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Research Article

The Correlation Between Body Mass Index (BMI) and Hemodialysis Adequacy in Hemodialysis Patients

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Abstract.
Hemodialysis is the most common renal replacement therapy in patients with chronic kidney disease and has a dose that must be achieved, known as hemodialysis adequacy. In fact, many hemodialysis patients do not reach the hemodialysis adequacy target. There are three main factors affecting hemodialysis adequacy: the solute, the patient, and the dialysis process. Patient factors are important because these factors can be modified, intervened, and anticipated by nurses. One of the interesting patient factors to study is the Body Mass Index (BMI). The purpose of this study was to determine the relationship between BMI and hemodialysis adequacy. This research was conducted in November 2021. This study used a cross-sectional design with a consecutive sampling technique and comprised of 84 samples that met the inclusion and exclusion criteria. The data were collected by using recording data from the medical records of hemodialysis patients. BMI using post-hemodialysis weight parameters and hemodialysis adequacy were assessed by looking at the Kt/V score. The results showed that there was a significant relationship between BMI and hemodialysis adequacy (p=0.001) with moderate strength and negative pattern (r=-0.362); this means that the greater the BMI value, the less hemodialysis adequacy. The results indicated that maintaining a normal BMI can increase hemodialysis adequacy in patients. This can prevent complications, improve quality of life, reduce treatment costs, and reduce the frequency of hospitalization.

Keywords: hemodialysis adequacy, body mass index, chronic kidney disease

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1. INTRODUCTION

Hemodialysis is the most common treatment for chronic kidney disease (CKD) patients worldwide and in Indonesia with the aim of removing the remnants of protein metabolism and correcting electrolyte and protein balance imbalances (Black & Hawks, 2014). As with treatment, hemodialysis must also achieve the prescribed dose adequacy which is referred to as adequacy of hemodialysis (1). Adequate hemodialysis (HD) is the

recommended dose to obtain adequate results so that the benefits of hemodialysis can be achieved. Inadequate HD will result in the progression of kidney function damage to increase so that morbidity and mortality also increases. In addition, inadequate HD can result in material losses and reduce the productivity of HD patients in daily life (1), (2).

The number of CKD cases in the United States reaches 30% of the million patients. In 2015, there were 124,111 new cases of CKD, and a total of nearly 500,000 patients underwent hemodialysis treatment, and more than 200,000 CKD patients underwent kidney transplantation (3). Based on the Basic Health Research (RISKESDAS) in 2018, the prevalence of CKD in Indonesia is still high at 4% and those undergoing hemodialysis are 19% with the prevalence of chronic kidney failure in East Java at around 2%, and those undergoing hemodialysis 20% (4). Data on HD adequacy at one hospital in Malang obtained an average Kt/V of 1.4 with a frequency of 2 times per week and a duration of 5 hours (5). This result is far from the target of HD adequacy which should be 1.8 with a frequency of 2 times per week (6).

Hemodialysis adequacy is measured periodically quantitatively by calculating URR (Urea Reduction Ratio) or Kt/V. URR is the percentage of urea that can be cleared in one hemodialysis. Meanwhile, Kt/V is the ratio of urea clearance and hemodialysis time to the volume of distribution of urea in body fluids which shows the effectiveness of hemodialysis in clearing metabolic waste toxins [6], [8]. HD adequacy measurement is easier using Kt/V because it can be seen directly on the HD machine. The ideal Kt/V target is 1.2 with HD 3 times per week and a duration of 4-5 hours per HD while the target Kt/V in HD patients is 2 times a week with a duration of 4-5 hours is 1.8 (7).

Assessment of HD adequacy is an important factor in the management of hemodialysis patients because HD adequacy is associated with morbidity and mortality and quality of life of HD patients and increases the life expectancy of HD patients (1). In addition, the clinical condition of hemodialysis is said to be adequate if the general condition of the patient is good and there are no manifestations of uremia (8), (9). Some clinical conditions that arise because of inadequate HD are weakness, thin body, high blood pressure, anemia, itching, darker skin color, and nausea. Adequate hemodialysis has an impact on the quality of life and the average survival of patients, the level of morbidity and mortality, the number of treatment costs, and the frequency of hospitalization (2), (9).

There are 3 main elements that affect HD adequacy, namely solute/molecule elements, patients, and the dialysis process (2). Various kinds of factors of these elements have been studied and some of them are still debated on their influence. Patient

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factors are important factors because these factors can be modified, intervened, and anticipated by nurses who treat HD patients. One of the most interesting patient factors to study is Body Mass Index (BMI). The purpose of this study was to determine the relationship between Body Mass Index (BMI) and adequacy of hemodialysis at UMM Hospital.

2. MATERIALS AND METHODS

This study uses a correlative analytic design with a cross-sectional approach and variable measurement and research is carried out only once at the time of observation or during the observation (10). The population of this study was all hemodialysis patients at the Muhammadiyah University of Malang Hospital, which amounted to 150. This study used the Rule of Thumb formula with the chosen multiplier number 12 times the number of independent variables, so the result was 7 times 12 were 84 respondents (10), (11). Sampling techniques using nonprobability sampling using the Consecutive Sampling method. The criteria for the research sample are: 1) chronic hemodialysis patients for at least 3 months, 2) Mentis and Cooperative Compost Awareness, 3) Able to read and write in Indonesian, 4) Willing to be respondents 5) Not experiencing Intra -HD complications. The questionnaire used in this study contains age, BB, TB, BMI, IDWG, total time (months) on HD, Quick of Blood (QB), and HD adequacy (KT/V values).

3. RESULTS

TABLE 1: Distribution of Respondents.

Variables	Median	Min-Max
Total time (months) on HD	25.5	4-45
IDWG	1	0-3
Quick of Blood	240	200-385
HD Adequacy	1.70	1.20-1.90

Based on table 1, the median duration of HD patients in this study was 25.5 months with the shortest period of 4 months and the longest of 45 months. The median IDWG value in this study was 1 kg, with the lowest IDWG being 0 kg (no difference) and the largest being 3 kg. The median value of Qb in this study was 240 ml/minute with the lowest Qb being 200 ml/minute and the highest QB 385 ml/minute. The middle value of the HD advertisement in this study was 1.7 kT/V with the lowest value of 1.20 kT/V and the highest value of 1.90 kT/V.

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TABLE 2: Distribution of Respondents.

Variables	Mean	95% CI
Age	54.77	52.47-57.08
BMI	22.67	21.91-23.42

Based on Table 2, the average age in this study was 54.77 years and from the estimated interval it could be concluded that 95% was believed to be an average age between 52.47 to 57.08 years. The average BMI in this study was 22.67 and from the estimated interval it could be concluded that 95% was believed to be the average BMI between 21.91 to 23.42.

TABLE 3: Relationship between BMI and HD Adequacy.

	HD Adequacy
BMI	r = - 0,362 p = 0,001

Statistical test results based on Table 3 obtained the value of p = 0.001 (α <0.05), it can be concluded that there is a significant relationship between BMI and HD adequacy. The relationship of BMI with HD Adequacy shows the strength of moderate relationships (r = 0.362) and negative patterns which means the greater the BMI value, the less HD adequacy.

4. DISCUSSION

The study's findings indicate that there is a relationship between BMI and HD adequacy in negative correlation, meaning that as BMI increases, HD adequacy decreases. Body Mass Index (BMI) post HD that is persistent more clearly indicates that the fluid volume present in the patient tubule is substantial. The current situation indicates that the ultrafiltration and diffusion processes are not operating at their best. This is because the volume distribution fluid and the weight post HD that are positioned in the numerator position have a very large number, which means that they will be replaced by a smaller number of adequacy (2). BMI also serves as a reliable indicator of renal function (RRF), with a normal BMI score resulting in a 0.4% increase in GFR and an obese BMI score in a 1.2% increase in GFR, respectively. BMI increase also correlates with an increasing URR (Ureum Reduction Ratio), necessitating a large dose of Kt/V to ensure adequate function (12).

Many of a large patients have normal BMIs. Several studies claim that BMI is a reliable indicator for assessing overall health and that it correlates with HD milk fat in the stomach to determine overall health. BMI is typically normal, and sometimes even increases in

HD patients can be caused by several factors. The most common is that HD patients typically suffer from uremia, which necessitates that they consume foods high in protein to prevent the development of inflammatory bowel diseases like mucus and kidney stones. As a result, they consume foods high in calories, such as foods high in fat, more frequently (13) (12).

The BMI-based nutritional status parameter is also described as being less accurate in the case of patients with HD and periorbital edema who have CKD, as the patient's weight will likely increase in response to fluid, thus impairing the patient's BMI. Edema prefers in the patient with CKD may occur due to increased fluid and nitrate tension in the extracellular space (13) (12).

The results of this study also show that there is a relationship between BMI and IDWG where the BMI taken is post-hemodialysis body weight (second). Increasing the IDWG value will increase vascular volume where decreased kidney function cannot remove excess body fluids so excess fluid will be trapped in the tissues and will increase body weight. Body weight greatly affects the value of V where the value of V is obtained from the result of multiplying the patient's weight by the estimated amount of fluid in the body. A high V value will result in a decrease in hemodialysis adequacy (5) (2) (12).

5. CONCLUSION

The results showed that there was a relationship between BMI and HD adequacy where the higher the BMI, the lower the HD adequacy value. The results indicated that maintaining a normal BMI can increase hemodialysis adequacy patients so that this can prevent complications, improve quality of life, reduce treatment costs, and reduce the frequency of hospitalization.

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