Carbapenemases – Containing the Threat

Antimicrobial resistance (AMR) occurs when microbes develop resistance to antibiotics. The significant global impact on human health has been highlighted by the World Health Organization (WHO), Center for Disease Control (CDC), and the Public Health Agency of Canada (PHAC). A recent expert panel endorsed by PHAC, “When antibiotics fail” sounds the alarm on the negative health, economic and social impact of AMR (1). Although AMR can occur in nature, the rate of resistance has increased significantly, driven by antibiotic over-use. Resistance to carbapenems, a broad-spectrum antibiotic that was previously held in reserve to treat drug resistance due to extended spectrum β-lactamases (ESBL), has recently emerged and is now a global threat. Antimicrobial resistance including carbapenemase-producing Enterobacteriaceae (CPE) has been identified by the WHO as one of the ten greatest threats to global human health (2).

Epidemiology in Ontario
CPE were first detected in Ontario in 2008. A recent population based surveillance of Toronto and Peel found an increase in incidence of all CPE infections from 0 before 2007 to 0.33 cases/100,000 population in 2015 (3). Class B metallo-β-lactamase NDM family enzyme was the most common and was associated with travel to the Indian subcontinent. NDM-1 was initially detected in a patient of Indian origin in 2007, and has disseminated widely in India. The second most common CPE was Class A serine-β-lactamase KPC family enzyme. KPC has been associated with ICU outbreaks, and is now endemic in parts of Europe, South America, North America and the Middle East (4). Class D OXA-48 like were also detected.
and were associated with healthcare or travel outside of Canada. Concerning was that KPC and VIM acquisition was not associated with travel or healthcare abroad, and most likely was acquired in hospitals in Canada.

The direct impact of AMR on mortality is significant. In Canada in 2018, 25% of infections were resistant to first line antibiotics and approximately 40% of patients who died with resistant infections would likely have survived if the infection was not due to AMR (1). Preventing the spread of AMR requires a multi-faceted approach combining accurate and rapid laboratory detection and robust infection control programs. Recently, detection of CPE became a reportable disease and must be communicated to Public Health, highlighting the importance and priority to contain CPE.

**Laboratory Methods**

Surveillance for intestinal carriage of CPE requires a sensitive method to detect low amounts of organism, low level carbapenem resistance, and must be timely and cost efficient. The HRLMP microbiology laboratory has evaluated several chromogenic media. Chromogenic media are composed of an enzyme substrate that releases a pigment when hydrolyzed by certain bacteria. In addition, antibiotics are added to selectively grow resistant organisms.

Since 2015, the HRLMP has been using a chromogenic media to enhance detection of CPE from rectal swabs and recently changed to SuperCARBA agar in early 2019. Validation data showed Supercarba agar to have a better sensitivity (100%) and specificity (99%) than other media.

Identification of the type of carbapenemase (e.g., KPC versus NDM) was previously performed on cultures using a phenotypic method that required an additional 16-18 hours incubation and was limited to detection of Class A versus B carbapenemases. A new lateral flow assay, Carba5 was evaluated and provides a result in 15 minutes and is able to differentiate between KPC, OXA, VIM, IMP and NDM genes. The test is highly sensitive, specific and can be done directly from the SuperCARBA agar, improving the reporting time.

Rapid reporting of the type of carbapenemase is important for infection control and epidemiology, but is also increasingly important to help guide treatment. Antimicrobial choices are limited for CPE. Newer agents such as ceftazidime-avibactam are frequently susceptible against Class A KPC and Class D OXA but are not effective against Class B NDM (5).

**Enhanced surveillance for CPE**

In Hamilton, we currently screen for ESBL/CPE infected patients if they have been hospitalized outside of Canada in the past year. An analysis of CPE outbreaks in Ontario revealed that the strongest risk factor for CPE colonization or infection was previous hospitalization in Ontario, and up to half of colonized patients are missed with the current out-of-country screening strategy (6). The Provincial Infectious Diseases Advisory Committee (PIDAC) is currently soliciting feedback on recommendations to expand CPE screening on hospital admission. Enhanced, risk-based screening strategies will roll out in early 2020, and help prevent hospital-acquired CPE outbreaks.
Summary
The emergence and spread of CPE is a global health threat. HRLMP combines the use of a sensitive and specific chromogenic agar with a new lateral flow assay for the rapid detection and reporting of CPE from rectal swabs. In conjunction with the implementation of enhanced screening strategies in 2020, the incidence of CPE will hopefully be contained.

Submitted by:
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References:

News from Administration

After 46 years with Hamilton Health Sciences, St. Joseph’s Healthcare, and HRLMP, our Quality Manager, Cathie McCallum, retired on January 2, 2020.

Cathie has had an immense influence on the development of our Quality Management Systems, and has impacted our test quality, point-of-care testing, and successful accreditations over many years.

She leaves behind an incredible legacy of people and processes committed to excellent patient laboratory diagnosis, and her influence will live on long after her departure.

We wish her a well-deserved retirement, and enclose a letter of thanks that incorporates comments from many HRLMP staff.

Thank You, Cathie!

Click on the link below to read the full announcement:
C. McCallum Retirement announcement_Dec 13, 2019.pdf
It is with heavy hearts that we announce the passing of Kathy Rooke, MLT in the McMaster Core Laboratory, on Sunday November 24th, 2019, after a valiant battle with cancer.

Kathy will always be remembered for her positive attitude. She made everyone’s day brighter and her laughter was something her co-workers looked forward to. Kathy had a wonderful way of telling stories that drew people in and often resulted in laughter.

The announcement and Kathy’s obituary are available on the links below.


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Education News

On Saturday November 23rd, 2019 the HRLMP hosted its 12th annual Rapid Fire Showcase “Building the Future Together”.

As in previous years, the event was a great success!

A tremendous thank you to all of our presenters who made the event such a wonderful learning experience for everyone: Natalie Daily, Jeannette Gauthier, Bruce Young, Jayne Clemens, Bett Hohenadel, Felicia Dollinger, Brenda Helpard, Janice Kariatsumari, Kelly Lightfoot, Tim Kulikowski, Candy Rutherford, Stacey Nezic, Linda Mattina and Suzanne Kort.

At the end of the event, we asked attendees to describe the event in just one word to create the word cloud above.

A special thank you to our breakfast and break sponsors, Instrumentation Laboratory and Ortho Diagnostics.

We hope to see everyone at Rapid Fire Showcase 2020!

Hematology News

Dr. Jeff Weitz presenting the Ernest Beutler Lecture as Prize winner for Clinical Science/Translational Research at the 61st Annual American Society of Hematology (ASH) meeting in Orlando, Florida, December 9, 2019.
**ASH** ran December 7 to 10, 2019 in Orlando, Florida and the HRLMP and Hematology were well represented once again this year. **Congratulations!**

**Dr. Cheryl Main** will take on the role of Head of Bacteriology. **Dr. Daniela Leto** will take on the role of Head of Virology. **Dr. Deb Yamamura** will take on the challenges of Acting Microbiology Discipline Director after her years as Head of Bacteriology. She will continue as Head of Mycology.

**Congratulations** to all!

To read the full announcement, please click on the link below:

J:\HRLMP_CoreLab\Microbiology Leadership memo 2019-12-12.pdf

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**Quality News**

‘**Quality Leads’ Team celebrates one-year anniversary**

The Quality Leads (QL) team first met in December 2018 and recently celebrated its one-year anniversary!

The team is composed of representatives from each major laboratory discipline from each site, with most members being senior MLTs. QL team members act as a quality resource and liaison.

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**Microbiology News**

There have been some important changes in the HRLMP’s Microbiology laboratory leadership.

**Congratulations** to **Dr. Shuoyan Ning** for being awarded the **AABB Outstanding Abstract Award** for Trainees!

The abstract was titled, "**An Evaluation of the Clinical Impact of 7 Day Platelets**". 
Lab Connections

between the Quality department and their respective laboratories.

The QL team members differ in technical expertise, years of experience and working environments. This diversity encourages valuable conversation about how processes are carried out in different disciplines, including what has worked well with respect to continuous quality improvement initiatives.

Over the past year, the QL team has been working towards improved consistency in how change is managed across the laboratory program, as well as engaging in activities to prepare for the Spring 2020 IQMH Accreditation visit. A significant focus has been revamping the HRLMP Training Process to ensure that staff members receive a positive training experience and that proper training records are maintained. Through providing input about the preexisting training system and the development of training document ‘Master Lists’, the QL team has helped move this initiative forward.

The QL team meets monthly; meeting minutes are available for all staff to view in Paradigm. Location: e) Records>a) Records for Quality Systems>a) Organization>Quality Leads Team

Submitted by:
Anna Haase, HRLMP Quality Specialist
Susie Maia-Castellan, HRLMP Quality Specialist

Research News

A study led by McMaster University’s Dr. Clive Kearon with translation by Dr. Kerstin de Wit has identified a better way to interpret blood tests, reducing the need for CT scans to diagnose pulmonary embolism. Testing for this condition will decrease by one-third.

It is great news for patients and the health system.

Click on the link below to access this NEJM article: https://www.nejm.org/doi/full/10.1056/NEJMoa1909159?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dpubmed

Congratulations to Dr. James Douketis for being awarded the American College of Physicians Laureate Award for distinguished contributions to research.

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