

## Long Overdue Need to Reduce Infections with Hemodialysis

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In this issue of the *Clinical Journal of the American Society of Nephrology*, Chaudry *et al.* (1) report a retrospective, register-based study examining the risk of infective endocarditis in Danish patients with CKD treated with hemodialysis (HD), peritoneal dialysis (PD), or renal transplantation. They confirm previous observations from United States dialysis centers showing a high endocarditis incidence in patients on HD or PD (2). This study is particularly robust, examining >10,000 patients over 16 years, incorporating data from Danish registries that permit linkage between nationwide administrative registries on the individual patient level. Information on all outpatient appointments, hospital admissions, primary and secondary diagnoses, dispensed prescriptions, comorbidities, and deaths were collected from several validated registries. All patients with ESRD who initiated RRT were captured, and all changes in RRT modality and type of vascular access were obtained, allowing analysis with time-updated exposure. The authors claim that there was no patient with missing data on any variable. They found that the incidence of infective endocarditis in patients on HD was >70-fold higher than in the general Danish population, and for patients on PD, it was >20-fold higher. The adjusted hazard ratio for first-time endocarditis events in HD compared with PD was 5.46 (95% confidence interval [CI], 3.28 to 9.1); the similar adjusted hazard ratio for patients using cuffed or uncuffed central venous catheters was 10.03 (95% CI, 5.51 to 18.24) and 14.1 (95% CI, 7.76 to 25.5), respectively. Risk factors for developing endocarditis were central venous catheter use, first 6 months of RRT, aortic valve disease, and previous endocarditis.

In the United States, the Centers for Disease Control and Prevention (CDC) have created the National Healthcare Safety Network (NHSN), a national data system to collect information about infections in patients on dialysis (3). They reported 29,516 bloodstream infections (BSIs) in outpatient HD centers in 2014. This number may underestimate the true incidence of BSI because the NHSN is a self-reporting database, and hospitalization events coded as bacteremia-sepsis in this same time period is much higher (4). NHSN findings are similar to the Danish registries: in the United States, about 75% of BSIs in patients on HD are related to vascular access; in Denmark, approximately 70% of endocarditis cases are related to cuffed and

uncuffed central venous catheters. The US Renal Data System and the Peer Kidney Care Initiative database show that infections are the primary cause of death for approximately 10% of patients on dialysis, largely related to central venous catheter use. In 2012, >63,000 patients on dialysis died from infectious complications (4). This is second only to cardiovascular disease as the cause of death for patients on dialysis. Of even more concern, although the rate of hospitalization for cardiovascular disease in this population has declined substantially over the past decade, hospitalizations for infections have hardly changed at all. Infection now leads cardiovascular disease for hospital days for patients on dialysis. Why is it that while overall dialysis patient mortality has fallen 28% over the past 12 years, and morbidity from cardiovascular disease has likewise fallen, infection-related morbidity and mortality have hardly budged (4)?

The CDC has for years been working on ways to reduce blood stream infections and its related morbidity and mortality. They have assembled and published a list of core interventions for BSI prevention (5), including reducing catheter prevalence, use of chlorhexidine for catheter site skin antiseptics, disinfecting the catheter hub (“scrub the hub”), use of antimicrobial ointment at the catheter exit site, performing observations of how the staff performs catheter and vascular access care, training staff on infection control, use of hand hygiene between every patient contact and performing observations of these techniques, conducting monthly surveillance for BSIs using the NHSN, calculating facility infection rates and comparing these with other NHSN facilities, and importantly, engaging patients in preventing infection, including patient education. Despite these evidence-based, published best practices, HD-related BSIs continue at alarming rates. One example of how staff and patient training has been inadequate is a technique that has been used to preserve arteriovenous fistulas and make cannulation easier for both center-based and home-based patients, the “button hole” technique. This technique entails repeated use of the same puncture site and cannulation with a dull needle after the scab is lifted off the site. BSIs are an all-too common complication. Infections can be avoided if the antiseptic skin scrub is applied in a wide enough area and given sufficient time to dry. The recommended skin preparation for preoperative

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chlorhexidine scrub is that the boundaries of skin preparation should be much wider than the planned incision site (6). The skin should air dry for 1 minute (7). Dialysis staff and patients should be trained to apply this skin preparation correctly. Inadequate training and short-cutting the recommended procedures likely results in inadequate skin sterilization and resultant BSIs. In the inpatient setting, many efforts to reduce central line–associated BSIs for the general hospital population have been successful (8). Why then, have we not seen similar improvement in our patients on HD?

One possible reason for lack of progress to end preventable infections in patients on dialysis is a lack of appreciation for the scope of this problem in the renal community. The CDC has established the Making Dialysis Safer for Patients Coalition (9) to raise awareness, improve adherence to evidence-based recommendations, share best practices, and engage patients to prevent infections. This public–private partnership hosts regular dialysis care stakeholder meetings to learn about health care–associated infection prevention and treatment, network, share tools and best practices, and hear from and engage patients in these efforts. In association with the American Association for Kidney Patients, the coalition developed a “Conversation Starter” tool, to give practical advice on how to discuss infection prevention with patients, staff, and facility owners. More than 650 members take part in this coalition, including individual dialysis facilities, care providers, patients, and patient advocates. In 2016, the CDC awarded a grant to the American Society of Nephrology (ASN) to fund Nephrologists Transforming Dialysis Safety (NTDS), a nationwide project to engage nephrologists as team leaders to “target zero infections” by actively pursuing the elimination of preventable infections in dialysis facilities (10). Building on the foundational principles of the CDC’s Making Dialysis Safer for Patients Coalition, NTDS convened a project committee to engaging nephrologists, infectious disease specialists, a hepatologist, dialysis nurse, technician, ASN councilor, and CDC representatives. This leadership group and derivative workgroups have begun to engage the community, including dialysis owners, develop a roadmap and implementation plan, and empower nephrologists as leaders of care teams to end preventable infections.

Ending preventable infections will take more than simply doing more of what we have done before. We suggest that nephrologists and their care teams restructure the dialysis unit visit, and address the two basic issues that are responsible for most morbidity and mortality: volume control to address cardiovascular complications, and infections. If more focus and attention were devoted to assessing and achieving real “dry” weight, and to utilizing evidence-based best practices to avoid infections, and less time focused on biochemical measurements and  $Kt/V_{urea}$ , these imminent threats to patients’ lives might be reduced. The CDC clearly has provided best practices and tools to reduce HD-associated infections and the deaths they cause. To successfully incorporate these practices into everyday care, a cultural change will be needed in dialysis care, where nephrologists, nurses, dialysis facility operators, and patients all take responsibility for surveillance, hand hygiene, catheter reduction and care, precautions to prevent spread of hepatitis C and other viral diseases, antibiotic stewardship to reduce the risk of multiple drug-resistant organisms, and

appropriate partnerships between care teams and state and federal health care–associated infection experts. In addition to establishing and monitoring these practices, dialysis owners need to empower nephrologists as local team leaders, so they might find local solutions to solve local challenges. Patients must be educated about infection prevention, and empowered to speak up and participate in the surveillance and best practice system when they observe deviations from best techniques of care. Teams of caregivers and patients must exchange information and work together to end preventable infections.

The time to target zero preventable infections in dialysis care, and prevent endocarditis and other life-threatening complications that take the lives of tens of thousands of patients on dialysis in the United States every year, is long overdue.

#### Disclosures

A.S.K. has no conflicts to report. A.J.C. is Chief Medical Officer for NxStage and a Consultant for FibroGen.

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See related article, “Risk of Infective Endocarditis in Patients with End Stage Kidney Disease,” on pages 1814–1822.