according to the McNab criteria (1). Park et al. also reported that there was no significant difference in the decrease of neurological symptoms when radiologically less space was decompressed by decompressing the opposite side by a unilateral approach (8). Thomé et al. reported a statistically significant increase in dural sac size after laminotomy or laminectomy, but found no statistical relationship between the extent of decompression and clinical outcome (13). We applied decompression to the opposite side by a contralateral approach after standard laminotomy using the operation microscope and so both facet joints of the level were protected. This is a facet-sparing approach of both sides. We compared clinical outcomes of the patients who were operated from the same side with unilateral radiculopathy and contralateral side with unilateral radiculopathy. Clinical findings after spinal canal decompression were consistent with the literature.

To our knowledge, there is no publication reporting the clinical outcomes of the contralateral approach by microscopic surgery in unilateral radiculopathy in the literature. There is also no study on the clinical comparison between the groups treated via the ipsilateral and contralateral approaches for unilateral radicular symptoms. In our study, we emphasized that laminotomy (standard or less than standard laminotomy) at the medial side is enough to perform the surgery and decompression of the contralateral side. A little shaving or removal of the lower part of the spinous process is enough. After fenestration, the table should be tilted toward the opposite side. In this technique, bone removal remains very limited and instability is not expected. Facet joints of both sides are also protected. It is inevitable to shave the facet joint when approaching from the same side for spinal stenosis because of hypertrophy and medialization of the facet joints.

Facets are hypertrophic and rotated, and even laminae cannot be detected due to abnormal facet joints in some patients and the whole spinal canal can be obliterated. Undoubtedly, in these patients, approaching from the contralateral side may

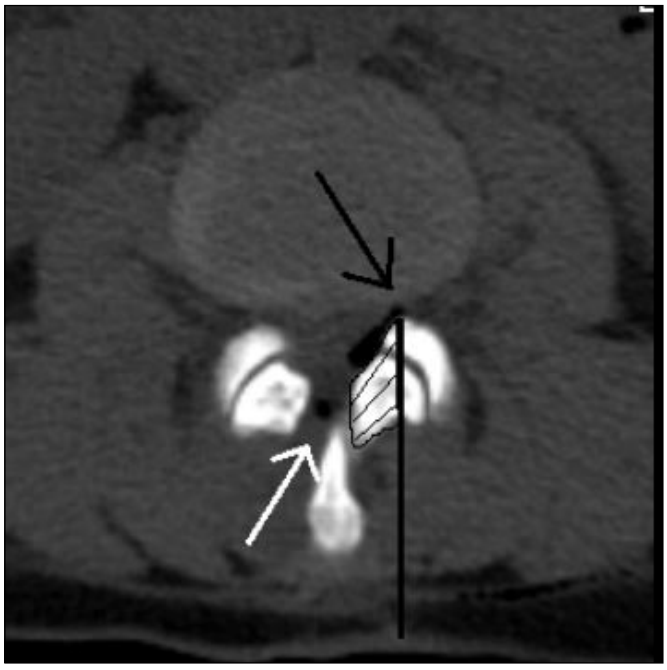

Figure 1: As shown by the air density and black arrow in the figure, it is possible to decompress the opposite site via the contralateral approach by facet-sparing (the patient had left radicular symptoms). The diagonal lined area shows the bone structures to be removed in order to decompress the same area with the ipsilateral approach. The white arrow shows the direction of the contralateral view. It is observed that the inner face of the facet joint at the contralateral side is slightly curetted, removed and straightened.

require disruption of the facet joint on the operation side. However, it would be reasonable to decompress from the opposite side in patients with sagittal-oriented facet joints and patients with moderate spinal stenosis with/without the lateral recess syndrome.

Removing the opposite side ligamentum flavum in the patients, expanding the recess and curetting below the lamina, will cause the regression of radicular symptoms. The medial part of facet joints should be shaved to perform foraminotomy and open the lateral recess in spinal stenosis in ipsilateral surgeries. This may cause an increase in the back pain of the patient in the postoperative period and instability-related facet joint impairment. In our Group 2, instability was considered due to shaving of the facet joint in two patients who were operated via an ipsilateral approach. The pain was not improved at the postoperative 2nd month and there was also a serious increase in the radicular and back pains. Dynamic graphs of these patients were evaluated and instability was diagnosed. The complaints of the patients regressed after surgical instrumentation. We believe we would not have to perform stabilization in these 2 patients by treating them by decompression from the contralateral side.

According to the statistical data there was no clinical difference in the postoperative periods in the patients of both groups when if instability did not develop. But, perhaps, longer follow-up periods are needed for better results.

Durotomy is an undesirable condition that can be encountered during the contralateral approach. In our cases, a dural tear was seen in one patient of group 1 and in one patient of group 2. There was no further intervention except applying a fat graft on the tear region. The rate of durotomy was in accordance with the literature (5,6). Another unexpected condition is neural tissue damage. Neural injury was not present in any of our patients in either group. This is of course related to the experience of the surgeon.

There are also some limitations in our study. The comparisons could be made with larger patient groups. In addition, there is a need for a longer follow-up period. In the contralateral approach, decompression of the same side is not performed. Neurological symptoms may therefore occur or increase on that side (laminotomy side) in the long-term follow-up. This will require surgical intervention in the future due to spinal stenosis. Epidural fibrosis and related complaints may also develop when the epidural space is opened. Nevertheless, this surgical technique can be highly effective to restore symptoms by protecting the facet joints of both sides without causing instability. In these cases, the primary surgery may even be considered as an option in the future.

CONCLUSION

Patients with unilateral radiculopathy with spinal stenosis with/without the lateral recess syndrome can be counter-decompressed by tilting the table and this surgery can be performed with a microscope after a small laminotomy of the contralateral side. There is no difference in clinical outcome between the ipsilateral approach and contralateral side approach in relieving unilateral radicular symptoms if instability does not occurs. However, there is a risk of instability in the ipsilateral approach and surgery owing to shaving of the facet joint, especially in sagittal-oriented joints. In the contralateral approach, the recess of the contralateral side and foramen can be seen better than the ipsilateral approach. Facet joints are protected from possible instability with the contralateral approach. Longer follow-up periods with larger series are needed to obtain more conclusive results.

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