Original Article

Paucity of Nosocomial Surveillance Programmes, Infection Prevention and Control Practices in Pakistan: Impact of International Nosocomial Infection Control Consortium In the Developing Countries (INICC)

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Objective: To isolate/identify device associated bacteria with their antibiotic sensitivity/resistance patterns in 2015 and to compare them with such 2010 results. Further the impact of MSDS on device associated infections.

Methods: This cross-sectional study was carried out by the Microbiology Laboratory on devices or device-associated samples from intensive care units of Services Hospital Lahore in 2015. Bacteria were identified and their antibiotic sensitivities/resistance were tested.

Results: Samples submitted by ICUs were 446 with 302 from devices. Tracheal samples were 189(62.6%) whereas CV tips (30%)and Folleys catheter (4.3%). Growth positive samples were 219 (72%). Non fermentors comprised 54 % isolates with Acinetobacter predominating (33%) followed by Pseudomonas(21.8%). Enterobacteriaceae were 44% with E coli(16%) Klebsiella (12%) Proteus (10.7%) and Citrobacter (5.9%). Gram positive isolates comprised (n=23) isolates. Oxacillin resistant were (n=4). Acinetobacters (n=20) Pseudomonas (n=15) and Enterobactericeae (n=18)with Klebsiella (n=12) were resistant to all drugs tested. ESBLs were 14.

Conclusion: DAIs are a serious threat in ICU. Surveillance Programmes should be carried out under guidance of INICC.

Keywords: ICU, devices, acinetobacter, pseudomonas, enterobacteriaceae.

Introduction

Globally Surveillance Programmes for nosocomial infections have a positive impact[1,2,3]both in terms of reduction in infection,[4] morbidity, mortality and economy.[5,6] Intensive care units are a nidus of such infections[7] due to immuno-compromised population segregation[8] and use of devices.[9] Pakistan is a developing country with a poor population. There is a paucity of participation in such international infection control programmes but the Punjab Health Commission in 2014 implemented the Minimum Service Delivery Standards [MSDS][10] The samples submitted before and after the implementation of PHC will reflect of any change in Device Associate Infections(DAIs) in ICUs of a tertiary care hospital.

Methods

These cross-sectional, observational studies were carried out at the Microbiology Section, Department of Pathology, and Services Institute of Medical Sciences from the periods January to December 2010 & January to December 2015 on intensive care units of Services Hospital Lahore. Clinical specimens from devices were obtained from Medical & allied and Surgical & allied ICUs. These included tracheal aspirates, tips from unidentified source, urine catheter tips, central venous tips and drainage tubes. These samples were transported to the laboratory within 2 hours of collection.

Samples were cultured onto appropriate culture media as Blood agar, MacConkey's agar, Chocolate agar and CLED medium. Culture plates were incubated aerobically for 24-48 hours at 37C^0. Isolates were identified by colony morphology, Gram's staining, catalase, coagulase, oxidase and relevant biochemical tests.[11]

Antimicrobial sensitivity testing was performed on Mueller Hinton agar using Kirby-Bauer Disc Diffusion Method12.Antibiotic discs used for Gram negative bacteria were Ampicillin, Augmentin, sulfamethoxazole/trimethoprim, Ceftrioxone, Cefoperazone, Doxycycline, Azectam, Ofloxacin, Imipenem, Amikin, Tazobactam and Tigycycline. Antibiotic discs used for Gram positive isolates were Ampicillin, Augmentin, Vancomycin, Oxacillin, Ciproxin, Erythrocin, Doxycycline, Gentacin. Septran, Linezolid and Fucidic acid. All the antibiotic discs used in the present study were manufactured by Oxoid UK.

In the present study, DAIs, their associated bacteria,
and their sensitivity/resistance to antibiotics were studied. Organisms resistant to major / all the above groups of antibiotics were labelled as Resistant (R) organisms either MDR or Pan resistant. The results were analyzed and reported.

Results

In 2010, a total of 886 samples were submitted for culture and sensitivity from Services Hospital Lahore to the Microbiology Section of Services Institute of Medical Sciences Lahore. Devices or device-associated samples comprised almost 40% (n=350) of these samples. Growth was yielded by 267(76%) samples whereas 83 samples were growth negative. Tracheal samples were 60% followed by CV tips 27%. Folley's catheter samples were 12%. **(Table 1)**

Positive cultures were obtained from 76% of 350 device-associated samples yielding 237 bacterial isolates. Candida was isolated from 8.6% of these samples. Total Gram negative isolates predominated (n=216) comprising 91% of bacterial isolates and Gram positive 8.8% only of 237 isolates. Monomicrobial growth was found in 187 samples, dimicrobial in 26 and trimicrobial in 3 samples. Non lactose fermenters were 133 and fermenters 83. Acinetobacters sp. comprising 40%, Pseudomonas (22%), E coli (18.5%) and Klebsiella (16.6%)

Acinetobacters were the most drug resistant. A quarter were pan resistant, half were sensitive to one drug only mainly to imipenem. 21% were sensitive to two drugs. Three Acinetobacters were sensitive to 3 drugs. Totally 40% Acinetobacters were imipenem sensitive. Total and partial resistance was seen in 77% strains. Pseudomonas were 94% sensitivity to imipenem. Only 3.3% exhibited resistance to imipenem. Pan resistance was exhibited in 30 Gram negative strains with 4 ESBLs. **(Table 3)**

In 2015 a total of 446 samples were sent for culture sensitivity from ICUs of which 302 (67.7%) were of device-associated. Growth of 309 isolates was yielded from 219 (72.5%) samples. Coincidently in 2015 growth negative samples were 83 like 2010. Tracheal samples constituted 62.6% samples, non tracheal 37.4%, tips 90 (30%) samples, Folley's catheter were 13.**(Table1**) From 189 tracheal samples growth was obtained in 166 (54.5%) samples. No growth was obtained in 26 tracheal samples. From the 113 non tracheal samples 54 samples were growth positive and 59 growth negative. In 2015 Gram negative bacteria were 270 in number (87.4%) of the total 309 isolates. Non lactose fermenters constituted one large group of bacteria n=149 and comprised 55% of the total gram negative isolates, followed by lactose fermenters (n=119) comprising 44% of Gram negative isolates **(Table 2).** Gram positives constituted 12.6% and Candida 5.2% of the total isolates.

The total Acinetobacters isolated were 90 with 84.4% from trachea. Twenty of these were pan resistant, 43 sensitive to one drug mainly tigycycline, 17 sensitive to 2 drugs and 10 to 3 drugs. Likewise a quarter of Pseudomonas was pan resistant and 13 sensitive to one drug. Eighteen lactose fermenters exhibited pan resistance. Proteus and Citrobacter isolates have increased in number, in pan resistance and in ESBLs production **(Table-3)**. In total 53 pan resistant isolates with 14 ESBLs were recorded. Resistant bacteria n=66 (21.5%) were isolated from trachea only.

Table-1: Comparison of Type of Samples submitted to ICUs and their Culture results

Year	Total samples submitted	Device samples No.	%	Growth Positive No.	%	Growth negative No.	%	Tracheal samples No.	%	CV Tips No	%	Folley's Catheter No	%
2010	886	350	39.5	267	76	83	23.7	212	60	96	27	43	12
2015	446	302	67.7	219	72	83	27.4	189	62.6	90	30	13	4.3
Diff	440	48	04	48	04	0	3.7	23	06	06	03	30	7.7

Table-2: Bacterial Profiles in DAI Studies 2010 and 2015.

Samples			Gram Positive Bacteria										Gram Negative Bacteria							
Year	Device Growth N	%	No	ORSA No.	%	CONS	CONS	No	Acinet No.	%	Pseud. No.	%	E coli No	%	Kleb No	%	Prot. No	%	Citro. No	%
2010	267	76	21	05	24	07	08	216	86	40	47	21.7	49	18.5	36	16.6	08	3.7	01	0.5
2015	219	72	39	12	31	01	06	270	90	33	59	21.8	43	16	33	12	29	10.7	16	5.9
Diff	48	04	18	07	07	06	02	54	04	07	12	0	03	2.5	03	4.4	21	07	15	5.5

Table-3: Microbiological drug resistance patterns in the years 2010 & 2015.

Isolate	Total no 2010	Pan Resistant 2010		Single drug sensitivity 2010		Total no 2015	Pan Resistance 2015		Single drug Sensitivity 2015	
Acinetbacter	86	21	24.4%	45	Imp* 23	90	20	22.2%	43	tcg* 24
Pseudomonas	47	01	2%	10	Imp 09	59	15	25.4%	15	taz* 07
E coli	40	03	2 ESBL*	07	Imp 05	43	01	5 ESBL	05	imp/tgc
Klebsiella	36	04	2 ESBL	07	Imp 06	33	12	4 ESBL	15	imp 07
Proteus	07	01		01	Imp 01	29	04	4 ESBL	08	taz 04
Citrobacter	01					16	01	1 ESBL	12	tgc 07
S aureus	12	05	ORSA*			15	14	ORSA		
CONS	06	01	ORSS*			08	08			
	265	36	13.6%	70	26.4%	309	754	24.4%	96	31.3%

Table-4: Comparative studies for type of isolates.

Studies	Samples total no	Culture Positive		Gram Negative		Gram Positive		CONS		Fungi	
		No	%	No.	%	No	%	No	%	No	%
Polish 2016	206	200	70		46.5		53.	40	01	09	4.3
Irfan 2015	228	129	3.7	141	61.8	59	26	06	21	-	
Pak 2015	302	219	2.5	270	87.4	39	12.6	06	2.2	16	5.2
Pak 2010	350	267	6.2	216	81	21	7.9	08	2.9	30	1.2

Table-5: Comparative studies for Bacterial Profiles and Drug Resistance in Baseline Period and after Intervention.

Bacteria	Turkey		2013[15]		Cuba 2013[16]		5 Countries[17]		Pakistan			
	Pre n=65		Post n-394		Pre	Post	Pre	Post	Pre 2010[1,8] n = 350		Post 2015 n=302	
Ram negative	%	R	%	R	%	%	%	%	n	PanR%	N	PanR%
Acinetbacter	22	Imp78.3	33	Imp 64.4	100	07	2	18	86	24.4	90	22.2
Pseudomonas	32	Imp 43.3	30	Imp 40.6	00	36	57	55	47	2.1	59	25.4
E coli	09		05		00	14	07	18	40	12.5	43	13.9
Klebsiella	07		11		00	29	29		36	1636	33	48.5
Proteus	01		01						08	14.3	29	27.6
Citrobacter	20	80	-						01	4.5	16	14.9
S aureus ORSA	0		13	73.2		07	00	09	12	83.3	14	93
Staphylococci	03		01	ORSS*					06	16.6	10	80
Candida	03		01						30	-	16	-

Disucssion

ICUs harbour a dependant and immuno compromised population of patients who further have device dependency e.g. premature infants or with respiratory distress have endotracheal intubation and mechanical ventilation.[8] The altered host response plus large bacterial load with all types of pressures on bacteria by drugs, disinfectants in the milleu interior and exterior of the patient result in resistant strains. Further transmission of such strains to other patients by personnel and fomites, aid spread in hospitals. Thus resistant strains emerge, colonize, contaminate and infect the patients. These two studies were compared for any change in the pattern over a period of 5 years with implementation of Infection control MSDS Policy by Punjab Health Care Commission in the year 2014.

The total number of samples submitted to Microbiology laboratory has decreased drastically from 886 to 446. In 2015, a decrease of 440 samples submitted by ICUs was witnessed. The Foley's catheter samples also decreased by 44 samples. The total samples have decreased by 50% but device associated by 28%**Table 1.**

Table2 shows a greater number of device-associated samples in 2010 but in terms of percentage the difference is of 4%. This means with a 50% reduction in submitted samples the ratios of device associated samples are almost the same which shows high infection rates. All the microbial profiles have not changed much. *Proteus* spp and *Citrobacte*r spp isolation rates are on the increase. Candida isolation has decreased.

Table 3 is very significant. Resistance to antibiotics have increased as has pan resistance. In 2010, thirty six pan-resistant strains were isolated and in 2015 their number has increased to 75 in 2015. An increase from 13.6% to 24.4%.There is a decrease in *Acinetobacter* resistance by 2% but an increase in *Pseudomonas* pan-resistance from 2 to 24% in 2010 & 2015 respectively. Likewise ESBLs increased from 4 to 14 in Enterobacteriaceae. They were only seen in *E coli* and *Klebsiella* spp. Now they are found in *Proteus* and *Citrobacter* too**.(table3)** The developed countries maintain data base on device-associated healthcare associated infection [DAHAI] in ICUs. Surveillance is pivotal in infection control practices and quality assurance [12] The incidence rate of DAIs decreased in ICUs after establishment of Korean Nosocomial Infection Surveillance Systems [KONIS] in 2006. Like ventilator associated pneumonia [VAP] rate per 1000 ventilator days from 3.48 to 1.93.[3]

The focus of hospital infection is the surgical and allied theatres. ICUs should be targeted more than the theatres as they are a perpetually ill segment of patients who are device dependant. Ventilators are open channels for all saprophytic bacteria like *Acinetobacters* and *Pseudomonas*. Compared to close channel devices the ventilator associated infections are more in number.

Inexpensive preventive strategies can be made as avoidance of devices until mandatory, daily anti-sepsis of oral area, intra venous devices and catheters. Earliest possible removal of devices, disinfection of environment, hand hygiene, waste management, Antibiotic Stewardship Programmes all may help in circumventing DAIS in ICUs.

International Nosocomial Infection Control Consortiu (INICC) is an international non profit, open, scientific community that works interactively through a network that aims at reducing hospital acquired infections, mortality, bacterial resistance, length of stay in hospital and thus extra cost. INICC in developing countries helps in global surveillance programmes based on Centre for Disease Control (CDC) and Prevention's National Healthcare Safety Network (NHSN) and provide guidelines with basic and inexpensive tools and resources for systematic control and prevention of nosocomial infection.[1,14,15,16]

INICC was started in 1998 by Dr Victor D Rosenthal. In 1993 he joined doctors National Infection Control Guidelines in Argentina; Infectious Disease Society of Argentina; but non compliance followed. So multinational surveillance and research was started on voluntary basis to asses the magnitude of infection problems, their risks and translation to economic burdens. With this risk factors and cost effectiveness were highlighted and compliance improved[1] In US for over 50 years, CDC methods are applicable for measuring nosocomial infection. With this infection control and prevention guidelines were laid. Infection rate differs by ratio of 1:5. Now it has become a multi-centric organization with 2000 healthcare centres voluntarily joined in 500 cities, 66 countries and 4 continents. Confidentiality of the healthcare set-up is maintained. There are two phases of studies, phase 1 baseline period of participation in INICC programme and phase 2 the intervention period.[14]

All the above stated studies describe the impact on bacteria after interventions.

Studies are mostly from developing countries. Studies report decrease in bacteria after interventions. The Turkish study seems to have increased number of bacterial isolates post intervention but the number of samples have also increased six-fold (ie from n=65 to n=365) in 3 months interval. The total number of samples have increased over 5 years by 48 in our study. However it records a significant increase in isolation of *Pseudomonas, Proteus, Citrobacter*. Moreover pan-resistance also increased tremendously by Pseudomonas (6.3%) Klebsiella four fold (16.6%-48.5%), Proteus by 13.3%, *Citrobacter* by 10%. Also gram positive MRSA isolates were increased by 51% and coagulase negative staphylococci by 83%. The increase in bacteria and their pan resistance just reflects that there is need of affiliation with INICC and educational interventions for systematic infection control as per guidelines are mandatory. Current infection control practices need to be improved. All this is aimed at patient and state welfare which would reduce the nation's economic burden of health.

Conclusion

DA-HAIs are a serious threat in hospitals to all patients but more so in ICUs. A database should be maintained for infection in ICUs. National Surveillance Programmes should be carried out and

linked to INICC or CDC to follow their guidelines for infection control in our hospitals too like the developed nations. This would decrease DAIs and translated in decrease in economic expenditure by less antibiotic use, short hospital stay, less morbidity and mortality.

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