Carbapenemase-Producing Enterobacteriaceae (CPE)
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Objectives

- Differentiate the acronyms related to CPE (CPE, CPO, CRE, CRO)
- Discuss the incidence and prevalence of CPE in Peel and Ontario
- Identify risk factors for acquiring CPE
- Describe prevention strategies to combat CPE transmission
Definitions

- **Multi-Drug Resistant Organism (MDRO) or Antibiotic-Resistant Organism (ARO):** Bacteria that have become resistant to certain antibiotics so these antibiotics can no longer be used to control or kill the bacteria for example, MRSA, VRE, CPE, etc.

- **Carbapenems:** A class of broad spectrum antibiotics that are used for treating infection caused by resistant bacteria (e.g. ertapenem, meropenem, imipenem, doripenem)

Definitions

- **Carbapenemase Genes:** Genes, made up of DNA, that instruct the bacteria to make protein or enzyme called carbapenemase (genes: KPC, NDM, OXA, VIM, etc.)

- **Carbapenemase:** Enzymes that break down most antibiotics including carbapenems

- **Enterobacteriaceae:** A large family of bacteria present normally (part of gut flora) in the human intestinal tract or pathogenically (e.g., E.coli, Enterobacter, Klebsiella, etc.).
Acronyms: CPO,CPE,CRE,CRO

- C ➔ Carbapenems (antibiotics)
- R ➔ Resistant
- P ➔ Producing (carbapenemase enzyme)
- O ➔ Organisms
- E ➔ Enterobacteriaceae

Putting it All Together . . .

**CRO**

Carbapenem Resistant Organism ➔ Any organism resistant to carbapenems antibiotics by a variety of ways, e.g., mutation, inherent resistance, and by production of carbapenemase (enzyme which breaks down antibiotics)

**CRE**

Carbapenem Resistant Enterobacteriaceae ➔ Enterobacteriaceae that are resistant to carbapenems by mutation, inherent resistance, or production of carbapenemase (enzyme which breaks down antibiotics)
Putting it All Together . . .

CPO
Carbapenemase Producing Organism ➔ Any organism resistant to carbapenems by producing carbapenemase (enzyme which breaks down antibiotics)

CPE
Carbapenemase-Producing Enterobacteriaceae ➔ Enterobacteriaceae that are resistant to carbapenems by producing carbapenemase (enzyme which breaks down antibiotics)

What is C-3PO?

Image source: https://en.wikipedia.org/wiki/C-3PO
Mechanisms of Antimicrobial Resistance

Is CPE a problem here?

Incidence of CPE in Peel and Ontario

Figure 3: CPE positive isolates by Local Health Integration Network (LHIN) in Ontario, January-December 2015 (n=70)

Source: Public Health Ontario Laboratories, Carbapenemase-producing Enterobacteriaceae database, extracted by Public Health Ontario (2016/11/14)
Prevalence?
Percentage of Ontario CPE Isolates in Peel LHINs (CW & MH)

Source of Isolates

Table 1: Number and proportion of CPE isolates by source of submission in Ontario, January-December 2015

<table>
<thead>
<tr>
<th>Source of submission</th>
<th>No. of CPE positive isolates</th>
<th>Proportion of all positive isolates (%)</th>
<th>Total submitted isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large community hospital</td>
<td>50</td>
<td>86</td>
<td>364</td>
</tr>
<tr>
<td>Acute teaching hospital</td>
<td>10</td>
<td>14</td>
<td>97</td>
</tr>
<tr>
<td>Community laboratory</td>
<td>NA</td>
<td>NA</td>
<td>165</td>
</tr>
<tr>
<td>Small community hospital</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Complex Continuing Care &amp; Rehabilitation</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>100</td>
<td>631</td>
</tr>
</tbody>
</table>

Source: Public Health Ontario Laboratories, Carbapenemase-producing Enterobacteriaceae database, extracted by Public Health Ontario [2016/03/14]
Risk Factors for Acquiring CPE

- Receiving healthcare outside of Canada, specifically in areas that have high prevalence of CPE for example, Greece, Israel, Eastern US, and **Indian subcontinent**
- Prolonged hospital stay
- Admission to ICU
  - Ventilation
  - Surgery
  - Infection

Risk Factors for Acquiring CPE (continued)

- Male
- > 60 years old
- Patient/residents with an **indwelling device** such as central venous catheter or urinary catheter
- Multiple exposure to different **antibiotics**
  - Poor **functional status**: 
    - Diabetes mellitus
    - End stage renal disease
    - Cancer/chemotherapy
How is CPE Spread?

- Most people who have CPE present with no symptoms of infection and are said to be colonized.
- Primary site of colonization is the lower gastrointestinal tract.
- CPE can be spread from one person to another by unwashed hands (direct contact) or from contact with contaminated equipment and surfaces (indirect contact).
- Infection occurs when CPE enters the body at a specific site and causes symptoms of disease for example, pneumonia and UTI.
- CPE is resistant to many types of antibiotics hence treatment can be difficult and may involve antibiotics which have significant side effects.

Why is CPE a Concern?

- CPE infections have limited treatment options.
- Can contribute to death in up to 50% of infected patients.
- Highly transmissible leading to serious infection control implications.
It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

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Follow up screening (rectal swabs) of 97/137 CRE patients post-discharge

Time to clear – mean 387 days (95% CI; 312-463)
Preventing the Spread of CPE

- Routine practices
- Contact precautions for CPE positive patients
- Cohorting
- Minimize use of invasive devices
- Promote antibiotic stewardship
- Screening

Routine Practices

Including:

- Point of care risk assessment
- Hand hygiene - 4 moments
- Dedicate equipment where possible. Clean and disinfect shared equipment between patients/residents
- Environmental cleaning*
Contact Precautions

- Single room or cohort with someone with the same organism
- Dedicated toilet/commode
- Dedicated equipment
  - Wheelchair
  - Feeding pump
  - BP cuff
  - Stethoscope
- Gowns and gloves for care
- Environmental cleaning – attention to sinks

Preventing the Spread of CPE (continued)

- Dedicated hand hygiene sinks for hand washing only. Body fluids and bath water should not be disposed in these sinks
- Bathing with chlorhexidine
- Contact screening: minimum 3 sets of specimens taken on different days, with at least one taken 21 days after last exposure
Protecting Yourself from CPE

- Avoid unnecessary exposures to health care measures in endemic countries
- Inform your healthcare professional if you had a medical procedure done recently while travelling to an endemic country
- Take antibiotics as prescribed
- Clean your own hands especially before preparing or eating food, before and after wound dressings, after using the bathroom, after coughing or sneezing
- Note: Health care workers have NOT been found to be at increased risk of CPE acquisition in the workplace – use RPAPs

Scenario 1

The hospital is asking that your Home accept a new resident who has CPE.
- Are you obliged to accept this resident?
  - Why or why not?
Scenario 2

A resident returns from hospital with a recent history of a CRO in her urine.

- What precautions and actions should you initiate?

Scenario 3

You are the charge nurse at a LTCH. You receive a call from the local hospital to say that Mrs. Brown (87 years old) is returning back to the home now that she has recovered from pneumonia.

Mrs. Brown is incontinent of stool and requires total care. Two days after her transfer to LTCH, an ICP from the hospital calls to inform you that Mrs. Brown tested positive for CPE on a swab taken just before transfer to your Home.

a) What would be your first steps to prevent CPE from spreading?

- Contact Precautions
- Adherence to hand hygiene and PPE
- Environmental cleaning
- Ensuring shared equipment in between residents is being disinfected
- Private room
- Residents in close proximity should be screened for CPE (minimum 3 sets of specimens taken on different days, with at least one taken 21 days after last exposure)
Scenario 3 - continued

b) Mrs. Brown’s daughter asks if she can take her mother out for a walk. How would you response to this request?

Mrs. Brown can leave her room but the nurse should assist with hand hygiene before and after entering her room. In addition, the nurse should ensure that Mrs. Brown’s clothes are clean; body fluids are contained and any lesions are covered.
Key References


Additional References


Additional References

