Rapid phenotypic antimicrobial susceptibility testing can facilitate early intravenous-to-oral transition in Gram-negative bloodstream infections

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Abstract

Background: Early switch from intravenous (IV) to oral (PO) antibiotic is an important antimicrobial stewardship opportunity in Gram-negative bloodstream infections (GN-BSI). Timing, however, is often limited by delays in availability of conventional antibiotic susceptibility testing (AST) results. Newly emerging rapid AST provides phenotypic susceptibility results in less than 24 hours . We evaluated the potential of ASTar to accelerate targeted therapy and enable earlier IV-to-PO conversion.

Materials/Methods: This multicenter retrospective cohort study included adult patients with GN-BSI across three hospitals within the same health system. All three hospitals completed Gram stain and BioFire RDT on-site, standard-of-care (SOC) AST with MicroScan was centralized to the university hospital. Turnaround times (TAT) were measured from index blood-culture collection to Gram stain, RDT, SOC AST, and theoretical Q-linea ASTar . Among patients transitioned to oral therapy, timing and organism-specific susceptibility profiles were analyzed.

Results: A total of 118 GN-BSI were included. TAT for traditional AST results were 69 ± 19 hours, while theoretical ASTar results were determined to be 23 ± 15 hours, representing a potential 46-hour decrease in time to actionable AST. A total of 51 (43%) patients transitioned to oral therapy. The most common organisms were *Escherichia coli* (36, 71%), *Klebsiella pneumoniae* (7, 14%), *Pseudomonas aeruginosa* (2, 4%). Urinary tract (34, 67%) and intra-abdominal (3, 6%) were the most common sources. The most common oral options were levofloxacin (11, 22%), cefpodoxime (9, 18%), and amoxicillin/ clavulanate (9,18%). Time to oral therapy was highly variable, 115 ± 51 hours from blood culture collection and 45 ± 52 hours after SOC AST results. Using ceftriaxone as a reference, concordance between MicroScan and ASTar susceptibility for second/third generation cephalosporins was high: ceftriaxone 96%, cefotaxime 96%, cefuroxime 93%, cefoxitin 69%. Concurrence was also high for fluroquinolones (96%) and TMP/SMX (94%).

Conclusions: Rapid phenotypic AST with Q-linea ASTar substantially shortened time to definitive AST and demonstrated high agreement with MicroScan for key β-lactams and fluoroquinolones oral agents. Earlier availability of reliable AST results could enable IV-to-PO transition approximately two days sooner, supporting safe, effective antimicrobial stewardship in GN-BSI.

Methods

- **Design:** Retrospective, multicenter observational review including adult inpatients with Gram-negative bacteremia across three University of Maryland Medical System hospitals in the state of Maryland.
- **Study Population:** Adults with positive blood cultures for Gram-negative organisms on-panel for Qlinea ASTar.
- **Data Sources:** Electronic health record–extracted timestamps for patient demographics, clinical care, index blood culture, Gram-stain, BCID2, MicroScan AST, and antibiotic therapy.
- Discarded blood samples were prospectively collected and run on Qlinea ASTar.
- **Outcome Measures:** time to Gram-stain, BCID2, MicroScan AST, and theoretical time to ASTar results, time to antibiotic changes, and time to IV to PO conversion among those changed to PO therapy.
- **Analytical Approach:** Descriptive statistics of time-to-event metrics, antibiotic stewardship actions, and resistance phenotype distributions across hospital sites and infection sources.

Results

- A total of 118 patients with unique blood cultures were included.
- Mean (SD) age of included patients was 65.4 (16) years and 48.3% had an ID consult.
- Severely immunocompromised: 19.7%
- Sepsis severity: 33.8% suspected sepsis; 29.1% septic shock
- Prior MDR GNR (12 months): 5.1% (diagnostic), 0.8% (surveillance)
- Acuity distribution: Medical floor (32%), ICU (21%), ED (20%), IMC (19%), Trauma (7%)
- Source of BSI: Urinary (48%), unknown (15%), pulmonary (10%), intra-abdominal (10%), endovascular/catheter (8%), skin/soft tissue (6%), other (3%)

Background

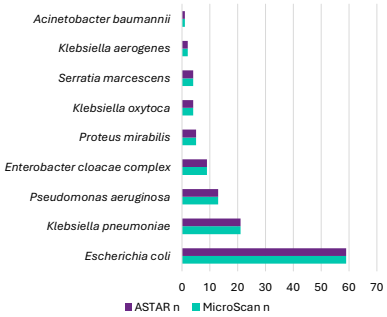
- Gram negative bloodstream infections (BSI) remain a major cause of morbidity and mortality, necessitating timely optimization of antimicrobial therapy.
- Historically, Gram negative bloodstream infections (GN BSI) were treated almost exclusively with prolonged intravenous (IV) antibiotics due to concerns about bacteremia relapse, inadequate oral drug exposure, and/or limited bioavailability of PO agents.
- Over the past decade, accumulating evidence shows that in uncomplicated GN BSI, clinically stable patients can be safely transitioned to oral therapy after adequate initial IV treatment without compromising outcomes.
- Transitioning to PO antibiotics substantially reduces complications associated with prolonged IV access, including catheter related bloodstream infections, thrombosis, occlusion, and phlebitis. This shift also improves patient mobility, comfort, and discharge readiness.
- As part of ongoing antimicrobial stewardship (AMS) efforts, appropriate transition from intravenous (IV) to oral (PO) therapy can shorten hospital length of stay, reduces nursing and inpatient pharmacy burden, lowers drug cost.
- Despite strong evidence, implementing IV to PO conversion remains variable. U.S. data from 24 hospitals show only 43% transitioned to PO therapy by day 7, highlighting persistent hesitation among clinicians, often related to antimicrobial resistance patterns.
- Hospitals increasingly rely on rapid diagnostic platforms—such as BioFire BCID2, MicroScan AST, and QLinea ASTar—to shorten time to organism identification and susceptibility results.
- This study examines the theoretical impact of rapid antimicrobial susceptibility testing (rAST) on transition from IV to PO.

Results

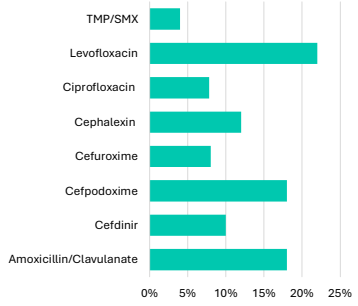
The most common organisms were *Escherichia coli* and *Klebsiella pneumoniae*

A total of 51 (43%) patients transitioned to oral therapy

Organism ID Traditional vs ASTar

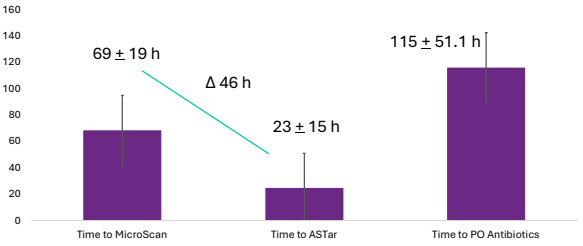


Oral Options Used (%)

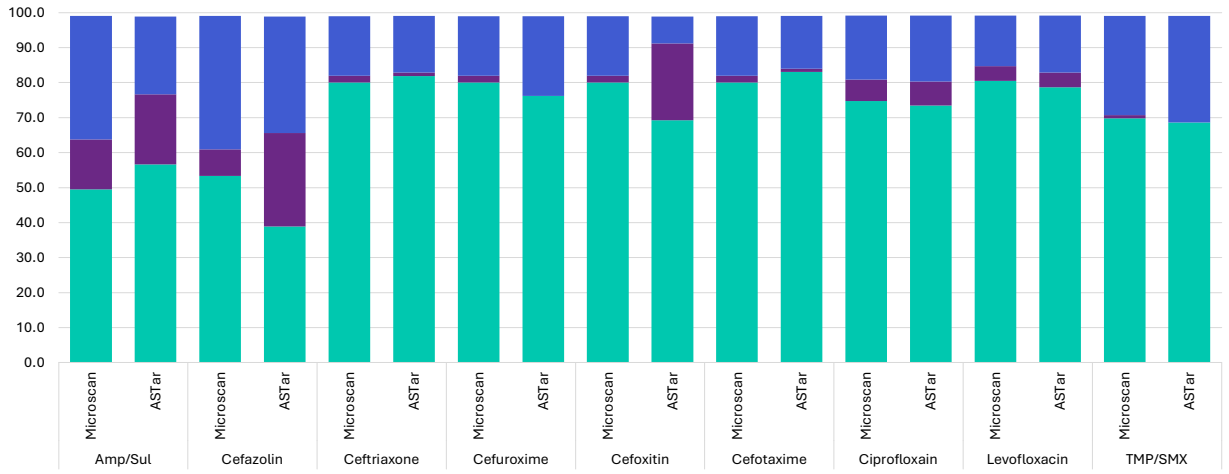


Time to Actionable AST Results and PO Antibiotics

Comparison of time to actionable phenotypic susceptibility results between traditional testing and ASTar, demonstrating a mean 46-hour difference. Standard of care time to oral therapy add for reference.



Categorical Agreement PO Agents



Comparison of susceptibility categories and agreement between MicroScan and Qlinea ASTar for oral therapy options. Ceftriaxone was used as reference standard for 2nd and 3rd generation oral cephalosporins (cefuroxime, cefoxitin, cefotaxime) based on recent data from Claeys KC et al. *Antimicrob Agents Chemother*. 2025 Feb 13;69(2):e0138724. doi: 10.1128/aac.01387-24.