Concurrent Serious Bacterial Infections in Febrile Infants Less Than 90 Days Old

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Background

- Serious bacterial infections (SBI) such as bacteremia, urinary tract infection (UTI), or bacterial meningitis (BM) in febrile infants can lead to significant morbidity and mortality.
- Physical exam findings alone are often inadequate to determine which infants <90 days old should undergo a full septic workup.
- Several protocols exist in the literature but none are universally accepted. Many use different cutoff values for screening labs and temperature in determining risk severity, making it difficult to standardize an ideal work-up.
- Prior studies have shown a 6-10% average prevalence for SBI in febrile infants <90 days old.[1]

Objective

We aimed to determine patient characteristics associated with risk of concurrent SBI in order to improve management of febrile infants less than 90 days old.

Methods

- Retrospective cohort study at a tertiary care, freestanding academic children's hospital in an urban setting.
- **Inclusion**: Infants < 90 days old admitted between July 2004 – July 2013 from our emergency department (ED), with a documented cerebrospinal fluid (CSF) culture (N=4,045).
- **Exclusion:** No documented rectal temp ≥38.0 °C or history of tactile fever, discharged home from the ED, <30 weeks gestational age, prior sepsis rule out, congenital anomalies, transfer to/from an outside hospital (OSH) or admitted for other serious illness.
- **Positive UTI**: >10,000 cfu/mL of a single pathogen plus a positive urinalysis or >50,000 cfu/mL of a single pathogen via catheterization.
- **Bacterial meningitis:** True positive CSF cultures or in patients with negative CSF cultures but with a pleocytosis > 50 WBC's +/- bacteremia and without a UTI.

Figure 1. Exclusion reasons.

EXCLUDED INFANTS (N = 2,719, 67.2%)	
Discharged from ED	1,087 (39.9%)
Afebrile and no history of tactile fever	428 (15.7%)
Major Congenital Anomaly • Included congenital hydrocephalus, congenital heart disease, diaphragmatic hernia, intestinal atresia or abdominal wall defect, renal anomalies, etc.	406 (14.9%)
Admitted for other serious illness • Included respiratory failure, surgical emergency, seizure, hyperbilirubinemia etc.	294 (10.8%)
Transfer to or from an OSH	231 (8.5%)
Prior Rule Out Sepsis Hospitalization	195 (7.2%)
<30 Weeks Gestation	78 (2.9%)

Results

- 1,326 febrile infants < 90 days old were included.

Figure 2. Sample demographics.

Age (N, %)		Sex (N, %)	
≤28 days old	617 (47%)	Male	829 (63%)
≥29-90 days old	709 (53%)	Female	497 (37%)
Ethnicity (N, %)		Language (N, %)	
Hispanic	1058 (79.8%)	English	663 (50.0%)
Non-Hispanic	179 (13.5%)	Spanish	633 (47.7%)
Black	34 (2.6%)	Armenian	7 (0.5%)
Asian / Pacific	16 (1.2%)	Chinese	7 (0.5%)
White	11 (0.8%)	Korean	7 (0.5%)
Asian	10 (0.7%)	Tagalog	1 (0.1%)
Other	18 (1.4%)	Other	8 (0.6%)

Figure 3. Inclusion and exclusion rates.

Infants <90 days old with CSF culture (July 2004 – July 2013) N = 4,045

- INCLUDED INFANTS N = 1,326 (32.8%)*
- EXCLUDED INFANTS N = 2,719 (67.2%)
- No SBI Identified N = 1036 (78.1%)
- SBI Identified N = 290 (21.9%)
- Single SBI N = 264 (19.9%)
- Concurrent SBI N = 26 (1.9%)

*N = 1,323 (99.8%) of patients had a blood culture performed.
N = 1,314 (99.1%) of patients had a urine culture performed.
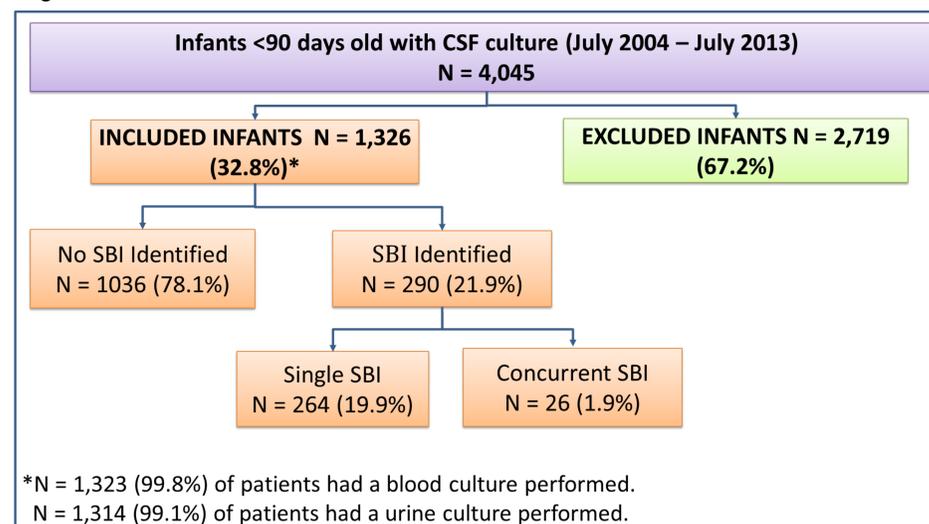
- **Total Serious bacterial infections:**
- UTI cases N = 254 (19.2%)
- Bacteremia cases N = 41 (3.1%)
- Bacterial Meningitis cases N = 22 (1.7%)

- **Concurrent infections**: within this subset
- N = 11 (42.3%) of those had meningitis and bacteremia
- N = 12 (46.2%) had bacteremia and UTI
- N = 2 (7.7%) had meningitis and UTI
- N = 1 (3.8%) patient had all three SBI.

- The odds of having concurrent meningitis in a patient with bacteremia were 50 times higher than in a patient without bacteremia (OR 50.8, CI 20.4 - 126.8, p<0.001)

- Patients ≥29-90 days old had 1.6 times higher odds of having a UTI than younger patients (OR 1.55, CI 1.17 – 2.0, p=0.02).

Figure 4, 5, 6. Single and concurrent SBI incidence.

Concurrent SBI Rates: Total patients with ≥1 SBI = 290 Total patients with ≥2 SBI = 26

Bacterial Meningitis 8 · 11 · 2 · 1 · Urinary tract infections 239 · Bacteremia 17 · 12

Total Meningitis cases = 22
Total UTI cases = 254
Total Bacteremia cases = 41

N = 1326

Total SBI Cases — UTI, Bacteremia, Bacterial Meningitis

Concurrent SBI — and UTI, and Bacteremia, and Bacterial Meningitis, All 3 SBIs
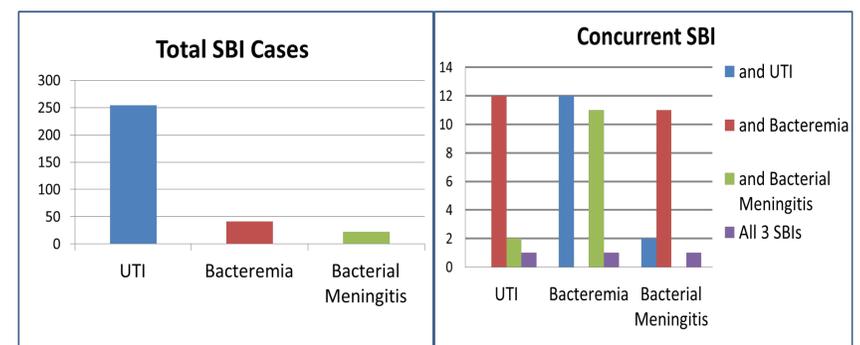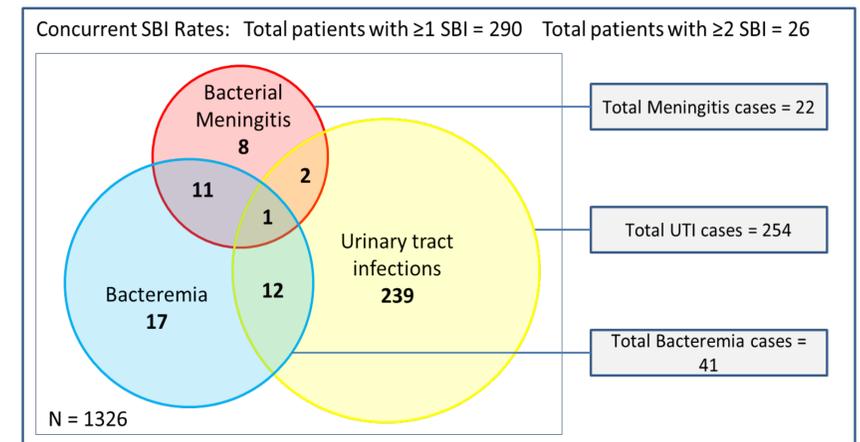
Discussion

Febrile infants < 90 days old with bacteremia have a significantly higher incidence of concurrent meningitis than those without. Therefore, it is important to consider a lumbar puncture in patients who failed to have one upon initial evaluation. Our sample demonstrated a higher incidence of SBI than previous studies indicate, likely due to our selected inclusion/exclusion criteria.

Future Directions

Our next step is to apply a more sophisticated small-sample statistical approach (e.g., naïve Bayes classification) to develop a predictive model for determining appropriate management in febrile infants without an initial lumbar puncture.

References

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