HAMSTRING INJURY

A CLINICAL DIAGNOSIS

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INTRODUCTION

An accurate diagnosis is essential to ensure that the injured athlete receives appropriate treatment and rehabilitation, and correct information related to the prognosis[1]. In most cases the diagnosis is straightforward and already put forward by the athlete himself. However, these 'simple' cases might not be as simple as initially expected.

The diagnosis and prognosis for time to return to sport (RTS) after acute hamstring injuries are mainly based on a comprehensive clinical examination[2–7]. In cases where the clinical appearance and severity is unclear, determining the optimal treatment can be difficult. Additional radiological imaging is often used to confirm the diagnosis and to provide information about the severity and the location of the injury. This information can provide guidance for further treatment[8]. Complete ruptures or avulsion of the tendinous insertions (with or without a bony fragment) usually have a worse prognosis and in some cases, surgery may be warranted[9,10]. Therefore, an important goal of these initial investigations is to identify those infrequent yet severe cases where surgical treatment might be indicated[9].

CLINICAL EXAMINATIONS

The initial clinical examination starts with a comprehensive medical history taking followed by specific physical assessments and tests[2,3,5], preferably performed within the first days after injury[5,11–15]. An early initial clinical diagnosis is essential to initiate optimal loading and rehabilitation after the injury[3,4,16].

PATIENT HISTORY

Patient history is considered the foundation of the diagnosis. In fact, it might by itself provide an accurate diagnosis in many cases. Even in the acute situation on the field, the athlete will tell you in that he has sustained a hamstring injury and, in the majority of the cases, is unable to continue.

The patient history provides an important overall picture of the injury situation and a preliminary impression of the injury severity. In order to get a good assessment of the injury situation, the clinician gathers information about:

1. the injury mechanism (i.e. high-speed running or more slow stretching related type of injury)[5,17],
2. whether there was a sudden onset with sharp/severe pain in the posterior thigh,
3. if the athlete was forced to stop immediately, and
4. an audible 'pop'.

This can aid the clinician in confirming the diagnosis, and might give some indication about severity[6,7]. Commonly,

subjective pain at the time of injury is measured with a visual analogue scale (VAS) or a numeric rating scale and higher scores have been associated with longer time to full RTS[18].

INJURY MECHANISM

Injury type and injury situation / mechanism

The evidence regarding the actual injury mechanism related to acute hamstring injuries is limited, and the subject of much debate. The majority of hamstring injuries are reported to occur during high-speed running when the athlete is accelerating or running at (or close to) maximal speed[13,17,19–22] typical in sports like football[20,21], rugby[23], and athletics[13,24]. Another hamstring injury type is referred to as the slow-speed stretching type of injury[17], occurring during slow movements with excessive stretch and large joint excursions including hyper-flexion of the hip combined with knee extension, typically seen in dancers[14,25]. Other injury situations, such as kicking, high kicking, glide tackling, twisting and cuttings are also reported[17,19]. Hip hyper-flexion combined with knee extension is commonly seen in patients sustaining a proximal hamstring tendon avulsion injury. Recently, an alternative injury mechanism was suggested in a smaller case series (n=3), involving a substantial hip abduction component (flexion-abduction injury mechanism)[26]. The biceps femoris long head is reported to be the most frequently injured muscle[21,27–29].

Biomechanical studies show that the hamstrings are most active from the mid-swing until the terminal phase of the stride cycle during running and sprinting[30–34]. It actively lengthens during the terminal swing phase with a combination of hip flexion and knee extension, absorbing energy from the decelerating limb in preparation for foot contact[6].

Muscle strain injuries during high-speed running are thought to occur during eccentric muscle contractions when the muscles are lengthened while producing forces[35,36]. Other biomechanical studies[37–41], including two independent case reports with video footage of hamstring injuries occurring during high-speed running[38,39,41], have hypothesised that hamstring injuries most likely occurs during this terminal swing phase of high-speed running. During this terminal swing phase, the peak hamstring musculotendinous stretch seems to occur, and is significantly greater for biceps femoris (probably because of a shorter knee extension moment arm)[30]. However, controversies exist and the early stance phase has also been suggested as highest risk period during the gait cycle, since the hamstring muscles are also working against potentially large opposing forces[42].

RED FLAGS DURING HISTORY TAKING - DO NOT MISS COMPLETE AVULSIONS

To rule out more severe injuries, consider a combination of signs and symptoms that include excessive pain located at the tendons insertions (proximally at the ischial tuberosity or distally); and typical acute injury situations with a mechanism of extreme hip flexion with the knee extended (e.g. sagittal split or falling forwards with the upper body while the leg is fixated to the ground). Combined with an audible 'pop', this should raise concern for a possible

Box 1: Clinical features suggestive of proximal hamstring tendon avulsion injury[44]

Clinical features suggestive of proximal hamstring tendon avulsion injury

- *Trauma mechanism involves combined hip flexion with knee fully extended*
- *Tearing or popping sensation*
- *Severe pain, sitting is painful*
- *Severe loss of function, walking is difficult*
- *Extensive posterior thigh bruising appears within days*
- *Pain on palpation of ischial tuberosity*
- *Palpable loss of bone-tendon continuity during resisted knee flexion*

Pitfalls

- *Bruising can be subtle, located only at the proximal part of the back of the knee*
- *Loss of function (knee flexion) may not be complete, as it can be masked by intact gastrocnemius muscle function*
- *Range of motion (straight leg raise and active knee extension test) may be full or even more than the contralateral leg*

Key differences with acute partial-thickness hamstring injury

- *Trauma mechanism typically involves high-speed sprinting*
- *Mild loss of function*
- *Bruising is limited if present*
- *Pain on palpation of muscle belly only*
- *Range of motion is reduced*

total rupture of the proximal tendon(s), and further radiological investigations are indicated[10]. Less common in football, the type of sport may lead to a suspicion of a complete rupture; for example, water skiers are at a high risk of avulsion injuries[8,43].

Red flags on history taking include pain on sitting, severe loss of function and force on isometric contraction, as well as difficulty when walking. Extensive bruising after some days are indicative of a complete avulsion. However, absence of these signs do not completely exclude complete avulsions and without the need to flag every patient, clinicians should be aware of the risk that these injuries might be missed (see Box 1)[44].

PHYSICAL ASSESSMENT

The physical assessment starts with observation of gait pattern and function, followed by inspection of the injured area, palpation of the hamstring complex, active and passive flexibility and range of motion (ROM) testing of the hip and knee joint, isometric pain provocation, and muscle strength testing[2,5,6,11]. Pain provocation tests and deficits compared to the contralateral uninjured leg are usually registered[5]. A VAS or a numeric rating scale is used to quantify the athlete's subjective pain[5,45] during flexibility and strength testing. To measure side-to-side differences in ROM and muscle strength, objective assessment tests use goniometers or inclinometers and hand-held dynamometers[5,11,15,46]. Hamstring flexibility of the injured leg is usually reduced compared to the uninjured leg after acute hamstring injury[5,6,11,47], and commonly examined in conjunction with other assessments to establish a diagnosis.

The active and passive straight leg raise tests and active and passive knee extension tests are most commonly referred to in the literature following hamstring injuries[5,11,15,48–50]. In studies among healthy participants, these flexibility tests demonstrate moderate to good reliability[49]. But since these tests are usually limited by pain and discomfort in an acutely injured athlete, reliability results from healthy participants may not be directly applicable to injured athletes. To date, only one study has reported on the reliability of flexibility testing in athletes with acute hamstring injuries[50], showing good intertester reliability for the active and passive knee extension tests. Pain with isometric contraction and hamstring muscle strength deficits compared to the uninjured leg is

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commonly present initially after an acute hamstring injury[5,6,51]. Just recently, a meta-analysis reported that lower isometric strength was found in the first week post-injury, but did not persist beyond seven days[51]. However, there are few studies that have reported strength deficits immediately after the injury, as the focus in the literature mainly has been directed towards isokinetic and eccentric strength deficits at or after RTS[51]. Additional neurological and diagnostic tests may also be performed to rule out other possible sources of posterior thigh pain[6,52,53].

In adolescents reporting an acute onset injury, the possibility of an apophyseal avulsion fracture must be excluded[54,55]. The cartilaginous growth plates at the apophyses of adolescents are more vulnerable than other parts of the musculotendinous unit, and are the first to fail, resulting in avulsion fractures. The pain is typically more severe during activity and decreases with rest, and clinical examination reveals local tenderness, reduced ROM and swelling[56]. Radiography (X-ray) of the pelvis in at least two planes should be performed in athletes with typical clinical findings and a relevant history of trauma[54].

POST RETURN TO SPORT: CLINICAL FOLLOW-UP

In daily clinical practice, an athlete is generally regarded as being fit to RTS if there is an absence of pain on palpation, absence of pain during strength and flexibility testing and asymptomatic completion of sports-specific testing. Despite this approach, re-injury rates remain high during the first two months after RTS[57].

Clinical examination during the first week after RTS has been shown to be of significant value for identifying athletes at risk for re-injury. Significant independent predictors are the presence of localised discomfort on posterior thigh palpation, more degrees of active knee extension deficit, and isometric knee flexion force deficit at 15°[58]. With easy-to-assess clinical evaluation—performed by clinicians or physiotherapists—those athletes with an increased re-injury risk can be identified. These findings emphasise that it is of major importance to monitor the athlete in the first week after RTS[58].

CONCLUSION

Simple clinical tests allow the practitioner to perform a reliable assessment to confirm the presence of hamstring injury. A lack of flexibility, strength, and pain on palpation are the main objective features, but more importantly, listen to the athlete. Very often elite athletes know their bodies well or have experienced similar injuries before. A detailed account of the injury mechanism and situation may provide valuable information in the assessment process. Understanding the goals and expectations of the athlete will ensure that both athlete, support team and medical team are all aligned to provide the best possible outcome for the individual.

References available at www.aspetar.com/journal

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