Comparison of Drug Dosing Equations for Continuous Renal Replacement Therapy (CRRT)

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Background

- Continuous renal replacement therapy (CRRT) is a commonly used method for solute and fluid management in critically ill patients.
- Although many CRRT drug dosing guidelines have been published, none have been prospectively validated.
- Three different drug dosing equations have been published.
  - Equation A - Kroh
  
  \[ D = D_n x (P_r + (Q_s x S_r)/CL_r) \]
  
  - Equation B - Bugge
  
  \[ D = D_n x (1 - P_r) x C_{CL}(CL_{tot}) \]
  
  - Equation C - Reetze-Bonorden
  
  \[ D = D_n x [1 - ((Q_s x S_r)/(Q_s + C_{CL}(CL_{tot})) \]

- A prospective literature search was conducted to obtain pharmacokinetic parameters for 10 commonly used antibiotics:
  - Acyclovir, cefepime, daptomycin, fluconazole, gentamicin, levofloxacin, linezolid, meropenem, piperacillin, and vancomycin

- A hypothetical 70 kg patient with Acute Kidney Injury on CRRT with an effluent rate of 25 ml/min (23.3 ml/kg/hr) based on the KDIGO CRRT effluent rate recommendations was modeled.

- The antibiotic doses were calculated using three different CRRT drug dosing equations (Kroh, Bugge, and Reetze-Bonorden) and standardized to mg/day to facilitate comparison.

- Doses were compared to Aronoff et al book which was used as the reference comparator.

- Descriptive statistics were used to compare the calculated doses.

Methods

- To compare the four literature-based CRRT dosing recommendations for 10 commonly used antibiotics.

Recommended Antibiotic Doses by Different Dosing Resources

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Aronoff (mg/d)</th>
<th>Bugge (mg/d)</th>
<th>Kroh (mg/d)</th>
<th>Reetze-Bonorden (mg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>525</td>
<td>260</td>
<td>117</td>
<td>592</td>
</tr>
<tr>
<td>Cefepime</td>
<td>4,000</td>
<td>2,363</td>
<td>2,150</td>
<td>378</td>
</tr>
<tr>
<td>Daptomycin</td>
<td>280</td>
<td>242</td>
<td>328</td>
<td>386</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>400</td>
<td>225</td>
<td>640</td>
<td>386</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>120</td>
<td>94</td>
<td>113</td>
<td>98</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>250</td>
<td>370</td>
<td>319</td>
<td>328</td>
</tr>
<tr>
<td>Linezolid</td>
<td>1,200</td>
<td>770</td>
<td>797</td>
<td>1,526</td>
</tr>
<tr>
<td>Meropenem</td>
<td>3,000</td>
<td>1,477</td>
<td>1,227</td>
<td>1,899</td>
</tr>
<tr>
<td>Piperacillin</td>
<td>12,000</td>
<td>6,882</td>
<td>5,370</td>
<td>11,181</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>1,000</td>
<td>1,083</td>
<td>1,109</td>
<td>179</td>
</tr>
</tbody>
</table>

Results

- This study unveils a wide variability among antibiotic dosing recommendations from published CRRT dosing equations that can potentially lead to inappropriate pharmacotherapy.
- Limitations of the study include:
  - This study was not designed to show which method is best.
  - Dosing recommendation from Aronoff is based on an effluent rate of 33 ml/min.
  - Prospective evaluation of antibiotic dosing schemes with pharmacokinetic trials are needed.

Conclusions

- To compare the four literature-based CRRT dosing recommendations for 10 commonly used antibiotics.

References


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### Abstract

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### Methods

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