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The Effect of Hydrotherapy on Pain Intensity and Functional Ability in Lumbar Disk Herniation (LDH) Patients that Undergo Non-operative Procedure Pre-experimental Study at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang

Theresa Rahmadhani[1], Nyimas Fatimah[2], Eka Febri Zulissetiana[3]

[1]Medical Education Study Program, Faculty of Medicine, Sriwijaya University,
[2]Medical Rehabilitation Department, RSUP Dr. Mohammad Hoesin Palembang,
[3]Biomedical Division, Faculty of Medicine, Sriwijaya University,

E-mail: theresarahmadhani31@gmail.com

Abstrak

Hernia nukleus pulposus (HNP) lumbal merupakan penyakit yang paling sering menjadi penyebab nyeri punggung bawah dan disabilitas fungsional. Beberapa studi menyebutkan bahwa hidroterapi merupakan terapi efektif untuk pasien dengan nyeri punggung bawah. Oleh karena itu, penelitian ini dilakukan untuk mengetahui pengaruh hidroterapi terhadap penurunan intensitas nyeri dan perbaikan kemampuan fungsional pasien HNP lumbal. Jenis penelitian ini adalah praeksperimental dengan desain *one group pretest-posttest*. Pengambilan data dilakukan melalui wawancara langsung mengenai intensitas nyeri yang diukur menggunakan *visual analogue scale* (VAS) dan kemampuan fungsional yang diukur menggunakan *Modified Oswestry Low Back Pain Disability Questionnaire* sebelum dan sesudah hidroterapi selama 4 minggu dengan durasi satu kali seminggu. Uji normalitas data dilakukan dengan metode *Shapiro-Wilk* dan selanjutnya dianalisa dengan *Paired t-Test* atau *Wilcoxon*. Dari 30 subjek penelitian, didapatkan bahwa hidroterapi berpengaruh terhadap penurunan intensitas nyeri ($p<0,001$) dan perbaikan kemampuan fungsional ($p<0,001$) pasien HNP lumbal yang tidak menjalani tindakan operatif di Instalasi Rehabilitasi Medik RSUP dr. Mohammad Hoesin Palembang. Terdapat pengaruh hidroterapi terhadap intensitas nyeri dan kemampuan fungsional pasien HNP lumbal yang tidak menjalani tindakan operatif.
Kata kunci: Hernia nukleus pulposus (HNP) lumbal, hidroterapi, *visual analogue scale* (VAS), Oswestry.

Abstract

The effect of hydrotherapy on pain intensity and functional ability in lumbar disk herniation (LDH) patients that undergo non-operative procedure; pre-experimental study at medical rehabilitation installation of RSUP dr. Mohammad Hoesin Palembang. Lumbar disk herniation (LDH) is the most common disease that becaused low back pain and functional disability. Some studies mentioned that hydrotherapy is an effective treatment for low back pain. Therefore, this study was conducted to determine the effect of hydrotherapy on reducing pain intensity and improving functional ability in LDH patients. This study was a pre-experimental study with one group pretest-posttest design. Data was collected by direct interviews to the patients using *visual analogue scale* (VAS) to measure pain intensity and *Modified Oswestry Low Back Pain Disability Questionnaire* to assess functional ability before and after underwent hydrotherapy once a week for 4 weeks. The data then undergo Shapiro-Wilk normality test and continue with Paired t-Test or Wilcoxon test. From 30 subjects, it was found that there are effects of hydrotherapy on reducing pain intensity ($p<0,001$) and improving functional ability ($p<0,001$) in LDH patients that undergo non-operative procedure at the Medical Rehabilitation Installation of RSUP Dr. Mohammad Hoesin Palembang. There are effects of hydrotherapy on pain intensity and functional ability in LDH patients that undergo non-operative procedure.

Keywords: Lumbar disk herniation (LDH), hydrotherapy, *visual analogue scale* (VAS), Oswestry.

1. Introduction

Herniated nucleus pulposus (HNP) is a condition where there is a protrusion of part or all parts of nucleus pulposus through the annulus fibers of intervertebral disc, which can be directed to spinal canal and pressing the spinal root.[1] HNP is a spinal degeneration disease that often caused low back pain. HNP most commonly affects adults in the age of 30-50 years old.[2] About 15-45% of adults in developed countries suffer from low back pain each year.3 The prevalence of low back pain in Indonesia have not been clearly obtained, but are estimated between 7,6% to 37%.[4]

According to Donnally and Dulebohn (2017), more than 90% of HNP occur at the L4-L5 or the L5-S1 disc space, which will impinge on the L4, L5 dan S1 nerve root that caused local pain in the lower back area and radicular pain in the lower limb, precisely at the posterior lower leg and dorsal foot.[5] Pain perception aims to limit movements involving the back muscles. This movement limitation is caused by muscle spasm which is a protection against more severe injuries. Muscle spasm will cause a decrease in range of motion (ROM) or flexibility of the back and spine.[6]

Impinge on the L4, L5 and S1 nerve will also cause limited movement of plantar dorsiflexion and toe extension, quadriceps muscle weakness and decreased Achilles tendon reflexes and patellar tendons resulting in functional disability such as limitations when walking, sitting up from the chair and lifting weights. Lumbar disc herniation (LDH) cause not only discomfort due to local and radicular pain, but also functional disability that interferes with daily activities.[5]

Management of LDH can be done by surgery or conservative therapy. However, surgery has a high risk of causing trauma.[7] On the other hand, conservative therapy with analgesics is only symptomatic, that is mean patients must take it continuously for long time so that it can cause side effects such as gastrointestinal bleeding, liver and kidney damage.[8]

Other conservative therapies that can be given to LDH patients are physical exercise which can be done on land (land-based exercise) or in water (water-based exercise or hydrotherapy). Hydrotherapy has a lower risk of injury than land-based exercise.[9]

Based on research conducted by Olson (2011), hydrotherapy is an effective therapy for patients with low back pain and has proven to be more effective than patients who have not undergone any therapy.[10] Another research was conducted by Nemčić et al. (2013) showed that hydrotherapy was able to increase spinal mobility and reduce physical disability.[11] Likewise with the research conducted by Mahjur et al. (2016), hydrotherapy has a significant influence on increasing the balance ability of patients with low back pain.[9] The effects of hydrotherapy are due to the physical characteristics of water, namely: (1) the effects of buoyancy can reduce stress on the joints so it can reduce pain and facilities joint mobility, (2) warmth can reduce muscle tone, increase blood flow, reduce muscle spasticity and pain, (3) viscosity and hydrostatic pressure are able to train the resilience, strength of muscles, and body balance so these are make water as an ideal medium for rehabilitation of patients with low back pain.[11]

In Indonesia, studies on LDH have not been widely carried out, especially those related to hydrotherapy.2 Therefore, this study was conducted to analyze the effect of hydrotherapy on LDH patients that undergo non-operative prosedure so that it could be seen whether there was an effect of hydrotherapy on decreasing pain intensity and improvement functional ability.

2. Methods

This study was a pre-experimental study with one group pretest-posttest design at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang from July to December 2018. The population were all LDH patients that undergo non-operative procedure at Medical Rehabilitation Installation of RSUP

dr. Mohammad Hoesin Palembang from October to November 2018 and samples were all LDH patients who met the inclusion criteria and there were no exclusion criteria. Samples were taken by consecutive sampling method.

The inclusion criteria in this study are LDH patients that undergo non-operative procedure and would undergo hydrotherapy at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang, and at the age ≥18 years old. Exclusion criteria are patients with verbal and nonverbal communication disorders, patients with diseases that can cause functional disabilities other than LDH, and LDH patients with hydrotherapy contraindications such as fever, open wounds, skin infections, urinary incontinentia, alvical incontinentia and severe cardiovascular disease. The drop out criteria are that at the time of the study, the subjects experienced serious illness/resigned for certain reasons/did not undergo hydrotherapy three times in a row/did not undergo hydrotherapy twice of therapies prescribed.

The independent variable in this study was hydrotherapy, while the dependent variable was pain intensity and functional ability of LDH patients.

Data was collected by direct interviews to the patients using visual analogue scale (VAS) to measure pain intensity and Modified Oswestry Low Back Pain Disability Questionnaire to assess functional ability before and after hydrotherapy once a week for 4 weeks. The data then analyzed using the Statistical Package for Social Science (SPSS) 21.0 for Windows. Univariate analysis was performed to obtain a frequency distribution of the variables. Bivariate analysis to determine the effect of independent variables on the dependent variables by looking at the differences in the mean of one pair of data groups (before and after intervention). The data normality test was carried out by the *Shapiro-Wilk* method and then analyzed by *Paired t-Test* or *Wilcoxon.*

3. Results

For two months (October-November 2018) research was conducted with subjects LDH patients who underwent hydrotherapy at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang. Research was conducted on Monday to Friday, at 08.30-12.00 WIB. During this period 32 subjects were obtained and 30 subjects who met the inclusion criteria were taken. Two subjects were excluded because they had undergone operative procedure before getting hydrotherapy.

Table 1 shows that the highest incidence was at the age group of 51-60 years old which amounted to 12 individuals (40%), ranging from 35-76 years old. Most of them are women, 23 individuals (76.7%), while men were 7 individuals (23.3%).

Table 2 shows that from 30 subjects, the mean value of VAS before hydrotherapy was 5.27±1,507 with standard error (SE) 0,275; median 5; mode 4; and range 3-8, while the mean value of VAS after 4 weeks of hydrotherapy was 3.10±1,125; SE 0,205; median 3; mode 3; and range 2-6. The mean value of Modified Oswestry Low Back Pain Disability Questionnaire score before hydrotherapy was 59,40±15,880; SE 2,899; median 58; range 26-88, with multiple modes namely 38, 50, 52, 54, 58, 66, 72, 74 and the value that is shown in the table 2 is the smallest one. The mean value after 4 weeks of hydrotherapy was 34.80±11.11; SE 2.029; median 34; mode 28; range 14-56.

Table 3 shows the mean value of 10 aspects of Modified Oswestry Low Back Pain Disability Questionnaire before and after hydrotherapy for 4 weeks which all aspects have decreased. The biggest decline was found in the aspect of sleep, from 3.23 to 0.87. The smallest decline was found in the aspect of running, from 2.70 to 2.17. Before hydrotherapy, the highest mean value was found in lifting activities at 3.90 and after hydrotherapy for 4 weeks, the highest mean value was also found in the lifting activities at 2.97.

From the normality test with Shapiro-Wilk on VAS, which can be seen in **table 4**, p value before and after hydrotherapy for 4 weeks is

p=0,000<0,05 (α). This means that VAS data is not normally distributed

After the normality tests were done, the data was not normally distributed, then Wilcoxon was tested with VAS of LDH patients before and after hydrotherapy for 4 weeks. The Wilcoxon results are p=0,000<0.05 (α) so that H0 is rejected. This means that it can be said that the hydrotherapy that was carried out by LDH patients at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang for 4 weeks had a significant influence on VAS.

From the normality test with Shapiro-Wilk on Modified Oswestry Low Back Pain Disability Questionnaire score before and after hydrotherapy for 4 weeks, which can be seen in table 6, p=0.901 (before) and p=0.502 (after) >0.05 (α). This means that data of Modified Oswestry Low Back Pain Disability Questionnaire score is normally distributed.

After the normality test was found that the data were normally distributed, then tested with Paired t-Test on Modified Oswestry Low Back Pain Disability Questionnaire score before and after hydrotherapy for 4 weeks. The results of Paired t-Test was p=0,000<0,05 (α) so H_0 was rejected. This means that with 95% confidence interval (CI) there is enough evidence to state that hydrotherapy that carried out by LDH patients at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang for 4 weeks had a significant influence on Modified Oswestry Low Back Pain Disability Questionnaire score with 95% confidence.

Table 1. Distribution of Subjects by Age Group and Gender (N=30)

Variable	Category	N	%
Age	31-40	2	6.7
	41-50	3	10
	51-60	12	40
	61-70	9	30
	71-80	4	13.3
Gender	Men	7	23.3
	Women	23	76.7

Table 2. VAS and Modified Oswestry Low Back Pain Disability Questionnaire Scores in The Study (N=30)

Variable	Category	Mean (SD)	SE	Median	Mode	Min	Max
VAS	Before	5,27 (1,507)	0,275	5	4	3	8
	After	3,10 (1,125)	0,205	3	3	2	6
Modified Oswestry Low Back Pain Disability Questionnaire	Before	59,40 (15,880)	2,899	58	38*	26	88
	After	34,80 (11,112)	2,029	34	28	14	56

*multiple modes exists, the value that is shown is the smallest one

Table 3. The Mean of Each Aspect of Modified Oswestry Low Back Pain Disability Questionnaire (N=30)

Aspects	Mean	
	Before	After
Pain Intensity	2,37	1,13
Self-care	2,70	1,60
Lifting	3,90	2,97
Walking	2,70	2,17
Sitting	3,17	1,83
standing	3,03	1,90
Sleep	3,23	0,87
Social life	2,40	1,40

Travelling	2,80	1,57
House chores	3,47	1,90
Max	3,90	2,97
Min	2,40	0,87

.

Table 4. Normality Test of VAS before and after Hydrotherapy (N=30)

Visual Analogue Scale	N	*Shapiro-Wilk*	P value
Before	30	0,840	<0,001
After	30	0,779	<0,001

Table 5. Wilcoxon Test Results for Visual Analogue Scale of LDH Patients before and after Hydroterapy

Visual Analogue Scale	N	Mean±sd	P value
Before	30	5,27±1,507	<0,001
After	30	3,10±1,125	

Table 6. Normality Test of Modified Oswestry Low Back Pain Disability Questionnaire before and after Hydrotherapy (N=30)

Modified Oswestry Low Back Pain Disability Questionnaire	N	*Shapiro-Wilk*	P value
Before	30	0,983	0,901
After	30	0,969	0,502

Table 7. Results of Paired t-Test for Modified Oswestry Low Back Pain Disability Questionnaire score of LDH patients before and after Hydrotherapy

Modified Oswestry Low Back Pain Disability Questionnaire	N	Mean±sd	P value	CI (95%)	
				Lower	*Upper*
Before	30	59,40±15,880	<0,001	21,644	27,556
After	30	34,80±11,112			

4. Discussions

4.1. Subject Characteristics

The results of this study shows that the highest incidence of LDH was at the age group 51-60 years old, ranging from 35-76 years old. There results are in accordance with Ikhsanawati et al., (2015) which in their research found that the incidence of LDH peaked in the age group 51-60 years old.[2] Other research conducted by Schroeder, Guyre, & Vaccaro (2016) support that LDH are mostly found at the age above 30 years old because at this age the degenerative process begins.[12]

In this study also found that from 30 subjects, the number of women was more that of men (76.7% to 23.3%). Previous research conducted by Ikhsanawati et al., (2015) found that LDH was commonly found in men than women. This is related to work activities such as lifting heavy loads which is mostly done by men.[2] However, another research conducted by Hao et al., (2017) shows that women suffer from LDH more than men.[7] It is associated with

hormonal factors. Women will experience degenerative processes faster than men, including intervertebral disc degeneration.[13] In addition, it is related to daily activities and habits such as using high heels, carrying children, and other household activities that require lifting heavy loads can make women vulnerable to suffer from LDH.[14] Baines and Murphy (2010) also added that women who had been pregnant and gave birth once or more would change their posture and cause weakness of pelvic muscles, increasing the pressure on the intervertebral disc that could cause LDH.[15]

4.2. The Effects of Hydrotherapy on Pain Intensity of LDH Patients

After once a week hydrotherapy for 4 weeks, it was found that there was a decrease in the mean value of pain intensity of LDH patients from 5 to 3. It could be said that before hydrotherapy the average patients had moderate pain (VAS 4-6) and after hydrotherapy for 4 weeks decreased to mild pain (VAS 0-3).

Based on the results of Wilcoxon test on VAS of LDH patients before and after hydrotherapy for 4 weeks in this study, $p=0,000<0,05$ (H_0 was rejected) which means that hydrotherapy for 4 weeks has a significant effect on decreasing pain intensity of LDH patients. Similar research has also been carried out by Sjogren et al. (1997), Pratrisna (2013), Irandoust and Taheri (2015), and Backhausen et al. (2017), but the duration of hydrotherapy given is different.[16,17,18,19] In this study, hydrotherapy observations were only carried out within 4 weeks, shorter than previous studies, due to limited research time. Nonetheless, this study also showed significant results in decreasing pain intensity.

The mechanism of decreasing pain intensity by hydrotherapy is caused by warmth which results in vasodilation of blood vessels, so that it can reduce muscle spasticity and pain.[17] In addition, reduction of muscle spasticity will also reduce the activity of gamma motor neuron fibers which results in decreased excitability of muscle fiber so that the muscles will relax, muscle spasm decreases, and reduce pain intensity.[20] Hydrotherapy also utilizes the water characteristic which is the effect of buoyancy which can reduce weight so that the pressure on intervertebral disc decrease and reduce pain.[11] Other characteristic of water, viscosity and hydrostatic pressure, can cause a strengthening effect that can increase muscle strength of the spine and lower abdominal muscles so that suppression of the intervertebral disc is reduce and decrease pain intensity.[18,19]

4.3. The Effect of Hydrotherapy on Functional Ability of LDH Patients

Hydrotherapy carried out for 4 weeks in this study also showed a decrease in the mean value of Modified Oswestry Low Back Pain Disability Questionnaire score from 59.40 to 34.80. Based on the Oswestry Disability Index (ODI), it can be said that from 30 subjects, before hydrotherapy the average LDH patients had severe disabilities (ODI 41%-60%) and after hydrotherapy for 4 weeks improved to moderate disability (ODI 21%-40%).

Based on the results of Paired t-Test on Modified Oswestry Low Back Pain Disability Questionnaire score, $p=0,000<0,05$ (H0 was rejected). It means that hydrotherapy for 4 weeks has a significant effect on improving functional ability of LDH patients. The results of this study are appropriate with the results of a study conducted by Nemčić et al. (2013) and Susanto, Adiputra, and Sugijanto (2015), the duration of hydrotherapy given was different.[11,21] In this study, hydrotherapy observations were only carried out within 4 weeks, shorter than previous studies, due to limited research time. Nonetheless, this study also showed significant results in improving functional abilities.

Nemčić et al. (2013) stated that viscosity and hydrostatic pressure have a strengthening effect that can improve the resilience of the back muscle so that the range of motion (ROM) increases and causes improvement of functional abilities.[11] Setyohadi (2009) stated that pain can cause disability.[22] World Health Organization (WHO) defines disability as a condition when

there is a limitation of ability to do daily activities where healthy human should be able to do it normally. This is appropriate with the research conducted by Naufal (2013) which shows that there is a relationship between pain intensity and physical disability of LDH patients, so it can be said that the improvement in pain intensity will improve functional ability or reduce physical disability.[23] When muscle spasm decreases, intensity of pain will also decrease and together with increased muscle strength due to strengthening effect from viscosity and hydrostatic pressure so that resulting in increased ROM and decreased physical disability.[18,19,21]

The assessment of functional ability using Modified Oswestry Low Back Pain Disability Questionnaire includes 10 aspects, there are pain intensity, self-care, lifting, walking, sitting, standing, sleeping, social life, travelling and house chores. In this study, before hydrotherapy the average LDH patients had moderate disability, which meant that pain caused disruption to daily activities. However, after hydrotherapy for 4 weeks, it has improved to moderate disability, which means that patients feel more ill and have difficulty when sitting, lifting and standing, travelling and social life will be more avoided, while for self-care and sleep are not really affected.

From the results of the mean of each aspect on Modified Oswestry Low Back Pain Disability Questionnaire score, it was found that out of 30 subjects, before hydrotherapy, the heaviest complaint was felt in lifting activities as indicated by the highest mean value compared to other aspects at 3.90. Although there were improvements after hydrotherapy for 4 weeks, lifting activity remained the most severe complaint felt by LDH patients with a mean value of 2.97.

All aspects of Modified Oswestry Low Back Pain Disability Questionnaire improved as indicated by a decrease in mean values in each aspect. The biggest decrease was found in sleep, which is from 3.23 to 0.87. It means that hydrotherapy for 4 weeks in this study has the greatest influence on improving sleep in LDH patients. The smallest decrease was found in walking, which is from 2.70 to 2.17. It means that hydrotherapy for 4 weeks in this study has the least influence on improving walk in LDH patients.

5. Conclusions

Based on the results of research on the effect of hydrotherapy on pain intensity and functional ability of lumbar disc herniation (LDH) patients at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang, it can be concluded that:

1. From 30 subjects, the mean value of visual analogue scale (VAS) before hydrotherapy was 5.27±1,507 (moderate pain), ranging from 3 to 8, while the mean value of VAS after hydrotherapy for 4 weeks was 3.10±1,125 (mild pain), ranging from 2 to 6.
2. From 30 subjects, the mean value of Modified Oswestry Low Back Pain Disability Questionnaire score before hydrotherapy was 59.40±15.880 (severe disability), ranging from 26 to 88, while the mean value after hydrotherapy for 4 weeks was 34.80±11.112 (moderate disability), ranging from 14 to 56.
3. There are effects of hydrotherapy on pain intensity ($p<0,001$) and functional ability ($p<0,001$) LDH patients at Medical Rehabilitation Installation of RSUP dr. Mohammad Hoesin Palembang.

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