

FEATURES OF WALKING AFTER A STROKE

Stroke is an acute disruption of cerebral blood flow, characterized by the sudden (within minutes or hours) onset of focal and/or general cerebral neurological symptoms that persist for more than 24 hours or result in death within a shorter period of time due to cerebrovascular pathology.

With the development of central hemiparesis syndrome following a stroke, a pathological gait pattern develops, which represents a combination of three pathological factors: impaired function of several muscles, impaired joint mobility, and changes in the support position of the lower limb.

The pathological gait pattern and compensatory mechanisms associated with motor deficits are aimed at reducing functional losses and optimizing motor function under pathological conditions. These mechanisms include:

1. Increasing the duration of the locomotor cycle by reducing gait pace, increasing the duration of the support and double-support phases, and increasing the support period on the side of the intact limb;

2. A "triple shortening" step with the paretic leg—simultaneous hip flexion, knee flexion, and foot lift off the floor by leaning the torso backward, as opposed to the normal sequential hip, knee, and ankle flexion;

3. "Mower's walk"—the patient makes a semicircular movement with the straight paretic leg around the vertical axis of the torso, or drags the straightened leg with the knee elevated and the torso tilted forward.

Some patients with severe paresis are quite capable of maintaining balance, and their risk of falling remains low. However, patients with minimal muscle strength loss in the paretic limbs, and even with complete recovery of paresis, may experience limited mobility, which may be due to a change in the balance stereotype when standing and walking.

In terms of joint kinematics, several types of biomechanical disorders can manifest. One common type of hemiparesis is Wernicke-Mann syndrome. In this case, the range of flexion in the hip and knee joints is reduced several-fold due to spasticity. Consequently, the limb cannot be extended forward in the usual manner, as such a movement requires combined flexion of the hip and knee joints. This condition is called functional limb lengthening. Consequently, the patient uses a different type of lateral limb swing. This movement can be achieved by abducting the paretic leg at the hip (which is not always functionally possible), while also tilting the torso toward the supporting limb. Plantar flexion of the ankle joint increases at the end of the swing period and the beginning of the support period.

Another type of hemiparesis is passive closure of the knee joint on the side of hemiparesis. This disorder is found in patients with decreased quadriceps strength. This condition can occur with paresis of this muscle, as well as with changes in its automaticity during the gait cycle. If these changes are not corrected during the early rehabilitation period, when the patient begins to walk (knee brace, etc.), then when stepping on the paretic limb, the quadriceps will be unable to prevent uncontrolled knee flexion. Without correction, the most common strategy used by patients is to shift the body's center of gravity forward by leaning the body.

This position positions the overall center of gravity anteriorly over the knee joint, ensuring its passive closure. Under the influence of this moment of force, the knee joint fully extends and is passively locked in hyperextension by the ligaments. This gait pattern is recorded by the patient. Another consequence of this compensation pattern is that it leads to significant functional asymmetry, which can be partially compensated for by the formation of a similar movement pattern on the healthy side.

Typical postural disturbances in patients with hemiparesis are associated with a shift in the body's center of gravity, usually toward the healthy leg and forward. This is a normal compensatory response. Another typical symptom is increased oscillation of the body's center of gravity, both in the sagittal and frontal planes. Consequently, this leads to less stability in the upright position. All the basic principles of normal balance, including the ankle strategy, are preserved, but the quality of stability is lower.