A Comprehensive, One Year, Hospital-Wide Snapshot of All Serious Complications in People Who Inject Drugs

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BACKGROUND

Scope of Problem

- Dramatic rise in opioid use and associated mortality and morbidity in the last two decades [1-4]
- Worldwide, 13 million people inject drugs including morphine, heroine, cocaine, amphetamine, methamphetamine, PCP, ketamine, and prescription drugs [5]
- Drug overdose rate is 12.3-16.3 per 100,000 [6,7]
- Total cost of the Injection Drug use (IDU) epidemic to the US > $1 trillion in the last 15 years; $215.7 billion were spent on health care associated costs [6,7]

Gap in Knowledge

- Infectious complications of IDU are frequently associated with poor outcomes, protracted and difficult courses of treatment, and lack of consensus on treatment guidelines.
- Ideal management at the patient and policy level is not known
  - Need to improve surveillance, build medical workforce capacity, increase access to treatment, and invest in research
- The relative burden and impact of the various serious complications of IDU has not been studied, presenting a barrier to these efforts

Goals and Research Approach

- Kentucky sits at the heart of the IDU epidemic in the United States
  - Highest rates of HCV in the US; a well described marker of IDU
  - Nearly 20% of the most vulnerable counties for an IDU associated epidemic are located in Kentucky [11]
- Provides an opportunity to assess IDU at the epicenter of the epidemic
- **Goal:** To better define the relative burden and impact of serious infectious complications of IDU
- **Approach:** We undertook a comprehensive study of all admissions to University of Kentucky associated hospitals across an entire year that were associated with infectious complications of IDU.

METHODS

- IRB approved retrospective review of all adult patient admissions in 2018 who were:
  - Admitted to the University of Kentucky Albert B. Chandler Hospital or the University of Kentucky Good Samaritan Hospital
  - Seen by the ID consult service
  - Had an ICD9 (19 unique codes) or ICD10 (108 unique codes) billing code associated with drug use or drug abuse or had methadone or buprenorphine as active medications
- Charts were reviewed to confirm each admission was the result of IDU and involved an infectious complication
- Demographics, past medical history, social history, drug use, reason for admission, laboratory testing including microbiology, treatment, and outcomes were reviewed in detail for each admission
- Data analyzed using GraphPad Prism (version 7.00 for Mac) and the Statistical Package for the Social Sciences (SPSS, version 25.0, IBM Corp, USA) using:
  - Basic descriptive statistics
  - Chi^2 analysis tests for categorical data
  - Multivariate linear and logistic regression analysis

FUNDING

This research was supported by the Infectious Disease Society of America Foundation Grant for Emerging Researchers/Clinicians Mentorship (G.E.R.M) awarded to J.T. Henderson, the University of Kentucky Center for Clinical & Translational Science, and the Fogarty International Center Global Health Equity Scholars Program of the National Institute of Health award number D43TW010540

RESULTS

Descriptive Statistics

Patient Characteristics

	n	%
Age (years)	38.3 +/- 10.2	
BMI (kg/m^2)	25.4 +/- 5.7	
Gender (Female)	230	49.3%
Pregnant	14	3.0%
Any Comorbidity	183	39.2%
Hypertension	100	21.4%
Diabetes mellitus	41	8.8%
Congestive Heart Failure	24	5.1%
Liver Cirrhosis	27	5.8%
Chronic Kidney Disease	13	2.8%
COPD	48	10.3%
Coronary Artery Disease	11	2.4%
Immunocompromise	12	2.6%
Prior IE	119	25.5%
Tobacco Use	387	82.9%
EtOH	105	22.5%
Illicit Drug Use	302	64.7%
Methamphetamine	190	40.7%
Heroin	198	42.4%
Cocaine	48	10.3%
HIV Status	18	3.9%
HCV Ab	314	67.2%

- 390 patients (467 visits) met study criteria
- Average age was 38.3 +/- 10.2 years and female patients made up 49.3% of admissions
- Hypertension was the most common comorbidity but 39.2% of patients had one of 8 selected key comorbidities
- Nearly 1/4 of admissions had prior infective endocarditis
- A majority (82.9%) smoked while only 22.5% reported alcohol use
- The top illicit substances used were methamphetamine (40.7%), heroin (42.4%), and cocaine (10.3%)
- While only 4.1% of tested patients were HIV+, 67.2% were HCV antibody positive

Diagnosis, Outcomes and Interventions

- Endocarditis (40.7%), bacteremia (26.3%), vertebral osteomyelitis (26.3%), abscess (12.0%) and septic arthritis (11.8%) were the most common infectious complications
- The in-patient death rate was 3.0%; 37.9% required an ICU stay; and 32.1% of patients were readmitted within the study period
- Average length of stay was 26 +/- 18 days
- Nearly half of admissions received an addiction medicine consult
- A majority (77.5%) underwent a transthoracic echocardiogram (TTE) while only 5.8% underwent a transesophageal echocardiogram (TEE)

Infectious Diagnosis

	n	%
Infectious Endocarditis	190	40.7%
Bacteremia	123	26.3%
Vertebral Osteomyelitis	100	21.4%
Epidural Abscess	31	6.6%
Cellulitis	26	5.6%
Abscess	56	12.0%
Necrotizing Fasciitis	5	1.1%
Endogenous Endophtalmitis	4	0.9%
Lung Empyema	10	2.1%
Septic Arthritis	55	11.8%

Outcomes and Interventions

	n	%
Inpatient Mortality	14	3.0%
ICU Stay	177	37.9%
Surgical Intervention	142	30.4%
Readmission	150	32.1%
Length of Stay (days)	26 +/- 18	
Addiction Medicine Consult	219	46.9%
TTE	362	77.5%
TEE	27	5.8%

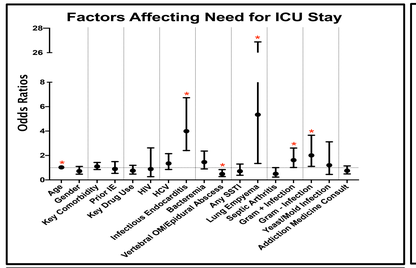
Multivariate Regression Analysis

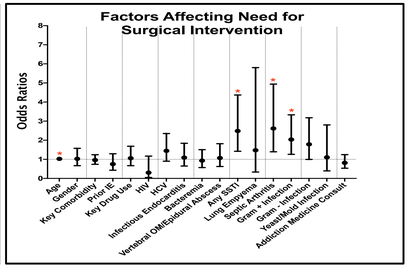
- Four key outcomes had sufficient numbers to support multivariate regression analysis; similar variables were grouped
- Odds ratios were reported for logistic regression (Need for ICU Stay, Need for Surgical Intervention, and Readmission)
- **β** estimates were reported for linear regression (Length of Stay)
- Numerical values plotted below and displayed in graphical form in next column

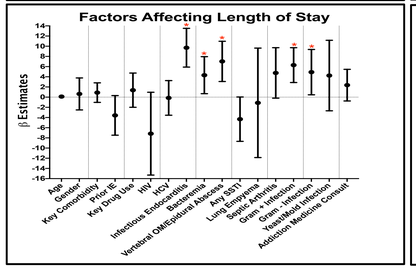
	Need for ICU Stay				Need for Surgical Intervention				Length of Stay				Readmission			
	Odds Ratio	95% CI		Significant?	Odds Ratio	95% CI		Significant?	Beta Estimate	95% CI		Significant?	Odds Ratio	95% CI		Significant?
Age	1.03	1.01	1.06	*	1.02	1.00	1.05	*	0.11	-0.06	0.28		1.00	0.97	1.02	
Gender	0.72	0.47	1.10		1.03	0.67	1.58		0.63	-2.51	3.77		1.03	0.68	1.57	
Key Comorbidity	1.10	0.85	1.43		0.96	0.74	1.24		0.89	-1.03	2.81		1.19	0.93	1.54	
Prior IE	0.90	0.54	1.50		0.75	0.43	1.29		-3.58	-7.48	0.31		1.17	0.70	1.93	
Key Drug Use	0.76	0.48	1.19		1.06	0.67	1.69		1.37	-2.00	4.73		1.10	0.70	1.74	
HIV	0.89	0.26	2.62		0.30	0.05	1.17		-7.17	-15.30	0.96		3.79	1.37	10.90	*
HCV	1.35	0.85	2.15		1.45	0.90	2.35		-0.15	-3.55	3.25		1.93	1.21	3.13	*
Infectious Endocarditis	3.99	2.41	6.73	*	1.09	0.65	1.84		9.71	5.90	13.51	*	1.21	0.73	2.01	
Bacteremia	1.46	0.90	2.37		0.93	0.57	1.51		4.32	0.68	7.95	*	1.13	0.70	1.80	
Vertebral OM/Epidural Abscess	0.49	0.28	0.85	*	1.07	0.63	1.82		7.02	3.07	10.97	*	0.97	0.57	1.65	
Any SSTI	0.71	0.38	1.30		2.48	1.42	4.37	*	-4.32	-8.68	0.03		1.92	1.10	3.33	*
Lung Empyema	5.34	1.35	26.88	*	1.47	0.33	5.80		-1.12	-11.86	9.63		2.18	0.56	8.56	
Septic Arthritis	0.50	0.23	1.01		2.62	1.39	4.94	*	4.76	-0.20	9.72		1.49	0.78	2.80	
Gram + Infection	1.62	1.02	2.61	*	2.04	1.26	3.33	*	6.29	2.87	9.72	*	1.47	0.92	2.35	
Gram - Infection	2.01	1.11	3.66	*	1.79	1.00	3.18	*	4.91	0.48	9.36	*	1.82	1.03	3.20	*
Yeast/Mold Infection	1.20	0.45	3.12		1.10	0.40	2.80		4.24	-2.68	11.16		0.51	0.16	1.39	
Addiction Medicine Consult	0.75	0.49	1.15		0.82	0.53	1.25		2.36	-0.75	5.47		0.88	0.58	1.33	

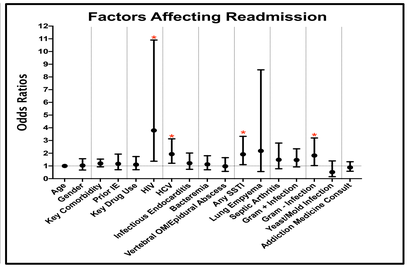
RESULTS

- Infectious endocarditis was associated with need for an ICU stay and increased length of stay
- Infectious endocarditis, bacteremia, vertebral osteomyelitis/epidural abscess were associated with increased length of stay









Mortality

- Given limited numbers, mortality was compared by Chi^2 analysis with:
  - Infectious Endocarditis (OR 3.792, 95% CI 1.270 to 11.10)
  - Presence of key selected comorbidities (OR 0.6123, 95% CI 0.2088 to 1.825)
  - Age (**β** 0.9654, 95% CI 0.9054 to 1.021)

CONCLUSIONS

- We report a comprehensive review of admissions to University of Kentucky Hospitals over the course of the year and the relative effects of key infectious complications on health and healthcare resource usage
- The scope of the IDU epidemic, especially in places like Kentucky is sobering
- Infectious Endocarditis is a leading cause of morbidity, mortality, and healthcare resource usage but a spectrum of infectious complications of IDU contribute to the epidemic
- A lack of an ICD code associated with IDU is a significant barrier to research
- Additional research is underway to extend these analyses and identify targeted interventions that can improve these outcomes

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