Prevention

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QUESTION 1: What perioperative antibiotic prophylaxis should be used in patients undergoing arthroscopic surgery without the use of implants or grafts? What about patients with non-anaphylactic or anaphylactic penicillin allergy?

RECOMMENDATION: The literature neither supports nor refutes the use of antibiotic prophylaxis for routine arthroscopic surgeries, without the use of implants or grafts. For non-compromised, non-implant arthroscopy, antibiotic prophylaxis is not required. Patients with comorbidities which have been shown to cause higher risk for infection may benefit from antibiotic prophylaxis. A first-generation (cefazolin) or a second-generation (cefuroxime) cephalosporin can be used as first line, including for those with a non-anaphylactic penicillin allergy. For patients with an anaphylactic penicillin allergy, other antibiotics such as vancomycin, clindamycin or teicoplanin can be used.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

The overall risk of infection following routine elective arthroscopic procedures is low (for the knee it is 0.1–3.4% [1–3] and for the shoulder it is similar at 0–3.4% [4,5]). Various patient-related risk factors that are associated with higher risk of infection have been identified including the patients being young and male, conditions resulting in immunocompromised status and history of depression [1,2]. Additional risk factors that have been identified using databases include higher body mass index, history of diabetes, longer operative time and smoking [1,2]. In these patients at higher risk of infection, special consideration should be given to the use of perioperative antibiotic prophylaxis.

In a prospective study by Qi et al. there were similar infection rates in 1,326 patients irrespective of the antibiotic prophylaxis [6]. In a randomized controlled trial (RCT) by Wieck et al., administration of antibiotics did not provide additional benefit for prevention of infection in 437 patients [7]. However, it is important to note that because of the smaller cohort size, the findings may have introduced a type II error. Similarly, a recent large database study on 40,810 simple knee arthroscopies demonstrated no association between administration of perioperative antibiotics and postoperative infection [8]. Although the rate of deep infection was lower in the antibiotic group, the difference did not reach a statistical significance.

Randelli et al. reported an infection rate of 0.16% (15 infections) in their review of a series of 9,385 shoulder arthroscopies, with a significant difference in rates between patients receiving antibiotic (0.095%) and those not receiving antibiotic (0.58%) ($p = 0.01$) [4]. Conversely, Bert et al. retrospectively analyzed 3,231 knee arthroscopies (2,780 meniscectomies) and found patients who received preoperative antibiotics had an infection rate of 0.15% compared to 0.16% in those who did not ($p = 0.59$) [9].

A recent retrospective study by Pauzenberger et al. on 3,294 arthroscopic rotator cuff repairs with implants, demonstrated a reduced infection rate from 1.54% to 0.28% in patients who received no antibiotic prophylaxis compared with those who received 2 grams of cefazolin routinely, respectively. Further, those patients who received no antibiotic demonstrated a 5.53 times higher rate of infection [10].

In elective surgery, the preferred preoperative antibiotic is a first or second-generation cephalosporin (cefazolin or cefuroxime) [11]. They are broad spectrum, cost-effective and allow newer, more expensive antibiotics to be used for more resistant organisms. Cephalosporins cover gram-positive bacteria as well as clinically important aerobic gram-negative bacilli and anaerobic gram-positive bacteria. They have good distribution in muscle, bone and synovium, achieving fast bactericidal levels after administration [11].

One placebo-controlled trial evaluating prophylactic cefazolin in 2,137 total hip arthroplasty patients showed a significant reduction in infection[12] whereas another RCT of cefuroxime compared to vancomycin and fusidic acid in 435 arthroplasty patients showed no difference in infection rate, the lack of difference may have been because of the small sample size and underpowered nature of the study [13]. Alternative first line agents are penicillins including cloxacillin and flucloxacillin [11]. In known cases of anaphylactic penicillin allergy, other agents such as clindamycin, vancomycin or teicoplanin, if available, should be considered. Clindamycin is bacteriostatic and alone has poor activity against *Staphylococcus aureus* (MRSA) so other agents (e.g., levofloxacine) may need to be coadminsitered [11]. With a non-anaphylactic penicillin allergy, a second-generation cephalosporin can still be used as there is limited cross-reactivity and penicillin skin testing can assess for a true allergy [11]. Patients colonized with MRSA should receive vancomycin or teicoplanin [14]. A recent report from Europe showed that teicoplanin was the most common agent used in high-risk patients with associated comorbidities (84% of practices), but is not available in the US, Canada or China [15].

Septic arthritis post-arthroscopy remains very rare with rates of 0.009–1.1% [16]. Despite its rarity, this complication is serious as its treatment often warrants multiple surgical procedures and prolonged antibiotic treatment, with risks of significant chondral damage and patient morbidity. Despite successful eradication of infection, the joint may develop secondary osteoarthritis and functional loss [17]. Moreover, the additional short and long-term treatment costs to the patient and hospital, is a factor to consider when using antibiotic prophylaxis [18]. However, the increasing prevalence of antibiotic resistance and the occurrence of drug-related adverse events cautions its routine use [19].

Overall, the literature on antibiotic prophylaxis for knee and shoulder arthroscopy is limited. For routine elective arthroscopy

without the use of implants or grafts in the healthy patient, there is no evidence to support the use of perioperative antibiotic prophylaxis. Antibiotics may be considered when implants are being used or when the patient has certain comorbidities which are considered risk factors for infection. A first- or second-generation cephalosporin antibiotic can be used as a first line agent, including in patients with a non-anaphylactic penicillin allergy. In patients with an anaphylactic penicillin allergy, other agents such as vancomycin, clindamycin or teicoplanin can be considered.

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QUESTION 2: Should routine methicillin-resistant *Staphylococcus aureus* (MRSA) screening be in place for patients undergoing elective sports procedures?

RECOMMENDATION: Routine MRSA screening is not warranted for patients undergoing elective sports procedures. Screening may be appropriate in higher-risk patients and patients undergoing more complex procedures.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

Staphylococcus aureus (*S. aureus*) is the most frequent pathogen isolated from surgical site infections (SSIs) in patients undergoing orthopaedic procedures [1]. SSIs caused by *S. aureus* can be serious and difficult to treat, often requiring debridement with removal of orthopaedic implants. *S. aureus* resides on skin surfaces and asymptomatically colonizes approximately one-third of the population, most commonly the anterior nares [2]. Multiple studies have shown that *S. aureus* nasal colonization is a significant risk factor in developing *S. aureus* SSIs [3]. *S. aureus* is also found in the throat, axilla and groin [4], as well as in eczematous skin lesions [5]. Screening for and decolonization of *S. aureus* has been shown to decrease SSI rates in a variety of surgical specialties [6], but not specifically in patients undergoing sports procedures.

In some hospitals, 57% of isolates of *S. aureus* causing orthopaedic infection are resistant to methicillin [1]. Compared to methicillin-sensitive *S. aureus* (MSSA) causing SSI, patients with MRSA SSIs have been shown to have a higher risk of morbidity, mortality and greater hospital costs [7]. Indeed, one study showed that intranasal carriage of *S. aureus* was the only independent risk factor for SSIs following orthopaedic implant surgery [8].

Most studies evaluating MRSA screening and decolonization in orthopaedic patients were performed in elective total joint arthroplasty patients [9,10]. Other studies have also included spine patients (e.g., fusion) and trauma patients [11], and many did not state the specific type of elective orthopaedic patient included. These non-specific studies often had a minimum inpatient stay inclusion criterion, which therefore excludes almost all elective orthopaedic sports surgery cases.

Our extensive search of the literature identified a study by Kim et al. that evaluated patients undergoing sports procedures who