

Lumbar Dorsal Ramus Block for Low Back Pain

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Objective: The goal of this study was to establish the benefits and prognostic factors of lumbar dorsal ramus block (DRB) for low back pain. **Methods:** A retrospective analysis was done with the data obtained from 344 patients with low back pain. The lumbar dorsal rami of L3, 4, 5 were blocked with 0.5% bupivacaine hydrochloride and methylprednisolone acetate. Visual analogue scale (VAS) was evaluated at 2 weeks, 1 month and 3 months and compared with pretreatment values. It was considered to be successful when the VAS grade at 3 months was improved more than 50%. **Results:** The patients had underlying disorders like as sprain (172), spinal stenosis (67), lumbar fracture (36), herniated lumbar disc (35), acute post-operative pain (8), and chronic post-operative pain (26) with success rate of 62.8%, 22.4%, 58.3%, 22.9%, 87.5%, and 34.6%, respectively. **Conclusion:** In sprain, the patients in young age (<60 years) and without leg pain showed good response to DRB. (J Kor Neurotraumatol Soc 2007; 3:82-86)

KEY WORDS: Low back pain · Lumbar dorsal ramus block · Prognostic factor.

Introduction

Low back pain is a disabling condition affecting millions of people worldwide. To elucidate the pathophysiology of low back pain, there have been many studies in this field over the last decade when have been achieved anatomical, pharmaceutical, and surgical advances. Various underlying diseases including vertebral instability, neuromuscular disease, disc disease, ligamentous disease, infection, and neoplasm may affect low back to the cause of a pain.^{1,2,6,17)}

Sometimes, we are facing of difficulty in treatment of medically intractable low back pain without any underlying disease which must be treated surgically. In spite of such achievements and various treatment modalities for low back pain, there still have been no satisfactory clues to solve this problem. Among various treatment modalities, the dorsal ramus block (DRB) to be one of the minimally invasive treatment options for this kind of low back pain.

To establish the benefits and reveal the prognostic factors of DRB, we analyzed the patients who underwent this procedure for medically intractable low back pain with various underlying diseases.

Materials and Methods

Patient population

A retrospective analysis was done with the data obtained from 344 patients with low back pain who visited our hospital from January 2001 to April 2006. These patients were diagnosed as sprain, lumbar fracture, spinal stenosis, herniated lumbar disc (HLD), and acute/chronic post-operative pain.

The diagnosis of sprain was based on the presence of low back pain without any other underlying diseases. Acute post-operative pain was defined as the pain which was severe and persisted for less than 6 weeks after the lumbar operation (fusion, laminectomy, discectomy, etc). Chronic post-operative pain was defined as the pain which persisted for more than 6 weeks after the lumbar operation. Stenosis, HLD, and lumbar fracture were diagnosed by radiologic findings.

The inclusion criteria were; 1) sprain, 2) stenosis, HLD, and lumbar fracture without clinical indication of surgery, 3) acute/chronic post-operative pain. The low back pain should not respond to medical treatment including analgesics and physiotherapy for 4 weeks. The all patients complained of pain worsened by the spinal motions (forward flexion, hyperextension, and/or extension-rotation) and showed local paravertebral tenderness.

Lumbar dorsal ramus block

The patient was placed prone on the fluoroscopy table.

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The skin over the joint was prepared with betadine, and was draped aseptically. With maximum fluoroscopic magnification, the junction of the base of the transverse process and the superior articular process was centered in a straight anteroposterior (AP) projection. The patient was then rotated 10 to 20 degrees contralaterally.

The following procedure was used for targeting L4, 5, and S1 vertebrae, which are the dorsal rami of L3 to L5, bilaterally. The puncture site for optimal approach to the medial branch was located at the junction of superior margin of the transverse process and lateral margin of the superior articular process. Skin puncture was made with a 22-gauge spinal long needle. Under fluoroscopic view, the needle was advanced anteromedially and slightly caudad until the needle tip contacted between the base of the transverse process and the superior articular process, and advance the needle flowing into the target point. A lateral view of the lumbar spine was obtained to confirm the needle tip not to enter the neural foramen. Then 3 cc of the mixed solution of bupivacaine hydrochloride and methylprednisolone acetate was injected for the one dorsal ramus. The L5 “dorsal ramus nerve” was approached in a similar fashion, but the target was at the superomedial aspect of the sacral ala just lateral to the superior articular process of S1 (Figure 1).

Outcome measurement

Patients were evaluated by a visual analog scale (VAS)^{24,25} at two weeks, 1 month and 3 months after DRB. Response was graded as: Excellent (improvement >75%), Good (50–75%), Fair (25–50%), Poor (<25%). It was considered to be successful when the VAS grade was improved more than 50% compared with pretreatment value. We compared the success rates (at 2 weeks, 1 month, 3 months) and VAS grades (at 3 months) according to the patient's underlying diseases (Table 1). Also, in sprain, we

analyzed the success rates at 3 months according to the patient's age, sex, symptom duration, and presence of leg pain (Table 2).

Statistical analysis

Statistical significance was determined via analysis of variance (ANOVA) and t-tests. Results were considered statistically significant if the *p*-value was less than 0.05.

Results

Of total 437 patients underwent DRB, 344 patients were analyzed and 93 patients were excluded from this study. Of the excluded 93 patients, 66 patients were treated surgically (radiofrequency facet rhizotomy, kyphoplasty, laminectomy) and 27 patients were lost to follow up. The mean age was 56.8 ± 16.0 years (18 years to 92 years) and the male to female sex ratio was 1 : 1.6. The mean symptom duration was 24.4 ± 90.8 weeks (4 weeks to 24 years). All patients

TABLE 1. Underlying diseases and success rate of dorsal ramus block

	Success rate (%) [*]		
	2 weeks	1 month	3 months
Sprain (n=172)	86.0	69.2	62.8 [†]
Other than sprain (n=172)	50.6	40.1	34.9
Stenosis (n=67)	41.8	28.4	22.4
Lumbar fracture (n=36)	83.3	66.7	58.3
HLD (n=35)	31.4	25.7	22.9
Acute post-operative pain (n=8)	87.5	87.5	87.5
Chronic post-operative pain (n=26)	42.3	38.5	34.6

^{*}It was considered to be successful when the VAS grade at 2 weeks, 1 month, and 3 months was improved more than 50% compared with pretreatment value, [†]*p*<0.05: sprain vs. other than sprain. VAS: visual analog scale, HLD: herniated lumbar disc

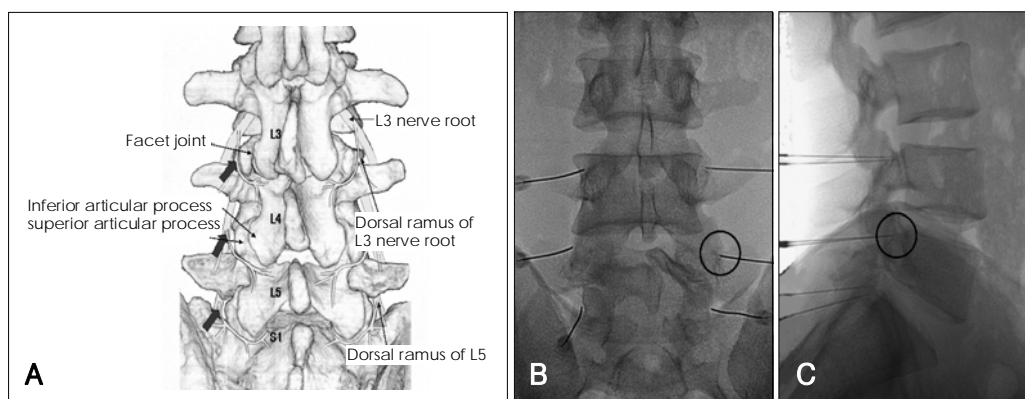


FIGURE 1. Target points for dorsal ramus block. A: Picture showing the target point of dorsal ramus block (large arrows), the angle between transverse process and superior articular process. B, C: Radiographs showing needles injected to the target points of dorsal ramus block for bilateral L3, 4, 5 dorsal rami. Black circle indicating the target point of L4 dorsal ramus block (A: Anteroposterior view. B: Lateral view).

complained primarily of low back pain, and 178 patients (51.7%) had leg pain.

Degree of pain relief

Types of underlying disorder in 344 patients were sprain (172), stenosis (67), lumbar fracture (36), HLD (35), acute post-operative pain (8), and chronic post-operative pain (26). The effects of DRB according to underlying diseases are various (Table 1) and the success rates of DRB in sprain, fracture and acute post-operative pain were relatively better than those in stenosis, HLD and chronic post-operative pain (Table 2). Also, in sprain, the success rates at 3 months were significantly different according to the patient's age and presence of leg pain (Table 3). The sprain patients in relatively young age (<60 years) and without leg pain ($p<0.001$) responded better with DRB. But, there was no significant difference in success rate according to sex and symptom duration.

Adverse effects

Adverse effects were headache (5.5%), nausea/vomiting

TABLE 2. The pre-block VAS vs. post-block (3 months) VAS score according to the underlying diseases

	Pre-block VAS	Post-block VAS
Sprain (n=172)	6.3±1.0	3.4±1.9
Other than sprain (n=172)	6.4±0.9	4.9±2.0
Stenosis (n=67)	6.5±1.0	5.5±1.7
Lumbar fracture (n=36)	6.4±1.1	3.7±2.0
HLD (n=35)	6.3±0.8	5.5±1.7
Acute post-operative pain (n=8)	6.8±0.9	1.9±1.4
Chronic post-operative pain (n=26)	6.2±0.8	4.9±1.7

VAS: visual analog scale, HLD: herniated lumbar disc

TABLE 3. Results of dorsal ramus block in sprain according to gender, age, symptom duration, and presence of leg pain

	Success	Fail	Success rate (%)	p value*
Gender				0.567
Male	44	21	67.7	
Female	64	43	59.8	
Age				0.029
<60	71	32	68.9	
≥60	37	32	53.6	
Symptom duration				0.401
<6 months	64	28	69.6	
≥6 months	44	36	55.0	
Leg pain				0.000
Yes	33	38	46.5	
No	75	26	74.3	

*ANOVA test, p-value less than 0.05 was considered statistically significant. ANOVA: analysis of variance

(6.4%), paresthesia or weakness of the legs (4.3%), worsening of pain (2.6%), and decreased consciousness (0.9%), all of which lasted transiently (<24 hours) without any specific treatment (Table 4).

Discussion

Low back pain is known to originate from the external periosteum, facet joints, muscle, and the ligamentous connection of the neural arches.^{20,22} The dorsal ramus is divided into the medial and lateral branches. In 1980, Bogduk and Long³ demonstrated that pain in the back and thigh could be produced by injecting 6% hypertonic saline in the regions of the medial branch. The medial branches of dorsal ramus of the spinal nerve are distributed on the external periosteum, facet joints, and ligamentous connections of the neural arches and the sinuvertebral nerve (ramus meningeus) ramifies on the structures related to the spinal canal.⁴ The lateral branch of dorsal ramus is distributed on thigh and is connected with gluteal nerve. As a result, it is conceivable that DRB could suppress a low back pain and leg pain.

According to the literatures,^{9,11-13,16,19,21} 29–60% of the patients were improved of low back pain at the following 3 months after facet block or medial branch block (MBB). Facet block represents a selective block of nerve endings in the richly innervated joint capsule.^{1,7} These nociceptive nerve endings continue the medial branch of the dorsal ramus. The therapeutic effects of MBB and facet block are thought to be similar^{11,15,16,19,21} because facet pain is believed to originate from the dorsal rami which innervate the joint capsule.^{4,14} In our study, 70.3% of the patients (242/344) had pain relief in varying degrees (pain relief >25%) at 3 months after DRB. Better results may be attributed to developed imaging studies and better patient selection. Detection of the minor surgical lesions (small HLD, extraforaminal stenosis/HLD, etc) with aid of better imaging studies made us possible to select patients more properly for DRB. The target of DRB is both nerves of the medial and lateral branches, so the DRB is effective for a low back pain and a portion of leg pain. Also, we treated with medications and physiotherapy different from those of previous

TABLE 4. Adverse effects of dorsal ramus block

Symptom	No. of patients	Rate (%)
Headache	19	5.5
Nausea or vomiting	22	6.4
Paresthesia or weakness of the legs	15	4.3
Worsening of pain	9	2.6
Decreased consciousness	3	0.9

study, these additional therapies may affect the outcomes of DRB.

The DRB in the patients with combined diseases such as stenosis, HLD, and chronic post-operative pain were less effective (Table 1) and their success rates were significant low compared to other disease's (Table 2). On the other hand, success rate in the sprain group was much higher than stenosis (22.4%), HLD (22.9%), and chronic post-operative pain (34.6%) groups, respectively (Table 2). These differences are thought to be due to the differences of the pain mechanisms. In sprain, the pain is evoked by irritation not by compression of the nerve. But in stenosis, HLD and chronic post-operative pain, the pain is evoked mostly by mechanical compression at the nerve root proximal to the dorsal ramus. In sprain, stenosis, HLD, and chronic post-operative pain, all the patients complained of pain worsened by the spinal motions (forward flexion, hyperextension and/or extension-rotation) and showed local paravertebral tenderness. These signs were included in "dorsal ramus syndrome".^{3,10)} Although the patients with stenosis, HLD, and chronic post-operative pain had the similar signs, their symptoms originated from the mechanical compression of nerve root as well as the facet joint that the block was less effective in these patients.¹⁰⁾

The success rate of DRB at 2 weeks, 1 month and 3 months decreases with time in various combined diseases (Table 2). These results show that the DRB does not provide permanent effect. However, the DRB is a minimally invasive and its effect may last for a prolonged period of time. Also, the patients who responded better with the block may become good candidates for percutaneous radiofrequency neurotomy for long term effect (9, 17). Therefore, the DRB seems to be useful for diagnostic as well as therapeutic modality.

In acute post-operative pain, the DRB was very effective and lasted the effect (Table 1, 2). But, this result needs further study, because the number of patient with acute post-operative pain was only 8 and it is not certain whether symptom improvement was due to clinical course or therapeutic effect in these patients. Also, DRB was effective in lumbar fracture (Table 1, 2), but this result needs further study due to same reasons in acute post-operative pain.

In sprain, we analyzed the success rates at 3 months according to the patient's age, sex, symptom duration, and presence of leg pain (Table 3). Factors such as old age (≥ 60 years) ($p < 0.05$) and presence of leg pain ($p < 0.001$) were related with poor prognosis after the DRB (Table 3). Mechanical deformations such as degenerative changes of the spine are known to be the primary source of low back pain and leg pain.^{2,17,23)} Most of senile patients have spinal degen-

erative changes, which can cause leg pain originating from spinal ventral ramus. It can be one of the reasons why the success rate of DRB is low for the patients in old age or with leg pain.

Adverse effects of DRB appeared as various forms (Table 4). Most serious adverse effect was change of consciousness. The decreased consciousness was reported in 3 patients over 80 years of age. These patients were treated with close observation and hydration. The adverse effects such as headache, nausea/vomiting and decreased consciousness can be induced by bupivacaine. Bupivacaine hydrochloride is a local anesthetic agent related to the amniocetyl group. The fundamental composition of these agents consists of a benzene ring linked to a piperidine group by an intervening amide group.¹⁴⁾ Contraindication of using a bupivacaine include hypersensitivity to this drug or related compounds. Systemic absorption varies by mode of administration and dosage. Peak blood levels are attained in 30 to 40 minutes after peripheral nerve block, with a gradual decline over 3 to 6 hours. Because its metabolism is dependent on hepatic derangements, the patients with chronic liver diseases may predispose to cardiovascular and central nervous system disturbances.¹⁴⁾ Paresthesia and weakness of the legs were thought to be induced by injecting anesthetic agent around nerve root. These symptoms disappeared spontaneously within 24 hours.

Conclusion

Based on this study, it seems that DRB appears to be a useful and safe treatment option for low back pain in properly selected patients. Low back pain without surgical conditions (stenosis, HLD, and chronic post-operative pain) was good indication for DRB. Especially, the patients of sprain without leg pain and in relatively young age (< 60 years) were expected to good response for DRB.

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