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ROLE AND SIGNIFICANCE OF ULTRASOUND IN SPORT MEDICINE

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ANNOTATION

Ultrasonography (US) is a safe and noninvasive imaging modality that is gaining popularity in different medical and surgical fields. Its introduction in musculoskeletal and sports medicine has taken this advanced subspecialty to a higher level. It has the advantage over other imaging techniques with regards to ease of use, availability, comfort and cost. Not to mention, in terms of safety profile, patients are not exposed to radiations, like in x-rays, and it can be performed on patients with metal or pacemaker implants, which are contraindicated in MRI. Standard diagnostic sonography doesn't have any known harmful effects on humans. In this article we will discuss the role of ultrasound in sports medicine, highlighting the diagnostic and interventional indications, uses and limitations.

Keywords: Ultrasound Ultrasonography Musculoskeletal disorders Orthopedics Upper and lower extremity

INTRODUCTION

Timely diagnosis and correct assessment of the state of damaged tissues in a sports injury is the basis for adequate therapy.

When analyzing the frequency of sports injuries of the lower extremities in football athletes, it was found that the most common (in descending order): injuries of the knee joint, muscle mass of the thigh and ankle joint. Among the above pathology, the least studied due to the lack of reliable diagnostic criteria, and therefore relevant, is the diagnosis of damage to the muscles of the lower extremities.

Ultrasound diagnostics (USL) in the detection of sports injuries is a new, not yet widespread method. Other methods of radiation imaging in the diagnosis of sports injury have their drawbacks. So, radiography in case of muscle damage is not very informative, the availability of computed tomography (X-ray and magnetic resonance imaging) is limited due to the high cost and duration of the study. It is worth considering the radiation exposure in X-ray research methods. Thus, due to its informativeness, harmlessness, availability, the possibility of repeated use for dynamic control, mobility (when using portable ultrasound scanners), ultrasound diagnostics is a promising method for diagnosing muscle injury.

At the moment, there is no single classification of muscle injury. But of the many existing ones, the most acceptable, in our opinion, is the classification of V. Krejci and P. Koch (1976), which most fully reflects the pathomorphological substrate of damage.

According to the classification of V. Krejci and P. Koch, muscle injuries are divided into three groups:

1. Muscle stretching with anatomical disruption of the integrity of one or more muscle fibers and muscle stretching, in which the elastic limit is reached;

2. Partial muscle ruptures with a gross violation of the integrity of the bundles of muscle fibers;
3. Complete muscle tears.

Before the advent of ultrasound examination, the diagnosis of complete muscle ruptures did not cause difficulties, and injuries belonging to groups 1 and 2 according to the above classification were usually detected on the operating table.

The diagnosis of microtraumas deserves special attention, since these injuries are often underestimated due to insignificant clinical manifestations, however, despite their “micro size” and “microclinic”, they can lead to changes (sometimes irreversible) that impede sports improvement. Microtrauma, if timely measures are not taken, can lead to an increase in the degree of damage and a transition to macrotrauma.

Thus, the timely diagnosis of sports muscle injury using available non-invasive methods is an urgent problem.

The aim of this work was to study the capabilities of ultrasound in the diagnosis of sports muscular injury of the lower extremities.

For the period 2004-2005, 55 sportsmen-football players (men aged 18-29 years) with closed injuries of the lower extremities were examined. In 16 (29.1%) cases, injuries were received during training, in 39 (70.9%) - during the game. Patients complained of pain during limb movement, limitation of mobility, swelling, bruising,

Ultrasonic scanning was performed on ultrasound scanners HDI 5000, Logiq 3. Linear transducers 10-12 MHz, convex 5.0-7.5 MHz were used.

In 17 (30.1%) cases, minimally invasive treatment was performed under ultrasound control - percutaneous puncture aspiration of hematomas, laser photocoagulation (high-energy surgical HES laser) of a bleeding vessel, irrigation of the hematoma area with an antiseptic and administration of medicinal substances.

According to the mechanism of damage, three types of muscle trauma of the lower extremities can be distinguished.

1. Damage due to sudden overload. With an intense start load, especially with insufficient warm-up and hypothermia, a rupture is possible. Thus, in the study group, 16 (29.1%) athletes were injured while playing in cold weather. Also, when overloaded, muscle overstretching may occur, leading to a tear or damage to the fascial sheath, which is most typical for the adductor muscles of the thigh and the posterior group of the thigh muscles.
2. Actually injuries due to an external damaging factor - direct impact, indirect (fall).
3. Injuries resulting from prolonged overload, "chronic microtraumatization".

As a rule, microtrauma and muscle rupture occur at the site of the transition of muscle fibers into the tendon, which is due to the different mechanical strength of the muscle fibers and the tendon at the site of their transition, where the tissue loses its homogeneity.

Complete tears arise, as emphasized by J. Comtet and W. Muller [], in muscles with a separate function. In the quadriceps femoris muscle, this is m. rectus femoris, which has no synergists. This injury occurs most often in football players during a “blank” kick on the ball. The rectus femoris is most commonly injured at the junction of the muscle into the tendon. Partial tears are more often localized in the biceps and adductors of the thigh (Bashkirov V.F). The integrity of the adductors is disrupted not only at the site of the tendon-muscle junction, but also at the

site of attachment to the pubic bone. In foreign literature, such an injury is called "ARS-complex" (adductor rectus syndrome complex). As the name suggests, along with damage to the adductor muscles, the rectus abdominis muscle is injured at the site of its attachment to the symphysis.

Conditionally, muscle injuries can be divided into microfractures (damage zone 3-5 mm) and tears larger than 5 mm. Injuries can be longitudinal - along the muscle fibers, and transverse. Longitudinal injuries are more common, better diagnosed and treated. Echographically at the site of injury, hematomas and synoviomas are visualized. In transverse tears and ruptures due to atypical traction and muscle ischemia, the ultrasound picture is polymorphic, which significantly complicates the diagnosis.

The use of ultrasound scanners with a 5-12 MHz transducer allows high-precision visualization of muscle damage caused by a sports injury. The following features are characteristic.

1. In the area of injury, the structure is disturbed (striation), hyperechoic linear structures corresponding to the sheaths of the bundles of myofibrils are visualized.

2. The presence of hypoechoic and isoechoic areas of various sizes with indistinct contours - hematomas. Doppler sonography plays an important role in their diagnosis. When viewed in the color Doppler imaging mode, blood flow in these structures is not detected; and during instrumental palpation using the energy Doppler mapping mode, eddy currents are observed, indicating the movement of free fluid in a closed space. This feature allows you to differentiate hematomas with a tissue process. With conservative management of hematomas in dynamics, there is an increase in perifocal blood flow. Some authors (Zubarev A.V., Nikolaev A.P., Dolgova I.V. []) describe this acceleration as "inflammatory" blood flow. In our opinion, the term "inflammatory" is not accurate,

For a complete diagnosis, it is necessary to conduct an examination both with a tense and a relaxed state of the muscles. The identified pathological zones must be measured for subsequent dynamic control.

Ultrasound examination revealed the following groups of injuries:

1.micro-tears of the muscle (up to 5 mm) –36 (65.4%), which in 33 (91.7%) cases were accompanied by the formation of hematomas 1-3 cm in size in the longitudinal dimension

2. muscle tears (5-20 mm) - 15 (27.3%), in all cases were accompanied by hematomas 3-5 cm in size

3.Muscle ruptures in 4 (7.3%) patients, of which 1 (1.8%) had a complete rupture and 3 (5.5%) had a partial rupture, with the formation of hematomas of 5 cm or more

Thus, the majority of injuries (94.5%) were muscle tears up to 20 mm in size, which are difficult to diagnose by other methods. At the same time, the wrong therapeutic tactics and the wrong choice of the training regimen for such injuries can lead to the development of further muscle damage, leading to the limitation of sports activity. This fact indicates the importance of ultrasound in the diagnosis of muscle injury in athletes.

As studies have shown, in most cases (94.5% of the entire study group), muscle tears and tears are accompanied by hematomas of various shapes and sizes. Only in 3 cases with microfractures of muscles measuring 5-7 mm. no hematomas were identified. Intermuscular hematomas are localized along the muscle fibers; during polypositional scanning, they were visualized as

hypoechoic formations of various shapes, depending on their location inside the muscle, changing shape during exercise. An important diagnostic point for determining the size of the hematoma is the assessment of the prevalence of pathological fluid along the muscles, detected by compression of the studied area. It is also mandatory to assess the integrity of the intrinsic fascia of the muscle under study to diagnose the possible prolapse of muscle bundles into the fascia defect with the development of muscle hernia.

Thorough ultrasound diagnostics of muscle injury makes it possible to resolve the issue of the possibility of its minimally invasive therapy. In sports medicine, it is extremely important to avoid additional surgical injuries while treating an injury. Interventional ultrasound allows you to:

1. Percutaneous puncture aspiration of hematoma (Fig. 5),
2. The introduction of drugs directly into the pathological focus,
3. Coagulation of the bleeding vessel.

Minimally invasive interventions were performed in 17 (30.1%) patients. This group included patients with tears and partial muscle tears complicated by hematomas of 5 cm or more in longitudinal dimension. In all cases, a therapeutic effect was achieved. Complications associated with minimally invasive hematoma therapy were not observed.

Out of 55 patients in the study group, 2 (3.5%) cases required surgical treatment of the injury, of which 1 patient with a complete rupture of the rectus femoris muscle at the tendon-muscle junction, and 1 patient with a partial rupture of the rectus femoris muscle with damage to more than half of the muscles. fibers complicated by hematoma.

In other cases (36 (65.4%) patients), treatment was carried out conservatively with dynamic ultrasound control. Dynamic ultrasound control during treatment and during the recovery period allows, if necessary, to adjust the treatment in order to achieve the desired result, to identify and stop possible complications in the long term.

Our experience shows that almost any scanners can be used for ultrasound diagnostics of sports injuries. With an increase in the scanner class, the accuracy and reliability of diagnostics increases due to an increase in its resolution. Modern scanners (3-4 generation) reliably diagnose muscle damage from 3 mm in size. The use of Doppler modes expands the possibilities of diagnosing muscle trauma by assessing blood flow, detecting hematomas, determining hemorrhages in the pathological zone, and also allows you to optimize minimally invasive therapeutic interventions by increasing their safety and guidance accuracy.

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