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Ask.
Learn.

Decreasing Hemodialysis Catheter Infections and Peritonitis

January 2022

ESRD NW 10 & 12/ Telligen QIN/QIO



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Housekeeping

- Q & A at the end of presentation
 - Raise hand feature
 - Question box

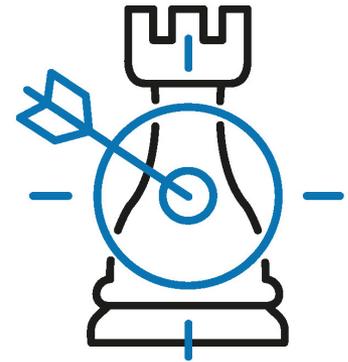


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Objectives

- Understand the clinical significance and morbidity of dialysis catheter infections
- Understand best practices to prevent catheter infections
- Diagnosis of peritoneal and hemodialysis catheter infections



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ESRD Network Program Overview

The End Stage Renal Disease Network Organization Program (ESRD Network Program) is a national quality improvement program funded by the Centers for Medicare & Medicaid Services (CMS), a federal agency of the U.S. Department of Health and Human Services.

Following passage of the 1972 Amendments to the Social Security Act, in response to the need for effective coordination of ESRD care, hospitals and other health care facilities were organized into networks to enhance the delivery of services to people with ESRD.

In 1978, Public Law 95-292 modified the Social Security Act to allow for the coordination of dialysis and transplant services by linking dialysis facilities, transplant centers, hospitals, patients, physicians, nurses, social workers, and dietitians into Network Coordinating Councils, one for each of 32 administrative areas.

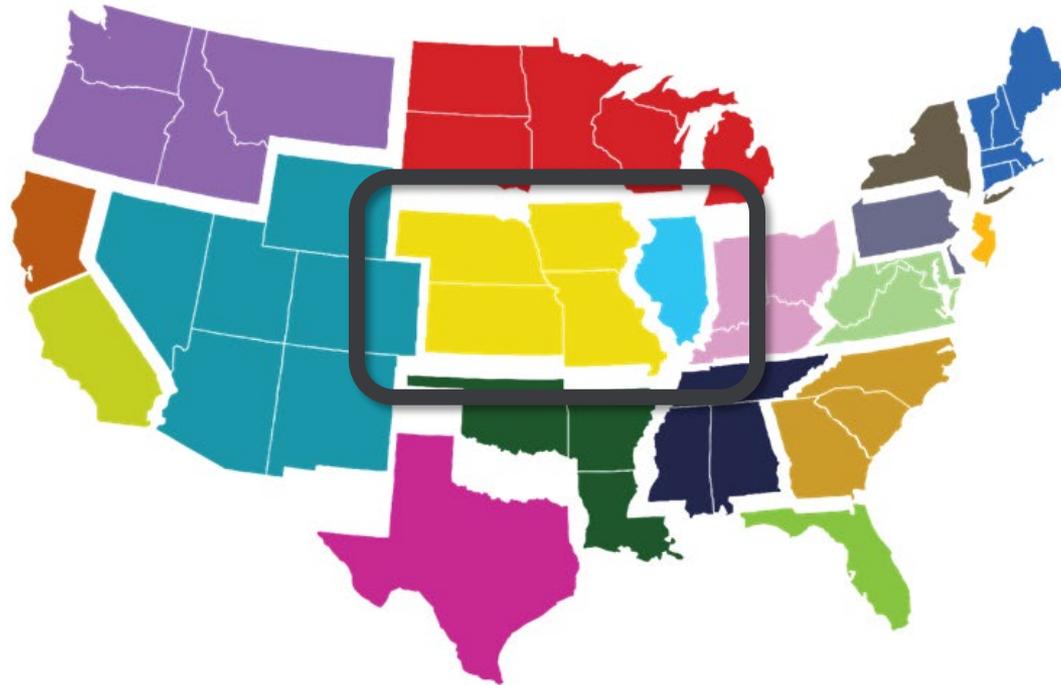
In 1988, CMS consolidated the 32 jurisdictions into 18 geographic areas and awarded contracts to 18 ESRD Network Organizations, now commonly known as ESRD Networks. The ESRD Networks, under the terms of their contracts with CMS, are responsible for: supporting use of the most appropriate treatment modalities to maximize quality of care and quality of life; encouraging treatment providers to support patients' vocational rehabilitation and employment; collecting, validating, and analyzing patient registry data; identifying providers that do not contribute to the achievement of Network goals; and conducting onsite reviews of ESRD providers as necessary.



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Qsource ESRD Networks Service Area



| | | |
|---|--|---|
|  ALASKA |  PUERTO RICO |  U.S. VIRGIN ISLANDS |
|  HAWAII |  GUAM and MARIANA ISLANDS |  AMERICAN SAMOA |



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Telligen QIN-QIO brings together Medicare providers, beneficiaries, and communities together in data-driven initiatives that increase patient safety, improve clinical quality, better coordinate post-discharge care, and make communities healthier. Learn more and join us in partnership at [Telligen QIN-QIO](#).



Telligen QIN-QIO is funded by CMS to deliver quality improvement services at no cost to you or your organization. We partner with and leverage local, regional and national expertise with our:

- Training, service, and data infrastructure
- Education and support through quality improvement learning and action sessions
- Peer-to-peer learning through our monthly coalition calls and resource sharing platforms
- Technical assistance programs reflecting evidence-based practices



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Guest Speaker



Seth Furgeson, MD, is an associate professor of medicine at the University of Colorado-Anschutz Medical Campus and a nephrologist at Denver Health. He serves as the medical director of outpatient hemodialysis and home dialysis at the Fresenius Pavilion clinic at Denver Health. Dr. Furgeson has a strong clinical interest in peritoneal dialysis and has authored several textbook chapters on peritoneal dialysis. In addition to his clinical work at Denver Health, Dr. Furgeson also serves as the associate program director for the nephrology training program at the University of Colorado.



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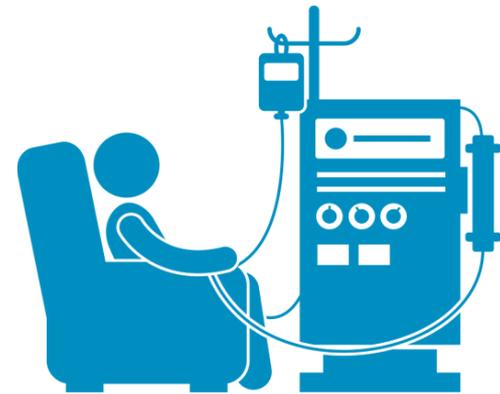
Disclosures

Nothing to disclose

Outline

- Hemodialysis catheter infections
- Infectious complications of peritoneal dialysis
- Preventing infections in nursing home residents

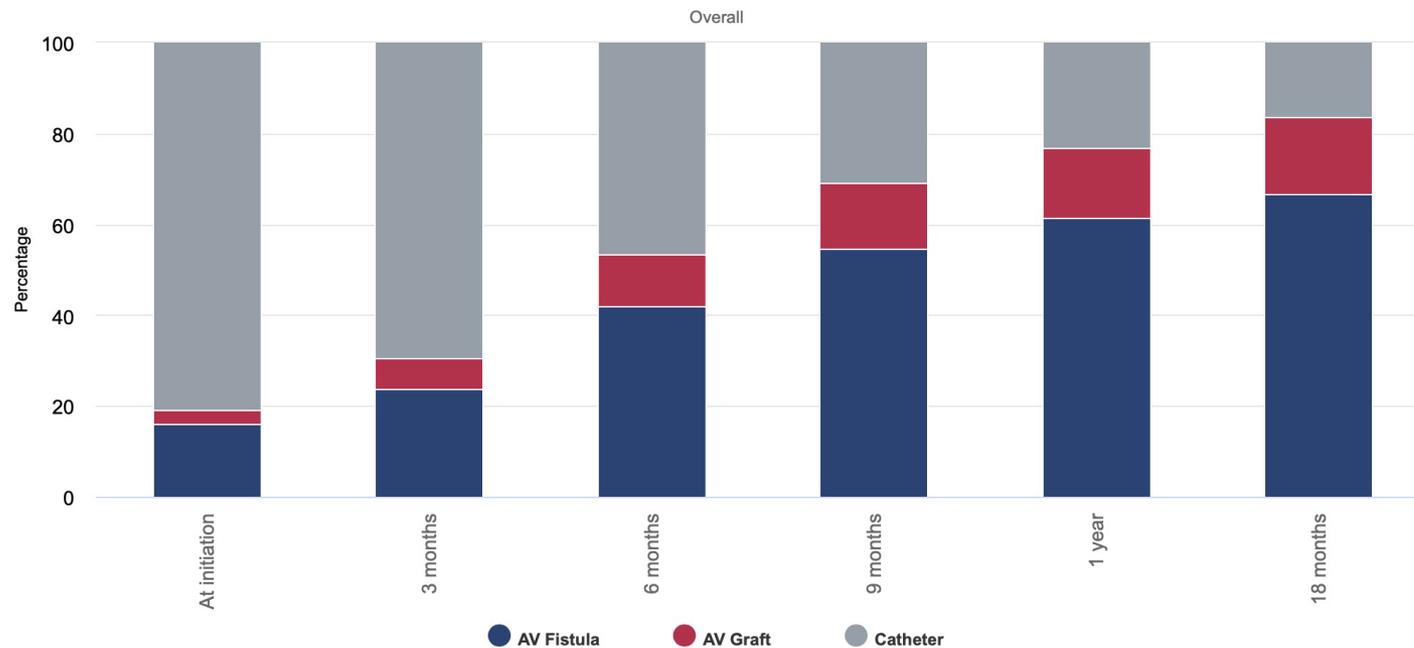
Hemodialysis Catheter Infections



Hemodialysis Catheters Are Widely Used for Dialysis Access in United States

- Most patients in the US initiate hemodialysis (HD) through a catheter
 - 82% of incident patients in 2019 (over 60% without maturing fistula or graft)
 - No significant change over 10 years
- After six months on dialysis, most patients who initiated dialysis through catheter are still using a catheter

Changes in Vascular Access Type in Prevalent Patients on Dialysis

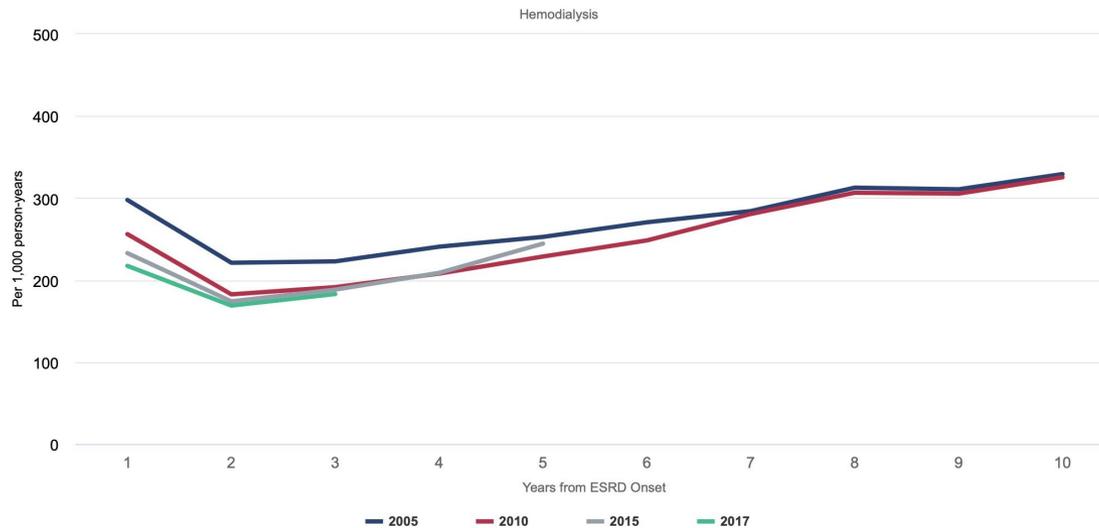


Data Source: 2020 United States Renal Data System Annual Data Report

Association of HD Catheter Infection with Morbidity and Mortality

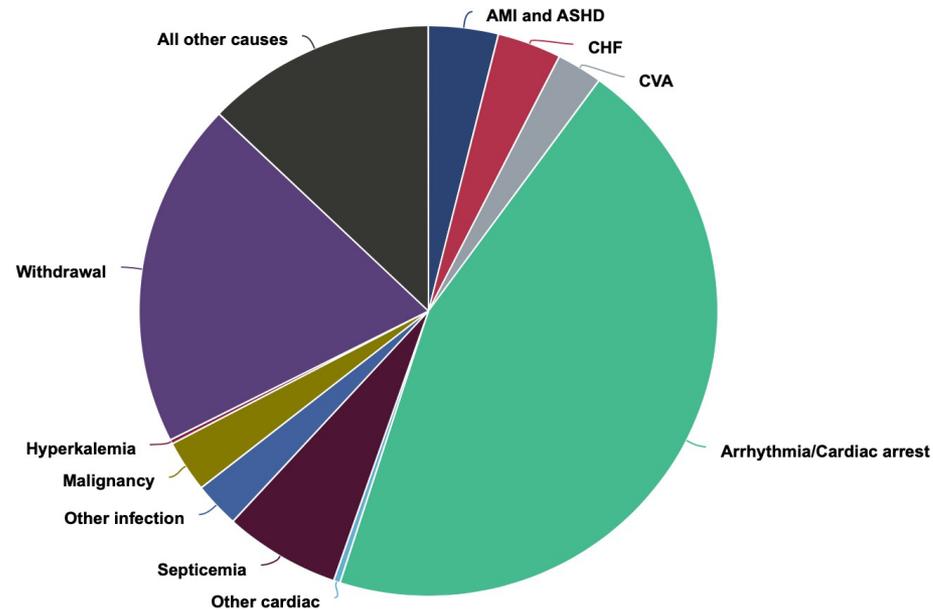
Infections are second most common cause of hospitalizations for patients on HD (after cardiovascular disease)

Infection-Related Mortality on Patients on HD



Data Source: 2020 United States Renal Data System Annual Data Report

Sepsis Accounts for 7% of Deaths in Patients on HD



Data Source: 2020 United States Renal Data System Annual Data Report

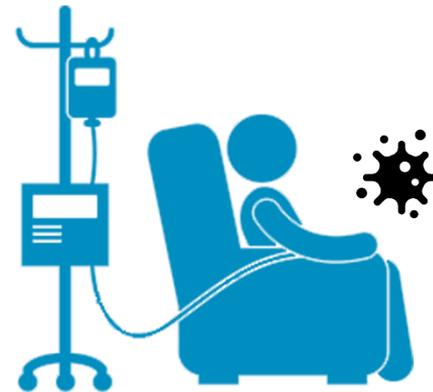
Other Complications of HD Catheter Infection

- Endocarditis
- Osteomyelitis
- Vertebral abscess
- Septic shock
- Loss of vascular access

Pathogenesis of HD Catheter Infection

- Extraluminal: Skin bacteria infecting external surface of the HD catheter
 - Organism can migrate down catheter to intravascular portion
- Intraluminal
 - Contaminated catheter hubs
 - Hands of healthcare workers
 - Surrounding skin/clothing

Diagnosing HD Catheter Infections



Exit Site and Tunnel Infections Can Lead to Catheter-Related Bacteremia

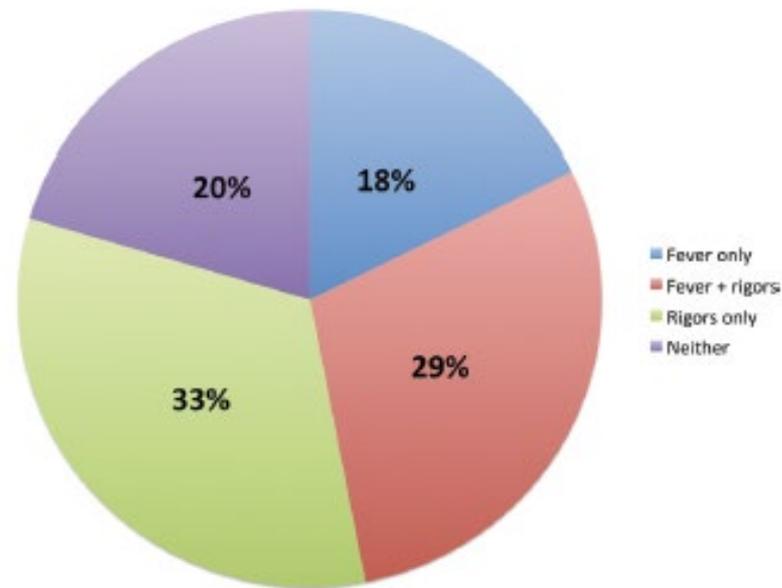


Kumbar L and Yee J. *Advances in Chronic Kidney Disease* 2019 26:16-22 DOI: (10.1053/j.ackd.2018.10.005)



Lok C and Mokrzycki. *Kidney International*. 2011 79: 587-598.

Fever is Not Universal in Catheter-Related Bacteremia



Al-Solaiman Y, Estrada E, Allon, M. The spectrum of infections in catheter-dependent hemodialysis patients. *Clin J Am Soc Nephrol*. 2011 Sep;6(9):2247-52.

Diagnosing HD Catheter Infections

- If purulent drainage at exit site, swab should be sent for culture
- For patients with bacteremia
 - Catheter-Related Blood Stream Infection (CRBSI): Catheter is identified as the source of the BSI
 - Catheter and Central Line-Associated Blood Stream Infection (CLABSI): Blood stream infection in which catheter has been in place > 48 hours
- Criteria for confirming CRBSI are burdensome for patients on HD
 - Quantitative cultures
 - Peripheral venipuncture
 - Catheter tip cultures

Diagnosis of HD Catheter Infections

In practice, HD catheter is assumed to be source of BSI in patients with:

- HD catheter
- Signs and symptoms of infection
- Positive blood cultures
- Absence of other infections (UTI, diabetic foot infection)

Prevention of HD Catheter Infections



Prevention of HD Catheter Infections

- Catheter reduction
- Self-care
- Best practices while accessing HD catheter
- Exit site and hub care
- Catheter manipulations

Catheter Reduction

- Early referral to nephrology (pre-dialysis) and vascular surgery
- Collaborative decision-making regarding best access
 - AV fistula versus AV graft
- Vascular access teams

Catheter Self-Care

- Monitoring of dressing, exit site
- Showering
 - Avoidance of showers is associated with a decrease in quality of life for patients.
 - Past guidelines have discouraged showers, but many patients still shower with HD catheters.
 - Some clinics have adopted post-showering catheter-care guidelines.
 - Kosa S et al. *KI Reports*, 2017 2: 228-238.

Best Practices for HD staff

- Hand hygiene before and after catheter care
- New clean gloves
- Face protection
- Before accessing catheter, apply antiseptic to catheter hub and allow to dry (“Scrub the hub”)
- Connect and disconnect catheter to lines using sterile technique
- Remove gloves and perform hand hygiene

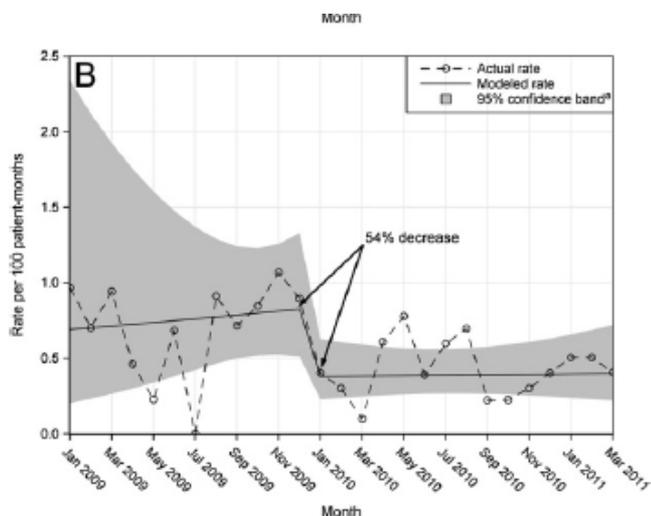
Best Practices For HD Staff

- Routine evaluation of staff technique
 - Observe hand hygiene, catheter dressing change, and correct use of antiseptics
 - At time of hire and at quarterly intervals
- Diligent reporting of BSI
 - Need communication between dialysis clinic, hospital, and nursing home

Exit Site and Hub Care

- Exit-site ointment
 - Bacitracin/gramicidin/polymyxin B (not available in US)
 - Povidone iodine ointment
 - Mupirocin ointment (concerns about resistance)
 - **Ensure catheter compatibility**
- Chlorhexidine-impregnated sponge dressing
 - Low risk for resistant organisms

Quality Improvement Project Based On CDC Guidelines Was Linked To Decreased BSI



Patel P et al. Am J Kidney Dis. 62(2): 322-330 (2013).

Access-related BSI

Interventions for patients with catheters:

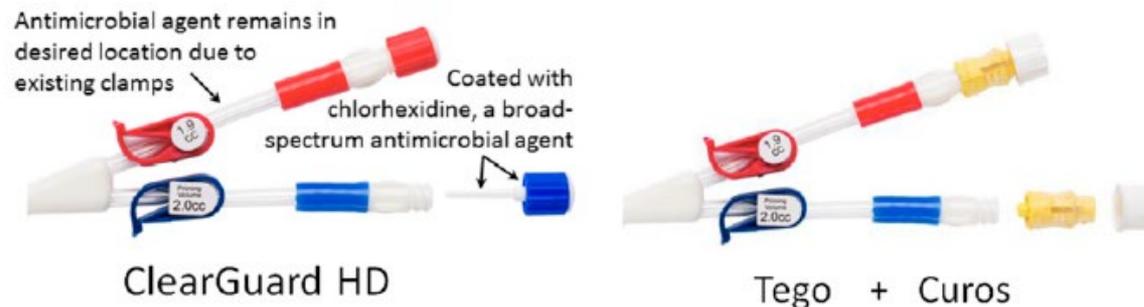
1. Skin antisepsis during dressing changes (chlorhexidine preferred but povidone-iodine or 70% alcohol acceptable)
2. Hand hygiene surveillance (monthly)
3. Catheter access observations (quarterly)
4. Patient education (signs of infection, risks of catheters)
5. Staff education and competency evaluations (every 6 months to 1 year)
6. Catheter reduction (vascular access coordinator)
7. Exit-site ointment or chlorhexidine-impregnated sponge dressing

Other Interventions

- Antibiotic lock solutions
 - Not routinely used for prophylaxis
 - Concern regarding resistance
- Non antibiotic lock solutions (TPA, ethanol, sodium bicarbonate)
 - Not widely used due to inadequate clinical data and cost
- Nasal mupirocin
 - Associated with lower intravascular infections in staph aureus nasal carriers
 - Drug resistance rare (but studies had short-term follow-up)

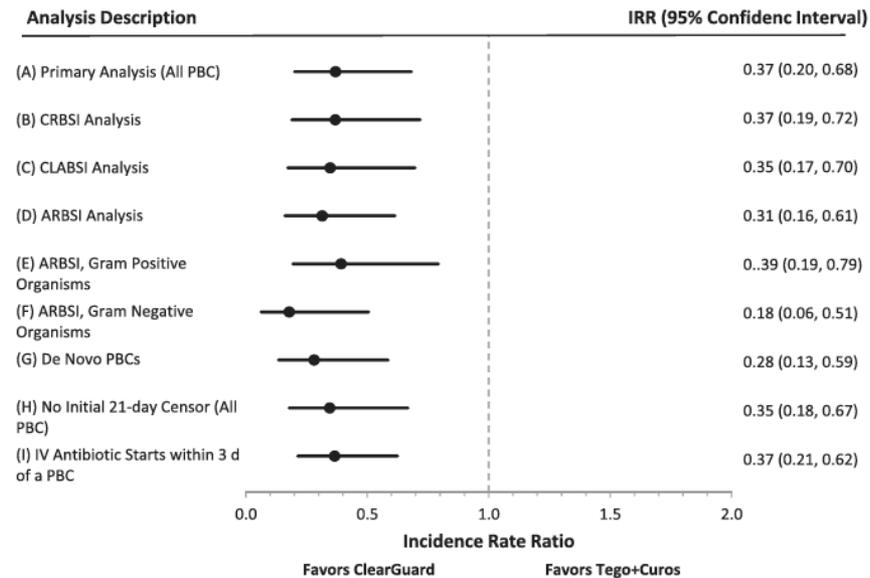
Hub Devices

- Chlorhexidine-coated rod (ClearGuard)
- Neutral-valve connector (Tego needle-free connector)



Brunelli S, Van Wyck D, Njord L, Ziebol R, Lynch L, Killion D. *JASN* 2018, 29: 1336-1343.

Chlorhexidine-Coated Rods Decrease Risk of CRBSI



Brunelli S, Van Wyck D, Njord L, Ziebol R, Lynch L, Killion D. *JASN* 2018, 29: 1336-1343.

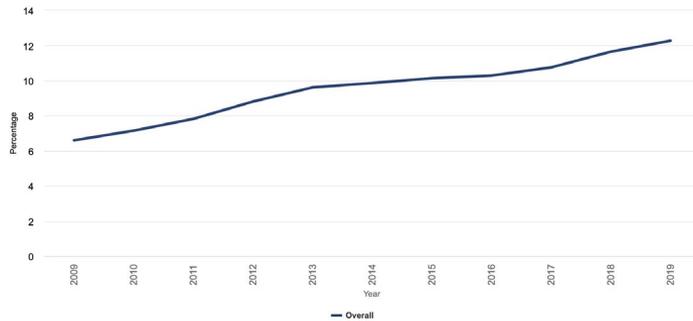
Summary: HD Catheter Infections

- HD catheter-related infections are associated with high mortality, hospitalizations, and morbidity.
- Prevention of catheter infections is crucial and involves catheter reduction, vigilance of catheter care, exit-site care, and antimicrobial interventions.
- A culture of safety is paramount, and constant vigilance for potential sources of contamination is crucial.

Infection Complications of Peritoneal Dialysis (PD)

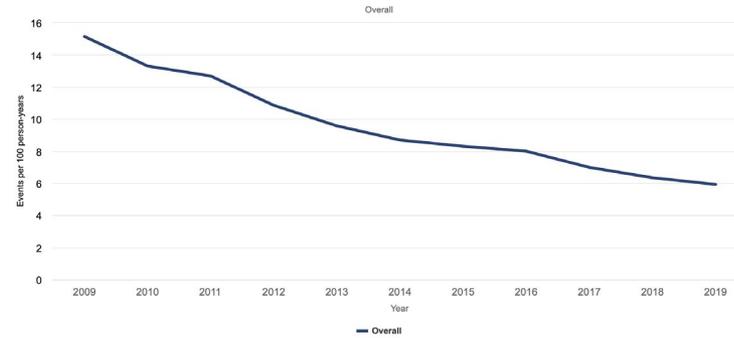


PD Usage Is Increasing and Peritonitis Rates Are Decreasing in US



Data Source: 2020 United States Renal Data System Annual Data Report

PD usage among incident ESRD patients



Data Source: 2020 United States Renal Data System Annual Data Report

Peritonitis rates

Exit-Site and Tunnel Infections

- Exit site infection: Purulent drainage with or without erythema
 - Erythema alone may be seen in other conditions (trauma, allergic skin reaction, etc.)
- Tunnel infection: Presence of inflammation along tunnel site (physical exam or ultrasonography)
- Exit-site infections and tunnel infections can lead to peritonitis and catheter removal

Diagnosing PD Exit-Site Infection



Erythema but no drainage = not-exit site infection

Schmitt R, Haller H, Hiss M. *AJKD* 2012, 60:A29-A31.



Erythema + purulence = exit-site infection

Gloembiewska E and Ciechanowski K. *BMC Infectious Disease* 2021, 21: 624.

Risk Factors for Exit-Site Infections

- Poor compliance with exit-site care
- Trauma at exit site
- Animals
- Swimming

Prevention of Exit-Site Infections

- Exit site needs to be created in an easy-to-clean location
- Daily exit-site cleaning (povidone iodine or chlorhexidine) and antibiotic cream (gentamicin or mupirocin)
- Prevention of trauma or “tugging” on exit site (anchor tape)
- Baths or swimming in natural bodies of water (lakes, ocean, etc.) are generally discouraged
- Swimming in chlorinated pools is acceptable for many clinics
 - Immediate exit-site care after swimming
 - Some clinics recommend use of ostomy bags to protect catheter and exit site

PD-Related Infections Cause Significant Morbidity

- Small studies have suggested that peritonitis is associated with an increase in mortality.
- Peritonitis is a very common cause of modality change (to hemodialysis).
- Peritonitis can be associated with changes in peritoneal membrane and fluid/solute removal.

Diagnosis of Peritonitis

- Commonly presents with cloudy peritoneal fluid and abdominal pain
 - Patients and caregiver taught to inspect fluid regularly
- Diagnostic criteria
 - 2 out of the following 3 criteria:
 - Abdominal pain and/or cloudy effluent
 - Effluent WBC $>100/\mu\text{l}$ with $>50\%$ PMNs
 - Positive fluid gram stain and/or culture

Prevention of Peritonitis

- Prevention of extraluminal catheter infection
 - Exit-site care
- Prevention of intraluminal catheter infection
 - Touch contamination
 - Catheter damage
- Prevention of intra-abdominal infection
 - GI and GU procedures
- Fungal peritonitis prophylaxis

Prevention of Intraluminal Infection

- Patient and caregiver training and with follow-up education and observation
 - Identifying potential sources of contamination
 - Dry contamination (clamp closed, no exposure of PD fluid to non-sterile environment → may only require transfer set change
 - Wet contamination (exposure of PD fluid to non-sterile environment) → transfer set exchange and antibiotics
- Risk of peritonitis with wet contamination is low (<5% in case series) but much higher than risk with dry contamination
 - Yap D, Chu W, Ng F et al. *PDI* 2012, 32: 612-616.
- Prophylactic antibiotics should cover skin organisms (Staph sp.)
- Cephalexin (oral), cefazolin (IP), or vancomycin (IP) can be used

Prevention of Intra-Abdominal Infection

- In patients undergoing colonoscopy:
 - Abdomen should be dry on day of procedure
 - Many centers avoid dialysis the following night, especially if biopsies were taken
 - Prophylactic antibiotics are recommended, although there is not high-quality data
- Patients undergoing invasive GU procedures such as IUD placement should also be treated in the same manner

Antibiotic Prophylaxis Reduces Risk of Peritonitis Post-colonoscopy

Table 4. Effect of Prophylactic Antibiotics on the Incidence of Endoscopy-associated Peritonitis.

| Group | Peritonitis (%) |
|--------------------------------------|------------------------|
| EGD (n = 81) | 1 (1.2%) |
| Prophylactic antibiotics (n = 10) | 0 (0%) |
| No prophylactic antibiotics (n = 71) | 1 (1.4%) |
| Non-EGD (n = 44) | 7 (15.9%) ^a |
| Prophylactic antibiotics (n = 15) | 0 (0%) ^b |
| No prophylactic antibiotics (n = 28) | 7 (25%) |

Table 5. Effect of Prophylactic Antibiotics on the Incidence of Endoscopy-associated Peritonitis in Patients Undergoing Non-EGD Procedures with Invasive Therapies.

| Antibiotic use | Peritonitis |
|--------------------------------------|---------------------|
| Invasive therapies (n = 23) | 7 (30.4%) |
| No prophylactic antibiotics (n = 13) | 7 (53.8%) |
| Prophylactic antibiotics (n = 10) | 0 (0%) ^a |

Table 6. Effect of Prophylactic Antibiotics on the Incidence of Endoscopy-associated Peritonitis in Patients Undergoing Gynecologic Procedures.

| Antibiotic use | Peritonitis |
|-------------------------------------|---------------------|
| Gynecologic procedures (n = 13) | 5 (38.5%) |
| No prophylactic antibiotics (n = 9) | 5 (55.6%) |
| Prophylactic antibiotics (n = 4) | 0 (0%) ^a |

EGD and non-invasive colonoscopy

Invasive endoscopy (polypectomy, biopsy)

Gynecologic Procedures

Wu H, Li I, Weng C, Lee C, Chen Y, Chang Y, Fang J, Hung C, Yang C, Tian Y. *Plos One* 2013 8:e71532.

Prophylaxis for Fungal Peritonitis

- Fungal peritonitis is associated with higher mortality than bacterial peritonitis and requires catheter removal.
- Prolonged antibiotic use is a major risk factor for fungal peritonitis.
- ISPD recommends fungal prophylaxis for PD patients receiving antibiotics.
 - This includes prophylaxis for patients receiving antibiotics to treat a nondialysis infection (diabetic foot infection, etc.).

Efficacy of Fungal Prophylaxis

Table 1. Fungal Peritonitis Without and With Prophylaxis While Receiving Antibiotics

| Incidence of Fungal Peritonitis, episodes/y | Prophylaxis | Reference |
|---|--------------------------|---|
| 0.29 vs 0.02 | Nystatin 3×/d | Zaruba et al. <i>Am J Kidney Dis.</i> 1991;17:43-46 |
| 0.17 vs 0 | Nystatin or ketoconazole | Robitaille P. <i>Perit Dial Int.</i> 1995;15:77-79 |
| 0.08 vs 0.01 | Fluconazole QOD | Wadhwa et al. <i>Adv Perit Dial.</i> 1996;12:189-191 |
| 0.02 vs 0.01 | Nystatin 4×/d | Lo et al. <i>Am J Kidney Dis.</i> 1996;28:549-552 |
| 0.02 vs 0.02 | Nystatin 4×/d | Thodis et al. <i>Perit Dial Int.</i> 1998;18:583-589 |
| 0.01 vs 0.01 | Nystatin 4×/d | Williams P, et al. <i>Perit Dial Int.</i> 2000;20:352-353 |

Abbreviation: QOD, every other day.

Al Sahlawi M, Bargman J, and Perl J. *Kidney Medicine* 2: 467-475 (2020).

Infectious Complications of PD Summary

- Peritonitis is associated with a significant risk of morbidity and modality change.
- Techniques to prevent peritonitis include exit-site care, frequent education/training, and possibly antibiotic prophylaxis in cases of wet contamination.
- Antibiotic prophylaxis should be considered for patients undergoing endoscopy.
- Antifungal prophylaxis should be considered for patients receiving prolonged antibiotics.

Preventing Infection in Nursing Home Residents



Preventing HD Infections In Nursing Home Residents

- Communication between dialysis team and nursing home staff is crucial.
 - Plans for vascular access (appointments for imaging, interventional radiology, surgery, etc.)
 - Diagnoses of any infections should be shared by NH, and staff should review whether there have been preventable infections.
- Early identification of infections
 - Exit-site inspection
 - Signs/symptoms of bacteremia
- Exit-site care training (especially in patients post-shower)

Preventing PD Infections in Nursing Home Residents

- Training and retraining regarding sterile technique and exit-site care
- Monitoring for contamination
 - Antibiotics for wet contamination
- Recognizing signs and symptoms of peritonitis
- Understanding situations in which peritonitis risk is elevated and when antimicrobial prophylaxis may be needed

Resources

Centers for Disease Control and Prevention

<https://www.cdc.gov/dialysis>

International Society of Peritoneal Dialysis

<https://ispd.org>

American Society of Nephrology/Nephrologists Transforming
Dialysis Safety

<https://www.asn-online.org/ntds>

Q & A



Thank you! Connect with us...

Dr. Seth Furgeson:

seth.furgeson@cuanschultz.edu

Qsource

Quality Improvement Department:

qsource-qidept@qsource.org



facebook.com/QsourceESRDNetworks

Telligen

Lynne Bergero, MHSA, CPHQ

lbergero@telligen.com



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