



HEPA FILTER – GOLDEN HALF HOUR

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ABSTRACT Infection control is an important discipline concerned with prevention of nosocomial infections and in prevention of surgical site infections. Infections can spread through any means like blood, oral fluid, other secretions, surfaces, instruments, air etc. The most intangible means of pathogen transmission is air. The HEPA (High-efficiency particulate air) filter is capable of removing 99.97 percent of all particles larger than 0.3 microns in diameter. However the effect of HEPA filter on reducing the existent room air microbial burden takes time. In this study we analyzed how much time it takes for the HEPA filter to act in order to achieve a nil growth on culture plate. We were able to achieve nil growth on culture plate by 30 minutes hence emphasizing the need to switch on the HEPA filter half an hour prior to surgery for maximum benefits in prevention of surgical site infections.

KEYWORDS : Ot Sterilization, Hepa Filters, Prevention Of Surgical Site Infection

INTRODUCTION

Infection control is an important discipline concerned with prevention of nosocomial infections and in prevention of surgical site infections. Infections can spread through any means like blood, oral fluid, other secretions, surfaces, instruments, air etc. The most intangible means of pathogen transmission is air.

Four technologies that target the decontamination of air are:

1. Filtration or decontamination - Through high-efficiency particulate arrestor (HEPA) filters.
2. Ozonization — It subjects the air to high voltage charges. This results in the separation of adjacent oxygen atoms which brings about the creation of the ozone isotope. Ozone molecules are highly reactive and when they come into contact with microorganisms they react, rendering them harmless. However, the amount of ozone required to destroy pathogens in the air would present a health risk to doctors and patients.
3. Ionization - It uses charged electrodes to project negative ions into the air. The microorganisms floating in the air attract these negatively charged ions and become heavier as a result and then precipitate onto surfaces. However, the microorganisms are not destroyed through this process. They remain viable and thus require further treatment through some more conventional form of disinfection.
4. Air sterilization —with the use of ultraviolet irradiation. The DNA of all bacteria and viruses are ruptured, thus, rendering them sterile and incapable of reproduction.

Filtration is the physical removal of particulates from the air and is a key step in achieving acceptable indoor air quality. It is also stated that to maintain the air cleanliness in operating room permanently, air exchange rate in the operating room should be more than 20 times in 1 h. (NABH protocols 2018). Air purifiers utilize different types of filtration such as carbon, HEPA, or a mixture such as a carbon/HEPA filtration unit. While a carbon filter is ideal for chemicals and odors in the air, HEPA is ideal for air particles.

High-efficiency particulate air (HEPA) filters direct air over the operating table in one direction, usually from above downward or horizontally across the table, usually from the foot toward the head. The spent air is filtered through HEPA filters and then recirculated. These enclosures provide air remarkably free of particulate and microbial matter.^{1,2,3} This new filtration technology now permits cleaning of large volumes of air,⁴ so that the filtered air is essentially

sterile. The HEPA filter is capable of removing 99.97 percent of all particles larger than 0.3 microns in diameter.

MATERIAL AND METHOD

The study was done at Sushrut Hospital, Nallasopara, India. 12 Nutrient agar plates were kept in the operation theatre below the laminar airflow that was being filtered by the HEPA filter. The method used for the experiment was settle plate technique for the testing efficacy of HEPA filters in achieving nil growth on nutrient agar plate. The agar plates were named in order. The HEPA filter was switched on and the nutrient plates were opened periodically. The first plate was opened before the HEPA filter was switched on. This gave an idea about the presence of existing colonies in the OT room air. Later, HEPA filter was switched on and the second plate was opened after 10 mins, while rest 10 plates remained covered. Now, the third plate was opened after 20 mins giving the idea about the difference in bacterial quantity in the air load post 20 minutes of HEPA filter used. The fourth plate opened after 30 mins, the fifth opened after 40 minutes and so on. This was done until the 12th agar plate was opened at 110 mins after HEPA filter was switched on. These plates were left in the OT for 24 hours and were later sent to pathological analysis of the colonies. This experiment was done 15 times on different occasions in the same OT and results were analyzed. The conducted experiment was done in a general surgical OT. (Figure I)

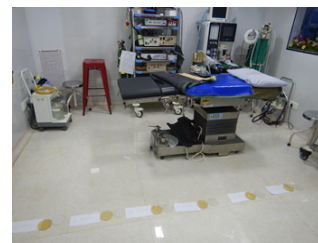


Figure I – The agar plates placed in the OT

RESULTS

The colonies identified were of *Staphylococcus aureus*. The number of colonies detected kept decreasing in the subsequent growth cultures as the air in the OT kept getting filtered by HEPA. “No growth” report was achieved at 30 mins after HEPA filter was started in the OT. The target result of no growth was achieved at 20 minutes at 4 different occasions, whereas it was achieved at 30 minutes on 11 occasions. (Figure II)

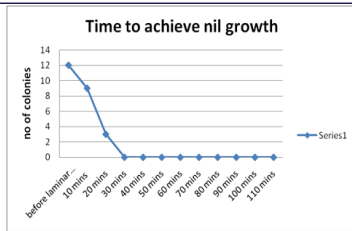


Figure II – no of colonies and time taken to achieve nil growth

CONCLUSION

This study highlights the functioning of HEPA filter in reducing the microbial content in the operation theater and focuses on the importance of switching it on at least half hour before a case is posted to achieve the best desired results.

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