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Case Report

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Magnetic Resonance and Ultrasound Imaging of Intra-Tendinous Suture Reaction: A Case Series

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Abstract

Foreign body reactions to suture material are a rare, but described in repair of superficial tendons. Though encountered by orthopedic surgeons clinically, they are rarely imaged. Imaging findings of foreign body reaction to suture material can often be confused for other pathology such as infection or malignancy, triggering extensive workup. The following cases demonstrate the imaging appearance of intra-tendinous suture reaction on MRI and ultrasound as well as describe the distinct imaging features to aid in a prompt diagnosis.

Keywords: Anchors; Foreign Body Reaction; Granulomatous Reaction; Imaging; Sutures

Introduction

Surgical sutures are categorized as either monofilamented or braided and absorbable or non-absorbable. Absorbable sutures are made to be broken down by the body, with varying timelines of degradation based on the suture composition. The majority of absorbable sutures are now made from synthetic polymer fibers replacing catgut sutures processed from collagen of sheep's intestine, silk or hair. Non-absorbable sutures are either made of natural silk or synthetic fibers such as nylon, polyester or polypropylene. Larger gauge and braided sutures are potentially more reactive than smaller gauge and monofilamented sutures. Synthetic sutures generally elicit less reactivity compared to natural sutures. Sutures used in tendon repair are required to withstand higher tensile forces and are therefore predominantly braided in composition and non-absorbable. Orthopedic suture material may have additional synthetic coating to add malleability for ease of use [1,2]. Common materials used for coating include silicone, polybutylate, and cyanoacrylate [1]. Non-absorbable sutures are not metabolized by the body and will stay indefinitely or until the sutures can be removed and hence, are more reactive [3].

Foreign body reaction to suture material is a rare but clinically recognized complication of orthopedic tendon repair. Suture reaction is considered a delayed reaction of which there are two types: allergic and foreign body reactions. Allergic reactions are a rare, delayed, hypersensitivity type reaction usually localized in presentation. Surgical gut suture is contraindicated in patients with collagen and chromium allergies. Certain types of synthetic, coated suture are contraindicated in patients with allergy to triclosan [4]. There is no currently accepted method for pre-testing for suture allergies [5]. Placement of a single interrupted dermal suture can incite a reaction with progressive erythema and swelling and aid in diagnosis of an allergic reaction [5]. In addition to a positive skin test, histologically allergic reactions show prominent lymphocytes, few polymorphonuclear cells, and no giant cells [6].

In contrast to allergic reactions, intra-tendinous foreign body reaction to suture material is the end result of an inflammatory response in which activated macrophages adhere and form giant cells at the tissue/foreign body interface in an attempt to degrade the foreign body [6]. Histologically, foreign body reactions are characterized by giant cells and a mixture of acute and chronic inflammatory cells [1,3,7,8]. Because of the predominantly synthetic and braided composition of sutures used in orthopedic surgeries, this process may lead to the formation of encysted suture material within the tendon substance. Patients may present with a tender palpable abnormality at the site of suture reaction and in an extreme case, develop a draining sinus to the skin. Prolonged inflammation can cause a delay in healing, weakening and degeneration of the repaired tendon and the potential for rupture. Although foreign body reactions are commonly sterile on tissue

sampling, there is also a potential for superinfection.

Intra-tendinous reactions can often present a diagnostic dilemma to radiologists and orthopedists as the imaging findings may vary, and the final diagnosis can be difficult without a proper history. Clinical symptoms are not uniform, and onset may also vary in timeline from weeks to years after the initial surgery [3]. For this reason, foreign body reactions should always be considered for new findings near a site of tendon repair. The following cases demonstrate the range of imaging findings due to intra-tendinous suture reactions.

Case Reports

Case 1

A 34-year-old man presented with an erythematous skin lesion anterior to the patella which occasionally drained bloody and serous fluid (Figure 1).

Figure 1: Clinical image of the left knee demonstrating an erythematous skin lesion anterior to the patella embedded within the anterior, midline, surgical scar which would intermittently drain serous material.

Past surgical history was significant for traumatic patellar fracture 28 months prior. Patient also underwent a patellar tendon repair with #5 and #2 braided, ultra-high molecular weight polyethylene suture anchors (FiberWire, Athrex, Naples FL) 26 months prior due to traumatic patellar tendon rupture. Surgical consultation was sought for the draining sinus. Imaging was not obtained. Operative, superficial debridement was performed with removal of sinus tract and inciting superficial, subcutaneous suture material. No surgical pathology was submitted.

The draining sinus never resolved after surgery and MRI was performed. MRI revealed a sinus tract extending from the lateral patellar tendon suture anchor, coursing through the lateral patellar cortex and proximal patellar tendon, extending into the anterior pre-patellar subcutaneous tissue and skin (Figures 2,3).

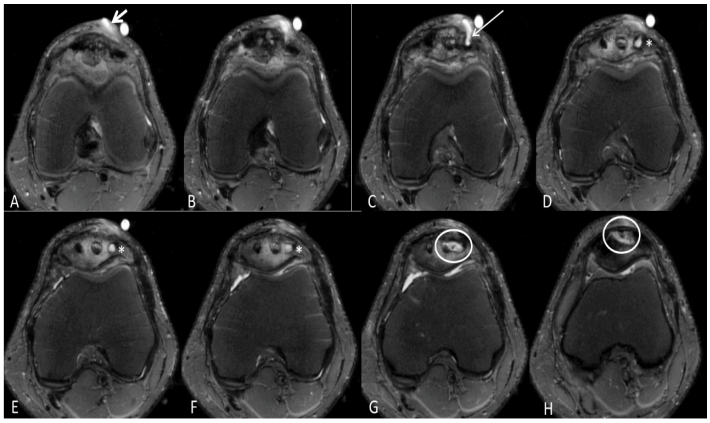

Figure 2: Axial short tau inversion recovery imaging (A-H) in a 30-year-old man with a draining sinus at the anterior left knee after patellar tendon repair more than 2 years earlier. At the anterolateral skin marker, there is a high T2 signal sinus tract which extends from the skin to the subcutaneous tissues (short arrow, A). The subcutaneous portion of the lesion extends superiorly and posteriorly (B, C) extending through the patellar cortex (long arrow, C) and is continuous which an encysted tract in the lateral patella, consistent with the patient's known suture anchor tract (asterisks D-F). This encysted lateral tract becomes continuous with the central suture anchor tract (oval, G-H), which contains encysted suture material. Note the involved suture anchor track demonstrates increased fluid signal compared to lower signal material within the uninvolved portion of the central suture anchor and the medial suture anchor.

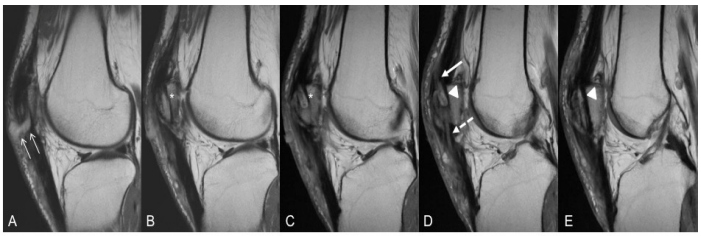

Figure 3: Sequential, sagittal intermediate weighted images (A-E) of the left knee for anterior draining sinus after patellar tendon repair. Anterior skin sinus tracks through the pre-patellar subcutaneous tissue and proximal patellar tendon (arrows, A) where it breaches the patellar cortex and is continuous with the lateral patellar tendon suture anchor tract (asterisks, B-C). As seen in Figure 2, the sinus track in the lateral suture anchor tract is contiguous with the central suture anchor tract (arrowheads, D-E). The lateral suture anchor tract has additional sinus tracts extending into the quadriceps tendon superiorly (solid arrow, D)) and the more central patellar tendon inferiorly (dashed arrow, D).

More extensive debridement and resection of the sinus tract was performed 2 months later with removal of remnant suture

material within the patellar tendon and wound. Surgical pathology was consistent with suture granuloma. Patient initially did well but a second sinus tract to the skin formed 12 months later. More extensive operative debridement was performed with exploration and debridement of the patellar tendon and patella itself, with removal of a 6-inch segment of intraosseous woven suture material containing a loop and two knots. The patient did well for an extended period of time with recurrence of the sinus tract 26 months after the initial superficial debridement and nearly 1 year since the third debridement. Extensive dissection of the patellar tendon and patella itself was again performed with removal of additional residual woven intra-osseous suture material. Dissection was partially limited to maintain integrity of the surgically repaired patellar tendon. To date, there is resolution of the previously noted sinus tract to the anterior patellar skin with the structural integrity of the surgically repaired patellar tendon maintained.

Case 2

A 52-year-old woman, status post right Achilles tendon repair 2 years prior using #2 coated, synthetic, absorbable, braided suture (Vicryl, Ethicon, Somerville, NJ) and #2 non-absorbable, braided, ethylene terephthalate suture coated with polybutylate (Ethibond, Ethicon, Somerville, NJ), presented with Achilles thickening and tenderness. On physical exam, there was noticeable thickening of the Achilles tendon, without signs of infection or erythema. Ankle radiograph was completed showing extensive longitudinal thickening of the Achilles tendon extending from the site of prior repair (Figure 4).

Figure 4: Lateral ankle radiograph in patient 2 demonstrates a diffuse thickened, painful Achilles tendon (arrows) 23 months after surgery.

Tendinosis was suspected clinically. Ultrasound was performed for further evaluation of the Achilles and for possible peri-tendinous therapeutic injection. Prior to injection, diagnostic ultrasound revealed a central Achilles, intra-tendinous cyst, surrounding linear, hyperechoic foci along the long axis of the tendon, consistent with suture material (Figure 5).

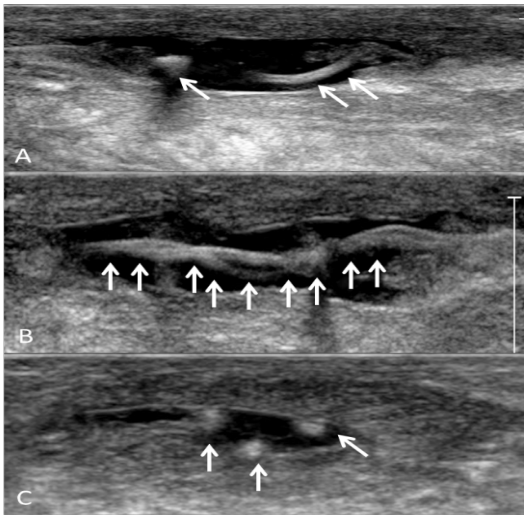

Figure 5: Longitudinal (A, B) and transverse (C) gray scale ultrasound images of the Achilles tendon in patient 2 demonstrate an irregular-walled cystic structure within the Achilles tendon which contains linear, hyperechoic, looped material, consistent with encysted, longitudinally-oriented, sutures within the tendon substance.

The cyst was percutaneously injected, under sonographic guidance, with 1.5 mL of a 50:50 mixture of 1% lidocaine and 0.25% bupivacaine, which resulted in temporary pain relief. A MRI was recommended by the interpreting radiologist for the evaluation of possible suture reaction. MRI revealed a fluid collection within the substance of the tendon with a cyst surrounding longitudinally oriented, low-signal loops of suture material (Figure 6).

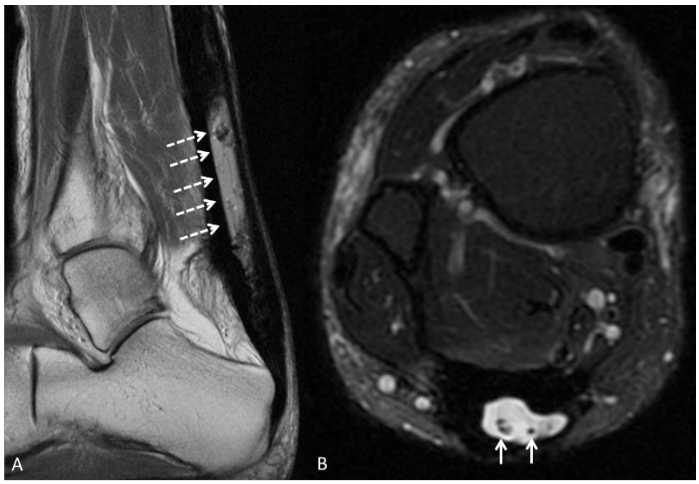

Figure 6: Sagittal intermediate weighted (A) and axial T2 weighted with fat saturation (B) images of patient 2 demonstrate a large cystic structure (dashed arrows, A) within the substance of the Achilles tendon in A. Cross-

section of this intra-tendinous cyst in B demonstrates linear, longitudinally oriented foci within the cyst compatible with sutures (arrows, B).

The patient was taken to the operating room, where upon entering the site of prior repair, 10mL of clear fluid was encountered. Suture material was found to be intact but the tendon around it appeared to have liquefied into a cyst. The sutures were easily removed, and the wound was debrided. The tendon was otherwise intact and did not require placement of additional deep sutures. The subcutaneous tissue was closed with 2-0 Vicryl (Ethicon, Somerville, NJ) and skin was closed using 3-0 nylon sutures. Post-operatively, the patient improved but did have multiple instances of Vicryl suture material spitting from the wound. Operative cultures were negative. On follow up two years later, patient continued to have tenderness over the Achilles tendon. An MRI was repeated demonstrating a decreased in size, but persistent intra-tendinous cyst with granulation tissue and fat surrounding residual suture material. A repeat ultrasound was done to look for any residual retained suture material as a cause of the patient's persistent pain (Figure 7).

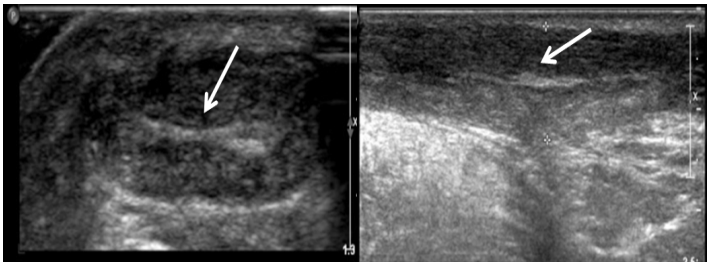

Figure 7: Ultrasound of the Achilles tendon. Thickened Achilles tendon with a longitudinally oriented focus of increased echogenicity (arrows) reflected intra-tendinous persistent suture. Resolution of encysted material surrounding the sutures when compared to previous ultrasound.

Ultrasound revealed partial resolution of the intra-tendinous cyst by with inflammatory tissue surrounding the hyperechoic residual suture material. Surgical options were discussed including more extensive debridement as well as the possibility of Achilles tendon reconstruction with allograft. Wound care consultation with a plastic surgeon was also performed. The patient continued with ongoing physical therapy and pain management.

Case 3

54-year-old male with a history of right Achilles tendon repair in 20 years prior, with unknown suture material, presented with dull pain at the Achilles insertion while training for a marathon. The patient reported no history of trauma. The patient cut down on running, with persistent pain. Over the course of the next few weeks, the patient reported a bump over the posterior ankle, which began to drain purulent material. MR evaluation demonstrated a thickened Achilles tendon, with an intra-tendinous collection which contained linear suture material that was devoid of signal, suspected to be encysted suture (Figures 7-9).

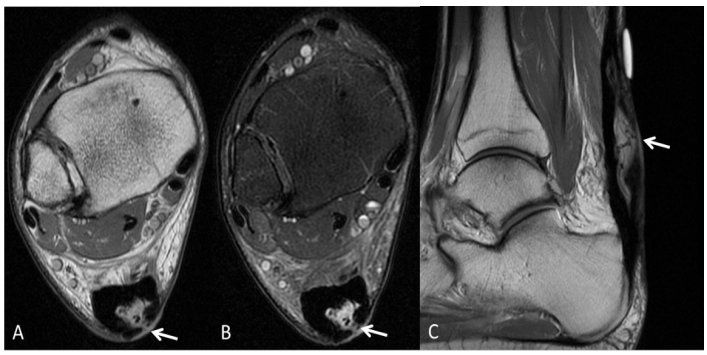

Figure 8: Axial intermediate (A, T2 weighted with fat saturation (B) and sagittal intermediate weighted images of a 52-year-old man with a draining sinus 20 year after Achilles tendon repair. Axial images (A-B) reveal a cystic structure within the Achilles tendon with a focal tendon defect postero-medially consistent with a draining sinus. Punctate foci of low attenuation within the cyst represent encysted non-absorbable sutures. Sagittal intermediate weighted image (C), again reveals an elongated cyst within the substance of the Achilles tendon with a focal rent in the tendon, compatible with the source for draining sinus. Thin, longitudinally oriented, linear foci within the tendon are consistent with encysted non-absorbable sutures from prior repair consistent with a granulomatous reaction.

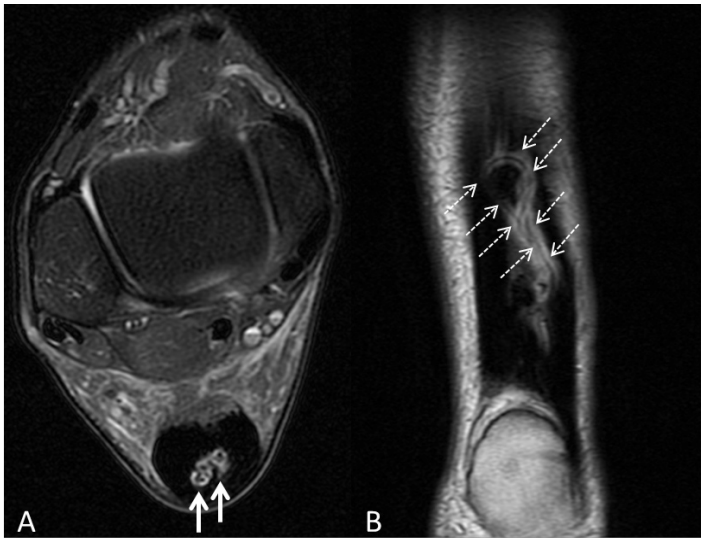

Figure 9: Axial T2 weighted fat saturation (A) and coronal intermediate (B) images in patient 3 demonstrate a markedly thickened Achilles tendon status post prior repair. Irregular walled, high fluid sensitive signal, cystic structure is present in A within the Achilles tendon substance containing punctate low signal foci compatible with encysted loops of intratendinous suture material. In B, you can see the longitudinally oriented cyst within the tendon containing looped suture material (arrows).

The patient was taken to the operating room and upon entering the site of prior repair, a large collection was identified

encysting non-absorbable sutures. The sutures were removed in their entirety and the cyst was then debrided down to healthy tissue. The remainder of the Achilles tendon was found to be intact and therefore no deep sutures were placed. The skin containing the draining sinus was sharply excised and re-approximated using 3-0 nylon sutures. Upon follow-up, the patient reported complete resolution of symptoms and returned to full activity within 6 months after surgery. Operative cultures were negative.

Discussion

It remains uncertain what characteristics of suture material predispose to the development of a suture reaction. It has been hypothesized that for non-absorbable sutures, the type of polymer, mono- or multi-filamented characteristics and the presence of additional coating may play a role in inciting a foreign body reaction [1,3,8]. Absorbable sutures have also been known to create an extensive inflammatory response, which is associated with the absorption process [1,8,9]. Superficial absorbable or non-absorbable sutures placed in the dermis may lead to suture "spitting" which presents as painless sterile granulomas or erythema with suture material being pushed to the skin surface and eliminated from the body [9,10]. On histological evaluation, these rejected sutures will reveal the presence of giant cells confirming the diagnosis of a foreign body reactions rather than acute infection [1,3,7].

In the setting of prior tendon repair, it is necessary to consider foreign body reactions as part of the differential when post-operative tendon pathology is identified. The most pertinent information is the history of prior surgery in the area of concern. Clinical history of a waxing and waning process due to repetitive acute on chronic inflammation should clue the radiologist that this process is reactive rather than malignant, especially in the absence of any active treatment. In conjunction with detailed surgical history and pathology, identification of retained suture material can therefore result in prompt diagnosis and treatment.

Multiple cases of reactions to suture material have been described in the current literature. However, the imaging findings of suture reaction have not been described or are incompletely elucidated. The above cases illustrate the similarity of imaging findings in these pathologic and surgically proven foreign body reactions to intra-tendinous suture material. Based on this small case series, patients with intra-tendinous suture reaction may present in a wide time interval after tendon repair with a wide range of symptoms including pain, decreased range of motion, intra-tendinous cyst, intra-osseous sinus tract, and draining sinus tract to the skin from the surgical site.

Common MR imaging characteristics include an intra-tendinous cyst with minimal surrounding enhancement. In the cases described herein, these simple, intra-tendinous cystic collections were sterile and yielded no bacterial growth. Often the suture inciting the reaction in question can be identified within the reactive inflammatory collection on ultrasound or MRI. As inflammatory cells attempt to engulf the suture material, the subsequent cyst that forms are high in signal on fluid sensitive imaging, providing contrast to the loops of low-signal suture within the cyst. In cases where the suture is not readily visible on imaging, granulomatous tissue can often mimic soft tissue neoplasm, confounding the diagnosis [5,11,12]. In these cases, ultrasound evaluation may be helpful in identifying the foreign body when not visible on MRI [12,13]. On ultrasound, the hypoechoic, reactive cyst surrounds hyperechoic loops of suture. Although imaging characteristics vary, this short case series demonstrates that sinus tracts associated with prior tendon repair can form as a result of intra-tendinous suture reaction.

There is a wide range of complications that may arise in the setting of suture reaction. This short case series highlights unifying imaging features of intra-tendinous suture reaction that include the development of an encysted, sterile collection surrounding the suture material within the tendon substance. Development of draining sinus tracts to the overlying skin in the setting of chronic inflammation has been previously described in the literature [14]. It is hypothesized that sinus tracts may result from shedding of the particulate coating from the suture material, which could occur due to the high tensile forces applied to the sutures in the Achilles and patellar tendons [14].

Common clinical features seen in this series include intra-tendinous or suture anchor cyst forming around sutures in cases of superficial (Achilles, patellar) tendon repair. Although theoretically, chronic inflammation from this process can weaken the adjacent tendon/ligament, potentially leading to rupture, this was not observed in our series – all patients maintained the structural integrity of their involved tendons. Patients in our series that underwent debridement and removal of the offending suture material experienced near total to total resolution of their presenting symptoms. However, some patients required multiple surgical procedures to remove all the inciting suture material, resulting in extensive surgery on an already abnormal tendon.

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