

# Painful Pretibial Cyst with Bioabsorbable Poly-L-lactic Acid Screw Migration 4 Years after Anterior Cruciate Ligament Reconstruction

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*Several reported complications have been specifically linked to bioabsorbable interference screws. Due to the rarity of their occurrence, we aim to report a case of simultaneous pretibial cyst formation and intact screw extrusion, 4 years after successful anterior cruciate ligament (ACL) reconstruction using hamstrings autograft. The neoligament was fixed using button and loop on the femoral side and a poly-L-lactic acid (PLLA) interference screw on the tibia. Three and a half years after index reconstruction the patient complained of pain in the area of the extraarticular tibial aperture. Magnetic resonance imaging (MRI) revealed bone edema surrounding the tunnel. The patient went on to develop a progressively aggravating painful lesion. Repeated MRI showed screw extrusion and subcutaneous pretibial cyst formation. A slight tunnel enlargement was also noticed. Surgical debridement revealed cystic membrane with aseptic fluid content. The PLLA screw showed no signs of degradation and was removed intact. There was no apparent joint communication and therefore no bone grafting was deemed necessary. The patient had a favorable outcome with no reoccurrence at 3 months. Although very rare, adverse event from PLLA implants requiring removal may question their most valuable characteristic – biodegradability.*

*Keywords: pretibial cyst, PLLA, screw extrusion, ACL reconstruction*

Anterior Cruciate Ligament (ACL) tears are a very common sporting injury. Reconstruction surgery is widely performed to address resulting instability. Current standard technique is the anatomic single bundle reconstruction using hamstrings autograft. The preferred fixation is cortical button and loop for the femur and bioabsorbable interference screw for the tibia [1].

Outcomes are favorable with return to preinjury physical level, very low infection rate or hardware related complications. Revisions are performed in less than 5% of cases, due to technical errors, failure of graft biological integration or a new traumatic event [2].

Several complications have been reported, specifically linked to the bioabsorbable screws used for interference fixation [3]. Tibial cyst formation and screw extrusion have been previously reported. Both seem to be linked to the reaction between the living host and poly lactic acid degradation. Due to the rarity of such occurrence we aim to report a case of simultaneous pretibial cyst formation and intact screw migration, 4 years after successful ACL reconstruction using hamstrings autograft.

A 20 years old male professional athlete had a successful single bundle ACL reconstruction in 2011, using quadruplicated ipsilateral hamstrings (semitendinosus and gracilis) autograft. Index surgery occurred 6 weeks after injury. The 7.5/8mm sized neoligament was fixed using button and loop on the femoral side and a 9.28 bioabsorbable poly-L-lactic acid (PLLA) interference screw for the tibia. Following physical therapy the patient had a full return to competitive sports 7 months postoperatively.

Three and a half years after index reconstruction the patient complained of pain in the area of the extraarticular tibial tunnel aperture. Magnetic resonance imaging (MRI) examination (fig. 1-2a) showed a continuous, homogenous, in hyposignal neoligament with appropriate orientation, proving biological healing and competent function [4]. Proton density fat saturation (PD FAT SAT) revealed bone edema surrounding the tibial tunnel and a fully threaded shadow of the biodegradable interference screw (fig. 1-2 a). There were no signs of tunnel enlargement or cyst formation. The patient went on to develop a progressively aggravating painful cystic lesion underneath the tibial tunnel scar (fig. 4a). Repeated MRI (fig. 1-3b) showed screw extrusion and subcutaneous pretibial cyst formation. There was no apparent joint communication or synovial fluid extravasations. A slight tunnel enlargement was also noticed. Surgical debridement revealed cyst membrane

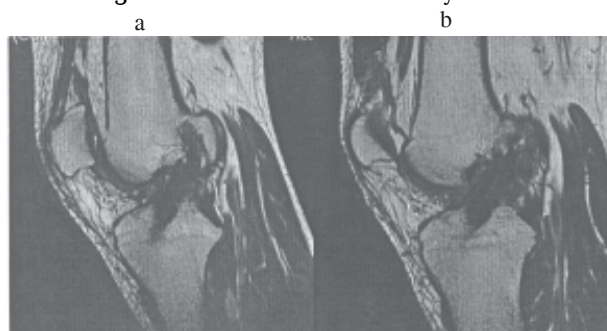


Fig. 1 Sagittal oblique T2 FSE MRI at onset of symptoms (a) and before hardware removal (b); both show a completely healed graft.

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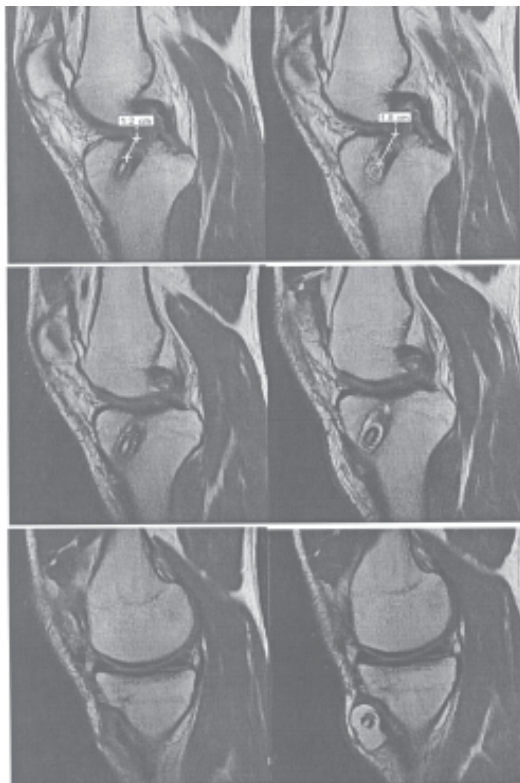


Fig. 2 Serial Sagittal PD T2 FSE MRI at onset of symptoms (a) and before hardware removal (b); from central to medial we observe screw migration of approximately 6mm in the last 6 months before hardware removal, as measured by eFilm standard tool with automated calibration from the articular aperture; the screw protrudes over the cortex into the subcutaneous tissue leading to cyst formation.

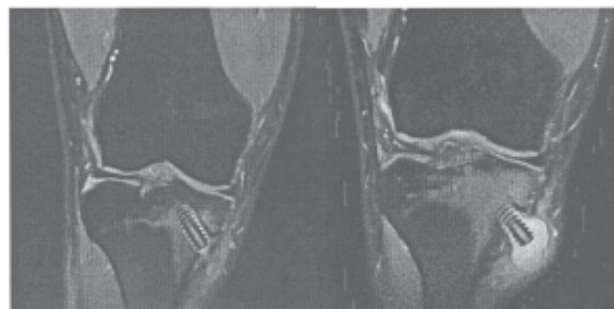


Fig. 3 Coronal PD FAT SAT MRI at onset of symptoms (a) and before hardware removal (b) shows enlargement of the bone edema area, screw protrusion and pretibial cyst formation.

with aseptic straw yellow fluid content. The bioabsorbable screw showed no signs of degradation and was removed intact. There was no apparent joint communication and therefore no bone grafting was deemed necessary (fig. 5). The patient had a favorable outcome with no recurrence at 3 months (fig. 4 b). Histopathological examination revealed nonspecific inflammatory granulation tissue, without any foreign body reaction, most likely due to the absence of screw degradation.

### Results and discussions

We present a rare case of simultaneous tibial screw extraarticular migration and cyst formation, 4 years after successful ACL reconstructions with hamstrings autograft. Compared to the previously published data in the peer reviewed literature this is the only case of painful pretibial cyst caused by the migration of an intact bioabsorbable PLLA interference screw (table 1) [5-18]. Pretibial cyst formation is more common than screw extrusion. When present only inside the bone and around the tunnel they



Fig. 4 Clinical aspect before screw removal shows a cystic lesion at the site of tibial tunnel external aperture; postoperative healed scar.

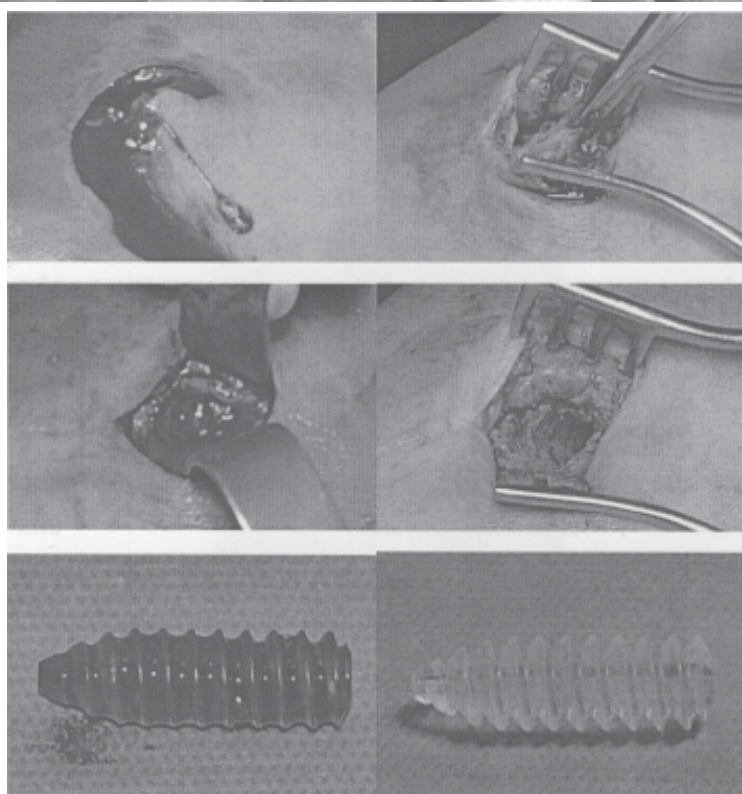


Fig. 5 Clear yellow fluid content, cyst membrane, screw protrusion, tibial tunnel after removal and the intact screw after saline wash

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Authors	Article type	Time from surgery	Cyst formation	Screw migration	Screw condition	Graft type	Neoligament	Joint communication	Tunnel enlargement
Simonian et al 1998	4 cases	avg 44 months	present	absent	-	soft tissue	healed	present in 2	absent
Martinek et al 1999	case report	8 months	present	absent	-	B-PT-B	healed	-	present
Deie et al 2000	2 cases	12 months	present	absent	-	hamstrings	healed	present in 1	-
Malhan et al 2002	case report	-	present	absent	degraded	-	healed	-	-
Sassmannshausen et al 2003	case report	12 months	absent	present	intact	hamstrings	healed	absent	-
Sekiya et al 2004	case report	5 years/recurrent	present	absent	degraded/absent	-	healed	absent	-
Tsuda et al 2006	case report	2 years	present	absent	-	-	healed	present	-
Thaunat et al 2007	case report	5 years	present	absent	absorbed	hamstrings	healed	present	absent
Busfield et al 2007	2 cases	-	present	absent	degraded	-	healed	-	minimal
Dujardin et al 2008	case report	6 months	present	absent	degraded	double bundle	healed	present	present
Anakwez et al 2010	case report	15 months	absent	present	broken nondegraded	allo	healed	absent	absent
Apostolopoulos et al 2012	case report	4 years	present	absent	absorbed	hamstrings	-	present	-
Bernard et al 2013	case series	-	present	absent	degraded	auto and allo	healed	-	-
Shen et al 2013	case report	2 years	present	absent	degraded	-	healed	absent	-
<b>Current study 2015</b>	<b>case report</b>	<b>4 years</b>	<b>present</b>	<b>present</b>	<b>intact</b>	<b>hamstrings</b>	<b>healed</b>	<b>absent</b>	<b>minimal</b>

**Table 1**  
SYNTHETIC  
PRESENTATION  
OF PUBLISHED  
DATA

are asymptomatic. Nevertheless, due to the rarity of these events and possible publication bias, such complications are only reported as case reports or case series with few patients (table 1) [5-18].

Treatment options are thorough surgical debridement and full curettage of cyst membrane to prevent reoccurrence [10]. If joint communication is present, autologous bone graft is packed into the tibial tunnel to seal fluid leakage [5,7,11,12,16]. Even if joint communication is proved with continuous synovial fluid leakage maintaining cyst volume, there is no reported association with incompetent neoligament requiring revision (table 1) [5-18]. The tibial tunnel has several anatomic factors that predispose to local complications. The tibial metaphyseal bone is frequently soft, with poor mechanical purchase. The extraarticular aperture lays just underneath the subcutaneous tissue making it susceptible to mechanical stress [1]. There are some limitations of our report. Short postoperative follow-up after screw removal was not sufficient to exclude reoccurrence [10]. Furthermore we did not perform any microstructural

analysis of the removed screw, since macroscopic evaluation showed no signs of degradation.

Bones replacing structural materials used in orthopedic and trauma surgery are constantly improving. As a result, specific complications are decreasing yet not uncommon [19,20] Poly lactic acid is biodegradable polyester derived from renewable resources, such as corn starch. Being able to degrade into nontoxic lactic acid ( $H_2O$  and  $CO_2$ ), it has long been used to produce orthopedic implants such as anchors and screws. Combination with calcium compound is supposed to induce bone formation in the gap left after degradation. With simple PLLA implants this void may be predominantly replaced by fibrotic tissue [3]. PLLA is the levorotatory isomer of the poly lactic acid. It has a crystalline, hydrophobic structure with prolonged degradation time. Therefore, adverse events from their degradation may become evident only years after implantation. Natural evolution is towards degradation but the exact time is highly variable depending on the particular biochemical structure and manufacturing process. In our case the screw was made of a low crystallization material

with known difficult degradation when used with soft tissue grafts [21].

## Conclusions

Advantages of biodegradable systems over metallic implants are: less damaging to the soft tissue grafts, spontaneous degradation without the need for removal, easier revisions, no artifacts on MRI or computed tomography (CT), preferred by patients. Several other specific complications have been described but are also very rare: intra or extra articular migration, synovitis or foreign body reaction [3]. Portrayed drawbacks are cost, the fact that these are invisible on radiographs, decreased mechanical strength which may lead to breakage during insertion, especially with composite implants with high calcium content. High variability with poly lactic implants absorption may also render uncertainty regarding different product lines [1-4]. PLLA screws are more expensive compared to metallic (titanium) ones and more reactive than those made from PEEK (Polyether ether ketone). Although very rare, adverse event from PLLA implants requiring removal may question their most valuable characteristic – biodegradability. Therefore, biodegradable PLLA screws may in fact prove to lack significant advantages over less expensive implants with safety and efficacy profiles based on long term outcomes.

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