

ATYPICAL RUPTURE OF THE TRICEPS SURAE MUSCLE COMPLEX IN HANDBALL: PARTICULAR CASE

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Abstract

The game of handball is based on a dynamic that is in continuous development, this has a direct impact on athletes, bringing more and more musculature to a high degree of overload. The muscle injuries described in the specialized literature are in a proportion high among men aged between 22 and 28, the most serious injuries resulting in total loss of functionality. The injuries that occur at the level of the complex triceps sural are produced with the knee extended, the ankle swings in dorsiflexion, thus the muscle is overloaded beyond physiological limits. Rehabilitation in case of a total injury to the level the posterior compartment of the calf involves a long period of time of, facilitating muscle regeneration, progressive increase in ankle functionality and the promotion of the professionalism specific to the game of handball. (I would also mention all the techniques performed).

Introduction

Muscle injuries are present in high proportion within sport pathologies, approximately 10% to 50% of these. The most serious injuries can manifest themselves in the form of chronic pain, joint dysfunction that can even cause compartment syndrome [1].

The incidence of calf injuries is predominantly present in older athletes between 22 and 28 years, mostly affecting men [2]. At the same time, the injury in the third distal part of the lower limb, at the level of the Achilles tendon, is a serious injury, with significant repercussions, as only about 70% of athletes manage to return to the form before the trauma [3].

The gastrocnemius muscle consists of two heads (lateral and medial) originating at the femoral condyle level, being the most voluminous and superficial muscle in the posterior compartment of the calf [4]. Together with the soleus muscle, this muscle complex is called the triceps surae [5].

From a biomechanical point of view, the gastrocnemius is dense in muscle fibers with a role in fast contraction while the soleus has fibers with a slow contraction response that helps control posture, being injured when subjected to an explosive contraction [2][6].

The rupture of the gastrocnemius occurs as the knee realizes, or is already in, hyperextension, and the ankle swings in dorsiflexion, these anomalies occur at speeds of high running combined with incorrect dynamic postures causing length changes muscle beyond physiological limits [7].

For locating lesions and distinguishing them along the path of the triceps sural muscles a physical examination is necessary, this allows us to identify the place and severity of the condition; these examinations are based on palpation of the area, resistance tests, and stretching. When the injury is severe and muscle testing cannot take place, opt for clinical examinations such as: MRI and ultrasound [8].

The Thompson test is used to examine the integrity of the Achilles tendon, this technique involves positioning the patient in the prone position with the legs off the table; executing compressions at the level of the posterior calf portion to produce slight plantar flexion of the ankle. If movement occurs then the Thomson is negative [9]. Some studies suggest the use of this test alone being insufficient in detecting lesions and identifying the muscles involved, accurately [10].

When it comes to recuperative treatment there is a debate in choosing the optimal one. The biggest disadvantage in choosing non-operative management, is the risk of relapse reaching 40% compared to a 1% to 2% risk when considering operative management [11].

Early functional rehabilitation in case of operative management is more important than surgery. Early integration of active, free exercise with resistance is more effective than prolonged immobilization. Postoperative immobilization in a cast or splint that lasts more than 3 weeks is not necessary [12]. Instead, some studies suggest using a brace between 8-10 weeks because exercises can be used to maintain joint mobility, it prevents muscle atrophy, while also avoiding dorsiflexion of the ankle [13].

Rehabilitation after an Achilles tendon rupture should be done within the first 6 months, according to varying protocols: in the first 2 months relapse will be prevented, between 2 and 3 months from injury there would be a focus on increasing muscle strength, and from 3 to 6 months they will perform proprioception exercises specific to the practiced sport [12].

Material-method

After studying the specialized literature, we find that a previous classification of muscles injuries, distinguish them in 3 different grades according to O'Donoghue: Grade I (without appreciable injury of tissues, function and strength were not lost), Grade II (tissue damage with reduction of muscle strength) and Grade III (complete rupture with loss of function) [14] . Latest results confirms a new classification system that differentiates the lesions into 4 distinct types: type I (muscle functionality disorders), type II (neuromuscular disorders) without macroscopic lesions of the muscle fibers, type III (partial ruptures of muscle fibers) and type IV (total ruptures or subtotals/tendon avulsions)[15]. The patient I had under observation presented after the new classification system a total rupture of the triceps sural complex, at the level of the junction musculotendinous from the distal compartment.

During the anamnesis, a series of parameters were identified that helped in the optimal conduct of the recovery plan. The 27-year-old patient, a performance athlete in the game of handball, who plays in the position of inter, suffered a total tear of the triceps sural complex in the distal region of the calf at the tendon-muscle junction through a propulsion mechanism at the moment performing a jump.

The condition began progressively due to muscle overuse, the athlete complaining of exaggerated pain that was visible through the loss of ankle functionality on the plantar flexion movement. After the surgical intervention that took place in Austria, he was immobilized for 6 weeks in a brace to facilitate the healing of the injured muscle.

The functional parameters, the degree of pain and edema were monitored using, the goniometer, the metric tape but also the VAS, QOL and FADI scales; these tools helped me identify the steps needed to go forward to a next stage of kinetic recovery [16]–[18]. To combat inflammation, cryotherapy was used immediately after, as a complementary method, which was used 3-5 times a day for 15 minutes each application without affecting the regeneration process of the muscle injuries [19].

The recovery plan lasted approximately about 7 months, it was staged, each stage presented objectives of progression that were reached by means and methods appropriate to the potential that patient presented, the recovery program being consistent with the literature of specialty.

Each recovery session consisted of 3 training phases. The first stage is called the warm-up phase, which has the role of integrating and preparing the muscles for the effort to which it will be submitted. The second stage includes the actual training, through which we achieve our proposed goals. The recovery phase is designated the last stage of the recovery session having the role of stabilizing functional parameters.

Working hypotheses established in the elaboration of this study are:

-Determining the most effective postoperative recovery techniques in case of rupture of the triceps sural complex that can significantly reduce the recovery period;

- The inclusion of the patient in an early training program, adapted to the pathology, which has the role of decreasing the time of reintegration into socio-professional activity;
- Using integrated active mobilizations as soon as possible can decrease the period of recovery, by increasing the functionality of the affected ankle

Recovery plan phased by weeks

Phase I (6 weeks) was called the immobilization period, the left lower limb being positioned in the orthosis, emphasis was placed on facilitating muscle regeneration, pain control, inflammation, but also wound hygiene. From a kinetherapeutic point of view, free active exercises were used but with light resistance as well to maintain joint strength and suppleness without involving the affected ankle and muscles. The exercises were done progressively, the athlete being taught how to carry on walking with crutches and daily activities without involving the affected lower limb.

Phase II recovery lasted approximately 8 weeks and had as its main objectives the following: pain reduction, increased mobility and muscle strength involving the whole lower kinematic chain, integration of coordination exercises, reeducation of walking divided into phases but also the integration of coordination exercises. Physiotherapy has been used to reduce pain, inflammation and edema using different techniques and procedures such as: TENS for creating the gate effect, LASER to combat inflammation and edema, and ultrasound to facilitate the biotrophic process speeding up the regeneration process at the same time [20], [21]. Physiotherapy exercises were performed both in the pool and on the mattress. Recovery in water, also called hidrokinetotherapy facilitated the recovery of the muscle rupture, by relieving the pressure, it reduced the impact of weight on the important joints, a constant resistance was used throughout the movements, muscle trophicity being improved [22].

Phase III recovery lasted 6 weeks, the recovery plan was adapted every 2 weeks, exercises with an ascending degree of difficulty were used, part of the exercises being continued from phase II recovery plus a series of kinetic techniques that aided progression.

In this stage we pursued a series of objectives such as: increasing muscle parameters, improving motor coordination, integrating running exercises. The objectives were achieved with success thanks to the kinetherapeutic plan, in which I used isometric exercises for anterior-posterior muscles of the thigh, exercises with elastic bands for the affected muscles and bodyweight exercises to increase the athlete's confidence. At the end of the recovery, the muscles of the upper part were also trained to maintain the muscular tonus and to facilitate a successful return to sport activity without risking getting out of shape.

Phase IV of recovery lasted approximately the same as the previous one but with a higher level execution of the proposed exercises; it had the following main objectives: maximization of muscle parameters, the integration of dynamic pivoting exercises, increasing exercise tolerance and gaining the professionalism of movements specific to the game of handball. In this phase of recovery high resistance exercises were used for both anterior and posterior muscles of the lower limbs, circuit type recovery methods, dynamic jumps, isometric exercises followed by isotonic unloading exercise and resistance exercise.

Results and discussions

The obtained results were monitored with the help of the goniometer by which we determined joint amplitude, the scales used were: VAS, QOL and FADI.

Table 1 - Impaired ankle joint mobility

Joint	Movement	Initial assessment	Final assessment
Ankle	Dorsal flexion	7°	15°
	Plantar flexion	15°	30°
	Inversion	5°	20°
	Eversion	0°	17°

In Table 1 are represented the values of joint mobility, the initial assessment was carried out at the beginning of the recovery plan and the final one at the end of it on every possible move at ankle level.

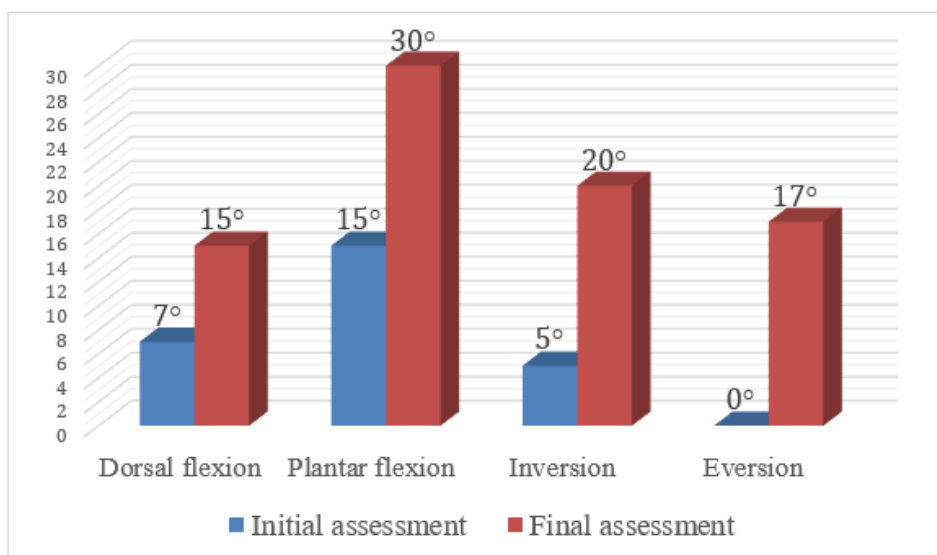


Figure 1- Impaired ankle joint mobility

Figure 1 shows the joint mobility of the affected segment, notice from the values marked in blue the significant impairment of joint mobility at early recovery but later mobility and function were improved toward maximum values.

Table 2 – Utilized scale

Scale	Initial assessment	Final assessment
VAS	5	1
QOL	58	109
FADI	33	134

In Table 2 are represented the scales used that we performed both at the beginning and at end of recovery.

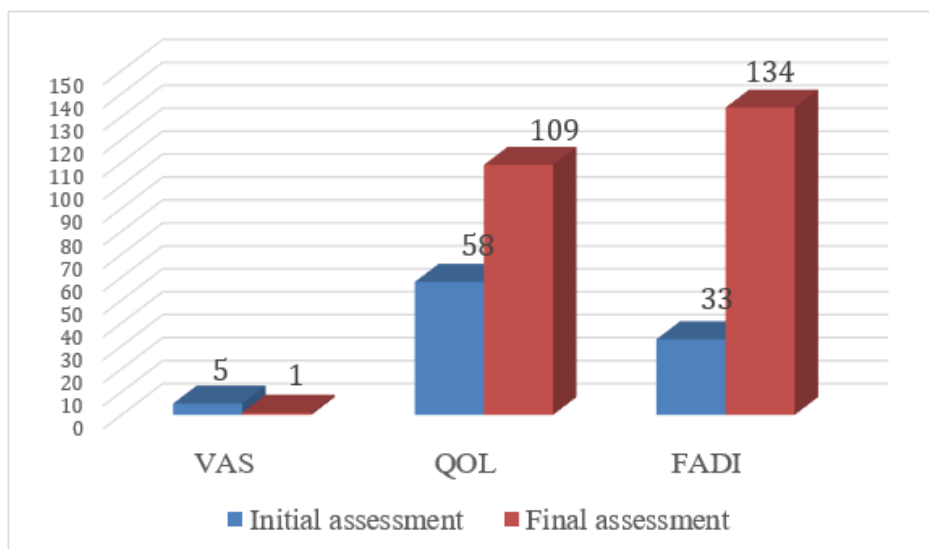


Figure 2- Values of applied scales

Figure 2 shows the values obtained after applying the monitoring scales of different functional parameters. The pain felt, rendered by the VAS scale, did not record any raised values, this facilitated the recovery itself; the patient's quality of life but also ankle functionality were affected reaching values of 58 points on the QOL scale and 33 on the FADI scale.

Following the final evaluation, an improvement can be seen in the scales mentioned above, the maximum parameters that could be reached were 112 QOL scale and 136 FADI scale.

Table 3- Representation of muscle strength

Joint	Movement	Initial assessment	Final assessment
Ankle	Dorsal flexion	F3	F5
	Plantar flexion	F2	F5
	Inversion	F3	F5
	Eversion	F3	F5

In Table 3 is represented the muscle force present at the ankle level at the beginning but also at the end of the recovery plan. The parameters recorded at the first assessment marked a decrease in muscle strength of F3 on the MRC scale and subsequently muscle strength was improved towards maximum values.

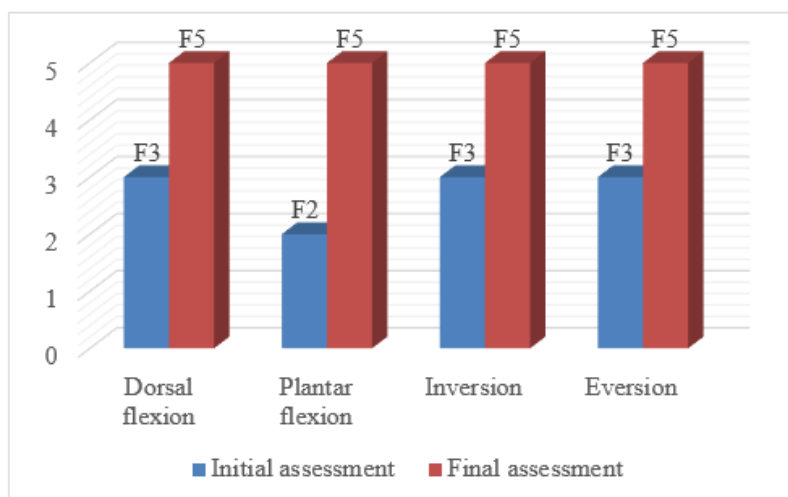


Figure 3-Representation of muscle force

The techniques I used had a positive impact on recovery, each element presented its recuperative role. Water exercises showed a positive muscle response. The opposing resistance facilitated resistance exercises on all anatomical planes, an improved trophicity through isotonic muscle contractions, reduced the mechanical force performed on the injured muscle. The early implementation of active mobilizations with resistance prevented muscle atrophy, improved joint range, muscle strength, confidence presented by the sportsman increased. Maximum joint mobility was the element worked on the most, the techniques used gave positive results. Increased stiffness together with local edema have influenced this parameter and towards the end of the 2nd phase of recovery the results were satisfying.

Ankle functionality was monitored with the FADI scale that recorded increased dysfunction and reduction in daily activities towards the end of the recovery plan.

These parameters returned to normal values, the athlete being ready to resume sport activity.

Static and dynamic stability was achieved in the last phase of recovery, based on exercises of stability and skill that had the role of maximizing muscle parameters and a combats relapse at the level of the injured complex.

Conclusions

The injuries that occur at the level of the posterior compartment result in damage to the triceps sural complex, that is present in performance athletes need a multidisciplinary approach and cooperation between the interventional team and the physiotherapist to be able to establish the degree of muscle load correlated with the

recovery time, plus a series of specific recommendations for the type of intervention performed.

The recovery plan must be individualized and adapted to each individual patient in order to obtain the most satisfactory functional results and to combat the relapse that may occur as a cause a defective recovery, thus including the patient in an early program of pathology-adapted training, has demonstrated its role and effectiveness regarding the reintegration of the athlete in their socio-professional activity, resuming the sports activity in just 6 months from accident.

In conclusion, this case report reinforces the information from the literature according to to which, the integration of active mobilizations as early as possible by loading the injured tendon shows a much better evolution than prolonged immobilization.

Physiotherapy determined a decrease in local edema, increase in trophicity and decrease in pain; hydrokinetic therapy improved postoperative management which resulted in increased muscle strength. Also the techniques used in the recovery plan paid off, the athlete returned to their form pre/injury about 7 months after the incident.

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