Adequacy of Prior Antibiotic Use in Patients with Clostridium difficile Infection: A Retrospective Analysis

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Abstract

Background

Clostridium difficile infections (CDI) are the main cause of healthcare associated diarrhea. Inappropriate use of antibiotics (AB) is a significant risk factor for CDI. It is estimated that up to 50% of all antibiotics prescribed may be unnecessary.1,2 The proportion of cases that could potentially be prevented through careful use of AB remains unclear. The aim of this study is to determine the proportion of CDI patients who received inappropriate AB therapy prior to developing CDI.

At the time of study, The Jewish General Hospital (JGH), a tertiary care hospital, had one of the highest nosocomial CDI incidence rates within the province of Québec.3 The commonly used broad-spectrum antibiotic is piperacillin/tazobactam. Patients initiated on this antibiotic are often left to complete 1-2 weeks of therapy despite culture sensitivity results.

Methods

This is a retrospective cohort study to assess the proportion of newly diagnosed CDI patients whose AB regimen could have been optimized prior to CDI episode at a tertiary medical center. The study population, identified through a Microbiology lab database, included patients with a first episode of CDI between February and May 2013 (n=50).

Each patient’s AB regimen, indications and culture results were reviewed using a standardized form. AB therapy was defined as inappropriate when 1 of the following were met: (1) absence of a clear and valid indication to initiate therapy; (2) deviation of initial empiric therapy from local recommendations; (3) inappropriate de-escalation or duration of therapy. Inappropriateness of AB was determined by a panel of experts in CDI and Antibiotic Stewardship (ASP).

Ethics approval was obtained before initiating the chart review.

Results

Table 1: Demographics

<table>
<thead>
<tr>
<th></th>
<th>Appropriate Ab (26)</th>
<th>Inappropriate Ab (24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (yr)</td>
<td>78</td>
<td>77</td>
</tr>
<tr>
<td>Median (yr)</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>46% (12)</td>
<td>58% (14)</td>
</tr>
<tr>
<td>Female</td>
<td>54% (14)</td>
<td>42% (10)</td>
</tr>
<tr>
<td>Antibiotic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prop-β-lactam</td>
<td>55% (15)</td>
<td>71% (17)</td>
</tr>
<tr>
<td>Antibiotic on day of CDI diagnosis</td>
<td>39% (10)</td>
<td>66% (16)</td>
</tr>
<tr>
<td>Received 1 or more AB within past 5 weeks</td>
<td>46% (12)</td>
<td>50% (12)</td>
</tr>
<tr>
<td>Received 1 or more AB within past 5 weeks</td>
<td>65% (17)</td>
<td>79% (19)</td>
</tr>
<tr>
<td>Duration of ABX courses</td>
<td>6.8 days</td>
<td>7.3 days</td>
</tr>
<tr>
<td>Median</td>
<td>4 days</td>
<td>6 days</td>
</tr>
</tbody>
</table>

Basic demographics as seen in Table 1. The inappropriate group contained more patients on a β-lactam, a greater proportion were on antibiotics on day of CDI diagnosis and more had received at least one quinolone or beta-lactam. Both the average and median duration of antibiotic courses were longer in the inappropriate group. The breakdown of antibiotic classes in the 5 weeks prior to CDI diagnosis are as follows:

Figure 1: Antibiotic Class Breakdown

- Carbapenems: 15%
- β-lactam: 19%
- Quinolone: 19%
- Other: 9%
- Reclassed: 11%

The 2 main antibiotic classes that contribute to CDI at our institution are quinolones and penicillins with β-lactamase inhibitor (Figure 1). It has been described elsewhere that these classes cause CDI at an odds ratio of 3.9 and 1.2 respectively.3

The 4 main indications for inpatient use of antibiotics are for the treatment of Pneumonia, UTI, cSSTI and OM, and as prophylaxis (Figure 2).

Results

Table 2: Breakdown of inappropriate antibiotic therapy

<table>
<thead>
<tr>
<th>Indication</th>
<th>Inappropriate AB (24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAP</td>
<td>54% (13)</td>
</tr>
<tr>
<td>UTI</td>
<td>38% (9)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>16% (4)</td>
</tr>
<tr>
<td>Other</td>
<td>10% (2)</td>
</tr>
</tbody>
</table>

The duration of CAP, HAP, Aspiration Pneumonia appear elevated. Both ABDominal infections and OM are >15 days as expected due to the severity of infection. (Figure 3)

The indications that mostly contribute to inappropriate use are Pneumonia, UTI and cSSTI (Figure 4).

Figure 2: Indications for Antibiotic Use

- Pneumonia: 34%
- UTI: 23%
- cSSTI: 19%
- OM: 11%
- Aspiration Pneumonia: 6%

Figure 3: Duration of Antibiotic based on Indication

<table>
<thead>
<tr>
<th>Indication</th>
<th>Duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAP</td>
<td>6.8 days</td>
</tr>
<tr>
<td>UTI</td>
<td>7.3 days</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>4 days</td>
</tr>
<tr>
<td>Other</td>
<td>6 days</td>
</tr>
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</table>


Results

Indication of antibiotic therapy.

- CAP: 54% (13) of patients
- UTI: 38% (9) of patients
- Pneumonia: 16% (4) of patients
- Other: 10% (2) of patients

Reasons for inappropriate antibiotic use include: lack of knowledge on the treatment of asymptomatic bacteriuria, clinicians feeling more comfortable with longer treatment durations rather than shorter ones, using a broad-spectrum antibiotic for dosing convenience rather than narrowing therapy.

Discussion

Our study demonstrates Pneumonia and UTI to be the most common indications associated with inappropriate antibiotic prescribing. This is in concurrence with multiple other studies.1,4,5


We wish to thank the following individuals:

- Anne Desmarais, RN
- Eve Cohen, MSc Pharm
- Ryan Kacser, MSc Pharm
- Jonathan Yee, MD

Acknowledgements

References


Figure 4: Inappropriate Antibiotic Use by Indication

- CAP: 54% (13) of patients
- UTI: 38% (9) of patients
- Pneumonia: 16% (4) of patients
- Other: 10% (2) of patients

We all call for a significant decrease in antibiotic prescribing overall in the treatment of asymptomatic bacteria. This can be achieved through a variety of treatments, including education, the development of new antibiotics and the implementation of a hospital-wide Antimicrobial Stewardship Program.

The need for Clinicians to be vigilant about infectious diseases and antibiotic therapy is crucial. Treatment guidelines are readily available to help facilitate appropriate antibiotic prescribing.

Discussion/Conclusion

Approximately 50% of patients who developed CDI had an inappropriate antibiotic prescribed.

Inappropriate antibiotic prescribing poses a serious threat at both the local and global levels as organisms develop resistance to commonly used antibiotics and contribute to the development of Clostridium difficile infections.

Although a small chart review, this study highlights the need for judicious use of antibiotics at our hospital through the implementation of a hospital-wide Antimicrobial Stewardship Program.

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