

# The Effectiveness of Strengthening Exercise on Improving Physical Function in Chronic Dialysis with Comorbidity: A Case Study

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## ABSTRACT

**BACKGROUND:** Individuals living with End stage renal disease (ESRD) on long term hemodialysis (HD) generally has a sedentary life style. This leads to reduction of physical function and poor quality of life. Exercise intervention improves muscular strength, physical fitness and Quality of life (QOL) in maintained hemodialysis Individuals.

**CASE SCENARIO:** A 67-year-old female presented with chronic hemodialysis period was carried on wheelchair with the help of relative as she was referred to physiotherapy department with chief complain of weakness in both lower limb and difficulty in walking for 1 year. In this case along with chronic dialysis related dysfunction, patient had atherosclerosis had an acute coronary event and she was on AKT since last one year as she was having pott's spine.

**METHODOLOGY:** In our evaluation, she had full range of motion of lower limb with muscle weakness by manual muscle testing (MMT=3-4/5), Reduced balance and physical performance by short physical performance battery (SPPB=4/12), and partially dependent for functional activity by functional independent measure (FIM=81/126). In Physiotherapy intervention:

Exercise program started with active exercise, cycling, balance and gait training. Progressively in active exercise increased weight with weight cuff, increase cycling time and task specific balance activities with independent walking each week.

**RESULT:** After four week of intervention improvement in muscle strength (MMT=4-5/5), balance (SPPB=7/12), minimal assistance in functional activities (FIM=109/126).

**CONCLUSION:** Individualized strengthening exercise program improve physical function and muscle strength in chronic dialysis patient.

**Keywords:** Hemodialysis, physical function, muscle strength.

## INTRODUCTION

Chronic kidney disease refers to abnormalities in kidney structure or function that last for more than three months and have implications for one's health and depends on dialysis for survival. The prevalence of patients undergoing hemodialysis for the treatment of chronic renal failure has been steadily increasing over the past few decades. A 2018 estimate put the number of patients on chronic dialysis in India at about 175,000, giving a

prevalence of 129 per million populations.<sup>(1)</sup> A systematic review estimated that about two thirds of all patients with kidney failure died without receiving dialysis in 2010.<sup>(2)</sup> It is indeed a matter of concern in the medical field. Previous studies have shown that compared to healthy individuals, HD patients have significantly limited physical and aerobic capacity. It's unfortunate, but it's something that needs to be taken into consideration when designing treatment plans for these patients.<sup>(3)</sup>

## CASE REPORT

### PATIENT INFORMATION:

A 67 year old female carried on wheelchair with the help of relative as she was referred to physiotherapist with chief complain of weakness in both lower limb and difficulty in walking since 1 year. She was a k/c/o chronic kidney disease-5 on maintenance hemodialysis via brachiocephalic fistula (3 times/week) since last 6 years. Also she had HTN since last 6 years. She was diagnosed with pott's spine with psoas abscess. She had episodes of sudden breathlessness and was admitted at cardiac hospital for 5days and diagnosed with ACS-NSTEMI (high sensitive troponine I = 223.3ng/L), Acute LVF with HTN, moderate MR and sever LVD. She was readmitted and coronary

angiography was done and final diagnosis was k/c/o CKD, RECENT ACS, MODERATE MR, P/W ACS-UA, H/O CPR, and severe LVD. Medical management was advised for coronaries. (High sensitive troponine I = 225.3ng/L). She was also diagnosed with left femoral hematoma managed by medications.

### CASE PRESENTATION:

On the day of assessment, she was conscious, oriented and followed commands. She was maintaining 99% SpO<sub>2</sub> on room air, blood pressure 138/79 mmHg, respiratory rate was 21bpm and heart rate was 108bpm. She was vitally stable.

Physical examination: The patient presented with full range of motion and preserved sensation with reduced lower limb strength (MMT = 3/5), altered gait, moderate frailty (SPPB = 4/12) and partially dependent in transfer and locomotion (FIM = 81/126).

### INTERDIALYTIC STRENGTHENING EXERCISES PROTOCOL:

When patient was stable between sessions of dialysis, exercises were done with proper supervision in form of following exercises. Table 1 provides a summary of the intervention.

Week 1	Supine lying	Glute squeeze Straight leg raise (SLR) Static quadriceps exercise (SQE) Bridging
	Side lying	SLR
	High sitting	Knee extension Marching in sitting Sit to stand with two hand support
	Standing-g:	Hip abduction Hip extension Heel raise with support One leg standing with support
		Cycling for 5 min.
		Walking with two person hand support
		Active exercise of bilateral upper limb and lower limb advice at home
Week 2	Supine lying	Glute squeeze SLR with 500 gm weight SQE Bridging with 5 sec hold
	Side lying	SLR with 500 gm weight
	High sitting	Knee extension with 500 gm weight Sit to stand with two hand support
	Standing:	Hip abduction with 500 gm weight Hip extension with 500 gm weight Heel raise with support One leg standing with support

		Spot matching with support
		Cycling for 10 min.
		Walking with one hand support
Week3	Supine lying	Glute squeeze SLR with 1kg weight Bridging with 10 sec hold SQE
	Side lying	SLR with 1 kg weight
	High sitting	Knee extension with 1kg weight Sit to stand with one hand support
	Standing:	Hip abduction & extension with 1 kg weight Heel raise with one hand support One leg standing with one hand support Spot matching with minimal support
		Cycling for 15 min
		Walking with 2 finger hand support
Week 4	Supine lying	SLR with 1.5kg weight SQE Bridging with 10 sec hold
	Side lying	SLR with 1.5 kg weight
	High sitting	Knee extension with 1.5 kg weight Sit to stand
	Standing:	Hip abduction & extension with 1.5 kg weight Heel raise with 2 fingers support One leg standing with two fingers support Spot matching without support
		Cycling for 15-20 min.
		Walking without support or minimal assistance

## RESULT

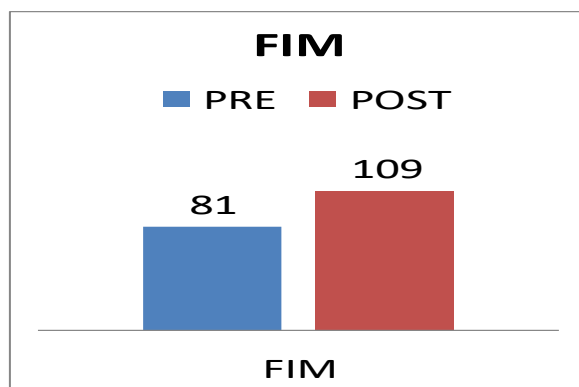
After 4 week of intervention patient was able to walk independently with improved lower limb strength (MMT = 4-5/5), mild frailty (SPPB = 7/12) and modified independent (FIM = 109/126). Table 2 shows improvement in SPPB score from

moderate to mild frailty and table 3 shows that MMT was improved from 3/5 to 4-5/5 in lower limb muscles. Figure 1 shows improvement in FIM score from 82 to 109 and figure 2 shows improved hand grip strength of both upper limb.

SPPB	PRE score	POST score	MMT	PRE (Right)	POST (Right)	PRE (Left)	POST (Left)
Total	4/12	7/12	Hip flexors	3/5	4 /5	3/5	4/5
Balance	2/4	3 /4	Hip extensors	3/5	4 /5	3/5	4/5
Gait speed test	1 /4	2/4	Knee flexors	4/5	5/5	4/5	5/5
Chair stand test	1/4	2 /4	Knee extensors	3/5	4/5	3/5	4/5
Interpretation:	Moderate frailty	Mild frailty	Planter flexors	4/5	5/5	4/5	5/5
			Dorsi flexors	4/5	5/5	4/5	5/5

**Table 2 : Short physical performance battery score(SPPB)**

**Table 3: Manual muscle testing of lower limb muscle (MMT)**



**Figure 1: functional independence measure**

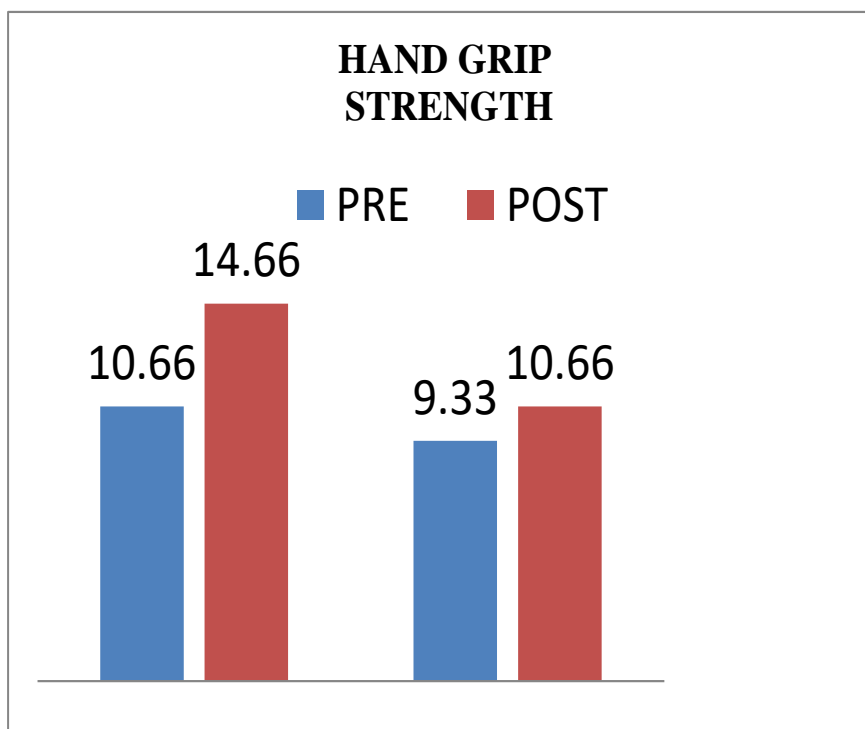


Figure 2: Hand grip strength

## DISCUSSION

Patient with undergoing HD (since last 6 years) was referred to us with complains of lower limb weakness and difficulty in walking independently.

The patient had history of atherosclerosis due to acute coronary event and medically managed and stabilized. Non-ST elevation myocardial infarction (NSTEMI) is The "intermediate" form of ACS, a blockage either occurs in a minor coronary artery or causes partial obstruction of a major coronary artery.<sup>(8)</sup>According to WHO guidelines for MI (2020) – Cardiac rehabilitation which includes physical exercises improves coronary artery risk factors and reduces risk of major cardiac events in people after MI. It's important to start exercising as soon as you can after a MI to get energy and strength back. Both aerobic and strength exercises are great for heart.<sup>(9)</sup>

She was having pott's spine and was on AKT since last one year. Pott's disease refers to vertebral body osteomyelitis and intervertebral discitis from tuberculosis (TB). The spine is the most frequent

location of musculoskeletal tuberculosis, and commonly related symptoms are back pain, kyphotic deformity of the spine, lower limb weakness, and paraplegia.<sup>(6)</sup> In our patient presented with history of pott's spine with symptom of lower limb weakness and she was on AKT since last one year. In order to treat patients with TB spine, goal-oriented medical as well as physiotherapy management is required. A planned and goal-oriented physiotherapy regimen along with medications leads to early recovery and easing of symptoms of patients with Pott's disease.<sup>(7)</sup>

A Meta analysis by Xiaoyu Shu et al in 2022 has found that sarcopenia appears to be associated with negative health outcomes in dialysis users, such as functional deterioration, falls, hospitalization and even mortality. Combined endurance-resistance training program had a very likely beneficial effect on physiological outcomes in chronic HD patients. They also recommend that nephrologists consider and implement such training programs as standard clinical practice in HD units.<sup>(10)</sup>

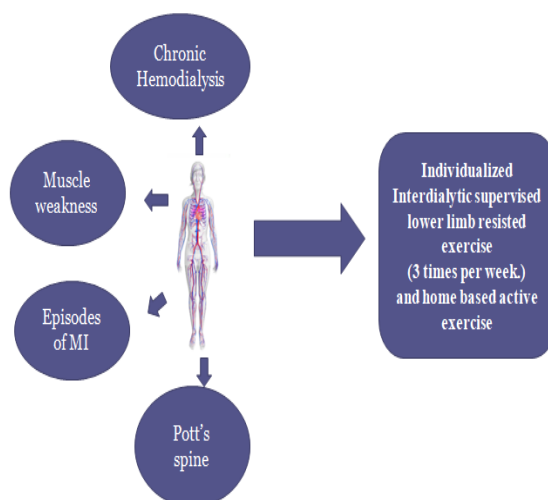


Figure 3: patient's affection and treatment regimen

Exercise has been considered one of the pillars for reversing or delaying the negative effects on functional capacity and quality of life<sup>(5)</sup> Due to combination of all this co morbidity, designing an exercise program was a real challenge (figure -3). So unique individualized exercise program was designed considering all this factors. The ideal FITT principle of exercise for individuals with CKD has not been fully developed, but based on the research that has been done, program for these patients consisted of a combination of aerobic and resistance training. Poor physical functioning is perhaps the most pervasive and disabling disturbance in patients with stage 5 CKD maintained on chronic dialysis (CKD-5D)<sup>(4)</sup> In line with mentioned studies we found improvement in our patient as she was independently walking and improve lower limb muscle strength. In limitation, Continuous cardiac monitoring was not possible but subjective breathlessness score was monitored during exercise session.

### CONCLUSION

Individualized strengthening exercise program between the sessions of dialysis under supervision improve physical function and muscle strength in chronic dialysis patient with co morbidity.

**FOLLOW UP:** Progressive exercise in continuation with home exercise program to make patient functionally independent.

### Declaration by Authors

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**Conflict of Interest:** The authors declare no conflict of interest.

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