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The etiology, pathogenesis, clinical presentation and differential diagnosis in Lower Back Pain with comparison of possible methods of treatment

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Abstract

Introduction and purpose

Non-specific and specific lower back pain syndrome is one of the leading causes of musculoskeletal disability and affects more than half of the population worldwide. The aim of this paper is to confront the problem of lumbar pain, possible diagnostic options, conservative and surgical opportunities with long term satisfactory rate.

State of knowledge

The paper reviews literature on lower back pain syndrome, sciatica, radiculopathy and lumbar disc herniation in regards to detection of the problem, classifying it and possible methods of resolvent. The WHO defines lower back pain as one of the leading causes of musculoskeletal dysfunction and it focuses on reducing the occurrence by programs like WHO Rehabilitation 2030 Initiative, UN Decade of Healthy Ageing and others. The paper also focuses on non-surgical options of treatment.

Material and method

A review of the literature available in the "PubMed" and Google Schoolar was conducted. We focused on differential diagnosis depending on clinical presentation and possible treatment methods depending on symptoms, pathogenesis of the disorder and available procedures.

Summary

Our review managed to present the current state of development, possible differential diagnosis, prevalence of neural compressions, sciatica and radiculopathy in different diagnostic options. By receiving multiple studies we confront varied opinions of specialists regarding the approach to lower back pain syndrome and favorable forms of care. Additionally we came to the conclusion that the difference of patients' long term satisfactory rate in regards to nonoperative and operative treatment is not significant, and flattens over the years.

Keywords: Lower Back Pain; Disc Herniation; Lumbar Discopathy; Radiculopathy; Sciatica; Rehabilitation;

Introduction

Lower back pain has the highest prevalence globally among musculoskeletal conditions and is the leading cause of disability worldwide, associated with multiple different disease entities. Even up to 80% of all the individuals will suffer from lower back pain during their lives. It can present as pain, muscle tension or stiffness localized below the costal margin and above the inferior gluteal folds. Sometimes lower back pain syndrome can occur with accompanying sciatica.[1,2]

Classification of back pain introduces three categories: specific spinal pathology, nerve root pain or radicular pain and non-specific lower back pain. We are able to divide lower back pain into three groups depending on its location, temporal nature and aggravating factors: axial pain, referred pain and radicular pain. [1,3,4]

Purpose

The purpose of this study is to examine possible differential diagnosis and available treatment methods in lower back pain. The aim of this work is to provide valuable information on the potential health risks, diagnostic difficulties, surgical and non-surgical methods of care analyzing the scientific literature and relevant studies. The study aims to shed light on the problem of differential diagnosis and the development of treatment methods in disc herniations and lower back pain.

Material and methods

The term lower back pain regulated by WHO, describes pain between the lower edge of the ribs and the buttock. It can last for a short time (acute), a little longer (sub-acute) or a long time (chronic). An estimated 619 million people live with lower back pain and it is the leading cause of disability worldwide, that produces an immense economic burden on individuals and societies . Therefore lower back pain is a major public health issue.

The recommended treatment methods are limited by availability of diagnostic procedures and similarity of the symptoms to different diagnosis. Most epidemiological studies do not differentiate between types of pain in lower back pain syndrome.[5,6]

In our work, we will look at different treatment methods with an emphasis on verifying diagnosis and possible options of therapy depending on the pathology. For this purpose, We browsed publicly available article databases such as PubMed and Google Schoolar.

Results

Our review managed to summarize possible diagnostic differentiation and introduce the newest forms of treatment options. By reviewing many articles, we shed light on the problems that can occur in lower back pain regarding stigmatization of the patients that struggle with this syndrome. Our analysis presents that rehabilitation and non-surgical approach is a very effective management method for most of the conditions that function as lower back pain.

Non-specific Lower Back Pain

Non-specific lower back pain is characterized by the absence of an identifiable correlate of the symptoms. Approximately 80% of patients consulting health care providers for NSLBP can expect to resume normal activities within 6-12 weeks, nevertheless the recurrence of lumbar pain is common and depending on the study has been estimated between 25% to 70%. The term refers to more than 60 differential diagnoses. The common feature is the causal link between the structural pathology and the expected pain experience. With regard to the time course, lower back pain can be divided into acute (under 4 weeks), subacute (4 to 12 weeks) and chronic (over 12 weeks). [2,5,7]

Pathogenesis of NSLBP finds correlates to pain in peripheral pain generator model, neurophysiological model, mechanical loading model, motor control model and biopsychosocial model. [5]

The division of patients with lower back pain syndrome is beneficial to establish an appropriate treatment plan. The flag system identifies serious spinal pathologies and possible obstacles in recovery. Red flags are symptoms and signs that may indicate early referral to a specialist. A history of trauma, cancer, systemic disease, major neurological compromise and infection may indicate serious spinal pathology. Yellow flags include delayed recovery predisposition. Factors are mostly related to psychological and behavioral beliefs. Blue flags represent predisposing work-related factors for delayed recovery such as loss of job and fear of losing patients' jobs, lack of job satisfaction, poor relationship with supervisors and fellow workers. Black flag relate to societal and occupational factors that predispose to lower back pain syndrome. [3,8]

Epidemiology and pathogenesis

In available studies the correlation between sciatica and discopathy was discovered in the XX century, first acknowledged in 1934. Nowadays disc herniation can be defined as a focal displacement of nuclear, annular or endplate material beyond the adjacent vertebral bodies with a contour abnormality of the disc margin. [1,5] Studies show that women and men have an almost equal risk of suffering from sciatic pain, even considering the occupational factors. Compared to the previous study, different analysis has acknowledged that males are operated on twice as often as female patients. The first episode of sciatic pain was at the average age of 37 years. Up to 70% of patients also experience leg pain, in some cases characterized as radicular pain. The epidemiology of cauda equina and conus medullaris lesions are not well known. The studies present yearly prevalence of those lesions at around 5-10%.[6,9–12]

Lumbar intervertebral disc herniation occurs typically as a result of age related changes in the extracellular matrix of the discs with weakening of the anulus fibrosus, susceptible to fissuring and tearing. Available articles emphasize on methodological limitations used to identify risk factors in lower back pain and sciatica. Several occupational factors are believed to be associated with increased risk of sciatica and disc herniation: frequent twisting and turning, heavy lifting, vibration exposure, driving and sedentary lifestyle. Studies also discuss genetic disposition and post traumatic disc herniation as frequent risk factors.[13–15]

Radiculopathy

The pathophysiology of radiculopathy is to this day not well understood. Sciatica is a compromise of the nerve root both by mechanical compression and chemical irritation. [16]

Mechanical deformation can be achieved by edema, onset and level of compression, compromised cerebrospinal fluid flow, reduced blood supply. Studies have shown that the compression on at least two levels of cauda equina induces lower blood flow not only in the compromised area, but also in the surrounding tissue, even with minimal pressure.[17,18]

Inflammatory properties of nucleus pulposus can occur as alterations of chemical irritation that plays a decisive role in sciatica. Proinflammatory cytokines also play a dominant role in the generation of the sciatica. Studies have shown that TNFα concentration causes allodynia and hyperalgesia responses, as a part of the chemical irritation.[13,19]

Clinical Presentation

Most of the lumbar disc herniations occur between 30 and 50 years of age. Frequently patients report an acute episode of back pain radiating increasingly to one leg within hours or days. Later patients mostly complain of leg pain, sometimes together with sensorimotor deficit. [20]

Main symptoms in lower back pain syndrome contain: radicular pain, motor weakness, sensory loss corresponding to the respected myotome and dermatome of the compromised nerve root. Sometimes patients complain of paresthesia of the dermatome, relief of pain in supine positions and radicular pain provoked by sneezing, coughing and pressure. Symptoms in children and adults can differ significantly. Rarely disc herniation can cause cauda equina syndrome which is presented with constant back and leg pain, numbness and weakness of the lower extremities, bowel and urinary incontinence. [21,22]

The clinical examination of patients is crucial for proper diagnosis and decision regarding future treatment. It is predominantly focused around neurologic examination, testing of dermatomal sensation and muscle force of the lower extremities. It is obligatory to test sensation in the perianal region and tonus sphincter. Patients with disc herniation often present with positive Lase'gue sign, positive reversed Lase'gue sign, crossed Lase'gue test, vertebral shift, trigger points along ischial nerve and restricted spinal movement. Positive Lase'gue sign is indicative of radiculopathy. Neurological pain has to be differentiated with non-radicular pain, mostly tendon pain. [20,23]

Diagnosis

Imaging studies are an important part of the diagnostic workup. Standard radiographs are not helpful in the diagnosis of radiculopathy and disc herniations. The decrease of disc height is not a reliable indicator of pathology. The images are useful in eliminating differential transitional abnormalities such as sacralisation or lumbarisation.[24]

Magnetic resonance Imaging is the method of choice for the assessment of disc disorders. It is also preferred due to possible differentiation of recurrent herniation and scar formation. Contrast enhanced imaging can improve diagnostic accuracy.[25,26] In patients with contraindications for MRI, Computed Tomography suffices as a diagnostic tool in disc herniation. Computed tomography combined with myelography is used for better depiction of the nerve roots.[14,27–29]

Neurophysiological assessment can differentiate peripheral and radicular nerve compromise. Ultrasonography of the bladder is helpful in diagnosis of cauda equina syndrome.

Classification

Disc herniation can be classified according to their localisation: median, lateral and posterolateral. Most of the herniations occur posterolaterally in the weakest locus of posterior longitudinal ligament. Mediolateral herniations are most common in the axial plane, whereas lateral herniations are not that common.[30]

The studies describe two types of lumbar disc herniations regarding the penetration of posterior anulus and longitudinal ligament as contained or non-contained. Contained discs are not in direct contact with epidural tissue.[25]

The most commonly used classification is based on magnetic resonance imaging of morphology in disc herniation. The classification divides bulging, protrusion, extrusion and sequestration. The bulging disc definition is the most problematic, because it is mostly discovered in patients without any symptoms. We can also classify the nerve root compromise: no contact, contact, deviation and compression. [14,25,31]

Non-surgical treatment

Symptomatic lumbar disc herniation is a condition which exhibits bening history. Only cases with cauda equina syndrome and severe paresis are indicated for surgical approach. Main objectives of treatment are the reduction of pain, reversal of the neurological function, regaining the activity for daily living and return to work. [23]

Favorable indications for non-surgical treatment are young age, sequestrated disc herniation, minor neural compromise, small herniation, mild disc degeneration and mild sciatica. Studies show that those factors were associated with an improved outcome.[32,33]

In most cases an acute episode of sciatica takes a brief course, this phase is followed by a subacute or chronic period of residual symptoms. Most patients recover within a month, the recurrence rate is approximately 10-15%. Extruded or sequestered herniation disc symptoms disappear within a few weeks. Conducted studies evaluated the evolution of lumbar herniation using MRI imaging. Performed measurement demonstrated that 48% of patients had a reduction in size of their disc herniation greater than 70%. The largest disc herniations have shown the greatest degree of reduction in size.. In different studies almost 85% of patients' clinical outcome corresponded to a decrease of herniated disc. Patients with morphologic changes showed significantly lower duration of leg pain compared to patients with slight clinical improvement, corresponding to clinical outcome. However disc protrusion does not have a tendency to resolve over a 5-year period. The exact mechanism of disc disappearance is not fully known. [14,16]

The key measures of non-operative treatments include bed rest not prolonged by more than three days, analgesics, physiotherapy, anti-inflammatory medication. Research presents that conservative treatment has a 70-80% success rate. In the Buttermann report epidural corticoid therapy was not an effective enough method of treatment and most of the patients underwent the surgery after 6 weeks of injection therapy.

Carrete et al. study conducted that patients with epidural injections of methylprednisolone acetate had no significantly better outcome after 3 months compared to patients in the placebo group. Authors of another research concluded that selective nerve root injections with bupivacaine and steroids are more effective than with bupivacaine alone and they can reduce the percentage of patients undergoing surgery. [16,31,34]

Rehabilitation

Rehabilitation is one of the non-surgical treatment methods that has made the most advancement in recent years. Weber et al. compared conservative treatment techniques with surgical procedures in advanced lumbar disc herniation. The result of overall observation in two groups had a similar outcome after 6 years. In Spine Patient Outcomes Research Trial prospective observation of patients with sciatica due to herniated disc in comparison to treatment methods has shown that both groups have seen improvement. The difference in both groups' satisfactory rate for sciatica patients were comparable. [32,33]

Main lumbar spine study demonstrated that patients undergoing surgery observe greater improvement in symptoms, but in longer observation the difference had vanished. [35]

Multiple rehabilitation techniques are available, mechanical traction, hydrotherapy, stretch and strength treatment, manual therapy, psychological interventions, yoga-based therapy are only some of the conservative care possibilities.

Surgical treatment

Main goal of surgical treatment is decompression of neurological structures with strong correlation between clinical symptoms and radiological evidence. Cauda equina syndrome and acute or subacute compression syndrome of the spinal cord are absolute indications for early surgery. Study of Kostiuk has shown that the surgery in previous cases does not have to be performed in the first 6 hours after occurrence of the syndrome. Other indications include significant muscle paresis and severe incapacitating pain not responding to any non-surgical treatment options. Meta-analysis presents that there is no difference in the effect of the surgery performed in the first 24 hours and within 24 to 48 hours after occurrence. The authors suggest the protocol of two months of non-surgical treatment followed by a surgery. [11,12,36]

Chemonucleolysis is a percutaneous injection of chymopapain into the vertebral disc. It is a minimally invasive technique that is showing to be effective in randomized studies. The role of chemonucleolysis has decreased over the years due to complications such as transverse myelitis, paraplegia and the development of new surgical techniques.[37,38]

Percutaneous techniques through the posterolateral approach to herniated disc allows evacuation and decompression of the nerve root without penetration into the spinal cord. The added benefit is also preservation of articular processes and ligamentum flavum.

Automated percutaneous lumbar discectomy (APLD) and laser discectomy are techniques which enable indirect decompression of neural structures. Their success rate differs between 55% to 85%.[38]

Endoscopic discectomy can be performed using medial, lateral and posterolateral approaches. Throughout the year they have evolved from indirect decompression into direct removal of herniated fragments of the disc. Kambin et al. reported a similar outcome of 87% to open microdiscectomy. The procedure offers the advantages of outpatient surgery, early functional recovery and less surgical trauma. [30,39]

Standard limited laminotomy with unilateral approach through interlaminar window, partial flavectomy and the exposure of neural structures is the current gold standard for discectomy. Optionally this technique can be used with magnification loops or headlights.

A more severe surgical approach by complete bilateral removal of ligamentum flavum and partial laminotomy can be performed in cases with massive disc herniations and congenitally narrow spinal canal.

Microdiscectomy is the technique introduced by Caspar and Williams using the microscope to expose the compressed root nerve. It results in less nerve root irritation than with standard techniques, allows the three-dimensional depth view into the wound, can be performed using a smaller approach which all results in shorter recovery. McCulloch has indicated that the outcome of the lumbar discectomy is not affected by the use of the microscope or any other surgical techniques. [30,40]

Sequestromy is the preferred technique in cases involving sequestered herniated discs in need of complete discectomy. In studies comparing complete discectomy and sequestromy, recurrence of disc herniation comes to 5% in sequestration and 10% in patients after discectomy.[33,41]

Discussion

Lower back pain syndrome has become one of the most prevalent factors in disability, job loss, lowering of QALY and possible chronic illness. The development of sedentary lifestyle, physical work and personal genetic predisposition has been strictly linked to more frequent diagnosis of lower back pain and more specifically disc herniation with accompanying sciatica. The vastness of differential diagnoses, non-specific symptoms and efficacy of treatment methods caused lower back pain syndrome to become difficult to identify and treat.

Moreover, an increase in the overuse of medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs), opioids and the prevalence of certain risk factors such as obesity, work involving heavy lifting, contribute to the rising incidence of herniated discs in modern times. Addressing these factors and promoting a more balanced approach to work, activity and well-being is crucial in mitigating the prevalence of lower back pain syndrome in current society.

Conclusion

Lower back pain syndrome and lumbar herniated disc present multiple differential symptoms, possible treatment options and availability to personally fitted rehabilitation and surgical therapy plans. This area is in rapid development and further study of diagnosis and care possibility is crucial to access most of the patients struggling with these conditions. Risk factors and allocation of patients to the flags system may be helpful to determine opportunities to reduce the menace of chronic lower back pain syndrome. The evolving field of surgical intervention holds significant promise to patients with sciatica, greater lumbar spine degeneration and nerve compression.

DISCLOSURE

Author's contribution

Conceptualization, Kaja Surowiecka and Michał Urbaś; methodology, Dawid Kociołek.; software, Martyna Kępczyk; check, Michał Urbaś and Jakub Misiak; formal analysis, Kaja Surowiecka and Michał Urbaś; investigation Alicja Chrościcka and Aleksandra Kościołek; resources, Kaja Surowiecka; data curation, Konrad Szalbot and Martyna Kępczyk; writing - rough preparation, Kaja Surowiecka and Aleksandra Kościołek; writing - review and editing, Miłosz Ojdana and Jakub Misiak; visualization, Konrad Czchowski; supervision, Konrad Szalbot; project administration, Michał Urbaś and Dawid Kościołek; receiving funding - no specific funding.

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The data presented in this study is available upon request from the correspondent author.

Conflict of interest

The authors deny any conflict of interest

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