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Research Article

The Role of US Diagnostics and Monitoring of the Conservative and Operative Treatment of Massive Partial or Total Tears of the Medial Gastrocnemius Distal Tendon

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Summary

The paper presents capabilities of US in medial gastrocnemius distal tendon diagnostics. It is the best diagnostic tool for the visualisation of the anatomy, tears, monitoring during conservative and operative treatment, with full tendon reconstruction. US images were confronted with anatomical findings which enabled the correlation between reality and US. Complement of the paper is the tendon reconstruction operative images.

Keywords: Achilles Tendon; Medial Gastrocnemius Muscle; Tear; Tendon; Tennis Leg; Reconstruction; Treatment; US

Introduction

Achilles tendon is the strongest tendon in human body. It is made of three tendinous bands deriving from three separate myotendinous units – soleus, medial gastrocnemius and lateral gastrocnemius. The fibers of the three fuse and rotate along the course of the tendon. Every myotendinous unit consists of the tendinous system [1-3] which includes the tendons and the tendinous tissue within the muscle belly. Most muscles have at least two tendons – proximal and distal. They may run on the surface of the belly or inside it or both depending on the level. Medial gastrocnemius distal tendon runs on the anterior surface of the muscle occupying the whole width of the belly (Figures 1,2). Partial Achilles tendon tears account for as much as 25% of all pathologies of this region. Ljungqvist as the first described partial Achilles tendon tear in 1968 [1]. The aim of the study is to show the capabilities of US examination in visualizing the anatomy, tears and healing during conservative and after operative treatment of the medial gastrocnemius distal tendon.

Materials and methods

Embalmed anatomical specimen of the triceps surae muscle (Figure 1-2), two cases of the tendon rupture treated with operative anatomical reconstruction. Patients treated conservatively were US monitored at 3-4months, the postoperative at 3 and 6 weeks.

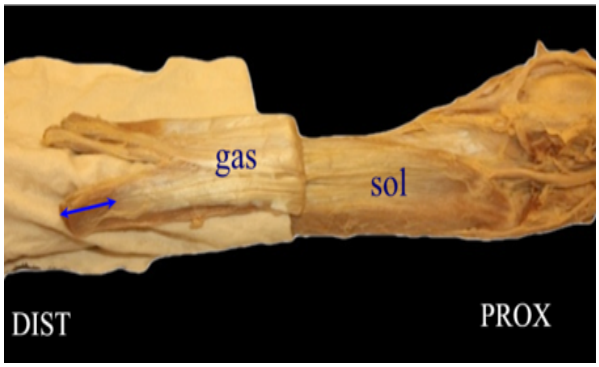


Figure 1: Embalmed specimen of the triceps surae. Medial gastrocnemius cut off from its origins. Between the proximal tendon (runs on the posterior surface of the muscle, not visible) and the distal tendon you can see a stretch of bare myofibers which are approx 5cm long (blue double arrow). The anterior surface of the muscle is folded to the left (distally onto the Achilles tendon). It is fully covered by the distal semipennate tendon which is as wide as the whole muscle belly. Medial gastrocnemius separated from the soleus up to approx. 10mm below distal gastrocnemius belly margin.

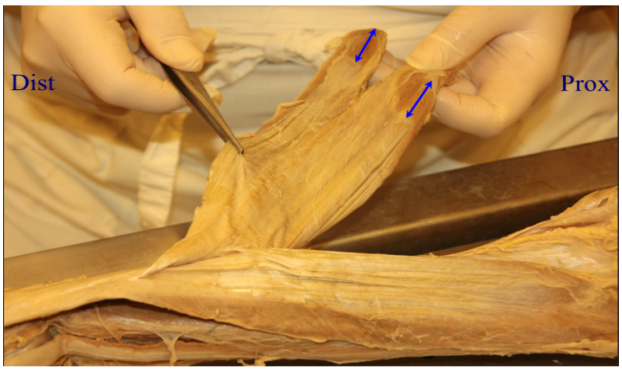


Figure 2: Another view of the medial gastrocnemius and medial soleus; same specimen as in fig1. These tendons together with lateral gastrocnemius distal tendon form a structure which is called the Achilles tendon (on the left). An unfortunate name for the triceps surae tendon which components are formed at the level of the knee joint. Blue double arrows – the length of myofibers of the medial gastrocmenius muscle.

Postoperative treatment

Most patients come back to full sports activity after 4-5 months postoperatively after fullfiling criteria of RTS (return to sport). They are: no pain, psychological subjective and objective readiness to come back to activity, US confirmation of proper healing and biomechanical assesment.

Results

In the US assesment there is clearly an advantage of the operative tendon reconstruction over conservative. It is because it gives the possibility of return to normal anatomy of the muscles tendinous system; in the conservative treatment the healing results with thick scars overlying the medial gastrocnemius and soleus tendons and the shortening if the belly which disturbes normal muscle tension and may lead to muscle atrophy and that may cause some disability when coming back to sports activities. In the muscle which lost tension undergoes partial atrophy and muscle fibers shortening. On top of that the haematoma dissecting medial gastrocnemius and soleus muscles generates fibrotic layers of many milimeters in thickness which are covering the healthy soleus tendon and untouched part of the gastrocnemius tendon above and below the tear level on the length of many centimiters (Figures 6-10). That means a serious stiffening of the tendinous system of both muscles which in turn leads to uneven load distribution of the triceps surae. Full anatomical reconstruction of the tendon prevents from fibrotic scar layers on the tendons and allows for an early intensive rehabilitation which helps in a proper scar formation. Thanks to early motion and controlled load bearing the tendon receives proper impulse regarding the load/healing direction which is a positive factor of the functional healing process. What more the possibility of early mobilisation lowers the risk of unwanted scar formation which would cripple its function (Figures 3-5).

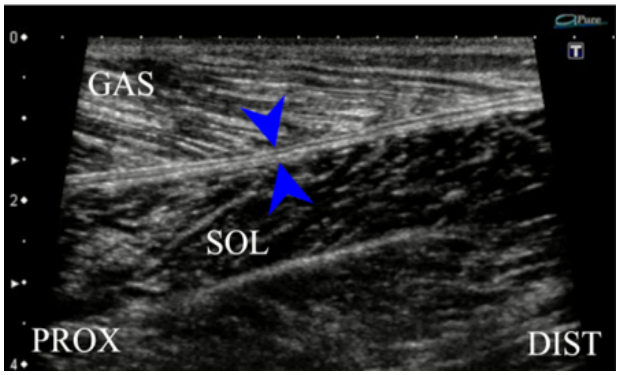
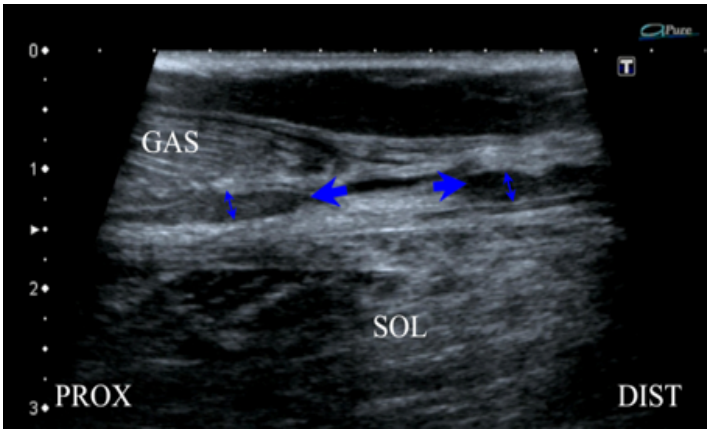


Figure 3: US of the normal medial gastrocnemius and soleus tendinous systems. at the distal portion of the gastrocnemius – the most frequent site of tears (both tendons are of similiar thickness of about 1mm on this.



level – blue arrowheads).

Figure 4: US image of a total distal medial gastrocnemius tendon tear at the level of the distal margin of the gastrocnemius. The stump ends - big arrows, thickness of the stumps – double arrows. Retraction of the stumps approx 15mm.

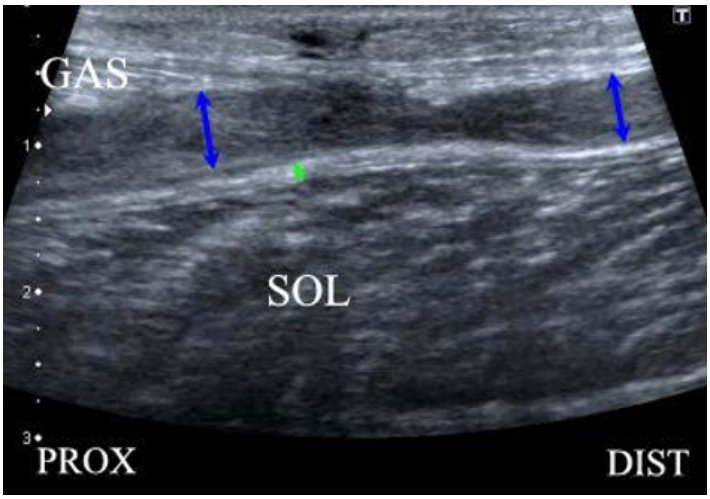


Figure 5: Result of the conservative treatment of the total distal medial gastrocnemius tear right below the belly margin. Massive scar of 8mm thickness (double arrows) is covering both medial gastrocnemius and soleus tendons above and below the tear level with approx. 15mm retraction of the stumps (tha narrowing of the scar). Four months post injury. Green double arrow – soleus tendon.

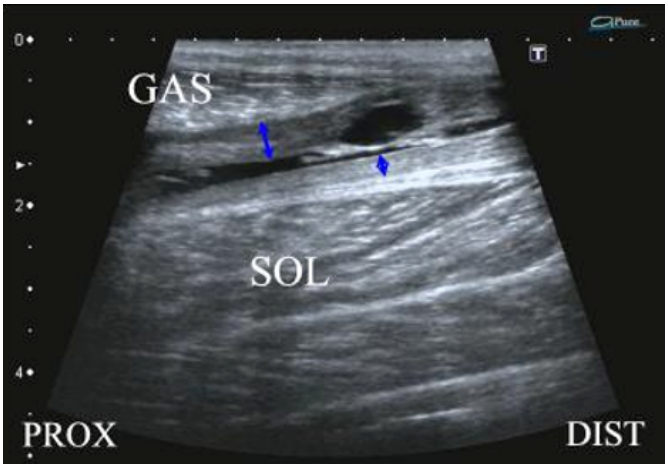


Figure 6: The result of the conservative treatment of the total tear of the distal medial gastrocnemius tendon. At this stage it is not possible to determine where the tear was. Massive up to 5mm scars covering medial gastrocnemius and soleus tendons (blue double arrows). Three months post injury. The scar has a defect of unknown endurance. There is still a fluid layer between gastrocnemius and soleus scars. US diagnostics is superior in the gastrocnemius distal tendon tears diagnostics with its ability to measure the strumps retraction which in massive/total tears may vary from 10 to 30mm as well as in tendon healing observation after a reconstructive surgery.

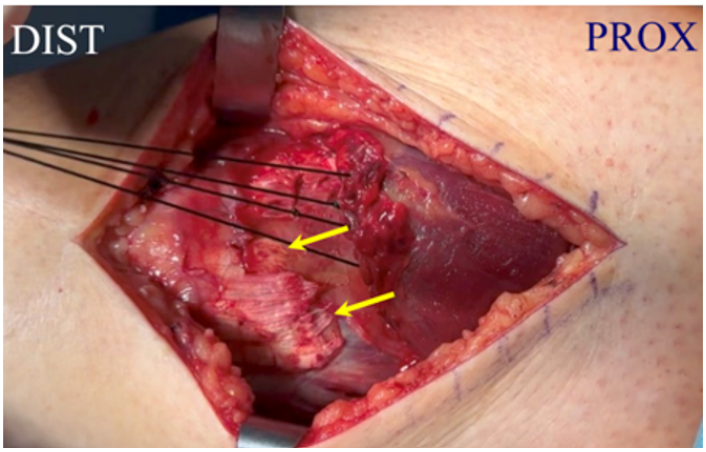


Figure 7: Intraoperative image of a complete medial gastrocnemius distal tendon tear with retraction of the stumps by 20mm. The tear is located where the tendon runs - on the ventral side of the distal end of the muscle – that's where the tendon is and where the sutures are hooked. From the posterior intraoperative look it seems that the tendon is ripped off the muscle belly. Multiple pulling Krakow sutures were applied on the tendon on the anterior side of the belly just above its distal margin and on the distal tendon stump (yellow arrows).

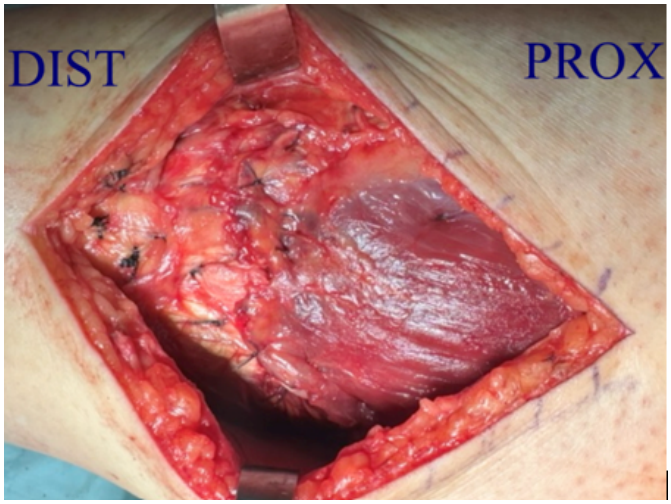


Figure 8: Patient from fig 7. Final stage of the gastrocnemius tendon reconstruction. Pulling sutures were supported with multiple adaptive ones on the belly to stabilize the whole structure with the normal preinjury tension of the tendinous system which is crucial for the stable reconstruction.

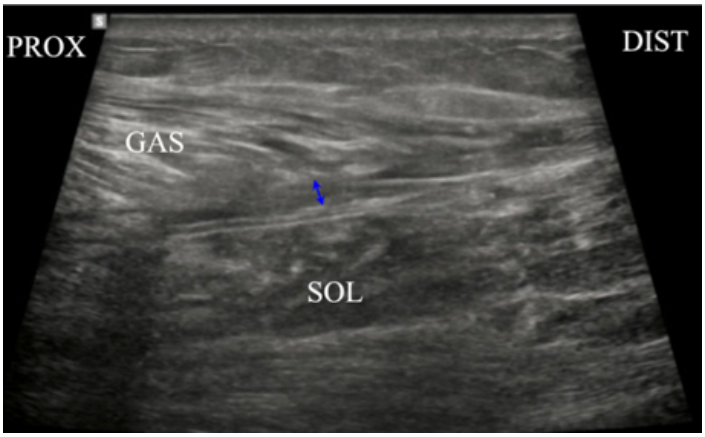


Figure 9: US of the patient from fig. 7,8. Three weeks post operative. The gastrocnemius tendon is marked by a blue double arrow. The tendon is healed enough not to show where it was torn, which is in the middle of the image. The scar has moderate to high echogenicity from the beginning because it is the thickened tendon, due to a tear.

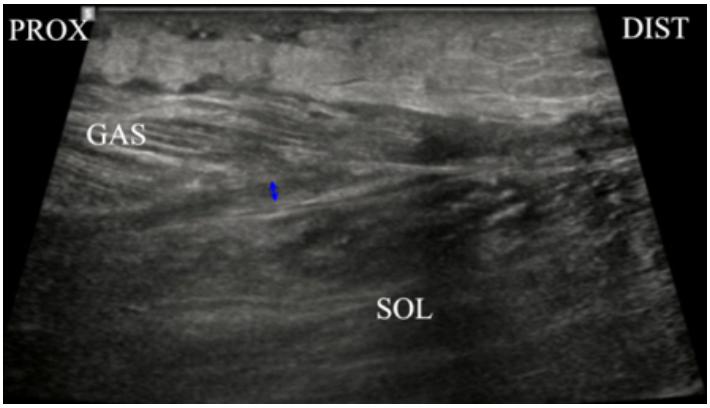


Figure 10: Patient from fig.9. Six weeks postoperative. The tendon (double blue arrow) is pretty much the same as after 3 weeks. That means the 6 weeks control study is not of much importance and should be skipped as it doesn't contribute to the treatment process decision making.

Conclusions

Operative treatment of the distal medial gastrocnemius tendon tears is a very good alternative to conservative treatment in patients with massive or total tears with substantial stump retraction. It should be seriously considered in active patients. However we must bear in mind that it is possible to obtain clinically and subjectively accepted result in such tears with conservative approach. Such approach means there will be some loss of the triceps surae muscle function. In patients with low demand of physical activity this deficit may not be subjectively noticed and the final result is accepted as satisfactory.

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