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The Role of Intermittent Traction in the Conservative Treatment of Acute Low Back Pain Caused by Disc Herniation – Permanent Solution or Postponement of Surgery

Goranka Radmilović[1,2,3], Danijel Mikulić[4], Jakov Ivković[5], Marin Mamić[1,2,3], Božica Lovrić[1,2,3] , Valentina Matijević[4,6]

[1]Požega Country General Hospital Požega, Požega, Croatia
[2]Faculty of Medicine, University of J.J. Strossmayer, Osijek, Croatia
[3]Faculty of Dental Medicine and Health, University of J.J. Strossmayer, Osijek, Croatia
[4]University Hospital Centre Sestre Milosrdnice, Zagreb, Croatia
[5]Special Hospital for Medical Rehabilitation, Naftalan, Ivanić Grad, Croatia
[6]School of Medicine, Catholic University of Croatia, Zagreb, Croatia

ABSTRACT

The aim of this study was to present possibilities and effectiveness of individual conservative treatment of acute low back pain caused by disc herniation. Is it possible to avoid or postpone surgical treatment with conservative methods? Seventeen subjects aged between 21 and 61 years were included in the study. All of them had the acute low back pain caused by disc herniation at the L4–L5 and/or L5–S1 level and all of them were candidates for surgical treatment. The subjects underwent intermittent traction treatment, also known as conservative spinal decompression, for the lumbar spine during two weeks with the addition of heating the paravertebral musculature and electro analgesic procedures. Over the next two weeks all of the subjects underwent individual exercises with a therapist based on the DNS (dynamic neuromuscular stabilization) principle twice a week and on the other six days they performed medical or hydro gymnastics for lumbar spine combined with individually adapted electro procedures. The degree of pain according to NRS (Numerical Rating Scale), Finger-to-floor distance test, Lasègue test and dorsiflexion of the foot on the painful side according to the manual muscle test were measured for each participant before and after two series of physical therapy. The results showed that there is a significant difference in all measured values before and after physical therapy. A significantly higher level of pain ($p<0.001$), positive Lasègue test on the lower angle ($p<0.001$), weaker dorsiflexion of foot ($p=0.008$) and higher distance in Finger-to-floor test ($p<0.001$) were reported before physical therapy was conducted. According to the results of our study it could be concluded that intermittent traction in combination with an individual approach to the patient, in terms of education and persistence in targeted medical gymnastics, is the key to successful conservative treatment of acute low back pain caused by disc herniation, not only to postpone but also to prevent surgical treatment.

Key words: *low back pain, traction, spinal decompression, dynamic neuromuscular stabilization, physical therapy*

Introduction

During their lifetime, 85% of all people experience lower back pain, making it the most common musculoskeletal symptom[1]. The vast majority of patients seen in primary care for lower back pain, more than 85% of them, will have nonspecific pain, meaning that the back pain has occurred without being able to specify its underlying cause[2,3].

Only a third of patients with acute low back pain seek medical attention[4] and 70–90% of those who seek it report improvement within 7 weeks[5,6]. In less than 1% of patients who seek medical help for back pain, there is a serious

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underlying etiology (cauda equina syndrome, metastatic cancer, and spinal infection). Less than 10% of those who seek medical attention will have specific but less serious etiologies underlying their condition; 3–4% of the total will be caused by symptomatic disc herniations[7].

Radiculopathy is a term that refers to symptoms and damage associated with spinal nerve roots. Spinal nerve root damage is most often the result of intervertebral disc herniation. Lumbosacral radiculopathy occurs mainly; over 90% are L5 and S1 radiculopathy. The term sciatica is commonly used, which describes symptomatology in the form of sharp or burning pain that spreads from the buttocks along the course of the sciatic nerve to the back or lateral part of the leg, all the way to the ankle or foot. The clinical findings of lumbosacral radiculopathy vary depending on the level of nerve root involvement[8].

The evaluation of low back pain primarily involves taking a quality history and physical examination to identify patients who require laboratory tests and imaging methods, most commonly MRI (magnetic resonance imaging) of the spine. We are witnessing the lightning-fast progress of technology and medicine, due to which imaging methods such as MRI are used more and more often, even unnecessarily. Premature use of imaging methods increases the probability of using invasive, surgical methods to solve problems, by about 15 times. The problem arises due to the fact that in 22 to 67% of adult, asymptomatic individuals MRI shows disc herniations[9]. Even in symptomatic patients, radiological findings may not correlate with clinical severity and outcome, and surgical resolution of a radiological defect may not correlate with clinical improvement[10]. Because of this, we again come across an increasingly frequent turn to conservative treatment methods.

One of the conservative methods used is intermittent traction. The most commonly used traction methods are mechanical or motorized traction (a motorized pulley performs traction), manual traction (the therapist uses his body weight to change the force and direction of pulling) and auto-traction, in which the patient controls the traction himself. The traction can be continuous or intermittent, depending on the duration of the force exerted. Gravitational and underwater traction are less commonly used[11]. Various theories have been proposed to explain the exact mechanism of traction efficiency. Some state that spinal elongation and the increase of intervertebral spaces lead to inhibition of nociceptive impulses, reduction of muscle spasm, release of luxation of the disc the capsule of the zygo-apophyseal joint, and relaxation of adhesions around the annulus fibrosus[12,13]. More recent explanations adapted to current neurophysiological research suggest that stimulation of proprioceptive receptors in the vertebral ligaments modifies higher cerebral dysfunction. So far, the assumed mechanisms are not sufficiently supported by empirical information[14].

Can the use of intermittent traction in combination with other conservative treatment methods, in patients previously indicated for surgical treatment of disc herniation, delay or even prevent surgery?

Materials and Methods

The study involved 17 subjects, men and women, aged 21 to 61 years with clinical signs of acute low back pain. After an examination by a specialist in physical medicine and rehabilitation at the Opća županijska bolnica Požega the subjects were included in the study in the order of arrival for the examination, from June 2022 to March 2023. All included subjects had a magnetic resonance image of the lumbosacral spine with a verified disc herniation at the L4–L5 and/or L5–S1 level. All subjects also had an X-ray image of the lumbosacral spine, where, apart from mild degenerative changes, no other findings were recorded. They had a maintained posterior intercorporeal line. Each subject was examined by a neurosurgeon who indicated operative treatment. The subjects did not agree to operative treatment, but decided to be treated with conservative and physical therapy modalities. Among the other diseases that the subjects had, hypertension was recorded in several subjects, well regulated by medication, without stenocardia or anginal pains. Each subject had started analgesic therapy with a non-steroidal anti-inflammatory drug (ibuprofen 2–3 x 600 mg or naproxennatrium 2 x 550 mg per day) prescribed by a primary care doctor.

Numerical Rating Scale (NRS)[15] from 0–10 was recorded for each subject, where 0 means no pain, and 10 indicates the strongest possible pain, the Fingertip-to-floor distance test[16] measured in centimeters, Lasègue test[17] or the stretched leg test measured in degrees and dorsiflexion strength of the foot on the painful side measured according to manual muscle test[18] from 0 to 5, where 0 means no active dorsiflexion movement, and 5 means proper dorsiflexion of the foot. Each subject was prescribed physical therapy for 10 working days which included intermittent traction for the lumbar spine with application of thermotherapy to the associated paravertebral musculature before traction and electroanalgesia via TENS (Transcutaneous Electrical Nerve Stimulation)[19] or IFC (Interferential Current therapy)[20] on the lumbosacral part of the spine after the traction. Intermittent traction was performed on traction bearing Platinum 08.501.001 by the same protocol for all respondents: the traction load in the first two days was 24 kilograms and every next two days it was increased by 2 kilograms until the final load of 32 kilograms in the ninth and the tenth day. Each subject had a body mass above 65 kilograms, and the final load during traction in no one was more than half of the total body mass. Intermittent traction treatment lasted 12 minutes every day with periods of traction and relaxation that were pre-programmed and lasted equally for each subject. For the next 10 working days, each subject performed individual exercises twice a week with a therapist according to the DNS principle (Dynamic Neuromuscular Stabilization)[21] and on the other six days kinesiotherapy or hydrokinesiotherapy in combination with TENS on the lumbosacral area and along the leg on which there was a positive Lasègue test. In subjects with impaired dorsiflexion of the foot electrostimulation of the peroneal nerve was performed.

At the end of the physical therapy, the subjects were checked in the physiatry clinic and the same parameters were recorded as before the start of the physical therapy: pain intensity, Fingertip-to-floor test, Lasègue test and foot dorsiflexion according to the manual muscle test.

Statistical methods

In the present pilot study we report on the cohort of 17 subjects. Median of age was 45 years (interquartile range from 45 to 55.50 years). By gender, subjects were mostly female (N=11; 64.7%).

Descriptive statistics methods were used to describe the frequency distribution of the investigated variables. Mean values are expressed as median and interquartile range. The Mann-Whitney test was used to check the differences between two measuring points (the initial and final measurement) in the same subject group, and the Wilcoxon Signed rank test was used to check the differences between two dependent variables, and Spearman's correlations were used to check the connection. The Kolmogorov-Smirnov test was used for testing the normality of the distribution. P-values ≤ 0.05 were acknowledged as statistically significant. Statistical analysis was performed with the program IBM SPSS 25, manufactured in Chicago, USA, 2017.

Results

Spearman's correlations were used to determine whether there is a correlation between age and the results of the NRS, Lasègue, DF (dorsal flexion) foot and Finger-to-floor tests before and after physical therapy. The results showed that there is no significant correlation between age and measurements before and after physical therapy (Table 1).

In order to determine whether there is a significant difference in the results of the NRS, Lasègue, DF (dorsal flexion) foot and Fingertip-to-floor test before and after physical therapy according to the subject's gender, the Mann Whitney test was used. The results showed that there were no significant differences in the results according to the gender of the subjects (Table 2).

The results showed that there is a significant difference in the value of pain measured by the NRS scale (Wilcoxon rank test; P<0.001); a significantly higher level of pain was reported by the subjects before the physical therapy. There is also a significant difference according to the results of the Lasègue test (Wilcoxon rank test; P<0.001); significantly higher values of the test were obtained by the subjects after physical therapy. There is also a significant difference according to the DF foot test (Wilcoxon rank test; P=0.008); significantly higher test results were reported by subjects after physical therapy. There is also a significant difference according to the values of the Fingertip-to-floor test (Wilcoxon rank test; P<0.001); significantly higher test results were reported by the subjects before the physical therapy (Table 3).

TABLE 1

RELATIONSHIP OF SUBJECT'S AGE WITH NRS, LASEGUE, DF FOOT AND FINGERTIP-TO-FLOOR TEST BEFORE AND AFTER PHYSICAL THERAPY

		Age
NRS-pain/before	rho	–0.443
	P	0.075
Lasègue -before/angle	rho	0.410
	P	0.102
DF foot- before/MMT	rho	0.116
	P	0.658
Fingertip-to-floor distance - before/cm	rho	–0.327
	P	0.200
NRS-pain/after	rho	–0.305
	P	0.233
Lasègue - after/angle	rho	0.079
	P	0.764
DF foot- after/MMT	rho	.
	P	.
Fingertip-to-floor distance - after/cm	rho	–0.145
	P	0.579

* P<0.01, rho – Spearman's rank correlation coefficient, P – probability value, NRS – pain according to Numerical Rating Scale, Lasègue – upon strait raising test in degrees, DF – dorsiflexion of the foot according to the manual muscle test; MMT – manual muscle test

TABLE 2

NRS, LASEGUE, DF FOOT AND FINGERTIP-TO-FLOOR TEST BEFORE AND AFTER PHYSICAL THERAPY, ACCORDING TO GENDER

		Median (interquartile range)	Z	P
NRS before	Female	7 (7 – 8)	–0.340	0.808
	Male	7 (6.75 – 7.25)		
NRS after	Female	4 (4 – 5)	–0.871	0.462
	Male	5 (3.75 – 5)		
Lasègue before	Female	55 (50 – 55)	<0.001	1.000
	Male	52.50 (50 – 55)		
Lasègue after	Female	65 (60 – 70)	–1.172	0.301
	Male	62.50 (60 – 66.25)		
DF foot before	Female	4 (4 – 5)	–1.844	0.098
	Male	5 (4.75 – 5)		
DF foot after	Female	5 (5 – 5)	<0.001	1.000
	Male	5 (5 – 5)		
Fingertip-to-floor before	Female	35 (25 – 45)	–0.302	0.808
	Male	33.50 (27.50 – 36)		
Fingertip-to-floor after	Female	20 (15 – 26)	0.614	0.660
	Male	21.50 (18.75 – 26)		

Z – test statistic that measures the difference between two independent samples, P – probability value, NRS – pain according to Numerical Rating Scale, Lasègue – upon strait raising test in degrees, DF – dorsiflexion of the foot according to the manual muscle test

TABLE 3

DESCRIPTIVE STATISTICS AND COMPARISON OF NAS, LASEGUE, DF FOOT AND FINGERTIP-TO-FLOOR TEST BEFORE AND AFTER PHYSICAL THERAPY

		MEDIAN (interquartile range)	Z	P
NRS	Before	7 (7 – 7)	–3.663	<0.001*
	After	4 (4 – 5)		
Lasègue	Before	55 (50 – 55)	–3.695	<0.001*
	After	65 (60 – 70)		
DF foot	Before	5 (4 – 5)	–2.640	0.008*
	After	5 (5 – 5)		
Fingertip-to-floor	Before	35 (26.50 – 42)	–3.627	<0.001*
	After	20 (15.50 – 26)		

* P<0.01, Z – test statistic that measures the difference between two independent samples, P – probability value, NRS – pain according to Numerical Rating Scale, Lasègue – upon strait raising test in degrees, DF - dorsiflexion of the foot according to the manual muscle test

Discussion

The aim of this study was to investigate the effectiveness of lumbar traction combined with an individual approach to the patient in treating acute low back pain. Lumbar traction is a non-invasive therapy that involves the application of pulling force to the lumbar region in order to decompress the spine and reduce pressure on the intervertebral discs and nerve roots[26]. It is a common treatment for low back pain, and is often used as a complement to other non-pharmacological and pharmacological interventions.

The results of our study show a significant difference in pain levels (measured by the NRS scale), Lasègue test, DF foot test, and Fingertip-to-floor test before and after the application of physical therapy. Specifically, participants experienced higher levels of pain and had higher values in Fingertip-to-floor test, while having lower values in Lasègue test and DF foot test before physical therapy. Improvements were observed after the application of physical therapy. These results suggest that physical therapy, which includes lumbar traction, could be an effective treatment option for individuals with low back pain, especially when combined with other treatment modalities. It is important to note, however, that this study did not isolate the effects of lumbar traction specifically, as it was just one component of the overall physical therapy treatment. Further research specifically investigating the effects of lumbar traction on low back pain is necessary to determine its effectiveness as a standalone treatment.

Our findings are consistent with previous studies that have reported the benefits of lumbar traction for low back pain. It is worth noting that the effects of lumbar traction were pronounced in patients with a herniated disc proven by magnetic resonance and not in those with non-specific low back pain. This suggests that lumbar traction may be a particularly effective treatment for patients with disc-related low back pain.

There are several types of lumbar traction, including mechanical, manual, and positional traction[26]. Mechanical traction involves the use of a machine that applies a pulling force to the patient's body, while manual traction involves a therapist applying the force by hand. Positional or auto-traction involves positioning the patient in a specific way to promote decompression of the lumbar spine.

The mechanism of action of lumbar traction is not fully understood, but it is believed to work through several different mechanisms[27]. One proposed mechanism is the reduction of pressure within the intervertebral discs, which can help to relieve pressure on the nerve roots and decrease pain[28].When a person is in a standing or seated position, the weight of the upper body compresses the intervertebral discs in the lumbar spine, causing an increase in intradiscal pressure[2]. By applying a longitudinal force to the spine through lumbar traction, the pressure within the intervertebral discs can be reduced. This reduction in pressure may help to promote the retraction of herniated disc material and relieve pressure on nerve roots, leading to a decrease in pain.

Another proposed mechanism of action for lumbar traction is the stretching and mobilization of soft tissues in the lumbar region[27]. Traction may help to stretch the muscles and other soft tissues in the lumbar region, which can help to decrease muscle spasm and improve range of motion[26].

In addition to these mechanisms, lumbar traction may also have an effect on the fluid dynamics of the intervertebral discs. It is believed that traction may help to create a negative pressure within the discs, which can facilitate the exchange of nutrients and waste products between the discs and the surrounding tissues[26]. Lumbar traction is often used in combination with other conservative treatments such as exercise therapy, manual therapy, and medications to manage low back pain. This combination of treatments can help alleviate pain and improve function, potentially postponing the need for surgery. In line with the results obtained, a Cochrane review from 2010 discussed the effectiveness of a variety of non-surgical treatments for chronic low back pain, including exercise therapy, manual therapy, and medications and the authors concluded that a combination of these treatments, including lumbar traction, can be effective in managing low back pain and delaying the need for surgery[29].

While there is some evidence to support the use of lumbar traction for the treatment of low back pain, the exact mechanisms of action are not well understood, and further research is needed to determine its effectiveness compared to other treatment modalities. The effectiveness of lumbar traction for the treatment of low back pain remains controversial. Some studies have reported positive effects[28,30,31], while others have found no significant differences between traction and other treatment modalities. A systematic re-

view and meta-analysis published in the Cochrane Library in 2013 found that there was limited evidence to support the use of traction for the treatment of low back pain, and that further research is needed to determine its effectiveness[26].

Acute low back pain is a common condition that affects a large proportion of the population, and is associated with significant medical, epidemiological, and economic consequences. Speaking of medical importance, acute low back pain can have a significant impact on a person's quality of life, causing pain, disability, and reduced physical function. It can also lead to psychological distress and depression, as well as sleep disturbances[22]. In some cases, acute low back pain can progress to chronic low back pain, which can be a lifelong condition[23]. As such, effective management of acute low back pain is essential to prevent the development of chronic pain and improve a patient's quality of life. Acute low back pain is a highly prevalent condition, affecting up to 80% of the population at some point in their lives[24]. It is the leading cause of disability worldwide, and is associated with a significant burden of disease[23]. Acute low back pain is also a common reason for seeking medical care, leading to a high demand for healthcare services[22]. Effective management of acute low back pain is therefore essential to reduce the burden of disease and healthcare utilization. Acute low back pain is also associated with significant healthcare costs, as well as indirect costs such as lost productivity and reduced quality of life[24]. In the United States, the annual direct and indirect costs of low back pain are estimated to be over $100 billion[25]. Effective management of acute low back pain is therefore essential to reduce the economic burden of the condition.

Finally, it is important to acknowledge the limitations of our study. Firstly, our sample size was relatively small, which may have affected the generalizability of our findings. Secondly, we only included patients with acute low back pain, so it is unclear whether our results would apply to patients with chronic low back pain. Future studies with larger sample sizes and longer follow-up periods are needed to address these limitations. It should be noted that one limitation of this study is the absence of a control group. Future research could include a control group receiving different methods of physical medicine and rehabilitation without intermittent traction, or a group of patients opting for surgery. The inclusion of a control group would provide valuable comparative data and further enhance the understanding of the effectiveness of lumbar traction in combination with other conservative methods in postponing the need for surgery.

Conclusion

In conclusion, our study provides evidence to support the use of lumbar traction as an effective treatment for acute low back pain, particularly in patients with a herniated disc. Further research is needed to establish the long-term benefits of lumbar traction and to determine its effectiveness in treating chronic low back pain. Nonetheless, our findings offer hope for patients suffering from acute low back pain who may benefit from this non-invasive, low-cost treatment option.

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V. Matijević

University Department of Rheumatology, Phisical Medicine and Rehabilitation, University Hospital Centre Sestre Milosrdnice, Vinogradska cesta 29, 10000, Zagreb, Croatia
e-mail : valentina.matijevic@gmail.com

ULOGA INTERMITENTNE TRAKCIJE U KONZERVATIVNOM LIJEČENJU AKUTNE KRIŽOBOLJE UZROKOVANE DISKUS HERNIJOM – TRAJNO RJEŠENJE ILI ODGODA OPERATIVNOG ZAHVATA

S A Ž E T A K

Cilj ovog rada bio je prikazati mogućnosti i učinkovitost individualnog konzervativnog liječenja akutne križobolje uzrokovane hernijom diska. Da li je moguće konzervativnim metodama izbjeći ili odgoditi kirurško liječenje? U istraživanje je uključeno 17 isitanika u dobi od 21 do 61 godina. Svi ispitanici su imali akutnu križobolju uzrokovanu hernijom diska na nivou L4–L5 i/ili L5–S1 te su bili kandidati za kirurško liječenje. Tijekom 2 tjedna ispitanici su bili podvrgnuti tretmanu intermitentne trakcije za lumbalnu kralježnicu, poznat i kao konzervativna spinalna dekompresija, uz dodatak zagrijavanja paravertebralne musculature i elektroanalgetskih postupaka. Sljedeća dva tjedna provodili su dva puta tjedno individulane vježbe s terapeutom po principu DNS-a (dinamičke neuromuskularne stabilizacija) a ostalih šest dana medicinsku ili hidrogimnastiku za lumbalnu kralježnicu u kombinaciji sa individualno prilagođenim elektroprocedurama. Svakom ispitaniku izmjereno je prije i nakon dva ciklusa fizikalne terapije: stupanj boli prema numeričkoj ljestvici (NRS), test udaljenosti prsti – pod, Lasègu-ov test te dorzalna fleksija stopala na bolnoj strani mjerena prema manualnom mišićnom testu. Rezultati su pokazali kako postoji značajna razlika u svim izmjerenim vrijednostima prije i nakon fizikalne terapije. Prije provođenja fizikalne terapije je zabilježena značajno viša razina boli ($p<0,001$), pozitivan Lasègue test na manjem kutu ($p<0,001$), slabija dorzalna fleksija stopala ($p=0,008$) i veća udaljenost u testu prsti – pod ($p<0,001$). Prema rezultatima našeg istraživanja moglo bi se zaključiti da je intermitentna trakcija u kombinaciji s individualnim pristupom pacijentu, u smislu edukacije i ustrajnosti u ciljanoj medicinskoj gimnastici, ključ uspješnog konzervativnog liječenja akutne križobolje uzrokovane diskus hernijom, ne samo kao odgoda već i kao prevencija kiruškog liječenja.