Authors: Warren Haggard, Arvind Nana

QUESTION 4: Is there a role for a combination of local and systemic antibiotic delivery systems to treat open fractures with overlying contaminated wounds?

RECOMMENDATION: The administration of systemic antibiotic and a local antibiotic delivery device (system) is an effective treatment strategy for open bone fractures with contaminated wounds.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 87%, Disagree: 4%, Abstain: 9% (Super Majority, Strong Consensus)

RATIONALE

The use of local antiseptic or antibiotic in the treatment of open bone fractures for infection prevention has a history of over 100 years, and this treatment approach continues today [1,2]. The use of systemic antibiotics for the treatment of open bone fractures is supported by landmark clinical studies by Patzakis, Harvey and Ivler, as well as Gustilo and Anderson [3,4]. Their early studies indicated that systemic antibiotic treatment was therapeutic and prophylactic in preventing wound infections in open bone fractures.

With the development of the addition of antibiotics, first in bone cement and later in other biomaterials, local antibiotic delivery for the treatment of open bone fractures became a therapeutic option for infection prevention [1,4–8]. While several recent reviews by Isaac et al., Warrender et al. and Gosselin et al. support the role of systemic antibiotic delivery in the treatment of open bone fractures [9–11], the 2014 systematic review by Craig et al. directly addresses the role of systemic and local antibiotic delivery in open tibia bone fractures [12]. Their study conclusion was,*"The findings support consideration of augmenting the antibiotic prophylaxis regimen to include locally delivered antibiotics. Patients with severe fractures will obtain greatest benefit from infections avoided"* [12]. Another key comment in the Craig et al. study conclusions is, *"No trial directly compared the two treatments for open tibia fractures, limiting the ability to attribute the differences in observed infection rates directly to the treatments themselves.* ***A large comparative study to improve the evidence on relative effect size is merited****"* [12]. A more recent meta-analysis by Morgenstern et al. concluded that there is a risk reduction with respect to infection of 11.9% if additional local antibiotics are given prophylactically for open limb fractures. Although the authors stated that due to limited quality, heterogeneity and considerable risk of bias, the pooling of data from primary studies has to be interpreted with caution [13].

Despite the lack of the mentioned direct comparison study and many other technical questions that range from antibiotic therapy duration to antibiotic selection, several retrospective studies do support the combination of systemic and local antibiotic delivery for infection prevention during the treatment of open bone fractures.

Limitations

- Used only English language journal articles for review

REFERENCES

[1] Cancienne JM, Burrus MT, Weiss DB, Yarboro SR. Applications of local antibiotics in orthopedic trauma. Orthop Clin North Am. 2015;46:495–510. doi:10.1016/j.ocl.2015.06.010.

[2] 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.

[3] Patzakis MJ, Harvey JP, Ivler D. The role of antibiotics in the management of open fractures. J Bone Joint Surg Am. 1974;56:532–541.

[4] Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. J Bone Joint Surg Am. 1976;58:453–458.

[5] Carver DC, Kuehn SB, Weinlein JC. Role of systemic and local antibiotics in the treatment of open fractures. Orthop Clin North Am. 2017;48:137–153. doi:10.1016/j.ocl.2016.12.005.

[6] ter Boo G-JA, Grijpma DW, Moriarty TF, Richards RG, Eglin D. Antimicrobial delivery systems for local infection prophylaxis in orthopedic- and trauma surgery. Biomaterials. 2015;52:113–125. doi:10.1016/j.biomaterials.2015.02.020.

[7] Metsemakers W-J, Moriarty TF, Nijs S, Pape HC, Richards RG. Influence of implant properties and local delivery systems on the outcome in operative fracture care. Injury. 2016;47:595–604. doi:10.1016/j.injury.2016.01.019.

[8] Ostermann PA, Seligson D, Henry SL. Local antibiotic therapy for severe open fractures. A review of 1085 consecutive cases. J Bone Joint Surg Br. 1995;77:93–97.

[9] Isaac SM, Woods A, Danial IN, Mourkus H. Antibiotic prophylaxis in adults with open tibial fractures: what is the evidence for duration of administration? A systematic review. J Foot Ankle Surg. 2016;55:146–150. doi:10.1053/j.jfas.2015.07.012.

[10] Warrender WJ, Lucasti CJ, Chapman TR, Ilyas AM. Antibiotic management and operative debridement in open fractures of the hand and upper extremity: a systematic review. Hand Clin. 2018;34:9–16. doi:10.1016/j.hcl.2017.09.001.

[11] Gosselin RA, Roberts I, Gillespie WJ. Antibiotics for preventing infection in open limb fractures. Cochrane Database Syst Rev. 2004:CD003764. doi:10.1002/14651858.CD003764.pub2.

[12] Craig J, Fuchs T, Jenks M, Fleetwood K, Franz D, Iff J, et al. Systematic review and meta-analysis of the additional benefit of local prophylactic antibiotic therapy for infection rates in open tibia fractures treated with intramedullary nailing. Int Orthop. 2014;38:1025–1030. doi:10.1007/s00264-014-2293-2.

[13] Morgenstern M, Vallejo A, McNally MA, Moriarty TF, Ferguson F, Nijs S, et al. The effect of local antibiotic prophylaxis in open limb fractures: a systematic review and meta-analysis. Bone Joint Res. 2018 Aug 4;7(7):447–456.