

Bloodstream Infections in Children Following Solid Organ Transplantation

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Background

- Infections in the early period following solid organ transplantation (SOT) are associated with substantial morbidity and mortality.
- The epidemiology of bloodstream infections (BSI) in children following SOT has not been well described.

Objective

The objective of this study is to describe the incidence, timing, and microbiologic distribution of BSIs in children who have undergone SOT.

Methods

- **Study design:** Retrospective cohort study
- **Study sites:** The Children's Hospital of Philadelphia
- **Data source:** Electronic health records
- **Study population:** Children < 19 years of age who received SOT at the Children's Hospital of Philadelphia between 2000 and 2013.
- **Data abstraction:** Demographics, transplant information, and blood culture data were systematically collected from all SOT patients through structured chart review. Patients were followed for 180 days after transplantation or until death.
- **Outcome:** Bloodstream infection within 180 days of transplantation.
 - Blood cultures were obtained at times of clinical suspicion of infection, without a standard protocol.
 - Defined by the National Healthcare Safety Network criteria for a lab-confirmed bloodstream infection: 1) Recognized pathogen isolated from one or more blood cultures, **or** 2) A common commensal isolated from two or more blood specimens drawn on separate occasions within the 7 day infection window period **and** the patient had symptoms (fever or hypotension) within three days of the first positive blood culture.
 - Polymicrobial blood cultures were excluded.
 - A positive blood culture occurring beyond the 14-day repeat infection timeframe from a previously identified BSI was considered a separate episode.
- Data analysis:
 - Incidence of BSI was reported as rate per 1,000 patient days.
 - Similar metrics were determined for each SOT subgroup

Results

- Among the 591 children who received SOT in the 13 year time period (142 heart, 42 lung, 169 liver, and 240 kidney transplant recipients), 87 BSI episodes were identified.
- The incidence rate of BSI was highest for heart and lung recipients, followed by liver and was lowest among kidney recipients.
- The median time from transplantation to first BSI was 27 days for heart, 58 days for lung, 32 days for liver, and 32 days for kidney recipients.

Demographics

	Heart (n=140)	Lung (n=42)	Liver (n=169)	Kidney (n=240)	Total (n=591)
Age at time of transplant, median (IQR)	6.4 y (0.8-13.7)	11.1 y (4.9-15.1)	2.7 y (0.9-11.7)	13.0 y (7.8-16.3)	9.7 y (2.2-14.7)
Female	66 (47.1%)	28 (66.7%)	74 (43.8%)	92 (38.3%)	260 (44%)
Black	37 (26.4%)	5 (11.9%)	31 (18.3%)	55 (22.9%)	128 (22%)
White	79 (56.3%)	25 (59.5%)	105 (62.1%)	153 (63.8%)	362 (61.3%)
Hispanic	14 (10%)	9 (21.4%)	27 (16.0%)	73 (12.4%)	73 (12.4%)

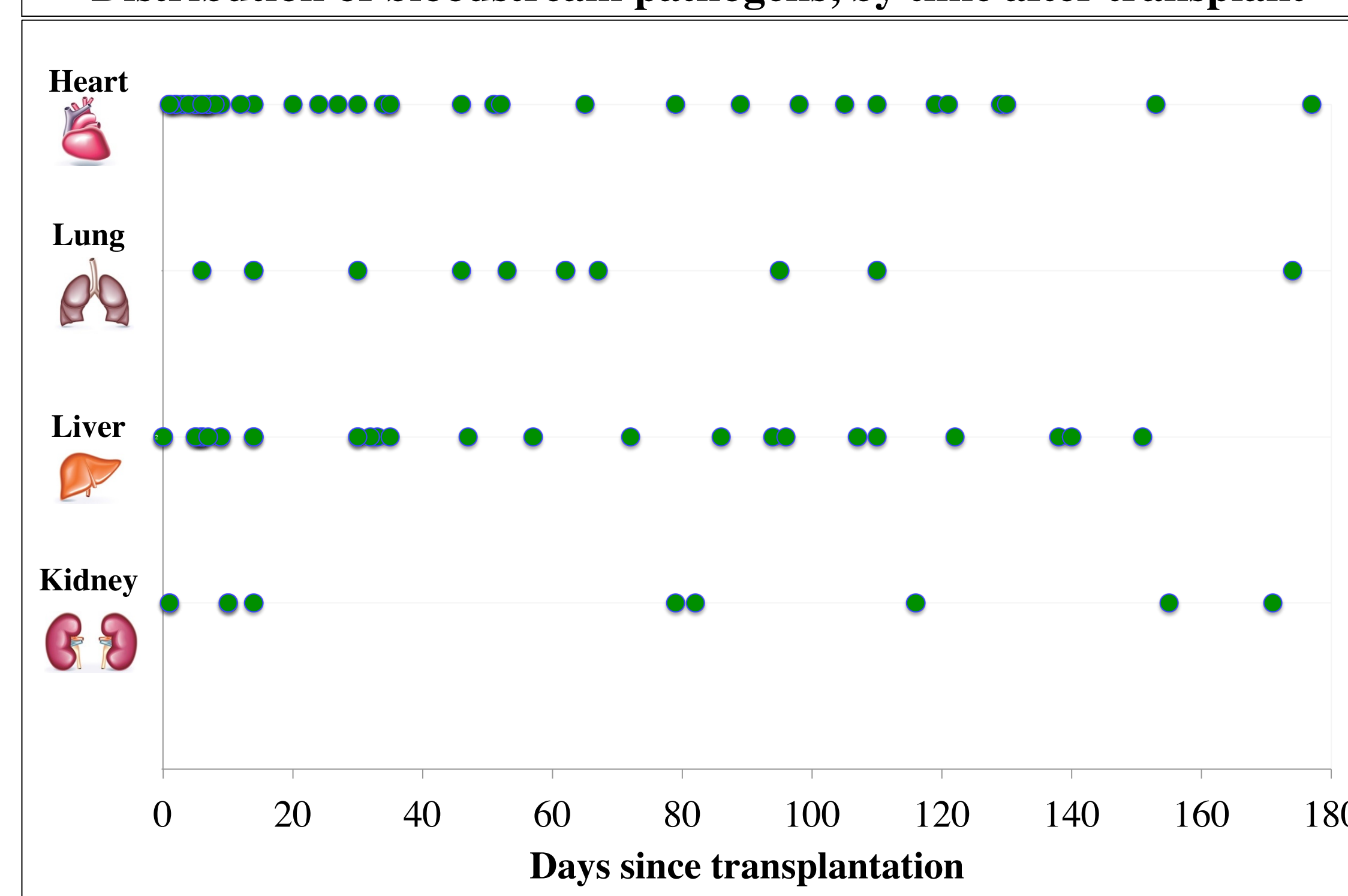
Pathogens

	Heart (n=140)	Lung (n=42)	Liver (n=169)	Kidney (n=240)	Total (n=591)
Number of episodes of BSI	39	10	29	10	88
Gram positive	18	4	15	8	45 (51%)
Coagulase negative <i>Staphylococci</i>	9	1	6	6	22 (25%)
<i>Enterococcus</i> spp.	2	2	7	1	12 (13%)
<i>S. aureus</i>	4	0	1	0	5 (6%)
<i>S. pneumoniae</i>	1	0	0	1	2 (2%)
Gram negative	19	4	9	2	34 (39%)
<i>P. aeruginosa</i>	8	2	2	0	12 (14%)
<i>Enterobacter</i> spp.	3	0	2	1	6 (7%)
<i>Serratia</i> spp.	2	2	1	0	5 (6%)
<i>E. Coli</i> spp.	2	0	2	0	4 (5%)
<i>Klebsiella</i> spp.	1	0	0	1	2 (2%)
Candida species	2	2	5	0	8 (9%)
<i>C. albicans</i>	0	0	4	0	4 (5%)
<i>C. non-albicans</i>	2	1	1	0	4 (5%)

Bloodstream infections

	Heart (n=140)	Lung (n=42)	Liver (n=169)	Kidney (n=240)	Total (n=591)
Number of episodes of BSI	39	10	29	10	88
Incidence rate per 1,000 patient-days	1.73	1.46	1.01	0.23	0.86
Proportion of patients with at least one BSI	29/140 (20.7%)	8/42 (19.0%)	20/169 (11.8%)	10/240 (4.2%)	67/591 (11.3%)
Median time from transplant to first BSI	27 d (6-89)	58 d (30-95)	32 d (7-94)	47 d (10-116)	32 d (7-94)

Distribution of bloodstream pathogens, by time after transplant



Conclusions

- The timing, frequency, and epidemiology of BSI varied across organ type.
- One-half of BSIs were due to Gram positive organisms, ~40% due to Gram negative organisms, and ~10% due to *Candida* species.
- BSIs were more frequent and occurred earlier after transplant among heart and lung recipients.
- As BSIs have significant potential morbidity for the patient and the donor organ, these data can be leveraged to inform organ specific interventions to reduce and manage BSI.