Operating theaters as a source of nosocomial infection in district hospital: A systematic review

Gaurishanker Pashabhai Shrimali[1], Komal Dasharathbhai Patel[2,*]

[1]Associate Professor, GMERS Medical College, Gandhinagar, Gujarat, [2]Class 1 Microbiologist, Dept. of Microbiology, General Hospital, Mehsana

***Corresponding Author:**
Email: drkomalpatel3011@gmail.com

Abstract

Microbial contamination of operation theaters (OTs) is a major cause of nosocomial infections (NIs). Nosocomial infection is a main hassle in any healthcare facility. UTI, Surgical site infection, pneumonia and blood stream infections are the big four healthcare associated infections. Purpose of the study is to find out prevalence rate of microorganisms in Operation Theatre to find out the frequency of contamination from various sites in Operation Theatre.

The study was carried out at the Department of Microbiology, General Hospital, Mehsana for a period of five years (from January 2012 to December 2016). Total of 5600 swab samples were collected from various Operation Theatres over a period of five years. Out of total 5600 swab samples were collected 503 (8.98%) were positive for growth. Among GNB isolates from swab sampling Pseudomonas 84 (42.64%) is the most frequently isolated organism and among GPC CONS 49(81.66%) is most frequently isolated organism. Gynec OT has highest rate of GNB 16(12.70%) isolation. GPC isolation rate 20(2.30%) is highest in Surgical OT. While GPB isolation rate 46(5.35%) is highest in Family planning OT. From organisms isolated from various surfaces by swab sampling it is evident that most organisms were isolated from Laprotomy Instrument 37(82.22%).

Keywords: Nosocomial infection, Operation theaters

Introduction

Microbial contamination of operating theaters (OTs) is a major cause of nosocomial infection.[1,2] Nosocomial infection is a main hassle in any healthcare facility. UTI, Surgical site infection, pneumonia and blood stream infections are the big four healthcare associated infections.[3,4] The environment in the operation theatre is dynamic and subject to continuous change. Invasive procedures, high antibiotic usage and transmission of bacteria between patients due to inadequate infection control measures explain why OTs are “hot zones” for the spread of antibiotic resistant organisms.[5] Environmental monitoring means the microbiological testing of air, surface and equipment in order to detect changing trends of microbial counts and micro-flora.

Purpose of the study is to find out prevalence rate of microorganisms in Operation Theatre to find out the frequency of contamination from various sites in Operation Theatre.

Material & Methods

The study was carried out at the Department of Microbiology, General Hospital, Mehsana for a period of five years (from January 2012 to December 2016).

Sample Collection and Transport: Air and surface samples were taken randomly without prior discussion with the cleaning staff and adequate care was taken to ensure that there was no trafficking in these areas while the sampling procedures were completed. Air sampling was done by settle plate method. Blood Agar and Sabourd’s Dextrose Agar plates were taken to the operation theaters in sealed plastic bags. The plates were labeled with sample number, site within theatre, time and date of sample collection. One plate each was kept at the center of operation theatre and the four corners of the operation theatre at about 1 meter above the ground, 1 meter from the wall and exposed for 1 hour (Baird, 1996). Surface sampling was done by soaking a swab in nutrient broth which was rolled over to the surfaces of equipments, instruments trolley, operation tables at the head end, Over head lamp, monitor, an aesthesia Table 4 infusion pumps, crash cart, door handles.

The inoculated plates were incubated aerobically in the incubator at 37°C for 24 hours, and the plates were observed for growth. The growth was identified by colony characteristics, gram’s stain and standard biochemical tests described in Mackie and McCartney, Practical Medical Microbiology,[6] and Bailey and Scott’s Diagnostic Microbiology[7] and Koneman.[8] Samples which did not yield any growth following 48 hours incubation period were reported negative.

Results

Total of 5600 swab samples were collected from various Operation Theatres over a period of five years. Out of total 5600 swab samples were collected 503(8.98%) were positive for growth.

Table 1; Distribution of Organisms isolated from Operation Theatre

Micro-organism isolated	No. of positive growth(N=503)	Percentage (%)
GPC	60	11.92
GNB	197	39.16
GPB	246	48.90

Table 2: Distribution of various organisms among GPC isolates from samples

Name of organism	No of positive growth (N=60)	Percentage (%)
CONS	49	81.66
Staphylococcus aureus	11	18.33
Total	60	100

Table 3: Distribution of various organisms among GN Bisolates from samples

Name of organism	No of positive growth (N=197)	Percentage (%)
Pseudomonas	84	42.64
E.coli	28	14.21
Acinetobacter	25	12.69
Klebsiella	60	30.45
Total	197	100

Table 4: Percentage of organism isolated from various sites

Site	No. of Samples	GNB	%	GPB	%	GPC	%	Total
Table	966	42	4.34	56	5.79	12	1.24	110(11.38%)
Light	834	33	3.95	42	5.03	7	0.84	82(9.83)
Floor	869	26	2.99	35	4.03	9	1.03	70(8.05%)
Anesthesia Trolley	1327	28	2.11	34	2.56	14	1.05	76(5.73)
Wall	980	9	0.92	18	1.84	4	0.41	31(3.16%)
A.C.	411	3	0.73	14	3.41	1	0.24	18(4.38%)
Microscope	102	13	12.74	17	16.67	2	1.96	32(31.37%)
Suction Bottle	66	27	40.90	13	19.70	7	10.61	47(71.21%)
Laprotomy Instrument	45	16	35.55	17	37.78	4	8.89	37(82.22%)

Table 5: Organisms isolated from various Operation Theatres

Name	No. of samples taken	GNB	Percent	GPB	Percent	GPC	Percent
Surgical OT	869	31	3.56	37	4.26	20	2.30
EYE OT	1017	29	2.85	55	5.41	7	0.68
ENT OT	917	34	3.71	39	4.25	9	0.98
Orthopedic OT	1101	27	2.45	37	3.36	11	0.99
Family planning OT	859	29	3.38	46	5.35	8	0.93
Obstetrics OT	711	31	4.36	27	3.79	8	1.12
Gynec OT	126	16	12.70	5	3.97	1	0.79

Among GNB isolates from swab sampling Pseudomonas 84 (42.64%) is the most frequently isolated organism followed by Klebsiella 60(30.45%). Among GPC CONS is most frequently isolated organism 49 (81.66%). Gynec OT has highest rate of GNB 16(12.70%) isolation. GPC isolation rate 20(2.30%) is highest in Surgical OT. While GPB isolation rate 46(5.35%) is highest in Family planning OT. From organisms isolated from various surfaces by swab sampling it is evident that most organisms were isolated from Laprotomy Instrument 37(82.22%) followed by Suction Bottle 47(71.21%). Highest rate of GNB isolation and GPC isolation is from suction bottle 27(40.90%) and 7(10.61%) respectively. GPB were considered non-pathogenic and were not processed further.

Discussion

Operation theatres are termed as the most sensitive areas for infection control. The source of most infection cases reported in the recent past has been the Operation Theatre/ Operation Room. Hospital-associated infections are an important cause of patient morbidity and death.[9,10] Bacterial load in operation theatres are influenced by the number of individuals present, ventilation and air flow.[11,12] Prevalence rate varies in

different study. S.Ensaye[13] has done the study in 2001 and 2002. In 2001 rate was 3.7% while in 2002 rate was 4.0%. Rate in the study by Dr. Baha[14] was 6.35%. Rate in our study is 8.98% which is comparable to other studies. In present study prevalence of GPB is 48.90%. It is 75% in the study by S.K. Agrwal.[15] Prevalence rate of GPC is 11.92% in present study. S.Ensayef[13] had 56.5% prevalence in 2001 while 12.5% in 2002. S.Ensayef[13] had 43.5% prevalence rate of GNB in 2001 and 87.5% prevalence in 2002. It is 39.16% in Present study. It is 89.64% in study by Dr. Baha.[14] There is changing trend towards GNB isolation. It may be due to their ability to survive in adverse conditions.[15] It may also be due to lake of proper disinfection or fumigation of facilities, overcrowding and unnecessary visiting of Critical facilities by people or due to improper ventilation of OTs.[16,17] Hayath Kownhar[18] had GNB rate 58% and GPC rate 41.9%. Moataz M[19] had GNB rate 66.2% and GPC rate 31.8%. Both studies indicate that GNBs are now the emerging organisms in surgical site infections.

Conclusion

Present study shows that GNB and GPC are isolated in significant proportion from OTs. They can contribute in surgical site infection. Isolation of GNB or GPC from OTs could not be considered as contaminants and proper measures should be taken. Prevention measures that need to be practiced to avoid such critical situations rest not only with the operating personnel but also with the entire infection control team. Monitoring and microbiological surveillance can serve as warning systems for change in the type and load of micro-organism.[20,21]

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