Impact of a new rapid antimicrobial susceptibility test in a Swedish university hospital – a retrospective analysis of time until targeted treatment

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Introduction

Correct antibiotic treatment is crucial in sepsis, and rapid susceptibility testing can help shorten the times to appropriate treatment. Traditional antimicrobial susceptibility testing (AST) from blood cultures (PBC) takes 24-48 hours, but new direct-from-PBC tests such as EUCAST RAST can be interpreted after 4–8 hours. The QuickMIC system determines MICs in 2–4 hours from PBC (Fig 1A-D). This study compares standard disc-diffusion/RAST with QuickMIC for Gram-negative PBCs with regards to agreement, time-to-result and potential impact on time to guided therapy.

Methods

138 Gram-negative PBCs were consecutively tested in parallel during 2021–2022. Turnaround-times (TAT) were calculated from the time of sampling and microscopy. The timepoint for routine results was recorded from the electronic medical record system, and the time of QuickMIC results was obtained from the QuickMIC Analyst software. Appropriateness of empirical treatment and time of treatment adjustment was investigated via retrospective chart review.

Results

Of 138 samples, 24 were excluded due to technical (n=10) or biological (polymicrobial, anaerobic, or hard-to-culture samples, n=14) reasons. QuickMIC agreement compared to routine diagnostics was on average 96.0% (Table 1). Median TAT was 6.8h (IQR:3.4h), compared to 5.3h (IQR:1.7h) for RAST and 24.0h (IQR:3.2h) for disk diffusion (Figure 2). Inadequate empirical treatment was given in 14 cases (12.2%). Antibiotic treatment was adjusted for 35 patients (30.7%) (Table 2) of which 18 cases were after AST result (10 de-escalations, 7 escalations, 1 lateral switch). RAST results were available in 13/114 cases (11.4%) and led to 3 (2.6%) treatment changes (1 escalation, 2 de-escalations). For the 18 AST-guided cases, rapid QuickMIC results could have enabled an average reduction in time to targeted treatment by 36.9h (range: 4.9h–97.9h), and could theoretically have optimized treatment for a total of 643 care hours (151h of ineffective treatment, 492h of unnecessarily broad treatment).

Conclusions

- Rapid AST methods such as QuickMIC are associated with higher cost per test but can reduce unnecessary use of broad-spectrum antibiotics and shorten time to targeted treatment, even in a clinical context with low resistance levels.
- Prospective studies are warranted to investigate whether this results in improved clinical outcomes.

The QuickMIC® system gives precise MIC values in 2-4 hours directly from positive blood cultures

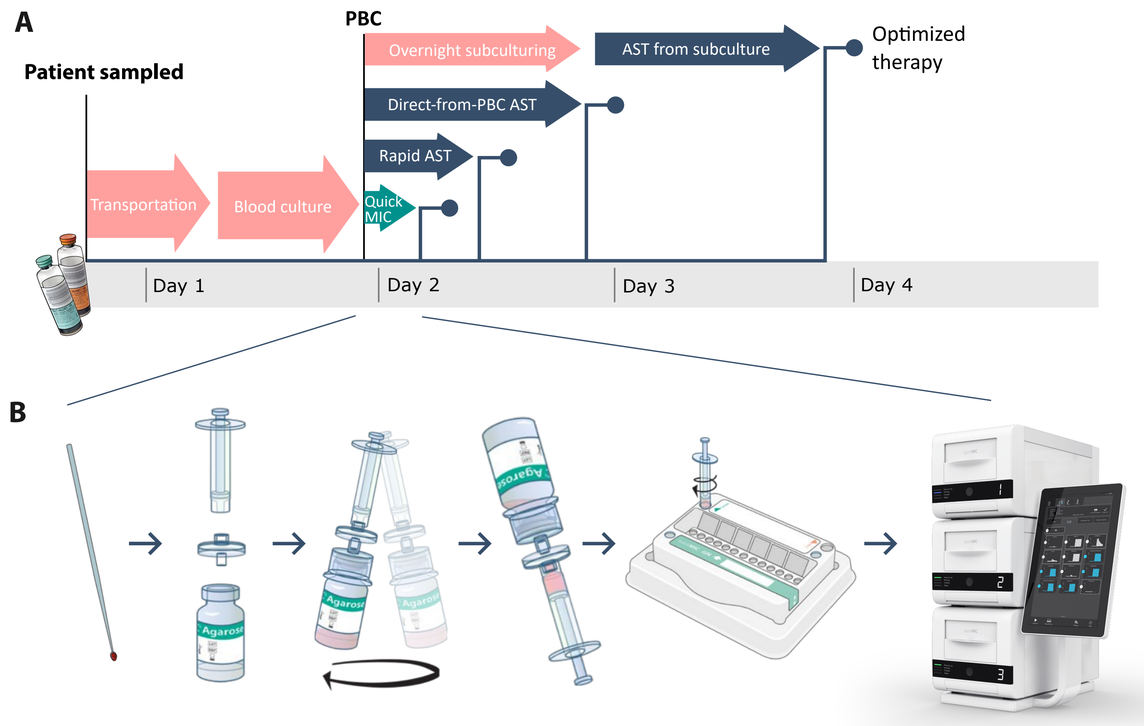

Table 1: QuickMIC performance in comparison to disc diffusion

Antibiotic	Tests	CA (%)	S	I	R	MiD (%)	MD (%)	VMD (%)	Time (min)
Amikacin	95	95 (100)	97	0	0	0 (0)	0 (0)	0 (0)	202
Ciprofloxacin	105	95 (90.5)	88	8	11	7 (6.7)	2 (1.9)	1 (1)	180
Cefotaxime	103	101 (98.1)	95	0	8	0 (0)	1 (1)	1 (1)	175
Ceftazidime	109	105 (96.3)	97	8	6	3 (2.8)	0 (0)	1 (0.9)	176
Piperacillin-tazobactam	111	106 (95.5)	101	4	7	1 (0.9)	0 (0)	4 (3.6)	124
Tobramycin	105	101 (96.2)	101	0	6	0 (0)	2 (1.9)	2 (1.9)	181
Total	**628**	**603 (96)**	**579**	**20**	**38**	**11 (1.8)**	**5 (0.8)**	**9 (1.4)**	**172**

Out of 12 antibiotics on the QuickMIC GN panel, only six were routinely tested as reference.
CA, Categorical agreement; S, Susceptible; I, Susceptible with increased exposure; R, Resistant;
MiD, Minor error (S instead of I or vice versa); MD, Major error (R instead of S); VMD, Very major error (S instead of R)
Time, in-instrument analysis time of the QuickMIC test result

Table 2: Adjusted Empirical Treatment

Type of adjustment	All	After AST Result	Potential time saved (QuickMIC)
De-escalation[a]	15	10	492 h
Escalation[b]	17	7	151 h
Lateral switch[c]	3	1	21 h
Total	**35**	**18**	**664 h**

[a]Dose reduction, switch to narrower spectrum agent, or oral step-down
[b]Dose increase or switch to broader spectrum agent
[c]Switch to another agent of similar spectrum

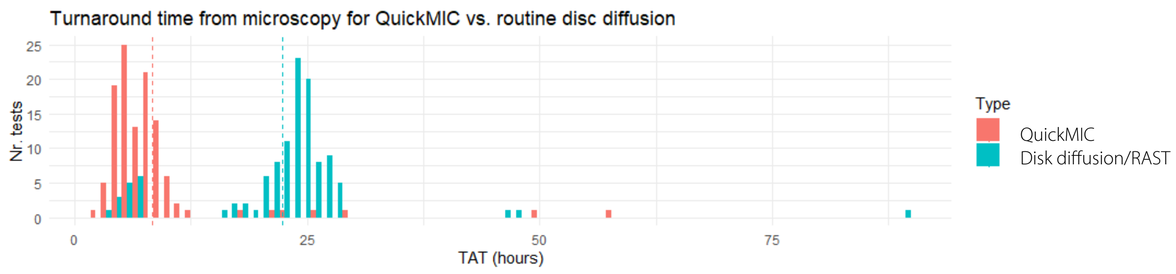

Figure 2. Comparison of turnaround-time (time from microscopy to AST result) by QuickMIC and the clinical laboratory routine disk diffusion, including RAST result when available. The dashed line indicates median TAT.

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