

NOSOCOMIAL INFECTIONS – THERAPEUTIC CHALLENGES

Nosocomial infections occur as a result of treatment in a hospital or a health care service unit, but secondary to the patient's original disease. Infections are considered nosocomial if they first appear 48 hours or more after hospital admission or within 30 days after discharge. Nosocomial is a greek word – *nosokomeion* meaning hospital (*nosos*=disease, *komeo*=to take care of). This type of infection is also known as a **hospital acquired infection** or more generally **health care associated infections (HAI)**. HAI's are inherent dangers of modern therapy especially for the critical ill patient in the ICU and lead to increased morbidity, mortality and costs. Increased incidence of nosocomial infections is due to chronic overcrowding in the hospitals, movement of medical staff from patient to patient providing a way for pathogens to spread, poor sanitation, underfunding, many medical procedures bypassing the body's natural protective barriers and emergence of antimicrobial resistance. Thorough hand washing and/or use of alcohol rubs by medical personnel before each patient contact is one of the most effective ways to combat nosocomial infections. More careful use of antimicrobial agents is also considered vital. In 1990 it was estimated that 5267 million population lived in developing countries. Of the 39.5 million deaths in developing countries, 9.2 million were estimated to have been caused by infectious diseases. The frequency distribution of major types of HAI is: UTI-28%, surgical wound infection -17%, pneumonia-17%, bacteraemia usually with intravascular devices 16% and others 20%. MS Magazine reports that as many as 92% of deaths from hospital infections could be prevented². The most common nosocomial infections are of the urinary tract, surgical site and various pneumonias³. Micro organisms are *transmitted* in the hospital by *five main routes* – *contact* (direct and indirect), droplet, airborne, common vehicle and vector borne. Direct contact transmission involves a direct body surface to body surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person, such as occurs when a person turns a patient, gives a patient a bath or performs other patient – care activities that require direct person contact. Direct contact transmission also can occur between two patients, with one serving as the source of infectious microorganisms and the other as a susceptible host. Indirect contact transmission involves, contact of a susceptible host with a contaminated intermediate object, usually contaminated needles, instruments or gloves. *Droplet* transmission occur when droplets are generated from the source person mainly during coughing, sneezing and talking and during the use of procedures like bronchoscopy. Airborne transmission occurs by dissemination of either airborne droplet nuclei of evaporated

droplets containing microorganisms which remain suspended in the air for longer periods. Common vehicle transmission applies to microorganisms transmitted to the host by contaminated items such as food, water, devices etc. *Vector* transmission occurs when vectors like flies, mosquitoes transmit microorganisms. *Antibiotic resistance* with some microorganisms has become a worldwide concern. After Worldwar-II, penicillin resistance among gonococci and staphylococcal strains were first noted⁴. Methicillin resistant *Staphylococcus aureus* (MRSA) emerged in 1970's. Aminoglycoside resistant *Pseudomonas aeruginosa* was noted after widespread use of gentamicin while ceftazidime-resistant and ciprofloxacin-resistant *P.aeruginosa* remains a concern today. There has been a rapid increase in antibiotic resistance among respiratory microorganisms. Penicillin resistance in *Streptococcus pneumoniae* has increased in an epidemic manner in the past 10 years^{5,6}. Previously *Enterococcus faecalis*, now *Enterococcus faecium* has emerged commoner pathogen and it constitutes nearly all vancomycin-resistant enterococci (VRE) strains. This is not an example of increasing antibiotic resistance but rather a change in the selective pressures of the fecal flora favouring the widespread emergence of VRE as a colonizer⁷. Various factors leading to antibiotic resistance (AR) include antibiotic misuse or agent specific AR etc. A study has shown that low serum drug levels may be associated with an increased risk of selecting resistant mutants for a variety of bacteria⁸. Regarding agent specific antibiotic resistance, among the third generation cephalosporins, only ceftazidime has been associated with resistant *K.pneumoniae*, *Enterobacter* and *P.aeruginosa*, all other third generation cephalosporins have not been associated with significant resistance problems with these or other organisms^{9,10}. Similarly among aminoglycosides, gentamicin¹¹ and among fluoroquinolones, ciprofloxacin¹², have been associated with significant resistance to various organisms. So the usual recommendation is change of ceftazidime with cefepime, ciprofloxacin with levofloxacin, imipenem with meropenem and gentamicin with amikacin. As neither volume or duration of antibiotic use is a determinant or predictor of antibiotic resistance, there is no rationale for reserving an antibiotic with little or no resistance potential for further use¹³.

Prevention of hospital infection is essential by a big policing operation and consists of **infection control programme**. The *core committee* consists of a physician, a surgeon, a senior nurse, microbiologist and representatives from the operation theatres, CSSD and ICUS. Inputs are also required from others like housekeeping, laundry, food services and engineering, who work as a team to maintain the hygiene and cleanliness of the institution.

The committee performs three main functions: (i) The *first function* is to collect data regarding high risk areas such as ICUs, operation theatres, dialysis units and oncology services. Good microbiology laboratory is necessary to isolate organisms and also to indicate to clinicians trends and changes in hospital flora. For example **methicillin resistant staphylococcus aureus (MRSA)** has been a feared hospital pathogen in the past decade but is now overtaken by organisms such as E.coli and Klebsiella that secrete extended spectrum betalactamases (ESBL). MRSA is a bacterium responsible for difficult to treat infections in humans so that they are resistant to large group of antibiotics called betalactams. MRSA has evolved an ability to survive treatment with betalactamase resistant beta-lactam antibiotics, including methicillin, dicloxacillin, nafcillin and oxacillin. A 2007 report on Emerging Infectious Diseases, a publication of the Center for Disease Control and Prevention (CDC), estimated that the number of MRSA infections treated in hospitals doubled nationwide from approximately 127000 in 1999 to 278000 in 2005 while at the same time deaths increased from 11000 to more than 17000¹⁴. Mortality in MRSA is higher as compared to methicillin susceptible Staphylococcal aureus (MSSA) bacterium¹⁵. Staph.aureus most commonly colonizes the anterior nares (the nostrils), although respiratory tract, opened wounds, intravenous catheters and urinary tract are also potential sites for infection. MRSA can be detected by swabbing the nostrils of patients and isolating the bacteria found inside. Many people who are symptomatic present with pus filled boils and occasionally with rashes. In this issue, Majumdar Devjyoti et al in their article "Prevalence of nasal carriage of methicillin resistant staphylococci in healthy population of Gangtok, East Sikkim" recruited 280 apparently healthy adults out of which 247 (88.2%) subjects showed positive for staphylococcus and 31 (24%) subjects reported positive nasal swabs among those positive for S.aureus. The prevalence of MRSA in their study has been reported to be 11.1% which is of great concern. Vancomycin and teicoplanin are glycopeptide antibiotics used to treat MRSA infections and are given intravenously. Several newly discovered strains of MRSA show resistance even to vancomycin and teicoplanin and respond to linezolid, quinupristin/dalfopristin, daptomycin and tigecycline¹⁶. MRSA infections can be treated with oral agents including linezolid, rifampicin+fusidic acid, rifampicin and fluoroquinolone, prisinamycin, co-trimoxazole, doxycycline or minocycline and clindamycin¹⁷. Recently a new antibiotic-platensimycin and maggot therapy has been found to be successful to treat MRSA.

(ii) The *second function* of the infection control committee is to carryout surveillance at the local level, national/international level in order to understand the magnitude of the problem and to assess the impact of interventions in containing antimicrobial resistance. Public awareness, education of health care professionals is the need of hour with regard to prevention of antibiotic resistance. (iii) The *third function* of the committee is to enforce good infection control practices. An "infection prevention week" once a year can be used to galvanize the whole staff for prevention of hospital infections since hospital infections cannot be eliminated but can only be controlled.

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Best Wishes for Very Happy & Prosperous 2009

Members of BOTICEC and Fellows/Members

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