



Meta-analysis to assess the effectiveness of topically used vancomycin in reducing sternal wound infections after cardiac surgery

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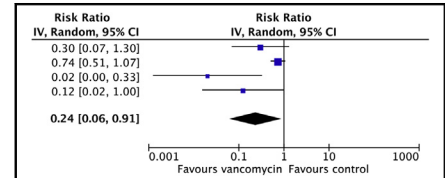
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Reduction of risk for developing sternal wound infections with topically used vancomycin.

Central Message

With results concordant with recent expert consensus on the prevention and management of sternal wound infections (SWIs), a current meta-analysis shows topical vancomycin significantly reduces the risk of SWI.

See Editorial Commentary page 1324.

Supplemental material is available online.

Deep sternal wound infections (DSWIs), although relatively rare, are associated with increased morbidity and mortality rates and decreased long-term life expectancy after cardiac surgery procedures.¹ Although the role of intravenous antibiotic prophylaxis and strict intraoperative glycemic control is beyond doubt, whether additional topically administered antibiotics may further reduce the incidence of DSWI remains a subject of fierce debate. A recent expert consensus review on the prevention and management of sternal wound infections (SWIs)² for the first time assigned a Class I Recommendation; Level of Evidence = B for topical antibiotics to be applied to the cut edges of the sternum on opening and before closing all cardiac surgical procedures involving a sternotomy, as they been found to significantly reduce the incidence of SWIs. The aforementioned statement primarily was driven by several reports of excellent results achieved with implantable gentamicin-collagen sponges^{3,4} and vancomycin paste administered topically to the sternal edges.^{5,E1,E2}

One recent study,^{E3} in contrast to previous reports, demonstrated that vancomycin paste neither reduced the incidence of DSWI nor was its use was a negative predictor of DSWI in a multivariate analyses accounting for body mass index >30 kg/m², New York Heart Association Class IV, or Society of Thoracic Surgeons DSWI Risk Index. Given the highest potential of this study to guide decision making because of the number of patients involved, we

performed a systematic review and meta-analysis of studies assessing topical use of vancomycin in reducing the incidence of SWIs after cardiac surgery.

A meta-analysis was performed in accordance to Preferred Reporting Items for Systematic Reviews and meta-analyses statement.^{E4} Major online databases (PubMed, MEDLINE, EMBASE, CENTRAL, Web of Science) as well as abstracts from major cardiothoracic surgery societies' meetings were screened for inclusion of relevant reports until December 31, 2016. Keywords used were “vancom*cin; -paste, -gel, -ointment, -slurry”; “topical*-, local*- vancom*cin”; “vancom*cin AND stern*”; “vancom*cin AND mediastin*.” The search process was conducted by 2 reviewers (M.K. and G.M.R.); any divergences were resolved by a third reviewer (L.A.). Studies were considered eligible when comparing prophylactic topically administered vancomycin-based therapy versus no vancomycin/placebo in the setting of heart surgery performed via median sternotomy. Endpoints assessed were any SWIs, DSWIs, and superficial sternal wound infection (SSWIs). Risk ratio (RR) and 95% confidence intervals (CIs) served as primary statistics. Data were pooled in the meta-analysis via the DerSimonian and Laird random effects model. Data were analyzed at reported follow-ups. Publication bias was assessed by constructing a funnel plot in which logRR was plotted against standard error. *P* values were significant if less than or equal to .05.

TABLE 1. Studies and patients' baseline characteristics

Study	Hamman and colleagues, 2014 ^{E8}	Lander and colleagues, 2016 ^{E3}	Lazar and colleagues, 2014 ⁵	Vander Salm and colleagues, 1989 ^{E7}
Type of study	Retrospective	Retrospective	Retrospective	RCT
Adjustments	Propensity score*	No	Propensity matching†	NA
No. patients	548 vs 1318	4997 vs 9495	1075 vs 2190	223 vs 193
Surgery	CABG 62.6% vs 74.2%‡ CABG + valve 16.6% vs 13.1%‡ Isolated valve 20.8% vs 12.8%‡	CABG 36.2% vs 36.8% CABG + valve 20.2% vs 18.7% Isolated valve 43.6% vs 44.5%	CABG 55% vs 58% CABG + valve 12% vs 12% Isolated valve 30% vs 25% Combined 3% vs 5%	CABG 75% vs 78%
Vancomycin paste composition	5 mL of 10% calcium chloride; 5000 IUs of topical thrombin (bovine origin). 0.6 mL of the resulting suspension with 3 mL of PRP, and 2 g of vancomycin hydrochloride powder	5 or 10 g of powdered vancomycin in a small amount of sterile water	2.5 g of powdered vancomycin (Eli Lilly Inc, Indianapolis, Ind) diluted in 2 mL of saline	1 g of powdered absorbable gelatin (Gelfoam, Upjohn Co., Kalamazoo, Mich); topical thrombin (1000 units/mL; Armour Pharmaceutical Co., Kankakee, Ill); 250 mg powdered vancomycin
Background antibiotic prophylaxis	Started within 1 h of incision and discontinued 48 h of surgery. Before 2006 usually vancomycin or ceftazidime. Cefazolin in 2006 and afterwards.	Routine preoperative prophylaxis	Cefazolin (2 g IV every 8 h) and vancomycin (1 g IV every 12 h) on induction of anesthetic and continuing for 48 h after surgery.	Cefazolin; vancomycin in case of penicillin allergy; continued for 36 h after surgery
SWI definition	SSWI: (1) suture granuloma or suture reaction or wire reaction; (2) bone click or unstable bone; (3) skin dehiscence or skin-only superficial wound infection; (4) deep tissue infection from the subcutaneous to the bone but no bone involvement; DSWI: (5) infection including bone involvement; (6) infection including bone involvement plus septicemia.	DSWI: infection involving any or all of the muscle, bone, or mediastinum that occurred within 90 d of the operation, required operative intervention (incision and drainage or re-exploration), had positive cultures if obtained, and the patient was not receiving antibiotics at the time of sampling, and received antibiotic treatment beyond routine perioperative prophylaxis.	Depths 1 and 2 were defined as superficial infectious process limited to the subcuticular and subcutaneous layers with no involvement of the sternal bone. Depths 3 and 4, which involved the sternal bone or wires and collections beneath the sternum, were considered deep infections.§	DSWI: sternal or mediastinal infections always necessitating a major operation; SSWIs: no sternal involvement.
Infection assessment	In hospital, during follow-up office visits, and via telephone calls for 12 mo	Manual record review	Infection only if above + positive culture for an organism was obtained	NR
BIMA	NR	NR	At discretion of the operator; 3%	Three patients had BIMA grafts vs 3%
Male, %	69.5 vs 66.8	64.0 vs 66.5‡	68.9 vs 68.0	69.1% vs 66.8
Age, y	64.9 ± 11.7 vs 64.1 ± 11.6	NR	65.7 ± 11.6 vs 65.9 ± 12.7	62.5 vs 62.0
BMI	NR	28 (22-36) vs 27 (22-36)‡	NR	NR
Diabetes, %	33.0 vs 34.7	27.1 vs 26.3	34 vs 33	21.1 vs 19.2
COPD	16.1% vs 14.6%	15.1% vs 13.2%‡	9% vs 11%‡	NR
Preoperative NYHA III/IV	41.1% vs 25.9%‡	36.0% vs 36.6%‡	NR	NR
Nonelective status	44.5% vs 12.2%‡	31.2% vs 35.1%‡	58% vs 57%	NR

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