CASE REPORT

Granuloma formation associated with patellar tendon necrosis in response to Ethibond confirmed by histopathological examination

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SUMMARY

The aim of this study is to describe a case of delayed granuloma formation associated with tendon necrosis in response to Ethibond confirmed by histopathological examination and to review and discuss the related literature. A 40-year-old woman underwent a patellar tendon repair with Krakow-like #5 Ethibond sutures. Four years after the repair, she noticed progressive soreness with knee extension and swelling. An ultrasound examination revealed a proximal partial patellar tendon rupture. Based on these findings, the patient was advised to undergo surgical intervention due to a diagnosis of re-rupture. Tendinosis, fibrosis and necrosis scar tissue surrounding the previous suture were observed and excised, and samples were sent for histopathological and microbiological examination. Stripping of the patellar paratenon was performed. Surprisingly, a giant cell foreign body reaction surrounding the synthetic refringent material, as well as polymorphonuclear cells surrounding the necrotic tendon, was reported.

BACKGROUND

Ideal orthopaedic sutures must combine two proprieties: resistance to tension forces and avoidance of excessive inflammatory responses (otherwise they could cause a foreign body reaction).^{1 2} Ethibond (Ethicon, Somerville, New Jersey, USA) is a high-strength orthopaedic suture composed of an ultra-high molecular weight polyethylene (UHMWPE) coated with polybutylate that theoretically decreases the foreign body reaction.^{1 3}

Granuloma formation in response to braided silk sutures and Ticron (Tyco, Waltham, Massachusetts, USA) has previously been reported,⁴ but to our knowledge, granuloma formation with tendon necrosis in response to Ethibond has never been reported.³ The aim of this study is to describe a case of delayed granuloma formation associated with tendon necrosis in response to Ethibond confirmed by histopathological examination and to review and discuss the related literature.

CASE PRESENTATION

A 40-year-old woman was admitted to our emergency room after falling down a set of stairs. She complained of knee soreness, swelling, loss of knee extension and an altered gait pattern. She was otherwise healthy. A physical examination revealed a patellar tendon gap, and X-rays

indicated patella alta with no other remarkable findings. An ultrasound examination confirmed patellar tendon rupture and the patient agreed to open repair. Krakow-like repair with double patellar tunnel-loop attachment was performed with #5 Ethibond sutures. The patient was advised not to bear weight, and a full-time knee extension orthotic device was prescribed. After 3 weeks of knee flexion-extension, passive and active-assisted range-of-motion (ROM) was allowed, and progressive active knee extension was introduced after 6 weeks. After 12 weeks, mild quadriceps atrophy was observed; the patient had 140° of knee flexion and 0° of knee extension, and no patellar tendon gap was palpated. After 9 months of physical therapy, the quadriceps strength and volume were equal to that of the contralateral leg. Ten months postoperatively, MRI showed complete patellar tendon repair, and patellar height was restored; she had no pain and full quadriceps strength; therefore, she was discharged (figure 1).

Four years after the repair, the patient noticed progressive knee extension soreness and discomfort after participating in sports, despite not having suffered any trauma. A physical examination showed knee swelling and knee extension impairment. The patient showed no sign of infection, and her skin was intact. A preoperative blood test showed a normal blood count: $9.32 \times 10^9/L$ leucocytes and $6.94 \times 10^9/L$ neutrophils. An X-ray examination showed no patella alta or other pathological features. An ultrasound examination revealed proximal partial patellar tendon rupture with a small fluid collection surrounding the partial rupture. Based on these findings, the patient was advised to undergo surgical intervention due to a suspected diagnosis of re-rupture.

TREATMENT

Double patellar and quadricipital longitudinal incision following previous surgical wounds was performed, and tendinosis, fibrosis and necrosis scar tissue surrounding the previous suture were observed (figure 2) and excised; samples were sent for histopathological and microbiological examination. Stripping of the patellar paratenon was performed. However, we could not find any patellar or quadricipital rupture. The skin was closed in a regular manner.

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Figure 1 Midsagittal T1-weighted MRI of the knee; (A) 1 year after the first surgery, (B) 6 months after the second surgery and (C) 20 months after the second surgery. A black arrow indicates the patellar tunnel created to perform the repair. A black star denotes osteophytic changes in the patella. Please note the postsurgical changes in both the quadriceps and patellar tendons, but no evidence of rupture was observed after surgery (black triangle).

OUTCOME AND FOLLOW-UP

A knee extension orthosis was prescribed for 3 weeks; afterwards, progressive knee extension exercises were introduced. Five months postoperatively, the patient had full ROM, and she was able to swim without problems. After 20 months of follow-up, she was completely asymptomatic, and MRI findings indicated correct patellar height and no signs of re-rupture.

A microbiological examination (quadriceps and patellar) indicated no sign of infection. Additionally, a histopathological examination of the patellar tendon showed a macroscopic yellowness in the central area and peripheral whiteness that microscopically corresponded to vascularised tissue, perivascular mononuclear lymphocytes and a giant cell foreign body reaction surrounding synthetic refringent material, together with numerous of polymorphonuclear cells surrounding the necrotic tendon.

DISCUSSION

To our knowledge, this is the first report of tendon necrosis in response to Ethibond. The foreign body reaction is composed of local histiocyte and lymphocyte clusters attempting to eliminate the foreign material. When these mechanisms fail, an amplified inflammatory response is activated, and giant cells attempt to

encapsulate the foreign material. Macrophage secretion can cause necrosis, local tissue damage and inflammation.⁵ The inflammatory response activity is proportional to the cross-sectional area of the suture as well as its chemical composition; braided sutures are associated with a more vigorous inflammatory response than monofilaments.¹

We would like to highlight that we found no sign of intra-operative patellar tendon rupture (it was not a re-rupture). Instead, the remarkable findings were the macroscopic fibrotic area surrounding the previous Ethibond repair and the necrotic area that was confirmed by a histopathologist (figure 2). The patient's complaints (knee swelling, knee extension impairment and discomfort after practising sports) and complementary tests were non-specific, and we decided to perform surgery due to a doubtful suspicion of re-rupture. We found literature supporting that a granulomatous foreign body reaction can clinically manifest as tenderness, warmth, swelling and erythema.^{1 3 5} The microbiological tests in our case were always negative, and histopathological examination confirmed a granulomatous foreign body reaction with associated tendinous necrosis.³ After 20 months of follow-up, our patient is asymptomatic, with full knee ROM.

A notable finding is that the necrotic area around the suture was confirmed both macroscopically and microscopically (figure 3). Foreign body response and histiocyte secretions may result in local tissue damage and necrosis that can even simulate caseation, abscesses and soft tissue sarcoma.^{5 6} It is uncertain whether such an inflammatory response is caused by suture antigens or is a consequence of aggressive surgery.^{5 7}

Allergic hypothesis

Lymphocytes, plasmacytes, histiocytes and giant cells related to foreign body material (Ethibond) were reported after the histopathological examination. Setzen and Williams found similar cell recruitment in a study using rabbits.⁸ They found different cell recruitment in response to monofilament (histiocytes and giant cells; grade 1) than in response to Ethibond (histiocytes, giant cells, lymphocyte clusters and small plasmatic cells; grade 2).

Infectious hypothesis

Unlike a case report published by Pabari *et al*⁴ that involved granuloma formation in zone 3 after flexor digitorum reconstruction with Ticron, in which microbiological culture confirmed *Staphylococcus aureus*, microbiological examinations in our

Figure 2 Intraoperative images of the second surgery. (A) A reaction against previous Ethibond sutures was diagnosed. The surrounding yellow-like area was associated with microscopic necrosis and a foreign body reaction. (B) We obtained samples of both tendons to perform histopathological and microbiological examinations.

Figure 3 Optical microscope, 40× magnification, H&E staining. Arrows denote a giant cell foreign body reaction surrounding the synthetic sutures of the patellar tendon.

case were always negative. However, these authors thought that previous aspiration could have caused contamination of a potentially sterile granuloma. They also found histiocytes, giant cells and lymphocytes in a foreign body reaction similar to ours. They hypothesised that the number of throws per knot could have increased the amount of material, with a

Learning points

- Despite the use of coated braided sutures, such as Ethibond, in orthopaedic surgery to enhance the mechanical properties and reduce inflammatory responses, all types of sutures have a potential risk to induce an inflammatory response or even a foreign body reaction.
- The clinical manifestations of granuloma formation with tendon necrosis are non-specific and include tenderness, warmth, swelling, redness and functional impairment.
- Granulomas can also mimic abscesses and soft tissue sarcomas.
- Extensive surgical debridement, including all foreign material and associated necrosis, is the treatment of choice for this condition.
- Microbiological and histopathological examinations are mandatory.

consequent increase in the inflammatory response. Unlike the report by Kara *et al.*³ we did not find a fistulous tract during physical examination.

Other procedures associated with reported granuloma formation include shoulder surgery, breast augmentation, endoscopic bladder neck suspension, abdominal fascial closure and ovarian surgery.^{5 6 9–13}

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