Original Article

Effect of Therapeutic Exercise and Activities of Daily Living Instructions on Prolapsed Lumbar Intervertebral Disc

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Abstract

Background: *Clinically significant sciatica due to disc prolapse occurs in 4-6% of the population. Among various options for the treatment of Prolapsed Lumber Intervertebral Disc (PLID) Pharmacotherapy, thermotherapy and exercise therapy are commonly used. Therapeutic exercises and ADL instruction can enable greater return of neurological function and improves long term outcome and quality of life.*

Objective: *To see the effects of therapeutic exercises and ADL instructions on the treatment of PLID and their outcome.*

Materials and Methods: *This prospective randomized clinical trial was performed over a period of six months on the patients of PLID. Evaluation was made at initial visit and follow up was done at third and sixth week by same investigator. In each visit pain intensity was seen by using straight leg raising test (SLR), Visual Analogue scale (VAS) respectively. Post intervention result was compared with baseline result.*

Results: *The pain was mild in 11.4% cases of group A and 17.1% cases of group B (p=0.587). LBP was intermittent in most of the cases in both groups which was 71.4% cases and 80.0% cases in group A and group B respectively. Pain aggravates in most of the patient by walking (28.6%) and bending (21.3%) in both groups. However significant difference between group A and group B was found at week 6 follow up (p=<.005). During the study the SLR was improved significantly on week 6 follow up. The significant difference between group A and group B was found at week 6 follow up (p=<.005) regarding straight leg raising test (SLR) score.*

Conclusions: *This study demonstrates the superiority of therapeutic exercises and activities of daily living in reduction of pain in management of patients with PLID.*

Key words: *Therapeutic exercises, Prolapsed lumbar disc, Activities of daily living.*

Date of received: *03.09.2023*

Date of acceptance: *25.02.2024*

DOI: https://doi.org/10.3329/kyamcj.v15i01.75830

KYAMC Journal. 2024; 15(01): 08-15.

Introduction

Low back pain with or without sciatica is a major cause of morbidity throughout the world. The life time incidence is 50-70% and the incidence of sciatica may be as high as 40%. The degeneration of intervertebral disc from a combination of factors can result in herniation, particularly at the L4-L5 and L5-S1 levels in more than 90% of the cases. The L3-L4 and L2-L3 accounts for the majority of remaining herniations. The presence of pain radiculopathy and other symptoms depend on the site and degree of herniation, detailed history, physical examination supplemented by neuroimaging can differentiate herniated lumbar disc prolapse from other causes of low back pain and sciatica.[1]

Defining LBP is difficult, but refers to a symptoms complex in which pain is localized to the lumbar spine or referred to the leg or foot.[2] Pain that radiates from the lower back down one or other leg is known as sciatica. It is often exacerbated by exertion, coughing, sneezing, or straining. One of its most common causes is a 'slipped disk' which exerts pressure on one of the roots of the sciatic nerve and it can also be triggered by a temporary local trapping or straining of the nerve or its roots.[3]

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Lumbar disc herniation is a pathological condition in which a tear in the outer, fibrous ring (annulus fibrosus) of an intervertebral disc allows the soft, central portion (nucleus pulposus) to be extruded (herniated) to the outside of the disc.[4] Displaced disk material can be initially classified as a bulge (disk material is displaced >50% of its circumference) or as a herniation (<50% of its circumference). Disk herniations can then be subclassified into protrusions or extrusions.

The symptoms of prolapsed lumbar intervertebral disc are predominantly those of pain, which may be felt either in the lower part of the back or in the leg or in both sites together. Acute disc prolapse may occur at any age, but is uncommon in the very young and the very old.[5] Diseases affecting the upper lumbar spine tend to refer pain to the lumbar region, groin, or anterior thighs. Diseases affecting the lower lumbar spine tend to produce pain referred to the buttocks, posterior thighs, or rarely the calves or feet. Coughing, sneezing, or voluntary contraction of abdominal muscles (lifting heavy objects or straining at stool) may elicit the radiating pain. The pain may increase in postures that stretch the nerves and nerve roots. Sitting stretches the sciatic nerve (L5 and S1 roots) because the nerve passes posterior to the hip.[6]

Radicular symptoms can be the result of overt mechanical compression of a nerve root, or a chemically mediated inflammatory process. The most common compressing lesion by far is a disk protrusion.[7] The mechanical benign causes are divided into static (postural) and kinetic (faulty biomechanical) types. Of the static causes, the most prevalent is excessive lordosis, in which there is exorbitant facet weight-bearing and foraminal closure.

There are various options for treatment of chronic low back pain. Of them Pharmacotherapy, thermotherapy and exercise therapy are commonly used. Exercise therapy remains one of the conservative mainstays of treatment for chronic low back pain and may be tailored to include aerobic exercise, muscle strengthening and stretching exercises.[7] One meta-analysis of the current literature exploring the role of Exercise therapy in patient with varying duration of symptoms found a graded exercise program implemented within the occupational setting demonstrated some effectiveness in sub-acute low back pain. Among those suffering chronic low back pain symptoms, small, but statistically significant improvements were observed with regard to pain reduction and functional improvement.[8]

In our country, although many people in the community have been suffering from chronic non-specific low back pain, not much work has done in this field. In this study an attempt has been made to see the effects of back muscle strengthening exercises and ADL instruction in the treatment of prolapsed disc and their outcome. The information thus gathered may provide useful guidelines for further study about various aspects on prolapsed intervertebral disc.

Materials and Methods

This randomized control trial was carried out in the Department of Physical Medicine and Rehabilitation at Chittagong Medical College Hospital, Chittagong, Bangladesh. It was conducted from August 2015 to January 2016 for a period of six (6) months on all the patients who were presented with PLID in an age group of 20 to 55 years of both sexes. The patients were selected by randomized sampling method. Incorporation of the patients in the two groups was performed by lottery.

Selection criteria were • pain radiates beyond knee • paresthesia in same distribution • age: 20–55 years of age (male or female) • Nerve irritation signs (reduced straight leg raising) • PLID identified by the presence of that reproduces leg pain • Unilateral leg pain worse than low back pain. Exclusion criteria were painful spinal deformity, severe/symmetrical spinal deformity, Cauda equina syndrome, progressive neurological signs/muscle-wasting, multiple levels of root signs, previous spinal surgery, scoliosis, spinal cord disease, tuberculosis, tumor. All the PLID patients attending in the department of Physical Medicine and Rehabilitation of Chittagong Medical College Hospital were recruited as per inclusion and exclusion criteria. Data was collected using a preformed data collection sheet from all patient of group A and group B in a predesigned questionnaire from the first visit. Follow up data were collected from each patient in every 3 weeks interval from the first visit for up to 6 weeks.

Computer based statistical analysis were carried out with appropriate techniques and systems. All data were recorded systematically in preformed data collection form (questionnaire). Data was presented on a categorical scale compared between the groups using Chi-square (X2) or Fisher's Exact Probability test, while the data presented on a quantitative scale was compared between the groups using Student's 't' test. For all analytical tests, a probability (p) value of < 0.05 ($p<0.05$) was considered statistically significant and $p<0.01$ was considered highly significant but $p>0.05$ was taken as non-significant. Statistical analysis was performed by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-17) (SPSS Inc, Chicago, IL, USA). 95% confidence limit was taken.

Results

A total number of 70 PLID patients were recruited for this study of which 35 patients were in study group (group A) and the rest 35 patients were in the control group (group B).

Table I: Distribution of sex among the study groups

Sex	Study Groups				Total	
	Group A		Group B			
	N	%	n	%	n	%
Male	25	71.4	28	80.0	53	75.7
Female	10	28.6	7	20.0	17	24.3
Total	35	100.0	35	100.0	70	100.0
Male:Female Ratio	2.5: 1		4: 1		3.1: 1	

Table I shows the distribution of patients according to gender. In group A male was predominant than female which was 25(71.4%) cases and 10(28.6%) cases respectively. In group B male was also predominant than female which was 28(80.0%) cases and 20(20.0%) cases respectively. The difference between these two group was not statistically significant (p=0.403).

Table II: Distribution of the age among the study groups (with $\chi 2$ test and t - test significance).

Age In Groups	Study Groups				Total	
	Group A		Group B			
	n	%	n	%	N	%
< 30 Years	7	20.0	2	5.7	9	12.9
30 – 40 Years	10	28.6	7	20.0	17	24.3
40 – 50 Years	9	25.7	15	42.9	24	34.2
> 50 Years	9	25.7	11	31.4	20	28.6
Total	35	100.0	35	100.0	70	100.0

* $\chi 2$ value = 5.007. P = 0.171. Not Significant (P > 0.05)

Age (Years)	Study Groups	N	Mean ± SD		Median	Range	Sign*
	Group A	35	42.31	9.85	45.00	25–55	**t** = 1.403
	Group B	35	45.31	7.94	45.00	27–55	P = 0.165
	TOTAL	70	43.81	9.01	45.00	25–55	NS

*Independent samples t - test. NS = Not Significant (P > 0.05)

Table II shows distribution of patients according to age. In group A, majority of the patients were in the age group of 30 to 40 years which was 16 (28.6%) cases followed by 40 to 50 years group, more than 50 years and less than 30 years age group which were 9(25.7%) cases, 9(25.7%) cases and 7(20%) cases respectively. In group B, majority of the patients were in the age group of 40 to 50 years which was 15 (42.9%) cases followed by more than 50 years group, 30 to 40 years group and less than 30 years age group which were 11(31.4%) cases, 7(20%) cases and 2(5.7%) respectively. The mean±SD age of the patients was 42.31±9.85 and 45.31±7.94 in group A and group B respectively. The difference of age between these two groups was not statistically significant (p > 0.05).

Table III: Distribution of Study Population according to Socio-demographic Factors.

Socio-demographic Factors		Study Groups				Total	
		Group A		Group B			
		n	%	n	%	N	%
Occupation	House Wife	10	28.6	7	20.0	17	24.3
	Service Holder	5	14.3	5	14.3	10	14.3
	Businessman	5	14.3	6	17.1	11	15.7
	Farmer	10	28.6	11	31.5	21	30.0
	Day Laborer	5	14.2	6	17.1	11	15.7
Socio - economic Status	Poor	21	60.0	24	68.6	45	64.3
	Middle Class	13	37.1	9	25.7	22	31.4
	Rich	1	2.9	2	5.7	3	4.3

Table III shows distribution of patients by socioeconomic condition. Most of the patients were from poor in both groups which were 21 (60%) cases and 24 (68.6%) cases in group A and group B respectively; this was followed by middle class which were 13 (37.1%) cases and 9 (25.7%) cases respectively. Only few patients were rich in both groups.

Table IV: Distribution of pain related variables among the study groups (with $\chi 2$ test significance).

Variables	Distribution of pain	Study Groups				Total		$\chi 2$ Test Significance
		Group A		Group B				
		n	%	n	%	n	%	
Radiation	Leg	19	54.3	11	31.4	30	42.9	$\chi 2 = 6.508$
	Thigh	7	20.0	11	31.4	18	25.7	P = 0.164 **NS**
	Back	1	2.9	4	11.4	5	7.1	
	Leg and Thigh	6	17.1	4	11.4	10	14.3	
	Back and Thigh	2	5.7	5	14.4	7	10.0	
Aggravating Factors	Walking	10	28.6	10	28.6	20	28.6	$\chi 2 = 9.562$
	Bending	7	20.0	4	11.4	11	15.7	P = 0.215 **NS**
	Walking and Bending	5	14.3	10	28.6	15	21.3	
	Walking and Standing	6	17.1	7	20.0	13	18.6	
	Standing	2	5.7	2	5.7	4	5.7	
	Sitting	2	5.7	0	0.0	2	2.9	
	Standing and Bending	3	8.6	0	0.0	3	4.3	
	Sitting and Bending	0	0.0	2	5.7	2	2.9	
Relieving Factors	Rest	20	57.1	20	57.1	40	57.1	$\chi 2 = 0.000$
	Drug	3	8.6	3	8.6	6	8.6	P = 1.000 **NS**
	Rest and Drug	12	34.3	12	34.3	24	34.3	

* NS = Not Significant (P > 0.05)

Table V: Distribution of the vertebral herniation among the study groups (with $\chi 2$ test significance).

Sites of Herniation	Study Groups				Total	
	Group A		Group B			
	n	%	N	%	n	%
L 3 – L 4	1	2.9	0	0.0	1	1.4
L 4 – L 5	7	20.0	6	17.1	13	18.6
L 4 – L 5 – S 1	7	20.0	7	20.0	14	20.0
L 5 – S 1	20	57.1	22	62.9	42	60.0
Total	35	100.0	35	100.0	70	100.0

* $\chi 2$ value = 2.249. P = 0.690. Not Significant (P > 0.05).

Table V shows Type of herniation is more on L 5 – S 1 region (57.1%) followed by L 4 – L 5. level (20%), L 4 – L 5 – S 1. level (17.1%) and L 3 – L 4. Level (2.9%) in group A. On the other hand in group B herniation is more on L5 – S 1 region (62.9%) followed by L 4 – L 5 – S 1. level (20%), L 4 – L 5.level (17.1%).

Table VI: Statistics of anthropometric variables among the study groups (with t - test significance).

Variables	Study Groups	N	Mean	± SD	Median	Range	Sign .*
Height (m)	Group A	35	1.63	0.04	1.64	1.56 – 1.68	**t** = 0.564
	Group B	35	1.64	0.03	1.65	1.57 – 1.69	P= 0.575
	TOTAL	70	1.63	0.03	1.64	1.56 – 1.69	**NS**
Weight (Kg)	Group A	35	63.97	7.25	65.00	51 – 78	**t** = 2.146
	Group B	35	67.63	7.01	69.00	50 – 76	P = 0.035
	TOTAL	70	65.80	7.31	67.00	50 – 78	**S**
BMI (Kg/m^2)	Group A	35	23.95	2.01	23.87	20.43 – 27.97	**t** = 2.615
	Group B	35	25.18	1.92	25.65	20.03 – 27.89	P = 0.011
	TOTAL	70	24.57	2.05	24.83	20.03 – 27.97	**S**

* Independent samples t - test.
NS = Not Significant (P > 0.05); S = Significant (P < 0.05)

Table VI shows distribution of patients by anthropometric variables. The mean height (m) of the patients was 1.63 ± 0.04 and 1.64 ± 0.03 in group A and group B respectively (p=0.575). The mean weight (kg) of the patients was 63.97 ± 7.25 and 67.63 ± 7.01 in group A and group B respectively (p=0.035) The mean BMI (kg/m2) of the patients was 23.95 ± 2.01 and 25.18 ± 1.92 in group A and group B respectively(p=0.011). The mean BMI (kg/m2) of the patients was 23.95 ± 2.01 and 25.18 ± 1.92 in group A and group B respectively (p=0.011).

Table VII: Statistics of straight leg raising (SLR) test scores among the study groups (with t - test significance)

	Study Groups		Mean ± SD		Median	Range	Sign .*
SLR – Right	Group A	35	69.57	18.76	70.00	30 – 90	**t** = 0.340
(Week 0)	Group B	35	68.00	19.86	70.00	25 – 90	P = 0.735
	TOTAL	70	68.79	19.19	70.00	25 – 90	**NS**
SLR – Left	Group A	35	68.86	21.83	80.00	20 – 90	**t** = 0.349
(Week 0)	Group B	35	67.14	19.22	70.00	30 – 90	P = 0.728
	TOTAL	70	68.00	20.44	70.00	20 – 90	**NS**
SLR – Right	Group A	35	80.57	11.10	85.00	100 – 270	**t** = 1.127
(Week 3)	Group B	35	77.43	12.21	75.00	110 – 150	P = 0.264
	TOTAL	70	79.00	11.69	80.00	100 – 270	**NS**
SLR – Left	Group A	35	78.14	13.34	80.00	45 – 90	**t** = 0.322
(Week 3)	Group B	35	77.14	12.62	80.00	40 – 90	P = 0.748
	TOTAL	70	77.64	12.90	80.00	40 – 90	**NS**
SLR – Right	Group A	35	86.57	5.39	90.00	75 – 90	**t** = 2.779
(Week 6)	Group B	35	81.71	8.82	80.00	60 – 90	P = 0.007
	TOTAL	70	84.14	7.66	90.00	60 – 90	**HS**
SLR – Left	Group A	35	86.00	5.12	90.00	75 – 90	**t** = 2.408
(Week 6)	Group B	35	82.14	7.98	85.00	65 – 90	P = 0.019
	TOTAL	70	84.07	6.93	85.00	65 – 90	**S**

* Independent samples t - test. NS = Not Significant
(P > 0.05); S = Significant (P < 0.05); HS = Highly Significant (P < 0.01)

Table VII shows outcome of patient assessed by Straight side) before treatment were 69.57 ± 18.76 and 68.00 ± leg raising(SLR) test. The mean score of SLR test(right 19.86 (p=0.735) in group A and group B respectively.

The mean score of SLR test(left side) before treatment were 68.86 ± 21.83 and 67.14 ± 19.22 (p=0.728) in group A and group B respectively. The mean score of SLR test(right side) after treatment of 3 weeks were 80.57 ± 11.10 and 77.43 ± 12.21 (p=0.264). The mean score of SLR test(left side) after treatment of 3 weeks were 78.14 ± 13.34 and 77.14 ± 12.62 (p=0.748) in group A and group B respectively. The mean score of SLR test(right side) after treatment of 6 weeks were 86.57 ± 5.39 and 81.71. ± 8.82 (p=0.007) in group A and group B respectively. The mean score of SLR test (left side) after treatment of 6 weeks were 86.00 ± 5.12 and 82.14 ± 7.98 (p=0.019) in group A and group B respectively.

Discussion

A total number of 70 PLID patients were recruited for this study of which 35 patients were in study group (group A) who were treated with therapeutic exercises and ADL instructions and the rest 35 patients were in the control group (group B) who were treated without therapeutic exercises and ADL instructions.

In group A male was predominant than female which was 25(71.4%) cases and 10(28.6%) cases respectively. In group B male was also predominant than female which was 28(80.0%) cases and 7(20.0%) cases respectively. The difference between these two group was not statistically significant (p= 0.403). It has been found that male is more commonly affected by PLID. This may be due to the heavy works done by them.

The distribution of patients according to age is recorded. In group A, majority of the patients were in the age group of 30 to 40 years (28.6%) followed by 41 to 50 years group (25.7%), less than 50 years age group (25.7%) and less than 30 years age group (20.0%). In group B, majority of the patients were in the age group of 41 to 50 years (42.9%) which was 24 cases followed by less than 50 years age group (31.4%) 30 to 40 years group (20.0%) and less than 30 years age group (5.7%). The difference of age between these two groups was not statistically significant (p=0.171). It has been found from the above result that in both groups age of the patients was more than 30 years.

The distribution of patients according to occupation is recorded. In group A most of the patients were housewife (28.6%) and farmer (28.6%), followed by service holder (14.3%), businessman (14.3%) and day laborers (14.2%). In group B most of the patients were farmer (31.5%) followed by housewife (20.0%), businessman (17.1%), day laborers (17.1%) and service holder (14.3%).

The distribution of patients by socio-economic condition is also recorded. Most of the patients were from poor in both groups followed by middle class. Only few patients were rich in both groups. There are no studies regarding the relationship of socioeconomic status and PLID; however, in this present study the majority people of the government hospital are from lower class as well as middle class. Therefore, the lower-class patients are predominant here.

LBP with radiation to leg was present in most of the cases in both groups which was 54.3% cases and 31.4% cases in group A and group B respectively (p=0.164). In PLID patients LBP frequently radiated to the leg. Most of the patients got relieve while resting which was 57.1% cases and 57.1% cases in group A and group B respectively (p=1.000). Similar to the present result, Schwarzer et al. were performed a study and have found that low back pain is one the most common clinical features of PLID.[9] Waddell G have reported that PLID caused severe low back pain with radiation to the leg.[10]

The aggravating factor of the patients is recorded. walking (28.6%), bending (20.0%) were the main aggravating factors in group A whereas in group B walking (28.6%), walking and bending (28.6%), walking and standing (20.0%) and only bending (20.0%) were the main aggravating factors. Similar to the present study Mundt et al. have reported that non-occupational lifting of objects or children weighing 25 or more pounds with knees straight and back bent are associated with increased risk of herniated lumbar disc.[11]

Type of herniation is more on L5 – S1 region (57.1%) followed by L4 – L5. level (20%), L4 – L5 – S1. level (17.1%) and L3 – L4. Level (2.9%) in group A. on the other hand in group B herniation is more on L5 – S1 region(62.9%) followed by L4 – L5 – S 1. level (20%), L 4 – L5.level (17.1%) and L3 – L4. Level (2.9%).

The outcome of patient assessed by Straight leg raising test was recorded. The mean score of Straight leg raising test (right) before treatment were 69.57± 18.76 and 68.00± 19.86 (p=0.735). In left side before treatment were 68.86± 21.83 and 67.14± 19.22 in group A and group B respectively (p=0.728). The mean score of Straight leg raising test (right) 3 weeks after treatment were 80.57± 11.10 and 77.43± 12.21 (p=0.264). In left side 3 weeks after treatment were 78.14± 13.34 and 77.14± 12.62 in group A and group B respectively (p=0.748). The mean score of Straight leg raising test (right) test 6 weeks after treatment were 86.57± 5.39 and 81.71± 8.82 (p=0.007). In left side 6 weeks after treatment were 86.00± 5.12 and 82.14± 7.98 in group A and group B respectively (p=0.019) In both groups trend of improvement was positive. The improvement rate was better in group A than group B. The difference between two groups in improvement was statistically significant after 6 weeks. In both groups trend of improvement was positive. The improvement rate was better in group A than group B. Amir Hosang et al. have been reported similar result and have mentioned that back exercise with activity of daily living have decreased the pain intensity of PLID and improves SLR.[12] Aaron B. Welk DC also found similar result on improving SLR after conservative treatment.[13]

Conclusion

Therapeutic exercises and activities of daily living reduces the pain in patients with PLID by reduction of VAS score and increment of Straight leg raising test score.

Acknowledgement

We express our gratitude to Professor Dr. Aminuddin A Khan sir as well as the participant patients.

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