170. Predictors of Recurrent Infective Endocarditis in Intravenous Drug Users

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Background. Caring for hospitalized patients with infective endocarditis (IE) can be challenging due to the nature of the disease and its complications, underlying medical and psychiatric problems, socioeconomic status and environmental factors. Some of these patients develop recurrent IE after the first episode treated. On-going intravenous (IV) drug use after hospital discharge is the highest predictive factor for recurrent IE. Besides IV drug use, there are limited data of other contributing factors to recurrent IE. Those factors may be modifiable during the first hospitalization to reduce the incidence of recurrent IE.

Methods. A retrospective cohort study was conducted at a large tertiary acute care medical center in Tampa, Florida. All consecutive patients with IE with history of IV drug use from January, 2011 to December, 2017 were included. Basic demographic information, co-morbidities (diabetes, hypertension, chronic lung and kidney diseases, HIV, Hepatitis B and C status, coronary artery diseases), valves involved, length of stay, complications at their first IE episode such as septic shock and stroke were included. Groups were identified based on the first episode, first recurrence and second or more recurrences of IE.

Results. A total of 106 patients were identified based on the inclusion criteria. The association between the type of valve infection (right side and left side) and IE recurrence was found to be statistically significant. ($P = 0.003$). Right side valves are prone to have recurrent IE episodes. People with recurrent IE were more likely to have septic shock ($P = 0.02$) and requiring intensive care unit (ICU) admissions ($P < 0.001$) during their first episode There was no statistically significant difference between other demographic information and recurrent endocarditis as well as other parameters such as organisms or type of substance used. (Table 1)

Conclusion. Right-sided IE and presence of septic shock during their first episode of IE may be the predictors for recurrent IE. Interventions including closer follow-up, more aggressive septic shock recognition and management, socioeconomic assessment in addition to substance abuse treatments after discharge should be considered to prevent recurrent IE.

Table 1: Demographic Characteristics and Risk factors for IE Patients

Parameters	IE First event	IE first recurrence	IE second recurrence or more	P-value
Gender				0.688
Male	25	15	4	
Female	32	21	9	
Mean Age (year-old)	36 (22-64)	36 (24-58)	37 (12-55)	
Mean Length of Stay (days)	42 (8-118)	57.5 (3-139)	45 (12-93)	
Ethnicity				0.722
Asian	1	0	0	
Black	13	8	1	
Hispanic	9	8	4	
White	33	18	8	
Others	1	2	0	
Medical Insurance				0.803
Medically Insured	46	27	10	
Uninsured	11	9	3	
Living Status				0.391
Stable	55	33	13	
Homeless	2	3	0	
Toxicology				0.705
Amphetamine, Opiates	4	4	2	
Cocaine, Opiates	9	10	4	
Opiates	17	12	2	
Opiates, Oxycodone	8	2	2	
Oxycodone, Cannabinoids, Cocaine	3	0	0	
Oxycodone, Cannabinoids, Opiates	12	5	2	
Underlying Co-Morbidities				
Diabetes mellitus	23	12	7	0.426
Hypertension	32	21	8	0.932
COPD	36	15	7	0.128
CAD	27	17	3	0.257
CKD (serum Cr > 2)	27	12	9	0.075
History of Belligerent in hospital	20	8	6	0.220
HIV	17	13	6	0.504
HBsAg positive	9	21	4	**<0.001**
HCV Ab reactive	38	23	9	0.487
Requiring ICU during first admission	35	34	12	**< 0.001**
Type of Valve Infection				**0.003**
Right-sided valve infection	22	27	7	
Left-sided valve infection	35	9	6	
Initial blood culture				0.233
MSSA	2	1	0	
MRSA	7	6	2	
Streptococcus	19	12	3	
Enterococcus	9	9	4	
Gram negative bacteria	4	4	0	
Mycobacteria	5	4	0	
Yeast (Candida)	2	0	2	
Mixed organisms	9	0	2	
Persistent Blood Culture (72 hours)	13	15	4	0.355
Septic Shock	20	23	7	**0.022**
Baseline Ejection Fraction (EF)				0.883
Normal EF (> 50%)	47	27	11	
Borderline EF (40-50%)	6	6	1	
Low EF (< 40%)	4	3	1	
CV Events (during first admission)	21	13	8	0.225

Abbreviation

CAD	=	Cardiovascular Disease
CKD	=	Chronic Kidney Disease
COPD	=	Chronic Obstructive Pulmonary Disease
Cr	=	Creatinine
CV	=	Cerebrovascular
IE	=	Infective endocarditis
MSSA	=	Methicillin-sensitive Staphylococcus aureus
MRSA	=	Methicillin-resistant Staphylococcus aureus

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171. Rising Rates of Gram-Negative Bacilli Blood Stream (GNB-BSI) Infection in Adults

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Background. Monitoring bloodstream infections provides updates of the microbiology and antibiotic susceptibility trends. We elected to examine GNB-BSI.

Methods. We retrospectively studied adults (≥18 years old) inpatients with gram-negative bacilli (GNB) bloodstream infection (BSI; January 1, 2010–December 31, 2017), determined the demographics, onset place, microbiology and source. The results were stratified to study year and evaluated by the extended Mantel–Haenszel chi square for linear trends.

Results. GNB were encountered in 4520/14314 (31.6%) positive blood culture (BC) accounting for 2811 BSI episodes (2291 patients) with a steadily increasing rate (table). The 3 most common organisms were *Escherichia coli* (EC; 44.4%), *Klebsiella pneumoniae* (KP; 19.2%) and *Pseudomonas aeruginosa* (PA; 9.6%). GNB-BSI rate increase was mainly in EC-BSI ($P = 0.01$). The rate of other GNB-BSI did not change. Source distribution of EC-BSI did not change and antibiotic resistance did not change.

Conclusion. GNB-BSI is rising, primarily due to EC, without changes in source distribution or antibiotic susceptibility. Prospective studies to look at EC lineage and virulence factors are needed to determine the reason for EC-BSI rise.

Table 2: Trends in bloodstream infection among adults due to gram-negative bacilli over an eight-year period: N (rate) [a].

		Year of study							
	2010	2011	2012	2013	2014	2015	2016	2017	P [b]
All GNB	320 (10.3)	304 (9.5)	313 (10.4)	300 (10.4)	305 (11.5)	294 (11.1)	319 (12.2)	283 (11.0)	0.006
E. coli	135 (4.3)	142 (4.4)	153 (5.1)	146 (5.1)	143 (5.4)	139 (5.2)	172 (6.6)	121 (4.7)	0.008
KI P [c]	60 (1.9)	48 (1.5)	37 (1.2)	36 (1.2)	44 (1.7)	45 (1.7)	42 (1.6)	42 (1.6)	1.0
PA [d]	29 (0.9)	26 (0.8)	24 (0.8)	20 (0.7)	23 (0.9)	17 (0.6)	21 (0.8)	24 (0.9)	0.8
Other GNB	80 (2.6)	65 (2.0)	73 (2.4)	72 (2.5)	60 (2.2)	66 (2.5)	59 (2.3)	73 (2.8)	0.1
Mixed	16 (0.5)	23 (0.7)	26 (0.9)	26 (0.9)	35 (1.4)	27 (1.1)	25 (1.2)	23 (1.1)	0.5
# discharges	31156	31931	30166	28860	26635	26520	26132	25796	

a: Per 1000 discharges; b: Extended Mantel-Haenzel test for linear trends; c: *Klebsiella pneumoniae*; d: *Pseudomonas aeruginosa*.

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172. Risk Factors for 30-Day Mortality in Patients with Staphylococcus aureus Bacteremia at a Community Hospital: A Prospective Case–Control Study

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Background. *Staphylococcus aureus* bacteremia (SAB) is associated with 30-day all-cause mortality rates approaching 20–30%. The purpose of this case–control study was to evaluate risk factors for 30-day mortality in patients with SAB at a community hospital.

Methods. As part of an antimicrobial stewardship program (ASP) initiative mandating Infectious Diseases consultation for episodes of SAB, our ASP prospectively monitored all cases of SAB at a 341-bed community hospital in Jefferson Hills, PA from April 2017–February 2019. Cases included patients with 30-day mortality from the initial positive blood culture. Only the first episode of SAB was included; patients were excluded if a treatment plan was not established (e.g., left against medical advice). Patient demographics, comorbidities, laboratory results, and clinical management of SAB were evaluated. Inferential statistics were used to analyze risk factors associated with 30-day mortality.

Results. 100 patients with SAB were included; 18 (18%) experienced 30-day mortality. Cases were older (median age 76.5 vs. 64 years, $P < 0.001$), more likely to be located in the intensive care unit (ICU) at time of ASP review (55.6% vs. 30.5%, P = 0.043), and less likely to have initial blood cultures obtained in the emergency department (ED) (38.9% vs. 80.5%, $P < 0.001$). Variables associated with significantly higher odds for 30-day mortality in univariate analysis: older age, location in ICU at time of ASP review, initial blood cultures obtained at a location other than the ED, and total Charlson Comorbidity Index (CCI). Variables with $P < 0.2$ on univariate analysis were analyzed via multivariate logistic regression (Table 1).

Conclusion. Results show that bacteremia due to MRSA and total CCI were not significantly associated with 30-day mortality in SAB, whereas older age was identified as a risk factor. Patients with initial blood cultures obtained at a location other than the ED were at increased odds for 30-day mortality on univariate analysis, which may raise concern for delayed diagnosis.

Table 1. Multivariate analysis of variables associated with 30-day mortality

Exposure variable	OR (95% CI)	p-value
Age	1.1 (1.03–1.16)	0.001
MRSA	2.0 (0.62–6.25)	0.252
Total CCI	1.1 (0.89–1.33)	0.412
Area under the receiver operating characteristic curve = 0.8198		

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173. Successful Treatment of Carbapenem-Resistant Klebsiella pneumoniae (CR-Kp) Aortic Valve Endocarditis with Ceftazidime–Avibactam

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Background. The emergence of carbapenem-resistant *Klebsiella pneumoniae* (CR-Kp) presents significant clinical challenges with our limited antibiotic armamentarium. Infective endocarditis caused by CR-Kp is rare, with few cases reported in the literature. The use of the novel β-lactam/β-lactamase inhibitor combination ceftazidime–avibactam (CAZ-AVI) in this setting has only been described in one 2018 case in Italy. Guidance in how these novel antibiotics should be used becomes more prudent as the prevalence of complicated CR-Kp infections increases.

Methods. A 51-year-old male with a past medical history of a gunshot wound to the neck, type 2 diabetes, and osteomyelitis status post right below-the-knee and left toe amputations presented to the emergency department with altered mental status and right upper extremity weakness. The patient's hospital course was complicated by hemorrhagic stroke, left above-the-knee amputation, and intraoperative cardiac arrest. Subsequently, blood cultures on hospital days 41 and 43 grew CR-Kp and a transthoracic echocardiogram (TTE) showed moderate to severe aortic regurgitation.

Results. Antimicrobial therapy was changed from imipenem-cilastatin and colistin to CAZ-AVI and amikacin. The organism was found to be susceptible to CAZ-AVI and amikacin, intermediate to colistin, and resistant to all carbapenems. A transesophageal echocardiogram (TEE) confirmed the presence of a small mobile vegetation on the aortic valve with perforation and severe regurgitation. CAZ-AVI and amikacin were continued for two weeks, and then switched to CAZ-AVI and ertapenem for an additional four weeks. Follow-up blood cultures on and after day 44 were negative for CR-Kp. A TTE performed after therapy completion no longer demonstrated aortic regurgitation; however, the valves were poorly visualized. The patient then suffered anoxic brain injury after a second cardiac arrest, thought to be unrelated to endocarditis. The patient's family then decided on hospice care and the patient expired.

Conclusion. We report the successful treatment of CR-Kp endocarditis with CAZ-AVI and amikacin for two weeks followed by CAZ-AVI and ertapenem for four weeks. This regimen can be a viable option for patients that present with this rare multidrug-resistant infection.

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174. Temporizing Surgical Measures for Deep Mechanical Circulatory Support Device Infections: Case Series Report

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Background. Durable mechanical circulatory support device (MCSD) use continues to grow. MCSD deep-seated infections are a serious complication. Removal of the infected hardware is not always possible.

Methods. Single institution retrospective review of all culture-proven deep MCSD infection (pump and/or driveline) from 2009–2019. Patients were managed with intravenous (IV) and oral (PO) antibiotics; definitive surgical interventions included incision and drainage (I&D), device replacement, and heart transplant; and temporizing surgical measures were chronic chest tube (CCT) drainage for pump pocket and mediastinum and antibiotic impregnated bead implantation for driveline infection. Outcomes were analyzed.

Results. Total of 29 patients identified, 23 (79%) were male. Median age at device implantation was 44 years (20–68). MCSD were 18 (62%) destination therapy and 11 (38%) bridge to transplant. MCSD included 1 Heartmate I, 17 Heartmate II, 1 Heartmate III, 4 Heartware HVAD, and 6 Syncardia TAH. The median time to infection of 258 days (43–1551), affecting pump in 8 (28%), pump + driveline in 13 (44%), and driveline in 8 (28%). Microorganisms were *S. aureus* in 17 (60%, MRSA 11 and MSSA 6); coag-negative *staphylococci* in 3 (10%); *Viridans streptococci* in 1; *Serratia marcescens* in 3; *P. aeruginosa* in 2; *Klebsiella oxytoca* in 1; *Mycobacterium abscessus* in 1 and *C. albicans* in 1. Antibiotics are given to 28 patients, 23 (80%) with initial IV for a median of 6 weeks (1–14) and 5 (17%) with initial PO, for a median of 7 weeks (2–20). Nineteen patients (83%) on IV received PO antibiotics after. 17 patients (61%) remained on chronic suppression antibiotics (13 PO, 2 IV, 2 PO and IV). Twenty-six (90%) patients had I&D, 6 (21%) had device replacement and 11 (38%) had transplant. Of 21 patients with pump infection 16 (76%) had CCT drainage of pump pocket site or mediastinum for a median of 116 days (range 10–887 days). Of 21 patients with driveline infections, 6 (29%) had antibiotic impregnated bead implants. Overall survival at 90 days was 28/29 (95%) and 24/29 (83%) at 1 year. Infection-related mortality in Table 1.

Conclusion. Deep MCSD infection remains a challenging clinical problem. CCT drainage (for pump) and antibiotic-impregnated bead implant (for driveline) may be temporizing options for patients unable to undergo timely device replacement or heart transplant.

Infection site with/without surgical contemporizing measures	90-day mortality	1-year mortality
Pump infection with chronic chest tube drainage	1/16 (6%)	3/16 (19%)
Pump infection without chronic chest tube drainage	0/5	1/5
Driveline infection with antibiotic impregnated bead	0/6	0/6
Driveline infection without antibiotic impregnated bead	0/15	1/15
Overall	1/29 (3%)	5/29 (17%)

Table 1. Mortality from infection related complications in patients who underwent temporizing surgical measures.

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175. There Was a Fungus Among Us: A Cohort of Fungal Infectious Endocarditis Cases in East Tennessee

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Background. Fungal infective endocarditis (IE) represents less than 2% of all IE cases, but it carries a mortality rate as high as 50%. While cases of IE are on the rise in recent years due to the increased prevalence of persons who inject drugs (PWID), there are few published studies of fungus as the cause. *Candida* species is the most likely fungal pathogen in IE. Known risk factors include prosthetic heart valves, healthcare-associated infections, and injection drug use. Since fungi are a rare culprit in endocarditis, there is little information on incidence, treatment recommendations, and outcomes.

Methods. A retrospective cohort of patients with *Candida* IE was analyzed between October 2013 and September 2018 at a university hospital in East Tennessee. Demographic, microbiologic, substance use status, mortality, and echocardiographic data were collected.

Results. Nine patients with *Candida* IE met inclusion criteria. Mean age was 37, 67% were males. Risk factors included PWID, oral opioid abuse, previous valve surgery and autoimmune disease. 5 (55%) were caused by *Candida albicans*, 3 (33.3%) *Candida paraipsalosis*, and 1 (11%) grew both *Candida tropicalis* and *albicans*. Valves involved: 4 (66.7%) native tricuspid, 2 (22%) native aortic. 2 (22%) had native mitral, 1 (11%) had both tricuspid and mitral valve involvement. Echinocandins were used in 5 (55%) and 2 (22%) underwent surgery. There was 1 (11%) in-hospital mortality and 2 (22%) within 1 year of discharge (Table 1).

Conclusion. Fungal IE is a rare disease with high mortality and increasing incidence, especially in PWID. High index of suspicion is required for early diagnosis. Treatment is traditionally a combination of surgery and antifungal therapy. Although, medical treatment alone can be successful in patients who are not surgical candidates, such as in PWID.