#03541

Effect of rapid molecular microbiology on clinical and economic outcomes in sepsis and bacteraemia in resource-limited settings

11. Public health & vaccines
11h. Infections in low-resource settings (incl disease burden, health infrastructure, health disparities and vulnerable populations)

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Background

Sepsis represents a major global burden with millions of annual cases and high mortality. Rapid molecular diagnostics using multiplex PCR panels enable faster pathogen and resistance gene identification compared with conventional methods. When integrated with antimicrobial stewardship programmes, molecular microbiology may reduce mortality, hospital length of stay, and costs. This study determined whether molecular method (MM)–guided therapy reduces hospital length of stay and antibiotic-related costs in patients with bacteraemia and sepsis in resource-limited settings.

Methods

We conducted a retrospective observational study in a level III private hospital in Lima, Peru (October 2019–December 2023). Patients meeting Sepsis-3 criteria with hospital stays >48 hours and positive conventional blood cultures plus molecular tests (FilmArray BCID or Xpert MRSA/SA) were included. COVID-19 cases and clinically irrelevant isolates were excluded. Primary outcomes were hospital length of stay, mortality, and total costs. Appropriate MM-guided therapy was defined as selection of in-vitro active antibiotics within an antimicrobial stewardship framework. Statistical analysis used log-binomial regression for mortality, negative binomial regression for length of stay, and linear regression on log-transformed costs, adjusting for mechanical ventilation, ICU admission, urinary infection, and Escherichia coli infection.

Results

MM-guided therapy achieved 100% appropriate treatment versus 90.9% in controls (p=0.007). Median length of stay decreased from 22 to 8 days (p<0.001), with adjusted analysis confirming a 28% reduction (aIRR 0.72; 95% CI 0.58–0.90; p=0.004). In ICU patients, MM-guided therapy remained associated with shorter stays (IRR 0.69; p = 0.009). Mortality was similar between groups (aRR 0.91; p=0.827). Mechanical ventilation (aRR 11.43; p<0.001) and ICU admission were the strongest predictors of mortality. E. coli infection independently predicted shorter stays (aIRR 0.66; p=0.002) and lower costs (β = –0.560; p=0.001). MM-guided therapy did not significantly reduce adjusted total costs (β = –0.192; p=0.158), while mechanical ventilation and ICU admission markedly increased them.

Conclusions

In patients with sepsis and bacteraemia, MM-guided therapy significantly reduces hospital length of stay but does not alter mortality or adjusted costs. These findings support integrating rapid molecular diagnostics within antimicrobial stewardship programmes to enhance clinical and operational efficiency.

Clinical and demographic characteristics

Table 01. Clinical and demographic characteristics.

Variable	Guided treatment for MM (n=76)	Not guided treatment for MM (n=124)	p-value
Sex			
- Male	48 (63.1%)	75 (60.4%)	0.706[a]
- Female	28 (36.9%)	49 (39.6%)	
Age*	66 [1;95]	57,5 [1;95]	0.029[b]
Procedence			0.146[c]
- Lima	77 (100.0%)	118 (95.2%)	
- Province	0 (0.0%)	5 (0.04%)	
- Foreing	0 (0.0%)	1 (0.01%)	
HSPU			0.011[a]
- ICU	46 (60.5%)	96 (77.4%)	
- Hospitalization	30 (39.5%)	28 (22.6%)	
Main diagnostic			0.012[a]
- Pneumonia	16 (21.1%)	40 (32.2%)	
- Abdominal infection	9 (11.8%)	11 (8.8%)	
- Skin and soft infection	6 (7.8%)	9 (7.2%)	
- Urinary tract infection	35 (46.1%)	30 (24.2%)	
- Other sources of sepsis	6 (7.8%)	14 (11.2%)	
- Sepsis without focus	4 (5.2%)	20 (16.1%)	
Bacteria identified			<0.001[a]
- Escherichia coli	40 (52.6%)	26 (21.3%)	
- Klebsiela pneumoniae	2 (2.6%)	7 (5.7%)	
- Pseudomona aeruginosa	0 (0.0%)	19 (15.3%)	
- Serratian marcescens	1 (1.3%)	5 (4.0%)	
- Staphylococcus aureus	7 (9.2%)	11 (9.0%)	
- Streptococcus pneumoniae	1 (1.3%)	4 (3.3%)	
- Others Staphylococcus	4 (5.2%)	17 (13.9%)	
- Others Streptococcus	1 (1.3%)	10 (8.2%)	
- Others bacterias	10 (13.0%)	24 (19.6%)	
Mortality	8 (10.5%)	20 (16.1%)	0.268[a]
Appropriate treatment	76 (100.0%)	111 (90.9%)	0,007[c]
Adequate empirical treatment	52 (68.4%)	82 (66.1%)	0,738[a]
Escalate/de-escalate	23 (30.3%)	17 (13.7%)	<0,001[b]
Use of mechanical ventilator	19 (25.0%)	46 (37.0%)	0,076[a]
Septic shock	6 (7.9%)	9 (7.3%)	0,868[a]
Hospital stay(days)*			
- Total, hospitalization stay	8 [6.5;17.5]	22 [9;41.5]	0.004[b]
- ICU stay	4,5 [0;12]	11.5 [3.5;27]	0,003[b]
Cost*			
- Total, cost	1,811.2 [588.1;5427.3]	4,905.5 [1597;11,318.0]	<0,001[b]
- Antibiotic cost	89.7 [29.7;174.1]	139.5 [51.3;308.6]	0,029[b]

HSPU: Health Service Provider Unit; ICU: Intensive care unit; *Median; IQR: interquartile range; a: Chi_2; b: U de Mann Whitney; c: Fisher's exact test.

Regression analysis

Table 02. Clinical factors associated with mortality: cRR and aRR in regression models

	cRR (CI 95%)	p-value	aRR (CI 95%)	p-value
Guided treatment for MM	0.65 (0,30 - 1,41)	0.278	0.91 (0.43 – 1.95)	0.827
Mechanic ventilation	12.46 (4.49 – 34.51)	<0.001	11.43 (3.57 – 36.58)	<0.001
ICU admission (OR) [a]	29.1 (1.75 – 485.7)	0,019	-	-
E. coli infection	0.44 (0.17 – 1.11)	0.083	-	-
Urinary tract infection	0.24 (0.77 – 0.79)	0.019	0.80 (0.22 – 2.90)	0.741
Hospitalary stay (days)	0.99 (0.98 – 1.01)	0.991	-	-

cRR: crude relative risk; aRR: adjusted relative risk; CI 95%: confidence intervale 95%; OR: Odds ratio; MM: molecular method; ICU: Intensive care unit; a: Analysis penalized by Firth.

Table 03. Association between clinical factors and hospital length of stay: crude and adjusted IRR from negative binomial regression

	cIRR (CI 95%)	p-value	aIRR (CI 95%)	p-value
Treatment adequate for MM	0.53 (0.41 - 0.68)	<0.001	0.72 (0.58 – 0.90)	0.004
Mechanical ventilation	2.06 (1.60 - 2.65)	<0.001	1.42 (1.12 – 1.79)	0.003
E. coli infection	0.40 (0.31 – 0.52)	<0.001	0.66 (0.50 – 0.86)	0.002
Urinary tract infection	0.54 (0.41 – 0.70)	<0.001	0.89 (0.69 – 1.16)	0.430
ICU admission	3.79 (2.96 – 4.85)	<0.001	2.58 (1.99 – 3.34)	<0.001

cIRR: crude incidence rate ratio; aIRR: adjusted incidence rate ratio; ICU: Intensive care unit; MM: molecular method

Table 04. Factors associated with total hospital costs using log-transformed linear regression

Variable	beta	p-value
Treatment adequate MM	-0.192 (-0.46;0.07)	0.158
Mechanical ventilation	0.410 (0.10;0.71)	0.008
E. coli infection	-0.560 (-0.89;-0.22)	0.001
Sepsis pp. urinary	0.140 (-0.19;0.47)	<0.412
ICU admission	2.05 (1.75;2.35)	<0.001

MM: molecular method; ICU: Intensive care unit;
Model Fit: $R^2 = 0.622$: Linear regression on log-transformed costs.

Keyword 1
Antibiotic stewardship (AMS)
Keyword 2
Molecular and rapid diagnostics
Keyword 3 (Please provide your suggestion)
Bacteremia

Conflicts of interest

Do any of the authors have conflicts of interest related to the studies presented in this abstract?
No