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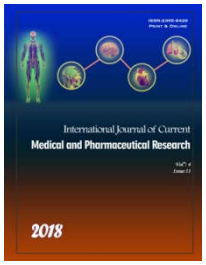

PROTECTION OF PHYSICIAN FROM AIR BORNE INFECTION IN OUT PATIENT DEPARTMENT

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ABSTRACT

Introduction-Physicians are at greater risk of air borne infection from patients. They must protect themselves from the diseases to serve the society better. There are four methods by which air borne infections can be minimized - Air Filter, Ioniser, Directed Air Flow and Air Curtain. All these methods can be used in OPD by using already available device in market in specific manner.
Method-100 patients were selected for this study. Hepa filter placed at appropriate level in between physician and patients in out-patient setting. Soap bubble spray toy used for measuring the efficiency of protection of infections from patients to physicians. Confirmation done by growth of microorganism over culture media.
Results-Negative growth of bacteria on culture media when filter in switched on suggest its effectiveness as barrier of spread of infections from patients to physicians.
Conclusions-Hepa filters were effective in prevention of infections from patients to physicians and is confirmed by negative cuture report. However more study is warranted regarding this issue and there is a need for such medical device development.

INTRODUCTION

Less is talked about physician safety from airborne infection. There are literatures and methods for protection of patients from air borne infection in hospitals but methods regarding protection of Health care workers specially doctors are not stressed. As physicians and specially Ear Nose Throat surgeons are more exposed to air borne infection as they are at lesser distance from the patients and are directly examining the mouth and nose. Other than infections, badodor, spillage of secretions and blood also pose problems while examining patients.

MATERIALS AND METHOD

We took a small unit of HEPA filter with Ionizer available in market (model- Philips, model –NL-9206AD-4DRACHEN, AC-4014) here called as 'device'. Model was selected suitable to room volume (approx 5x6x4 meter^3) andfixed it horizontally in out patient setting of Pankaj ENT hospital in a manner that it projects air jet between the patient and physician and also at physician face at the level of their interaction and jets on physician's face.

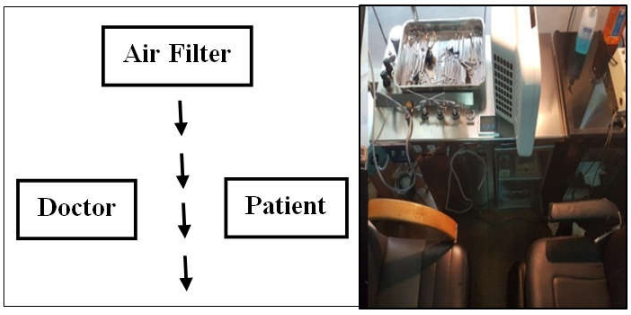

Fig 1 Setup of Air Filter between doctor and patient

In this way it acted simultaneously as air curtain between patients and doctor. HEPA filter, Ionizer and air jet when falls on examiner face it acts as directed air flow.100 cases (patients attending OPD at Pankaj ENT Hospital) were selected based on their primary complains and after examining them. All selected cases were informed about the study and proper informed consent have been taken from them in their own language.

Inclusion criteria

1. Patient mainly of infective etiology like cough with expectoration, dry Cough, Acute and Chronic

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Tonsillitis, Chronic Sinusitis, Malignancy oro-pharynx and Maggots nose.
2. Age 2 yrs and above.

Exclusion criteria

1. Ptients diagnosed of non infective etiology.
2. Age less than 2 years
3. Patients with asthama, crtically ill patients and who are not cooperative for examinations and not following commands.
4. Patients who were not ready or didn't give consent for this study.

Objective of the study

1. Efficiency of air curtain if patient coughs, simulated by soap bubble spray (Figure-2).
2. Efficiency of directed air flow by measuring how efficiently surrounding soap bubble gun is not able to reach physician because of air jet directed towards him.
3. Bad Odour and overall examination comfort.
4. Bacterial culture while patients cough with Air filter switch on and off.

Fig 2 Bubble spray toy

- IN the OPD, the device was first switched off then a bubble gun started at imaginary patient's mouth and distance of the bubble travelled was noted. (figure3)

Fig 3 Air bubble reaching upto doctor without air filter

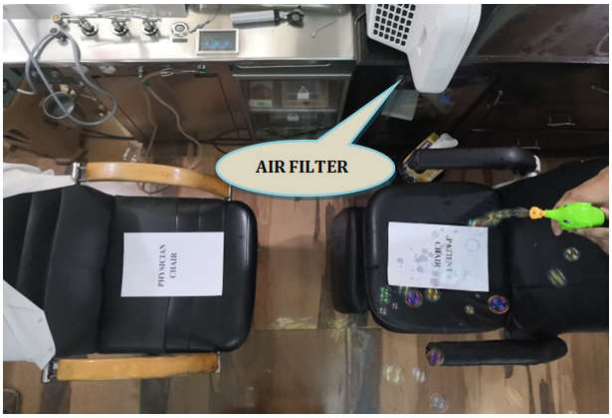

Fig 4 Air bubble distracted due to air filter on

- Then the device was switched on and the experiment was repeated and distance traveled by the bubble was noted.
- Subjective comfort of examining the patients were noted in patients with bad odour with device switched on and off.
- Agar culture dish (culture media) was kept at imaginary examiner/physician's face level and collection of bacterial sample for culture was done by static method of air sampling with device switched off and after switched on. Patients were asked to cough. Culture was done for 72 hrs and readings were noted.

OBSERVATION & RESULT

Following things noticed while going through these tests:

1. When the device was not working, the soap bubbles were reaching till imaginary doctor's face but when the device was switched on all the soap bubbles were reflected (figure-4).
2. Overall subjective comfort of examination in problematic patients was improved. Although no statistical measurements were done, the sprays done on patient's side did not cross the air curtain signifying it can arrest the droplets (figure-4).
3. Bacterial culture while patients cough with Air filter switch on and off. (table)

No.	Patients	Culture results	
		Filter Off	Filter on
16	Cough with expectorations	0	0
14	Dry cough	0	0
22	Acute tonsillitis	B -haemolytic streptococcus-4	0
16	Chronic tonsillitis	0	0
8	Chronic sinusitis	0	0
6	AFB positive	0	0
12	Malignancy-oropharynx	Staphylococcus-2	0
2	Maggots- nose	0	0

REVIEW OF LITERATURE AND DISCUSSION

In order to extract 420 litres of oxygen that is crucial for human survival and function, a total of 10,000 litres of air enters the lungs every day[1]. The quality of air we breathe determines the health of the lungs as well as other organs. Indeed clean air is considered to be a basic requirement of human health and well-being in general.

Airborne transmission is the spread of infectious pathogens over large distances through the air. Infectious pathogens, which may include fungi, bacteria, and viruses, vary in size and can be dispersed into the air in drops of moisture after coughing or sneezing. Small drops of

moisture carrying infectious pathogens are called droplet nuclei. Droplet nuclei are about 1 to 5µm in diameter. This small size in part allows them to remain suspended in the air for several hours and be carried by air currents over considerable distances. Large drops of moisture carrying infectious pathogens are called droplets. Droplets being larger than droplet nuclei, travel shorter distances (about 1 metre) before rapidly falling out of the air to the ground. Because droplet nuclei remain airborne for longer periods than do droplets, they are more amenable to engineering infection control methods than are droplets.[2]

Tested under a variety of conditions, in-room air cleaners, including portable or ceiling mounted units with either a HEPA or a non-HEPA filter, portable units with UVGI lights only, or ceiling mounted units with combined HEPA filtration and UVGI lights, have been estimated to be between 30% and 90%, 99% and 12% and 80% effective, respectively. Plasmacluster ion air purifier uses a multilayer filter system composed of a prefilter, a carbon filter, an antibacterial filter, and a HEPA filter, combined with an ion generator to purify the air. Because influenza is primarily acquired by large droplets and direct and indirect contact with an infectious person, any in-room air cleaner will have little benefit in controlling and preventing its spread. Therefore, there is no role for the Plasmacluster ion air purifier or any other in-room air cleaner in the control of the spread of influenza. [1].

Tuberculosis is an important public health problem in India, and considerable effort is being devoted to the diagnosis and management of this condition in an attempt to lower the overall disease burden in the community. Clinicians and other paramedical staff involved in diagnosis and care of these patients are likely to be frequently exposed to live mycobacteria. Although the issue has never been openly or seriously discussed, there is need to be aware of these risks. Two important considerations need attention. [2]

One study evaluated the use of a system that delivers a small field of local, directed air from a high-efficiency particulate air (HEPA) filter to reduce airborne particulate and airborne bacteria in the surgical field. All particulate and bacterial counts at the surgical site were significantly lower in the directed air flow group ($P < .001$). The directed air flow system was effective in reducing airborne particulate and colony-forming units in the surgical field during total hip arthroplasty. [3]

If properly installed and maintained, in room air cleaners with HEPA or combined HEPA and UVGI air cleaning technology are effective in removing airborne pathogens. However, there is only weak evidence available at this time regarding the benefit of using an in-room air cleaner with combined HEPA and UVGI air cleaner technology instead of those with HEPA filter technology only.[1]

Currently available air purifiers usually use a multilayer filter system composed, often of a prefilter, a carbon filter, HEPA filter and often with Ioniser. Prefilter takes care of large floating impurities like fibers. Then is a layer of Charcoal particles which can absorb various toxins and odor from the air. It is usually activated which attracts negatively charged particles.

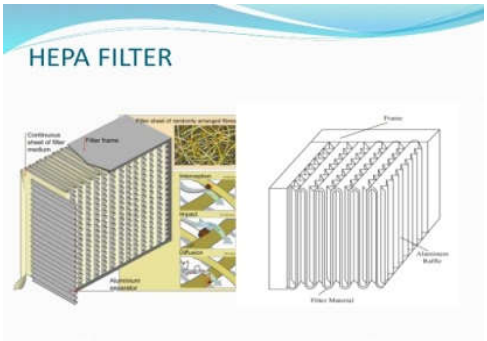

Fig 5 HEPA FILTER

Then comes HEPA filter. The HEPA filters are traditionally used in hospitals and has indeed been a significant inclusion to home air purifiers. A HEPA filter uses mechanical filtration to remove airborne particles. A HEPA filter is standardized at a minimum 99.97% efficiency rating for removing particles greater than or equal to 0.3µm (1/83,000 of an inch) in diameter. This means that for every 10,000 particles that are 0.3µm in diameter, 3 will pass through the filter, and the rest will be trapped by the filter[4] (figure-5).

High efficiency particulate air (HEPA) filter is effective in the collection and removal of airborne microbes, and is used in the biological clean room. [5]

Reduction in particulate matter and allergens is achieved successfully through efficient air filters. The British Guideline on Asthma Management from the British Thoracic Society recommends the use of air filters for removal of pet and other allergens. [6]In-room air cleaners may be used to protect health care staff from airborne infectious pathogens such as tuberculosis, chicken pox, measles, and disseminated herpes zoster. [7]

An air door or air curtain is a device used to prevent air or contaminants from moving from one open space to another. The most common use is a downward-facing blowerfan mounted over an entrance to a building, or an opening between two spaces conditioned at different temperatures. The directed air flow system was effective in reducing airborne particulate and colony-forming units in the surgical field during total hip arthroplasty.[3]

Sometimes there is spillage of blood in epistaxis patients or oro- nasal secretions exposure while examining. This may also be prevented to some extent by this device.These air filters also trap Allergens and pollutants. This can be an added advantage for Allergic physicians to some extent and in general for all.

CONCLUSION

We reached a conclusion that four things can reduce the risk of airborne infection to physicians in out patient department if properly manufactured and installed:

1. Air curtain,
2. Directed air flow
3. HEPA filtration of indoor air and
4. Ionization.

More study is warranted regarding this issue and we feel that there is a need of detailed laboratory study about Air filters at industrial level and production of Medical air filters specifically for OPD in hospitals. This will safeguard the health of Physicians.

References

1. Medical Advisory Secretariat. Total knee replacement: an evidence-based analysis. Ontario Health Technology Assessment Series 2005; 5(9).
2. Tuberculosis transmission in healthcare facilities in India. *Lung India*. 2009; 26(2):33-4.
3. Stocks GW, O'Connor DP, Self SD, Marcek GA, Thompson BL.J Arthroplasty.2011Aug; 26(5):7716. (doi:10.1016/j.arth.2010.07.001. Epub 2010 Sep 18).
4. Vijayan VK, Paramesh H, Salvi SS, Dalal AA. Enhancing indoor air quality -The air filter advantage. *Lung India*. 2015; 32(5):473-9.
5. Fuji K, Mizuno J., Design, equipment, and management for air conditioning in operating room, Masui. 2011 Nov;60(11):1347-50.
6. British Guideline on the Management of Asthma, British Thoracic Society May 2008, revised May 2011.
7. Air cleaning technologies: an evidence-based analysis. *Ont Health Technol Assess Ser*. 2005;5(17):1-52.