Routine Antibiotic Prophylaxis for Totally Implantable Venous Access Device Placement: Meta-Analysis of 2,154 Patients

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ABSTRACT

Purpose: To provide a meta-analysis of currently available literature on the topic of antibiotic prophylaxis for totally implanted venous access device (TIVAD) placement.

Materials and Methods: A systematic review of MEDLINE/PubMed was performed to identify studies that met Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria reviewing antibiotic prophylaxis in TIVAD placement. Four studies were identified that met criteria. The analysis included 2,154 patients undergoing TIVAD placement; 360 (16.7%) received antibiotic prophylaxis, and 1,794 (83.3%) received no periprocedural antibiotics.

Results: In the period after TIVAD placement, 27 (1.25%) infections were identified. Of infections, five occurred in the antibiotic prophylaxis group (1.39%), and 22 occurred in the nonprophylaxis group (1.23%) with an odds ratio of 0.84 (CI = 0.29–2.35).

Conclusions: The odds ratio of infection was 0.85 with antibiotic use but one was contained within the confidence interval suggesting no significant difference in infection rate when antibiotics were used.

ABBREVIATIONS

OR = odds ratio, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses, TIVAD = totally implantable venous access device

Totally implantable venous access devices (TIVADs) are commonly placed in patients who require intravenous chemotherapy or long-term intravenous access. The most common complication after TIVAD placement is catheter-related bloodstream infection (2.4%–16%), followed by port site infection (2.5%) and thrombosis (1%–56%) (1). Subsequent infections in these patient populations can have serious consequences. In an attempt to reduce the number of infection-related complications, many patients undergoing these procedures are given a prophylactic dose of intravenous antibiotics.

Morbidity related to antibiotic use can be serious. Anaphylaxis after antibiotic administration can lead to hospitalization and death. Of emergency department visits related to allergic drug reactions, 19.3% have been shown to be secondary to antibiotics (2). Penicillin is a documented allergen in 9% of patients (3). Unchecked antibiotic use has also been implicated in the increasing incidence of antibiotic resistance. A recent meta-analysis demonstrated correlation of increased antibiotic use with the development of multidrug-resistant organisms (4).

Several studies evaluated the correlation between administering intravenous antibiotics and the rate of infection after TIVAD placement. The purpose of this meta-analysis is to combine the data from these studies to increase the power of their results.

MATERIALS AND METHODS

Literature Search Strategy

A systematic literature search was performed by one of the authors (E.J.) using the PubMed database (US

National Library of Medicine, National Institutes of Health) and the following terms: "port," "chemotherapy," "totally implantable venous access device," and "antibiotic prophylaxis." The purpose of the search was to identify studies that evaluated the correlation between antibiotic prophylaxis for TIVAD placement and postprocedural infection rate and met Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria. PRISMA provides a 27-item checklist for identifying well-performed systematic reviews.

Inclusion Criteria

Studies were included if they met the following criteria. (a) Study populations comprised patients receiving implantable central venous access. (b) The intervention was TIVAD placement. (c) For outcome, all patients were documented to have either infection or no infection over a sufficient follow-up interval. (d) An observational study design was used in all studies.

Exclusion Criteria

All studies that met the inclusion criteria were accepted.

Data Extraction

Two authors (E.J. and D.S.) reviewed each article independently to extract the following data: total number of patients, size of antibiotic and no antibiotic cohorts, length of follow-up, and subsequent infection rate.

Statistical Analysis

A meta-analysis was conducted to combine the results from the studies to produce an overall summary estimate of the rate of infection in each patient group (with vs without antibiotics) and a summary odds ratio (OR) as a measure of the overall group difference in terms of the rate of infection. The OR was defined as the odds of infection with antibiotics divided by the odds of infection without antibiotics so that an OR < 1 implies that the odds of infection are lower among patients with antibiotics. The assumption of homogeneity was tested using Cochran Q test. The Freeman-Tukey transformation (arcsine square root transformation; [5]) was used to calculate the weighted summary rate of infection under the fixed-effects and random-effects models (6). The Mantel-Haenszel method was used to calculate the weighted summary OR under the fixed effects model. The heterogeneity statistic Q was incorporated to calculate the summary OR under the random-effects model (6). The statistical analysis was conducted using MedCalc 15.6.1 software (MedCalc Software bvba, Ostend, Belgium).

RESULTS

Four studies performed during the period 2010–2012 (Table 1) were identified that met the criteria: two

Table 1. Studies Included in Meta-Analysis

Study, Year	Country	Study Type	Length of Study	Average Age (y)	Female	Arms	No. Patients	Follow-up (d)	Infection Rate	95% CI	OR	95% CI	RR	95% CI
Scaife et al, 2010 (7)	US	Retrospective	33 mo	55.7	66%	ABx	103	30	0	0–3.52	0.18	0.01–3.06	136.72	0.01–3.08
						No ABx	356		2.53	1.16–4.75				
Covey et al, 2012 (8)	US	Retrospective	13 mo	59.2	61%	ABx	81	30	0	0–4.45	0.54	0.03–9.12	1249.38	0.03–9.01
						No ABx	1,102		1.09	0.56–1.89				
Karanlik et al, 2011 (9)	Turkey	Prospective	16 mo	53.3	51%	ABx	203	30	2.96	1.09–6.32	1.19	0.36–3.98	39.8	0.37–3.83
						No ABx	201		2.49	0.81–5.71				
Di Carlo et al, 2011 (10)	Italy	Prospective	48 mo	Unlisted	50%	ABx	54	30	0	0–6.60	NA	NA	109	NA
						No ABx	54		0	0–6.60				
Pooled results						ABx	441		0.93	0.05–2.88	0.84	0.29–2.35	175.53	0.31–2.32
						No ABx	1,713		1.74	0.85–2.93	(P = .733)			
P values						ABx			0.078					
						No ABx			0.128					

ABx = antibiotics; CI = confidence interval; NA = not applicable; OR = odds ratio; RR = relative risk.