Interdialytic Weight Gain as the side effect of Hemodialysis Therapy: A Literature Review

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Abstract

Patients with Chronic Kidney Disease undergo kidney replacement therapy, one of which is hemodialysis. In patients with end-stage CKD, the physiological functions of the kidneys are reduced so that the kidneys are no longer able to regulate urine output. The kidney's response to changes in fluid and sodium intake is not functioning as it should. Excess fluid intake between the two hemodialysis therapies as indicated by an increase in body weight is known as Interdialytic Weight Gain (IDWG). High interdialytic weight gain is associated with poor survival and increased mortality, one of which is due to disorders of the cardiovascular system, edema, heart failure, and hypertension. This literature study aims to identify IDWG as the side effect of therapy as well as the complications that may arise from it.

Keywords : Interdialytic Weight Gain, Hemodialysis, Side effect

1. Hemodialysis Therapy

a. Definition

The basic principle of Hemodialysis is to send blood from the patient to the dialyzer, which will then efficiently remove uremic toxins and excess fluid and send the blood back to the patient [1]. KDOQI recommends that patients with low residual kidney function (GFR less than 2 ml/min) undergo hemodialysis three times a week with a duration of 3 hours each time hemodialysis The use of hemodialysis therapy 2 times a week, is widely practiced in developing countries along with the increasing hemodialysis patient [2]. The main components of the dialysis system are dialysis machines, dialyzers, dialysates, and water treatment systems. The dialyzer controls the transfer of solutes in the blood and water that can cross the semipermeable membrane. The flow of dialysate and blood is simultaneous and opposite. The dialysis semipermeable membrane separates the blood flow compartment

from the dialysate flow compartment—the process of transport across the membrane diffusion (dialysis) and convection (ultrafiltration).

Diffusion is the movement of solutes through a semipermeable membrane based on differences in the concentration of substances or molecules. This is the primary mechanism for excreting small molecules such as urea, creatinine, electrolytes, and for the addition of serum bicarbonate. Ultrafiltration is convection flow (water and solutes) that occurs due to differences in hydrostatic pressure and osmotic pressure. The ultrafiltration value depends on the pressure gradient per unit of time. Membrane permeability is measured by the ultrafiltration coefficient with units of mL/mmHg/hour with a range between 2-50 mL/mmHg/hour [3].

a. Indication and Contraindications

The indication for starting hemodialysis therapy is when CKD has entered category five, with a GFR of less than 15 mL/minute. According to Suhardjono, indications for hemodialysis therapy are carried out when there is excess extracellular fluid, hypertension, hyperkalemia, metabolic acidosis, hyperphosphatemia, anemia, neurological disorders such as nephropathy or encephalopathy, and a decrease in the patient's capacity or quality of life. Contraindications for hemodialysis therapy are if there is no vascular access in the patient. In addition, phobia of needles, coagulation disorders, and heart failure are also relative contraindications [4].

b. Complications

In hemodialysis therapy, complications in patients can occur acutely or chronically. Hypotension is an acute complication that often occurs in patients undergoing hemodialysis. Chronic complications in patients undergoing hemodialysis, namely cardiovascular disorders are the main cause of death in patients with end-stage CKD. It is influenced by risk factors such as diabetes mellitus, chronic inflammation, large changes in extracellular volume due to high IDWG, non-healing hypertension, dyslipidemia, anemia, or due to changes in cardiovascular hemodynamics during dialysis.

2. Interdialytic Weight Gain

a. Definition

The increase in IDWG was largely thought to be the result of salt and water intake between two successive dialysis sessions. Fluids and salt are often consumed together with carbohydrates, fats, and

protein, indicating that a higher IDWG may be associated with better nutritional status. However, more water and salt intake expand the extracellular volume. This expansion is considered a key factor for the development of high blood pressure and left ventricular hypertrophy, both of which can substantially increase the risk of death from heart disease [5]. IDWG can be classified based on the percentage of patient's weight gain per dry body weight into Mild < 3%, Moderate 3 – 3.9%, and Severe ⩾ 4% [6].

b. Measurement

Measuring the patient's weight before dialysis, then subtracting the post-dialysis weight from the previous dialysis session divided by the dry body weight produces a large IDWG which can assess patient compliance in limiting fluid intake. IDWG can describe patient compliance with fluid management [7]. The patient's weight is weighed routinely for each hemodialysis therapy both before and after therapy. IDWG was measured by calculating the patient's weight after hemodialysis therapy in the first hemodialysis (first measurement) and right before the second hemodialysis therapy (second measurement), then calculating the delta II measurement

c. Complications

Excess fluid that occurs in patients with high IDWG can increase mortality. In addition, excess fluid can cause several complications such as pulmonary edema, heart failure, delayed wound healing, tissue damage, and impaired bowel function [8]. IDWG values that exceed 4.8% can also be a factor in increased patient mortality. The addition of IDWG values that are too high can have negative effects on the body including hypertension, hypotension, muscle cramps, shortness of breath, nausea, and vomiting [9]. In long-term hemodialysis patients, a higher IDWG is known to be associated with a poorer end of life and increased cardiovascular mortality. In addition, IDWG is positively correlated with the incidence of LVH [10]. Kalantar-Zadeh et al (2009) also revealed that the risk of cardiovascular mortality was significantly higher in Hemodialysis Patients with an IDWG of more than 4 kg [11].

3. Conclusion

This paper concludes that IDWG is one of the side effects of Hemodialysis therapy. However, IDWG is not the only side effect experienced by hemodialysis patients. Therefore, the side effects of hemodialysis therapy should be monitored to reduce complications that cause patient mortality and morbidity.

References

Johnson, R., Feehally, J. and Floege, J., 2015. Comprehensive clinical nephrology. 5th ed. Philadelphia: PA : Elsevier/Saunders.

Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney inter., Suppl. 2013; 3: 1–150.

Daugirdas, JT, Blake, PG, & Ing, TS, 2015, Handbook of Dialysis, 5th ed, Wolters Kluwer Health

Suhardjono. 2015. 'Hemodialisis'. dalam Sudoyo, A. W., Setiyohadi, B., Alwi, I., Simadibrata, M., & Setiadi, S. Buku Ajar Ilmu Penyakit Dalam Edisi VI. Jakarta Pusat: Interna Publishing. pp.2192-2196

Sarkar, S., Kotanko, P. and Levin, N., 2006. Fellows' Forum in Dialysis: Interdialytic Weight Gain: Implications in Hemodialysis Patients. Seminars in Dialysis, 19(5), pp.429-433.

Lee, M., Doh, F., Kim, C., Koo, H., Oh, H., Park, J., Han, S., Yoo, T., Kim, Y., Kim, Y., Yang, C., Kim, N. and Kang, S., 2014. Interdialytic Weight Gain and Cardiovascular Outcome in Incident Hemodialysis Patients. American Journal of Nephrology, 39(5), pp.427-435.

Linberg, M. 2010. Excessive fluid overload among hemodialysis patients: Prevalence, individual characteristic and self regulation of fluid intake (tesis). Sweden : Faculty of Medicine Uppsala Universitet.

Claure-Del Granado, R. and Mehta, R., 2016. Fluid overload in the ICU: evaluation and management. BMC Nephrology, 17(1).

Moissl, U. et al. (2013) "Bioimpedance-guided fluid management in hemodialysis patients," Clinical Journal of the American Society of Nephrology, 8(9), pp. 1575–1582. Available at: https://doi.org/10.2215/cjn.12411212.

Shawky, S.M. et al. (2020) "Correlation between interdialytic weight gain, left ventricular hypertrophy and FGF- 23 in prevalent hemodialysis patients," Journal of Clinical Nephrology, 4(2), pp. 036–043. Available at: https://doi.org/10.29328/journal.jcn.1001057.

Kalantar-Zadeh, K., Regidor, D., Kovesdy, C., Van Wyck, D., Bunnapradist, S., Horwich, T. and Fonarow, G., 2009. Fluid Retention Is Associated With Cardiovascular Mortality in Patients Undergoing Long-Term Hemodialysis. Circulation, 119(5), pp.671-679.