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Causative Factors of Chronic Kidney Disease in Patiens with Hemodialysis Therapy

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Abstract

Chronic kidney disease (CKD) is a pathological process with various etiologies, causing decreased kidney function progressively and irreversibly. The prevalence of CKD in the last ten years has increased. Causative factors of CKD vary highly in each countries around the world. Hemodialysis is still the primary kidney therapy besides peritoneal dialysis and kidney transplantation. This study aims to discover the causative factors of chronic kidney disease in patients with hemodialysis therapy at the Medan Rasyida Kidney Specialty Hospital in 2019. The design of this research is a descriptive method, the respondents were 307 chronic kidney disease patients with hemodialysis therapy taken by total sampling. The most common factors causing chronic kidney disease in patients with hemodialysis therapy were hypertension (59.6%), diabetes mellitus (32.2%), obstructive nephropathy (2.6%), and gout nephropathy (2.3%), polycystic kidney (2.0%) and glomerulonephritis (1.3%). Hypertension is the most common cause of CKD in Medan Rasyida Kidney Hospital in 2019.

Introduction

Chronic kidney disease (CKD) is a pathological process with various etiologies, causing decreased kidney function progressively and irreversibly. Chronic Kidney Disease (CKD) is a significant general medical issue portrayed by chronical frailty results and exceptionally high medical services costs. CKD, characterized as an expected glomerular filtration rate (eGFR) of under 60mL/min/1.73 m2, influences 10% to 16% of everyone worldwide and is related to death and kidney failure. The commonness of CKD increments with age (from 4% at more youthful than 40 years to 47% at 70 years or more established), as accomplish more extreme CKD stages described by lower eGFR and more regrettable results. The number of people with CKD will continue to increase as the elderly population grows, as will the number of people with diabetes and hypertension. Primary care clinicians will be faced with managing the complicated medical conditions specific to patients with chronic renal disease as the number of CKD patients grows. The nephrologist seldom handles the medical needs of CKD patients before renal replacement therapy is needed, as well established in the literature. We'll describe CKD staging and go through five CKD complications: anemia, hyperlipidemia, diet, osteodystrophy, and cardiovascular risk in this chapter (Matovinović, 2009; Tonelli, 2014; Ravani, 2020). The prevalence of chronic kidney disease over the past ten years has increased. Changes in the prevalence of CKD over time are debatable. According to data from the American National Health and Nutrition Examination Study, the prevalence of CKD stages 1 to 4 increased dramatically between 1999 and 2004 compared to 1988 to 1994 (131 versus 100 percent). Women had a higher prevalence of CKD than men. They were found to have a higher prevalence of CKD in two-thirds of studies that documented gender-specific CKD prevalence. Muscle mass is a significant determinant of serum creatinine concentration, and women have less muscle

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mass than men. The GFR estimation equations, on the other hand, use a correction factor for women to account for gender differences. These findings add to the growing body of evidence indicating that CKD prevalence differs by gender (Ângelo, 2012; Hill, 2016; Hasan, 2018). The rising frequency of chronic diseases such as chronic kidney disease has significant health and economic consequences in emerging countries. The rapid growth of common risk factors like diabetes, hypertension, and obesity, particularly among the poor, will result in even higher and more deep costs that emerging countries would be ill-equipped to cope. More than 7 million people in Europe suffer from chronic kidney disease, and 300,000 are undergoing kidney replacement therapy, either dialysis or kidney transplantation (Nugent, 2011; Ojo, 2014). According to Baseline Health Research Indonesia 2018, the prevalence of chronic kidney disease has increased since 2013 from 2% to 3.8%. A group with older patients (65-74 years) has a higher prevalence of chronic kidney disease than the other age groups, which is 8.23%. The chronic kidney disease prevalence according to gender is 4.17% for males and only 3.52% for females (Indonesia Health Profile, 2018).

According to the Indonesian Renal Registry (IRR) 2017, hypertension is the most common etiology of chronic kidney disease at 36%, diabetic nephropathy at 29%, primary glomerulopathy at 12%, chronic pyelonephritis/ PNC at 7%, nephropathy obstruction 4%, nephropathy lupus / SLE 1%, polycystic kidney 1%, uric acid nephropathy 1%, and unknown etiology 1%, etc. 8% (Indonesian Renal Registry, 2017). Hemodialysis is still the primary kidney therapy besides peritoneal dialysis and kidney transplantation worldwide (Liu, 2015; Hyodo, 2016). About 400,000 patients are currently treated with hemodialysis in the United States (USRDS Annual Data Report, 2013; Chirakarnjanakorn, 2017). While in Indonesia, the prevalence of hemodialysis patients continues to increase annually, counting the number of new patients in 2017 as 7,444 people and 21,051 active patients. New patients are patients who got their first dialysis in 2017, while active patients are all new patients both in 2017 and old patients from the previous year who are still on routine process treatment of hemodialysis and still alive (Indonesian Renal Registry, 2017; Prasad, 2015).

Methods

The research was conducted after obtaining permission from the Health Research Ethics Committee Faculty of Medicine University of Muhammadiyah Sumatera Utara No 380/KEPK/FKUMSU/2020. The research design is descriptive; the respondents were 307 chronic kidney disease patients with hemodialysis therapy taken by total sampling who meet the inclusion criteria. The samples were taken from patients with hemodialysis treatment starting from January to December 2019. The secondary data are collected from medical records that included a history of previous illnesses. The study inclusion criteria were patients diagnosed with CKD in the medical record, with hemodialysis therapy history in the Hemodialysis Unit of the Rasyida Kidney Hospital in Medan, and patients with complete medical record data.

Results And Discussions

The study took place at the Medan Rasyida Kidney Hospital with 307 medical records. Samples are taken from patients with hemodialysis therapy starting from January to December 2019.

Table 1. Distribution of CKD Patients Based on Respondent's Characteristic in the Hemodialysis Unit of the Medan Rasyida Kidney Special Hospital 2019

	Frequency	Percentage (%)
Age		
15-24	1	0.3
25-34	18	5.9
35-44	117	38.1
45-54	118	38.4
55-64	21	6.8
≥65	32	10.4
Gender		
Male	216	70.4
Female	91	29.6
Causative Factors		
Hypertension	183	59.6
Diabetes Melitus	99	32.2
Obstructive nephropathy	8	2.6
Uric acid nephropathy	7	2.3
Polycystic kidney	6	2.0
Glomerulonephritis	4	1.3
Total	**307**	**100.0**

Source: Primary data, 2019

The results found that the most group suffering from CKD is the 45-54 age category totaling 118 people (38.4%), and the second level is the 35-44 age category with 117 people (38.1%). Furthermore, ≥ 65 age category were 32 people (10.4%), 55-64 age category there were 21 people (6.8%), 25-34 age category there were 18 people (5.9%), and 15-15 age category with one person only (0.3 %).

The study found that the gender with a higher percentage suffering CKD in patients with hemodialysis therapy was male with 216 (70.4%) and female with 91 (29.6%). The study found that the factors causing chronic kidney disease in patients with hemodialysis therapy were hypertension (59.6%). The second, there was diabetes mellitus (32.2%), then obstructive nephropathy (2.6%), uric acid nephropathy (2.3%) %), polycystic kidney (2.0%), and glomerulonephritis (1.3%).

Table 2. Overview of the Causes of CKD by Gender.

Causative Factors	Male	%	Female	%	Total
Hypertension	127	58.8	56	61.6	183
Diabetes Mellitus	69	31.9	30	33	99
Polycystic kidney	4	1.9	2	2.2	6
Uric acid nephropathy	5	2.3	2	2.2	7
Obstructive nephropathy	8	3.7	0	0	8
Glomerulonephritis	3	1.4	1	1	4
Total	**216**	**100**	**91**	**100**	**307**

Source: Primary data, 2019

Based on the table above, 127 patients with hypertension in male (58.8%), followed by Diabetes Mellitus in 69 participants (31.9%). While female, 56 participants (61.6%) suffered from hypertension, and 30 (33%) suffered from Diabetes Mellitus.

Table 3. Overview of the Causes of CKD by Age.

Causative Factors	15-24	%	25-34	%	35-44	%	45-54	%	55-64	%	≥ 65	%	Total
Hypertension	1	0.5	8	4.4	74	40.4	71	38.8	9	4.9	20	11	183
Diabetes Melitus	0	0	6	6.1	37	37.4	37	37.4	9	9.1	10	10	99
Polycystic kidney	0	0	1	16.7	0	0	3	50	1	16.7	1	16.6	6
Uric acid nephropathy	0	0	2	28.6	2	28.6	3	42.8	0	0	0	0	7
Obstructive nephropathy	0	0	0	0	1	12.5	4	50	2	25	1	12.5	8
Glomerulonephritis	0	0	1	25	3	75	0	0	0	0	0	0	4
Total													**307**

Source: Primary data, 2019

Based on the table above, it was found that the most hypertension sufferers were in the age range of 35-44 years, with as many as 74 participants (40.4%), and the highest number of people with Diabetes Mellitus was in the age range of 35-44 and 45-54 years, namely 37 participants (37.4%).

Aging is a normal, progressive, and unavoidable biological process marked by a gradual loss of cellular function and structural changes in many organ systems. These morphological and physiological changes define senescence, a word that describes age-related changes that are more predictable than those caused by diseases. Patients with chronic kidney disease with an age range of 45-54 years have a higher percentage (38.4%) of 118 people. Following the reported Indonesian Renal Registry (IRR) in 2018, the most age suffering from CKD in hemodialysis patients is the age range 45-64 years. Patients aged less than 25 years contributed 2.57% to active patients. (Denic, 2016; Indonesian Renal Registry, 2017).

There is a high prevalence of CKD in the elderly. It is attributable mainly to the increas¬ing prevalence of traditional risk factors for CKD, such as diabetes, hypertension, and cardiovascular disease (CVD), as well as due to new definitions that have expanded the estimated glomerular filtration rate (eGFR) range for CKD. Among people aged 60 years or older, approximately 30% have proteinuria, and 26% have a GFR below 60 ml/min/1.73 square meters. The elderly are also prone to kidney damage due to other chronic diseases such as high blood pressure, diabetes, and renal tubulointerstitial disease. The CKD prevalence in the US adult population, was noted to be 11%. The prevalence in the US elderly was much higher at about 39.4% of persons aged 60+ years have been noted to have CKD verses 12.6 and 8.5% of persons aged 40–59 years and 20–39 years, respectively. Serum creatinine depends on muscle mass. The relation with GFR is influenced by age, gender, and body weight. The correct assessment of GFR is for the classification of patients with CKD. Serum creatinine has been used as a GFR marker in clinical practice for several years. It is widely acknowledged that serum creatinine is not a reliable indicator of GFR. The relationship between serum creatinine and GFR is affected by age, gender, weight, and based on muscle mass. As a result, formulas for estimating GFR have been established. The K/DOQI guidelines recommend that GFR calculation is by the recently formulated 'Modification of Diet in Renal Disease (MDRD)' method. Renal diseases, enhanced protein catabolism, and dietary variables have little effect on the generation of cystatin C in the body. Unlike creatinine, it does not alter with age or muscle mass. Its biochemical properties enable free filtration in the renal glomerulus, followed by metabolism and reabsorption in the proximal tubule. For these reasons, serum cystatin C suggested to be an ideal endogenous marker of GFR (Mallappallil, 2014; Murty, 2013; Malekmakan, 2013).

CKD is more common in older adults than in younger people. The kidneys are unable to create new nephrons. Therefore, when kidney disease or aging begins, the number of nephrons falls. Because birth weight has a positive relationship with nephron number, it can be used to estimate nephron number at delivery. Every ten years, the number of functioning nephrons drops by around 10%, and by the age of 80, just 40% of the nephrons are functional. Normal aging causes nephron loss due to nephrosclerosis and, more precisely, glomerulosclerosis. It is consistent with nephrosclerosis and subsequent nephron loss caused by reasons other than normal aging. Unfortunately, subclinical nephrosclerosis cannot currently be detected without a biopsy (Denic, 2017; Fattah, 2019). If CKD events occur at a younger age, it is possible due to unhealthy lifestyles. Especially the habits of consuming certain nephrotoxic substances such as coffee, energy supplement drinks, vitamin C supplements, soft drinks, smoking, consumption of NSAIDs (Non-Steroid Anti-Inflammatory Drugs), and herbal medicines. Globally, the overall number of people with diabetes is projected to rise from 415 million (8.8%) in 2015 to 642 million (10.4%) in 2040, with the highest changes expected in low- and middle-income countries' urban populations (LMICs). According to evidence from LMICs, there is significant CKD heterogeneity between urban and rural areas. Furthermore, relative

to high-income countries, the etiology of CKD among T2DM patients in LMICs is multifactorial and influenced by the burden of both non-communicable and communicable diseases. Unhealthy lifestyles, such as a high-fat diet and lack of physical activity, can hasten the onset of diabetes and its complications in more urbanized areas. In a nationwide study, 35.4 percent of Thai T2DM patients had CKD (eGFR 60 mL/min/1.73 m2), according to the findings (Jitraknatee, 2020; Michishita, 2017; Rahman, 2021).

The study found that the most gender suffering from CKD were male with 216 (70.4%) and female with 91 people (29.6%). This picture is almost the same as that reported by IRR in 2018 that the male gender is more in the amount of 57% and female in 43% (Indonesian Renal Registry, 2017). CKD progressions may differ depending on gender. Male patients show a substantially higher prevalence of CKD and incidence rate of ESRD than those observed in female patients. A survey conducted by the Japanese Society for Dialysis Therapy indicated sex differences in mean age at the start of dialysis. According to the United States Renal Data System (USRDS), 62% of CKD patients that reached end-stage renal failure in 2015 were men, whereas only 38% were women. In addition, it has been previously shown that women with CKD have a slower decline in renal function with time when compared with men. Chronic inhibition of NO, a powerful physiological vasodilator, causes systemic vasoconstriction with negative renal hemodynamic consequences, including renal ischemia and glomeruli collapse. Cultural and social environmental disparities (e.g., differences in medication prescriptions or disease perceptions) and biologically influences are possible reasons for sex differences in progression risk factors (e.g., hormonal and genetic factors) (Chang, 2016; Fanelli, 2017; Ricardo, 2019).

The study shows that hypertension is the most common cause of CKD in Medan Rasyida Kidney Special Hospital in the January-December 2019 period of 183 patients (59.6%) and secondly Diabetes mellitus among 99 patients (32.2%). Furthermore, Obstructive Nephropathy had four patients (2.6%), Gout Nephropathy had four patients (2.3%), Polycystic Kidney was six patients (2.0%), and finally, Glomerulonephritis was four patients (1.3%). These results are consistent with data submitted by IRR in 2018 that hypertension occupies the first position as a cause of CKD in patients undergoing hemodialysis therapy, equal to 36%, and diabetic nephropathy is second-order at 28% (Indonesian Renal Registry, 2017). Hypertension is a major risk factor for cardiovascular and renal disease. Conversely, chronic kidney disease (CKD) is the most common form of secondary hypertension, and mounting evidence suggests it is an independent risk factor for cardiovascular morbidity and mortality. The prevalence of hypertension is higher among patients with CKD, progressively increasing with the severity of CKD. Based on a national survey of a representative sample of no institutionalized adults in the USA estimated hypertension occurs in 23.3% of individuals without CKD, and 35.8% of stage 1, 48.1% of stage 2, 59.9% of stage 3, and 84.1% of stage 4-5 CKD patients. The relationship between increased blood pressure (BP) and kidneys is multidirectional. The kidneys participate in the development and perpetuation of essential hypertension. Chronic kidney diseases (CKDs) are one of the most common causes of secondary hypertension. When hypertension of any etiology can lead to renal impairment (benign or malignant nephrosclerosis), increased BP accompanied by proteinuria is a vital factor related to CKD progression. Despite the high incidence of hypertension and the availability of appropriate treatments, only a few patients meet their treatment objectives. However, in the general population, this condition might be changing. Comparison of recent cohorts to patients from previous decades, it is clear that hypertension understanding and control have increased from 69 percent to 80 percent and 27 percent to 50 percent, respectively. Rates of hypertension recognition and control in CKD patients participating in prospective observational studies have been reported to be close to current levels in the general population. However, population statistics show that those with CKD have a lower likelihood of not only being informed of and controlling hypertension but also receiving sufficient care for other

cardiovascular risk factors. The unintended consequences of research participation on clinical treatment or adherence, as well as variations in the composition of different study populations, may explain this disparity. Although a large proportion of CKD patients need multiple antihypertensive drugs—in one study, 32% of CKD patients were taking four or more antihypertensive drugs—nonadherence does not seem to be any more frequent than in patients without the disease (Tedla, 2011; Monhart, 2013; Rahman, 2020).

In Indonesia, hypertension is the most common cause of CKD. As stated by Indonesia Health Profile in 2018, some people with hypertension do not know they are hypertensive. So they do not get treatment. The reasons hypertension sufferers do not take the medication include feeling healthy, irregular visits to health facilities, taking traditional medicine, using other therapies, forgetting to take medication, not being able to buy drugs, and there are side effects of drugs. According to this systematic analysis, CKD places a significant burden on the health systems of South Asian countries (India, Bangladesh, Pakistan, and Nepal). The high prevalence of diabetes and hypertension in this region is not surprising. The primary risk factor for CVD is high blood pressure, and Sub-Saharan Africa (SSA) has the highest prevalence of hypertension in the world. However, in South Asia, people are generally unaware of noncommunicable diseases such as diabetes, hypertension, and CKD. They seldom seek medical attention before a sign or symptom of CKD occurs. Furthermore, many people choose self-treatment or depend on unlicensed and unqualified practitioners. South Asian countries' health systems, like those of other LMICs, are unprepared to deal with the massive burden of NCDs. In these nations, the number of human capital devoted to the prevention and treatment of childhood diseases is also low and disproportionate. In addition, the weak referral mechanism prevalent in South Asian countries makes early detection of CKD cases difficult. Untreated CKD is clearly linked to the development of end-stage renal disease (ESRD) and cardiovascular diseases (CVDs), both of which are leading causes of death in LMICs. CKD has also been linked to a decrease in health-related quality of life and a loss of productivity (Hasan, 2018; Indonesia Health Profile, 2018; Jorgensen, 2020).

Conclusion

Based on the results of this research conducted on factors that cause chronic kidney disease in patients with hemodialysis therapy at the Rasyida Kidney Special Hospital Medan in January-December 2019, Hypertension is the most common cause causing chronic kidney disease (59.6%) and followed by Diabetes mellitus with (32.2%).

We recommend future researchers use this research as a consideration and reference to conduct research with a higher number of samples. For all doctors in Indonesia to be able to provide information and education to patients about hypertension. For colleagues to be able to give understanding to patients that anti-hypertensive drugs are always taken even though blood pressure is stable. Because anti-hypertensive drugs are neutralizing and will not cause blood pressure to rise even though it is stable. We hope health workers can provide better data and status on medical records. So easier to research patient medical record data and can provide better results for further research.

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