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Correlation Between Gender, Age, and Body Mass Index with Length of Stay in Nephrolithiasis Patients

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Introduction. The increasing prevalence of nephrolithiasis in several countries in recent years has made it a serious public health concern. Three days is the typical duration of stay for nephrolithiasis treatment, so longer length of stay will burden society in various ways, especially in terms of expensive costs. This study aims to determine the relationship between the length of stay patients with nephrolithiasis at RSU PKU Muhammadiyah Mojoagung and gender, age, and body mass index.
Methods. Descriptive analytic with a cross-sectional design is used in this research, applying the method of consecutive sampling. The chi-square statistical test will be used to assess the data in both univariate and bivariate formats. This research was carried out at RSU PKU Muhammadiyah Mojoagung on inpatients diagnosed with nephrolithiasis within 2023.
Results. In this study, 111 patients were included, including 61 men and 50 women. Of the patients, 46.8% were between the ages of 45-65 years old, and the major criteria is non-obesity (64,9%). The patients had a stay of at least 4 days. According to Chi Square Test analysis, body mass index and length of stay have a significant correlation (p=0.012). Meanwhile, there was no correlation between age (p = 0.548) and gender (p = 0.089) with length of stay.
Conclusion. Body mass index has correlation with length of stay in nephrolithiasis patients at RSU PKU Muhammadiyah Mojoagung, while gender and age has no correlation with length of stay of nephrolithiasis patients.

Keywords: age, body mass index, gender, length of stay, nephrolithiasis patients

Introduction

Nephrolithiasis is among the most prevalent kidney illnesses, the prevalence of which has increased in recent years [1]. Nephrolithiasis is a non-communicable disease that causes major problems in the field of public health [2]. There are several factors, both internal and external, that put people at risk for stone formation. The internal factors include age, gender and heredity. In contrast, external factors include geographical conditions, work environment, sitting habits, obesity, adequate water intake, urinary retention, high vitamin C intake, and others [3].

In certain nations, kidney stones are becoming more common. In 2015, the Global Burden of Disease (GBD), which combines the incidence and prevalence of diseases and injuries, found 22.1 million nephrolithiasis cases, resulting in approximately 16.100 fatalities. Around 1 to 15 percent of people worldwide will develop kidney stones during their lifetime [4]. Nephrolithiasis is among the most prevalent kidney conditions in Indonesia. The prevalence of kidney stones is 6 per 1,000 population or 1,499,400 people in Indonesia suffer from kidney stones. Based on the age of people with kidney stones, the age range of 41 to 60 is the most significant risk factor. The prevalence will increase at the age of 55-64 years (around 1.3%), 65-74 years (around 1.2%), and age ≥ 75 years (around 1.1%). While based on gender as much as 15% of cases happens in men and 10% happens in women [5]. The number of hospitalized patients was 19.018, and the number of deaths was 378 or 1.98% of all patients treated [2].

Research by Antoneli (2015) stated that there is an increased incidence of urinary tract stones of more than 75% in overweight (obese) individuals [6]. Additionally, compared to people with lower BMIs, those with a BMI over 30 kg/m2 have a higher chance of developing nephrolithiasis because they excrete more oxalate, uric acid, salt, and phosphate in their urine [7].

The increasing prevalence of nephrolithiasis is becoming an important public health concern [8]. Furthermore, kidney stone therapy is expensive. Currently available information shows that the average length of stay (LOS) is three days, and the total cost needed is 9% of the entire cost of hospitalization in the US [9]. Length of stay can be used as an indicator to evaluate operational and clinical performance efficiency. Length of stay can also indicate the quality of service and the needs of further observation [10]. Hospital services are considered more effective and efficient when patients stay in the hospital for a shorter period of time. The patient's health is expected to improve and long-term hospitalization will no longer be necessary. Prolonged hospitalization can lead to increased costs and impact patient safety. The longer the hospital stay, the higher the cost of hospitalization [11].

To date, no research has examined the variables linked to the duration of hospitalization for nephrolithiasis patients. However, risk factors for nephrolithiasis may be related to the severity of the disease, so it may be related to the length of stay. Therefore, researchers are interested in studying the factors of gender, age, BMI associated with length of stay in nephrolithiasis patients.

Materials and Method

This quantitative study uses a cross-sectional research design to study the relationship between several factors and the length of stay in observational nephrolithiasis patients at PKU Muhammadiyah Mojoagung Hospital in 2023. This study was conducted from December 2023 to February 2024. The samples in this study were those that met the inclusion criteria, namely: a) Inpatients diagnosed with nephrolithiasis based on ultrasound results in 2023, b) Inpatients in the observational therapy category. The exclusion criteria were: a) Patients referred to other hospitals, b) Patients forcibly discharged during treatment, c) Patients who died during treatment, d) Patients undergoing nephrolithiasis surgery, and e) Patients with comorbid diseases. The sample collected from this study was 111 observational nephrolithiasis patients from a total population of 162 patients. This study used secondary data. The data were obtained from the medical records section at PKU Muhammadiyah Mojoagung Hospital, which consisted of data on gender, age and body mass index (BMI).

Data were analyzed univariately and presented descriptively. In addition, bivariate analysis was performed to determine the relationship between variables using the chi-square test. Data results were calculated using the SPSS program and presented as narratives and tables.

Result

The sample that has been analyzed in this study is 111 samples, consisting of 61 male (55%) and 50 female(45%). The majority of respondents are aged 45 - 65 years old, by 52 people (46.8%). From the normality test related to age, the p value obtained was= 0.070 with a mean of 50.65 ± 1.558, indicating normal data distribution. Respondents with non-obese BMI were 72 people (64.9%), while respondents with an obese BMI were 39 people (35.1%). The normality test showed a p value of=0.126 with a mean of 24.31 ± 0.444, which indicates normal data distribution (Table 1).

Table 1. Research Subject Characteristics

Variable	n	%	Mean±SD
Gender			
Men	61	55%	-
Woman	50	45%	
Age			
< 45 y.o	37	33.3%	50.65±1.558
45-65 y.o	52	46.8%	
> 65 y.o	22	19.8%	
BMI			
Non-obese	72	64.9%	24.31±0.444
Obese	39	35.1%	
LOS	-	-	3.57±0.88

Table 2 shows 61 male patients, of whom 22 have less than 4 days and 39 have more than 4 days of LOS. Of the 50 female patients, 27 have less than 4 days and 23 have more than 4 days of LOS. The chi-square test statistical data results in no significant correlation between the length of stay of nephrolithiasis patients and their gender (p= 0.089, $\alpha > 0.05$).

Table 2. Chi-Square Test Results Analysis

Variable	Days		r	p
	<4	≥4		
Gender				
Men	22	39	0.180	0.089
Woman	27	23		
Age				
< 45 y.o	15	22	0.035	0.548
45-65 y.o	27	25		
> 65 y.o	7	15		
BMI				
Non-obese	25	47	-0.258	0.012
Obese	24	15		

Of the 37 patients with an age range of < 45 years, 15 patients has LOS of less than 4 days, while 22 patients stayed for more than 4 days. Of the 52 patients aged 45 - 65 years, 27 have less than 4 days LOS and 25 have more than 4 days LOS. There were 19 patients with an age more than 65 years; 7 of them have less than 4 days LOS while the other, 15 have more than 4 days LOS. The chi-square statistical test results showed no significant correlation between the length of stay of nephrolithiasis patients and age ($p=0.548$, $\alpha>0.05$).

Of the 72 patients with non-obese BMI, 25 have stayed for less than 4 days, and 47 have stayed for more than 4 days. Of the 39 patients with obese BMI, 24 have stayed for less than 4 days, and 15 have stayed for more than 4 days. The chi-square statistical test results showed a significant correlation between the length of stay and body mass index (BMI) ($p=0.012$, $\alpha<0.05$).

Discussion

Correlation Between Gender with Length of Stay in Nephrolithiasis Patients

The characteristics of the respondents, as described by the gender distribution of the researcher, were 61 male nephrolithiasis patients (55%) and 50 female nephrolithiasis patients (45%). This line with Haerudin's (2015) research, who discovered as many as 59.2% (61) male nephrolithiasis patients, and 40.8% (42) female nephrolithiasis patients [2]. These findings also support Perdede et al. (2021), in which nephrolithiasis is more common in males than females [4]. Ilham's (2019) research also yielded a value of $\rho = 0.178$, indicating no correlation between gender and the duration of hospitalization for a sickness. Thus, either male or female, are at risk of experiencing longer treatment [12].

Men's anatomical structure is longer, so the chance for stone-forming substances to precipitate into stones is higher. Androgen hormones in males will enhance stone formation by increasing renal deposition and urine oxalate excretion. In contrast estrogen hormones in women may reduce oxalate excretion, plasma oxalate concentrations, and plasma calcium crystal deposition. The incidence of stones in women is less frequent due to lower urinary calcium levels than men and higher urinary citrate levels, which can prevent stone formation [13]. Thus, nephrolithiasis is more common in males than females, although there is no correlation between a patient's gender and the length of stay.

Correlation Between Age with Length of Stay in Nephrolithiasis Patients

The respondents' age distribution was as follows: < 45 years old (33.3%), 45-65 years old (46.8%), and > 65 years old (19.8%). These results are in line with age as the internal risk factors of urolithiasis, with the average age for nephrolithiasis cases in Indonesia was 30-59 years old. These findings also align with Pardede et al. (2021), which discovered that the most significant proportion of nephrolithiasis patients was 46-65 years (36 patients, 44.9%), followed by the 36-45 years age group, (39 patients, 26.5%) [4]. Nurfitriani's research (2019) showed that adult age respondents had a 3.5 times higher chance of experiencing urinary tract stones than elderly respondents [3].

As the age increases, the incidence of kidney stones also increases, peaking in adulthood. This results from a high deposition process in the loop of Henle caused by an increasing capacity of the kidneys during adulthood. Since their nephrons are still developing, children are less likely to produce stones. However, some nephrons may malfunction in older adults, which is characterized by a decrease in the proximal tubule's or loop of Henle's volume. Urinary stones are more common in adults than in children and the elderly [3,14].

Yulfanita's research (2013) showed that the older the patient, the longer the hospital stay. In some studies, the age factor affects the length of the patient's stay. Age has a relationship with the level of exposure, the magnitude of risk and the nature of certain resistance. In addition, age is closely related to various characteristics of a person [15]. Thus, urolithiasis cases are strongly correlated with age since adults are more likely to acquire it than

children and teenagers. However, this does not significantly affect the length of stay of nephrolithiasis patients.

Correlation Between Body Mass Index with Length of Stay in Nephrolithiasis Patients

Respondents with non-obese categories were 72 (64.9%) and respondents with obese categories were 39 (35.1%). The exact mechanism by which obesity increases the risk of nephrolithiasis is not yet understood. Some theories link obesity to the development of insulin resistance, which promotes stone formation by interfering with renal ammonia formation and lowering urine pH. Elevated insulin levels raise the chance of calcium-containing urinary stones to develop, as well as elevating levels of salt, uric acid, phosphate, and oxalate in the urine [16].

In terms of physiology, obesity is linked to the kidneys excreting more calcium and uric acid, which makes the urine more acidic and raises the chance of stone formation. A study by Poore et al. (2020) found that weight gain and obesity raised the incidence of renal stones. Serlina et al. (2022) also demonstrated that obesity can raise the excretion of stone components in the urine. On the other hand, obese individuals had decreased urine calcium excretion than normal individuals. Based on the connection between obesity and kidney stone production, two theories might be put forth: (1) obesity itself is a risk factor for kidney stones, (2) obesity is linked to additional risk factors for the development of urinary stones, such as elevated calcium or oxalate secretion. Presume that obesity is a sign of metabolic syndrome, which is linked to kidney stone risk, both physiologically and epidemiologically [17-18]. This study's findings was also confirmed by Nurfitriani (2019), who discovered no connection between kidney stones and obesity in patients at Sanglah Denpasar General Hospital (p=0.564) [3]. Howevwe, Anhar's (2014) research revealed that, among patients at Muslimat Ponorogo Hospital from January 2007 to December 2010, there was no discernible correlation between nephrolithiasis and obesity (p=0.403) [19].

Obesity is strongly associated with several health problems. However, the findings regarding the association between hospitalization and obesity have been varied. A few studies show an increase in length of stay associated with obesity, while others show no association or even a decrease in length of stay. According to Pieloch et al. (2014), hospitalization rates for some obese populations are similar to those of numerous populations of normal weight [20]. For medical patients, the majority of obese patients require a longer LOS, whereas surgical patients require a shorter LOS. By moving patients to other hospitals, hospitals can shorten the length of stay for obese patients, reducing the risk of treating these patients who are more likely to experience complications. Another reason for obese individuals' shorter length of stay is that problems are more likely to claim their lives [21].

Obesity had no discernible impact on the prevalence of nephrolithiasis based on the bivariate analysis, which may be due to the limited location of the research site, which is only in PKU Muhammadiyah Mojoagung Hospital. In addition, due to the research sampling procedure that uses secondary data, the BMI determination is not based on direct measurement, but on data from medical records instead. However, there is a moderately unfavorable link between obesity and the length of stay for nephrolithiasis patients.

Conclusion

Nephrolithiasis is more prevalent among men as opposed to women (1,22:1) and occurs mostly between the ages of 45 and 65 years in non-obese patients. Observational nephrolithiasis patients have an average hospital stay of <4 days. The study also found that body mass index was correlated with the length of stay of observational nephrolithiasis patients at RSU PKU Muhammadiyah Mojoagung, while gender and age were not correlated with the length of stay of the patients.

More study is needed with longer observation time, larger number of patients from several different hospital locations, details of the case, surgical technique, during the operation, and complications after the surgery, etc., to minimize the bias and to know more other possible factors that might affect the patient's length of stay.

Conflict of interest

The authors declare no conflict of interest.

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