Surgical Results of 300 Patients of Lumbar Spine Diseases with Special Concern to "Pseudoradicular Pain"

Jun-ichiro ISHIKAWA, Akinori KONDO, Tsuneki KONISHI,
Kenji KANEMARU and Masanori MORIMOTO

Department of Neurosurgery, Fukui Red Cross Hospital, Fukui

Abstract

The results of the microsurgical treatment of 300 patients with painful lumbar spinal diseases were reported. Radical removal of the disc material, preservation of the epidural fat tissue around the lumbar nerve roots, and meticulous hemostasis produced good results. Yet, even with this technique, a pseudoradicular or referred pain still developed after surgery, despite of the disappearance of a radicular pain or radicular signs.

Pseudoradicular pain is characterized by: 1) Lasègue sign only after raising the straightened leg more than 40 degrees; 2) no radicular signs; 3) marked pains localized in the area innervated by the dorsal ramus which is involved in a pathological process; and 4) no pain in the popliteal fossa.¹⁰⁾

Our operative results revealed that this uncomfortable pain developed most frequently after operative procedures involving facets and lateral recesses, such as in facetectomy or foraminotomy for superior facet syndrome (80% postoperatively) and for cases of lumbar herniated disc (63% postoperatively). The pain could be elicited by stimulation or irritation of the dorsal rami of the lumbar spinal nerves during surgery involving the articular facets. That was why pseudoradicular pain frequently developed after treatment of superior facet syndrome based on hypertrophied articular process or lumbar herniated discs.

Key words: pseudoradicular pain, lumbar herniated disc, superior facet syndrome

Introduction

The application of microsurgical techniques to lumbar spine surgery has numerous advantages. It may permit early mobilization of the patients and may shorten hospitalization by lessening damage to the normal tissue by preserving the epidural fat around the nerve roots, and by allowing radical removal of the disc material. Meticulous hemostasis also serves to shorten the hospital stay. Although radical removal of the disc material and spondylotic spurs under the microscope appears to reduce the recurrence rate of radicular pain, some patients complain of a "pseudoradicular pain", or referred pain, postoperatively. Pseudoradicular pain is characterized by: 1) positive Lasègue sign only after the straight leg is raised more than 40 degrees; 2) no radicular signs; 3) marked pains localized in the area innervated by the dorsal ramus

which is involved in a pathological process; and 4) pain which spares the popliteal fossa.¹⁰⁾ Since injection of hypertonic saline into the intervertebral joints causes a referred pain in the gluteal region and at the posterior aspect of the thigh,^{7,8)} referred pain is not thought to be of discal origin. In fact, referred pain is often expressed as a spontaneous pain and/or a tenderness in the lateral upper one third of the gluteal region, which are often present in patients with painful lumbar spine diseases, either before or after surgery, or both.

In this communication, the postoperative occurrence of pseudoradicular pain was evaluated in 300 patients with lumbar pathology, and consideration was given to its pathogenesis and treatment.

Materials and Methods

Three-hundred cases of painful lumbar spine diseases

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Author's present address: T. Konishi, M. D., Department of Neurosurgery, Kyoto University Kyoto, Japan; K. Kanemaru, M. D., Department of Neurosurgery, Mie University Tsu, Mie, Japan; M. Morimoto, M. D., Department of Neurosurgery, Kochi Medical College Kochi, Japan.

were surgically treated at the Department of Neurosurgery, Fukui Red Cross Hospital, from April 1975 to December 1979. The operative results were analyzed in these 300 patients (147 men and 153 women).

Tenderness in the lateral upper one third of the gluteal region, which is one of the most common signs of pseudoradicular pain, was examined during the hospital stay of these patients.

The diagnosis of painful lumbar spine diseases was made by neurological examination, and their etiology was confirmed by lumbar myelography with Dirax®. Lumbar herniated discs were found in 190 cases (Group I); lumbar spinal canal stenosis combined with herniated discs in 49 cases (Group II); lumbar canal stenosis in 46 cases (Group III); and superior facet syndromes in 15 cases (Group IV).

The operations were performed under a microscope with the following technique. For a herniated disc, a small portion of the upper lamina and the medial portion of the facet on the affected side were partially removed with a high speed air drill and an oblique punch rongeur. To avoid recurrence, these procedures were performed bilaterally in the most recent cases. For canal stenosis with herniated discs, a conventional laminectomy was performed after removal of the herniated discs, and for canal stenosis with or without spondylosis, a conventional laminectomy alone was performed. For superior facet syndrome produced by compression of the lumbar nerve roots with an anomalously enlarged superior articular process, a partial facetectomy and foraminotomy without discectomy were performed.

Operative Results

The average period of bed rest was 4 days for Group I, 10 days for Groups II and III, and 2 days for Group IV, and the average hospital stay of the patient was 15 days for Group I, 25 days for Groups II and III, and 10 days for Group IV (Table 1).

Table 1 Average period of bed rest and hospital stay of operated patients

	Average period of bed rest	Average period of hospital stay
Group I	3.8 ± 1.9 days	15.5 ± 5.1 days
Groups II & III	9.7 ± 1.9	25.4 ± 6.1
Group IV	1.8 ± 0.4	10.2 ± 1.2

Group I : Cases of herniated discs only

Group II : Cases of canal stenosis combined with herniated discs

Group III: Cases of canal stenosis only

Group IV: Cases of superior facet syndrome

The tenderness in the gluteal region, used as an index of the pseudoradicular pain, was classified as follows: The patients were divided into 4 groups. Type I consisted of 89 cases without pseudoradicular pains either before or after surgery. Type II included 25 cases who had tenderness in the gluteal region before surgery which disappeared postoperatively. Eighty-two cases in Type III had pseudoradicular pains both before and after surgery. Type IV included 104 cases who had no pseudoradicular pains before surgery, but developed tenderness in the gluteal region postoperatively (Table 2).

Table 2 The tenderness in the gluteal region before and after surgery

	preoperative	postoperative	cases
Type I	—	—	89
Type II	+	—	25
Type III	+	+	82
Type IV	—	+	104

Table 3 The incidence of tenderness in the gluteal region for each operative procedure

	Type I (cases)	Type II (cases)	Type III (cases)	Type IV (cases)	Total (cases)
Group I	53	18	54	65	190
Group II	12	3	12	22	49
Group III	21	4	8	13	46
Group IV	3	0	8	4	15

Table 4 The incidence of tenderness in the gluteal region before and after surgery

	Types II + III (cases)	(%)	Types III + IV (cases)	(%)
Group I	72	(38)	119	(63)
Group II	15	(31)	34	(69)
Group III	12	(54)	21	(46)
Group IV	8	(53)	12	(80)

Types II + III: preoperative incidence

Types III + IV: postoperative incidence

Table 5 The levels of the surgical intervention for herniated discs

	Levels	Cases
1 level	L3/4	2
	L4/5	111
	L5/S1	20
2 levels	L3/4, L4/5	17
	L4/5, L5/S1	37
3 levels	L3/4, L4/5, L5/S1	3

Table 6 The incidence of tenderness in the gluteal region after partial laminectomy

L4/5	intervertebral discs	73/111 cases (66 %)
L5/S1	intervertebral discs	8/20 cases (40 %)

Tenderness in the gluteal region was noted more frequently after operative procedures (186 cases) than before surgery (107 cases), and the occurrence rates of pseudoradicular pain in each group are shown in Table 3 and Table 4.

Among the 190 patients in Group I, surgical intervention was at the L4/5 intervertebral space in 111 patients and at the L5/S1 in 20 patients (Table 5). The relationship between the levels of the partial laminectomy and the occurrence of pseudoradicular pain is shown in Table 6.

Tenderness in the gluteal region was more frequently elicited after partial laminectomy at the L4/5 level than at the L5/S1, although the numbers of operated discs at the L5/S1 were limited. In almost all cases, pseudoradicular pain was easily controlled by local anesthetics in the gluteal region and at other points of tenderness where the pain radiated, while in a few cases the effect of local anesthesia was only transient.

Discussion

In 1911, Goldthwait⁵⁾ first reported abnormalities of the lumbosacral articulation which caused sciatica. Kellgren^{7,8)} experimentally elicited referred pains by injection of hypertonic saline into various muscles and interspinous ligaments and mapped the segmental areas of deep pains and tenderness. The same technique was used by other authors to produce the same kinds of pain from muscles and other supportive structures.^{3,6,19,20)} In 1956, Pedersen *et al.*¹⁵⁾ reported that the posterior rami of the lumbar spinal nerve projects sensory fibers to the fascia, ligaments, periosteum, and the intervertebral joints, and that the sinu-vertebral nerves supply the posterior longitudinal ligament, dura mater, periosteum, and blood vessels (Fig. 1). They also suggested that a painful stimulus to any deep structure could provoke low back and leg pain. Little attention was paid to these studies, however, until 1971 when Rees¹⁶⁾ reported a new approach of transcutaneous section of the posterior rami as a successful treatment for intervertebral disc syndrome. After this report, some physicians recognized the importance of the posterior ramus in pseudoradicular pain.^{4,9,12,17)} Bogduk¹⁾ described four anatomical elements (*i.e.*, lumbar nerve roots, lumbar spinal nerves, dorsal rami, and sinu-vertebral nerves) that are responsible for low

Fig. 1 Diagram of the course of the posterior ramus of the lumbar spinal nerve and its branches. Redrawn from Pedersen *et al.*¹⁵⁾ (Fig. 2, 379 pp) with permission from the J Bone Joint Surg, Inc.

back pain and lower limb symptoms, and pointed out that two mechanisms might produce these symptoms: "Type 1 mechanism" was the direct irritation of nerve roots or spinal nerves and "Type 2 mechanism" was stimulation of the dorsal rami or sinu-vertebral nerves.

In our series, even after successful operative relief of radicular pains and the disappearance of other radicular signs, 62% of the patients (186 out of 300 patients) still complained of some amount of pain in the lateral upper one third of the gluteal region or at the posterior aspect of the thigh when they started to walk after surgery. These pains usually diminished with several injections of local anesthetics to the tender points. Therefore, such pains were considered as pseudoradicular or referred pains, rather than as radicular pains.

Pseudoradicular pain occurrence most frequently in Group IV and least in Group III. This was because with conventional laminectomy (Group III), the articular facets are not disrupted by surgery, while for superior facet syndrome (Group IV), the medial portion of the facets were partially removed and consequently the facets were most highly disrupted during this surgery. For herniated discs (Group I), a partial

Fig. 2 Schematic drawing of nerve roots and sciatic nerve explaining mechanism of "pseudoradicular pain" in the lower lumbar region.

facetectomy and/or foraminotomy were performed and the articular capsules of the facets could have been moderately traumatized by this procedure. Our results showed that pseudoradicular pain was produced by a surgical intervention at either the L4/5 or L5/S1 intervertebral joints, especially at the former level. This difference after operation may be due in part to the different innervation of the facets by the posterior ramus, or partially to the difference in the areas where the pain would radiate. At levels L1 through L4, each dorsal ramus runs across the root of the superior articular process, whereas the L5 dorsal ramus runs along a groove between the ala of the sacrum and its superior articular process.²⁾ In consequence, the dorsal ramus at the L4/5 level is likely to be injured upon partial removal of the medial portion of the superior articular process during facetectomy.

Pseudoradicular pain was considered to be caused by dorsal rami injured during operative procedures such as facetectomy or foraminotomy. Irritation of the medial branch of the dorsal ramus was referred to the anterior ramus, including the superior gluteal or sciatic nerve (Fig. 2), and finally evoked pseudoradicular pain.

Recently we have been performing a radiofrequency neurotomy of the posterior ramus for the relief of pseudoradicular pain.^{11,13,14,18)} The results will be reported in a separate paper.

Conclusions

Even after successful operation for painful lumbar diseases, 62% of the patients still complained of tenderness in the gluteal region or at the posterior aspect of the thigh despite disappearance of the radicular pain or radicular signs. Such a pseudoradicular pain was produced by the disruption of the facet and the resulting irritation of the posterior ramus of the lumbar spinal nerves. The pain most frequently appeared after operation of superior facet syndrome (hypertrophied superior articular process) and after disc surgery at the L4/5 level.

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References

- 1) Bogduk N: The anatomy of the lumbar intervertebral disc syndrome. *Med J Aust* 1: 878-881, 1976
- 2) Bogduk N, Long DM: The anatomy of the so-called "articular nerves" and their relationship to facet denervation in the treatment of low-back pain. *J Neurosurg* 51: 172-177, 1979
- 3) Feinstein B, Langton JNK, Jameson RM, Schiller F: Experiments on pain referred from deep somatic tissues. *J Bone Joint Surg [Am]* 36-A: 981-997, 1954
- 4) Fox JL, Rizzoli HV: Identification of radiologic coordinates for the posterior articular nerve of Luschka in the lumbar spine. *Surg Neurol* 1: 343-346, 1973
- 5) Goldthwait JE: The lumbar-sacral articulation. An explanation of many cases of "lumbago", "sciatica" and paraplegia. *Boston Medical and Surgical Journal* 64: 365-372, 1911
- 6) Inman VT, Saunders JBdeCM: Referred pain from skeletal structures. *J Nerv Ment Dis* 99: 660-667, 1944
- 7) Kellgren JH: Observations on referred pain arising from muscle. *Clin Sci* 3: 175-190, 1938
- 8) Kellgren JH: On the distribution of pain arising from deep somatic structures with charts of segmental pain areas. *Clin Sci* 4: 35-46, 1939
- 9) King JS, Lager R: Sciatica viewed as a referred pain syndrome. *Surg Neurol* 5: 46-50, 1976
- 10) Loew F, Caspar W: Surgical approach to lumbar disc herniations, in Krayenbuhl H (ed): *Advances and Technical Standards in Neurosurgery*, vol. 5. Wien, Springer-Verlag, 1978, pp 153-174
- 11) Lora J, Long D: So-called facet denervation in the management of intractable back pain. *Spine* 1: 121-126, 1976
- 12) Macnab I, Cuthbert FH, Godfrey CM: The incidence

- of denervation of the sacrospinales muscles following spinal surgery. *Spine* 2: 294-298, 1977
- 13) Oudenhoven RC: Articular rhizotomy. *Surg Neurol* 2: 275-278, 1974
 - 14) Oudenhoven RC: Paraspinal electromyography following facet rhizotomy. *Spine* 2: 299-304, 1977
 - 15) Pedersen HE, Blunck CFJ, Gardner E: The anatomy of lumbosacral posterior rami and meningeal branches of spinal nerves (sinu-vertebral nerves). *J Bone Joint Surg [Am]* 38: 377-391, 1956
 - 16) Rees WES: Multiple bilateral subcutaneous rhizolysis of segmental nerves in the treatment of the intervertebral disc syndrome. *Ann Gen Prac* 26: 126-127, 1971
 - 17) Shealy CN: The role of the spinal facets in back and sciatic pain. *Headache* 14: 101-104, 1974
 - 18) Shealy CN: Percutaneous radiofrequency denervation of facets. *J Neurosurg* 43: 448-451, 1975
 - 19) Sinclair DC, Feindel WH, Weddel G, Falconer MA: The intervertebral ligaments as a source of segmental pain. *J Bone Joint Surg [Br]* 30: 515-521, 1948
 - 20) Steinbrocker O, Isenberg SA, Silver M, Neustadt D, Kuhn P, Schittone M: Observations on pain produced by injection of hypertonic saline into muscles and other supportive tissues. *J Clin Invest* 32: 1045-1051, 1953

Request reprints to: J. Ishikawa, M.D., Department of Neurosurgery, Fukui Red Cross Hospital, 2-4-1 Tsukumi, Fukui 910, Japan.