AN INTERVENTIONAL STUDY TO DECREASE CENTRAL VENOUS CATHETER RELATED BLOOD STREAM INFECTION IN INTENSIVE CARE UNITS AT ZAGAZIG UNIVERSITY HOSPITAL

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ABSTRACT

Background: Catheter related blood stream infection (CRBSI) is a complication of central venous catheter (CVC) use. This Infection particularly in the ICU population results in higher levels of morbidity and mortality coupled with greater costs in terms of care and increased duration of hospital stay. **Aim & Objectives:** The aim of this study is to improve the safety of patients with CVC via decreasing the incidence of CRBSI in ICUs patients at Zagazig University Hospital through the following objectives: 1- Calculation the incidences of CRBSI in ICUs patients over six months before and after intervention through active surveillance. 2- Assessment the level of the knowledge and adherence of health care providers in ICUs to evidence based guidelines recommended by CDC to decrease the incidences of CRBSI in ICUs patients before and after intervention. 3- Implementation of health education program on ICUs health care providers i.e. providing them by information about evidence based guidelines recommended by CDC to decrease the incidence of CRBSI in ICUs patients.

Subjects & Methods: An interventional study was conducted in surgical and emergency ICUs at Zagazig University Hospital during the academic year between 2011 and 2012. All patients with CVC in the studied ICUs were consecutively enrolled in the study and all health care providers working in the studied units and involved in insertion, maintenance and care of CVC during the period of study were included in the study. The study was carried out through 3 phases. **Results:** Statistically, there is a significant improvement in physician practice in both ICUs after intervention. The incidence of CRBSI decreased after intervention in surgical ICU but in comparison with that before intervention it was found no significant difference. In emergency ICU, the incidence of CRBSI after intervention is 0% and in comparison with that before intervention it was found a significant difference. Incidence of CRBSI decreased from 6.01/1000 catheter-days to 3.9/1000 catheter-days after intervention in surgical ICU. In emergency ICU, the incidence of CRBSI was 0% after intervention. **Conclusion:** This study revealed that, implementation of simple education program increased adequacy of knowledge, improved the practice of healthcare providers and reduced CVC blood stream infection rates in ICUs by almost 50%, during the intervention period.

Keywords: Central venous catheter, Blood stream infection, Intensive care unit

INTRODUCTION

Catheter related blood stream infections (CRBSIs) are associated with significant morbidity, mortality, and costs [(1)]. Risk factors for CRBSI include the introduction of bacteria into the circulation through invasive central venous and arterial catheter, tunneled central catheters, and peripherally inserted central lines and intravenous lines. Additionally, multiple factors can lead to primary infection with secondary bacteremia including head injury, sedation, malnutrition, immuno- suppression, mechanical ventilation and surgery [(2)].

Patients in intensive care units (ICUs) are at an increased risk for CRBSIs because 48% of ICU patients have indwelling central venous catheters (CVC), accounting for 15 million central catheter days per year in United States ICUs [(3)].

According to the report from the National Healthcare Safety Network (NHSN) of the U.S and Centers for Disease Control and Prevention (CDC), CRBSI occurs at a mean rate of 2.9 per 1000 catheter days for medical ICUs in American hospitals [(4)]. Mortality attributable to CRBSI has been estimated to be as high as 35%, and the length of hospital stay is increased among infected patients [(5)]. The average cost of care for a patient with this infection is $45,000 such infections could cost up to $2.3 billion annually [(6)].

Therefore, interventions aimed to decrease the infection rate are necessary to reduce serious public health consequences of this nosocomial infection. Many studies have shown reductions in the rates of CRBSI by various interventional efforts, including education and surveillance [(7-9)].
The CDC, the Society of Critical Care Medicine, the Society of Healthcare Epidemiologists of America, the Infectious Disease Society of America and several other societies have recently developed evidence based guidelines for the prevention of catheter related blood stream infection [(3)]. These recommended guidelines are educating and training healthcare personnel who insert and maintain catheters; using maximal sterile barrier precautions during CVC insertion; using 2% aqueous chlorhexidine skin preparation for antisepsis; and replacement of CVC with aseptic measures. [(10)].

The aim of this study is to improve the safety of patients with CVC via decreasing the

occurrence incidence of CRBSI in ICUs patients at Zagazig University Hospital through the following objectives: 1- Calculation the occurrence incidences of CRBSI in ICUs patients over six months before and after intervention through active surveillance. 2- Assessment the level of the knowledge and adherence of health care providers in ICUs to evidence based guidelines recommended by CDC to decrease the incidences of CRBSI in ICUs patients before and after intervention. 3- Implementation of health education program on ICUs health care providers i.e. providing them by information about evidence based guidelines recommended by CDC to decrease the incidence of CRBSI in ICUs patients.

SUBJECTS AND METHODS

I. Technical design:

Study design: An interventional study was conducted in two ICUs [surgical ICU (25 beds) and emergency ICU (14 beds)] at Zagazig University Hospital during the academic year between 2011 and 2012. the These selected two ICUs fulfilled inclusion **criteria** which are the following:

1- Have high percentage of patients with CVC.

2- Patients admitted for duration suitable for acquiring CRBSI.

3- Studied units have good recording system.

Target groups:

(A) All patients with CVC of both ICUs were consecutively enrolled during the period of study (6 months before and after intervention).

1- In surgical ICU, **435 patients before intervention and 336 patients after intervention** were included in the study.

2- In emergency ICU, 306 patients before intervention and 381 after intervention were included in the study.

(B) All health care providers (nurses and physicians) who were working in the studied units and involved in insertion, maintenance and care of CVC during the period of study were included in the study. They were 52 health care providers, 40 of them were nurses and 12 were physicians in surgical ICU and 32 health care providers, 24 of them are nurses and 8 physicians in emergency ICU.

II. Operational design:

A. Data collection: 3 phases

1st phase (Pre-intervention):

Duration: 6 months (from November 2011 to May 2012).

Activities:

***A- Active surveillance for calculating the incidence of** CRBSI **(CVC-related BSI).**

Incidence of CVC –related BSI =number of CVC related BSIs / number of CVC-days [12].

Surveillance Methodology

The collection of infection data for BSIs and their corresponding denominator data was performed using active, patient-based, prospective surveillance of the population at risk (i.e. patients who have central lines). This means that the infection was sought out during a patient's stay by screening a variety of data sources, such as microbiology reports, patient records, clinical notes, temperature charts.

Denominator

Central venous catheter – days (CVC-days)

At the same time every day, the number of patients with central venous catheter was counted, if a patient with central lines is temporarily off the unit for testing, the central line day is counted. If patient with CVC has been discharged or transferred to another unit, the central line day is not counted. The sum of these daily counts was recorded at the end of the study period.

Specimen collection:

For clinically suspected CR -BSI: the central line was aseptically removed, the distal 5 cm of the catheter was amputated and cultured using a standardized semi-quantitative method. In addition to another blood sample from a peripheral vein was taken on blood culture bottles, subcultured on blood agar plates [12].

Laboratory-confirmed CR–BSI is laboratory confirmed as a patient with a central venous catheter in place has a recognized microorganism that isolated from another peripheral vein blood cultures after at least 48 hours of central venous catheterization and is not related to an infection at another site [12].

B- Extra period of ICU stay was calculated by subtracting the average period of ICU stay of patients without CRBSI from that of patients with CRBSI in this study [13].

C- Observation of catheter insertion by health care providers using catheter insertion checklist which include items about procedure (site used, hand washing, sterilization procedure site, use maximal sterile precaution and if sterile dressing was applied to site after procedure) [14].

D- Assessment of health care providers' knowledge about nosocomial infection and CVC through a constructed questionnaire that covers the following areas:

1- Socio-demographic characteristics of health care providers in studied ICUs (age, education, duration of experience per years).

2- Training courses on infection control and obstacles confronting infection control practice in ICUS.
3- Knowledge about nosocomial infection (definition, causes, sources, mode and route of transmission).
4- Knowledge about CVC (uses, measures taken during insertion, time of replacement, frequency of dressing change, etc.

E-Assessment of infection control infrastructure in both ICUs [15,16].

2nd phase (Intervention phase):

Duration: 1 month

Activities: Evidence Based guidelines recommended by CDC was disseminated in intensive care units as
1- Arabic booklet to all health care providers in intensive care units to improve practice within institution. It covered the following items:
A- Nosocomial infection (definition, causes, mode of transmission, route of transmission and sources of infection).
B- Infection control (hand washing and protective equipments).
C- CVC (uses, measures taken during insertion, time of replacement, frequency of dressing change, symptoms of catheter related blood stream infection and factors affecting its occurrence).
2-group discussion.

3rd phase (Post intervention):

Duration: 6months (from June 2012 to December 2012).

Activities: A-active surveillance for recalculating incidence rate of CVC –related BSI after intervention.
B- Extra length of ICU stay was calculated
C- Re-observation of catheter insertion by health care providers using catheter insertion checklist to assess adherence to guidelines after intervention.
D- Reassessment of health care providers' knowledge about nosocomial infection and central venous catheter after intervention.
E- Reassessment of infection control infrastructure in both ICUs.

III. Administrative design and Ethical issues:

An official permission from Zagazig University, Faculty of medicine was taken to both intensive care units. The title and objectives of this study was explained to them to insure their cooperation. The local authority and manager of ICUs at Zagazig university hospital was informed about the nature and steps of the study and written consent was taken. The study group was informed about the nature and the purpose of the study and verbal consent was taken before interview. The study group was not exposed to any harm or risk. Patient's data was confidential.

IV. Statistical analysis of the recorded data:

The collected data were computerized and statistically analyzed using SPSS program (Statistical Package for Social Science) version **16** [17]. For the statistical calculations Data coding was done, and Qualitative data were represented as frequencies and percentages, Chi-square test (χ^2), Mc Nemar test and Fisher Exact test was carried out for testing the association between the qualitative data whenever possible. Quantitative data were compared using student's t-test and Mann-Whitney test. The test results were considered significant when p-value **<0.05**.

RESULTS

The mean age of studied sample was 26.28 ± 3.9 years old in surgical ICU and 28.063±5.2 years old in emergency ICU**.** More than half of nurses in surgical ICU had general diploma while only 15% of them had BSC Nursing. In emergency ICU, 45.8% of nurses had general diploma and 20.9% had BSC Nursing. The experience duration of nearly half of healthcare providers in surgical ICU ranged from 5-10 years, while in nearly half of studied health care providers in emergency ICU was less than 5 years. Training courses on infection control was received by 34.6% and 37.5% of health care providers in surgical and emergency ICU **respectively (Table 1).**

Infection control obstacles in both ICUs

The main obstacles to implement infection control program in surgical ICU were work overload, inadequate resources and lack of infection control guidelines application**,** while in emergency ICU, these were inadequate resources, improper design, lack of guidelines and insufficient training **(Figures 1,2).**

Healthcare providers' knowledge about nosocomial infection and CVC:

The majority of healthcare providers in both ICUs had adequate knowledge about nosocomial infection which increased to 96.15% and 96.9% in surgical ICU and emergency ICU respectively after intervention without significant difference between them. 34.6% and 18.6% of healthcare providers in surgical and emergency ICU respectively had adequate knowledge about CVC which increased to 81.8% and 88.5% in surgical ICU and emergency ICU respectively after intervention with highly statistically significant difference **(Table 2).**

Patients' characteristics in both ICUs.

The mean age of patients in surgical ICU was 40.02± 21.2 years old before intervention and 38.4 ± 21.7 years old after intervention while in

emergency ICU, mean age of patients was 39.3±20.1 years old before intervention and 39 ± 20.4. years old after intervention **(Table 3, 4).**

Duration of stay was 4.96 days before intervention and 4.6 days after intervention in surgical ICU , while it was 4.8 before intervention and 4.07 after intervention in emergency ICU.

The most frequent used site for catheter insertion in emergency ICU was internal jugular vein, with no use of femoral vein. Internal jugular vein was used in 54.2% and 60.1% of emergency ICU cases before and after intervention respectively. In surgical ICU, the most frequent used site before intervention was subclavian vein (63.4% of cases) , while internal jugular vein was the most used site after intervention (56.6% of cases) with no use of femoral vein **(Table 3,4).**

Physician attitude during CVC insertion in both ICU.

Before intervention 63% of health care providers in surgical ICU performed hand washing preceding CVC insertion with significant improvement in performance after intervention. In emergency ICU, only 20% of health care providers performed hand washing.

Before CVC insertion, all healthcare providers in both ICUs used povidone iodine for sterilization the site of insertion . In both ICUs of this study chlorhexidine was not used.

Before intervention, less than half of health care providers in both ICUs draped patients in a sterile fashion preceding catheter insertion with significant improvement after intervention in surgical ICU **(Table 5, 6).**

All healthcare providers in both ICUs wore sterile gloves during central venous catheter insertion before and after intervention, while none of them used hat and mask**.** Also there is highly significant improvement in physician practice in surgical ICU after intervention regarding use of sterile gown and fulfilling precaution by all personnel **(Table 5, 6)**.

In surgical and emergency ICUs, 89.5% and 98.7% of the studied healthcare providers respectively, applied a sterile dressing after procedure.

Catheter related blood stream infection in both ICU before and after intervention

CRBSI was clinically suspected in 3.9 % and 2.08% of surgical ICU cases before and after intervention respectively. It was confirmed by blood culture test in 3.0% and 1.8% of surgical ICU cases before and after intervention respectively

Although the incidences of CRBSI after intervention were numerically less than those before intervention but statistically, there was no significant differences **(Figure 3)**.

CRBSI was clinically suspected in 1.96 % and 0.05% of emergency ICU cases before and after intervention respectively. It was confirmed by blood culture in 1.6% and 0.0% of emergency ICU cases before and after intervention respectively with statistically significant decrease in CRBSI after intervention **(Figure 4).**

The most common organism in pre intervention phase in surgical ICU was Staph followed by klebsiella and citrobacter while candida albicans represented 7.7% of all detected organisms. However after intervention the most detected organism was klebsiella followed by E.choli and Staph **(Figure 5).** The most common organism in pre intervention phase in emergency ICU was Staph followed by klebsiella and citrobacter After intervention catheter related blood stream infection reached zero (**Figure 6).**

The incidence of CRBSI decreased from 6.01/1000 catheter-days to 3.9/1000 catheter-days after intervention in surgical ICU **,** while it decreased from 4.01/1000 catheter-days to 0/1000 catheter-days after intervention in emergency ICU **(Table 7) .**

The stay of patient with CRBSI in both ICUs before and after intervention, was prolonged and hence long hospital stay of these infected patients compared with others **(Table 8).**

Table (1): Sociodemographic characteristics of the studied sample from health care providers in surgical and emergency ICUs.

Items	Surgical ICU (N=52)		Emergency ICU (N=32)			p value
Age (years)					t test	
X± SD	26.28 ± 3.9		28.063±5.2		1.8	.07
	N	**%**	**N**	**%**	χ^2	**p**
20-30	47	90.4	23	71.8	3.64	.06
>30	5	9.6	9	28.2		
Education:						
**** Nurses***						
General diploma	25	48.1	11	34.4		
Technical institute	9	17.3	8	25.0		
BSC Nursing	6	11.5	5	15.6	1.73	0.8
****Physicians***						
Resident	6	11.5	4	12.5		
Assistant lecturer	6	11.5	4	12.5		
Duration of experience in ICU (years):						
< 5	14	26.9	15	46.9		
5 – 10	28	43.9	10	31.3	4.59	0.1
> 10	10	29.2	7	21.8		
Training courses on infection control :						
Yes	18	34.6	12	37.5	0.16	0.7
No	34	65.4	30	62.5		

***Statistically significant**

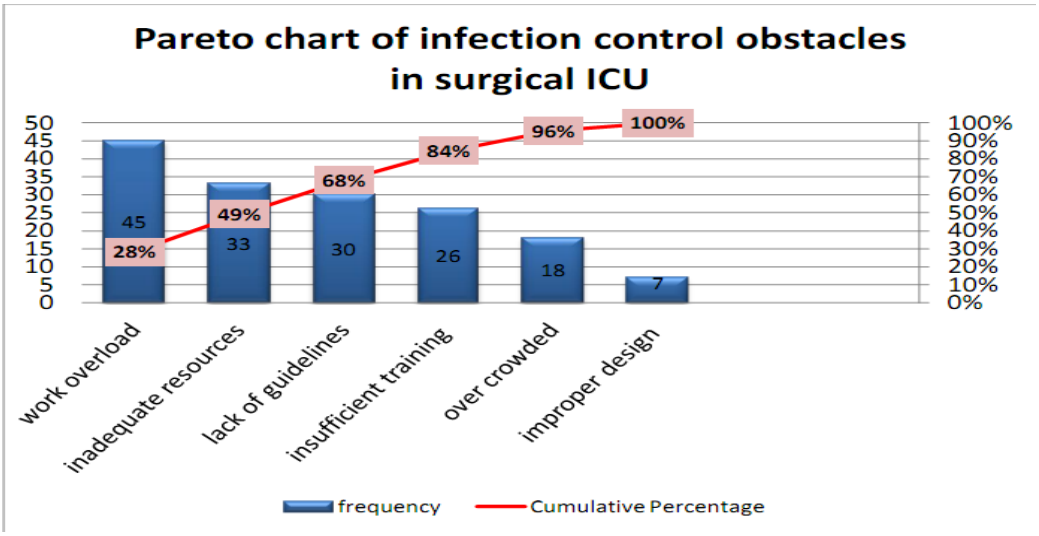


Figure (1): Pareto chart shows the most frequent obstacles to implement infection control program in surgical ICU.

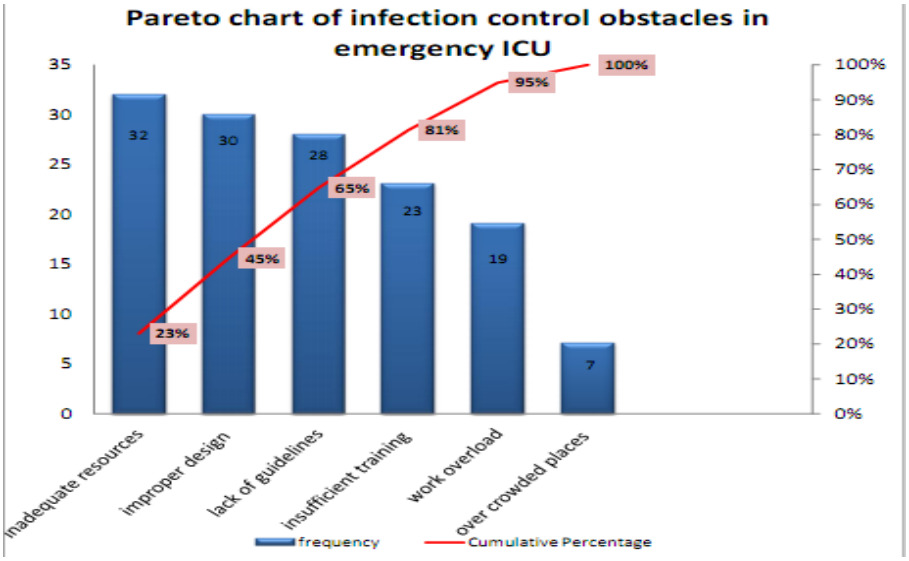


Figure (2): Pareto chart shows the most frequent obstacles to implement infection control program **in emergency ICU.**

Table (2): Level of knowledge of health care providers about nosocomial infection and CVC before and after intervention in both ICUs.

Level of knowledge	Before intervention		After intervention		p value
	N=52		N=52		
Surgical ICU:	N	%	N	%	
Level of knowledge about nosocomial infection:					
Adequate.	46	88.5	50	96.15	0.298
Inadequate.	6	11.5	2	3.85	
Adequacy of knowledge about CVC :					
Adequate.	18	34.6	42	81.8	
Inadequate.	34	65.4	10	19.2	0.0001*
Emergency ICU:	N=32		N=32		
Level of knowledge about nosocomial infection:	N	%	N	%	
Adequate.	29	90.6	31	96.9	0.625
Inadequate.	3	9.4	1	3.1	
Level of knowledge about CVC :					
Adequate.	6	18.6	28	88.5	0.000*
Inadequate.	26	81.4	4	11.5	

***Statistically significant**

Table (3): Patients' characteristics before and after intervention in surgical ICU.

Pts characteristics	Before intervention (N = 435)		After intervention (N = 336)			p value
Age (years):						
X ± SD	40.02± 21.2		38.4 ± 21.7		t test 1.06	0.2
	N	**%**	**N**	**%**	χ^2	**p**
<20	80	18.4	74	22.0		
20-40	122	28.0	77	22.9	3.26	0.2
>40	233	53.6	185	55.1		
Sex :						
• Male.	222	51.5	174	51.8		
• Female.	213	49.0	162	48.2	0.02	0.9
Duration of stay (days):					Mann–Whitney U test 65798.5	* **0.01**
X ± SD	4.96± 4.96		4.6±4.8			
Range	1 – 60		1-30			
Median	4.0		3.0			
Site used for catheter insertion:	**N**	**%**	**N**	**%**	χ^2	**p**
Internal Jugular vein.	157	36.1	190	56.6		*
Subclavian vein.	276	63.4	146	43.4	33.2	**0.00**
Femoral vein.	2	0.5	0	0%		

***Statistically significant.**

Table (4): Patients' characteristics before and after intervention in emergency ICU.

Patient characteristics	Before intervention (N = 306)		After intervention (N = 381)			p value
Age (years):						
X±SD	39.3±20.1		39± 20.4		t test 0.17	0.9
	N	**%**	**N**	**%**	χ^2	**p**
<20	41	13.4	71	18.6		
20-40	145	47.4	161	42.2	3.9	0.14
>40	120	39.2	149	39.2		
Sex :						
• Male	173	56.6	212	55.6		
• female	133	43.5	169	44.4	0.02	0.8
Duration of stay (days)						
X ± SD	4.8±4.16		4.07±4.14		Mann–Whitney U test 49486.5	* **0.001**
Range	1 – 23		1 - 20			
Median	3		2			
Site used for catheter insertion	**N**	**%**	**N**	**%**	χ^2	**p**
Internal Jugular vein.	166	54.2	229	60.1		
Subclavian vein.	140	45.8	152	39.9	2.15	0.14
Femoral vein.	0	0	0	0		

***Statistically significant.**

Table (5): The level of physician adherence to evidence based guidelines recommended by CDC to decrease CRBSI during CVC insertion before and after intervention in surgical ICU.

Level of physician adherence to evidence based guidelines recommended by CDC to decrease CRBSI.	Before intervention (N=435)		After intervention (N=336)		χ^2	P value
Before procedure	**N**	**%**	**N**	**%**		
Hand washing:					12.16	**0.000***
Done	275	63.2	252	75.0		
Not done	160	36.8	84	25.0		
Sterilize procedure:						
Done	435	100.0	336	100.0	Fisher exact	1.000
Not done	0	100.0	0	100.0		
Drape pt in sterile fashion:						
Done	155	35.6	150	44.6	9.67	**0.002***
Not done	280	64.4	168	55.4		
During procedure						
use sterile glove :						
Done	435	100.0	336	100.0	Fisher exact	1.000
Not done	0	0.0	0	0.0		
Use sterile gown :						
Done	85	19.5	92	27.4	6.59	**0.01***
Not done	350	80.5	244	72.6		
Use hat, mask :						
Done	0	0.0	0	0.0	Fisher exact	1.000
Not done	435	100.0	336	100.0		
Did all personnel fulfill precaution:						
Done	130	29.9	135	40.2	8.9	**0.003***
Not done	305	70.1	201	59.8		
After procedure						
was a sterile dressing applied:						
Done	430	89.5	336	100.0	Fisher exact	0.07
Not done	5	1.5	0	0.0		

***Statistically significant.**

Table (6): The level of physician adherence to evidence based guidelines recommended by CDC to decrease CRBSI during CVC insertion before and after intervention in emergency ICU.

The level of physician adherence to evidence based guidelines recommended by CDC to decrease CRBSI	Before intervention (N=306)		After intervention (N=381)		χ^2	P value
Hand washing :	**N**	**%**	**N**	**%**		
Done	62	20.3	267	70.1	141.2	**0.001***
Not done	244	79.7	114	29.9		
Sterilize procedure:						
done	306	100.0	381	100.0	Fisher exact	1.000
Not done	0	0.0	0	0.0		
Drape pt in sterile fashion						
Done	60	19.6	76	19.9	0.01	0.911
Not done	246	80.4	305	80.1		
During procedure use sterile glove:						
Done	306	100.0	381	100.0	Fisher exact	1.000
Not done	0	0.0	0	0.0		
Use sterile gown :						
Done	0	0.0	50	13.1	43.310	*
Not done	306	100.0	331	86.9		**0.0001**
Use hat, mask :						
Done	0	0.0	0	0.0	Fisher exact	1.000
Not done	306	100.0	381	100.0		
Did all personnel fullfil precaution :						
Done	61	19.9	123	32.3	13.2	**
Not done	245	80.14	258	67.7		**0.0003**
After procedure was a sterile dressing applied :						
Done	302	98.7	280	99.7	Fisher exact	0.18
Not done	4	1.3	1	0.3		

***Statistically significant.**

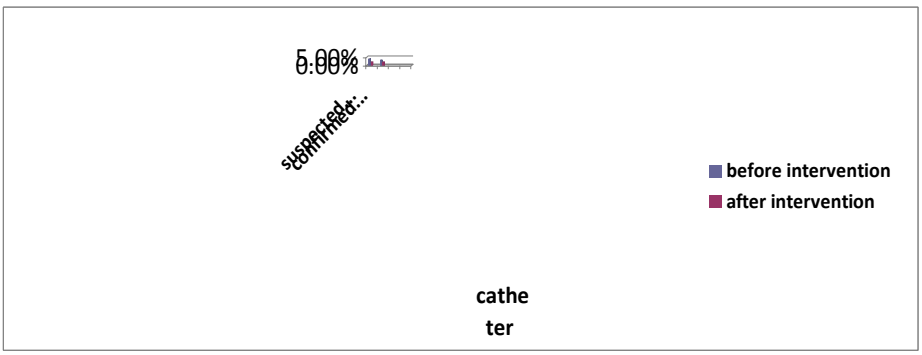
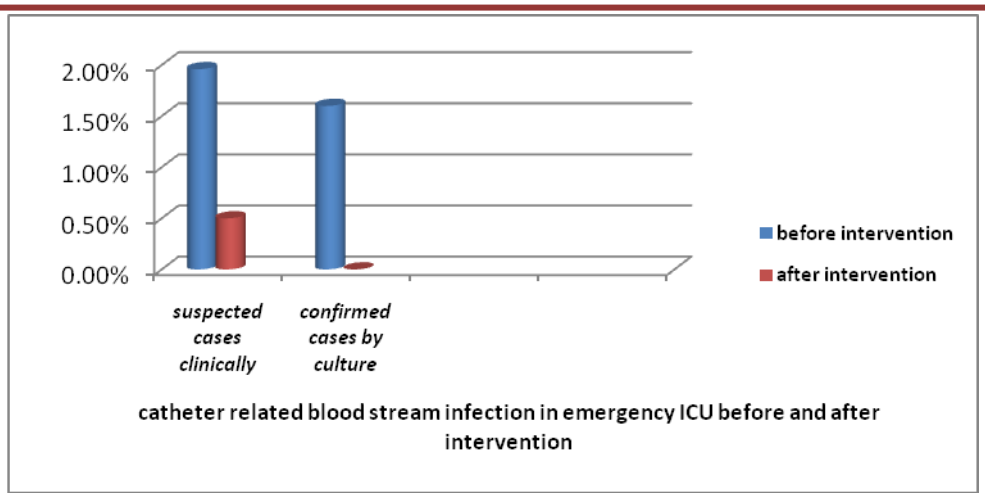


Figure (3): Incidences of CRBSI before and after intervention in surgical ICU.
(Numerically, after intervention, the incidence of CRBSI is les than that before intervention but statistically, there is no significant difference between both).



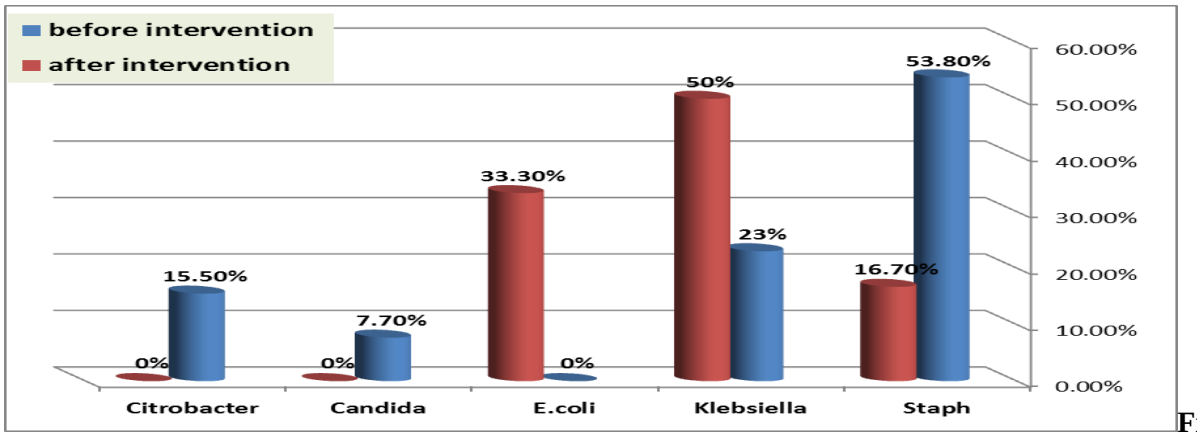


Figure (4): Incidences of CRBSI before and after intervention in emergency ICU. (Statistically before intervention, the incidence CRBSI is significantly less than that after intervention).

Figure (5): The most common isolated microorganisms from Catheter in surgical ICU befo
Figure (5): The most common isolated microorganisms from catheter before and after intervention in surgical ICU

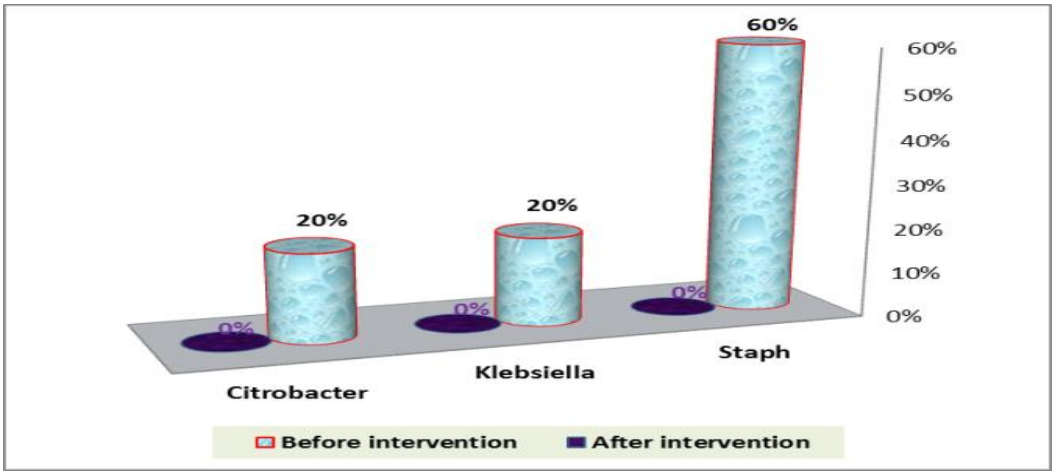


Figure (6): The most common isolated microorganisms from catheter before and after intervention in emergency ICU

Table (7): Incidences of CRBSI before and after intervention in both ICU.

ICUs	Number of cases	Number of catheter-days	Incidence of CRBSI
Surgical ICU before intervention	13	2160	6.01/1000 catheter-days
Surgical ICU after intervention	6	1554	3.9/1000 catheter-days
Emergency ICU before intervention	5	1246	4.01/1000 catheter-days
Emergency ICU after intervention	0	1823	0/1000 catheter-days

Table (8): Stay period and extra-period of patient with CRBSI in both ICUs (values are represented in mean±SD).

ICUs	Stay period (days)	Stay extra-period (days)
Surgical ICU before intervention	23.8±5.0	19.1±0.5
Surgical ICU after intervention	21.6±13.0	17.0±8.5
Emergency ICU before intervention	17.3±2.9	12.23±2.5

DISCUSSION

Catheter related blood stream infection (CRBSI) is a complication of central venous catheter use. [18].

From the present study, the detected sociodemographic characteristics of the studied health care providers sample in surgical and emergency ICUs were nearly similar to the reported sociodemographic characteristics of the studied health care providers samples by other workers. [13, 19 - 21]

The present study showed that, the main obstacles to implement infection control program in surgical ICU were work overload, inadequate resources and lack of infection control guidelines application**,** while in emergency ICU these were inadequate resources, improper design, lack of guidelines and insufficient training. These obstacles can be solved by focusing on increasing infection control budget, intense training for health care providers and adapting standard infection control guidelines will solve 80% of the problem of CRBSI. This was in agreement with the finding of other workers [22]**.**

From this study it was found that, majority of healthcare providers in both ICUs had adequate knowledge about nosocomial infection which increased to 96.15% and 96.9% in surgical and emergency ICUs respectively after intervention without significant difference**.** These findings were in agreement with the reported findings of Qayyum et al [9], Ahmed [19], Abd EL-Aziz [23], and Adebimpe et al., [25]..

The present study showed also that, only 34.6% and 18.6% of healthcare providers in both ICUs had adequate knowledge about CVC which increased to 81.8% and 88.5% in surgical and emergency ICUs respectively after intervention with highly significant difference between them. This was attributed to effective health education message delivered during the intervention phase. These findings were opposite to that reported by **Ahmed** [19]. He reported that, more than half of his studied group from healthcare providers had adequate knowledge about CVC.

From the present study it was found that, the mean stay period was 4.96 days before and 4.6 days after intervention in surgical ICU , , it was 4.8 before intervention and 4.07 days after intervention in emergency ICU. These findings were similar to that reported by **Longmate et al.** [26] and **Cherry-Bukowiec et al.** [27]**.**

From the present study it was found that, the most frequent used site for catheter insertion in emergency ICU was internal jugular vein 54.2% and 60.1% of cases before and after intervention respectively with no use of femoral site. In surgical ICU, the most frequent used site before intervention was subclavian vein (63.4%) , while internal jugular vein was the most used site after intervention (56.6%) with no use of femoral site. These findings were nearly similar to that reported by other workers. [26, 28]

From the present study it was found that, 63% of health care providers in surgical ICU performed hand washing preceding central venous catheter insertion before intervention with significant improvement in performance after intervention . This finding was similar to that of **Sean et al.** [3]. In emergency ICU, only 20% of health care providers performed hand washing , This finding is in partial accordance with **Ahmed** [19] who reported that half of healthcare providers didn't wash their hands before catheter insertion**.**

The detected low percent of health care providers who performed hand washing in emergency ICU may be attributed to inadequate resources in that ICU beside healthcare providers' attitude regarding hand washing, This attitude had been improved significantly in post intervention phase after dissemination of CDC guidelines and the significant improvement in infection control infrastructure **.**

From the present study it was found that, all healthcare providers in both ICUs performed skin sterilization by povidone iodine before CVC insertion In both ICUs of the present study, chlorhexidine was not used for skin sterilization. A meta-analysis of 4,143 catheters suggested that chlorhexidine preparation reduced the risk of catheter related infection by 49% relative to povidone iodine [29].

The present study clarified that less than half of health care providers in both ICUs draped patients in sterile fashion preceding catheter insertion with significant improvement after intervention in surgical ICU .This result was in accordance with **Ahmed** [19] reported findings but in contrast with **Sean et al.** [3] reported findings. They reported that, 85% of healthcare providers draped patients in a sterile fashion.

This present study also clarified that, all healthcare providers in both ICUs wore sterile gloves during central venous catheter insertion before and after intervention, while none of them used hat and mask . Also it showed that there is highly significant improvement in physician practice in surgical ICU after intervention regarding use of sterile gown and fulfilling precaution by all personnel. These finding were similar to that reported by **Taylor et al.** [30] but against to thast reported by **Sean et al.** [3]. They found that 92% of healthcare providers used hat, mask, and sterile gown and 100% of them used sterile gloves**.**

From the present study it was found that 89.5% and 98.7% of studied healthcare providers in surgical ICU and emergency ICU respectively applied a sterile dressing after procedure .These findings were similar to **that reported by Sean et al.** [3] , **Ahmed** [19] , **Abd El-Aziz** [24] **and Gillies et al** [31]**.**

Also from this study, it was found that, the incidences of CRBSI based on clinical suspicion in surgical ICU were 3.9 % before and 2.08% after intervention while the incidences of CRBSI that was confirmed by blood culture test were 3.0% before and 1.8% after intervention . Although the incidences of CRBSI after intervention were numerically less than that before intervention but statistically, there was no significant differences. The incidences of CRBSI that had been detected in the present study were higher than that reported by **Sallam et al.** [32], and similar to that of **van der Kooi et al** [33] and lower than that reported by **El Nakera et al.** [13] which was 12.0%**.**

Also from this study, it was found that that, the incidences of CRBSI based on clinical suspicion in emergency ICU patients were 1.96 % before and 0.05% after intervention respectively while the incidences of CRBSI that was confirmed by blood culture test were 1.6% before and 0.0% after intervention. Statistically, the incidences of CRBSI after intervention were significantly less than those after intervention. The incidences of CRBSI that had been detected in the present study were similar to those reported by **Sallam et al.** [32]**, Dogru et al.** [34] and **Sood** [35].

From the present study, the most common detected organisms in surgical ICU were Staph, klebsiella and citrobacter while candida albicans represented 7.7% of all detected organisms. However after intervention the most common detected organisms were klebsiella, E.choli and Staph. In emergency ICU the most common organism in pre intervention phase were klebsiella and citrobacter**.** After intervention, the occurrence incidence of CRBSI reached zero. The most common organisms that had been detected in the present study, differ from those detected by some other workers**. Sunmi et al.** [5] reported that, the most common pathogens identified at baseline were Candida species, followed by Staphylococcus aureus and coagulase-negative staphylococci.

During the intervention period, there was a decrease in the percentage of gram-negative bacterial isolates and a relative increase of gram-positive bacterial isolates. This phenomenon persisted until the period after the intervention, except for the increase of CA-BSI by Acinetobacter species. I

From the present study, it was found that, the incidence of CRBSI decreased from 6.01/1000 catheter-days to 3.9/1000 catheter-days after intervention in surgical ICU **,** while it decreased from 4.01/1000 catheter-days to 0/1000 catheter-days after intervention in emergency ICU These finding were in accordance with the reported findings of **Longmate et al. [25] , Pronovost et al. [35] and Sunmi et al. [5]**

From the present study, it was found that, the stay of patient with CRBSI before and after intervention, in both ICUs was prolonged and hence long hospital stay of these infected patients compared with others This result was similar to **El Nakera et al. [13].** The prolonged stay in ICU augments the risk and danger of catheter related blood stream infection [36] **.**

In conclusion, This study revealed that, implementation of simple education program increased adequacy of knowledge, improved the practice of healthcare providers and reduced CVC blood stream infection rates in ICUs by almost 50%, during the intervention period.

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دراسة تدخلية لتقليل الاصابة بعدوى الدم الناشئة عن القسطرة الوريدية المركزية فى وحدات العناية المركزة بمستشفى الزقازيق الجامعى

المقدمة: تعد العدوى المكتسبة للمستشفيات من اخطر المشاكل بوحدات العناية المركزة حيث انها تعد سببا رئيسيا لزيادة نسبة المرض وحالات الوفاة لمرضى الحالات الحرجة فضلا عن ما يصاحبها من طول فترة الاقامة بالعناية المركزة وبالتالى زيادة التكلفة.ويعد مريض العناية المركزة من اكثر الناس عرضة للعدوى المكتسبة بسبب الحالات المرضية الشديدة للمرضى بالإضافة إلى كثرة التدخلات الطبية العميقة.وتعتبر عدوى الدم الناشئة عن القسطرة الوريدية المركزية من اخطر المشاكل لمرضى العناية المركزة حيث انها تتسبب فى زيادة حدوث المرض والوفيات فضلا عن زيادة التكلفة الناتجة عن طول فترة الاقامة وزيادة الرعاية المقدمة. لذا وجب العمل على الحد من حدوث هذه العدوى من خلال مجموعة من الدراسات التى تهدف الى تقليل العدوى او منع حدوثها.

الهدف من الدراسة:تهدف الدراسة الى تحسين سلامة المرضى ذوى القسطرة الوريدية المركزية عن طريق تقليل العدوى الناشئة عن القسطرة الوريدية المركزية بوحدات العناية المركزة بمستشفى الزقازيق الجامعى .

الطرق والوسائل:لتحقيق هذه الاهداف فقد اجريت دراسة تدخلية بوحدتين للعناية المركزة (وحدة العناية المركزة الجراحية (٢٥ سريرا) وعناية الطوارئ (١٤ سريرا) بمستشفى الزقازيق الجامعى اثناء العام الاكاديمى ٢٠١١-٢٠١٢.وقد ضمت الدراسة كل المرضى ذوى القسطرة الوريدية المركزية بوحدات العناية المركزة محل الدراسة اثناء فترة الدراسة (٦ شهور قبل التدخل و٦ شهور بعد التدخل).كما ضمت كل مقدمى الخدمة الصحية بوحدات العناية المركزة محل الدراسة والقائمين بدورهم على تركيب والعناية بالقسطرة الوريدية المركزية.

جمع البيانات: وقد مرت الدراسة بثلاث مراحل:

المرحلة الاولى والثالثة:و قد تم فيهما:

١- الترصد النشط لحساب معدل حدوث عدوى الدم الناشئة عن القسطرة الوريدية المركزية.

٢-حساب مدة الاقامة الزائدة الناتجة عن العدوى.

٣- ملاحظة تركيب القسطرة الوريدية المركزية من قبل مقدمى الخدمة الصحية.

٤-تقييم معلومات الفريق الطبى عن العدوى المكتسة والقسطرة الوريدية المركزية .

٥-تقييم البنية التحتية لمكافحة العدوى لوحدات العناية المركزة محل الدراسة.

المرحلة التانية:(مرحلة التدخل)و قد تم فيها تعريف مقدمى الخدمة الصحية فى وحدات العناية المركزة محل الدراسة بالارشادات الموصى بها من قبل مركز مكافحة ومقاومة العدوى من خلال كتيب تناول النقاط التالية:

١-تعريف العدوى المكتسبة واسبابها ومصادرها وطرق انتشارها.

٢-طرق مكافحة العدوى المكتسبة.

٣-القسطرة الوريدية المركزية :استخدامها و الاجراءات الاحترازية التى يجب اخذها عند تركيبها وغيرها .

نتائج الدراسة

1-العناية المركزة الجراحية تحتوى على ٢٥ سرير ويتناوب عليهم ٤٠ ممرضة و١٢ طبيب مقيم و مدرس مساعد حيث النسبة بين عدد الممرضات والاسرة في النبتطشية ٢:١بمعنى ممرضة واحدة لكل سريرين .

٢-وحدة العناية المركزية بمستشفى الطوارئ تحتوى على ١٤ سرير ويتناوب عليهم ٢٤ ممرضة و٨ طبيب مقيم و مدرس مساعد حيث النسبة بين عدد الممرضات والاسرة في النبتطشية٢:١. اما نسبة الحاصلين على دورات تدريبية في مكافحة العدوى جاءت اقل من النصف فى كلتا الوحدتين.

٣- للوصول الى المعوقات المؤدية الى تطبيق طرق مكافحة العدوى بكلا الوحدتين قمنا بعمل "pareto chart" للوقوف على اهم المعوقات وكانت النتائج كالاتى فى وحدة العناية المركزة:زيادة التحميل فى العمل وعدم توفر الموارد ونقص الارشادات وعدم كفاية التدريب .أما في عناية الطوارئ فكانت المعوقات كالتالي وبالترتيب: عدم توفر الموارد والامكانيات والتصميم الخاطئ للمكان ونقص الارشادات وعدم كفاية التدريب.

٤-لا توجد علاقة ذو دلالة احصائية بين معلومات الفريق الطبى قبل التثقيف الصحى وبعده بالنسبة للعدوى المكتسبة ولكن توجد علاقة ذو دلاله احصائية بالنسبة لبعض النقاط الخاصة بالقسطرة الوريدية المركزية موضحة بالجداول.

٥-اوضحت الدراسة تحسن فى اداء الفريق الطبى بعد التدخل من حيث غسل اليدين وتغطية المريض بطريقة صحية وكذلك استخدام الجاون وتطبيق الاجراءات الاحترازية من قبل العاملين.

٦-نتج عن التدخل تقليل نسبة عدوى الدم الناشئة عن القسطرة الوريدية بمعدل 1.2بالمائة بوحدة العناية المركزة الجراحية اما بعناية الطوارئ فقد وصلت النسبة للصفر.

٧-واشارت الدراسة الى وجود طول ملحوظ بفترة الاقامة للمرضى المصابين بعدوى الدم الناشئة عن القسطرة الوريدية المركزية.

الخلاصة:نستنتج من هذه الدراسة ان برنامج تثقيف صحى لتطبيق الارشادات الموصى بها من قبل مركز مكافحة ومقاومة العدوى بالاضافة الى تحسين البنية التحتية لمكافحة العدوى سوف يقلل عدوى الدم الناشئة عن القسطرة الوريدية المركزية.وتطبيق هذا البرنامج فى هذه الدراسة ادى الى زيادة كفاءة معلومات وتحسن اداء الفريق الطبى بالاضافة الى تقليل نسبة الاصابة بمعدل ٥٠% اثناء فترة الدراسة

التوصيات:

١-زيادة الميزانية الخاصة بمكافحة العدوى الخاصة بوحدات العناية المركزة.

٢-عمل مسح دورى للبنية التحتية والمنتجات المتوفرة الخاصة بمكافحة العدوى بوحدات العناية المركزة.

٣-تنفيذ الاجراءات والارشادات الخاصة بمكافحة العدوى بصرامة وحزم.

٤-توفير الملصقات والكتيبات التى تشمل على اجراءات مكافحة العدوى بوحدات العناية المركزة.

٥- ضرورة العمل على زيادة البرامج التدريبية لمقدمى الخدمة الصحية بوحدات العناية المركزة بمستشفيات جامعة الزقازيق عن كل ما هو جديد فى مكافحة العدوى مع تقييم معلومات الفريق الطبى بصفة دورية.
٦-التعليم والتدريب المستمر للفريق الطبى عن دواعى استعمال القسطرة الوريدية والطرق السليمة لتركيبها والعناية بها وكذلك اجراءات مكافحة العدوى اللازمة لتقليل الاصابة بعدوى الدم الناشئة عنها
٧-التقييم الدورى والمستمر لمعلومات الفريق الطبى وكذلك الالتزام بالاجراءات الاحترازية عند تركيب القسطرة وكذلك عند العناية بها.
٨-التأكد من وجود عدد مناسب من التمريض داخل وحدات العناية والذى يؤثر بدوره على الاداء داخل وحدات العناية المركزة.
٩-قياس مدى الخطورة والنفع من تركيب القسطرة الوريدية المركزية.
١٠-استخدام ٢% من الكلورهيكسدين فى تعقيم مكان تركيب القسطرة .
١١- عمل وحدة خاصة لترصد حالات العدوى المكتسبة بالمستشفيات تهدف الى ترصد الحالات الجديدة وعمل اللازم للحد من انتشار العدوى بين وحدات العناية.