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Sciatica - radiating pain affecting an increasing part of society

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Introduction: Sciatica is a current and more common problem affecting normal functioning. Along with the development of civilization, the lifestyle has also changed, contributing to spend a large amount of time in a sitting position.

Material and Methods: Review of literature data available in the Pubmed, Cochrane and Google Scholar databases.

Results: Both in a standing and sitting position, the pressure exerted on the intervertebral discs increases leading to a hernia which, pressing on the roots of the L4-S1 nerves, lead to symptoms characterized by pain in the lumbar region, back of the buttock, thigh, calf, foot and paresthesia of these areas. Due to the progressive changes associated with aging, the frequency of sciatica increases with age. The basis for the diagnosis of sciatica is a carefully collected interview and examination of the patient, while imaging and neurophysiological tests can be helpful in determining the degree of compression on nerve structures. Treatment of sciatica is dependent on the cause and can be both conservative and surgical.

Conclusions: Due to the increasing number of cases of sciatica, it seems necessary to expand the knowledge on the diagnostic and therapeutic possibilities of this disease.

Keywords: sciatica; herniated disc; back pain; nerve compression; neuralgia; radiculopathy

Introduction

Sciatica is more and more common among Polish society, due to the fast lifestyle and overloads. Few people remember and realize that taking the right posture at work or lifting things plays an important role in protecting the spine.

Neuralgia may occur suddenly, for example, as a result of sneezing, lifting something or as a result of changes occurring for a long time - degenerative changes, microtraits. Sciatica most often, because in about 90% of cases, it occurs as a result of intervertebral disc herniation in the lumbar spine [1, 2].

The symptom that comes to the first place is a strong, radiating pain in the course of the sciatic nerve, which intensifies during coughing or stretching of the nerve. This is why the patients bend the affected lower limb in the hip and knee joints to stretch the nerve as little as possible and prevent the appearance of pain. Other symptoms include: limited spinal mobility in the lumbar region, increased muscle tone of the spinal extensors and paraspinal muscles on one side, as well as a reduction in muscle strength of the affected lower limb due to the patient relieving it [1, 2].

The patient's examination is divided into: subjective, during which the patient should be closely monitored from the very beginning of the visit and a detailed medical history should be collected, which consists of palpation, checking of mobility and conducting clinical tests and additional tests.

The studies conducted show that conservative treatment is often the first to be used in patients with sciatica. Its main goal is to reduce pain, which significantly reduce the quality of life of patients. In addition, the aim is to relax muscles or increase the range of mobility [3].

Sciatica constantly affects more and more people. For this reason, prevention and knowledge of risk factors is very important. One should, among others, take care of physical fitness, eat properly, do not smoke or take the correct posture. All this will cause that our spine will be less loaded and exposed to the appearance of sciatica.

Anatomy of the sciatic nerve

The sciatic nerve is the thickest and the largest nerve in the human body. The ventral rami of spinal nerves from L4 to S3 create the sciatic nerve from both divisions of the lumbosacral plexus. Inferior to the piriformis muscle, the nerve exits the pelvis through the greater sciatic foramen with others accompanying nerves and vessels. The sciatic nerve runs along the longitudinal axis of the posterior compartment of the thigh, crosses posteriorly the long head of the biceps femoris muscle, lies on adductor magnus, and is located laterally to semitendinosus and semimembranosus muscles. At the popliteal fossa, the nerve divides into its two branches: the tibial nerve, which progresses down in the posterior compartment of leg, and the common peroneal nerve, which descent in the lateral and anterior compartment of the leg. The sciatic nerve provides motor innervation to the knee flexors and all the muscles below the knee. Via its end branches the sciatic nerve supplies sensation to the skin of the foot and the lower leg - except for its inner side, which is innervated by saphenous nerve [4, 8].

Split into the tibial and common peroneal nerves can occur at any level from the sacral plexus to the inferior part of the popliteal space. According to cadaver study in the Indian population the highest incidence of sciatic nerve bifurcation (40.7 percent) was

observed in the lower part of the posterior compartment of the thigh, in 34.9 percent of the specimens in the popliteal fossa and 16.3 percent of extremities showed sciatic nerve division proximal to its entrance in the gluteal region [2]. Moreover, the results of another cadaver study seem to confirm a thesis of mentioned rare frequency of occurrence. In that study on 25 cadavers (50 lower limbs), 4 lower limbs with high division of sciatic nerve was observed – one in the back of a thigh and 3 within pelvis. In 46 (92%) the split of sciatic nerve was outside the pelvis [6].

There are 6 anatomic variants described in the current literature and included in Beaton and Anson classification system:

- A. Undivided sciatic nerve exits below piriformis muscle
- B. Common peroneal division exits through muscle and tibial division exits below piriformis muscle
- C. Common peroneal division exits above muscle and tibial division exits below piriformis muscle
- D. Undivided sciatic nerve exits through piriformis muscle
- E. Common peroneal division exits above piriformis muscle and tibial division exits through it
- F. Undivided sciatic nerve exits above piriformis muscle

Type A is considered to represent the normal anatomic relationship. In MR frequency study from 2017 the type A variant was identified in 83.6% of extremities. There were total 16.4% extremities with other sciatic neuromuscular variants. Of the other variants identified, 72.7% were type B and 6.8% were type C and in 20.5% cases A variant was identified, but tibial and peroneal division were divided by a thin fibrous slip. The other variants were not identified in this MR study, but they were reported in available cadaveric and surgical series [7]. The presented anatomical variations may contribute to clinical conditions [8].

Ethiology of sciatica

Sciatica is called a syndrome of symptoms caused by pressure on the spinal nerves at the L4, L5 or S1 level that form the sciatic nerve [9]. The cause of sciatica may be many factors. The most often of them is discopathy in the L-S segment, ie mechanical compression of the spinal nerve root caused by disc herniation - fissal ring rupture and extrusion of the nucleus pulposus outside [10]. In addition, symptoms can be caused by degenerative disease, which is a natural biological process associated with aging. It causes the weakening of the intervertebral disc, which in turn may lead to a disc hernia and pressure on the nerve roots. With age, there is also vascular changes in the intervertebral disc, which causes the vascular diffusion of nutrients to decrease, and as a result, the ability to bind water decreases. The crush-like core becomes more fibrous and stiff, and therefore less resistant to load and damage. Such a structure can be destroyed more quickly and cause symptoms of sciatica. Another reason may be the narrowing of the spinal canal causing pressure on the spinal nerves giving symptoms in the course of the sciatic nerve. Less common causes of sciatica are inflammation and cancer. Apart from purely neurological reasons, one can also mention the piriformis syndrome, which gives symptoms of sciatica, where the cause is not a hernia or other structure that presses the nerve roots, but the irritation of the sciatic nerve is most often strained m. Piriformis [2]. It can therefore be said that the origin of sciatic pain in the sciatica is multifactorial, because it involves mechanical nerve stimulation, direct compression to the nerve roots and a series of inflammatory states caused by the extruded nucleus [11, 12].

Symptoms and diagnosis of sciatica

The characteristic and a main symptom of sciatica is a pain in the lumbar area, which may be varied. Therefore, the diagnosis should be taken also due to individual factors. Many patients describe pain as a severity that prevents carrying out basic activity. A specific is

radiation down the posterolateral part of the lower limb [13]. Likewise motor dysfunction or weakness in the lumbar area and legs are listed as coexisting [14]. Sensory loss of sacrum section may occur. Also, the important is appearing of paresthesia. This symptom may be separated, f.e. tingling and numbness in the one foot as well as manifestation of sensory disorders in the whole painful area [13]. Comparing the pain and a paresthesia symptoms, patients point that the first one is more obtrusive than the second [14]. During the episode of the sciatica, patients awake at night with the back pain forcing them to change the position or body verticalization [13] or have difficulties while sitting, because of lancinate pain [14]. Unfortunately, the problems mentioned above persists for months or even a years [13]. In addition to complete a patient history of disease, to classify those conditions as a sciatica, there are a few tests listed below, which are used by specialists:

Straight leg rising test – Lasègue’s sign

The positive results is when lifting the straight lower limb of a patient in a supine position is accompanied by pain in lumbar area. It means that the clinician raises the patient's leg below the angle 45 ° without pain appearing. The straight leg rising test, despite the high sensitivity with the value 0,8-0,97, has a low specificity within 0,4. It indicate that many of patients with a disorder in examined part of the body will be diagnosed, but it is not necessarily that the cause of pain may be sciatica. Thus, it cannot be used like a significant test, because of the risk of misdiagnosis [15].

Diagnostic imaging techniques

Very helpful tests to detection visible changes in tissues are X-ray, Computer Tomography (CT), Magnetic Resonance Imaging (MRI) and myelography. Each of those methods have both advantages and disadvantages. They differ in the type of imaged tissues, testing time, availability and exposure to radiation. Due to higher costs of using CT or MRI, X-ray tests also known as plain radiography is the most frequently used test. Myelography involves using contrast medium, which makes it more invasive than the others methods. Unfortunately, imagining techniques have not the best accuracy of diagnostic, due to appearing many discordance depending on the patient. Although high cost and variable diagnostic accuracy, according to science, the suggested method, using in diagnosing sciatica, is MRI [16]. On the other hand, research on the effectiveness of CT over MRI is ongoing, with analysing using this test in combination with the other, non-imaging methods [17].

Electrophysiological tests

It is possible to use some electrophysiological methods, which may be helpful with evaluate nerve root function. Those tests may be source of an important information. The main disadvantage is low sensitivity and specificity, what disqualifies this type of tests as a prime method [18].

Non-invasive methods of treatment

Non-invasive methods of treatment of sciatica are aimed at preventing symptoms by applying painkillers and by reducing the pressure on the nerve root in various ways [2]. In the past, the most important conservative method was resting in bed, but with the progress of medicine and research on sciatica, the researchers concluded that this method of treatment for sciatica should be absent. Another non-invasive method of treatment for sciatica is pharmacology and its analgesics, non-steroidal anti-inflammatory drugs and muscle relaxants. These drugs have been shown to work slightly better than placebo [19]. One of the studies showed that epidural steroidal injections are effective in patients with acute sciatica [19]. It is necessary to precisely administer the drug in the place of nerve compression, because by acting directly in place of pain means that it is the most effective non-invasive

method. They are conducted under the control of fluoroscopy, which helps to accurately and effectively introduce the drug [20].

Muscle relaxing massage can be used only when you get rid of inflammation. Rehabilitation of sciatica should be individually matched to each patient. Relaxation exercises should be used, but in such a way as not to worsen the pressure on the nerves, which would worsen the condition of the patient. In other studies, it was found that exercises with a physiotherapist are not so effective in controlling sciatica, because similar therapeutic efficacy was demonstrated during normal rest in bed and during the following treatments: traction, manipulation, hot packs, or corsets [21].

The next non-invasive method used to treat sciatica is physical therapy. It consists of TENS and diadynamic reducing the feeling of pain, ultrasounds that are used to relax the muscles and the anti-inflammatory effect of the laser treatment [22].

Other methods used to prevent sciatica are kinesiotaping, consisting in the appropriate adhesion of specially designed tapes that relieve the muscles. Patients also opt for acupuncture, which reduces pain. There were also cases of effective Chinese cupping therapy [23].

Pharmacotherapy

Sciatica is an increasingly common problem in the everyday functioning of people. The pathogenesis of this disease can be distinguished by three pathogenic components, i.e. a mechanical component consisting of the nerve root compression due to a hernia, an inflammatory component that may show increased serum cytokine levels and a neuropathic component caused by neural damage. Due to the occurrence of bothersome pain and a decrease in the quality of life, it requires the implementation of pharmacotherapy. There are many clinical trials discussing the treatment of sciatica, which focuses on one of the three components discussed. These include non-opioid analgesia, surgery, acupuncture, muscle stimulation, epidural injections, which will be discussed below [2,24]. Transforaminal epidural corticosteroids (TESI) are an increasingly popular method of treatment for patients with sciatica. A study was conducted that compares TESI with levobupivacaine (TESI-plus) added to oral analgesics with analgesics alone or in comparison with transforaminal injections with local short-term anesthesia in the acute phase of the disease. A significant benefit has been demonstrated in the administration of TESI-plus in patients with acute sciatica (predominant inflammation) in the first few weeks. They should not be treated conservatively with painkillers only. It is worth mentioning that in another study the effect of this drug was also compared. Researchers focused on the effectiveness of intraforaminal and intradiscal injections of a mixture of a steroid, local anesthetic and oxygen ozone versus intraforaminal and intradiscal injections of the steroid and an anesthetic in the treatment of sciatica caused by a lumbar disc herniation. Significantly higher efficacy in therapy with oxygen ozone mixture (74%) has been demonstrated than in the opposition method (47%) after 6 months of testing [25, 26, 27, 28]. Most patients are treated conservatively in many ways. Only a small part of them are subjected to surgical intervention. This is most often the case when the symptoms of acute sciatica last for over 6 weeks and are caused by hernia compression. The operation involves decompressing the nerve root and reducing the risk of relapse. A study was carried out comparing the efficacy of early surgery and extended conservative treatment. The 1-year results were similar in both groups, while the pain relief and recovery rates were faster for those assigned to previous surgery [29]. Another method

of treatment for sciatica is stimulation of muscles and nerves. In this trial, the short-term application of High-Tone Electrical Muscle Stimulation (HTEMS) and Transcutaneous Electrical Nerve Stimulation (TENS) in chronic sciatica were evaluated. Ultimately, HTEMS showed greater potential for short-term pain relief than TENS and may be a new therapeutic strategy in the treatment of chronic disease [30].

It is also worth mentioning the acupuncture. The operation of this method is not entirely certain, but now people are increasingly using this type of treatment. Acupuncture is convenient and cheap, which can be used as premedical or supportive therapy. 14 studies focusing on the aforementioned method were analyzed. It has been shown that meridians and acupuncture points are necessary to significantly reduce pain. The bladder and gallbladder meridians can also be used for this [31].

In the treatment of sciatica an attempt was made to treat by the biological drugs. Adalimumab was used for this purpose. It is an antibody directed against TNF-alpha, released from broken intervertebral discs. A clinical trial was initiated in which the effectiveness of injections with adalimumab and physiotherapy for saline and physiotherapy were compared. Unfortunately, the research was not completed due to the small number of participants [26].

Taken together, studies confirm the efficacy of non-opioid drugs, epidural injections, antiepileptic drugs and surgical treatment. They also suggest the possibility of using acupuncture and anti-inflammatory biological agents. The findings do not support the efficacy of opioid analgesia, bed rest, exercise therapy, education or advice (when used alone) or traction. An important challenge remains the question of how to best assess the effectiveness of treatment methods in accordance with their order in the context of sequential treatment [28].

Prevention of sciatica

In order to prevent back pain, the patient should be educated on prevention [32].

The main factor of prevention is the modification of lifestyle, such as avoiding alcohol and smoking, leading an active lifestyle, avoiding overloading the spine and lifting objects when the lower limbs are bent and the spine is straightened [32, 33, 34].

In order to prevent recurrence of pain in the sciatic spine, it is necessary to take proper care of several important principles. The main factor is to maintain and restore the correct posture by limiting the time spent in a sitting position. Change the working position as often as possible and avoid lifting heavy objects. When lifting the object, it should be kept close to the body, which reduces the load on the lumbar vertebrae [35, 36].

It is very important to maintain proper body weight, because too much body weight puts too much strain on the cartilage joints, causing them to wear out more quickly. Back pain is caused by the large abdomen, which causes the body's centre of gravity to shift. Poor lifting of the object on upright lower limbs and bent spine may contribute to the formation of a hernia or the prolapse of the atherosclerotic nucleus.

Care should be taken to strengthen the muscles of the spine in order to maintain its good condition. Using a short daily exercise is better than a hard, long exercise once a week.

Back muscle training consists of several stages, such as warm-up, stretching, strengthening exercises and relaxation. A warm-up includes running or walking, which is designed to raise the temperature of the muscles, resulting in increased flexibility and resistance to injuries.

Stretching exercises will reduce the risk of injury because an unstretchable shortened muscle is at risk of tearing or stretching as a result of reduced muscle elasticity.

On the other hand, strengthening exercises make trained muscles a better function of stabilization and protection of the spine. Relaxation at the end of the exercise can reduce chronic pain or relieve it.

Recommended physical activities include swimming, as it relieves the intervertebral discs with simultaneous muscle activity; mainly the crawl and back style, the frog style is not recommended. Rhythmic walking, including jogging and Nordic walking, causes constant stretching and relaxation of muscles, contributing to their strengthening. The symmetrical pendulum movement of the hands strengthens the pumping mechanism, which plays an important nutritional role for the discs. Another activity is cycling, which relieves the support camera and improves fitness. It is recommended to use a stationary bike in order to avoid falls and uneven terrain, or a folding bike in order to position the spine correctly. Aerobics is an exercise involving larger muscles, which acts on them in a stretching and strengthening way [36].

Discussion

The problem of sciatica in the elderly should constitute an important element of clinical practice, due to the relatively high frequency of its occurrence and the problem of underestimating significant symptoms by patients. There is also an effort to systematize and unify knowledge about the disease. Attempts to summarize knowledge in the field of sciatica epidemiology, made by Konstantinou et al., perfectly illustrate the problem in scientific research conducted on the sciatica. They reviewed 23 publications from 1980-2006, in which the incidence of sciatic neuralgia fluctuated between 1.2% and 43%. Such large differences in the results of research should be explained by different methods of conducting research or lack of unified standards for conducting research [37]. These types of problems should be resolved in the future in order to increase the effectiveness of future research. Review publications, such as those made by us, may also be needed in the future.

Despite many diagnostic possibilities, physical examination, which is still an important element in the diagnosis of sciatica, should be remembered. This is especially important considering the need to plan treatment after diagnosis. Most patients with sciatic neuralgia can be treated by conservative treatment, however a certain percentage will require a surgical treatment, and it is easier to find them among the rest of the patients after careful physical examination. The importance of such examination was highlighted in the review by van der Windt et al., exemplified a sciatica caused by disc herniation and clinically manifested by back pain [38].

Significant directions for the development of knowledge about sciatica are methods of its treatment. The article deals with conservative treatment, emphasizing the importance of preventive measures. If, however, the prevention is not sufficient and the disease will occur, pharmacotherapy, which is currently developing intensively, may be necessary. The latest methods of pharmacological treatment include biological drugs. An example is the anti - Tumor Necrosis Factor - alpha therapy with the use of infliximab, whose efficacy in the treatment of pain caused by sciatica has been confirmed clinically [39].

An important treatment for sciatica is invasive procedures, including surgery. They were not the essence of our article, in which we focused on conservative treatment and prevention, but we should not forget about invasive options in clinical practice. We do not recommend treating pain due to traction, because a review of 25 studies with 1045 established tractions suggests a relatively low efficacy in the treatment of pain, comparable to that of placebo [40]. Much more attention should be paid to surgical treatment. Despite the relatively high risk of recurrence, ranging from 5% to 15%, for patients with sciatica caused by a hernia, research is conducted to develop knowledge about the factors contributing to recurrence [41]. They can increase the effectiveness of the treatment, therefore, further work

should be undertaken on therapies of this type and the invasive procedures in the treatment of sciatica should be considered and promoted.

Conclusions

The sciatic nerve is the largest nerve in the human body whose irritation causes symptoms of sciatic neuralgia. Sciatica is a common medical problem. The vast majority of cases (about 90%) are caused by a hernia of the intervertebral disc in the lumbar region of the spine. Radiant pain in the course of the sciatic nerve, which intensifies during coughing or nerve stretching, is a typical symptom of this disease entity.

The etiology of the disease may be associated with micro-injuries and degenerative changes of the spine that have been going on for years. Sciatica can also appear suddenly, for example, as a result of sneezing or lifting a heavy object. Treatment of sciatica depends on the cause that causes it and the severity of pain.

In order to reduce pain, conservative treatment in the form of pharmacotherapy and physiotherapy is used, which significantly improve the quality of life of patients. Analgesics, cooling or warming ointments for topical use will not eliminate pressure on the sciatic nerve which is usually the cause of severe pain. In the chronic form, additional methods are used in the field of physical therapy such as TENS current therapy or kinesitherapy.

To reduce the risk of sciatica, it is important to implement preventive measures including avoiding excessive spine loads, regular physical activity and attention to the correct posture.

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