COMPARISON OF CHLORHEXIDINE DRESSING VERSUS SIMPLE OCCLUSIVE DRESSING IN PREVENTING CENTRAL VENOUS CATHETER RELATED BLOOD STREAM INFECTION (CRBSI) IN MEDICAL INTENSIVE CARE UNIT

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ABSTRACT

Objective: To compare chlorhexidine dressing versus simple occlusive dressing in preventing central venous catheter related blood stream infection (CRBSI) in medical intensive care unit.

Study Design: Prospective comparative study.

Place and Duration of Study: Study was conducted in Medical Intensive Care (ICU) of Pakistan Institute of Medical Sciences, Islamabad, from Jan 2018 to Jun 2018.

Methodology: Patients were divided randomly into two groups (1:1 randomization). In group A chlorhexidine dressing was applied and in group B normal occlusive dressing was done. Patients were followed after 2 weeks. Ethical approval and consent forms were taken.

Results: Total 48 patients were included in study. There were 21 (43.8%) males and 27 (56.3%) females in study. Mean age of patients was 50.2 ± 11 years. Chlorhexidine dressing had shown statistical significant reduction in catheter related blood stream infection as compare to simple occlusive dressing (p=0.01). Type of dressing is statistical significantly associated with gender (p=0.02). Site of insertion is significantly associated with catheter related blood stream infection infection (p<0.001).

Conclusion: catheter related blood stream infection is the most common form of bacterial infections. Chlorhexidine dressing had significant contribution in reduction of catheter related blood stream infection as compare to simple occlusive dressing. Hospital based strategies are required to reduce risk and complications associated with catheter related blood stream infection.

Keywords: Chlorhexidine dressing, catheter related blood stream infection, Simple occlusive dressing.

INTRODUCTION

Catheter-related blood stream infection (CRBSI) is 3rd leading cause of hospital acquired infection, worldwide[1]. CRBSI is termed as infection due to presence of bacteremia origination from (intravenous) catheter[2]. According to John Hopkins University, these infections accounts for 12-25% of total mortality rate. Incidence of CRBSI in North America is 2.1/1000 catheter days for respiratory intensive care unit (ICU)[3]. Another study reported CRBSI infection rate 0.48/1000 device days[4].

CRBSI is most frequent complication of central venous catheterization (CVC). CRBSI is most commonly caused by nosocomial bacteremia. Majority of CRBSI cases are associated with CVCs with relative risk 64 times greater than peripheral venous catheters. CRBSI is associated with potential risk factors including method of catheter insertion, purpose of catheterization, duration and site of catheter insertion[5]. However, local risk factors include occlusive transparent dressing, poor personal hygiene, *S.aureus* nasal colonization and moisture around the colonization[6].

Safdar *et al* reported that chlorhexidine impregnated dressing is associated with lower incidence of CRBSI (p=0.002) and catheter colonization (p=0.001)[7]. Biehl *et al* reported that incidence of CRBSI is significantly lower in chlorhexidine group (2.6%) as compare to control group (3.9%) (p=0.03)[8]. Levy *et al* reported that chlorhexidine impregnated sponge is safe intervention for reducing CRBSI and CVC coloniza-

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tion among infants[9]. Robert & Cheung reported that chlorhexidine had high contribution in reducing risk of CRBSI in 70% cases[10]. One recent study has compared chlorhexidine versus simple occlusive dressing and found that CRBSI was 57% in chlorhexidine dressing while it is 43% in normal occlusive dressing.

Limited data is available on role of chlorhexidine dressing in reducing CRBSI in Pakistan. Present study will contribute knowledge in understanding efficacy of chlorhexidine dressing in CRBSI prevention.

Aim of the study was to compare chlorhexidine dressing versus simple occlusive dressing in preventing central venous catheter related blood stream infection (CRBSI) in medical intensive care unit.

METHODOLOGY

A prospective comparative study was conducted in Medical Intensive Care (ICU) of Pakistan Institute of Medical Sciences, Islamabad. Study duration was six months from January 2018 to June 2018. A sample size of 48 patients (24 in each group) was calculated using WHO calculator keeping confidence level 95% with n1 43% and n2 57% and absolute precision 5%. Non probability consecutive sampling was used for recruitment of patients. Patients with centeral intravenous catheter for >24 hours, age between 18-70 years and both genders were included in study. Patients with pregnancy, malignancy, hypertension, breast feeding mothers and hepatitis B and C patients were excluded from sample. Ethical approval was taken from ethical review board of PIMS. Written informed consent forms were taken from all participants. After selection of patients, they were divided into two groups using simple random sampling (lottery method). In group A chlorhexidine dressing was applied and in group B normal occlusive dressing was done. Patients were assessed daily for temperature and physical signs of infection at dressing site. If infection suspected blood cultures were sent. Positive blood cultures were labeled according to standard protocol and noted in proforma by researcher. Patients were followed after 2 weeks. Data were analyzed using SPSS version 22.0. Mean and standard deviation was calculated for continuous variable. Frequency and percentages were calculated for qualitative variables. Chi-square test was applied for measuring association. The *p*-value ≤0.05 was considered significant.

RESULTS

Total 48 patients were included in study (24 patients in each group). There were 21 (43.8%) males and 27 (56.3%) females in study. Mean age of patients was 50.2 ± 11 SD years. There were 14

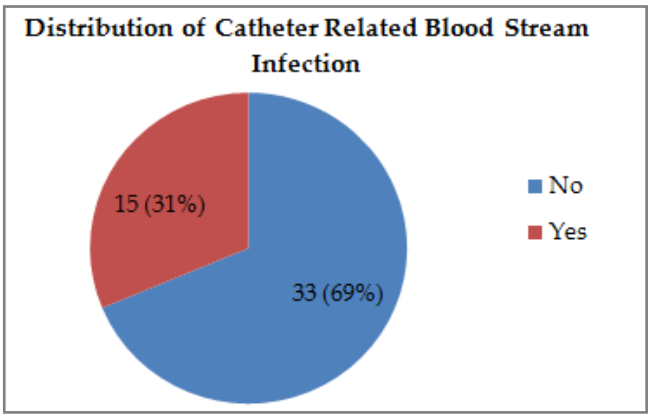

Figure-1: Distribution of catheter related blood stream infection in total sample.

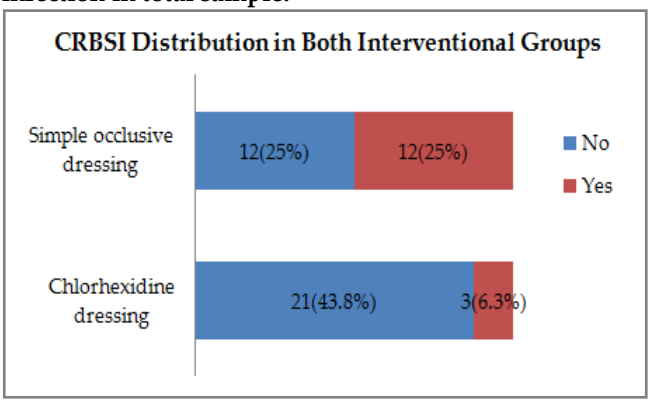

Figure-2: catheter related blood stream infection distribution in both interventional groups.

(29.2%) patients in age group 18-40 years and 34 (70.8%) patients in 40-70 years age group. Duration of disease was ≤3 months in 16 (33.3%) and >3 months in 32 (66.7%) patients. Chronic kidney disease was reported in 25 (52.1%) patients while 23 (47.9%) did not had CKD. Diabetes mellitus

was reported in 28 (58.3%) while 20 (41.7%) were not diagnosed with Diabetes. Types of dressing were chlorhexidine in 24 (50%) patients and simple occlusive dressing in 24 (50%) patients. Frequency of catheter related blood stream infection was 15 (31%) in total sample (fig-1). in age group 18-40 years and 16 (33.3%) were in age group 40-70 years. Similarly among all those who underwent simple occlusive dressing 24 (50%), 6 (12.5%) were in age group 18-40 years and 18 (37.5%) were in 40-70 years (x^2=0.403, *p*=0.315, df=1). Among all male 21 (43.8%), 16

Table-I: Association between type of dressing and independent variables.

Age	Dressing		Chi-square	*p*-value
	Chlorhexidine	Simple Occlusive		
18-40 years	8 (16.7%)	6 (12.5%)	0.403	0.315
40-70 years	16 (33.3%)	18 (37.5%)		
Gender				
Male	16 (33.3%)	5 (10.4%)	10.243	0.0012
Female	8 (16.7%)	19 (39.6%)		
Duration of Disease				
≤3 months	11 (22.9%)	5 (10.4%)	3.375	0.066
>3 months	13 (27.1%)	19 (39.6%)		
Chronic Kidney Disease				
No	9 (18.8%)	14 (29.2%)	2.087	0.1485
Yes	15 (31.3%)	10 (20.8%)		
Diabetes Mellitus				
No	9 (18.8%)	11 (22.9%)	0.343	0.55
Yes	15 (31.3%)	13 (27.1%)		

Table-II: Association between catheter related blood stream infection and independent variables.

Age	Catheter Related Blood Stream Infection		Chi-square	*p*-value
	No	Yes		
18-40 years	8 (16.7%)	6 (12.5%)	1.239	0.266
40-70 years	25 (52.1%)	9 (18.8%)		
Gender				
Male	16 (33.3%)	5 (10.4%)	0.962	0.36
Female	17 (35.4%)	10 (20.8%)		
Duration of Disease				
≤3 months	11 (22.9%)	5 (10.4%)	0.000	1.00
>3 months	22 (45.8%)	10 (20.8%)		
Chronic Kidney Disease				
No	17 (35.4%)	6 (12.5%)	0.548	0.45
Yes	16 (33.3%)	9 (18.8%)		
Debiates Millitus				
No	14 (29.2%)	6 (12.5%)	0.025	0.87
Yes	19 (39.6%)	9 (18.8%)		
Type of Dressing				
Chlorhexidine	21 (43.8%)	3 (6.3%)	7.855	0.005
Simple occlusive	12 (25%)	12 (25%)		

Chlorhexidine dressing had shown significant reduction in CRBSI as compare to simple occlusive dressing (fig-2).

Among all those who underwent chlorhexidine dressing 24 (50%), 8 (16.7%) were (33.3%) underwent chlorhexidine dressing and 5 (10.4%) underwent simple occlusive dressing. Among all female 27 (56.3%), 8 (16.7%) underwent chlorhexidine dressing and 19 (39.6%) underwent simple occlusive dressing (x^2=10.243,

p=0.0013, df=1). Among all those who had duration of disease ≤3 months 16 (33.3%), 11 (22.9%) underwent chlorhexidine dressing and 5 (10.4%) underwent simple occlusive dressing. Similarly among all those who had duration of disease >3 months 32 (66.7%), 13 (27.1%) underwent chlorhexidine dressing and 19 (39.6%) underwent simple occlusive dressing (x^2=3.375, *p*=0.066, df=1). CKD and DM also had insignificant association with type of dressing (*p*>0.05) (table-I).

Among all those in age group 18-40 years 14 (29.2%), 6 (12.5%) had CRBSI while 8 (16.7%) did not had CRBSI. Similarly among all those in 40-70 years 34 (70.8%), 9 (18.8%) had CRBSI while 25 (52.1%) did not had CRBSI (x^2=1.239, *p*=0.26, df=2). Among all males 21 (43.8%), 5 (10.4%) had CRBSI while 16 (33.3%) did not had CRBSI. Similarly among all females 27 (56.3%), 10 (20.8%) had CRBSI while 17 (35.4%) did not had CRBSI (x^2=0.962, *p*=0.36, df=2). Among all those who had chlorhexidine dressing 24 (50%), 3 (6.3%) had CRBSI and 21 (43.8%) did not had CRBSI. Similarly among all those who underwent simple occlusive dressing 24 (50%), 12 (25%) had CRBSI while 12 (25%) did not had CRBSI (x^2=7.855, *p*=0.01, df=2). Duration of disease, CKD and DM had insignificant association with CRBSI (table-II).

Among all the patients who underwent chlorhexidine dressing 24 (50%), majority of patients who were diagnosed with CRBSI had subclavian site of catherter insertion as compare to internal jugular site of insertion (12.5% vs 0%, 0=0.00). No statistical significance was found in CRBSI and site of catheter insertion in patients who underwent simple occlusive dressing (*p*=0.51) (table-III).

DISCUSSION

CRBSI are most common cause of hospital acquired infections leading towards mortality and morbidity[11]. In present study total 48 patients were included with 1:1 randomization (24 patients in each group). Frequency of catheter related blood stream infection was 15 (31%) in total sample. Rosenbaum *et al* reported that frequency of CRBSI infection in chronic kidney disease patients was 14.9%[12]. Kollef *et al* reported that frequency of CRBSI is more common among males as compare to females (49% vs 30%)[13]. A meta-analysis reported that cholrhexidine impregnated dressing was very effective as compare to traditional care for vascular catheter colonization prevention and CRBSI inhibition. They reported a relative risk reduction 45% and 48% for CRBSI and catheter colonization respectively[14].

Table-III: Association between catheter related blood stream infection and site of insertion.

Type of Dressing	Catheter Related Blood Stream Infection	Site of Insertion		Total	*p*-value
		Internal Jugular Site	Subclavian Site		
Chlorhexidine Dressing	No	13 (54.2%)	8 (33.3%)	21 (87.5%)	0.00
	Yes	0 (0%)	3 (12.5%)	3 (12.5%)	
Simple Occlusive Dressing	No	8 (33.3%)	4 (16.7%)	12 (50%)	0.51
	Yes	7 (29.2%)	5 (20.8%)	12 (50%)	
Total		28 (58.3%)	20 (41.7%)	48 (100%)	

In present study, Chlorhixidine dressing had was found to be significantly lower at internal jugular site as compare to subclavian site (*p*= 0.000). Ruesch *et al* reported that Internal jugular catheter insertion is associated with limited mechanical complication and high efficacy as compared to subclavian site for 5-7 days (*p*=0.01)[15]. Another similar study reported that subclavian access is associated with high hemodialysis complication as compared to femoral access (*p*=0.01)[16]. However, femoral access was not considered in our study.

Present study found out that among all those who had chlorhexidine dressing 24 (50%), 3 (6.3%) had CRBSI and 21 (43.8%) did not had CRBSI. Similarly among all those who underwent

simple occlusive dressing 24 (50%), 12 (25%) had CRBSI while 12 (25%) did not had CRBSI (x^2=7.855, p=0.01, df=2). Lai *et al* reported that chlorhexidine is associated with relative reduction of catheter related blood stream infections (p<0.05). Cleaning the skin wound with antiseptic had significant contribution in lowering CRBSI[17]. Garland *et al* reported that chlorhexidine dressing (replaced weekly) is more effective in critically ill neonates for reduction of CRBSI[18].

Present study found out that among all male 21 (43.8%), 16 (33.3%) underwent clorhexidine dressing and 5 (10.4%) underwent simple occlusive dressing. Among all female 27 (56.3%), 8 (16.7%) underwent chlorhexidine dressing and 19 (39.6%) underwent simple occlusive dressing (x^2= 10.243, p=0.02, df=2). Gerceker *et al* reported that males are more prone to develop CRBSI infection as compare to females (p=0.001)[19]. Heimann reported that males are more likely to develop CRBSI infections provided with chlorhexidine dressing as compare to females in ICU (p=0.000)[20].

In the present study, an insignificant association was reported between type of dressing and age (p=0.266), duration of disease (p=0.125), CKD (p=0.248) and DM (p=0.77). Grady *et al* reported that chlorhexidine impregnated dressing had significant association with duration of disease and reduction in CRBSI (p<0.05)[21].

LIMITATION OF STUDY

Small sample size and conduction of study at single center limits generalisability of study.

CONCLUSION

Chlorhexidine dressing had significant contribution in reduction of CRBSI as compare to simple occlusive dressing. Hospital based strategies are required to reduce risk and complications associated with CRBSI.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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