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Effectiveness of Intradialytic Leg Ergometry and Stretching Exercises on Fatigue and Muscle Cramps Among Patients Subjected to Hemodialysis at Tertiary Care Hospitals of Sikkim

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ABSTRACT

Fatigue and severe muscle cramps have a significant impact on patients' health-related quality of life and are common in chronic hemodialysis patients. The purpose of this study was to see how effective intradialytic leg ergometry and stretching exercises were at reducing fatigue and muscle cramps in hemodialysis patients at tertiary care hospitals. A quasi-experimental study conducted among 58 patients undergoing hemodialysis, randomly selected experimental and control group. Experimental group received intradialytic leg ergometry and stretching exercises during the first 2 hrs of dialysis session for a total duration of 4 weeks. Data on fatigue and muscle cramps were assessed using Multidimensional Assessment of Fatigue Scale (MAF) and PENN Spasm Frequency Scale (PSFS) respectively, at the beginning prior to implementation of intervention and re assessed during the 4th week. The study finding showed that the mean posttest score of fatigue in the experimental group was 26.86±8.228 was lesser than mean posttest score in control group 32.40±8.726, where the differences between the two groups was statistically significant at $p<0.05$ level. Similarly with regard to muscle cramps the mean posttest score in experimental group was 1.21±0.491 was lesser than mean posttest score in control group 2.07±0.884 where the differences between the two groups was statistically significant at $p<0.05$ level. The findings concluded that intradialytic leg ergometry and stretching exercises were beneficial in reducing fatigue and muscle cramps in hemodialysis patient.

Keywords: *Hemodialysis, Fatigue, Muscle Cramps, Intradialytic ergometry*

INTRODUCTION

"Bones can break off, muscles can go weak and weary, glands can laze off, and even the brain can nod off without threatening one's life. Still then, if the renal function acts up, no bone, muscle, gland, or brain will be able to function." This phrase highlights the importance of kidneys in mortal survival. The kidneys are the major organs of the urinary system. They are in charge of regulating salt, potassium, and acid levels in the body. The kidneys produce hormones that impact the performance of other organs. Chronic kidney disease is distinguished as having a renal anomaly, or "indicator," such as protein in the urine, and having reduced kidney function, for three months in a row or more.Chronic kidney disease (CKD) has changed over the years, but existing global guidelines describe it as an acute renal failure exhibited by a glomerular filtration rate (GFR) of less than 60 mL/min per 1.73 m, or indicators of kidney damage, or sometimes both, for at least three months,

regardless of actual cause.[3]Chronic kidney disease (CKD) is a fast expanding public health concern. According to the 2015 Global Disease Burden Report, CKD is the 12th main cause of death, with a 37.1 percent increase in deaths over two decades. According to the 2017 Global Burden of Disease Study, 12 million people succumbed from CKD.

Dialysis is generally required when 90 percent or above of the renal function has been impaired. Renal function can be diminished quickly or over months or decades. Other treatments are employed early in the course of renal disease to attempt in sustaining renal function and postpone the necessity of replacement therapy. Hemodialysis is a serum treatment that involves the use of a dialysis machine and a specific filter referred as an artificial kidney, or dialyzer. Throughout the treatment, patients may encounter problems such as hypotension, muscle cramps, disequilibrium disorder, and vomiting. Hypotension, infection, muscle spasms, skin irritation, and other complications might occur as a result of hemodialysis.

Hemodialysis patients should be administered 30-minute daily exercise sessions, according to the American National Kidney Association. Intradialytic exercise (IDE) is described as exercise training that occurs during a hemodialysis (HD) session in terms of improving the patient's strength and stamina while also addressing a variety of physiological and psychosocial aspects. The IDE might range from resistance through aerobic and stretching exercises, with range of equipment being utilised depending on the type of activity.

The Kidney Disease Improving Global Outcomes (KDIGO) guidelines (2012) propose that chronic kidney disease patients incorporate exercise into their daily lives (at least 30 minutes per day, 5 times per week), taking into account their cardiovascular health and endurance level.

Despite advancements in End stage renal disease with hemodialysis, functional capacity and health-related quality of life are still relatively low in these patients due to pain, fatigue, and sleep pattern disruptions when compared to the general population. Patients on continuous hemodialysis frequently have painful muscular cramps, primarily in the lower limbs. These cramps usually occur near the conclusion of dialysis sessions, precede hypotension in certain cases, and are linked to increased fluid removal. Repeated muscle cramps are a common cause of failure to comply with hemodialysis treatment, which has a negative influence on patients' quality of life.

Intradialytic leg ergometry is a simple exercise that lowers fatigue and improves physical fitness in patients with chronic renal disease who are already active, as well as in those who are sedentary. During the clinical trials, the investigator discovered that the majority of dialysis patients experience muscle cramps and exhaustion during the procedure. The investigator chose to conduct this study in order to help avoid muscle cramps and tiredness by applying intradialytic leg exercises in patients with muscle cramps and exhaustion in order to lessen the degree of problems.

The aim of the study to assess the effectiveness of intradialytic leg ergometry and stretching exercises on fatigue and muscle cramps among patients subjected to hemodialysis at tertiary care hospital.

Add appropriate original references to the sentences/paragraphs taken from other media/sources.

MATERIALS & METHODS

Research approach: Quantitative approach was adopted for the study

Research design: Quasi-Experimental Research Design

Setting of the study: Tertiary care hospitals of Sikkim.

Sample: 58 patients diagnosed with chronic kidney disease and undergoing hemodialysis and experiencing fatigue and muscle cramps at tertiary care hospitals of Sikkim, out of

which 29 for experimental and 29 for control group.

Sampling technique: Nonprobability Purposive sampling technique.

Criteria for sample selection:
Inclusion criteria

- Hemodialysis patients;
- All age groups
- All the gender
- Have stable cardiac profiles
- Have no musculoskeletal impairments

Exclusion criteria

- Hemodialysis patients;
- Irregular for hemodialysis
- Have femoral catheters
- Have known psychiatric disorders
- Weak and critically ill

Data Collection Tools and Techniques
Socio Demographic data & Clinical data - Self Report
Multidimensional Assessment of Fatigue Scale- Self-Report
PENN Spasm Frequency Scale- Self-Report
Establishment of content validity
Validity of the tools were established by subjecting the tools to seven subject experts (content validity of the tool-1 and face validity of tool-2 and tool-3) and incorporating the suggestions and opinions given by the seven experts from the field of medicine, physiotherapy and nursing. The validation of each tool was done based on the percentage of agreement among the experts. An agreement of 80% or above was taken as valid.

Establishment of reliability
To establish the reliability of the tool, it was administered among 6 patients undergoing hemodialysis at tertiary care hospital in Sikkim. The reliability of Tool-1: Demographic data and clinical data was done with Intra-rater reliability and was found to be reliable (100%) .
Reliability of Tool-2: MAF Scale and Tool-3: PSFS was established by Test-retest method. Established 'r' for MAF scale = 0.7 and PSFS = 0.8.

Data Collection procedures
The final study was conducted from 07/02/22 to 13/03/22 among 58 patients undergoing haemodialysis and having certain level of fatigue and muscle cramps at tertiary care hospitals in Sikkim after Administrative approval was taken from the Concerned authority, informed written consent from each sample under study was taken. Total of 58 samples including 29 each sample for both control and experimental groups who fulfilled the stated criteria were selected using purposive sampling technique. Before Administering the intra- dialytic leg ergometry and stretching exercise to the subjects, demographic data, fatigue and muscle cramp status were assessed as a pre-test. Then the intervention was implemented for the experimental group from the very first day. Exercise Duration comprised of :- 25 minutes (10 minutes of leg ergometry, 5 minutes each of warming up and cooling down before and after the intradialytic leg ergometry and 5 minutes rest in between). Post test scores were obtained on the 4th week (after 9 consecutive sessions of the exercise) after successful completion of exercise program.

Plan For Data Analysis
The data collected were entered into a master data sheet. Data analysis was done using both descriptive and inferential statistics using SPSS.

RESULT

Table 1: Frequency and Percentage Distribution of Demographic Variables (N=58; n_1=29; n_2=29)

S. No	Demographic Variables	Experimental group		Control group	
		Frequency *(f)*	Percentage (%)	Frequency *(f)*	Percentage (%)
1	Age in years				
	18 years & below	2	6.9	4	13.8
	19-30 years	7	24.1	3	10.3
	31-40 years	8	27.6	10	34.5
	41-50 years	6	20.7	7	24.1
	Above 50 years	6	20.7	5	17.2
2	Gender				
	Male	23	79.3	20	69
	Female	6	20.7	9	31
3	Education				
	No formal education	1	3.4	3	10.3
	Primary education	11	37.9	15	51.8
	Secondary education	8	27.6	5	17.2
	Graduate and above	9	31	6	20.7
4	Lifestyle				
	Active	5	17.2	6	20.7
	Limited activity	22	75.9	20	69
	Sedentary	2	6.9	3	10.3

Table 2 : Frequency and Percentage Distribution of clinical Variables. (N=58; n_1=29; n_2=29)

S. No	Clinical Variables	Experimental group		Control group	
		Frequency *(f)*	Percentage (%)	Frequency *(f)*	Percentage (%)
1	Duration of dialysis				
	< 1 year	5	17.2	3	10.3
	1-3 years	9	31	10	34.5
	> 3 years	15	51.8	16	55.2
2	Frequency of dialysis				
	Twice a week	17	58.7	19	65.5
	Thrice a week	12	41.3	10	34.5
3	Any comorbidities				
	Hypertension	19	65.5	17	58.7
	Diabetes mellitus	14	48.2	10	34.5

Table 3: Distribution of pre-test and post-test level of fatigue among patients subjected to hemodialysis in experimental and control group (N=58; n_1=29; n_2=29)

Level of Fatigue	Experimental group(n_1)				Control group(n_2)			
	Pretest		Post-Test		Pretest		Post-Test	
	f	%	*f*	%	*f*	%	*f*	%
Mild	3	10.3	19	65.6	2	6.9	5	17.2
Moderate	15	51.8	8	27.5	17	58.6	16	55.3
Severe	11	37.9	2	6.9	10	34.5	8	27.5

The data presented in Table 3 depicts that in experimental group during pre-test 15(51.8%) of hemodialysis patients were having moderate fatigue, 11(37.9%) had severe fatigue and 3(10.3%) had mild fatigue while in post-test 19(65.6%) had mild fatigue, 8(27.5%) had moderate fatigue and 2(6.9%) had severe fatigue. In control group during pre-test 17(58.6%) of hemodialysis patients were having moderate fatigue, 10(34.5%) had severe fatigue and 2(6.9%) had mild fatigue but in post-test 16(55.3%) of hemodialysis patients were having moderate fatigue, 8(27.5%) had severe fatigue and 5(17.2%) had mild fatigue.

Table 4: Distribution of pre-test and post-test level of muscle cramps among patients subjected to hemodialysis in experimental and control group (N=58; n_1=29; n_2=29)

Level of Muscle cramps	Experimental group(n_1)				Control group(n_2)			
	Pretest		Post test		Pretest		Pos Test	
	f	%	*f*	%	*f*	%	*f*	%
Mild	6	20.7	20	68.9	4	13.8	5	17.3
Moderate	13	44.8	6	20.7	14	48.3	15	51.7
Severe	10	34.5	3	10.3	11	37.9	9	31

The data presented in Table 4 illustrates that in experimental group during pre-test 13(44.8%) of hemodialysis patients had moderate muscle cramps, 10(34.5%) had severe muscle cramps and 6(20.7%) had mild muscle cramps where as in post-test 20(68.9%) of hemodialysis patients had mild muscle cramps, 6(20.7%) had moderate muscle cramps and 3(10.3%) had severe muscle cramps. In control group during pre-test 14(48.3%) of hemodialysis patients had moderate muscle cramps, 11(37.9%) had severe muscle cramps and 4(13.8%) had mild muscle cramps while in post-test 15(51.7%) of hemodialysis patients had moderate muscle cramps, 9(31%) had severe muscle cramps and 5(17.1%) had mild muscle cramps.

Table 5: Comparison of post-test level of fatigue and muscle cramps among patients subjected to hemodialysis in experimental and control group. (N=58)

Comparison		Mean	SD	Mean d	t value	df	p value
Fatigue	Experimental group	26.86	8.228	5.54	2.487	56	0.016*
	Control group	32.40	8.726				
Muscle cramps	Experimental group	1.21	0.491	0.86	4.592	56	0.001*
	Control group	2.07	0.884				

***p<0.05 level of significance**

The data presented in Table 5 illustrates that regarding fatigue among patients subjected to hemodialysisin Experimental group, mean posttest score was 26.86±8.228 was lesser than mean posttest score in control group 32.40±8.726 with mean difference of 5.54 with obtained t value (t=2.487 at df=56) was statistically significant at p<0.05 level.

With regard to muscle cramps among patients subjected to hemodialysis in Experimental group, mean posttest score was 1.21±0.491 was lesser than mean posttest score in control group 2.07±0.884 with mean difference of 0.86 with obtained t value (t=4.592 at df=56) was statistically significant at p<0.05 level.

Table 6: Association between pre-test level of fatigue with their selected demographic variables among patients subjected to hemodialysis in experimental group. n=29

S. No	Demographic Variables	Pre-test level of Fatigue		χ^2 value	df	p value
		<34 *f*	≥34 *f*			
1	Age in years					
	18 years & below	2	0			
	19-30 years	2	5	5.925	4	0.205^{NS}
	31-40 years	6	2			
	41-50 years	2	4			
	Above 50 years	3	3			
2	Gender					
	Male	11	12	0.676	1	0.411^{NS}
	Female	4	2			(0.651)
3	Education					
	No formal education	0	1			
	Primary education	5	6	3.171	3	0.366^{NS}
	Secondary education	6	2			
	Graduate and above	4	5			
4	Lifestyle					
	Active	4	1			0.152^{NS}
	Limited activity	11	11	3.770	2	(1.000)
	Sedentary	0	2			
5	Duration of dialysis					
	< 1 year	3	2			
	1-3 years	7	2	4.615	2	0.099^{NS}
	> 3 years	5	10			
6	Frequency of dialysis					
	Twice a week	9	8	0.024	1	0.876^{NS}
	Thrice a week	6	6			(1.000)

***p<0.05 level of significance NS-Not significant**

Table 7: Association between pre-test level of muscle cramps with their selected demographic variables among patients subjected to hemodialysis in experimental group. n=29

S. No	Demographic Variables	Pre-test level of Muscle cramps		χ^2 value	df	p value
		<2 *f*	≥2 *f*			
1	Age in years					
	18 years & below	1	1			
	19-30 years	4	3	4.552	4	0.336^{NS}
	31-40 years	7	1			
	41-50 years	4	2			
	Above 50 years	2	4			
2	Gender					
	Male	14	9	0.068	1	0.794^{NS}
	Female	4	2			(1.000)
3	Education					
	No formal education	0	1			
	Primary education	8	3			
	Secondary education	5	3	2.330	3	0.507^{NS}
	Graduate and above	5	4			
4	Lifestyle					
	Active	4	1			
	Limited activity	13	9	0.889	2	0.641^{NS}
	Sedentary	1	1			
5	Duration of dialysis					
	< 1 year	2	3			
	1-3 years	7	2	2.005	2	0.367^{NS}
	> 3 years	9	6			
6	Frequency of dialysis					
	Twice a week	12	5	1.266	1	0.260^{NS}
	Thrice a week	6	6			(0.438)

***p<0.05 level of significance NS-Not significant**

DISCUSSION

Present study findings revealed that 19(65.6%) of the patients had mild fatigue in the post test level of fatigue compared to only 3(10.3%) of the patients in the pretest level of fatigue in the experimental group. On the other hand, in the control group during pre-test 17(58.6%) of hemodialysis patients were having moderate fatigue, 10(34.5%) had severe fatigue and 2(6.9%) had mild fatigue but in post-test 16(55.3%) of hemodialysis patients were having moderate fatigue, 8(27.5%) had severe fatigue and 5(17.2%) had mild fatigue.

The current findings are congruent with those of Farzaneh Salehi et al., who conducted a study on the effectiveness of exercise on fatigue in hemodialysis patients. In total, 37 individuals took part in the study. The fatigue level was assessed using the Multidimensional Fatigue Inventory. During and after the intervention, the patients' fatigue was measured four times. The intervention group's mean fatigue score began at 58.80 ± 15.29 and steadily fell to 58.78 ± 13.54, 58.75 ± 14.73, 54.20 ± 15.16, and 54.23 ± 13.60 after 3 months of intervention and 1 month post-intervention, respectively. This study is in consistent with the present findings as we see that there is gradual decrease in the level of fatigue among the interventional group and statistically significant differences were observed in the third month (P = 0.001) and one month following the intervention ($P < 0.001$), between the intervention and control groups.

Present study findings revealed that during the post test 20(68.9%) of the patients had mild muscle cramps as compared to only 6(20.7%) patients during the pre test in the experimental group. Whilst in the control group during pre-test 14(48.3%) of hemodialysis patients had moderate muscle cramps, 11(37.9%) had severe muscle cramps and 4(13.8%) had mild muscle cramps which almost reflected the same score even during post-test with 15(51.7%) of hemodialysis patients having moderate muscle cramps, 9(31%) had severe muscle cramps and 5(17.1%) with mild muscle cramps.

The findings of the study is similar to Vimala, who reported that majority of the patients had severe to moderate muscle cramps before the intradialytic intervention which significantly improved to mild level of pain after the intervention.

Present study findings revealed that the test of significance for both the fatigue and muscle cramps, p-value is 0.001<0.05 which infers that intradialytic leg ergometry and stretching exercises were effective in reducing fatigue and muscle cramps among the experimental group subjected to hemodialysis.

The study findings supported by Ramai Palar and Diana Lobo, conducted a quasi-experimental study on effectiveness of intradialytic exercise on fatigue in maintenance hemodialysis patients. In this study, 40 samples were included. This study revealed p value <0.001 indicating that intradialytic exercise program was effective in decreasing the fatigue.

CONCLUSION

The main centre of the study was to identify the severity of fatigue and muscle cramps experienced by patients undergoing hemodialysis and also to explore the effectiveness of intradialytic leg ergometry and stretching exercises in reducing the severity of fatigue and muscle cramps. The study revealed that most of the hemodialysis patients experiences some certain level of fatigue and muscle cramps for which interfered with their daily activities. The study also revealed that the intradialytic ergometry and stretching exercises implemented during the dialysis session was effective in reducing the severity of fatigue and cramps and thus improving the quality of life.

Declaration by Authors

Ethical Approval: Approved by Institutional Ethics Committee, Sikkim Manipal Institute of Medical Sciences

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