Foreign Body Reaction After PLC Reconstruction Caused by a Broken PLLA Screw

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Abstract

Foreign body reactions may occur in patients who receive bioabsorbable implants during orthopedic surgery for fractures and ligament repair. The authors describe a 34-year-old man who presented with a palpable tender mass on the lateral aspect of the left knee of 1 month’s duration. He underwent posterior cruciate ligament and posterolateral corner reconstruction 3 years earlier. Physical examination showed a 1×1-cm soft, nontender mass without localized warmth on the lateral epicondyle of the distal femur. Magnetic resonance imaging showed a broken screw fragment surrounded by a cyst-like mass. Under general anesthesia, the surgeon excised the screw fragment and the fibrotic mass, enclosing it in the subcutaneous tissue at the lateral epicondyle, the site at which a poly-L-lactic acid bioabsorbable screw had been inserted to fix the graft for posterolateral corner reconstruction. Histologic evaluation showed a foreign body reaction to the degraded screw particles. To the authors’ knowledge, this report is the first description of a patient presenting with a delayed foreign body reaction to a broken poly-L-lactic acid bioabsorbable screw at the lateral femoral epicondyle after posterolateral corner reconstruction. Because delayed foreign body reactions can occur at any site of poly-L-lactic acid bioabsorbable screw insertion, care should be taken to avoid screw protrusion during ligament reconstruction because it can lead to screw breakage and delayed foreign body reaction. [Orthopedics. 2014; 37(12):e1129-e1132.]

Figure: Coronal magnetic resonance imaging showing a broken screw surrounded by a mass with isosignal intensity on T1-weighted image (A) and high signal density on T2-weighted image (B) in the subcutaneous layer at the lateral epicondyle of the distal femur.
Bioabsorbable implants are widely used in orthopedic surgery for fractures and ligament repair. The increase in ligament reconstruction surgery has been accompanied by an increased use of interference screws to secure the graft to the tunnel. These bioabsorbable screws can be degraded and replaced by host tissue, decreasing image distortion during radiologic evaluation and eliminating the need to remove the implant.

The main disadvantage of bioabsorbable interference screws is their relatively low mechanical strength, which can cause intra- and postoperative screw breakage and later screw migration. These screws can also induce foreign body reactions, although the incidence of such reactions has decreased because of changes in screw composition from polylactic acid and polyglycolide to poly-L-lactic acid. However, foreign body reactions to poly-L-lactic acid bioabsorbable screws have been reported, presenting as tibial cysts, osteolytic femoral tunnel widening, and delayed intra-articular inflammatory reaction. Almost all of these reactions occurred after anterior cruciate ligament (ACL) reconstruction. To the authors’ knowledge, no patient has experienced a foreign body reaction to a poly-L-lactic acid bioabsorbable interference screw used for graft fixation at the lateral femoral epicondyle during posterolateral corner reconstruction using the fibular sling technique.

Case Report

A 31-year-old man had a combined pelvic and ankle fracture of the left leg as well as posterior cruciate ligament (PCL) rupture and posterolateral rotatory instability of the left knee after a motor vehicle accident in February 2006. At that time, the authors performed open reduction and internal fixation for the combined pelvic and ankle fracture. Because of the difficulty of rehabilitation, the authors treated the ligament injury of the left knee conservatively. However, 18 months later, in August 2008, the patient had instability of the left knee and frequently stumbled. Therefore, the authors performed PCL and posterolateral corner reconstruction with Achilles tendon and tibialis anterior tendon allografts, respectively. For the PCL rupture, the graft was fixed to the tibial tunnel with a bioabsorbable screw (Bio RCI; Smith & Nephew, Andover, Massachusetts), in combination with post-tie screw fixation and a metal interference screw in the femoral tunnel. For the posterolateral rotatory instability, the authors performed posterolateral corner reconstruction with the fibular sling technique, with the graft fixed with bioabsorbable screws to the tunnels at the lateral femoral epicondyle and fibular head. Recovery was uneventful, and the patient was able to return to full sports activity 9 months after surgery.

In August 2011, 3 years after ligament surgery, the patient had severe pain on the lateral aspect of the left knee. Other than the earlier motor vehicle accident, he had not experienced trauma to the knee. Physical examination showed a palpable, 1x1-cm soft, tender mass on the lateral epicondyle of the distal femur without localized warmth. He had full range of motion without ligamentous instability. Laboratory studies showed that the erythrocyte sedimentation rate and C-reactive protein concentration were within normal limits. Plain radiographs showed no specific abnormality. Magnetic resonance imaging showed an isolated fragment of the screw that had been inserted at the lateral epicondyle to fix the graft used for posterolateral rotatory instability reconstruction 3 years earlier. Also observed was a cyst-like mass enclosing the broken screw fragment. On T1-weighted images, the mass was isointense to muscle, whereas on T2-weighted images, the signal intensity of the mass was higher than that of muscle (Figure 1).

The authors removed the screw fragment with the patient under general anesthesia. Intraoperatively, they observed a broken screw surrounded by a yellow-white fibrotic mass on the subcutaneous tissue of the lateral femoral epicondyle, the site at which the bioabsorbable interference screw had been inserted previously (Figure 2). The broken screw fragment and the fibrotic mass were removed and sent for culture and histologic examination. All remaining interference screw fragments in the tunnel were also removed with a curette. The allograft used for posterolateral corner reconstruction was healed completely. Culture results were negative for microorganisms. Histopathologic examination showed crystalized particles consistent with the debris of a bioabsorbable screw, surrounded by many inflammatory cells, giant cells, and macrophages, suggesting a foreign body reaction (Figure 3). Recovery from surgery was uneventful. Twenty-five months...
later, the patient was asymptomatic and had returned to normal activities.

**DISCUSSION**

Bioabsorbable interference screws are used to hold the graft to the tunnel with sufficient strength to resist applied loads during early rehabilitation after knee ligament reconstruction surgery. Bioabsorbable screws are manufactured from various materials, including polylactic acid, poly-lactic-co-glycolic-acid, poly-L-lactic acid, and poly-D-lactic acid. These materials degrade over time into particles and are removed through phagocytosis by macrophages. The degradation rate is dependent on the composition of the interference screws. Earlier implants made of polylactide were rapidly degraded, resulting in complications such as osteolysis and foreign body reactions. Implants made of poly-L-lactic acid, however, have better mechanical properties, slower rates of absorption, and fewer complications than polylactide implants. For example, the incidence of adverse tissue reactions was much higher with polylactide screws (5.3%) than with poly-L-lactic acid screws (0.2%).

In addition to the composition of the implant, the degradation rates of bioabsorbable implants depend on their size, design, and surface structure as well as on the implantation site, blood flow, stress on the implant, and patient age. Stress on the implant can cause screw breakage, making stress clinically important after ligament surgery. The causes of foreign body reactions remain unclear, but broken screws, with a larger surface area, resorb more quickly than intact screws, producing higher concentrations of crystalline substances in local tissue. Moreover, overload the ability of macrophages to clear these particles by phagocytosis may enhance foreign body reactions.

Several reports have described foreign body reactions after ACL reconstruction using poly-L-lactic acid implants in the tibial and femoral tunnels. For example, 1 patient had tibial cyst formation after a poly-L-lactic acid interference screw was used to fix the hamstring, suggesting that screw breakage and the container phenomenon may promote foreign body reactions. An additional 7 patients had pretibial cysts after ACL reconstruction surgery with poly-L-lactic acid interference screws, suggesting that these pretibial cysts arose from foreign body reactions as a result of screw breakdown. In both of these reports, removal of the cyst and screw fragments resulted in symptom relief. Another patient had an intra-articular inflammatory reaction 45 months after ACL reconstruction in which the graft was fixed in the femoral tunnel with a poly-L-lactic acid interference screw. This finding suggested that the degraded screw in the femoral tunnel and the knee joint was responsible for the intra-articular inflammatory reaction.

A foreign body reaction as a result of bioabsorbable pins used for femoral fixation in ACL reconstruction was also reported in a patient who had osteolytic femoral tunnel widening and collection of a large amount of extra-articular fluid 22 months after ACL reconstruction. The broken bioabsorbable pin may have exceeded the clearing capacity of macrophage phagocytosis, with a similar finding observed in the current patient.

Although several patients had foreign body reactions to broken poly-L-lactic acid implants after ACL reconstruction in the tibial or femoral tunnel, to the authors’ knowledge, no patient before the current case had a foreign body reaction after posterolateral corner reconstruction using a poly-L-lactic acid interference screw in the tunnel of the lateral epicondyle of the distal femur. The screw insertion site and foreign body reaction in the authors’ patient may differ from the insertion site and bioabsorbable implant reactions after ACL reconstruction in most patients. In most cases, bioabsorbable intra-articular screws and pins inserted during ACL reconstruction involve intra-articular communication through femoral or tibial tunnels. Therefore, degradation of a screw or pin within a bone tunnel results in osteolysis, tunnel widening, and cyst formation. However, in this patient, there was no connection with the intra-articular space because the insertion site of the bioabsorbable screws was in the lateral aspect of the femoral condyle, a definite extra-articular location. Therefore, the foreign body reaction in the current patient was likely due to both a mechanical and a biologic reaction because a broken screw fragment was located adjacent to the deep surface of the iliotibial band. Postoperative computed tomography scan after the initial surgery showed slight protrusion of the screw head from the lateral epicondyle cortex (Figure 4), suggesting that this screw may
have been too long relative to the size of the femoral tunnel or may not have been inserted far enough. Therefore, the greater mechanical stress on a protruding screw may have led to screw breakage and a foreign body reaction.

**Conclusion**

To the authors’ knowledge, the current report is the first description of a delayed foreign body reaction to a poly-L-lactic acid screw at the lateral femoral epicondyle after posterolateral corner reconstruction. Because delayed foreign body reactions can occur at any site of poly-L-lactic acid screw insertion, care should be taken during ligament reconstruction to avoid screw protrusion, which can lead to screw breakage and a delayed foreign body reaction.

**References**


