

Post Mechanical Ventilation, Through Tracheotomy Treated with Pulmonary Rehabilitation – An Evidence Based Case Study

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Abstract- Respiratory distress, an acute emergency situation requires mechanical ventilatory support and tracheotomy. Rehabilitation with residual pulmonary and neurological means needs critical analysis when adopting customized physical therapy. **Aims & Objectives** of this original research was to evaluate the impact of pulmonary rehabilitation on quality of life of this subject. **Materials & Methodology:** After gradual weaning and the subject getting discharged to home daily domiciliary physiotherapy from 10.02.2017 to 28.05.2017 and he was getting treated at the rehabilitation centre as an outpatient from 1.06.2017 till 30.09.2017 with twice a week frequency in Chennai with principles of pulmonary rehabilitation. **Results** of pre and post PR were analyzed on QOL SF 36 $P < .01$ **Conclusion:** periodical evaluation, feedback, functional activity based exercises, combining pulmonary and neurological therapy can facilitate due rehabilitation in a shorter time frame.

Index Terms- Pulmonary Rehabilitation, Tracheotomy, Mechanical Ventilation, Respiratory Distress, Quality of Life

I. INTRODUCTION

Since most human ARDS (Acute Respiratory Distress Syndrome) patients require mechanical ventilation, several pulmonary ventilator strategies (Amato et al 1998) based on massive alveolar collapse, cyclic lung reopening, over distension of the lungs occurring during mechanical ventilation to decrease lung injury during ventilation (Borges et al 2008)

Pulmonary insults can lead to a varying degree of respiratory compromise and failure described as ARDS (Ware and Matthey 2000) and reported with a mortality rates between 40% to 60% (Declue and Cohn 2007). A smoking history is particularly associated with respiratory complications (Berlly and Shem 2007). Cindy et al 2012 in a meta analysis evaluating the effects of exercise training on measures of physical activity using accelerometer proposed thrice a week and 6 months duration to obtain significant results and changes in behavior (Vanhelst 2012).

Tracheotomies may be performed to ensure a safe and patent air way in patients to facilitate mechanical ventilation for respiratory failure (Heffner 2008) while there are complications including death, associated with tracheostomy, its performance has become common (Kapadia et al 2000)

One tenth of the patients receiving MV undergo tracheotomies (Kollef et al 1999)

Use of mechanical ventilation, development of pneumonia, use of tracheotomy explain more hospital costs (Winslow et al 2003)

An improved exercise performance was highly evidenced with PR by ACCp/ AACVPR (Ries et al 2007)

Strength training component in PR increases muscle mass and strength (Ries et al 2005)

Aims & Objectives of this original research was to evaluate the efficacy of PR on QOL following weaning from MV and tracheostomy

Keywords: ARDS, Thacheostomy, Pulmonary Rehabilitation, Dyspnea, Vital Capacity, Anxiety

Past History H/O

Mr.XXX, Aged 55 years was on ventilatory support through tracheotomy for respiratory distress from 02.02.2017 till 08.02.2017 was known type II diabetes and CAD with EF of 55% as on 08.02.2017, he was treated with due antibiotics for rlessilla and pseudomonas aeruginosa. Known smoker and an alcoholics, his complaints since June 2017 were inability to walk unaided frequent falls and lowered energy levels.

BMI: 24Kg/m²

O/E

- Left hypertonicity legs > arms
 - Bilateral hamstring tightness
 - Spirometer VC- 1200 CC
 - Balance in standing needs support
 - Vastus Medialis left weak > right
 - Hip Abdomen – 2/5
Ext – 2/5
 - Knee Ext – 2/5
 - Abdominal muscles moderate
 - Exaggerated lumbar lordosis
 - Bilateral upper extremities 3/5
 - Low exercise tolerance
 - Reaction time was decreases
 - Nil visible deformities / soft tissue tightness except resisted cervical spine movements
- But he was treated with daily domiciliary physiotherapy from the time of discharge from hospital till May 2017 by some other physiotherapist

- And he has been attending this centre and is treated by the author with weekly twice frequency during the period from June to September 2017

Treatment & Clinical Prognosis

Problem Identified	Exercises	Outcome Measures
June 2017 I. Dyspnea on exertion II. Motor power of LE 2/5 III. Balance disturbance IV. Fatigue on mild exertion	I. Incentive Spirometer II. Active exercises with mild resistance in all postures 1 set of 10 exercises with rest 15 minutes duration	Outcome measures moderate reduction in fatigue, able to walk with confidence still wobbly and fear of fall, requires monitoring
July 2017 ➤ 2 occasions had fallen down ➤ Vital capacity was 1200 CC	Physioball based Pilates exercises started, balance training 2 set of 15 exercises 3 repetitions 20 minutes	Started attending office and regular walking for 10 minutes with monitoring
August 2017 ➤ Getting up and down from low level chair findings tough ➤ Anxiety in open environment.	➤ Floor level exercises with core strengthening of upper and lower extremities for 5 repetitions, 20 exercises 25 minutes	Able to drive car, social activities he has started with improved confidence, walking duration was increased 20 minutes
September 2017 ➤ Coming down the steps, ramps, has difficulty ➤ New places, surfaces balance, with fear he gets disturbed for walking	Dynamic resistance in standing, sitting on ball manually and using Physioball with 5 repetitions: Set of 20 exercises 30 minutes duration	Vital capacity was 3600 CC, level of fatigue has come down, able to walk on different surfaces and new places

Hypothetical Questions from this Case Study Were:

- I. Pattern of prognosis post respiratory distress, treated with mechanical ventilation and tracheotomy later?
- II. Neurological rehabilitation on balance, motor power and functional activities how effective are factors involved and therapies available with evidence?
- III. Pulmonary rehabilitation evidenced clinical modalities and duration of prognosis and factors influencing?

Table on Results of Pre and Post – Rehabilitation of the subject with paired ‘t’ test using SF 36 QOL questionnaire

	Pre	Post	SD	SE	t	p
Score	68	31	21	12	3.08	<.01

A. Spirometric values improve with physiotherapy as supported by (Divisi et al 2013) but few studies found no significant improvement with spirometer (Bobbio et al 2008). Patients who are liberated from MV and have their tracheotomies tubes removed have the best survival (Engoren et al 2003). Chatila et al 2001 who evaluated 25 survivors of a ventilator rehab unit found mild moderate impairment in quality of life

B. Inactivity leads to deconditioning, mainly caused by breathlessness, which can lead to an increased fear of exertion, avoidance of physical and social activities adding further isolation and depression accompanied by a reduced health related quality of life (Core Hay et al 2014). An RET with 2 years follow up where reduction in health care utilization with PR was recorded (Guell et al 2000). Muscular functional disorders are reversible with moderate to high intensity rehab exercises (Sala et al 1999) ie 60-80% peak work rate are sufficient to elicit adequate physiologic training effects in 30 minutes (Nici et al 2006). With endurance exercises of the leg muscles being the main focus (Bogdanis et al 2012) upper limb exercises should be incorporated to facilitate daily activities such as dressing, washing and carrying groceries (Nici et al 2006).

C. Adherence to pulmonary rehabilitation by smokers remains less than that of ex smokers (Young et al 1999). 6 weeks pulmonary rehab had low hospital admission in a one year follow up (Griffiths et al 2000). Griffiths et al 2000 reported PR to be cost effective and resulted in financial benefits.

Meta analysis (Sin etal 2003) have recommended with PR coming COPD subjects a highly significant St Georges respiratory questionnaire. Dyspnea relief with PR in grade a evidence was recorded by gold (Vestbo etal 2013) on chronic respiratory questionnaire. 6 months PR programs have shown with more successful outcomes (Guell etal 2000 and maintenance of benefits of PR such as physical activity and life style changes are important challenge for those who have undergone a comprehensive PR program (Ries etal 2003)

II. CONCLUSION

Weaning from mechanical ventilation through tracheotomy, post rehabilitation of the subject with due physiotherapeutic means requires synchronizing both cardio respiratory and neurological exercises. Proper evaluation with analysis and feed back from the subject ensures maximized achievement of quality of life.

Limitations of this research study was being a single case study report, outcome measures were not measured wit PFT and shorter duration follow up was the main outcome of this original presentation.

Further Studies on similar subjects with pulmonary and neurological deficit with larger sample size and more physical therapy variables can be carried out.

Critical analysis of this study findings:

- a. Rehabilitation of balance, was not mentioned with evidence
- b. Lower extremity and core exercises were only done during first two months, here as upper extremities were exercised later period only
- c. Subject was able to drive car, walk independently for 20 minutes, ascending and descending stairs and his level of confidence has improved but anxiety prevails with beginning of any physical activity, which was unanswered
- d. Through vital capacity using incentive spirometer has improved to 5000cc, status of respiratory condition were not qualitatively evaluated using pulmonary function test in this subject

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