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# QUESTION 5: Should autograft or allograft be soaked in an antiseptic or antibiotic solution prior to implantation during anterior cruciate ligament reconstruction (ACLR)?

**RECOMMENDATION:** Yes, autograft tissue should be soaked in an antibiotic solution prior to implantation during ACLR.

**LEVEL OF EVIDENCE:** Moderate

**DELEGATE VOTE:** Agree: 91%, Disagree: 9%, Abstain: 0% (Super Majority, Strong Consensus)

## RATIONALE

Infection after ACLR is rare but can cause serious complications [1]. Contributing factors that may predispose to infection include diabetes, smoking, increased time of surgery and tourniquet inflation, additional or larger incisions for arthroscopic portals and the use of a drain [2].

The use of a preoperative prophylactic antibiotic has been previously established to reduce infection rates in orthopaedic surgery procedures [3]. Historically, ACL allografts have been associated with a higher risk for infection. However, a recent systematic review reported no difference in infection rates between allograft and autograft tissue for ACLR [4]. Further, hamstring autograft grafts have been reported to have a higher incidence of infection compared to both allografts and bone-tendon-bone (BTB) patellar tendon autografts [5–7].

Among the published studies, there are strong evidences that pre-soaking of hamstring grafts in topical vancomycin reduced the rate of postoperative infection when compared to intravenous (IV) antibiotics alone.

Vancomycin has been reported for its use for local antibiotic infusion into joints [8]. Vertullo et al. investigated the utility of soaking hamstring autografts with vancomycin before implementation during ACLR. In their investigation, both patient cohorts received preoperative IV antibiotics while one group additionally received a pre-soaked vancomycin graft. A statistical difference in infection rates was noted between the two patient groups as the preoperative IV antibiotic-only group reported an infection rate of 1.4% compared to a 0% rate for the group with the vancomycin-soaked allograft [9].

Pérez-Prieto et al. performed a similar study. Both patient cohorts received preoperative IV antibiotics while one group additionally received a pre-soaked vancomycin graft. However, in this series, BTB autografts were included as well. The group without vancomycin saturation of the graft had an infection rate of 1.85% while the group of patients who received systemic antibiotic prophylaxis and graft pre-soaking with vancomycin did not experience any infections (0%) [10].

Phegan et al., reporting on the use of vancomycin-soaked hamstring autografts, noted no infections in a series of 1,300 patients receiving prophylactic vancomycin pre-soaked hamstring grafts in addition to systemic antibiotics [11]. Additionally, Yazdi et al. reported using gentamicin irrigation solutions in conjunction with preoperative IV antibiotics with an infection rate of 0.57% compared to an infection rate of 2.1% in patients receiving only IV antibiotics. All patients in this series received autologous grafts [12].

Vancomycin has activity mostly against gram-positive microorganisms, while gentamicin is a broad–spectrum antibiotic targeting both gram-positive and gram-negative microorganisms [11].

Due to the high impact of literature supporting the use of soaking autograft tissue in an antibiotic solution prior to implantation during ACLR, we conclude that soaking autografts in antibiotic solution is an effective treatment in reducing infection postoperatively.

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# QUESTION 6: What is the most appropriate/effective sterilization method of an anterior cruciate ligament (ACL) graft dropped on the operating room (OR) floor during ACL reconstruction (ACLR)? Should the tissue instead be disposed and alternate graft acquired?

**RECOMMENDATION:** Rinsing the contaminated graft in a 4% solution of chlorhexidine gluconate is the most effective decontamination method in the event that an ACL graft is dropped on the OR floor. When a chlorhexidine gluconate solution is used for decontamination of the dropped ACL graft, the subsequent rates of infection are very low, suggesting that there is no need to dispose of the ACL graft.

**LEVEL OF EVIDENCE:** Moderate

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

## RATIONALE

Injuries to the ACL are among the most common injuries to the knee, with reconstruction being the preferred method of treatment when functional instability is present [1]. Autografts are frequently used for ACLR, but it has been shown that the use of autografts is associated with contamination as a result of the harvesting and manipulation process [2]. Contamination of the autograft can also occur accidentally, by dropping the graft on the OR floor or allowing it to come into contact with non-sterile surfaces. In fact, a 2008 survey showed that 75% of plastic surgeons had dropped an autograft on the OR floor at least once [3]. In 94% of those cases, the autograft was decontaminated and the operation was completed. This protocol may put the patient at risk for the development of an intraoperative infection if proper decontamination procedures are not followed. This is particularly concerning given the sheer volume of ACL autograft reconstructions done each year, which has led to a variety of case studies to attempt to identify the best method for sterilizing a dropped autograft during ACLR.

Numerous studies have shown that a contaminated autograft can be effectively decontaminated by rinsing it in a 4% chlorhexidine gluconate solution [4–8]. There is some discrepancy regarding the length of time that a graft should be rinsed in the chlorhexidine solution, with 90 seconds [8], three minutes [6,7], 15 minutes [9] and 30 minutes [4] all being recommended. Khan et al. determined that rinsing a contaminated autograft in a 4% chlorhexidine gluconate solution was the most effective decontamination technique in a systematic review of seven studies [10]. The studies included used samples from a variety of sources (fresh-frozen, autograft, cadaver) and they found that 98% of contaminated grafts soaked in chlorhexidine showed no bacterial growth [10].

Bacitracin, polymyxin B and povidone iodine were additional proposed methods of decontaminating a dropped graft, but there were conflicting recommendations regarding their use. Of note, bacitracin was shown to be highly effective in decontaminating hamstring autografts [6,7], but it did not decontaminate bone-patellar tendon-bone grafts [11]. The clinical relevance of the latter observation has not been explored further. While a povidone iodine rinse was found to be a useful method of decontamination when used on grafts dropped on the OR floor, it was ineffective on samples artificially contaminated with *Staphylococcus aureus* and *Pseudomonas aeruginosa* [12].

There is a lack of patient outcomes data and randomized control trials on the subject, as well as some discrepancy regarding the length of time a graft should be rinsed prior to implantation. However, there is agreement between numerous case studies indicating that rinsing a contaminated ACL graft in a 4% chlorhexidine gluconate solution is an effective and appropriate decontamination method.

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