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# DIAGNOSIS OF LUMBAR VERTEBRAL CANAL OBSTRUCTIVE PROCESSES: REVIEW OF LITERATURE

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**Abstract.** Narrowing of the spinal canal is a major societal concern, as patients with this condition are among the most challenging cases in neurosurgery, often facing significant disability. Spinal canal stenosis is any condition that causes the canal to narrow and compress nerve structures at any point [1,3]. This can result from various spinal disorders, including degenerative diseases like spondylosis, arthritis, degenerative and spondylolytic spondylolisthesis, intervertebral disc herniations, or combinations of these issues.The study evaluates the effectiveness and relevance of different radiological techniques used to diagnose stenosis in the lumbar spine. It highlights the advantages and disadvantages of each method for detecting spinal canal stenosis.

**Key words:** radiological diagnostic techniques, spinal canal narrowing

**Introduction.** Narrowing of the spinal canal is a major societal concern, as patients with this condition are among the most challenging cases in neurosurgery, often facing significant disability. Spinal canal stenosis is any condition that causes the canal to narrow and compress nerve structures at any point. This can result from various spinal disorders, including degenerative diseases like spondylosis, arthritis, degenerative and spondylolytic spondylolisthesis, intervertebral disc herniations, or combinations of these issues. Other causes include compression by abnormal soft tissues, as well as iatrogenic, post-traumatic, metabolic, and other pathological conditions [2,7,19]. The incidence of lumbar spinal canal stenosis is 11.5 cases per 100,000 people annually.

Degenerative-dystrophic diseases are the most common spinal conditions leading to spinal canal stenosis. These conditions account for 60–95% of all neurological manifestations in the peripheral nervous system [4,13,15,27]. Most patients are between 30 and 50 years old, with pain being the primary factor reducing their ability to work. Degenerative-dystrophic spinal diseases constitute 20.4% of all disability cases related to musculoskeletal disorders.

Numerous studies by both domestic and international authors have examined the normal dimensions of the spinal canal, which remain crucial tools for diagnosing stenosis. These dimensions are measured using standard spondylograms in both direct

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and lateral projections, focusing on the sagittal (anteroposterior) and interlaminar (frontal, transverse) dimensions [5,9,16].

In addition to examining the sagittal and frontal dimensions of the spinal canal, morphometric indicators of lateral root canals and foraminal openings have been studied. These measurements can be taken from lateral spondylograms or during MRI and CT scans. R.A. Altunbayev divided the lateral canal into three sections: upper, middle, and lower. As per Altunbayev's findings, the most significant concern is the narrowing of the upper section of the lateral canal. He measured its height and anteroposterior diameter (width). According to his data, at the L4–L5 level, the height of the upper section of the lateral canal was 5.4 ± 0.29 mm on the left and 5.8 ± 0.30 mm on the right, while the width was 5.9 ± 0.16 mm on the left and 6.2 ± 0.15 mm on the right. At the L5–S1 level, the height on the right was 4.1 ± 0.22 mm and on the left was 3.8 ± 0.22 mm, while the width on the right was 5.7 ± 0.17 mm and on the left was 5.4 ± 0.14 mm [10,11,17,24].

H.A. Musalatov and colleagues proposed a method for diagnosing lumbar intervertebral foraminal stenosis using MRI. They calculated the area of the intervertebral foramen and the area occupied by the spinal nerve root within it, then determined their ratio (the reserve space index). If this ratio was less than 1.22, stenosis was diagnosed.

The level at which the spinal canal is measured is also crucial. Although the authors mentioned above conducted measurements at one level, stenotic processes in the spinal canal can be caused not only by bone changes but also by alterations in soft tissue structures, ligaments, and intervertebral discs, which are not visible on conventional spondylograms. R.A. Altunbayev's research examines the spinal canal not only at the vertebral body level (the "fixed" bony part) but also at the intervertebral disc level. He demonstrated that the sagittal diameter of the spinal canal in the lower lumbar segments of the spinal motor segment at the intervertebral disc level is significantly smaller ($p < 0.05$) than at the vertebral body level – by 1.9 mm at L4–L5 and 1.8 mm at L5–S1, regardless of disc pathology. Moreover, the degree of this difference depends on the type of posterior disc protrusion.

According to several authors, the mandatory examination protocol for patients with lumbar spinal stenosis should include an overview spondylography in both direct and lateral projections. This method is a simple, informative, and readily available means of assessment. Spondylograms evaluate both quantitative (frontal and sagittal dimensions of the spinal canal) and qualitative indicators. Qualitative indicators include changes in lumbar lordosis, the presence of scoliosis, anomalies in the shape, number, and position of vertebrae, pathological changes in vertebral structure (destruction, compression, fracture lines, spondylolytic lines of enlightenment), changes in intervertebral disc height, various alterations in vertebral bodies during

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degenerative spinal processes (marginal bone overgrowths, subchondral sclerosis of facet joints, osteoarthritis of facet joints), and calcifications of soft tissues (ossification of yellow ligaments, ossification of anterior and posterior longitudinal ligaments) [3,18,23]. When assessing these indicators, spondylography allows for the evaluation of osteochondrosis periods, the severity of spondylosis and spondyloarthrosis, scoliosis, spondylolisthesis, and spinal canal stenosis.

It's worth noting that the results of overview spondylography are significantly complemented by functional spondylography and functional spondylography with load. This involves taking lateral X-rays in flexion and extension positions with and without load. Functional spondylography provides insight into existing vertebral stability in the spinal motor segment, its absence, and changing hidden instability under load. However, these methods are limited in their ability to investigate the soft tissue component of the spinal motor segment. This limitation is overcome by additional investigative methods such as myelography. This method detects intraspinal formations invisible on regular X-rays by identifying contrast medium filling defects in the contrast-enhanced dural sac and nerve root sleeve. Poster and Ward (1992) introduced a classification of myelographic manifestations of spinal canal stenosis based on the extent of the filling defect: partial occlusion – segmental narrowing of the contrast column; subtotal occlusion – slight accumulation of contrast below the block; total occlusion – contrast stops at the block level. When performing oblique projections during myelographic examination, it's possible to detect foraminal herniations of intervertebral discs [5,24,27]. Herno et al. demonstrated the high informativeness of this study. Before the advent of CT and MRI, myelography was the only reliable method for evaluating the spinal canal. However, its invasive nature and the impossibility of conducting it in outpatient settings limit its widespread use, as noted by N.A. Zorin. Comparative assessment of the informativeness of myelography, CT, and MRI revealed that CT and MRI are the primary visualization methods when there is suspicion of intervertebral disc herniation.

Due to the increasing availability of modern imaging technology such as computed tomography (CT) and magnetic resonance imaging (MRI) in our country, the number of myelographic studies has steadily decreased in recent years. CT is one of the contemporary methods for examining the spine. This method is based on measuring the absorption of X-rays with subsequent computer-generated imaging. With conventional step-and-shoot CT technology (first-generation devices), the area of examination is typically limited to 1-3 spinal segments. However, the use of modern spiral and multislice CT scanners allows for an expanded examination zone covering 1-2 spinal segments, enabling thinner slices to be obtained in a shorter examination time and providing higher-quality three-dimensional and volumetric information. CT scans readily differentiate between epidural, bony, and paravertebral soft tissues.

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Numerous studies have described various CT signs of normal and pathological spine conditions, including normal and pathological intervertebral disc states, symptoms characterizing changes in anatomical structures of the spinal canal, neural structure changes, etc. To evaluate the condition of the intervertebral disc, parameters such as disc contour, deformation of the posterior disc border (prolapse), local protrusion (dorsal, foraminal, lateral, ventral), and circumferential protrusion are determined. Symptoms of changes in the vertebral border and adjacent disc ratios are also assessed. In normal conditions, the disc and vertebral body edges correspond to each other [6,27]. Pathologically, disc size increases due to disc prolapse. Another significant factor is the alteration in the physical properties of the nucleus pulposus, where densitometric indicators can increase around the perimeter and decrease to the density of gas in central areas, known as the "vacuum phenomenon."

Stenosing symptoms include primary stenosis of the spinal canal (reduction in the size of the spinal canal at the vertebral body level - bony part, fixed part), and secondary stenosis of the spinal canal caused by pathological changes in anatomical structures of the spinal canal: deformation and enlargement of articular processes, intervertebral disc herniation, thickening of the posterior longitudinal ligament and hypertrophy of the yellow ligaments, and ligament ossifications. Changes in the epidural adipose tissue (changes in its densitometric indicators) also play a role in assessing the severity of the stenosing process, as they are manifestations of aseptic inflammatory postoperative scar complications. In the first months after surgery, scar tissue has densitometric indicators 20-30 units lower than those of the intervertebral disc. However, over time, it densifies, and even calcifications may form, resulting in a reduction in the differences between the densitometric characteristics of the disc and adipose tissue. Among the symptoms of spinal canal narrowing involving neural structures, several authors include changes in the contour or position of the dural sac, attributed to intervertebral disc herniation, as well as changes in articular processes, thickened ligaments, marginal osteophytes, and scar tissue adhesions. These pathological processes deform and displace the dural sac, altering the position and shape of nerve roots.

The main limitation of computed tomography (CT) is poor differentiation of the dural sac and its contents. To visualize the dural sac, CT myelography is utilized, which involves contrast enhancement of the subarachnoid space [3,24,25]. This method combines the advantages of CT and myelography techniques. CT myelography allows for determining the relationship between intervertebral discs, the dural sac, altered ligamentous structures, the level of cerebrospinal fluid circulation blockade, identification of sequestered disc herniations, and determination of intradural formations (clarifying their shape, contour dimensions, and position). The primary drawbacks of CT myelography, similar to conventional myelography, are the invasive nature of the procedure and potential side effects such as allergic reactions to contrast

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agents, post-puncture meningismus, and neurological disturbances due to mechanical damage to nerve structures.

Currently, magnetic resonance imaging (MRI) represents the pinnacle of diagnostic capabilities for assessing the spinal canal. It allows for the detection of stenotic processes in the spinal canal, their cause, extent, and differential diagnosis of identified formations in most cases. However, several studies have compared CT myelography and MRI, indicating both methods are highly informative. CT myelography more accurately detects changes in bony structures, while a study by R. Bishoff et al. highlighted greater sensitivity and specificity in identifying disc herniation and spinal canal stenosis at pre- and postoperative stages using CT myelography.

In contemporary literature, there is a significant subjective component in diagnosing spinal canal stenosis, determining its severity, and extent. Consequently, this issue has prompted the development of a more advanced and objective diagnostic methodology for stenosis utilizing high-tech equipment such as CT and MRI, as well as proposing a more refined classification of spinal canal stenosis based on morphometric research methods.

## References

1. Amundsen T, Weber H, Nordal HJ, Magnaes B, Abdelnoor M, Lilleâs F. Lumbar spinal stenosis: conservative or surgical management?: A prospective 10-year study. Spine. 2000;25(11):1424–35. discussion 35.
2. Manchikanti L, Cash KA, McManus CD, Pampati VV, Abdi SS. Preliminary results of a randomized, equivalence trial of fluoroscopic caudal epidural injections in managing chronic low back pain: Part 4--Spinal stenosis. Pain physician. 2008;11(6):833–48.
3. Vasilyev A.Yu., Vitko N.K. Computed tomography in the diagnosis of degenerative changes in the spine. Moscow: Vidar-M, 2000. 120 p.
4. Stewart MA, Sherman WR, Kurien MM, Moonsammy GI, Wisgerhof M. Polyol accumulations in nervous tissue of rats with experimental diabetes and galactosaemia. J Neurochem. 1967;14:1057–1066.
5. Zorin N.A. Vertebrogenic myelopathies and radiculopathies. Moscow: Medicine, 1993. 132 p.
6. Kadyrova L.A., Kharon N.S., Rechitsky I.Z. On the issue of clinical-rhegnetometric diagnosis of spinal canal stenosis in patients with lumbar osteochondrosis. Vertebrology. 1993. Vol. 1. P. 27–31.
7. Kishkovsky A.N., Kuznetsov S.V., Bazhanov E.A. Radiosymptomatology of osteochondrosis: new signs and comparative analysis of the informativeness of traditional methods and computed tomography. Bulletin of Radiology and Radiology. 1998. No. 6. P. 48–53.
8. Musalatov K.A., Aganesov A.G., Telpukhov V.I., Chensky A.D. et al. Method for diagnosing stenosis of the lumbar intervertebral foramen: patent 2177348

Russian Federation: MKI A61N5/00; applicant Moscow Medical Academy named after I.M. Sechenov; patent holder Moscow Medical Academy named after I.M. Sechenov; Musalatov Hasan Alaskhanovich; - No. 2000107989/14; appl. 03.04.2000; publ. 27.12.2001, Bull. 24. - 1 p.

9. Zucherman JF, Hsu KY, Hartjen CA, Mehalic TF, Implicito DA, Martin MJ, et al. A multicenter, prospective, randomized trial evaluating the X STOP interspinous process decompression system for the treatment of neurogenic intermittent claudication: two-year follow-up results. Spine. 2005 Jun 15;30(12):1351–8.

10. Martinelli TA, Wiesel SW. Epidemiology of spinal stenosis. Instr Course Lect. 1992; 41:179–181.

11. Spinal Disorders; Co-Editors in Chief, Robert M. Pascuzzi, M.D., Karen L. Roos, M.D.; Guest Editor, John W. Engstrom, M.D. Seminars inNeurology, Volume 22, Number 2, 2002.

12. Watanabe R, Parke WW. Vascular and neural pathology oflumbosacral spinal stenosis. J Neurosurg 1986;64:64–70

13. Friedly JL, Comstock BA, Turner JA, et al. A randomized trial of epidural glucocorticoid injections for spinal stenosis. N Engl J Med 2014;371:11-21.

14. Hong SW, Choi KY, Ahn Y, et al. A comparison of unilateral and bilateral laminotomies for decompression of L4-L5 spinal stenosis. Spine (Phila Pa 1976) 2011; 36:E172

15. Tashmurodovich, Husanov Zafar. "ANALYSIS OF DIAGNOSTICS AND SELECTION OF SURGERY APPROACHES IN VARIOUS SPINAL CORD TUMORS." Достижения науки и образования 6 (86) (2022): 96-98.

16. Tuychiev L. N. et al. NASOPHARYNGEAL EXTRACTION OF S. PNEUMONIAE FROM ADULT PATIENTS WITH ACUTE RESPIRATORY INFECTIONS AND ANTIBIOTIC RESISTANCE OF ISOLATED STRAINS //Art of Medicine. International Medical Scientific Journal. – 2022. – Т. 2. – №. 1.

17. Раббимова Н. Т., Матякубова Ф. Э., Тиркашев О. С. ЧАСТОТА ВЫДЕЛЕНИЯ STREPTOCOCCUS PNEUMONIAE ПРИОСТРЫХ РЕСПИРАТОРНЫХ ИНФЕКЦИЯХ ДЫХАТЕЛЬНЫХ ПУТЕЙ //VOLGAMEDSCIENCE. – 2021. – С. 589-591.

18. Tuychiev L. N. et al. Antimicrobal susceptibility OF S. Pneumoniae, isolated from adults //湖南大学学报 (自然科学版). – 2021. – Т. 48. – №. 11.

19. Раббимова Н. и др. Математическое моделирование и прогнозирование заболеваемости кожным лейшманиозом в республике узбекистан //Журнал проблемы биологии и медицины. – 2017. – №. 1 (93). – С. 104-107.

20. Сувонкулов У. и др. Идентификация видовой принадлежности возбудителей кожного лейшманиоза методом полимеразной цепной реакции //Журнал проблемы биологии и медицины. – 2016. – №. 3 (89). – С. 91-92.

21. Egamovna M. F. et al. CLINICAL AND EPIDEMIOLOGICAL FEATURES OF THE COURSE OF SHIGELLOSIS IN ADULTS AT THE PRESENT

ISSN 2181-3187

STAGE IN 2009-2019 //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 5. – С. 1285-1294.

22. Абдухалилова Г. К. и др. Назофарингеальное носи-тельство str. e у взрослых. – 2022.

23. Egamovna M. F. et al. CLINICAL AND EPIDEMIOLOGICAL FEATURES OF THE COURSE OF SHIGELLOSIS IN ADULTS AT THE PRESENT STAGE IN 2009-2019 //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 5. – С. 1285-1294.

24. Абдухалилова Г. К. и др. Динамика устойчивости к антибиотикам и частота назофарингеального выделения S. Pneumoniae у взрослых с острыми респираторными инфекциями. – 2022.

25. Ярмухамедова Н. и др. Особенности течения хронического гепатита с на фоне туберкулеза //Журнал вестник врача. – 2019. – Т. 1. – №. 1. – С. 129-132.1

26. Anvarovna, Y. N., Egamovna, M. F., Tashtemirovna, R. N., Buribayevna, M. G., & Saidovich, T. O. (2021). Clinical and Epidemiological Characteristics of Shigellosis in Adults at the Contemporary Stage. Central Asian Journal of Medical and Natural Science, 2(3), 311-318. https://doi.org/10.47494/cajmns.v2i3.221

27. Тиркашев, О. С. Клинико-эпидемиологическая характеристика кори в Самаркандской области / О. С. Тиркашев, Ф. Э. Матякубова, Н. Т. Раббимова // VOLGAMEDSCIENCE : Сборник тезисов VII Всероссийской конференции молодых ученых и студентов с международным участием: материалы конференции, Нижний Новгород, 16–18 марта 2021 года. – Нижний Новгород: Федеральное государственное бюджетное образовательное учреждение высшего образования "Приволжский исследовательский медицинский университет" Министерства здравоохранения Российской Федерации, 2021. – С. 624-625. – EDN GZYHJQ.

28. Tirkashev O. S. et al. MEASLES AT THE PRESENT STAGE //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 5. – С. 177-185.