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Airborne Infection Control

INTRODUCTION

Exposure of human beings to heterogeneous airborne microorganisms has precipitated multiple outbreaks / epidemics / pandemics of respiratory infections [1]. The pathogens released from an infectious patient tend to disperse in wide geographical area and remains a potential source of infection to other susceptible individuals who have had no direct contact with the primary / secondary case [2]. In-fact, the airborne transmission deserves more attention in healthcare settings of developing nations, which are generally overburdened and has a significant load of immune-suppressed patients [3].

Tuberculosis is transmitted mainly by droplet infection and droplet nuclei generated by sputum-positive patients with pulmonary TB [4]. In-fact, it has been revealed that most of the nations where a significant reduction in the incidence / prevalence of TB has been observed, airborne infection control practices have played a crucial role [5,6]. However, in India, implementation of airborne infection control strategies is still in the nascent stages, probably because of budgetary constraints [7].

CONSEQUENCES OF POOR AIRBORNE-INFECTION CONTROL

Inadequate or absence of infection-control guidelines in hospitals has resulted in

- Acquisition of infections among health care workers (doctors, nursing staff, sweeper, ward boys, etc.)

- Nosocomial infections among patients admitted for some other reasons and even their family members

- Contraction of TB among immune-compromised patients (most common opportunistic infection)

- Deterioration in the quality of life of patients

- Fear among different cadres of health workers (reluctant to work in hospitals, especially TB hospitals) and

- Aggravates the human resource crisis [7-9].

In-fact, research findings of studies done among health professionals have revealed that the annual incidence of occupationally acquired TB was 5.8% and 1.1% in low- and high-income countries, respectively; which is remarkably higher than the TB incidence in the general population [8]. This has been attributed to the ubiquitous presence of mycobacterium tuberculosis and inappropriate / absence of airborne infection control [8,9].

NEED OF AIRBORNE INFECTION CONTROL

The above discussion clearly suggests that poor or absence of airborne infection control strategies, especially in health care establishments are unacceptable and definitely avoidable [10]. Recognizing the importance, the World Health Organization, Center for Disease Control and Prevention and International Union of tuberculosis and Lung Disease has developed TB infection-control guidelines for both developed and developing nations. The suggested measures have been broadly categorized into three major categories, namely administrative control or work practice; environmental control; and personal respiratory protection measures [6,7,11,12]. These guidelines are framed in such a manner that they can be implemented in both the public health policy and local facility implementation levels [7,12].

AIRBORNE INFECTION CONTROL IN HOSPITAL SETTINGS

Administrative Controls

It is considered as the first line defense for interrupting the chain of transmission and includes interventions to decrease generation of infective particles [5]. The ultimate goal of these measures is to minimize exposure of susceptible persons to infectious cases [13]. Administrative control measures vary according to the settings and generally include:

a.   Assessment of all newly proposed health institutes so that they are built-in accordance with infection-control standards (viz. design to optimize flow of patient or promotion of natural ventilation) [5,11].

b.   Development of standardized guidelines to allow supervision of the infection control practices in different hospitals [5].

c.   Sensitization of the health care staff about

•   Principles & practices of infection control and

•   Designating clear roles & responsibilities [13].

d.   Encouraging prompt recognition, separation, and appropriate referral of persons with potentially infectious TB [3,6].

e.   Outpatient department initiatives:

•   Screening of patients for respiratory complaints

- Information--education--communication for promoting cough etiquette by the patients

- Segregation of respiratory symptomatic in a separate well--ventilated waiting area and

- Fast--tracking of respiratory symptomatic / seating arrangement of doctor and patients [7,11].

f. Inpatient department initiatives:

- Minimizing hospitalization of patients

- Decreasing the duration of hospitalization

- Educating patients and attendants about cough hygiene

- Routine segregation of patients to separate infectious wards or separate areas in same ward

- Maintain spacing by ward decompression

- Advocating safe sputum collection [7,14,15].

In-fact, each of the existing health care facilities should earmark one of the staff in collaboration with the hospital administrators / management to achieve above mentioned tasks [6,11].

Environmental Controls

These measures are proposed to ensure reduction in concentration of infectious particles present in the health care set-up [12,13]. However, more attention should be given to high-risk settings like anti-retroviral therapy centers, MDR-TB wards, etc [13]. These range of measure comprise of

a. Indoor patient segregation and bed spacing [13].

b. Measures to facilitate adequate ventilation at all times and in all seasons [16].

c. Natural ventilation in health settings:

- Advantages – low cost, low maintenance, and is applicable in wide variety of settings

- Drawbacks – weather dependent; and difficult to monitor or regulate wind speed / flow [16,17].

d. Employment of mechanical ventilation in health settings –

- It is generally based on the phenomenon of air exchange per hour (a measure of how many number of times the air within a defined space is replaced per hour)

- Advantages – can be monitored

- Limitations – need careful design, expensive, require ongoing maintenance [9,11,18,19].

e. Ultra-violet lights: Application of upper-room ultra-violet lights has shown a definite scope (because of climate independent, relatively low cost, and utility in large areas) in reducing the airborne infection in different settings [20-22].

Personal Controls

a. Constant and proper wearing of N95 respirator masks to guard against inhalation of TB bacilli [6,13].

b. Mandatory screening for active TB disease at the start of employment (pre-placement examination) and at periodic intervals [8].

c. Sensitization of health care workers to not neglect symptoms suggestive of TB [10], and

d. Ensuring continuous supply of personal respirators [9,13].

AIRBORNE INFECTION CONTROL IN NON−HEALTH CARE SETTINGS

The international health agencies have realized that owing to the presence of stigma, presence of myths / misconceptions associated with the disease, and poor treatment seeking behavior, a major proportion of patients either do not come or come in very advanced stages of the disease to the health centers. Thus, the Centers for Disease Control and Prevention and the WHO has even expanded the scope of airborne infection control in community settings [6,12]. It includes measures like promotion of household contact tracing, and raising awareness about the disease in all possible arenas (viz. public transportation, taxi ranks, bars, schools, and social gatherings, etc.) [12,23-25].

CONCLUSION

To conclude, recognizing the enormous impact of tuberculosis on the society, there is a crucial need to promote implementation of airborne infection control guidelines in health care and community settings to keep the tuberculosis disease under check.

SUMMARY

Exposure of human beings to heterogeneous airborne microorganisms has precipitated multiple outbreaks / epidemics / pandemics of respiratory infections. Inadequate or absence of infection-control guidelines in hospitals has resulted in acquisition of infections among health care workers, and deterioration in the quality of life of patients. Recognizing the importance, the World Health Organization, Center for Disease Control and Prevention and International Union of tuberculosis and Lung Disease has developed TB infection-control guidelines for both developed and developing nations. The suggested measures have been broadly categorized into three major categories, namely administrative control or work practice; environmental control; and personal respiratory protection measures. These guidelines are framed in such a manner that they can be

implemented in both the public health policy and local facility implementation levels. To conclude, recognizing the enormous impact of tuberculosis on the society, there is a crucial need to promote implementation of airborne infection control guidelines in health care and community settings to keep the tuberculosis disease under check.

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