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# Intradialytic and post-dialytic complications in chronic kidney disease patients undergoing maintenance hemodialysis

## Complicaciones intradialíticas y posdiálisis en pacientes con enfermedad renal crónica sometidos a hemodiálisis de mantenimiento

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**SUMMARY**

**Background:** *Acute complications can happen during dialysis or after dialysis, and often those complications are inevitable. Although hemodialysis is claimed to be a relatively safe option, these complications often bring significant discomfort for chronic kidney disease (CKD) patients. This study was to determine CKD patients' characteristics and figure out the frequencies and varieties of acute hemodialysis complications.*
**Methods:** *A descriptive cross-sectional study was conducted from July 01, 2020, to August 01, 2020, at the dialysis unit of Arsani hospital, Indonesia. The data for this study were taken using history taking and monitoring the patients during the dialysis process.*
**Results:** *A total of 25 patients met the criteria and were observed in one month study period. There were 14 (56 %) males and 11 (44 %) females. The most common etiology of CKD was hypertension (68 %), followed by type 2 diabetes (24 %), and nephrotic syndrome (8 %). Among 251 hemodialysis sessions, 85 (33.8 %) of them experience one or more intradialytic or post-dialytic complications. Acute hypertension (18.7 %) and fatigue (18.7 %) were both the most common complications, followed by gastrointestinal manifestations (17.1 %), fever (13.0 %), acute hypotension (11.4 %), muscle cramps (7.3 %), hypoglycemia (1.6 %), and others (12.2 %).*
**Conclusion:** *Acute complications in hemodialysis are prevalent, and most are not life-threatening. Monitoring, rapid treatment, and good nutritional status are necessary to overcome those complications and maintain CKD patients' quality of life.*

**Keywords:** *Chronic kidney disease, hemodialysis, intra- & post-dialytic complication.*

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## RESUMEN

**Antecedentes:** *Las complicaciones agudas pueden ocurrir durante la diálisis o después de la diálisis y, a menudo, esas complicaciones son inevitables. Aunque se afirma que la hemodiálisis es una opción relativamente segura, estas complicaciones a menudo provocan un malestar significativo para los pacientes con enfermedad renal crónica (ERC). Este estudio fue para determinar las características de los pacientes con ERC y averiguar las frecuencias y variedades de complicaciones agudas de la hemodiálisis.*

**Métodos:** *Se realizó un estudio descriptivo transversal desde el 01 de julio de 2020 al 01 de agosto de 2020, en la unidad de diálisis del hospital Arsani, Indonesia. Los datos para este estudio se tomaron utilizando la historia clínica y el seguimiento de los pacientes durante el proceso de diálisis.*

**Resultados:** *Un total de 25 pacientes cumplieron los criterios y fueron observados en un período de estudio de un mes. Había 14 (56 %) hombres y 11 (44 %) mujeres. La etiología más común de la ERC fue la hipertensión (68 %), seguida de la diabetes tipo 2 (24 %) y el síndrome nefrótico (8 %). Entre las 251 sesiones de hemodiálisis, 85 (33,8 %) de ellas experimentan una o más complicaciones intradiálisis o posdiálisis. La hipertensión aguda (18,7 %) y la fatiga (18,7 %) fueron las complicaciones más frecuentes, seguidas de las manifestaciones gastrointestinales (17,1 %), fiebre (13,0 %), hipotensión aguda (11,4 %), calambres musculares (7,3 %), hipoglucemia (1,6 %) y otros (12,2 %).*

**Conclusión:** *Las complicaciones agudas en hemodiálisis son prevalentes y la mayoría no ponen en peligro la vida. La monitorización, el tratamiento rápido y un buen estado nutricional son necesarios para superar esas complicaciones y mantener la calidad de vida de los pacientes con ERC.*


**Palabras clave:** *Enfermedad renal crónica, Hemodiálisis, complicación intra y posdiálisis.*

## INTRODUCTION

The number of chronic kidney disease (CKD) patients is increasing each year and is predicted to be constantly abundant in the future. There are five stages of CKD with End-Stage Renal Disease (ERDS) as its end-stage (1). ESRD has become the primary concern in the medical world due to its high prevalence, increasing cardiovascular risk, and mortality rate (2). The prevalence of chronic kidney disease is increasing around the world. According to Basic Health Research, the prevalence of CKD in Indonesia is about 0.2 % in 2013 to 0.38 % in 2018 (3-5). CKD is defined as irreversible loss of renal function to excrete metabolite waste products and regulate fluid homeostasis, which means patients with ERDS need to undergo renal replacement therapy (RRT), including renal transplantation, peritoneal dialysis, or hemodialysis. Besides pharmacological treatment, hemodialysis is one of the most common therapy for CKD patients (6). Hemodialysis is a process of removing the waste metabolic product and toxic substances out of the body. While the hemodialysis process is happening, metabolic and hemodynamic changes will occur. These changes will bring several complications in a short or long period (7). This effect can be felt by the patient while having the dialysis or after the dialysis process, which can influence the quality of life of CKD patients (6,8).

Usually, CKD patients undergoing hemodialysis treatment spend 9-12 hours a week in a dialysis unit. Each session lasts for about 3-5 hours, and it is performed 2-3 times a week (8). Although it is recommended to do hemodialysis three times a week, many practitioners still scheduled their patients for twice a week hemodialysis, mainly in developing countries in Asia or Africa (9). Generally, the frequency of hemodialysis in Arsani Hospital, Bangka Belitung, Indonesia, is twice a week. Usually, three-time-session hemodialysis is scheduled for patients who experience worse signs and symptoms of the disease.

Hemodialysis is claimed to be relatively safe, but actually, it often comes with several acute complications. Acute complications are defined as signs or symptoms within the dialysis or 24 hours after the dialysis session. It varies from hypotension, hypertension, shivering, gastric problem, muscle soreness, fatigue, and many more (1). Sometimes, a hemodialysis session is stopped because of unbearable complications. Those complications can cause issues that are even more complicated such as stress, low quality of life, or even death (8,10).

This study aims to determine the characteristics of CKD patients in Arsani hospital Indonesia; to find out the prevalence of acute intradialytic and post-dialytic complications of patients with

ESRD that undergo hemodialysis. The purpose of this study also to see if hemodialysis is a relatively safe option for CKD patients. This study is hoped to be a reference for healthcare to anticipate and manage the upcoming complications.

## METHODS

This study was a descriptive study with a cross-sectional design. The data were collected from 1st July 2020 to 1st August 2020 in the hemodialysis unit of Arsani Hospital, Sungailiat, Bangka Belitung, Indonesia. The dialysis unit in Arsani Hospital had eight beds for patients without infectious diseases and one bed for patients with infectious diseases, such as Hepatitis type B and C. The population of this study was CKD patients that came to the dialysis unit to do regular hemodialysis. Samples were chosen by using non-probability sampling, which was quota sampling. The total of samples were 25 patients, including men and women.

The samples for this study met the inclusion and exclusion criteria. Inclusion criteria were patients already done the hemodialysis session for at least 3 months and routinely doing 2 -3 sessions each week. Exclusion criteria were patients with acute kidney injury that only needed emergency hemodialysis, patients with congenital kidney disease such as kidney agenesis, kidney artery stenosis, or polycystic kidney disease (11).

Intradialytic hypertension was defined as increasing mean arterial pressure (MAP) ≥15 mmHg during or after hemodialysis. Meanwhile, intradialytic hypotension meant decreased systolic blood pressure ≥20 mmHg or systolic blood pressure was observed to be <90 mmHg during or after the hemodialysis session (12). Other acute complications such as nausea, vomiting, epigastric discomfort, headache, fatigue, muscle soreness, muscle cramps were observed intra-dialysis or post-dialysis. Blood glucose measurement was tested while necessary.

## RESULTS

A number of 25 patients undergoing routine hemodialysis were observed for one month starting July 2020 until August 2020. Among those patients, 14 were male (56 %), and 11 were female (44 %). Based on Table 1, most of the samples have normal body mass index (40 %), followed by obese (28 %) and overweight (24 %).

Table 1

Basic characteristics of the subjects

| Category | Frequency (%) |
|---|---|
| Sex | |
| Male | 14 (56.0) |
| Female | 11 (44.0) |
| Age | |
| <40 years old | 4 (16.0) |
| 40 – 49 years old | 5 (20.0) |
| 50 – 59 years old | 5 (20.0) |
| ≥60 years old | 11 (44.0) |
| Body mass index | |
| Underweight | 2 (8.0) |
| Normal weight | 10 (40.0) |
| Overweight | 6 (24.0) |
| Obese | 7 (28.0) |

These patients were diagnosed with CKD with various etiologies; the most common etiology was hypertension (68 %). Other etiologies were type 2 diabetes (24 %), nephrotic syndrome (8 %). Among all patients, 18 (72 %) patients undergo hemodialysis sessions twice a week, and 7 (28 %) patients have three times a week session.

Table 2 describes the acute complications during or after hemodialysis. There were 123 acute complications found in the observation of this study. Some patients even experienced more than one complication during the hemodialysis process. Hypertension and fatigue (18.7 %) were the most common acute complications to be found, followed by gastrointestinal manifestations such as nausea, vomiting, or epigastric pain (17.1 %).

There was a significant association between body mass index (BMI) and acute complication during or after dialysis in CKD patients (p-value= 0.043), as seen in Table 3.

Table 2

Distribution of acute intradialytic and post-dialytic complications

| Acute complications | Frequency (%) |
|---|---|
| Hypertension | 23 (18.7) |
| Hypotension | 14 (11.4) |
| Fever | 16 (13.0) |
| Gastrointestinal manifestation | 21 (17.1) |
| Muscle cramps | 9 (7.3) |
| Hypoglycemia | 2 (1.6) |
| Fatigue | 23 (18.7) |
| Others | 15 (12.2) |
| Total | 123 (100.0) |

Table 3

Correlation between body mass index and acute intradialytic and post-dialytic complications

| BMI | Acute complications | | | | | | | p-value |
|---|---|---|---|---|---|---|---|---|
| | Hypertension/ hypotension | Fever | GI manifestations | Muscle manifestation | Hypoglycemia | Others | Total | |
| UW | 1 (11.1 %) | 0 (0.0 %) | 3 (33.3 %) | 3 (33.3 %) | 1 (11.1 %) | 1 (11.2 %) | 9 (100.0 %) | 0.043 |
| NW | 14 (29.8 %) | 3 (6.3 %) | 12 (25.6 %) | 11 (23.4 %) | 0 (0.0 %) | 7 (14.9 %) | 47 (100.0 %) | |
| OB | 22 (32.8 %) | 13 (19.4 %) | 6 (8.9 %) | 18 (26.9 %) | 1 (1.5 %) | 7 (10.5 %) | 67 (100.0 %) | |
| Total | 37 (30.1 %) | 16 (13.0 %) | 21 (17.1 %) | 32 (26.0 %) | 2 (1.6 %) | 15 (12.2 %) | 123 (100.0 %) | |

Note: BMI=body mass index, UW=underweight, NW=normal weight, OB=overweight-obese, GI=gastrointestinal.

## DISCUSSION

Among all 251 hemodialysis sessions observed in this study, 85 patients (33.8 %) were involved in at least one acute complication. This result is per the previous study. This result is relatively high, but the percentage of acute complications follows a study in Eritrea, Eastern Africa, that found out the percentage of acute complications found in 30.7 % of all hemodialysis sessions (11). Hypertension and fatigue are the most common complications, followed by gastrointestinal manifestation, fever, hypotension, muscle cramps, and hypoglycemia. Other complications include headache, itching, and sensation of spinning.

Acute hypertension was defined as increased MAP ≥ 15 mmHg during or 24 hours after the dialysis session. Meanwhile, acute hypotension meant decreased systolic blood pressure ≥ 20 mmHg or systolic blood pressure was lower than 90 mmHg (12). In this study, hypertension was one of the most common complications and was higher than the previous study, with the percentage of acute hypertension only 5.06 % (11). The difference could happen because the total samples with hypertension as the main disease etiology were way higher in this study. Patients with ERDS lose the function to filter waste products and maintain homeostasis.

Hemodialysis could help to remove waste products, such as urea, creatinine, and many more. However, during the hemodialysis process, there was a significant change in plasma volume, and it can cause hemodynamic instability. Ultrafiltration, cardiac factors such as left ventricular hypertrophy could be the reason for

intradialytic complications (13). Administration of oxygen, placing the patient in Trendelenburg position, or discontinuing hemodialysis can be options to treat acute hypotension in hemodialysis and preventing life-threatening conditions (6).

In this study, fever was found in 13 % among all sessions. The temperature of dialysate could affect body temperature. Normal human body temperature varies from 36.5 ºC-37.5 ºC. Dialysate temperature of more than 37.5 ºC can cause fever that manifests as shivering in patients. Room temperature also held key factor in causing fever in patients. To prevent fever from happening, maintaining dialysate temperature, the room temperature was crucial (14).

Gastrointestinal manifestations were commonly found in this study, and it was higher than previous studies in Labore, Pakistan (9 %) and Surabaya, Indonesia (7.69 %) (11,14,15). Gastric manifestations vary from gastric pain, nausea, or even vomiting. Uremia also contributes to gastrointestinal manifestations, patients having only twice a week-dialysis sessions had a bigger risk to have high blood urea levels. Gastrointestinal manifestations could happen because of changes in blood pressure, anxiety, eat less or overeat during the session. In this study, the patients felt gastrointestinal manifestations mostly because they overate during the session. Patients who felt this complication were given antihistamine injection (Ranitidine 50 mg/2 mL) (14).

Muscle cramps could happen because of plasma volume depletion, imbalance of electrolytes, or high ultrafiltration rate. Patients with CKD lose their ability to balance certain electrolytes such as potassium and calcium. Dialysis did help the kidney to remove some electrolytes. However, this sudden change could cause patients to feel muscle cramps. In this study, muscle cramp was found in 7.3 % of all sessions, usually, the patients were recommended to do stretching before and after dialysis to cope with the muscle soreness (14).

Hypoglycemia rarely happened in this study. The number similar to the recent study, which was 1.8 %, was low glucose level (≤ 60 mg/dL) (16). Hypoglycemia during or after hemodialysis was less found because in Arsani hospital Indonesia, blood sugar levels were only tested if patients had the signs of hypoglycemia such as sweating, pallor, or loss of consciousness (1). Intradialytic hypoglycemia often happened to patients with type 2 diabetes that were prescribed insulin. Prescribing oral anti-diabetic causes less risk of hypoglycemic episodes in a hemodialysis patient.

Fatigue in CKD patients was often found in this study. Routine hemodialysis takes 3-5 hours for each session, and often patients could feel tired physically and mentally (11). However, sometimes fatigue is also correlated to patients' medical conditions, such as anemia, uremia, malnutrition, and many other conditions. Some patients could feel fatigued because of being immobile for several hours. It is recommended to do aerobic exercise daily and also simple exercise during dialysis to reduce muscle soreness and reduce depression (17).

Other complications include headache, the sensation of itch, and the sensation of spinning. Headache mostly happened because of metabolic changes during the hemodialysis process; sometimes, acute hypertension or hypotension could also cause headaches. Itching is often found in the patient with high blood urea level. Hemodynamic instability (sudden hypertension or sudden hypotension) and low hemoglobin level could be the cause of lightheadedness, the spinning sensation (1).

Most of the patients in this study were overweight or obese, followed by normal weight and underweight. Although BMI measurement cannot differentiate fat mass and lean mass, some studies showed that BMI was a predisposing factor for intradialytic hypotension in hemodialysis sessions (18). Poor nutritional status (low BMI) was associated with higher mortality in CKD patients (19). A study stated that CKD patients with high BMI (except > 40 kg/m2) had a lower mortality rate than CKD patients with lower BMI (< 18.5 kg/m2) (20). There was a significant association between BMI and acute complications in hemodialysis, with underweight and overweight patients being more prone to experiencing acute dialysis complications in this study.

This study provided important information, especially for healthcare in Arsani Hospital and other hospitals around the city. The limitation of this study was the limitation of samples and the short duration of observation. Lack of laboratory checking such as blood glucose level

and kidney function test for the patients due to limited resources.

## CONCLUSION

The number of acute complications during dialysis and post-dialysis is high. Acute complications during and after hemodialysis are commonly not preventable. However, those complications can be anticipated and treated rapidly. Healthcare that works in the hemodialysis unit is recommended to have essential skills and awareness in coping with those complications.

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