



Effectiveness of intradialytic exercise to reduce interdialytic weight gain in patients on hemodialysis at Private Hospital Yogyakarta[☆]



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KEYWORDS

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Abstract Hemodialysis is a treatment for patients with kidney failure. One of the main problems in patients on hemodialysis is increasing of interdialytic weight gain (IDWG) due to decreased kidney excretion function. Increasing of interdialytic weight gain cause dangerous conditions and reduce the function of whole-body systems, especially cardiovascular and respiratory systems. These conditions require appropriate intervention. Various references reported intradialysis exercise can be an alternative intervention to reduce interdialytic weight gain. The purpose of this study was to determine the effectiveness of intradialytic exercise intervention to reduce interdialytic weight gain in patients on hemodialysis. A quantitative descriptive analytic study was conducted. Sixty-four patients on hemodialysis were randomly selected in hemodialysis unit. Patients performed intradialytic exercise twice a week for 8 weeks. Statistical analysis with general linear model repeated measure showed there was decrease in the interdialytic weight gain mean in patients on hemodialysis after 3–8 weeks intervention intradialytic exercise with p value of 0.000; <0.05 . The interdialytic weight gain mean decrease between 0.281 and 1.438 kg. Performed minimal four weeks intradialytic exercise was effective to reduced interdialytic weight gain in patients on hemodialysis. Based on the results of the study, it is suggested for nurses to educate patient on hemodialysis about intradialytic exercise. Intradialytic exercise can be an alternative independent nursing intervention to reduce interdialytic weight gain in patients on hemodialysis.

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Introduction

Hemodialysis is a live saving treatment to replace of kidney function, especially excretion function in patients with end stage renal disease (ESRD). The aims of hemodialysis to remove nitrogenous substances from the blood and remove excess volume of body fluids.¹ The number of patients on hemodialysis is increasing, therefore special intervention is needed to anticipate various problems.

The incidence of new case patients undergoing hemodialysis has increased year by year. The data from² in 2017 showed the incidence of new case patients on hemodialysis increased from 21,050 to 24,460 (20.8%) in 2016 and increased from 24,460 to 30,831 or 21.1% in 2017. Based on the data, there are 70% of hemodialysis patients who stop hemodialysis die due to cardiovascular disorders 37%.

One of the main problems in patients on hemodialysis is increasing of interdialytic weight gain (IDWG). IDWG is weight among dialysis calculated based on pre-dialysis weight minus post-dialysis body weight in the previous dialysis session from the prior treatment. IDWG is one of indicator of the success on hemodialysis.³ Interdialytic weight control is an important intervention for patients undergoing hemodialysis.⁴ Increasing of IDWG can cause cardiovascular disorders. High level of IDWG can cause negative effects on the body including hypotension, muscle cramps, shortness of breath and vomiting.⁵ Absolute IDWG > 3 kg was associated with outcomes other than myocardial infarction: point estimates ranged from 1.11 to 1.20 (heart failure).⁶ High level of IDWG is an indication of inadequate hemodialysis. Therefore, patients on hemodialysis need intervention to achieve hemodialysis adequacy and normal IDWG levels.

Intradialytic exercise is one alternative intervention to manage IDWG. Intradialytic exercise is all active and passive movements, especially in the upper and lower extremities performed during hemodialysis.⁷ Intradialytic exercise improves muscle pump function, peripheral vasodilation and increase venous return, thereby increasing the process of diffusion, osmosis and ultrafiltration during dialysis.⁸ The effect of intradialytic session is IDWG level more controlled during the interdialysis session.

Based on a preliminary study in the Hemodialysis Unit in Yogyakarta, the incidence of ESRD increased by 17.08% and hemodialysis visits increased by 48.86% in 2017. Almost all patients undergoing hemodialysis have increased of IDWG. Based on interviews with hemodialysis nurses that hemodialysis is just a routine procedure. Nurses have not developed nursing intervention yet to reduce IDWG during hemodialysis. This phenomenon is a new issue to be studied. Therefore, it is important to know the effectiveness of intradialytic exercise to reduce IDWG in patients on hemodialysis.

Methods

The purpose of this study was to determine the effectiveness of intradialytic exercise intervention to reduce interdialytic weight gain in patients on hemodialysis. A quantitative descriptive analytic study was conducted. Sixty-four patients on hemodialysis were randomly selected in hemodialysis unit. Patients performed intradialytic exercise consisting of *stretching* and *strengthening* exercise

twice a week for 8 weeks. Each patient given an example of the movement in the IDWG exercise and leaflet about the movement in the IDWG exercise. The research instruments used include weight scales hat have been standardized by hospitals and observation sheets to write body weight before hemodialysis and after hemodialysis in the previous period.

Results

Based on Table 1, it is known that the largest number of respondents were male, 43 people (61.2%). It showed that male has a greater risk to ESRD and undergoing hemodialysis. It is also known that the majority of respondents 41–65 years old (70.3%). It showed that people in advanced adulthood and early elderly have a risk to ESRD and undergoing hemodialysis.

Based on Table 2, it is known that the mean IDWG in the intervention group was greater than the control group before the intradialytic exercise intervention. The mean of IDWG in the intervention group was 3.04 ± 1.21 kg. This IDWG is still in normal tolerance, which is less than 5% body weight after dialysis.

Based on Table 3, there is a significant difference in average body weight before and after intradialytic exercise with $p = 0.000, < 0.05$. It showed that intradialytic exercise intervention can reduce the IDWG in patients on hemodialysis.

Fig. 1 depicts significant differences in weight variables occurred from the first week after the intervention. This study found that intradialytic exercise interventions were very effective to reduce IDWG.

Table 4 shows significant difference of IDWG between the intervention group and the control group with $p = 0.000; < 0.05$. It showed that intradialytic exercise interventions were effective to reduce IDWG in patients on hemodialysis.

Fig. 2 reveals statistically intradialytic exercise has significant effect on the IDWG. The effect was starting the

Table 1 Characteristics of respondents (N = 64).

No	Characteristics	N	Percentage (%)
Sex	Female	21	32.8
	Male	43	61.2
Age	20–40	12	18.8
	41–65	45	70.3
	>65	7	10.9

Source: Primary data.

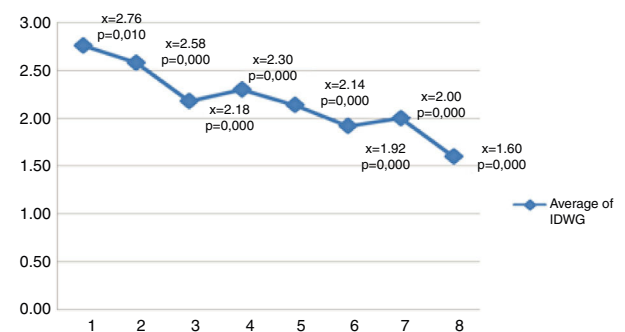


Figure 1 Average of IDWG by observations every week.

Table 2 Characteristics of respondents based on IDWG (N = 64).

Variable	Intervention group n = 48		Control group n = 16	
	Mean	SD	Mean	SD
IDWG	3.04	1.21	2.78	0.91

Source: Primary data.

Table 3 Difference of IDWG before and after intradialytic exercise in intervention group.

Variable	Before intradialytic exercise		After intradialytic exercise		p-Value
	Mean	SD	Mean	SD	
IDWG	3.04	1.21	1.60	0.98	0.000

Source: Primary data.

Unit: Kilogram (kg).

Table 4 Average of IDWG in the intervention and control groups.

Variable	Intervention group n = 48		Control group n = 16		p-Value
	Mean	SD	Mean	SD	
IDWG	1.60	0.98	2.98	0.95	0.000

Source: Primary data.

Unit: Kilogram (kg).

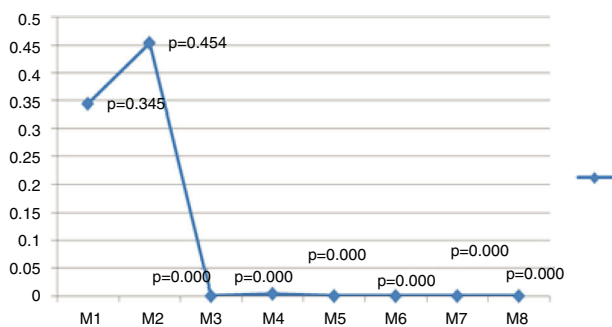


Figure 2 Effect of intradialytic exercise on IDWG.

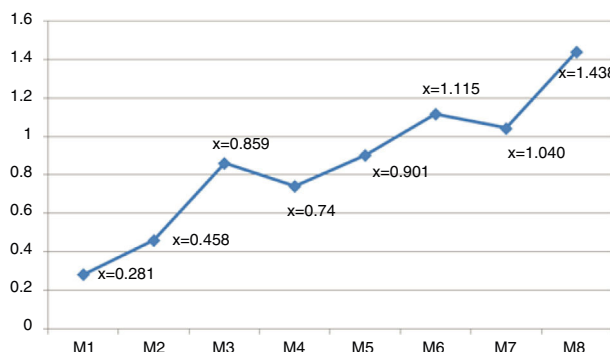


Figure 3 Average decrease on IDWG in observations every week.

third week. That effect was stable after the fourth week compared before intradialytic exercise.

Fig. 3 depicts the average IDWG decreased significantly from 0.281 kg in the first week to 1.438 kg in the eighth week compared before intradialytic exercise intervention.

Discussion

Statistically, there is a significant difference on IDWG before and after intradialytic exercise with $p=0.000$, <0.005 . The mean difference of IDWG from 3.04 ± 1.21 before the intradialytic exercise intervention to 1.60 ± 0.90 after the intradialytic exercise intervention. It indicates that intradialytic exercise has an influence on control IDWG in patients on hemodialysis. The difference of IDWG after exercise occurred because intradialytic exercise improves the pumping system in all of body tissue compartment.

The accumulation of fluid in the tissue compartment will be pumped into the vascular system, the process of diffusion and ultrafiltration becomes more effective as a result weight loss after dialysis becomes more optimal and decreases of edema.⁹ The results of this study are consistent with research by¹⁰ about exercise training in hemodialysis patients: a systematic review and meta-analysis, the study states that exercise include knee extension, abduction and pelvic flexion are performed within six months during dialysis significantly reduced body weight after hemodialysis with $p < 0.0001$.

Statistically, there was also significant differences of IDWG in the intervention group compared with control group $p=0.00$, <0.05 . It indicates that intradialytic exercise is effective in controlling the IDWG of hemodialysis patients.

The mean difference of IDWG in the intervention group was 1.60 ± 0.98 kg compared with control group 2.98 ± 0.95 kg. There was a very adaptive IDWG response. This also means that exercise is very effective in creating pump mechanisms, increasing the mobilization of body fluids and facilitating the process of ultrafiltration.

Statistically, it is also known that the intradialytic exercise interventions have a significant effect on IDWG with a *p* value of 0.000, <0.05 after 8 weeks. When analyzed based on data in every week, it known that statistically intradialytic exercise was a significant effect in the third week. The effect was stable after the fourth week. Based on the average decrease of IDWG, it known that the longer of the exercise duration, the better of IDWG. It is supported by the average IDWG reduce 0.281 kg in the first week to 1.438 in the eighth week compared before intradialytic exercise. This shows that exercise effective to reduce IDWG.

Intradialytic exercise has an effective effect on IDWG because intradialytic exercise as a vascular pumping which increases the mobilization of tissue fluid into the vascular system. Furthermore, the vascular fluid will be withdrawn during the ultrafiltration process. This condition led decreasing the degree of edema and body weight until interdialysis. This vascular pumping system also strongly influenced by the physiological adaptability of blood vessels. Intradialytic exercise will improve body compensation by optimizing venous development and improving mobilization of body fluids through activation of muscle pumps, especially in the lower limb muscles thereby increasing fluid mobility from lower extremities and reducing the severity of edema during ultrafiltration in the intrahemodialysis phase. The results of this study support the research by⁹ that the movement of muscles in the lower limb during the dialysis process will optimize the function of ultrafiltration. This condition causes the remove of fluid out of the body up to 78–96% of the target.

Exercise in hemodialysis patients is an adjuvant therapy, which recommended to improve the effectiveness of the hemodialysis intervention.¹¹ Intradialytic exercise during hemodialysis has been shown to increase muscle mass. It prevents the occurrence of protein catabolism. Increased muscle mass causes weight gain but not due to water retention in free space which causes edema. Furthermore, interdialysis exercise increases fluid mobilization and makes balance of body compartment. Patients on hemodialysis are suggested to do aerobic exercise for 30 min 5 days a week and resistance exercise for 10 min 2 times a week.¹²

However, to control IDWG, hemodialysis exercise, and excessive fluid intake should be monitored. Patients on hemodialysis are recommended to restrict fluid intake by calculating the amount of urine output in a day 300–600 cc/day.¹³ The decrease on IDWG is one of the important indicators because it indicates the hemodialysis adequacy and improve healthy status in patients on hemodialysis.¹⁴ Minimal three weeks Intradialytic exercise

was effective to reduced intradialytic weight gain in patients on hemodialysis. Based on the results of the study, it has been suggested for nurses to educate patient on hemodialysis about intradialytic exercise.

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Conflict of interests

The authors declare no conflict of interest.

References

- Hinkle JL, Cheever F K.H. Brunner & Suddarth's textbook of medical surgical nursing. 14th ed. Philadelphia: Wolters Kluwer; 2018.
- Indonesian Renal Registry (IRR). 10th Report of Indonesian Renal Registry; 2017. Available at: <http://www.um.es/eglobal/5/05b01.html> [accessed 18.11.19].
- Maheswari J. Essential orthopaedics. London: Jaypee Brothers Medical Pub; 2012.
- Ignatavicius DD, Workman ML, Rebar C. Medical-surgical nursing: concepts for interprofessional collaborative care. 9th ed. USA: Elsevier; 2018. p. 2018.
- Moisl U, Guillen MA, Wabel P, Fonsere N, Carrera M, Campistol JM, et al. Bioimpedance-guided fluid management in hemodialysis patients. *Clin J Am Soc Nephrol*. 2013;8:1575–82.
- Stefánsson BV, Brunelli SM, Cabrera C, Rosenbaum D, Anum E, Ramakrishnan K, et al. Intradialytic hypotension and risk of cardiovascular disease. *Clin J Am Soc Nephrol*. 2014;9:2124–32.
- Mahrova A, Svagrova K. Exercise therapy – additional tool for managing physical and psychological problems on hemodialysis. *INTECH*; 2013, <http://dx.doi.org/10.5772/53058>. Chapter 36 [accessed 18.11.19].
- Jung TD, Park HS. Intradialytic exercise program for hemodialysis patients. *Chonnam Med J*. 2011;47:61–5.
- Madhavan G, Nemcek MA, Martinez DG, McLeod KJ. Enhancing hemodialysis efficacy through neuromuscular stimulation. *Blood Purif*. 2009;27:58–63.
- Smart N, Steele M. Exercise training in haemodialysis patients: a systematic review and meta-analysis. *Nephrology*. 2011;16:626–32.
- Kirkman DL, Roberts LD, Kelm M, Wagner J, Jibani MM, Macdonald JH. Interaction between intradialytic exercise and hemodialysis adequacy. *Am J Nephrol*. 2013;38:475–82.
- Kosmadakis GC, Bevington A, Smith AC, Clapp EL, Viana JL, Bishop NC, et al. Physical exercise in patients with severe kidney disease. *Nephron Clin Pract*. 2010;115:c7–16.
- Ignatavicius DD, Workman ML. Medical surgical nursing: patient centered collaborative care. 6th ed. USA: Elsevier; 2010.
- Wilund KR, Jeong JH, Biruete A, Fernhall B. Effects of acute intradialytic exercise on cardiovascular responses in hemodialysis patients. *Hemodial Int*. 2018;22:524–33.