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ORIGINAL ARTICLE

Effect of Vancomycin Soaking of Hamstring Autograft on Postoperative Infection Rates in Cases of Primary ACL Reconstruction

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ABSTRACT

Background: Although intravenous antibiotic prophylaxis is used, the incidence of septic arthritis after ACL reconstruction is relatively rare but devastating, ranging from 0.14% to 2.6%. Serious adverse effects on clinical outcomes, such as graft failure, arthrofibrosis, degenerative arthropathy, and even osteomyelitis, can result from postoperative infection.

Methods: 210 patients between the ages of 19 and 46 participated in this study. In our study, the preferred graft was hamstring autograft, and all patients had isolated ACL injuries. The patients in the study were randomly divided into 2 groups (group 1: control group) and (group 2: treatment group). Saline solution was used in group 1, and vancomycin solution was used in group 2. Both groups were prospectively followed.

Results: At 2, 4, 6, and 8 weeks, all cases were scheduled for routine follow-up. After that all cases were followed up every 3 months for 2 years..Two cases of postoperative septic arthritis were observed in group 1 (1.8%), while group 2 had no infections at all (0%). $P < 0.05$ indicated that the difference was significant.

Conclusions: Prophylactic vancomycin soaking of hamstring autograft is effective to reduce the infection rate in our study and should be a standard procedure to prevent this serious complication.

Keywords: Vancomycin; ACL reconstruction; septic arthritis.

INTRODUCTION

Although intravenous antibiotic prophylaxis is used, the incidence of septic arthritis after ACL reconstruction is relatively rare but devastating, ranging from 0.14% to 2.6%[1-3].

Serious adverse effects on clinical outcomes, such as persistent pain, graft failure, arthrofibrosis, degenerative arthropathy, and even osteomyelitis, can result from postoperative infection [4, 5].

Even after the infection was eliminated, osteophyte formation, degenerative knee changes, and compromised knee function could not be reversed [6].

Compared to other grafts like quadriceps tendon, patellar tendon, or allograft, hamstring autograft has been linked to a higher risk of postoperative infection after ACL reconstruction [7].

The most widely accepted explanation for this is contamination during harvesting and preparation, though the precise cause is still unknown [8].

The use of a graft soaked in an antibiotic with unique properties was first developed in 2012 because contaminated grafts are one of the most frequent causes of postoperative septic arthritis [9].

Vancomycin is utilized due to its optimal pharmacokinetic properties, which include low allergenicity, heat stability, and local application safety. Its bactericidal action targets skin commensals, such as Coagulase Negative Staphylococci and Staphylococcus Aureus, which are the most common pathogens linked to ACL reconstruction infections [10, 11].

We hypothesized that soaking the graft in vancomycin solution prior to implantation significantly reduces the incidence of postoperative septic arthritis.

The purpose of the study was to investigate whether pre-soaked hamstring graft with a solution of vancomycin provides an effective way to reduce the risk of post-operative infection.

METHODS

210 patients between the ages of 19 and 46 participated in this study: 172 were male and 38

were female. In our study, the preferred graft was hamstring autograft, and all patients had isolated ACL injuries. Patients who required an extraarticular procedure or who suffered from multiligamentous injuries were not allowed to participate in the study. Additionally, patients with prior knee punctures or surgeries were not included.

All patients were operated in our department during the period between May 2019 and February 2022. The study was approved by Ethical committee of faculty of Medicine, Zagazig University (IRB number 843). An informed written consent was obtained from all patients.

The patients in the study were randomly divided into 2 groups (group 1: control group without vancomycin soaking) and (group 2: treatment group with vancomycin soaking). Both groups were prospectively followed. When the hallmark clinical symptoms of septic arthritis were observed, or when bacterial growth was detected from joint aspiration or biopsies, the diagnosis of postoperative infection was deemed confirmed [12].

At 2, 4, 6, and 8 weeks, all cases were scheduled for routine follow-up. After that all cases were followed up every 3 months for 2 years.

Technique of ACLR

Preoperative Infection Prophylaxis Protocol

The same preoperative infection prophylaxis procedures were applied to both groups. Prior to surgery, patients were instructed to have their hair epilated 24 hours beforehand and shower with a povidone-iodine scrub brush.

About half an hour before the tourniquet was applied, a prophylactic intravenous 2 gmcefazolin bolus was given. After that, the skin was precleaned via a brush of alcoholic betadine. A final step was performed using alcoholic betadine.

Operative details

A pneumatic tourniquet was placed high in the thigh of both groups during surgery while they were supine and under spinal anaesthesia.

Autologous hamstring tendons (both ipsilateralGracilis and Semitendinosus tendons were harvested) were the preferred graft in both groups, and all reconstructions were performed arthroscopically with independent femoral tunnel placement through an anteromedial portal. For every patient, an intraarticular drain was inserted at the end of the procedure and removed 48 hours later.

Using an open-ended tendon stripper, the hamstring graft is harvested. After harvesting, it is assessed to see if tripling or quadrupling the graft will result in an 8–10 mm graft diameter [13]. (Figure 1)

The graft was wrapped in moist, sterile gauze after it had been fully prepared. Saline solution was used to soak this gauze in group 1, and vancomycin solution (5 mg/ml) was used in group 2.

A bowl containing 200 millilitres of sterile solution and 1000 milligrammes of vancomycin powder was used to make the vancomycin solution. Following wrapping, the graft was left for a minimum of 25 to 30 minutes until it was implanted. The graft was unwrapped prior to implantation, but it was not washed [7]. (Figure 2)

Both groups underwent the same surgical procedure, which involved an adjustable-length loop with interference screw fixation on the tibial side and cortical button fixation on the femoral side.

Postoperative protocol:

Following the same postoperative protocol, patients in both groups received intravenous antibiotics, cryotherapy (ice packs), anti-edematous treatment, anticoagulation, and static quadriceps exercises during their two days in the hospital. Prior to discharge, the suction drain had been removed.

For a week, patients were released on oral antibiotics and painkillers. Both groups received a two-week prescription for oral anticoagulation therapy to prevent DVT.

It was recommended to extend the knee to zero degrees and to gradually flex it up to 90 degrees. Full weight bearing was allowed, and two crutches were used for balance.

One crutch was discarded after two weeks, and weight bearing without crutches was permitted after a month.

After that physiotherapy was started, following the same rehabilitation protocol for both groups.

Statistical analysis:

Data collected, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis.

RESULTS

All cases were scheduled for routine follow-up at 2, 4, 6, and 8 weeks. After that all cases were followed up every 3 months for 2 years. The last follow up for all cases was at 2 years postoperative.

Two cases of postoperative septic arthritis were observed in group 1 (without vancomycin soaking; incidence: 1.8%), while group 2 (with vancomycin soaking) had no infections at all (incidence: 0%). $P < 0.05$ indicated that the difference was significant.

Within two weeks of the index surgery, group 1 experienced two cases of acute onset postoperative septic arthritis.Warmth, fever, swelling, and discomfort were the typical symptoms in both cases. Aspiration of coagulase-negative staphylococci revealed a positive culture in one case and a negative culture in the other.

There was no statistical difference in the demographics of the two groups in terms of age and gender (P> 0.05). (Table 1)

Thetwo postoperative septic arthritis cases in group 1 were admitted immediately. As a standard procedure, we used arthroscopic irrigation and debridement (I&D), graft retention, and concurrent intravenous antibiotics. Initially administered empirically, antibiotic therapy was later reassessed and modified based on culture results. Evaluation of the follow-up was based on the laboratory inflammatory markers (CRP) and the clinical course.

Patients were discharged on oral antibiotics and antibiotic therapy was stopped when CRP value is within normal value [12].

Due to clinical and laboratory deterioration in one of the two cases, another arthroscopic irrigation and debridement (I&D) and graft resection was necessary because the graft was unstable and almost necrotic.

Table 1: Demographics (age and gender) of the 2 study groups.

	Group 1	Group 2
Sample size (n)	**105**	**105**
Age at ACLR (Years)	**27.459**	**29.364**
Gender (Male/Female)	**83/22**	**89/16**

Age at ACLR is presented as Mean (Standard deviation).There was no statistical difference in the demographics of the two groups in terms of age and gender (P> 0.05)

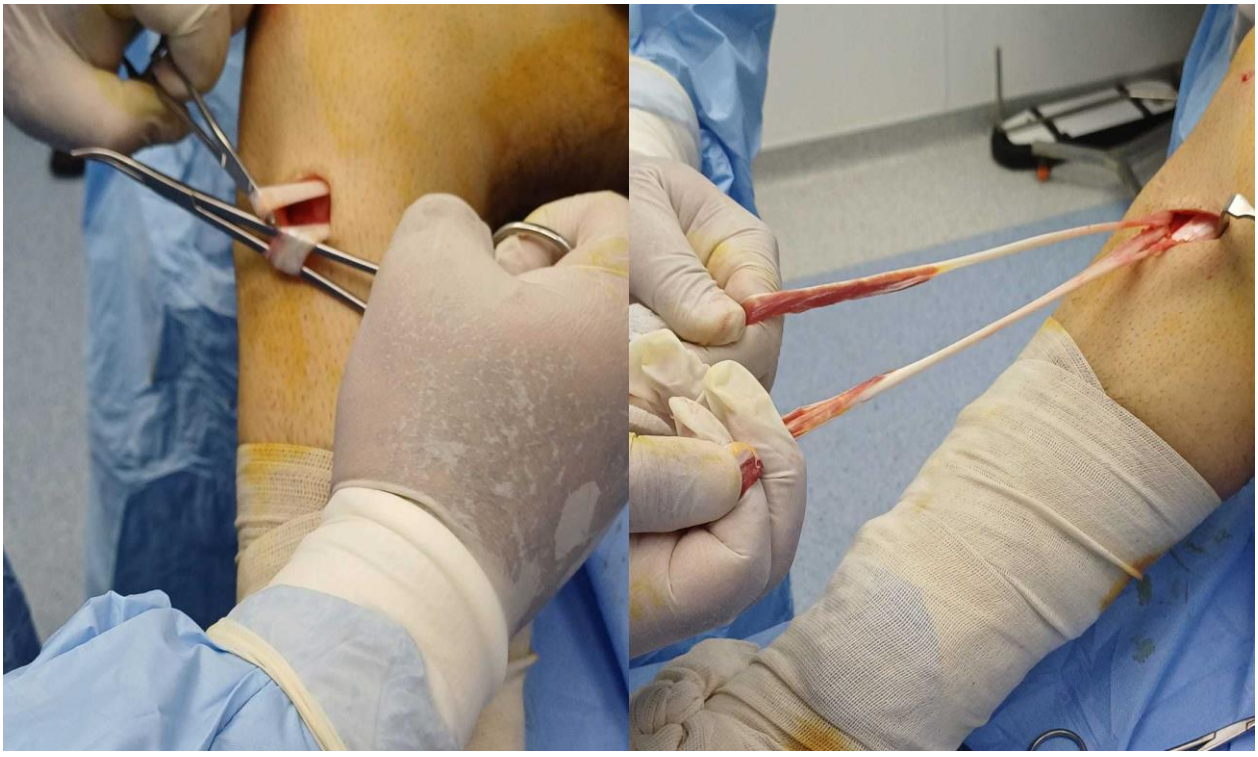

Figure 1: Hamstring graft harvesting

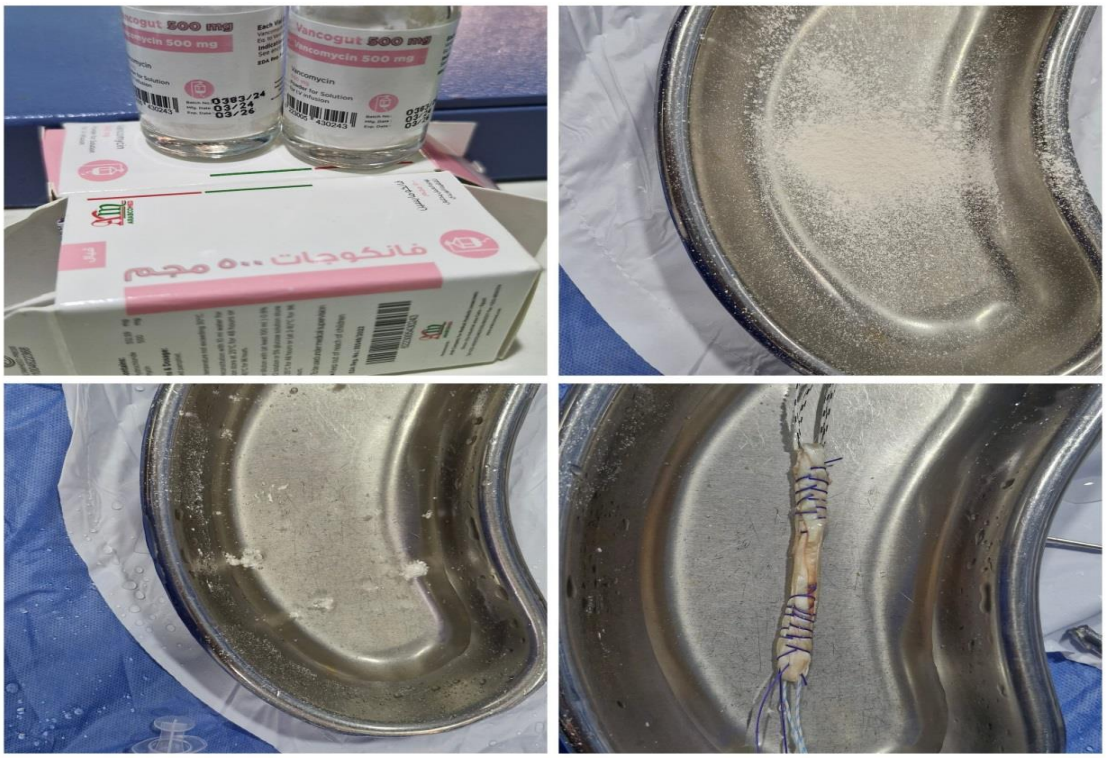

Figure 2: Preparation of vancomycin solution and graft soaking

DISCUSSION

Septic arthritis is a rare but serious complication following anterior cruciate ligament reconstruction.Apart from surgical morbidity, septic arthritis following ACLR can have serious complications, such as instability, chondral damage, arthrofibrosis, pain, and the requirement for additional surgery. After ACLR, the great majority of postoperative infections occur within 30 days following the operation [12].

Vancomycin is used extensively in orthopaedic surgery, particularly joint surgery, and has emerged as one of the preferred preventative antibiotics for ligament reconstruction and joint replacement surgery due to its antimicrobial activity against a wide variety of gram-positive cocci [14].

Vancomycin has a very low allergic potential, which is the only significant contraindication, and it is highly effective against the common causative bacteria in reconstructive knee surgery. Additionally, compared to other antibiotics like cefazolin or gentamicin, vancomycin is less harmful to local tissues, including osteoblasts, osteoclasts, and chondrocytes [9]. In order to lower the risk of postoperative infection, Vertullo et al. initially suggested presoaking ligament grafts with vancomycin [9]. When using Vancomycin, the dosage concentration and the amount of time needed for presoaking to achieve the intended antimicrobial effect are two crucial considerations [15]. Presoaking times have, unfortunately, varied widely across the majority of clinical studies. The Vertullo et al. study required a soaking time of 20 minutes and a concentration of 5 mg/ml to clean all of the tendons under investigation [9].

The soaking time in Schuster et al. ranged from 1 to 41 minutes, with an average of 13 ± 6 minutes [7].The graft was wrapped for a minimum of 15 minutes in Figueroa et al. [16].We used a 5 mg/ml concentration and a 25–30 minute soaking period prior to implantation in our study.

Several publications have shown that vancomycin soaking reduces the risk of postoperative infection after primary anterior cruciate ligament reconstruction (ACLR).A study of 1135 patients by Vertullo et al. proved that Prophylactic vancomycin pre-soaking of HT autografts diminished the infection incidence more than intravenous antibiotics alone.[9]Phegan et al. concluded that Compared to intravenous antibiotics alone, pre-soaking of HT autografts with topical vancomycin diminished the incidence of postoperative infection.[17]Figueroa et al. reported that Pre-soaking of HT autografts in vancomycin for ACLR prevented the appearance of postoperative septic arthritis compared to not soaking of the grafts.[16]Hees et al. confirmed that Graft soaking in vancomycin (1 mg/ml) was efficacious in preventing septic arthritis after ACLR after studying 1636 patients. (18)

Some limitations can be found in the present study, the most important being the practical correlation of contamination with infection. However, the bacteria that have been identified are the same as found in clinical practice.

The small cohort of patients could be considered another limitation, but a sample size calculation was made beforehand. Further important limitations included the inability to study (because of the unavailability of data) patient, surgical, and socioeconomic factors that could have influenced the rates of infections.

The present study provides evidential support for the use of vancomycin ACL graft soaking during ACLR in the daily clinical practice.

On the other hand for future studies, we recommend to use a large sample size including different types of grafts taking in mind patient, surgical and socioeconomic factors. In addition more studies should be performed to evaluate other aspects of the vancomycin soaking technique such as vancomycin joint concentrations after ACLR or its effect on supposed allograft contamination.

Conclusions:

Soaking the graft in vancomycin solution prior to implantation significantly reduces the incidence of postoperative septic arthritis and should be a standard procedure to prevent this serious complication because using hamstring autografts has been associated with a higher risk of infection after ACL reconstruction than using other grafts.

Conflict of Interest: None

Financial Disclosure: None

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