

EXPLORING RISK FACTORS AND THEIR IMPACT ON CHRONIC KIDNEY DISEASE IN HEMODIALYSIS PATIENTS: A COMPREHENSIVE STUDY

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ABSTRACT

Chronic kidney disease (CKD) is a global health problem with increasing prevalence, poor prognosis, and high costs. Hemodialysis is a type of kidney replacement therapy used as a treatment for CKD and obstructive and non-obstructive causes of CKD. This study aims to determine the relationship between risk factors for the occurrence of CKD in patients undergoing hemodialysis. Research is correlational analytical research with a cross-sectional approach. Sampling was based on a non-probability sampling technique, namely purposive sampling, with a sample size of 100 respondents obtained from January to December 2023 from medical record data. Analysis using Chi Square. Bivariate analysis test results of risk factors associated with CKD in hemodialysis patients, it was found that there was a relationship between HT and the incidence of CKD with a significant value of $p=0.000$ ($0.000 p<0.05$), DM and the incidence of CKD $p=0.000$, coronary heart disease and the incidence of CKD $p=0.000$, polycystic kidney disease and the incidence of CKD $p=0.000$, urinary tract stones and the incidence of CKD $p=0.000$, cervic cancer and the incidence of CKD $p=0.000$, BPH and the incidence of CKD. There is a relationship between work and the incidence of CKD $p=0.026$ ($0.026 p>0.05$), education and the incidence of CKD $p=0.034$, and there is no relationship between age and the incidence of CKD $p=0.341$ also gender and the occurrence of CKD $p=0.607$. Conclusion of the research were hypertension, diabetes mellitus, coronary heart disease, polycystic kidneys, urinary tract stones, cervical cancer, and BPH impact on CKD in hemodialysis patients.

Keywords: *CKD, Hemodialysis, Risk Factors*

BACKGROUND

Chronic kidney disease (CKD) is a disease that causes irreversible and progressive kidney damage, so that it is unable to maintain the balance of metabolism, electrolytes, fluids and acid bases, thus causing increased levels of creatinine and urea and decreased kidney function (Chukwumaife & Bannard-Smith, 2021). One of the treatments for CKD patients is hemodialysis (Lee et al., 2023), Additionally, itching is a CKD symptom (Minera et al., 2023; Retnaningsih et al., 2023).

Based on a survey from Fresenius Medical Care in 2018, around 2,786,000 CKD patients underwent treatment and there was an increase of 6-7% in line with the increase in world population and around 2,164,000 underwent hemodialysis (Halimah et al., 2022). In Indonesia, based on 2018 Risdakes data, there is an increase in CKD patients every year, amounting to 0.38% or 3.8 cases per 1000 population. The highest prevalence was recorded in the North Kalimantan region at 0.64%. Age characteristics, the highest prevalence is in those aged 65 to 74 years (0.82%), gender, the prevalence of kidney failure is higher in men (0.42%) than women (0.35%). Education, the highest prevalence of kidney failure is in the group who do not attend school (0.57%) (Risksedas, 2018).

Various risk factors are known to be associated with the development of CKD. The National Basic Health Survey (2007-2018) shows a progressive increase in metabolic diseases related to the development of CKD, hypertension, and diabetes mellitus (Hustrini et al., 2023; Lilia & Supadmi, 2020). Hypertension and diabetes mellitus is the highest factor causing CKD (Prihatiningtias & Arifianto, 2020). Other factors that may be related to the incidence of CKD are energy supplements and smoking (Lilia & Supadmi, 2020). These causal factors include non-obstructive risk factors, while obstructive factors also need to be studied for their contribution to the occurrence of CKD, so researchers are interested in conducting research that analyzes the risk factors associated with CKD in patients undergoing hemodialysis, both non-obstructive risk factors and obstructive risk factors. The aim of this study was to determine the relationship between CKD risk factors and the incidence of CKD in hemodialysis patients. It is hoped that from the results of this research the public will be able to know about the risk factors for CKD so that it will influence preventive and promotive actions against the increasing incidence of CKD.

METHODS

This type of research is quantitative and analytical with a cross-sectional design. CKD patients undergoing hemodialysis at Dr. Adhyatma MPH Regional Hospital from January to December 2023 were used as the study population. Sampling was based on a non-probability sampling technique using purposive sampling, with a sample size of 100 respondents, from data obtained from medical records, with ethical test no. 004/KEPK.EC./2024. The variables studied by researchers included age, gender, education, occupation, and history of illness. A bivariate analysis was carried out to determine the relationship between risk factors for CKD (age, gender, education, occupation, hypertension, diabetes mellitus, coronary heart disease, polycystic kidney disease, kidney stones, ureteral stones, vesical stones, cervical ca, and benign prostatic hypertrophy) and the occurrence of CKD in hemodialysis patients. The correlation test uses the Chi Square statistical test with a significance limit of $\alpha \leq 0.05$.

RESULTS

The research data consisted of 100 respondents, from patient medical record data from January to December 2023 at Dr. Adhyatma MPH Regional Hospital. The research was conducted in January 2024. The results of the research showed that 52% of the respondents were male, with the highest risk factor being hypertension; the highest age of the respondents was late elderly (48%), with the most cases at that age being diabetes mellitus; the highest education was public high school (as much as 77%); and the most employment was private (40%) (Table 1).

Table 1. Risk Factors for CKD Events

Category	HT	DM	Coronary heart disease	Polycystic kidney	Kidney Stone	Ureteral Stone	Urinary bladder stones	Cervical cancer	BPH	n	%
Gender											
Male	20	17	4	4	3	2	0	0	2	52	52
Female	13	19	1	5	6	2	1	1	0	48	48
Age Category											
26-35 Years	4	4	0	1	0	0	0	0	0	9	9
36-45 Years	10	3	2	1	1	0	0	0	1	18	18
46-55 Years	4	9	3	4	2	2	0	1	0	25	25
56-65 Years	15	20	0	3	6	2	1	0	1	48	48
Education											
Not in School	1	2	0	0	1	0	0	1	0	5	5
Elementary School	1	4	0	0	0	0	0	0	0	5	5
Junior School	2	4	0	1	1	0	0	0	2	10	10
High School	28	14	5	8	7	4	1	0	0	77	77
Bachelor	1	2	0	0	0	0	0	0	0	3	3
Worker											
Doesn't work	3	4	1	0	0	0	0	0	0	8	8
self-employed	19	11	2	3	3	1	0	0	1	40	40
Farmer	1	1	0	0	0	1	0	1	0	4	4
ASN	0	2	0	2	1	0	0	0	0	5	5
Laborer	0	0	0	2	2	0	0	0	0	4	4
trader	0	1	0	0	0	0	0	0	1	38	38
Other Job	10	17	2	2	3	2	1	0	0	1	1

The results of the bivariate test with the square test showed that the factors age (0.341 $p > 0.05$) and gender (0.607 $p > 0.05$) were not related to the occurrence of CKD in hemodialysis patients. Meanwhile, there is a relationship between education (0.034 $p < 0.05$) and employment (0.026 $p < 0.05$) and the prevalence of CKD in hemodialysis patients. Risk factors for diseases that can cause CKD are hypertension (0.000 $p < 0.05$), diabetes (0.000 $p < 0.05$), coronary heart disease (0.000 $p < 0.05$), polycystic kidney disease (0.000 $p < 0.05$), kidney stones (0.000 $p < 0.05$), ureter stones (0.000 $p < 0.05$), bladder stones (0.000 $p < 0.05$), cervical ca (0.000 $p < 0.05$), and benign prostatic hypertrophy (0.000 $p < 0.05$), which are associated with the prevalence of CKD in hemodialysis patients (Table 2).

Table 2. Risk factors for the occurrence of CKD in hemodialysis patients

Variable	p Value	Results
Gender	0.607	Not Related
Age	0.341	Not Related
Education	0.034	Relate
Worker	0.026	Relate
Risk Factors		
Hypertention	0.000	Relate
Diabetes Mellitus	0.000	Relate
Coronary heart disease	0.000	Relate
Polycystic kidney	0.000	Relate
Stone of Kidney	0.000	Relate
Ureteral Stone	0.000	Relate
Urinary Bladder Stone	0.000	Relate
Cervical Cancer	0.000	Relate
BPH	0.000	Relate

DISCUSSION

Demographic factors (age, gender, education, occupation) with the occurrence of CKD in hemodialysis patients

Chronic Kidney Disease (CKD) is a condition characterized by decreased kidney function, characterized by a glomerular filtration rate (GFR) of less than 60 ml/minute per 1.73 square meters and signs of kidney damage or both that persist for at least 3 months. It is the disease that causes it (Sukmawati et al., 2022; Webster et al., 2017). One of the treatments for CKD patients is hemodialysis. This is a type of renal replacement therapy (renal replacement therapy) used to treat advanced stages of chronic kidney disease (CKD) (Ladesvita¹ & Herlina, 2020).

According to research, most of the kidney failure patients studied were elderly (56 to 65 years), while 48 to 25 patients were early elderly (46 to 55 years). The risk of chronic kidney failure increases with age. The elderly group, both young and old, have a higher risk of developing chronic kidney failure. People aged 61 to 86 years have a 4.51 times greater risk of developing chronic kidney disease than people aged 18 to 30 years (Baroleh et al., 2019; Salsabila, 2023). The age range of CKD patients undergoing hemodialysis varies greatly, in general, hemodialysis is usually required for people aged 41 to 60 years or over 45 years (Irawati et al., 2023; Nasution et al., 2020; Sukmawati et al., 2022; Tampake & Doho, 2021).

The results of the study stated that there was no relationship between age and the occurrence of CKD. CKD can occur at any age (Arianti et al., 2020), but judging from research results, the most common age group is old age with comorbid hypertension, so hypertension is often associated with chronic kidney disease (CKD), especially in old age. This is different from research by Rustandi et al. (2018), which states that there is a relationship between age and the occurrence of CKD. Chronic diseases begin to appear with increasing age (Rustandi et al., 2018; Salsabila, 2023b; Sukmawati et al., 2022). At the age of 50 and over, the elasticity of blood vessels begins to decrease and the blood vessels become calcified, resulting in a tendency for blood pressure to increase. Uncontrolled blood pressure can cause the arteries around the kidneys to narrow, weaken, or harden, so that blood supply and nutrition to the kidneys decrease, causing the nephrons to not function to filter blood properly (Kuwa et al., 2022).

Based on gender, the majority of CKD respondents were men. Data shows an increased risk of chronic kidney failure compared to women (Arianti et al., 2020; Arriyani & Wahyono, 2023; Mait et al., 2021; Purwati, 2018; Salsabila, 2023b). This is because women value their health more than men and maintain a healthy lifestyle. Several studies show that women are more likely to take medication regularly as prescribed by a doctor, adhere to healthy eating recommendations, and seek health information and advice from medical professionals. This can have a positive impact on the management of health conditions such as hypertension and diabetes which are the main risk factors for chronic kidney disease (Arriyani & Wahyono, 2023; Purwati, 2018; Salamah et al., 2022).

Analysis results of study show that gender is not related to the occurrence of CKD, thus providing the conclusion that gender is not always the main risk factor in the occurrence of chronic kidney disease (CKD). Although there are differences in the prevalence of CKD between men and women in some populations, this is often related to factors such as differences in hormone levels, lifestyle, and genetic factors. This can be confirmed by the results of the

study (table 1), which explain that the largest number of respondents are men. The decline in kidney function related to gender is often related to increasing age, systemic hypertension, smoking habits, the presence of dyslipidemia, atherosclerosis disease factors, and the emergence of obesity (Arianti et al., 2020)

The research results show that the majority of education is from public secondary schools (77%), with the majority of jobs being in the private sector at 40%. The level of education is related to the ability to absorb and receive health information and is one of the internal factors that influences a person's level of knowledge. The higher a person's level of education, the higher their knowledge (Fitria & Blandina, 2023). Based on research results, education (0.034 $p < 0.05$) and employment (0.026 $p < 0.05$) are related to the occurrence of CKD. Low education is more at risk of having kidney disease (Sarastika et al., 2019). Education is related to knowledge about health, where higher education tends to provide greater access to knowledge about healthy lifestyles, including healthy diet, exercise and stress management (Priadini et al., 2023). Education has a significant impact on the knowledge a person has, because education allows a person to obtain the knowledge and skills needed to develop their potential and improve their health (Dharmapatni & Putri, 2022). People with higher education may be better able to access information about how to prevent CKD and take necessary precautions (Fitria & Blandina, 2023).

Work is related to the occurrence of chronic kidney disease (CKD) due to economic stability and work stress or exposure to dangerous substances (Rustandi et al., 2018). High levels of stress can trigger increased blood pressure and inflammation in the body, and it is possible that a work-related lifestyle can affect a person's life (Qi et al., 2023). Thus, education can play an important role in understanding and managing work-related CKD risks, both through knowledge of risk factors and the ability to access health-supportive resources.

Relationship between non obstructive risk factors for CKD in hemodialysis patients

The results of this study indicate that diabetes (36%) and hypertension (33%) are the main nonobstructive risk factors for CKD. Diabetes mellitus is a highly significant risk factor (0.000 $p < 0.05$) in the development of chronic kidney disease (CKD). Diabetes mellitus is another factor that causes CKD (Arriyani & Wahyono, 2023; Baroleh et al., 2019; Salsabila, 2023b). Diabetes is a major risk factor for chronic kidney failure, high blood sugar levels, and changes in kidney blood vessels due to diabetes. This condition is called diabetic nephropathy. High blood sugar damages the small blood vessels in the kidneys, making them less efficient at filtering waste and water from the blood. Over time, this damage can lead to chronic kidney failure, a long-term loss of kidney function. (Arianti et al., 2020; Hustrini et al., 2023; Lilia & Supadmi, 2020; Purwati, 2018). Proteinuria and blood sugar are the main clinical symptoms of diabetic nephropathy. Proteinuria indicates severe damage to the kidney's filtration function, and blood sugar indicates that the kidneys are unable to absorb all the glucose filtered into the blood. These two diseases are important indicators that the kidneys are not functioning properly and if not treated properly, can cause the development of chronic kidney failure (Arianti et al., 2020; Lilia & Supadmi, 2020; Salsabila, 2023b). Damage to the blood vessels in the kidneys or diabetic nephropathy can cause gradual loss of kidney function and ultimately lead to CKD (Arriyani & Wahyono, 2023; Salsabila, 2023b; Siagian & Damayanty, 2015). Therefore, patients with diabetes mellitus have a higher risk of developing CKD compared to those who do not have this condition.

According to research results, hypertension is related to the occurrence of CKD, hypertension is a risk factor that develops as a cause or consequence of CKD (Aristoteles, 2018; Arriyani & Wahyono, 2023; Baroleh et al., 2019; Nasution et al., 2020). HT sufferers experience damage to the blood vessels in the kidneys, causing damage and affecting the kidneys' ability to filter waste and body fluids properly, conversely, existing chronic kidney disease can also trigger an increase in blood pressure. The two are interconnected and can worsen each other's conditions. Hypertension can also cause an increase in workload on the kidneys, so that the kidneys work harder to maintain water and electrolyte balance in the body when blood pressure is high (Hasanah et al., 2023). Clinically, people with hypertension are 13 times more likely to experience chronic kidney failure than people without hypertension (Lilia & Supadmi, 2020). Hypertension is a very important risk factor for chronic kidney failure (Arriyani & Wahyono, 2023). Enhancement of the renin-angiotensin-aldosterone system "RAAS" is one of the main pathways involved in the regulation of blood pressure and fluid homeostasis. Chronic kidney disease can cause overactivation of this system, especially in response to decreased blood flow to the kidneys or kidney damage. The cause is increased production of angiotensin II which has a vasoconstrictive effect and causes salt and water retention. This accumulation of salt and water increases the amount of circulating fluid, causing an increase in blood pressure. In addition, angiotensin II can also cause vasoconstriction of renal efferent arterioles, increasing glomerular pressure and causing progressive damage to the kidney. In addition to the RAAS mechanism, sympathetic overactivity can also occur in patients with chronic kidney disease. This can cause further systemic vasoconstriction, increase blood pressure, and contribute to further kidney damage (Arianti et al., 2020; Hustrini et al., 2023; Lilia & Supadmi, 2020; Purwati, 2018; Salsabila, 2023b).

Another factor based on research results is that there is a relationship between heart disease and the occurrence of CKD, this may be due to the patient's hypertension. Heart disease is a risk factor for CKD (Lilia & Supadmi, 2020). High blood pressure and dyslipidemia are risk factors for coronary heart disease. Increased blood pressure that occurs for a long time can damage blood vessels by causing arteriosclerosis, including the coronary arteries which supply blood to the heart (Sagita et al., 2018). Dyslipidemia will accumulate in cells, including kidney cells, resulting in kidney damage, including due to diuretic drugs which worsen kidney function (Baroleh et al., 2019)

A non-obstructive risk factor that influences the occurrence of CKD is the presence of polycystic kidneys. The fluid pockets that form in the kidneys in polycystic kidneys can cause pressure on the surrounding tissue and damage it, which can interfere with the normal function of the kidneys which if it lasts for a long time there is a risk of CKD (Arianti et al., 2020).

Relationship between obstructive risk factors for CKD in hemodialysis patients

Obstructive factors associated with the occurrence of CKD, according to the research results, are the presence of urinary tract stones, cervical cancer and benign prostatic hypertrophy. Urinary stones can inhibit the flow of urine from the kidneys through the ureters to the bladder, this obstruction causes excessive pressure on the kidneys. This excessive pressure can cause damage to kidney tissue, causing impaired kidney function. If urine flow is significantly obstructed, this can lead to urine retention in the kidneys, which can increase the risk of kidney infection and further kidney damage (Madias, 2021), apart from urinary tract stones, other obstructive risk factors are the presence of cervical CA and BPH. Cervical cancer that has reached stage III or IV, where there has been metastasis to other organs and BPH can cause kidney obstruction caused by hydronephrosis. Hydronephrosis is a condition where the kidneys enlarge due to a buildup of urine which obstructs its flow from the kidneys to the bladder (Salsabila, 2023b).

CONCLUSION

The non-obstructive risk factors associated with CKD at Dr Adhyatma MPH Hospital who underwent hemodialysis from the research results were education, employment, and hypertension, diabetes mellitus, coronary heart disease, polycystic kidneys, while the obstructive risk factors for CKD were urinary tract stones, cervical ca. and BPH. This means that patients with a history of this disease are at risk of developing chronic damage to the kidneys that leads to CKD and will later have to undergo hemodialysis due to kidney damage.

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