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Symposium: Prevention and Management of Infection in ACL Reconstruction General Considerations for Prevention of Infection

Intraoperative Precautions

Introduction

Surgical site infection (SSI) can be inflicted by several sources, such as contaminated skin/hands of the surgeon and / or patient, and underlying acute infection of the patient, inadequate skin disinfection, contamination of the surgical room, non-sterile draping of the patient, use of non-sterile instrumentation and non-adequate postsurgical wound care.

The following information will focus on intraoperative measures to minimize the possibility of SSI.

Evidence-Based Recommendations for Intraoperative Prevention of SSI

Intraoperative Antiseptic Skin Preparation of the Patient

It was shown that intraoperative skin disinfection with alcohol-based antiseptic agents resulted in to significant lower SSI rates than with aqueous solutions. Alcohol-based Chlorhexidine groups were shown to be advantageous vs. aqueous povidone-iodine solutions.

Leaper et al., Curr Opin Infect Dis 2015; 28: 158-163

Berrios-Torres et al., JAMA, Online Pub.05/2017

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Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

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Category IA—strong recommendation; high-quality evidence

Moderate quality evidence shows that the use of alcohol-based antiseptic solutions for surgical site skin preparation are more effective compared to aqueous solutions in reducing SSI. A meta-analysis of available studies (low quality of evidence) showed that alcohol-based CHG is beneficial in reducing SSI rates compared to alcohol-based povidone-iodine (PVP-I). As a result, the GDG agreed to recommend the use of an alcohol-based antiseptic solution preferably based on CHG for surgical site preparation on intact skin. The strength of this recommendation was considered to be strong.

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016
(<http://www.who.int/gpsc/ssi-prevention-guidelines/en/>)

Antiseptic Skin Preparation should be carried out with sufficient safety margin to the surgical wounds during ACL reconstruction. Therefore, it is recommended to carry out skin disinfection from the heel to the hip of the leg of ACL reconstruction.

Antiseptic Surgical Drapes / Gowns

Recommendation:

- Using sterile, disposable non-woven or sterile, reusable woven drapes and gowns for shielding the surgical area from pathogen contamination has been shown to be effective in reducing SSI rates.

The strength of this recommendation was considered to be conditional.

- There is no benefit for using plastic adhesive incise drapes with or without antimicrobial properties for reducing SSI.

The strength of this recommendation was considered to be conditional.

Available evidence from one RCT, one quasi-RCT and 2 observational studies (moderate quality for RCTs and very low for observational) shows that the use of sterile disposable non-woven drapes and sterile surgical gowns has neither benefit nor harm when compared to sterile reusable woven drapes and surgical gowns in reducing the SSI rate. Considering the quality of the evidence, it has been agreed to suggest that either sterile disposable non-woven or sterile reusable woven drapes and surgical gowns can be used.

Bellchambers et al. Europ J Cardiothorac Surg. 1999;15(1):45-50

Belkin et al. Today's Surg Nurse. 1998;20(6):18-23.

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016

There is no evidence for the potential effect of the timing or usefulness of changing surgical drapes or gowns in the course of a surgical operation for the purpose of preventing SSI.

Evidence available from one RCT, one quasi-RCT and 2 observational studies (overall very low quality for both RCTs and observational) shows that the use of adhesive iodophor-impregnated incise drapes has neither benefit nor harm when compared to no adhesive incise drapes in reducing the SSI rate.

Considering the lack of evidence that plastic adhesive incise drapes (with or without antimicrobial properties) prevent SSI, it has been agreed on by the WHO that they should not be used. Given the quality of the evidence (moderate to very low), the strength of this recommendation was considered to be conditional.

Daeschlein et al. Int J Infect Dis. 2014;29:274-8.

Webster et al. Cochrane Database Syst Rev.2013;1:CD006353

Perioperative Parenteral Antibiotic Prophylaxis

Recommendation:

- Perioperative parenteral administration of antibiotic significantly decreases SSI in ACL reconstruction
- Antibiotics such as cefazolin, cefoxitin, penicillins should be given immediately before ACL reconstruction less than 60 min before surgical incision and minimum 5 min before tourniquet inflation

The strength of this recommendation is considered to be strong

- There is no medical evidence that intraoperative antimicrobial irrigation can reduce SSI
- There is no medical evidence that intraoperative application of PRP can reduce SSI

Overall low quality evidence shows that the administration of antibiotic prophylaxis after the incision causes harm with a significant increase of the SSI risk compared with administration of SAP prior to incision. Adequate tissue concentrations of the antibiotic should be present at the time of incision and throughout the procedure for SAP to be effective. This necessitates administration prior to incision.

Further evidence shows that a low tissue concentration of antibiotics at the time of wound closure is associated with higher SSI rates.

A moderate quality of evidence comparing different time intervals prior to incision shows significant harm when antibiotic prophylaxis is administered before 120 minutes compared to within 120 minutes pre-incision. Attention must be paid to pharmacokinetics of antibiotics, such as cefazolin or cefoxitin, suggested for use in ACL reconstruction, which have a short half-life. Therefore, it has been recommended to administer the antibiotic less than 60 minutes prior to surgical incision to maintain adequate antibiotic blood concentrations for a period of 2 hours. The same attention should be paid to the single antibiotic half-life when considering re-dosing during prolonged surgery.

Bratzler et al. Surg Infect (Larchmt) 2013;14(1)

Zelenitsky et al., Antimicrob Agents Chemother. 2002;46(9)

In clean and clean-contaminated procedures, such as ACL reconstruction, no significant advantage was shown for additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain, unless half-life of the antibiotic is shorter than surgical time.

Berrios-Torres et al., JAMA Surgery, Online Publication May, 2017

Glycemic Control

Recommendation:

- Implement perioperative glycemic control and use blood glucose target levels less than 150 mg/dL in patients with and without diabetes.

The strength of this recommendation is considered to be strong with high to moderate-quality of evidence

Overall low quality evidence shows that a protocol with more strict blood glucose target levels has a significant benefit in reducing SSI rates when compared to a conventional protocol. There was evidence that the effect was smaller in studies that used intensive blood glucose controls intraoperatively only compared to studies that used an intensive protocol postoperatively or both intra- and postoperatively. Among the intensive protocols, the effect was similar in studies with a target blood glucose level of ≤ 110 mg/dL (6.1 mmol/L) and an upper limit target level of 110-150 mg/dL (6.1-8.3 mmol/L). Similar to meta-regression analysis, there was no evidence that the effect of intensive blood glucose control differed between studies of diabetic and non-diabetic patients.

Berrios-Torres et al., JAMA Surgery, Online Publication May, 2017

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016

Oxygenation

Recommendation:

Administration increased FIO₂ during surgery for patients with normal pulmonary function and general anesthesia with endotracheal intubation and after extubation postoperatively.

The strength of this recommendation is considered to be strong with high to moderate-quality of evidence

A moderate quality of evidence shows that providing high FiO₂ (80%) is beneficial in patients undergoing procedures under general anaesthesia with endotracheal intubation and results in a significant decrease of the risk of SSI compared to 30-35% FiO₂. As a result, it has been agreed to recommend that patients undergoing surgical procedures under general anaesthesia should receive 80% FiO₂ intraoperatively and in the immediate postoperative period for 2-6 hours, if feasible.

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016, pp 110-115

Intraoperative Surgical Precautions

Graft Specific Considerations

It has been shown that hamstring tendons carry a 3-8 fold increased risk of SSI compared to BPTB & Allografts. Studies have shown that in 10-16% hamstrings graft showed a pathogen contamination at the time of tissue harvest. It was also shown that pathogen contamination was found in between 3 – 6% at the skin site of tissue harvest. Based on this findings, special care should be carried out that ACL grafts, especially hamstring tendons, will have no contact with the skin of the patient at time of graft harvest. This can be achieved by covering the skin around the surgical incision with a sterile gauze. Also, different instruments should be used for graft harvest and graft preparation to further minimize the risk of SSI during ACL reconstruction.

Badran et al., Int Orthop. 2016 Sep;40(9)

Gavriilidis et al., KSSTA (2009) 17:1043–1047

Nakayama et al., Arthroscopy. 2012 May;28(5)

Several studies showed a substantial reduction in SSI after ACL reconstruction following graft irrigation with Vancomycin prior to graft preparation. Such tissue processing must be recommended for all tissue grafts.

Vertullo et al., Arthroscopy. 2012 Mar;28(3):337-42

Pérez-Prieto et al., KSSTA 2016 Sep;24(9):2724-8

Sterility of Surgical Instruments

Surgical personnel must be made aware of obligatory check of instruments for true sterility. It has been shown that specific instrumentation in ACL reconstruction, such as tendon strippers, cannulated screw drivers or drills or fixation specific devices often carry tissue remains from previous surgeries, which have been identified as a source of SSI.

There is good medical evidence that flash sterilization increases the risk of SSI. Therefore, such sterilization should not be applied for instruments used in ACL reconstruction.

Judd et al., Arthroscopy. 2006;22:375-384

Wang et al., Arthroscopy. 2009;25:243-249

Wound Closure

Antimicrobial Sutures

- Consider the use of triclosan-coated sutures for the prevention of SSI

Conditional recommendation, moderate quality of evidence

Overall low to moderate quality evidence shows that antimicrobial-coated sutures have significant benefits in reducing SSI rates in patients undergoing surgical procedures when compared to noncoated sutures. The effect seems to be independent of the type of suture, procedure or wound contamination classification. In meta-regression analysis, there was no evidence that the effect of antimicrobial-coated sutures differed between braided and monofilament sutures, clean, cardiac or abdominal surgery, and other surgeries.

Turtiainen et al., World J Surg. 2012;36(10)

Isik et al., Heart Surg Forum. 2012;15(1)

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016, pp 153-157

Drains

- There is no evidence that drains increase the incidence of SSI
- It is not recommended to continue postoperative antibiotic prophylaxis with drains in-situ

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016, pp 174-177

Sterile Wound Dressings

- There is no evidence that any type of advanced dressing vs. standard dressing on primarily closed surgical wounds reduces the risk of SSI

World Health Organization, GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION, Nov. 2016, pp 171-173