HOSPITAL ACQUIRED INFECTION

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Almost 150 years ago in 1847, Ignac F Semmelweis, then a young assistant to Johann Klein, Professor of Obstetrics at University of Vienna, through series of clinical observations, identified medical practices within hospitals as a major source and mode of spread of infections and demonstrated that with modification of such practices, control could be accomplished. His observations remain sufficiently cogent today.

Hospital is a complex organization with many connecting links. It is the hospital environment in which complex interplay between patient, health care worker and the microorganisms occur. Patients as such in hospital are more susceptible to infections than their counterparts in the general population. This is often related to pre-existing disease such as diabetes, medical and surgical procedures or immunosuppressive treatment. The risk of spread of infection in hospitals is also increased since patients admitted with existing infection are in close contact with susceptible patients and usually cared by the same staff. In other words various models of interaction between source, host and microorganisms are available in the hospital environment. Hospital acquired infections (HAI) continue to present a major problems in hospitals world over and the importance of Hospital acquired infection has been re-emphasized with emergence of AIDS [1].

The source of infection may be endogenous when the patients own flora in the presence of underlying disease can cause many opportunistic infections. The hospital acquired infections are mostly from the exogenous source which may be inanimate hospital objects or animate environment composed of other patients and health workers. For infection to take place, the organism must be transferred from a reservoir to an acceptable site on a susceptible host in sufficient number for multiplication of agent to take place. These pre-requisites for the infection to establish are in abundance in the hospital setting. The infection may

be transferred by direct contact i.e. direct transmission from another host or from an environmental reservoir by direct contact. Indirect transmission is the most common mechanism of transfer of an agent of nosocomial infections. This most frequently takes place by the mechanical transfer of an agent on hands and clothing of health care worker contaminated with organisms from their own body or from other patient. This may also be vehicle borne from contaminated food, water or biological fluids or shared medical devices. Air borne transmission and vector borne transmission are other mechanism of transmission of infection.

In this issue Garg et al have dealt with the disinfection/sterilization of anaesthetic equipments, which could be the possible vehicle for indirect transmission of infection from one patient to another if not disinfected/sterilized properly between two surgical procedures thus can lead to HAI. The frequently used anaesthetic equipments have shown high colony forming unit both before and after use, more so after use, thus can be source of cross infection. This study highlights the need for more efforts to disinfect/sterilize anaesthetic equipment between procedures to prevent any possible outbreak of HAI.

In the scenario given above and/or in case of an outbreak of such an infection the hospital laboratory has the responsibility of supporting activities related to surveillance, control and prevention of nosocomial infection while working hand in hand and with close cooperation with the persons responsible for infection control. Laboratory can be shareholder in an attempt to bring down the rate of HAI and it may act in the following ways [2].

1. Participation in activities of the hospital infection control committee.
2. Accurate identification of responsible organisms.
3. Careful attention to antibiotic susceptibility test-

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ing.

4. Timely reporting of laboratory data and participation in surveillance of nosocomial infection.

5. Provision of additional studies, when necessary to establish similarity or difference of organisms.

6. Provision, on occasion of microbiologic studies of the hospital environment.

7. Training of infections control personnel.

Clinical microbiologist or any laboratory staff with clinical inclination can contribute significantly as a member of the infection control committee. Such participation is essential in contributing to a harmonious relationship among clinical infection control and microbiology personnel [3]. Any diagnostic laboratory do work on culture in relation to infection. In this process, if the basic techniques are well coordinated i.e. from the specimen collection to transportation, to primary isolation/speciation, antibiogram and typing, can generate very useful data which in turn can be used by the infection control committee of the hospital.

Investigating outbreaks of bacterial diseases requires recognition and differentiation of the strains causing the outbreak from the organisms of the same genus and species which, although present are not involved [4]. Traditionally the epidemic strain has been defined with phenotypic methods by genus, species, biotype, serotype, phagetype, bacteriocine production and antimicrobial susceptibility pattern [5].

Phenotypic methods reflect genetic traits and are usually quite specific. Sometimes isolates share phenotypic marker but are actually genotypically different, this implies the presence of two separate strains and infection from two different sources. Thus genotyping of bacterial plasmid or chromosomal DNA goes beyond the current limitations of phenotyping and provide more accurate data during outbreak investigations, and these methods also help in studying the outbreaks of viruses and free living organism [6]. Specific strain identification is critical in identifying the source of outbreaks. An important feature of an epidemiologic evaluation is the determination of clonality of the suspected pathogen regardless of the mode of transmission [7]. A clone is a set of isolates that have been recovered independently from different sources, in different location and possibly at different time but which show many identical phenotypic and genetic trait which explains most of the time the common origin [8]. Successful clone identification requires knowledge of the genetic stability, the selective pressure of the environment and the discriminatory

power of the given procedure used to characterize the isolate [7].

Molecular methods are becoming more useful when combined with epidemiologic analysis of infectious disease outbreak. To gain acceptance and be routinely applied in clinical situation the method must be easy to perform, rapid, reproducible and cost effective and should also provide additional information not obtained from traditional typing techniques [9]. The strength of typing depends on the discriminatory power of the methods used. There is currently no 'gold standard' or definitive typing system available, and or even an authoratively validated collection of isolates against which a new method can be evaluated [10].

Molecular methods available are a) Plasmid profile analysis (PPA) or Plasmid finger printing : The technique is convenient for use in diagnostic laboratory and require a minimum equipment and expense. Because many bacterial species harbour plasmids in frequently and because plasmids can be gained or lost, PPA may not be satisfactory for long term follow up studies [11]. b) Restriction Endonuclease Analysis (REA) relies on enzyme that recognizes unique plasmid or chromosomal DNA sequence and cleave the double stranded DNA at specific site within the targets [2]. Unlike PPA, small differences in bacterial strains with identical profiles can be detected with Restriction fragment length polymorphism RFLP profile produced by REA. The advantage of total DNA RFLP include universal applicability, high sensitivity and ease of performance [11]. c) Pulse field gel electrophoresis (PFGE): Because some REA patterns were too large and indistinct when obtained with Agarose gel electrophoresis, PFGE was developed to provide clear pattern and better discriminatory power. PFGE appears to give the best results for investigating staphylococci, enterococci and *P. aeruginosa* [11]. d) DNA hybridization or genetic probing with Southern blotting is another method that uses a labelled DNA probe to reduce the number of visible fragments to a manageable number and thus produces a clearer finger printing of the organisms [5,7]. e) Ribotyping Ribosomal RNA (rRNA) represents highly conserved nucleotide sequence and the probes produced based on rRNA are unique to species, genus and groups. Ribotyping with rDNA is the method of choice when evaluating *Enterobacteriaceae*, *Pseudomonas capacia* and *Xanthoma maltophilia* [11]. f) Polymerase chain Reaction (PCR): The most sensitive of all the typing methods is the repetitive cycling of three simple reactions in a semi-automated, self contained system capable of am-

plifying a single strand of DNA or RNA with 50 to over 2000 base pairs more than a million folds in only a few hours. With this tool hospital epidemiologist with laboratory help can rapidly diagnose an otherwise difficult to detect pathogen and thus initiate specific infection control measures promptly [13].

The rapid advancement of genotypic typing techniques in the last few years has helped in understanding the epidemiology of the various pathogens especially frequently encountered in the hospital acquired infection. If these techniques are made available to the hospitals at affordable cost, the agencies involved in prevention and control of hospital acquired infection can develop better prevention strategies.

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