## 2145. Carbapenem-Resistant Enterobacteriaceae infections at the Maharaj Nakorn Chiang Mai Hospital

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**Session:** 243. Bacterial Diagnostics

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***Background.*** Nowadays, carbapenem-resistant enterobacteriaceae (CRE) infection has been spreading worldwide in a tertiary care hospital and causing globally health damage. In Thailand, the studies of the epidemiology of CRE are scarce. This study aimed to describe epidemiology, clinical characteristics and treatment outcome of CRE infection.

***Methods.*** A retrospective cohort study was conducted among patients admitted to the Maharaj Nakorn Chiang Mai Hospital between January 2014 and December 2016 who had clinical diagnosis of CRE infection. Characteristics between groups were compared using Chi-square, Fisher exact test or Student *t*-test, Mann–Whitney U test. Factors associated with mortality in univariate analysis were analyzed in the logistic regression model.

***Results.*** Among 241 patients who had clinical specimens grew CRE, 51 had infection. Twenty-five patients (49%) were previously hospitalized within 90 days and 42 patients (82.4%) had exposed to antibiotics before documented CRE infection. The most common sites of clinical isolates were urine (33.3%), sputum (29.4%), and blood (21.6%). The mortality rate was 47.1%, which 17 (33.3%) patients' death was attributable to CRE infection. Factor associated with mortality was higher body temperature (OR 4.8, $P = 0.005$) and thrombocytopenia.

***Conclusion.*** CRE infections cause high mortality. Strategies to prevent emergence through prudent uses of antibiotics and transmission through infection control measures should be implemented in order to reduce mortality.

***Disclosures.*** **All authors:** No reported disclosures.

## 2146. MALDI-TOF Mass Spectrometry Rapid Pathogen Identification and Outcomes of Patients with Bloodstream Infection: A Systematic Review and Meta-analysis

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***Background.*** Several studies showed inconsistent results on the efficiency measures of the matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS) technology and patients' clinical outcomes. A meta-analysis was conducted to determine the effectiveness of MALDI-TOF MS-based bacteriology in improving the accuracy of microbiology report and clinical outcomes.

***Methods.*** PubMed and EMBASE databases were searched from database inception through May 1, 2018 for pre–post and parallel comparative studies that evaluated the use of MALDI-TOF MS for identification of microorganism from blood culture. Pooled effect estimates were derived using the random-effects model. Univariate meta-regression on trial-level covariates was used to assess heterogeneity sources. Funnel plot, Begg's and Egger's tests were used to assess publication bias.

***Results.*** Thirteen studies with 3,534 patients were meta-analyzed. Compared with conventional methods, MALDI-TOF MS was associated with 34% reduction in mortality (RR = 0.66; 95% CI: 0.54; 0.81; $I^2 = 27.6\%$; 9 studies); 5.3-hour reduction in time-to-effective antibiotic therapy (95% CI: -6.4; -4.3; $I^2 = 98.0\%$), 24.5-hour reduction in time to identify bacteria (95% CI: −25.7; −23.3; $I^2 = 91.0\%$); 0.9-day reduction in hospital stay (95% CI: −1.4; −0.3; $I^2 = 56.6\%$), and US$4100 saving in direct hospitalization cost (95% CI: $−8,200; $−113; $I^2 = 66.1\%$). No significant heterogeneity sources were found (all *P*-interaction from meta-regression > 0.05) and no statistical evidence for publication bias was found (all $P > 0.05$).

***Conclusion.*** Rapid pathogen identification by MALDI-TOF MS with or without antibiotic stewardship was associated with reduced mortality, improved outcomes of bloodstream infection, and may be cost-effective among patients with bloodstream infection. Nevertheless, a multicenter randomized controlled trial is needed to confirm findings of these pre–post comparison studies.

Table 1. Summary risk ratios of mortality before and after the introduction of MALDI-TOF for identification of bacteriology

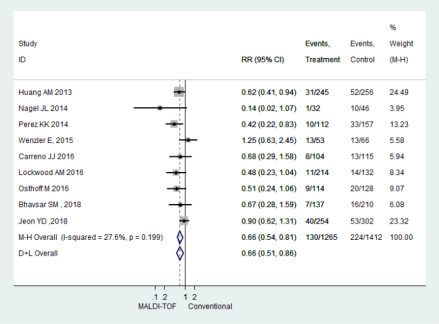
| Category | Number of Studies | Summary Estimate (95% CI) | $I^2$ | Meta-regression p-Value | Publication Bias |
|---|---|---|---|---|---|
| Overall | 9 | 0.66 (0.54-0.81) | 27.6% | ref | 0.14, 0.30 |
| Adult population | 7 | 0.62 (0.50-0.78) | 22.4% | 0.22 | 0.03, 0.18 |
| Reporting 30-day mortality | 7 | 0.62 (0.50-0.78) | 22.3% | 0.21 | 0.03, 0.18 |
| Patients with BSI | 5 | 0.71 (0.56-0.90) | 0.0% | 0.61 | 0.38, 0.62 |
| MALDI-TOF with AST | 5 | 0.57 (0.42-0.78) | 0.0% | 0.38 | 0.21, 0.14 |
| MALDI-TOF without AST | 4 | 0.74 (0.57-0.97) | 56.8% | 0.38 | 0.54,1.00 |

Abbreviations: BSI, bloodstream infection, MALDI-TOF, matrix-assisted laser desorption ionization time-of-flight mass spectrometry, AST, antibiotic stewardship team

Table 2. Summary mean difference of continuous outcomes before and after the introduction of MALDI-TOF for identification of bacteriology

| | Number of studies | Mean difference (95% confidence interval) | P-value | $I^2$ |
|---|---|---|---|---|
| Time to effective antibiotics (hrs.) | 12 | -5.3 (-6.4, -4.3) | 0.001 | 98.0% |
| Time to bacteriology identification (hrs.) | 10 | -24.5 (-25.7, -23.3) | 0.001 | 91.0% |
| Length of hospital stay (days) | 10 | -0.9 (-1.4, -0.3) | 0.005 | 56.6% |
| Length of ICU stay (days) | 8 | -0.2 (-0.4, 0.8) | 0.494 | 87.1% |
| Direct hospitalization cost (US$) | 5 | -4,100 (-8,200, -113) | 0.044 | 66.1% |

Figure 1. Forest plot of the included studies comparing in-hospital mortality between MALDI-TOF MS bacteria identification and conventional methods

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## 2147. Human Infections due to *Actinotignum* Species: A 5-Year Retrospective Review at Mayo Clinic Rochester, Minnesota

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**Session:** 243. Bacterial Diagnostics

*Saturday, October 5, 2019: 12:15 PM*

***Background.*** We aim to investigate the incidence, clinical presentation, management, and outcome of infections due to *Actinotignum* species observed at Mayo Clinic Rochester over the last 5 years.

***Methods.*** We searched the clinical microbiology laboratory database to identify isolates of *Actinotignum* spp. from all body sites between January 1, 2014 and December 31, 2018.

***Results.*** Fifty-four patients with positive culture with *Actinotignum* were identified. Mean age was 67 years and 27 (50%) had an underlying urogenital condition. *Actinotignum* was isolated in 26 urine cultures, 6 blood cultures, 12 abscess fluid cultures, and 10 bone/joint tissue cultures (Table 1). Fifteen (28%) specimens were monomicrobial while 39 (72%) were polymicrobial. Recovery from urine cultures was interpreted as colonization in 11 (20%) cases. Of the 54 patients with positive cultures, 43 patients had *Actinotignum*-associated clinical infection; 15 (35%) with urinary tract infections (11 with cystitis and 4 with pyelonephritis), 12 (28%) with abscesses (skin, intraabdominal, and surgical site infections), 10 (23%) with bone/joint infection, and 6 (14%) with bacteremia (Table 2). Most frequently isolated species was *A. schaalii* ($n = 40$); followed by 2 cases of *A. sanguinis*. Susceptibility testing ($n = 40$) showed that all stains were susceptible to penicillin (MIC< = 0.5), 36% were susceptible to clindamycin (MIC < = 2) and 10% susceptible to metronidazole (MIC < = 8). There was no recurrence of *Actinotignum*-related infections in any of the treated cases. Two patients with bone/joint infection underwent repeat surgical intervention due to worsening infection while on antibiotic treatment prior to resolution of infection. There was 1 death in a patient with bacteremia (polymicrobial) who had presented with a massive stroke (Table 3).

***Conclusion.*** *A. schaalii* was most commonly associated with urinary tract infections followed by abscesses and bone/joint infections in elderly population. Majority of the infections were polymicrobial. All tested isolated were susceptible to penicillin; however, resistance was frequent for clindamycin and metronidazole. All appropriately treated patients had resolution of infection without recurrence from *Actinotignum*, except for one patient with bacteremia who died from massive stroke

**Table 1 Baseline characteristics**

| Patient characteristics (n=54) | | Comments |
|---|---|---|
| **Age** | | |
| Mean (range) yrs | 67.4 (28-95) | |
| **Gender** | | |
| Men | 23 (43%) | |
| Women | 31 (57%) | |
| **Comorbid condition** | | |
| Urogenital condition[a] | 27 (50%) | |
| CVD[b] | 22 (41%) | |
| DM | 14 (26%) | |
| Dementia | 8 (19%) | |
| **Source of Positive cultures** | | |
| Urine | 26 (48%) | |
| Blood | 6 (11%) | |
| Abscess | 12 (22%) | |
| Bone/joint | 10 (19%) | |
| **Pure culture (monomicrobial)** | 15 (28%) | 11 urine cultures<br>2 blood cultures (1 patient with monomicrobial growth in blood but polymicrobial growth from abdominal abscess which was source of infection)<br>2 abscess fluid (breast, pelvis) |
| **Significance of positive culture** | | |
| Infection related to *Actinotignum* sp (all sites) | 43 (80%) | |
| Asymptomatic bactiuria/colonization of urinary catheter/tubes/stents | 11 (20%) | |
| ***Actinotignum* species** | | |
| *Actinotignum schaalii* | 40 | |
| *Actinotignum sanguinis* | 2 | |
| *Actinotignum schaalii/ sanguinis* | 4 | |
| *Actinotignum spp (unable to determine species)* | 8 | |
| **Mean in hospital stay (range), days** | 8 (1-90) | |
| **Outcome** | | |
| Death | 1/54 | |
| Recurrence of infection with *Actinotignum* | 0/43 | |

[a] **Urogenital abnormality defined as** Underlying conditions defined as one or more of catheterization, prostatic hyperplasia, prostatic cancer, bladder cancer, hydronephrosis, renal failure, urethral stricture, kidney stones, uterine/vaginal prolapse, injury to urogenital system (traumatic/atraumatic)
[b] CVD defined as underlying conditions defined as atrial fibrillation, pacemaker, peripheral vascular disease, ischemic heart disease, myocardial infarction, or stroke

Table 2 *Actinotignum* related urinary tract infections and colonization

| Type of urinary tract infection | Underlying diseases of the genito-urinary tract | Polymicrobial infection | Treatment | Outcome[a] |
|---|---|---|---|---|
| Cystitis/urethritis (n=11) | BPH, neurogenic bladder with intermittent self-catheterization, vaginal hysterectomy, prostate cancer, invasive bladder cancer, cervical cancer, Renal cell carcinoma s/p nephrectomy | 6/11 (55%) | **Monotherapy**<br>β-lactam antibiotics (n=4)<br>- 1 patient treated with IV antibiotics<br>- 3 patients with oral antibiotics<br>Duration 3-10 days<br>Quinolones (n=3)<br>Duration 3-10 days (data available for 2 patients)<br>Sulfonamide (n=1)<br>Duration: 7 days<br>**Combination therapy**<br>Two β-lactam antibiotics (n=2)<br>- oral cephalosporin followed by penicillin for 14 days<br>- IV cephalosporin followed by oral penicillin for 10 days<br>Macrolide and oral cephalosporin (n=1)<br>Duration: 7 days | Favorable no recurrence |
| Pyelonephritis (n=4) | **Nephrolithiasis (staghorn calculi), neurogenic bladder requiring self-catheterization/indwelling suprapubic/Foley catheter, horseshoe kidney,** metastatic prostate cancer, cystectomy with ileal conduit formation | 3/4 (75%) | IV β-lactam antibiotics and metronidazole for 28 days (n=1)<br>≥ 1 IV β-lactam antibiotics (2-14 days) followed by transition to oral sulfonamide (10-18 days) (n=2)<br>Oral β-lactam antibiotic for 30 days (n=1) | Favorable no recurrence<br>Nephrostomy tube placement for decompression at time of infection (1 case)<br>Stone extraction after finishing treatment (1 case) |
| Urinary tract infection complicated by bacteremia (n=3) | BPH, uterine/bladder prolapse, neurogenic bladder with chronic Foley | 2/3(67%) | IV β-lactam antibiotic for 14 days (n=2)<br>Oral Quinolone for 14 days (n=1) | Favorable with complete resolution and no recurrence<br>1 patient presented with septic shock |
| Positive cultures during elective urological procedure (n=5)[a] | Hydronephrosis, nephrolithiasis, traumatic bladder/ureteral injury with colo-vesical/recto-urethral fistula, invasive high-grade renal papillary carcinoma, invasive bladder cancer, cystectomy with ileal conduit formation | 4/5 (80%) | Oral β-lactam antibiotics (n=4)<br>Duration: 5-14 days (data available for 2 patient)<br>IV β-lactam antibiotics (n=1)<br>Duration: 3 days | Recurrent UTIs with other organisms |
| Asymptomatic bacteriuria (n=6) | Stress incontinence, nephrolithiasis, **neurogenic bladder requiring self-catheterization** | 2/6 (33%) | Oral sulfonamide for 7 days for polymicrobial urine culture (n=1) | Repeat culture did not grow *Actinotignum spp* |

[a] recurrence of *Actinotignum* infection
[b] Also had nephrostomy tube placement for decompression
[c] exchange of nephrostomy tube, suprapubic catheter, ureteral stent and percutaneous nephrolithotomy

Table 3 *Actinotignum* related infections (other than UTI)

| Infection Syndrome | Clinical Presentation | Polymicrobial Infection | Treatment | Outcome |
|---|---|---|---|---|
| Bacteremia (n=6) | 3 cases of UTIs (1 with septic shock)<br>1 case of tubo-ovarian abscess<br>1 case of diabetic foot ulcer<br>1 presented with massive CVA | 4/6 (67%) | IV β-lactam antibiotics for 14 days (n=2)<br>IV carbapenem for 14 days followed by oral β-lactam antibiotics for 70 days (also had *actinomyces* infection) (n=1)<br>Oral quinolone for 14 days (n=1)<br>Oral metronidazole for 14 days (n=1) | Complete resolution (5 cases)<br>Recurrence of UTI from different organism (1 case)<br>1 death (patient presented with massive CVA and was transitioned to comfort care) |
| Abscess (n=12) | SSTI (7 cases)<br>Surgical site (2 cases)<br>Intraabdominal: (3 cases):<br>- Urinary fistula in setting of prostate cancer<br>- Iatrogenic bladder wall rupture<br>- Infected hematoma after C section | 10/12 (83%) | IV antibiotics only (n=3): 10-14 days<br>Combination of IV then transition to oral Abx (n=3):<br>- Total duration: 7-30 days<br>- Received 4-7 days of IV Abx prior to transition<br>PO antibiotics only (n=5): 10-14 days<br>Abx: TMP/SMX, levofloxacin, metronidazole, amoxicillin, azithromycin | All patients underwent drainage<br>Complete resolution in all cases |
| Bone/joint (n=10) | All cases of osteomyelitis<br>- Ischium/pubic symphysis (2 cases)<br>- Lower extremity (tibia, metatarsal, distal phalanx): (6 cases)<br>- Right shoulder (1 case)<br>- Hardware associated (1 case) | 10/10 (100%) | Complete amputation (n=6):<br>- None Abx: 1 case<br>- Treatment for residual SSTI (4 case): 5-14 days of PO Abx<br>- 5 weeks for IV antibiotics for OM: 1 case<br>Debridement (n=2)<br>Debridement partial hardware removal (n=1)<br>- 6 weeks IV antibiotics (1 case)<br>- 6 weeks of IV Abx followed by PO amoxicillin for 6 weeks for *actinomyces* (2 case)<br>No debridement (n=1)<br>- pubic symphysis osteomyelitis: IV carbapenem for 6 weeks, followed by oral suppression | 1 patient transitioned to IV Abx after 5 days of PO. Required debridement followed by 14 days of IV antibiotics.<br>1 patient with ankle hardware associated osteomyelitis: drainage after 12 weeks of therapy and screw removal -> underwent removal of retained hardware and retreatment with 6 weeks of IV and 4 weeks of PO Abx<br>Finished IV therapy but unable to tolerate PO suppression due to side effects. |

BSI: Blood stream infection, SSTI: Skin and of tissue infection, PO: per oral, Abx: Antibiotics, TMP/SMX: trimethoprim/sulfamethoxazole

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## 2148. Performance of the BioFire FilmArray Gastrointestinal Panel in a Clinical Setting of Infectious Diarrhea

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***Background.*** Infectious diarrhea remains as one of the leading causes of morbidity and mortality worldwide among all age groups. Conventional methods for diagnosis are time consuming and expensive. The BioFire FilmArray gastrointestinal panel (FA-GIP) tests for 22 enteric pathogens, provides results in a few hours and improves healthcare costs. The impact on antibiotic stewardship is unknown.

***Methods.*** We conducted a retrospective cohort, multi-center study to evaluate FA-GIP clinical performance in hospitalized patients with acute diarrhea. Patients from 3 hospitals from the Christus Muguerza health group were included between January 2017 and August 2018. The FA-GIP was ordered by the treating physician and was not influenced by the study. Duration of antibiotic therapy, length of hospital stay, and therapy modification were assessed. The comparison group consisted of patients with acute diarrhea in which no FA-GIP was ordered.

***Results.*** Data from 130 patients with FA-GIP and 107 patients with conventional methods were collected. Pathogens were detected by FA-GIP in 72.3% of the cases. The median of duration of antibiotic therapy in FA-GIP group was 5 days (IQR 0–8) vs. 3 days (IQR 0–6) in conventional methods group, ($P < 0.05$). The mean length of stay was 3.3(SD ± 2.4) in FA-GIP group vs. 1.9 (SD ± 1.0) in the control group ($P < 0.05$). Patients in FA-GIP group had more days with diarrhea, lower hemoglobin levels, and higher creatinine levels at admission (Table 1). The most frequent pathogens detected were enteropathogenic *Escherichia coli* in 24.4%, norovirus in 19.1%, *Clostridium difficile* in 17.0% and *Campylobacter jejuni* in 15.9% (Table 2). Therapy modification after FA-GIP results was made in 51.1% of the patients with a detected pathogen, and in 42.8% of patients with no pathogen detected in FA-GIP the antibiotic was stopped.

***Conclusion.*** Patients in the FA-GIP group had a more complex clinical scenario upon admission, they also had a longer duration of antibiotic therapies and longer length of stay. Although antibiotic therapy was positively influenced by the FA-GIP result, and no pathogen detection leads to withdrawal of unnecessary antibiotics.

**Table 2. Frequency of pathogens detected by FA-GIP**

| n=143 | n | % |
|---|---|---|
| Adenovirus | 2 | 1.1 |
| Astrovirus | 1 | 16.0 |
| *Campylobacter jejuni* | 15 | 17.0 |
| *Clostridium difficile* | 16 | 2.1 |
| *Cryptosporidium* | 2 | 3.2 |
| *Cyclospora Cayetanensis* | 3 | 1.1 |
| *E coli* O157 | 1 | 12.8 |
| EAEC | 12 | 9.6 |
| EIEC | 9 | 24.5 |
| EPEC | 23 | 10.6 |
| ETEC | 10 | 3.2 |
| *Giardia lamblia* | 3 | 19.1 |
| Norovirus | 18 | 7.4 |
| Rotavirus | 7 | 10.6 |
| *Salmonella* | 10 | 2.1 |
| Sapovirus | 2 | 3.2 |
| *Shigella* | 3 | 4.3 |
| STEC | 4 | 2.1 |
| *Vibrio cholerae* | 2 | 1.1 |

EAEC: enteroaggregative *E. coli*, enteroinvasive *E. coli*, EPEC: enteropathogenic *E. coli*, ETEC: enterotoxigenic *E. coli*. STEC: Shiga toxin-producing *E coli*.

**Table 1. Clinical characteristics of hospitalized patients with diarrhea**

| | FA-GIP n=130 | No FA-GIP n=107 | p value |
|---|---|---|---|
| Age, mean (SD) | 43.8 (±19.5) | 40.0 (±17.7) | 0.12 |
| Men, n (%) | 61 (46.9) | 42 (39.3) | 0.23 |
| BMI, median (IQR) | 25.3 (22.5-29.4) | 26.0 (23.0-30.0) | 0.08 |
| Charlson Index, mean (SD) | 0.8 (± 1.8) | 0.6 (± 0.9) | 0.27 |
| **LOS, media (SD)** | **3.3 (± 2.4)** | **1.9 (± 1.0)** | **<0.05** |
| ICU admission, n (%) | 7 (5.4) | 3 (2.8) | 0.32 |
| qSOFA ≥ 2 pts., n(%) | 9 (6.9) | 3 (2.8) | 0.15 |
| Symptoms | | | |
| Abdominal pain, n (%) | 79 (60.8) | 79 (73.8) | <0.05 |
| Fever, n (%) | 45 (34.6) | 35 (32.7) | 0.75 |
| Nausea/vomitting, n (%) | 55 (42.3) | 72 (67.3) | <0.05 |
| Hematochezia, n (%) | 17 (13.1) | 5 (4.7) | <0.05 |
| No. stools, median (IQR) | 7.0 (4.0-10.0) | 6.5 (4.0-12.0) | 0.93 |
| **No. days with diarrhea, median (IQR)** | **3.0 (1.0-5.0)** | **1.0 (1.0-2.0)** | **<0.05** |
| Pre-hospitalization antibiotic therapy, n(%) | 33 (25.4) | 16 (15.0) | 0.08 |
| **Antibiotic therapy days, median (IQR)** | **5.0 (0.0-8.0)** | **3.0 (0.0-6.0)** | **<0.05** |
| C-reactive protein, mean (SD) | 65.1 (± 75.7) | 91.9 (± 94.7) | 0.38 |
| **Hemoglobin gr/dL, mean (SD)** | **13.7 (± 2.2)** | **14.6 (± 1.9)** | **<0.05** |
| Leukocytes, mean (SD) | 9,939 (± 4,036) | 10,791 (± 4,265) | 0.19 |
| **Creatinin, mean (SD)** | **1.1 (± 0.9)** | **0.9 (± 0.6)** | **<0.05** |
| LDH, mean (SD) | 359.5 (± 130.5) | 343.4 (± 63.1) | 0.84 |

FA-GIP: FilmArray Gastrointestinal panel, ICU: intensive care unit, IQR: interquartile range, LDH: lactate dehydrogenase, LOS: length of stay, SD: standard deviation

***Disclosures.*** **All authors:** No reported disclosures.

## 2149. Performance of a Gradient Diffusion Method (Etest®) on Mueller–Hinton Agar with Sheep Blood for *Aerococcus urinae* Antimicrobial Susceptibility Testing

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