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Research Article

ASSESSMENT OF THE OUTCOME OF STRUCTURAL CHANGE ANALYSIS IN PATIENTS WITH BACK PAIN, AGAINST THE BACKGROUND OF A ROUTINE NEUROIMAGING EXAMINATION OVER THE PERIOD 2021-2023

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ABSTRACT

Back pain is by far the most common ailment in the working-age population, with the WHO (2023) reporting that musculoskeletal disorders occur in 80% of the general population, mostly in the 30-50 age bracket, and that with advances in technology and increasing urban culture the disease is on the rise.

KEYWORDS

Back pain, structural changes, spinal cord.

INTRODUCTION

The main factors leading to this problem include a variety of metabolic patterns characteristic from an early age (rickets, scoliosis, natal trauma), but the greater potential for an increase in this degenerative process, is the prolonged statistical position of the back, with increased muscle spasm, stereotyped movement, low mobility and uncomfortable posture, stress and unstable sleep, overweight . Whereas previously the back pain process was seen as a single symptom, the current approach to the disease is a comprehensive one that takes into account the musculoskeletal structure, the condition of ligaments and intervertebral discs, the structure of the anatomical features of the spinal cord, nerves, blood

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and lymphatic vessels, the condition of internal organs of the abdomen, micro-elements, immune and endocrine systems, etc. . Thus, before starting therapy and rehabilitation of patients it is necessary to thoroughly diagnose such patients to look for the causative aspects of the disease. Neuroimaging is considered to be the most informative and reliable test, but which method is better than CT, MRI or MSCT?

While the CT scan allows to reveal the cause in terms of bone tissue (spondylolisthesis, bone destruction, including oncological genesis), MRI is necessary to visualise soft tissue, unlike CT scans of intervertebral disc and spinal cord disorders are clearly visible, even without the introduction of contrast, where changes in the ligaments and muscles are recorded, which is not unimportant - ionising radiation is safe for patients. With regards to the multispiral CT scanner it is an examination of high precision images with minimum radiation exposure, fast procedures and a good overview of the intervertebral discs, spinal roots and ligaments and muscles. Numerous publications in the last decade are devoted to the study of neuroimaging in back pain, however, most often they give a descriptive character of destructive disorders of the bony system, while a number of dynamic manifestations of the spinal cord itself (myelopathies), correlation between compression of the myocardium, degree of spinal canal stenosis, severity and intensity of pain syndrome, differentiation between inflammatory and degenerative lesion, abnormal anatomic findings remain important for prognosis. Thus, the need for neuroimaging in a routine study, the analysis of the findings should be studied and the percentage should be statistically determined, as this informativeness remains relevant and poorly understood.

Objective of the study. To study the pattern of spinal cord changes in patients with back pain and to determine the diagnostic potential of neuroimaging to assess the condition in relation to clinical and anamnestic findings.

Material and Methods. The neuroimaging studies (MRI, MSCT) of patients at the Department of X-ray Radiology, Samarkand State Medical University (Samarkand Multi-Disciplinary Hospital) were studied and conducted in the period of 2021-2023 in the outpatient and inpatient stages of diagnosis. Totally 4955 neuroimaging studies of lower thoracic and lumbosacral spine were done during this period, 3167 women and 1788 men, aged 20 to 75 years old. All patients underwent a comprehensive examination, which included examination by a neurologist (to assess the clinical nature of the lesion and medical history), a neurosurgeon (to assess the severity of the injury), and a physician (to differentiate between somatic diseases). Inferior thoracic MSCT - 187 studies, including 106 women, 81 men; lumbosacral MSCT - 2518 studies, including 1625 women, 893 men. In terms of age, 20 to 30 years old accounted for 22% of cases, 30 to 60 years old 68%, over 60 years old 8(10)%.

Table 1

Results of routine MRI/MSCT examinations of patients treated between 2021 and 2023 in the Department of Radiology at Samara State Medical University

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Research method	Date of study.	Number of patients	Female.	Men	By age (%)		
					1938-1960	1960-1990	1990-2003
MSCT							
Lower thoracic region	2.07.2021 9.06.2023	187	106	81	15	60	25
Lumbosacral spine	2.06.2021 9.06.2023	2518	1625	893	8	62	30
MRI							
Lower thoracic region	4.01.2022 15.06.2023	140	101	39	10	65	25
Lumbosacral spine	4.01.2022 15.06.2023	2110	1335	775	12	58	30

Neuroimaging was performed with referral by doctors of all specialties, with suspected degenerative process in the spinal cord (mainly lower thoracic, lumbosacral) to assess quantitative and qualitative parameters. MRI was performed on an MRI scanner, Signa Explorer (GE) USA (2020) at 1.5 Tesla, slice thickness 3 mm, MSCT "Revalution EVO (GE)" USA (2020), where the slice thickness is 1.25 mm, voltage 120-170 mA. Statistical processing was performed on an individual computer using a specially selected program Statistica for windows (2012), with standard Spearman's mathematical tests and Mann-Whitney test analysis.

Results of the study. The study design was a catamnestic and retrospective study of neuroimaging data of patients with back pain, where the exclusion criteria were re-treatment of patients only on the basis of primary treatment. Prior to MRI/MSCT examination, patients were seen by a neurologist, neurosurgeon, general practitioner (in some cases an obstetrician-gynecologist, surgeon), where the main referring factor for neuroimaging was the complaint of back pain. The inclusion criteria for the study group included several indicators: history of back pain (chronicity of pain), risk factors for the disease (deficit of movement, office workers, where the duration of statistical stress was increased); unaccustomed or habitual physical activity (lifting weights); occupational characteristics (experienced drivers, with a long stay in transport); overweight (up to 100 kg, as the neuroimaging potential required a certain weight limit); history of disease (suffered from COV.

The retrospective evaluation of younger patients had a peculiarity, a small sample size, which confirms the literature data on the non-specificity of back pain of this age trend (Frank M. et al., 2007, Kedra A. Et al., 2019, Amr Chaabeni et al., 2023). In almost all the young sample, pain symptom onset occurred at 28±3.5 years, in addition, the pain phenomenon was characterised by no loss of function, indicating relatively low pain severity mainly in the morning hours (on awakening). Pain was localised to the lumbosacral region only in 19% of cases, with irradiation into the leg. The presence of pain was associated with overexertion in sports (professional) or gym (without an instructor). At the time of the study MRI structural changes showed the most frequent lesion (herniation/protrusion) was at the L5-S1 level (90% of the total sample), which was $p<0.05$ compared to patients with no intervertebral disc degeneration. The average herniation size was 4.0 mm. In the remaining cases compression was detected

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and listhesis was detected in 2 patients. Consequently, the neuroimaging data revealed changes preceding the pain phenomenon up to the stage of progression in the lumbar spine.

Lumbosacral radiculopathies were the main group of patients with the highest percentage of exacerbations in the age range of 30 to 60 years. While isolated L5 radicular compression accounted for 16% and S1 for 30%, the remaining percentage corresponded to bioradicular syndrome. The patients had a long disease history ranging from 6 to 26 years. The period of exacerbation (spring-autumn period), 2-3 times a year. In patients with L5 compression, neuroimaging revealed herniation/protrusion, pain syndrome irradiating to the outside edge of the hip, difficulty standing for long periods (more often on the heel side of the lesion). Isolated S1 lesion, with pain radiating through the lower back and gluteal region. Correspondingly, with a larger volume of L5-S1 radicles, the symptoms were united by an increase in pain (Table 2). Thus, in this category of patients detected intervertebral disc protrusion and mushrooming, predominantly on the median side, soft tissue exposure and changes, particularly in the dural sac, were noted in patients with a long period of disease, referred with exacerbation, in 100% of cases stenosis of radicular canals was determined.

Table 2

Result of a routine MRI scan of patients aged 30 to 60 years with primary referral (A) and with acute lumbosacral radiculopathies (B) (number of indicated patients, as an example in the table, n=150) %

Indicators	(A) n=50	(Б) n=100
Altered bone structure	47	98
Intervertebral disc protrusion	25,1	77
Disc herniation	7	54,3
Altered disc height	33	86,6
Change in soft tissue	39,9	81,5

The nature of the pain suggests the involvement of the areas most subject to movement in the pathological process, with an abundant innervation zone or so-called 'facet pain'. This process can be seen by enlarging the neuroimaging slices, which clearly show the displacement of the articular process. In a total of 19.3% of the patients studied in the lower thoracic region these changes are identified. The mechanism of pain is explained by the displacement of the articular process, which in turn compresses the nerve, vessels and gradually deforms. Foreign literature sources note that this phenomenon is sometimes an incidental finding on MRI (Ganchalski V.V., 2014, Baster T., 2016).

Equally important was the identification of back pain associated with an infectious genesis. According to WHO data, the incidence of this nature of lesion, spondylodiscitis - does not exceed 5% of all changes in the spine, in addition, is very difficult to diagnose, as there is no clear distinction on neuroimaging and infection is possible of any nature (herpes, TORCH infection, brucellosis, tuberculosis, COVID-19,

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staphylococcus, proteins infection), the character of pain symptom itself is also not different. The main symptom is a pain that increases on movement in 83% of cases, mostly localised in the lumbosacral region. MRI (MSCT) confirms degenerative-dystrophic process in the spine (in 100% of cases), signs of intervertebral discs (herniated/protrusional) changes in the soft tissues, stenosis. A marker for differentiation is the laboratory examination of the blood (elevated sedimentation rate, leukocytosis), history, description of the onset of pain signs. However, there are significant changes that need to be emphasized when examining the images of such patients. Thus, a characteristic feature is increased edema in the laminae, increased thickness of the ligaments, decreased height of the disc itself, and the quality of the vertebral body is deformed. This result coincides with the literature (Dnarte R.M., 2013, Herrero C.F.P.S., 2014, Khakimova S.Z., 2021).

Patients who underwent COVID-19, 100% male, complained of pain in the lumbar region with irradiation to the gluteal region, the pain symptom was pronounced (severe) according to the VAS score of 9-10, patients had a characteristic limp. In this regard, this category of patients was examined (diagnosed) using the method "Diagnosis of ligamentosity of the iliopsoas ligament" patented by Yurkovsky A.M. (2017), where neuroimaging provides a morphometric way to diagnose ligamentosity. The pain symptom is intensified by pressure on the affected/local area, which is one of the specific diagnostic methods. The MRI examination reveals an increased intensity of the T2-image in only 6% of cases. This underestimates the insufficiency of this method of examination in the detection of ligamentous pathology in the lumbar region, which requires an additional diagnostic level and a deeper study of this specificity.

The practice that studies the problem of back pain shows that the need for neuroimaging is not evaluated in the issue of excluding not only destructive changes in the spine (disc, vascular and nerve endings, etc.), but also the importance of excluding tumours (primary and metastatic). According to the literature, the lumbosacral region is affected in 20 to 25% of cases. In the cases analysed by neuroimaging studies, our data showed a 9% incidence, which was mainly secondary metastases. In the group below 60 years of age, the majority were women and in the group above 60 years of age, the majority were men.

One of the most studied, taking into account literature sources, is considered to be a spondylodystrophy of hormonal genesis, characteristic for women with impaired reproductive function. The main triggering factor is the change in the bone structure caused by dyshormonal background, which deforms the vertebrae under the effect of gravity (basic mass and gravitation) and compresses the vascular and nerve bundles. Pain is of a nagging nature, starts in the spine and mostly irradiates to the pelvis and leg on the inside. Structural changes on MRI/MSCT show clear signs of osteoporosis, coxoarthritis. Out of a total sample of 30-60 years old women surveyed (3060 women), dystrophic-degenerative changes in the lumbosacral region were found according to neuroimaging data in 19% of cases, most of them were detected throughout the spine (generalised process type).

CONCLUSIONS

1. Neuroimaging diagnostic MRI/MSCT is an important component and informative for patients with back pain. However, issues of specificity must be considered, as MRI is characteristically used to study the structure of the spinal cord, radicular and intervertebral discs; MSCT is used to study the structure of the bone system and ligaments,

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indicating a complementary anatomo-topographic picture,

2. Routine MRI/MSCT examination shows the need for a clear physician indication, referral for neuroimaging examination cannot serve as a definitive diagnosis but only as an adjunct to the overall clinical picture of the disease
3. A comparative analysis of the MRI/MSCT findings provides an opportunity for a differentiated and individualised approach to optimising treatment.

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