The Epidemiology of Dialysis Catheter-Associated Bloodstream Infections in an Emergent Hemodialysis Cohort

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Introduction

The Harris Health System in Houston, Texas provides dialysis to hundreds of undocumented immigrants with end stage renal disease (ESRD) on an emergent basis. Harris Health does not provide arteriovenous (AV) fistula or graft placement for the majority of these patients leaving them chronically dependent on tunneled dialysis catheters.

Central-related bloodstream infections (CRBSIs) associated with dialysis catheters are known to cause significant morbidity and mortality in ESRD patients. However, while the epidemiology of CRBSIs in patients receiving scheduled outpatient dialysis has been previously described, relatively little data exists regarding CRBSIs in patients receiving emergent hemodialysis.

Therefore, we studied the characteristics of the emergent hemodialysis population in Harris Health as well as the CRBSIs they acquired.

Methods

A retrospective chart review was performed of all ESRD patients receiving hemodialysis solely on an emergent basis through the Harris Health System in Houston, Texas between 1/1/2012 and 12/31/2015.

Patient demographics, comorbidities, and characteristics of all CRBSIs that occurred during the study period were recorded. CRBSI was defined as a positive blood or catheter tip culture treated as a catheter-related infection by the treatment team. Recurrent CRBSI was defined as infection whose causative pathogen had been implicated in a prior CRBSI in the same patient within the study period.

CRBSI and recurrent CRBSI risk factors were identified by univariate and multivariate analysis.

Results

CRBSIs in Emergent Hemodialysis Patients

	No. (%)
Patients receiving emergent HD in the study period	342 (100%)
…with at least one CRBSI	78 (22.8%)
…with multiple CRBSIs	23 (6.7%)
Total CRBSIs during the study period	133 (100%)
CRBSIs representing recurrent infections	25 (18.8%)

Incidence of CRBSIs in Patients Receiving Emergent versus Scheduled Hemodialysis

Study:	Hemodialysis Type:	Incidence of CRBSIs per 1000 catheter-days
Present study	**Emergent**	**1.0**
Rojas-Moreno 2016	Emergent	2.6
Wang 2014	Scheduled	7.8
Camins 2010	Scheduled	5.2*
Taylor 2004	Scheduled	1.2

*Standard care arm of RTC

Clinical Characteristics of Emergent Hemodialysis Patients With and Without CRBSIs

	Pts with CRBSIs (%) n=78	Pts without CRBSIs (%) n=264	*P* value
Age	52.0	51.3	NS
Male gender	40 (51.3)	152 (57.6)	NS
Diabetes Mellitus	52 (66.7)	154 (58.3)	NS
HIV	1 (1.3)	1 (0.38)	NS
Illicit drug abuse	2 (2.6)	6 (2.3)	NS
Duration of HD during study (mo)	20.5	15.1	0.0039
Avg # HD sessions/month*	5.88	5.15	<0.001
Receiving HD by AV fistula or graft only	0 (0)	18 (7)	0.018

*Pts receiving >6 sessions/mo of HD were at 2.3 (95% CI 1.0-5.6) times higher risk of CRBSI than those receiving ≤3 sessions per month (p<0.05)

Results

Clinical Characteristics of Emergent Hemodialysis Patients with Nonrecurrent and Recurrent CRBSIs

	Pts with nonrecurrent CRBSIs (%) n=61	Pts with recurrent CRBSIs (%) n=17	*P* value
Age	52.7	49.1	NS
Male gender	28 (45.9)	12 (70.6)	NS
Diabetes Mellitus	40 (65.6)	12 (70.6)	NS
HIV	1 (1.6)	0 (0)	NS
Illicit drug abuse	1 (1.6)	1 (5.88)	NS
Duration of HD during study (mo)	18.8	24.6	0.04
Avg # HD sessions/month	5.89	5.88	NS

Microbiology of CRBSIs in Emergent Hemodialysis Patients*

Organism	No. isolates (%) n=133
Gram-positive bacteria:	77 (57.9)
Methicillin-sensitive *Staphylococcus aureus* (MSSA)	30 (22.6)
Methicillin-resistant *Staphylococcus aureus* (MRSA)	20 (15)
Coagulase-negative staphylococci (CONS)	18 (13.5)
Enterococcus faecalis	5 (3.8)
Others	4 (3)
Gram-negative bacteria:	55 (41.4)
Enterobacter spp.	25 (18.8)
Klebsiella spp.	7 (5.3)
Pseudomonas spp.	5 (3.8)
Stenotrophomonas spp.	4 (3)
Escherichia coli	4 (3)
Others	10 (7.5)
Mycobacterium chelonae ss. Abscessus	1 (0.8)

*13 of 78 patients (16.7%) had a polymicrobial CRBSI

Results

Comparison of the Microbiology of CRBSIs Associated with Scheduled versus Emergent Hemodialysis

Study:	Hemodialysis type:	Gram-positive bacteria	Gram-negative bacteria	Others
Present Study	**Emergent**	**57.9%**	**41.4%**	**0.8%**
Rojas-Moreno 2016	Emergent	33.3%	66.7%	0%
Fram 2015	Scheduled	72.8%	25.9%	1.2%
Dalgaard 2015	Scheduled	64.1%	26%	10%*

*Included anaerobes, yeasts, and polymicrobial infections

Risk Factors for Recurrent Infection in Patients with CRBSIs Associated with Hemodialysis

	Recurrent CRBSIs n=25	Nonrecurrent CRBSIs n=108	Relative Risk (95% CI)	*P* value
Pts undergoing catheter exchange (%)	21 (84)	94 (87)	0.97 (0.80-1.16)	0.71
Avg duration of antibiotics (days)	17.8	17.5	-	0.9
Gram-positive bacteria isolated (%)	19 (76)	58 (53.7)	1.42 (1.07-1.88)	0.016
Staphylococcus aureus isolated (%)	16 (64)	34 (31.5)	2.03 (1.37-3.08)	< 0.001
Gram-negative bacteria isolated (%)	6 (24)	49 (45.4)	0.52 (0.25-1.07)	0.076

Additional Results:

19/120 (14%) of CRBSIs involved an ICU admission. 4 patients died during an episode of CRBSI; the per-episode mortality rate was 3.3%.

In patients with multiple infections, the mean duration between episodes was 149.6 days.

Gram-positive infections were treated with longer courses of antibiotics than gram-negative infections (19.3 versus 15.1 days, p = 0.016), but still had more than twice the rate of relapse (24.7% versus 10.7%; p=0.032).

Conclusion

CRBSIs in patients receiving emergent hemodialysis carry a 3.3% per-episode rate of mortality and a 14% risk of ICU admission, and are associated with the total duration and frequency of dialysis as well as the receipt of dialysis via tunneled catheter rather than AV fistula or graft.

More than 40% of CRBSIs in the cohort were due to gram-negative organisms, which is consistent with the sole prior study of CRBSIs in patients receiving emergent hemodialysis and significantly higher than the rates of gram-negative CRBSIs reported in patients receiving scheduled hemodialysis. There was also less CRBSIs per 1000 catheter days in this cohort in comparison to other studies.

Recurrent CRBSIs were common (18.8% of cases) and associated with gram-positive infections, particularly *Staphylococcus aureus*, despite these patients receiving longer courses of antibiotic treatment. Neither shorter initial durations of antibiotic therapy nor lower rates of catheter exchange were associated with development of recurrent CRBSI.

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