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Pseudomonas aeruginosa infection of shoulder joint after latissimus dorsi tendon transfer: A case report

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Abstract

Infection rates of arthroscopic procedures have been consistently reported at approximately 1% and are even less common in shoulder arthroscopy (0.3%). We are unaware of any prior reports of infection associated with an arthroscopic-assisted latissimus dorsi transfer and report on a 60-year-old male who experienced this event. At the 2-month follow-up, he reported an infection of the shoulder joint, characterized by a fistula on the portal scar. Laboratory tests revealed a *Pseudomonas aeruginosa* infection which was treated with arthroscopic irrigation and debridement of the shoulder joint followed by oral antibiotics for 6 weeks. At 1-year follow-up no findings of infection were presented. To our knowledge, this is the first case of *P. aeruginosa* infection of the shoulder after an arthroscopic-assisted latissimus dorsi tendon transfer. Because the empirical pharmacological therapy initially adopted did not produce a clinically important improvement, a more organism-specific antibiotic was used. In conclusion, the key points of positive results were surgical approach with careful washout, debridement of surgical accesses, and targeted antibiotic therapy.

Keywords

Irreparable rotator cuff tears, latissimus dorsi tendon transfer, arthroscopy, *Pseudomonas aeruginosa*, resistant infection

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Introduction

Massive rotator cuff tears (MRCT) are defined as a lesion >5 cm, or a complete lesion involving at least two tendons, and affects 10%–40% of all rotator cuff lesions.[1,2] Irreparable posterosuperior rotator cuff tears (RCT) may lead to pain and loss of normal motion of the upper arm and result in a specific loss of active abduction, forward flexion, and active external rotation when the tears involve the infraspinatus and supraspinatus.[3] According to the literature, there is no consensus regarding the optimal management of irreparable MRCT, especially in younger patients.[4] For RCT, conservative treatment remains the first option.[5] However, when that fails, surgical treatment should be considered. Although numerous surgical treatment options have been proposed for MRCT such as rotator cuff debridement with or without biceps tenotomy,[6] partial cuff repair with or without graft augmentation,[7] subacromial internal spacer,[8] superior capsule reconstruction,[9] and with the best reported outcomes, reverse total shoulder arthroplasty.[10] Although reverse shoulder arthroplasty is successful in elderly patients with significant joint degeneration, controversy persists whether these procedures are indicated in active and young patients with MRCT or if these are best treated with different surgical options.[11] A latissimus dorsi transfer (LDT), originally described by Gerber et al.[12] in 1988, seems to be a viable option for young active patients with irreparable posterior superior RCT. A LDT restores the biomechanical imbalance between the anterior and posterior soft tissue structures of the shoulder around the glenohumeral joint by centralizing

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the humeral head and improving the shoulder kinematics.[13] Recently, an arthroscopic LDT has been proposed with comparable or better clinical results to the open technique.[14] It is a safe procedure with an overall reported complication rates of 9.5%, including deep infections (0.4%), hematomas (0.7%), peripheral nerve injury (2.7%), wound dehiscence (1.5%), and failures of transferred tendon (3.4%).[15] *Cutibacterium acnes* (formally known as *Propionibacterium acnes*) is the most prevalent organism in infections after non-arthroplastic shoulder surgery, especially after arthroscopy.[16] Even in the case of negative culture tests, empirical antibiotic therapy proved to be decisive.[17] The aim of this work is to describe a case of arthroscopic-assisted LDT in which a late *Pseudomonas aeruginosa* infection was revealed.

Case report

A 60-year-old man, presented with severe right shoulder pain. At the first visit, the patient showed a substantial limitation of right shoulder motion with positive impingement test, Jobe, Palm up, and Napoleon test. By X-ray, there emerged small periarticular calcifications. The glenohumeral joint space was preserved while the sub-acromial space was reduced. The magnetic resonance arthrography showed a large supraspinatus and infraspinatus tear. The preoperative American Shoulder and Elbow Surgeons (ASES) and Constant scores were 25/100 and 26/100, respectively.

The patient underwent an arthroscopically assisted latissimus dorsi tendon transfer. An arthroscopic exploration of the cuff was performed confirming the irreparable posterosuperior lesion of the cuff. Following the surgery, the patient was asymptomatic for 2 months. There was no swelling or discharge from the wound site and the wound healed well. At 2 months, the patient reported pain and swelling in the right shoulder. Due to a suspicion of infection, the patient started Levofloxacin (LVFX) antibiotics orally for 2 weeks. We observed a reduction of swelling, while the pain persisted. At this point, the X-ray evaluation was negative. Washout was not performed as the first choice of treatment because the infection had the characteristics of superficial localization to the soft tissue.

After another 2 months of follow-up, pain and swelling reappeared in the right shoulder. By examination, there was a fistula on the anterior arthroscopic portal scar with a greenish corpuscolated liquid secretion, and crepitus with movements of the right shoulder. Furthermore, the range of motion was globally limited and there was wasting of the deltoid. Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were 64 mm/h and 37.8 mg/L, respectively. Based on clinical evaluation, the senior investigator (A.P.) performed an arthroscopic irrigation and debridement of the glenohumeral joint and subacromial space taking the secretion without removing sutures and anchors. The secretion was sent for culture revealing the *P. aeruginosa* positivity and specific antibiotic sensitivity.

The evidence of *P. aeruginosa* includes an exudate greenish in color, when present. This infection can also present with fistula, pain, joint swelling, restricted range of motion, biological inflammatory syndrome that includes elevated levels of erythrocyte sedimentation rate (>50 mm/h) and CRP, and even radiological bone lysis. Hospitalization may raise doubts as it is a nosocomial germ. The choice of LVFX is justified due to the patient allergy to beta lactams, the sensitivity of the germ at cultural tests (MIC_{50} 0.25 µg/mL; MIC_{90} 16 µg/mL) and in relation to the need for an oral therapy that can be done at home.

After 3 more weeks pain and swelling reappeared. On examination, there was warm skin without evidence of a fistula and his range of motion was globally restricted and painful. Computed tomography (CT) of right shoulder showed diffuse soft tissue empyema and periarticular effusion of the right shoulder. The senior author (A.P.) then performed a second arthroscopic irrigation and debridement of the glenohumeral joint and subacromial space.

The transferred tendon was healthy and well positioned on the greater tuberosity of the humerus and there were no signs of intra-articular infection. During the procedure, the senior author found in correspondence of the anterior arthroscopic portal a small swollen and reddened area. The area was opened with a small incision revealing an exudate, greenish in color, not clearly purulent, among the deltoid muscle fibers without glenohumeral joint involvement. The senior author debrided the area, the washout was sent for culture which reported growth of *P. aeruginosa* and the wound was irrigated with antiseptic solution. Ciprofloxacin (CPFX) was started orally and performed for 6 weeks based on the results of culture tests (CPFX: MIC_{50} 0.25 µg/mL, MIC_{90} 16 µg/mL; LVFX: MIC_{50} 0.5 µg/mL, MIC_{90} 32 µg/mL). Laboratory values for inflammatory markers fluctuated throughout the course of postoperative care (Table 1). At 12 months of follow-up, there were healed arthroscopic portal scars and the patient was able to carry out his daily activities without pain and terminal restriction of range of motion. At the final follow-up, the ASES and constant scores were 76.6/100 and 82/100, respectively. Based on a minimal clinically important difference (MCID) of 12–17 points for ASES and ~10 points for the constant score, the pre–post change was clinically significant. Written informed consent was obtained from the patient for publication of this case report.

Discussion

Septic arthritis is consistently reported as occurring in less than 1% of arthroscopy procedures. After shoulder arthroscopy, infections occur with a frequency of about 0.3%.[18] The most common organism isolated from a septic joint after arthroscopy is *Staphylococcus aureus* and *Cutibacterium acnes* and rarely by *P. aeruginosa*.[16,19] Infection with *P. aeruginosa* is very difficult to manage due to the intrinsic antibiotic resistance to this bacterium and the possibility of

Table 1. Values of the post-operative laboratory tests of leukocytes ESR and CRP.

	2 months	3 months	4 months	5 months	6 months	9 months	12 months
Leukocytes (n.v. 3.7–9.7 × 10^3/μL)	8.4	8.3	8.8	9.1	9.2	8.7	9.3
ESR (n.v. 1–15 mm/h)	36	15	64	15	59	9	10
CRP (n.v. <2.9 mg/L)	11.2	3	37.8	<2.9	36.7	<2.9	<2.9

ESR = erythrocyte sedimentation rate; CRP = C-reactive protein; n.v.: normal value.

developing others during antibiotic therapy.[20] This led to the use of a combination therapy of two antibiotics for a long time.[21] In fact Stutz et al.[22] suggest that the treatment must combine abundant arthroscopic lavage, with synovectomy as indicated by the stage of the infection and the concomitant administration of two effective antibiotics for at least 6 weeks. More recently Laghmouche et al.[23] conducted a study on the eradication of *P. aeruginosa* infection as monotherapy and for a limited period of time, achieving good results. They recommend starting antibiotic treatment intravenously and possibly associating, only for the first 5 days, a second antibiotic, switching to oral fluoroquinolone therapy as soon as the sensitivity of the bacterium has been demonstrated. The American Academy of Orthopedic Surgeons guideline for management of surgical site infections[24] recommended using both fluid and tissue cultures along with CRP to assist in making a diagnosis of infection. They also found that 8 weeks of antibiotic protocols may be sufficient when compared with longer durations. The Infectious Diseases Society of America recommended an antibiotic protocol of at least 4–6 weeks of pathogen-specific intravenous or highly bioavailable oral antimicrobial therapy.[25] In light of this, the failure of our first two treatments could be imposed on the oral administration mode and the lack of a combined therapy for the first 5 days, as well as the duration of the therapy, only 2 weeks.

Several hypotheses could be formulated to help explain why the infection occurred. Tosh et al.[26] suggested that infection should be determined by retention of tissue in the lumen of arthroscopic shaver handpiece. In our case the first surgery could have missed some infected tissue. On the contrary, in light of the simultaneous infection of five other patients hospitalized with *P. aeruginosa*, but subjected to different surgical procedures and with a different instrument, it is conceivable an accidental contamination occurred during the pre-, intra-, or post-operative procedures. Unfortunately, we have no data to identify the correlation of events.

It should be noted that there are strains of *P. aeruginosa* that are more sensitive to CPFX when compared to Levaquin.[27] This might help explain why a switch in antibiotics proved to be effective. These different strains may also explain the MIC50 and MIC90 values showed relatively greater bactericidal capacity of CPFX for this patient's infection.

Conclusion

In conclusion, although it is very rare and still not well described in the literature, pseudomonas aeruginosa can cause an infection after arthroscopically assisted LDT without involvement of the glenohumeral joint. Eradication can occur with irrigation and debridement of the glenohumeral joint, the sub acromial space and the arthroscopic portals combined with adequate oral therapy based on culture tests. Depending on the strains involved, a switch from LVFX to CPFX may be necessary to eradicate the infection.

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Ethical approval

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Informed consent

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