Case Report

Unusual Tibial Ganglion Cyst Formation Due to Bioabsorbable Screw 13 Years After Anterior Cruciate Ligament Reconstruction: A Case Report

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ABSTRACT

Bioabsorbable screws are widely used as interference screws in anterior cruciate ligament reconstruction. Despite many advantages, they have certain complications associated with their usage. Pretibial and/or tibial cysts formation is a rare complication seen generally in the first few years of the operation. We reported a patient with a painful tibial ganglion cyst, which presented 13 years after ligament reconstruction. The diagnostic arthroscopy and surgical exploration were performed. No hardware was present in the tibial tunnel; however, there were gelatinous material and degraded particles caused by the breakdown of the bioabsorbable screw. The cystic lesion was debrided and grafted with a mixture of autologous and allogeneic grafts. Histopathological examination was consistent with an intraosseous ganglion cyst. Removal of the screw debris, besides curettage and grafting, resulted in complete recovery. Bioabsorbable screws used for anterior cruciate ligament reconstruction may cause a local tissue response and cyst formation even decades after the initial procedure. Although adverse effects and cystic changes occur in the first few years of implantation, physicians must be aware such complications can be seen even after a decade.

INTRODUCTION

Over the last decade, Anterior Cruciate Ligament (ACL) reconstruction has become a widespread operation in orthopedic practice for knee instability. For several years, metallic implants were the primary choice for tibial graft fixation. After the late '90s, bioabsorbable interference screws have become much more popular than those metallic ones for some advantages on further revision surgery. They also cause less distortion on radiological images [1,2]. However, bioabsorbable screws are not out of problem. The complications of bioabsorbable screws could be listed as early, late and biological complications. Pretibial and/or tibial cyst formations are rare biological complications [2]. Several published studies [1,3-12] concerned tibial tunnel cyst occurring after ACL reconstruction. Although it is stated that bioabsorbable screws are completely resorbed in the first three years following ACL reconstruction, some studies reported that it might take much more extended period up to five years [2,31,14]. According to the English language literature review, only one study presents two patients with tibial cyst formation ten years after the initial surgery [12]. Our study presents a painful tibial cystic lesion that occurred 13 years after ACL reconstruction. We aimed to summarize previous studies on tibial tunnel cyst formation and report

successful management of the late presenting tibial ganglion cyst that occurred after the initial ACL reconstruction.

CASE DESCRIPTION

A 38-year-old male patient presented to our clinic with complaints of effusion and pain at the right knee without any history of trauma. He had undergone an arthroscopic ACL reconstruction using autologous gracilis and semitendinosus tendons at another institute 13 years ago. The femoral side was held by a transfemoral screw and the tibial side by a Poly-L-lactide (PLLA) bioabsorbable interference screw (Arthrex Inc., Naples, FL, USA) and a staple. After the patient's first anterior cruciate ligament reconstruction, a 6-week active assistive and resistive physiotherapy was applied. He stated that he returned to sports activities six months after the operation.

Physical examination revealed local tenderness, minimal joint effusion, and focal swelling at the anteromedial side of the initial tibial incision. The Lachman and anterior drawer tests were negative. Plain radiographs revealed a 3×5 cm radiolucent lesion around the tibial tunnel (Figure 1a). Magnetic Resonance Imaging (MRI) scans confirmed cystic enlargement of the tibial tunnel with increased signal intensity on T2 sequences and degraded particles of the bioabsorbable screw in the tunnel (Figure 1b). The Lysholm knee score was 68.

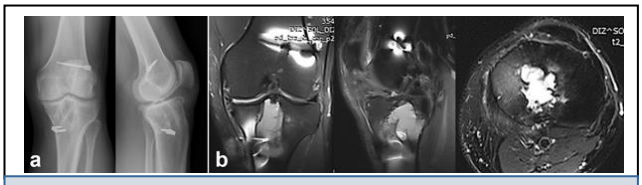

Figure 1: Preoperative anteroposterior and lateral radiographic views of the knee joint (a), MRI sequences of the tibial cyst (b).

Before the operation, previous MRI scans of the patient were evaluated. Tibial tunnel enlargement with a tibial cyst was first detected seven years after the initial procedure (Figure 2a). It was observed that the tibial cyst had grown over the years (Figure 2b). The patient stated that the knee pain and tenderness at the tibial incision appeared 13 years after the operation and gradually increased until admission.

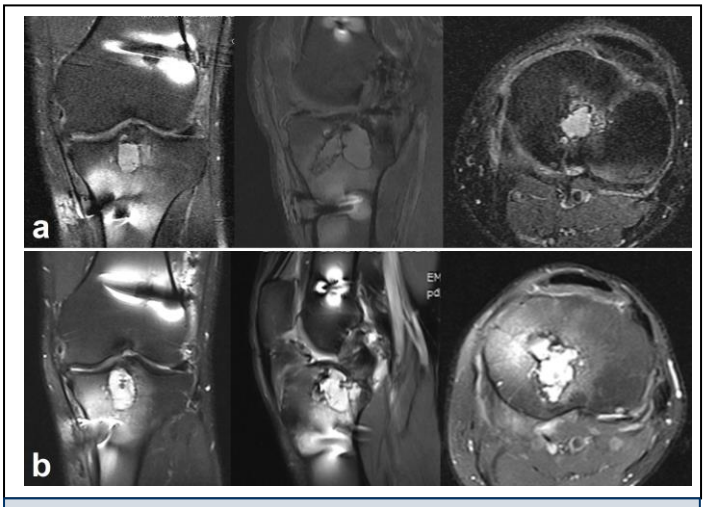

Figure 2: MRI sequences of the tibial cyst at 7 (a) and 9 (b) years after the initial surgery.

After obtaining informed consent, the patient underwent diagnostic arthroscopy to rule out any intra-articular pathologies. During the arthroscopic examination, ACL was intact, and no meniscal tear or chondral damage was observed. The tibial tunnel was explored through the old tibial incision. The staple was removed. No hardware was observed in the tibial tunnel, but there were gelatinous material and degraded particles caused by the breakdown of the bioabsorbable screw (Figure 3a). The cystic lesion in the tibial tunnel was curetted completely, and all pathological remnants were removed (Figure 3b and 3c). There was no connection between the tibial tunnel and the knee joint. The curetted cystic lesion was filled with a mixture of 50 cc autologous iliac and allogeneic corticospongious grafts (Figure 3d). The histopathologic examination showed inflammation with mononuclear cells within the fibrohyalinized wall, consistent with an intraosseous ganglion cyst (Figure 4).

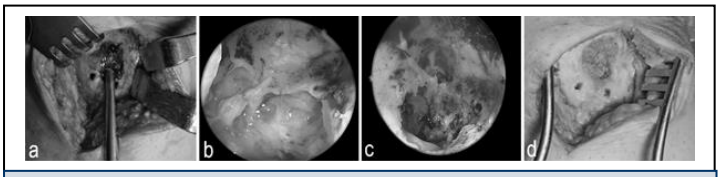

Figure 3: Intraoperative views of the gelatinous material (a), the tibial tunnel before (b) and after (c) curettage, and grafted tibial tunnel (d).

After the operation, the patient walked with partial weight-bearing using a crutch and brace for three weeks. At the end of the 3rd week, the brace was removed. He started to walk without a crutch, and active physiotherapy including quadriceps strengthening and proprioception was initiated. At the final follow-up on the 18th month, the patient had a full range of motion without

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any complaints. Plain radiographs showed complete consolidation at the grafted cystic lesion with ongoing healing on MRI scans (Figure 5a and 5b). The Lysholm knee score was 100. He did not describe any limitations in sports and daily activities.

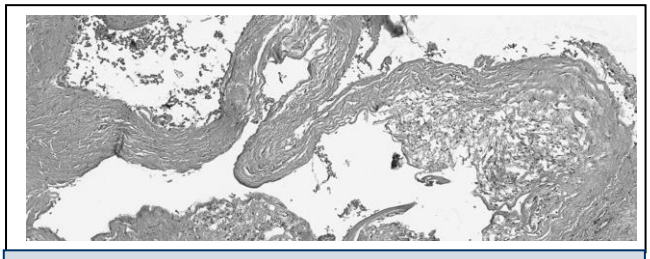

Figure 4: Histopathologic examination showed inflammation with mononuclear cells within the fibrohyalinized wall, consistent with intraosseous ganglion cyst.

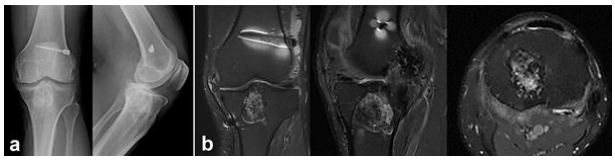

Figure 5: Anteroposterior and lateral radiographic views (a) and MRI sequences (b) of the knee joint 18 months after curettage and grafting.

DISCUSSION

ACL reconstruction using either patellar or semitendinosus-gracilis tendons is one of the most performed surgical procedures in orthopedic surgery [3]. Historically, surgeons widely used metal screws and washers as fixation devices. However, metal implants can sometimes removal problems during revision surgery. In addition, they also have possibilities of obstructed imaging for MRI and computed tomography, and potential damage to the adjacent tissues [2,3,13-15]. For the last two decades, bioabsorbable implants became the most popular fixation method instead of metal implants. They are less likely to damage tissues and reduce stress shielding due to their ability to transfer load as they degrade gradually. They develop less distortion on MRI scans, and there is no need for additional surgery to remove those implants [3,4,12,13,15]. However, bioabsorbable implants have their own set of problems, including breakage during implantation, undesired inflammatory and biological reactions (pretibial and/or tibial cysts, lytic changes, intraarticular granuloma), and migration [1-4,6,13,14].

Commonly used bioabsorbable interference screws composed of different types of polymer, including polyglycolic acid (PGA), poly-L-lactide (PLLA), poly-DL-lactide (PDLA), and composite materials consisting of PLLA/tricalcium phosphate or PLLA/hydroxyapatite [2,3,6,13,15]. PLLA screws are used more frequently than the others and are associated with a slower degradation time which can take up to 30 months [2,13-15]. Because of their frequent usage and slower degradation time, complications related to the bioabsorbable screws reported in the literature are primarily associated with PLLA screws [12,13]. The degradation of a bioabsorbable screw goes through several stages, including hydration, depolymerization, loss of mass integrity, absorption, and elimination [3,13,14]. Lactic acid produced by these stages is eliminated by the Krebs cycle and dissimilated to carbon dioxide and water. Lactic acid and glycolic acid monomers, by-products of the hydrolysis, cause an acidic environment that is supposed to stimulate resorption and is linked to the inhibition of new bone formation [3,14,15]. Biological complications of bioabsorbable screws (pretibial and/or tibial cysts formation, bone tunnel widening, and inflammatory reactions) are thought to occur by these acidic degradation products or due to the presence of foreign material [2,13]. Newer biocomposite screws, combining bioceramics (mostly used β-tricalcium phosphate and hydroxyapatite) with PLLA or co-polymer of PLLA creates a more amorphous compound with faster degradation time. With bioceramic depolymerization, primary ions are released, and the acidic environment becomes neutralized. This chemical reaction promotes bony ingrowth and encourages osteoinductivity [2,3].

In the literature review, we have found 11 studies (four case series, seven case reports) with a series of patients with pretibial and/or tibial cysts that occurred after ACL reconstruction by using bioabsorbable screws for tibial fixation [1,3-12] (Table 1). In those studies, intraosseous cysts were mostly diagnosed and treated in the first decade after ACL reconstruction. There is only one study presenting two patients with tibial cyst formation ten years after the initial surgery. But there is not enough information about those cases in this article [12]. Some theories have attempted to explain the development of the intraosseous ganglion cyst after ACL reconstruction, including incomplete bony in growth and leakage of the synovial fluid to the tibial tunnel [8-10], and a foreign body reaction to the disintegrated screw particles [1,3,5,13,15]. Multiple factors affect the degradation process and rate, including material

composition, biochemical properties, molecular weight, sterilization type, implant size, age of patients, and blood flow rate [3,6,13,15]. Therefore, it is difficult to isolate the exact cause of the cyst and other adverse effects [3,13].

Table 1: Previously published studies in the literature with pretibial and/or tibial cysts formation after ACL reconstruction.

	Published in	n	Type of Study	Mean Follow-up	Mean cyst emergence time post operatively	Location of cyst	Type of the screw
Chevallier R et al. [12]	2019	53	Retrospective Case Series	5.4 years	4.6 years	Tibial	PLLA, Biocomposite, PGA
Ramsingh V et al. [3]	2014	14	Retrospective Case Series	12 months	26 months	Pretibial	Biocomposite
Shen MX et al. [5]	2013	1	Case report	Undefined	2 years	Pretibial	PLLA
Sprowson Ap et al. [4]	2012	7	Prospective MRI Assessment	10 years	Undefined	Tibial	PLLA
Gonzalez- Lomas G et al. [1]	2011	7	Retrospective case series	6 months	2,5 years	Pretibial	PLC
Dujardin J et al. [6]	2008	1	Case report	3 months	6 months	Tibial	PLLA
Busfield BT et al. [7]	2007	2	Case report	6 months	27 months	Pretibial	PLLA
Thaunat M et al. [8]	2007	1	Case report	2 months	5 years	Tibial & Pretibial	PLLA
Tsuda E et al. [9]	2006	1	Case report	12 months	2 years	Pretibial	PLLA
Malhan K et al. [10]	2002	1	Case report	3 months	12 months	Tibial	Biocomposite
Martinek V et al. [11]	1999	1	Case report	2 months	8 months	Tibial & Pretibial	PDLA

n: number of patient; MRI: Magnetic Resonance Imaging; PLLA: Poly-L-lactide; PGA: polyglycolic acid; PLC: ploy actide carbonate; PDLA: Poly-DL-lactide

CONCLUSION

The manufacturers state that the bioabsorbable interference screws are completely resorbed in the first three years after implantation. However, bioabsorbable screws may cause a local tissue response and cyst formation even decades after the initial procedure. To the best of our knowledge, our study presents one of the most extended periods of intraosseous ganglion cyst emergence of the bioabsorbable screw after implantation. A tibial cyst and other adverse biological reactions should be considered as possible complications in ACL reconstruction with bioabsorbable interference screws. Although adverse effects and cystic changes occur in the first few years of implantation, physicians must be aware such complications can be seen even after a decade. Removal of the screw remnants in addition to curettage and grafting will improve the clinical symptoms.

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ETHICAL APPROVAL

Informed patient consent obtained for the patient.

CONFLICT OF INTEREST

The authors have no conflicts of interest relevant to this article.

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