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## Abstract

**Background:** Central line associated bloodstream infections (CLABSI) are a known complication of central venous access. Pulmonary artery catheters (PAC) are frequently used in status 1A pre-heart transplant patients, at the top of the heart transplant waiting list. These patients often have a PAC in place for extended periods of time and are thus at risk for CLABSI. Our institution's practice includes routine PAC exchange after 21 days of use. We sought to estimate the risk of CLABSI and determine whether factors influenced infection rate.

**Methods:** We conducted a retrospective, descriptive study from January 2013 to December 2016 identifying characteristics of PAC use and infection rate in adult status 1A pre-heart transplant patients. Time to CLABSI was analyzed with Kaplan-Meier estimates. The effect of CLABSI on time to transplant and death were analyzed in time-dependent Cox models.

**Results:** We identified 61 status 1A pre-heart transplant patients with PACs during this time period with 219 PACs and 2566 line-days. Median duration of PAC was 11 days. There were 14 CLABSIs for an infection rate of 5.46/1000 line-days (95% CI: 2.98-9.15), compared to 1.06/1000 line-days for our institution's intensive care unit rate. Causative organisms were coagulase-negative *Staphylococcus* (79%), *Enterobacter* (7%), *E. coli* (7%), and *Klebsiella* (7%). There was a trend towards higher infection rate per 1000 line-days with longer duration of PACs. Lines in place for 0-10 days resulted in an infection rate of 3.14 (1.02-7.32); 11-20 days with a rate of 8.70 (3.19-18.94); and >20 days with a rate of 32.61 (6.72-95.30). There was a trend towards higher infection rate with more concomitant non-PAC lines used (0 other lines, 4.57; 1 line, 6.21; 2 or more, 11.56). Median time to infection diagnosis from PAC placement was 29 days (23-49). Line infection was associated with shorter time to transplant (Hazard ratio 2.49; P = 0.027), but no effect on mortality (Hazard ratio 1.79; P = 0.355).

**Conclusions:** Our study demonstrated a high rate of CLABSI with PAC, with a trend towards increased risk with longer use, and presence of concomitant lines. Infection was associated with a shorter time to transplant, though not with time to death. Prolonged PAC use in the status 1A population should be revisited.

## Background

- Central line associated bloodstream infections (CLABSI) are associated with significant morbidity, mortality, and cost while being largely preventable.
- Swan-Ganz pulmonary artery catheters (PAC) are widely used in status 1A heart transplant patients due to continuous infusions of inotropes and need for hemodynamic monitoring.
- This population will have PACs in place for weeks to months, while duration of PAC is cited as a significant risk factor for CLABSI.<sup>1</sup>
- A past study comparing replacement of PAC every 4 to 7 days found 14.1% PAC tip colonization, 10.5% bacteremia, and 1.1% catheter-related bacteremia (1.1 episodes of bacteremia per 1000 line-days).<sup>2</sup>
- Another study utilizing antimicrobial prophylaxis with cefazolin or vancomycin for beta-lactam allergy showed 11.6% colonization, 0.6% bacteremia, with 0.93 episodes of bacteremia per 1000 line-days.<sup>3</sup>
- Our practice includes routine PAC replacement every 21 days.
- There is currently no uniform practice regarding prophylaxis or line replacement.
- At our institution, these patients account for 10% of CLABSI while being less than 1% of the population at risk.

## Objectives

- Evaluate the risk of CLABSI in heart transplant patients with PAC
- Estimate the incidence of CLABSI in the pre-heart transplant population associated with PAC and associated risk factors.

## Methods

- Retrospective, descriptive study
- Accrued January, 2013 to December, 2016
- Adult status 1A heart transplant patients with a PAC in an intensive care unit
- Infection rate was analyzed as episodes of CLABSI per 1000 line-days.
- Statistics were analyzed with Kaplan-Meier estimates and time-dependent Cox models.

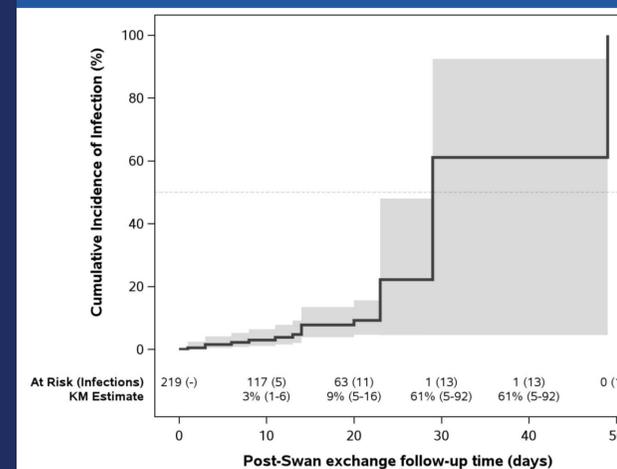
**Table 1: Patient Characteristics**

|   |               |
|---|---------------|
| Gender  |               |
| - Female  | 18 (29.5%)    |
| - Male  | 43 (70.5%)    |
| Average age at first PAC insertion                | 55.9 years    |
| PAC line-days                                     | 219 line-days |
| Indication for PAC Insertion                      |               |
| - Status 1A                                       | 34 (55.7%)    |
| - Titration of pulmonary hypertension medications | 13 (21.3%)    |
| - Postoperative hemodynamic monitoring            | 9 (14.8%)     |
| - Other hemodynamics                              | 5 (8.2%)      |
| PAC location                                      |               |
| - Internal jugular                                | 200 (91.3%)   |
| - Non-internal jugular                            | 19 (8.7%)     |

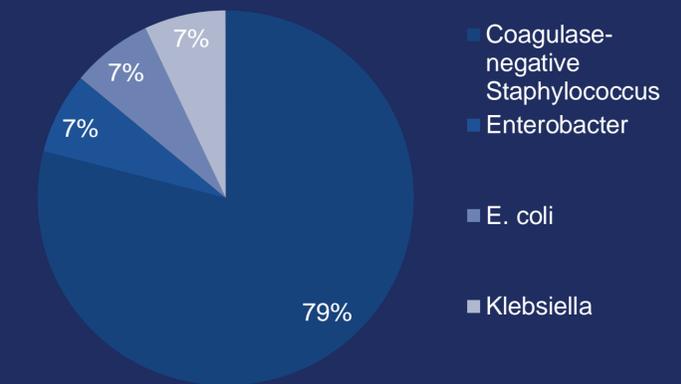
## Results

- 61 status 1A heart transplant patients with 219 PACs in place and 2566 line-days were collected.
- Median duration of PAC was 11 days.
- 14 CLABSIs with an infection rate of 5.46/1000 line-day (95% CI: 2.98-9.15), compared to 1.06/1000 line-days at the same institution's intensive care units.
- Infection rate by duration of PAC was 3.14 (1.02-7.32) for 0-10 days, 8.70 (3.19-18.94) for 11-20 days, and 32.61 (6.72-95.30) for > 20 days.
- Infection rate by number of concomitant non-PAC lines was 4.57 for 0 lines, 6.21 for 1 line, and 11.56 for > 1 line.
- Median time to infection diagnosis from PAC placement was 29 days (95% CI: 23-49).
- Time to transplant by CLABSI had a hazard ratio of 2.49 (P = 0.027).
- Mortality rate by CLABSI had a hazard ratio of 1.79 (P = 0.355).

**Figure 1: Infection Risk Since PAC**



## Causative Organisms



## Discussion

- PAC use in status 1A pre-heart transplant patient is associated with high rates of CLABSI.
- CLABSI had a trend to significance with duration of PAC and concomitant lines.
- These patients will keep lines in place for extended period of time, putting them at risk for multiple line infections.
- Further studies could be performed to compare PAC to other line-related infections in this population.
- The use of PAC in the pre-heart transplant population should be revisited.

## References

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