

## Tennis Leg: A Unique "Strain", Management Approach and Review of the Literature

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### INTRODUCTION

Originally described in 1883 by Powell<sup>[1]</sup>, tennis leg also known as calf strain refers to an acute traumatic injury of the medial head of the gastrocnemius muscle. The exact anatomical cause was not always clear and initially often described to involve the plantaris muscle. Following a study in which Arner and Lindholm<sup>[2]</sup>, surgically explored patients with clinical tennis leg however, it was proposed that all such patients suffered from an isolated injury to the medial head of gastrocnemius usually at the myotendinous junction. Since then, the description of similar pathology has become common within the literature.

With the advent of ultrasound and magnetic resonance (MRI) scans, the exact pathoanatomy underlying cases of tennis leg can be determined without surgical exploration. Delgado et al, performed a cadaveric study assessing the diagnostic findings of ultrasound and MRI, concluding the majority of patients thought to have tennis leg suffered from a partial rupture of the medial head of gastrocnemius within 2cm from its myotendinous junction (67%), with a significant proportion demonstrating fluid between the medial head and soleus but no actual rupture (21%)<sup>[3]</sup>. This study highlighted the variation in anatomical injury patterns associated with tennis leg. More recently however the existence of isolated injuries to the plantaris muscle in elite athletes has once again been brought into question<sup>[4]</sup>. As our understanding evolves, it would seem that those with clinical findings suggestive of tennis leg are likely to be suffering from a variation of multiple potential complex injury patterns, commonly affecting the gastrocnemius medial head, with a smaller proportion suffering from injuries to the plantaris muscle<sup>[3]</sup>.

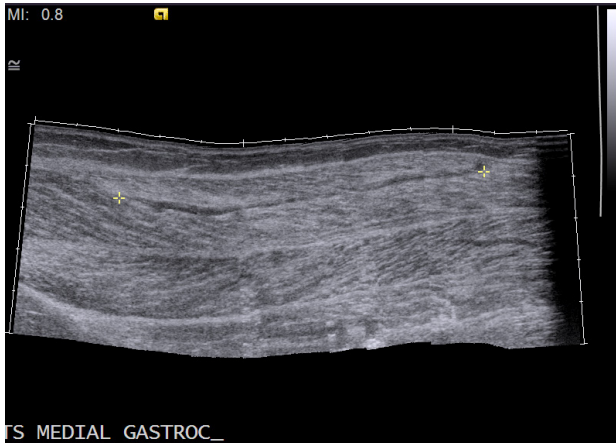
With the plantaris and gastrocnemius muscles both spanning three joints, it is thought these structures are often at risk of injury particularly with explosive actions during sports activity. Tennis leg

### ABSTRACT

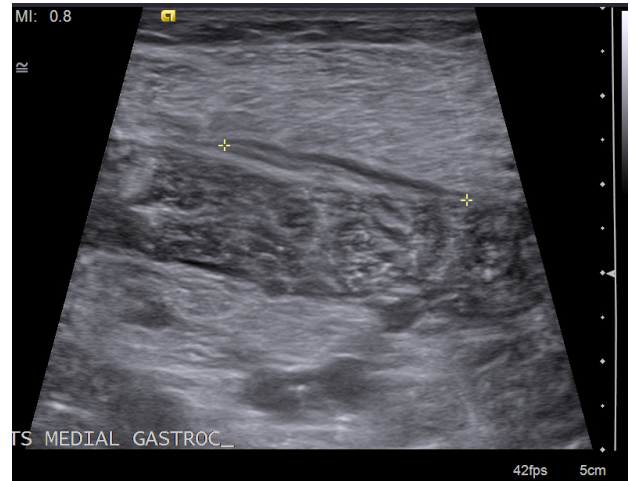
The term tennis leg is often used to denote any pathology resulting from acute injury to the medial head of the gastrocnemius muscle. Management of such cases is usually conservative, with scarce evidence in the literature describing cases of surgical intervention for such patients. Authors performing surgical repair, have done so for complete ruptures of the medial gastrocnemius head, usually in the acute setting. In these cases reported outcomes have been encouraging. As our imaging capabilities evolve variations in the exact pathoanatomy denoting clinic tennis leg are now emerging. We present a unique case of a linear type myotendinous tear affecting the medial head of the gastrocnemius muscle in a 45-year-old athletic patient. Following failed conservative measures, we describe an approach to management in the non-acute setting, which successfully resulted in resolution of our patient's symptoms and return to competitive activities. We also address the evidence available within the literature regarding the management options available for tennis leg.

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**Key words:** Tennis Leg; Calf Strain; Medial head Gastrocnemius; Medial Gastrocnemius Head Release; Surgical Repair; Sports



**Figure 1** Ultrasound demonstrating split type tear of the medial head of gastrocnemius in the longitudinal plane (86.8mm).



**Figure 2** Ultrasound demonstrating split type tear of the medial head of gastrocnemius in the horizontal plane (28mm).

injury results from the action of sudden ankle dorsiflexion with an extended knee. Patients commonly report feeling a sudden “pop” at the time of their injuries followed by swelling, warmth and pain around the entire calf. These features have often been described to mimic the clinical picture seen in that of acute deep vein thrombosis, and this should be considered in the list of differential diagnoses. As the acute injury settles, patients can expect to suffer from prolonged discomfort and weakness on dorsiflexion for several months.

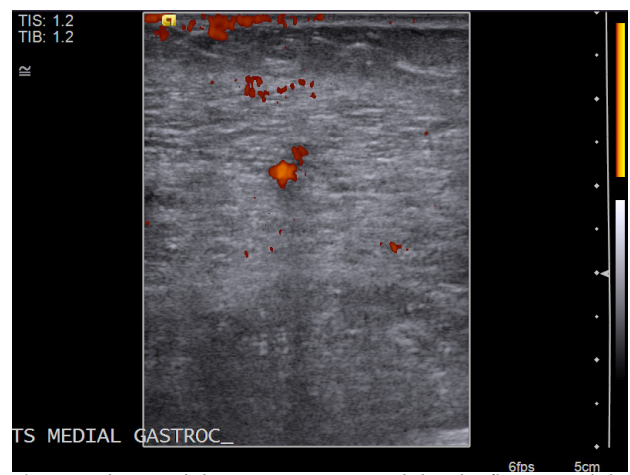
Management is traditionally conservative, with the majority of patients returning to full activity within months. Surgical management has largely been advocated in cases with associated lower leg compartment syndrome<sup>[5,6]</sup>. We present a case presenting with clinical features indicative of tennis leg, and ultrasound findings suggestive of a form of the same pathology. We describe the use of a proximal medial gastrocnemius release procedure to successfully treat this case following a period of no response to the classically prescribed conservative measures.

## CASE STUDY

A 45 years old fit and well female was referred in from primary care, with a 10 months history of isolated left sided mid-calf pain. She recalled an initial injury whilst playing tennis in which she felt a sudden “pop” sensation in the mid calf level on suddenly changing direction. Following this event she suffered from ongoing sharp pains in her left calf on minimal exertion. She was initially referred for a course of physiotherapy, which had resulted in minimal improvement to her symptoms.

On examination, our patient had no bruising to the calf and good muscle bulk bilaterally. She had full range of ankle plantarflexion and dorsiflexion with the knee in flexion however on passive manipulation was tender on the extreme of dorsiflexion. Silfverskiöld’s test was positive at this stage. Palpation in the popliteal fossa elicited marked tenderness over the supero-medial aspect. Furthermore palpation around the medial mid-calf level elicited a similar level of discomfort. Due to apprehension of pain, she unable to complete a single heel raise on the affected side. There was some tenderness over the achilles tendon, but this was clinically intact.

An ultrasound scan was performed and revealed a longitudinal partial split tear of the myotendinous junction measuring 86.8mm in the longitudinal plane and 28mm in the transverse, see figures 1 and 2. There was increased doppler flow around the tear in keeping with an



**Figure 3** Ultrasound demonstrating increased doppler flow around the tear.

associated ongoing inflammatory response, see figure 3.

In view of her ongoing symptoms, not responding to conservative measures over several months, surgical intervention in the form of a medial gastrocnemius head release with repair of the myotendinous split tear was discussed and accepted by the patient.

## PROCEDURE

Under general anaesthesia, the patient was setup in the prone position, with a tourniquet applied at the thigh level and inflated to 300mmHg. Antibiotic prophylaxis was not deemed necessary. The entire lower limb was prepped using alcoholic chlorhexadine and draped in the routine fashion.

A transverse incision was made along the flexor crease overlying the medial head of the gastrocnemius muscle, followed by an incision through the fascia of the posterior compartment. The medial head of the gastrocnemius was then visualized and released from its proximal attachment. A second longitudinal incision was made at the level of the musculotendinous junction in keeping with the site of the patient’s pain, which was marked prior to surgery. Scarring along the medial aspect of the gastrocnemius was identified, and found to be adhesive to the underlying soleus musculature. All adhesions were divided and the split tear was repaired using 3’0 Polysorb™ suture material. Following the procedure the patient was allowed to mobilise with

no restrictions in place. At 3 months she was referred for formal physiotherapy.

Our patients overall disability was formally evaluated using the AOFAS Ankle-hindfoot scale at the time of injury, following 3 months of physiotherapy and 6 months following surgery, revealing scores of 0, 56 and 86 respectively. Clinically her calf pain had completely resolved at 6 months and functionally she was able to recommence high level sports activities at this stage.

## DISCUSSION

Variations in the precise pathoanatomy of tennis leg are now emerging as our diagnostic capabilities evolve. Most recently an isolated longitudinal split type tear of the medial gastrocnemius head tendon was recognized as a rare variant of tennis leg<sup>[7]</sup>. Although this pattern of tear is similar to that described in our case study, the exact location was reported as distal to the myotendinous junction and hence different in overall anatomical position. Prior to this, most descriptions arising from imaging studies describe clinical tennis leg injuries as either, strain pattern of injury, complete rupture or partial tear. Our ultrasound findings describe a unique form of injury, under the umbrella term of tennis leg. With a split type tear, overall tension across the myotendinous junction persists unlike those cases with complete or partial rupture. This is likely to have at least in part contributed to the persistent inflammation as demonstrated by the increased doppler flow around the tear, and progression into chronicity of our patients symptoms.

Conservative management is generally advocated in the management of all forms of tennis leg initially. Froimson indicated such treatment was effective and did not result in any long-term disability<sup>[8]</sup>. Wide variation in rehabilitation protocols exists in the literature however, with treatment ranging from complete immobilization of the affected limb in plaster<sup>[9]</sup> to the use of heel lifts and compression stockings to protect the injured muscle<sup>[10]</sup>. Most authors recommend the use of rest, ice, compression and elevation immediately following injury followed by passive stretching exercises and isometric strengthening rehabilitation until full intensity sports can be resumed<sup>[11,12]</sup>. Ultrasound follow-up has even demonstrated primary union at the rupture site, taking place as early as 4 weeks after the initial injury, following conservative measures only<sup>[13]</sup>.

Cases of surgical management of tennis leg are scarce within the literature. The earliest reported cases of surgical intervention were by Arner and Lindholm who described the exploration of 20 medial gastrocnemius ruptures with the acute repair in 5 of those patients<sup>[2]</sup>. Miller later described the repair of 3 complete ruptures of the medial gastrocnemius head in two patients<sup>[14]</sup>. In both cases surgical repair was performed in the acute setting and the reported outcomes were positive. At the same time Durig *et al.* compared acute operative management in 12 cases of complete medial gastrocnemius head rupture to 7 cases managed conservatively<sup>[9]</sup>. In this case series there was considerable functional advantage in the operative group with earlier return to activity. Most recently Cheng *et al.*, describe two cases of surgical management following complete medial gastrocnemius rupture at the level of the musculotendinous junction<sup>[15]</sup>. Repair was conducted acutely in one instance and delayed after 10 months of failed conservative measures in the second. In both cases significant improvement in pain and function are reported. Delayed surgical intervention is increasingly being explored and cases of such are reporting encouraging findings<sup>[16]</sup>. Authors performing surgical repair for tennis leg commonly advocate reserving surgical intervention to younger patients with high sporting demand.

The indications for the described surgical techniques reported in the current literature for tennis leg differ significantly from the current case. This is largely due to the morphology of the tear described in our patient. In the reported cases of surgically managed tennis leg, almost all have been for complete medial head rupture. Furthermore in all but 2 cases this had been in the acute setting. Our case posed the challenges that this was a partial split type tear larger in the longitudinal plane than the transverse and this was on the background of a delayed presentation. The deformity often described in the literature was not immediately obvious, but the pain described was anatomically at the level of the tear during physical exertion.

Modern gastrocnemius recession procedures broadly target the distal musculotendinous junction, approximately 2cm distal to the muscle belly with the aim of releasing the gastrocnemius tendon from the underlying soleus tendon<sup>[17]</sup>. This procedure (Strayers) is conventionally used to manage conditions resulting from equinus contracture, including plantar fasciitis<sup>[18]</sup>, acquired adult flatfoot<sup>[19]</sup> and metatarsalgia<sup>[20]</sup>. Although good function is often reported following gastrocnemius recession procedures, long-term follow-up has highlighted significant issues due to reduced strength and endurance affecting high demand activities in particular<sup>[21]</sup>.

Proximal medial gastrocnemius release (PMGR) has been described in the management of various conditions with clinical gastrocnemius tightness as an alternative to the conventional Strayers procedure<sup>[22]</sup>. This procedure is generally considered less invasive and disabling than a gastrocnemius recession operation with smaller potential risk to neurovascular structures. In view of our patient developing clinical gastrocnemius tightness with a background of high athletic demand, a PMGR was considered a more suitable first line surgical intervention. The aim of our procedure was to reduce tension across the site of injury whilst allowing the tendon to heal, through minimal disturbance in the muscular anatomy using a recognized and safe technique.

## CONCLUSION

There have been few authors to report or advocate surgical management of cases of tennis leg. To our knowledge there have been no cases of delayed surgically managed split type tears of the medial head of the gastrocnemius muscle and no reports for the use of PMGR in the management of such pathology. Our technique was successful in achieving complete analgesia and restoring adequate function in a young athletic patient.

Outlining clear indications for surgery to this form of injury has proven difficult in the past, with advanced understanding of the pathoanatomy likely to further complicate the issue. We would stress that our radiologist colleagues should be encouraged to clearly define variants in the morphology of medial head of gastrocnemius tears in order to progress our understanding in managing such injuries.

## CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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