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# DIAGNOSTIC ASPECTS OF NEUROVASCULAR DISORDERS IN LUMBAR SPINE DORSOPATHIES

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**Abstract:** Dorsopathy is not an independent disease, but only a generalised term for back diseases such as osteochondrosis, traumas, tumours, spinal infections (tuberculosis, syphilis, osteomyelitis). In dorsopathy, the pathological process involves not only bones, but also cartilage tissue, intervertebral discs, as well as nerves, ligaments, vessels and muscles that are located near the spine. Treatment of lumbosacral dorsopathy is associated with the genesis, severity of symptoms and duration of the disease.

**Key words**: dorsopathy, neurovascular, chronic pain, electroneuromyography, duplex scanning.

**Introduction.** In dorsopathy there can be pathology in any part of the spine. Often there is a combined form of dorsopathy, when pathological changes are noted in several parts of the spine. However, the lumbosacral region is the most vulnerable region for the development of dorsopathy, as this region has the highest vector loads.

Despite the fact that this section of the spine has the largest vertebrae, discs and muscles, nevertheless, systematic loads lead to damage to the structures of the lumbar spine (muscles, discs, nerves) and the development of degenerative changes such as disc herniation, protrusion. As the integrity of the fibrous ring of discs is destroyed, conditions arise for compression of nerve roots and the development of corresponding radicular symptoms.

Dorsopathy of the lumbar spine at the initial stage is characterised by minor morphological changes in cartilage tissue. In this stage, there are few or no symptoms and patients usually do not seek help from a doctor. When bone tissue joins the degeneration process, there is a displacement of the structures of the motor segments of the spine and the flattened intervertebral disc begins to affect the nerve endings, which leads to the appearance of symptoms - the patient may experience discomfort or pain.

Further morphological changes in the discs are often irreversible and pain can already occur with any sudden movement or axial load on the lumbar region. In case of severe compression of the nerve structures, the pain becomes unbearable.

**MATERIALS AND METHODS:** A research platform consisting of clinical, laboratory, neurophysiological (ENMG, USDG) and radiological statistical methods was established to solve the tasks set before us. The presence of clinical syndromes of lumbar spine dorsopathies was found in 105 (100%) of the examined patients with radicular syndromes of lumbar spine dorsopathies, including 79 (44.5%) men and 99 (55.4%) women. In 13 (11.8%) patients there was a lumbar radicular injury (LIV disc herniation), who complained of sharp pain on the inner-anterior surface of the thigh. In 4 (3.6%) patients the pain spread to the groin area, genitals, and in 7 (6.3%) cases it reached the knee joint.

Weakness and hypotrophy of quadriceps muscles were noted in 3 (2.7%) patients. The knee reflex on the affected side was reduced in 5 (4.5%) patients. Sensory disturbances were detected in 12 (10.9%)

patients. Hyperaesthesia on the antero-internal surface of the thigh was detected in 8 (7.2%) patients, in 3 (2.7%) patients - on the antero-internal surface of the tibia. Hypesthesia was detected in 4 (3.6%) patients in the inguinal region.

Damage of the fifth lumbar radicle (L4-L5 disc herniation) was revealed in 44 (40%) patients. Among them 32 (29%) patients had acute development of the disease, in 12 (10.9%) - gradual. In the majority of cases in 35 (31.8%) the pain spread along the outer edge of the thigh and along the lateral surface. leg. In 8 (7.2%) patients, the pain reached the inner edge of the foot and the first toe of the foot.

In 7 (6.3%) patients with the phenomena of motor prolapse against the background of pain spreading to the area of the affected dermatome, pain in the laterally located muscles of the lower leg appeared. In 34 (30.9%) patients a decrease in the strength of writing with the first finger was revealed. Hypotonia and hypotrophy of the anterior calf muscle were revealed in 18 (16.3%) cases. In 19 (17.2%) patients there were difficulties with standing on the ankle joint. Information about muscle group lesions in L5 root pathology.

Consequently, in patients with L5 root syndrome, the muscles of the lower leg and adductor muscles of the thigh are predominantly overstretched (Table 1). In 32 (29%) patients palpation of these muscles revealed neurodystrophic or muscle-tonic foci. In 20 (18%) patients neurodystrophic areas of dense consistency ranging in size from 0.3-0.5 mm to 1-2 cm, not spreading and not decreasing on heating, were detected. Muscle-tonic changes were detected in 12 (10.9%) patients from 1.5-3 mm to 2-4 cm. They are characterised by less dense consistency and disappear when writing. Due to the restoration of the function of the affected root, the previously ‘put out of action’ muscles were activated, which, in turn, were subjected to overload. Sensory disorders were observed in 30 patients. In the majority of patients (18) hypoesthesia was detected on the outer surface of the thigh, shin, in 5 cases - on the big toe of the foot. Hyperaesthesia on the outer surface of the big toe and in the rear of the foot was detected in 4 patients, hyperaesthesia in the area of the big toe was detected in 3 patients. Damage to the S1 root (L5-S1 disc) was the most frequent localisation and was detected in 53 patients. Most of them (36) had an acute onset of the disease. The pain spread along the external posterior edge of the thigh in the scrotal region, from the external edge of the tibia to the heel, and in 5 patients - to the fifth toe of the foot. Pain along the medial surface of the tibia and lateral surface of the thigh appeared in 19 patients with signs of motor insufficiency against the background of pain of the corresponding localisation. Hypotrophy and hypotonia of the triceps muscles of the lower leg were detected in 12 patients, 19 patients showed a decrease in the strength of the flexor muscles of the toes of the foot, especially the fifth toe. Achilles reflex was weakened in 40 cases. Difficulties in standing up and walking on toes were observed in 20 patients.

Walking - with external rotation and adduction of the foot, later, as the symptoms of radicular compression regressed, with internal rotation and adduction of the foot. Information on the localisation of lower leg muscle damage in patients with S1 radicular injury.

These results indicate that when the S1 root is affected, the extensor muscles of the thigh and the adductor muscles of the lower leg in the affected leg are affected to a greater extent. In these muscles, palpation revealed neurodystrophic or muscle-tonic lesions in 48 (43.6%) patients. The first one is presented in the form of non-vanishing and non-reducing areas of stone consistency with sizes from 0.2-0.6 mm to 1-2.5 cm. They were found in 35 (31.8%) patients. These results indicate that when the S1 root is affected, the extensor muscles of the thigh and the adductor muscles of the lower leg in the affected leg are affected to a greater extent. In these muscles, palpation revealed neurodystrophic or muscle-tonic lesions in 48 (43.6%) patients. The first one is presented in the form of non-vanishing and non-reducible areas of stone consistency with sizes from 0.2-0.6 mm to 1-2.5 cm. They were found in 35 (31.8%) patients.Neurovascular disorders in patients with lumbar dorsopathies and radicular syndrome.

Peripheral neurovascular disorders are considered as a part of clinical manifestations of lumbar radiculopathy. In the modern concept of the pathogenesis of radiculopathy the most convincing is the idea of compression-ischaemic mechanisms of syndrome formation, which is considered as a tunnel

syndrome [Belyakov V. V., Sitel A. B. et al., 2002; Kuznetsov V. F., 2004]. According to the classification of V. P. Veselovsky they are usually divided into arterial, venous and mixed. Patients with arterial vascular pathology are characterised by stabbing, cutting, twisting pain, the pain increases with movement and cold. Pain relief occurs with rest, warm treatments and analgesics. Vegetative disorders are manifested by pallor of the skin, decreased pulsation of peripheral arteries, brittle nails, hair loss [Kipervas I.P., 2002].

Patients with impaired venous outflow complain of throbbing pain in the legs. The pain increases at rest, after hot procedures and decreases when changing the position of the body and muscle massage. The skin on the affected side is moist, pink, subcutaneous veins are dilated.

In patients with lumbar radiculopathy, combined lesions of the arteriovenous system predominate. They demonstrate symptoms common to both pathologies.

In the affected leg, the amplitude of the M-response is significantly reduced and its duration is increased. These types of changes are characterised by the lesion of the muscle itself. In addition, a decrease in the impulse conduction velocity and an increase in the residual delay were found, which indicated a violation of the functional state of peripheral nerves and slowing of impulse conduction along the terminal branches of the studied nerves. Compared with the control group, these changes were statistically significant. In the healthy leg, all ENMG parameters were the same as in the control group.

Thus, the ENMG data of the first group of patients showed that damage to the neuromuscular apparatus plays an important role in the pathogenesis of the formation of extravertebral syndromes of lumbar osteochondrosis. This was confirmed by a decrease in muscle-tonic tension of the affected leg. It also revealed a violation of the functional state of peripheral nerves in the form of delayed excitation along the terminal branches. The parameters of DS of the common femoral and knee arteries in the patients of the first group were the same as in the control group. On the side of the lesion the posterior part of the tibia is enlarged and there is a decrease in the systolic and end-diastolic branch of the dorsal artery. This is directly against the background of the blood count study, which was judged on distal examination.

Thus, the results of duplex scanning revealed in the patients of the first group on the diseased side a statistically significant decrease in peak systolic velocity and end-diastolic velocity in the dorsal artery of the foot and posterior tibial artery, which indicated a decrease in blood flow in the distal parts of the affected limb as a result of increased tone and decreased elasticity of the vessels under study. In patients of the second group the blood flow in the lower limbs did not suffer.

The study of the composition of multifunctional inflammatory cytokine interleukin-10 was carried out in 62 patients with spondylogenic neurological syndrome. Interleukin-10 is secreted by phagocytic mononuclear cells, is involved in the development of specific and nonspecific defence reactions of the body and is active against various cells, including endothelial cells [Lederer A.K, Maly C, Weinert T, Huber R. 2019] . Its increase in blood was found against the background of inflammatory reactions and manifestations of endothelial dysfunction in pathological conditions of the cardiovascular system, micro- and macroangiopathies developing in diabetes mellitus, angioretinopathies

In our studies, marked expression of interleukin-10 was detected only in the group of patients with PCR syndromes in the exacerbation stage. As shown in Table 9, the interleukin-10 concentration was 5.67 [5.47;5.59] pg/ml, which was 9 times higher than in the control group (0.68[0.56;0.60] $p<0.01$). In patients with dorsalgia syndrome, the concentration of interleukin-10 corresponded to 1.31[1.10; 1.45] pg/ml and was indistinguishable from the values in the control group ($p>0.05$), but was more than 8 times lower compared to the group of patients with PCD ($p<0.001$). Correlation analysis revealed a moderate negative correlation between interleukin-10 concentration in peripheral blood serum and blood flow velocity in the epidural vascular system in patients with biradicular PD syndromes at the level of the affected L5-S1 PDS ($r = -0.3464$), $p < 0.01$, $n = 104$). There was no correlation between those studied.

Thus, differences in the concentration of interleukin-10 in peripheral blood serum of patients with spondylogenic neurological syndrome in the exacerbation phase were established. An increase in the concentration of cytokine interleukin-10 in the serum of patients with PR syndromes ($p < 0.01$) compared to the group of healthy individuals and patients with dorsalgia syndromes was found.

In the exacerbation stage, the study of inflammatory markers in the peripheral blood serum of patients with lumbar radicular syndromes allows to identify signs of inflammatory process in patients with lumbar radiculopathy syndromes.

Currently, among many laboratory markers homocysteine occupies one of the leading places in the determination of endothelial dysfunction [Abramova, E. A. Moscow, 2009]. Homocysteine is a homologue of the amino acid cysteine and differs by one methylene group. HT were obtained as a chemical derivative as a result of the reaction of highly concentrated methionine acids described by chemists Butz and Vigneault in 1932. HTs enter the human body as methionine with animal proteins. Excess accumulated homocysteine in the body is converted back to methionine. Homocysteine metabolism depends on cofactors - derivatives of vitamins such as folic acid, pyridoxine, cyanocobalamin, and riboflavin. Their deficiency can lead to the development of hyperhomocysteinemia (HHC) [Pavlova, N. N. Moscow, 2006. - 21c]. The amount of homocysteine in the blood was determined in 115 patients. Thus, homocysteine differences were found in peripheral blood serum in patients with spondylogenic neurological syndrome in the stage of exacerbation. An increase in serum homocysteine concentration was found in patients with PCP syndromes ($p < 0.01$) compared to the control group and patients with dorsolgia syndromes.

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**Conclusions:** Using Dopplerographic methods, a decrease in the velocity of regional blood flow in the vascular system of the injured leg, venous stasis in radicular syndrome of dorsopathies of the lumbar spine was noted; this condition was not found in dorsalgias. Haemodynamic disorders are one of the mechanisms of formation of lumbar radiculopathy in the exacerbation phase. The occurrence of arterial-venous disorders in patients in the affected leg during the acute period of radicular syndrome depends on this factor: the simultaneous effect of disc herniation on the roots and accompanying vessels. The basis of this effect is mechanical compression, venous oedema, which causes damage to the endothelium of the roots and blood vessels. In patients with radicular syndrome of lumbar osteochondrosis, mixed arteriovenous nerve-vascular abnormalities are found in the affected leg. In patients with lumbar radiculopathies in the exacerbation phase the signs of vascular insufficiency and endothelial dysfunction (IL-10, homocetin) in the legs evaluated by UTD indices had the form of direct positive correlation. The functional state of peripheral nerves, clinically assessed by ENMG and VAS scale, correlated with inflammation, endothelial dysfunction and the state of neurotransmitter systems in patients with lumbar radiculopathy in the acute stage. Patients with pathology of arterial vessels have stabbing, cutting, twisting pains that increase with movement and cold. The condition improves with rest, heat procedures and taking analgesics. Vegetative disorders are manifested by pallor of the skin, decreased pulsation of peripheral arteries, brittle nails and hair loss in the area. In patients with venous network disorders, leg pain worsens after treatment with massage, rest and heat treatment. It is reduced by changing the position of the body. The skin of the affected side is moist and cyanotic and the veins are dilated.

In cases of damage to the arteriovenous system, pain in the affected leg is aggravated by changes in posture and gait. The swollen leg improves when wet, cold, resting and exercising the leg muscles. The study revealed the presence of neurovascular disorders on the affected side in all patients of the first group. Mixed arterial and venous disorders (80%).

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