

Estimate the Best Method Associated with Lower Infection Rate with Central Line Insertion in Adult Patients in

King Abdulaziz Medical City (KAMC)

¹Dr. Mohammed Al Harbi, ²Dr. Derar Alrifai, ²Ms. Nour Mohamed, ²Mr. Salem Mohammed Alshammari, ²Rahaf Fahad Alswailem, ²Aysha Aziz Alanazi, ²Azizah Marzouq Alkhalidi, ²Aisha Saud Alenezi, ³Mr. Abdulla Alharbi , ³Ms. Ihssan Abdelrahman, ³Mr. Ibrahim Noreldien.

Dr. Mohammed Al Harbi

¹Associate professor, Anesthesiology, Anesthesia Technology program, King Saud Bin Abdul Aziz University for Health Science, Mail Code 3129, P.O Box 3660, Riyadh 11481, Saudi Arabia

²Research units, College of Applied Medical Sciences, King Saud Bin Abdul Aziz University for Health Science, Riyadh, Saudi Arabia

Corresponding Author: Dr. Derar Alrifai

¹Anesthesiology, Anesthesia Consultant, Anesthesia Technology program, King Saud Bin Abdul Aziz University for Health Science, Mail Code 3129, P.O Box 3660, Riyadh 11481, Saudi Arabia

² Research units, College of Applied Medical Sciences, King Saud Bin Abdul Aziz University for Health Science, Riyadh, Saudi Arabia

Corresponding Author: Ms. Nour Mohamed, Anesthesia

¹Anesthesia lecture, Anesthesia Technology program, King Saud Bin Abdul Aziz University for Health Science, Mail Code 3129, P.O Box 3660, Riyadh 11481, Saudi Arabia

² Research units, College of Applied Medical Sciences, King Saud Bin Abdul Aziz University for Health Science, Riyadh, Saudi Arabia.

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Abstract

Background: Central venous catheter (CVC) is a procedure uses catheter inserted in a central vein to state in vena cava. This procedure provides central venous pressure which indicates the volume status of patient, and it is used to administrate fluid, blood,

medication and nutrition. Despite the fact that CVC has a very important role in critical patients, CVC could have some complications such as developing infection, one of which is a central-line associated blood-stream infection (CLABSI). Moreover, infection incidences could be affected by some factors related to CVC such

as the technique utilized during insertion and site of insertion. This research will estimate the most effective method to reduce infection rate associated with CVC by identifying the technique and CVC site of insertion, and the relation between infection rate and other factors.

Method: The study conducted in operative room and intensive care unit in King Abdul-Aziz Medical City Riyadh from January 2018 to October 2019. The study design was cross sectional retrospective. The study subject was 255 patients. Data had been collected from the hospital data system, including type of technique used, site of insertion, and number of attempts, ASA classification, age and gender of the patient.

Results: 225 patients had CVC; males 54.5% and 45.5% females. All anesthetists followed the audit technique (100%) and the total of infection incidence was 73, three out of which was CLABSI. 215 (84%) of the patients undergo one attempt of insertion. The internal jugular was the highest site selected (56.5%), and (50.7 %) had developed infection. Patients who classified as ASA 3 and 4 were (43 %), on average of (42.25 %) had developed infection. The average percentage of infection rate for departments and patient's gender were (50 %).

Conclusion: The audit technique shows effectiveness in reducing infection rate while other factors had insignificant relation to infection rate

Keywords: Central venous catheter, central-line associated with blood-stream infection, Operating room, Intensive Care Unit, infection rate.

Introduction

Central venous catheter (CVC) is a procedure that uses a flexible tube to give fluid, medication, nutrition and sometimes blood for a long duration of time. (1). Also, central venous catheter provides numerous advantages especially with a critically ill patient who requires a fast

induction of drugs such as the cardiac patient. Despite the fact that the central line has a very important role in critical patients, the central venous catheter has complications including the technique utilized during insertion and site of insertion.(2) Moreover, Infection that is related to the central line could increase or decrease depends on some factors such as the site of insertion.

According to a study that is applied to 289 adult patients in the intensive care unit, the femoral access is considered as the highest site of infection. (3) Central line catheter can be inserted through different sites such as an internal jugular vein, subclavian vein, and femoral vein. (4) Furthermore, the infection that is associated with CVC such as bloodstream infection can be a serious complication that might induce shock or sepsis, which might affect the patient morbidity and mortality. (5) For example, one of the most serious complications related to the insertion of the central venous catheter is a central-line associated blood-stream infection (CLABSI), which is a laboratory-confirmed bloodstream infection that occurs during central line insertion and not secondarily to another site that can be developed usually within 2 days (48 hours). (6) As a result, these typically cause prolongation of hospital staying and increase in cost and risk of mortality. (7) Since that the rate of central-line associated blood-stream infection at King Abdulaziz Medical City (KAMC) is considered slightly increased, this study will focus mainly on the audit technique, which is the sterilization guideline used in KAMC that anesthetist is supposed to follow during insertion of central line, that can reduce the rate of central-line associated blood-stream infection.(8) Moreover, a lot of studies has been conducting to reduce the infection rate in different ways such as patient's bathing with chlorohexidine. The first

study was conducted in 2005 at Rush University Medical Center on 30 patients with central line insertion at intensive care unit (ICU). The study was done as a replacement of soap-and-water bathing to Chlorohexidine Gluconate (CHG) impregnated clothes to reduce the infection rate. As a result, the study compared the rates of central-line associated blood-stream infection (CLABSI) during soap-and-water bathing and chlorohexidine gluconate impregnated clothes and they conclude the study by that the chlorohexidine gluconate impregnated clothes technique has less or no significant effect in decreasing central-line associated blood-stream infection (CLABSI).(9) Another study has been done at Department of Medical Specialties, University of Texas on 343 patients and divided them into two groups 176 for the first group and 167 for the other group. The first group was the group whose catheter was inserted by using a maximal sterile barrier precaution, consisting of large drape, mask, sterile gloves, cap and gown, and the other group was using sterile gloves and drape only. The study was done on 3 months of following the patient after central line insertion to assist the rate of infection and they finally founds that the second group can develop the infection in the first two months of insertion while the other group can recognize the infection immediately after the insertion. In conclusion of this study, the study was successfully state that the maximal sterile barrier precaution technique can reduce the rate of central-line associated blood-stream infection (CLABSI).(10) Consequently, this research will estimate the effectiveness of audit technique to reduce infection rate associated with CVC by identifying the CVC site of insertion, and the relation between infection rate and other factors such as

department, gender, age, number of attempts and ASA classification, American Society of Anesthesiologists.

Methodology

Study Design: The study design was cross sectional, retrospective. Cross sectional is considered to be one of the most effective methods in finding the rate of infection.

Study area: The study was conducted at all the critical areas such as operating room, intensive care unit. In King Abdul-Aziz Medical City (KAMC) KSA-Riyadh, the city is under the umbrella of Ministry of National Guard Health Affairs (MNGHA). In addition, King Abdulaziz Medical City was established on May 1983 and has a capacity of 1505 beds.

Population: In this study, all patients who undergo a central line insertion was included in term of evaluating the rate of infection.

Inclusion criteria

1. Adult patient's female/male above 18 years old.
2. Patients who undergo central Line insertion
3. Patient is not diagnosed for blood stream infection before/after central line insertion
4. Patient is diagnosed for blood stream infection after central line insertion

Exclusion criteria

1. Patient is diagnosed for blood stream infection before central line insertion
2. Trauma patients
3. Patients with immunodeficiency diseases such as leukemia, AIDS, patients who take immune depressors.

Sampling technique: The sampling technique in this study was Systematic Sampling where the population was evenly sampled, and a clustered selection of subjects was avoided. The sampling interval (population size / Sample size) for systematic sampling was 3.

Every third person from the complete list of the participants was included in the proposed study.

Sample size: According to King Abdulaziz Medical City data the number of patients undergoing central line insertion was 250 per month. With margin of error 5% and 95% confidence level, the minimum required sample size for three months was calculated as 255 using Raosoft Sample size calculator.

Statistical plan: The statistical data was analyzed using Statistical Package for Social Sciences (SPSS) version 22 and, it was checked by different personal for accuracy and completeness. Categorical variables were analyzed as frequencies and percentages. Appropriate statistical test was used to examine the association between central line insertion and central-line insertion blood-stream infection. The significance was considered at a P-value of <0.05.

IRB approval: Study was conducted after receiving the IRB approval from King Abdullah International Medical Research centers (KAIMRC) and the study used patient’s data from hospital/ Best-care system, Electronic Health Records, (informed consent from the patient is not required). The privacy and confidentiality of each patient’s health information gathered ensured and data access was restricted to investigators only.

Result

A total of 255 patients with central line catheter from Intensive Care Unit (ICU) and Operating Room (OR). The demographics of the study population is showing in table 1. As shown in table 1, Patient samples were almost equally collected from ICU and OR, respectively 51% and 49%. Most of the population was males 54.5%, while 45.5% were females. Also, the mean age was 61 years old (± 18.335).

Table 1: Demographic Data (n=255)

Variable		
Department (Number, %)	ICU	130 (51.0 %)
	OR	125 (49.0 %)
Gender (Number, %)	Male	139 (54.3 %)
	Female	116 (45.5 %)
Age (Mean, ±SD)		61.09 (± 18.335)

Table 2 presents the characteristics of central line insertion regards to the technique and the prevalence of infection. As showing in the table 2, all anesthetists followed the audit technique (100%) and the total of infection prevalence was 73, three out of which was CLABSI. This indicate the effectiveness of audit technique to reduce central line infection.

Table 2: characteristics of central line insertion regard to technique and infection prevalence .(n=255)

Variable		Value (Number, %)
Technique	Audit Technique	255 (100.0 %)
	Total	73 (28.6 %)
Infection prevalence	CLABSI	3 (4.1 %)

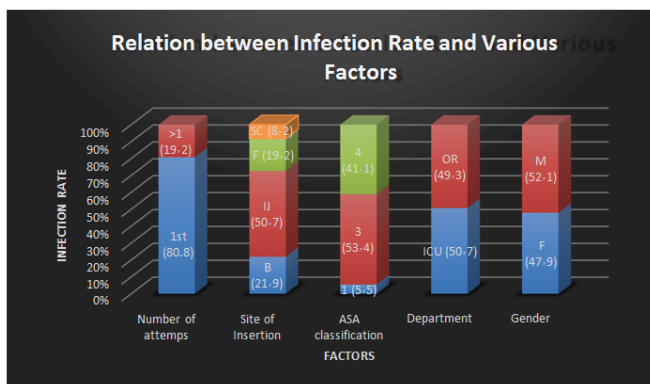
Table 3 demonstrates the number and percentage of central line insertion sites and ASA classification for all the patients who undergo a central line catheterization while the bar chart illustrates the relation between infection incidence rate and different factors, including number of attempts, site of insertion, ASA classification, departments and patient’s gender. There was insignificant relation between the number of attempts and the infection rate, 215 (84%) of the patients undergo one attempt of catheter insertion. Furthermore, as shown in table 3 the internal jugular vein was being the highest site used for central line insertion (56.5%), most of them had developed infection (50.7%). Moreover, the majority of patients

who had central line were classified as ASA 3 and 4 with a percent of approximately (43 %), on average of (42.25 %) had developed infection. Regarding the departments and patient’s gender, the percentages of infection rate were almost equal, about (50 %).

Table 3: The number and percentage of central line insertion sites and ASA; classification.(n=255)

Variable	Value	
	(Number, %)	
Site of Insertion	Internal Jugular	144 (56.5 %)
	Basilic	44 (17.3 %)
	Femoral	45 (17.6 %)
	Subclavian	22 (8.6 %)
ASA Classification	1	23 (9.0 %)
	2	12 (4.7 %)
	3	111 (43.5 %)
	4	109 (42.8 %)

Chart 1: Relation between Infection Rate and Various Factors (n=255)



Discussion

The results displayed that patients were collected almost equally from each department and the majority of them were males with a mean age of 61.09 years old. The prevalence of CLABSI was 3 patients out of 255 patients while the total infection rate was 73 out of 255 patients, which indicates that in this research, the CLABSI’s infection rate was low comparing to other types of infections. A total of 215 patients who undergo one attempt of central line insertion and only 3 of them developed CLABSI, thus there is no effect

of number of attempts with increasing the central line infection. On the other hand, 218 patients were classified as class 3 and 4 of ASA classifications, 69 out of 73 patients who developed infection were from class 3 and 4, which obviously showed that the higher the ASA classification, the higher the infection rate. In addition, 37 patients out of 73 who got the infection were performing the central line at Internal Jugular Vein and this prove that regarding the research’s results, this site was considered as the highest site of infection. Our study conclude that the audit technique was the most effective method used to reduce the infection rate in KAMC with no other techniques to be used in this hospital, while there was a study conduct in 2017 used a different technique to reduce central line infection which was the use of Antimicrobial Lock Therapy, instillation of antimicrobial solution inside the lumen of catheter. Both studies showed a decreased prevalence of central line infection even though they used different techniques. In addition, our study led to the result that the patients who developed the CLABSI were all from ICU while the OR patients showed no prevalence of CLABSI.(11) Similarly, a study was conducted in 2018 on patients collected from different departments to detect the prevalence of CLABSI and they concluded their study by that ICU has the highest rate of CLABSI infection among other groups. (12) Our study collected patients from different departments equally, therefore it represented a variety of population to be used in this research. The large sample size permitted the study to be applicable on variety of ages, genders and ASA classifications. In addition, this study included the different sites of insertion and the number of attempts which are not mentioned in the previous studies. Furthermore, the hospital is limited with one technique used to reduce

the central line infection, so our study has found it difficult to compare other techniques and see which of them was the most effective method to reduce central line infection. Also this technique doesn't contain the duration time, so it was difficult to see the effect of duration on the infection rate.

Conclusion

In conclusion, the results of this study showed that the audit technique was properly followed by the all anesthetists and the infection incidence of CLABSI was 3 out of 73 of the total infection prevalence. That indicates the effectiveness of audit technique to reduce the central line associated blood stream infection rate in King Abdul-Aziz Medical City with no other techniques to be used. Moreover, most of the patients who developed infection were from high classes, class 3 and 4 which refer to critically ill patients, from ASA classification and Internal Jugular Vein considered as the highest site of infection in our study. However, other considered factors in the study such as number of attempts, age and gender of the patient had insignificant relation to central line infection rate. Our results significantly support that the infection rate of CLABSI can be controlled through applying the audit technique. The impact of the central line duration in this study was difficult to follow. Therefore, we suggest the future studies to focus in the duration of the central line in order to understand the association between the duration and infection rate of CLABSI which seems to have an impact on central line infection.

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Appendix

1. Copy of the IRB approval memo
2. Copy of the questioner/ consent form/ data collection sheet

Kingdom of Saudi Arabia
Ministry of National Guard - Health Affairs



المملكة العربية السعودية
وزارة الحرس الوطني - الشؤون الصحية



King Abdullah International Medical Research Center
(KAIMRC)

IRB NCBE Registration No.:
H-01-R-005

(84) 94456

1515

94466

irb@ngha.med.sa

IRB Office

Memo Ref.No. IRBC/0771/19

E-CTS Ref. No.



RYD-19-419812-87784

Study Number: **SP19/176/R**
Study Title: **Estimate the best method to reduce infection associated with central line insertion in adult patients in KAMC.**

Study Sponsor: **Non Grant**
IRB Approval Date: **27 MAY 2019**
IRB Review Type: **Expedited Review** **Full Board**
Study site(s): **Central Region**

Dear **Dr. Derar Al Rifai**
Consultant Anesthesiologist, King Abdulaziz Medical City , Riyadh
Ministry of National Guard – Health Affairs

Sub-investigators: Aysha Alanazi, Azizah Alkhalidi, Rahad Alswilem, Aisha Alenezi, Dr. Mohammed Alharbi, Mr.Salem Alshammari and Nour abdelathim .

After reviewing your submitted research proposal/protocol and related documents, the IRB has APPROVED the submission.

The approval includes the following related documents:

Document/Title	Version	Date
Research Proposal	01	27 May 2019
Data Collection	01	27 May 2019

The approval of the research study is valid for **one year** from the above approval to expiration date.

Terms of Approval:

- **Annual Reports:** An Annual report must be submitted for approval to avoid termination/suspension of your research.
- **Financial report:** If your study is funded project, details financial report should be submitted with the scientific report.
- **Final Report:** After completion of the study, a final report must be forwarded to the IRB.
- **Retention of original data:** The PI is responsible for the storage and retention of original data pertaining to the project for a minimum of five years.
- **Reporting of adverse events or unanticipated problems:** The PI is responsible to report any serious or unexpected adverse events or unanticipated problems, which could involve a risk to participants or others.
- **Biological samples:** No biological samples to be shipped out of the Kingdom of Saudi Arabia without prior IRB approval.
- **Participant incentives:** No financial compensation or gifts to be given to participants without prior IRB approval.
- **Storage of biological samples:** All biological samples collected for the purpose of this research must be stored in the KAIMRC related repository.


29 MAY 2019
Dr. Abdallah Adlan
Chairman, Institutional Review Board (IRB)
Head, Biomedical Ethics Section - KAIMRC
Ministry of National Guard - Health Affairs

AA/AG/Areej

P.O. Box 22490, Riyadh 11426
Tel. 8011111
Telex : 403450 NGRMED SJ
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تلفون: ٨٠١١١١١
تلكس ٤٠٣٤٥٠

Data Collection Sheet

Encrypted ID

Age	18-40	41-60	61-80	81+
Gender		Male		Female
Body mass index (BMI)				
Type of surgery				
Medical history				
Site of insertion	Internal jugular	Subclavian		Femoral
Positive culture of the septicemia		Tip of catheter		Blood vessels
Technique	Coated	Non-coated	Smaller size	Follow the audit