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Case Report

Physical therapy intervention for low back pain et causa lumbar spondylolisthesis: a clinical case report

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ABSTRACT

Lumbar spondylolisthesis is a kind of low back pain (LBP) that involves the displacement of one of the vertebral bodies as a result of trauma. Spondylolisthesis can lead to spondylolysis or fracture injury, which commonly occurs in the elderly as a result of degenerative disorders. However, physical therapy modalities such as transcutaneous electrical nerve stimulation (TENS), infrared (IR), and exercise treatment in the form of William flexion exercise can be employed in situations of LBP that cause lumbar spondylolisthesis. Thus, this clinical case study aimed at investigate the effects of these physical therapy intervention towards patients with LBP spondylolisthesis. LBP was reported by a 62-year-old female patient in Malang clinic. Patient had difficulties walking and sitting for lengthy periods of time. Straight leg raise (SLR) examination, Valsalva test, Trendelenberg test and Barthel index were performed as the physical examination test. While, during intervention period, patient was given TENS, IR, and William flexion exercise for twice a week, with each movement being repeated ten times during three months intervention. There was a positive change in the form of a decrease in tenderness, which was followed by a decrease in active lumbar motion discomfort and a decrease in spasm. Tenderness and motion discomfort are both symptoms of pain alterations. The findings of the treatment show that traditional treatments such as TENS and IR, as well as exercises using the William's flexion exercises approach, can help the elderly with LBP related to spondylolisthesis reduce pain and increase muscular tone.

Keywords: Physical therapy, Low back pain, Spondylolithesis

INTRODUCTION

Low back pain (LBP) is a musculoskeletal illness, as well as a psychological disorder and the outcome of improper movement. LBP affects around 70-80 percent of the population in developed countries, and one out of every 20 sufferers need home treatment for acute bouts. In Indonesia, LBP affects 18% of the population. LBP becomes more common as people get older, with the majority of cases occurring in their middle and early fourth decades.[1,2]

Lumbar spondylolisthesis is a kind of LBP that involves the displacement of one of the vertebral bodies as a result of trauma.[3] Lumbar spondylolisthesis, which affects 5.4 percent of the population, is a disorder caused by damage to the L4-L5 lower spine. Spondylolisthesis can lead to spondylolysis or fracture injury, which commonly occurs in the elderly as a result of degenerative disorders.[4,5]

Low back discomfort is caused by lumbar spondylolisthesis, age, trauma, obesity, lengthy periods of sitting, and poor posture practices.[2,6] According to the Association of Indonesian neurologists (PERDOSSI), LBP patients accounted for 35.86 percent of total low back pain patient visits, 45 percent of low back pain patients were women, and the biggest percentage of patients were between the ages of 41 and 60.[3,7]

Lower back discomfort, muscle spasms, decreased lumbar muscle strength, limited range of motion in the lumbar joints, and diminished functional activity skills are some of the issues that patients with LBP et cause lumbar spondylolisthesis face. Spondylolisthesis can cause irritation of the first nerve fibers because the pressure only occurs on the nerve covering membranes that are rich in nociceptors and nerves that cause inflammatory pain. The second possibility is that there is an emphasis on nerve fibers that allows for disturbance of the balance of sensory neurons through molecular changes that cause abnormal afferent nervous system (ANS) activity because the accumulation of sodium ions around the lesion can cause the lesion area to be very sensitive to mechanical or thermal stimuli.[2,8]

Physiotherapy uses modalities, exercise therapy, and communication to build, maintain, and restore movement and function throughout the life cycle. Modalities such as transcutaneous electrical nerve stimulation (TENS), infrared (IR), and exercise treatment in the form of William flexion exercise can be employed in situations of LBP et cause lumbar spondylolisthesis.[3]

TENS is a tool or modality using electrical stimulation to reduce the sensation of LBP by blocking pain impulses sent to the brain.[9] A study by Bydon in subjects with a diagnosis of low back pain concluded that there was a reduction in pain with the use of TENS with a duration of 330 s and a frequency of 20 Hz. in the case of LBP due to the high demand for non-invasive non-pharmacological interventions.[1]

IR therapy is a type of physiotherapy that is frequently used to treat low back pain. IR has the ability to improve blood flow and relax tissues, reducing discomfort and increasing functional activity.[4,10] IR has a wavelength of 1.5-5.6 µ, emits radiation with a wavelength of 5.6-1000 microns, and has a depth of 3.75 cm, causing deeper tissues in the wounded muscle area to heat up.[3] Physiotherapy uses physical movements called William's flexion exercises to treat musculoskeletal issues. These exercises are aimed to strengthen the muscles that flex the lumbo sacral spine, particularly the abdominal and gluteus maximus muscles, as well as the extensor group, in order to relieve lower back discomfort. The effect of William flexion exercise therapy is to relax the muscles so that the more relaxed and not tense they are, the more easily they may move. Previous studies revealed patients with low back discomfort et cause lumbar spondylolisthesis, who received a combination of these exercises can relieve pain in the lower back, reduce muscular spasm, raise the strength of the lumbar muscles, increase the range of motion of the lumbar joints, and improve functional abilities.

However, there were lack of researches in Indonesia which concerns of this physical therapy towards LBP et causa lumbar spondylolisthesis, thus this study aimed to investigate the effects of these physical therapy intervention towards patients with LBP spondylolisthesis through a clinical case study in Malang.

CASE REPORT

LBP was reported by a 62-year-old female patient in Malang clinic. Since 2015, she's been experiencing LBP. The pain starts in the lower back and travels to the hamstrings like an electric shock. Due to back pain, the patient had difficulties walking and sitting for lengthy periods of time. The patient had previously been injured when he fell from a motorcycle in a sitting position. When the patient was catheterized at the time, the patient was instructed to take bed rest and stay in the hospital for 20 days. In addition, the patient is encased in the catheter. The patient was urged to undergo surgery at the time, but the patient declined. The patient had another X-ray test in 2017 and the patient was treated at the hospital with the state of the patient with diabetes and hyperlipidemia after a few years, in 2019. Following therapy, the patient received outpatient treatment and was referred to a cardiologist for follow-up. Pain radiates from the back of the neck to the buttocks and down to the feet, according to the patient. The patient is also encouraged to see a neurologist for a more thorough assessment. The patient was referred to medical rehabilitation for physiotherapy after the evaluation. On physical examination, the patient's blood pressure was 120/80 mmHg, his pulse was 85 beats per minute, his body temperature was 360°F, and his respiration rate was 21 beats per minute. On 28 September 2015, AP and lateral lumbosacral plain radiographs were taken for a radiological evaluation, and the results of the L4-5 spondylolisthesis reading were acquired (Figure 1).

Figure 1: Radiographic X-ray.

During static inspection, the patient appears to be in pain and during dynamic inspection: the patient's body is not straight, his posture is bowed also L4-5, there was tenderness. The lumbar paravertebrae, gluteus maximus, m. quadratus lumborum, and M. hamstring are all spasming. The rectus abdominis m. obliques have a weakness. Examination of the trunk's basic movements full ROM but the patient feels pain.

Physical examination

Straight leg raise (SLR) examination was performed with the aim of knowing the presence of pressure on the nerve root. This examination can indicate the presence of radiating pain caused by disc pressure on the nerve root.[11] The implementation of the SLR examination is that the therapist passively lifts the patient's leg where the pain radiates as high as the leg flexion is 15-30 degrees and does not exceed 70 degrees. With SLR examination performed on the patient, resulting in pain radiating in the right leg, it proves that there is nerve compression on the disc. Furthermore, the patient's Valsalva test is asked to push hard, the cerebrospinal fluid (CSF) will increase and there is radicular pain. With Valsalva test produces radicular pain which proves there is pressure on the nerve. The Trendelenberg test aims to measure the strength of the gluteus muscles. With the Trendelenberg test on the patient, it was found that there was a descending buttock line on the raised leg which proved that there was weakness in the gluteus muscle. Functional examination was also performed on patients using the Barthel index. The Barthel index is used to determine the functional ability and functional activity of geriatric patients. The Barthel index consists of 10 questions with the following interpretations: 0-20: fully dependent, 21-61: heavily dependent/very dependent, 62-90: moderately dependent, 91-99: mild dependence, 100: independent. Where the results of the test in these patients is 90 with moderate dependence interpretation.

Intervention

In the pain reduction intervention, TENS is used, which is aimed at reducing pain at the nerve level in patients. TENS is a non-pharmacological treatment method to reduce pain. TENS can be used to reduce acute pain and chronic pain.[1] Furthermore, TENS is aimed at reducing pain through a mechanism that inhibits pain transmission through a pain mechanism to the brain (gate control theory) and a mechanism for releasing endorphins (a hormone in the spinal cord that reduces sensitivity to pain and affects emotions). TENS is given at a dose of three times a week, an intensity of 60 mA, continuous type and a time of 15 minutes.[10] Furthermore, conventional therapy for pain reduction. IR is a physiotherapy modality that is often used for the treatment of LBP. IR radiation can increase blood flow and relax tissues so as to reduce pain and maximize functional activity. The physiotherapy modality used is infrared light which has a wavelength of 750 m-100 m, a frequency of 400 THz-3 THz, and a photon energy of 12.4 meV-1.7 eV.[12]

William's flexion exercises method is an exercise that aims to balance the postural flexor and extensor muscles in order to reduce stress on the facet joints caused by body weight, stretch muscles and fascia in the dorsolumbar area (increase soft tissue extensibility), open the intervertebral foramen, and correct incorrect posture.[4] Lower back flexion is the focus of this back workout. Furthermore, the flexion motions in this exercise will cause the abdominal muscles (M. rectus abdominis, M. obliquus externus abdominis, M. obliquus internus abdominis, and M. transversus abdominis) to contract and strengthen, resulting in an increase in intra-abdominal pressure, which will drive the vertebral column backwards, improving body posture by minimizing lumbar hyperlordosis, reducing articular weight-bearing stress, and expanding the intervertebral foramen, relieving pressure on the facet joints and intervertebral discs, and lowering LBP.[2] Exercise therapy is done twice a week, with each movement being repeated ten times during three months intervention. During therapy, the therapist keeps an eye on the patient's condition and ensures that they are performing the exercises appropriately

Table 1: Changing of pain, functional performance, and range of motion of participants over the baseline, 1st and 2nd follow-up.

Parameters	Baseline	1st follow-up (6 weeks)	2nd follow-up (12 weeks)
Pain (NRS)*	8	6	2
Barthel index	93	95	100
Range of motion (degree)			
Hip flexion			
Right	100	115	120
Left	95	113	120
Knee flexion			
Right	130	135	140
Left	130	135	140
Lumbar flexion	20	30	55
Lumbar extension	0	0	20

*Numeric rate scale

Table 2: Changing of pain, functional performance, and range of motion of participants over the baseline, 1st and 2nd follow-up.

Muscle strength (kg)	Baseline	1st follow-up (6 weeks)	2nd follow-up (12 weeks)
Hip abduction			
Right	23	32	39
Left	20	33	40
Hip abduction			
Right	25	39	43
Left	26	40	45
Hip flexion			
Right	36	40	45
Left	38	42	46
Knee flexion			
Right	33	42	49
Left	33	43	50

According to Table 2, there was a positive change in the form of a decrease in tenderness, which was followed by a decrease in active lumbar motion discomfort and a decrease in spasm. Tenderness and motion discomfort are both symptoms of pain alterations. TENS can produce a current that is conveyed to the surface of the skin of the lower back through electrodes, causing physiological stimulation of the tissue in question, both direct and indirect.

DISCUSSION

According to Aoki et al TENS can produce a current that is conveyed to the surface of the skin of the lower back through electrodes, causing physiological stimulation of the tissue in question, both direct and indirect.[13] At the cellular, tissue, segmental, and system levels, direct effect occurs. The use of TENS proved to be beneficial in reducing LBP with the use of TENS with a duration of 330 seconds and a frequency of 20 Hz. In line with the research of Bydon et al on the extrasegmental mechanism, TENS will induce the activity of small diameter nerves (A-delta) and produce analgesia at the extrasegmental level.[1] The application of TENS with a duration of 330 seconds and a frequency of 20 Hz was found to be effective in relieving LBP. TENS will cause the activity of small diameter nerves (A-delta) and produce analgesia at the extrasegmental level, according to Soriano et al, research on the extrasegmental mechanism.[2] The use of IR to alleviate pain and muscular spasm can be achieved through the circulation mechanism and the gate control theory mechanism, according to Soriano et al.[2] An increase in blood circulation can bring back irritant substances and metabolic waste that can increase nocisensory conductivity (bradykinin and histamine) in the circulation mechanism, whereas a decrease in the level of these irritants can slow down nocisensory conductivity, resulting in pain and discomfort. Spasms will lessen. Meanwhile, according to the gate control theory, a pleasant thermal effect has a calming impact on sensory nerve terminals, causing sensory nerve activity to decrease nocisensory activity, which transmits pain impulses, and pain to decrease.[4,13]

The application of exercise therapy William's flexion exercises decreases pain levels in the elderly with LBP with pain levels while mild pain in William's flexion exercises can increase lumbar stability because it actively trains the abdominal muscles, gluteus maximu and hamstrings. In addition, William's flexion exercise can increase intra-abdominal pressure which pushes the vertebral column backwards, thereby helping to reduce lumbar hyperlordosis and reducing pressure on the intervertebral discs which can reduce pain in the abdomen and back. Based on the research that has been done there is a significant effect between giving William flexion exercises (stretching) and decreasing pain levels in the elderly with low back pain. This can be used as a non-pharmacological therapy that can be done to reduce low back pain levels.[5]

CONCLUSION

In conclusion, tenderness and active movement in the lumbar region are common in the elderly with LBP related to spondylolisthesis. Furthermore, it impairs the elderly's ability to operate. The findings of the treatment show that traditional treatments such as TENS and IR, as well as exercises using the William's flexion exercises approach, can help the elderly with LBP related to spondylolisthesis reduce pain and increase muscular tone.

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