

- [2] Hort KR, DeOrto JK. Residual bacterial contamination after surgical preparation of the foot or ankle with or without alcohol. *Foot Ankle Int.* 2002;23:946–948. doi:10.1177/107110070202301010.
- [3] Ostrander RV, Brage ME, Botte MJ. Bacterial skin contamination after surgical preparation in foot and ankle surgery. *Clin Orthop Relat Res.* 2003;246–252. doi:10.1097/01.blo.0000030176.56585.d3.
- [4] Zacharias J, Largen PS, Crosby LA. Results of preprocedure and postprocedure toe cultures in orthopaedic surgery. *Foot Ankle Int.* 1998;19:166–168. doi:10.1177/107110079801900310.
- [5] Goucher NR, Coughlin MJ. Covering of the toes during hindfoot and ankle surgery: a randomized, controlled, clinical study. *Foot Ankle Int.* 2007;28:413–415. doi:10.3113/FAL.2007.0413.
- [6] Hunter JG, Dawson LK, Soin SP, Baumhauer JF. Randomized, prospective study of the order of preoperative preparation solutions for patients undergoing foot and ankle orthopedic surgery. *Foot Ankle Int.* 2016;37:478–482. doi:10.1177/1071100715623037.

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Author: Jens Richter

QUESTION 8: should antibiotic-impregnated cement be used during primary total ankle arthroplasty (TAA)?

RECOMMENDATION: Unknown. There is insufficient evidence for the routine use of antibiotic-impregnated cement during primary TAA.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

The main sources for this systematic review were the Medline, Embase, CINAHL and Cochrane CENTRAL databases, beginning with the first citation of ankle arthroplasty in July 2003, the 2016 Swedish Ankle Registry [1] and the 2016 New Zealand Joint Report [2].

In their report on the New Zealand Joint Registry, Rothwell et al. reported on 1,261 TARs from January 2000 to December 2015. Cement fixation was used only in 13 tibial components and in seven talar components. Antibiotic-impregnated cement was used seven times for tibial component fixation and three times for the talus component fixation. However, there was no statistical evaluation in this registry for the item periprosthetic joint infection (PJI) according to the type of cement used.

Considerable research is available related to PJI and antibiotic-impregnated cement for total knee arthroplasty (TKA) procedures. Gutowski et al. stated in their study that the absolute rate of infection increased when antibiotic-loaded cement was used in TKA, although this was less when compared to infection rates after use of plain cement [3]. In 2016, Schiavone et al. performed a systematic review determining the effectiveness of utilizing antimicrobials and the safety of antibiotic-loaded bone cement in primary TKA [4]. The

authors concluded that there was no significant difference in the rate of deep or superficial surgical site infection in patients receiving antibiotic-impregnated cement in primary TKA compared with those receiving plain cement.

Based on the lack of proven efficacy for antibiotic-impregnated cement in the prevention of PJI in the TKA literature and the lack of research into antibiotic-impregnated cement in TAA, we cannot provide a recommendation for or against the routine use of antibiotic-impregnated cement during TAA. However, this point may be of limited current importance anyway, as the majority of modern generation TAA are cementless in design.

REFERENCES

- [1] här S. SwedAnkle. The Swedish Ankle Registry n.d.:28.
- [2] Rothwell A. Annual Report Editorial Committee n.d.:180.
- [3] Gutowski CJ, Zmistowski BM, Clyde CT, Parvizi J. The economics of using prophylactic antibiotic-loaded bone cement in total knee replacement. *Bone Joint J.* 2014;96-B:65–69. doi:10.1302/0301-620X.96B1.31428.
- [4] Schiavone Panni A, Corona K, Giulianelli M, Mazzitelli G, Del Regno C, Vasso M. Antibiotic-loaded bone cement reduces risk of infections in primary total knee arthroplasty? A systematic review. *Knee Surg Sports Traumatol Arthrosc.* 2016;24:3168–3174. doi:10.1007/s00167-016-4301-0.

1.2. PREVENTION: NON-TOTAL ANKLE ARTHROPLASTY-SPECIFIC

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Authors: Gaston Slullitel, Yasuhito Tanaka, Ryan Rogero, Valeria Lopez, Eiichiro Iwata, Yusuke Yamamoto

QUESTION 1: What are the benefits and risks associated with the use of vancomycin powder in the wound during total ankle arthroplasty (TAA) or other foot and ankle procedures?

RECOMMENDATION: Though one study supporting topically-applied vancomycin has shown it to reduce the rate of deep infection in diabetic patients undergoing foot and ankle surgery, there is insufficient evidence to show benefits or to show any risks associated with the use of vancomycin powder during TAA or other foot and ankle procedures in a general population.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

The effects of the use of vancomycin powder in foot and ankle surgery are ill-defined. Wukich et al. evaluated the use of vancomycin powder exclusively in foot and ankle procedures, though this was performed in a population composed solely of patients with diabetes mellitus [1]. The authors concluded that odds of surgical site infections (SSIs) (73% decrease) and deep infections (80% decrease) were significantly reduced in diabetic patients who underwent reconstructive surgery of a foot and/or ankle deformity or trauma and received topically-applied vancomycin when compared with a group of patients who did not receive topically-applied vancomycin. The rate of superficial infections did not differ significantly between the two groups. Based on this retrospective controlled study, the authors concluded that foot and ankle surgeons may consider topically applying 500 to 1,000 mg of vancomycin powder prior to skin closure in patients who are not allergic to vancomycin. To our knowledge, no others studies have evaluated the use of vancomycin powder exclusively in foot and ankle surgery.

The effectiveness of vancomycin powder has been documented more extensively in other orthopaedic subspecialties than foot and ankle [2–6]. A systematic literature review by Kanj et al. showed local vancomycin-impregnated cement and powder to be associated with lower infection rates while also being safe and effective in clean orthopaedic surgery [2]. The authors especially recommended utilizing local vancomycin in spine surgery, in which patients without local antibiotic prophylaxis were more than four times more likely to experience a deep postoperative wound infection. Evaniew et al. concluded through their meta-analysis that there is a lack of high-quality evidence to inform the use of intrawound vancomycin in spine surgery [3]. Xie et al. found from their meta-analysis on intrawound vancomycin in spinal surgery that the odds of developing postsurgical wound infection without prophylactic local vancomycin use were 2.83-fold higher than the odds of experiencing wound infection with the use of intrawound vancomycin [4]. Furthermore, a retrospective review performed by Singh et al. that assessed the efficacy of intraoperative vancomycin powder administration on preventing deep SSI in high-energy lower extremity trauma (including tibial plateau fractures and pilon fractures) found that the rate of deep SSI between the groups was not statistically significantly different [7].

Concerns have been raised about the potential risks of the local use of vancomycin, including selection for gram-negative and multi-drug-resistant bacteria, increased local tissue irritation, hypersensitivity or anaphylaxis, impaired renal function, and increased seroma

formation [8]. However, these adverse effects are mostly hypothetical and have not been reported in the literature, though a case of circulatory collapse due to topical vancomycin application during spine surgery was identified [9].

Although vancomycin powder appears to be effective at decreasing postoperative infections in spine surgery according to some studies, a large void remains in the evidence for other orthopaedic subspecialties, especially foot and ankle. Randomized controlled trials, particularly within the fields of arthroplasty and trauma, are needed to determine the efficacy of local vancomycin powder for infection reduction. In this scenario, a phase III prospective randomized clinical trial is being conducted among high-risk tibial fracture patients to assess the efficacy of locally administered vancomycin powder in the prevention of SSI after fracture surgery [10], which may bring increased clarity to this matter.

REFERENCES

- [1] Wukich DK, Dikis JW, Monaco SJ, Strannigan K, Suder NC, Rosario BL. Topically applied vancomycin powder reduces the rate of surgical site infection in diabetic patients undergoing foot and ankle surgery. *Foot Ankle Int.* 2015;36:1017–1024. doi:10.1177/1071100715586567.
- [2] Kanj WW, Flynn JM, Spiegel DA, Dormans JP, Baldwin KD. Vancomycin prophylaxis of surgical site infection in clean orthopedic surgery. *Orthopedics.* 2013;36:138–146. doi:10.3928/01477447-20130122-10.
- [3] Evaniew N, Khan M, Drew B, Peterson D, Bhandari M, Ghert M. Intrawound vancomycin to prevent infections after spine surgery: a systematic review and meta-analysis. *Eur Spine J.* 2015;24:533–542. doi:10.1007/s00586-014-3357-0.
- [4] Xie LL, Zhu J, Yang MS, Yang CY, Luo SH, Xie Y, et al. Effect of intra-wound vancomycin for spinal surgery: a systematic review and meta-analysis. *Orthop Surg.* 2017;9:350–358. doi:10.1111/os.12356.
- [5] Alcalá-Cerra G, Paternina-Caicedo A, Moscote-Salazar LR, Gutiérrez-Paternina JJ, Niño-Hernández LM. [Application of vancomycin powder into the wound during spine surgery: systematic review and meta-analysis]. *Rev Esp Cir Ortop Traumatol.* 2014;58:182–191. doi:10.1016/j.recot.2013.10.004.
- [6] Chiang H-Y, Herwaldt LA, Blevins AE, Cho E, Schweizer ML. Effectiveness of local vancomycin powder to decrease surgical site infections: a meta-analysis. *Spine J.* 2014;14:397–407. doi:10.1016/j.spinee.2013.10.012.
- [7] Singh K, Bauer JM, LaChaud GY, Bible JE, Mir HR. Surgical site infection in high-energy peri-articular tibia fractures with intra-wound vancomycin powder: a retrospective pilot study. *J Orthop Traumatol.* 2015;16:287–291. doi:10.1007/s10195-015-0352-0.
- [8] Armaghani SJ, Menge TJ, Lovejoy SA, Mencia GA, Martus JE. Safety of topical vancomycin for pediatric spinal deformity: nontoxic serum levels with supratherapeutic drain levels. *Spine.* 2014;39:1683–1687. doi:10.1097/BRS.0000000000000465.
- [9] Mariappan R, Manninen P, Massicotte EM, Bhatia A. Circulatory collapse after topical application of vancomycin powder during spine surgery. *J Neurosurg Spine.* 2013;19:381–383. doi:10.3171/2013.6.SPINE1311.
- [10] O'Toole RV, Joshi M, Carlini AR, Murray CK, Allen LE, Scharfstein DO, et al. Local antibiotic therapy to reduce infection after operative treatment of fractures at high risk of infection: a multicenter, randomized, controlled trial (VANCO Study). *J Orthop Trauma.* 2017;31 Suppl 1:S18–S24. doi:10.1097/BOT.0000000000000801.



Authors: Kristin Englund, Nima Heidari

QUESTION 2: Is there a role for the use of dilute povidone-iodine (betadine) irrigation or other antiseptic irrigation solutions during total ankle arthroplasty (TAA) or other foot and ankle procedures?

RECOMMENDATION: With regards to TAA, there is a lack of evidence to recommend for or against the use of betadine solution.

LEVEL OF EVIDENCE: Consensus

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