



The Impact Of Breath Stacking Technique On Improving Pulmonary Function In Kidney Transplant Patient: A Case Report

Ketaki Ravindra Naik¹, Dr. Sabih Khan², Payal Padole³, Dr. Satyam Bhodaji^{4*}
^{1,3}Intern, ^{2,4}Assistant Professor,
MGM School of Physiotherapy, Aurangabad, A Constituent unit of MGMIHS,
Navi Mumbai, Maharashtra, India

***Corresponding Author:
Satyam Bhodaji**

Assistant Professor, MGM School of Physiotherapy, Aurangabad, A Constituent Unit of MGMIHS, Navi Mumbai, Maharashtra, India

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Abstract

Background and objectives: chronic kidney disease (CKD) is defined as a gradual and irreparable loss of kidney function, resulting in a condition wherein the kidneys are no longer functioning due to nephron destruction, limiting the body's ability to maintain metabolic and hydro electrolytic renal balance. CKD is associated with an increased rate of mortality and morbidity. This case report aims to investigate the use of breath stacking technique in order to improve the functional capacity of the CKD patients.

Case presentation: A 37year old female diagnosed case of chronic kidney disease with hypertension underwent kidney transplantation. She underwent 11 sessions of physiotherapy treatment in which 1 session included breath stacking technique along with hall ambulation.

Results: Breath stacking technique along with hall ambulation was effective in improving functional capacity of the patient.

Conclusion: Breath stacking technique was not administered in kidney transplant patients in any of the previous studies but when we performed it in our study it found out to be effective.

Keywords: Chronic Kidney Disease, Physiotherapy Rehabilitation, Breath stacking Technique

Introduction

Chronic Kidney Disease (CKD) is defined as a gradual and irreparable loss of kidney function, resulting in a condition wherein the kidneys are no longer functioning due to nephron destruction, limiting the body's ability to maintain metabolic and hydro electrolytic renal balance. CKD is associated with an increased rate of mortality and morbidity¹. In India, the prevalence of end-stage renal disease that usually requires a transplant is estimated to be between 151-232 per million people. Until now, about 7500 kidney transplant procedures have been performed in India's 250 kidney transplant centers. Ninety percent come from living donors, while ten percent come from deceased donors². Hemodialysis

(HD) is used to compensate for the lowered renal function at this phase¹.

The higher incidence of conventional cardiovascular disease (CVD) risk factors, such as diabetes, dyslipidemia, and hypertension, in kidney transplant recipients contributes to their increased threat for CVD³. Despite all the advantages of kidney transplantation for end-stage renal failure, cardiopulmonary and musculoskeletal related problems are prevalent after the procedure. People who undergo kidney transplant have debilitated postsurgical respiratory function, due to general anesthesia and diaphragmatic inhibition as it is an intra-abdominal procedure⁴. The goal of exercise training for patients with chronic kidney disease is to prevent potential cardiovascular diseases

by improving QOL, preventing lifestyle diseases, preserving transplanted kidney function and sustaining exercise tolerance⁵.

The breath-stacking technique was designed to evaluate the inspiratory capacity of uncooperative patients or those who are unable to provide inspiratory efforts due to pain, dyspnea, or muscle weakness⁶. The breath-stacking technique utilizes a one-way valve on a manual resuscitation bag to deliver large breath volumes to the patient via a suitable interface. Periodic lung expansion by breath stacking reduces atelectasis and preserves lung and chest wall compliance, leading to increased peak cough flow (PCF) and cough effectiveness⁷. Breath stacking consists of two steps: manual hyperinflation or volume augmentation, followed by a cough that is manually assisted. During general anesthesia, collapsed lung tissue is expanded by inflating to maximum insufflation capacity at a pressure of 40 cm H₂O⁸.

Methods

A single retrospective case was used to investigate the objectives of this study. This case report adhered to the CARE reporting guidelines⁹.

Case Description

A 37-year-old female diagnosed case of chronic kidney disease with hypertension underwent kidney transplantation on 30th Dec'21. Patient was apparently alright 9 months back when gradually she started having symptoms like vomiting, puffiness on face and swelling on lower limbs for which she visited hospital where she was diagnosed with hypertension and was prescribed medications for the same. Later after few days she again started having same symptoms for which she again visited the hospital where investigations were done and was diagnosed with chronic kidney disease and was suggested for haemodialysis. For initial 5 months dialysis was performed once a week later after 5 months dialysis was performed twice a week. Prior to the study patient's functional capacity was assessed using peak flow meter. A written informed consent form was taken from the patient.

Timeline Of Events

Month	Consultation	Events	Diagnosis	Treatment/ Suggestion
March 2021	Physician	-	Hypertension	Anti-hypertensive drugs
April 2021	Nephrologist	USG Abdomen & pelvis, RFT, CBC	Chronic Kidney disease	Dialysis [once a week]
September 2021	Nephrologist	USG Abdomen & pelvis, RFT, CBC	Chronic Kidney disease	Dialysis [twice a week]
December 2021	Urologist	RFT, CBC	Chronic Kidney Disease	Kidney transplant

Investigations [Renal Function Test]

Date	Blood urea (mg/dl)	Serum creatinine (mg/dl)	Serum albumin (g/dl)

16 th Sept 2021	101 [H]	12.60 [H]	4.10
30 th Dec 2021 Day of operation	31 [N]	2.70 [H]	-
4 th Jan 2022 POD 5	28 [N]	1.20 [N]	-

Outcome Measure

The outcome measure used in this study was Peak Expiratory flow Rate (PEFR) [Fig 1] which is used to measure functional capacity of the lungs.

Therapeutic Intervention

- Postoperative Day 1-3
 - Positioning [Supine to Supported sitting]
 - Diaphragmatic breathing exercises
 - Incentive spirometry [done with 300 cc] [Fig 3]
 - Active ROM Exercises of bilateral Upper limb and Lower limb
 - Ankle toe movements
 - Heel slides
- Postoperative day 4-7
 - Continue with previous protocol
 - Positioning [supported sitting- unsupported sitting- standing-spot marching- walking]
 - Thoracic expansion exercise [Fig 2]
 - Incentive spirometry [done with 600 cc]
 - Hall ambulation
- Postoperative day 7-11
 - Continue with previous protocol
 - Breath stacking with hall ambulation 3 repetitions, 3 sets
 - Incentive spirometry [done with 900 cc]
 - Dynamic knee extension [with 10 sec holds]



Fig 1



Fig 2



Fig 3



Pretreatment



Post treatment

Result

After 1 session of treatment, we found that breath stacking technique is effective in improving functional capacity of the patient. Prior to the exercise the peak flow meter readings were 150 L/min and post the exercise the readings were 180 L/min. Pretreatment and Post treatment vitals were as follows:

VITALS	PRE-TREATMENT	POST TREATMENT
SPO2	97%	100%
HEART RATE	99 beats/min	106 beats/min
RESPIRATORY RATE	18 breaths/min	23 breaths/min
PEFR	150 L/min	180 L/min

Discussion

This study assessed the effectiveness of breath stacking technique along with hall ambulation in chronic kidney patient who has undergone kidney transplant which showed improvement in PEFR values and on pulmonary function of the patient.

A systematic review conducted by Patrizia Calella, et al, stated that a well-structured physiotherapy exercise program can lead to enhancement of aerobic

capacity, peripheral muscle strength and overall quality of life of kidney transplant patient¹⁰. This study is parallel to our study.

A study conducted by José Roberto Sostena Neto et al, stated that respiratory system is affected by chronic kidney disease and dialysis. There is alteration in respiratory muscular strength and pulmonary gaseous exchange. Hence, they concluded that respiratory and motor exercises showed

significant improvement in patients' pulmonary function and respiratory muscle strength¹.

Conclusion

Breath stacking technique was not administered in kidney transplant patients in any of the previous studies but when we performed it in our study it found out to be effective. Hence, the current study concludes that breath stacking technique along with hall ambulation can be used in kidney transplant patients in order to improve their pulmonary function post operatively.

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