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Microbiological Surveillance of Operation Theatre and Critical Care Facilities

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Abstract: *Hospital acquired infections are important cause of morbidity and mortality. The airborne spread of nosocomial bacterial is known to occur. It is considered important to monitor the operating rooms and other sensitive hospital units in the control of hospital acquired infections.*
Objective*: Purpose of the study is to find out prevalence rate of microorganisms in Operation Theatre and Critical care facilities, to find out the frequency of contamination from various sites in Operation Theatre and Critical care facilities and evaluation of antibiotics susceptibility patterns of organisms isolated.*
Material & Methods*: The study includes total of 4368 swab samples collected from various Operation Theatres and Critical Care Facilities (NICU, Kidney Unit) over a period of one year. Organisms were identified and Antibiotic Sensitivity testing was performed by conventional method.*
Result*: Out of 4368 samples 384 (08.79 %) were positive for growth. Operation Theatre table showed highest growth (12.83%). Pseudomonas and Acinetobacter showed resistant to majority of antibiotics.*
Keywords: *Hospital acquired infection, Surveillance.*

I. Introduction

Hospital-associated infections are an important cause of patient morbidity and death[1]. UTI, Surgical Site Infection, Pneumonia, and Blood Stream Infections are the "big four" healthcare associated infections. The source of most infection cases reported in the recent past has been the Operation Theatre/ Operation Room. Experts say that proper design and ventilation of the Operation Theatre is necessary to prevent air-born infection. Besides there should be a proper record of fumigation and disinfection measures[2].Infection has always been a feature of human life and sepsis in modern surgery continues to be a significant problem for healthcare practitioners across globe[3].

Purpose of the study is to find out prevalence rate of microorganisms in Operation Theatre and Critical care facilities, to find out the frequency of contamination from various sites in Operation Theatre and Critical care facilities and evaluation of antibiotics susceptibility patterns of organisms isolated.

II. Material & Methods

During study period Sample from different site of operation theatre were collected. Sterile swab moistened in sterile normal saline were rubbed on surfaces. Samples were collected from following sites like floor, operation table, wall, anesthesia trolley, instruments etc. All swab samples were inoculated onto Blood agar & MacConkey agar. 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[4] and Bailey and Scott's Diagnostic Microbiology[5] and Koneman[6]. Samples which did not yield any growth following 48 hours incubation period were reported negative. Antibiotic sensitivity testing of isolates was performed by Modified Kirby Bauer Method[7] as per CLSI guidelines.

III. Results

Total of 4368 swab samples were collected from various Operation Theatres and Critical Care Facilities (NICU, Kidney Unit) over a period of one year. Out of total 4368 swab samples were collected 384 (08.79 %) were positive for growth.

Table 1. Distribution of Organisms isolated from Swab sampling

Organisms Isolated	No of Positive Growth (N = 384)	Percentage (%)

GNB	147	38.28
GPB	190	49.48
GPC	47	12.24

Table 2. Distribution of various organisms among GNB isolates from swab samples

Name of Organism	No of Positive Growth (N = 147)	Percentage (%)
Pseudomonas	56	38.09
Acinetobacter	34	23.12
Klebsiella	38	25.85
E.coli	15	10.22
Proteus mirabilis	4	2.72

Table 3. Distribution of various organisms among GPC isolates from swab samples

Name of Organism	No of Positive Growth	Percentage (%)
Staphylococcus aureus	04	8.51
CONS	43	91.49
Total	47	100

Table 4. Organisms isolated from various OTs and Critical Care Facilities by swab sampling

Name	No of Samples taken	GNB	Percent	GPB	Percent	GPC	Percent
Surgical OT	960	50	5.21	49	5.1	14	1.46
ENT OT	576	17	2.95	31	5.38	7	1.22
Urology OT	192	5	2.6	7	3.65	2	1.04
Neurology OT	192	13	6.77	8	4.17	1	0.52
Gynaecology OT	288	2	0.71	12	4.17	1	0.35
P.P. Unit	288	29	10.1	10	3.47	0	0
Obstetrics OT	288	2	0.71	6	2.08	2	0.69
Eye OT	816	17	2.08	33	4.04	14	1.72
Orthopaedics OT	384	1	0.26	19	4.95	1	0.26
NICU	240	7	2.92	10	4.17	4	1.67
Kidney Unit	144	4	2.78	5	3.47	2	1.39

Table 5. Organisms isolated from various surfaces by swab sampling

Surface/Article	No of Samples	GNB	Percent	GPB	Percent	GPC	Percent	Total
Table	912	53	5.81	50	5.48	14	1.54	12.83
Floor	816	27	3.31	50	6.13	14	1.72	11.16
Light	768	19	2.47	24	3.13	3	0.39	5.99
Anaesthesia Trolley	768	13	1.69	22	2.86	6	0.78	5.33
Wall	480	12	2.5	23	4.79	4	0.83	8.12
A.C.	288	4	1.39	11	3.82	1	0.35	5.56
Microscope	144	3	2.09	4	2.78	2	1.39	6.26
Suction Bottle	48	5	10.42	2	2.17	0	0	12.59
Laprotomy Instrument	48	4	8.33	0	0	0	0	8.33
Cradle	48	3	6.25	2	4.17	1	2.08	12.50
Warmer	48	1	2.08	2	4.17	1	2.08	8.33
Phototherapy Instrument	48	1	2.08	0	0	1	2.08	4.16
H.D. Machine	48	2	4.17	0	0	0	0	4.17

Table 6. Antibiotic Sensitivity Pattern of Klebsiella, E.coli and Proteus mirabilis

Antibiotic	Klebsiella spp. (38)	E.coli (15)	Proteus mirabilis(04)
Amikacin	00	6.7	00
Amoxy-Clav(Amoxycillin + Clavulinic acid)	2.6	20	50
Ampicillin	00	00	00
Ampicillin-Sulbactum	7.9	00	50
Cefpodoxime	00	00	00
Cefadroxil	00	00	00
Cefipime	00	00	00
Cefotaxime	00	00	00
Cefoxitin	00	00	00
Ceftazidime	00	00	00
Cefuroxime	00	00	00
Cefixime	00	00	00
Cefoperazone-Sulbactum	7.9	33.3	100
Cefotaxime- Clavulinic acid	5.3	26.7	75

Ceftazidime-Clavulinic acid	2.6	20	75
Chloramphenicol	42.1	100	100
Ciprofloxacin	00	00	00
Cotrimoxazole (Sulphamethoxazole + Trimethoprim)	00	00	00
Gatifloxacin	52.6	66.7	100
Gentamicin	00	00	00
Imipenem	00	100	100
Kanamycin	00	6.7	25
Levofloxacin	00	00	25
Piperacillin	00	00	00
Piperacillin Tazobactum	94.7	100	100
Ticarcillin	15.7	00	00
Ticarcillin Clavulinic acid	26.3	53.3	75
Tetracycline	00	00	00

Table 7. Antibiotic Sensitivity Pattern of Pseudomonas and Acinetobacter spp.

Antibiotic	Pseudomonas spp. (56)	Acinetobacter spp.(34)
Amikacin	71.4	14.7
Aztreonam	14.3	26.5
Cefepime	00	2.9
Ceftazidime	00	00
Ciprofloxacin	00	00
Gentamicin	00	00
Imipenem	44.6	20.6
Piperacillin	10.7	9.3
Piperacillin-Tazobactum	92.9	64.7
Ticarcillin	35.7	23.5
Tobramycin	53.6	38.2

Table 8. Antibiotic Sensitivity Pattern of Staphylococcus aureus and CONS

Antibiotic	Staph.Aureus (04)	CONS (43)
Azithromycin	00	00
Amoxycillin + Clavulinic acid	00	30.2
Cefazolin	00	00
Cefixime	00	00
Cefoxitin	00	00
Cefoperazone	00	6.98
Cefoperazone-Sulbactum	100	95.35
Cefotaxime	00	00
Cefpodoxime	00	2.3
Ceftriaxone	00	00
Cefuroxime	00	4.7
Chloramphenicol	00	11.6
Ciprofloxacin	00	00
Clindamycin	00	00
Cotrimoxazole	00	00
Gentamicin	00	00
Linezolid	50	44.19
Moxifloxacin	100	93
Penicillin-G	00	00
Piperacillin Tazobactum	100	86.1
Rifampicin	25	39.5
Tetracycline	00	00
Vancomycin	50	53.5

Among GNB isolates from swab sampling Pseudomonas 56 (38.09 %) is the most frequently isolated organism followed by Klebsiella 38 (25.85 %). Among GPC CONS is most frequently isolated organism 43 (91.49%).

Among organisms isolated from various facilities by swab sampling Surgical OT has highest rate of isolation. P.P. Unit has highest rate of GNB 29 (10.07%). GPC rate 14(1.72%) is highest in Eye OT. While GPB rate 31(5.38%) is highest in ENT OT. From organisms isolated from various surfaces by swab sampling it is evident that most organisms were isolated from Table surface followed by floor. Highest rate of GNB isolation is from suction bottle 5(10.42 %) from 48 samples taken. GNB isolation is 4(8.33%) out of 48 samples in Laprotomy instrument and 53(5.81%) from 912 samples in Surgical OT. GPB isolation is highest 50(6.13%) from floor.

Table 6 shows resistant pattern of Klebsiella, E.coli and Proteus mirabilis. They are resistant to Cephalosporins and to many other common antibiotics. They are least resistant to Piperacillin Tazobactum.

Table 7 shows resistant pattern of Pseudomonas and Acinetobacter spp. They are resistant to Ceftazidime, Ciprofloxacin, Gentamicin. The resistant to Tobramycin and Piperacilli-Tazobactum is low.

Table 8 shows resistant pattern of GPC. They are resistant to common antibiotics like Azithromycin, Cefuroxime, Chloramphenicol etc. They are least Resistance among Piperacillin-Tazobactum and Moxifloxacin.

GPB were considered non pathogenic and were not processed further.

IV. Discussion

Operation theatres and ICUs 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. Bacterial counts in operation theatres are influenced by the number of individuals present, ventilation and air flow.

Prevalence rate varies in different study. S.Ensayef[8] 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[9] was 6.35 %. Rate in our study is 8.79 % which is comparable to other studies.

In present study prevalence of GPB is 49.48 %. It is 75% in the study by S.K. Agrwal[10]. Prevalence rate of GPC is 12.24 % in present study. S.Ensayef[8] had 56.5 % prevalence in 2001 while 12.5 % in 2002. S.Ensayef[8] had 43.5% prevalence rate of GNB in 2001 and 87.5% prevalence in 2002. It is 38.28 % in Present study. It is 89.64% in study by Dr.Baha[9].

There is changing trend towards GNB isolation. It may be due to their ability to survive in adverse conditions. 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.

Hayath Kownhar[11] had GNB rate 58% and GPC rate 41.9%. Moataz M[12] had GNB rate 66.2% and GPC rate 31.8%. Both studies indicate that GNBs are now the emerging organisms in surgical site infections.

In present study GNB and GPC are isolated in significant proportion that

V. Conclusion

Present study shows that GNB and GPC are isolated in significant proportion from OTs and other critical areas.They can contribute in surgical site infection. Isolation of GNB or GPC from OTs and other Critical care facilities could not be considered as contaminants and proper measures should be taken. Evaluation of antibiotic susceptibility pattern of these organisms shows resistant pattern to commonly used antimicrobials and they can produce nosocomial infections if due precautions are not properly taken.

Abbreviations

OT – Operation Theatre, GNB – Gram Negative Bacilli, GPC – Gram Positive Cocci, GPB – Gram Positive Bacilli

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