screened 7,019 of 7,338 (95.6%) preoperatively for MRSA. They also included patients undergoing total joint replacement and spine surgery, with a minimum one-day inpatient stay, though no details on the types of cases or numbers were provided. There were 309 (4.4%) MRSA carriers, and these patients did have a significantly higher risk of SSI compared to non-MRSA carriers (0.97% vs. 0.14%, p = 0.0162). However, the rates of infection in the sports surgery group were not reported [3].

Given the significant lack of data on the efficacy and cost effectiveness of preoperative MRSA screening in patients undergoing orthopaedic procedures in general and those receiving sports procedures in particular, the routine practice of MRSA screening cannot be recommended. Rates of infection after sports surgery procedures are generally lower than rates after arthroplasty or spine procedures, suggesting that screening strategies may prevent fewer infections and be less cost-effective in sports surgery than in other orthopaedic procedures. Very limited data suggests that screening may be considered in sports patients who will be admitted for at least one overnight stay, particularly if implants are to be used [3]. Further studies are needed to evaluate the efficacy and cost-effectiveness of screening for Staphylococcal carriage (MRSA or MSSA) in patients undergoing sports surgery procedures.

REFERENCES

[1] Shams WE, Rapp RP. Methicillin-resistant staphylococcal infections: an important consideration for orthopedic surgeons. Orthopedics. 2004;27:565–568.

[2] Chen AF, Wessel CB, Rao N. Staphylococcus aureus screening and decolonization in orthopaedic surgery and reduction of surgical site infections. Clin Orthop Relat Res. 2013;471:2383–2399. doi:10.1007/s11999-013-2875-0.

[3] Kim DH, Spencer M, Davidson SM, Li L, Shaw JD, Gulczynski D, et al. Institutional prescreening for detection and eradication of methicillin-resistant Staphylococcus aureus in patients undergoing elective orthopaedic surgery. J Bone Joint Surg Am. 2010;92:1820–1826. doi:10.2106/JBJS.I.01050.

[4] Gorwitz RJ, Kruszon-Moran D, McAllister SK, McQuillan G, McDougal LK, Fosheim GE, et al. Changes in the prevalence of nasal colonization with Staphylococcus aureus in the United States, 2001-2004. J Infect Dis. 2008;197:1226–1234. doi:10.1086/533494.

[5] Abeck D, Mempel M. Staphylococcus aureus colonization in atopic dermatitis and its therapeutic implications. Br J Dermatol. 1998;139 Suppl 53:13–16.

[6] Bode LGM, Kluytmans JAJW, Wertheim HFL, Bogaers D, Vandenbroucke-Grauls CMJE, Roosendaal R, et al. Preventing surgical-site infections in nasal carriers of Staphylococcus aureus. N Engl J Med. 2010;362:9–17. doi:10.1056/NEJMoa0808939.

[7] Whitehouse JD, Friedman ND, Kirkland KB, Richardson WJ, Sexton DJ. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: adverse quality of life, excess length of stay, and extra cost. Infect Control Hosp Epidemiol. 2002;23:183–189. doi:10.1086/502033.

[8] Kalmeijer MD, van Nieuwland-Bollen E, Bogaers-Hofman D, de Baere GA. Nasal carriage of Staphylococcus aureus is a major risk factor for surgical-site infections in orthopedic surgery. Infect Control Hosp Epidemiol. 2000;21:319–323. doi:10.1086/501763.

[9] Walley G, Orendi J, Bridgman S, Davis B, Ahmed E-N, Maffulli N. Methicillin resistant Staphylococcus aureus (MRSA) is not always caught on the orthopaedic ward. Acta Orthop Belg. 2009;75:245–251.

[10] Murphy E, Spencer SJ, Young D, Jones B, Blyth MJG. MRSA colonisation and subsequent risk of infection despite effective eradication in orthopaedic elective surgery. J Bone Joint Surg Br. 2011;93:548–551. doi:10.1302/0301-620X.93B4.24969.

[11] Mehta S, Hadley S, Hutzler L, Slover J, Phillips M, Bosco JA. Impact of preoperative MRSA screening and decolonization on hospital-acquired MRSA burden. Clin Orthop Relat Res. 2013;471:2367–2371. doi:10.1007/s11999-013-2848-3.

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QUESTION 3: What perioperative antibiotic prophylaxis should be used in patients undergoing arthroscopic surgery who are methicillin-resistant *Staphylococcus aureus* (MRSA) carriers?

RECOMMENDATION: MRSA carriers should be administered vancomycin or teicoplanin as antibiotic prophylaxis prior to arthroscopic surgery involving an implant and/or a graft or for patients at higher risk of infection.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

Prevalence of MRSA colonization is increasing in some community settings, even in patients who lack traditional (or any) identifiable risk factors [1]. Surveillance studies have suggested that the colonization rate in the general population varies worldwide, with methicillin-sensitive *S. aureus* (MSSA) nasal carriers making up 20–36.4% of the population, and MRSA nasal colonization composing 0.6–6% of the population [2].

When simple arthroscopy is performed (meniscal tears, articular debridement, synovectomy and microfracture), the risk of surgical site infection (SSI) is extremely low and antimicrobial prophylaxis is not routinely recommended [3–7]. However, when arthroscopic procedures involve the use of implants, grafts, placement of several surgical incisions, prolonged operative time or knee ligament reconstruction, the SSI risk is higher than in simple arthroscopy, and prophylactic antibiotic administration may be justified [8–10]. Although the efficacy of prophylactic antibiotics in reducing SSI for major orthopaedic procedures has been proven, the role of antibiotic prophylaxis in routine arthroscopy remains controversial [3,4,11,12].

Regarding arthroplasty, some studies reveal that universal MRSA decolonization is effective in reducing the overall rate of SSIs and promoting economic gains for the health system related to the downstream savings accrued from limiting future reoperations and hospitalizations [13–15]. The American Academy of Orthopaedic Surgeons (AAOS) and Surgical Care Improvement Project (SCIP) recommend first- or second-generation cephalosporins as the prophylactic antibiotics of choice for patients who are not colonized with MRSA, with vancomycin prophylaxis reserved for those who are MRSA-colonized [16]. The addition of vancomycin or an aminoglycoside to the prophylactic perioperative antibiotic regimen results in a predicted activity of 83–97% against the most common pathogens causing SSIs [17].

Thus, based on the available evidence, it is unlikely that prophylactic antibiotics are needed for simple arthroscopic procedures

in the first instance and if the prophylaxis should be modified for patients who are MRSA carriers. In the absence of evidence, and due to the gravity of any SSI being caused by MRSA, we recommend that consideration be given to administration of vancomycin or teicoplanin as antibiotic prophylaxis prior to arthroscopic surgery involving an implant and/or a graft or for patients at higher risk of infection.

REFERENCES

[1] Lu PL, Chin LC, Peng CF, Chiang YH, Chen TP, Ma L, et al. Risk factors and molecular analysis of community methicillin-resistant Staphylococcus aureus carriage. J Clin Microbiol. 2005;43:132–139. doi:10.1128/JCM.43.1.132-139.2005.

[2] Berthelot P, Grattard F, Cazorla C, Passot JP, Fayard JP, Meley R, et al. Is nasal carriage of Staphylococcus aureus the main acquisition pathway for surgical-site infection in orthopaedic surgery? Eur J Clin Microbiol Infect Dis. 2010;29:373–382. doi:10.1007/s10096-009-0867-5.

[3] Kurzweil PR. Antibiotic prophylaxis for arthroscopic surgery. Arthroscopy. 2006;22:452.

[4] Bert JM, Giannini D, Nace L. Antibiotic prophylaxis for arthroscopy of the knee: is it necessary? Arthroscopy. 2007;23:4–6. doi:10.1016/j.arthro.2006.08.014.

[5] Yeranosian MG, Petrigliano FA, Terrell RD, Wang JC, McAllister DR. Incidence of postoperative infections requiring reoperation after arthroscopic knee surgery. Arthroscopy. 2013;29:1355–1361. doi:10.1016/j.arthro.2013.05.007.

[6] Wyatt RWB, Maletis GB, Lyon LL, Schwalbe J, Avins AL. Efficacy of prophylactic antibiotics in simple knee arthroscopy. Arthroscopy. 2017;33:157–162. doi:10.1016/j.arthro.2016.05.020.

[7] Qi Y, Yang X, Pan Z, Wang H, Chen L. Value of antibiotic prophylaxis in routine knee arthroscopy. Der Orthopäde. 2018;47:246–253. doi:10.1007/s00132-017-3486-3.

[8] Wang C, Ao Y, Wang J, Hu Y, Cui G, Yu J. Septic arthritis after arthroscopic anterior cruciate ligament reconstruction: a retrospective analysis of incidence, presentation, treatment, and cause. Arthroscopy. 2009;25:243–249. doi:10.1016/j.arthro.2008.10.002.

[9] Nakayama H, Yagi M, Yoshiya S, Takesue Y. Micro-organism colonization and intraoperative contamination in patients undergoing arthroscopic anterior cruciate ligament reconstruction. Arthroscopy. 2012;28:667–671. doi:10.1016/j.arthro.2011.10.023.

[10] Kim SJ, Postigo R, Koo S, Kim JH. Infection after arthroscopic anterior cruciate ligament reconstruction. Orthopedics. 2014;37:477–484. doi:10.3928/01477447-20140626-06.

[11] Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2017;152:784–791. doi:10.1001/jamasurg.2017.0904.

[12] Prokuski L. Prophylactic antibiotics in orthopaedic surgery. J Am Acad Orthop Surg 2008;16:283–293. doi:10.5435/00124635-200805000-00007.

[13] Stambough JB, Nam D, Warren DK, Keeney JA, Clohisy JC, Barrack RL, et al. Decreased hospital costs and surgical site infection incidence with a universal decolonization protocol in primary total joint arthroplasty. J Arthroplasty. 2017;32:728–734.e1. doi:10.1016/j.arth.2016.09.041.

[14] Weiser MC, Moucha CS. The current state of screening and decolonization for the prevention of Staphylococcus aureus surgical site infection after total hip and knee arthroplasty. J Bone Joint Surg Am. 2015;97:1449–1458. doi:10.2106/JBJS.N.01114.

[15] Goyal N, Miller A, Tripathi M, Parvizi J. Methicillin-resistant Staphylococcus aureus (MRSA): colonisation and pre-operative screening. Bone Joint J. 2013;95-B:4–9. doi:10.1302/0301-620X.95B1.27973.

[16] American Academy of Orthopaedic Surgeons. Recommendations for the use of intravenous antibiotic prophylaxis in primary total joint arthroplasty 2014.

[17] Berríos-Torres SI, Yi SH, Bratzler DW, Ma A, Mu Y, Zhu L, et al. Activity of commonly used antimicrobial prophylaxis regimens against pathogens causing coronary artery bypass graft and arthroplasty surgical site infections in the United States, 2006-2009. Infect Control Hosp Epidemiol. 2014;35:231–239. doi:10.1086/675289.

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QUESTION 4: What is the best method for anterior cruciate ligament (ACL) allograft sterilization to minimize the incidence of postoperative infections and mechanical weakening of the graft?

RECOMMENDATION: The best method for ACL allograft sterilization to minimize the incidence of postoperative infection and mechanical weakening of the graft is the use of irradiation (preferably less than 1.8 Mrad). Allografts should be harvested aseptically and fresh-frozen, whenever possible.

LEVEL OF EVIDENCE: Limited

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

RATIONALE

An exhaustive literature review of articles published in English was undertaken to identify studies related to allograft sterilization and the incidence of postoperative infections and graft failures. The search was performed across the PubMed, Scopus, and Cochrane databases as well as Google Scholar using the following search terms: "allograft sterilization," "infections and allografts in ACL reconstruction," "complications after allograft use for ACL" and "mechanical strength of allografts." Articles in languages other than English were not reviewed, nor were articles on non-human subjects. The articles included were from 1988 until March 2018, (Levels I-IV evidence) containing evidence of graft longevity, post-ACL infections, revision rates following use of allografts and other complications associated with allograft use. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses criteria (PRISMA) were followed.

Septic arthritis after ACL reconstruction (ACLR) is a rare event, occurring in 0.14 to 1.8% of cases [1–3]. Several studies have demonstrated a lower rate of deep infection after ACLR using allograft compared to hamstring autograft tendons and equal possibilities with the use of bone patellar tendon bone (BPTB) autograft [4–8]. The increasing use of primary allograft ACLR during the last few decades can be explained by the fact that allograft offers several advantages such as shortening operative time, reducing postoperative pain, allowing a variety of grafts to choose from and avoiding harvest site morbidity [9–11].

However, allografts bring with them an intrinsic risk of contamination, which is why every possible effort must be made in order to lower this risk as much as possible.

The American Association of Tissue Bank (AATB) has made several rules in allograft procurement, sterilization and conservation, in order to guarantee a Sterility Assurance Level, which is the probability of failing the sterilization after the whole process, lower than $1x10^{-6}$ [12]. The possibility of human immunodeficiency virus (HIV) transmission is one in 1,667,600 [13], but it drops to 1/173,600 for non-processed allograft [14]. In fact, there are several steps that follow a rigid protocol to ensure a lower risk of disease transmission. The donor must be checked for known disease and an examination of the body is taken to control any sign of infection or intravenous (IV) drugs stigmata [15].