(SYSTEMIC REVIEW STUDY) PHYSICAL THERAPY INTERVENTIONS FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASED PATIENTS

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Master Degree in Physical Therapy for Cardio-respiratory Disorders and Geriatrics

By

ABDELRHMAN AGAMY HASSAH AGAMY

B.Sc in Physical Therapy (2000)

6 October University

Supervisors

Prof. Dr. Azza A. Abdel Hady

Professor of Physical Therapy for Cardiovascular-respiratory Disorders and Geriatrics,

Faculty of Physical Therapy

Cairo University

Prof. Dr. Zahra M. H. Serry

Assistant Professor of Physical Therapy for Cardiovascular- respiratory Disorder and Geriatrics,

Faculty of Physical Therapy

Cairo Universitys

Faculty of Physical Therapy

Cairo University

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ACKNOWLEDGMENT

First and foremost, I would like to kneel thanking for ALLAH, This piece of work will never be accomplished without our God Almighty with his blessings and his power that work within me and also without the people behind my life for inspiring, guiding and accompanying me through thick and thin.

I am deeply indebted to ***Prof. Dr. Azza A. Abdel Hady,*** Professor of Physical Therapy for Cardiovascular- respiratory Disorders and Geriatrics, Faculty of Physical Therapy, Cairo University, for her great support and advice that gave me the confidence and encouragement to start and complete this study as the best as I could do.

Words fail to express my gratitude, respect and appreciation to ***Prof. Dr. Zahra M. H. Serry,*** Assistant professor of Physical Therapy for Cardiovascular- respiratory Disorders and Geriatrics, Faculty of Physical Therapy, Cairo University, for her sincere supervision, valuable advice, constructive criticism and continuous support.

Finally, I would like to extend my heartfelt gratitude to my family Thanks for all the love and support.

Dedication

To my parents

Physical Therapy Interventions For chronic obstructive pulmonary diseased Patients (Systemic Review Study)/ Abdelrhman Agamy: Cairo University, Faculty of Physical Therapy. 2009 Thesis M.sc, Physiotherapy for Cardiovascular-respiratory Disorders and Geriatrics. Supervisors: **Prof. Dr. Azza A. Abdel Hady**, Professor of Physical Therapy for Cardiovascular-respiratory Disorders & Geriatrics, Faculty of Physical Therapy, Cairo University. **Prof. Dr. Zahra M. H. Serry**, Assistant Professor of Physical Therapy for Cardiovascular-respiratory Disorders & Geriatrics, Faculty of Physical Therapy, Cairo University.

Abstract

Physical therapist plays a role in the multidisciplinary team in management of chronic obstructive pulmonary disease patients. This review was to provide evidence based practice of physical therapy interventions for those patients. Medical libraries were searched using a variety of keywords. Search results were presented in a problem solving approach in six problems usually encountered by physical therapist “airway clearance, respiratory muscle weakness, body de-conditioning, pulmonary rehabilitation, dyspnea and quality of life". The Levels of Evidence the Scottish Intercollegiate Guidelines Network were used to detect the level of evidence behind interventions for each problem for the purpose of comparison and discussion. From this review a series of clinical and research recommendations were driven to optimize the physical therapy management.

Key words: COPD, Physical Therapy, Airway clearance, Quality of Life

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I - Airway clearance

Introduction

In health, the production and continuous transport of airway mucus is an effective defense mechanism. Inhaled bacteria and dust are cleared and the lower airways are thus kept sterile. In airway diseases that cause mucus hypersecretion or impair mucus transport, inadequate mucus clearance increases the risk of infection and related morbidities, and is associated with faster decline in pulmonary function***(Der Schans C, 2007 rooted from Vestbo J,1996 & Lange P,1995)***

Chest physical therapy (CPT) is a widely used intervention in patients with airway diseases. The main goal is to improve mucus clearance, to decrease the risk of pulmonary infection, slow the decline in pulmonary function, and improve quality of life. Conventional CPT is used in stable patients with obstructive lung disease, to prevent complications in the preoperative period, and in some critically ill patients, such as those receiving mechanical ventilation***(der Schans C, 2007 rooted from Webber BA,1993)***

Airway clearance techniques include a variety of techniques such as the active cycle of breathing technique (ACBT), forced expiration technique (FET), postural drainage (PD), autogenic drainage (AD), positive expiratory pressure (PEP) adjuncts and intermittent positive pressure breathing (IPPB). The key indicator for determining use of any

airway clearance technique is the presence of sputum that the patient is unable to expectorate independently which may occur during an acute exacerbation. This will be a key indicator for a patient in the self-management of their disease and patients should be taught modifications of their airway clearance regime during an acute exacerbation**.** ***(*Mikelsons *C, 2008 rooted from Webber BA.1990)***

Evidence

Active cycle of breathing

Abebaw M. et al., (2007) investigated the use of percussion, vibration, shaking and active cycle breathing techniques (ACBT) by physiotherapists working in respiratory care and treating patients admitted with acute exacerbations of COPD (AECOPD). A postal questionnaire was used to survey physiotherapists working in respiratory care in 190 acute hospital trusts in the united king dome (UK) about chest clearance physiotherapy techniques used in the treatment of patients admitted with AECOPD. The results Of the 190 questionnaires mailed, 146 (77%) complete responses were received. One hundred and twenty-nine (88%) respondents reported that they always or often used ACBT, compared with 38 (26%), 16 (11%) and 12 (8%) respondents for vibration, shaking and percussion, respectively. The differences were statistically significant: ACBT used always/often versus vibration used always/often ($\chi 2 = 5.8$, $P = 0.01$); ACBT used always/often versus percussion used always/often ($\chi 2 = 8.3$, $P < 0.0001$); and ACBT used always/often versus shaking used always/often ($\chi 2 = 6.7$, $P < 0.001$). They concluded that Manual chest physiotherapy techniques (vibration,

percussion and shaking) were used infrequently for chest clearance in patients admitted with AECOPD, whereas ACBT was used always or often by 88% of responders.

Inal-Ince D. et al.,(2004) hypothesised that applying the active cycle of breathing techniques (ACBT) in patients with acute hypercapnic respiratory failure undergoing non-invasive ventilation would improve patient outcome. Thirty-four patients were randomized so that 17 patients with acute hypercapnic respiratory failure received the ACBT and non-invasive ventilation (ACBT group), and 17 patients received noninvasive ventilation alone (control group). The primary outcome measure was length of time requiring non-invasive ventilation, and secondary outcome measures were change in acute physiology score, change in arterial blood gas values, total duration of noninvasive ventilation, and length of stay in the intensive care unit. Although not significant, there was a greater decrease in arterial carbon dioxide pressure in the ACBT group compared to the control group (-21.41 mmHg vs -17.45 mmHg, p = 0.27). Total duration of ventilation tended to be shorter in the ACBT group than in the control group (64.9 hours vs 84.1 hours, p = 0.15). Length of time in need of non-invasive ventilation was significantly lower in the ACBT group than in the control group (5.0 days vs 6.7 days, p = 0.03). There was no significant difference in length of stay in the intensive care unit between the two groups (8.0 vs 9.4 days, p = 0.31). The use of ACBT may have positive effects in the treatment of patients with acute hypercapnic respiratory failure, resulting in a shorter length of time requiring non-invasive ventilation

Autogenic drainage

Moiz J. et al.,(2006) Evaluated the effects of a long-term treatment of autogenic drainage (AD) and the active cycle of breathing techniques (ACBT) were evaluated in patients with chronic obstructive pulmonary disease (COPD). Thirty clinically stable male COPD patients were randomly assigned to AD or the ACBT treatment for a 20-day treatment period. Patients were assessed through pulmonary function tests, arterial blood gases, a 6-minute walking test, and a modified Borg Scale before and immediately after the walking test. Autogenic drainage improved forced vital capacity, forced expiratory volume in one second, peak expiratory flow rate, forced expiratory volume from 25 to 75%, chronic hypercapnia, arterial oxygenation, exercise performance, and dyspnea perception during exercise. The ACBT increased forced vital capacity, peak expiratory flow rate, arterial oxygenation and exercise performance. Peak expiratory flow rate increased in AD more than in ACBT. In AD treatment, the increase in oxygen saturation was significantly higher than in ACBT treatment. Chronic hypercapnia improved significantly in AD treatment than in ACBT. No differences were found in other lung function parameters. They concluded that autogenic drainage is as effective as the ACBT in cleaning secretions and improving lung functions. These techniques can be used in stable COPD patients according to the patients' and the physiotherapists' preferences.

Postural drainage

Bellone A et al.,(2000) compared the short-term effects of postural drainage (PD), oscillating positive expiratory pressure (using the FLUTTER device), and expiration with the glottis open in the lateral posture (ELTGOL) on oxygen saturation, pulmonary function, and sputum production in patients with an acute exacerbation of chronic bronchitis. In a prospective randomized study, ten patients with chronic same respiratory therapist at about the same time of day on separate days and in random order. Oxygen saturation and pulmonary function were measured before, immediately after, and 15 minutes and 1 hour after each treatment. Improvement in sputum production was measured by total sputum wet weight immediately after and for 1 hour after treatment. PD consisted of positioning the patients in a posture that allows bronchial drainage by gravity. FLUTTER is a device that is claimed to combine oscillating positive expiratory pressure with oscillations of the airflow. ELTGOL is an airway clearance technique that uses lateral posture and different lung volumes to control expiratory flow rate to avoid airway compression. The total time spent for treatments was 30 minutes.All techniques were well tolerated, and oxygen saturation and pulmonary function did not change significantly during and after treatments. Thirty minutes after the beginning of treatment, sputum production increased significantly with all techniques, but during the one hour after the end of treatment, it was significantly larger with FLUTTER (from 15.0 ± 8.6g to 19.0 ± 9.3g, $p < .01$) and ELTGOL (from 17.0 ± 7.0g to 20.6 ± 6.9g, $p < .02$) than with PD (from 15.5 ± 4.0g to 17.5 ± 3.7g, NS). They concluded that all three treatments were safe and effective in removing secretions

without causing undesirable effects on oxygen saturation, but FLUTTER and ELTGOL techniques were more effective in prolonging secretion removal in chronic bronchitis exacerbation than was the PD method.

Positive expiratory pressure

Chien-Ling Su et al.,(2007) assessed how positive expiratory pressure (PEP) affected pulmonary function, functional capacity, and subjective cough difficulty in individuals with chronic obstructive pulmonary diseases (COPD). In a prospective, randomized, controlled study subjects were recruited from an outpatient department at a university hospital. Thirty-two patients with COPD were allocated to either PEP + FET (forced expiratory technique) group (n = 16) or FET only group (n = 16). Subjects in PEP + FET and FET groups were in a clinically stable condition before and during the study. Subjects in the PEP + FET group received PEP breathing using a mouth adjunct to FET, and the FET group was administered FET for 4 weeks only. Patients received weekly follow-up during the study period. Pulmonary function, 6-minute walk tests, and subjective cough difficulty scores were measured before and after the 4-week interventions. Subjects in the PEP + FET group had a significantly increased diffusing capacity of the lung for carbon monoxide (DLCO) compared to preintervention ($p < 0.05$) and after intervention in the FET group ($p < 0.05$). DLCO significantly increased in the PEP + FET group from 18.0±7.3 to 20.1±7.2 mL/min/mmHg. The 6-minute walking distance (6MWD) also increased significantly from 516.8 ± 94.1 to 570.6 ± 60.4 m in the PEP + FET group ($p < 0.001$) after intervention, compared to that for the FET group ($p < 0.05$). Additionally, the PEP +

FET group had significantly lower cough difficulty scores compared to those at baseline and in the FET group. They concluded that four-week PEP therapy as an adjunct to FET further enhanced DLCO and 6MWD, and reduced cough difficulty compared to FET only in COPD patients with mucus hypersecretion.

Placidi G. et al.,(2006) compared the short-term effect of positive expiratory pressure (PEP) physiotherapy via mask (PEP), continuous positive airway pressure (CPAP), and noninvasive positive-pressure ventilation (NPPV) physiotherapies on amount of sputum collected. Directed cough was standardized for each patient and used as the control treatment. They studied 17 patients with cyctic fibrosis CF (mean _ SD age 28 _ 7 y) and severe airway obstruction (forced expiratory volume in the first second 25_6% of predicted) admitted for pulmonary exacerbation. Mask PEP, CPAP, NPPV, and the control treatment (directed cough) were administered in a random sequence. Each patient received each treatment twice a day (in 70-min sessions) for 2 consecutive days. They measured the wet and dry weight of sputum collected and the number of directed and spontaneous coughs during each session. Spirometry and pulse oximetry were conducted before and after each session. For mask PEP, CPAP, and NPPV, each patient gave a subjective score for the efficacy and tolerability of the treatment, compared to the control treatment. There was no statistically significant difference in the dry weight of sputum collected: mask PEP 0.9 _ 0.6 g, CPAP 0.8 _ 0.4 g, NPPV 0.9 _ 0.6 g, control treatment 1.0 _ 0.8 g. There was a statistically significant difference in the wet weight of sputum collected: mask PEP 15.8 _ 5.5 g, CPAP 13.7 _ 5.5 g, NPPV 13.2 _ 5.0 g,

control treatment 14.0 _ 5.0 g ($p < 0.05$), but that difference became non significant when we took into account the number of spontaneous coughs. There were no statistically significant changes in the spirometry and pulse-oximetry values. The patients' subjective efficacy scores were similar for mask PEP, CPAP, and NPPV. Less fatigue was reported after NPPV and CPAP than after mask PEP. They concluded that differences in sputum clearance or pulmonary-function measures between mask PEP and short-term administration of either CPAP or NPPV combined with directed cough. After mask PEP these patients felt more tired than after CPAP or NPPV secretion-clearance therapy.

O'Donoghue F.J. et al.,(2002) examined the effect of CPAP on the inspiratory threshold load, muscle effort, and lung volume in this patient group. Nine patients were studied at baseline and with CPAP increasing in increments of 1 cm H2O to a maximum of 10 cm H2O. Breathing pattern and minute ventilation ($\dot{V}_I$), dynamic PEEPi, expiratory muscle activity, diaphragmatic (PTPdi/min) and oesophageal (PTPoes/min) pressure-time product per minute, integrated diaphragmatic (EMGdi) and intercostal EMG (EMGic) and end expiratory lung volume (EELV) were measured. Expiratory muscle activity was present at baseline in one subject. In the remaining eight, PEEPi was reduced from a mean (SE) of 2.9 (0.6) cm H2O to 0.9 (0.1) cm H2O ($p<0.05$). In two subjects expiratory muscle activity contributed to PEEPi at higher pressures. There were no changes in respiratory pattern but $\dot{V}_I$ increased from 9.2 (0.6) l/min to 10.7 (1.1) l/min ($p<0.05$). EMGdi remained stable while EMGic increased significantly. PTPoes/min decreased, although this non - statistical significance. PTPdi/min decreased significantly from