

Review

From clinics to imaging: Signs of severity and sport unavailability due to muscle injury[☆]

De la clinique à l'imagerie : signes de gravité et d'indisponibilité sportive d'une lésion musculaire

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Muscular pathologies of athletes can be presented in two distinct forms:

- either in the form of a trauma with a sudden onset occurring during the sport activity: this is the acute traumatic muscle pathology;
- or the pains appear progressively during, when stopping, or at distance from the sport activity: this represents delayed muscle soreness (DMS) [1].

In this paper we will only address the acute traumatic muscle pathology.

This muscle traumatology is principally of sports origin, representing 10 to 55% of all injuries occurring during the exercise of physical activity [2]. However, knowledge of muscle pathologies is limited compared to those of the bone or ligament, and sometimes resorts to a kind of “empirism in the domain” [3].

To presume that an injured muscle will be cured without any handicapping sequelae would be a serious mistake. The initial diagnosis of severity must be precise in order to guide the

treatment and the return to sport activity. Other than the clinical examination, sonography is often necessary and sufficient.

Reminder

Muscle is composed of muscle cells and an important fibrous skeleton (epimysium, perimysium, endomysium), support tissue in which the vessels circulate, and the function of which is capital because its at this level that the weaker areas are located, with their potential injuries; to mention a few:

- the musculotendinous junction, where the tendon layers issued from the tendon and the muscle interpenetrate; the most classical injury is the proximal lesion of the hamstrings;
- the myoaponeurotic junction, in the centre of the muscle body; the most frequent injury is in the fibrous layer of the rectus femoris of the thigh;
- the myoaponeurotic junction with the muscle; the commonest injuries are between the short and long heads of the biceps femoris in young sportsmen, and between the gastrocnemius and soleus in the older sportsman.

Two types of muscle injury should be distinguished:

- the intrinsic injury (90% of cases): the muscle function itself is responsible for the injury;
- the extrinsic injury (10% of cases): the muscle is crushed by a direct shock on the bone contour; this is the sportsman's “crutch”.

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Intrinsic injuries

Sports requiring short, repeated and intense efforts are the cause of such injuries. In a personal series of 95 muscle injuries [4], it was football that predominated with 67.4% of cases, followed by athletics (10.5%), basket ball (5.25%) and rugby (4.2%). . . However variations in function are possible, depending on the position occupied. With rugby, for example, the fullbacks present 8.3 muscle injuries for 1000 hours of match, whereas the incidence is only of 3.0 for the frontline players [5].

These injuries are mainly located in the lower limbs, affecting the biarticular muscles (hamstrings: 51%, quadriceps: 20%) [4]. There is a change with age, since after the age of 40 it is mainly the sural triceps that is injured.

The population affected is male (men 90%/women 10%) and young (under the age of 30). Precursor signs (muscle pain: “needle points”) during training just before the injury exist in 26 [6] to 36% [4] of cases.

The causes of muscle injuries are obviously multifactor and certain “beliefs” are false: the sportsman who injures himself is “hot” (the injury occurs on average after 37 minutes of play) and “in top form” (level of form estimated as 7/10) [4,6].

Demonstrated risk factors are: history of muscle injury [7,8], intensity of the game, because injuries occur more often during a match than during training [5] and fatigue (injuries are more frequent at the end of half-time) [9,10].

The interest of clinical examination compared with a diagnosis of severity

A positive clinical diagnosis is easy when faced with a patient during sport, who presents with sudden pain, in the centre of the muscle mass; that requires a modification or cessation of the effort.

Most important is the diagnosis of severity. Indeed, to define the severity of a muscle injury requires prescribing the cessation of any sport, capital element of the sport traumatology consultation. The notion of a sprain or tear is very empirical and with no value as regards severity.

There are several muscle injury severity classifications, among which:

- Rodineau’s classification [11], from grade 0 to 4, close to anatomical reality but, in our opinion not adapted to daily practice;
- the most classical three-stage classification of Järvinen et al. [2]:
 - grade 1 (mild, without severity or elongation): only a few fibres are torn; the clinical impairment is minimal with only slight handicap, minimal loss of strength and restriction of movements. The sonography is not frankly normal (disorganisation of the fibres, unclear outlines or thickening of the aponeurosis) but doesn’t clearly show a haematoma,
 - grade 2 (moderate, average injury, or tear/strain): pain and restriction of passive stretching are marked. On sonography there are clear signs with an intra- or inter-muscular haematoma,

- grade 3 (severe or serious, tear and/or disinsertion): this is a serious tear, sometimes total, of the muscle body. The injury can be visible (rectus femoris) or palpable. For us, this classification makes a classical mistake of stratifying the severity into 3 stages: “all is average”;
- Lenine et al.’s classification in two groups [12], separating the minor from the major injuries with a threshold of 40 days proposed by Askling et al. [13]. In our opinion [4,6,14], this classification in two stages is best adapted to daily practice:
 - minor muscle lesion (33 to 54% of cases in our series): sports stopped for less than 40 days with return to jogging after a mean of 15 days and return to all sport, at the same intensity as before, after an average of 21 days,
 - major muscle injury (46 to 67% of cases): sport stopped for more than 40 days with a return to jogging after an average of 40 days and return to all sport after an average of 60 days.

The clinical examination differentiates these two stages.

We have shown [6] that five clinical signs are significantly associated with a major muscle injury (Table 1).

Three signs during consultation

The three signs to look for are listed below:

- an initial pain greater than 6/10 on the Visual Analog Scale (VAS). Verrall et al. [10] has also shown a correlation between the intensity of the initial pain and the number of days of sport unavailability;
- pain during daily life for more than three days. Difficulty in dressing, walking, climbing up or down stairs. . . have also been found by Woods et al. [9], but with sport unavailability of at least three weeks if the daily pain persists after the first post-trauma day. If pain persists more than three days, sport unavailability is of around six weeks;
- perceived crack. Although the term ‘crack’ comes from a feeling of something perceived or heard, surprisingly enough there is no other study in the literature validating this sign of severity.

A sign for inspection

A sign for inspection is the presence of an ecchymosis. To our knowledge, there is no referenced study confirming this evidence.

A sign for examination

Pain on restriction of more than 15° with passive stretching of the injured muscle compared to the uninjured side, is the only sign of severity of the clinical examination. In a recent study, Maillaropoulos et al. [15] also based themselves on this restriction on stretching to appreciate the severity of muscle injury but with a difference: less than 20° suggesting a minor injury and, if more than 30°, a major injury (only in six cases in their series

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