CASE REPORT

Investigation and management of an isolated complete distal avulsion of semitendinosus

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SUMMARY

A 34-year-old male patient presented with right-sided posteromedial knee pain following an attempted tackle during a soccer match. MRI revealed that the semitendinosus (ST) tendon had completely avulsed from its distal insertion site. The patient was initially managed conservatively but eventually required surgery due to ongoing posteromedial knee pain. Surgical management was achieved through tenodesis of ST to gracilis. Postsurgery, the posteromedial knee pain had been alleviated, and following physiotherapy the patient regained a good range of motion.

BACKGROUND

The hamstring muscle group is one of the most commonly injured muscle groups in athletes, accounting for 29% of all sports-related muscle injuries.¹ Most of the injuries sustained to the hamstrings are myotendinous strains and tears, with biceps femoris being the muscle most commonly implicated in injury.^{2–3} Proximal avulsion injury is much less common but is still reported in the literature.⁴ In contrast, distal hamstring injury is rare and not widely reported.² A search of the literature yielded only a handful of cases of complete distal avulsion of the hamstring tendons from their insertion sites, with biceps femoris distal avulsion being the most commonly reported.^{5–9} No specific case reports were found but case studies of complete semitendinosus (ST) avulsion were found reported as part of wider studies on the surgical management (SM) and imaging of distal tears of the hamstrings.^{8–10} This report will focus on the case of an isolated complete distal avulsion of ST, with a review of the current literature on the investigation and management of such an injury.

CASE PRESENTATION

A 34-year-old male recreational athlete presented with a 2-month history of right-sided posteromedial knee pain following an attempted tackle during a soccer match. The patient reported feeling a 'popping' sensation over the medial aspect of the right knee as he turned to make a tackle. No direct trauma to the knee or thigh occurred, and the patient was unable to continue playing due to the pain he was experiencing in the right knee. The patient was unable to weight bear for 48 hours post-injury, however after 4 weeks the patient was able to return back to a normal walking pattern, but the pain in the right knee had not fully resolved.

Clinical examination revealed the patient had an overall mild varus leg alignment with normal hip alignment and movement bilaterally. Both patellofemoral joints tracked normally, and examination of the left knee joint was normal.

Examination of the right knee revealed tenderness over the posteromedial aspect of the joint near the popliteal fossa with no significant tenderness in the mid medial joint line. Additionally, there was no joint effusion present, and the patient had a good range of motion (0°–5°/140°). The medial collateral ligament (MCL) was stable in 0° and 30° of knee flexion. The Lachman's, pivot shift and anterior draw tests were all negative, and there was no rotational laxity of the joint.

The patient had no other comorbidities, was generally fit and well and reported no previous lower limb injuries.

INVESTIGATIONS

MRI of the right thigh and knee revealed no intra-articular abnormality of the right knee joint. There was, however, complete avulsion of the ST tendon from its insertion point with proximal retraction of the tendon ([figure 1](#)). In addition, there was oedema around and thickening of the ST tendon ([figures 2 and 3](#)). Proximal to the level of the avulsion, the ST muscle was swollen but intact ([figure 4](#)).

DIFFERENTIAL DIAGNOSIS

Due to the history, it was believed that the patient may have sustained an anterior cruciate ligament (ACL), MCL and/or medial meniscal injury. However, the clinical examination findings were definitive in ruling the above injuries out. It became clear after the patient's initial MR scans that the ST tendon had avulsed from its insertion site. The MRI findings were consistent with a history that was suggestive of an avulsion-type injury, and explained the clinical examination that did not seem to indicate any damage to the knee joint or supporting ligaments.

TREATMENT

The rarity of this injury meant that there was no proven treatment protocol that could have been followed in managing the patient. Given that routine harvesting of the ST tendon occurs in patients requiring ACL reconstruction, it was decided that initially the patient should be managed in a similar way. The patient was

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Figure 1 Sagittal MRI showing acute oedema surrounding the avulsed ST (yellow arrow). Sagittal MRI PD showing torn ST (red arrow). ST, semitendinosus. PD, proton density

referred to physiotherapy with the view of reducing the pain experienced on resisted hamstring exercise, and to strengthen the remaining intact hamstring muscles to increase functionality. The patient returned for follow-up imaging after 4 months to see if any reattachment of the ST tendon had occurred. Follow-up imaging revealed that the ST tendon was still proximally retracted and that there was tapering of the ST tendon into a thin fascial attachment (figure 4). Given that there was no tenderness or defect found in the ST muscle body or in the other hamstring muscles, it was believed that the fascial attachment of the ST tendon was the source of the patient's ongoing pain. The fascial attachment was thought to be causing traction on the vincula during hamstring contraction, leading to pain. It became clear that the patient could no longer be managed conservatively and that definitive treatment would have to be achieved surgically. The patient underwent a right knee posteromedial exploration. At the time of the surgery, it was found that the ST was trying to regenerate with neotendon scar tissue. Therefore, the scar tissue was released distally, and formal tenodesis of ST to gracilis was performed.

OUTCOME AND FOLLOW-UP

The pain in the posteromedial aspect of the patient's right knee largely resolved following surgery. The patient reported some mild pain, tenderness and swelling over the surgical site postoperatively which resolved within 12–16 days. Recovery was aided by the use of leg elevation and medications such

Figure 2 Axial MRI showing: (1) isolated acute ST tear-abnormal swelling with increased intratendinous and peritendinous signal indicating oedema (yellow arrow). (2) Attenuation and thinning of ST tendon with oedema (red arrow). ST, semitendinosus.

Figure 3 Axial MRI showing (1) thickened ST tendon above the knee (yellow arrow). (2) More inferior slice showing markedly thinned ST tendon continuing to insert onto fascia via a thin remnant (red arrow). ST, semitendinosus.

as ibuprofen and co-codamol as required. During this initial recovery period, the patient mobilised for approximately 7 days using crutches and required 10 days' sick leave. There were no indications of postoperative infection or wound dehiscence, and the patient reported that using wound massage for several weeks after his operation helped with pain and itching about the wound site.

The patient was referred for physiotherapy postoperation, and while the referral was being processed, the patient was provided with written information regarding exercises to begin. These exercises were to be started once the pain and swelling around the knee had reduced to a point where the patient could begin carrying out non-weight bearing stretches and exercises without too much discomfort. The patient attended physiotherapy once weekly for the duration of a month. By 6 weeks postoperation, the use of physiotherapy allowed the patient to regain and maintain a good range of motion about the knee joint, with the maintenance of full knee extension and loss of only a small amount of knee flexion (0°/0°/130°).

Follow-up with the surgeon at 3 months postoperation was unremarkable, with no significant concerns raised regarding

Figure 4 Ultrasound images: (1) Sagittal image showing a tear of the ST tendon (yellow arrow). (2) Sagittal image demonstrating torn ST tendon tapering into a thin fascial attachment (red arrow). (3) Axial image demonstrating an intact swollen ST above avulsion (green arrow). ST, semitendinosus.

the recovery of the patient, and no postoperative images were taken.

The patient began to return to sports at approximately 3 months postoperation, using golf as a way to 'test his hamstrings' and ease himself back into regular physical activity. Four months post-operation, the patient returned to regular weekly soccer training sessions and at 5 months post-operation, the patient played in his first competitive game for his soccer team since injury. Throughout these months of his graded return to sports, the patient did not feel the need to premedicate with analgesia or anti-inflammatory drugs before partaking in physical activity as he reported no significant pain around the site of his previous injury and no pain in the hamstrings during or after physical activity. However, psychologically, the patient felt a certain degree of anxiety about returning to sports participation due to a fear of reinjury. This fear was augmented by the length of time that he was out injured and the frustration felt by not being able to be active without being in significant amount of pain. Interestingly, the anxiety of reinjury was dependant on his position on the field of play, with the patient feeling most anxious when required to play in the centre of midfield compared with in the fullback position. The patient attributed this to the '360 degree' nature of play in midfield and how he worried that twisting on his knee might lead to reinjury.

At 9 months postoperation, the patient did injure his previously affected hamstring during preseason training. He reported feeling pain, not in the original injury site but more proximally leading him to believe that he had sustained the more commonly occurring myotendinous hamstring injury. The patient did not seek medical attention for this injury and made a good recovery after a few weeks of rest. The patient reported that he has not sustained any further injuries.

Overall, the patient was very happy with the outcome of the surgery in that the injury site has not caused him any ongoing pain, and he has been able to return to preinjury activity levels. He comments that occasionally his previously injured hamstring feels 'tight' but not painful. The tight sensation can be accompanied by a temporary reduced range of knee motion, however the use of stretching exercises allows normal range of motion to return and the tightness to dissipate.

DISCUSSION

As previously mentioned, the management of a distal ST avulsion (DSTA) is not clear given the lack of evidence in the literature regarding the treatment of such an injury.⁸ Not only are there challenges in managing a DSTA but also in making its diagnosis. This is because, as was seen with the patient in this case report, the mechanism of injury may be suggestive of the more commonly seen intra-articular knee joint pathology. Even if one did suspect a hamstring pathology then the more commonly occurring muscle strain or tear may come to mind, leading one to believe that a patient may have sustained a distal third myotendinous injury to the hamstring(s).¹ Therefore, it is important to confirm and visualise a suspected DSTA injury using MRI of the thigh and knee.² MRI has been found to be more accurate in demonstrating hamstring avulsion injury compared with other imaging modalities such as sonography.⁹ Not only will imaging reduce the chances of clinical misdiagnosis, but along with ruling out important knee joint pathology, adequate visualisation of the ST tendon can help to determine the extent of injury and provide information on

the degree of tendon retraction.² Prompt diagnosis of a DSTA is important because on average DSTA causes greater time lost from sport than the more commonly occurring hamstring muscle belly injuries, and as will be discussed further in this section, the method of treatment employed for DSTA injury can significantly impact on the patient's recovery time and subsequent return to sports participation.¹

The management of the more commonly occurring hamstring strain is well established with the vast majority of these injuries being treated with non-operative management (NOM).¹¹ The same degree of certainty however is not found in the management of DSTA. Few studies have been published on the management of DSTA. Of the studies that have been reported, the majority have, to varying degrees, commented on the use of both NOM and SM of DSTA.^{8 10 12}

A study by Cooper and Conway¹⁰ used both NOM and SM on 17 athletes with DSTA. Athletes were either treated exclusively with NOM or SM or both NOM and SM.¹⁰ Athletes treated with NOM took on average 10.4 weeks to achieve recovery, with recovery being classified as clearance to return to sports participation. However, 42% of the athletes in the NOM group failed to achieve recovery and went on to receive SM, with an average recovery time of 29.6 weeks. Athletes managed exclusively with SM received surgery within 4 weeks of injury and achieved the fastest average recovery time of 6.8 weeks.¹⁰ Cooper and Conway¹⁰ concluded that early surgery should be considered for patients for whom time to recovery is the main priority, with a view to returning to sports participation as quickly as possible. However, they also recommended that clinical judgement is used when managing any given patient, as a patient progressing well without operative measures may benefit from continuing with NOM.¹⁰ The reported DSTA injury in the literature has commented and reported on DSTA occurring in professional/elite athletes. To the authors knowledge, there is no documented case of DSTA occurring in the recreational athlete population, as is described in this case report.¹⁰ This may be an important consideration for future research to try and understand how the indications for treatment and management may differ among athletes competing at different levels. Subsequently, management may have to take into consideration aspects such as the different resources available to recreational versus elite athletes. These resources may include access to and quality of rehabilitation and physiotherapy. In addition, urgency to return back to sports participation will be a further consideration in the professional/elite athlete population, a factor that may not be as important to the recreational athlete. At the moment, the uncertainty surrounding the management of DSTA is due to the fact that there is little evidence available to indicate which patients would or would not have good outcomes from NOM, and therefore which patients should have early SM.¹⁰ Even a parameter such as severity of injury may not be a reliable indicator of which management option is best for patients. Schilders *et al*¹² demonstrated this when their study reported that partial DSTA injuries experienced by their study participants failed to resolve using NOM. This is in contrast to the 58% of study participants with complete DSTA managed successfully with NOM in the study by Copper and Conway.¹⁰ Furthermore, for patients undergoing SM there is little evidence to suggest which technique is most beneficial to use. Some studies used tenotomy,^{10 12} while another study used tenodesis of the ST tendon to sartorius, in contrast to gracilis which was used in the management of the patient in this case report.⁸ The rationale for the type of

SM used by studies was largely based on the fact that the ST tendon is used for ACL reconstruction without any perceived adverse outcome.^{10 12} However, because of evidence of loss of knee flexor strength, and impaired dynamic stability with the loss of the ST tendon, one study decided to use tenodesis rather than tenotomy.^{8 13 14} The lack of clear evidence-based decision-making strengthens the argument that the technique used for SM of DSTA requires further investigation and research.

Given that there is no clear evidence base regarding the management of DSTA, many more studies with long-term follow-up are needed to establish which patient factors contribute to deciding whether the patient is treated with NOM or immediate SM. Furthermore, if patients are to be treated with SM, the technique which provides the best outcomes for the patient needs to be elucidated. To conduct studies that provide meaningful results, there would have to be a sufficient number of participants involved, and given the rarity of the reports of DSTA in the literature this may be difficult. However while DSTA may be uncommon, this type of injury may not be as rare as the literature suggests. This is because a DSTA is likely to go misdiagnosed as a distal third hamstring tear, especially if MRI is not used as part of the diagnostic process. Future studies investigating which patient factors are more favourable for the initiation of NOM or SM, and which technique for SM is most successful in the long term, will help provide an evidence base for future clinicians and surgeons to draw on. This is important as it will allow management of patients to be evidence based and help to ensure the best possible outcome is achieved for the patient.

Learning points

- Include distal semitendinosus avulsion (DSTA) on the list of differentials when a patient presents with an avulsion-like mechanism of injury to the knee.
- If a DSTA is suspected then the imaging modality of choice is MRI.
- The choice between non-operative management and surgical management for the time being should be largely informed by a shared patient–physician decision until such time that a sufficient evidence base emerges to help inform decisions further.

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