The Role of Clinical Microbiology laboratory in Detection and prevention of Nosocomial Infections

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Introduction

Nosocomial Infections or Health care-associated infections (HAIs) represent one of the most common of care, affecting 5 to 10% of patients admitted to acute-care hospitals worldwide.
Introduction

Preventing infections requires the ability to detect them when they occur and the clinical microbiology laboratory (CML) a key role in HAI prevention.
Briefly Some of the major roles played by the CML in infection prevention include:

(i) Drug resistance surveillance,
(ii) Outbreak detection and management,
(iii) Antimicrobial stewardship,
(iv) Member of the infection control committee
(v) Education.
Surveillance

- **Review of CML data remains** the most common method for case finding in HAI surveillance; therefore, the most important role of the CML is to promptly and accurately detect nosocomial pathogens and their antimicrobial resistance patterns.
Surveillance

The CML must also work with the infection prevention program (IPP) and the information technology (IT) department to determine how microbiology data are delivered and linked to other surveillance data to streamline this process.
Surveillance

- Major surveillance challenges facing the CML include the continued emergence of novel infectious agents (e.g., the 2009 H1N1 influenza A virus), novel antimicrobial-resistant pathogens (e.g., vancomycin-intermediate/resistant *Staphylococcus aureus* [VISA/VRSA], VRE carbapenem-resistant Enterobacteriaceae).

- Finally, CML to provide rapid test results. As results, hospital lengths of stay decrease.
Rapid Diagnostic Tests

ProCalcitonin
- Cacitonin precursor peptide that becomes elevated in bacterial infection (half life 20-24 hrs) - Expensive

Organism Detection/Identification/Resistance
- Peptide Nucleic Acid-Fluorescence In Situ Hybridization (PNA-FISH)
  - Bacterial 16SrRNA
  - meca
- qPCR (Singleplex, Multiplex)
- MALDI-TOF MS
- Nucleic Acid Microarray
Outbreak detection and management

The CML has important roles to play in any potential outbreak situation and including:

1- Early recognition of possible clusters and outbreaks.

2- Rapid notification of and collaboration with the IPP,

3- Additional case finding, and provision of molecular typing such as PFGE, RFLP, …….. for determination of relatedness, which requires maintenance of an organism bank.
Outbreak detection and management

- The laboratory should also act:
  In a consultative capacity with the IPP to help determine whether an outbreak is “real” or a potential pseudo-outbreak due to contamination of specimens outside or within the laboratory.

- In addition, the laboratory can help generate hypotheses as to the potential source of an outbreak, its reservoir, and its mode of spread, through molecular typing of the suspected organisms and through testing the environment and/or personnel as necessary.
Antimicrobial stewardship

Every hospital must now have an antimicrobial stewardship program, guidelines for which have been published by the Infectious Diseases Society of each country and the Society for Healthcare Epidemiology.
What is Antimicrobial Stewardship?

- Systematic approach to optimize clinical outcomes while minimizing consequence of antibiotic use
  - Toxicity
  - Selection of resistance
  - Selection of virulent organisms
  - Clostridium difficile
- Combine with comprehensive infection control to limit emergence and transmission of resistance
- Reduce healthcare costs without adversely impacting care

Dellit T et al. Clin Infect Dis 2007; 44: 159-177
Guidelines to develop an institutional Antimicrobial Stewardship Program (ASP)

- Antimicrobial Stewardship committee
- Computer surveillance and decision support software
- **Proactive microbiology lab**
- Monitoring of process and outcomes measures
- **Elements of an ASP**
  - Active Strategies
  - Supportive Strategies

2007 ASP Guidelines. *CID*. 159-177
Goals of Antimicrobial Stewardship

1. Combat the Emergence of Resistance
2. Control Costs
3. Improve Clinical Outcomes

Antimicrobial Stewardship

Antimicrobial stewardship

- Antimicrobial stewardship efforts are directly dependent on reports from the CML, so good communication between the laboratory, pharmacy, IPP, and a stewardship team is essential. For guiding empirical antimicrobial therapy, unit-specific and tailored antibiograms should be updated on a regular basis and provided to clinicians at the bedside.
Antimicrobial stewardship

- Such antibiogram data
- Can be used for evaluation of trends in important antimicrobial resistance rates
- Education of clinicians regarding optimal antimicrobial use.
- For guiding directed antimicrobial therapy, patient-specific culture and susceptibility data are needed. This allows for a prospective audit of antimicrobial use with feedback to the prescriber.
Antimicrobial stewardship

- A major challenge to effective stewardship is an inability to obtain antimicrobial susceptibility data from the CML in a timely and efficient manner. Reducing the analytic turnaround time is only the starting point, however.
Antimicrobial stewardship

- The data then have to be incorporated quickly into antimicrobial management, which often cannot be done if laborious chart reviews are required for each patient on antimicrobial therapy.
Antimicrobial stewardship

- **Computer** decision support systems can solve this problem by automatically identifying potential opportunities to optimize therapy, using real-time analysis of data from several sources (e.g., pharmacy, electronic medical record, and laboratory...
Infection control committee participation

- It is paramount that the clinical microbiologist participates on the infection prevention/control committee and acts as a consultant to infection preventionists. Clinical Microbiologist is the best person to provide expertise in the interpretation of culture results, advice about the utility of microbiological approaches to an infection control problem, and input regarding the CML resources needed to accomplish the goals of the committee.
Infection control committee participation

- Clinical microbiologist describe how changes in the methods used for detection, identification, and susceptibility testing of nosocomial pathogens will impact the IPP.
Infection control committee participation

- The benefits of close collaboration and interaction between the CML and the IPP are difficult to measure but are real. One large survey of CML directors found that those hospitals with CML directors on the infection prevention/control committee were more likely to have CML involvement in formulary decisions, to produce an annual antibiogram, and to provide molecular typing support.
Education

- CMLs also play an essential role in the education of future epidemiologists and infection preventionists. Most hospital epidemiologists are trained in infectious diseases (though some are also laboratorians and CML directors). The ACGME requirements for training in infectious diseases require structured clinical microbiology training, and infection preventionists also require microbiology training.
Thank you