Original Article

Effects of Placing Anterior Cruciate Ligament Grafts in Vancomycin Powder Reduces Infection Rate

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ABSTRACT

OBJECTIVE: To determine the effects of putting Anterior Cruciate Ligament (ACL) grafts in vancomycin powder before reconstruction surgery lowers the risk of infection post-operatively.
METHODOLOGY: An observational COHORT Study was conducted at Jinnah Hospital Lahore from 2017-202. Based on the use of vancomycin, all ACL reconstructions carried out between 2017-2022 at single Hospital settings were examined. This study contained a total sample of 100 subjects, all on pre-vancomycin protocol. A standard follow-up examination was conducted every two weeks (Follow-up rate was 95%). The Statistical analysis was done. The level of significance was < 0.05.
RESULTS: The study revealed that out of 100 participants, 96% Males and 4% females participated with a mean age of 25.26±3.86. Of them, 42(42%) were in the age range of 18-24 years, and 58(58%) were in the age range of 25-32 years. Out of 100 Participants, 63(63%) had mild pain, and 37(37%) had moderate pain after surgery. One hundred individuals underwent ACL Graft surgery; 97(97%) had no infection, and 3(3%) had an infection after the ACL grafts were placed in Vancomycin Powder.
Conclusion: Vancomycin pre-placing and vancomycin wrap dramatically lower the risk of infection after ACLR in hamstring auto grafts. According to statistical analysis, the ACL graft's previous use of vancomycin powder considerably decreased the infection rate compared to individuals for whom this procedure was not used.

KEYWORDS: Anterior Cruciate Ligament grafts, Vancomycin, Infection, Complication, ACLR

INTRODUCTION

The nemesis of surgery, and a significant worry in Orthopaedic surgery, is infection. For more than 30 years, it has been common practice to administer systemic prophylactic antibiotics before Orthopaedic surgeries, particularly those involving the placement of metals, implants, or grafts[1-3]. The frequency of injuries to the anterior cruciate ligament (ACL) is high, with 43.5 injuries for every 100,000 person-years. After an ACL rupture, a knee can be effectively stabilized by an ACL reconstruction[4]. Despite being rare, infections do happen following ACL repair[4-6]. For full ACL rupture, arthroscopic anterior cruciate ligament (ACL) repair is recommended. Even though this surgery is done more than 400,000 times a year in the US, difficulties can still arise. One especially harmful result of ACL repair is infection[7,8].

In Orthopaedic surgery, surgical site infections (SSIs) are an uncommon but potentially fatal complication. Even when preoperative precautions are established, SSIs can still happen in up to 1% to 2% of all Orthopaedic surgeries. Sports medicine treatments have a reduced infection rate; however, studies show that anterior cruciate ligament (ACL) repairs, notably, still have an infection prevalence of 0.14% to 1.7% [5,9,10]. Most current research indicates that the incidence is around 1% [11,8]. Following ACLR, the risk of knee infections has been linked to several variables, including prior knee surgery, further open operations and the use of hamstring grafts[13]. In multiple studies the prevalence of infection in patients who underwent ACLR surgery was evaluated. It turned out that this rate (1.8%) was more significant than anticipated[8,14,15].

The risk of infection depends on the graft selected for ACL restoration. Infection rates following ACL surgery with hamstring grafts were more significant than those following patellar tendon grafts, according to many studies[16]. Surgical site vancomycin usage has expanded in several subspecialties, including thoracic, trauma, spine, joint replacement, and sports medicine surgery to reduce the risk of postoperative infection[17]. Some surgeons have begun using antibiotics like vancomycin to lessen the likelihood of infection. Recently, some have recommended pre-implantation placing of ACL transplants in vancomycin powder[9]. To lower this risk of infection, pre-soaking the auto graft with vancomycin was used as a novel preventative strategy in the ACLR[8]. Recent research has demonstrated that, after initial ACLR, immersing the graft in vancomycin solution effectively reduces postoperative infection[19].

Vancomycin is a glycopeptide antibiotic that has been

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demonstrated to be acidic when produced in normal saline (NS) at the doses employed in these most recent clinical tests. It also has a high volume of distribution and water solubility[17,19,20]. Vancomycin's pharmacokinetic characteristics, which make it an appropriate agent, are the basis for its usage. Low allergenicity, thermal stability, local usage safety, and broad dissemination are a few of them. It has a bactericidal effect on skin commensals such as coagulase-negative staphylococci and Staphylococcus aureus, which are by far the most frequently identified pathogens in ACL reconstruction infections[21].

Extracellular matrix (ECM) proteins in the graft may be impacted by treatment with VS, with ensuing detrimental effects on the graft's material qualities that might cause laxity or rupture postoperatively[17,4].

The rationale of this study was to determine whether prophylactic graft saturation with vancomycin decreased the incidence of infection after an Anterior Cruciate Ligament Reconstruction Surgery.

METHODOLOGY

An observational COHORT Study was conducted using purposive sampling techniques. Data Was collected from 2017-2022. The sample size of the research was 100. The sample size was selected according to the formula:

$$N = \frac{\left(Z_{\alpha/2}\sqrt{2p(1-p)} + Z_{1-\beta}\sqrt{p_1(1-p_1)p_2(1-p_2)}\right)^2}{(p_1-p_2)^2}$$

Subjects undergoing ACL Reconstruction Both Genders and Age Range 18-32 Years were included in the study. Subjects proceeding with an ACL graft other than the hamstring tendons, revision ACL repair, or simultaneous osteotomy were Excluded from the study[12]. In the 22nd Version of SPSS, statistical software was used for the inquiry (analysis) of the collected data. Data was collected through Frequencies, Means, Standard Deviations, and pie charts.

RESULTS

The study revealed that out of 100 participants, 96% of Males and 4% of females participated with a mean age of 25.26±3.86. Of them, 42(42%) were in the age range of 18-24 years, and 58(58%) were in the age range of 25-32 years **(Table I)**. Out of 100 Participants, 63(63%) had mild pain, and 37(37%) had moderate pain after surgery. One hundred individuals underwent ACL Graft surgery; 97(97%) had no infection, and 3(3%) had an infection after the ACL grafts were placed in Vancomycin Powder. Moreover, out of 96 males, only 3 participants contracted an infection even after putting the graft in vancomycin powder **(Table II)**.

Table I: Demographic data

		Age	Gender	Pain
N	Valid	100	100	100
	Missing	0	0	0
Mean		25.26	1.04	2.86
Median		25.00	1.00	2.00
Std. Deviation		3.863	.197	1.341
Minimum		18	1	1
Maximum		35	2	6

Table II: Gender* Infection

		Infection		Total
		Yes	No	
Gender	Male	3	93	96
	Female	0	4	4
Total		3	97	100

DISCUSSION

In 2019, Offerhaus C 2019[13] conducted a study who underwent ACLR. There was no postoperative infection in the knees after putting ACL grafts in 5mg/ml Vancomycin solution. When the auto graft was bathed in vancomycin, statistical analysis showed that the postoperative infection rate was considerably lower ($p < 0.01$). In contrast to our study, where we put ACL grafts in Vancomycin powder for 20 minutes before surgery, 3 out of 100 participants got postoperative knee infections. Males were affected more than females. The level of significance was set at < 0.05.

In 2020, Bohu Y et al.[23] conducted a study on 1674 patients with knee pain who underwent ACLR surgery. The auto graft was properly soaked in the vancomycin solution for 10 minutes after it had been harvested before being fixed in the tibial and femoral tunnels. 1 (0.2%) participant underwent postoperative knee infection even after soaking in vancomycin solution, which following our study, which stated that out of 100 participants, 3(3%) got postoperative infection even after putting the ACL graft in vancomycin powder 20 minutes before surgery.

In multiple studies one of the study mentions that one hundred twenty patients had ACLR with a graft that had been pre-soaked in vancomycin and received intravenous antibiotics before surgery before the tourniquet was inflated. Following graft harvest, the grafts were immersed in a 5 mg/ml vancomycin solution for one minute. The graft was then secured inside the graft-size tube and wrapped in sterile gauze previously soaked in the vancomycin solution. Patients undergoing systemic antibiotic prophylaxis and vancomycin pre-soaking of the transplant had no infections found. The prevalence of infection was 0% (0 out of 120). This is in contrast to our study, which stated that out of 100 participants, 3% got

postoperative knee infection even after putting the grafts in Vancomycin powder for 20 minutes before surgery, as shown in **Table III**.[14,24,8]

Table III: Infection Rate

		Frequency	Percentage
Valid	Yes	3	3.0
	No	97	97.0
	Total	100	100.0

The study was limited because it did not record the surgeon's experience or the number of ACL cases treated annually, two factors that might also influence the choice of whether to use vancomycin in ACL reconstruction. However, this study is clinically useful because it provides information on the current practices for putting ACL grafts in vancomycin powder and could help surgeons who have not yet used this method.

CONCLUSION

Vancomycin pre-soaking and vancomycin wrap dramatically lower the risk of infection after ACLR in hamstring auto grafts. According to statistical analysis, the ACL graft's previous saturation in a vancomycin powder considerably decreased the infection rate compared to individuals in whom this procedure was not used.

LIST OF ABBREVIATIONS

- ACLR: Anterior Cruciate Ligament Reconstruction
- VS: Vancomycin Solution
- NS: Normal Saline
- ECM: Extracellular Matrix
- SSIs: Surgical Site Infections

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AUTHOR CONTRIBUTION

Sohail MA: Literature review, study design & concepts
Saddique I: Data collection, analysis
Mazhar T: Data interpretation and drafting

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