

Effects of Inspiratory Accessory Muscles Strengthening by Electrical Muscle Stimulation on Lung Function and Inspiratory Muscle Strength on Inter Dialysis Patient with End Stage Renal Diseases: A Case Series

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ABSTRACT

Background: Chronic kidney disease is a complicated disease that affects several organs and systems (including the musculoskeletal and cardiorespiratory systems), resulting in decreased functional capability. Chronic kidney disease (CKD) is a global health concern with large economic consequences to health systems, affecting around 11 to 13% of the world's population.

Methodology: Study is based on case series. Study was conducted at DVVPF's haemodialysis Unit. 6 patients were considered to be the subjects who were suffering through end stage renal disease.

Procedure: At first ethical clearance was obtained from Institutional Ethical Committee (IEC), which is a government registered agency. The patients were screened according to the inclusion and exclusion criteria from the dialysis care unit of a tertiary care medical college hospital. Once the subjects are included, written informed consent will be taken from the patients. A dialysis patient was chosen as a subject for examination. The pulmonary function test (PFT) and maximum inspiratory pressure (MIP) were performed. Following the completion of the dialysis session, post-treatment outcome measures were evaluated. The patient had done exercises under the direction of the therapist. The duration was 15 minutes. The exercise protocol was followed for a month to track the improvement in inspiratory muscle strength.

Result: p values and t values of the outcome measures that were used in the study.

The study shows that there is no significance in MIP as the p value is 0.1647 and t value is 1.499. Besides, the study shows that the relevance of PEFR is considerably significant, the p value is 0.0465 and the t value is 2.271.

Conclusion: According to the above result it is concluded that EMS stimulation that was provided to the subjects improves lung function in CKD patients and also their quality of life.

Keywords: Chronic kidney disease, Electrical muscle stimulator, Inspiratory accessory muscles, Dialysis.

INTRODUCTION

Complex chronic kidney disease affects numerous organs and systems, including the

musculoskeletal and cardiorespiratory, which reduces one's ability to operate. About 11 to 13% of the world's population

suffers from chronic kidney disease (CKD), which is regarded as a worldwide health issue with large financial costs to healthcare systems. Irreversible renal injury, which directly affects normal kidney function (including hormonal, regulatory, and excretory effects), is what distinguishes CKD from other kidney diseases. Consequently, haemodialysis (HD) is the most often used substitute renal therapy. Complex chronic kidney disease affects numerous organs and systems, including the musculoskeletal and cardiorespiratory, which reduces one's ability to operate. About 11 to 13% of the world's population suffers from chronic kidney disease (CKD), which is regarded as a worldwide health issue with large financial costs to healthcare systems. Irreversible renal injury, which directly affects normal kidney function (including hormonal, regulatory, and excretory effects), is what distinguishes CKD from other kidney diseases. Consequently, haemodialysis (HD) is the most often used substitute renal therapy. Impaired functional capacity in CKD patients is connected with uremic myopathy and HD, both of which promote protein breakdown and can affect the strength and endurance of both inspiratory and peripheral muscles. When compared to healthy persons, CKD patients often have a 40%---50% drop in exercise capacity. When compared to predicted values, CKD patients typically appear with decreased inspiratory muscle strength or muscle weakness. In order to increase the performance of the respiratory muscles, inspiratory muscle training (IMT) has been proposed as an alternative or supplement to traditional exercise, and data in the literature has indicated the efficacy of this therapy in CKD patients in recent years. Haemodialysis is a type of renal

replacement therapy. It is used in patients with end stage renal disease. Patients are unable to maintain internal body homeostasis and hence need haemodialysis. Accessory muscles of inspiration include the sternocleidomastoid, pectoralis minor and major, serratus anterior and latissimus dorsi. Expiration, in contrast, is a passive process produced by elastic recoil of the thoracic cage.

MATERIALS AND METHODS

Devices like maximum inspiratory pressure (MIP) and peak expiratory flow rate (PEFR) were used to assess the respiratory muscle strength of each individual. Study is based on case series. Study was conducted at DVVPPF's haemodialysis Unit. Six patients were considered to be the subjects who were suffering through end stage renal disease. Study trial lasted for six months. Electrical muscle stimulator was used to strengthen the superficial inspiratory accessory muscles.

STATISTICAL ANALYSIS

The descriptive variables were reported in the form mean + standard deviation. MIP and PEFR pre and post treatment generated values were averaged. The data was analysed using InStat software and the Unpaired t test.

RESULT

Six patients were considered subjects in this study. Each of the six patients had Stage V chronic renal failure.

BMI wise Distribution of CKD Patients

NORMAL	01
UNDERWEIGHT	02
OVERWEIGHT	03

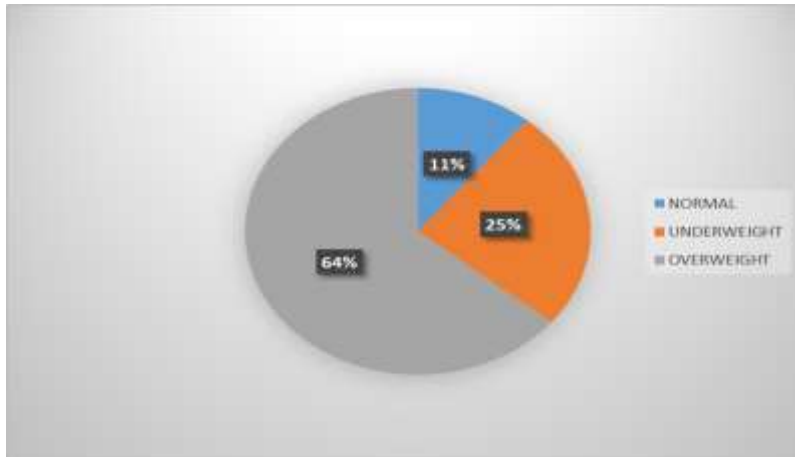
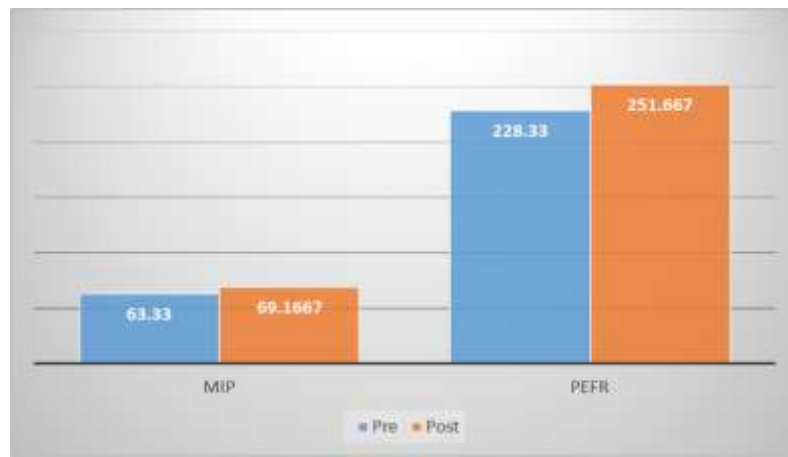


Table 1. Represents Mean SD of MIP and PEFR

Parameters	Mean +-SD (Pre)	Mean +-SD(Post)
MIP	63.333+-8.75595	69.1667+-2.49537
PEFR	228.33+-24.8328	251.667+-4.08248



The above graph shows that the values of MIP pre is 63.33 and post is 69.1667. Besides the values of PEFR pre is 228.33 and post is 251.667.

Table 2. Represents p value and t value of MIP and PEFR.

Parameters	p value	t value	Relevance
MIP	0.1647	1.499	Not Significant
PEFR	0.0465	2.271	Significant

Table 2 represents p values and t values of the outcome measures that were used in the study. The study shows that there is no significance in MIP as the p value is 0.1647 and t value is 1.499. Besides, the study shows that the relevance of PEFR is considerably significant, the p value is 0.0465 and the t value is 2.271.

DISCUSSION

In this study, 6 participants were inculcated who were suffering through Stage V chronic kidney failure. p values and t values of the outcome measures that were used in the study. The study shows that there is no significance in MIP as the p value is 0.1647 and t value is 1.499. Besides, the study shows that the relevance of PEFR is considerably significant, the p value is 0.0465 and the t value is 2.271. Electrical muscle stimulator (EMS) is a method of pain relief that involves use of mild electrical current. Also it is used in a way through which it increases strength of the superficial muscles. According to the results of the study EMS modality does not improve the strength of the diaphragm which is the major inspiratory muscle as it is

a deep muscle but it is observed that there is improvisation in the strength of the abdominal and accessory inspiratory muscles. However there is significant improvement in the pulmonary functions of the patients that were put under the study for 4 weeks. Thiago Dippa, Fabrício Edler Macagnana, Jociane Schardong, et.al stated the results obtained in the randomized controlled trial demonstrated that five weeks of high-intensity IMT was able to increase inspiratory muscle strength of patients with CKD on HD. However, no differences were found regarding exercise tolerance and endothelial function after protocol training. Weiner P, Zidan F, Zonder HB, et.al concluded that CKD patients receiving maintenance hemodialysis has reduction in inspiratory muscles strength and less significant reduction in endurance. Both the inspiratory muscle strength and endurance has significantly increased following hemodialysis in most but not all subjects. Otadi K, Nakhostin Ansari N, Sharify S, Fakhari Z, Sarafraz H, et.al has concluded their study that pain, static stability and dynamic balance were improved to a greater extent in diaphragm training plus TENS than TENS alone in amateur athletes with CLBP. Smith BK, Fuller DD, Martin AD, Lottenberg L, et.al stated that diaphragm pacing has potential rehabilitative value to reduce reliance on mechanical ventilation in people with Pompe disease.

CONCLUSION

Chronic kidney disease is a condition in which kidneys are damaged and cannot filter blood as well as they should. Due to this the excess fluid and waste from blood remain in the body and may cause other health problems such as anemia, increased occurrence of infections, low calcium levels, high potassium levels and high phosphorous levels in blood. Besides weakness of respiratory muscles causes reduced pulmonary functions which in turn reduces lung volume capacity. According to the above results EMS shows improvement

in lung function but does not show improvement in the strength of diaphragm muscle. However EMS stimulation that was provided to the subjects improves lung function in CKD patients and also their quality of life.

Declaration by Authors

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

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