The Future of Renal Care *Are We Ready?*

Editor's Note: *As a leading cause of death among dialysis patients, the problems associated with infection control will only get more complicated in the future as the patient population expands. Following are two articles that look at the need for a new data collection system for infection control problems and the value of maintaining a quality infection control program in your dialysis clinic.*

Electronic reporting of infections associated with hemodialysis

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Abstract

Monitoring infections and antibiotic resistance patterns in dialysis populations is an important component of efforts to improve patient safety and quality of health care. The objective of this report is to update findings from the Dialysis Surveillance Network and describe the soon-to-be-available National Healthcare Safety Network.

Methods: Volunteer dialysis centers in the DSN submitted reports of hospitalizations, outpatient intravenous antimicrobial starts, and positive blood cultures. From these reports, an online system calculated rates of important adverse events. For this report, we summarize adverse-event data submitted to the DSN from September 1999 through March 2005.

Results: There were 53,804 events in the 321,519 patient-months during the period of analysis. The rate of hospitalization was 13 per 100 patient-months; the rate of outpatient IV vancomycin starts was 3 per 100 patient-months. The rate of vascular access infection was 3.1 per 100 patient-months and varied from 0.6 for fistulas to 10.1 for temporary catheters. Of the 8,359 blood isolates reported, 77% (6,427) were primary bacteremias (5,275 were catheter-associated, 1,152 were fistula- or graft-associated), 19% (1,587) were secondary bacteremias, and 4% (345) were contaminants.

Conclusions: Infection-related adverse events remain lowest among patients with vascular access in the form of fistulas and grafts. In the future, adverse events in dialysis will be monitored in the NHSN. The new, Web-based, NHSN surveillance system allows centers to monitor their rates and compare with other outpatient dialysis centers. In 2006, CDC plans to open enrollment for outpatient dialysis centers not already in the DSN.

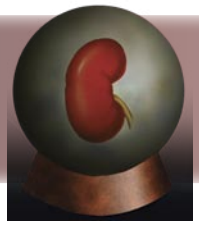
Introduction

Chronic hemodialysis patients are especially vulnerable to infections, frequently with antimicrobial-resistant organisms.[1] They are at higher risk for infections because they are immunosuppressed and need to puncture their vascular access site routinely. Hemodialysis patients are susceptible to resistant infections because they require frequent hospitalization, exposing them to antibiotic-resistant pathogens, and are frequently treated with long courses of antimicrobials. Five of the first seven reports of *Staphylococcus aureus* with intermediate level resistance to vancomycin, and the first of three patients with *S. aureus* resistant to vancomycin in the United States, were dialysis patients.[2] Monitoring infections and antibiotic resistance patterns in dialysis populations is an important component of improving patient safety and quality of health care.

Although studies published in the literature can provide useful guidance for preventing infections at the local level, surveillance data collected at the facility level can provide the information to quickly identify problems and target control measures. For comparisons of data on infections or complications across outpatient facilities, it is necessary to adjust the number of events for patient risk factors, the time period at risk, or the number of dialysis sessions. Several investigators have outlined methods and definitions for hemodialysis access infections surveillance.[3–5] In 1999, the Centers for Disease Control and Prevention initiated a surveillance system available to all centers caring for hemodialysis outpatients—the Dialysis Surveillance Network. Although this system remains operational for existing participants, there has been a moratorium on new enrollments while it merges with two pre-existing CDC surveillance systems to create the National Healthcare Safety Network.[6] The objective of this report is to update findings from the DSN and describe the upcoming NHSN.

Surveillance methods

Methods and preliminary results from the DSN were described by Tokars.[5] Briefly, beginning in 1999, volunteer outpatient dialysis centers enrolled by providing facility characteristics and agreeing to use a standard protocol. An Internet-based system launched in 2000 allowed participants to enter data online, and analyze them compared to other participants. In this system,



three events trigger a report: overnight hospital stay; outpatient start of an IV antimicrobial; and/or a positive blood culture. Data on the infection or event (e.g., hospitalization), type of vascular access, outpatient start of IV vancomycin, and other information are collected on the report form. In the DSN, information to calculate a rate is collected; the infection data become the numerator, and the number of months patients are at risk become the denominator. Denominator data are collected once a month (e.g., on the first two working days of the month) and include the percentage of patients with various types of vascular access (fistula, graft, cuffed catheter, non-cuffed catheter, port). All information is confidential, and identifying information is optional; no identifying information on patients or dialysis centeres is published. For this report, we summarized data submitted to the DSN through April 2005.

Dialysis surveillance results

Data from 321,519 patient-months were available for analysis. Of these, 36% were among patients with fistulas, 35% with grafts, 27% with cuffed catheters, 2% with non-cuffed catheters, and 0.2% with ports. There were 53,804 events in the 321,519 patient-months during the 3-year analysis period. Most, 77%, were hospitalizations and on average, 13% of the patients had a hospitalization each month. The rate of vascular access infection was 3.1 per 100 patient-months. Of these, 57% were access-related bacteremias, and the remainder were local access infections without bacteremia. The rate of outpatient IV vancomycin starts was 3 per 100 patient-months.

Event rates varied by type of vascular access (see Table 1). The hospitalization rate was lowest for fistulas and grafts, and highest for non-cuffed catheters (range 8.7–26.6 per 100 patient-months). Event rates were lowest for fistulas and grafts, and highest for ports: IV antimicrobial starts (range 2.3–12.6 per 100 patient-months), positive blood cultures (range 0.6–12.4 per 100 patient-months), vascular access infection (range 0.6–13.7 per 100 patient-months), access-related bacteremia (range 0.3–11.4 per 100 patient-months), and outpatient vancomycin starts (1.2–10.0 per 100 patient-months).

Of the 8,359 blood isolates reported, 77% were primary bacteremias (5,275 were catheter-associated and 1,152 were fistula- or graft-associated), 19% were secondary bacteremias, and 4% were considered contaminants. The frequency of common skin contaminants (e.g., coagulase-negative *staphylococci*) exceeded that of *Staphylococcus aureus* among access-related bacteremias in patients with catheters (see Table 2). Of isolates among access-related bacteremias in patients with fistulas or grafts, 50.5% were *S. aureus* and 28.6% were common skin contaminants.

Discussion

We updated findings from surveillance of adverse events in a chronic hemodialysis population. We found, on average, 13% of hemodialysis patients were hospitalized and 3% received intravenous vancomycin, each month. Our concern is these vulnerable patients are at risk of developing vancomycin-resistant infections. Evidence of this possibility has already been demonstrated.[7]

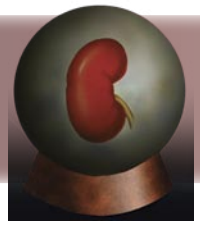
The variability of infection rates by type of vascular access is well documented. In this surveillance system, the infection rate varied from 0.6 for fistulas to 10.1 for temporary catheters. The Centers for Medicare and Medicaid Services launched a major initiative to promote fistula use because of their lower infection rates, and this effort is critical to prevent vascular access infections in hemodialysis patients.[8] In contrast, the report of higher rates of certain adverse events associated with ports is new. Currently, few data on patients with ports are available beyond case series[9,10] and these findings should be interpreted with caution. Continued monitoring of adverse-event rates among patients by type of vascular access is necessary to identify potential problems and design prevention strategies. Individual facilities are encouraged to analyze

Table 1. Number of events and event rate by type of vascular access, dialysis surveillance, September 1999 through March 2005

Event	Fistula No. (Rate*)	Graft No. (Rate*)	Cuffed Catheter No. (Rate*)	Non-cuffed Catheter No. (Rate*)	Port No. (Rate*)
Hospitalizaton	9,985 (8.7)	13,486 (12.0)	16,291 (18.6)	1,767 (26.6)	129 (17.7)
IV Antimicrobial start	2,601 (2.3)	3,605 (3.2)	8,255 (9.4)	616 (9.3)	92 (12.6)
Positive blood culture	656 (0.6)	1,241 (1.1)	4,855 (5.6)	559 (8.4)	90 (12.4)
Vascular access infection	675 (0.6)	1,760 (1.6)	6,681 (7.6)	674 (10.1)	100 (13.7)
Access related bacteremia	301 (0.3)	767 (0.7)	4,041 (4.6)	487 (7.3)	83 (11.4)
Outpatient vancomycin starts	1,404 (1.2)	2,133 (1.9)	5,609 (6.4)	445 (6.7)	73 (10.0)
Total incidents	12,134 (10.6)	16,301 (14.5)	22,925 (26.2)	2,239 (33.7)	205 (28.2)

**The rate is the number of events per 100 patient-months*

(Incidents might include more than one event)



their own data and monitor trends to evaluate needs for prevention and determine effectiveness of prevention efforts.

Of the blood isolates reported to the DSN, 77% were from primary bacteremias. The use of catheters is the most common factor related to primary bacteremia in hemodialysis patients. In addition to promoting the use of fistulas and grafts as vascular access alternatives to catheters, other measures can help prevent bacteremias. These include training personnel, methods for catheter insertion, site of insertion for a catheter, and use of antiseptic ointments at the catheter exit site consistent with catheter material.[11]

Surveillance is critical to patient safety and improving health care quality. Monitoring infections is one of the guidelines for vascular access from the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative.[12] Surveillance is supported by CDC and an important part of guidelines to prevent intravascular catheter-related infections.[11] Surveillance of infections can help identify specific areas where improvements in infection control might be needed. Monitoring antimicrobial use and antimicrobial resistance of organisms associated with infections in dialysis patients is critical to programs to prevent antimicrobial resistance.[13]

Conclusion

Hemodialysis patients are at high risk for infection because they are immunocompromised and require a vascular access site to remove and replace blood. The vascular access could be an implanted access (fistula or graft), catheter, or port. However, rates of selected adverse events are highest for catheters and, possibly, for ports. Because of frequent infections and need for antimicrobial therapy, resistance to antimicrobials (particularly vancomycin) is high in hemodialysis patients. Surveillance is the first step toward improving patient safety and quality of health care. The new, Web-based, NHSN surveillance system allows centers to monitor their rates and compare them with other outpatient dialysis centers. CDC plans to enroll additional outpatient dialysis centers into the NHSN in 2006. For further information about surveillance and prevention of dialysis associated adverse events, visit www.cdc.gov/ncidod/hip/dialysis/dsn.htm.

In the future, all U.S. outpatient hemodialysis centers will be invited to enroll in NHSN. Participating centers could be freestanding dialysis centers or centers affiliated with a hospital, but should serve mostly hemodialysis outpatients. Requirements for participation in NHSN will include internet access, a valid email address, the ability to download a digital certificate, annual completion of a survey about general infection control practices and facility characteristics, and submitting surveillance data for dialysis incidents at least six months per year among chronic hemodialysis patients. The Dialysis-Incident Event portion of NHSN will be essentially identical to the current DSN, with expanded capacity for reporting pathogens and antimicrobial resistance. Through partnerships with professional infection control organizations and journals, CDC will announce when NHSN enrollment opens for outpatient dialysis centers not already participating in the DSN. ◆

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Table 2. Microorganisms isolated from blood cultures from access-related bacteremias reported to dialysis surveillance, September 1999 through March 2005

	Catheter-related bacteremia (N=5275) (N=%)	Fistula or graft access related bacteremia (N=1152) (N=%)
Staphlococcus aureus	1,538 (29.2)	582 (50.5)
Other gram-positive	537 (10.2)	97 (8.4)
Gram-negative rods	1,100 (20.9)	116 (10.1)
Common skin contaminants (e.g., coagulase-negative *staphylococci*)	2,008 (38.1)	329 (28.6)
Fungi	27 (0.5)	9 (0.8)
Other	65 (1.2)	19 (1.6)