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ORIGINAL ARTICLE

INTER DIALYTIC WEIGHT GAIN AND ULTRAFILTRATION GOAL OF POST COVID-19 AMONG HEMODIALYSIS PATIENTS IN RIAU PROVINCE: A DESCRIPTIVE STUDY

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ABSTRACT

Key indicators for assessing the adequacy of hemodialysis include Inter-Dialytic Weight Gain (IDWG) and Ultrafiltration Goal (UFG), both of which are closely related to patients' hemodynamic status. However, there is limited information on the specifics of IDWG and UFG, particularly in Riau Province. This quantitative study with a descriptive design aims to describe IDWG and UFG in the aftermath of the COVID-19 pandemic in Riau. The research was conducted across three regional hospitals in Riau Province, involving 138 hemodialysis patients. This study employed univariate statistical analysis, using secondary data as the primary source. The findings indicate that in the first four months following the COVID-19 pandemic among hemodialysis patients in Riau Province, the average UFG and IDWG levels exhibited fluctuations, with IDWG in the three hospitals ranging from 2.28 to 3.12, while UFG was be 2.13 to 3.09. The results suggest that stabilizing of IDWG and UFG is crucial to prevent complications arising from these fluctuations, such as activation of the renin-angiotensin-aldosterone system, stimulation of the sympathetic nervous system, and increased cardiac output.

Keywords: *Inter-dialytic weight gain; ultrafiltration goal; haemodialysis*

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INTRODUCTION

During the Covid-19 pandemic, significant changes occurred in hemodialysis patients, both in terms of patient conditions and hemodialysis therapy services provided. No study has specifically assessed hemodialysis therapy in patients receiving adequate hemodialysis in the province, especially in the post-Covid-19 in Riau, most research has concentrated on diseases affecting coastal communities or the behavior and influence of the coastal environment on public health (Indonesian Renal Registry, 2017; Neuman, 2019; Linberg, 2020; Muttaqin, 2019; Widyastuti, 2020).

Riau Province covers an area of 87,023.66 km^2. It comprises both land and water, featuring numerous islands along the Malacca Strait (Indonesian Renal Registry, 2017). Many residents inhabit coastal areas, but environmental conditions and community habits can affect health. One prevalent disease among coastal communities is chronic kidney disease (Septiwi, 2019).

According to the Indonesian Renal Registry report (2017), the number of patients undergoing hemodialysis increased from 30,554 patients in 2015 to 52,835 patients in 2016, and further rose to 77,892 patients in 2017. If each patient undergoes hemodialysis 2 to 3 times a week, this results in approximately 155,784 to 233,676 hemodialysis treatments performed weekly. In Riau Province, it is estimated that around 800,000 individuals suffer from chronic kidney disease, yet only 2-5% of them receive hemodialysis treatment.

An essential aspect of assessing hemodialysis therapy is measuring IDWG (Interdialytic Weight Gain) and UFG (Ultrafiltration Goal). The IDWG is crucial because the increase in fluid volume, shown through an increase in body

weight, serves as the basis for determining the amount of fluid that enters during the interdialytic period (Istanti, 2020).

According to Neuman (2013), the IDWG indicates that the body can tolerate more than 3% of its dry body weight. Dry body weight refers to the weight of body when there are no clinical signs of fluid retention (Linberg, 2020). A higher IDWG, a greater amount of excess fluid in the patient's body, which can lead to more severe negative impacts, such as hypotension, muscle cramps, hypertension, shortness of breath, nausea, and vomiting, and others (Muttaqin, 2019).

An essential condition that must be considered is the UFG. During the hemodialysis process, the removal of excess body fluids is achieved through ultrafiltration process. This process effectively eliminates excess fluid volume, thereby, reducing oedema in the patient's body (Wong & Sarjana, 2017). However, if excess fluid is not removed, it can accumulate over time, leading to conditions such as anasarca or even pulmonary edema, which can interfere with breathing and pose a risk of death (Sulastri, Septimar & Winarni, 2021).

Several previous studies have discussed the relationship between the length of time on hemodialysis and the IDWG, the impact of health education on patients' knowledge regarding fluid restrictions and IDWG in hemodialysis patients, and the significant correlation between IDWG and the occurrence of hemodialysis complications. These studies focused on one health area in Riau during the pre-pandemic period (Bayhakki, Utomo & Dewi, 2021; Cholina, et al, 2021)

This study provides valuable insights into the hemodialysis procedure following the lifting of COVID-19 pandemic restrictions. It serves as a foundation for optimizing hemodialysis adequacy, ensuring that patients receive optimal benefits from their treatments. Additionally, hemodialysis adequacy can be used as an indicator of patient compliance with fluid restrictions and possible negative effects on their health.

METHOD

Research design

This research design employed quantitative approach utilizing statistical techniques and descriptive analysis methods to characterize the IDWG and UFG of post-COVID-19 hemodialysis patients in Riau Province. The data processing was conducted using SPSS version 20 software. The study was carried out at Regional General Hospitals (RSUD) across various regencies or cities in Riau Province, including Dumai General Hospital, Puri Husada General Hospital, and Arifin Achmad General Hospital.

Population and sample

This study used total sampling with a sample size of 138 patients. The inclusion criteria encompassed all hemodialysis patients who underwent treatment between June 22 and September 30, 2023. The use of total sampling of respondents was intended to gather more heterogeneous set of results from a non-general target population of patients receiving hemodialysis.

Instruments

The data collection technique utilized a secondary data obtained from hospital medical records. This study did not use a specific instrument; the demographic data included only gender, age, and hemodialysis duration, and the average of the patients' IDWG and UFG.

Statistical analysis

Statistical analysis in this study was univariate Secondary data from hemodialysis patients were obtained from medical records in three hospitals in Riau Province were input and processed using the SPSS 2.1 application and presented in graphical format.

Ethical consideration

This study has been approved by the Ethics Committee of Nursing and Health Research at Riau University, under the approval number 146/UN19.5.1.8/KEPK.FKp/2023.

RESULT

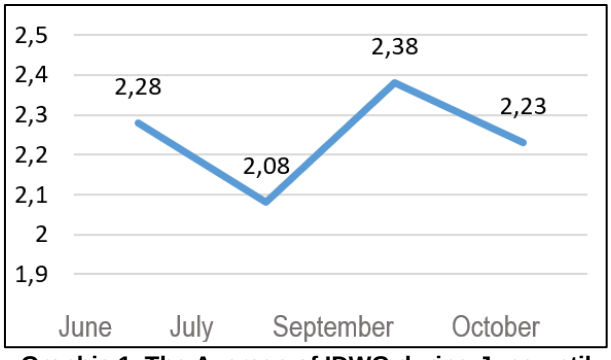
The data collection results from three hemodialysis units, which are RSUD Arifin Achmad, RSUD Dumai, and RSUD Puri Husada Tembilahan, yielded a total of 138 hemodialysis patient records available for analysis. Specifically, there were 60 patients from Dumai Regional Hospital, 49 patients from Puri Husada Tembilahan Regional Hospital, and 29 patients from Arifin Achmad Regional Hospital. The characteristics of the 138 patients are presented in the table below.

Table 1. Respondent Characteristics

Hospital	Variable (n= 138)			
	Gender		Age	HD Timing
	Female	Male		
	Presentage		Mean	
Arifin Ahmad General Hospital	9 (3.03%)	20 (68.97%)	49 (17-66)	4 hours
Dumai General Hopital	28 (46.67%)	32 (53.33%)	47 (23-74)	5 hours
Puri Husada General Hospital	19 (38.78%)	30 (61.22%)	48 (25-70)	5 hours
Total	56 (40.58%)	82 (59.41%)	48 (17-74)	5 hours

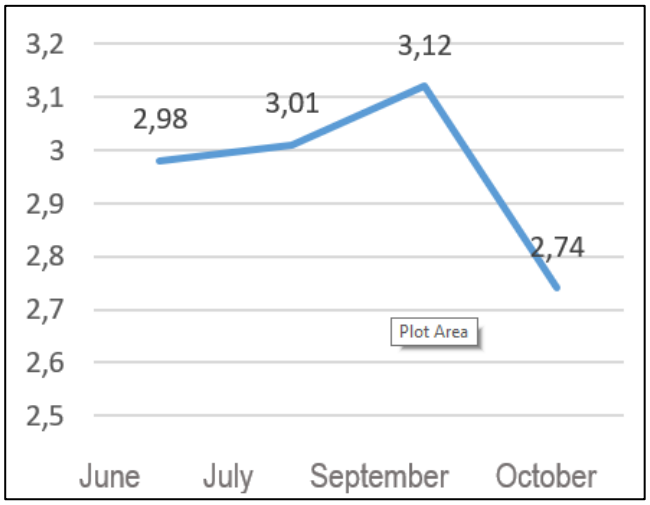
Table 1 shows the data from three hospitals, indicating that the total number of male respondents (59.42%) exceeded that of female respondents (40.58%). Furthermore, the average age of respondents from RSUD Arifin Achmad was 48.48 years old, while the average age from RSUD Dumai was 46.98 years, and from RSUD Tembilahan, it was 47.89 years old. The youngest respondent was 17 years old, and the oldest was 74 years old. On average, the duration of each hemodialysis sessions at RSUD Arifin Achmad was 5 hours.

The following information presents the results of the descriptive analysis of the average Inter-Dialytic Weight Gain (IDWG) and Ultrafiltration Goal (UFG), which refers to the amount of fluid removed during each session of hemodialysis from June 22 to September 30, 2023.



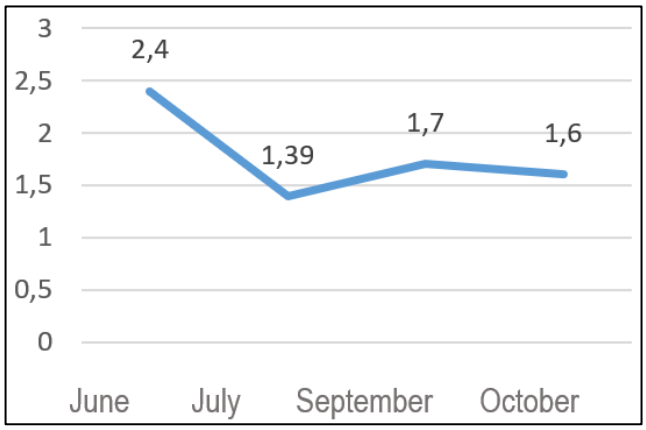
Graphic 1. The Average of IDWG during June until September 2023 in Arifin Achmad Pekanbaru Hospital

Graphic 1 above illustrates the average IDWG of respondents at RSUD Arifin Achmad from June to September 2023. Initially, the IDWG was 2.28 kg at the end of June, then decreased to 2.08 kg in July, before increasing again to 2.38 kg in August. However, from August, the average IDWG dropped to 2.23 kg in September 2023. The average IDWG during the early post-COVID-19 Pandemic as shown fluctuations, with minimal differences in the rates of increase or decrease.



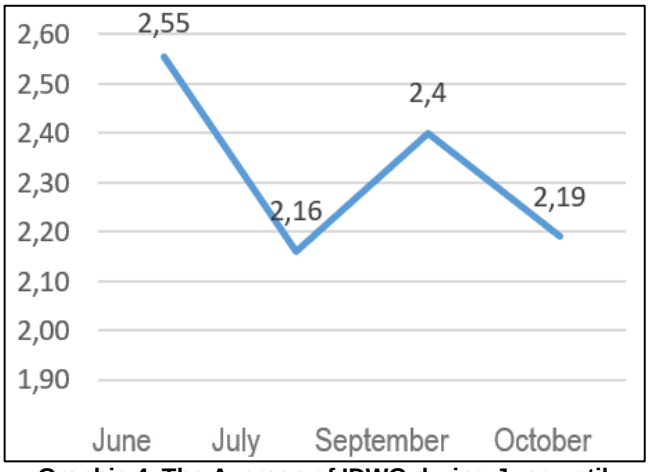
Graphic 2. The Average of IDWG during June until September 2023 in Dumai Hospital

Graphic 2 depicts that from the end of June to September 2023, the average IDWG of respondents at RSUD Dumai was 2.98 kg. This figure increased slightly to 3.01 kg in July, continued to rise to 3.12 kg in August, and then experienced a rapid decline to 2.74 kg in September 2023.



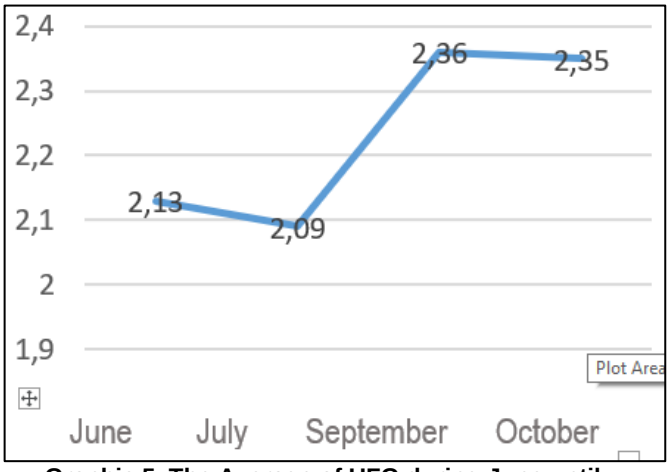
Graphic 3. The Average of IDWG during June until September 2023 in Puri Husada Tembilahan Hospital

Graphic 3 shows the average IDWG of respondents at RSUD Tembilahan. In June 2023, the average IDWG was 2.4 kg; however, it decreased to 1.39 kg in July. There was a slight increase in August, bringing the average to 1.7 kg, but it fell again in September 2023 to 1.6 kg. Overall, the average IWDG of respondents in this hospital decreased during the first four months after the declaration of post-COVID-19 pandemic status in Indonesia.



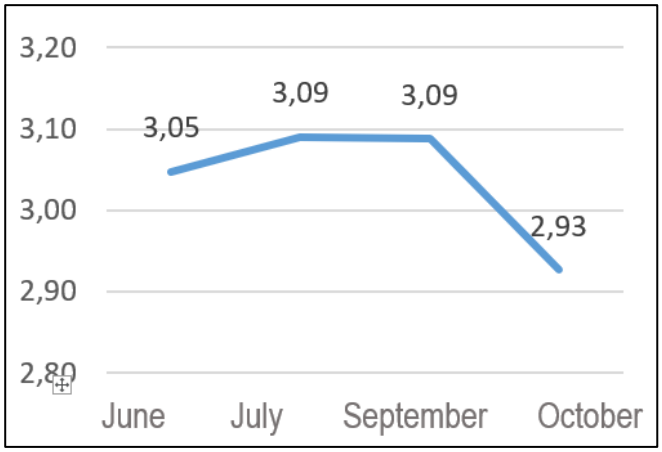
Graphic 4. The Average of IDWG during June until September 2023 in three Hospital

Graphic 4 illustrates that the average IDWG of the three hospitals decreased from 2.55 kg at the end of June to 2.16 kg in July. Subsequently, the average IDWG increased to 2.4 kg in August, before dropping again to 2.19 kg in September 2023. trend indicates that, in general, IDWG in the first 4 months following the post-COVID-19 pandemic status in the three research hospitals is fluctuating downward.



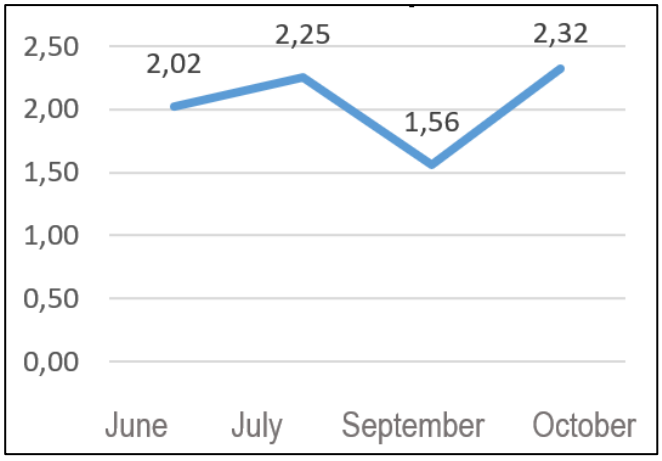
Graphic 5. The Average of UFG during June until September 2023 in Arifin Achmad Pekanbaru Hospital

Graphic 5 depicts that the average UFG in June 2023 was 2.13 kg. Following the Covid-19 Pandemic status, it decreased to 2.09 kg in July, then then increased to 2.36 kg in August. From August to September, it decreased again to 2.35 kg, yet remined above the average UFG recorded in July. Therefore, it can be concluded that from June to September 2023, the average UFG at RSUD Arifin Achmad exhibited a fluctuating trend.



Graphic 6. The Average of UFG during June until September 2023 in Dumai General Hospital

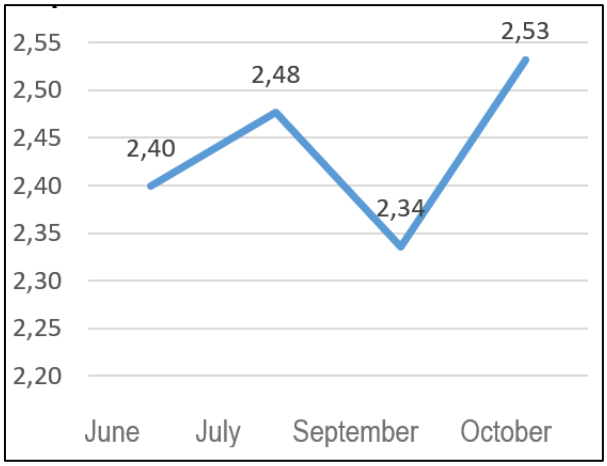
Graphic 6 shows that the average fluid removed during hemodialysis in June was 3.05 kg, which increased to 3.09 kg in July and remained stable until August. However, there was a significant decrease in September, dropping at 2.93 kg. From this graph, it can be concluded that the average UFG at RSUD Dumai tends to increased, then stabilized, and subsequently decreased.



Graphic 7. The Average of UFG during June until September 2023 in Puri Husada General Hospital

Graphic 7 illustrates that the average UFG of respondents at RSUD Tembilahan increased from 2.02 kg in June to 2.25 kg in July 2023. However, this figure declined to 1.56 kg in August before rising again to 2.32 kg in September. It can be concluded that the average UFG of respondents at RSUD Tembilahan exhibited fluctuations during the period from the end of June to September 2023.

Graphic 8 shows that when the data from the three hospitals are combined, the average UFG rose from 2.4 kg the end of June to 2.78 kg in July, before decreasing to 2.34 kg in August. Subsequently, the average UFG rose again to 2.49 kg in September 2023. This graph demonstrates that the average UFG fluctuated upward between the end of June and September 2023.



Graphic 8. The Average of UFG during June until September 2023 in three Hospital

DISCUSSION

The high number of reported COVID-19 related deaths has caused anxiety and fear among many people, deterring them from seeking treatment services at hospitals. Research indicates that the prevalence rate of fear and various psychosocial problems has increased during the COVID-19 pandemic (Özdin & Bayrak Özdin, 2020; Al-Balas et al., 2022).

This finding is supported by another study that analysed the level of fear among hemodialysis patients during the COVID-19 pandemic, which reached 57.5, showing thata these patients experienced severe stress (Syahrizal et al., 2020). However, despite the researchers conducted, the number of patient visits remained stable even after entering the endemic period. Therefore, it is crucial to monitor the adequacy of the hemodialysis process, which can be assessed through the stability of IDWG and UFG.

The status of IDWG is influenced by several factors, including fluid intake. The human body is composed of approximately 60% water, and healthy kidneys excrete and reabsorb water to balance blood osmolarity. Meanwhile, patients with chronic kidney disease who undergo hemodialysis experience impaired urine formation of urine, which can lead to excess fluid volume in the body. In addition, patients with kidney issues often experience excessive thirst, which as a stimulus for the sensation of thirst. This thirst or the desire to drink can be triggered by various factors, including high sodium levels, decreased potassium levels, angiotensin II, increased plasma urea, post-dialysis hypovolemia, and psychological factors (Dewi, 2022).

In addition, age also contributes to changes in IDWG status. This study found that the majority of respondents were male (59%), with total body water constituting 60% of their body weight, while the total body water in female accounted for 50% of their body weight. Males have a different body composition than women, possessing a higher proportion of muscle tissue. Since fat is a substance that contains little water, a lower fat percentages results in a higher percentage of water relative to a person's body weight (Prasetyo, 2020).

Mild to moderate IDWG thresholds are generally well-tolerated by patients, allowing the hemodialysis process to proceed comfortably. In addition, some patients adapt to these conditions, experiencing leg swelling and tightness that are not overly disruptive (Wibowo & Siregar, 2020; Sridhar et al., 2023). However, patients with moderate to severe IDWG are primarily found among those with further disease complications (Ayunarwanti & Maliya, 2020).

The IDWG status in this study exhibited fluctuating conditions, although it did significantly exceed the maximum limit. Nonetheless, other studies have raised concerns about rapidly declining IDWG, as this condition is a particularly dangerous as an indicator of short-term mortality risk due to frailty and malnutrition, which often precedes a patient's death (Hecking et al., 2018).

High IDWG-induced excessive ultrafiltration during hemodialysis can activate the sympathetic nervous system, the renin-angiotensin-aldosterone system (RAAS), and cardiac output. This process may lead to reduction during the intradialytic ultrafiltration. The decline in the total blood volume (TBV) and relative blood volume (RBV) stimulates Renin release, which subsequently kidney blood flow. The conversion of Angiotensin I to angiotensin II by renin causes vasoconstriction and the release of aldosterone. Consequently, vasoconstriction and aldosterone secretion can result in an increase in intradialytic blood pressure (Armiyati, et al., 2021).

A significant increase in interdialytic weight gain (IDWG) due to fluid fluctuations can have serious effects, resulting in complications like impaired physical function, hypertension, and shortness of breath from pulmonary edema, all of which can disrupt hemodialysis. Furthermore, heart failure associated with these fluctuations is linked to a higher risk of ventricular hypertrophy (Robinson, Akizawa, & Jager, 2016). These more severe cardiac complications are caused by increased vascular resistance, which is triggered by excessive pre-dialysis fluid overload. This overload leads to elevated vascular resistance, resulting in patients experiencing high blood pressure during dialysis (Chiaranai, 2016; Badawi & Ryoo, 2022). Eventually, monitoring by healthcare professionals to limit fluid intake can help maintain health and prevent excessive increases in IDWG, thereby preventing the risk of mortality (Sari, Isro'in & Andayani, 2023).

The adequacy of hemodialysis is also determined based on the UFG. Ultrafiltration occurs due to the pressure differential between the positive pressure in the blood compartment and the negative pressure in the dialysate compartment, which is generated by the dialysate pump. The ultrafiltration rate should not exceed 13 ml/kg/hour, as higher rates are associated with increased mortality and morbidity (Widiana, 2017). These methods of fluid transfer are commonly used to facilitate the removal of excess fluid. UFG should be adjusted according to the patient's clinical condition and blood pressure to prevent hypotension and hypertension (Lim & Wah, 2018; Tita & Szychowski, 2022).

Multiple factors such as male gender, the duration of hemodialysis session, the presence of medical history, are associated with a high proportion of UFG (Naverraete et al., 2022). This finding is consistent with the previous research indicating that males dominate at 59% of the population studied, with an average hemodialysis duration of 5 hours. Hemodialysis is directly affected by fluid management. Therefore, maintaining the appropriate volume is crucial for enhancing patient health outcomes (Loutradis, 2021).
The study demonstrated a significant increase in UFG in the final month. This increase can be attributed to unstable hemodynamic conditions, such as hypotension, which may arise hemodialysis due to excessive ultrafiltration or inadequate vascular filling compensation mechanisms. These factors can lead to autonomic and vasoactive response disorders, as well as a reduction in cardiac volume. Notably, even a decrease in blood volume can cause hypotension (Kandarini & Winangun, 2021).

However, in reality the practice of UFG remains constrained. This limitation arises from the need for precise interventions to assess volume status and decide the appropriate amount of fluid should be removed during the dialysis process. Other studies have shown that higher ultrafiltration rates contribute to a poor prognosis for hemodialysis patients (Zhang et al., 2023). Therefore, in case of adverse condition, the patient is positioned in Trendelenburg position as an initial treatment to restore blood circulation volume, receiving a normal bolus of 0.9% saline as indicated, along with vasopressors to reduce the ultrafiltration rate.

UFG and IDWG are ultimately interconnected, as impact of inadequate UFG is assessed by evaluating dry body weight (Kandarini & Winangun, 2021). In addition, it is known that high IDWG or short treatment times require high ultrafiltration, but the rapid fluid removal from this process can lead to the potential recurrent episodes of intradialytic hypotension, which negatively affects clinical outcomes, resulting in increased morbidity and mortality (Lee et al., 2020).

The strength of this study lies in its clear analysis of IDWG and UFG over the past 4 months, utilizing a diverse sample obtained from 3 different hospitals in Riau province following COVID-19 pandemic. The data obtained is varied and comprehensive. The results indicate that both IDWG and UFG exhibit a similar trend, with both showing an increase, which aligns with findings from another underlying research. Through this study conveyed that the need for ongoing monitoring by the medical personnel to prevent potential complications arising from these increases.

This study has several limitations, use of descriptive research design, which provides an outline of the discussed variables rather than in-depth causal conclusions. Additionally, the limitations of the demographic data displayed restrict the analysis of the core variables. Therefore, further study development such as case studies and qualitative research, is necessary to explore the phenomena of IDWG and IFG in patients and to identify influencing factors.

CONCLUSION AND RECOMMENDATION

This illustrates that the average UFG and IDWG tend to fluctuate during the first four months following the declaration of the COVID-19 pandemic in the three research hospitals of Indonesia. IDWG monitoring offers an overview of the effectiveness of fluid and urea management, while UFG assignment sets the goal of ensuring optimal fluid balance and metabolic control. This approach is based on clinical conditions and patient care needs, but comprehensive monitoring is necessary, along with health education, to stabilize conditions and prevent complications arising from fluctuations in ultrafiltration and IDWG. Such fluctuation can activate sympathetic nervous system, trigger activation of the renin-angiotensin-aldosterone system, and increase cardiac output.

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