

CONCISE COMMUNICATION

Wide Variability in the Use of Antimicrobial Lock Therapy and Prophylaxis among Infectious Diseases Consultants

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We surveyed infectious diseases physicians to determine their practice patterns with regard to both antimicrobial lock prophylaxis and antimicrobial lock therapy. Antimicrobial lock prophylaxis is relatively uncommon; only 19% of infectious diseases physicians reported using it at least once. Although antimicrobial lock therapy is more commonly used, we found a significant variation in practice patterns.

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The intraluminal instillation of antimicrobial solutions in catheters when they are not in use has been suggested as a way to both prevent and treat central line-associated bloodstream infections (CLABSIs).¹⁻⁵ However, few data are available on the practice patterns of infectious diseases consultants with regard to antimicrobial lock prophylaxis and antimicrobial lock therapy. Recently published guidelines on the diagnosis and management of catheter-related infections contain information on the recommended dose and duration of antimicrobial lock therapy but not antimicrobial lock prophylaxis.¹ Thus, the goal of our study was to determine the practice patterns of infectious diseases consultants with regard to the use of antimicrobial lock prophylaxis and treatment.

METHODS

The Infectious Diseases Society of America's Emerging Infections Network is a healthcare provider-based network of infectious diseases clinicians in clinical practice who are members of either the Infectious Diseases Society of America or the Pediatric Infectious Diseases Society. In September 2007, this network surveyed its 1,084 members by fax or e-mail.⁶ Members who did not respond were sent 2 reminders.

Members were asked whether they used antimicrobial lock prophylaxis. Those who reported using it were asked which types of intravenous (IV) catheters were candidates for this type of prophylaxis and which specific antimicrobial agents were the most frequently used. Members were also asked whether they used anticoagulants as part of the lock solution, and if members observed "breakthrough" CLABSIs, they were asked to list the organisms causing these infections in rank order.

With regard to antimicrobial lock therapy, members were

asked whether they attempted catheter salvage for cases of CLABSI caused by a variety of different pathogens and, if so, whether they used antimicrobial lock therapy in addition to systemic therapy. Finally, members who did use antimicrobial lock therapy were asked which specific antimicrobial agents were used against each pathogen as well as about the duration of therapy and the number of days of catheter dwell time.

RESULTS

There were 1,094 members who received this survey, 606 (55%) of whom responded. Of these 606 respondents, 135 (22%) primarily had pediatric infectious diseases practices, and 488 (81%) reported that they had never administered antimicrobial lock prophylaxis. For those 118 members (19%) who reported administering prophylaxis, it was most commonly used for long-term catheters (eg, cuffed or tunneled catheters, hemodialysis catheters, or ports); antimicrobial lock prophylaxis was infrequently used for short-term central venous catheters and peripherally inserted central venous catheters (Table 1). Respondents were not asked about location of the catheters (ie, femoral artery or subclavian vein). Of the 118 members who reported using antimicrobial lock prophylaxis, only 16 (14%) reported using antimicrobial lock prophylaxis routinely for any type of long-term catheter. The majority of respondents (102 [86%]) reserved antimicrobial lock prophylaxis for special circumstances (eg, patients with limited IV access). For the 97 respondents who reported antimicrobial lock prophylaxis regimens, the 3 most frequently reported regimens included vancomycin with heparin (45 respondents [46%]), vancomycin alone (21 respondents [22%]), and ethanol (9 respondents [9%]). Of the 118 respondents who used antimicrobial lock prophylaxis, 72 (61%) reported adding an anticoagulant to the lock solutions, and reports of heparin use greatly exceeded reports of either ethylenediaminetetraacetic acid or citrate use, with only 2 respondents not using heparin. Finally, 80 respondents (68%) reported breakthrough CLABSIs among patients treated with antimicrobial lock prophylaxis. In rank order, the most common organisms reported were coagulase-negative staphylococci, *Staphylococcus aureus*, gram-negative rods, followed by yeast or *Candida* species.

A majority of respondents (344 [57%]) reported that they had attempted salvage of catheters for patients with CLABSI (ie, treating the patient with antimicrobial therapy without immediate removal of the catheter). Of the 344 infectious diseases consultants attempting salvage, 168 (49%) reported using antimicrobial lock therapy, almost always in addition to treatment with systemic therapy. Of these respondents, only 5 (3%) reported using it without systemic antibiotics.

TABLE 1. Survey Data on Types of Intravenous Catheters Used for Antimicrobial Lock Prophylaxis, as Reported by Members of the Emerging Infections Network

Type of catheter	No. (%) of respondents (n = 118)	
	Routinely used	Used under special circumstances
Cuffed or tunneled catheter	13 (11)	81 (69)
Hemodialysis catheter	12 (10)	57 (48)
Port or implanted catheter	11 (9)	69 (58)
Short-term central venous catheter	2 (2)	24 (20)
Peripherally inserted central venous catheter	1 (1)	27 (23)
Other ^a	1 (1)	0 (0)

^a All neonatal catheters.

Of the 387 members who responded to the questions about catheter salvage and use of antimicrobial lock therapy, 336 (87%) reported attempting to salvage catheters in patients with coagulase-negative staphylococcal CLABSI, and 150 (45%) of these 336 members reported using antimicrobial lock therapy; 194 (50%) reported attempting to salvage catheters in patients with *S. aureus* CLABSI, and 91 (47%) of these 194 members reported using antimicrobial lock therapy; 195 (50%) reported attempting to salvage catheters in patients with *Enterococcus* species CLABSI, and 76 (39%) of these 195 members reported using antimicrobial lock therapy; 186 (48%) reported attempting to salvage catheters in patients with Enterobacteriaceae CLABSI, and 65 (35%) of these 186 members reported using antimicrobial lock therapy; 123 (32%) reported attempting to salvage catheters in patients with *Pseudomonas* species CLABSI, and 39 (32%) of these 123 members reported using antimicrobial lock therapy; 108 (28%) reported attempting to salvage catheters in patients with *Acinetobacter* species CLABSI, and 25 (23%) of these 108 members reported using antimicrobial lock therapy; and 44 (11%) reported attempting to salvage catheters in patients with *Candida* species CLABSI, and 16 (36%) of these 44 members reported using antimicrobial lock therapy (Table 2). Of the 150 members who reported using antimicrobial lock therapy to treat patients with coagulase-negative staphylococcal CLABSI, 133 (89%) used vancomycin alone. Of 79

respondents, 55 (70%) recommended 10–14 days of this therapy. Wide variability in the number of days of catheter dwell time with a vancomycin-based solution was noted, with 29 (34%) of 86 respondents reporting use for 6–12 hours per day, 17 (20%) of 86 respondents reporting use for at least 1 hour per day, and 10 (12%) of 86 respondents reporting use for 12–24 hours per day.

Infectious diseases consultants mentioned a variety of barriers, including lack of formal guidance or protocols, with many reporting uncertainty regarding concentrations of solutions. A number of respondents commented that data from clinical trials are needed both for specific agents and to establish efficacy in specific populations. Respondents also raised questions about dosing and duration, difficulty with longer dwell times because of conflicts with other uses of the catheter, and concern about compatibility of agents.

DISCUSSION

Our results indicate that antimicrobial lock prophylaxis is used by only a small proportion of infectious diseases consultants. In fact, 81% of respondents reported never using it. A number of studies have indicated that antimicrobial lock prophylaxis might be effective in certain clinical settings.^{2–5} However, respondents reported a number of barriers. For

TABLE 2. Survey Data on Catheter Salvage and Antimicrobial Lock Therapy, as Reported by Members of the Emerging Infections Network

Contaminating organism	No. (%) of respondents who attempted catheter salvage (n = 387)	Proportion (%) of respondents who used antimicrobial lock therapy
Coagulase-negative staphylococci	336 (87)	150/336 (45)
<i>Staphylococcus aureus</i>	194 (50)	91/194 (47)
<i>Enterococcus</i> species	195 (50)	76/195 (39)
Enterobacteriaceae ^a	186 (48)	65/186 (35)
<i>Pseudomonas</i> species	123 (32)	39/123 (32)
<i>Acinetobacter</i> species	108 (28)	25/108 (23)
<i>Candida</i> species	44 (11)	16/44 (36)

^a For example, *Escherichia coli*.

example, members raised concerns about the potential incompatibility of both vancomycin and gentamicin with heparin. Respondents also reported confusion about orders on the part of pharmacies, nurses, patients receiving home infusion therapy, and primary care physicians. Much of this confusion may be due to the fact that no commercial lock solutions exist, so lock solutions must be compounded locally. Also, patients who might benefit from antimicrobial lock prophylaxis are often required to have near-continuous infusions, making it difficult to have a catheter dwell time lasting for a significant period. Finally, respondents expressed concerns about antimicrobial resistance and also about breakthrough CLABSIs. Indeed, 68% of respondents reported seeing such infections.

We found that a wide variety of agents and concentrations are used for antimicrobial lock prophylaxis. Nonetheless, the majority of respondents instill a vancomycin-based solution. Interestingly, recent *in vitro* data suggest that vancomycin lacks activity against biofilm-embedded organisms and that a variety of other agents (including minocycline, daptomycin, and tigecycline) may be more efficacious.⁷ Two recent studies have reported that using ethanol for antimicrobial lock prophylaxis was effective at preventing CLABSIs among patients receiving chemotherapy⁴ and patients receiving hemodialysis,⁵ respectively. Yet, only a minority of respondents reported using ethanol for prophylaxis, and several reported concern regarding whether ethanol was safe in polyurethane catheters.

A wide variation of practice patterns was also reported for antimicrobial lock therapy. In general, members who used antimicrobial lock therapy seemed most comfortable using it for coagulase-negative staphylococcal infections, as has been reported in the literature.^{1,8} Lock therapy used for the treatment of other types of infections seemed to be reserved for patients with very limited IV access options; although not recommended in the guidelines, some respondents also reported using it for fungal infections. Finally, respondents reported barriers to the use of antimicrobial lock therapy that were similar to the reported barriers to the use of antimicrobial lock prophylaxis.

Our study has several limitations. First, although response rates were not significantly different when we compared respondents with nonrespondents according to geographic census region ($P = .13$) or type of practice (ie, academic vs private practice; $P = .10$), our results may still be subject to a form of response bias. Second, we did not ask respondents about their patient populations, about their years in practice, or the about the placement site of catheters (femoral artery vs subclavian vein). Finally, we did not require chart abstractions for this survey.

On the basis of the high response rate to this survey and the wide array of comments, infectious diseases physicians are very interested in antimicrobial lock solutions. Although these solutions are infrequently used for prophylaxis, the majority of the respondents do attempt catheter salvage, and one-half of those use antimicrobial lock therapy with systemic

therapy to treat uncomplicated CLABSIs. However, the wide variation of practice patterns and the frequent barriers reported with regard to the use of antimicrobial lock therapy indicate that more well-designed studies on a variety of patient populations are needed. Also, more data regarding compatibility with antimicrobial agents, anticoagulants, and, in the case of ethanol, catheters themselves would be extremely helpful. Some of these data may exist, but given the responses from this survey, they need to be more widely disseminated. The recently published clinical practice guidelines for the diagnosis and management of intravascular catheter-related infections provide more guidance regarding antimicrobial lock therapy,¹ but further investigations will be needed to determine whether additional information can help respondents overcome the barriers identified in our study.

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