Lumbar Disc Herniation with Radiculopathy: A Prospective Study of the Functional Outcome with Physical Therapy Management.

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ABSTRACT

The purpose of this study was to demonstrate the functional outcome of physical therapy management on patients with Lumbar disc herniation (LDH) and radiculopathy without surgical interference. Eighty-two patients (48 males and 34 females) with lumbar disc herniation were selected for this study. Their ages ranged between 24 44 years. Twenty two of those patients (26.8%) discontinued the physical therapy program and were referred for surgery while the remaining 60 patients (73.2%) were available for comprehensive follow up. All patients had undergone a physical therapy rehabilitation program consisting of exercise training and pain control modalities for successive 3 months with every other day setting. The therapeutic effects were evaluated by the Japanese Orthopedic Association score, the verbal numerical scale, Hannover Activities of Daily Living (ADL) Questionnaire, trunk muscle strength and mobility. The measurements were performed before treatment and 12 weeks after its start. Results of the study indicated significant functional outcome (P<0.001) of patients with lumbar disc herniation (LDH) and radiculopathy who could continue the physical therapy rehabilitation program. This study also showed that, many patients with LDH and radiculopathy who were identified for surgical interference can be successively treated non-operatively with physical therapy management.

INTRODUCTION

Lumbar disc herniation (LDH) is a common condition with a favorable prognosis in the majority of circumstances[9]. It is considered a prominent source of low back pain and lower extremity radiculopathy[6]. Lumbar disc herniation typically occurs as a result of annular degeneration leading to weakening of the annulus fibrosis, leaving it susceptible to annular fissuring and tearing[16]. Nuclear migration caused by annular disruption leads to the most common forms of clinically recognized LDH[1]. The spinal canal location of disc trespass will determine the type of neural compromise and clinical pain pattern[9]. The degree of neural compromise can not be judged accurately by the size, type or location of the disc material[4]. The factors that determine the pain producing capability of

LDH is unclear and may be related to its chemical potential more than its anatomic characteristics[11]. The goal of care must be directed to the improvement of patient s function and treatment. Approaches that do not establish a clear path to this goal should be discouraged[9]. There is no data to support the premise that operative intervention will restore neurologic function more rapidly than natural history or non-operative intervention[17]. Controversy still exists regarding the indication for surgical interference of LDH and the appropriate surgical procedure of choice and the functional outcome after surgery[10]. On the other hand, recent researches clearly indicated the importance of trunk muscle strength and mobility exercise for the integrity and repair of intervertebral discs and zygapophysial joints[13].

MATERIALS AND METHODS

(A)- Subjects:

Eighty two patients with lumbar disc herniation (48 males and 34 females), twenty-two to forty-four years old were involved in this study. To be included in the study, the patient had to complain from low back pain with radicular sensory and motor deficits of the lower limbs of at least three months duration without relief although of continuous medications and rest. The clinical findings of LDH were verified by magnetic resonance imaging (MRI) or computed tomography (CT). All patients with all forms of bladder disturbances were excluded from the study. General characteristics of the subjects are demonstrated in table (1):

Table (1): General characteristics of the study group:

Variable		*No.*	*%*
Sex	Male	48	58.5
	Female	34	41.5
Level of lesion	L4 -- L5	39	47.6
	L5 -- S1	35	42.6
	L3 -- L4	8	9.8
Type of lesion	Protrusion	33	40.2
	Extrusion	38	46.4
	Sequestration of free fragment	11	13.4
Single or multiple level	Single	72	87.8
	Multiple	10	12.2
Associated pathology with LDH:	No associated pathology	66	80.5
	Spinal canal stenosis	5	6.1
	Spondylolithesis	3	3.7
	Facet joint arthropathy	8	9.7

(B)- Measurements:

Subjects were subjected to the following examinations at the start of the treatment period and at the end of the 12th week after termination of the physical therapy treatment program.

1- Japanese Orthopaedic Association (JOA) Score (Quoted from Takemasa et al., [13]).

It assesses the clinical symptoms and treatment responses of low back pain. The normal JOA score is 29 points including 9 points in the rating of three symptoms, 6 points in the rating of three clinical signs and 14 points in the rating of seven activities of daily living.

2- *Verbal Numerical Scale (VNS):*

It was used to measure the degree of pain by allowing the patient to choose a number between 1 to 10 which represents his pain intensity.

3- *Hannover Activities of Daily Living (ADL) Questionnaire (Quoted from Michel et al., [8]):*

It is a functional scale for ADL consisting of 12 items of ADL of trunk.

4- *Trunk Muscle Strength*:

It includes assessment of flexors and extensors of the trunk by manual muscle testing.

5- *Trunk mobility:*

It includes measurement for range of motion of flexion, extension, right and left side bending, rotation of the trunk to the right and to the left by using an O.B. hydraulic Goniometer.

(C)- Treatment Procedures:

A specific physical therapy program was applied for successive 12 weeks; 3 times/weekly, for each patient in the form of:

- Preliminary superficial heating of the low back for 20 minutes, 5 minutes of deep heat by continuos ultrasonic 2-2.5 w/cm^2 on paraspinal muscles of lumbar vertebrae and TENS for 15 minutes if there is radicular pain.
- Graduated well-designed program of trunk muscles strength including isometric and dynamic flexion and extension exercises.

This program included a series of graduated exercises. The patient started with the most easier one and ended with the most difficult. He started in the first session with the first two progressions and in each following session started with the previous progressions, and another new step was then added. Any exercise provoked or exaggerated the pain was stopped at once. Each patient repeated each exercise 20 times during the session and was instructed to repeat that three times daily at home.

This program includes:

From supine crook lying position:

- The patients started with isometric exercises of flexor and extensor muscles of the trunk for at least 10 seconds hold for each exercise (Draw umbilicus in, squeeze buttocks and adduct the thighs).
- Single-knee-to chest exercise.
- Double-knee to chest exercise.
- Pelvic bridging exercises.
- Curl up exercises (trunk raising).
- Diagonal curl up exercises (trunk raising to the left and right).

From prone lying position:

- Unilateral hip hyperextension with extended knee.
- Bilateral hips hyperextension with extended knees.
- Head and trunk raising with support on forearms.
- Head and trunk raising with the upper limbs beside the body.
- Head, trunk and upper limb raising exercise.

- Head, trunk, upper and lower limbs raising with support on the abdomen only.
- The same exercise with both hands behind the head.
- The same exercise with both upper limbs in abduction.
- The same exercise with elevated upper limbs.

- Soft tissues flexibility and joint mobility program of the back and lower limbs.
- Graduated strengthening exercises of pelvic girdles, hips, knees and ankles musculature especially of those with weakness as a result of the radicular affection of LDH.

RESULTS

Of eighty-two patients in the study, sixty were able to undergo the study till the end. The remaining 22 patients showed progressive neurological deficits and were referred for surgery without delay (10 of them suffered from severe intolerable pain, 6 showed progressive muscle weakness, one of them showed bladder disturbance in the form of urinary incontinence and 5 discontinued the physical therapy rehabilitation program for unknown causes).

There was a significant improvement of all measures of the sixty patients who continued the physical therapy rehabilitation program to its end as shown in table (2 & 3 and 4) and figures (1 & 2 and 3).

The mean pre-treatment value of JOA score was increased from 21.2±2.5 at the initial evaluation to 26.5±3.4 at the final evaluation which is statistically significant (P<0.001).While, the mean pre- treatment value of VNS was decreased from 7.3±1.5 at initial evaluation to 3.2±1.3 at final evaluation which is statistically significant (P<0.001). Also the mean value of Hannover ADL questionnaire score was increased from 12±2 to 18±4 at the end of the treatment which is statistically significant (P<0.001) as shown in table (2) and Figure (1).

Table (2): Pre and Post- treatment values of JOA score, VNS and Hannover ADL questionnaire of the study group.

Variables	*Statistics*	*Pre-treatment*	*Post-treatment*	*Level of Significance*	
				T. value	*P. value*
JOA score	Mean SD	21.2 ±2.5	26.5 ±3.4	9.73	< 0.001
VNS	Mean SD	7.3 ±1.5	3.2 ±1.3	16.00	< 0.001
Hannover ADL	Mean SD	12 ±2	18 ±4	10.39	< 0.001

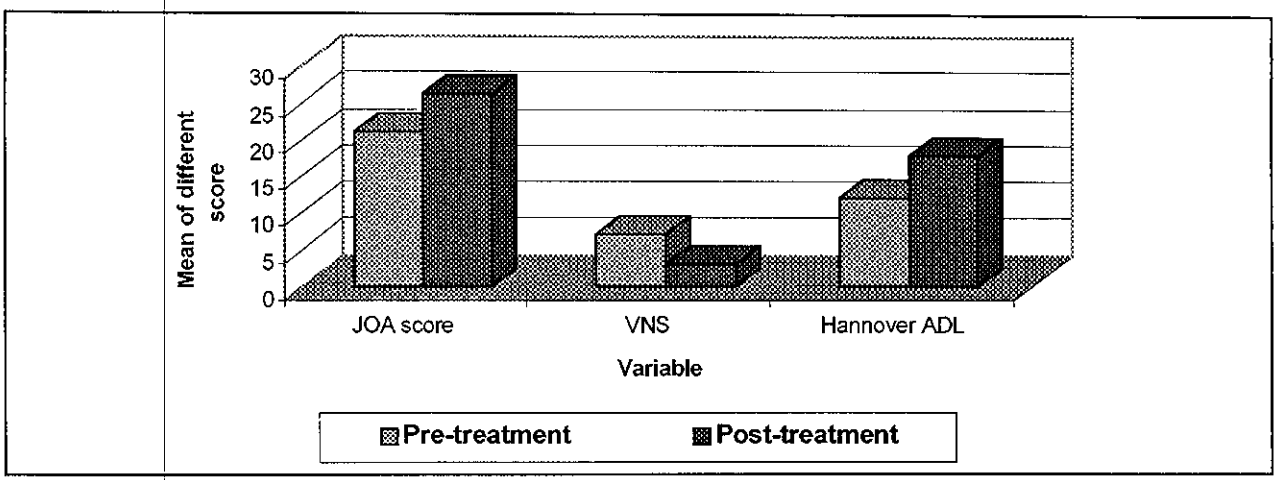

Fig. (1): Comparison between pre and post-treatment values of JOA score, VNS and Hannover ADL questionnaire of the study group.

Concerning the trunk muscle strength, there was an increase of trunk flexor muscle strength from 3.2±0.15 to 4.5±0.18 and of the trunk extensor muscles strength from 2.3±0.38 to 4.3±0.96 at the final examination which were statistically significant (P<0.001) as shown in table (3) and Figure (2).

Table (3) : Pre and Post- treatment values of trunk muscles strength of the study group.

Variables	*Statistics*	*Pre-treatment*	*Post-treatment*	*Significance of change*	
				T. value	*P. value*
Trunk flexors muscle strength	Mean SD	3.2 ± 0.15	4.5 ± 0.18	42.9	< 0.001
Trunk extensors muscle strength	Mean SD	2.3 ± 0.38	4.3 ± 0.46	25.96	< 0.001

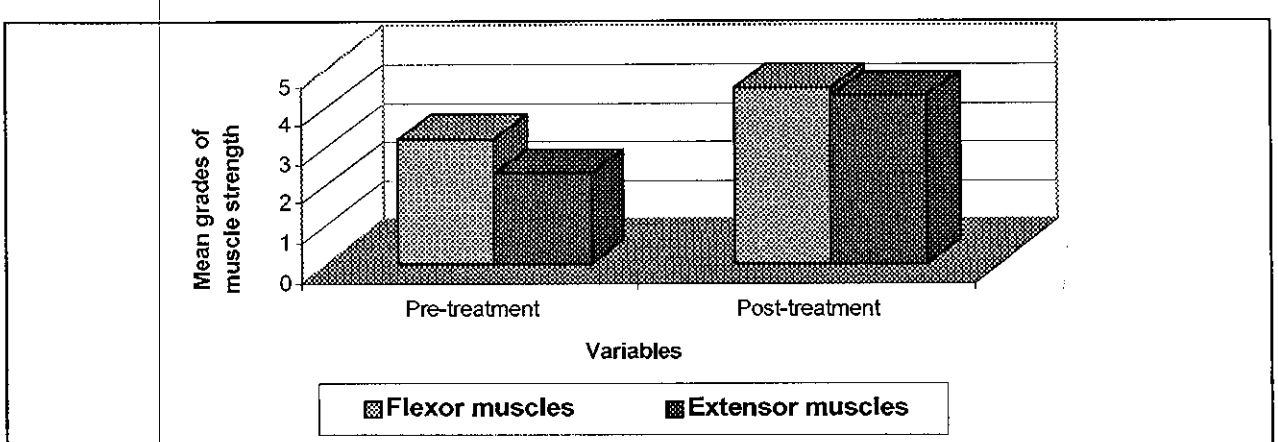

Fig. (2): Comparison between pre and post-treatment grades of trunk muscle strength of the study group.

Concerning the trunk mobility, there was an increase of range of motion of the trunk in all directions with significant differences (P<0.001) at the end of the treatment as shown in table (4) and figure (3).

Table (4): Pre and Post- treatment values of range of motion of trunk movements of the study group.

Variables	*Statistics*	*Pre-treatment*	*Post-treatment*	*Level of Significance*	
				T. value	*P. value*
Flexion	Mean SD	30.4 ± 14.2	51.3 ± 17.6	7.16	< 0.001
Extension	Mean SD	12.2 ± 6.5	18.5 ± 9.2	4.33	< 0.001
Rt side-bending	Mean SD	20.9 ± 12.3	31.5 ± 13.8	4.65	< 0.001
Lt side-bending	Mean SD	13.2 ± 9.5	32.5 ± 15.2	6.18	< 0.001
Rotation to Rt	Mean SD	25.2 ± 11.5	48.2 ± 19.8	7.78	< 0.001
Rotation to Lt	Mean SD	23.4 ± 11.1	45.9 ± 18.7	8.01	< 0.001

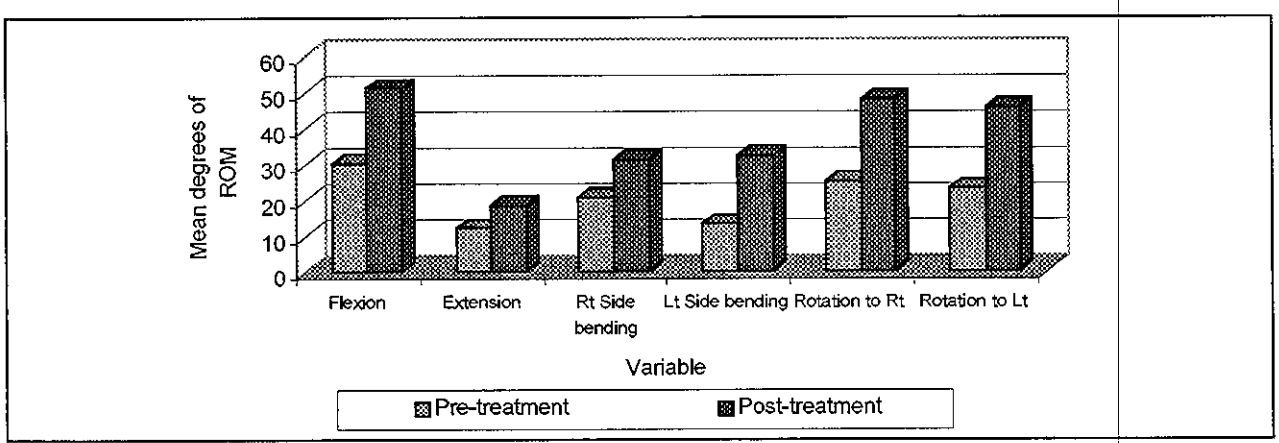

Fig. (3): Comparison between pre and post-treatment values of range of motion of trunk movements of the study group.

DISCUSSION

In this study, a well planned physical therapy rehabilitation program was applied to 82 patients with LDH with radiculopathy. The efficacies of treatment were tested by using JOA score, VNS, Hannover ADL questionnaire, trunk muscle strength and mobility.

The findings of this study, showed significant improvement of all parameters in the group of patients who continued the physical therapy rehabilitation program to its end.

Similar findings were reported by Saal and Saal[10] who studied the functional outcome of condensed physical therapy rehabilitation program consisting of back school and stabilization exercise program in patients with herniated lumbar discs. Their study showed that 90% of the patients subjected to this program had a significant improvement based on measurement criteria and 92% could return to work.

Other numerous studies agree with the findings of this study concerning the functional improvement of lumbar disc herniation with physical therapy active approaches especially that of Mayer et al.,[7]; Twomey and Taylor,[15] and Takemasa et al.[13].

The functional improvement of patients with LDH with physical therapy rehabilitation program may be explained by the proper flow of fluid and nutrients across the inter-vertebral discs (IVD) and zygapophysial joints during the regular loading and unloading of joint cartilage of the facet joints, so it can be expressed and then sucked back into the articular cartilage as the pressure changes during movement[14,17]. The trunk muscle strength coordinates the movement of the spinal column and body posture which play an important role in supporting and stabilizing the lumbar spine[13].

The reversal of the neurologic deficits in the absence of surgical removal of the offending disc can be explained by the gradual dessication of the disc materials which in turn relieve the compression on the nerve roots[10]. Also, the local circulatory changes secondary to inflammation could cause an extruded disc fragment or contained herniation to maintain its high water content, thereby causing the compressive injury on the nerve roots. Resolution of the inflammation therefore would allow for resolution of compression by several mechanisms[11].

The findings of the present study showed a success rate of 73.2% of the total population of the study group with only 26.8% who had unsatisfactory improvement and were referred for surgery.

These findings are almost similar to a previously published success rate of surgical intervention with lumbar disc herniation. De Palma and Rothman[2] applied a retrospective study of a large series of patients who had surgical interference of LDH and reported that 11 to 15 % of whom had disabling low back pain postoperatively due to radicular symptoms. Hakelius[5] reported a 15% incidence of low back pain after excision of a disc, while Salenius and Laurent[12] found a 16% incidence. The series of Weber[17] had the most meticulous tracking of patients; four years postoperatively, 13% had disabling low back pain. In recent study, Fritsch et al.,[3] stated that the results after lumbar disc operations in open standard techniques are poor in 10 to 14% of patients and added that the rate of necessary re-intervention after primary disectomy ranged between 5% to 18%.

Comparison of the success rate of the surgical interference of LDH of these previous studies with the success rate of physical therapy management in this study showed similar results, though the selected population had both the clinical symptoms attributable to LDH and the imaging data confirming it, besides all patients had failed conservative management and were considered requiring surgical interference without delay.

Most of the remaining 22 patients who discontinued the physical therapy rehabilitation program and were referred for surgery had another associated pathology in

addition to lumbar disc herniation as spinal canal stenosis (3 of 5 patients), spondylolithesis (2 of 3 patients) and facet joint arthropathy (2 of 8 patients). Five patients with sequestrated discs from eleven suffered from severe pain and were referred for surgery. Some of the patients had a psychological factors that create a barrier against recovery and others needed another rapid measure rather than physiotherapy to relief their signs and symptoms.

CONCLUSION

This study demonstrates that patients with LDH can be treated non-operatively with a high degree of success rate. In addition to this, those who have a neurological deficits and no function impairing pain may not necessarily require operative intervention and therefore they have the option to be treated without surgery. However, it may be reasonable to operate on the patient with progressive neurological deficits and profound neurological loss that does not demonstrate any improvement with physical therapy rehabilitation program.

Finally, the indications of surgical interference of lumbar disc herniation must be revised. The decision to operate should be based on the patient s level of function and the possibility of improving it by physical therapy program, rather than being based on imaging studies and physical examination findings.

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الملخص العربي

رؤية مستقبلية لتوضيح فاعلية برامج العلاج الطبيعي لعلاج حالات الانزلاق الغضروفي القطني المصاحبة بضغط على الضفائر العصبية بدون جراحة

الهدف من البحث:
أجريت هذه الدراسة لمعرفة تأثير برامج العلاج الطبيعي المكثفة على نسبة التحسن الوظيفي لمرضى الأنزلاق الغضروفي القطني المصاحب بضغط على الضفائر العصبية والذين كانوا يُعالجون غالباً بالجراحة.

عينة وأساليب البحث:
أختير لهذه الدراسة ٨٢ مريضاً يعانون إكلينيكيا من أعراض انزلاق غضروفي قطني ويؤكد هذا تقارير أشعة الكمبيوتر المقطعية والرنين المغناطيسي، وتتراوح أعمارهم بين ٢٤ , ٤٤ سنة منهم ٤٨ من الذكور و ٣٤ من الإناث.
وتم استخدام عدة قياسات عند بداية الدراسة وبعد ثلاثة شهور من أجراء برنامج العلاج الطبيعي التأهيلي لقياس درجة التحسن وتشمل المقياس الياباني الإكلينيكي ومقياس هانوفر للأنشطة اليومية وكذلك مقياس درجة الألم، بالإضافة إلى قياس المدى الحركي للجذع في كل الاتجاهات وكذلك قياس قوة عضلات ثني وفرد الجذع.

نتائج البحث:
أثبتت نتائج البحث وجود تحسن ملحوظ (٧٣,٢ %) من مجموع عينة البحث في جميع نواحي الأداء الوظيفي للظهر مما يؤكد أهمية العلاج الطبيعي كبديل جيد عن الجراحة في بعض حالات الانزلاق الغضروفي القطني وكذلك التأكيد على التريث في مثل هذه الحالات وعدم اللجوء للجراحة إلا بعد إعطاء المريض فترة كافية من العلاج الطبيعي المكثف.