Activity of piperacillin/tazobactam and meropenem against extended-spectrum β-lactamase-producing Escherichia coli

Kamrul Islam1, Fekade B. Sime1, Michelle Bauer2, Saiyuri Naicker1, Steven C. Wallis2, Meerjady Sabrina Flora3, Tahmina Shirin3, Zakir Hossain Habib3, Jason A. Roberts1,2,4-5,6

1Centre for Translational Anti-Infective Pharmacodynamics, School of Pharmacy, The University of Queensland, Brisbane, Australia; 2The University of Queensland Centre for Clinical Research (UQCCR), Faculty of Medicine, The University of Queensland, Brisbane, QLD, Australia; 3Institute of Epidemiology, Disease Control and Research (IEDCR), Dhaka, Bangladesh; 4Department of Intensive Care Medicine and Pharmacy Department, Royal Brisbane and Women’s Hospital, Brisbane, QLD, Australia; 5Division of Anaesthesiology Critical Care Emergency and Pain Medicine, Nimes University Hospital, University of Montpellier, Nimes France; 6Pharmacy Department, Royal Brisbane and Women’s Hospital, Brisbane, Australia

Background and purpose:
Urosepsis is associated with a mortality rate of 20-40% in critically ill patients (1). Piperacillin/tazobactam (PTZ) as an alternative to meropenem against ESBL-producing E. coli (ESBL-EC) remains debated. This study aims to compare the activity of PTZ and meropenem against ESBL-producing E. coli to suggest therapeutic choices for urosepsis.

Methods:
- Three ESBL-producing (blaCTX-M-15) and two ESBL-non-producing E. coli clinical strains were collected from national antimicrobial resistance surveillance, Bangladesh.
- Piperacillin/tazobactam and meropenem standard regimens were simulated in a dynamic hollow-fibre infection model over 7-days.

Results:
- PTZ regimens resulted in approximately ≥ 4-log10 initial bacterial killing and meropenem exhibited approximately ≥ 6-log of bacterial killing against all E. coli strains over 8 h.
- The results suggest, piperacillin/tazobactam could be an effective alternative to meropenem for the treatment of ESBL-EC urosepsis where there is a non-biofilm source of pathogen.

Conclusion:
- PTZ regimens resulted in approximately ≥ 4-log10 initial bacterial killing and meropenem exhibited approximately ≥ 6-log of bacterial killing against all E. coli strains over 8 h.
- The results suggest, piperacillin/tazobactam could be an effective alternative to meropenem for the treatment of ESBL-EC urosepsis where there is a non-biofilm source of pathogen.