Follow-Up Blood Cultures in Gram-Negative Bacteremia: How Do They Impact Outcomes?

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SAINT JOSEPH MERCY HEALTH SYSTEM

INTRODUCTION

As opposed to Staphylococcus. aureus bacteremia where follow-up blood cultures (FUBCs) to document clearance of bacteremia are recommended, no similar guidelines exist for repeating blood cultures in Gram-negative bacilli bacteremia (GNB). In fact, few studies have questioned the utility of such practice in GNB. Blood cultures are overutilized investigations that are frequently low yield leading to unnecessary increases in healthcare costs and hospital length of stay (LOS). As such, they should be judiciously used as clinically warranted.

AIM OF STUDY

To study the practice of collecting FUBCs in GNB at our institution and to assess if this practice had any impact on the clinical outcomes of 30-day mortality, 30-day readmission rate, duration of antibiotic use, and hospital LOS.

METHODS

Study Design and Patient Population

A retrospective single-center study was performed at St. Joseph Mercy Hospital, Ann Arbor, Michigan.

Patients eligible for the study were individuals with GNB, and:

- ≥18 years of age
- Admitted between January 1, 2017 and December 31, 2018

Patients were excluded if: they died within 24hrs of admission or of the index blood culture (23), did not complete the recommended course of antibiotic therapy (29), or were transitioned to comfort care and antibiotics were discontinued (50).

We divided the cohort into two groups: those with at least one FUBC obtained, and those without any FUBCs collected.

PRIMARY OBJECTIVE: To compare 30-day mortality between the two groups

SECONDARY OBJECTIVES: Differences in 30-day readmission rate, hospital LOS, and antibiotics duration between the two groups

Study was approved by the institutional review board.

DEFINITIONS

Index blood culture: the first blood culture with clinically significant GNB that occurred for a patient during the study period.

Follow-up blood culture(s) (FUBCs): Blood culture(s) obtained after 24 hours and within 7 days from the index blood culture. Blood cultures obtained within 24 hours were considered as being part of the index bacteremia. Any cultures obtained >7 days after the index culture were not considered FUBCs for the purpose of this study, and they were deemed a separate episode.

Persistent bacteremia: Any FUBC drawn in the 1-7-day window if growing the same organism(s) as the index blood culture.

Hospital-acquired infection: Clinically significant Gram-negative bacteremia developing after at least 48 hours of hospital admission.

RESULTS

Patient Breakdown

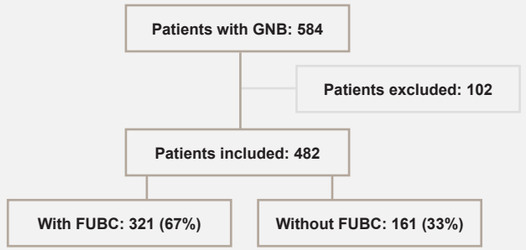

Table 1: Patients baseline and clinical characteristics

VARIABLE	WITH FUBCs (N=321)	W/O FUBCs (N=161)	P-VALUE
Age	69.4 (14.8)	70.2 (14.8)	0.603
Sex			> 0.999
Female	163 (50.8%)	82 (50.9%)	
Male	158 (49.2%)	79 (49.1%)	
Current Smoker	44 (14.3%)	16 (10.5%)	0.316
Presumed source			
UTI	174 (54.2%)	86 (53.4%)	0.946
Intra-Abdominal Infection	61 (19.0%)	24 (14.9%)	0.324
Severe Skin/Soft Tissue Infection	14 (4.6%)	5 (3.1%)	0.674
Other	24 (7.5%)	10 (6.2%)	0.747
No source identified	50 (15.6%)	35 (21.7%)	0.122
Hospital-Acquired Infection	40 (12.5%)	15 (9.4%)	0.395
Comorbid Condition/Risk Factor			
Diabetes mellitus	106 (33.0%)	53 (32.9%)	> 0.999
Hypertension	175 (54.5%)	94 (58.4%)	0.478
Congestive heart failure	55 (17.1%)	28 (17.4%)	> 0.999
Ischemic heart disease	51 (15.9%)	20 (12.4%)	0.381
Peripheral arterial disease	14 (4.4%)	8 (5.0%)	0.944
Impaired liver function	14 (4.4%)	6 (3.7%)	0.93
ESRD	21 (6.5%)	10 (6.2%)	> 0.999
Immunosuppression/steroids/chemotherapy	42 (13.1%)	20 (12.4%)	0.952
Neutropenia	11 (3.4%)	6 (3.7%)	> 0.999
Indwelling central line	17 (5.3%)	9 (5.6%)	> 0.999
Bladder catheter and/or nephrostomy tube	35 (10.9%)	13 (8.1%)	0.414
Prosthetic Heart Valve	4 (1.3%)	1 (0.6%)	0.669
Presumed Source Controlled	205 (75.37%)	91 (70.54%)	0.365
Type of Bacteremia			0.372
Polymicrobial	38 (11.84%)	14 (8.7%)	
Monomicrobial	283 (88.16%)	147 (91.3%)	

Table 2: FUBCs characteristics

VARIABLE	N = 321
Mean number of FUBCs	1.19 (SD 0.44)
Negative FUBCs	309 (96.3%)
Positive FUBCs	
Same pathogen (persistent bacteremia)	9 (2.8%)
Different pathogen	2 (0.6%)
Contaminant	1 (0.3%)
At time of FUBC	
Fever (>100.3 °F)	47 (14.6%)
Hypotension (SBP < 90, or on vasopressors)	22 (6.9%)
Mean WBC count	12 (SD 6.74)
Recorded reason for obtaining FUBC	91 (28.5%)
To document clearance	69 (75.8%)
Fever	18 (19.8%)
Others (leukocytosis, high lactate, unclear source)	4 (4.4%)
Susceptibility of pathogen to empiric antibiotics	286 (89.1%)

Figure 1: Microbiology of index blood cultures in those with and without FUBCs

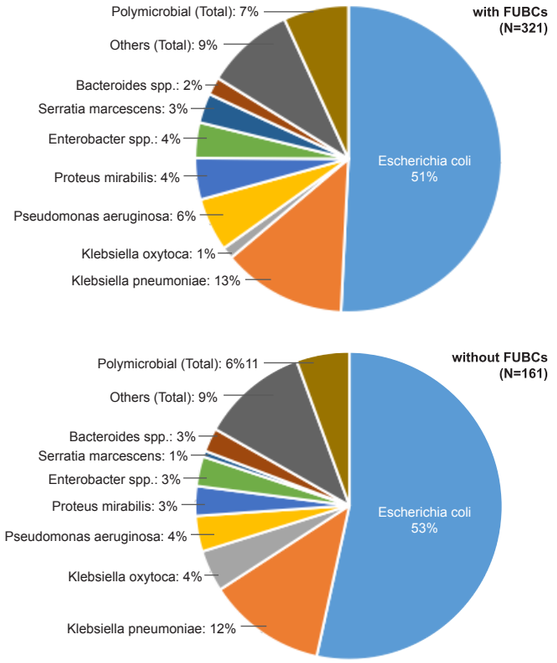

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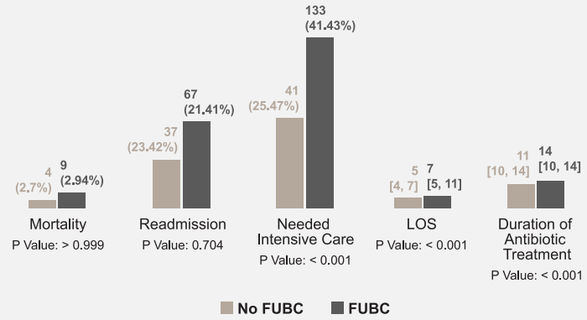
Figure 2: Outcomes



CONCLUSION

We found no significant difference in 30-day mortality between those with or without FUBCs in GNB. There was no significant difference in 30-day readmission rate between the two groups. The group with FUBCs had longer hospital LOS and longer duration of antibiotic therapy. A higher percentage of patients in the FUBCs group needed ICU care which may be secondary to the fact that these patients were more critically ill and frequent blood cultures were ordered for evaluation.

Our findings suggest that routine FUBCs are low yield in GNB and may not be needed in all patients. Prospective studies are needed to further examine the utility of this practice in GNB. To our knowledge, this is the first study to assess 30-day mortality exclusively in patients who had FUBCs in GNB.

Mean and standard deviation were used to present continuous variables, whereas frequency and proportion were used for categorical variables. These statistics were calculated separately for the two groups, and balance between the groups was tested. We used t-tests to determine P-values for continuous variables; Fisher's exact test and $\chi 2$-tests for categorical variables. Outcomes were tested using Mann-Whitney U and $\chi 2$-tests. All statistical tests were 2-sided and a p-value <0.05 was defined as statistically significant. All statistical analysis was performed using the software environment R v4.0.0 (R Foundation, Vienna, Austria).