



Quality Improvement of *Staphylococcus aureus* Bacteremia Management and Predictors of Relapse-free Survival

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ABSTRACT

PURPOSE: The purpose of this study is to improve the quality of care and patient outcomes for *Staphylococcus aureus* bacteremia.

METHODS: A quasi-experimental pre- and postintervention study design was used to compare process and clinical endpoints before and after a quality-improvement initiative. All inpatients >18 years of age with a positive blood culture for *S. aureus* during the specified pre- and postintervention period with clinical information available in the electronic medical record were included. An institutional protocol for the care of patients with *S. aureus* bacteremia was developed, formalized, and distributed to providers using a pocket card, an electronic order set, and targeted lectures over a 9-month period.

RESULTS: There were 167 episodes of *S. aureus* bacteremia (160 patients) identified in the preintervention period, and 127 episodes (123 patients) in the postintervention period. Guideline adherence improved in the postintervention period for usage of transesophageal echocardiogram (43.9% vs 20.2%, $P < .01$) and adequate duration of intravenous therapy (71% vs 60%, $P = .05$). In a multivariate Cox proportional hazard model, the variables associated with increased relapse-free survival were postintervention period (hazard ratio [HR] 0.48; confidence interval [CI], 0.24-0.95; $P .035$) and appropriate source control (HR 0.53; CI, 0.24-0.92; $P .027$). Regardless of intervention, presence of cancer was associated with an increased risk of relapse or mortality at 90 days (HR 2.88; $P < .0001$; CI, 1.35-5.01).

CONCLUSION: A bundled educational intervention to promote adherence to published guidelines for the treatment of *S. aureus* bacteremia resulted in a significant improvement in provider adherence to guidelines as well as increased 90-day relapse-free survival.

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Authorship: All authors had access to the data, made intellectually significant contributions to the project, and had a role in writing the manuscript.

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Staphylococcus aureus bacteremia is one of the most common causes of bloodstream infections worldwide and causes extensive morbidity and mortality, with death rates ranging from 20%-40%.¹⁻⁴ Numerous studies have demonstrated that treatment of *S. aureus* bacteremia in consultation with Infectious Disease specialty services or evidence-based bundled interventions can improve mortality rates.⁵ In this study, we present the results of a quality improvement initiative to improve management and outcomes of *S. aureus* bacteremia. This paper describes the process improvement methods and results, and also predictors of

90-day survival or freedom from relapse. Previous studies mostly used 30-day mortality as the primary clinical endpoint. Relapses of deep-seated infections often lead to readmissions, increased health care costs, and significant morbidity for patients. Given the propensity of *S. aureus* to relapse from deep sources if undertreated and prolonged effects on survival, 90-day freedom from relapse or survival may be a more meaningful marker of cure for *S. aureus* bacteremia.

The objectives of this study were to 1) improve adherence to current guidelines for treatment of *S. aureus* bacteremia, and 2) to measure impact of improved adherence on survival and freedom from relapse at 90 days.

METHODS

Setting, Intervention, and Design

The intervention was performed at Parkland Memorial Hospital, a 784-bed public academic hospital in Dallas County, Texas, which averages 40,000 admissions annually. The facility serves as the main teaching hospital for the University of Texas Southwestern Medical Center. The patient population comprises largely uninsured minority patients with a large burden of HIV, diabetes, and end-stage renal disease.⁶⁻⁸ The study was designed as a resident-initiated and resident-run quality-improvement (QI) initiative with pre- and postintervention analysis. The effort was initiated and led by an Internal Medicine resident (JT) under faculty supervision (PS). The preintervention period was 1 year long, between October 1,

2010 and September 30, 2011. The intervention period was from December 2012 to September 2013. Postintervention data collection included the 6-month period from October 1, 2013 through March 28, 2014. The follow-up period ended June 28, 2014, giving a minimum of 90-day follow-up for postintervention cases. A timeline of the intervention is presented in **Figure 1**. Quality measures for the QI intervention were derived from published society guidelines, available at the time of study design, regarding treatment of *S. aureus* infections. Key definitions and treatment recommendations were extracted from the 2009 methicillin-resistant *S. aureus* (MRSA) treatment guidelines,⁹ the 2005 endocarditis guidelines from the American Heart Association,¹⁰ and the Infectious Diseases Society of America guidelines for treatment of catheter-related infections.¹¹ The target measures were presented to the Infectious Disease Division for consensus review, and the Division endorsed them as the institutional

standard of care for *S. aureus* bacteremia at Parkland. The Infectious Disease division's recommendations for universal transesophageal echocardiogram (TEE) in *S. aureus* bacteremia at Parkland were discussed at a noninvasive cardiology meeting and endorsed by the Division of Cardiology. Simplified recommendations regarding universal TEE, treatment duration by infection complexity, and first-line agents were compiled into an order set in the electronic medical record for treatment of *S. aureus* bacteremia as well as a pocket teaching card for house staff (**Figure 2**). A total of 160 surgical and medical house staff were given teaching cards. In

CLINICAL SIGNIFICANCE

- A resident-run and trainee-focused educational initiative led to increased rates of transesophageal echocardiography and longer treatment duration for patients with *Staphylococcus aureus* bacteremia.
- Improved adherence to guidelines led to a decrease in the relapse rate for *S. aureus* bacteremia.
- This intervention was successful in a resource-limited hospital, and could be implemented in numerous other clinical settings.

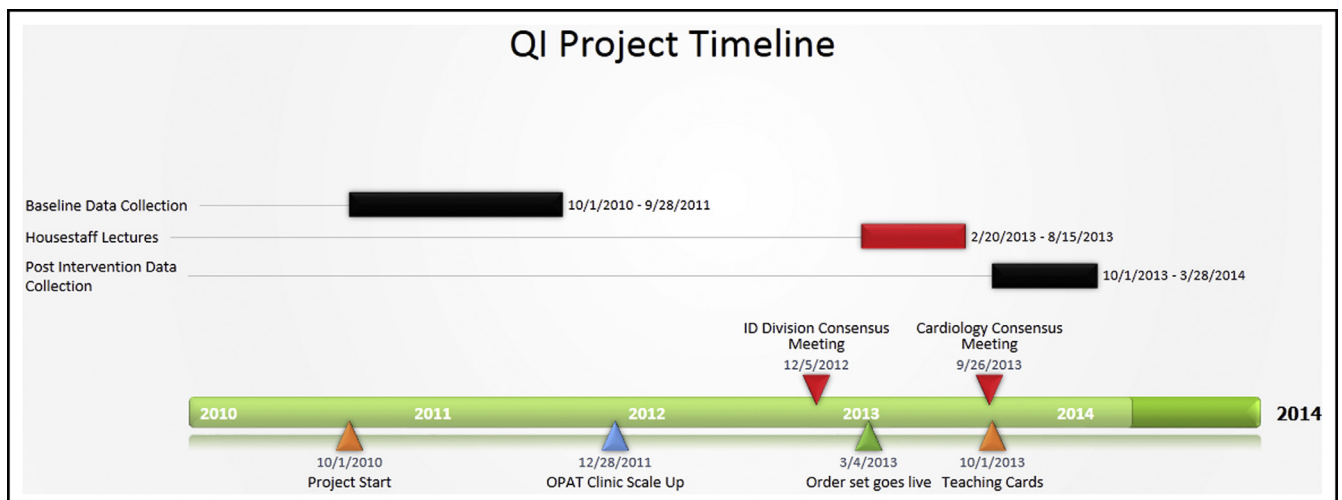


Figure 1 Project timeline for quality improvement initiatives for *Staphylococcus aureus* bacteremia, October 2010-March 2014.

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