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Research Article

Incidence of Microbial Pattern Pre and Post Infection Control Training at Newly Established Teaching Centre; Experience from Pakistan

Uzma Mahar[1], Naveena Fatima[2], Aisha Arshad[1], Aisha Jamal[1], Qurat-ul-Ain Rizvi[1], Ali Saleem[1] and Nida Anwar[1]*

[1]Department of Clinical Hematology, National Institute of Blood Diseases and Bone Marrow Transplantation, Karachi, Pakistan

[2]Department of Research and Development, National Institute of Blood Diseases and Bone Marrow Transplantation, Karachi, Pakistan

***Corresponding Author:** Nida Anwar, Consultant Hematologist and Associate Professor, Department of Research and Development, National Institute of Blood Diseases and Bone Marrow Transplantation, Karachi, Pakistan.

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Abstract

Background: One of the main downside of a hospital is healthcare related infections which impose great challenge to health systems despite many advances. These infections affect morbidity/mortality and also increase the economic burden. Our study was designed to compare the difference in infection control at our hospital before and after taking measures at our newly established centre.

Methods: A cross-sectional study was conducted after ethical approval from February, 2018 to January2019.The study was divided into two phases. First phase comprised of initial 6 months and second phase for later 06 months of hospital establishment. Data were collected from the laboratory in form of cultures reports. Descriptive and inferential statistic was done by using SPSS version 23.0.

Results: A total of 1151 cultures were sent, out of which 681 (59%) were sent in initial phase and 470 (41%) were sent in later phase. It was found out that in initial and later phase there was increased rate of fungal growth in environment cultures. In majority of the patients no bacterial growth was reported in initial and later phase. Overall, absence of any organisms was found to be statistically same in both phases. However, bacterial and fungal growth reduced in later than the initial phase and the reduction in fungal growth was statistically significant. The growth of organism from the environment, accessories inside the patient's room, nursing counter, and patients was found statistically non-significant.

Conclusions: Our study revealed that the number of organisms isolated in initial phase was greater than the later phase but the reduction was not satisfactory. Implementation of policies and protocols are needed in this regard.

Keywords: Infection Control; Infection Prevention; Health Care Associated Infections

Introduction

Hospital is an area prone to harbor pathogenic microorganisms and some pathogens have ability to spread and survive for weeks and months in the hospital environment. Healthcare associated infection (HAI) is global health problem and main reasons behind these infections are suboptimal infection control practices along with excessive antibiotics consumption [1].

During patient care HAI is not an uncommon event and is responsible for significant morbidity and mortality [2]. The overall rate may vary among different countries, but the average rate of mortality associated with HAI is presumed to be as high as 10% in developed and 25% in developing countries [3]. However, a recent review article has reported the incidence to be 7% in developed and 10% in countries with limited resources [4].

The risk factors for HAI can be health care, environmental and patient related factors including invasive devices and surgical interventions [5]. Device related infections and surgical site infections are the most important HAI associated with multi drug resistant organisms resulting in significant morbidity and mortality [5]. However, on the other hand, environmental factors including inadequate ventilation, bed spacing, contaminated water supply, environmental surfaces and improper disposal of waste etc are other concerns. The World Health Organization's Essential Environmental Health Standards in Health Care has outlined few important temporary measures like clean water, waste management with focus on visible dust and soil to protect patients in centres with limited resources [6]. Suleyman., *et al*. reported that environmental contamination plays a very important role in transmission of nosocomial pathogens and cross transmission occurs through soiled hands of healthcare professionals [7]. Apart from the above discussed factors, patient characteristics such as co morbidities, extremes of age, severity of illness and prolonged hospital stay also play an important role in HAI [8].

The HAI risk can be minimized by implementation of infection prevention and control program, which is comprised of activities directed to dig out problems and applying various techniques to bring about a change in healthcare workers attitude to improve infection control practices [9]. For teaching and implementation of such practices a dedicated team including trained infection control physician and nurses are important [10]. A study conducted at a tertiary care hospital in India comprised questionnaires which were given to 100 intensive care nurses to assess the knowledge of infection control practices and revealed that only 05% nursing professionals had excellent knowledge and scored >90%, 37% had good knowledge (score: 80-90%), however 40% scored average (70-80%) and 18% scored below average (<70%) [11].

In the last decade infection prevention and control at hospital has been significantly improved globally. Measures such as hand hygiene, environmental cleaning, culture based screening are implemented in order to minimize hospital stay, morbidity and mortality. Thus, with this rationale our study was designed to compare the difference in infection control at our hospital before and after taking measures at our newly established centre.

Methods

It was an analytical cross-sectional study carried out at our new campus. The study was conducted from February 2018 to January 2019. Ethical approval was taken from research committee prior to the study and informed consent was taken from the patients and staff. The study was fabricated in two phases i.e. initial and later six months of hospital establishment. Based on the results obtained in the initial six months, we assigned an infection control team, along with facilitation of training sessions for our staff. Culture samples were taken from patients, patient's rooms, patient's wards, accessories inside the patient's room, from counters and corridors. Data were included cultures reports taken from the laboratory.

Statistical analysis

For statistical analysis, SPSS version 23.0 was used. Descriptive statistics was applied for categorical variables and chi square test was used to observe the association with significance level as $p = 0.05$.

Results

A total of 1151 cultures were sent including patients, staff and environmental cultures. Out of which 681 (59%) were sent in initial phase and 470 (41%) were sent in later phase. The number of samples sent in initial and later phase and its distribution is depicted in Table 1. The growth of organisms was observed in initial and later phase from the samples and it was found out that there was increased rate of fungal growth in environment cultures in initial and later phase. In majority of the patient's samples, no bacterial growth was reported in initial and later phase (Table 2).

Overall, absence of any organisms was found to be statistically same in both phases. However, bacterial and fungal growth reduced in later than the initial phase and the reduction in fungal growth was statistically significant as shown in Table 3.

The samples taken from the patients and environment in initial and later phase were compared and are depicted in table 4. The growth of organism from the environment, accessories inside the patient's room, nursing counter, and patients was found statistically non-significant.

Table 1: The distribution of samples in initial and later phase.

Samples Taken From	Initial Phase N = 681	N (%)	Later Phase N = 470	N (%)
Environment, N = 144 Initial = 104, Later = 40	Accessories inside room	19 (18)	Accessories inside room	9 (22.5)
	Corridor	5 (4.8)	Corridor	2 (5)
	Nursing counter	7 (6.7)	Nursing counter	8 (20)
	Patients' room	47 (45)	Patients' room + wards	19 (47.5)
	Rest rooms	26 (25)	Water	2 (5)
Patients, N = 992	577 (58.2)		415 (41.8)	
Staff, N = 15	-		15	

Table 2: The frequency of organisms in the collected samples.

AIR: Accessories Inside Room; CDR: Corridor; NC: Nursing Counter; Pts: Patients; PR: Patient Room; RR; Rest Room; Stf: Staff; Wr: Wards; WTR; Water.

Organisms	Sample taken from (initial Phase)							Sample taken from (Later Phase)								
	AIR	CDR	NC	Pts	PR	RR	Total	AIR	CDR	NC	Pts	PR	Stf	Wr	WTR	Total
Aspergillus albus	0	0	0	0	1 (100)	0	1									
Aspergillus falvus	0	1 (4.2)	1 (4.2)	0	14 (58.3)	8 (33.3)	24	0	1 (12.5)	3 (37.5)	0	4 (50)	0	0	0	8
Aspergillusmucor	0	0	0	0	1 (100)	0	1	0	0	1 (100)	0	0	0	0	0	1
Aspergillusniger	0	2 (10.5)	2 (10.5)	0	7 (36.8)	8 (42.1)	19	0	0	1 (14.2)	0	6 (85.7)	0	0	0	7
Candida albicans	0	0	0	10 (100)	0	0	10	0	0	0	7 (100)	0	0	0	0	7
E. coli	0	0	0	31 (100)	0	0	31	0	0	0	14 (100)	0	0	0	0	14
Enterococcus spp	0	0	0	10 (100)	0	0	10	0	0	0	3 (100)	0	0	0	0	3
Klebsiella Pneumoniae	0	0	0	17 (100)	0	0	17	0	0	0	21 (100)	0	0	0	0	21
Klebsiella spp	0	0	0	11 (100)	0	0	11	0	0	0	7 (100)	0	0	0	0	7
Mixed insignificant bacterial growth	0	0	0	4 (100)	0	0	4	0	0	0	2 (100)	0	0	0	0	2
MRSA	3 (14.3)	1 (4.8)	0	7 (33.3)	6 (28.6)	4 (19)	21	0	1 (5.3)	2(10.5)	4 (21.1)	3 (15.8)	9 (47.4)	0	0	19
MSSA	1 (5.9)	1 (5.9)	2(11.8)	0	8 (47.1)	5 (29.4)	17	2 (50)	0	0	0	1 (25)	0	1 (25)	0	4
NBG	15 (3.4)	0	1 (0.2)	410 (94.3)	8 (1.8)	1 (0.2)	435	7 (2.4)	0	1(0.3)	278 (95.5)	3 (1)	0	0	2 (0.7)	291
NCF	0	0	0	55 (100)	0	0	55	0	0	0	53 (100)	0	0	0	0	53

NFG	0	0	1 (33.3)	0	2 (66.7)	0	3	0	0	0	0	1 (14.3)	6 (85.7)	0	0	7
Pseudomonas aeruginosa	0	0	0	7 (100)	0	0	7	0	0	0	4 (100)	0	0	0	0	4
Pseudomonas spp	0	0	0	14 (100)	0	0	14	0	0	0	19 (100)	0	0	0	0	19
Salmonella typhi	0	0	0	1 (100)	0	0	1	0	0	0	2 (100)	0	0	0	0	2
Staphylococcus pneumonia-	-	-	-	-		-	-	0	0	0	1 (100)	0	0	0	0	1

Table 3: Association of occurrence of organisms in initial and later phase.

	Initial phase	Later Phase	P-value
Overall presence of organisms	188	119	0.388
Overall absence of organisms	493	351	
Bacterial growth	133	96	0.581
No bacterial growth	435	291	
Fungal growth	55	23	0.011
No fungal growth	03	07	

Discussion

Healthcare associated infections have a very dreadful consequence such as infection related mortality, prolonged hospital stays and financial burden on patients. To overcome this problem present study was conducted to assess the impact of infection control and prevention measures in order to minimize HAI. This study revealed that 27.6% of cultures obtained in initial phase depicted growth of one or more micro-organisms. After establishment of infection control team and implementation of various teaching and preventive measures such as hand hygiene education, use of gloves, isolation of patients infected with resistant organism and carbolisation of patient rooms on every discharge, the later phase revealed some reduction in culture positivity.

A total of 144 environmental cultures were obtained from patient rooms and wards, nursing counter, corridors, accessories, washrooms, water and hospital staff. Among 66 cultures taken from patient's room including floor and walls, 42% showed fungal growth, 14% were positive for MSSA and MRSA each. However, according to study by Deshpande and colleagues *C. difficile* was the most frequently isolated organism from floors of patient rooms, other pathogens isolated were MRSA and vancomycin resistant enterococci and was suggested that floors in hospital rooms could be an underestimated source of spread of pathogens [12].

Total of 28 cultures were collected from accessories of patient room among which 19 cultures were taken in initial phase out of which 15% of cultures showed MRSA, 6% were positive for MSSA and rest of the cultures had no growth. In later phase the only organisms isolated was MSSA. A study conducted in Ethiopia revealed the isolation of *S. aureus* along with *P. aeruginosa*, *E. coli*, Proteus species, *Klebsiella species* and *Enterobacter species* from the inanimate objects surrounding patients [13].

It has been reported that admission of a patient in a room which was previously occupied by a resistant organism such as *Vancomycin-resistant Enterococcus* (VRE) or MRSA positive patient increases the risk of transmission of pathogen and healthcare associated infections [14].

In present study 992 cultures were obtained from patients out of which 577 were taken in initial phase. The most common or-

ganism isolated was E. coli, whereas MRSA was the only resistant organism isolated from patients and its prevalence was not more than 1% in both phases. The cultures obtained from patients were not indicative of HAI but rather indicated the frequency and type of organisms to which our hospital is exposed. These are acquired hospital brought infections from community, as in our hospital majority of inpatients are neutropenic they need an aseptic environment and hospital colonization can be very hazardous for them. So, it served as a guide to decide what measures should be taken to prevent and control its spread.

Although there was a reduction in isolation of organisms in later phase but it wasn't as much as expected. There could be multiple reasons behind this but one of the main concern of developing world which can be an essential cause in our study as well is non-compliance of health workers to infection control measures stringently [15,16]. We can achieve compliance by making training and knowledge readily available to health care professionals about transmission of organisms and their potential hazards [17]. Loftus., *et al*. suggested that by knowing the transmission story of the predominant pathogens responsible of healthcare associated infections one can prevent and control its spread [18].

Another way to achieve this goal is to find loop holes in the system for infection prevention and control measures. One of the review conducted at Swiss university teaching hospital revealed that not only hands but the stethoscope used by health professionals is an essential source of bacterial contamination and leads to spread of pathogens [19]. Therefore, stethoscope should be cleaned with alcohol swab after every contact with patient and it should be incooperated in infection control measures.

Literature review revealed that health care associated pathogens are increasingly demonstrating antimicrobial resistance which has posed a challenge for clinicians who are left with limited options of antimicrobials [20]. Antibiotic stewardship is trending as one of the option to reduce the antimicrobial resistance [21]. The goal of antimicrobial stewardship program is to promote evidence based prescription of antibiotics for treatment of infections and to prevent its overuse which is the main reason of antimicrobial resistance [22].

Limitations

The limitation of the study was that some samples that were taken in later half of the establishment were not analyzed in initial phase of establishment.

Conclusions

Our study revealed that the number of organisms isolated in initial phase was greater than the later phase but the reduction was not satisfactory. Bringing about a change in healthcare workers attitude is always a big challenge. Constant reinforcement is imminent for compliance of healthcare professionals towards infection control and prevention. There is always a need to make sure that staff at every level is working collectively to change mindset and attitude of health care professionals and sufficient knowledge as well as skills regarding infection control, prevention is provided to everyone. To get over antimicrobial resistance, introduction of antibiotic stewardship program can help a lot as Aristotle stated, "We are what we repeatedly do. Excellence then, is not an act, but a habit".

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Ethical Considerations

Ethical approval was taken from research committee prior to the study and conducted as per Declaration of Helsinki.

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