Journal of Human Perfomance and Health 2019; 1 (1): e1-7
Gdansk University of Physical Education and Sport In Gdansk
The Jerzy Kukuczka Academy of Physical Education in Katowice
Faculty of Physical Education and Sport, Charles University in Prague

VIEWPOINT

doi: 10.29359/JOHPAH.1.4.05

Pathomechanisms and differential diagnosis of pain in the lumbosacral spine

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Wioletta Jagucka-Mętel[1 ABCEF], Anna Machoy-Mokrzyńska[1 ADEF], Katarzyna Leźnicka[2 BEF]

[1] Department of Experimental and Clinical Pharmacology, Pomeranian Medical University, Szczecin

[2] Department of Molecular Biology, Gdansk University of Physical Education and Sport

abstract

Spinal pains are a common ailment of modern civilization. The number of people suffering from spinal pains is increasing along with the ongoing civilization changes and an improvement in the quality of life.

The term "lumbar spine pain syndrome" is rather imprecise. The pathomechanism that triggers pains in this area is very complex; furthermore, it may be influenced by many factors, depending both on the patient and the nature of his work and individual habits. An assessment of the clinical condition of a patient with lumbosacral pain relies on collecting a thorough history and physical examination, supplemented with imaging tests. Despite the technological progress used in diagnostics (increasing resolution of imaging devices), treatment of back pain syndromes is unsatisfactory.

The subject of this study concerns the impact of disorders in the structures that make up the biokinematic chain of the pelvis and the lumbar spine which can significantly accelerate or delay the onset of pathology in the above-mentioned area.

Due to the complexity of the problem associated with the incidence of lower back pain, attempts should be made to explain it because it still constitutes a diagnostic and therapeutic challenge. In everyday practice, the best therapeutic effects are brought by making the patient aware of the type of dysfunction they are experiencing and of the need to cooperate with a therapist, which will allow properly implementing an individually planned treatment program.

Key words: spinal pain, differentiation, pathomechanism.

article details

Article statistics: Word count: 2,126; Tables: 0; Figures: 0; References: 34
Received: October 2019; Accepted: December 2019; Published: December 2019

Full-text PDF: http://www.johpah.com

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interests: Authors have declared that no competing interest exists.

Corresponding author: Dr hab. Katarzyna Leznicka, Department of Molecular Biology, Gdansk University of Physical Education and Sport, Gorskiego str. 1, Gdansk 80-336, Poland; e-mail: k.leznicka@o2.pl

INTRODUCTION

Spinal pains are a common ailment of modern civilization. The number of people suffering from spinal pains is increasing along with the ongoing civilization changes and an improvement in the quality of life [1].

The term "lumbar spine pain syndrome" is rather imprecise. The pathomechanism that triggers pain in this area is very complex; furthermore, it may be influenced by many factors depending on both the patient and the nature of his work and individual habits [2]. An assessment of the clinical condition of a patient with lumbosacral pain relies on collecting a thorough history and physical examination, supplemented with imaging tests. Despite the technological progress used in diagnostics (increasing resolution of imaging devices), treatment of back pain syndromes is unsatisfactory.

LUMBAR CURVATURE CHANGES

The physiological curvature in the lumbar spine, with the arch directed towards the abdomen, is called lumbar lordosis and is characteristic of a human being. The most common pathologies in this area include: increased curvature (lumbar hyperlordosis), reduction or flattening (lumbar hypolordosis or dyslordosis) and sideways deviation of the curvature in the frontal plane (scoliosis). Lumbar hyperlordosis can be caused by poor motor habits, excessive body weight, as well as limitation of physical activity, which consequently leads to static disorders in the lumbar spine and the pelvis [3]. Congenital (primary) lumbar hyperlordosis can be caused by: incorrect positioning of the sacrum, disruption of the vertebral arch without its displacement, spondylolisthesis, lumbalization of the S1 vertebra and sacralization of the L5 vertebra. The causes of secondary (acquired) hyperlordosis may include: muscular dystonia, muscle weakness and stretching, rickets, post-traumatic changes, Huck's static hyperlordosis (so-called concave back), emotional disorders, or neurological diseases associated with muscle paralysis [4–6].

The opposite of hyperlordosis is hypolordosis, characterized by a reduction in natural lordotic curvature in the sagittal plane. This dysfunction is much rarer than the previous one. In the lateral projection, the patient's silhouette is characterized by a posterior pelvic tilt, where the buttocks are "retracted" and the coccyx is "rolled up", which consequently leads to muscular imbalance in this area [7, 8].

Scoliosis, formerly known as lateral curvature, is another type of lumbar lordosis disorder. It is now known that in this curvature there are disorders in both the frontal, sagittal and horizontal planes. Therefore, it is a three-plane curvature [9–11]. There are many divisions of scoliosis. One of them distinguishes primary and secondary scoliosis, another one depends on the degree of curvature, and yet another one refers to its location. In scoliosis, soft tissues (muscles, ligaments, joint capsules, blood vessels, nerves) stretch on the convex side, and these structures become shortened on the concave side thus creating trigger points.

PATHOMECHANISMS OF SACROILIAC JOINT PAIN

The paired sacroiliac joints, which are part of the iliac girdle, are formed from the auricular surfaces of the sacrum and the ilium bones. Their slight mobility results from movements within the trunk and the lower extremities. These small, but very important movements affect the leveling of asymmetry and the cushioning of transferred loads.

Pain ailments coming from the SIJ are associated with disorders within the joint itself (blockage and hypermobility) as well as within the soft tissues that surround it (primarily ligaments that directly and indirectly affect this joint). This occurs as a result of overloading and adding micro-injuries [12, 13]. The most common disorder within the joint itself is functional blockage, which involves a dislocation of the sacrum relative to the hip bone. Then there is locking in the joint that prevents a return movement. Hypermobility occurs far more seldom. Excessive stretching of the SIJ ligaments, caused by micro-injuries, muscular imbalance, and in particular hormonal changes, consequently leads to this condition. Rarely are the above ligaments examined in a doctor's office. Most often, doctors are guided by visible changes in imaging examination, which is why it seems important to compare ligament pain with pain caused by other pathologies [13, 14].

DEGENERATIVE CHANGES

Degenerative and deforming changes of the spine may occur in vertebral bodies as well as in the joints of the spine. Locomotor degenerations associated with degeneration of the bone tissue are a natural process resulting from the aging of the body [15]. In the lumbosacral segment, which is subjected to the greatest loads, degenerative changes occur the fastest. The degenerative process that progresses over the years causes gradual intensification of symptoms, the most common of which include: pain, limited mobility of the spine, as well as neurological symptoms. Imaging tests are performed to verify and locate degenerative changes accurately. X-ray examination is the most accessible, popular and the least expensive one, which is enough to detect changes in the bone tissue. The following pathologies can be observed in this examination: a reduction of intervertebral holes, a reduction of space between vertebral bodies, reduction of the cross-section of the vertebral canal, deformation changes and osteophytes (bone growths on the edges of vertebrae). If damage to soft tissue structures is suspected, the patient is referred for more accurate tests, such as computed tomography (CT) or magnetic resonance imaging (MRI) [16].

SPINAL CANAL STENOSIS

The location of degenerative changes (resulting from the natural aging process) within the internal diameter of the spinal canal or the intervertebral hole leads to the formation of spinal canal stenosis. It can cover one or several segments of the spine. Stenosis of the spinal canal is its narrowing which results in a disproportion between the content of the canal and its volume. This narrowing can be caused by soft tissues (ligaments, intervertebral disc) or the bone tissue (degenerative changes, osteophytes).

The location of the changes within the diameter of the canal will result in pressure on its contents (dura mater or horse tail). In case of pressure on the root together with blood vessels, nerve root ischemia occurs, which causes chronic pain and disturbances in muscular sensation and strength in the lower limbs [17]. Ailments of patients with stenosis intensify when walking. This sometimes takes a form of neurogenic claudication [18]. Pain usually radiates from the loins through the buttocks to the lower extremities and is symmetrical. In order to reduce symptoms, the patient assumes a bent position which leads to flattening of lordosis, increasing the internal diameter of the canal, better blood supply to the nerve structures. Incorrect lifestyle, obesity,

excessive loads, accompanied by a congenitally narrow spinal canal, accelerate stenosis-related ailments and may occur as early as in the fourth decade of life.

DAMAGE TO THE INTERVERTEBRAL DISC

Disk disease associated with damage to an intervertebral disc is a broad concept. It includes changes in its individual elements (fibrous ring, nucleus pulposus, endplate) which may be a result of acute trauma (jerk, lift) or microtraumas associated with degenerative processes [19]. This is accompanied by sharp pain (unilateral, along the lower limb up to the foot), which is the body's natural defense mechanism. The ailments intensify during movement (mostly during bending and extending), and bending the trunk towards the radiation of pain is impossible [20].

In a typical, root pain syndrome, pain intensifies during sneezing, coughing, pressure, and during palpation along the sciatic nerve (Valleix points). Along with the body aging, pathologies occur within the intervertebral disc – both its central and peripheral parts. The disease process is most often long-lasting, with periodic exacerbations [20]. The fibrous ring structure also weakens due to dehydration of its central part. This leads to a reduction in spaces between intervertebral discs, and thus to loosening of the ligament apparatus and fibrous ring fibers. It becomes increasingly weaker and thinner, and the pressure of its mass causes further damage in its structure, resulting in hernia [21]. Most often, the displacement of the intervertebral disc happens in the posterior-central or posterior-lateral direction. Depending on the extent and location of the changes, this may be a reason for discomfort of a local or root character. In the lumbar section of the spine, the root damage of the L4, L5, S1 usually occurs.

DISORDERS OF INTERVERTEBRAL DISC NUTRITION

The intervertebral disc is a structure devoid of blood vessels. The diffusion process allows the disk to take in nutrients, which is facilitated by the pressure difference affecting the intervertebral disc. During the day, a person most often assumes a standing or sitting position, which causes compression of the disc. At night, it is relieved, which allows water and nutrients absorption. Appropriate movement during the day prevents the pulp of the nucleus pulposus from drying out and ensures proper nutrition [22]. In patients in whom the detached fragment has lost contact with the elements that nourish it, the pain will decrease, and the remaining spine structures will gradually adapt to the disc losing volume [22].

The repair mechanism in a damaged disc varies depending on age. In adults, damaged areas fill with defective fibrous tissue, and over time calcification and bone formation may occur due to the penetration of osteoblasts from adjacent vertebral bodies. The healing process can be counted on only in growing persons. In these case, at the site of the damage, within the hematoma, the process of granulation and formation of new blood vessels occurs [23].

DIFFERENTIAL DIAGNOSIS

Due to the complexity of the anatomical structure of the lower section of the spine and the pelvis, any dysfunction of one of the numerous elements causes pain in the lumbar region, the pelvis and the lower limbs. To plan the treatment properly, it is necessary to determine the cause of pain, the pathomechanism

of its formation and to identify the anatomical structures involved in this process. Making a proper diagnosis in a patient with lumbar and sacral pain is complicated. The clinical inference process consists of several stages which include anamnesis (interview), physical examination (functional tests) as well as orthopedic and neurological examination together with imaging tests. (X-ray, CT, MRI) [23, 24]. Observation of the patient begins the moment he crosses the doorstep of the doctor's office, when his gait, analgesia, movement patterns, and positioning of the feet and pelvis relative to other parts of the body are analyzed [25–27].

The interview with the patient aims to collect as much information about him/her as possible. When examining a patient, the range of motion in all planes and directions as well as muscle strength should be assessed. The Lovetta test is the most common test for assessing the strength of a given muscle group. Other most common tests used by physiotherapists to assess mobility of the L-S segment include mobility assessment according to Rakowski and the Sagittal Frontal Transverse Rotation (SFTR) [28]. To assess the source of pain (root or pseudo-root), Laseque, Bragard and Hoover tests are mainly used [29, 30]. Neri, Turin, and Kernig tests are less common ones from this group. Another group of tests that differentiate disorders in the lumbar spine, the sacroiliac joint and the hip are Patrick and Mennell tests [26, 27]. If these tests show the origin of ailments from the SIJs, then this diagnosis should be confirmed by a test of overtaking or a compression test [7]. When assessing the SIJ, we also consider disorders within the ligaments and muscles acting on this joint [31].

When patients have a root-disc conflict, the severity and extent of the changes are assessed using neurological tests: examining the patellar and the ankle reflex, performing the toe walking test, the heel walking test and the S1-S2 roots test. These tests indicate whether reflexes are present or suppressed, increased or excessive, symmetrical or asymmetrical [26, 32, 33]. Reflex suppression is found when the reflex arc is torn, i.e. in damage to the peripheral motor neuron. Neurological tests also include testing sensation, which is an important test but burdened with a large error; therefore, repeating it several times is required in good cooperation with the patient. It also requires in-depth knowledge of sensory innervation as well as patience and accuracy. Exteroceptive sensation refers to touch, pain and temperature sensation (hot and cold) [31].

Imaging tests supplement the above diagnostic methods. These include X-ray, CT and MRI. These tests serve three purposes: recognition of structural changes, an assessment of the motor function (kinematics) as well as an assessment of the static function (curvature of the spine, arrangement of individual vertebrae) [34]. In diagnostically doubtful cases, specialist consultations are often necessary: internal medicine, surgical, gynecological, or urological, which will allow identifying or excluding the source of ailments not related to the spine.

CONCLUSIONS

Due to the complexity of the problem associated with the occurrence of lower back pain, attempts should be made to explain it because it still presents a diagnostic and therapeutic challenge. In everyday practice, the best therapeutic effects are brought by making the patient aware of the type of dysfunction they are experiencing and the need to cooperate with the therapist, which will allow them to properly implement an individually planned treatment program.

REFERENCES

[1] Karło A, Szmelcer B, Kontowicz, M. Anyaki P, Zaborna D, Wilczyński M, et al. Degeneration of the lumbar intervertebral discs as a cause of root discomfort in the lumbar spine. J Educ Health Sport. 2019;9(8):343-55.

[2] Wróblewska E, Szymańska J, Witkoś J, Rudzińska A, Mazurczak S. Some possibilities of measuring changes in pain perception under the influence of manual therapy in people with back and peripheral joint pain syndromes. Physiotherapy. 2006;14:37-44.

[3] Derewiecki T, Mroczek K, Duda M, Kościk M: Knowledge of the principles of spinal pain prevention among the inhabitants of the Zamość district. Hygeia Public Health. 2012;47(3):365-369.

[4] Chaitow L, DeLany J. Clinical application of neuromuscular techniques: Practical case study exercises. Edinburgh: Chrchill Livingstone; 2005.

[5] Danneels LA, Vanderstraeten G, Cambier D, et al. Effect of three diffrent trining modalities on the cross sectional area of the lumbar multifidus muscule in patient with protect low back pain. Br J Sports Med. 2001;35:186-191. https://doi.org/10.1136/bjsm.35.3.186

[6] Kałużna A, Kałużny K, Wołowiec Ł, Płoszaj O, Zukow W, Kochański B, Hagner W. Spine pain prevention - Review of literature. J Educ Health Sport. 2017;7(7):912-26.

[7] Greenman PE: Principles of manual medicine. 3rd ed. Philadephia: Williams & Wilkins; 2003.

[8] Husky MM, Farin FF, Compagnone P, Fermanian Ch, Kovess-Masfety V. Chronic back pain and its association with quality of life in a large French population survey. Health and Quality of Life Outcomes. 2018;16(195):1-9. https://doi.org/10.1186/s12955-018-1018-4

[9] Kotwicki T, Cheneau J. Biomechanical action of a corrective brace on thoracic idiopatic scoliosis: Cheneau 2000 orthosis. Disabil Rehabilit Assist Technol. 2008;3:146-153. https://doi.org/10.1080/17483100801905744

[10] Nowakowski A, Napiontek M, Rzymski K. Torsions and rotation of the apical vertebrae and thoracic deformity in idiopathic thoracic scoliosis examined on computed tomography. Chir Narz Ruchu. 1991;56:6-8.

[11] London: The Royal College of General Practitioners; 2001. [cited 2004 Aug 23]. Clinical guidelines for the management of acute low back pain [monograph on the Internet].

[12] Chaitow L. Positional relaxation techniques. Wrocław: Elsevier Urban & Partner; 2011.

[13] Cibulka MT, Koldehoff RM. Clinical usefulness of a cluster of sacroiliac joint tests in patients with and without low back pain. J Orthop Sports Phys Ther. 1999;29:83-92. https://doi.org/10.2519/jospt.1999.29.2.83

[14] Freburger JK, Riddle D. Using published evidence to guide the examination of the sacroiliac joint region. Phys Ther. 2001;81:1135-1143.

[15] Kawasaki T, Kurosawa H, Ikeda H, et al. Additive effect of glucosamine or risedronate for the treatment of osteoarthritis of the knee combined with home excercise: A prospective randomized 18-month trial. J Bone Miner Metab 2008;26:279-87. https://doi.org/10.1007/s00774-007-0813-5

[16] Lateef H, Patel D. What is the role of imaging in acute low back pain? Curr Rev Musculoskelet Med. 2009 Jun;2(2):69-73. https://doi.org/10.1007/s12178-008-9037-0

[17] Epstein JA, Epstein BS, Lavine L. Nerve rot compression associated with narrowing of the lumbar spinal canal. J Neurol Neurosurg Psychiatry. 1962;25:165-76. https://doi.org/10.1136/jnnp.25.2.165

[18] Sobański D, Strohm W, Kolasa P. Assessment of surgical treatment of patients with lumbar degenerative stenosis by hemilaminectomy. Current Neurol. 2014;14:70-4. https://doi.org/10.15557/AN.2014.0008

[19] Rauschning W. Pathoanatomy of lumbar disc degeneration and stenosis. Acta Otrhop Scand Suppl 1993;251:3-12. https://doi.org/10.3109/17453679309160104

[20] Panjabi MM. Clinical spinal instability and low back pain. J Electromyog Kinesiol. 2003;13:371-79. https://doi.org/10.1016/S1050-6411(03)00044-0

[21] Hancock MJ, Maher CG, Latimer J, et al. Systematic review of tests to identify the disc, SIJ or facet joint as the source of low back pain. Eur Spine J. 2007;16:1539-1550. https://doi.org/10.1007/s00586-007-0391-1

[22] van Boxen K, van Zundert J, Patijn J, van Kleef M. Pseudoradicular and radicular low-back pain: How to diagnose clinically? Pain. 2008;135:311-16. https://doi.org/10.1016/j.pain.2008.02.003

[23] DePalma MJ, Ketchum JM, Saullo TR. Multivariable analyzes of the relationships between age, gender, and body mass index and the source of chronic low back pain. Pain Med. 2012;13:498-506. https://doi.org/10.1111/j.1526-4637.2012.01339.x

[24] Garczyński W, Lubkowska A. Physhiotherapy in osteoarthritis of the lumbar spine. J Health Sci. 2013;3:118-30.

[25] Vecchiet L, Giamberardino MA, De Bigontina P, Dragani L. Comperative sensory evaluation of parietal tissues in painful and nonpainful areas in fibromyalgia and myofascial pain syndrome. In: Gebhart GF, Hansmond DL, Jensen TS, eds. Proceedings of the 7th world congress on pain, progress in pain research and management. Seattle: IASP Press; 1994; 177-85.

[26] Poley RE, Borchers JR: Sacroiliac joint dysfunction: Evaluation and treatment. Phys Sportsmed. 2008;36:42-9. https://doi.org/10.3810/psm.2008.12.10

[27] Robinson HS, Brox JI, Robinson R, Bjelland E, Solem S, Telje T. The reliability of selected motion - and pain provocation tests for the sacroiliac joint. Man Ther. 2007;12:72-9. https://doi.org/10.1016/j.math.2005.09.004

[28] Zembaty A, ed. Kinesitherapy. Krakow: Kasper Publishing House; 2002, vol.1. 4-6.

[29] Rupert MP, Lee M, Manchikanti L, Datta S, Cohen SP. Evaluation ofsacroiliac joint interventions: A systematic appraisal of the literature. Pain Physician 2009;12:399-418

[30] Laslett M, Aprill CN, McDonald B, Young SB: Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. Man Ther. 2005;10:207-18. https://doi.org/10.1016/j.math.2005.01.003

[31] Arab AM, Abdollahi I, Joghataei MT, Golafshani Z, Kazemnejad A. Inter-and intra-examiner reliability of single and composites of selected motion palpation and pain provocation tests for sacroiliac joint. Man Ther. 2009;14:213-21. https://doi.org/10.1016/j.math.2008.02.004

[32] Machado LA, Maher CG, Herbert RD, Clare H, McAuley J. The McKenzie Method for the menagement of acute non-specific low back pain: design of a randomized controlled trial [ACTRN012605000032651]. BMC Musculoskelet Disord. 2005;6:50. https://doi.org/10.1186/1471-2474-6-50

[33] Kuijper B, Tans JT, Schimsheimer RJ, et al. Degenerative cervical radiculopathy: Diagnosis and conservative treatment. A review. Eur J Neurol. 2009;16:15-20. https://doi.org/10.1111/j.1468-1331.2008.02365.x

[34] Fisher MA, Bajwa R, Somashekar KN. Routine electrodiagnosis and a multiparameter technique in lumbosacral radiculopathies. Acta Neurol Scand. 2008;118:99-105. https://doi.org/10.1111/j.1600-0404.2007.00987.x

Cite this article as:

Jagucka-Metel W, Anna Machoy-Mokrzynska A, Leznicka K.
Pathomechanisms and differential diagnosis of pain in the lumbosacral spine
J Hum Perform Health. 2019;1(1):e1-7
doi: 10.29359/JOHPAH.1.4.05