

**Image Article**

Rectus Femoris Muscle – US Anatomy and Diagnostics

Zbigniew Czyrny*

Private practice, Consultant, EnelSport, ul. Łazienkowska 3, Warsaw, Poland

***Corresponding Author:** Zbigniew Czyrny, Private practice, High-Med, ul. Kasprowicza Jana 27 lok. 2, 01-817 Warsaw, Poland; zbigniew.czyrny@wp.pl, czyrny.pl

Citation: Czyrny Z (2026) Rectus Femoris Muscle – US Anatomy and Diagnostics J Surg 11: 11661 DOI: 10.29011/2575-9760.011661

Received Date: 08 July 2026; **Accepted Date:** 15 July 2026; **Published Date:** 17 July 2026

Abstract

Summary: Aim of the study: presentation of US anatomy and pathologies of the rectus femoris muscle. Materials and methods: US examinations of the rectus femoris muscle in transverse and longitudinal sections. Examinations focus on the tendinous system of the muscle that is tendon, Endomysium and Perimysium (EP).

Results: US examination is a very precise tool for examination of the tendinous system of the muscles allowing to differentiate anatomy from pathologies presented here, that is ruptures. Figures with normal anatomy of the tendinous system of the rectus femoris muscle and all types of ruptures of the muscle seen by the author are presented in the paper.

Conclusions: US is a very precise tool for diagnostics of muscle ruptures and should be used as a primary method in the diagnostic chain of muscle pathology.

Keywords: Muscle; Tendon; US

US Anatomy of the Rectus Femoris Muscle: Proximal tendon of the rectus femoris muscle, which inserts to anterior inferior iliac spine, (Figure 2,3) has a few cm of bare stretch, than the belly tendon (semipennate) is located medially from the muscle belly (Figure 6) to mid-distally become centrally located intramuscular (pennate) tendon reaching the length of distal $\frac{3}{4}$ of the muscle belly (Figure 1,4,5,7,8). The distal tendon is mostly semipennate and is located on the posterior surface of the muscle, touching the tendon of the vastus intermedius muscle (Figure 7-11). Distally

two semipennate tendons of vastus intermedius and rectus femoris fuse (Figure 8,11,12) with tendons of vastus medialis and lateralis to form the central portion of the distal quadriceps muscle tendon inserting to the base of the patella and to it's anterior surface interweaving with patellar retinacula. Anterior patellar surface is mainly covered (and tightly bond to it) by fibers from rectus femoris (there is no anatomical name for this region so I call it the patellar tendinous coif) – covering it also becomes a part of the patellar ligament (Figure 13) interweaving wit patellar retinacula in the widest sense of their anatomy.

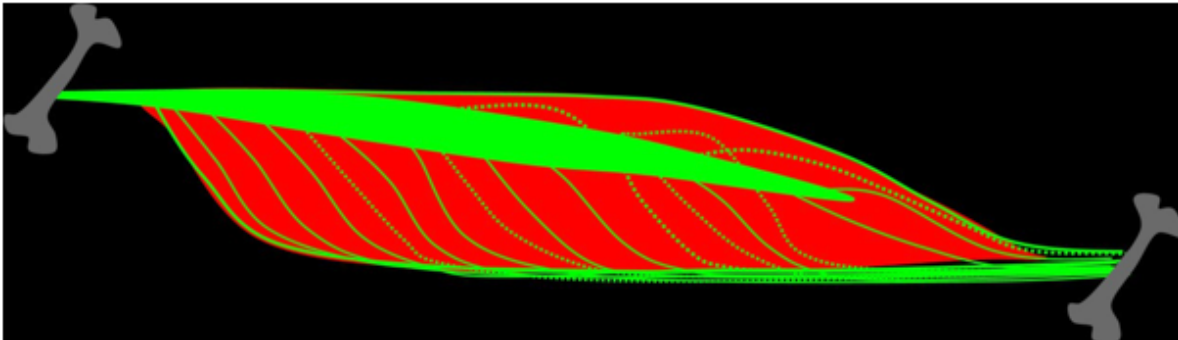


Figure 1: Scheme of the tendinous system of rectus femoris muscle. Left proximal, right distal.

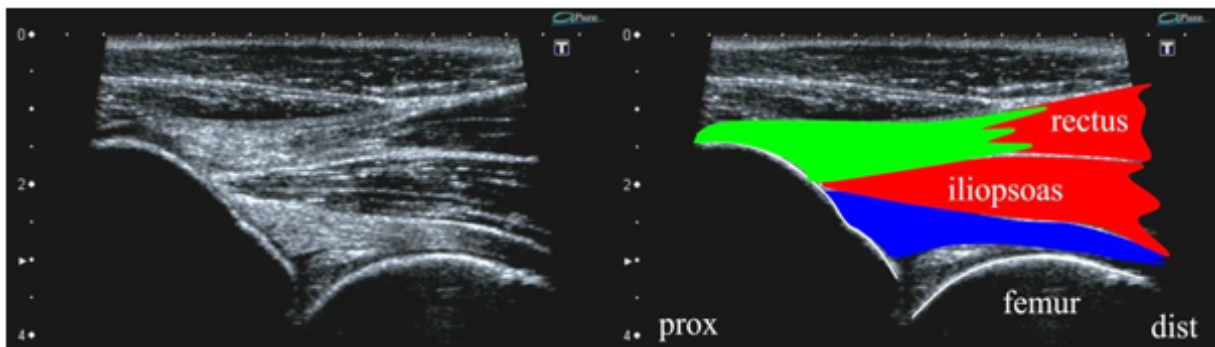


Figure 2: Proximal insertion and stretch of the rectus femoris (Green). Blue – hip joint capsule.

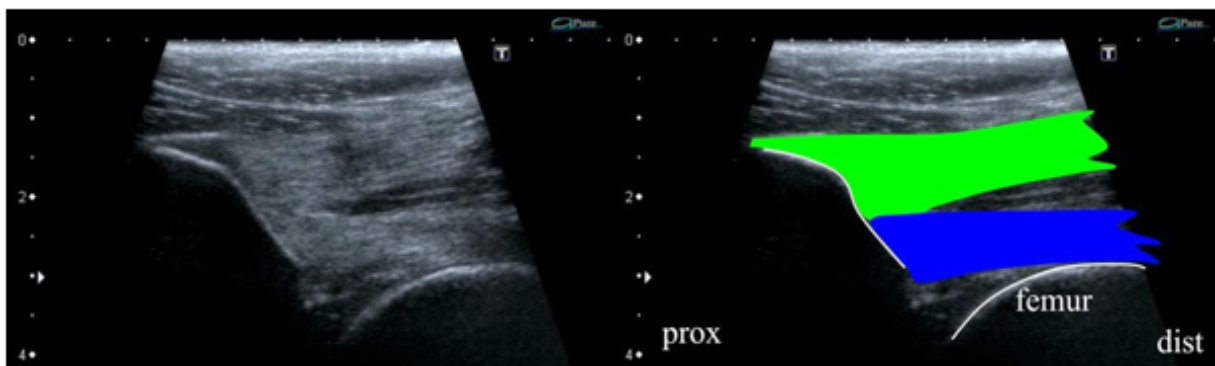


Figure 3: Proximal insertion and stretch of the rectus femoris muscle (Green) with fusion of tendinous fibers with capsular ones. Blue – hip joint capsule.

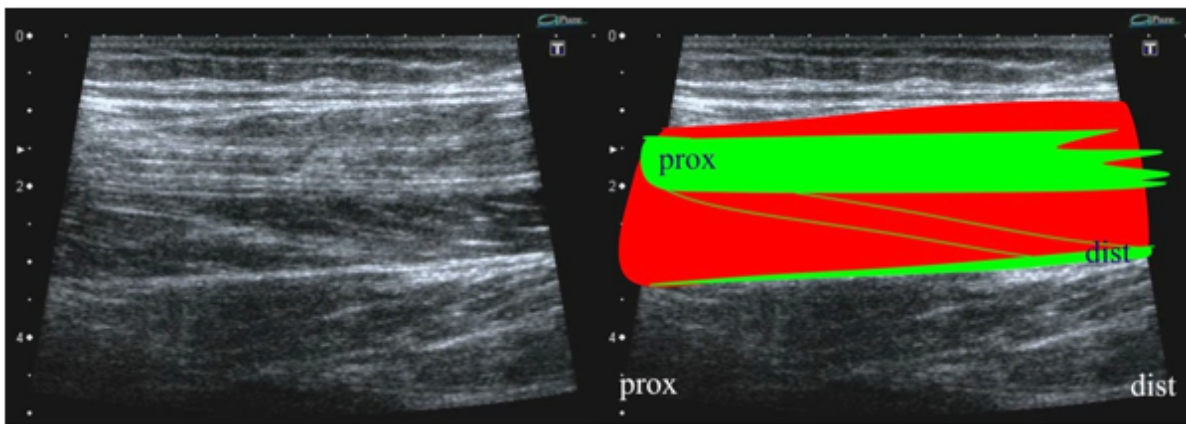


Figure 4: Proximal intramuscular stretch of the proximal rectus femoris tendon (prox) and stretch of the distal.

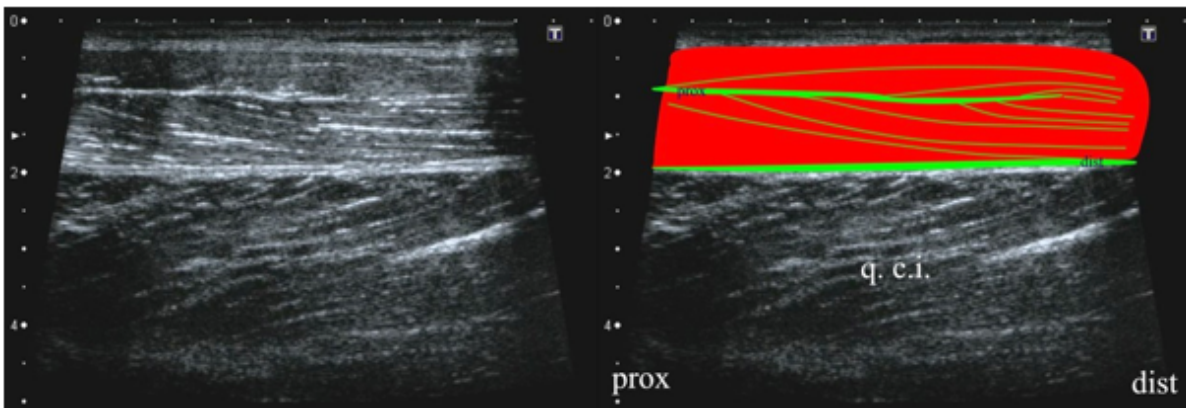


Figure 5: Distal stretch of the proximal tendon of the rectus femoris muscle (prox) and midportion of the distal tendon (dist). Tendinous system – green.

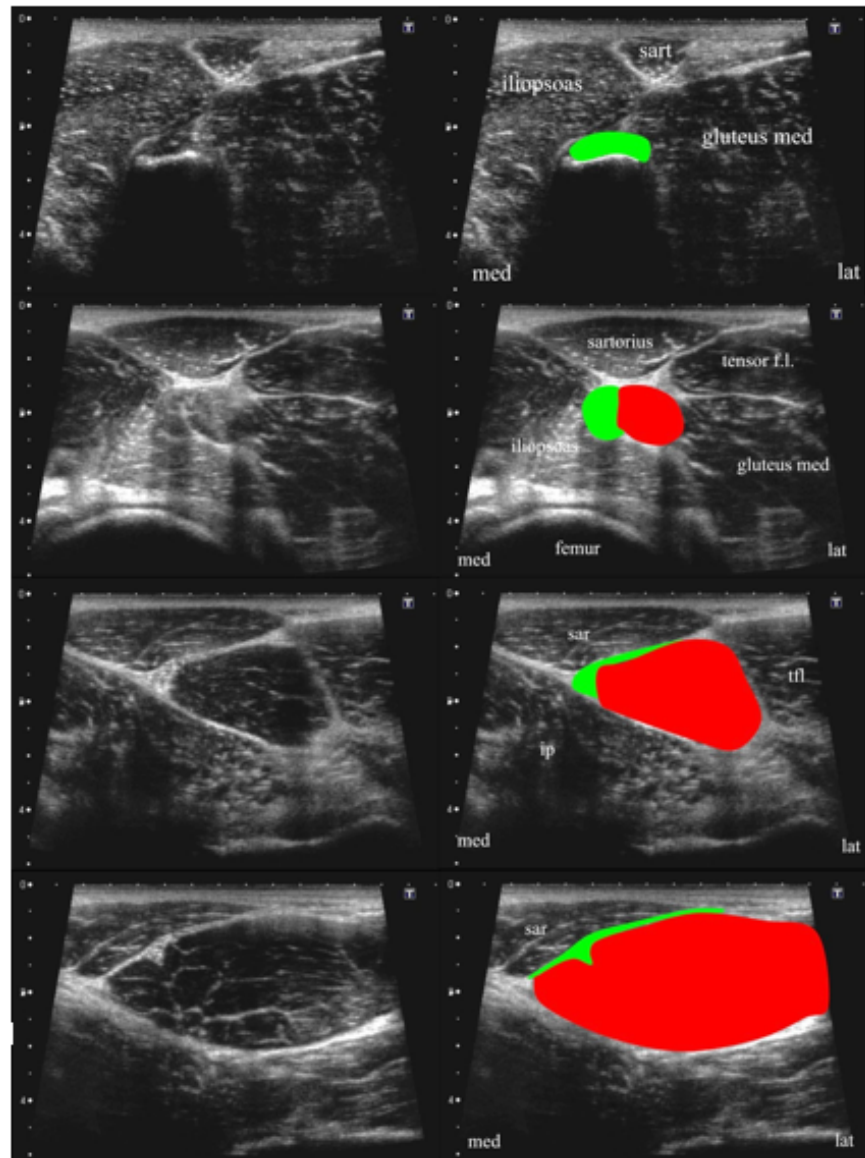


Figure 6: Transverse sections of the left rectus femoris muscle from the insertion to the anterior inferior iliac spine to the level of the trochanter major. Red – muscle belly, green- tendon.

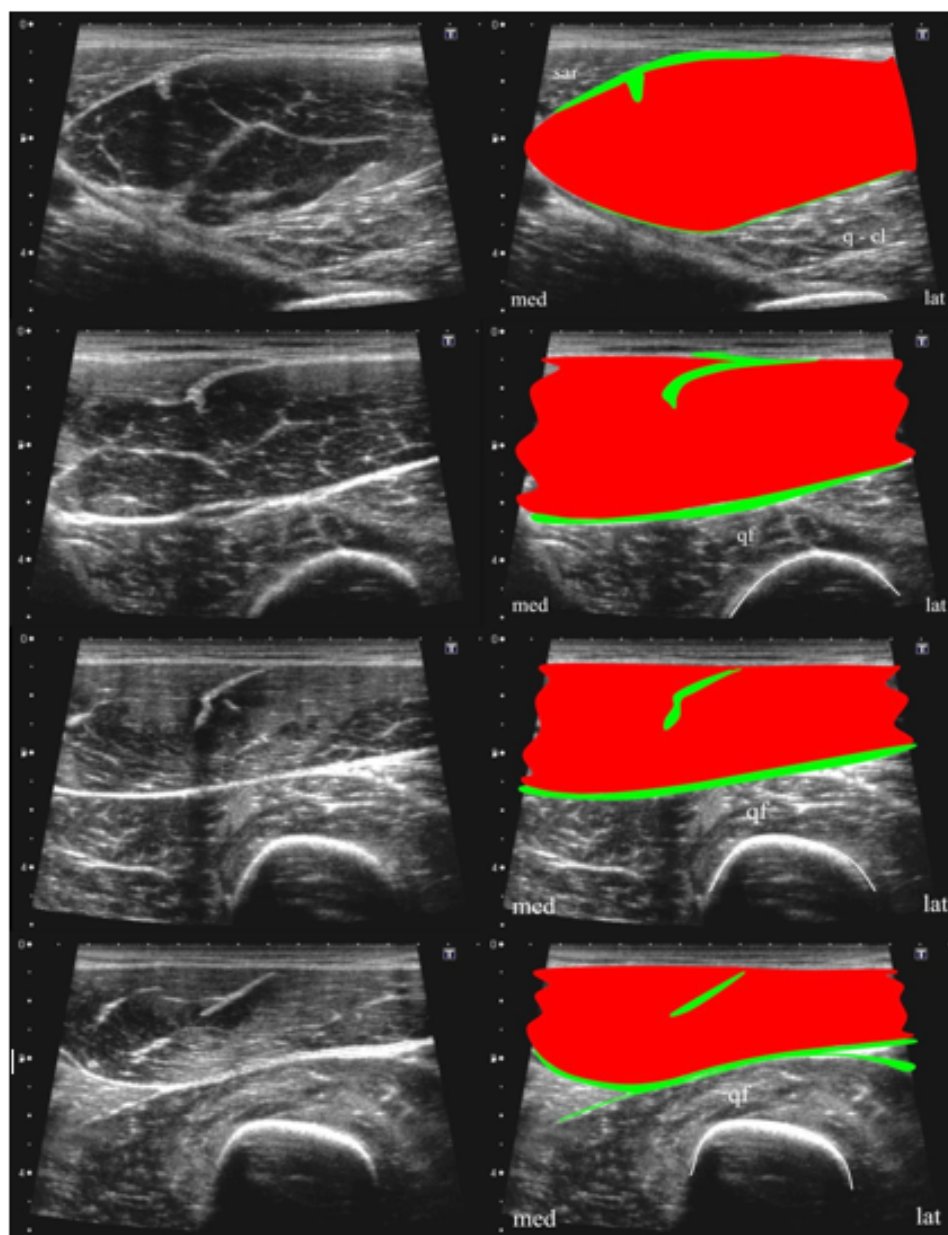
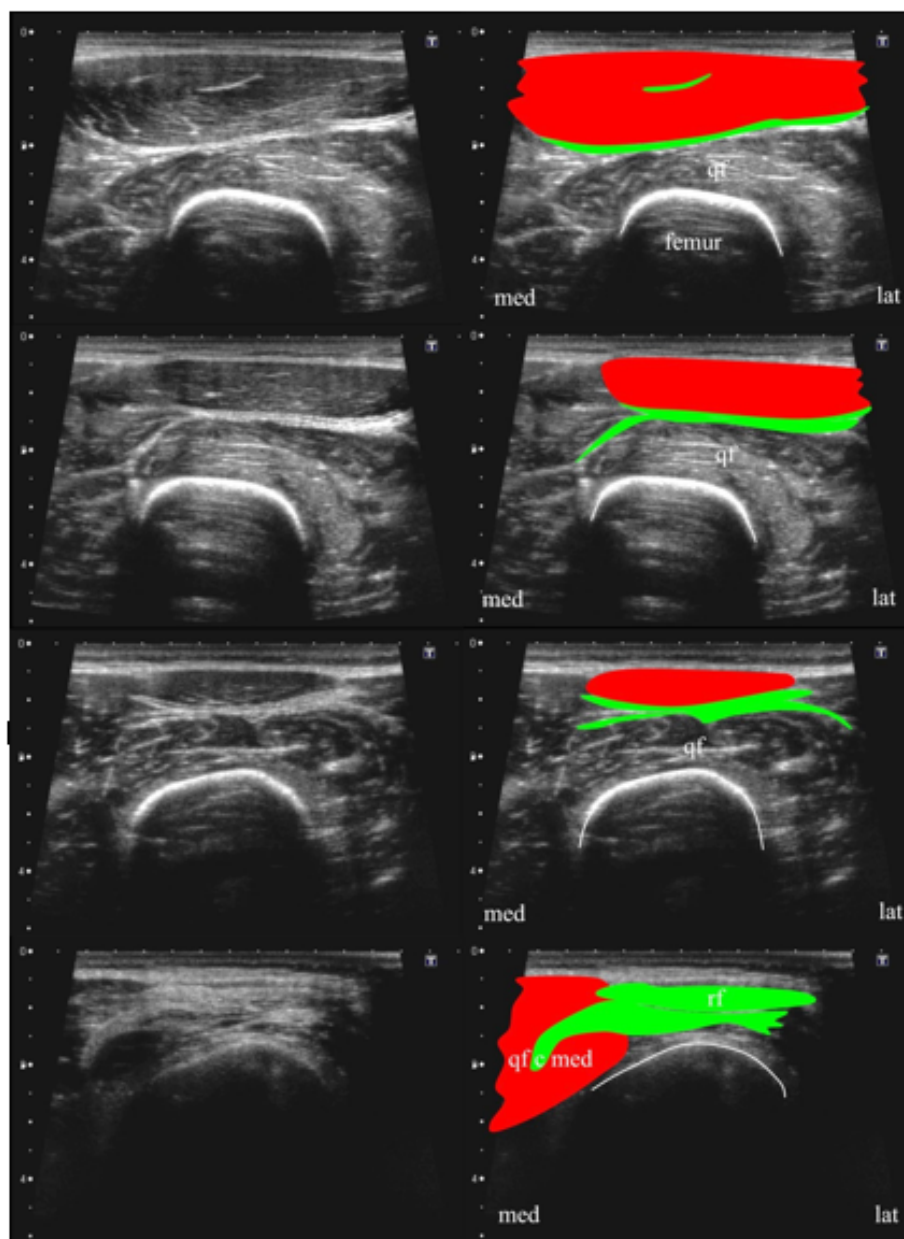


Figure 7: Patient from previous Figuer – midportion of the rectus femoris. Red – muscle belly – Green – tendons.



Ryc. **Figure 8:** Patient from previous Figuer – distal rectus femoris. Red – muscle belly, green – tendons.



Figure 9: Transverse sections of the proximal rectus femoris starting from the level distally from the insertion to the anterior inferior iliac spine to the level of proximal femoral shaft. Slightly different anatomical variant than on the three previous Figures. Red – muscle belly, green – tendons.

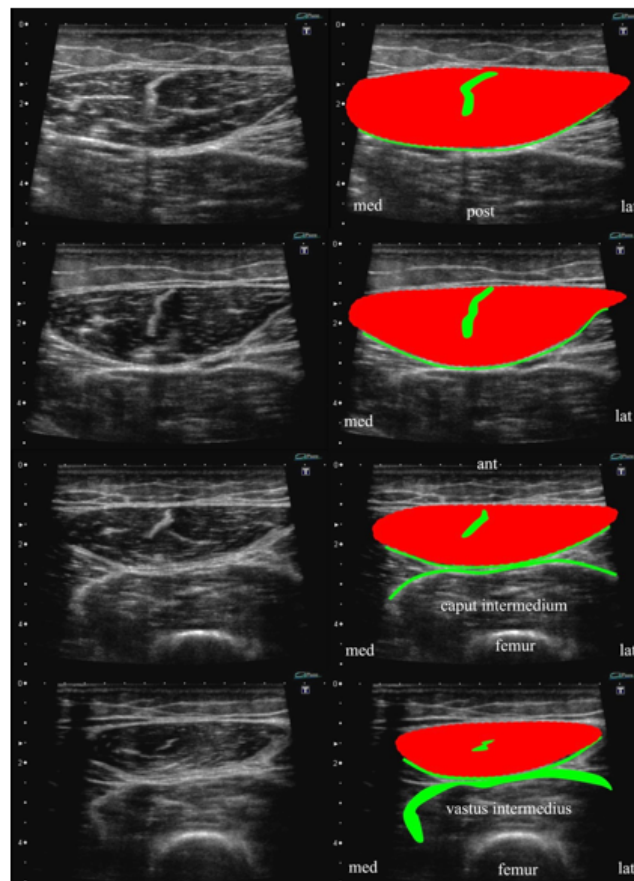


Figure 10: Patient from the previous Figuer. Transverse sections of the left rectus femoris muscle at the mid-distal level. Red-muscle belly, green –tendons.

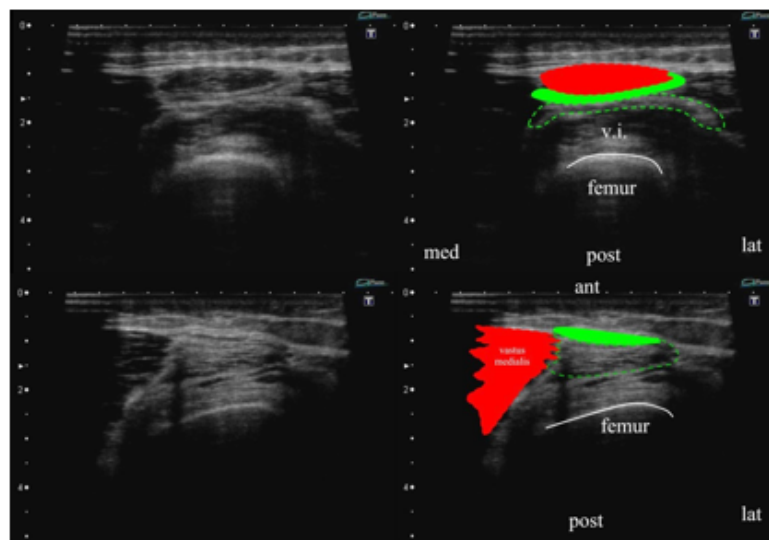


Figure 11: Patient from previous Figuer. Transverse sections of the left rectus femoris muscle at the distal

level. Red-muscle belly of the rectus femoris and vastus medialis, green – distal rectus femoris tendon . Dotted green lines indicate tendon formed by all other heads of the quadriceps muscle.

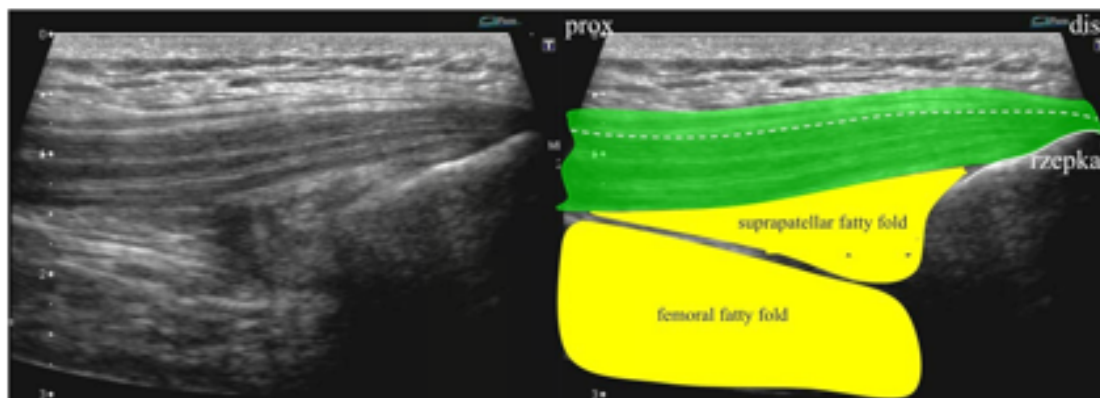


Figure12: Longitudinal section of the bare distal quadriceps femoris muscle (green).

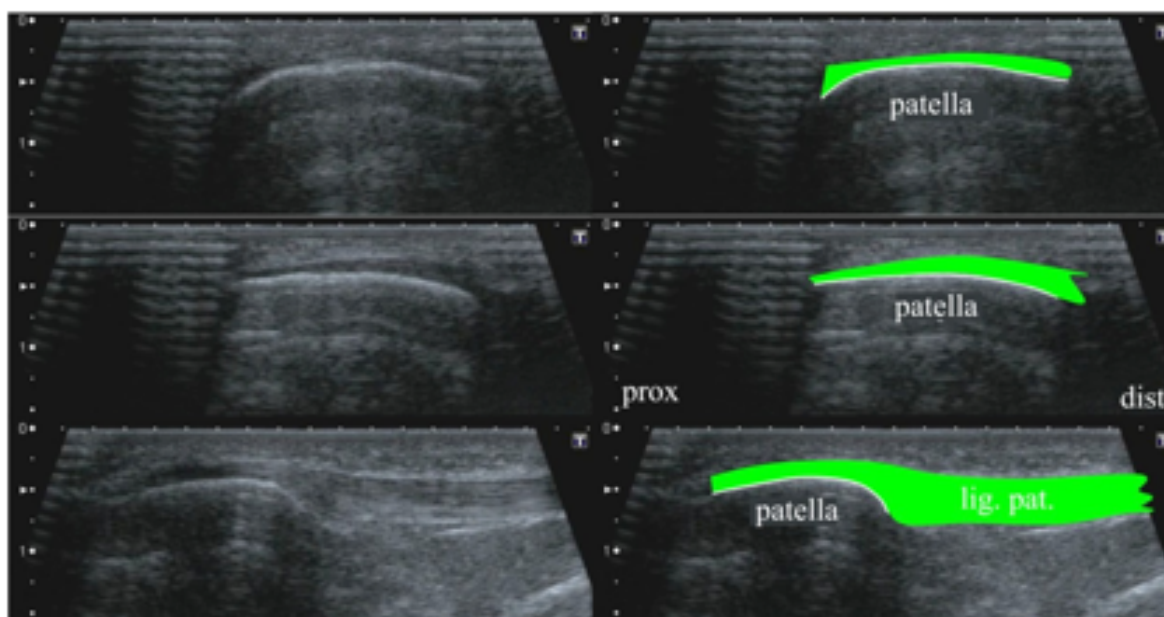


Figure 13: Tendinous/ligamentous cover (patellar tendinous coif) of the anterior patella (rzezka). Green - tendinous coif and patellar ligament.

Typical striated built of the tendon resulting from it's anatomy. Anterior layer – rectus femoris, mid layer – vastus medialis and vastus lateralis tendons, posterior layer – vastus intermedius. White dotted line indicates posterior border of the rectus femoris muscle tendon. Fałd nadrzepkowy – suprapatellar fatty fold, fałd udowy – femoral fatty fold. Rectus femoris muscle has anatomical variants of both tendons. Most spectacular is the variant of distal tendon, which has its semipennate part and a secondary pennate tendon (Figure 14,15,16). Secondary tendon when ruptures may give an image of a mass in the muscle.

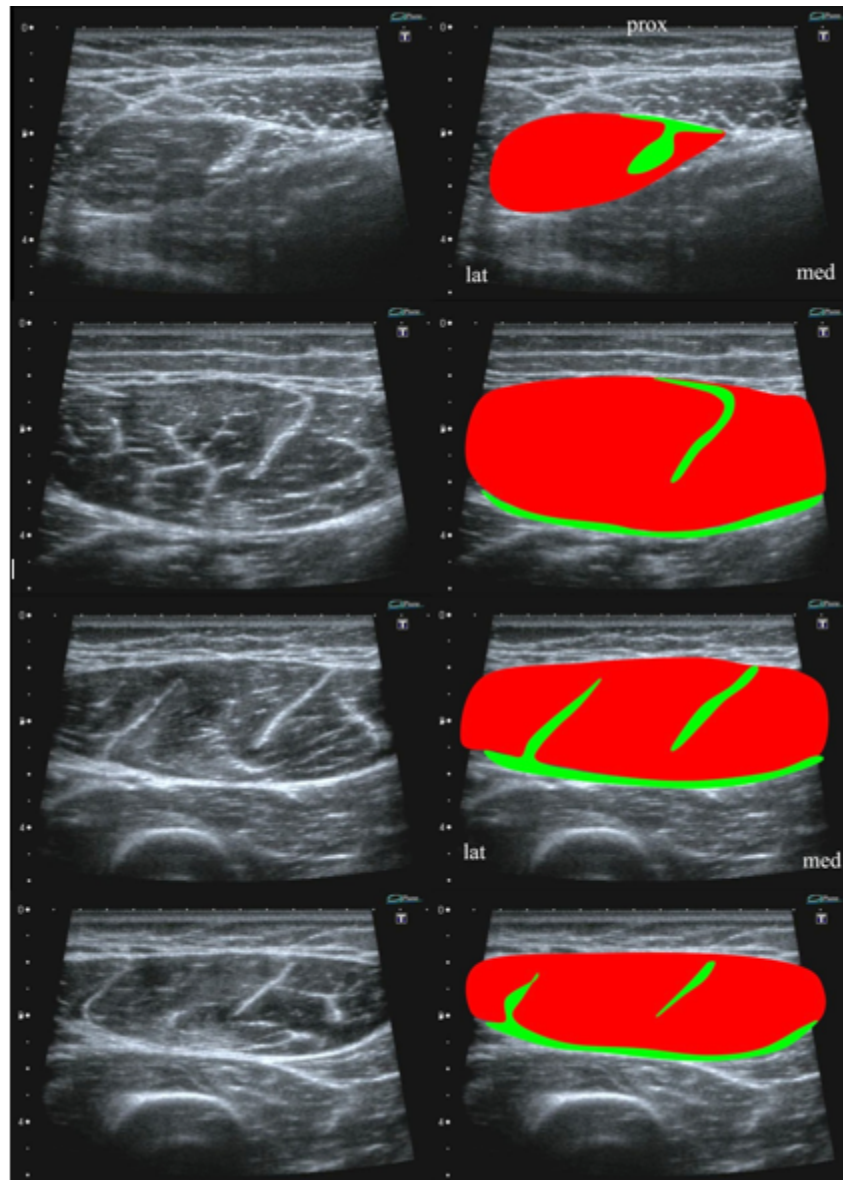


Figure 14: Transverse sections of the right rectus femoris muscle from the proximal to midportion. Red – muscle belly, green - tendons. Distal tendon which usually run on the posterior surface of the muscle here has a partly pennate part of the tendon.

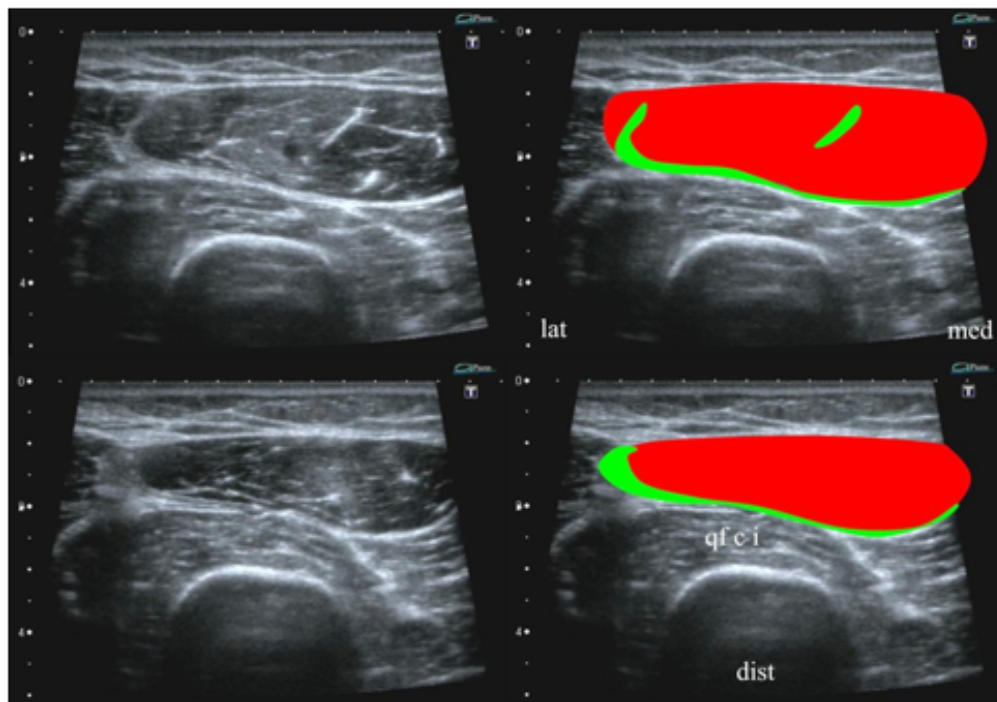


Figure 15: Patient from previous Figuer. Transverse sections of the rectus femoris muscle at the distal level.

Red – muscle belly, green – tendons. Secondary tendon finally contributes all it's fibers to the semipennate tendon.

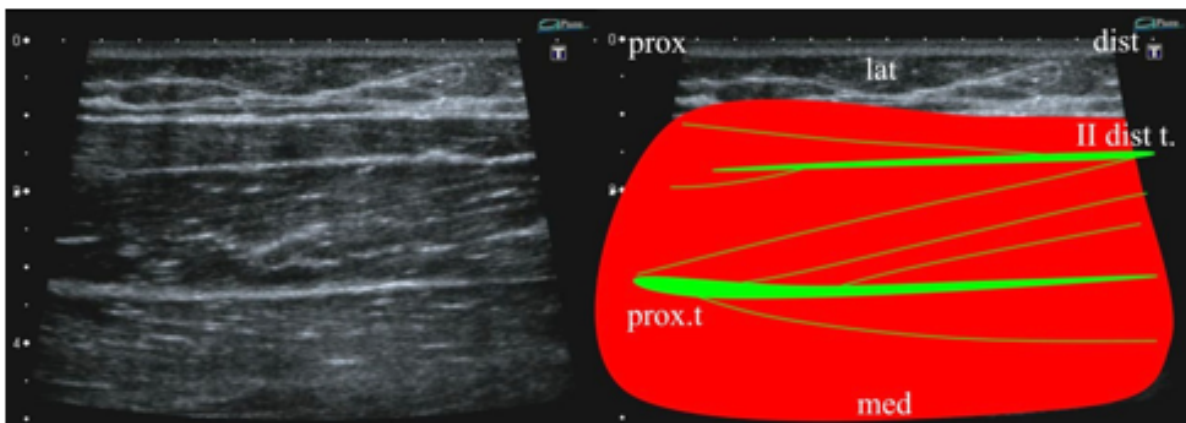


Figure 16: Coronal section of the right rectus femoris at the midportion. Transducer located on the lateral surface of the thigh. Red – muscle belly, green – tendinous system. Prox.t. – proximal tendon, II dist t – distal secondary tendon.

Diagnostics

Proximal insertion of rectus femoris is located right anteriorly from the hip joint capsule. Chronic microtears of the proximal insertion have typical image of a scar and mineral deposits/ossifications (Figure 17-19).

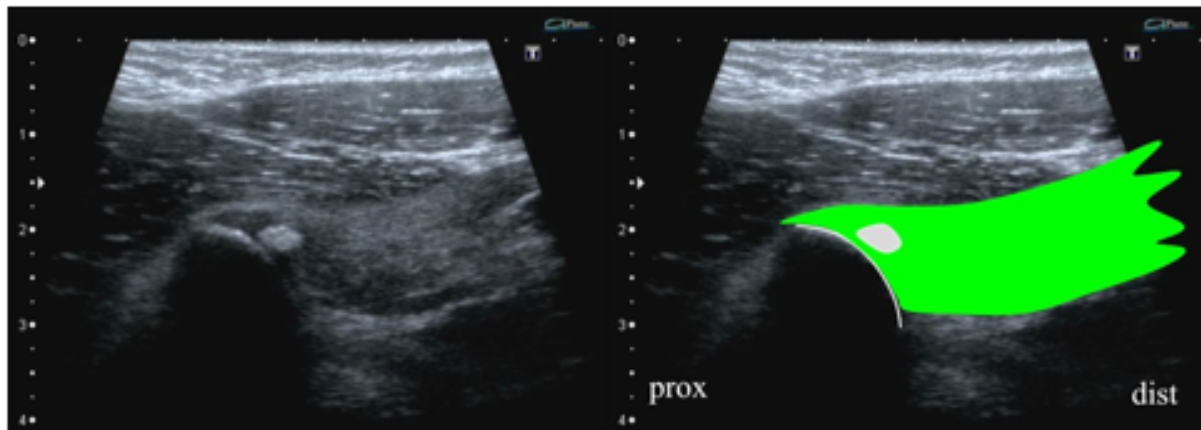


Figure 17: Longitudinal image of a slightly mineralized scar following microtears of the enthesis of the rectus femoris muscle. Green – tendon, gray – mineral deposit in the scar, white line – surface of the anterior inferior iliac spine.



Figure 18: Longitudinal image of a slightly mineralized scar (black dotted line) after microtears of the enthesis of rectus femoris muscle. Green – tendon, white – bony surface and mineral deposit in the scar.

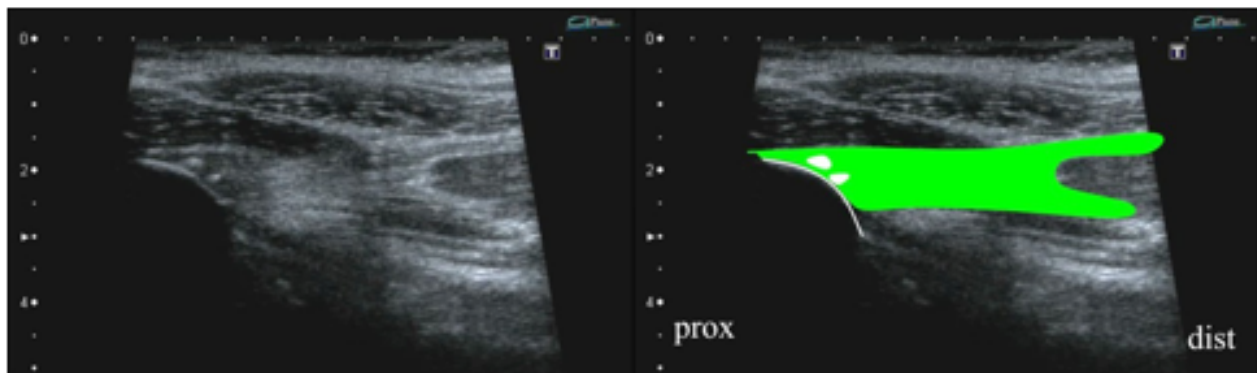


Figure 19: Longitudinal image of the partly mineralized scar (white dots) after microtears of the tendon's insertion of the rectus femoris muscle. Green – tendon, white line – surface of the anterior inferior iliac spine.

Proximal tendon of the rectus femoris tears most frequently at the belly level. It gives the effect of massive oedema of intramuscularly running belly tendon and surrounding EndomysiumPerimysium (myofibers' cover) zone. (Figure 20,21). Oedema in this kind of injury results in increased echogenicity of the image (fresh blood is bright in US) of the muscle along it's tendon (Figure 20). Dark (low echogenicity) zones in the area of oedema most frequently indicate presence of Endomysium/Perimysium (EP) tear or high concentration of hemolized blood. In time there may be that some blood from ruptured capillaries soaks into one location forming a hematoma. Those blood collections usually absorb fast. Those ruptures are usually teen cm long.

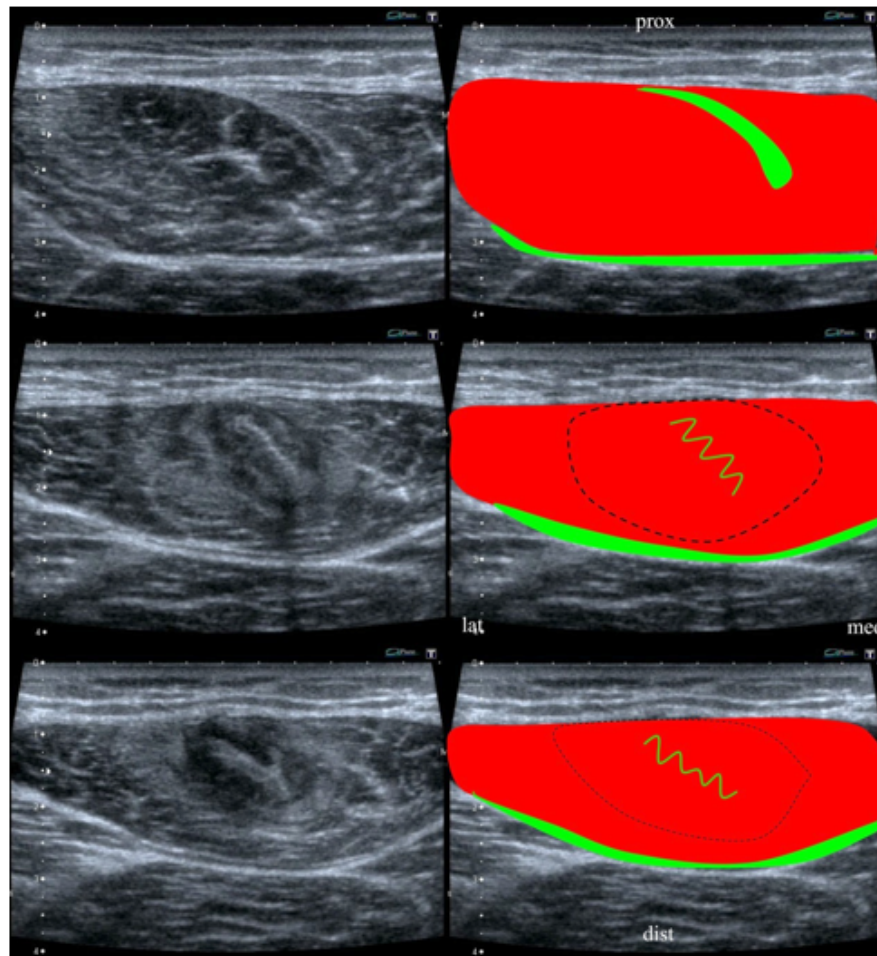


Figure 20: Transverse sections from the midportion of the muscle belly to distal level of the proximal tendon of the rectus femoris. Image of the intratendinous, partial tear of the proximal tendon at the mid-distal level of the rectus femoris with a wide zone of EP tears (dark halo around the tendon and bright halo around the dark one on the left image, zone encircled by a black line on the right image).

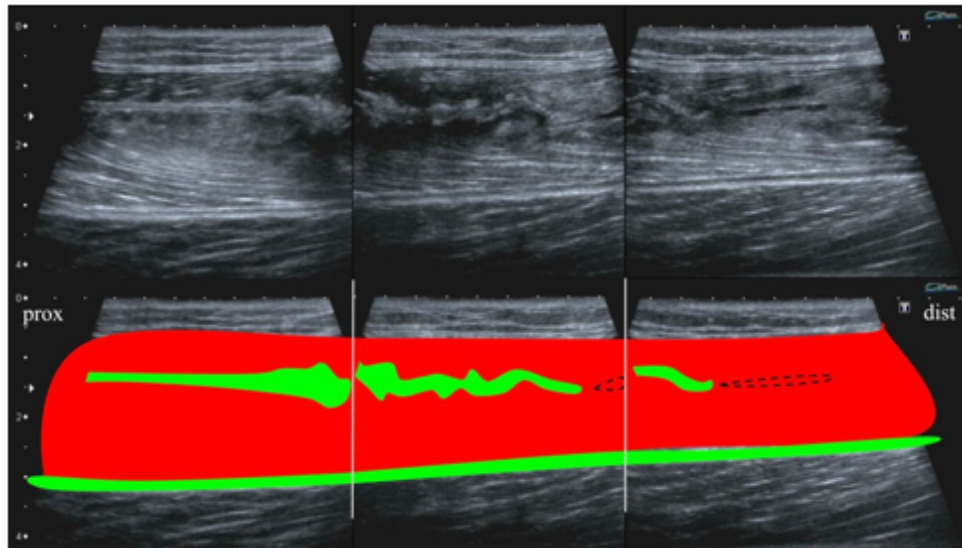


Figure 21: Longitudinal section, three subsequent images at the level distally from the previous image. Image (from left to right) of a normal proximal tendon of the rectus femoris, than midportion and distally multilevel partial and total tears of the tendon.

Injuries of the EP zone look quite different (Figure 22,23). Both tendons mostly look normal. Directly by the proximal tendon there is a hematoma indicating a tear of the Endomysium and Perimysium (EP) close to the tendon.

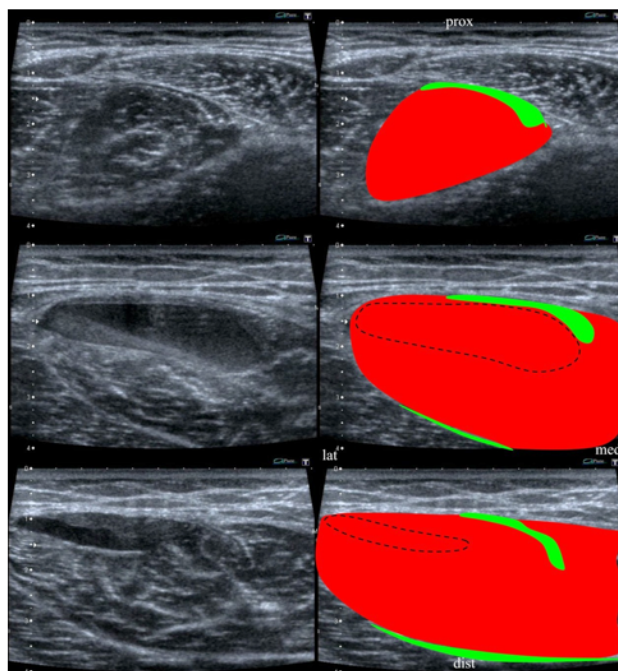


Figure 22: Transverse sections. Image of an EP tear at the proximal level of the rectus femoris. Black lines surround the hematoma zone.

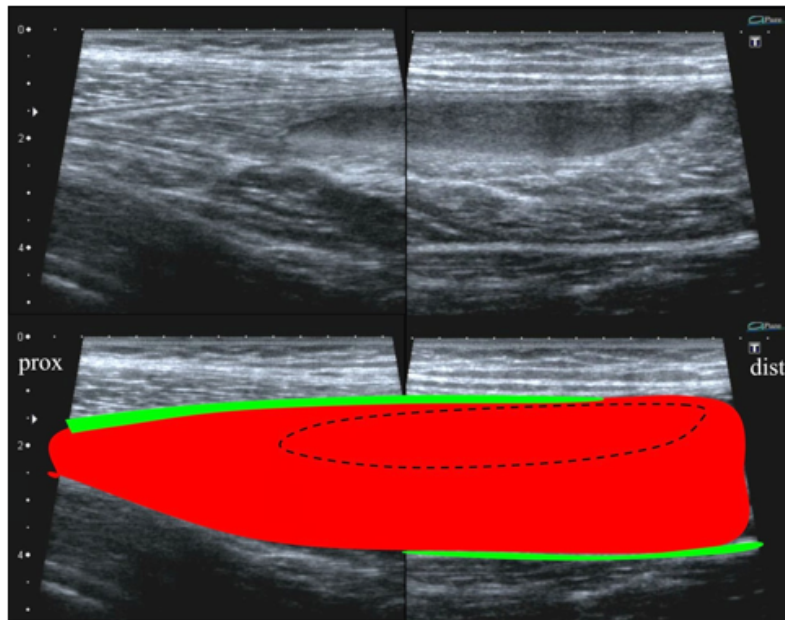


Figure 23: Longitudinal section at the level from the previous image. Image of the EP zone tear at the mid-level of the rectus femoris. Black dotted lines indicate a hematoma zone.

Yet another image is produced by an EP zone tear in the near proximity to the proximal tendon. On transverse images the tendon at the proximal level (Figure 24) looks normal as far as the structure and thickness (compare to the other side). Around the tendon there is a tear of the EP and oedema around them. The tendon gets thick and blurred structure (partial tear) at the distal level (Figure 25).

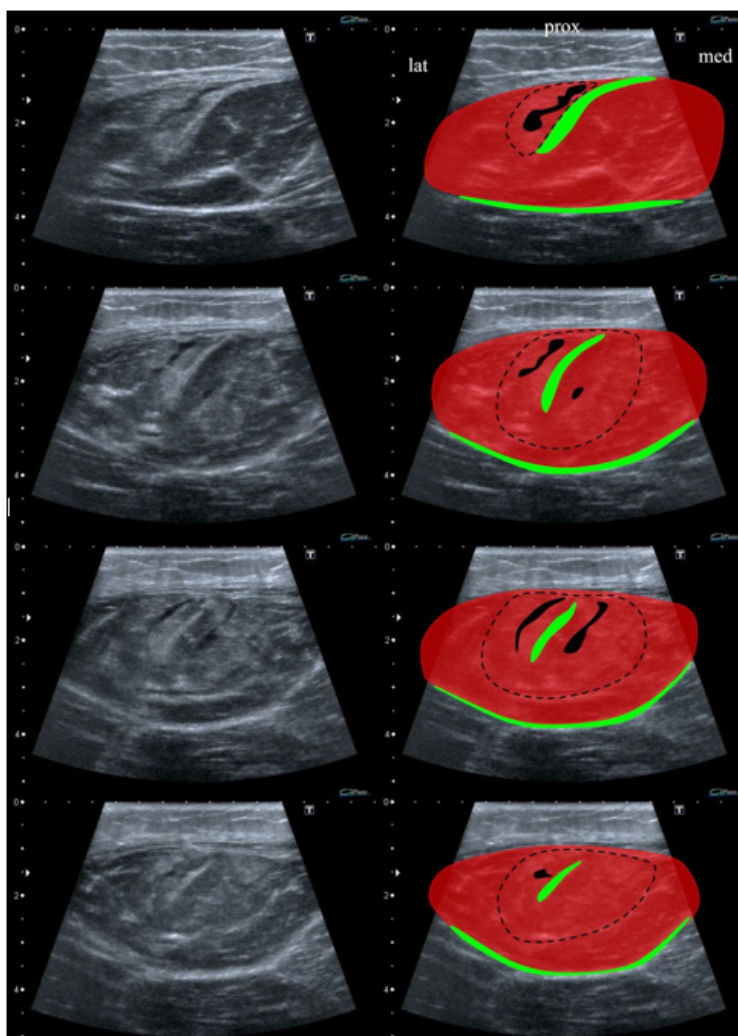


Figure 24: Transverse sections of the proximal-midportion of the rectus femoris muscle images of nearly normal proximal tendon with zones of total tears of the EP zone close to the tendon (black) and partial EP zone tears around them (black dotted lines on the right image).

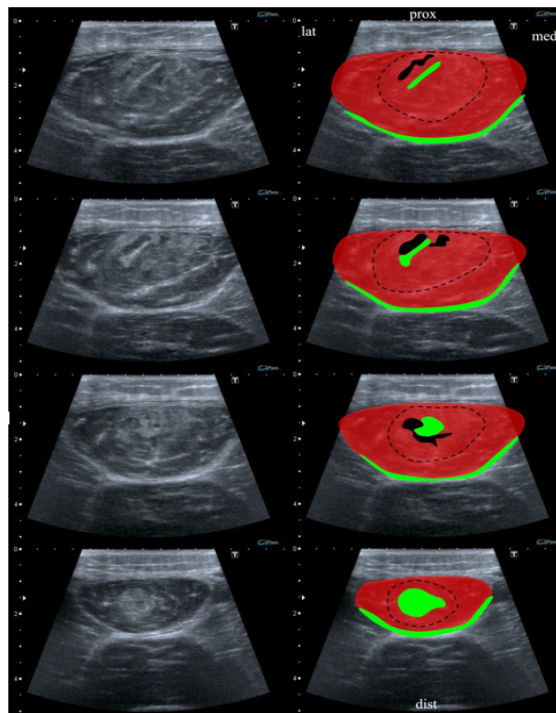


Figure 25: Patient from the previous Figuer - mid-distally. Transverse sections. Images of the partial tear of the mid-distal proximal tendon (pennate) of the rectus femoris with zones of Total EP zone tears in the near proximity of the tendon (black) as well as partial tears of the EP zone indicated by black dotted lines.

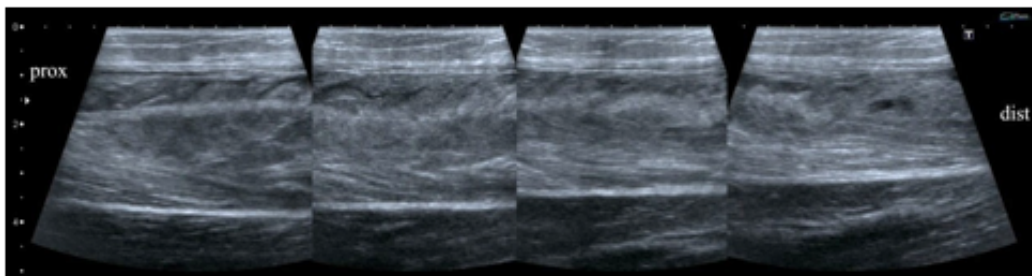


Figure 26: Longitudinal image combined of four subsequent images of the patient from two previous Figuers. Partial tears of the proximal tendon and EP zone (images 2,3,4 from the left).

Partial and then total tears which are not diagnosed and adressed property may result in vast scar formation and prematurely terminate a sports career of the patient (Figure 27,28).

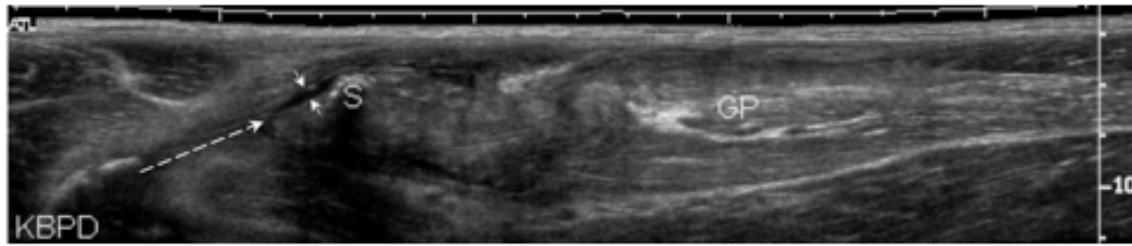


Figure 27: Longitudinal image of a chronic partial leading to total tear of the proximal tendon of the rectus femoris (GP) and a total tear of the tendon at the insertion. S – scarified stump of the tendon. Arrows – fluid at the anatomical location of the tendon, dotted line arrow – anatomical location of the proximal bare tendon, KBPD – anterior inferior iliac spine.



Figure 28: Operative photographs of the operation of suturing a proximal rectus femoris total tendon tear supported by US imaging. US defined where the structure of the proximal tendon was normal. That was at the belly level, so invisible when looking at the muscle with a bare eye. The interstitial tear was teen cm long. Two sutures were introduced at the level of a healthy tendon (small image on the left) which were proximally anchored to the anterior inferior iliac spine, what was also monitored by US (small image on the right). Author on the right, on the left – the surgeon dr Andrzej Mioduszewski.

Rectus femoris muscle undergoes tears in the EP zone other than near the tendons (Figure 29-32). These are tears which usually heal fast and well.

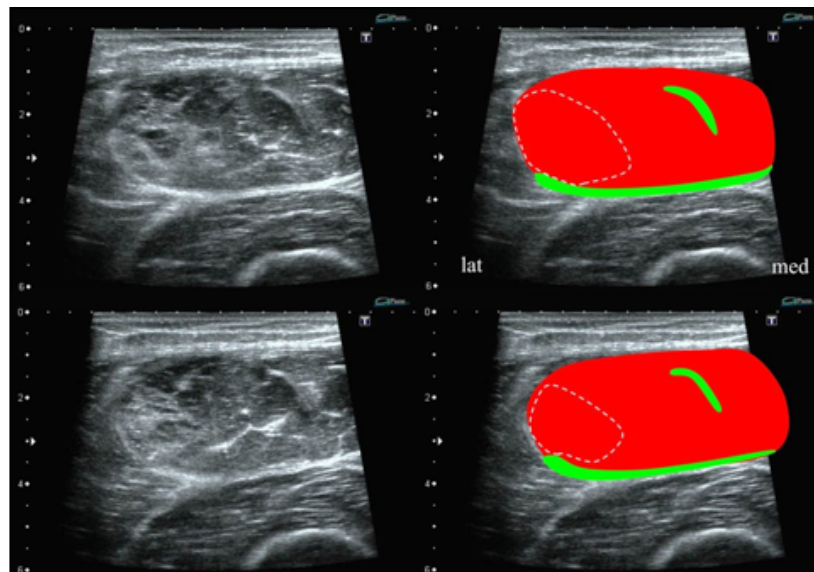


Figure 29: Transverse sections. Tear of the EP zone with a faint oedema of the distal tendon. Dotted white lines surround the hematoma and partial EP tears around it. Green – tendons. Such contusions when addressed early and properly heal fast without leaving a significant scar.

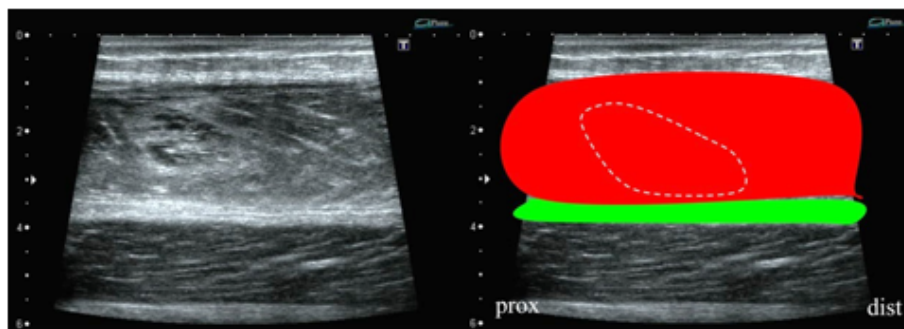


Figure 30: Patient from the previous Figure longitudinal section. Dotted white line surrounds the tear zone and oedema of surrounding fibers, green – tendons of the rectus femoris and vastus intermedius of the quadriceps muscle..

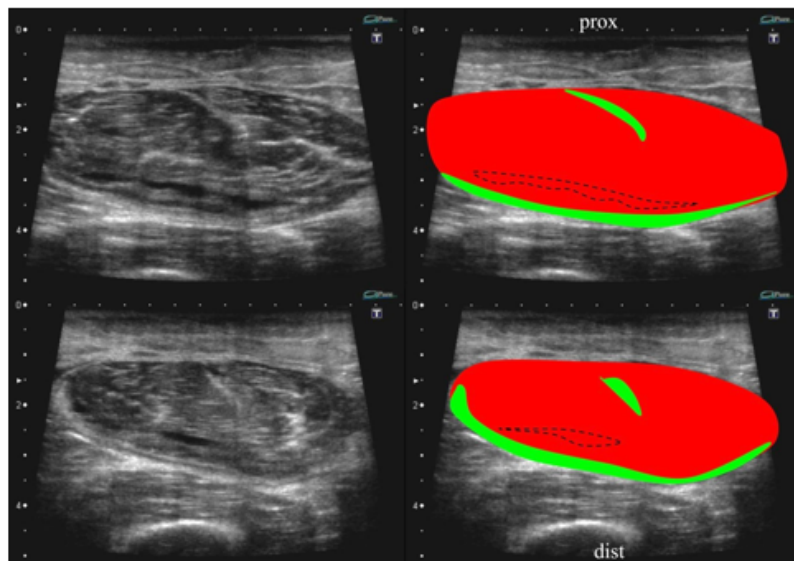


Figure 31: Transverse sections. EP zone tear (hematomas indicated by black dotted lines). Both tendons normal.

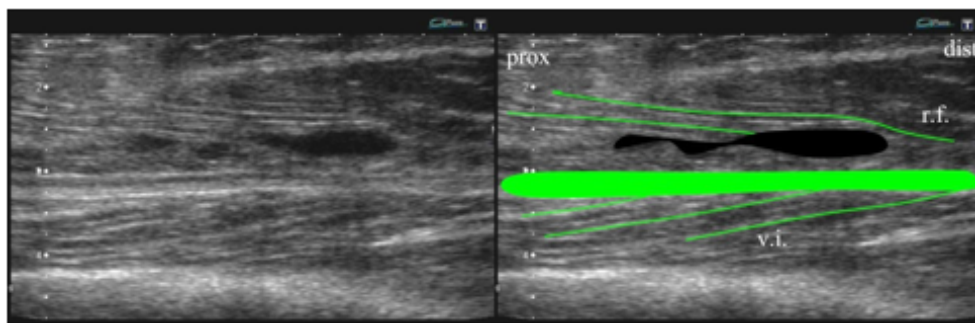


Figure 32: Patient from the previous image, longitudinal section.

Total tear of the proximal tendon of the rectus femoris muscle presents as thickened, wavy tendon with zones of no continuity (Figure 33,34)

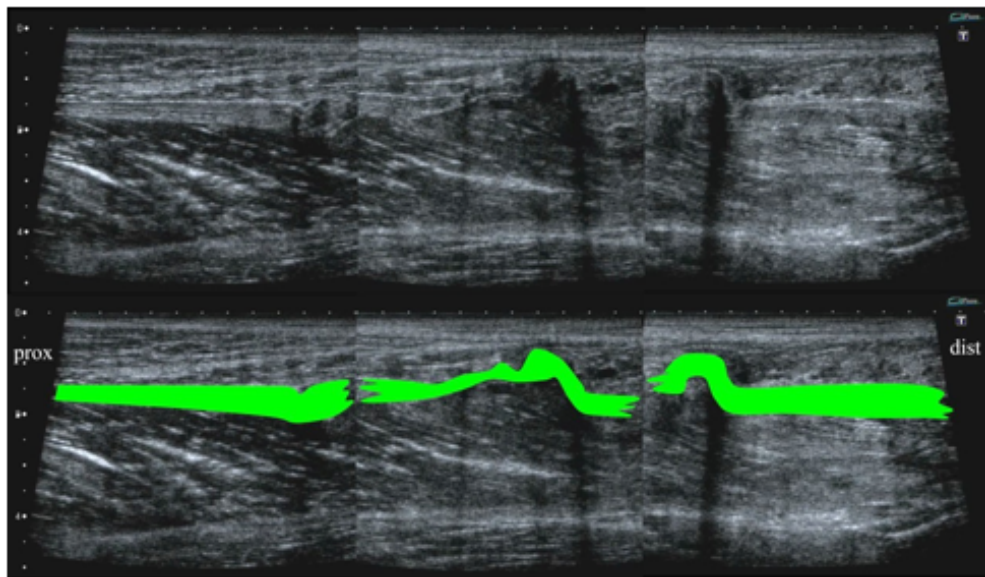


Figure 33: Image of a total and partial tears of the proximal tendon of the rectus femoris muscle at the belly level. The tendon at the second and third image from the left bends like a siphon. Image made of three overlapping ones.

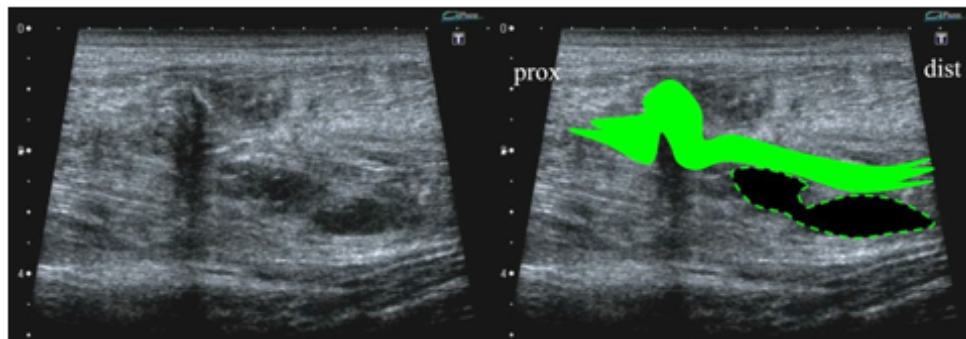


Figure 34: In the proximity of the siphon-like bending of the proximal tendon (green) there is a zone of EP tear (black zone surrounded by a green dotted line) between proximal and distal tendon.

After a tear one expects to see a scar. Scars following partial tears of tendons present as well defined structures, thickened compared to the other side. The EP zone around the tendon is usually well rebuilt/healed with restoration of original structure (Figure 35). There usually are no fluid collections and if there was such it should be drained.

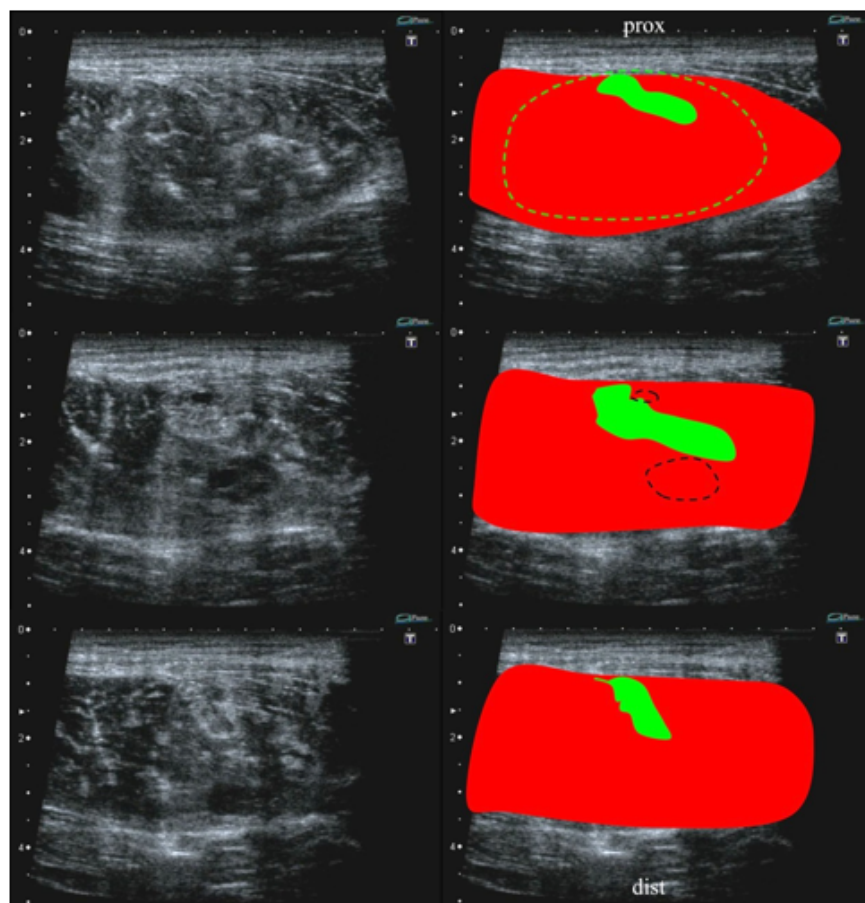


Figure 35: Transverse sections. Typical scars (thickening, blurring of structure) after a partial tear of the proximal tendon of the rectus femoris muscle. Scars are visible also around the scar of the thickened tendon.

The distal tendon of the rectus femoris is in the majority of cases semipennate and located on the posterior surface of the muscle belly occupying its all width. Tendinous fibers are located on the posterior surface of a muscle directly on the vastus intermedius distal tendon. There is no blood extravasation in minor injuries but in partial tears with separation of a portion or all tendon there is a hematoma early after contusion which spreads between the rectus femoris and vastus intermedius. That alone indicates an important tear of the rectus femoris distal tendon (haven't seen a tear of the vastus intermedius tendon). If that moment is missed and hematoma not drained it may lead to a massive scar formation reinforcing a distal tendon and lead to contraction. Therefore early diagnostics and draining of hematomas even if repeated if needed. Massive tears of this tendon lead to contraction of the muscle above the tear level which results in it's rounding. Operative treatment should be considered in such cases especially in patients sport active. Even in cases of total tears of the distal tendon the patient may arrive at the examination after the hematoma is absorbed (Figure 36-39).

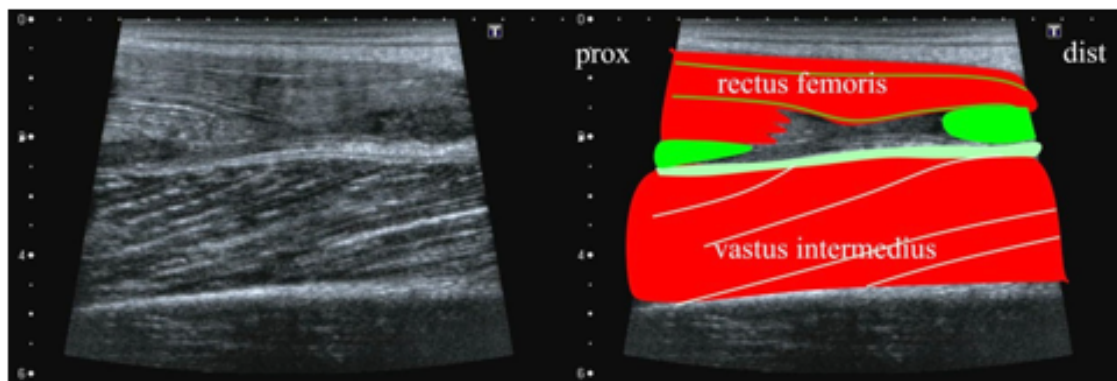


Figure 36: Longitudinal image of a total tear of the distal tendon of the rectus femoris muscle at the distal part of the muscle belly. Green – stumps and EP fibers. Bright green – distal tendon of the vastus intermedius.

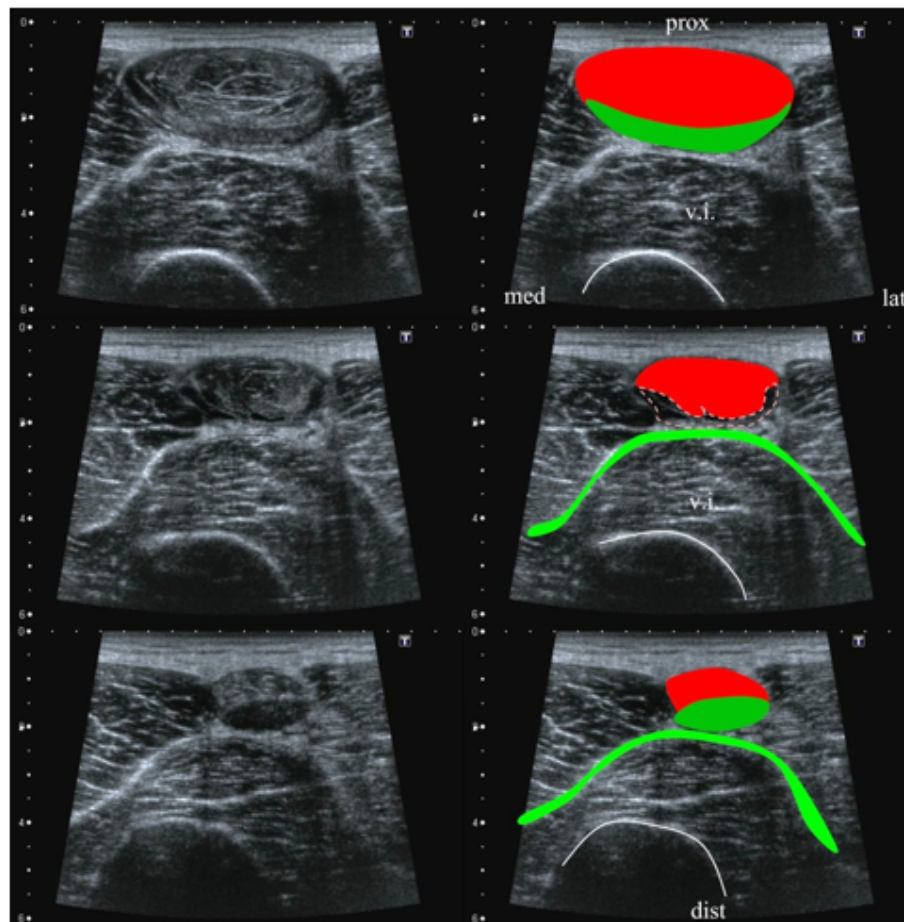


Figure 37: Transverse sections of a patient from previous Figure. Image of a fresh total tear of the distal tendon of the rectus femoris muscle at the level of the proximal stump (upper image), rest of hematoma (rose dotted line on the middle image) and at the level of a distal stump (bottom image) . Dark green - stumps of the distal rectus femoris tendon. Bright green – tendon of the vastus intermedius, lateralis and medialis.

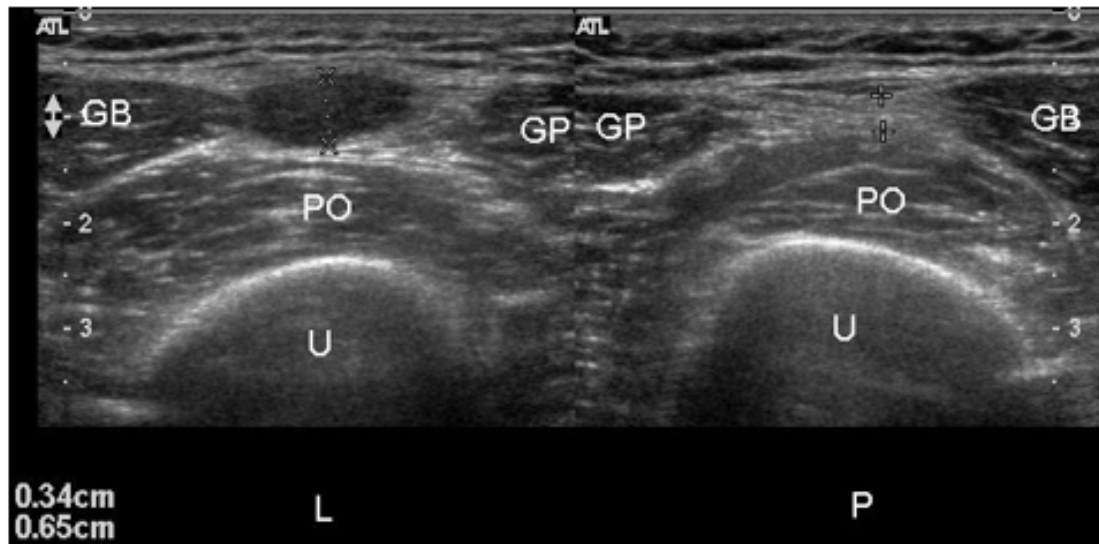


Figure 38: Partial, the whole volume tear of the distal tendon of rectus femoris muscle (L) in comparison to the healthy side (P). Scar after a tear is nearly two times thicker than the normal side and has blurred hypoechogenic structure and lowered echogenicity. U – femoral bone surface, GB – vastus lateralis, GP – vastus medialis, PO – vastus intermedius.

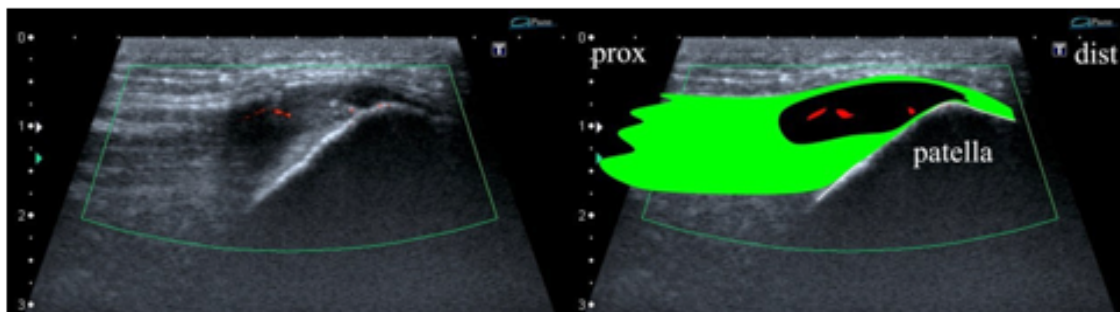


Figure 39: Partial tear of the distal tendon of quadriceps muscle at the patellar enthesis zone. The scar is located mainly within the rectus femoris fibers. Longitudinal section. A vessel within a scar indicate it's reparative/healing process. Fine mineral deposits typical of scars at the enthesis.

Finally a tear of the distal pennate part of the tendon localized exactly where the tendon appears anatomically (Figure 14,15,40,41).

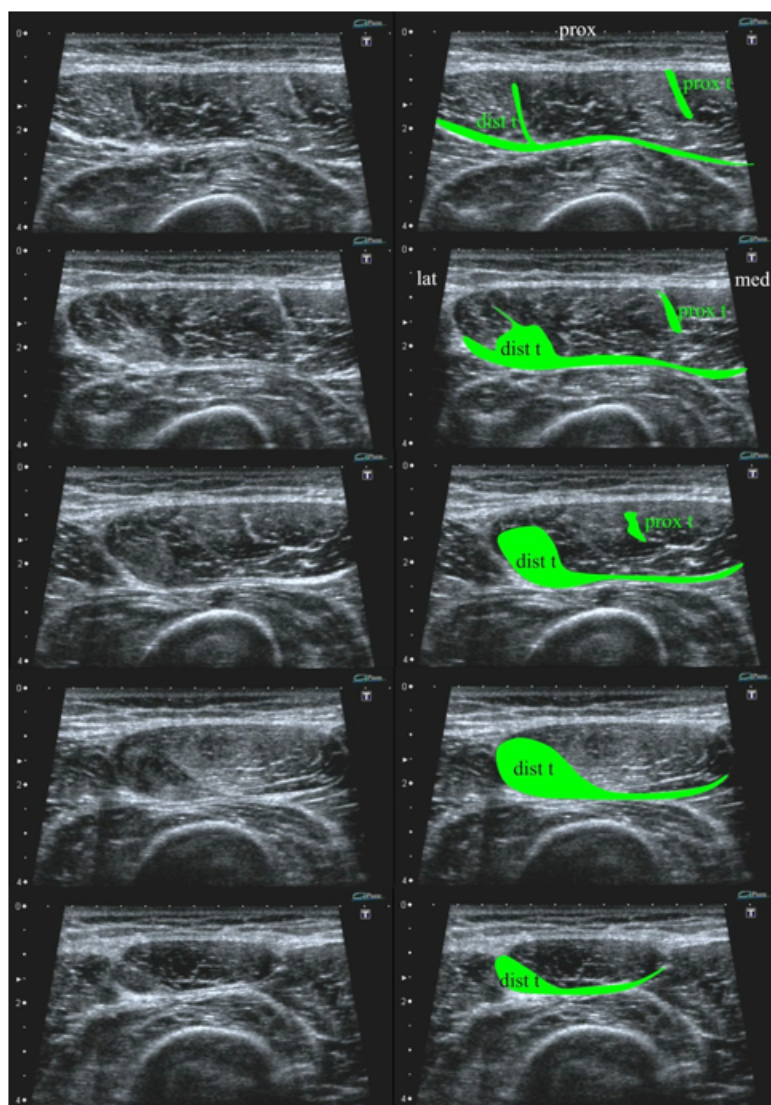


Figure 40: Transverse image of a tear of the distal secondary tendon -green pear-like thickening of the lateral distal tendon.

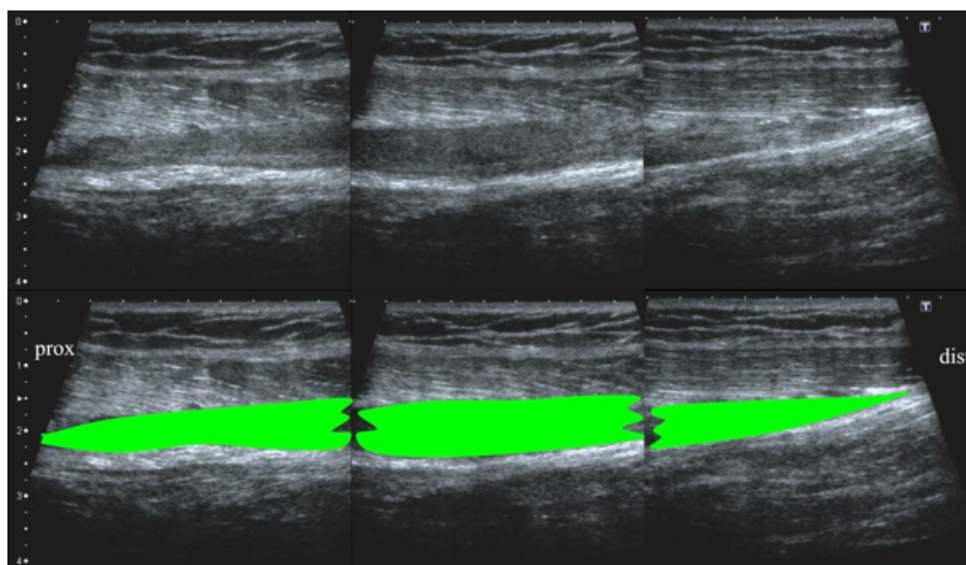


Figure 41: Longitudinal image (made of three) of the distal pennate part of the distal tendon tear (green).

Bibliography:

1. Czyrny Z (2021) On Tendinous Systems of Muscles - A Histology-US Correlation. J Surg 6: 1395. DOI: 10.29011/2575-9760.001395