Applied Microbiology Laboratory

Environmental Monitoring

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Indoor Microbial air flora in Hospital

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ABSTRACT

The microbiological quality of the air in operating theater is a significant parameter to control healthcare associated infections, and regular microbial monitoring represents an useful tool to assess environmental quality and to identify critical situations which require corrective intervention.

The microbiological content of the air is monitored by two methods: one active and one passive. Both methods should be considered in combination for general monitoring of air contamination, such as routine surveillance programs.

GLOSSARY / KEY WORD

Active air sampler, Aerosol, Airborne population, CCVS, CFU, Disease, Germ theory, HVAC, Illness, Infection, Microbes, Microbial load, Nosocomial infection, Pathogen, Pneumonia, Risk assessment, Settle plate, Slit air sampler, Sterile, Sterilization, TSA, TVC.

INTRODUCTION

The relatioship between microorganisms in air and infectious diseases was for the first time shown by the Italian Redy and Lazzaro Spallanzani and then confirmed by the French Louis Pasteur: “the germ theory of disease”. Airborne pathogens are reportedly a major cause of illnesses (e.g.: respiratory ailments, causing allergy, asthma and pathological involvement of respiratory tract).

ILLNESS FROM AIRBORNE MICROORGANISMS

- -Sick Building Syndrome

The Sick Building Syndrome (SBS) involves various nonspecific symptoms that occur in the occupants of a building. One of the etiologies of SBS is bacterial or fungal contamination.

Legionnaire’s disease is also a part of this building related spectrum of illnesses, that also includes humidifier fever, caused by droplets containing bacteria present in humidifier and resulting in extrinsic allergic alveolitis.

- -Legionnaire’s Disease

Legionellosis is an interstitial pneumonia caused by the Gram negative bacterium Legionella pneumonia, naturally present in heater of cooling towers of air conditioners and disseminated in the form of small droplets called aerosol. Quite often is present as nosocomial pneumonia.

- -Pulmonary tuberculosis

Infectious droplet nuclei are generated when a patient that has pulmonary or laryngeal tuberculosis cough, sneeze, shout or sing. Transmission occurs when a person inhales droplet nuclei containing Micobacterium tuberculosis and the droplet traverse the mouse or nasal passages, upper respiratory tract and bronchi to reach the alveoli of the lung.

- -MRSA (Methicillin resistant *Staphylococcus aureus*) can also spread by aerial routes.
- *-Acinetobacter spp* is a common bacterial pathogen transmissible by air.
- *-Clostridium difficile*, anaerobic bacteria, can be spread by aerosolisation.
- -Fungi in air

Fungi are very common in indoor and outdoor environments producing fungal allergy.

- -*Alternaria spp, Aspergillus spp, Botrytis spp, Cladosporium spp, Penicillium spp, Scopularioosis spp, Pneumocystis* are very common and are released by coughing, sneezing, carpets, plants.

METHODS for DETECTION of MICROORGANISM in AIR

Through air sampling, it is possible to evaluate microbial contamination in environments at high risk of infection. Moreover, these controls can be used to check the efficiency of both the Conditioned and Controlled Ventilation System (CCVS) and the team's hygiene procedures.
International Standards offer different techniques (active or passive sampling) and different kinds of air samplers, thus leaving the choice of system open.

- ACTIVE SAMPLING

In Active Monitoring a microbiological air sampler physically draws a known volume of air through or over a particle collection device which can be a solid culture medium and the quantity of microorganisms present is measured in CFU (Colony Forming Unit) / m3 of air.

- PASSIVE SAMPLING

Passive monitoring uses "settle plates" which are standard Petri dish containing culture media, which are exposed to the air for a given time in order to collect biological particles wich "sediment" out and are then incubated. Results are expressed in CFU/plate/time or in CFU/m2/hour.
According to some authors, passive sampling provides a valid risk assessment as it measures the harmful part of the airborne population which falls onto a critical surface, such as the surgical cut or on the instruments in operating theatres.

PROTOCOL for DETECTION of MICROORGANISMS in AIR IN OPERATING THEATRE

The sampling should be performed in each operating theater "at rest" (in the early morning before the beginning of surgical activity) and "in operational" (during surgery). The number of personnel present "in operational" is recorded to assess the association between the number of people in the room and the value of Total Viable Count (TVC). The sampling staff should take great care in hand and forearm washing and in accurate use of personal protective equipments such as gowns, masks, caps, gloves and overshoes.
The volume of aspirated air should be 1.000 litres.
The TVC is executed using Tryptic Soy Agar (TSA) with Petri dishes incubated at 36°C for 48 hours. The presence of filamentous fungi is evaluated using Petri dishes containing Sabouraud Chloramphenicol Dextrose Agar incubated at 30°C for 6/10 days and identified on the basis of their macroscopic and microscopic morphological features.

CONCLUSIONS

Active sampling and passive sampling should both be used in operating theater. The active to obtain information about the concentration of inhalable viable particles and the quality of the hygienic conditions; the passive to monitor the risk of microbial wound contamination at the surgical site.

REFERENCES

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