

Effect of Intradialytic Stretching Exercises on Lower Limbs Muscle Cramps among Patients Undergoing Regular Haemodialysis

M J Kumari¹, Kiruthika SR², Sreejith Parameswaran³, Arul Nisha⁴

Summary

Many patients suffer with muscle cramps and discomfort during the haemodialysis procedure. Intradialytic stretching exercises are helpful in reducing the intensity of muscle cramps. The study objective was to evaluate the effect of intradialytic stretching exercises on lower limbs muscle cramps on the patients undergoing regular haemodialysis in study group when compared with control group. Experimental research design were adopted for the study; 126 patients undergoing regular haemodialysis in outpatient haemodialysis centre were randomly allotted for study and control groups i.e. 63 in each group. The patients' muscle cramps was assessed using cramp questionnaire chart developed by Basemath SS Morris in both groups. Intradialytic stretching exercises were provided to the patients in the study group in each leg from their 3rd to 10th sitting. Post-assessment was carried out on their 4th, 7th, and 10th sitting in the study group and the control groups. The control group patients were received routine hospital care. The lower limb muscle cramps mean score was found improvement from pre-assessment lower limb muscle cramp mean score 4.11 to post-assessment 10th sitting means score 2.086 after intradialytic stretching exercise in the study group. The study result showed that in post-assessment the lower limb muscle cramps was much better among the patients in study group who received the intradialytic stretching exercise than the patients in the control group who received routine hospital care. Intradialytic stretching exercises are reducing the intensity of muscle cramps in patients undergoing haemodialysis.

Key words: Haemodialysis, Chronic kidney disease, Intradialytic stretching exercise.

Chronic kidney diseases (CKD) affects more than 850 million people worldwide and will become the fifth largest cause of years of life lost by 2040. CKD in India is often diagnosed late. Lack of awareness often plays an important role, and the absence of symptoms (higher incidence of interstitial nephritis and CKD of unknown origin) contributes to the delay. The burden of kidney failure is increasing, with almost 210,000 new cases being diagnosed each year (Borg et al, 2023; Raghavan et al, 2023). Ten percent of the population worldwide is affected by chronic kidney disease and millions die each year because they do not have access to affordable treatment (Jha et al, 2013). Over 2 million people worldwide currently receive treatment with dialysis or a kidney transplant to stay alive, yet this number may only represent 10 percent of people who actually need treatment to live (Jha et al, 2013; Couser et al, 2011). As the patients coming for the department of nephrology with the diagnosis of chronic kidney disease, renal failure

and end-stage renal disease are undergoing the treatment of haemodialysis (HD). While undergoing haemodialysis procedure, patients experience muscle cramps and leg pain due to prolonged sitting. The present study outlines intradialytic stretching exercises to the patients undergoing haemodialysis, which helped them in reducing their muscle cramps. It is a non-invasive cost effective procedure and with no harm to the patients; and by teaching exercises patients may feel more comfort as it has reduces their muscle cramps (Cruz et al, 2011). They have to come twice or thrice in a week and have to sit for complete four hours during the procedure. Intradialytic stretching exercises are helpful in reducing the intensity of muscle cramps.

Objectives

The objective of this study was to evaluate the effect of intradialytic stretching exercises on lower limbs muscle cramps on the patients undergoing regular haemodialysis in the study group by comparison with the control group. By practice and teaching, this simple exercise will help to reduce their muscle cramps. So, the investigator undertook this study.

The authors are: 1. Professor & Principal (Ag.); 3. Additional Professor and Head of the Dept.; 4. Tutor, all are College of Nursing, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry.

Review of Literature

Sheng et al (2014) in a study on Intradialytic Exercise in Haemodialysis (HD) Patients: A Systematic Review and Meta-Analysis systematically analysed the effect of intradialytic exercises on haemodialysis patients and studied various randomised control trials. Medline, Embase, and Cochrane Central Register of Controlled studies were analysed and it was found that intradialytic exercises are very useful in increasing peak oxygen consumption and physical performance in physical function of life. Further, it does not bring any changes in mental health, cardiovascular and musculoskeletal condition of the patients. They also found that exercises to the study group for more than six months significantly increase the peak oxygen consumption; if the trial period is less than 3 months then it will not produce significant changes in peak oxygen consumption (Salem & Elhadary, 2017).

Carletti et al (2017) conducted a study on intradialytic exercise and postural control in patients with chronic kidney disease undergoing haemodialysis. A pilot study with seven individuals was undertaken. The Berg Balance Scale evaluated balance and postural balance. Secondary outcomes about functional capacity and body composition (DEXA) were evaluated. The ergo metric exercises were given through attaching bicycle to the haemodialysis machine and exercises given for 50 to 60 minutes in the first two hours of haemodialysis for three times a week for 12 weeks. Every Monday, Wednesday, Friday in a week, participants were allotted to experiment group and on Tuesday, Thursday, and Saturday, participants' were allotted to control group. Through this study they concluded that aerobic exercises will be useful only in decreasing leg lean mass, leg body mass and improve lower limb strength. It will not produce any changes in the postural control of the patients undergoing haemodialysis (Sheng et al, 2014).

Frih et al (2017) conducted a study on the effect of interdialytic combined resistance and aerobic exercise training on health-related outcomes in chronic haemodialysis patients: They recruited patients undergoing HD from the nephrology and internal medicine service in Tunisia. Eligible patients (21 and 20 respectively) were randomised and allotted to study and control group. The authors examined the effect of endurance-resistance training programme on physical capacity, biochemical markers, nutritional status, and psychological outcomes in chronic HD patients. They provided exercises for the intervention group for the time period of 4 months about four times once a month. The experimental sessions were conducted on non-

dialysis days, 18-24 hr following a dialysis treatment. On the first visit, patient's anxiety was assessed and underwent 24-hr ambulatory blood pressure monitoring (ABPM). On the 2nd visit nutritional status was assessed using mini nutritional assessment and on 3rd visit exercises were taught to them. It was found that combined resistance and aerobic exercise programme are helpful in patients undergoing haemodialysis in terms of physical performance and nutrition. Systolic and diastolic blood pressure also decreased but there were no significant changes in the cholesterol, albumin, C-reactive protein levels (Carletti et al, 2017).

Lekha et al (2016) conducted a study on effectiveness of intradialytic stretching exercises on prevention and reduction of muscle cramps among patients undergoing haemodialysis at PSG Hospitals, Coimbatore. The researchers conducted study using 60 samples in, 30 samples each in experiment and control group. The experimental group will get intradialytic stretching exercises for about 20 minutes during third hour of haemodialysis till the patients finishing post-test III. Intradialytic exercises were provided to the patients up to their 10th sitting; post-test will be done on 4th, 7th, and 10th sitting of HD. Assessment was done using cramp questionnaire chart; visual analogue scale, and demographic and clinical variables were assessed. Results showed that intradialytic stretching exercises help in reducing the muscle cramps of the patients undergoing hemodialysis (Frih et al, 2017).

Rhee et al (2017) conducted a study on role of intradialytic exercise on physical function and reducing intradialytic hypotension and depression in HD patients. They enrolled 22 patients from the haemodialysis centre and conducted a non-randomisation study for six months. Data including physical fitness test results, dialysis-related measurements, and biochemical laboratory results were collected at baseline on third and sixth months. Depression and quality of life were assessed using Beck Depression Inventory and Short Form-36 health survey. They were given combination of both aerobic and anaerobic exercises using bicycle ergometer and with elastic bands respectively during haemodialysis. Results that intradialytic exercises are helpful in reducing intradialytic hypotension, depression in terms of mental health and also effective on physical health status (Lekha et al, 2016).

Materials and Methods

Experimental research design was adopted for the study (pre- and post-assessment with control group research design). The study inclusion

criteria were patients undergoing regular haemodialysis in outpatient haemodialysis centre JIPMER, both gender with above 18 years, patients who were able to communicate Tamil or English language. Exclusion criteria of the study were patients undergoing emergency, patients with other co-morbid illnesses (e.g. heart diseases, malignancy, and liver diseases), patients with femoral catheters, and patients with lower limbs disability.

In study group the patients were assigned randomly to whom interventions were provided i.e. intradialytic stretching exercises. For control group, such patients were assigned randomly who had received their routine hospital care. The study was conducted in the outpatient haemodialysis centre in JIPMER. The sample size was 126 participants i.e. 63 in each group. The sample size was calculated by comparing the frequency of leg muscle cramps among study participants with before and after leg stretching exercises as mean of 2.03 ± 1.71 and standard deviation of 0.63 ± 0.8 respectively and power of the study as 80 percent and with 5 percent level of significance (Salem & Elhadary, 2017). Randomisation was done by using simple random method by allocating patients to study group or control group by using lottery method. Demographic and clinical variables were assessed using subject data sheet on their 1st sitting in haemodialysis. Pre-test was assessed on 2nd sitting among patients in the study and control groups' using cramp questionnaire chart. The patients muscle cramps was assessed using cramp questionnaire chart developed by Basemath SS Morris Scoring interpretation for cramp questionnaire chart; '0' denote as no cramps, 1-4 notes as mild cramps, 5-8 as moderate cramps, and 9-13 indicated severe cramps. No score was assigned for demographic and clinical variables.

Intervention for the Study Group

Pre-assessment was carried out on 2nd sitting among patients in the study group using cramp questionnaire chart. Intradialytic stretching exercises namely ankle dorsiflexion, soleus-passive stretching and hamstring stretching were provided to the patients in the study group in each leg for 20 minutes from their 3rd sitting to their 10th sitting. Post-assessment was carried out on their 4th, 7th, and 10th sitting in the study group. Intradialytic stretching exercises comprised as follows (Sheng et al, 2019; Carletti et al, 2017).

Intervention for the Control Group

Pre-assessment has done on 2nd sitting among patients in the control group using cramp questionnaire chart. The patients in the control

group received routine hospital care. Post-assessment was carried out on their 4th, 7th, and 10th sitting in both the control group.

Data Collection Methods

Ethical clearance was obtained from the Institute ethical committee before starting the research. Informed consent was obtained from each participant in both the groups. Demographic and clinical variables from the participants in both groups were obtained through face to face interviews and case sheet. The patients' lower limb muscle cramp was assessed by Basemath SS Morris structured questionnaire for both groups. Duration of haemodialysis procedure was four hours. Intradialytic stretching exercises were provided to the study group patients during their 3rd hour of haemodialysis. Intradialytic stretching exercises was given to each participant for 20 minutes in both legs in the study group. The control group patients received routine hospital care. Pre-assessment was done on 2nd sitting among patients in both the groups using cramp questionnaire chart.

The statistical analysis used for the study was demographic and clinical variables expressed as frequency and percentages. The continuous variables such as age, duration of haemodialysis, was expressed as mean with standard deviation. The comparison of effect of intradialytic stretching exercises between study group and control group was carried out by using independent 't' test/Student 't' test. The comparison of effect of intradialytic stretching exercises between pre-test and post-test in the study group was done by paired 't' test. All statistical analysis was carried out at 5 percent level of significance and $p < 0.05$ was considered as significant.

Results

The study results (Table 1) show the demographic and clinical variables of the haemodialysis patients in study and control groups. There is a homogeneity in the two groups such as age in years, gender, co-morbidity, duration of illness, education level, occupation, duration of haemodialysis treatment, experience of muscle while doing daily activities, experience of cramps during dialysis, side of the cramps leg, cramp restrict the activity, muscle cramp present.

Table 2 shows the effect of intradialytic stretching exercise on lower limb muscle cramp on the patients undergoing regular haemodialysis in the study group. Table 3 reveals that the comparisons of the effect of intradialytic stretching

Table 1: Demographic and clinical variables of the patient undergone haemodialysis

Demographic variables		Experimental group (n=63)		Control group (n=63)		Total (N=126)	
		No.	%	No.	%	No.	%
Age in years	<30	20	31.7	18	28.6	38	30.2
	31 -40	13	20.6	11	17.5	24	19
	>40	30	47.6	34	54	64	50.8
Gender	Male	42	66.7	47	74.6	89	70.6
	Female	21	33.3	16	25.4	37	29.4
Co-morbidity	Yes	17	27	16	25.4	33	26.2
	No	46	73	47	74.6	93	73.8
Duration of illness	<1 year	33	52.4	26	41.3	59	46.8
	1 – 3 years	22	34.9	20	31.7	42	33.3
	>3 years	8	12.7	17	27	25	19.8
Education level	Non-formal	14	22.2	9	14.3	23	18.3
	Primary	3	4.8	4	6.3	7	5.6
	High school	20	31.7	11	17.5	31	24.6
	HS school	6	9.5	16	25.4	22	17.5
	Graduate	20	31.7	23	36.5	43	34
Occupation	Unemployed	43	68.3	32	50.8	75	59.5
	Private job	4	6.3	9	14.3	13	10.3
	Business	10	15.9	16	25.4	26	20.6
	Govt. job	6	9.5	6	9.5	12	9.5
Duration of hemodialysis treatment	Weekly	31	49.2	32	50.8	63	50
	Monthly	12	19	12	19	24	19
	Yearly	20	31.7	19	30.2	39	31
Experience of muscle while doing daily activities	Yes	24	38.1	19	30.2	43	34.1
	No	39	61.9	44	69.8	83	65.9
Experience of cramps during dialysis	Yes	32	50.8	17	27	49	38.9
	No	31	49.2	46	73	77	61.1
Side of the cramps leg	Nil	22	34.9	38	60.3	60	47.6
	Right leg	9	14.3	7	11.1	16	12.7
	Left leg	9	14.3	6	9.5	15	11.9
	Both legs	23	36.5	12	19	35	27.8
Cramp restrict the activity	Yes	17	27	6	9.5	23	18.3
	No	46	73	57	90.5	103	81.7
Muscle cramp present in	Nil	22	34.9	39	61.9	61	48.4
	Calf muscle	28	44.4	16	25.4	44	34.9
	Hamstring	3	4.8	4	6.3	7	5.6
	Soleus	10	15.9	4	6.3	14	11.1

Table 2: Effect of intradialytic stretching exercise on lower limb muscle cramp on the patients undergoing regular haemodialysis within the study group (N=63)

Level of muscle cramp	Pre-assessment		Post-assessment					
			In 4th sitting		In 7th sitting		In 10th sitting	
	No.	%	No.	%	No.	%	No.	%
No cramp (0)	18	28.6	21	33.3	32	50.8	37	58.7
Mild cramps (1-4)	18	28.6	16	25.4	16	25.4	19	30.2
Moderate cramps (5-8)	18	28.6	24	38.1	14	22.2	7	11.1
Severe cramps (6-10)	9	14.3	2	3.2	1	1.6	0	0

exercise on lower limb muscle cramp of patients mean and standard deviation in the study group between pre- and post-assessment of 4th, 7th and 10th sitting. According to the data, the lower limb muscle cramp mean score was found to improve from pre-assessment mean score of 4.11 to post-assessment 10th sitting means score of 2.086 after intradialytic stretching exercise in the study group.

A comparison of the mean and standard deviation of lower limb muscle cramp on the patients undergoing regular haemodialysis in pre-

and post-assessment within the control group. On 4, 7 and 10 sitting is in Table 4. The lower limb muscle cramp mean score improved from pre-assessment mean score of 2.86 to post-assessment in 10th sitting with mean score of 2.843 after routine hospital care in the control group.

Table 5 shows the comparison of level of lower limb muscle cramp on the patients undergoing regular haemodialysis in pre- and post-assessment of 4th, 7th, and 10th sitting of dialysis in study and control groups. The study data showed that in post-assessment the lower limb muscle cramps

Table 3: Compare the effect of intradialytic stretching exercise on lower limb muscle cramp on the patients undergoing regular haemodialysis within the study group (n=63)

Comparing the lower limb muscle cramp assessment		Mean	Standard deviation	Mean difference	Paired t-test	p-value
Pair - 1	Pre-assessment	4.11	3.570	0.571	2.555	0.13
	Post-assessment in 4th sitting	3.54	3.177			
Pair - 2	Pre-assessment	4.11	3.570	1.794	5.259	0.000 ***(s)
	Post-assessment in 7th sitting	2.32	2.764			
Pair - 3	Pre-assessment	4.11	3.570	2.619	7.868	0.000 ***(s)
	Post-assessment in 10th sitting	1.49	2.086			
Pair - 4	Post-assessment in 4th sitting	3.54	3.177	1.222	4.291	0.000 ***(s)
	Post-assessment in 7th sitting	2.32	2.764			
Pair - 5	Post-assessment in 4th sitting	3.54	3.177	2.048	6.575	0.000 ***(s)
	Post-assessment in 10th sitting	1.49	2.086			
Pair - 6	Post-assessment in 7th sitting	2.32	2.764	0.825	3.157	0.002 **(s)
	Post-assessment in 10th sitting	1.49	2.086			

S = Significant (p<0.001) ***

Table 4: Comparing the mean and standard deviation of lower limb muscle cramp on the patients undergoing regular haemodialysis in pre- and post-assessment within the control group (n=63)

Comparing the muscle cramp assessment		Mean	Standard deviation	Mean difference	paired t-test	p-value
Pair - 1	Pre-assessment	2.86	3.582	-0.143	0.790	-0.433
	Post-assessment in 4th sitting	3.00	3.654			
Pair - 2	Pre-assessment	2.86	3.582	0.571	1.756	0.084
	Post-assessment in 7th sitting	2.29	2.915			
Pair - 3	Pre-assessment	2.86	3.582	0.683	2.524	0.014** (S)
	Post-assessment in 10th sitting	2.17	2.843			
Pair - 4	Post-assessment in 4th sitting	3.00	3.654	0.714	2.500	0.015
	Post-assessment in 7th sitting	2.29	2.915			
Pair - 5	Post-assessment in 4th sitting	3.00	3.654	0.825	2.793	0.007** (S)
	Post-assessment in 10th sitting	2.17	2.843			
Pair - 6	Post-assessment in 7th sitting	2.29	2.915	0.111	0.344	0.732
	Post-assessment in 10th sitting	2.17	2.843			

S = Significant (p<0.01) **

Table 5: Comparative levels of lower limb muscle cramp score of patients undergoing regular haemodialysis in pre- and post-assessment between study and the control groups (N=126)

Level of muscle cramp	Pre-assessment				Post-assessment											
					In 4th sitting				In 7th sitting				In 10th sitting			
	Study group		Control group		Study group		Control group		Study group		Control group		Study group		Control group	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No cramp (0)	18	28.6	34	54	21	33.3	33	52.4	32	50.8	34	54	37	58.7	34	54
Mild cramps (1-4)	18	28.6	7	11.1	16	25.4	5	7.9	16	25.4	12	19	19	30.2	17	27
Moderate cramps (5-8)	18	28.6	17	27	24	38.1	19	30.2	14	22.2	16	25.4	7	11.1	10	15.9
Severe cramps (6-10)	9	14.3	5	7.9	2	3.2	6	9.5	1	1.6	1	1.6	0	0	2	3.2

was much better among the patients in study group who received the intradialytic stretching exercise than the patients in the control group who received routine hospital care.

Discussion

The primary objective of the study was to evaluate the effect of intradialytic stretching exercises on lower limbs muscle cramps on the patients undergoing regular haemodialysis in the study group by comparison with the control group. The paired 't' test was carried out to find whether there was any difference in the lower limb muscle cramp between pre-assessment and post-assessment in 4th, 7th and 10th sitting. The significant 'p' value ($p < 0.001$) gave the inference that the difference in lower limb muscle cramp level existed after intradialytic stretching exercise among the pre- and post-assessments in 4th sitting, 7th sitting, 10th sitting and between the 4th, 7th and 10th sitting post-assessment which were statistically significant. There was better improvement within the study group in each sitting after intradialytic stretching exercise in the study group. Meanwhile in the control group there was improvement only in the pre-assessment and 4th, 10th sitting post-assessment which was significant 'p' value (< 0.01). Comparison of the effect of intradialytic exercise within the study group and a significant p value (< 0.0001) gave the inference that the intradialytic exercise was significantly better in every sitting in the study group (Table 3). Further, Table 3 and 4 show that in post-assessment the lower limb muscle cramps was much better (mean score 4.11 ± 3.570 in pre-assessment and mean score 1.49 ± 2.087 in 10th sitting post-assessment) in study group who received the intradialytic stretching exercise than the patients in the control group (mean score 2.86 ± 3.582 in pre-assessment and mean score 2.17 ± 2.843 in 10th sitting post-assessment)

who received routine hospital care. The study data reveal that the lower limb muscle cramp was reduced in study group after intradialytic stretching exercise in study group much better than the control group.

The present study finding supports the findings of Lekha et al (2016) in a study on effectiveness of intradialytic stretching exercises on prevention and reduction of muscle cramps among patients undergoing haemodialysis at PSG Hospitals Coimbatore. This study used 60 samples, 30 each in experiment and control group. The experimental group got intradialytic stretching exercises for about 20 minutes during third hour of haemodialysis till the patients finishing post-test III. Intradialytic exercises were provided to the patients up to their 10th sitting and post-test has done on 4th, 7th, and 10th sitting of haemodialysis. Assessment was done using cramp questionnaire chart, and demographic and clinical variables were assessed. The study found that intradialytic stretching exercises help in reducing the muscle cramps of the patients undergoing haemodialysis (Frih et al, 2017; Lekha et al, 2016; Rhee et al, 2017).

Intradialytic stretching exercise is an effective method which can be used as a preventive therapy in the treatment of muscle cramps. It helps improve the patient comfort and also quality of life in patients undergoing haemodialysis.

The secondary objective was to determine the pre-assessment association between selected demographic variables and clinical variables with lower limbs muscle cramps among the patients undergoing regular haemodialysis. A significant association was found between level of muscle cramps and education and co-morbidity of the patients in control group. A significant association was found between the level of lower limb muscle cramps and experience of muscle cramps in daily

activities, experience of lower limb cramps during haemodialysis, side of the leg involved in cramps, cramps restricted the activities and movement and area affects the muscle cramps in the study and control groups. 'p' value ($p < 0.001$) was significant in the control group.

There was no significant association between level of muscle cramps and age, gender, occupation, duration of illness, duration of dialysis treatment in study and control groups. The non-significant 'p' value confirmed that there was no association between the level of cramps and other demographic and clinical variables in study and control groups.

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Conclusion

The intradialytic stretching exercise helps to reduce the intensity of lower limb muscle cramps among the regular haemodialysis patients in the study group. It is simple and cost effective intervention that helps the patient cope with the haemodialysis procedure and also helps the staff and technicians to practice the intradialytic stretching exercises for the patients with muscle cramps when undergoing haemodialysis.

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