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Review

Antimicrobial susceptibility in hospitals in Hong Kong: The current status 2009–2011

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ABSTRACT

Hospitals in Hong Kong, like many hospitals in the world, are constantly challenged by the increasing rate of non-susceptible and multidrug-resistant organisms (MDROs). Accurate and timely surveillance is essential for effective control. The Hospital Authority of Hong Kong has developed a comprehensive antimicrobial susceptibility monitoring system that utilises data obtained from all of its 38 hospitals. In this review, the susceptibility pattern of more than 320 000 isolates covering the period 2009–2011 will be discussed. Special attention will be paid to MDROs.

Contents

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1. Introduction

Hong Kong is one of the most densely populated areas in the world. In mid-2010, the population was 7 067 800, with 0.21 million mobile residents. The population density stood at 6540 persons/km^2 [1]. On the other hand, Hong Kong relies heavily on imported food products; in 2011, local food production accounted for 2.3% of fresh vegetables, 57.0% of live poultry and 7.0% of live pigs consumed in the territory [2]. The driving force of antibiotic pressure in hospitals is a mirror of the region's overall situation: overcrowded, mobile and with constant challenges from outside the territory. The Hospital Authority had been fighting antibiotic-resistant organisms with the strategy of 'find and confine', an antibiotic stewardship programme, active surveillance of antimicrobial susceptibility, and real-time risk communications. The Chief Infection Control Office (CICO) of the Hospital Authority liaises with all of the Hospital Authority's Infection Control Officers to ensure that infection control practices are performed to high standards. One of the CICO's major tasks is the control of multidrug-resistant organisms (MDROs). The CICO utilises the Hospital Authority's corporate-wide information technology system to monitor the susceptibility pattern of all micro-organisms handled by the laboratories of the Hospital Authority. We have also created a comprehensive MDRO surveillance system with a user-friendly output format—the MDRO Super Bug Report. In this review, more than 320 000 isolates covering the period 2009–2011 were analysed. Particular attention was paid to MDROs. These data are further supplemented with update literature.

2. Materials and methods

All of the data are based on laboratory results retrieved from the Hospital Authority's Clinical Data Analysis and Reporting System (CDARS). Two sets of data were retrieved in this review. The first set concerns the antibiotic susceptibility patterns of different organisms. Data were retrieved from eight acute-care hospitals in Hong Kong, including Pamela Youde Nethersole Eastern Hospital, Queen Mary Hospital, United Christian Hospital, Queen Elizabeth Hospital, Princess Margaret Hospital, Kwong Wah Hospital, Prince of Wales Hospital and Tuen Mun Hospital. All isolates from all sites with a collection date from 1 January 2009 to 31 December 2011 were included. The method of de-duplication was performed according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) [3]. Only clinical isolates were included in this analysis.

The second set was the MDRO data, including meticillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), carbapenem-resistant Enterobacteriaceae (CRE), extended-spectrum β-lactamase (ESBL)-producing *Escherichia coli* and *Klebsiella* spp., multidrug-resistant *Acinetobacter* spp. (MDRA), carbapenem-resistant *Acinetobacter* spp. and multidrug-resistant *Pseudomonas aeruginosa* (MRPA). Data were retrieved from all 38 Hospital Authority's hospitals by the Hospital Authority's CDARS. Isolates collected between 1 January 2011 and 31 December 2011 were analysed. De-duplication was the same as for antibiotic susceptibility pattern data. Both clinical and surveillance isolates were included in the current MDRO analysis.

Differences in percentage susceptibility were analysed by the two one-sided test procedure. A difference of <5% was arbitrarily set as unimportant [4].

3. Results

3.1. Enterobacteriaceae

3.1.1. Escherichia coli

E. coli remained largely susceptible to amikacin (98.7–98.9%) and imipenem (100%). On the other hand, only a minority of strains were susceptible to ampicillin (27.4–28.8%) and cefuroxime (oral/axetil) (49.1–52.9%). *E. coli* were only moderately sensitive to amoxicillin/clavulanic acid (AMC) (74.7–75.7%), gentamicin (70.2–71.4%), levofloxacin (66.8–70.3%) and cefotaxime (67.0–75.6%). There was a significant decreasing trend for cefotaxime susceptibility from the three years surveyed (from 75.6% to 67.0%). The trend was observed both in blood isolates (from 75.6% to 72.4%) and non-blood isolates (from 75.1% to 65.7%). A similar but non-significant trend of decreasing susceptibility was also observed for levofloxacin (from 70.3% to 66.8%; blood isolates from 67.4% to 67.3%; and non-blood isolates from 70.3% to 66.6%) (Table 1).

3.1.2. Klebsiella *spp.*

Klebsiella spp. were generally less susceptible than *E. coli*. The *Klebsiella* spp. tested were only moderately susceptible to AMC (75.8–78.1%). The drop in susceptibility to cefotaxime and levofloxacin in *E. coli* was also seen in *Klebsiella* spp. The percentage of *Klebsiella* spp. susceptible to cefotaxime dropped from 84.1% to 77.7%. However, the degree of drop in percentage susceptibility to levofloxacin among *Klebsiella* spp. (from 89.4% to 89.1%) was not as prominent as in *E. coli*. The *Klebsiella* spp. isolates remained largely sensitive to amikacin (99.0–99.3%), gentamicin (92.9–93.5%) and imipenem (99.7–99.9%) (Table 1).

3.1.3. Carbapenem-resistant Enterobacteriaceae

CRE are rare but not unknown in Hong Kong. In 2009, the public health reference laboratory received 18 enterobacteria isolates that were shown to be non-susceptible to carbapenems from various hospitals in the region, of which 4 were confirmed to produce carbapenemase [IMI-3 (n = 1), IMP-4 (n = 2) and NDM-1 (n = 1)] [5].

Data gathered from the MDRO Super Bug Report in 2011 showed that the prevalence of CRE was 0.6% (681/117 287) (Table 2). Among all of the CRE isolates, 20 were confirmed carbapenemase-producers. The molecular mechanisms were diverse and as follows: NDM (n = 2); KPC (n = 4); IMI (n = 1); IMP (n = 10); NDM + IMP (n = 1); VIM (n = 1); and KPC + VIM (n = 1). Moreover, 50% were imported and 50% were indigenous. One-half were from clinical specimens [urine (n = 3), sputum (n = 4), bile (n = 2) and pus swab (n = 1)] and the other one-half were from screening specimens by rectal swabs.

3.2. Non-fermenting Gram-negative bacilli

3.2.1. Pseudomonas aeruginosa

P. aeruginosa isolates recovered were generally susceptible to all of the antibiotics tested [amikacin (98.6–99.0%), ceftazidime (97.3–97.7%), ciprofloxacin (91.9–92.3%), gentamicin (96.8–97.6%) and imipenem (97.0–97.3%)].

There were occasional multiresistant strains. MRPA is defined in the database as follows: any *P. aeruginosa* isolate that is concomitantly resistant to the 12 antibiotic indicators from the five antibiotic classes. The organisms should be resistant to all five antibiotic classes concomitantly, providing at least one antibiotic indicator in each class has been tested to be resistant.

The five antibiotic classes and the indicator antibiotics were as follows: cephalosporins [cefepime, ceftazidime and cefoperazone/sulbactam (CPS)]; aminoglycosides (amikacin and gentamicin);