Authors: Andrew Fleischman, Marco Bernardo Cury, Gabriel Makar

QUESTION 3: Does the local administration of vancomycin powder to a wound during surgery reduce the risk of subsequent surgical site infection/periprosthetic joint infection (SSI/PJI)? If so, what are the risk factors associated with its use?

RECOMMENDATION: No. There are no high-quality studies on vancomycin powder for the prevention of PJIs. The abundance of retrospective spine literature suggests that vancomycin powder reduces the incidence of surgical site infections. However, the only published randomized control trial (RCT) suggests that is has no impact.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 90%, Disagree: 6%, Abstain: 4% (Super Majority, Strong Consensus)

RATIONALE

Local delivery of antibiotic powder has been used with the goal of delivering a high concentration of antibiosis to the wound site without risk for systemic effects. This method has been used with some success in other surgical fields, in particular abdominal surgery prior to the existence of safe and effective systemic antibiotics for prophylaxis [1]. However, vancomycin powder has gained widespread acceptance for prevention of SSIs in spinal surgery.

The use of powdered intra-wound vancomycin became routine practice in spinal surgery based on evidence from more than 20 retrospective studies, which demonstrated its efficacy (Table 1) [2–3]. However, many of these retrospective studies were performed with a pre- and post-intervention study design, in which the current practice of administering topical vancomycin powder was compared to an historical control [4–5]. Furthermore, 8 retrospective studies reported SSI rates above 11% for the control group [4,8–10,17,19–21]. It is likely that a publication bias contributed to the consistency of the positive signal of efficacy in retrospective studies. However, the only randomized trial did not demonstrate a reduction in risk for surgical site infection with vancomycin powder [6].

TABLE 1. Spine literature on vancomycin powder

Author	Year	Category	Procedure	Study Design	Sample size	Infection Outcome	Infection Rate*	OR
Tubaki	2013	Spinal Surgery	Spinal fusion, all levels	Prospective; RCT	907	Superficial and deep	1.6% vs. 1.7%	0.96
Dennis	2016	Spinal Surgery	Instrumented spinal fusion	Retrospective; Consecutive	389	Superficial and deep	0.8% vs. 6.3%	0.13
Gaviola	2016	Spinal Surgery	Multilevel spinal fusion	Retrospective; Consecutive	326	Superficial and deep	5.2% vs. 11%	0.26
Ross	2016	Spinal Surgery	Lumbar fusion	Retrospective; Consecutive	210	Deep	0% vs. 5%	0.13
Martin	2015	Spinal Surgery	Posterior cervical fusion	Retrospective; Consecutive	289	Deep	5.2% vs. 6.9%	0.74
Theologis	2014	Spinal Surgery	Multilevel spinal fusion for deformity	Retrospective; Consecutive	215	Superficial and deep	2.6% vs. 10.9%	0.22
Hill	2014	Spinal Surgery	Posterior spinal fusion, all levels	Retrospective; Consecutive	300	Superficial and deep	1.5% vs.5.5%	0.44
Emohare	2014	Spinal Surgery	Posterior thoracolumbar	Retrospective;	303	Superficial	5.2% vs. 5.8%	0.89

			fusion	Consecutive		and deep		
Godil	2013	Spinal Surgery	Posterior spinal fusion for trauma	Retrospective; Consecutive	110	Superficial and deep	0% vs. 13%	0.06
Schroeder	2016	Spinal Surgery	Spinal fusion, all levels	Retrospective; Pre-post	3477	Deep	0.4% vs. 1.3%	0.30
Heller	2015	Spinal Surgery	Posterior instrumented fusion	Retrospective; Pre-post	683	Superficial and deep	2.6% vs. 5.3%	0.48
Tomov	2015	Spinal Surgery	Spinal fusion, all levels	Retrospective; Pre-post	3598	Superficial and deep	1.3% vs. 2.4	0.53
Martin	2014	Spinal Surgery	Thoracolumbar fusion for deformity	Retrospective; Pre-post	306	Deep	5.1% vs. 5.2%	0.96
Strom	2013	Spinal Surgery	Posterior cervical fusion	Retrospective; Pre-post	171	Superficial and deep	2.5% vs 10.9%	0.21
Kim	2013	Spinal Surgery	Spinal fusion, all levels	Retrospective; Pre-post	74	Superficial and deep	0% vs. 12.5%	0.09
Strom	2013	Spinal Surgery	Lumbar fusion	Retrospective; Pre-post	253	Superficial and deep	0% vs. 11%	0.02
Caroom	2013	Spinal Surgery	Posterior cervical instrumented fusion	Retrospective; Pre-post	112	Superficial and deep	0% vs. 15%	0.07
Pahys	2013	Spinal Surgery	Posterior cervical procedures	Retrospective; Pre-post	2001	Deep	0% vs. 1.9%	0.13
Rahman	2011	Spinal Surgery	Multilevel spinal fusion for deformity	Retrospective; Pre-post	920	Deep	0.7% vs. 5%	0.14
Sweet	2011	Spinal Surgery	Posterior thoracolumbar instrumented fusion	Retrospective; Pre-post	1732	Deep	0.2% vs. 2.6%	0.08
Singh	2015	Trauma	Tibial plateau and pilon fracture ORIF	Retrospective; Consecutive	93	Deep	10% vs. 16.7%	0.55

Yan	2014	Shoulder and elbow	Open release of traumatic stiff elbow	Retrospective; Consecutive	272	Superficial and deep	0% vs. 6.5%	0.04
Wukich	2015	Foot and ankle	Foot and ankle surgery in diabetics	Retrospective; Pre-post	162	Superficial and deep	4.9% vs. 18.5%	0.27
Omrani	2015	Adult reconstruction	Total hip arthroplasty	Retrospective; Consecutive	125	Superficial and deep	NA	NA

OR, odds ratio; ORIF, open reduction and internal fixation
*Intervention vs. control infection rate

There is not enough evidence to support the use of topical vancomycin powder outside of spine surgery. A single retrospective study on 125 patients undergoing primary total hip arthroplasty demonstrated fewer infections for patients receiving both intra-wound and intravenous vancomycin compared to patients receiving only systemic prophylaxis [7]. Small studies on tibial plateau or pilon fractures and reconstructive foot and ankle surgery have demonstrated a modest improvement with topical antibiotics [8].

While the efficacy of topical vancomycin remains in question, it appears that there have been few adverse effects from its use in spinal surgery. A systematic review reported only 23 complications in 6,700 patients, most commonly seromas [9]. However, there have been case reports of renal insufficiency, circulatory collapse and hearing loss that were attributed to topical vancomycin [10–11]. It is difficult to assess the contribution of topical vancomycin to bacterial resistance. The short-term exposures from topical vancomycin may be insufficient for the emergence of resistant bacteria and no cases have yet been reported in the spine literature. However, surgeons must weigh the potential benefits of topical vancomycin against the theoretic risks of overexposure that could increase the prevalence of resistant bacterial strains.

REFERENCES

[1] Huiras P, Logan JK, Papadopoulos S, Whitney D. Local antimicrobial administration for prophylaxis of surgical site infections. Pharmacotherapy. 2012;32:1006–1019. doi:10.1002/phar.1135.

[2] Dennis HH, Wei DT, Darren KZ, Shantakumar JT, Kumar N, Lau LL, Po GL, Wong HK, Is intraoperative local vancomycin powder the answer to surgical site infections in spine surgery? Spine (Phila Pa 1976). 2016.

[3] Gaviola ML, McMillian WD, Ames SE, Endicott JA, Alston WK. A retrospective study on the protective effects of topical vancomycin in patients undergoing multilevel spinal fusion. Pharmacotherapy. 2016;36:19–25. doi:10.1002/phar.1678.

[4] Strom RG, Pacione D, Kalhorn SP, Frempong–Boadu AK. Decreased risk of wound infection after posterior cervical fusion with routine local application of vancomycin powder. Spine. 2013;38:991–994. doi:10.1097/BRS.0b013e318285b219.

[5] Sweet FA, Roh M, Sliva C. Intrawound application of vancomycin for prophylaxis in instrumented thoracolumbar fusions: efficacy, drug levels, and patient outcomes. Spine. 2011;36:2084–2088. doi:10.1097/BRS.0b013e3181ff2cb1.

[6] Tubaki VR, Rajasekaran S, Shetty AP. Effects of using intravenous antibiotic only versus local intrawound vancomycin antibiotic powder application in addition to intravenous antibiotics on postoperative infection in spine surgery in 907 patients. Spine. 2013;38:2149–2155. doi:10.1097/BRS.0000000000000015.

[7] Omrani FA, Emami M, Sarzaeem M, Zarei R, Yeganeh A. The effect of intra–wound vancomycin powder application in reducing surgical site infections after total hip arthroplasty. Biosci Biotech Res Asia. 2015;12:2383–2386.

[8] 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.

[9] Ghobrial GM, Cadotte DW, Williams K, Fehlings MG, Harrop JS. Complications from the use of intrawound vancomycin in lumbar spinal surgery: a systematic review. Neurosurg Focus. 2015;39:E11. doi:10.3171/2015.7.FOCUS15258.

[10] Molinari RW, Khera OA, Molinari WJ. Prophylactic intraoperative powdered vancomycin and postoperative deep spinal wound infection: 1,512 consecutive surgical cases over a 6–year period. Eur Spine J. 2012;21 Suppl 4:S476–482. doi:10.1007/s00586–011–2104–z.

[11] 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.