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Genetic characterization and epidemiology of multidrug-resistant gram-negative ESKAPE pathogens, including extremely drug-resistant strains at a Naval hospital in Thailand

Apichai Srijan[1], Katie R Margulieux[1], Sirigade Ruekit[1], Patrick McGann[2], Erik Snesrud[2], Rosslyn Maybank[2], Oralak Serichantalergs[1], Rosarin Kormanee[3], Prawet Sukhchat[3], Mary Hinkle[2], John M Crawford[1] and **Brett E Swierczewski[1]**

[1]Armed Forces Research Institute of Medical Sciences, Thailand

[2]Walter Reed Army Institute of Research, USA

[3]Queen Sirikit Naval Hospital, Thailand

Multidrug resistant (MDR) gram-negative ESKAPE pathogens are one of the biggest threats to global public health and infections due to MDR strains resulting in a significant healthcare burden. We collected 150 clinical isolates of MDR gram negative ESKAPE pathogens at Queen Sirikit Naval Hospital in Thailand from October 2016 - May 2017, performed isolate whole genome sequencing (WGS), and determined epidemiology by *in silico* multi-locus sequence typing (MLST) techniques. All 32 (100%) of identified *A. baumannii* isolates were extremely drug resistant (XDR) and harbored atleast one carbapenemase gene (31/32 carried *blaOXA-23*, 1/32 carried *blaNDM-1*). MLST analysis showed 24/32 (75%) *A. baumannii* were assigned to ST-2, a prominent global strain. A total of 43 XDR *K. pneumoniae* isolates were identified with 43/43 (100%) of the isolates harboring CTX-M ESBL gene variants (*blaCTX-M-15* (93%),-27, or -55). The carbapenemase genes *blaNDM-1* and blaOXA-48 variants were found in 30/43 (69.8%), with 29/43 (67%) carrying both. Moreover, two *K. pneumoniae* isolates carried the transferable colistin resistance gene mcr-1. MLST analysis showed 31/43 (72.1%) *K. pneumoniae* isolates belong to ST-16. A total of 84 drug resistant *E. coli* isolates were identified with 79/84 (94%) carrying at least one extended spectrum β-lactamase (ESBL) gene (*blaCTX-M-14*,-15, -27, -55, or *blaVER-5*). The carbapenemases *blaNDM-4* and *blaKPC-2* were each detected in a single *E. coli* isolate. MSLT analysis of the 84 *E. coli* isolates separated them into 22 different ST groups with three primary STS: 33/84 (40%) ST-131, 10/84 (12%) ST-1193 and 8/84 (9.5%) ST-648. The identification and characterization of these pathogens demonstrates the spread of gram-negative ESKAPE pathogens at Queen Sirikit Naval Hospital. These findings serve to highlight the urgent need for continued surveillance and intervention measures of XDR bacterial pathogens, especially *A. baumannii* ST-2 and *K. pneumoniae* ST-16 in Thailand and Southeast Asia.

Recent Publications:

1. Srijan A, Margulieux K R, Ruekit S, Snesrud E, Serichantalergs O, Kormanee R, Sukhchat P, Sriyabhaya J, Hinkle M, Crawford J M, Mc Gann P and Swierczewski B E (2018) Genomic characterization of non-clonal mcr-1-positive multidrug-resistant *Klebsiella pneumoniae* from clinical samples in Thailand. Microbial Drug Resistance 24(4):403-410.
2. John Mark Velasco, Maria Theresa Valderama, Trent Peacock, Nirdnoy Warawadee, Kathyleen Nograd, Fatima Claire Navarro, Domingo Chua Jr, Srijan Apichai, Ruekit Sirigade, Louis R Macareo and Brett Swierczewski (2017) Carbapenemase-producing Enterobacteriaceae and non-fermentative bacteria, the Philippines, 2013–2016. Emerging Infectious Diseases 23(9):1597–1598.
3. Dyson Z A, Thanh D P, Bodhidatta L, *et al.,* (2017) Whole genome sequence analysis of *Salmonella typhi* isolated in Thailand before and after the introduction of a national immunization program. PLOS Neglected Tropical Diseases 11(1):e0005274.
4. Srijan A, Wongstitwilairoong B, Bodhidatta L and Mason C J (2015) Efficiency of plating media and enrichment broths for isolating salmonella species from human stool samples: a comparison study. Open Journal of Medical Microbiology 5(4):231-236.
5. Srijan A, Bodhidatta L, Mason C J, Bunyarakyothin G, Jiarakul W and Vithayasai N (2013) Field evaluation of a transport medium and enrichment broth for isolation of campylobacter species from human diarrheal stool samples. Open Journal of Medical Microbiology 3(1):48-52.

Biography

Apichai Srijan is a Senior Microbiologist at the Armed Forces Research Institute of Medical Sciences. He has his expertise in enteric diseases and antimicrobial resistance studies for more than 30 years. As an independent investigator, he develops the new research proposals, submit the proposals/protocols, get the research funding and progress the report and publish findings. As a Senior Microbiological Consultant, he provides microbiology support to research studies in the department; provide training to new technicians and/or visitors; refresh laboratory practices to other technicians and provide training and field laboratory setup. As a Field Coordinator, he is responsible for POC supply request, specimen receiving and transferring with sites etc. He is also responsible for preparation of manuscript and generating publication.

ApichaiS.fsn@afrims.org

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