



Case report

Treatment of recurrent infection at the tibial bone tunnel after anterior cruciate ligament reconstruction using a medial gastrocnemius muscle flap – A case report

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ABSTRACT

Introduction and importance: The incidence of postoperative infection after ACL reconstruction is reported to be 0.3 to 1.7%. Early debridement and complete removal of the artificial implant have been reported to be very important for complete recovery from postoperative infection after ACL reconstruction. Extra-articular infection of tibial tunnel post ACL reconstruction is a rare case and only a few cases are reported in the literature. The treatment for this lesion is not defined.

Case presentation: We report a 36-year-old case of recurrent infection at the tibial bone tunnel after ACL reconstruction. The treatment for the patient was debridement and then reconstruction using a medial gastrocnemius muscle flap. 9 months post-operative, there were no signs of infection at the surgical site and the knee joint. The patient reported no pain and was capable of walking without a crutch.

Clinical discussion: Treatment of infection post ACL reconstruction can be accomplished by arthroscopic and surgical wound irrigation and debridement and antibiotic therapy. It was reported that debridement and then bone cement mixed with vancomycin and gentamycin loaded into the tibial bone tunnel was a good method for treatment of this lesion. If the treatment is not successful, a partial medial gastrocnemius muscle flap should be another choice for treatment of the recurrent infection at the tibial bone tunnel after ACL reconstruction.

Conclusion: A partial pedicle medial gastrocnemius muscle flap is to be considered an alternative choice for treatment of the recurrent infection at the tibial bone tunnel after anterior cruciate ligament reconstruction.

Level of evidence: A case report.

1. Introduction and importance

The incidence of postoperative infection after ACL reconstruction is reported to be 0.4 to 0.9% [1–3]. Early debridement, constant joint irrigation, long-term intravenous antibiotics, and graft retention or removal have been reported to be very important for complete recovery from postoperative infection after ACL reconstruction [4]. Extra-articular recurrent infection of tibial tunnel post ACL reconstruction is a rare case and only a few cases are reported in the literature. The treatment for this lesion is not defined. Some studies suggested debridement and bone cement [1,2,5]. However, no study suggested another method after failure. This article presents a case of recurrent infection at the tibial bone tunnel after ACL reconstruction, he was treated with debridement and then bone cement mixed with

vancomycin and gentamycin loaded into the tibial bone tunnel. However, recurrent infection occurred 6 months after the operation. Our case was then treated by debridement, removal of bone cement, and reconstruction using a partial medial gastrocnemius muscle flap.

2. Case presentation

This case follows 2020 SCARE guidelines for reporting of cases in surgery [6]. A 36-year-old man underwent ACL reconstruction of his right knee using autologous hamstrings tendon at the age of 34 years at a local hospital. He had a prolonged infection at the tibial bone tunnel postoperative. Wound debridement with staple removal was performed 10 weeks after surgery. However, the wound did not heal, and a fistula eventually formed. The condition was left untreated for two years, and

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the patient was referred to our hospital at his request.

At the initial visit to our hospital (I level Institution of Trauma and Orthopaedics), the patient was in a good state overall. He had no fever or pain over the right knee and was able to walk. On examination, there were no inflammatory signs at the right knee joint, and the range of motion was unrestricted. His right knee was swollen but non-tender. There were signs of right knee instability but he did not feel any knee pain. Anterior drawer and Lachman's test were positive. Surgical scars on the knee were well healed. A purulent discharge was observed from the fistula at the right proximal lower leg. There was no compromising of blood flow, sensation, or motor-nerve function. Laboratory data showed complete blood count was normal, however C-reactive protein (CRP) was mildly raised at 0.45 mg/dl. X-rays showed partially discontinuous osteosclerosis and osteolytic change of the tibial bone tunnel wall (Fig. 1A). The MRI imaging indicated abscess formation with necrotic tissue within the tibial bone tunnel and widespread inflammation at the proximal tibia (Fig. 1B, C).

The patient had never been in inpatient medical treatment and had no history of weight loss, fever, or family history for any tumors, any relevant genetic information, and psychosocial history or relevant pre-existing illnesses.

The patient was presented to the orthopedic board and was diagnosed as having an extra-articular infection at the tibial bone tunnel after the ACL reconstruction using autologous hamstrings tendon 2 years ago. The decision was made for debridement and then bone cement mixed with vancomycin and gentamycin loaded into the tibial bone tunnel (Fig. 1E). Surgery was performed by the senior surgeons (Gioi Nang Nguyen and Luong Van Nguyen). The patient was treated with an antibiotic (cefoxitin 3 g/day) intravenously. Since *Staphylococcus aureus* was isolated from intraoperative tissue culture, vancomycin and

levofloxacin were administered for two weeks postoperatively. Signs of infection were not observed at the surgical site, and healing of the surgical site was achieved two weeks postoperatively.

After discharge, she has received levofloxacin orally for 4 weeks. The patient was permitted weight-bearing activities. Monthly follow-ups were conducted by us.

Six months post-operative, a recurrent purulent discharge was observed from the fistula at the right proximal lower leg (Fig. 2A). The range of motion of the knee joint was unrestricted. There was no compromising of blood flow, sensation, or motor-nerve function. Laboratory data showed mild elevation of C-reactive protein (CRP) at 0.5 mg/dl. X-rays showed an osteolytic change of the tibial bone tunnel wall around bone cement (Fig. 2B). The patient was diagnosed as having an extra-articular recurrent infection at the tibial bone tunnel. He underwent debridement, removal of bone cement (Fig. 2C), VAC (Vacuum Assisted Closure) therapy and then reconstruction following 2 weeks using a partial pedicle medial gastrocnemius muscle flap (Fig. 2D, E, F). Vancomycin and levofloxacin were administered for two weeks post-operatively. Signs of infection were not observed at the surgical site, and healing of the surgical site was achieved on postoperative day 14 following skin grafting.

Nine months post-operative, there were no signs of infection at the surgical site and the knee joint. The patient reported no pain and was capable of walking without a crutch. X-rays and MRI imaging showed no evidence of recurrent infection at the tibial bone tunnel (Fig. 3). He reported being very satisfied with the overall results. He is now checked regularly monthly by the authors.

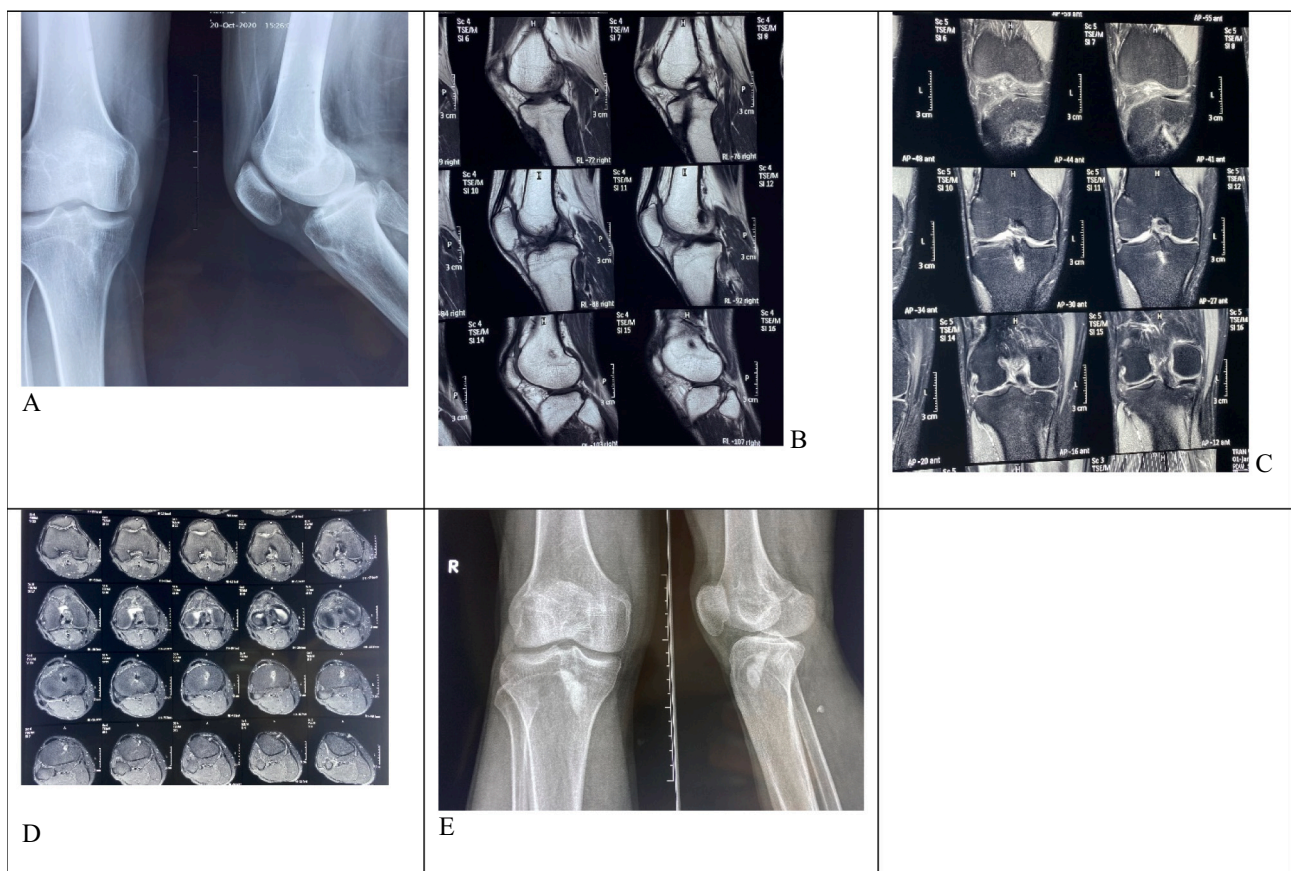


Fig. 1. X-rays and MRI before and after the first operation. A, X rays of right knee preoperative. B, C, D, MRI of right knee preoperative. E, X rays of right knee postoperative.

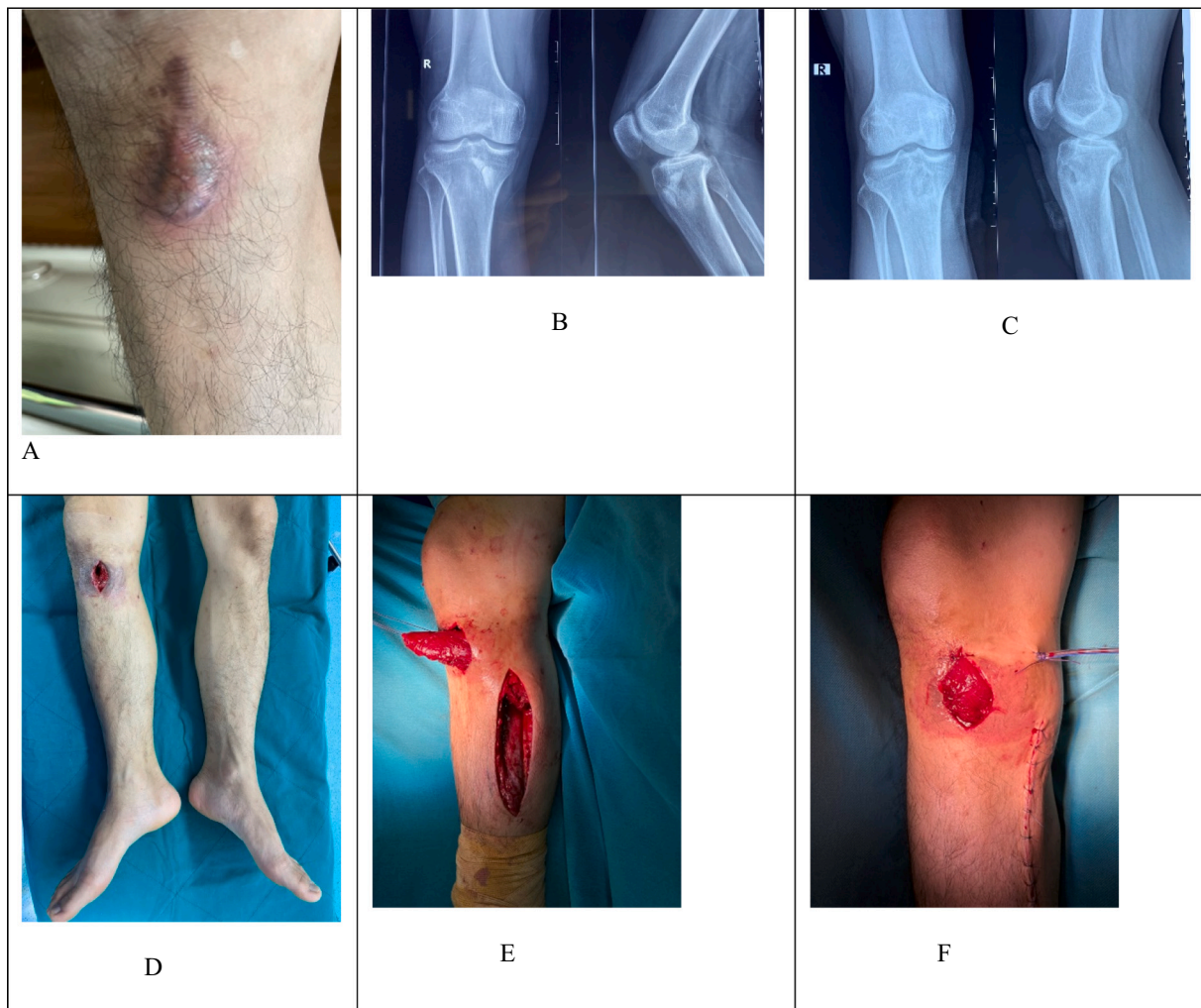


Fig. 2. Clinical condition and X-rays before and after the second operation. A, Clinical before the operation, B, X-rays of right knee pre-operative. C, X-rays of right knee post-operative. D, Clinical pre-operation of reconstruction. E, F, Reconstruction using medial gastrocnemius muscle flap.

3. Discussion

Development of infection after ACL reconstruction is extremely rare, however, it sometimes induces severe knee dysfunction [4,7]. Treatment of infection can be accomplished by early debridement, constant joint irrigation, long-term intravenous antibiotics, graft retention, or removal [1,2,5,8]. The most frequently used treatment is joint irrigation and debridement with graft retention [9,10]. Some authors suggested immediate removal of the infected ACL graft [3,11,12], but others advocated ACL graft removal only in cases of persistent infection [2,13]. Aggressive surgical debridement combined with proper antibiotics according to the isolated pathogen is thought to be the key to effective treatment in cases of persistent infection [3,5,8,12]. This case is an extremely miserable case of prolonged infection after ACL reconstruction with a fistula for two years despite complete removal of the metal implant and debridement of necrotic tissue. The main cause of persistent infection might be the remaining non-absorbable suture in the tibial bone tunnel. The case is unusual because the recurrent infection after the operation of debridement and using bone cement mixed with vancomycin and aminoglycosides loaded in the tibial bone tunnel. To our knowledge, this is the first reported case of treatment of recurrent infection at the tibial bone tunnel post-ACL reconstruction using a medial gastrocnemius muscle flap.

In our case, the patient underwent debridement and bone cement mixed with vancomycin, and gentamycin was loaded into the tibial bone

tunnel. However, recurrent infection occurred 6 months after the operation. The isolated organism was *Staphylococcus aureus*. There were some studies showing the efficacy of using bone cement mixed with vancomycin and aminoglycosides in treating the infection at the tibial bone tunnel post-ACL reconstruction [1,2,5]. This allows the targeted environment to achieve a high concentration of vancomycin and yet low plasma concentration to reduce the complication associated with vancomycin when administered intravenously. Aminoglycosides present in most conventional bone cement when combined with vancomycin have a synergistic bactericidal effect even against the multi-resistant gram-positive organism. However, in this case, we did not treat successfully the chronic infection at the tibial bone tunnel post-ACL reconstruction with this technique.

We have not encountered any published literature about treating the infection at the tibial bone tunnel post-ACL reconstruction using a medial gastrocnemius muscle flap. However, some authors reported good results of using this technique in treating osteomyelitis at the tibia fracture [14]. Medial gastrocnemius muscle flap was a quick, easy and reliable flap without causing much morbidity [14]. The muscle flap brings obliteration of the dead space and robust blood supply to the affected area which in turn expedites tissue healing and infection control. Moscona [15] and Agarwal [16] reported the safe splitting of the distal gastrocnemius muscle in 29 patients based on vascular anatomic studies. The advantages of gastrocnemius segmentation include the possibility of covering multiple defects with less contour deformity. In

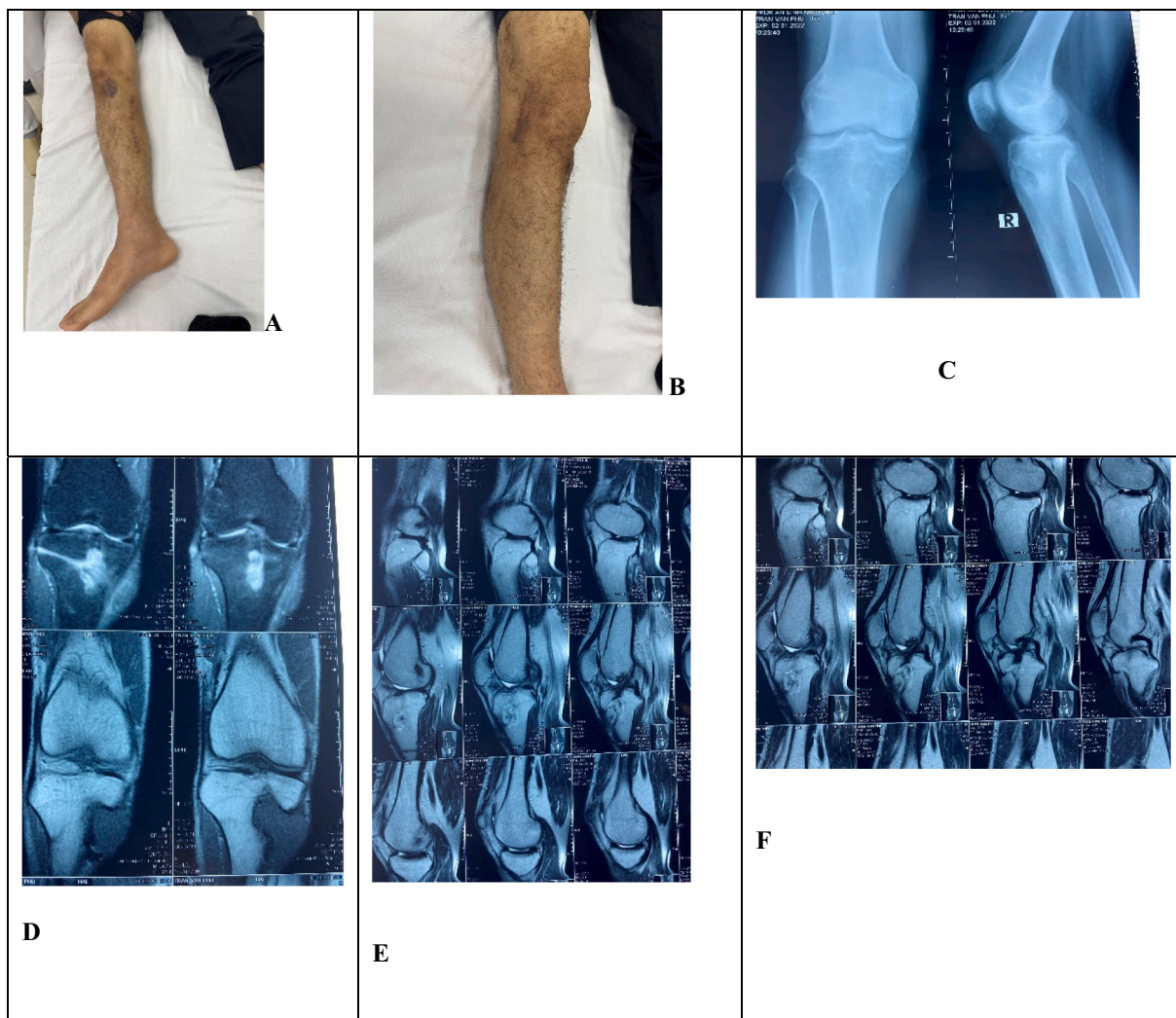


Fig. 3. Clinical condition, X-rays, and MRI 9 months after the operation. A,B Clinical condition 9 months postoperative C, X-rays of right knee 9 months after the operation. D,E,F MRI of right knee 9 months after the operation.

our case, the tibial tunnel was reamed to a bit larger size intra-operatively and a partial pedicle medial gastrocnemius muscle flap was raised with its pedicle artery that permitted load the flap into the tibial bone tunnel. Nine months post-operative, there were no signs of infection at the surgical site and the knee joint. The patient reported no pain and was capable of walking without a crutch.

4. Conclusion

Our case recommends that a partial medial gastrocnemius muscle flap is to be considered an alternative choice for treatment of the recurrent infection at the tibial bone tunnel after ACL reconstruction. A large sample study should be conducted to observe the outcomes of this technique.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Availability of data and materials

The data used to support the findings of this study are available from the corresponding author upon request.

Ethical approval

All procedures were approved by our Hospital's Institutional Review Board, Hanoi, Viet Nam.

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Guarantor

Dr. L.V.N.

Research registration number

Not applicable.

CRedit authorship contribution statement

Dr. G. N. N.: Conceptualization, Surgery, Supervision
 Dr. L. N. V.: Conceptualization, Surgery, Writing - Review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

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