OUTCOMES OF TEMPORARY VASCULAR ACCESS AND FACTORS INFLUENCING DELAYED ARTERIOVENOUS FISTULA CREATION AMONG INTERMITTENT HEMODIALYSIS PATIENTS: A STUDY IN HOSPITAL UNIVERSITI SAINS MALAYSIA, KELANTAN

DR ABDUL HANAN BIN ABDULLAH @ MOHD BAHARUDIN

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE MASTER OF MEDICINE (INTERNAL MEDICINE)



UNIVERSITI SAINS MALAYSIA

2023

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MAIN SUPERVISOR

DR ALWI BIN MUHD BESARI @ HASHIM

CO-SUPERVISOR DR MUHAMMAD IMRAN BIN KAMARUDIN DR NURUL HUDA BINTI ABDULLAH

ACKNOWLEDGEMENT

All praises to Allah S.W.T the Most Merciful and the Most Beneficent.

First, I would like to express my thankfulness to Allah S.W.T. for his blessing and for giving me the strength and ability to complete this research project.

I wish to take this opportunity to express my gratitude and appreciation to my supervisor Dr Alwi Bin Muhd Besari, and my co-supervisor, Dr Muhammad Imran Bin Kamarudin, Dr Nurul Huda Binti Abdullah and Dr Azriani Ab Rahman (statistician), for their supervision, guidance, and helpful suggestion.

Special appreciation goes to my beloved wife, Dr Nur Ilyia Syazwani Saidin, for standing by my side when times get hard, making me smile and laugh, and being my best supporter ever.

Thanks to my sunshine, everything becomes better when I get warm hugs from my lovely kids, Umar, Iman, Thaqif, Yusuf & Hamzah.

Finally, I would like to express my appreciation to all my family members for their prayers, encouragement, and endless support.

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LIST OF ABBREVIATIONS

RRT	Renal Replacement Therapy
CLABSI	Central Line Associated Blood Stream Infection
AVF	Arteriovenous Fistula
AVG	Arteriovenous Graft
CKD	Chronic Kidney Disease
ESRD	End Stage Renal Disease
CVC	Central Venous Catheter
PD	Peritoneal Dialysis
CRBSI	Catheter-Related Blood Stream Infection
BMI	Body Mass Index
NTHC	Non-tunnelled haemodialysis catheter
KDOQI	Kidney Disease Outcomes Quality Initiative

ABSTRAK

Pengenalan: Hemodialisis merupakan modaliti utama bagi rawatan penggantian fungsi buah pinggang di Malaysia. Walau bagaimanapun, kebanyakan pesakit memulakan hemodialisis melalui kateter vena pusat sebagai akses vaskular utama mereka sebelum menjalani pembedahan arteri-vena fistula (AVF) ataupun graft (AVG).

Objektif: Kajian ini bertujuan untuk mengenal pasti jenis akses vaskular di kalangan pesakit "hemodialisis perantara" dan untuk menentukan kadar jumlah komplikasi yang berkaitan akses vaskular. Kami juga berhasrat untuk mengkaji faktor yang menyumbang kepada kelewatan pembedahan AVF di institusi kami.

Kaedah: Ini adalah analisis retrospektif bagi pesakit buang pinggang kronik tahap 5 yang telah menjalankan hemodialisis di antara 1 Januari 2021 hingga 31 Disember 2021. Data pesakit telah diperoleh daripada unit rekod perubatan Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan. Demografi data, serta data berkaitan ko-morbiditi, komplikasi kateter, kematian dan faktor kelewatan pemasangan AVF telah dianalisis menggunakan SPSS versi 27. Perkaitan antara jenis kateter dengan komplikasi telah dianalisis dengan ujian chi-square. Nilai P yang kurang daripada 0.05 dianggap signifikan secara statistik.

Keputusan: Sebanyak 74 pesakit dengan "hemodialisis perantara" telah dikenalpasti. Daripada jumlah ini, lelaki adalah 52.7% dan perempuan adalah 47.3%. Kebanyakan pesakit adalah daripada etnik Melayu dengan purata umur 55 tahun. Kebanyakan mereka mempunyai komorbiditi hipertensi iaitu 95.9%, diabetes 79.7% dan penyakit jantung 23%. Kebanyakan mereka memulakan hemodialisis menggunakan kateter femoral sementara, iaitu sebanyak 93.2% dan kemudiannya, mereka menukar kepada kateter jugular dalaman sementara iaitu sebanyak 71.6%. Komplikasi tertinggi yang dilihat ialah jangkitan kuman di dalam saluran darah berkaitan penggunaan saluran darah pusat (CLABSI) yang terdapat pada 23 (17.6%) orang pesakit, diikuti oleh hematoma pada 11 (8.5%) orang pesakit. Kami mendapati tiada perkaitan yang signifikan antara jenis kateter hemodialisis yang digunakan dengan komplikasinya. Berkenaan dengan kelewatan dalam pemasangan AVF, majoriti pesakit menyebut ketakutan dialisis sebagai kebimbangan utama mereka, seramai 36.2%, diikuti oleh saluran vena yang kecil, iaitu seramai 34%. Sejumlah 18 orang pesakit telah meninggal dunia dalam tempoh kajian ini. Penyebab utama kematian mereka adalah disebabkan oleh jangkitan kuman di dalam saluran darah yang berkaitan dengan saluran pusat (5 orang pesakit) dan sepsis yang tidak berkaitan dengan kateter (5 orang pesakit).

Kesimpulan: Kesimpulannya, penggunaan kateter vena pusat bagi tujuan hemodialisis perantara meyumbang risiko untuk komplikasi terutamanya jangkitan, pendarahan, dan juga risiko kematian. Pembedahan awal arteri-vena fistula terhadap pesakit penyakit buah pinggang kronik adalah penting bagi meningkatkan mutu kualiti kehidupan pesakit.

ABSTRACT

Introduction: Haemodialysis is the main modality of Renal Replacement Therapy (RRT) in Malaysia. However, most of the patients are initiated with intermittent haemodialysis via a central venous catheter as their main vascular access before placement of arteriovenous fistula (AVF) or graft (AVG).

Objectives: This study aimed to identify types of vascular access among intermittent haemodialysis patients, and to determine the proportion of vascular access-related complications. We also aimed to study the factor that contributed to the delay of AVF creation at our institution.

Methods: This is a single-centre retrospective, cross-sectional analysis of CKD stage 5 patients who were initiated on intermittent haemodialysis between 1 January 2021 and 31 December 2021. Data were collected from the medical record unit of Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan. Demographic data, comorbidities, catheter-related complications, associated mortality, and factors of delayed AVF creation were analyzed using SPSS version 27. The association between types of a catheter with complication were analyzed by chi-square test. A P-value of less than 0.05 was considered statistically significant.

Results: A total of 74 patients with intermittent haemodialysis were identified. Of these, males were 52.7 % and females were 47.3 %. Most patients were of Malay ethnicity with a mean age of 55 years old. Most of them have comorbidities of hypertension 95.9%, diabetes 79.7 % and ischemic heart diseases 23%. Most of them initiate haemodialysis with an

uncuffed femoral catheter, 93.2% and later, they change to the uncuffed internal jugular catheter 71.6%. The highest complication seen was central line-associated bloodstream infections (CLABSI) which were in 17.6% of patients, followed by hematoma in 8.5% of patients. We found no significant association between the types of haemodialysis catheters used with their complications. With regards to the delay in AVF creation, the majority of patients (36.2%) mention dialysis fear as their main concern, followed by small venous access, 34%. A total of 18 patients died during this study period. The major causes of death are due to CLABSI (5 patients) and sepsis-not related to catheter insertion (5 patients).

Conclusion: In conclusion, the use of a haemodialysis central venous catheter among intermittent haemodialysis patients carries a significant risk for catheter-related complications, particularly infections and bleeding, with a risk of mortality. Early creation of arteriovenous fistula in pre-dialysis patients is vital in improving the outcomes of the patients.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Chronic Kidney Disease (CKD) is a debilitating illness which may progress into End Stage Renal Disease (ESRD). ESRD is defined by a glomerular filtration rate of less than 15 mL/min/1.73m² or the need for dialysis or renal transplantation (1) Patients with ESRD required Renal Replacement Therapy (RRT) via dialysis or renal transplant to survive. In our setting, we always encountered ESRD patients who were not prepared for RRT due to a variety of reasons. Consequently, they may be hospitalized due to symptomatic renal failure.

Patients with ESRD often present with a spectrum of symptoms which includes increasing anorexia, lethargy, symptomatic fluid overload, skin itchiness and rashes, and neurological or cardiac symptoms. Untreated ESRD may lead to significantly reduced quality of life and even death (2). An urgent hemodialysis is required to treat patients with symptomatic renal failure, and for those without vascular access, central venous catheters (CVC) will be used to initiate haemodialysis.

Intermittent haemodialysis is defined by patients who received haemodialysis through a temporary haemodialysis catheter while waiting for definite vascular access creation and maturation. The definitive vascular access is via arterio-venous fistula (AVF) or arterio-venous graft (AVG). For AVF to be ready for cannulation, it took at least 6 weeks from the day of surgery. Within that period, the patient must proceed with haemodialysis using a temporary catheter. However, the insertion of this haemodialysis catheter may contribute to infectious and mechanical complications, as well as an increase in the number of hospital admissions (3).

This study aims to estimate the outcomes of vascular access among patients who received intermittent haemodialysis at Hospital Universiti Sains Malaysia, Kelantan. The study's findings may be used by clinicians to emphasize the importance of pre-RRT counselling, vascular access preparation, and earlier haemodialysis to the patients. In managing ESRD, it is crucial for healthcare to provide comprehensive and updated information regarding haemodialysis. Data from this study may also benefit other hospitals and physicians.

1.2 Literature review

Almost three million people worldwide have been diagnosed with ESRD. Most of those who cannot undergo renal transplantation are treated with haemodialysis, while less than 10% are on peritoneal dialysis (PD) (4). In Malaysia, the number of new dialysis patients continues to increase over the last 10 years from 4,606 in 2008 to 8,431 in 2018, while the total prevalent RRT patients for 2018 were 45,937. In Kelantan, the total number of new dialysis patients in 2018 was 207 (5).

There are three types of vascular access available for haemodialysis, which are arteriovenous fistulas (AVF), arteriovenous grafts (AVG), and central venous catheters (CVC). Each access type has advantages and disadvantages (6). According to KDOQI guidelines, they consider it reasonable to have Arterio-venous access by fistulas (AVF) or graft (AVG) in a patient requiring haemodialysis (7).

KDOQI also considers it reasonable in valid clinical circumstances to use tunnelled CVCs for short-term or long-term durations for incident patients. Short term indication includes; AVF or AVG created but not ready for use and dialysis is required, acute transplant rejection or other complications requiring dialysis, peritoneal dialysis patient with complications that require peritoneal rest or the resolution of complication, a patient who has a living donor

transplant confirmed with an operation date in the near future but requires dialysis, AVF or AVG complications that result in temporary non-use until the problem is resolved (7).

The long-term indication of the catheter includes multiple prior failed AV accesses with no available options and the absence of AV access creation options due to a combination of inflow artery and outflow vein problems (7). In our setting, temporary central venous catheters for haemodialysis were used in intermittent haemodialysis patients before the AVF creation. In the United States, the proportion of CVC for haemodialysis has been reported at 25% (8) The obvious popularity of CVC is due to its relative ease of insertion and the ability to initiate dialysis immediately.

Dialysis-tunnelled catheters can either be cuffed or uncuffed. Catheters with cuffs are often made of silicone or polyurethane. The catheter is soft because silicone is thermoset, whereas polyurethane is thermoplastic and softens at body temperature. This lessens thrombogenicity and endothelial damage. It is believed that the creation of a subcutaneous tunnel and the incorporation of the cuff into the surrounding tissue act as physical barriers to infection. To decrease low flow and recirculation, cuffed tunnelled also has larger lumens and separate inlet and output lumens.

There are multifactorial factors that contribute to delays in AVF creation. According to Al Farhan et al., the most important patient factors associated with delay in AVF creation were denial of kidney disease or the need for AVF, dialysis fears and practical concerns as well as patient refusal. They also found that insufficient conduction of pre-dialysis education and late referral to a nephrologist was among the contributing factor for delay AVF creation (9).

Vascular access for haemodialysis is not without complications. Several studies have been done and proved its related complication. Arteriovenous access (AVF or AVG) is preferred to a CVC in most haemodialysis patients due to the lower infection risk (7). A retrospective study conducted in Italy on 100 patients between 2010 and 2015 found patients were more likely to die while undergoing dialysis by means of a CVC than AVF (10). Patients with CVC bore a higher risk of infections. However, they also observed an increased occurrence of failure of access among AVF compared to the permanent catheters (10).

A study in Egypt among 119 hemodialysis patients on all types of vascular access found stenosis and infection are the most common complications of vascular access. Their study revealed 68 (57%) patients have stenosis, 64 (53.7%) patients have positive swab culture, 44 (36.9%) patients have aneurysmal dilatation, 27 (22%) patients have positive blood culture and 25 patients (21%) have athermanous plaques. The infection was significantly high in male patients, with low Body Mass Index (BMI), increased blood urea and increased duration of haemodialysis sessions. Stenosis was the most common risk factor for vascular failure as it occurred in (29%) of patients. Diabetes was the second most common risk factor for vascular failure as it occurred in (17%) of patients(11).

The AVF is the preferred method for haemodialysis. It has a low risk of infection, a less frequent rate of thrombosis, and stenosis and can ensure long-term access as compared to AVG and CVC (12). However, the maturation of AVF is a complex process. Maturation mostly occurs 4 to 6 weeks after the initial fistula creation, however, it can vary with the average time ranging from 1 to 4 months. Thus, the maturation of AVF can be a relatively unpredictable process(13).

Adequate AVF maturation is based on the National Kidney Foundation's Kidney Dialysis Outcomes Quantitative Initiative (KDOQI) guidelines which define a viable fistula as one that resides approximately 0.6 cm from the skin surface, has a flow >600 mL/min, and has a diameter >0.6 cm. AVFs that do not mature adequately within that time frame may be abandoned altogether and classified as an early or primary failure (14).

Significant numbers of AVF fail to develop sufficiently before their use for haemodialysis. These were due to either lack of vessel maturation or spontaneous thrombosis. Lack of vessel maturation is due to endothelial dysfunction. Impairment of endothelial function results in decreased arterial remodeling and maintenance of lumen patency. Early fistula failure is usually due to thrombosis which can be triggered by hematomas, low flow rates resulting from low blood pressure, or a hypercoagulable state (15).

1.3 Dissertation Organization

This dissertation was arranged according to Format B (Manuscript ready format) according to the guideline of the Postgraduate Office, School of Medical Sciences (2019). The second chapter is about the study objective. Chapter three is the study protocol submitted and obtained ethical approval from JEPeM, USM (JEPeM Code: USM/JEPeM/22120774) Chapter four is the manuscript that is ready for submission to the Malaysian Journal of Medical Sciences (MJMS). The manuscript title is "A Study of Vascular Access Among Intermittent Haemodialysis Patients in Hospital Universiti Sains Malaysia Kelantan". The last chapter is the appendices containing the JEPeM approval letter, participant results sheath form, the additional reference, and guidelines to the author. The raw data was included in the attached CD.

CHAPTER 2

STUDY OBJECTIVES

Research question:

- 1. What are the implications of catheter use among intermittent haemodialysis patients?
- 2. How efficient is the current system in accommodating AVF creation among intermittent HD patients?

2.1 General Objective

To assess overall outcomes of CKD Stage 5D patients on intermittent haemodialysis at Hospital Universiti Sains Malaysia over the 1-year duration from January 2021 to December 2021.

2.2 Specific Objectives

- To study the type of vascular access among intermittent haemodialysis patients at Hospital Universiti Sains Malaysia.
- 2. To determine the proportion of vascular access-related complications among patients on intermittent haemodialysis at Hospital Universiti Sains Malaysia.
- 3. To study the factors that contributed to the delayed AVF creation.

CHAPTER 3

STUDY PROTOCOL

3.1 METHODOLOGY

Study Design

This is a **retrospective, cross-sectional study** that is using data obtained from the Medical Record Unit at Hospital Universiti Sains Malaysia from 1 January 2021 to 31 December 2021 with an additional follow-up of 12 weeks.

Study Period

The study period is 12 months in duration.

Study location

- Haemodialysis Unit Hospital USM.
- Medical wards Hospital USM (7 Selatan, 7 Utara, 1 Selatan, 2 Utara).

Study population

Reference population	All patients CKD Stage 5D.						
Source population	On intermittent dialysis programmed in Hospital USM						
	within the study period.						
Sampling subjects	All CKD Stage 5D patients on intermittent HD received						
	treatment in Hospital USM from January 2021 to						
	December 2021 which fulfilled the study criteria.						

Inclusion and Exclusion Criteria

Inclusion criteria

- Age \geq 18 years old.
- Newly diagnosed CKD stage 5D and dialysis-dependent for more than 4 weeks
- Undergo intermittent haemodialysis via central venous catheter from 1 January 2021 until 31 December 2021.
- Opted for haemodialysis as long-term RRT.

Exclusion criteria

- Patient on temporary dialysis due to acute kidney injury for less than 4 weeks.
- Patient on permanent haemodialysis catheter who is already on long-term haemodialysis.
- Patient on haemodialysis catheter due to conservative/palliative treatment for RRT.

Sample size calculation

• In objective 1, we want to study the type of vascular access among intermittent haemodialysis patients at Hospital USM. These different types of vascular access include uncuff Internal jugular vein catheter (IJV), cuffed Internal jugular vein catheter, temporary femoral catheter, and cuffed femoral Catheter. All these vascular accesses were grouped as Central venous catheters (CVC).

Therefore, for objective 1, the sample size is calculated by using single proportion formula, with 95% confidence, 5% error, Z: 1.96, and P is estimated from the previous reference (16). Xue et al found in their study, the use of CVC after the 90-day initiation of hemodialysis is approximately 70%.

The sample size is calculated by using single proportion formula:

- $n = \left(\frac{z}{d}\right)^2 \left[p(1-p)\right].$
- n = number of calculated sample sizes.
- Z = normal deviation that reflects type 1 error: 1.96 (95% CI).
- d = precision or detectable deviation = 0.05 (relative difference) 5% difference in between population findings
- p = the population proportion.
- Hence, $n = \left(\frac{1.96}{0.05}\right)^2 [0.70(1 0.70)]$
- Minimum sample size required: 322
- In objective 2, we want to determine the incidences of vascular access-related complications among patients on intermittent haemodialysis in Hospital USM. the sample size is calculated by using single proportion formula, with 95% confidence, 5% error, Z: 1.96, and P is estimated from the previous reference. The previous study had shown out of 119 patients, 57% had vascular access-related complications (17).

The sample size is calculated by using single proportion formula:

- $n = \left(\frac{z}{d}\right)^2 \left[p(1-p)\right]$
- n = number of calculated sample sizes.
- Z = normal deviation that reflects type 1 error: 1.96 (95% CI).
- d = precision or detectable deviation = 0.05 (relative difference) 5% difference in between population findings
- p = the population proportion.
- Hence, $n = \left(\frac{1.96}{0.05}\right)^2 [0.57(1 0.57)]$
- Minimum sample size required: **376**

• As for objective 3, we want to study the factors that contributed to the delay of AVF creation. No sample size calculation is required. The descriptive statistic will be used to answer the objective.

Study procedure

- From January 2021 to December 2021, patients on intermittent haemodialysis were identified from the Haemodialysis Unit (HDU) or the medical ward at Hospital USM.
- Data were collected from patient case notes and the online laboratory information system (LIS).
- SPSS version 27 will be used to enter and analyze data.

Sampling method

In view of the sample size required being larger than the population size, all patients within the study period were eligible and selected in this study (non-probability sampling method).

3.2 STUDY FLOW CHART



3.3 OPERATIONAL DEFINITIONS

Term		Definition
Chronic Kidney disease	:	Estimated glomerular filtration rate (eGFR) less
(CKD) stage 5 D		than 15 mL/mins/1.73m ² and dialysis-dependent for
		more than 4 weeks (18)
Uncuffed femoral	:	Uncuffed tunnelled catheters which are used for
catheter		haemodialysis which was temporarily inserted into
		the femoral vein and must be removed before
		discharge.
Uncuffed Internal jugular	:	Uncuffed tunnelled catheters which are used for
catheter		haemodialysis which was temporarily inserted into
		the jugular vein and not to be removed before
		discharge.
Cuffed femoral catheter	:	Cuffed tunnelled catheters which are used for
		haemodialysis and permanently inserted into the
		femoral vein and are not to be removed before
		discharge.
Cuffed Internal jugular	:	Cuffed tunnelled catheters which are used for
catheter		haemodialysis and permanently inserted into the
		jugular vein and are not to be removed before
		discharge.
Central line-associated	:	CLABSI is a surveillance definition used by the
bloodstream infections		CDC and defined as the recovery of a pathogen
(CLABSI)		from a blood culture (a single blood culture for an

organism not commonly present on the skin and two or more blood cultures for an organism commonly present on the skin) in a patient who had a central line at the time of infection or within 48 hours before the development of infection. The infection cannot be related to any other infection the patient might have and must not have been present or incubating when the patient was admitted to the facility (19)

Catheter-related:The definite diagnosis of CRBSI requires one of thebloodstream infectionfollowing:

Isolation of the same pathogen from a quantitative blood culture drawn through the central line and from a peripheral vein with the single bacterial colony count at least threefold higher in the sample from the central line as compared to that obtained from a peripheral vein (or) same organism recovered from percutaneous blood culture and from quantitative (>15 colony-forming units) culture of the catheter tip (or) a shorter time to positive culture (>2 hours earlier) in the central line sample than the peripheral sample (differential time to positivity [DTP]) (20)

Thrombosis

(CRBSI)

Venous Thromboembolism following a hemodialysis catheter placement.

13

Central venous stenosis	:	Central venous stenosis following a hemodialysis
		catheter placement.
Hematoma	:	A solid swelling of clotted blood in the tissues
		following a hemodialysis catheter placement.

3.3 STATISTICAL ANALYSIS

Version 27 of SPSS will be used for the data analysis.

Objectives 1, 2 and 3 will be analyzed using descriptive statistical analysis.

3.4 EXPECTED RESULTS

Variable	Proportion (%)
Gender	
Male	
Female	
Race	
Malay	
Chinese	
India	
Others	
Age (Mean)	
Comorbid	
Type 2 DM	
Hypertension	
IHD	
Hyperlipidemia	
GN	
SLE	
Others	

Table 1: Characteristics of the study sample.

Type of	Proportion	Duration catheter used (%)					
Vascular	(%)						
Access for							
Intermittent							
HD							
		\leq 4 weeks	5-12	> 12			
			weeks	weeks			
Uncuffed IJV							
catheter							
Uncuffed							
Femoral catheter							
Cuffed IJV							
Catheter							
Cuffed Femoral							
Catheter							

Table 2: Type of vascular access used for intermittent haemodialysis and itsduration.

		Cathe	eter					
	Californi							
Complications	Uncuffed	Uncuffed	Cuffed	Cuffed	Total			
	IJV	Femoral	IJV	Femoral	Proportion			
	catheter	catheter	Catheter	Catheter	n (%)			
Central line-								
associated								
bloodstream								
infection								
(CLABSI)								
Hematoma								
Vascular								
Abscess								
Deep vein								
thrombosis								
(DVT)								
Central vein								
stenosis								

Table 3: Proportion of vascular access-related complication among intermittenthaemodialysis patients.

Table 4: Factors that contribute to delayed AVF creation.

Factors contributing to delayed AVF creation	Numbers (%)
Denial of kidney diseases or need for AVF	
Dialysis fear or practical concern	
Patient refusal	
Delay Surgical clinic appointment	
Delay Operation date	

3.5 RISKS AND BENEFIT TO STUDY PARTICIPANTS.

As this is a retrospective observational study, there is little risk. While there is no direct benefit to the patient from this study, doctors treating patients with end-stage renal failure at hospitals around the country and in USM may benefit from it.

3.6 INFORMED CONSENT

For data collection

The study made use of data and details that were already present in the Hospital USM case note. The head of the hospital was informed and given permission to utilize the data with general consent. As the patient of choice will be identified by a registration number, the confidentiality of the data and information collected will be preserved. Data access is restricted to members of the research team. Data will be provided in groups rather than identifying individual respondents.

3.7 ETHICAL CONSIDERATION

- This study will be conducted in accordance with the principles laid by the 18th World Medical Assembly (Helsinki, 1964), and all subsequent amendments. The patients' personal identification and clinical data are confidential and will be reported as collective information and not on a personal basis.
- All data and findings will be kept confidential unless it is required by law.
- Approval from the USM Ethics Committee will be obtained prior to the commencement of the study.
- No conflict of interest will be involved in this study and no payment will be given or received from any company or organization.

3.8 GANTT CHART

Research activities	Month 2022				Month 2023			
	9	10	11	12	1	2	3	4
Literature review								
Study design, planning and ethic approval								
Patient screening and selection								
Data collection								
Data analysis/interpr etation								
Report writing								
Presentation and submission of report								
Project completed								
Submission of research papers								

3.9 ETHICAL REVIEW BOARD APPROVAL

This study protocol has been reviewed and approved by Jawatankuasa Etika Penyelidikan

Manusia Universiti Sains Malaysia.

3.10 PATIENT/PARTICIPANT INFORMATION SHEET AND CONSENT FORM

ASSESSMENT

Not Applicable in this study.

CHAPTER 4

MANUSCRIPT

MALAYSIAN JOURNAL OF MEDICAL SCIENCES (MJMS)

ORIGINAL ARTICLE

A Study of Vascular Access Among Intermittent Haemodialysis Patients in Hospital Universiti Sains Malaysia Kelantan

Abdul Hanan ABDULLAH^{1,2}, Alwi Muhd BESARI^{1,2}, Muhammad Imran KAMARUDDIN^{1,2}, Nurul Huda ABDULLAH^{1, 2}

¹Department of Internal Medicine, School of Medical Science, Health Campus, University Science Malaysia 16150 Kubang Kerian, Kelantan, Malaysia.

²Hospital Universiti Sains Malaysia, 16150, Kubang Kerian, Kelantan, Malaysia.

Main Author: Dr Abdul Hanan Bin Abdullah, abhanan@usm.my

Address for Co-Respondance Author: Dr Alwi Bin Muhd Besari, Department of Internal Medicine, School of Medical Science, Health Campus, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia. Phone Number: +6097676572. Fax Number: +6097673949 Email: <u>dralwi@usm.my</u>

Research Funding: Nil

Declaration of Interest: The Authors declare no conflict of interest upon submission of this article.

Abstract

Introduction: Haemodialysis is the main modality of Renal Replacement Therapy (RRT) in Malaysia. However, most of the patients are initiated with intermittent haemodialysis via a central venous catheter as their main vascular access before placement of arteriovenous fistula (AVF) or arteriovenous graft (AVG).

Objectives: This study aimed to identify types of vascular access among intermittent haemodialysis patients, and to determine the proportion of vascular access-related complications. We also aimed to study the factor that contributed to the delay of AVF creation at our institution.

Methods: This is a single-centre retrospective, cross-sectional study analysis of CKD stage 5 patients who were initiated on intermittent haemodialysis between 1 January 2021 and 31 December 2021. Data were collected from the medical record unit of Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan. Demographic data, comorbidities, catheterrelated complications, associated mortality, and factors of delayed AVF creation were analyzed using SPSS version 27. The association between types of a catheter with complication were analyzed by chi-square test. A P-value of less than 0.05 was considered statistically significant.

Results: A total of 74 patients with intermittent haemodialysis were identified. Of these, males were 52.7 % and females were 47.3 %. Most patients were of Malay ethnicity with a mean age of 55 years old. Most of them have comorbidities of hypertension 95.9%, diabetes 79.7 % and ischemic heart diseases 23%. Most of them initiate haemodialysis with an uncuffed femoral catheter, 93.2% and later, they change to the uncuffed internal jugular

catheter 71.6%. The highest complication seen was central line-associated bloodstream infections (CLABSI) which were in 17.6% of patients, followed by hematoma in 8.5% of patients. We found no significant association between the types of haemodialysis catheters used with their complications. With regards to the delay in AVF creation, the majority of patients (36.2%) mention dialysis fear as their main concern, followed by small venous access, 34%. A total of 18 patients died during this study period. The major causes of death are due to CLABSI (5 patients) and sepsis-not related to catheter insertion (5 patients).

Conclusion: In conclusion, the use of a haemodialysis central venous catheter among intermittent haemodialysis patients carries a significant risk for catheter-related complications, particularly infections and bleeding, with a risk of mortality. Early creation of arteriovenous fistula in pre-dialysis patients is vital in improving the outcomes of the patients.

Keywords: Intermittent haemodialysis, central venous catheter, AVF, catheter-related complications

4.1 Introduction

End-stage renal disease (ESRD) is a permanent chronic kidney disease. In ESRD, the kidney function has declined and can no longer function on its own. For survival, a patient with ESRD must receive renal replacement therapy (RRT) by dialysis or kidney transplantation. The method of dialysis available includes haemodialysis (HD), continuous ambulatory peritoneal dialysis (CAPD), automated peritoneal dialysis (APD) and intermittent peritoneal dialysis (IPD).

In Malaysia, it was reported 51299 ESRD patients received RRT in the year 2020. Of these, haemodialysis is the most popular therapy (86%), followed by peritoneal dialysis (10%). It was reported that only 4% of patients lived with a functioning kidney transplant at the end of 2020. The number of new renal transplant patients was not increased over the last ten years and the total number remained around 1800 patients only (1).

In Malaysia, the dialysis acceptance rates showed an increase over the last ten years. However, the dialysis acceptance rate in Kelantan state is still low as compared to other states (2). In our center, we always encounter ESRD patients who refused dialysis for various reasons. Consequently, they end up requiring emergency haemodialysis via a central venous catheter (CVC).

Intermittent haemodialysis was using CVC as a temporary vascular access while waiting for definite vascular access. It was introduced to prescribe temporary haemodialysis in patients who are initiating dialysis or for those awaiting maturation of permanent vascular access. CVCs are easy to place and provide quick access in urgent situations. The CVC also placed as a last resort when all other vascular access options have been exhausted.

According to National Kidney Foundation, the definitive choice of vascular access is via arterio-venous fistula (AVF) or arterio-venous graft (AVG). The use of AVF or AVG is preferred over CVC in haemodialysis patients due to the lower infection risk (3). Infection is the common indication for CVC removal in haemodialysis patients.

Apart from infection, haemodialysis patients using CVC are also exposed to other short and long-term complications. The short-term complications include pneumothorax, hemothorax, arterial puncture, bleeding, and arrhythmias. The long-term complications include central vein stenosis and catheter malfunction secondary to thrombus formation, catheter kinks or malposition (4).

Delayed AVF creation necessitates more alternate access to haemodialysis. Delays in AVF creation are caused by a variety of factors. The most important is the patient factors. According to Al Farhan et al., contributing factors include denial of kidney disease, denial of the need for AVF, dialysis fears, practical concerns, and patient refusal. In addition, inadequate pre-dialysis education and late referral to a nephrologist also cause delays in AVF creation (5).

This study aims to identify the type of vascular access among intermittent haemodialysis patients in Hospital Universiti Sains Malaysia and to determine the incidences of vascular access-related complications. We also want to study the relationship between different types of catheters used and their complications (infections, central vein stenosis, thrombosis, and bleeding). We also want to explore the factors that contributed to the delayed AVF creation among our populations.