HAND (2010) 5:307–312
DOI 10.1007/s11552-009-9240-5

CASE REPORTS

Inflammatory Response with Osteolysis Related to a Bioabsorbable Anchor in the Finger: a Case Report

Gregory J. Galano · Kevin N. Jiang · Robert J. Strauch · Melvin P. Rosenwasser · Peter Tang

Received: 2 August 2009 / Accepted: 14 October 2009 / Published online: 7 November 2009

Abstract Soft tissue fixation of ligaments and tendons in the hand can be achieved by the use of metal or bioabsorbable suture anchors. Advantages of bioabsorbable suture anchors include lack of interference in magnetic resonance imaging, resorption of anchor, replacement by bone, and no need for hardware removal. However, complications of these bioabsorbable implants include inflammatory response to the material use. We present what we believe to be the first case in the hand of a poly(L-lactide-co-D,L-lacitide) suture anchor causing an inflammatory response leading to significant osteolysis 4 months postoperatively after repair of a ring finger flexor digitorum profundus avulsion. Exploration of the distal phalanx revealed an intact implant and repair, no signs of infection, and an extensive bone defect. Pathology showed chronically inflamed tissue. This case has led us to reconsider the use of bioabsorbable anchor sutures in the hand. Further research is necessary to better define the contraindications to bioabsorbable suture anchor use in the hand.

Keywords Bioabsorbable · Osteolysis · Suture anchor · Jersey finger

Introduction

Prior to the invention of suture anchors, soft tissue fixation of ligaments and tendons in the hand was achieved by bone tunnels alone or bone tunnels and buttons. Studies have shown that suture anchors provide equivalent biomechanical strength to these past practices [1, 5, 19, 21]. The anchor materials for suture anchors are either metal or a bioabsorbable material with studies showing equivalence in strength and biocompatibility [9]. The theoretical advantages of bioabsorbable suture anchors include lack of interference in magnetic resonance imaging (MRI) in the future, resorption of the anchor, replacement by bone, and no need for hardware removal [23, 26]. However, none of the biodegradable polymers in bioabsorbable implants appear to be exempt from provoking an inflammatory response [3]. We present a case which we believe is the first report in the hand of an inflammatory response with significant osteolysis to a poly(L-lactide-co-D,L-lacitide) (PLDLA) suture anchor at 4 months postoperatively after repair of a ring finger flexor digitorum profundus (FDP) avulsion.

Case History

This is a 21-year-old gentleman who sustained a right ring finger FDP tendon avulsion while playing football. There was no bone injury and the injury was classified as a Leddy and Packer type I jersey finger [17]. He underwent repair 1 week after his injury. The volar, proximal aspect of the distal phalanx was exposed with an incision that proximally started midlateral and then curved volarly and distally. The tendon could not be retrieved from the fibro-osseous tunnel from the distal incision so an oblique incision was made over the A1 pulley which was divided and the tendon was identified. A pediatric feeding tube was placed in the proximal incision through the fibro-osseous tunnel to the distal incision. A suture was placed in the FDP tendon, and

G. J. Galano · K. N. Jiang (✉) · R. J. Strauch · M. P. Rosenwasser · P. Tang
Department of Orthopaedic Surgery,
Columbia University Medical Center,
622 West 168th Street, PH 11th Floor,
New York, NY 10032, USA
e-mail: KNJ2104@columbia.edu

the suture was passed through the feeding tube and the suture end was retrieved distally by pulling out the feeding tube. By pulling on the suture, the tendon was delivered to the distal phalanx. An Arthrex 2.4×8.5-mm Mini Bio-SutureTak bioabsorbable PLDLA suture anchor was placed in the distal phalanx. One limb of the suture was whip stitched through the tendon end up the ulnar side then transversely and then down the radial side. This suture was then tied to the other free limb. The anchor was noted to be prominent dorsally so a dorsal counter-incision was made, and the suture anchor was cut flush to the bone with a rongeur. This prominence was proximal to the germinal matrix.

Postoperatively, the patient followed up at 2 and 6 weeks after surgery but then was lost to follow up. At his last visit, his proximal interphalangeal joint range of motion was 20–100° actively and 10–100° passively. His distal interphalangeal (DIP) joint range of motion was 0–60°. Six months postoperatively, he presented with a 2-month history of pain and swelling at the distal end of the ring finger and drainage from under the eponychial fold. Examination of his finger at that time was significant for swelling and drainage underneath the eponychial fold and swelling at the volar aspect of the finger. The drainage was slightly murky but not frank purulence. His DIP motion was 0–30°. He had also developed a nail deformity in line with the large bony defect in the distal phalanx that was found on X-ray where the anchor had been placed (Figs. 1 and 2). He was brought to the operating room the following day for irrigation and debridement. His distal incision was reopened, and the FDP tendon was found to be firmly attached to the distal phalanx (Fig. 3). The suture anchor and its suture were removed from the bony defect (Fig. 4). The defect went from the volar to dorsal aspect of the distal phalanx (Figs. 5 and 6). A longitudinal incision was made at the corner of the eponychium and paronychium, and the triangular flap elevated to expose the destructive lesion which had extended through the germinal matrix (Fig. 7). No purulence was found at any point. A thorough irrigation and debridement was performed, and the wound, the anchor, and the suture were sent for culture. The patient was given intravenous cefazolin for 24 h and then discharged on 2 weeks of oral cephalexin. His cultures from the operating room were significant for light growth of *Streptococcus* B and C, sensitive to penicillin. Pathology showed chronically inflamed dense fibrous tissue and fragments of polarizable foreign material, but no organisms were present on Gomori methenamine silver, Gram, or acid fast bacilli stains. At 2 months postoperatively from the debridement, he had no signs of inflammation and active flexion of the DIP joint, and the lytic bone lesion had started to fill in (Figs. 8 and 9).

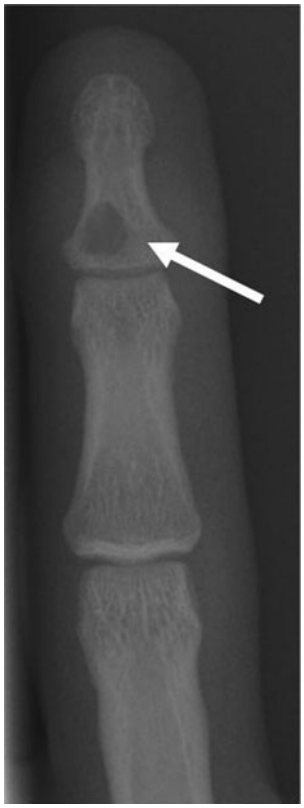

Figure 1 AP X-ray demonstrating osteolytic lesion of distal phalanx (*arrow*).

Discussion

In the literature, the reported rate of a clinically significant inflammatory reaction to bioabsorbable implants ranged from none to 47% [3, 6, 8, 18, 22]. The first generation of bioabsorbable implants consisted of polyglycolic acid and was found to rapidly degrade and cause an inflammatory reaction [3]. The homopolymer poly-L-lactic acid (PLLA) was the next generation and was made to degrade at a much slower rate [11, 20]. The implant reported in this case was made of PLDLA which degrades at a faster rate than PLLA.

It is unclear the cause of the local inflammatory/foreign body reaction which leads to osteolysis. Proposed theories implicate the inherent degradation and absorption of these polymers. Some theorize that when the gross geometry of the implant is lost, the large fragments cause an exuberant inflammatory response as macrophages and polymorphonuclear leukocytes phagocytize these products [10, 22, 24]. The rate of degradation depends on polymer weight, size, crystallinity, and stereocopolymer ratio [29]. Thus, the rapidity of degradation of the implants influences the amount of breakdown products at one time which may lead to an inflammatory response. Others have concluded that osteolysis is due not only to the resorption process but also the mechanical effect of a loaded anchor [12, 14]. In a case report by Glueck and associates, PLDLA anchors were used for a rotator cuff repair and a superior labral anterior posterior lesion, but only the cuff repair anchor led to

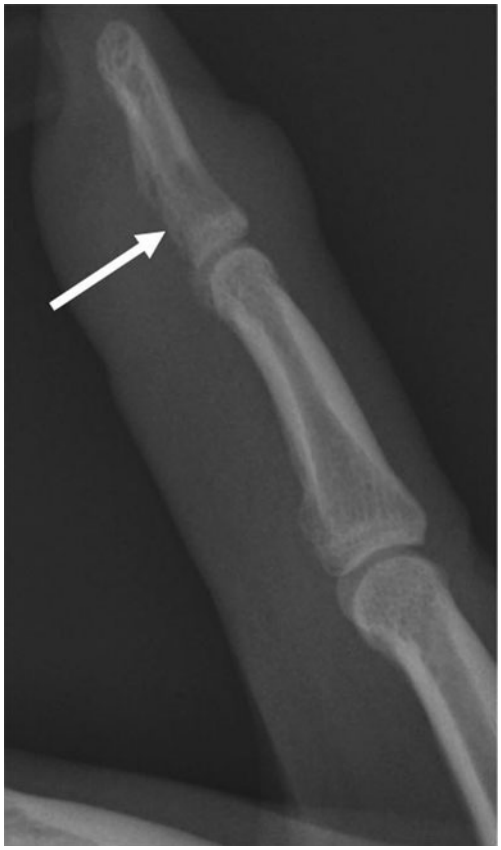

Figure 2 Lateral X-ray demonstrating osteolytic lesion of distal phalanx (*arrow*).

extensive osteolysis [12]. In this case report, we had a similarly loaded mechanical environment as the suture anchor was used to repair the flexor digitorum profundus insertion.

Prior to the development of suture anchors, soft tissue fixation in hand surgery was achieved with bone tunnels and buttons. Suture anchors have proven to be a feasible alternative for soft tissue fixation and avoids the morbidity of bone tunnels, counter-incisions, and nail bed injuries [1, 5, 19, 30, 31]. Several studies looking at the use of suture anchors specifically for FDP repair showed good biomechanical results [4, 16, 19]. In our case, an Arthrex 2.4×8.5-mm Mini Bio-SutureTak bioabsorbable PLDLA suture anchor was used to repair a FDP avulsion. The theoretical advantage of bioabsorbable suture anchors include providing immediate fixation, a lack of interference in MRI in the future, resorption of the anchor, and replacement by bone [23, 26]. To our knowledge, this is the first reported case in the hand of such an inflammatory reaction with osteolysis. There are multiple reports of foreign body reactions in the traumatology literature with bioabsorbable implants and sports literature with bioabsorbable interference screws and suture anchors [2, 3, 7, 12, 15, 18, 22–24].

Figure 4 Explanted suture and anchor.

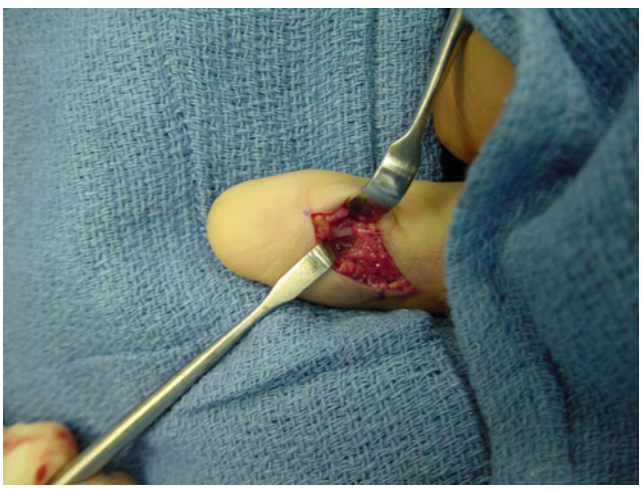

Figure 3 Volar exposure, demonstrating a firmly attached FDP tendon.

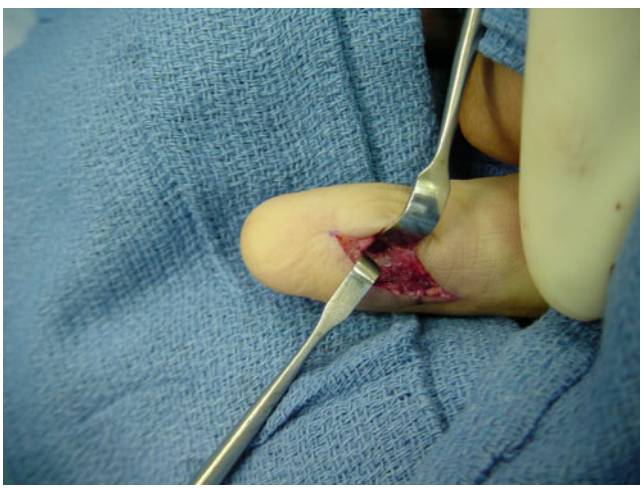

Figure 5 Volar exposure, demonstrating bony defect in distal phalanx.

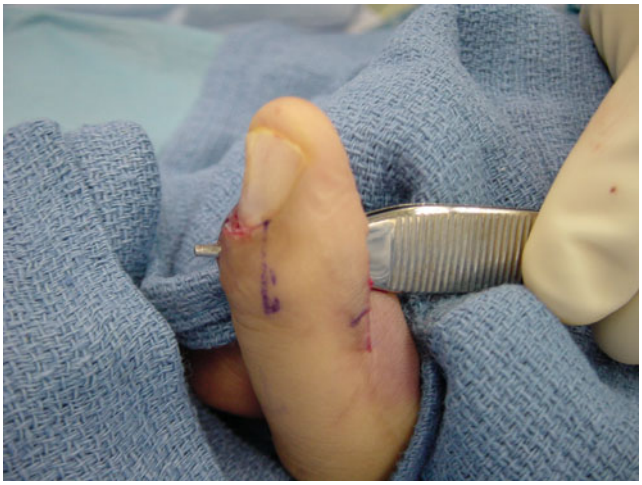

Figure 6 Side view, demonstrating through-and-through defect of distal phalanx.

There are several interesting issues to note in this case report. First, usually, the inflammatory reactions described in the literature are sterile, but in our case, the cultures grew out light *Streptococcus* B and C. Some may argue that this is evidence that it was not an inflammatory reaction but an infection. However, at no point in the case was frank purulence found, and bacteria were absent from the final pathology. If infection did cause the significant osteolysis, one would think that there would be purulence. Also, the finger never appeared infected and had no erythema. We believe that there was only light growth and the fact that two, instead of one, organisms grew out, supports the fact that this was a colonization of the 2-month-old draining wound. Furthermore, significant osteolysis occurred and led to injury of the germinal matrix which led to a nail deformity. In the initial operation, the suture anchor was prominent on the dorsal side so a dorsal counter-incision

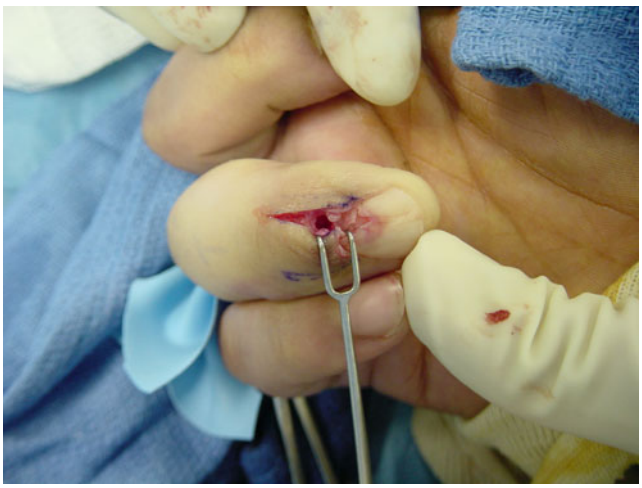

Figure 7 Nail bed exposure, demonstrating penetration of the lesion.

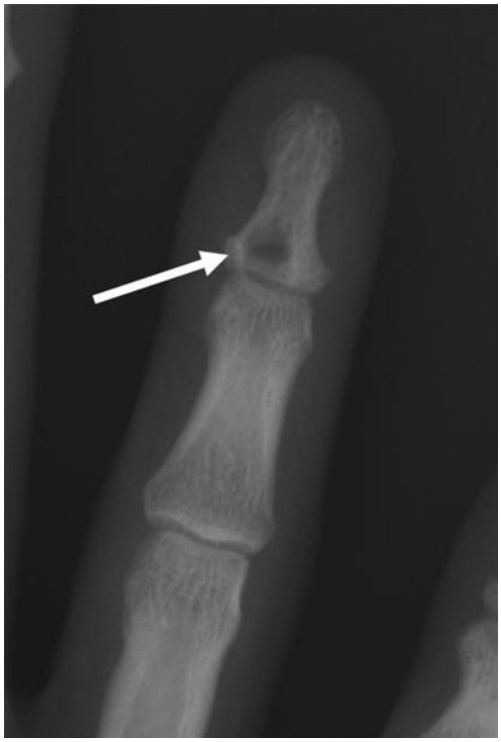

Figure 8 AP X-ray demonstrating partial resolution of osteolytic lesion (*arrow*).

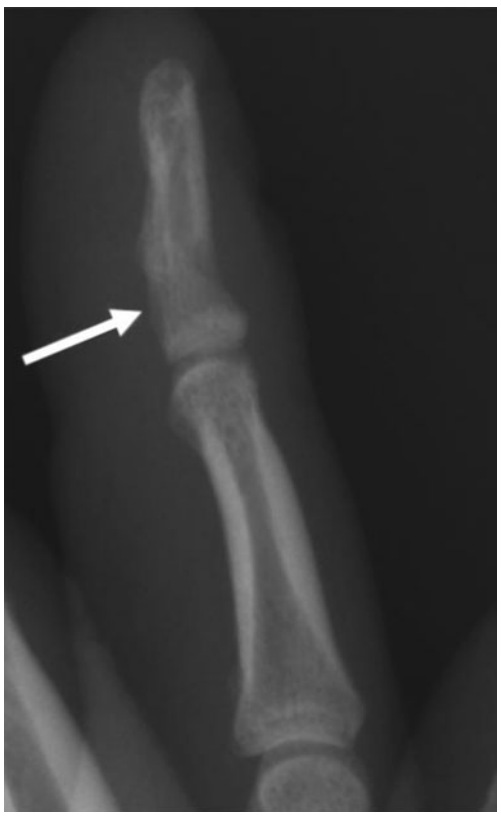

Figure 9 Lateral X-ray demonstrating partial resolution of osteolytic lesion (*arrow*).

was made to shorten the anchor. This prominence was not at the germinal matrix so we believe this did not lead to the nail deformity. At the revision surgery, severe osteolysis of the phalanx with obvious injury of the germinal matrix appeared to be the cause of the nail deformity (Fig. 7). Lastly, most reports of foreign body reactions implicate implant breakdown particles as leading to the reactions. However, when we retrieved the anchor at 6 months, the anchor was basically intact (Fig. 4) We hypothesize that the inflammatory reaction in this case was not due to breakdown of the implant but an inherent reaction to the implant material itself.

None of the bioabsorbable polymers are exempted from causing an inflammatory response and as evidenced in this case report, nor is anybody location exempted. We report this case to make others aware of this possibility in the hand and fingers. From this experience, the senior author now prefers metallic anchors when suture anchors are needed. Another important point to consider is that the inflammatory response may be influenced by a loaded mechanical environment as others have put forth [12, 14]. This may mean that bioabsorbable suture anchors may not be recommended for tendon avulsions, but may be indicated for ligament repairs such as radial/ulnar collateral ligament injury in the thumb metacarpophalangeal joint. Some evidence exists that no inflammatory reaction occurs with bioabsorbable implants used for thumb metacarpophalangeal fusion [25]. Bioabsorbable implants have also been employed in hand fracture fixation for more than 10 years without any reports of foreign body reaction [13, 27, 28]. Future research is needed to clarify the affect of the biomechanical environment on the tolerability of bioabsorbable implants.

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