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Editorial

Contents

This issue of Journal of Hygiene Sciences will surely take you one step higher in the field of Microbiology & Disinfection & the topics highlighted in this issue will keep you engrossed in reading…..

Our section on Mini Review describes airborne infectious Diseases in Health-care facilities. A variety of airborne infections can result from exposures to clinically significant microorganisms released into the air when environmental reservoirs (i.e., soil, water, dust, and decaying organic matter) are disturbed. Once these materials are brought indoors into a health-care facility by any of the vehicles (e.g., people, air currents, water, construction materials, and equipment), these microorganisms can proliferate & serve as a source for airborne health-care–associated infections.

Our Current Trends section sheds light on the Medical waste generated in Health-care facilities. **Medical waste**, also known as **clinical waste**, normally refers to waste products that cannot be considered general waste, produced from healthcare premises, such as hospitals, clinics, doctor's offices, veterinary hospitals and labs. Poor management of health care waste potentially exposes health care workers, waste handlers, patients and the community at large to infection, toxic effects and injuries, and risks polluting the environment. It is essential that all medical waste materials are segregated at the point of generation, appropriately treated and disposed off safely.

Our In Profile scientist is Dr. Salim Ali – The birdman of India. Dr. Salim Ali was among the first Indians to conduct systematic bird surveys across India and his bird books have helped develop ornithology. He wrote his first book "The Book of Indian Birds" in 1941. He became the key figure behind the **Bombay Natural History Society** after 1947 and used his personal influence to garner government support for the organization, create the Bharatpur bird sanctuary (Keoladeo National Park) and prevent the destruction of what is now the Silent Valley National Park. He was awarded the Padma Vibhushan in 1976.

Bug of the Month focuses on The Superbug – **Methicillin resistant Staphylococcus aureus (MRSA).** Methicillin-resistant *Staphylococcus aureus* (MRSA) is a gram positive bacterium responsible for several difficult-to-treat infections in humans. It is also called multidrug-resistant *Staphylococcus aureus* and oxacillin-resistant *Staphylococcus aureus* (ORSA). MRSA is any strain of *Staphylococcus aureus that has developed* resistance to beta-lactam antibiotics. MRSA strains are most often found associated with institutions such as hospitals, but are becoming increasingly prevalent in community-acquired infections.

Our Did You Know section gives you a brief idea of Collection, Transportation, Processing and testing of specimens such as deep wounds, abscess & pus. Infections in deep wounds and abscesses are often caused by a mixture of aerobic and anaerobic organisms.

Our Section on Best Practices helps you take a deeper look at the general techniques on collection of Specimens & Swabs. Samples can arrive at the microbiology laboratory in a variety of formats, either as sub-samples of a large production batch or in clinical setting as samples of body fluids. Swabs however, have to be efficiently collected from the sampling site, carried by an inert vector and then must be recovered from this for subsequent analysis. During transportation of the swab the number and proportion of micro-organisms present in the swab should be the same when it arrives at the lab as they were when first sampled. So swabbing techniques, and the swabs themselves, need to provide an efficient collection of sample, its subsequent preservation, and ultimately the release of the target cells.

"Laughter is the best medicine" This is taken care of by our Relax Mood section. Let us also explore the Thoughts of great people which will surely take us a step higher in life.

We look forward to your feedback towards our effort of making this Journal more effective.

Airborne Infectious Diseases in Health Care Facilities

A variety of airborne infections in susceptible hosts can result from exposures to clinically significant microorganisms released into the air when environmental reservoirs (i.e., soil, water, dust, and decaying organic matter) are disturbed. Once these materials are brought indoors into a health-care facility by any of a number of vehicles (e.g., people, air currents, water, construction materials, and equipment), the attendant microorganisms can proliferate in various indoor ecological niches and, if subsequently disbursed into the air, serve as a source for airborne health-care–associated infections.

Respiratory infections can be acquired from exposure to pathogens contained either in droplets or droplet nuclei. Exposure to microorganisms in droplets (e.g., through aerosolized oral and nasal secretions from infected patients) constitutes a form of direct contact transmission. When droplets are produced during a sneeze or cough, a cloud of infectious particles >5 µm in size is expelled, resulting in the potential exposure of susceptible persons within 3 feet of the source person. Examples of pathogens spread in this manner are influenza virus, rhinoviruses, adenoviruses, and respiratory syncytial virus (RSV). The spread of airborne infectious diseases via droplet nuclei is a form of indirect transmission. Droplet nuclei are the residuals of droplets that, when suspended in air, subsequently dry and produce particles ranging in size from 1–5 µm. These particles can (a) contain potentially viable microorganisms, (b) be protected by a coat of dry secretions, (c) remain suspended indefinitely in air, and (d) be transported over long distances. The microorganisms in droplet nuclei persist in favourable conditions (e.g. a dry cool atmosphere with little or no direct exposure to sunlight or other sources of radiation). Pathogenic microorganisms that can be spread via droplet nuclei include *Mycobacterium tuberculosis*, measles virus (i.e., rubeola), and smallpox virus (i.e., variola major). Several environmental pathogens have life-cycle forms that are similar in size to droplet nuclei and may exhibit similar behaviour in the air. The spores of *Aspergillus fumigatus* have a diameter of 2–3.5 µm, with a settling velocity estimate dat 0.03 cm/second (or about 1 meter/hour) in still air. With this enhanced buoyancy, the spores, which resist desiccation, can remain airborne indefinitely in air currents and travel far from their source.

Airborne Infectious Diseases in Health-Care Facilities

A. Aspergillosis and Other Fungal Diseases

Aspergillosis is caused by molds belonging to the genus *Aspergillus*. *Aspergillus* spp. are prototype health-care acquired pathogens associated with dusty or moist environmental conditions. *Aspergillus* spp. is ubiquitous, aerobic fungi that occur in soil, water, and decaying vegetation; the organism also survives well in air, dust, and moisture present in health-care facilities. The presence of aspergilli in the health-care facility environment is a substantial extrinsic risk factor for opportunistic invasive aspergillosis (invasive aspergillosis being the most serious form of the disease). Site renovation and construction can disturb *Aspergillus*-contaminated dust and produce bursts of air-borne fungal spores. Increased levels of atmospheric dust and fungal spores have been associated with clusters of health-care acquired infections in immune-compromised patients.

Patient-care items, devices, and equipment can become contaminated with *Aspergillus* spp. spores and serve as sources of infection if stored in such areas. Most cases of aspergillosis are caused by *Aspergillus fumigatus*, a thermotolerant/thermophilic fungus capable of growing over a temperature range from 12°C–53°C; optimal growth occurs at approximately 40°C, a temperature inhibitory to most other saprophytic fungi. It can use cellulose or sugars as carbon sources; because its respiratory process requires an ample supply of carbon, decomposing organic matter is an ideal substrate.

Other opportunistic fungi that have been occasionally linked with health-care–associated infections are members of the order Mucorales (e.g., *Rhizopus* spp.) and miscellaneous moniliaceous molds (e.g. *Fusarium* spp. and *Penicillium* spp.). Many of these fungi can proliferate in moist environments (e.g., water-damaged wood and building materials). Some fungi (e.g.*Fusarium* spp. & *Pseudoallescheria* spp.) also can be airborne pathogens. As with aspergillosis, a major risk factor for disease caused by any of these pathogens is the host's severe immunosuppression from either underlying disease or immunosuppressive therapy. Infections due *Cryptococcus neoformans, Histoplasma capsulatum*, or *Coccidioidesimmitis* can occur in health-care settings if nearby ground is disturbed and a malfunction of the facility's air-intake components allows these pathogens to enter the ventilation system. *C. neoformans* is a yeast usually 4 - 8 µm in size. However, viable particles of <2 µm diameter (and thus permissive to alveolar deposition) have been found in soil contaminated with bird droppings, particularly from pigeons.

H.capsulatum, with the infectious microconidia ranging in size from 2–5 µm, is endemic in the soil of the central river valleys of the United States. Substantial numbers of these infectious particles have been associated with chicken coops and the roosts of blackbirds. Several outbreaks of histoplasmosis have been associated with disruption of the environment; construction activities in anendemic area may be a potential risk factor for health-care–acquired airborne infection. *C.immitis*, with arthrospores of 3–5 µm diameter, has similar potential, especially in the endemic south western United States and during seasons of drought followed by heavy rainfall. After the 1994earthquake centred near Northridge, California, the incidence of coccidioidomycosis in the surrounding area exceeded the historical norm. Emerging evidence suggests that *Pneumocystis carinii*, now classified as a fungus, may be spread via airborne, person-to-person transmission. Controlled studies in animals first demonstrated that *P.carinii* could be spread through the air. More recent studies in health-care settings have detected nucleic acids of *P. carinii* in air samples from areas frequented or occupied by *P. carinii*-infected patients but not in control areas that are not occupied by these patients. Clusters of cases have been identified among immune-compromised patients who had contact with a source patient and with each other. Recent studies have examined the presence of *P. carinii* DNA in oropharyngeal washings and the nares of infected patients, their direct contacts, and persons with no direct contact. Molecular analysis of the DNA by polymerase chain reaction (PCR) provides evidence for airborne transmission of *P. carinii* from infected patients to direct contacts, but immunocompetent contacts tend to become transiently colonized rather than infected. The role of colonized persons in the spread of *P. carinii pneumonia* (PCP) remains to be determined. At present, specific modifications to ventilation systems to control spread of PCP in a health-care facility are not indicated.

B. Tuberculosis and Other Bacterial Diseases

The bacterium most commonly associated with airborne transmission is *Mycobacterium tuberculosis*. A comprehensive review of the microbiology and epidemiology of *M. tuberculosis* and guidelines for tuberculosis (TB) infection control have been published. A summary of the clinical and epidemiologic information from these materials is provided in this guideline. *M. tuberculosis* is carried by droplet nuclei generated when persons (primarily adults and adolescents) who have pulmonary or laryngeal TB sneeze, cough, speak, or sing; normal air currents can keep these particles airborne for prolonged periods and spread them throughout a room or building.

However, transmission of TB has occurred from mycobacteria aerosolized during provision of care (e.g., wound/lesion care or during handling of infectious peritoneal dialysis fluid) for extra pulmonary TB patients. Gram-positive cocci (i.e. *Staphylococcus aureus*, group A beta-hemolytic streptococci), also important health-care–associated pathogens, are resistant to inactivation by drying and can persist in the environment and on environmental surfaces for extended periods. These organisms can be shed from heavily colonized persons and discharged into the air. Airborne dispersal of S. aureus is directly associated with the concentration of the bacterium in the anterior nares. Approximately 10% of healthy carriers will disseminate *S. aureus* into the air, and some persons become more effective disseminators of *S. aureus* than others. The dispersal of *S. aureus* into air can be exacerbated by concurrent viral upper respiratory infection, thereby turning a carrier into a "cloud shedder." Outbreaks of surgical site infections (SSIs) caused by group A beta-hemolytic streptococci have been traced to airborne transmission from colonized operating-room personnel to patients. In these situations, the strain causing the outbreak was recovered from the air in the operating room or on settle plates in a room in which the carrier exercised. *S. aureus* and group A streptococci have not been linked to airborne transmission outside of operating rooms, burn units, and neonatal nurseries. Transmission of these agents occurs primarily via contact and droplets.

Other gram-positive bacteria linked to airborne transmission include *Bacillus* spp. which are capable of sporulation as environmental conditions become less favourable to support their growth. Outbreaks and pseudo-outbreaks have been attributed to Bacillus cereus in maternity, paediatric, intensive care, and bronchoscopy units; many of these episodes were secondary to environmental contamination. Gram-negative bacteria rarely are associated with episodes of airborne transmission because they generally require moist environments for persistence and growth. The main exception is *Acinetobacter* spp., which can withstand the inactivating effects of drying. In one epidemiologic investigation of bloodstream infections among paediatric patients, identical *Acinetobacter* spp. were cultured from the patients, air, and room air conditioners in a nursery.

Aerosols generated from showers and faucets may potentially contain legionellae and other gram-negative waterborne bacteria (e.g. *Pseudomonas aeruginosa*). Exposure to these organisms is through direct inhalation. However, because water is the source of the organisms and exposure occurs in the vicinity of the aerosol, the discussion of the diseases associated with such aerosols and the prevention measures used to curtail their spread is discussed in another section of the Guideline (see Part I: Water).

C. Airborne Viral Diseases

Some human viruses are transmitted from person to person via droplet aerosols, but very few viruses are consistently airborne in transmission (i.e., are routinely suspended in an infective state in air and capable of spreading great distances), and health-care–associated outbreaks of airborne viral disease are limited to a few agents. Consequently, infection-control measures used to prevent spread of these viral diseases in health-care facilities primarily involve patient isolation, vaccination of susceptible persons, and antiviral therapy as appropriate rather than measures to control air flow or quality. Infections caused by VZV frequently are described in health-care facilities. Health-care–associated airborne outbreaks of VZV infections from patients with primary infection and disseminated zoster have been documented; patients with localized zoster have, on rare occasions, also served as source patients for outbreaks in health-care facilities. VZV infection can be prevented by vaccination, although patients who develop a rash within 6 weeks of receiving varicella vaccine or who develop breakthrough varicella following exposure should be considered contagious.

Viruses whose major mode of transmission is via droplet contact rarely have caused clusters of infections in group settings through airborne routes. The factors facilitating airborne distribution of these viruses in an infective state are unknown, but a presumed requirement is a source patient in the early stage of infection that is shedding large numbers of viral particles into the air. Airborne transmission of measles has been documented in health-care facilities. In addition, institutional outbreaks of influenza virus infections have occurred predominantly in nursing homes, and less frequently in medical and neonatal intensive care units, chronic-care areas, HSCT units, and paediatric wards. Some evidence supports airborne transmission of influenza viruses by droplet nuclei, and case clusters in paediatric wards suggest that droplet nuclei may play a role in transmitting certain respiratory pathogens (e.g., adenoviruses and respiratory syncytial virus [RSV]). Some evidence also supports airborne transmission of enteric viruses. An outbreak of a Norwalk-like virus infection involving more than 600 staff personnel over a 3-week period was investigated in a Toronto, Ontario hospital in 1985; common sources (e.g., food and water) were ruled out during the investigation, leaving airborne spread as the most likely mode of transmission. Smallpox virus, a potential agent of bioterrorism, is spread predominantly via direct contact with infectious droplets, but it also can be associated with airborne transmission. A German hospital study from 1970 documented the ability of this virus to spread over considerable distances and cause infection at low doses in a well-vaccinated population; factors potentially facilitating transmission in this situation included a patient with cough and an extensive rash, indoor air with low relative humidity, and faulty ventilation patterns resulting from hospital design (e.g., open windows). Smallpox patients with extensive rash are more likely to have lesions present on mucous membranes and therefore have greater potential to disseminate virus into the air. In addition to the smallpox transmission in Germany, two cases of laboratory-acquired smallpox virus infection in the United Kingdom in 1978 also were thought to be caused by airborne transmission. Airborne transmission may play a role in the natural spread of hanta viruses and certain hemorrhagic fever viruses (e.g., Ebola, Marburg, and Lassa), but evidence for airborne spread of these agents in health-care facilities is inconclusive. Although hanta viruses can be transmitted when aerosolized from rodent excreta, person-to-person spread of hanta virus infection from source patients has not occurred in health-care facilities. Nevertheless, health-care workers are advised to contain potentially infectious aerosols and wear National Institute of Occupational Safety and Health (NIOSH) approved respiratory protection when working with this agent in laboratories or autopsy suites. Lassa virus transmission via aerosols has been demonstrated in the laboratory and incriminated in health-care–associated infections in Africa, but airborne spread of this agent in hospitals in developed nations likely is inefficient.

Yellow fever is considered to be a viral hemorrhagic fever agent with high aerosol infectivity potential, but health-care–associated transmission of this virus has not been described. Viral hemorrhagic fever diseases primarily occur after direct exposure to infected blood and body fluids, and the use of standard and droplet precautions prevents transmission early in the course of these illnesses. However, whether these viruses can persist in droplet nuclei that might remain after droplet production from coughs or vomiting in the latter stages of illness is unknown. Although the use of a negative-pressure room is not required during the early stages of illness, its use might be prudent at the time of hospitalization to avoid the need for subsequent patient transfer. Current CDC guidelines recommend negative-pressure rooms with anterooms for patients with hemorrhagic fever and use of HEPA respirators by persons entering these rooms when the patient has prominent cough, vomiting, diarrhea or hemorrhage. Face shields or goggles will help to prevent mucous-membrane exposure to potentially-aerosolized infectious material in these situations. If anante room is not available, portable, industrial-grade high efficiency particulate air (HEPA) filter units can be used to provide the equivalent of additional air changes per hour (ACH).

Recommendations—Air

I. Air-Handling Systems in Health-Care Facilities

A. Use AIA guidelines as minimum standards where state or local regulations are not in place for design and construction of ventilation systems in new or renovated health-care facilities. Ensure that existing structures continue to meet the specifications in effect at the time of construction.

B. Monitor ventilation systems in accordance with engineers' and manufacturers' recommendations to ensure preventive engineering, optimal performance for removal of particulates, and elimination of excess moisture.

1. Ensure that heating, ventilation, air conditioning (HVAC) filters are properly installed and maintained to prevent air leakages and dust overloads.
2. Monitor areas with special ventilation requirements (e.g., AII or PE) for ACH, filtration, and pressure differentials.
   a. Develop and implement a maintenance schedule for ACH, pressure differentials, and filtration efficiencies using facility-specific data as part of the multidisciplinary risk assessment. Take into account the age and reliability of the system.
   b. Document these parameters, especially the pressure differentials.
3. Engineer humidity controls into the HVAC system and monitor the controls to ensure proper moisture removal.
   a. Locate duct humidifiers upstream from the final filters.
   b. Incorporate a water-removal mechanism into the system.
   c. Locate all duct takeoffs sufficiently downstream from the humidifier so that moisture is completely absorbed.
4. Incorporate steam humidifiers, if possible, to reduce potential for microbial proliferation within the system, and avoid use of cool mist humidifiers.
5. Ensure that air intakes and exhaust outlets are located properly in construction of new facilities and renovation of existing facilities.
   a. Locate exhaust outlets >25 ft. from air-intake systems.
   b. Locate outdoor air intakes >6 ft. above ground or >3 ft. above roof level.
   c. Locate exhaust outlets from contaminated areas above roof level to minimize recirculation of exhausted air.
6. Maintain air intakes and inspect filters periodically to ensure proper operation.
7. Bag dust-filled filters immediately upon removal to prevent dispersion of dust and fungal spores during transport within the facility.
   a. Seal or close the bag containing the discarded filter.
   b. Discard spent filters as regular solid waste, regardless of the area from which they were removed.
8. Remove bird roosts and nests near air intakes to prevent mites and fungal spores from entering the ventilation system.
9. Prevent dust accumulation by cleaning air-duct grilles in accordance with facility specific procedures and schedules when rooms are not occupied by patients.
10. Periodically measure output to monitor system function; clean ventilation ducts as part of routine HVAC maintenance to ensure optimum performance.

C. Use portable, industrial-grade HEPA filter units capable of filtration rates in the range of 300–800 ft^3/min. to augment removal of respirable particles as needed. Category II

1. Select portable HEPA filters that can recirculate all or nearly all of the room air and provide the equivalent of 12 ACH.
2. Portable HEPA filter units previously placed in construction zones can be used later in patient-care areas, provided all internal and external surfaces are cleaned, and the filter's performance verified by appropriate particle testing.
3. Situate portable HEPA units with the advice of facility engineers to ensure that all room air is filtered.
4. Ensure that fresh-air requirements for the area are met.

D. Follow appropriate procedures for use of areas with through-the-wall ventilation units.

1. Do not use such areas as PE rooms.
2. Do not use a room with a through-the-wall ventilation unit as an AII room unless it can be demonstrated that all required AII engineering controls required are met.

E. Conduct an infection-control risk assessment (ICRA) and provide an adequate number of AII and PE rooms (if required) or other areas to meet the needs of the patient population.

F. When UVGI is used as a supplemental engineering control, install fixtures 1) on the wall near the ceiling or suspended from the ceiling as an upper air unit; 2) in the air-return duct of an AII room; or 3) in designated enclosed areas or booths for sputum induction.

G. Seal windows in buildings with centralized HVAC systems and especially with PE areas.

H. Keep emergency doors and exits from PE rooms closed except during an emergency; equip emergency doors and exits with alarms.

I. Develop a contingency plan for backup capacity in the event of a general power failure. Category IC (Joint Commission on Accreditation of Healthcare Organizations [JCAHO]: Environment of Care [EC]
   1. Emphasize restoration of proper air quality and ventilation conditions in AII rooms, PE rooms, operating rooms, emergency departments, and intensive care units.
   2. Deploy infection-control procedures to protect occupants until power and systems functions are restored.

J. Do not shut down HVAC systems in patient-care areas except for maintenance, repair, testing of emergency backup capacity, or new construction.
   1. Coordinate HVAC system maintenance with infection-control staff to allow for relocation of immunocompromised patients if necessary.
   2. Provide backup emergency power and air-handling and pressurization systems to maintain filtration, constant ACH, and pressure differentials in PE rooms, AII rooms, operating rooms, and other critical-care areas.
   3. For areas not served by installed emergency ventilation and backup systems, use portable units and monitor ventilation parameters and patients in those areas.
   4. Coordinate system start ups with infection-control staff to protect patients in PE rooms from bursts of fungal spores.
   5. Allow sufficient time for ACH to clean the air once the system is operational.

K. HVAC systems serving offices and administration areas may be shut down for energy conservation purposes, but the shutdown must not alter or adversely affect pressure differentials maintained in laboratories or critical-care areas with specific ventilation requirements (i.e., PE rooms, AII rooms, operating rooms).

L. Whenever possible, avoid inactivating or shutting down the entire HVAC system at one time, especially in acute-care facilities.

M. Whenever feasible, design and install fixed backup ventilation systems for new or renovated construction for PE rooms, AII rooms, operating rooms, and other critical care areas identified by ICRA.

II. Infection-Control and Ventilation Requirements for PE Rooms

A. Minimize exposures of severely immunocompromised patients (e.g., solid organ transplant patients or allogeneic neutropenic patients) to activities that might cause aerosolization of fungal spores (e.g., vacuuming or disruption of ceiling tiles).

B. Minimize the length of time that immunocompromised patients in PE are outside their rooms for diagnostic procedures and other activities.

C. Provide respiratory protection for severely immune-compromised patients when they must leave PE for diagnostic studies and other activities; consult the most recent revision of CDC's Guidelines for Prevention of Health-Care–Associated Pneumonia for information regarding the appropriate type of respiratory protection.
Incorporate ventilation engineering specifications and dust-controlling processes into the planning and construction of new PE units.
   1. Install central or point-of-use HEPA filters for supply (incoming) air.
   2. Ensure that rooms are well sealed by 1) properly constructing windows, doors, and intake and exhaust ports; 2) maintaining ceilings that are smooth and free of fissures, open joints, and crevices; 3) sealing walls above and below the ceiling, and 4) monitoring for leakage and making necessary repairs.
   3. Ventilate the room to maintain >12 ACH.
   4. Locate air supply and exhaust grilles so that clean, filtered air enters from one side of the room, flows across the patient's bed, and exits from the opposite side of the room.
   5. Maintain positive room air pressure (>2.5 Pa [0.01-inch water gauge]) in relation to the corridor.
   6. Maintain airflow patterns and monitor these on a daily basis by using permanently installed visual means of detecting airflow in new or renovated construction, or using other visual methods (e.g., flutter strips, or smoke tubes) in existing PE units. Document the monitoring results.
   7. Install self-closing devices on all room exit doors in protective environments.

E. Do not use laminar air flow systems in newly constructed PE rooms.

F. Take measures to protect immunocompromised patients who would benefit from a PE room and who also have an airborne infectious disease (e.g., acute VZV infection ortuberculosis).
   1. Ensure that the patient's room is designed to maintain positive pressure.
   2. Use an anteroom to ensure appropriate air balance relationships and provide independent exhaust of contaminated air to the outside, or place a HEPA filter in the exhaust duct if the return air must be recirculated.
   3. If an anteroom is not available, place the patient in AII and use portable, industrial grade HEPA filters to enhance filtration of spores in the room.

G. Maintain backup ventilation equipment (e.g., portable units for fans or filters) for emergency provision of ventilation requirements for PE areas and take immediate steps to restore the fixed ventilation system function.

III. Infection-Control and Ventilation Requirements for AII Rooms

A. Incorporate certain specifications into the planning, and construction or renovation of AII units.
   1. Maintain continuous negative air pressure (2.5 Pa [0.01-inch water gauge]) in relation to the air pressure in the corridor; monitor air pressure periodically, preferably daily, with audible manometers or smoke tubes at the door (for existing AII rooms) or with a permanently installed visual monitoring mechanism. Document the results of monitoring.
   2. Ensure that rooms are well-sealed by properly constructing windows, doors, and air intake and exhaust ports; when monitoring indicates air leakage, locate the leak and make necessary repairs.
   3. Install self-closing devices on all AII room exit doors.
   4. Provide ventilation to ensure >12 ACH for renovated rooms and new rooms, and >6 ACH for existing AII rooms. Direct exhaust air to the outside, away from air-intake and populated areas. If this is not practical,

air from the room can be recirculated after passing through a HEPA filter.

B. Where supplemental engineering controls for air cleaning are indicated from a risk assessment of the AII area, install UVGI units in the exhaust air ducts of the HVAC system to supplement HEPA filtration or install UVGI fixtures on or near the ceiling to irradiate upper room air.4 Category II.

C. Implement environmental infection-control measures for persons with known or suspected Air borne infectious diseases.
   1. Use AII rooms for patients with or suspected of having an airborne infection who also require cough-inducing procedures, or use an enclosed booth that is engineered to provide air supply and exhaust rate sufficient to maintain a 2.5 Pa negative pressure difference with respect to all surrounding spaces with an exhaust rate of >50 ft^3/min. air exhausted directly outside away from air intakes and traffic or exhausted after HEPA filtration prior to recirculation.
   2. Although airborne spread of viral hemorrhagic fever (VHF) has not been documented in a health-care setting, prudence dictates placing a VHF patient in an AII room, preferably with an anteroom to reduce the risk of occupational exposure to aerosolized infectious material in blood, vomitus, liquid stool, and respiratory secretions present in large amounts during the end stage of a patient's illness.
      a. If an anteroom is not available, use portable, industrial-grade HEPA filters in the patient's room to provide additional ACH equivalents for removing airborne particulates.
      b. Ensure that health-care workers wear face shields or goggles with appropriate respirators when entering the rooms of VHF patients with prominent cough, vomiting, diarrhea, or hemorrhage.
   3. Place smallpox patients in negative pressure rooms at the onset of their illness, preferably using a room with an anteroom if available.

D. No recommendation is offered regarding negative pressure or isolation rooms for patients with *Pneumocystis carinii* pneumonia.

E. Maintain back-up ventilation equipment (e.g., portable units for fans or filters) for emergency provision of ventilation requirements for AII rooms and take immediate steps to restore the fixed ventilation system function.

IV. Infection-Control and Ventilation Requirements for Operating Rooms

A. Implement environmental infection-control and ventilation measures for operating rooms.
   1. Maintain positive-pressure ventilation with respect to corridors and adjacent areas.
   2. Maintain >15 ACH, of which >3 ACH should be fresh air.
   3. Filter all recirculated and fresh air through the appropriate filters, providing 90% efficiency (dust-spot testing) at a minimum.
   4. In rooms not engineered for horizontal laminar airflow, introduce air at the ceiling and exhaust air near the floor.
   5. Do not use UV lights to prevent surgical-site infections.
   6. Keep operating room doors closed except for the passage of equipment, personnel, and patients, and limit entry to essential personnel.

B. Follow precautionary procedures for TB patients who also require emergency surgery.
   1. Use an N95 respirator approved by the National Institute for Occupational Safety and Health (NIOSH) without exhalation valves in the operating room. (Occupational Safety and Health Administration [OSHA]; 29 Code of Federal Regulations [CFR].
   2. Intubate the patient in either the AII room or the operating room; if intubating the patient in the operating room, do not allow the doors to open until 99% of the airborne contaminants are removed (Appendix B, Table B.1).4, 358 Category IB.
   3. When anesthetizing a patient with confirmed or suspected TB, place a bacterial filter between the anesthesia circuit and patient's airway to prevent contamination of anesthesia equipment or discharge of tubercle bacilli into the ambient air.
   4. Extubate and allow the patient to recover in an AII room.4, 358 Category IB.
   5. If the patient has to be extubated in the operating room, allow adequate time for ACHto clean 99% of airborne particles from the air (Appendix B, Table B.1) because extubation is a cough-producing procedure.

C. Use portable, industrial-grade HEPA filters temporarily for supplemental air cleaning during intubation and extubation for infectious TB patients who require surgery.
   1. Position the units appropriately so that all room air passes through the filter; obtain engineering consultation to determine the appropriate placement of the unit.
   2. Switch the portable unit off during the surgical procedure.
   3. Provide fresh air as per ventilation standards for operating rooms; portable units do not meet the requirements for the number of fresh ACH.

D. If possible, schedule infectious TB patients as the last surgical cases of the day to maximize the time available for removal of airborne contamination.

E. No recommendation is offered for performing orthopedic implant operations in rooms supplied with laminar airflow.

F. Maintain backup ventilation equipment (e.g., portable units for fans or filters) for emergency provision of ventilation requirements for operating rooms, and take immediate steps to restore the fixed ventilation system function.

V. Other Potential Infectious Aerosol Hazards in Health-Care Facilities.

A. In settings where surgical lasers are used, wear appropriate personal protective equipment, including N95 or N100 respirators, to minimize exposure to laser plumes.

B. Use central wall suction units with in-line filters to evacuate minimal laser plumes.

C. Use a mechanical smoke evacuation system with a high-efficiency filter to manage the generation of large amounts of laser plume, when ablating tissue infected with human papilloma virus (HPV) or performing procedures on a patient with extra pulmonary TB.

Regulation of Medical Waste in Health Care Facilities

Epidemiology

No epidemiologic evidence suggests that most of the solid- or liquid wastes from hospitals, other healthcare facilities, or clinical/research laboratories is any more infective than residential waste. Several studies have compared the microbial load and the diversity of microorganisms in residential wastes and wastes obtained from a variety of health-care settings. Although hospital wastes had a greater number of different bacterial species compared with residential waste, wastes from residences were more heavily contaminated. Moreover, no epidemiologic evidence suggests that traditional waste-disposal practices of health-care facilities (whereby clinical and microbiological wastes were decontaminated on site before leaving the facility) have caused disease in either the health-care setting or the general community.

Categories of Medical Waste

Precisely defining medical waste on the basis of quantity and type of etiologic agents present is virtually impossible. The most practical approach to medical waste management is to identify wastes that represent a sufficient potential risk of causing infection during handling and disposal and for which some precautions likely are prudent. Health-care facility medical wastes targeted for handling and disposal precautions include microbiology laboratory waste (e.g. microbiologic cultures and stocks of microorganisms), pathology and anatomy waste, blood specimens from clinics and laboratories, blood products, and other body-fluid specimens.

Federal, state, and local guidelines and regulations specify the categories of medical waste that are subject to regulation and outline the requirements associated with treatment and disposal. The categorization of these wastes has generated the term "regulated medical waste." The EPA's (Environmental Protection Agency) *Manual for Infectious Waste Management* identifies and categorizes other specific types of waste generated in health-care facilities with research laboratories that also require handling precautions.

Management of Regulated Medical Waste in Health-Care Facilities

Medical wastes require careful disposal and containment before collection and consolidation for treatment. OSHA (Occupational Safety and Health Administration) has dictated initial measures for discarding regulated medical-waste items. These measures are designed to protect the workers who generate medical wastes and who manage the wastes from point of generation to disposal. A single, leak resistant bio hazard bag is usually adequate for containment of regulated medical wastes, provided the bag is sturdy and the waste can be discarded. Without contaminating the bag's exterior. The contamination or puncturing of the bag requires placement into a second bio hazard bag. All bags should be securely closed for disposal. Puncture resistant containers located at the point of use (e.g. sharps containers) are used as containment for discarded slides or tubes with small amounts of blood, scalpel blades, needles and syringes, and unused sterile sharps. To prevent needle stick injuries, needles and other contaminated sharp object should not be recapped, purposefully bent, or broken by hand. Health-care facilities may need additional precautions to prevent the production of aerosols during the handling of blood-contaminated items for certain rare diseases or conditions.

Transporting and storing regulated medical wastes within the health-care facility prior to terminal treatment is often necessary. Both federal and state regulations address the safe transport and storage of on and off-site regulated medical wastes. Health-care facilities are instructed to dispose medical wastes regularly to avoid accumulation. Medical wastes requiring storage should be kept in labeled, leak proof, puncture-resistant containers under conditions that minimize or prevent foul odors. The storage area should be well ventilated and be inaccessible to pests. Any facility that generates regulated medical wastes should have a regulated medical waste management plan to ensure health and environmental safety as per federal, state, and local regulations.

Treatment of Regulated Medical Waste

Regulated medical wastes are treated or decontaminated to reduce the microbial load in or on the waste and to render the by-products safe for further handling and disposal. From a micro-biologic standpoint, waste need not be rendered "sterile" because the treated waste will not be deposited in a sterile site. Historically, treatment methods involved steam-sterilization (i.e. autoclaving), incineration, or interment (for anatomy wastes). Alternative treatment methods developed in recent years include chemical disinfection, grinding/shredding/disinfection methods, energy-based technologies (e.g. microwave or radio wave treatments), and disinfection/encapsulation methods. State medical waste regulations specify appropriate treatment methods for each category of regulated medical waste.

Of all the categories comprising regulated medical waste, micro-biologic wastes (e.g., untreated cultures, stocks, and amplified microbial populations) pose the greatest potential for infectious disease transmission, and sharps pose the greatest risk for injuries. Untreated stocks and cultures of microorganisms are subsets of the clinical laboratory or micro-biologic waste stream. If the microorganism must be grown and amplified in culture to high concentration to permit work with the specimen, this item should be considered for on-site decontamination, preferably within the laboratory unit. Historically, this was accomplished effectively by either autoclave (steam sterilization) or incineration. If steam sterilization in the health-care facility is used for waste treatment, exposure of the waste for up to 90 minutes at 250°F (121°C) in a autoclave (depending on the size of the load and type container) may be necessary to ensure an adequate decontamination cycle. After steam sterilization, the residue can be safely handled and discarded with all other nonhazardous solid waste in accordance with state solid-waste disposal regulations. On-site incineration is another treatment

option for micro biologic, pathology, and anatomic waste, provided the incinerator is engineered to burn these wastes completely and stay within EPA emissions standards. Improper incineration of waste with high moisture and low energy content (e.g. pathology waste) can lead to emission problems. State medical waste regulatory programs identify acceptable methods for inactivating amplified stocks and cultures of microorganisms, some of which may employ technology rather than steam sterilization or incineration.

Current laboratory guidelines for working with infectious microorganisms at bio safety level (BSL) 3 recommend that all laboratory waste be decontaminated before disposal by an approved method, preferably within the laboratory. These same guidelines recommend that all materials removed from a BSL 4 laboratory (unless they are biological materials that are to remain viable) are to be decontaminated before they leave the laboratory. A recent outbreak of TB among workers in a regional medical-waste treatment facility in the United States demonstrated the hazards associated with aerosolized micro-biologic wastes. The facility received diagnostic cultures of *Mycobacterium tuberculosis* from several different health-care facilities before these cultures were chemically disinfected; this facility treated this waste with a grinding/shredding process that generated aerosols from the material.

Several operational deficiencies facilitated the release of aerosols and exposed workers to airborne *M. tuberculosis*. Among the suggested control measures was that health-care facilities perform on-site decontamination of laboratory waste containing live cultures of microorganisms before release of the waste to a waste management company. This measure is supported by recommendations found in the CDC/NIH guideline for laboratory workers. This outbreak demonstrates the need to avoid the use of any medical-waste treatment method or technology that can aerosolize pathogens from live cultures and stocks.

In an era when local, state, and federal health-care facilities and laboratories are developing bio terrorism response strategies and capabilities, the need to reinstate in-laboratory capacity to destroy cultures and stocks of microorganisms becomes a relevant issue.

Discharging Blood, Fluids to Sanitary Sewers or Septic Tanks

The contents of all vessels that contain more than a few milliliters of blood remaining after laboratory procedures, suction fluids, or bulk blood can either be inactivated in accordance with state-approved treatment technologies or carefully poured down a utility sink drain or toilet. State regulations may dictate the maximum volume allowable for discharge of blood/body fluids to the sanitary sewer. No evidence indicates that blood borne diseases have been transmitted from contact with raw or treated sewage. Many blood borne pathogens, particularly blood borne viruses, are not stable in the environment for long periods of time; therefore, the discharge of small quantities of blood and other body fluids to the sanitary sewer is considered a safe method of disposing of these waste materials. The following factors increase the likelihood that blood borne pathogens will be inactivated in the disposal process: a) dilution of the discharged materials with water; b) inactivation of pathogens resulting from exposure to cleaning chemicals, disinfectants, and other chemicals in raw sewage; and c) effectiveness of sewage treatment in inactivating any residual blood borne pathogens that reach the treatment facility. Small amounts of blood and other body fluids should not affect the functioning of a municipal sewer system. However, large quantities of these fluids, with their high protein content, might interfere with the biological oxygen demand (BOD) of the system.

Although concerns have been raised about the discharge of blood and other body fluids to a septic tank system, no evidence suggests that septic tanks have transmitted blood borne infections. A properly functioning septic system is adequate for inactivating blood borne pathogens.

Medical Waste and CJD (Creutzfeldt-Jakob disease)

Concerns also have been raised about the need for special handling and treatment procedures for wastes generated during the care of patients with CJD or other transmissible spongiform encephalopathy (TSEs). Prions, the agents that cause TSEs, have significant resistance to inactivation by a variety of physical, chemical, or gaseous methods. No epidemiologic evidence, however, links acquisition of CJD with medical-waste disposal practices. Although handling neurologic tissue for pathologic examination and autopsy materials with care, using barrier precautions, and following specific procedures for the autopsy are prudent measures,1197 employing extraordinary measures once the materials are discarded is unnecessary. Regulated medical wastes generated during the care of the CJD patient can be managed using the same strategies as wastes generated during the care of other patients. After decontamination, these wastes may then be disposed in a sanitary landfill or discharged to the sanitary sewer, as appropriate.

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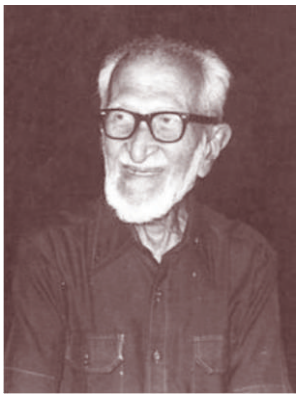


Dr. Salim Ali – The Birdman of India

Born : November 12, 1896
Mumbai, British India

Died: July 27, 1987 (aged 90)
Mumbai , India

Nationality: India

Field: ornithology natural history

Notable awards: Padma Vibhushan (1976)

Spouse: Tehmina Ali

Early Life:

Salim Moizuddin Abdul Ali, or Salim Ali as he is better known as, was born as the ninth and youngest child in a Sulaimani Bohra Muslim family. He was born in Mumbai to Moizuddin and Zeenat-un-nissa. Losing his father at the age of one and mother at three, Salim Ali and other kids were brought up by his maternal uncle, Amiruddin Tyabji, and childless aunt, Hamida Begum. He was also surrounded by another maternal uncle, Abbas Tyabji, a prominent Indian freedom fighter. He attended primary school at Zanana Bible Medical Mission Girls High School at Girgaum and was later admitted to St. Xavier's College at Mumbai. However, due to his frequent chronic headaches, he was forced to drop out of school every now and then since he was 13 years old. He was sent to Sind to stay with his uncle with hopes of the dry air making an improvement in his health. Thus, on returning, he just managed to clear his matriculation examination from Bombay University in 1913.

After spending a difficult first year in Xavier's College, Mumbai, Salim Ali dropped out of college and went to Tavoy, Burma to care of his family's Wolfram mining and timber business. The forests surrounding the area helped him further develop his naturalist and hunting skills. He developed good relations with J.C. Hopwood and Berthold Ribbentrop who worked with the Forest Service. On returning to India in 1917, he decided to complete his studies. Hence, he studied commercial law and accountancy from Davar's College of Commerce. He used to attend morning classes at Davar's College and go to St. Xavier's College to attend zoology classes to complete his course in zoology.

Career:

Ironically, Salim Ali had to struggle through many years of unemployment and hardship during the early years of his career. After returning to India from Burma, Ali failed to get an ornithologist's position which was open at the Zoological Survey of India due to the lack of a formal university degree. He was hired as guide lecturer in 1926 at the newly opened natural history section in the Prince of Wales Museum in Mumbai for the salary of Rs 350 a month. He however tired of the job after two years and took a study leave in 1928 to Germany, where he was to work under Professor Erwin Stresemann at the Zoological Museum of Berlin University, whom Salim Ali considered his Guru. In Berlin, Ali made acquaintance with many of the major German ornithologists of the time including Bernhard Rensch, Oskar Heinroth and Ernst Mayr apart from meeting other Indians in Berlin including the revolutionary Chempakaraman Pillai. Ali also gained experience in bird ringing at the Heligoland observatory.

On his return to India in 1930, he discovered that the guide lecturer position had been eliminated due to lack of funds. Unable to find a suitable job, Salim Ali and Tehmina moved to Kihim, a coastal village near Mumbai. He then discovered an opportunity to conduct systematic bird surveys of the princely states that included Hyderabad, Cochin, Travancore, Gwalior, Indore and Bhopal with the sponsorship of the rulers of those states.

Honours:

Although recognition came late, he received several honorary doctorates and numerous awards. The earliest was the "Joy Gobinda Law Gold Medal" in 1953, awarded by the Asiatic Society of Bengal and was based on an appraisal of his work by Sunder Lal Hora (and in 1970 received the Sunder Lal Hora memorial Medal of the Indian National Science Academy). He received honorary doctorates from the Aligarh Muslim University (1958), Delhi University (1973) and Andhra University (1978). In 1967 he became the first non-British citizen to receive the Gold Medal of the British Ornithologists' Union. In the same year, he received the J Paul Getty Wildlife Conservation prize consisting of a sum of $ 100,000, which he used to form the corpus of the Salim Ali Nature Conservation Fund. In 1969 he received the John C. Phillips memorial medal of the International Union for Conservation of Nature and Natural Resources. The USSR Academy of Medical Science gave him the Pavlovsky Centenary Memorial Medal in 1973 and in the same year he was made Commander of the Netherlands Order of the Golden Ark by Prince Bernhard of the Netherlands. The Indian government decorated him with a *Padma Bhushan* in 1958 and the *Padma Vibhushan* in 1976. He was also nominated to the Rajya Sabha in 1985.

Personal Life:

Salim Ali was married to a distant relative, Tehmina in December 1918. In 1939, Salim Ali's wife Tehmina died suddenly after minor surgery. It was a great blow. Her death was one of the greatest tragic experiences of Salim Ali, but, perhaps it drove him deeper into the world of birds. Dr. Salim Ali died in 1987, at the age of 91 after a prolonged battle with prostate cancer in Mumbai.

Timeline

1896: Born on November 12 in Mumbai
1913: Completed matriculation from Bombay University
1914: Admitted to St. Xavier's College and went to Burma
1917: Returned to India
1918: Married distant cousin, Tehmina in December
1926: Employed as guide lecturer in Prince of Wales Museum, Bombay
1928: Left the job and went to Germany
1930: Came back to India
1939: Wife Tehmina died
1941: Wrote first book "The Book of Indian Birds"
1953: Awarded with Joy Gobinda Law Gold Medal by Asiatic Society of Bengal
1958: Received doctorate degree from Aligarh Muslim University
1958: Honored with Padma Bhushan Award
1970: Bestowed with Sunder Lal Hora Memorial Medal from INSA
1973: Received honorary doctorate from Delhi University
1976: Conferred upon with Padma Vibhushan Award
1978: Received honorary doctorate from Andhra University
1985: Penned autobiography "The Fall of a Sparrow"
1987: Died on July 27 in Mumbai from prostate cancer, aged 90
1990: Salim Ali Centre for Ornithology and Natural History established at Coimbatore

Enjoy the humour

One man was searching for something in his safe for hours.
Wife: What are you searching for?
Husband: I give up. I was searching for our marriage papers.
Wife: But why?
Husband: I was searching for the expiry dates!!!

BOSS to an employee: Do you believe in life after Death?
EMPLOYEE: Certainly not! There's no proof of it", he replied.
BOSS: "Well, there is now. After you left early yesterday to go to your uncle's funeral, he came here looking for you.

One day a man spotted an old brass lamp by the roadside. He picked it up, rubbed the dirt off of it, and a genie appeared.
"I'll grant you your fondest wish," the genie said.
The man thought for a moment, then said, "I want a spectacular job - a job that no man has ever succeeded at or has ever attempted to do."
"Poof!" said the genie. "You are a housewife."

My friend Nancy and I decided to introduce her elderly mother to the magic of the Internet. Our first move was to access Google, and we told her it could answer any question she had.
Nancy's mother was very skeptical until Nancy said, "its true, Mom."
"Think of something to ask it."
As I sat with fingers poised over the keyboard, Nancy's mother thought a minute, and then responded, "How is Aunt Helen feeling?"

A noted psychiatrist was a guest at a chic gathering, and his hostess naturally broached the subject in which he was most at ease.
"Would you mind telling me, Doctor," she asked, "how you detect a mental deficiency in somebody who appears completely normal?"
"Nothing is easier," he replied. "I ask him a simple question, which everyone should answer with no trouble at all. If he hesitates, that tells me just what I need to know."
"What sort of question?"
"Well, I might ask him, 'Captain Cook made three trips around the world and died during one of them. Which one?
The hostess thought for a moment, then said with a nervous laugh, "You wouldn't happen to have another example, would you? I must confess I don't know much about history."

High Telephone Bill!
The phone bill was exceptionally high and the man of the house called a family meeting...
Dad: People this is unacceptable. You have to limit the use of the phone. I do not use this phone; I use the one at the office.
Mum: Same here, I hardly use this home telephone as I use my work telephone.
Son: Me too, I never use the home phone. I always use my company mobile.
House Maid: So what is the problem? We all use our work telephones...

THOUGHTS BY GREAT PEOPLE

"A true leader is a person who sees light when there is only darkness."
(Jordan Van Flute)

"Winning doesn't always mean being first. Winning means you are doing better than you have done before."
(BONNIE BLAIR)

"If you start judging people, you will be having no time to love them."
"If we cannot love the person whom we see, then how come we love god whom we cannot see."
(MOTHER TERESA)

"In a day when you don't come across any problems, you can be sure that you are travelling in a wrong path."
(SWAMI VIVEKANANDA)

"Think like a queen. A queen is not afraid to fail. Failure is another stepping stone to greatness."
(Oprah Winfrey)

"There are always flowers for those who want to see them."
(Henri Matisse)

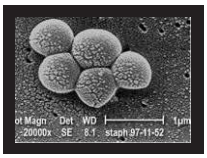
"Once you replace negative thoughts with positive ones, you'll start having positive results."
(Willie Nelson)

"Optimism is the faith that leads to achievement. Nothing can be done without hope or confidence."
(Helen Keller)

"A positive attitude may not solve all your problems, but it will annoy enough people to make it worth the effort."
(Herm Albright)

"Attitude is a little thing that makes a big difference."
(Winston Churchill)

"I am not afraid of tomorrow, for I have seen yesterday and I love today."
(William Allen White)



Superbug - Methicillin Resistant Staphylococcus Aureus

INTRODUCTION:

Staphylococcus aureus is a facultatively anaerobic, Gram-positive coccus, which appears as grape-like clusters when viewed through a microscope, and has large, round, golden-yellow colonies, often with hemolysis, when grown on blood agar plates. It is frequently found as part of the normal skin flora on the skin and nasal passages. It is estimated that 20% of the human population are long-term carriers of *S. aureus*. *S. aureus* is the most common species of staphylococcus to cause *Staph. S. aureus* is a successful pathogen due to a combination of bacterial immuno-evasive strategies. One of these strategies is the production of carotenoid pigment staphyloxanthin, which is responsible for the characteristic golden colour of *S. aureus* colonies.

Methicillin-resistant *Staphylococcus aureus* (**MRSA**) is a bacterium responsible for several difficult-to-treat infections in humans. It is also called **multidrug-resistant *Staphylococcus aureus*** and **oxacillin-resistant *Staphylococcus aureus*** (ORSA). MRSA is any strain of *Staphylococcus aureus that has developed* resistance to beta-lactam antibiotics, which include the penicillins (methicillin, dicloxacillin, nafcillin, oxacillin, etc.) and the cephalosporins. MRSA strains are most often found associated with institutions such as hospitals, but are becoming increasingly prevalent in community-acquired infections.

CLASSIFICATION:

Domain	: Bacteria
Kingdom	: Eubacteria
Phylum	: Firmicutes
Class	: Bacilli
Order	: Bacillales
Family	: Staphylococcaceae
Genus	: *Staphylococcus*
Species	: ***aureus***
Binomial name	: ***Staphylococcus aureus***

Signs and symptoms:

Healthy individuals may carry MRSA asymptomatically for periods ranging from a few weeks to many years. Patients with compromised immune systems are at a significantly greater risk of symptomatic secondary infection. MRSA may progress substantially within 24–48 hours of initial topical symptoms. After 72 hours, MRSA can take hold in human tissues and eventually become resistant to treatment. The initial presentation of MRSA is small red bumps that resemble pimples, spider bites, or boils; they may be accompanied by fever and, occasionally, rashes. Within a few days, the bumps become larger and more painful; they eventually open into deep, pus-filled boils. About 75 percent of community-associated (CA-) MRSA (community acquired) infections are localized to skin and soft tissue and usually can be treated effectively.

S. aureus can cause a range of illnesses, from minor skin infections, such as pimples, impetigo, boils (furuncles), cellulitis folliculitis, carbuncles, scalded skin syndrome, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome (TSS), bacteremia, and sepsis. Its incidence ranges from skin, soft tissue, respiratory, bone, joint, endovascular to wound infections.

Diagnosis

Diagnostic microbiology laboratories and reference laboratories are key for identifying outbreaks of MRSA. New rapid techniques for the identification and characterization of MRSA have been developed. This notwithstanding, the bacterium generally must be cultured via blood, urine, sputum, or other body fluid cultures, and cultured in the lab in sufficient quantities to perform these confirmatory tests first. Consequently, there is no quick and easy method to diagnose a MRSA infection. Therefore, initial treatment is often based upon 'strong suspicion' by the treating physician, since any delay in treating this type of infection can have fatal consequences. These techniques include Real-time PCR and Quantitative PCR and are increasingly being employed in clinical laboratories for the rapid detection and identification of MRSA strains.

Another common laboratory test is a rapid latex agglutination test that detects the PBP2a protein. PBP2a is a variant penicillin-binding protein that imparts the ability of S. aureus to be resistant to oxacillin.

Genetics

Antimicrobial resistance is genetically based; resistance is mediated by the acquisition of extrachromosomal genetic elements containing resistance genes. Exemplary are plasmids, transposable genetic elements, and genomic islands, which are transferred between bacteria via horizontal gene transfer. A defining characteristic of MRSA is its ability to thrive in the presence of penicillin-like antibiotics, which normally prevent bacterial growth by inhibiting synthesis of cell wall material. This is due to a resistance gene, *mecA*, which stops β-lactam antibiotics from inactivating the enzymes (transpeptidases) that are critical for cell wall synthesis.

SCC*mec*

Staphylococcal cassette chromosome *mec* (SCC*mec*) is a genomic island of unknown origin containing the antibiotic resistance gene *mecA*. SCC*mec* contains additional genes beyond *mecA*, including the cytolysin gene *psm-mec*, which may suppress virulence in hospital-acquired MRSA strains. SCC*mec* also contains *ccrA* and *ccrB*; both genes encode recombinases that mediate the site-specific integration and excision of the SCC*mec* element from the *S. aureus* chromosome. Currently, six unique SCC*mec* types ranging in size from 21–67 kb have been identified; they are designated types I-VI and are distinguished by variation in *mec* and *ccr* gene complexes.

Different SCC*mec* genotypes confer different microbiological characteristics, such as different antimicrobial resistance rates. Different genotypes are also associated with different types of infections. Types I-III SCC*mec* are large elements that typically contain additional resistance genes and are characteristically isolated from HA-MRSA (healthcare acquired) strains. Conversely, CA-MRSA is associated with types IV and V, which are smaller and lack resistance genes other than *mecA*.

mecA

mecA is responsible for resistance to methicillin and other β-lactam antibiotics. After acquisition of *mecA*, the gene must be integrated and localized in the *S. aureus* chromosome. *mecA* encodes penicillin-binding protein 2a (PBP2a), which differs from other penicillin-binding proteins as its active site does not bind methicillin or other β-lactam antibiotics. As such, PBP2a can continue to catalyze the transpeptidation reaction required for

peptidoglycan cross-linking, enabling cell wall synthesis in the presence of antibiotics. As a consequence of the inability of PBP2a to interact with β-lactam moieties, acquisition of *mecA* confers resistance to all β-lactam antibiotics in addition to methicillin.

mecA is under the control of two regulatory genes, *mecI* and *mecR1*. MecI is usually bound to the *mecA* promoter and functions as a repressor. In the presence of a β-lactam antibiotic, MecR1 initiates a signal transduction cascade that leads to transcriptional activation of *mecA*. This is achieved by MecR1-mediated cleavage of MecI, which alleviates MecI repression. *mecA* is further controlled by two co-repressors, BlaI and BlaR1. *blaI* and *blaR1* are homologous to *mecI* and *mecR1*, respectively, and normally function as regulators of *blaZ*, which is responsible for penicillin resistance. The DNA sequences bound by MecI and BlaI are identical; therefore, BlaI can also bind the *mecA* operator to repress transcription of *mecA*.

Treatment

Both CA-MRSA (community acquired) and HA-MRSA (healthcare acquired) are resistant to traditional anti-staphylococcal beta-lactam antibiotics, such as cephalexin. CA-MRSA has a greater spectrum of antimicrobial susceptibility, including to sulfa drugs (like co-trimoxazole/trimethoprim-sulfamethoxazole), tetracyclines (like doxycycline and minocycline) and clindamycin, but the drug of choice for treating CA-MRSA is now believed to be vancomycin, according to a Henry Ford Hospital Study. Linezolid is now felt to be the best drug for treating patients with MRSA pneumonia. HA-MRSA is resistant even to these antibiotics and often is susceptible only to vancomycin. Newer drugs, such as linezolid (belonging to the newer oxazolidinones class) and daptomycin, are effective against both CA-MRSA and HA-MRSA. Ceftaroline and ceftabiparole, a new fifth generation cephalosporins, are the first beta-lactam antibiotics approved in the US to treat MRSA infections (skin and soft tissue only).

Vancomycin and teicoplanin are glycopeptide antibiotics used to treat MRSA infections. Teicoplanin is a structural congener of vancomycin that has a similar activity spectrum but a longer half-life. Because the oral absorption of vancomycin and teicoplanin is very low, these agents must be administered intravenously to control systemic infections. Drugs are administered via a peripherally inserted central catheter, or a Picc Line, which is inserted by radiologists, doctors, physician assistants (in the U.S.), radiologist assistants (in the U.S.), or specially trained certified registered nurses. Treatment of MRSA infection with vancomycin can be complicated, due to its inconvenient route of administration. Moreover, many clinicians believe that the efficacy of vancomycin against MRSA is inferior to that of anti-staphylococcal beta-lactam antibiotics against methicillin-susceptible *Staphylococcus aureus* (MSSA).

Several newly discovered strains of MRSA show antibiotic resistance even to vancomycin and teicoplanin. These new evolutions of the MRSA bacterium have been dubbed Vancomycin intermediate-resistant. Linezolid, quinupristin/ dalfopristin (synercid), daptomycin, and tigecycline are used to treat more severe infections that do not respond to glycopeptides such as vancomycin.

Initial studies at the University of East London have demonstrated that allicin (a compound found in garlic) exhibits a strong antimicrobial response to the bacteria, indicating that it may one day lead to more effective treatments.

A report released in 2010 details the efficacy of the active ingredients like (Hydrogen Peroxide, Triclosan, Chlrohexidine Gluconate, Levofloxacin & silver) against MRSA. These active ingredients are now rapidly used in various antiseptics & disinfectant products. Triclosan used as hand sanitizer (hand wash/hand rub) can eliminate MRSA, thus preventing it to be transferred from one patient to the other. Hydrogen Peroxide & Silver based combination when used as fumigant, can be very effective against MRSA. Usually the active ingredients with nonspecific mode of action have been proven successful.

RECENT ADVANCES:

New research led by IBM Research-Almaden and the Institute of Bioengineering and Nanotechnology has developed a new treatment for drug-resistant superbugs such as *Staphylococcus aureus* (MRSA). The new MRSA treatment uses tiny nanotechnology structures to attack the cell membrane of MRSA bacteria.

This scientific breakthrough in a nanotechnology treatment might solve the massive of problem of drug resistant bacteria. Antibiotics have long been an essential player in the fight against bacteria and infections. However, their prolific use has created a significant hazard. Since antibiotics attack bacteria from within by passing through the cell membrane and disrupting the bacteria's DNA, the microbes can easily develop a resistance to these antibiotics.

IBM's new nanotech treatment hopes to bypass this problem by using tiny nano-structures to attack and destroy bacteria's cell membrane. This technique would prevent bacteria from becoming resistant to treatment and would significantly help the fight against MRSA by killing the drug-resistant bacteria even after antibiotic treatments have failed.

Additionally, the nanotech treatment is less harmful to the treated patients. While MRSA antibiotics attack both healthy and infected cells indescriminantly, the nanostructures can discriminate between healthy red blood cells and infected cells by detecting the electric charges each produces. During tests of the nanostrucutures there was no rupturing of healthy red blood cells even at doses 10 times higher than normal.

The new treatment would employ biodegradable nanostructures made of polycarbonate polymer. The structures are only 200 nanometers across and would reassemble themselves into a shape designed to disintegrate bacteria cell membranes when they came into contact with water on the skin or in the body.After the structures had successfully destroyed the bacterial infection they could be easily biodegraded by enzymes in the body and flushed out of the patient's system.

Although IBM's new nanotechnology treatment is far from complete it has enormous implications for the fight against MRSA. During the last yearly study by the U.S. Centers for Disease Control 19,000 Americans were killed by the MRSA infection.

This new nanotechnology treatment has the potential to help or even cure thousands of patients suffering from MRSA and other drug-resistant superbugs.

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Deep Wound, Abscess and Pus Specimens

Background:
Infections in deep wounds and abscesses are often caused by a mixture of aerobic and anaerobic organisms.

Specimen collection and Transport:
Pus from an abscess or deep wound should be sent in a clean sterile container and/or an anaerobic transport container.

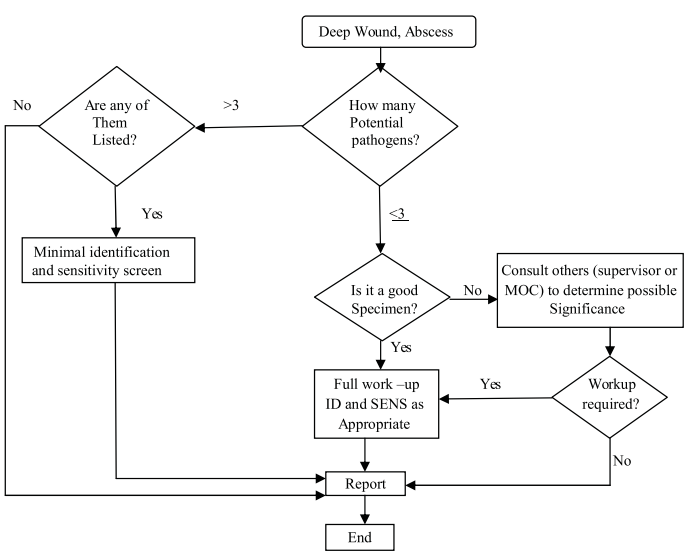
Procedure/Media:

A. **Processing of Specimens:**
Direct examination of Gram stained smear-Note the presence of polymorphonuclear cells, squamous epithelial cells and organisms. Quantitate as per Guideline for Quantitative Interpretation of Gram Stains.
If *Actinomyces sp*. or *Nocardia sp*. is requested or suggested on gram stain (branching or beaded gram positive organisms), the Modified Acid Fast stain should be performed. If the Modified Acid Fast stain is not performed in your laboratory, refer to a reference laboratory capable of isolating these organisms.
Culture on the following media, and incubate the plates as indicated.

Dehydrated Culture Media	Incubation
Blood Agar	CO_2 at 35^{0}C for 48 hour
MacConkey Agar	O_2/CO_2 at 35^{0}C for 48 hour
Chocolate Agar	CO_2 at 35^{0}C for 48 hour
Anaerobic Agar	AnO_2 at 35^{0}C for 72 - 96 hour

Other anaerobic agars as per laboratory protocol
If *Actinomyces* sp. requested or questioned on direct smear, incubate anaerobic media for 7 days.

B. **Interpretation of Cultures:**
Examine the aerobic plates daily for the total incubation time; and the anaerobic plates after 48 hours and 4 days. Potential pathogens include such organisms as *S. aureus*, *Beta haemolytic streptococci*, *Pasteurella* sp., *Capnocytophaga* sp. (animal bites) *Eikenella* sp. (human bites), *Enterobacteriaceae*, *P. aeruginosa*, *anaerobes*. Correlate with the results of the direct gram smear.



Potential Pathogens:	Listed Organisms
S. aureus	*S. aureus* - rule out MRSA
Beta haemolytic streptococci	beta-hemolytic streptococci (groups A, B, C, F, and G)
Pasteurella sp.	Yeast only when isolated in moderate to abundant amounts
Capnocytophaga sp. (animal bites)	(consult with MOC or supervisor before reporting)
Eikenella sp. (human bites)	*Pseudomonas species*
Enterobacteriaceae,	*Enterococcus species* – rule out VRE
P. aeruginosa	*Bacteroides fragilis* group
anaerobes	*Actinomyces israelii*
	Clostridium perfringens - if predominant

C. **Susceptibility Testing:**
Perform antimicrobial susceptibility tests according to the Antibiotic Reporting Guideline and laboratory protocol.

Reporting Results:
Gram stained smear: Report with quantitation the presence of polymorphonuclear cells, squamous epithelial cells and organisms.

Culture:

a. Negative report : No growth , Mixed aerobic flora, Mixed anaerobic flora, Mixed aerobic and anaerobic flora Including "Listed Organisms" or Type of flora, depending on site
b. Positive report: Report potential pathogens and sensitivities (as determined by organism). Quantitate. Single isolates of anaerobes may require susceptibility testing.
c. If organisms seen in the direct smear do not appear in culture, and anaerobic specimen was not submitted, it might suggest that the organisms seen failed to grow indicating the presence of fastidious or anaerobic organisms. It could also indicate that the gram stain was interpreted incorrectly. It is helpful to re-check the direct smear. If the gram stain is correct, the comment "Organism(s) seen in direct smear did not grow on aerobic culture, suggesting the presence of anaerobic or other fastidious organisms or previous antibiotic therapy."

References:

1. Isenberg, H. 1992. Clinical Microbiology Procedures Handbook. American Society for Microbiology. Washington DC.
2. Miller, J.M. 1996. A Guide to Specimen Management in Clinical Microbiology. American Society for Microbiology. Washington DC.
3. Murray, P.R. 1996. ASM Pocket Guide to Clinical Microbiology. American Society for Microbiology. Washington DC.
4. Patrick R. Murray, Ellen Jo Baron, James H. Jorgensen, Marie Louise Landry, Michael A. Pfaller, Manual of Clinical Microbiology, 9th ed., 2007: American Society of Microbiology Washington, DC.

Collection of specimens/swabs

Samples can arrive at the microbiology laboratory in a variety of formats, often sub-samples of a large production batch or in a clinical setting, samples of body fluids. Swabs however, are unique in their presentation, as the target microorganisms need to have been efficiently collected from the sampling site, carried by an inert vector and then must be recovered from this for subsequent analysis.

During transportation of the swab the numbers and proportions of micro-organisms present should be the same when it arrives at the lab as they were when first sampled. Swab transport systems should be able to keep the more delicate and fastidious bacteria viable whilst preventing the more robust ones from multipyling and obscuring others.

So swabbing techniques, and the swabs themselves, need to provide an efficient collection of sample, its subsequent preservation, and ultimately the release of the target cells. In 2003 the Clinical Laboratory Standards Institute (CLSI) published M40-A, an approved standard for the quality control of microbiological transport systems, this meant that for the first time swab products could be compared and evaluated using set criteria.

Disposable, single-use plastics revolutionized the microbiology laboratory, lending themselves particularly to the testing of surfaces or inaccessible areas of equipment and for clinical specimens.

Traditionally the swab would comprise a flexible shaft terminating in a bud of compacted material, e.g. cotton, viscose, contained within a pre-labelled, tamper-evident tube. The tube may also contain a transport medium designed to maintain the viability of any organisms collected.

There is a wide range of transport media available e.g. Amies with Charcoal Transport Medium, Stuart Transport Medium, and Universal Transport Medium (UTM), these are intended to maintain the viability of any cells present until the swab is returned to the laboratory.

The new nylon flocked swab design has oriented strands of nylon arranged perpendicular to the shaft creating micro-capillaries that not only improve sample collection but also release that sample more efficiently. Sample release efficiencies (>90%) allow truly quantitative results.

General principles:
Successful collection of specimens will depend on the following:
- Collection at the appropriate time
- Use of the correct technique
- Use of the correct equipment
- Safe transportation to the laboratory without delay

Healthcare practitioner's role:
- To identify the requirement of a microbiological investigation
- To initiate the procedure
- To collect the desired material in the correct container
- To arrange prompt delivery to the laboratory

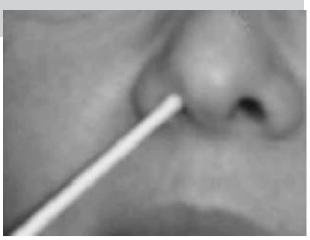
Collection of specimens:
- Samples should be collected before the start of any treatment
- If an unusual specimen is required check any specific requirements with the laboratory eg skin and mucous membranes, pus, biopsies

Types of investigation:
- Bacterial – culture and sensitivity
- Viral – culture; serology; ideally taken in hospital as viruses do not survive long outside the body
- Serological – antigens and antibodies
- Mycosis – fungal
- Protozoa – malaria

Generic equipment required:
Sterile Water, Spatula, Labelled Specimen Container, Swab in Transport Medium, Disposable gloves as necessary & Laboratory Request Form.

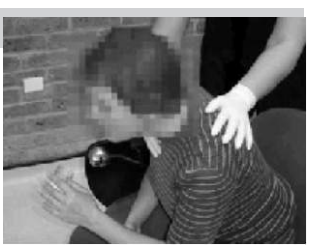
General techniques for collection of specimens:

Nose swab



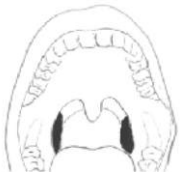
Action	Rationale
Moisten swab beforehand with sterile water	To prevent discomfort to the patient
Move swab from the anterior nares and direct upwards into the tip of the nose	To swab the correct site and obtain required sample
Gently rotate the swab once	

Sputum specimen



Action	Rationale
Use a clean, not necessarily sterile container	Sputum is never free from organisms due to passing through the pharynx & mouth
Ensure that the specimen is sputum NOT saliva	To obtain the required sample
Encourage the person to cough deeply or request the help of a physiotherapist	To facilitate expectoration

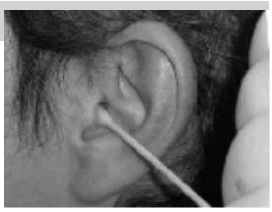
Throat swab



Tonsilar fossa

Action	Rationale
Sit the person facing a strong light and depress the tongue with a spatula	To ensure you can see the area to be swabbed. The procedure is likely to make the individual gag – the tongue moving to the roof of the mouth will contaminate the specimen
Quickly but gently swab the tonsillar fossa or any area with a lesion or visible exudates	To obtain the required sample

Ear swab



Action	Rationale
No drops should have been used 3 hours prior to taking the swab	To prevent collection of therapeutic material
Place the swab into the outer ear and rotate gently once	To avoid trauma to the ear and collect secretions

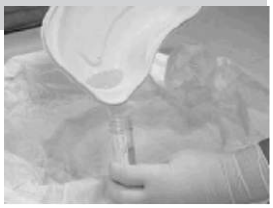
Wound swab

Action	Rationale
Take the swab before cleaning the wound	To collect the maximum number of organisms
Rotate the swab gently once	To collect the sample

Urine specimen – early morning

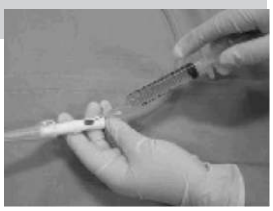
Action	Rationale
Early morning specimen required	The bladder will be full due to overnight accumulation of urine – later specimens may be diluted

Urine specimen – mid-stream



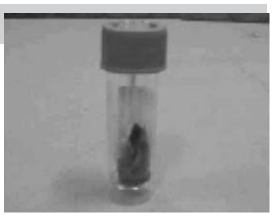
Action	Rationale
Ask the person or assist them to wash around the urethral area	To prevent other organisms contaminating the specimen
Ask the person to discard the first and last part of micturation and collect the middle stream	To avoid contamination with skin organisms

Urine specimen – catheter



Action	Rationale
Clean the access point on the tubing	To reduce cross infection
If there is no urine, clamp the tubing below the access point	To obtain an adequate specimen
Using a sterile needle and syringe aspirate urine through the access point	To prevent leakage
Re-clean the access point	To reduce contamination

Faeces specimen



Action	Rationale
Person to defaecate into a clean bedpan	To avoid unecessary contamination
Scoop enough material to fill a third of the specimen pot	To obtain a usable amount of specimen
Record colour, consistency and odour	To maintain an accurate baseline record
Segments of tapeworm are easily seen – send to the laboratory	Laboratory confirmation of the head of the tape worm is required to prevent further growth

References: (1) Baillie L. (2005), **Developing Practical Nursing Skills** and ed. Edward Arnold. (2) Dougherty L., Lister S. (2004), **The Royal Marsden Hospital Manual of Clinical Nursing Procedures** th ed. Blackwell Publishing. (3) Jamieson E.M., Whyte L.A., McCall J.M. (2007), **Clinical Nursing Practices** th ed. Churchill Livingstone Elsevier. (4) Johnson, R., Taylor, W. (2006), **Skills for Midwifery Practice 2nd Ed** Elsevier Churchill Livingstone.

Microxpress

Introducing.....

Gamma Irradiated Sterile Disinfectants

Historically pharmaceutical, biotechnology and medical device manufacturers have been using disinfectants and filter through 0.22 micron filter for further usage. Lack of availability of good quality sterile disinfectants is a major hurdle facing GMP plants today, which is being overcome on an ad hoc basis by taking recourse to 0.22 micron filtration of available disinfectants, solutions and products. Such ad hoc methods give rise to the issue of credibility of the performance of such products and require ongoing validation of process that are used to aseptically filter the disinfectants through 0.22 micron filter. Thus gamma sterilized products takes care of the aforesaid procedures and guarantees availability of sterile, effective and proven products for clean room usage.

Hand Disinfection

Cat No.	Products	Activity	Application
ANX0750	Alconox	Bactericidal, fungicidal and virucidal	Personal hand hygiene
PLG0750	Purellium Gel - C	Bactericidal, fungicidal and virucidal	Personal hand hygiene
TST0750	Triosept	Bactericidal, fungicidal and virucidal	Personal hand hygiene

Environment and Surface Disinfection

Cat No.	Products	Activity	Application
AST0750	Aerosept – C	Bactericidal, fungicidal and virucidal	For disinfecting laminar hoods, table tops, workstations, air and surface disinfection in ciritcal areas.
MLE0750	Microlyse – C	Bactericidal, fungicidal and virucidal	For floor mopping and surface disinfection
NST0750	Nusept – C	Bactericidal, fungicidal and virucidal	For surface disinfection and general purpose disinfection
NVC0750	Novacide	Bactericidal, fungicidal and virucidal	For surface disinfection
ATR0750	Acitar	Bactericidal, fungicidal and virucidal	For environment (fumigation) and surface disinfection

Pack Size Available – 750 ml

BioShields Presents Nusept

Composition - 1% w/v Poly (hexamethylene biguanide) hydrochloride, Perfume, Fast green FCF as color.

Description: NUSEPT™ is a new generation, powerful, non stinging, safe, highly effective and resistance-free microbicidal antiseptic solution. NUSEPT™ is an ideal antiseptic for use in medical settings. The main active ingredient of NUSEPT™ is poly (hexamethylenebiguanide) hydrochloride (PHMB). PHMB is a polymeric biguanide. There is no evidence that PHMB susceptibility is affected by the induction or hyper expression of multi-drug efflux pumps, neither there have been any reports of acquired resistance towards this agent.

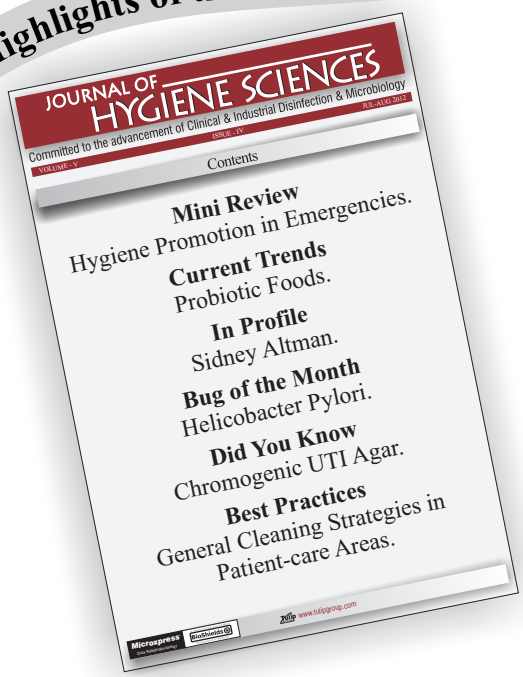
ACTIVITY : Broad spectrum: Bactericidal, Fungicidal & Virucidal.

CONTACT TIME : 1 min (undiluted & 10% v/v solution), 5 min (5% v/v solution), 10 min (2.5% v/v solution).

APPLICATIONS :
Medical: In Hospitals, Nursing homes, Medical colleges, Pathological laboratories for Inter-operative irrigation. Pre & post surgery skin and mucous membrane disinfection. Post-operative dressings. Surgical & non-surgical wound dressings. Surgical Bath/Sitz bath. Routine antisepsis during minor incisions, catheterization, scopy etc. First aid. Surface disinfection.
Industrial: In Pharmaceutical industry, Food & beverage industry, Hotel industry etc. General surface disinfection. Eliminating biofilms.

USAGE	DOSAGE AND ADMINISTRATION
Pre & post-surgery skin cleaning & disinfection	Use undiluted
Surgical, post operative, non surgical dressing	Use undiluted, once a day/alternate day
Surgical bath/Sitz bath	Add 50 mL of NUSEPT™ in 1 L of water & use
Antisepsis during minor incisions, Scopy, Catheterization, first aid, cuts, bites, stings etc	Use undiluted
Chronic wound management (diabetic foot, pressure and venous leg ulcers)	Use undiluted
Burn wound management (Only for 1st and 2nd Degree burns, chemical burns)	Use 100 mL NUSEPT™ in 1 L sterile water for both washing (with 1 minute contact time) and dressing of burn wound (Dressing must be changed everyday/ alternate days or as directed)
Midwifery, nursery & sickroom	Use undiluted
Intra-operative irrigation	Use 50 mL NUSEPT™ in 1 L sterile water
General hard surface disinfection	Add 100 mL of NUSEPT™ in 1 L of water and gently mop the floor or surfaces

Highlights of the coming issue



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