About rapid AST

Rapid antibiotic susceptibility testing (rAST) is not a new concept – the scientific community has been calling for ways to shorten the time from sample collection to lab result for decades.¹

The identification of bacteria and determination of their susceptibility to antibiotics is a vital aide for guiding clinical decisions and protecting against antimicrobial resistance (AMR). But in a world where timing is known to be critical and is linked to both hospital expenditure and mortality, traditional methods that take up to 72 hours to return a result are far from ideal.

Efforts to overcome this barrier have stepped up in recent years, yet limitations have lingered. In this SmartNote, we explore the rapid AST landscape and look at how imaging techniques and algorithms can shape the future of antibiotic susceptibility testing.

The case for rapid AST

Ensuring the right person receives the right treatment at the right time is essential for patient care. Ultimately, it can save lives.

In relation to severe bacterial infections, including septic shock and bacterial meningitis, data show that early antimicrobial treatment is associated with better outcomes.²

In sepsis, for example, every hour of delay in administering antibiotics after emergency department triage or the onset of organ dysfunction or shock has been documented to increase the likelihood of a poor outcome by between 3-7%.³

As such, clinicians regularly take a “just in case” approach, prescribing broad-spectrum antibiotics while they wait to identify the pathogen, and to determine its susceptibility to relevant antimicrobial agents. This delay in administering targeted, personalized treatment can have wide-ranging consequences.

The inappropriate use of antibiotics is one of the most important factors contributing to AMR, a global threat that could cause 10 million deaths a year by 2050 and push up to 24 million people into extreme poverty within the next decade.⁴
A 2015 review examined the outcomes of ICU patients with blood stream infections (BSIs), for example.

It found a three-fold increase in mortality among those with extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae BSIs who did not receive adequate antibiotics within 72 hours of blood cultures.

The authors also said inadequate antibiotic regimes were an independent risk factor for mortality in BSIs caused by methicillin-resistant Staphylococcus aureus (MRSA). 

Inappropriate antibiotic therapy in people with Gram-negative sepsis can also increase length of stay in hospital by, according to one study, a minimum of two days. With the average cost of a night in ICU being €1,200 (c.$1650), this is not an insignificant figure.

**What is rapid AST?**

Knowledge is power in bacterial infections – the sooner clinicians have AST data, the sooner they can initiate targeted treatment. Studies have shown that returning a result 24 hours earlier than standard time-frames could deliver per patient cost savings of between $2,500 and $20,000, largely through reducing disease severity and hospital stay duration. Crucially, speedier AST could cut mortality rates by a staggering 40%.

Despite the long-debated nature of rapid AST, however, its definition has remained largely elusive. Most commentators, studies, and approaches focus primarily on the time-to-result. And, for obvious reasons, it is this concept that has driven much of the field’s advancements in recent years.

However, evolutions in technology have allowed for a more method-focused view that ensures results are not only fast, but reliable, informative, and actionable.

The ISO standard for AST, ISO 20776-1, describes a broth micro-dilution reference method, highlighting the importance of gaining accurate minimum inhibitory concentrations (MIC); the lowest concentration of an antimicrobial agent that, under defined in vitro conditions, prevents the appearance of visible growth of a micro-organism within a defined period of time.

MIC values will differ greatly from species to species, and even within species, depending on multiple factors including the strain and clinical case.

An MIC allows, through the use of epidemiological cut-off values (ECOFFs), for the categorization of bacteria as susceptible (S), intermediate (I), or resistant (R). But it is important to remember that the SIR value is not as sensitive as the MIC. Indeed, for some antibiotics and bacteria, the determination of MIC is the only reliable phenotypic method for assessing drug sensitivity.

Precise MIC measurements, then, can be a crucial part of the diagnostic jigsaw. In particular, and for relevant patient populations, MIC measurements also help clinicians design individualized treatment plans that expose patients to the lowest dose of antibiotic agents possible – reinforcing AST’s utility in fighting AMR, improving outcomes, and supporting associated cost reductions.

The industry is continually striving to retain this advantage. Truly clinically valuable rapid AST will return quicker results while reflecting the gold standard method as closely as possible.
Q-linea ASTar® System

The ASTar System is one of the few rapid AST systems based on the broth microdilution methodology detailed in ISO 2776-1, but with the addition of cutting-edge advanced imaging techniques and algorithms developed to monitor bacterial growth during incubation, removing the need for the lengthy subculture steps.

Thermo Fisher Scientific and Q-linea have partnered to launch the fully automated ASTar System which can deliver accurate, actionable AST results in ≈6 hours*. By aligning more with the gold standard method, the ASTar System produces the all-important MIC results physicians use to deliver personalized antibiotic treatment (personalized medicine), and by its very nature this also supports the continued fight against AMR.

Over the next few months, the ASTar System team will be working with early adopter laboratories across Europe to assess the system’s impact on outcomes and health economics.

Both Thermo Fisher and Q-linea believe that the ASTar System marks a watershed moment in the quest for more accurate, reliable, rapid AST.

*Q-linea AB is the legal manufacturer of ASTar®.

Key features include:

- Phenotypic AST
  - Directly from positive blood cultures
  - Truly accurate MIC results in ≈6 hours
  - Harnesses the power of digital imaging advancements to standardize inoculum dose as well as overall performance
- Fully-automated analysis
  - Provides a walk-away automated laboratory workflow for technician level processing, requiring just two minutes of hands-on time per sample
  - 12 samples analyzed, random access
  - 24 samples per day throughput (minimum)
- Comprehensive AST panel
  - Gain data for 14 key pathogenic species across 24 antimicrobials for Gram-negative bacteria, including Haemophilus influenzae (fastidious) in one single test
  - Broad coverage of 6 to 14 two-fold dilutions of each antimicrobial, representing an output of 266 individual antibiotic dilution data points
  - Results generated from broth microdilution (CAMHB and fastidious)


For more information, visit thermofisher.com/ASTar

Q-LINEA

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