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Prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine

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Declaration

I am the undersigned Ahmad Mohammad Antari, holder ID Card No. (number). The work presented in this thesis, unless otherwise referenced, is based on my own work and has not been submitted elsewhere for any other degree or qualification.

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Dedication

I would like to thanks my parents, my family and my wife, for supporting me throughout my life. This accomplishment would not have been possible without them.

To everyone who gave me the moral support for the completion of this task, Thank you

Acknowledgement

First, I give all the glory to God, the source of my strength, for granting me both the mental and physical endurance to complete this monumental task.

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.

Author

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Abstract

Background: Patients on hemodialysis are at risk of dying from cardiovascular problems and sepsis. Death-related sepsis is the second leading cause of death among dialysis patients, it becomes more common in medical practice in recent years. Sepsis was responsible for 28% of all deaths among HD patients in 2016.

Aim: The purpose of this study was to determine the prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine.

Methodology: The research was a quantitative study, Retrospective. The study population was all patients who undergone hemodialysis in north west bank via central venous catheter (CVC) who developed central related blood stream infection (CRBSI) in 2019.

Result: The result showed that the mean age was 54.9 years, female gender more than male. The result showed that the prevalence of CRBSI among included sample was 39.2%, according to the risk factors, the previous history of CRBSI is significant with CRBSI. The most common comorbidities are DM then HTN. Staphylococcus epidermidis is the primary microorganisms. CRBSI outcomes are confined between ICU admission and septic shock.

Conclusion: Central related blood stream infection (CRBSI) is one of the most common cause of death and costly complications of central venous catheterization. CVCs are commonly associated with hospital-acquired bloodstream infections and result in both prolonged ICU stay and increased mortality. The study results could serve as a reference point for policy and decision makers and healthcare stakeholders to develop tailored strategies to improve patients' outcomes.

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List of Abbreviations

Abbreviation	Meaning
CRBSI	Central Related Blood Stream Infection
ESRD	End Stage Renal Disease
HD	Hemodialysis
CVC	Central venous catheter
HTN	Hypertension
DM	Diabetes Miletus
CKD	Chronic Kidney Disease
AVF	Arteriovenous Fistula
AKI	Acute Kidney Injury
DTP	Differential Time to Positivity

Chapter One

Introduction

1.1 Introduction

This chapter describes and provides an overview of the problem under investigation. It starts by the background of the study then statement of the problem, significant of the study, study aims and objectives, study questions and hypothesis, conceptual and operational definitions of study variables.

1.2 Background

Chronic Kidney Disease (CKD) is a condition in which kidney damage or a lower glomerular filtration rate (GFR) persists for three months or more, eventually progressing to end-stage renal disease (ESRD). Renal replacement therapy (RRT), often known as dialysis or renal transplantation, is a life-saving but expensive treatment for persons with end-stage kidney diseases (Hafez et al., 2019).

A central venous catheter (CVC) is one of the most often used types of HD vascular access in the United States, particularly during HD beginning. Although CVCs can be implanted without surgery in a timely manner, they have been related to a high rate of serious infection complications, such as septicemia, and a high mortality rate (Sawhney et al., 2017).

Temporary vascular access via a central venous catheter is frequently utilized in hemodialysis. Central venous catheters, on the other hand, have been associated to a range of issues, the most prevalent of which is infection. Central venous catheter-related infection includes both local infection and bloodstream infection. The use of central venous catheters has resulted in large increases in health-care costs, morbidity, and

mortality. This is especially true for people with end-stage renal disease, where sepsis is the second most common cause of death after cardiovascular disease (Sahli et al., 2017).

Patients on hemodialysis are at risk of dying from cardiovascular problems and sepsis. Death-related sepsis is the second leading cause of death among dialysis patients, it becomes more common in medical practice in recent years. Sepsis was responsible for 28% of all deaths among HD patients in 2016 (National Renal Registry, 2019; Drew and Lok, 2014).

Due to higher age and comorbidity burden in CKD patients approaching HD, the use of CVC has steadily increased over the last 20 years; in this population, Catheter-related bloodstream infection (CRBSI) represents one of the most critical determinants of morbidity and mortality. Furthermore, due to the immunosuppressive effect of uremic therapy, overall infection risk is anticipated to be increased in late-referral end-stage renal failure and refer to what acute kidney injury (AKI) cases (Sawhney et al.,2017).

In addition, bacteremia is more common in HD patients with indwelling catheters than in those with an arteriovenous fistula (AVF) or a graft (Shamira et al., 2021). AVF use is linked to improved clinical outcomes, such as lower incidence of infection, hospitalization, and mortality. As a result, for most patients, a mature, well-functioning AVF is the preferred method of vascular access for most patients on HD. Complications of central venous catheter use in HD patients include catheter-related bloodstream infection (CRBSI), exit-site infections, tunnel infections, and catheter colonization's (CCs) (Shamira et al., 2021).

The frequency of catheter-related bloodstream infection ranges from 1.1 to 5.5 episodes per 1000 catheter days, and it is linked to increased morbidity, hospitalization, and death.

When compared to patients with an AVF, those with a tunneled dialysis catheter (TDC) have a 15-fold higher risk of CRBSI and a 12 % to 25% higher risk of all-cause mortality (Ravani et al.,2013).

Clinical practice recommendations for vascular access, such as fistulas and grafts, have been developed by the Centers for Disease Control and Prevention (CDC) and the National Kidney Foundation's Dialysis Outcomes Quality Initiative, recommend the use of arteriovenous accesses designed for long-term use (O'Grady et al., 2011). CVC should only be used when there are no other options. Despite this recommendation, CVCs are still used as vascular access in HD patients in clinical practice, with a prevalence of over 20% in many countries (Pisoni et al.,2015).

Due to an increase in mean age and comorbidities such as vascular disease in this population, tunneled (T) CVCs have often become a necessary permanent vascular access in chronic HD patients; as a result, it is difficult to get well-functioning AVFs (Lee et al.,2017). Furthermore, in "late referral" or acute renal failure patients, temporary non-tunneled (NT) CVCs are routinely utilized to commence dialysis. About 66 % of incident patients in the United States and more than 40% of incident patients in Italy begin HD with a CVC (Bonucch et al.,2016; Mendu et al.,2017). CVCs are linked to a variety of in infections, including exit site, tunnel, and bloodstream infections caused by catheters. Due to the risk of sepsis and death, CRBSI are the most clinically important infections, and they are a serious complication in all extracorporeal therapy settings (Kim et al.,2016).

The incidence rate of catheter-related bloodstream infection in non –tunneled central venous catheter is higher than in tunneled central venous catheter, with rates of 3.1–6.6

episodes/1000 catheter-days and 0.5–5.5 episodes/1000 catheter-days, respectively (Gonçalves et al.,2017; Mohamed et al.,2019). Many studies looked at length of catheterization, past bacteremia, age, gender, diabetes mellitus (DM), hypoalbuminemia, anemia, concomitant immunosuppressive medication, and colonization by methicillin-resistant Staphylococcus aureus as potential risk factors for CRBSI (Kumbar and Yee ,2019).

Furthermore, the degree of the infection and the organism involved should influence the decision to remove the catheter. A systemic antibiotic plus an antibiotic lock should be given in cases where catheter salvage is attempted (Collins et al.,2010). To avoid consequences, it is critical to diagnose CRBSI as soon as possible. In 2009, the Infectious Disease Society of America (IDSA) published a CRBSI guideline, which is widely followed around the world. Positive blood cultures from the peripheral veins and catheter hub, which must all meet the quantitative or differential time to positivity (DTP) criteria, are the mainstay in diagnosing CRBSI according to this guideline (Zou et al.,2010).

Due to depleted vascular access, getting a culture from a peripheral vein can be difficult in HD patients (Quittnat Pelletier et al., 2016) Furthermore, many experts in the field believe that peripheral veins should be preserved for future fistula development. As a result, this strict IDSA advice for the diagnosis of CRBSI in HD patients is contentious because it has not been validated in this population. When compared to peripheral venipunctures, Quittnatt and colleagues (2016) found that a combination of venous catheter hubs and HD circuits was the most sensitive and accurate technique to detect CRBSI. There is a shortage of data on likely CRBSI patients who have positive catheter hub cultures but negative peripheral vein cultures.

In recent years, CRBSI has increasingly gained attention (Thompson et al., 2017), and CRBSI has emerged as a substantial clinical concern. The incidence of CRBSI is decreasing as the CVC's protective consciousness improves (Gahlot et al., 2014), but in kidney ICUs, CRBSI remains the major cause of hospital-acquired bloodstream infection. Patients' hospitalization costs and length of stay are considerably increased by CRBSI, which leads to patient morbidity and mortality (Nakamura et al., 2015). Chronic kidney disease is a serious public health concern as well as a substantial financial burden (Wang et al.,2016). ESRD is on the rise, and we need to pay more attention, especially in Palestinian hospitals because there has been no research on CRBSI in Palestine, to the best of the authors' knowledge.

1.3 Statement of the problem

On a global scale, the total number of individuals with chronic kidney disease, acute kidney injury and those on renal replacement therapy (RRT) exceeds 850 million, according to a global survey undertaken by Jager and colleagues in 2019.

In patients with chronic hemodialysis access, sepsis is one of the most dangerous and life-threatening complications. Several previous studies found that significantly higher number of patients initiating HD using a catheter (Locham et al.,2020)

In general, the public health system in Palestine lacks sufficient infrastructure to serve the enormous population in need of medical care. Years of restrictions on imports have left the Palestinian hospital system with critical shortages of supplies like medical equipment, prescription drugs, over-the-counter medications and protective equipment. Ongoing conflict has also left many hospitals and clinics in disrepair, and restrictions on goods make it difficult to procure supplies for rebuilding. In 2019, the Palestinian News

and Information Agency reported that the total number of hemodialysis units in the West Bank reached 11 units, with 5 units in Gaza. In addition, there were 1,545 patients who got dialysis on a regular basis in West Bank hospitals, with a total of 201,747 washings for these patients(Shaban, 2016).In our point of view Palestine has lacks sufficient infrastructure so it suffer from many obstacles that needed to improve patient care and prevent many complication mainly catheter blood stream infection because lack of suitable dressing , staff continuous education also updated research because of lack of clinical researcher .

To the best of the researcher's knowledge, no research has been done in Palestine that reveals the prevalence of CRBSI and risk factor. Because of the ambiguity and differences between the standard and real-world practice of identifying CRBSI in Palestine, the aim of this study was to determine the prevalence of CRBSI among patients receiving HD by central venous catheter and risk factor.

1.4 Significance of the study

In Palestine according to annual Palestinian health record 2021, over 2572 people are on regular hemodialysis, with approximately 1567 in the West Bank and 1005 in the Gaza Strip. By identifying the prevalence rate of sepsis and associated factors, the study result will add to the scientific data base.

This research will contribute to the current of knowledge concerning the incidence and prevalence of catheter-related bloodstream infection, as well as aid other researchers in their investigation into effective strategies to prevent catheter complications.

Furthermore, the findings of this study will assist decision-makers in developing appropriate guidelines and will provide crucial data for implementing cost-effective

measures and infection-prevention measures. It will also aid in the preparation of appropriate policy to lessen the burden of this serious infection.

Furthermore, by focusing on this issue, these studies raise awareness among patients and society about catheter care and the importance of working hand in hand with health care workers to reduce the prevalence of this complication.

It also benefits to the researcher, university and community by obtaining new data in the field of the study that will help to develop new recommendations and guidelines

1.5 Aim of the study

The purpose of this study was to determine the prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine

1.6 Research questions:

1- What is the prevalence of infection induced by central venous catheter in patients undergoing hemodialysis?
2- What are the risk factors associated with central venous catheter-related infection in patients undergoing hemodialysis?
3- What is the type and antimicrobial susceptibility profiles of the primary microorganisms?
4- Is there an association between presence of other comorbidities such as diabetes and prevalence of infection?
5- Is there an association between factors such as diet, obesity and smoking with prevalence of infection?

6- Is there an association between various socio-demographic factors and prevalence of infection?

1.7 Objectives of the study

Main Objectives

1- To determine the prevalence Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine in the North West Bank.
2- To estimate the prevalence of infection induced by central venous catheter in Palestine undergoing hemodialysis.
3- To evaluate the risk factors associated with central venous catheter related infections in patients undergoing hemodialysis.
4- To identify and characterize the type and antimicrobial susceptibility profiles of the primary microorganism.
5- To determine the relationship with presence of other comorbidities such as diabetes and prevalence of infection.
6- To examine the association between various socio demographic factors and prevalence of infection.

1.8 Hypotheses of the study

H_0: There is no significant correlation between patient demographic data and the occurrence of infection caused by a central venous catheter in patients undergoing hemodialysis in northern west bank hospitals as a significance level of 0.05.

H_0: There is no significant correlation between risk factors for infection induced by central venous catheter and the occurrence of infection in patients undergoing hemodialysis in west bank hospitals as a significance level of 0.05.

H_0: There is no significant correlation between comorbidities and prevalence of infection induced by central venous catheter in patients undergoing hemodialysis in west bank hospitals as a significance level of 0.05.

H_0: There is no significant correlation between the type antimicrobial usage and the prevalence of infection induced by central venous catheter in patients undergoing hemodialysis in west bank hospitals as a significance level of 0.05.

H_0: There is no significant correlation between various socio demographic factors and associated risk factor of infection induced by central venous catheter in patients

1.9 Conceptual and Operational Definition of Terms

1.9.1 Conceptual Definition

Dialysis: is defined as "a treatment for people in the end stage of chronic renal insufficiency (kidney failure). This treatment cleans the blood and removes wastes and excess water from the body". (Martens et al. 2012).

CRBSI is defined as "bacteremia that occurs in a patient who had a central line on the date of bacteremia or the day before", the central line must have been in place for at least 2 days before the onset of bacteremia (Chaftari et al., 2016).

Risk factor is a measurable construct used to classify participants along a continuum of risk of the probability of developing an outcome of interest (Weinrib et al., 2017).

1.9.2 Operational Definition

CRBSI and its risk factors to it: I used data sheet that contain sub questions to determine the prevalence of CRBSI during hemodialysis patient at 2019 in north West Bank.

Chapter Two

Literature Review

2.1 Introduction

The literature review was done to identify related research, validate the research problem, and to identify gaps in knowledge. This chapter includes introduction, search strategies. This literature review was assembled from studies on the CRBSI and prevalence, CRBSI and risk factor, CRBSI in worldwide, CRBSI in Arab countries, CRBSI in Palestine.

2.2 Search Strategy

In this chapter, the search was performed in different international databases including Google Scholar, PubMed, Medline, EBSCO. The following keywords were used: “central related blood stream infection” “dialysis”, “prevalence of sepsis”, “risk factor”, “worldwide”, “Arab countries”, These words were searched in combination with each other and in separated form. For example, during the initial search, the keyword “CRBSI” was combined with “hemodialysis”. Later, during each new search a new keyword added until including all keywords in the last search. However, the searching process was limited to the following inclusion criteria: full text, written in English.

kidney Dialysis is the artificial process of eliminating waste called diffusion and unwanted water called ultra-filtration from the blood. (Lakshmi et al., 2014).

A prospective cohort study done by (Garrick, 2006)) ,in 81 dialysis clinics in 19 united states. The aim of the study is to compare risk for death among patients with ESRD who receive deferent type of dialysis. The researcher mention that we have only two types of kidney dialysis, peritoneal dialysis and hemodialysis

The global average prevalence for dialysis was 215 patients per million. At least 8–10% of the population in Europe suffers from some form of chronic kidney disease (CKD) they on hemodialysis , also the number is growing steadily by about 4–6% per year in Europe (Younis et al., 2015).

An Observational study done by (Prasad & Jha, 2015) in New Delhi, India , The purpose of the study is to find the prevalence of hemodialysis patients in Asia by using Modeling data , the result show that at least 2.9 million people need dialysis in Asia.

An experimental study by Agarwal et al., (2014) was done The purpose of this study is to compare between dialysis patients with left ventricular hypertrophy by echocardiography and hypertension and the type of drug used to treat blood pressure in USA. The study found that the number of people who undergone hemodialysis was 2 million, and 20-25% were from the United States.

On the other hand, a prospective, randomized parallel-group trial study conducted by Hall et al., (2012) University of Washington, Seattle in Kidney Research Institute, , The aim of this study was to study physical changes and health among people who do hemodialysis six times per week and among A traditional hemodialysis three times, The researchers used short physical performance battery (SPPB), Research Analytical nonprofit decision-making (RAND) 36-item health survey physical health composite (PHC), and physical functioning subscale (PF) .It was mentioned that the number of patients who need dialysis is two million patients who have kidney failure in the United States.

Prevalence of hemodialysis in Arab countries

A cross-sectional study conducted by (Maoujoud et al., 2017) done in Morocco. This study aimed to estimation chronic kidney disease prevalence in the general population by blood tests and risk factors. The researchers used Maremar study to measure markers of kidney disease damage in the general population. The population was all patients who undergo dialysis.31,650 dialysis patients between 435 private and government centers. 99% of dialysis patients or CKD used hemodialysis and the rest used peritoneal dialysis and kidney transplant.

Another study was conducted in National Genetic Centre, Royal Hospital, Muscat, Oman by (Al Alawi et al., 2017) to count the number of patients who do dialysis ,the result showed that the estimated annual incidence of ESRD is 1339 patient who undergone hemodialysis from 120 patients per million population.

A cross-sectional, correlational study done by (Khalil et al., 2018) at the Jordanian university aimed to uncover the prevalence of chronic kidney disease (CKD) in a national sample of Jordanian patients at high risk and examine the association of CKD with demographic and clinical factors, the study found that 4,000 Jordanians with End stage kidney disease were on haemodialysis (HD).

Prevalence of hemodialysis in Palestine

According to the 2021 annual health report of the Palestinian Ministry of Health the last survey was done in August 2021 for dialysis patients in Palestine was 1,008 cases.

A cross sectional study was conducted by (Mousa et al., 2018) on CKD patients undergoing HD at 12 different dialysis centers in Palestine .The purpose of the study was to describe the relation between HD patients' self-efficacy and their quality of life , to

assess factors associated with self-efficacy among HD patients, and to assess factors associated with quality of life among HD patients. The tool that used in this study is if efficacy for Managing Chronic Disease Six-Item Scale (SEMCD-6), and HRQoL. They found that the overall number of dialysis patients in the West Bank/Palestine has increased from 1014 patients in 2015 to 1119 patients in 2016.

A descriptive of study conducted by (Younis et al., 2015) in Palestine government hospitals. The study aimed to assess the costs of HD in Palestine, by using interview with head of dialysis department, the study found that the prevalence in the West Bank\Palestine was 240 patients per million of population and the cost of HD per patient is $16 085 per year.

Sepsis

Sepsis defined as (a systemic response to infection, which causes a potentially damaging inflammatory response) (Levy et al., 2003).

Sepsis defined as life-threatening organ dysfunction caused by a dysregulated host response to infection (Singer et al., 2016).

Risk factors of sepsis

A cohort study done by (Williams, 2013) in the United States , the aim of study was to test whether inadequate exercise is related to sepsis mortality. the population in this study was 155,484 National Walkers' and Runners' Health Study participants residing in the United States. The researchers used The National Death index to monitor sepsis deaths. The Risk factors identified during the study that elevated sepsis were aging, male sex, and being of a non-Caucasian race and co-morbidities particularly was diabetes.

Prevalence of sepsis

A Retrospective cohort study conducted by (Rhee et al., 2017) done in USA The aim of study was to estimate the US national incidence of sepsis. The researchers used detailed clinical data from the electronic health record (EHR) systems of diverse hospitals by using International Classification of Diseases, Ninth Revision, Clinical Modification codes for severe sepsis or septic shock. Case-finding criteria were validated against Sepsis-3 criteria using medical record reviews. The study found that 173 690 sepsis cases were admitted to 409 hospitals between 2009 and 2014, from these cases 26 061 (15.0%) died in the hospital and 10 731 (6.2%) were discharged.

Another study conducted by (Abou Dagher et al., 2015)in Boston Medical Center, England .The study aimed to report on a series of patients with end stage renal disease on hemodialysis (HD) diagnosed with sepsis, all patients admitted to emergency department were above 18 years old diagnosed with sepsis , with exclusion of who presented secondary to trauma , pregnant and incomplete documentation population sample . the study found that the number of patients who undergone dialysis had sepsis is 75,000 patients who were admitted to the hospitals every year in the United States.

Prevalence of sepsis in Arab world

A prospective study conducted by (Nabi et al., 2009), in Al-Qassim, Saudi Arabia Th study aimed to determine the rate of infection for kidney dialysis, the risk factors and the type of bacteria that cause infection. The population was all patients with temporary catheter for more than a week. the population was all hemodialysis patients at Setif university hospital, a 900 beds hospital in the second most populated city in Algeria. The

researcher observed the patients and tested them for a month to see any signs of infection. The result showed that from 57 patients ,19.3% patients who developed infection.

Prevalence of CRBSI, definition, risk factors, comorbidities and microorganism

The Centers for Disease Control and Prevention (CDC) defines central line associated bloodstream infection (CLABSI) as "bacteremia that occurs in a patient who had a central line on the date of bacteremia or the day before", the central line must have been in place for at least 2 days before the onset of bacteremia (Chaftari et al., 2016).

A continuous prospective study done by (Hammarskjöld et al., 2014) in Sweden , the aim of study was to evaluating CRBSI and possible risk factor to all CVCs in Swedish hospital .Acute Physiology and Chronic Health Evaluation II (Apache II)tool was used. The population was all patients in hospital units using CVCs. The results show that the catheterization time is risk factor for central related infection and hemodialysis is risk factor for CRBSI.

A prospective cohort study done by (Haga et al., 2013) in Japan , the aim of study was to explore the risk factor for CRBSI in hospitalized patient. the researcher use data sheet and the Informed consent was obtained from the patient or the families if patients were not able to decide. The population in this study was twelve Japanese hospitals with patients aged 19 years or older who were scheduled for a central venous catheter. The result show that using of internal jugular vein is the most risk factor then the sterile precaution.

A secondary analysis of a randomized multicenter trial done by Timsit et al., (2012) in French . The aim of the study was to determine the risk factor of central related blood stream infection from the dressing disruption. The population was 1419 patient who did dressing from 1,636 patients in the original study. The result show that how the dressing

technique is important risk factor for CRBSI at the same time the study mention that the subclavian insertion reduces the risk of disruption dressing.

A prospective multicenter study done by (Bicudo et al., 2011) in Sao Paulo , Brazil. The aim of study was to found the incidence of blood stream infection in ICU patients who have CVC and the variables with this complication. The data collection done by observation of patients with CVC in ICU hospitals by infection control nurses' team who participating institutions. The population of this study was all patients above 18 years old who have non-tunneled CVC in six medical surgical ICU from three hospitals in Sao Paulo, Brazil. The researcher found that the risk factor of blood stream infection is duration of catheterization, approximately three times higher with patients who have CVC more than 13 days, and the place of insertion is not significant.

A retrospective study done by (Shahar et al., 2021) in University Kembangan Malaysia Medical Centre (UKMMC) , Malaysia . The aim of study was to evaluate the prevalence of CRBSI and catheter colonization (CC) for hemodialysis patients. The data was collected by reviewed the notes of the original hardcopy or electronic medical records for the patients who had the criteria for CRBSI, the study population was all hemodialysis patients above 18 years old, who doing dialysis by catheter and had symptoms of CRBSI in UKMMC. The result show that over 82 patients who met criteria of CRBSI, the mean age is 66 years old, the male patient is 59.4%, patients on tunneled dialysis catheter is 83%, the internal jugular vein is most common site in CRBSI 50%, duration of dialysis more than 3 months is common risk factor for CRBSI 87%, the most common comorbidities in CRBSI is hypertension 88% then diabetes mellitus 78%. The most common microorganism is gram-positive organism, methicillin-susceptible

Staphylococcus aureus, the outcome of CRBSI is Catheter salvage 35% and mortality rate was 1.1%.

A retrospective study done by (Yousif Salem et al., 2021) in Dubai, the aim of study was to found the incidence ,the type of microorganism , antibiotic can use , and the outcome of CVC in patients who doing hemodialysis by tunneled CVC. the researchers reviewed the records of hemodialysis patients from 1-2012 to 12-2016. The study population was patients above 14 years old who doing hemodialysis via permanent catheter. The result show that over 49 patients who exposure to CRBSI, the mean age was 53.5 years old, the male patient 59.2% more than female, the most common comorbidities is hypertension 53.4%, diabetes milletus 30.1% and ischemic heart disease 17.8%. The common micro-organism in this study is gram-positive 67.3% specifically staphylococci epidermidis 26.4%. The outcome of this patient is 38.7% had catheter removal and 8.1% septic shock.

A retrospective cohort study done by (El- et al., 2021) in Dr. Soliman Fakeeh Hospital , Jeddah , KSA. The aim of study was to evaluate the CRBSI outcome in hemodialysis patient with demographic, comorbidities and microbial. The medical record number tool was used to find the data they need in study. the population was all patient in hospital who doing hemodialysis and diagnosed with CRBSI over 18 years old. The researchers found in 139 hemodialysis patients with CRBSI the mean age was 60.79, the female 56.8% more than male, the most common comorbidities was diabetic 45.3% then cardiovascular 17.3%. According to central venous catheter the mean duration is 49.5 days. The common site was right jugular vein 43.9%. According to microbiology the most common cause is coagulase-negative staphylococci 39.6%.

A Retrospective cohort Analysis study done by (Zhang et al., 2019) in Texas , the aim of study was to determine the CRBSI risk factors including comorbidities , demographics

and duration and frequency of hemodialysis. The researchers use an electronic medical record dataset to find the sample. the study population was320 patients between 2012 and 2015 who received emergency-only hemodialysis in Houston hospital. The result of the study showed that the prevalence of CRBSI is 20.3%, average patients age was 51 years, 90% were Hispanic, the male patient more than female. The frequency of hemodialysis not effected the result but the duration of hemodialysis is increase with patient who have CRBSI. The comorbidities result show that 60% had diabetes mellitus. The most common causative organism was Gram-positive bacteria.

A cross-sectional study done by (Alirezaei et al., 2019) in Iran . The aim of the study was to determine the incidence of CRBSI in patient who doing hemodialysis in single center. The data was collected between 2017 and 2018 by using medical archives in shahid-Modarres hospital of Tehran. The population was 50 patient who doing hemodialysis in the hospital. The result show that 27 were males, the mean age was 49, the most common comorbidity was hypertension 84%. the length of catheter indwelling was less than 1-year equal to 74%. The most common causative organism was coagulase-negative staphylococci 24%.

summary

Central related blood stream infection (CRBSI) is common in hemodialysis patient who had central venous catheter (CVC). The number of CRBSI is increased from year to year and the complication of this problem leading to poor outcome. The mortality rate is high and the studies showed the prevalence is increasing related to more than one risk factor and comorbidity. the risk factors and comorbidities are confined, length of CVC, dressing on CVC, type and site of the catheter is affected on outcome. Patients with diabetes and

hypertension are more susceptible to infection. The method of treatment and outcome varies according to the result of the blood culture and the type of micro-organism.

This chapter clarified that the prevalence of CRBSI is existing in Arab country and worldwide despite of guidelines from Centers for Disease Control (CDC). The literature illustrates that there was a lack of knowledge from the patient himself about how to take care on CVC. There is lack in studies that can't be generalized because of sample size. the lack of studies in Arab countries. This gap in literature references motivated me to do a study in Palestine to find out the prevalence of CRBSI for dialysis patients, and since it is the first study in Palestine, we must continue to reduce it.

Chapter three

Methodology

3.1 Study design

A quantitative retrospective study was conducted at North West Bank Nablus, Jenin, Tulkarm, Qalqilya, Tubas during a period of 2019-2020 in Palestine, to find the prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients.

3.2 Setting

The study was conducted in North West Bank hospitals at Nablus, Jenin, Tulkarm, Qalqilya, Tubas during a period of 2019-2020 in Palestine at governmental and private hospital that doing hemodialysis.

3.3 Study sample

Population: All patients who were undergoing H.D sessions at North West Bank (Nablus, Jenin, Tulkarm, Qalqilya, Tubas) governmental and private hospitals.

Sample: Patients with known case of ESRD on hemodialysis (HD) during a period of 2019-2020 who used central venous access for dialysis and developed central related blood stream infection (CRBSI).

Inclusion criteria:

Patients were included if they had:

- HD therapy through CVL in 2019.

Exclusion criteria:

- All patients who have AV shunt.
- Missed or incomplete file information.

3.4 Study instrument:

The study included a set of questions that capture the prevalence of CRBSI among HD patients. The medical records of ESRD patients were reviewed and data were extracted from these records. The data were organized into two sections; first section contains demographic data (file number, age, gender), the etiology of ESRD and duration hemodialysis recorded. Second section included comorbid conditions and risk factors such as diabetes mellitus (DM), CVDs, virology report, and hypertension.

3.5 Validity

data sheet form that was formulated according to research questions.

A panel of experts consisted of two Nephrology consultants at An-Najah National University hospital, and four head nurse of dialysis department in north west bank hospitals, they revised the component of data sheet, file number, age, gender, comorbid conditions such as DM and HTN, risk factors such as type of CVL and duration hemodialysis, blood culture result to answer the research question.

The expert panel verified the instrument's clarity of wording, consistency of quality and style, feasibility, and cultural suitability.

3.6 Ethical consideration

Approval taken from the Palestinian health research council. After, approval obtained from respected hospitals to conduct the study. Moreover, to ensure anonymity, the

patients names was not be entered on the data sheet but will Identification the patient by medical record number. The file review will be reviewed only by the researcher.

3.7 Data Analysis

Data analyzed using the SPSS Statistics version 26.0. Means, Frequency, Standard deviation used for descriptive analysis, and chi square used for relationship between variables and answer the questions.

Chapter four

Results

The study included 112 patients over one year. The mean age was 54.9 years (SD = 14.8). The study included 65 females (58%). From 65 female the result show that 24 from them were infected. The study included 47 males (42%). From 47 male the result show that 20 from them were infected. Table 1 clarify this information.

Table 1: *Demographic data*

Variable	**Non-Infected**	**Infected**
Female	65 (58%)	24 (37.9%)
Male	47 (42%)	20 (42.5 %)

Regarding the location of catheter information, the type of CVL, 75% was TDC and 25% were NTDC. The majority of patients had Internal Jugular Vein (58%), the lowest was external jugular vein other locations listed in table (2) below.

Table 2: *Catheter information location*

Variable	**n**	**Percent**
Type of CVL		
TDC	84	75%
NTDC	28	25%
Location		
Internal Jugular Vein	65	58.0
Femoral Vein	23	20.5
Subclavian Vein	23	20.5
External Jugular Vein	1	1
Total		100%

The Research questions answered as below:

Research Q 1- What is the prevalence of infection induced by central venous catheter in patients undergoing hemodialysis?

The prevalence of CRBSI among included sample was 39.2%, whereas 60.7% had no CRBSI. (See table 3 below for more information)

Research Q 2 - What is the type and antimicrobial susceptibility profiles of the primary microorganisms?

The primary microorganism is Staphylococcus epidermidis 13(11.6%) from 44 patients and the lowest percent of microorganism was Coagulase-negative staphylococci. (See table 3 for more information)

Table 3: Blood culture results and the types of microorganism

Variable	N	Percent
Staphylococcus epidermidis	13	11.6
Staphylococcus aureus	9	8.0
enterobacter cloacae	3	2.7
staphylococcus SCIURI	2	1.8
ESBL	2	1.8
MRSA	2	1.8
Gram positive cocci	1	.9
micrococcus luteus	1	.9
Klebsiella	1	.9
staphylococcus Haemolyticus	1	.9
Staphylococcus saprophyticus	1	.9
Acinetobacter baumannii	1	.9
Gram negative bacilli	1	.9
Pseudomonas aeruginosa	1	.9
Escherichia coli	1	.9
extended spectrum beta-lactamase	1	.9
CANDIDA	1	.9
ACINETOBACTER	1	.9
Coagulase-negative staphylococci	1	.9
Free	68	60.7

Research Q 3- What is the risk factor associated with central venous catheter-related infection in patients undergoing hemodialysis?

The most common risk factor for CRBSI due to location is Internal Jugular Vein 58%.

About the duration of catheterization if it less than 14 days so the risk of infection increased up to 64.3%.

About the Duration of dialysis, the risk of infection is equal to 50% if the duration of analysis is more than or less than 3 months. (See table 4 below for more information)

Table 4: *Risk factor for CRBSI*

Variable	n	Percent
Location		
Internal Jugular Vein	65	58.0
Femoral Vein	23	20.5
Subclavian Vein	23	20.5
External Jugular Vein	1	1
Duration of catheterization (Days)		
<14	72	64.3
>=14	40	35.7
Duration of dialysis (months)		
<3	56	50
>3	56	50

Research Q 4- Is there an association between presence of other comorbidities such as diabetes and prevalence of infection?

The study revealed no relationship between comorbidities and prevalence of infection, DM ($\chi^2 = 4.460$, $p = .347$). (See table 5 below for more information)

Table 5: *Comorbidities*

Variable (Yes)	n	Percent	Chi- square
DM	83	74.1	4.460
HTN	69	61.6	2.615
IHD	31	27.7	7.723
Anemia	6	5.4	4.610
Polycystic kidney disease	1	.9	2.440
SLE	5	4.5	1.773
Hepatitis C	2	1.8	3.070
Hepatitis B	1	.9	2.440
CONGINETAL	2	1.8	2.440
CHRONIC_UTI	2	1.8	21.488
Spinal Pefda	1	.9	3.070
Neurogenic bladder	1	.9	3.070
Osteoporosis	1	.9	7.981
Hyper lipidemia	2	1.8	7.981
CHF	2	2.7	3.070

Research Q 5- Is there an association between factors such as diet, obesity and smoking with prevalence of infection?

The study showed no relationship between any factor such as smoking ($\chi^2 = 4.287$, $p = .369$). According to obesity and diet no information available in the files because most of patient long stay in HD units

Research Q 6- Is there an association between various socio-demographic factors and prevalence of infection?

The study revealed no relationship between demographic data and prevalence of infection ($\chi^2 = 4.332$, $P = .363$). (See table 6 below for more information)

Table 6: *Demographic data and CRBSI*

Gender	Value	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.332[a]	.363

Chapter five

5.1 Discussion

The use of CVCs to start hemodialysis saved the lives of individuals who needed renal replacement therapy without a doubt. CRBSI, on the other hand, is a significant obstacle to the use of these catheters. In patients undergoing hemodialysis, CRBSI is the second greatest cause of death. The purpose of this study was to determine the prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine. The research is quantitative study, Retrospective. The study population is all patients who doing hemodialysis in North west bank via central venous catheter (CVC) who developed central related blood stream infection (CRBSI) in 2019.

The study included 112 patients; The mean age was 54.9 years (SD = 14.8). The study included 65 females (58%). The result showed that the prevalence of CRBSI among included sample was 39.2%, this result is related to number of patients who met the inclusion criteria. A study done by Alirezaei et al., (2019) the result show that there were 27 males among the 50 hemodialysis patients in the research 54%. The average age of the participants was 49.7%. The prevalence is 64 % of patients, a positive blood culture was found.

Moreover, according to my research the associated risk factors, there was only a relationship between previous history of CRBSI ($c^2 = 23.215$, $p = .000$) with CRBSI. This result may relate to body resistant on microorganism in previous infection. On other hand, this study is inconsistent with (Sahli et al., 2017) who concluded that the most risk factor is longer duration of CVC use(P= 0.01). Another study shows that, CRBSI was found to be present in 3.7 percent of the population. Catheterization of the femoral vein

and a long catheter indwelling period were linked to central venous CRBSI for continuous renal replacement therapy (Cheng et al., 2019).

Furthermore, the primary microorganisms result is Staphylococcus epidermidis 13(11.6%) from 44 patients. This microorganism is found in normal flora as normal bacteria in body but when reach the blood become active so this may be blood drowning technique problem or staff. This result is consistent with Katneni & Hedayati, (2007)who mentioned that Staphylococcus epidermidis and Staphylococcus aureus 73% from 114 patients. Conversely, the result is inconsistent with (Alirezaei et al., 2019) in which Coagulase-negative staphylococci 64% from 50 patients .

Moreover, the result showed that the most comorbidities and other factors were DM 72.7% then HTN 70.1%, while smoking 4.5% no significant with CRBSI from 44 patients who had CRBSI. This is related to most patients who undergone hemodialysis had diabetes and hypertension, whether they had infection or not. This result is consistent with Zhang et al., (2019) who mentioned in his study that DM 66.2% from 65 patients who had CRBSI. Conversely, the result is inconsistent with Yap et al., (2018)who illustrated that the most common comorbidities is HTN 84% from 677 patients who using CVL . Also (Locham et al., 2021) mention that the most comorbidities is obesity 41% then congestive heart failure 37% .

Moreover, the result show that the duration of dialysis is more than 3 months is 52.3% from infected patient who had CRBSI, this this is indication for high infection rate due to prolonged use. This is result is consistent with Zhang et al., (2019) who mentioned is his study that Patients with CRBSI had a longer duration of hemodialysis (15.5 ± 9.7 months) further more Yap et al., (2018) show in his result that the average number of catheter days between the first bloodstream infection event and the first

catheter was (182.47 144.04) days . Longer catheter stays have been linked to an increased risk of bloodstream infection.

ICU admission 11.6% and septic shock 11.6% is the most common CRBSI outcome this is due to weak immunity and how CRBSI affects patients who have been infected, which is also an indication how seriousness of CRBSI. This result is inconsistent with (El- et al., 2021) who mentioned in her result that CRBSI caused complications in 60 (43.2%) of the 139 patients. endocarditis 11.5%. In addition, 10.1% of the patients required ICU admission, and 5.8% developed septic shock.

5.1 Recommendation

Based on the findings from this study several recommendations are suggested. Some recommendations are for policy maker and key person in MOH. They are suggested to standardized care in all hemodialysis units by disseminating the guidelines to all clinics in order to improve the quality of care and reduce inappropriate variations in clinical practice, so we ensure favorable health outcomes.

Implication for Nursing Practice

According to the result finding, the study has an impact on nursing practice they can minimize the prevalence of infection by: modify staff to patient ratio, Staff education, experienced nursing staff, be more awareness about hand hygiene and dressing policy compliance.

Implication for Nursing Research

Health outcomes research can help nurses find potentially viable techniques for improving patient care and quality of life. To decrease percentage of CRIBSI among HD patients, the finding of research encourages others to do applied research on the topic.

Implication for Nursing Education

Formal education served as a guide for new registered dialysis nurses, and multimodal teaching approaches were required to be used on an ongoing basis. To reinforce best practice for experienced registered dialysis nurses and facilitate learning for novice registered dialysis nurses, a dependable strategy incorporating several methodologies should be used. More effort should be made to improve the knowledge of registered dialysis nurses, and the success of converting evidence-based knowledge to practice must be objectively assessed.

5.2 The Study Strengths and Limitations

The current study has some strength, which include the following. This is the first study aimed to determine the prevalence of Catheter-related bloodstream infection (CRBSI) and associated risk factors among dialysis patients in Palestine.

There are limitations that need to be considered:

1- The setting of the study was in the north of West Bank and selected purposively (accessible). For that, the findings cannot be generalized for another setting because they did not include other Palestinian areas
2- The study was conducted retrospectively for one year only
3- There was missing data on the file example, obesity, smoking

5.4 Conclusion

Central related blood stream infection (CRBSI) is one of the most common, fetal, and costly complications of central venous catheterization. CVCs are commonly associated with hospital-acquired bloodstream infections and result in both prolonged ICU stay and increased mortality.

Implementation of continuous quality improvement programs, education and training of healthcare workers, and adherence to standardized protocols for insertion and care of intravascular catheters. The study results could serve as a reference point for policy and decision makers and healthcare stakeholders to develop tailored strategies to improve patients' outcomes.

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Appendices

Appendix 1: Data sheet collection

Age	Gender (Male / Female)	Location (Internal Jugular Vein / Femoral Vein /Other (Subclavian Vein, External Jugular Vein))	Type of CVL (TDC / NTDC)	Duration Of indwelling catheter placement (<14 / ≥14)	Duration of dialysis (<3 months/ >3 months)	Comorbidities	Previous history of CRBSI (Yes / No)	Outcomes for CRBSI (ICU admission / Mortality / Catheter salvage / Metastatic infection/ Recurrent CRBSI /Septic shock)	Blood culture result

Appendix 2: IRP PPROVAL

المجلس الفلسطيني للبحث الصحي
Palestinian Health Research Council
تعزيز النظام الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار
Developing the Palestinian health system through institutionalizing the use of information in decision making

Helsinki Committee
For Ethical Approval

Date: 2021/10/11 **Number:** PHRC/HC/980/21

Name: Ahmad Mohammad Antari الاسم:

We would like to inform you that the committee had discussed the proposal of your study about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:

Prevalence of Sepsis induced by central venous catheters and associated risk factors among dialysis patients in Palestine.

The committee has decided to approve the above mentioned research. Approval number PHRC/HC/980/21 in its meeting on 2021/10/11

و قد قررت الموافقة على البحث المذكور عاليه بالرقم والتاريخ المذكوران عاليه

Signature

Member Member

Chairman

Genral Conditions:-

1. Valid for 2 years from the date of approval.
2. It is necessary to notify the committee of any change in the approved study protocol.
3. The committee appreciates receiving a copy of your final research when completed.

Specific Conditions:-

E-Mail:pal.phrc@gmail.com

Gaza - Palestine غزة - فلسطين
شارع النصر - مفترق العيون

Appendix 3:

Arab American University
Faculty of Graduate Studies

الجامعـــة العربيـــة الأمريكيـــة
كلية الدراسات العليا

2021-7-18

الى من يهمه الامر،

تسهيل مهمة بحثية

تحية طيبة وبعد،

تهديكم كلية الدراسات العليا في الجامعة العربية الامريكية اطيب التحيات، وبالإشارة الى الموضوع أعلاه، تشهد كلية الدراسات العليا في الجامعة أن الطالب احمد محمد محمود عنتري والذي يحمل الرقم الجامعي 201912841 هو طالب ماجستير في الجامعة العربية الامريكية تخصص تمريض طوارئ ويعمل على دراسة علمية حول:

" نسبه انتشار تسمم الدم الناجم عن القسطرة الوريدية المركزية وعوامل الخطر المرتبطة بها بين مرضى غسيل الكلى في فلسطين"

نأمل من حضرتكم الايعاز لمن يلزم لمساعدته للحصول على المعلومات اللازمة للدراسة، علماً ان المعلومات ستستخدم لغاية البحث فقط وسيتم التعامل معها بغاية السرية، وقد أعطي هذه الرسالة بناءعلى طلبه.

وتفضلوا بقبول فائق الاحترام

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انتشار عدوى مجرى الدم المرتبطة بالقسطرة وعوامل الخطر المرتبطة بها بين مرضى غسيل الكلى في فلسطين

اعداد

أحمد محمد عنتري

اشراف

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د. عبير حسين

الملخص

الخلفية: المرضى الذين يخضعون لغسيل الكلى معرضون لخطر الموت بسبب مشاكل القلب والأوعية الدموية وتسمم الدم.

تسمم الدم المرتبط بالوفاة هو السبب الرئيسي الثاني للوفاة بين مرضى غسيل الكلى، ويصبح أكثر شيوعا في الممارسات الطبية في السنوات الأخيرة. كان تسمم الدم مسؤولاً عن 28٪ من جميع الوفيات بين مرضى غسيل الكلى في عام 2016.

الهدف: كان الغرض من هذه الدراسة هو تحديد انتشار عدوى مجرى الدم المرتبطة بالقسطرة وعوامل الخطر المرتبطة بها. بين مرضى غسيل الكلى في فلسطين.

المنهجية: كان البحث دراسة كمية، بأثر رجعي. كان جميع المرضى الذين خضعوا لغسيل الكلى في شمال الضفة الغربية الذين أصيبوا بعدوى مجرى الدم المركزية ذات الصلة عبر القسطرة الوريدية المركزية في عام 2019.

النتيجة: أظهرت النتيجة أن متوسط العمر كان 54.9 سنة، والإناث أكثر من الذكور. أظهرت النتيجة أن انتشار عدوى مجرى الدم المرتبطة بالقسطرة بين العينة المضمنة كان 39.2%، وفقاً لعوامل الخطر، فإن التاريخ السابق لـ عدوى مجرى الدم المرتبطة بالقسطرة مهم مع عدوى مجرى الدم المرتبطة بالقسطرة، أكثر الأمراض المصاحبة شيوعا هي السكري ثم ارتفاع ضغط الدم, المكورات العنقودية هي الكائنات الدقيقة الأولية المسببة لعدوى مجرى الدم المرتبطة بالقسطرة و تقتصر نتائج عدوى مجرى الدم المرتبطة بالقسطرة على دخول وحدة العناية المكثفة .

الاستنتاج: عدوى مجرى الدم المركزية ذات الصلة هي واحدة من أكثر أسباب الوفاة والمضاعفات المكلفة للقسطرة الوريدية المركزية ترتبط عادة بعدوى مجرى الدم المكتسبة من المستشفيات وتؤدي إلى الـبقاء في وحدة العناية المركزة لفترات طويلة وزيادة الوفيات. يمكن أن تكون نتائج الدراسة بمثابة نقطة مرجعية لصانعي السياسات والقرارات وأصحاب المصلحة في الرعاية الصحية لتطوير استراتيجيات مصممة خصيصا لتحسين نتائج المرضى.