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Overview of the management of arteriovenous shunts as hemodialysis access for chronic kidney disease patients at Ciputra Citra Raya Hospital (2020–2023)

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ABSTRACT

Introduction: The AV shunt is considered the gold standard in establishing vascular access in haemodialysis for individuals with chronic renal disease. This approach is meant to increase the efficiency of dialysis while lowering the risks and difficulties associated with alternative vascular access approaches. Moreover, studies that have conducted research on this topic previously are still very limited. This study aims to investigate the management of arteriovenous shunts as vascular access for hemodialysis in patients with CKD at Ciputra Citra Raya Hospital from 2020 to 2023.

Method: The research design used is descriptive-analytical with a cross-sectional design. The researchers collected secondary data from the medical records of patients at Ciputra Citra Raya Hospital from 2020 to 2023 during the period of July-August 2024. The sampling method employed was total sampling. The analysis was conducted univariately using SPSS ver. 25.

Results: It was found that 93 (100%) subjects were in CKD Stage 5, with the majority of subjects aged between 46-55 years old, as many as 37 (39.8%), male as many as 54 (58.1%), and most education, namely high school/high school as many as 46 (49.5%). The most risk factors in the subjects were HT and DM, as many as 34 (36.6%) had undergone hemodialysis for an average time of 179 months, with the shortest duration of hemodialysis being 23 months and the most extended duration of hemodialysis being 593 months, without the discovery of AV Shunt complications in all subjects of 93 (100%).

Conclusion: Patients with CKD Stage 5 with the most risk factors for HT and DM who have undergone hemodialysis either for a short or long time using an AV shunt as their access have no complications.

Keywords: arteriovenous shunt, chronic kidney disease, hemodialysis.
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INTRODUCTION

The kidneys are crucial organs for filtering blood, eliminating metabolic waste, and maintaining fluid and electrolyte balance in the body. Their responsibilities include regulating blood pressure, generating hormones that encourage red blood cell synthesis, and maintaining calcium balance. Additionally, the kidneys produce urine, which is the end product of the blood filtration process.[1] Moreover, the kidneys serve as an access point for hemodialysis, a process involving diffusion and ultrafiltration to remove specific substances from the blood by utilizing the differences in diffusion rates as blood passes through a semipermeable membrane. The most severe complication of kidney disease is end-stage renal disease (ESRD), which necessitates renal replacement therapy (peritoneal dialysis, haemodialysis, or kidney transplantation). This is linked to a variety of negative outcomes, including increased risks of cardiovascular disease (CVD), death, and infection.[2,3]

Chronic Kidney Disease (CKD) is a gradual and irreversible illness characterised by deterioration in kidney function.[2] CKD is a substantial public health concern.[3] CKD can be caused by a variety of factors and is distinguished by changes in kidney structure or function that last at least three months, resulting in negative health effects. According to the 2025 research, the prevalence and incidence of CKD have increased by 40% in the last three decades as a result of world expansion and population.[3,4] According to a 2024 study, CKD affects more than 10% of the global population. By 2040, the disease is expected to move up to fifth place. Kidney disease affects an estimated 850 million people globally, with the majority living in lower middle and low-income nations. CKD caused around 3.16 million deaths and 76.5 million disability-adjusted life years worldwide.[5,6]

In Chronic Kidney Disease (CKD), kidney function progressively declines, typically over several months to years.[2] This decline is irreversible and may eventually lead to kidney failure, necessitating renal replacement therapies such as dialysis or kidney transplantation.[2] Hemodialysis is a process involving diffusion across a semipermeable membrane to eliminate unwanted substances from the blood while introducing essential components,

serving as a replacement for kidney function.[7] The primary objective of hemodialysis is to replicate the kidney's excretory function by removing metabolic waste products such as urea, creatinine, and other toxins. Additionally, it can serve as an alternative therapy while awaiting definitive treatments.[8]

An arteriovenous (AV) shunt, also known as an arteriovenous fistula, is an important therapeutic strategy for treating kidney failure. This surgical operation includes connecting (anastomosing) an artery and a vein, generally in the arm or another portion of the body, in order to create a vascular access point for haemodialysis.[2,6] The AV shunt is considered the gold standard in establishing vascular access in haemodialysis for individuals with chronic renal disease.[2,8] This approach is meant to increase the efficiency of dialysis while lowering the risks and difficulties associated with alternative vascular access approaches.[2,9]

A study involving 22 patients using AV shunts reported that 15 patients (66.7%) experienced successful outcomes, while 8 patients encountered complications or failure.[2,9] Until now, studies that have conducted research on this topic previously are still very limited, therefore the researchers aim to investigate the management and outcomes of arteriovenous shunts as vascular access for Hemodialysis in patients with CKD at Ciputra Citra Raya Hospital from 2020 to 2023.

METHODS

Study Design

The study design employed in this research is descriptive-analytic with a cross-sectional approach. This design was chosen due to its advantages in providing a comprehensive overview of phenomena occurring within a specific population, aligning with the research objective of examining the management of arteriovenous shunts as vascular access for Hemodialysis in patients with Chronic Kidney Disease (CKD) at Ciputra Citra Raya Hospital.

The inclusion criteria for this study were 1) patients diagnosed with CKD, 2) patients undergoing hemodialysis therapy with the arteriovenous shunt method, 3) recorded in the medical records of Ciputra Citra Raya Hospital from 2020 to 2023. The exclusion criteria for this study were 1) patients with incomplete medical record data, 2) patients with complications including thrombosis, stenosis, aneurysm, or hematoma before undergoing the arteriovenous shunt procedure.

Data Sources

A comprehensive search strategy was implemented to explore data sources relevant to the research objective: the management of arteriovenous shunts as vascular access for Hemodialysis in patients with Chronic Kidney Disease (CKD). The researchers collected secondary data from the medical records of patients at Ciputra Citra Raya Hospital from 2020 to 2023 during the period of July-August 2024. The sampling method employed was total sampling, wherein all eligible subjects meeting the inclusion criteria were included in the study until the required sample size was achieved.

Statistical Analysis

The data collected from medical record observations were analyzed using appropriate statistical techniques to describe and interpret the management of arteriovenous shunts as vascular access for hemodialysis in patients with Chronic Kidney Disease (CKD). The analysis was conducted univariately to determine the distribution of each variable using the computer program Statistical Package for the Social Sciences (SPSS) ver. 25. Categorical data is presented in the form of frequencies and percentages, while numerical data will begin with a normality test. If the data is normally distributed, then the numerical data is presented in the form of the mean and standard deviation. If the distribution is not normal, then it is presented in the form of the median with the minimum, maximum, and maximum. The statistical analysis focused on presenting descriptive findings to meet the study objectives.

RESULTS

This study used 93 samples obtained from medical records of patients at Ciputra Citra Raya Hospital from 2020 to 2023 during the period of July-August 2024. Based on age analysis, the majority were aged 46-55 (39.8%), followed by those aged 56-65 (24.7%), those aged 36-45 (22.6%), those aged 26-35 and over 65 (5.4%), and those aged 17-25 (2.2%). Regarding gender, the results were similar: 58% were male and 41.9% were female. Based on education, the majority of the sample were senior high school (49.5%), followed by elementary school and junior high school (17.2%) each, and university (16.1%). Based on risk factors, the majority of the sample had hypertension and diabetes mellitus (36.6%), hypertension (25.8%), diabetes mellitus (21.5%), and no risk factors (16.1%). All patients (100%) had CKD stage 5. None had AV shunt complications. The average duration of HD was 179.63 months. The distribution of each research variable can be seen in Table 1.

DISCUSSION

Global trends indicate that CKD is more prevalent among the elderly, which aligns with the findings of this study, where the majority of patients were aged 46–55 years (39.8%) and 56–65 years (24.7%). According to a 2017 study by Glassock and Winearls, the prevalence of CKD rises with age, as do risk factors such as hypertension, diabetes mellitus (DM), and cardiovascular disease. The rise in blood pressure and blood glucose levels with age promotes kidney damage through glomerular hypertrophy and vascular sclerosis, eventually contributing to CKD progression.[10] According to KDIGO, advanced age is a significant risk factor for CKD progression due to the susceptibility of kidney function, especially when combined with comorbidities such as hypertension or diabetes, which promote quicker reductions in glomerular filtration. KDIGO suggests regular screening and active preventative strategies to slow the progression of CKD to end-stage renal disease (ESRD), which necessitates renal replacement therapy.[11]

Gender also plays a significant role in the occurrence of CKD. Research by Carrero et al. in 2018 revealed that the prevalence of CKD is higher in men compared to women.[10] This is consistent with the findings of this study, where the majority of subjects were male

Table 1. Distribution of Subject Characteristics in Arteriovenous Shunt Access at Ciputra Citra Raya Hospital (2020–2023)

Variables		N	%
Age	17-25 year	2	2.2%
	26-35 year	5	5.4%
	36-45 year	21	22.6%
	46-55 year	37	39.8%
	56-65 year	23	24.7%
	> 65 year	5	5.4%
Gender	Male	54	58.1%
	Female	39	41.9%
Education	Elementary School	16	17.2%
	Junior High School	16	17.2%
	Senior High School	46	49.5%
	University	15	16.1%
Risk Factor	No	15	16.1%
	Hypertension	24	25.8%
	Diabetes Mellitus	20	21.5%
	Hypertension and Diabetes Mellitus	34	36.6%
CKD Stage	CKD Stage 5	93	100%
AV Shunt Complication	No Complication	93	100%
Hemodialysis Duration (in Months)	Mean ± Deviation Standard		179.63 ± 121.02

(58.1%). This is thought to be related to the nephrotoxic effects of the hormone testosterone on kidney function, as well as lifestyle risk factors such as higher rates of smoking and alcohol consumption in men. A study by Neugarten and Golestaneh in 2019 suggested that women have natural protection against the development of CKD due to the effects of estrogen, although this protection diminishes after menopause.[12]

A study by Wong et al. in 2020 found that patients with lower educational levels tended to have less understanding of CKD and performed fewer self-management actions for their condition.[13] This is consistent with the findings of this study, where the majority of subjects had education up to high school (49.5%), while only 16.1% had a university degree. Bash et al. in 2018 also highlighted that lower formal education is associated with limited access to healthcare services and a lack of information on CKD prevention and management.[14]

In this study, 36.6% of patients presented with a combination of hypertension (HT) and diabetes mellitus (DM), while 25.8% had only hypertension, and 21.5% had only diabetes. This indicates that hypertension and DM are significant comorbidities that contribute to the progression of CKD. A study by Kovesdy et al. in 2017 revealed that hypertension increases pressure within the renal glomeruli, which ultimately triggers glomerulosclerosis, while DM causes microvascular damage that accelerates the decline in kidney function.[15] Wanner et al. in 2018 also stated that poor control of blood pressure and blood glucose levels in patients with hypertension and DM accelerates kidney function deterioration. Other research emphasizes that dual comorbidities worsen prognosis and increase mortality risk in patients with end-stage CKD.[16]

A study by Jha et al. in 2013 also stated that CKD stage 5 is closely associated with high morbidity, and patients with comorbidities such as hypertension and diabetes mellitus tend to experience a faster disease progression towards ESRD.[17] In the findings of this study, it was noted that all subjects were at CKD stage 5 (100%), which indicates that they had already progressed to End-Stage Renal Disease (ESRD) and required regular Hemodialysis. This is further supported by KDIGO, which emphasizes the importance of good vascular access for CKD stage 5 patients undergoing Hemodialysis. Arteriovenous (AV) shunt is the preferred choice due to its better durability and lower risk of complications compared to other access methods.[11,17]

A study by Dhingra et al. in 2017 showed that AV shunt complications, such as thrombosis and stenosis, are common among hemodialysis patients, with incidence rates ranging from 25% to 50%.[18] Interestingly, the present study found no AV shunt complications (0%), reflecting the high quality of management at Ciputra Citra Raya Hospital, although it is essential to consider whether all complications have been properly documented. Additionally, McLafferty et al. in 2020 highlighted the significance of postoperative care and close monitoring to prevent shunt-related complications.[19]

Lok in 2021 explained that prolonged hemodialysis duration is often associated with an increased risk of complications, including vascular access issues such as an AV shunt.[20] Based on the findings of this study, the average duration of hemodialysis among the patients was 179.63 months, or approximately 15 years, with considerable variation. Interestingly, as previously mentioned, no AV shunt complications were found in this study. This result contrasts with the research by Ravani et al. in 2017, which found that patients with a hemodialysis duration of over 10 years were at higher risk for peritonitis, electrolyte disturbances, and vascular

calcification, which could affect long-term prognosis.[11,20] Consequently, KDIGO recommends regular monitoring of AV shunt conditions using ultrasonography to detect complications such as thrombosis and stenosis at an early stage. This approach allows for more effective preventive measures, thereby preserving the patient's quality of life and ensuring the continuity of hemodialysis therapy. Strict monitoring protocols in line with KDIGO guidelines are a crucial step in enhancing the quality of care and reducing the risk of adverse events in hemodialysis patients.[11,20]

This study has several limitations. The data were taken from secondary medical records, which could potentially lead to bias, particularly information bias. The sample size was small, therefore further research with a larger sample size is needed. The statistical analysis of this study was limited to descriptive analysis, resulting in additional research with bivariate and multivariate analysis needed to determine the independent influence of each variable. Further research with a different study design, such as a cohort study, can be carried out to obtain a causal relationship between the study variables. Further research with a larger sample size is also needed in the future.

CONCLUSION

Chronic Kidney Disease (CKD) is a progressive renal dysfunction that is irreversible and cannot be restored to its pre-disease state. Several factors influence the occurrence of CKD, including age, gender, educational level, and comorbidities, whether singular or multiple. All subjects in this study were classified under CKD Stage 5, indicating a high severity of the disease and the necessity for effective interventions such as hemodialysis. The AV shunt is a surgical procedure that connects an artery and a vein in the arm to provide hemodialysis access. An interesting finding of this study is the absence of reported complications among all subjects, reflecting the success of vascular access management, despite the average duration of hemodialysis being 179.63 months with a wide range (min 23 months, max 593 months). Overall, this data provides valuable insight into the demographic characteristics and risk factors of chronic kidney disease patients undergoing AV shunt therapy, while emphasizing the need for preventive interventions and patient education to manage the underlying conditions.

DISCLOSURES

Ethical Considerations

All data obtained from the medical record observations were treated with strict confidentiality and utilized solely for research purposes. Ethical approval for the study was obtained from the Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Kristen Krida Wacana, ensuring that all procedures adhered to ethical guidelines.

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Conflict of Interest

No conflict of interest to declare.

Author Contribution

ATTN contributed to building the concept, analyses, and results of the manuscript. R contributed to building the concept, analyses, and results of the manuscript. AL contributed to designs, analyses, and results of the manuscript. P contributed to designs, analyses, and results of the manuscript. All authors prepared the manuscript and agreed for this final version of manuscript to be submitted to this journal.

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