Background

- Meropenem is a broad-spectrum antibiotic with gram-positive, gram-negative, and anaerobic coverage and is considered a drug of choice for extended-spectrum beta-lactamase (ESBL) infections. 1
- The prevalence of multidrug-resistant gram-negative organisms has increasingly grown over the years, with the Centers for Disease Control and Prevention listing ESBL-producing Enterobacterales as a “serious” threat. 2
- Antimicrobial resistance continues to evolve within the United States which has led to an increased utilization of broad-spectrum antibiotics including carbapenem.
- Evaluation of meropenem use and prescribing is necessary to assess current practices, identify areas of improvement, and promote judicious use of broad-spectrum antimicrobials.

Methods

Study Design
- Single-center, randomized retrospective chart-review
- This study was institutional review board exempt

Inclusion Criteria
- Adult patients aged 18 through 89 hospitalized from January through July 2021
- Gram-negative culture necessitating treatment during study period
- Received ≥48 hours of meropenem during hospitalization

Exclusion Criteria
- Pregnancy
- Transplant recipients
- Neutropenia associated with immunosuppression
- Initial culture resistant to carbapenems

Data Collection
- The following information was collected from each patient: baseline demographics, source of infection, organism(s) isolated, indication, meropenem dose and duration, concomitant antibiotic(s) and duration, and prior antibiotic history.
- Appropriateness was assessed based on: carbapenem only susceptibility, culture with ESBL-producing organism, allergy precluded alternative therapy, subjective clinical worsening, simplification of antibiotic regimen, septic shock, and empiric treatment of bacterial meningitis.
- Data was analyzed using descriptive statistics

Results

Baseline Demographics

<table>
<thead>
<tr>
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<th>N = 55</th>
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<tbody>
<tr>
<td>Age, years, range</td>
<td>66 (33-83)</td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
</tr>
<tr>
<td>BCr, mg/dL, range</td>
<td>1.5 (0.4-4.34)</td>
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</tbody>
</table>

Inpatient Unit

- ICU: 17
- Medical Stepdown: 21
- General Medical: 11
- Medical Telemetry: 11

Length of Hospital Stay, days

Mean (range) 16.6 (2-80)

Patients on Mechanical Ventilation

8

Patients with Concurrent Diagnosis of COVID

Organism

- Escherichia coli: 17
- Pseudomonas aeruginosa: 10
- Klebsiella pneumoniae: 3
- Other*: 19

Indication

- Urinary Tract Infection: 27
- Pneumonia: 10
- Skin and Soft Tissue Infection: 8
- Osteomyelitis: 4
- Bacteremia: 4
- Peri-abdominal infection: 2

Duration, days

Mean (range) 11.7 (2-32)

De-escalation Based on Culture

Yes: 29

Assessment of Appropriate Use

<table>
<thead>
<tr>
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<th>N=55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive ESBL Infection, n (%)</td>
<td>19 (35)</td>
</tr>
<tr>
<td>Allergy, n (%)</td>
<td>8 (15)</td>
</tr>
<tr>
<td>Subjective Clinical Worsening, n (%)</td>
<td>13 (24)</td>
</tr>
<tr>
<td>Septic Shock, n (%)</td>
<td>3 (5.5)</td>
</tr>
<tr>
<td>Carbapenem Only Susceptibility, n (%)</td>
<td>2 (3.5)</td>
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<tr>
<td>Simplification of Antibiotic Regimen, n (%)</td>
<td>2 (3.6)</td>
</tr>
</tbody>
</table>

Secondary Outcomes

- In-hospital all-cause mortality, n (%) 5 (10)
- New Onset Multidrug-Resistant Organism, n (%) 1 (11)
- Readmission for Same Infection within 30 Days, n (%) 2 (9)
- Subsequent Carbapenem Resistance, n (%) 5 (9)

Limitations of the study include:
- Heterogeneity of prescribers
- Small sample size
- Study occurred during COVID-19 pandemic and delta-surge

Conclusion

- Overall appropriateness of meropenem use was 51%.
- Appropriate use based on culture and susceptibility was 65% whereas appropriateness of dosing regimen was 80%.
- Of those which were inappropriate, the most frequently identified reason for use was patients with a remote history of self-reported penicillin allergy.

Future Applications

- Targeted prospective audit and feedback with prescribers is necessary for appropriate use of meropenem.
- Provide nursing education and develop standard format to assist with review, clarification, and documentation of antibiotic allergies along with reported reactions.
- Results will be discussed with providers at upcoming Antimicrobial Stewardship subcommittee meeting.

References