

Cognitive-Behavioral-Based Physical Therapy for Patients with Severe Lumbar Spinal Stenosis: A Report of 38 Cases

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ABSTRACT

The aim of this study was to perform a follow-up of patients of lumbar spinal stenosis (LSS) with severe stenosis (narrowing of more than two-thirds/MRI axial T2) who received cognitive-behavioral-based physical therapy (CBPT) in our clinic.

From January 2019 through June 2019, 255 cases of history of LSS came to our clinic. Cases with fracture of vertebral body et al. were excluded.

Finally, 38 cases with severe stenosis were selected.

Among these 38 patients with severe LSS, 26 (68%) patients came back to our clinic for other reasons (neck pain etc.) and were free of LSS-related symptoms. On the other hand, 12 (32%) came back with LSS-related symptoms. Among these, 11 patients underwent CBPT again with good result. Revision of the decision not to operate occurred in 1 case.

Our study depicted the important aspect of good natural history of LSS patients with severe stenosis under CBPT program.

In CBPT program we set 3 phases of treatment which is acute phase, subacute phase and chronic phase. Exercise should be individualized in each phase.

The details of CBPT which have rarely been reported are discussed.

Keywords: lumbar spinal stenosis (LSS), cognitive-behavioral-based physical therapy (CBPT), 3 phases of treatment

INTRODUCTION

Despite unequivocal benefits of surgical interventions in patients with lumbar spinal stenosis (LSS), results based on pain and disability levels suggest incomplete long-term recovery [1]. The reoperation rate after surgery for LSS appeared to be higher recently than in the past, and consideration of this problem is required [2].

There is a mounting concern about the rising rates of surgery of LSS and opioid use in older adults [3].

And this concern makes a compelling case for the dissemination of new evidence about safe and effective nonsurgical treatment options for LSS.

A targeted CBPT program for patients at risk for poor recovery after spine surgery is suggested to result in significant and clinically meaningful improvement in postoperative outcomes, and CBPT has the potential to be an evidence-based program that clinicians can recommend [4].

The early cognitive behavioral intervention for back pain produces long-term health and economic benefits [5]. Linton et al. recommended that research be conducted on how best to incorporate a cognitive behavioral approach to typical clinical settings like primary care [5].

For all LSS patients who visited our clinic, we have recommended CBPT instead of surgery after confirming the absence of cauda equina

Cognitive-Behavioral-Based Physical Therapy for Patients with Severe Lumbar Spinal Stenosis: A Report of 38 Cases

syndrome. Supporting an initial non-operative attitude is the study by Zweig et al. [6] which showed that the duration of pre-operative conservative treatment was not associated with the ultimate outcome of decompression surgery. Thus, recommending conservative treatment due to moderate symptom levels without cauda equina syndrome could be done safely, with little risk of deterioration.

Except for a few patients, most of patients of our clinic agreed with enrolling in CBPT program.

In the past, CRBT of 2 cases was discontinued in the first 3months of first treatment. In these two cases, the patients preferred to try other more active exercise program. Otherwise almost all patients followed our proposal of CBPT program and completed it in our clinic.

After the initial CBPT program which takes 3-5 months (1-2times of CBPT a week), no patients needed surgery up to at least three years.

OBJECTIVES

The purpose of this study was to perform a follow-up of patients of LSS with severe

stenosis who received cognitive-behavioral-based physical therapy (CBPT) in our clinic and more than 3 years have passed since the first treatment.

A further purpose was to study the degree of pain, disability and need for surgery in case of relapse of symptoms.

MATERIALS AND METHODS

From January 2019 through June 2019, 255 cases with history of LSS came to our clinic for many reasons and examined mostly by one doctor(S.Yasuoka).

Clinical syndrome of LSS requires both the presence of a characteristic clinical presentation, including neurogenic claudication, radicular pain, or both, and radiographic or anatomic LSS [7]. The absence of the cauda equina syndrome was confirmed before and after recommending CBPT in each case.

The imaging protocol of MRI included sagittal T2-weighted fast spin echo and axial T2-weighted axial images were taken at each lumbar intervertebral level (L1/2–L5/S1) parallel to the vertebral endplates.

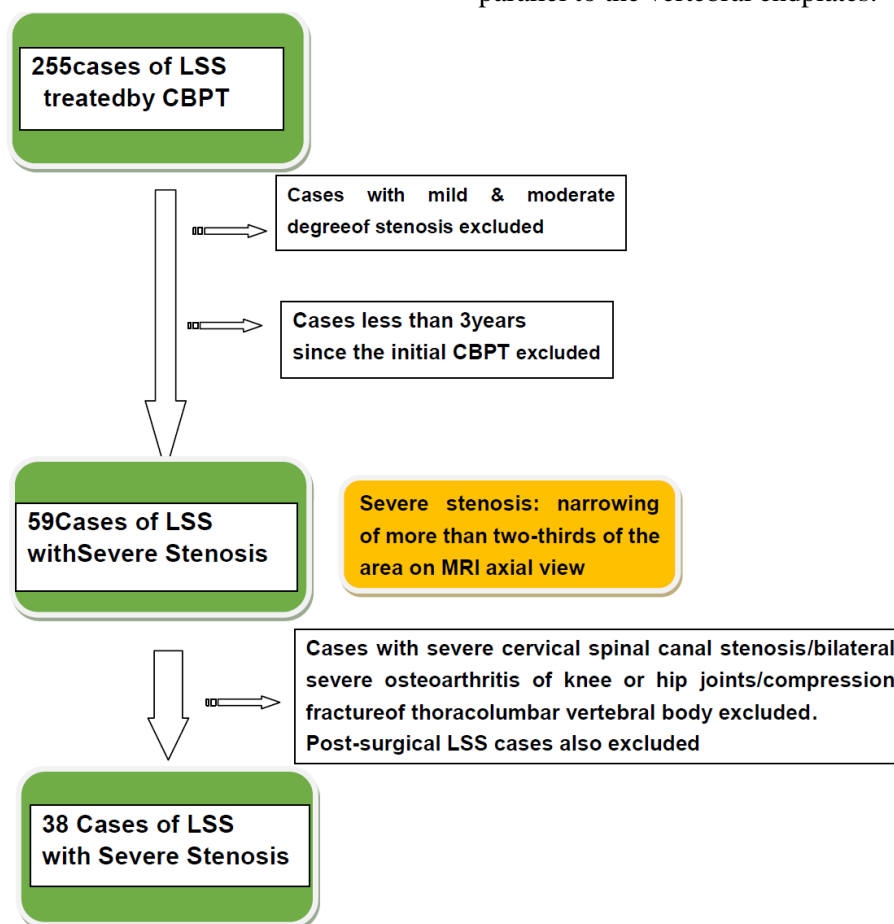


Fig1. Process of patient selections

Cognitive-Behavioral-Based Physical Therapy for Patients with Severe Lumbar Spinal Stenosis: A Report of 38 Cases

We applied the classification in a general guideline in which mild stenosis was defined as narrowing of one-third of the normal area or less, moderate stenosis as narrowing of between one- and two-thirds, and severe stenosis as narrowing of more than two-thirds of the area [7,8]. Central stenosis and lateral recess stenosis were rated on the axial images.

LSS cases with mild and moderate degree of stenosis were excluded (narrowing of less than two-thirds/MRI axial T2).

Also, cases less than 3 years have passed since the initial CBPT in our clinic were excluded, and 59 cases with severe stenosis were selected.

Another aspect of our selection was the exclusion of those who had

a. severe cervical spinal canal stenosis, b. bilateral severe osteoarthritis of knee or hip

joints, c. compression fracture of thoracolumbar vertebral body (a.b.c. total 11 cases), and d. prior surgery for LSS (10 cases).

Finally, 38 cases with severe LSS (narrowing of more than two-thirds/MRI axial T2) were selected and analyzed (Fig. 1).

The mean age of those 38 cases was 78.4 years old (68-91), and 55% were females.

Follow up periods since the first cognitive-behavioral-based physical therapy (CBPT) was from 3 years up to 17 years over a median of 7.1 years. In 26 patients the follow-up period was more than 5 years and in 7 patients the period was more than 10 years (Fig. 2).

The details of CBPT for LSS have not been discussed in the past. And so CBPT in our clinic are described later in *Discussion*.

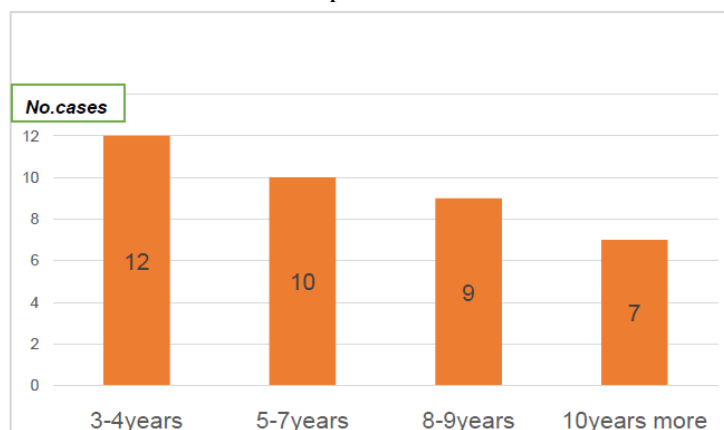


Fig2. Years after the first CBPT

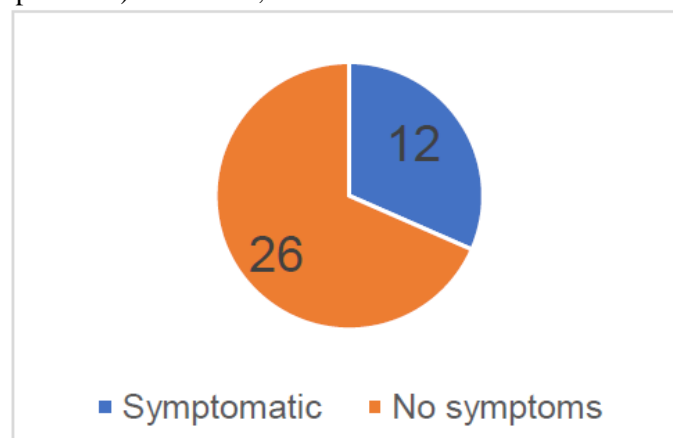
In 26 patients (68%) the follow-up period was more than 5 years, and in 7 patients the period was more than 10 years.

RESULTS

Among these 38 patients with severe LSS, 26 (68%) patients came back to our clinic for other reasons (trauma/neck pain etc.) than LSS, and

those patients were free of LSS-related symptoms. Little or no LSS-related pain was reported by these patients.

On the other hand, 12 (32%) patients (8 men and 4 women) came back with LSS-related symptoms (sciatica and or intermittent claudication) (Fig. 3).



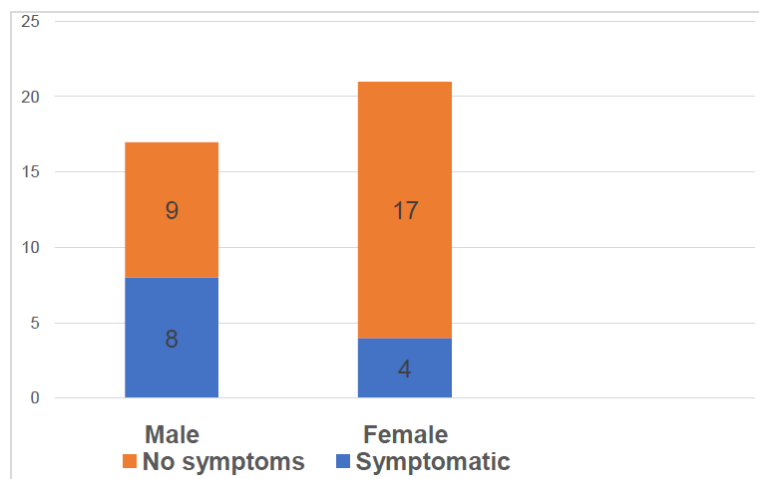


Fig3

LSS-related symptoms were present in 12 cases (Male 8/mean age 76.3 & Female 4/mean age 83.0).

No LSS-related symptoms in 26 cases (Male 9/mean age 80.3 & Female 17/mean age 77.5).

Among 8 symptomatic male patients, 4 patients were sports enthusiasts (golf 2, tennis 1, climbing-mountains 1), and 1 patient was overseas travel enthusiast. Among 4 symptomatic female patients, 88 years old woman was a volunteer activist and a mountain lover. Among 9 asymptomatic male patients, 1 patient were sports enthusiasts (golf 1, tennis 0, climbing-mountains 0), and 1 patient was overseas travel enthusiast. Among 17 asymptomatic female patients, 2 patients were sports enthusiasts (golf 1, dance 1) and most other patients enjoyed walking.

Among 12 symptomatic patients, 11 patients (29%) did not have severe pain, and surgery was not necessary. These 11 patients underwent same CBPT as before and LSS related sciatica and or intermittent claudication improved by resuming same CBPT program as the first time, and VAS score changed from 40~60 to 0~20 in 3 months.

Revision of the decision not to operate occurred in 1 male case (2.6%) who was a golf lover and had enjoyed playing golf from 4 to 8 times a month.

The results of our study showed that the history of LSS after CBPT was good.

This is supported by the fact that roughly two-thirds of the patients reported no pain and no walking disability at the time of follow-up. The relapse of symptoms was noted in one-third (58% for sciatica and 42% for intermittent claudication).

And LSS related symptoms relapsed were relieved without surgery in shorter periods of time after resuming CBPT program than before except for one case.

After CBPT, patients were more active, enjoyed better quality of life, and had better general health than before CBPT.

DISCUSSION

The Details of CBPT in Our Clinic- Time Schedule of Treatment

The details of CBPT have rarely been discussed.

In our CBPT program, patients visit our clinic once or twice a week for evaluation and treatment, and it takes 3-5 months for its completion.

Good communication and reliance are the first step of CBPT.

Patient-clinician relationship, particularly rapport building, plays an important role in treatment outcomes in patients with chronic pain [9]. Reassurance removes fears and concerns in patients with LSS. CBPT focuses on restructuring the negative cognition of the patient into a realistic appraisal [10].

Education of pathophysiology of LSS decreases negative and catastrophic thoughts of patients.

With extension, the hypertrophic ligamentum flavum buckles into the canal worsening the stenosis and exaggerating sciatica and/or claudication symptoms. Main rationale of CBPT for LSS is the limitation of excessive and repeated extension of lumbar spine in daily life. In CBPT the limitation of excessive extension of

Cognitive-Behavioral-Based Physical Therapy for Patients with Severe Lumbar Spinal Stenosis: A Report of 38 Cases

lumbar spine in daily life should be achieved for long period of life through Exercise, Education, Manual therapy and the ancillary use of Lumbar corset.

Time schedule of treatment

In our clinic the time schedule of treatment was divided into 3 phases (Table 1).

Table1. Time schedule of treatment at acute phase, subacute phase and chronic phase

	Symptoms	Exercise	Education	Corset
Acute Phase/ first 6-8 weeks	Aggravated/ Persistent	Isometric exercise Core muscle/draw-in	++	++ mandatory
Subacute Phase/ 8-12 weeks	Improving	Isometric exercise Core muscle/draw-in Stationary bicycle pole-walking	++	+
Chronic Phase/ 12 weeks after	Relieved	Isometric+Isotonic exercise Trial of Sports activity	++	+/-

Tailored and individualized CBPT program that included exercise, patient education, manual therapy and the use of corset. The intensity and contents of exercise should be differed in each phase.

Exercise in Each Phase

Exercise should be individualized in CBPT program.

Acute Phase/first 6-8 weeks: This is the period of activated mechanical inflammation surrounding cauda equina and nerve root. It is mandatory to wait to start sports activity until mechanical inflammation subsides.

Isometric exercise, especially core muscle training/draw-in is recommended.

Acute Phase/first 6-8 weeks of treatment: Symptoms are aggravated or persistent in this phase.

Subacute Phase/ first 8-12 weeks: Symptoms are improving.

Chronic Phase/ 12 weeks after: Symptoms are relieved in this phase.

Subacute Phase/8-12 weeks: Continue isometric exercise. Stationary bicycle in forward leaning posture and pole-walking are recommended

Chronic Phase/12 weeks after: Continue isometric exercise and start isotonic exercise. Try to resume sports activity very cautiously.

The **acute phase**, the first 6-8 weeks, is the most important period. Patients are advised to do isometric exercises (for example core muscle training, draw-in respiration). Isotonic lumbar exercise should be prohibited with or without any instrument. Limit all bending especially backward, twisting, and strenuous activity including lifting. Light activity such as walking with individualized corset is allowed, as tolerated in this phase (Fig. 4).

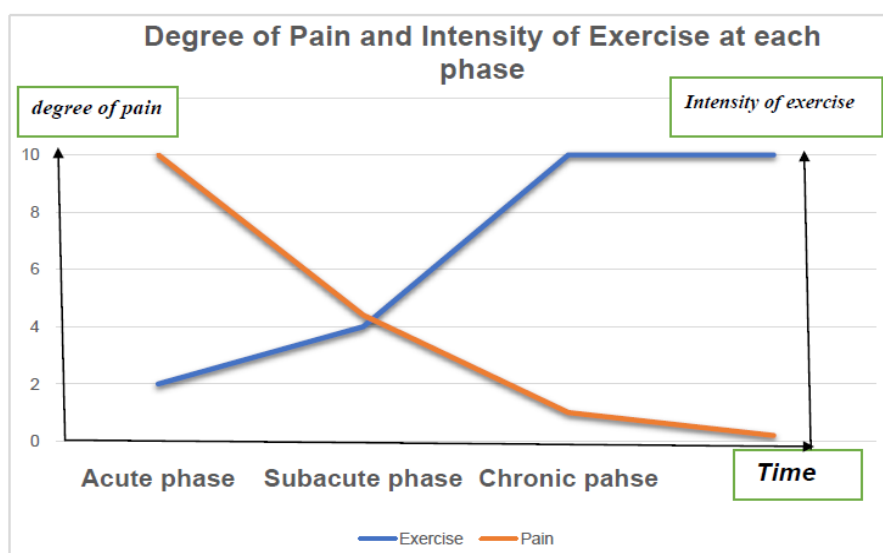


Fig4. Chart shows the degree of pain and intensity of exercise at acute phase, subacute phase and chronic phase. The acute Phase, the first 6-8 weeks, is the most important period. Patients are advised to do isometric exercises (core muscle training, draw-in respiration). Light activity such as walking with individualized corset is allowed, as tolerated in this phase.

Education

The education based on pathophysiology and clinical data is essential. In patients with LSS, dural sac, cauda equina, or nerve-roots are compressed by hypertrophic ligamentum flavum (LF), osteophytes, disc protrusions and facet enlargement. With extension of lumbar spine, the hypertrophic ligamentum flavum buckles into the canal, worsening the stenosis and exaggerating symptoms. LF hypertrophy is the main cause of LSS and mechanical stress plays a crucial role in LF hypertrophy through cartilage matrix increase [11]. To avoid repeated excessive mechanical stress to LF and lumbar disc which is enhanced by extension of lumbar spine is the key to the patient education and treatment. Patients were trained on posture and pelvic tilt to reduce the lumbar lordosis and maximize spinal canal diameter when standing and walking.

The statistical data of Wakayama Spine Study [8] and Fukushima Spine Study [12] removed fears and brought reassurance to the patients. The Wakayama Spine Study evaluated the prevalence of radiographic LSS and its association with clinical symptoms in the general population using MRI. Study showed that 77.9% of participants had more than moderate central stenosis and 30.4% had severe central stenosis, but only 17.5% of participants with severe central stenosis were symptomatic [8].

Another crucial aspect of education of CBPT is to point out and stop the inappropriate exercise or activity of patients which could be a trigger for relapse of symptoms. Any exercise or motion in which lumbar spine is extended could be a trigger. Turning over and stretching in bed could be a trigger of pain in LSS patients. Playing golf or tennis too often a week should be cautioned. Holding up and carrying very heavy stuff is a common cause of onset/recurrence of pain. Sometimes one exercise (action) was pointed out as a trigger of recurrence. It is just like “the straw that breaks the camel’s back”.

These educational suggestions are provided by a doctor and skilled and experienced physiotherapists.

Manual Therapy by Physiotherapists

Relaxation and stretching of lumbar spine and hip joint to reduce pain are replicated at each visit by physiotherapists. Patients are helped to

repeat draw-in exercise and master body repositioning especially pelvic tilt. Draw-in respiration exercise is combined with mindfulness meditation or mindfulness interventions [13].

Lumbar Corset

The use of a lumbar corset increased walking distance and decreased pain in patients [14]. In the acute phase patients were advised to wear individually designed lumbar corset with stiff and strong back support except for bedtime, shower time and dinner time. Stiff and strong back support of lumbar corset was used in an attempt to produce relative flexion of the lumbar spine which results in tightening of the hypertrophic ligamentum flavum and to prevent the ligamentum from buckling into the canal, maintaining a bigger canal diameter and enlarging the neural foramen. The main role of lumbar corset is more the limitation of extension of lumbar spine than the rigid fixation. Soft ready-made corset without strong back support was not used.

In Chronic Phase 12weeks after, the use of corset was advised to be tapered off.

In this study good results of corset as an ancillary treatment of CBPT are sustained even after the brace is removed.

Advantages and Disadvantage of CBPT

Our study suggests CBPT can be an effective and safe option for patients with severe stenosis but without the cauda equina syndrome.

In surgical cases it should be noted that the rate of side effects ranged from 10% to 24%. No side effects were reported for any conservative treatment.[15] No infection and no mortality by CBPT of course.

The advantage of surgery was no longer significant after 5 years of surgery [16]. The reoperation rate has been reported to range from 18 to 23% at 8 to10 years after surgery [16,17].

Indirect surgical decompression is contraindicated in cases with severe preoperative canal stenosis and neurological deficit because they were identified as risk factors for postoperative neurological deterioration [18].

Our study showed severe canal stenosis without cauda equina syndrome is not contraindicated for CBPT.

Another advantage of CBPT is the easiness of treatment in cases of recurrence. In cases of recurrence, good communication and reliance which are the essential step of CBPT are already established. The fears and concerns of patients about LSS are much less. The educational suggestions could be provided again by a doctor and physiotherapists in a shorter time of periods. And above all, patients don't have to learn the "Dos and don'ts" of LSS step by step, but they just need to recall it.

Even if symptoms relapsed several years after the first CBPT, symptoms were not severe and the duration of episodes were shorter compared with the first episode, and they were easily controlled by repeating CBPT in our clinic.

On the other hand, the disadvantage of CBPT is as follows.

- a. Patients with cognitive disorder or with severe depression are not candidates for CBPT.
- b. CBPT program takes time and cost to complete. Socioeconomic basis should be sound in each society.

Benign Nature of LSS- Could it be called a "Self-Limited Disease" in the Near Future

Because control study of LSS patients suffering from pain, discomfort and depression in medical institute has ethical problem and was not done in this study. But control study without intervention had been described by Wessberg et al. [19]

Our study depicted the aspect of good clinical history of LSS patients with severe stenosis under CBPT program.

There are several scientific evidences which suggest the benign nature of LSS.

- a. The Wakayama Spine Study using MRI [8] evaluated that among the participants with severe central stenosis only 17.5% were symptomatic.
- b. A study by Zweig et al. [6] showed that the duration of pre-operative conservative treatment was not associated with the ultimate outcome of decompression surgery.
- c. Wessberg et al [19] reported that the natural history of LSS with moderate symptoms was good. Their study showed that worsening was noted only in 10-13% for pain levels and 22% for walking ability over a median of 3.3 years,

and roughly one-third of the patients reported improvement of pain and walking ability, with half of the patients unchanged.

Above each evidence suggests each aspect of benign nature of LSS.

Our study also suggests another clinical aspect of benign nature of LSS.

The natural history of frozen shoulder is well known to be good, and patients follow the established treatments (for example wall climbing exercise) for several months, instead of rushing into surgical treatment, and frozen shoulder is called a "self-limited disease".

When good natural history of LSS is widely well recognized, and the most appropriate non-surgical treatment including CBPT for LSS were established, LSS also could be called a "self-limited disease" in the near future.

Limitations and Strength

There were some limitations associated with this study. Residents of Musashino-City suburban area of Tokyo are well-educated, and it was easier for clinicians to build patient-clinician relationship and to educate except for a few cases.

CONCLUSION

The findings of our study suggest that tailored CBPT that included patient education, exercise, manual therapy by physiotherapists and the ancillary use of corset is an effective and safe option even for patients with severe stenosis and with sciatica or intermittent claudication due to LSS.

We set 3 phases of treatment which are acute phase, subacute phase and chronic phase. The intensity and contents of exercise was differed in each phase.

The details of CBPT which have rarely been reported are discussed.

Our study depicted the important aspect of good natural history of LSS patients under CBPT program.

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Cognitive-Behavioral-Based Physical Therapy for Patients with Severe Lumbar Spinal Stenosis: A Report of 38 Cases

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