CLINICAL ARTICLE

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The Effect of Lumbar Medial Branch Block on Low Back Pain

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Objective : The goal of this study was to establish the benefit and prognostic factors of lumbar medial branch block(MBB) for low back pain.

Methods : A retrospective analysis was based on the data obtained from 281 patients with low back pain, who visited our hospital between January 2001 and November 2004. Pain relief was evaluated at 2 weeks, 1 month and 3 months. The authors analyzed the results of MBB according to the patient's age, sex, symptom duration, pathologic condition, and presence of radiating pain.

Results : Two hundred eighty one patients had sprain (151), lumbar fracture (27), spinal stenosis (50), herniated lumbar disc (24) acute post-operative pain (8), and chronic post-operative pain (21) with success rate of 63.6%, 59.3%, 26.0%, 25.0%, 87.5% and 42.9%, respectively. The effects of MBB in sprain, lumbar fracture, and acute post-operative pain were significantly better than those in stenosis, herniated lumbar disc and chronic post-operative pain patients. The patients in young age group (<60 years), with short symptom duration (<6 months) and without radiating pain showed good response to lumbar MBB.

Conclusion : The lumbar MBB appears to be safe and effective for low back pain in certain selected patients. Good prognostic factors were low back pain without surgical conditions and radiating pain, with short symptom duration (<6 months), and in relatively young age (<60 years) group.

KEY WORDS : Low back pain · Posterior primary ramus medial branch nerve 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 that have been achieved anatomical, pharmaceutical, and surgical advances. Various pathologic conditions including vertebral instability, neuromuscular disease, disc disease, ligamentous disease, infection, and neoplasm may affect low back to cause pain.

In spite of such achievements and various treatment modalities for disabling low back pain, there still have been no satisfactory clue to solve this problem. Among various treatment modalities, the medial branch block(MBB) of dorsal ramus seems to be one of the minimal invasive treatment options presently.

To establish the benefits and reveal the prognostic factors of MBB, the authors analyzed the patients who underwent this procedure for low back pain with various pathologic conditions.

Materials and Methods

Patient population

A retrospective analysis was done with the data obtained from 281 patients with low back pain who visited our hospital from January 2001 to November 2004. These patients were diagnosed as sprain, lumbar fracture, spinal stenosis, herniated nucleus pulposus(HNP), and acute/chronic post-operative pain.

The diagnosis of sprain was based on the presence of low back pain without combined diseases (lumbar fracture, stenosis, HNP, etc). Acute post-operative pain was defined as the pain which was severe and persisted for less than 4 weeks after

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the lumbar operation (fusion, laminectomy, discectomy, etc). Chronic post-operative pain was defined as the pain which persisted for more than 4 weeks after the lumbar operation.

The inclusion criteria were; (1) sprain not responding to medical treatment over 3 months, (2) stenosis, HNP and lumbar fracture without surgery but not responding to medical treatment for over 3 months, (3) acute/chronic post-operative pain, (4) the patients who were surgically indicated but refused operation or had high risk factors (old age, systemic disease, etc) for surgery. All of these patients complained of pain worsened by the spinal motions (forward flexion, hyperextension, and/or extension-rotation) and showed local paravertebral or percussion tenderness.

Technique of lumbar medial branch block(MBB)

The patient was placed prone on the fluoroscopy table. The skin over the joint was prepared with betadine, and lower back was draped. 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. Patient was then rotated 10 to 20 degrees toward the side of the pain.

The following procedure was used for targeting the medial branches of L3 to L4, bilaterally. The puncture site for optimal approach to the medial branch was located at slightly superior to the level of the transverse process and just lateral to the medial border of the superior articular process. Skin puncture was made with a 22-gauge spinal needle. Under the intermittent fluoroscopic viewing, 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. A lateral view of the lumbar spine was obtained to confirm the needle tip not to enter the neural foramen. Then 3cc of the anesthetic agent mixed solution (0.5% bupivacaine hydrochloride 20cc+ methylprednisolone acetate 40mg) was injected as the blockade. The L5 "medial branch nerve" was approached in a similar fashion. The target was at the superomedial aspect of the sacral ala, just lateral to the superior articular process of S1 (Fig. 1, 2).

Outcome measurement

Patients were evaluated at two weeks, 1 month and 3 months after the treatment. Response was graded as : Excellent (improvement > 75%), Good (50~75%), Fair (25~50%), Poor (<25%). The result was considered as success if the patient reported more than 50% pain relief after MBB (Table 1).

The authors analyzed the success rates according to the patient's pathologic conditions, age, sex, symptom duration, and

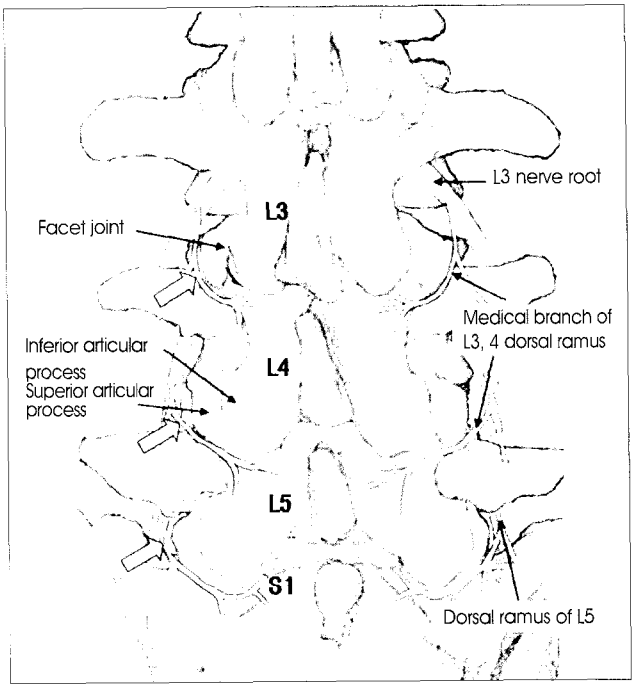

Fig. 1. Picture showing the target point of medial branch block (red arrows), the angle between transverse process and superior articular process.

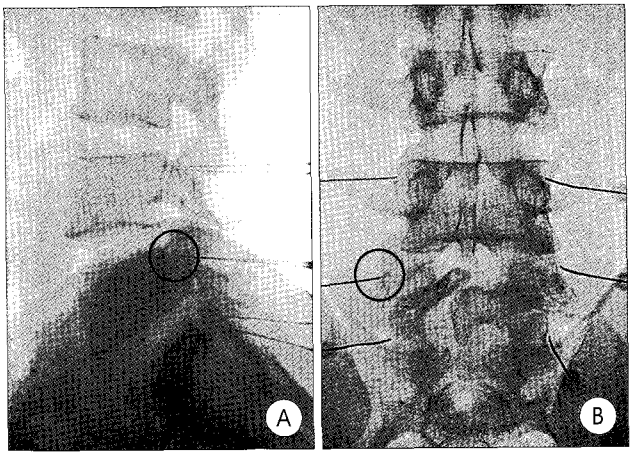

Fig. 2. Radiographs showing needles injected to the target points of medial branch block for bilateral L3, 4, 5 medial branches. Black circle indicating the target point of L4 medial branch block. A : Anteroposterior view. B : Lateral view.

Table 1. Results of medial branch block(MBB)

		2 weeks		1 month		3 months	
		No. of patients		No. of patients		No. of patients	
Excellent (improvement > 75%)	Success*	58	223	52	174	49	147
Good (50~75%)		165	(79.4%)	122	(61.9%)	98	(52.3%)
Fair (25~50%)	Fail	43	58	52	107	53	134
Poor (< 25%)		15	(20.6%)	55	(38.1%)	81	(47.7%)

* The result was considered as success if the patient reported more than 50% pain relief (excellent or good) after MBB

Table 2. Pathologic conditions and the result of medial branch block

	Success	Fail	Success rate (%)
Sprain (n=151)	96	55	63.6*
Lumbar fracture (n=27)	16	11	59.3
Stenosis (n=50)	13	37	26.0
HNP (n=24)	6	18	25.0
Acute post-operative pain (n=8)	7	1	87.5
Chronic post-operative pain (n=21)	9	12	42.9
Other than sprain (n=130)	51	79	39.2

* $p < 0.01$ vs. other than sprain

Table 3. Results of medial branch block according to gender, age, symptom duration, and presence of radiating pain

	Success	Fail	Success rate (%)	p value
Gender				0.535
Male	54	49	52.4	
Female	93	85	52.2	
Age				0.035*
< 60	85	63	57.4	
11-20	1	1	50.0	
21-30	15	9	62.5	
31-40	14	9	60.9	
41-50	17	18	48.6	
51-60	38	26	59.4	
≥ 60	62	71	46.6	
Symptom duration				0.047*
< 6 months	99	62	61.5	
≥ 6 months	48	72	40.0	
Radiating pain				0.000*
yes	50	94	34.7	
no	97	40	70.8	

* ANOVA test, P-value less than 0.05 was considered statistically significant

presence of radiating pain. Also, the authors compared success rate between sprain and other diseases (Table 2).

Statistical analysis

Statistical significance was determined via analysis of variance(ANOVA) and t-tests. P-value less than 0.05 was considered statistically significant.

Results

Of the 344 patients with low back pain, 63 patients were excluded from the evaluation. Fifty one patients were treated with radiofrequency facet rhizotomy and twelve patients were lost to follow up within 3 months. The mean age was 56.7±15.5 years (18 to 92) and the male to female sex ratio was 1:1.7. Symptom duration was from 3 months to 39 years. All patients complained primarily of low back pain, and 144 patients (51%) had unilateral or bilateral radiating hip, thigh, and/or leg pain.

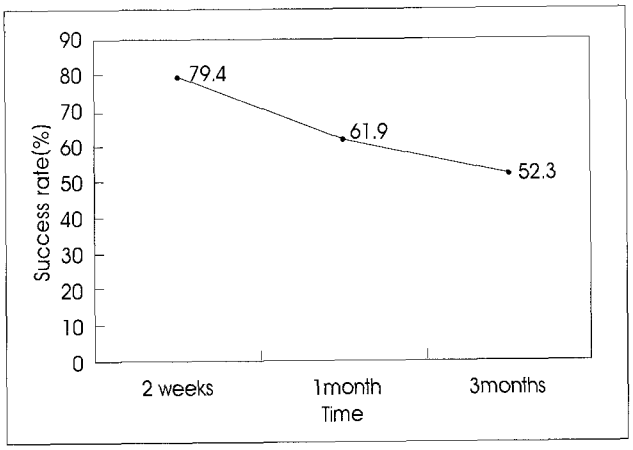

Fig. 3. The results of medial branch block (MBB). The effect of MBB decreased with time.

Table 4. Adverse effects of medial branch block

Symptom	No. of patients	Rate (%)
Headache	10	5.5
Nausea or vomiting	11	6.1
Paresthesia or weakness of the legs	9	5.0
Worsening of pain	8	4.4
Decreased consciousness	2	1.1

Degree of pain relief

Types of underlying disorder in 281 patients were sprain (151), lumbar fracture (27), stenosis (50), HNP (24), acute post-operative pain (8), and chronic post-operative pain (21). Total success rate at 3 months was 52.3% with various results according to the different pathologic conditions (Table 1). The effects of medial branch block(MBB) in sprain, fracture and acute post-operative pain were significantly better than those in stenosis, HNP and chronic post-operative pain ($p < 0.01$) (Table 2). The success rates at 3 months after the block in the patients with sprain, lumbar fracture, stenosis, HNP, acute post-operative pain, and chronic post-operative pain were 63.6%, 59.3%, 26.0%, 25.0%, 87.5%, and 42.9%, respectively (Table 2). The success rate was different according to the patient's age and presence of radiating pain (Table 3). The patients in relatively young age (<60 years), with short symptom duration (<6 months) ($p<0.05$), and without radiating pain ($p<0.001$) (Table 3) responded better with MBB. But, there was no significant difference in success rate according to sex.

The effect of block decreased with time. At 2 weeks, the success rate was 79.4%, but decreased to 52.3% at 3 months follow-up (Table 1) (Fig. 3).

Adverse effects

Adverse effects were headache (5.5%), nausea/vomiting (6.1%), paresthesia or weakness of the legs (5.0%), worsening of

pain (4.4%), and decreased consciousness (1.1%), which lasted only transiently (<24 hours) (Table 4). Headache, nausea/vomiting and paresthesia vanished next day and they did not require specific treatment but patient with decreased consciousness required close observation and hydration.

Discussion

In 1980, Bogduk and Long[3] demonstrated that pain in the back and thigh could be produced by injecting 6% hypertonic saline solution in the regions of the medial branch. Medial branches of the 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]. Low back pain may originate from the external periosteum, facet joints, muscle, and the ligamentous connection of the neural arches[19,21]. As a result, it is conceivable that medial branch block(MBB) of dorsal ramus could suppress low back pain.

In the literatures[8,10-12,15,18,20], 29~60% of the patients were improved of low back pain at the following three months after facet block or MBB. Facet block represents a selective block of nerve endings in the richly innervated joint capsule[1,6]. These pain-sensing nerve endings continues as sensory fibers and finally joins the medial branch of the dorsal ramus. The comparison of the therapeutic effect of MBB with facet block is thought to be meaningful, because facet pain is believed to originate from the dorsal rami which innervate the joint capsule[4,13] that there are reports indicating no difference in the effect between MBB and facet block[10,14,15,18,20]. In our study, 70% of the patients had pain relief in varying degrees (Table 1). Better results may be attributed to developed imaging studies and additional therapies. Detection of the minor surgical lesions (small HNP, extraforaminal stenosis/HNP, etc) with aid of better imaging studies made us possible to select patients more exactly to result in better outcome. Also, oral medications and/or physical therapy after the block may contribute to the additional symptomatic relief.

Therapeutic outcomes of the patients with combined diseases (stenosis, HNP, chronic post-operative pain) were less effective with the block ($p<0.01$) (Table 2). Success rate of sprain was much higher than stenosis (26.0%), HNP (25.0%), and chronic post-operative pain (42.9%), respectively. These differences of success rate are thought to be due to the differences of the pain mechanisms. In sprain, pain is evoked by irritation not by compression of the nerve. But in stenosis, HNP and chronic post-operative pain, pain is evoked mostly by mechanical nerve compression. This could explain why MBB showed different effect according to the causes of pain. In this study, all patients complained of pain worsened by the spinal motions (forward flexion, hyperextension and/or extension-rotation) and showed local paravertebral tenderness or percussion tenderness. These signs were included in "dorsal ramus syndrome". Although the patients with combined diseases (stenosis, HNP, chronic post-operative pain) had these signs, their symptoms originate from the complex spinal structures as well as the facet joint that the block was less effective in these patients[9].

Interestingly, acute post-operative and lumbar fracture pain were very effectively suppressed with the block. But, these results need 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.

Factors such as long symptom duration (≥6 months), old age (≥60 years) ($p<0.05$) and presence of radiating pain ($p<0.001$) were related with poor prognosis in MBB (Table 3). Pain is a complex phenomenon involving not only peripheral nociceptiors, but also the central nervous system, including the spinal cord and brain. When massive signals reach spinal nociceptive neurons, the central nervous system become sensitized. The release of large amount of glutamate and substance P cause permanent hyperexcitability of the neurons despite the diminution or even disappearance of the initial nociceptive message. When the treatment of chronic pain is considered, peripheral and central parameters must be carefully analyzed. Sensitization of the central nervous system can in itself be responsible for chronic pain[5,16]. This result may explain why long symptom duration (≥6 months) is one of the poor prognostic factors.

Mechanical deformations such as HNP, stenosis and other degenerative changes of the spine are known to be the primary source of low back pain and radiating pain[2,16,22]. Nearly all of the senile patients have spinal degenerative changes. Also, radiating pain originates from spinal ventral ramus. It may be one of the reasons why MBB is less effective for the patients in old age or with radiating pain.

The effect of MBB decreases with time. In our series, success rate was 79.4% at 2 weeks, but the success rate at 3 months was dropped to 52.3% (Table 1), (Fig. 3). In this sense, MBB is considered a therapeutic modality that does not provide permanent effect. However, it is a minimal invasive and its effect may last in 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, MBB seems useful option for diagnostic, prognostic as well as therapeutic modality.

Adverse effects of MBB appeared as various forms (Table 4). Most serious adverse effect was change of consciousness. The

decreased consciousness was reported in two patients over 80 years of age. The author treated with close observation and hydration in these patients. 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 amnioacyl group. The fundamental composition of these agents consists of a benzene ring linked to a piperidine group by an intervening amide group. Contraindication of using 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[13]. Paresthesia and weakness of the legs were thought to be induced by injecting anesthetic agent around nerve root. These symptoms disappeared within 24 hours.

Evaluation of pain requires objective methods. Visual analog scale (VAS)[23,24], McGill pain questionnaire[26], SF-36[25] and Oswestry disability index[7] have been used for pain evaluation. The percentage scoring method[17] which were used in this study compares between pre- and post-block effect. This method is suitable for the evaluation of block effect, but has certain limitations for measuring pain severity and character. The pain severity and character may influence the block effect, so further study will be needed by using VAS, McGill pain questionnaire, SF-36, and Oswestry disability index for the evaluation.

Conclusion

Based on this study, it can be concluded that medial branch block appears to be a very useful and safe treatment option for low back pain in selected group of patients. Good prognostic factors were low back pain without surgical conditions (stenosis, HNP and chronic post-operative pain) and radiating pain, with short symptom duration (<6 months), and in relatively young age (<60 years) group.

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Commentary

This article makes several contributions to neurosurgical practice. I enthusiastically agree with the use of lumbar facet block, and our experience[1] through many years corroborates the authors' findings. The procedure is simple to plan and successfully creates with fluoroscopy.

The author presents an interesting retrospective study of

the benefit and prognostic factors in lumbar medial branch block on low back pain. The data based on 281 patients with low back pain from 2001 to 2004. The author's inclusion criteria were lumbar sprain, lumbar fracture, spinal stenosis, HNP, acute and chronic postoperative pain with the successful result rate of 63.6%, 59.3%, 26.0%, 25.0%. 87.5% and 42.9%, in respective. Also, authors analyzed age group, gender, pain onset, pathogenic disease, and the presence of radiating pain. In conclusion, good prognostic factors were low back pain without surgical conditions and radiating pain, with short symptom duration (<6 months), and in relatively young age (<60 years) group. The author discussed that the minimally invasive, medial branch block was considered a therapeutic modality that did not provide permanent effect. The author expected oral medications and/or physical therapy after the block would be continued for additional symptomatic relief.

To the point of view in commentary, this article mainly based on the properties of diagnostic blocks. Although there were essentially 344 patients with low back pain, only 281 were correctly detected. As authors readily acknowledged weakness, they might omit to consider the result of unknown numbers of primary and/ or secondary diagnostic blocks, which should have been done prior to 51 cases of RF facet rhizotomy. Because of the author's intentional data analysis, the false negative rate of controlled blocks might be high and the false-positive rate of single diagnostic blocks might be low in result of any other diseases. After successful diagnostic blocks, additional symptomatic relief will be accomplished by RF facet rhizotomy in advance. Oral medications and/or physical therapy can not provide life-long effect for patients. Overall, this is an interesting article that provide data to support the low back pain control with medial branch block. With necessary procedures, the authors also described a useful treatment option for low back pain in detail.

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