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FAKULTAS ILMU KESEHATAN

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JURNAL 1

Effects of physiotherapy treatment in patients with bronchial asthma: A systematic review

Pendahuluan

Asma bronkial (BA) adalah penyakit radang kronis pada saluran pernapasan, yang melibatkan patogenesis sel dan mediator peradangan yang dikondisikan, dalam bagian, oleh faktor genetik. Ini memiliki respons hiper bronkial dan obstruksi aliran udara, yang mungkin seluruhnya atau sebagian dapat dibalik (Becker dan Abrams, 2017; Moral et al., 2019). Ini ditandai dengan gejala pernafasan seperti itu seperti mengi, sesak napas, udara ekspirasi terbatas mengalir, sesak dada dan batuk (García dan Pérez, 2012; Lundbäck, Backman, Lötvall, dan Rönmark, 2016). ini salah satu penyakit kronis yang paling sering terjadi di dunia dan itu mempengaruhi sekitar 300 juta orang. Terakhir 30 tahun prevalensi penyakit ini meningkat negara industri, yang tampaknya terkait dengan proporsi yang lebih besar dari populasi yang tinggal di pengaturan perkotaan tetapi tampaknya telah stabil dalam nilai dari 10 hingga 12% pada orang dewas. Meski penyebab BA masih belum diketahui, keberadaan faktor pengkondisi penampilan mereka, terutama genetik dan jenis lingkungan (seperti alergen, infeksi virus, merokok, polusi…) ditunjukkan (Becker dan Abrams, 2017). Ada tiga proses yang mempengaruhi patofisiologi penyakit ini: peradangan bronkial, alergi dan hiperreaktivitas bronkiala dan 15% pada anak-anak (Lundbäck, Backman, Lötvall, dan Rönmark, 2016). Pada inflamasi bronkial, sel inflamasi terlibat (mampu menyebabkan edema dan bronkokonstriksi). Faktor alergi termasuk atopi dan alergen. Tautan patofisiologis terakhir BA adalah hiperreaktivitas bronkial, yang didefinisikan sebagai kecenderungan pohon bronkial untuk bereaksi terhadap respons bronkokonstriktor yang berlebihan terhadap rangsangan fisik dan kimia (Becker dan Abrams, 2017).

Perawatan fisioterapi bertujuan untuk mengurangi frekuensi serangan asma dan intensitas gejala. Metode yang digunakan bertindak terutama melalui pendidikan pasien dalam manajemen mantra asma yang benar dan peningkatan elastisitas paru (McCracken, Veeranki, Ameredes, dan Calhoun, 2017). Tambahan, perubahan mekanis yang terkait dengan kelebihan otot pernapasan dapat menyebabkan perkembangan muskuloskeletal disfungsi dan perubahan postur, jadi pertahankan Mekanika ventilasi yang baik dan mencegah toraks kelainan bentuk juga merupakan tujuan intervensi fisioterapi. Selama serangan asma, yang utama adalah melakukannya mengontrol gejalanya, mencapai ventilasi yang baik, kontrol laju pernapasan dan mengendurkan otot-otot pernapasan (Porsbjerg dan Menzies-Gow, 2017)

Metode

Untuk pencarian publikasi yang sistematis, istilah Medical Subject Headings (MeSH) Terapi fisik modalitas dan Asma digunakan. Mengingat jumlah hasil yang sedikit, itu ditambahkan sebagai pencarian Fisioterapi deskriptor. Istilah-istilah ini diperkenalkan dalam delapan database: Cinahl, Cochrane, Medline, PEDRO, Pubmed, Web of Science, SCOPUS dan Direktori Terbuka Akses Jurnal. Proses pencarian berlangsung sepanjang bulan Januari 2019. Selama analisis hasil, kriteria berikut diterapkan: inklusi studi dari 2014 hingga saat ini, yang dievaluasi intervensi fisioterapi dan sampelnya dibentuk oleh pasien dengan BA. Pedoman PRISMA untuk tinjauan sistematis studi yang mengevaluasi perawatan

kesehatan intervensi mengikuti (Moher, Liberati, Tetzlaff, dan Altman, 2009). PICOS (populasi, intervensi, kriteria pembanding, hasil, desain studi) diformulasikan secara apriori untuk memandu ruang lingkup tinjauan dan pencarian, seleksi dan sintesis literatur. Kualitas studi dinilai menggunakan skala Jadad (Universitas Oxford, Oxford, Inggris) untuk acak, uji coba terkontrol (Jadad et al., 1996); skor itu tidak digunakan untuk mengecualikan artikel.

Manual terapi

Dalam studi oleh Löwhagen dan Bergqvist (2014) mereka menerapkan metode Lotorp selama enam minggu. Sebanyak 29 pasien berusia 20 sampai 52 tahun berpartisipasi dalam penelitian ini. Metode Lotorp diterapkan pada 17 pasien, sedangkan 12 sisanya diinstruksikan dalam program latihan direkomendasikan oleh Dewan Kesehatan Nasional Swedia dan Kesejahteraan. Metode Lotorp terdiri dari pertunjukan pijat dan pengobatan titik pemicu sekelompok otot punggung dan dada, di antaranya adalah tulang belakang dan lumbar square erectors atau pectorals dan diafragma (Bardin, Rangaswamy, dan Yo, 2018). Hasil penelitian menunjukkan bahwa terdapat penurunan gejala dominan yang signifikan baik saat istirahat maupun saat berolahraga dan peningkatan ekspansi toraks pada kelompok intervensi dengan metode Lotorp. Aliran ekspirasi puncak (PEF) meningkat secara signifikan tetapi volume maksimum yang dihembuskan di detik pertama (FEV1) dan kapasitas vital paksa (FVC) tidak membaik. Terakhir, gejala dada sesak dan sesak nafas juga menurun. Mengenai kelompok kontrol, peningkatan yang signifikan diamati dalam variabel yang sama tetapi pada tingkat yang lebih rendah daripada di kelompok intervensi.

Pandey dan Pandey (2015) menerbitkan studi kasus dengan tujuan mengevaluasi efek fisioterapi program yang terdiri dari terapi kraniosakral yang dilengkapi dengan pelepasan interkostal dan neuromuskuler proprioseptif fasilitasi untuk relaksasi diafragma pada anak berusia 10 tahun. Pendekatan fasia kraniosakral membahas tiga hal utama daerah: jaringan paru-paru, saraf vagus dan sinus hidung daerah. Penulis menganggap kraniosakral itu sehat siklus harus di atas 80 detik, dikurangi dalam pelajari pasien dengan interval waktu yang lebih rendah dari 10 detik. Pasien menerima pengobatan selama tujuh sesi 45 menit lebih dari 5 minggu. Hasil penelitian menunjukkan bahwa gejala seperti mengi, dispnea dan serangan batuk menurun penerapan terapi ini dan perbaikannya sedemikian rupa sehingga mereka mengizinkan penarikan pengobatan obat.

Dalam studi oleh Leonés-Macías et al. (2018) efeknya terapi manual pada diafragma dievaluasi oleh meregangkan otot pernapasan pada 32 pasien asma antara usia 18 dan 45 tahun. intervensi terdiri dari penerapan teknik peregangan diafragma selama 5–7 menit pada kelompok intervensi sedangkan kelompok plasebo diberikan menggunakan plasebo kepala ultrasonik terputus. Hasilnya menunjukkan bahwa terapi peregangan diafragma manual dipimpin untuk peningkatan tekanan inspirasi maksimum, fleksibilitas dan mobilitas tulang rusuk 5 menit setelah teknik. Dua parameter terakhir ini juga dipertahankan perbaikan pada 20 menit pasca-intervensi.

Hasil

Dua belas hasil ditemukan: empat mengevaluasi intervensi terapi manual, lima pengobatan dengan ventilasi teknik pendidikan ulang, dua intervensi menjelaskan berdasarkan latihan terapeutik dan yang difokuskan pengobatan dengan teknik relaksasi. Karakteristik metodologis dari studi yang dianalisis secara rinci

Pendidikan ulang pernapasan

Studi oleh Tehrany, DeVos, dan Bruton (2018) bertujuan untuk membuktikan adanya perubahan pola pernafasan pada pasien berusia 57 tahun setelahnya program fisioterapi. untuk ini, mereka mendaftarkan pola pernafasan dengan alat pernafasan induktif plethysmography, sebelum dan sesudah fisioterapi intervensi. Dia menerima tiga sesi tatap muka: salah satu evaluasi dan kesadaran tentang ventilasi pola; dan dua kontrol evolusi lainnya 16 minggu. Hasilnya menunjukkan bahwa itu mengurangi penggunaan salbutamol dari 12 hingga 6 inhalasi. Di Nijmegen kuesioner (NQ) untuk penilaian hiperventilasi, berubah dari 39/64 menjadi 10/64, dengan skor 23 atau indikasi yang lebih tinggi dari sindrom hiperventilasi dipertimbangkan pada skala ini. Hasil angket asma control (ACQ) menunjukkan bahwa skornya meningkat dari 3.8 hingga 2.3. Perubahan 0,5 poin pada skala ini dianggap penting secara klinis dan itu membenarkan perubahan pengobatan. Latihan ditujukan untuk melatih pasien dalam otomatisasi kombinasi diafragma, nasal, dan pernapasan lambat dengan latihan relaksasi.

Metode evaluasi adalah sebagai berikut satu: tes kontrol asma (ACT), yang dilakukan untuk mengukur tingkat pengendalian penyakit; skala efikasi diri umum (GSE) untuk mengukur perubahan persepsi kemampuan mengelola berbagai secara memadai situasi stres; waktu menahan nafas (BHT), untuk mengukur waktu apnea maksimum; NQ, untuk menilai hiperventilasi; kapnografi, untuk mengukur variasi konsentrasi karbondioksida yang dihembuskan dan pernapasan rate dan spirometri untuk pengukuran FEV.

Aktifitas fisik

Hasil yang diperoleh menandakan fakta bahwa, semua latihan aerobik pada anak sekolah dibandingkan dengan perlakuan konvensional selama 10 minggu. 38 anak usia sekolah (23 laki-laki dan 15 perempuan) berusia antara 8 dan 12 tahun berpartisipasi dalam program pelatihan.

Hasilnya menunjukkan bahwa latihan fisik menyebabkan peningkatan yang signifikan terhadap kontrol kelompok, sebagaimana tercermin dari hasil pasca-intervensi, dari semua parameter penilaian fungsi paru, kapasitas aerobik dan kualitas hidup.

Majewski, Dabrowska, Pawik, dan Rozek (2015) menganalisis efektivitas program rehabilitasi paru di rumah untuk perbaikan sistem pernapasan. fungsi, kekuatan otot inspirasi dan kondisi fisik pada wanita lanjut usia dengan BA. 10 wanita dengan usia rata-rata dari 70,8 tahun berpartisipasi dalam program rehabilitasi paru 8 minggu, yang terdiri dari 2 sesi rumah dan 1 sesi yang diawasi per minggu. Pelatihan utama termasuk delapan latihan, masing-masing dengan durasi 2 menit. Latihan dipisahkan dengan interval istirahat 1 menit.

Teknik relaksasi

Romieu dkk. (2018) membandingkan variasi PEF antara pengobatan konvensional (pemberian oksigen, kortikosteroid, bronkodilator dan fisioterapi) dan perawatan yang sama ini dengan menambahkan sesi sophrology. 74 anak dirawat di rumah sakit karena serangan BA berpartisipasi dalam penelitian ini, dibagi menjadi dua pengobatan kelompok dengan ukuran yang sama. Intervensi dimulai dengan dialog lima belas menit sebelumnya untuk menciptakan iklim kepercayaan.

Diskusi

Tujuan dari tinjauan ini adalah untuk mengevaluasi efek dari perawatan fisioterapi pada pasien dengan BA. Dalam terang dari hasil yang diperoleh, pada tingkat yang lebih besar atau lebih kecil, semuanya intervensi fisioterapi menghasilkan dampak positif pada gejala klinis yang disebabkan oleh BA.

JURNAL 1

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Effects of physiotherapy treatment in patients with bronchial asthma: A systematic review

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ABSTRACT

Background: Bronchial asthma is a chronic inflammatory disease of the respiratory tract. Its physiotherapy treatment aims to reduce the frequency of asthmatic spells and the intensity of symptoms. The methods employed act mainly through the education of the patient in the correct handling of the asthma attacks and the improvement of the pulmonary elasticity.
Objective: The objective of this review was to critically evaluate the available evidence on the effectiveness of different physiotherapy interventions in asthmatic patients.
Methods: To achieve this, the search was focused on scientific databases with the key words Physiotherapy and Asthma. The search was limited to studies that evaluated the effects of a physiotherapy intervention in patients diagnosed with bronchial asthma.
Results: 1794 articles were located and after the inclusion and exclusion criteria were applied, 12 studies were analyzed. Of these, 5 evaluated a respiratory reeducation intervention, 4 manual therapy techniques, 2 interventions based on therapeutic exercise and 1 relaxation techniques.
Conclusions: The results obtained revealed that physiotherapy provides a wide range of treatment options for bronchial asthma and all of them provide positive results against the exclusive application of pharmacological treatment.

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Introduction

Bronchial asthma (BA) is a chronic inflammatory disease of the respiratory tract, whose pathogenesis involves
cells and mediators of inflammation conditioned, in
part, by genetic factors. It has bronchial hyper response
and airflow obstruction, which might be totally or partially reversible (Becker and Abrams, 2017; Moral

et al., 2019). It is characterized by respiratory symptoms such as wheezing, shortness of breath, limited expiratory air flow, chest tightness and cough (García and Pérez, 2012; Lundbäck, Backman, Lötvall, and Rönmark, 2016). It is one of the most frequent chronic diseases in the world and it affects about 300 million people. In the last 30 years the prevalence of this disease has increased in industrialized countries, which is apparently related to the greater proportion of the population that lives in urban settings but it seems to have stabilized in values of 10 to 12% in adults and 15% in children (Lundbäck, Backman, Lötvall, and Rönmark, 2016). Although the causes of BA remain unknown, the existence of conditioning factors for their appearance, mainly of a genetic and environmental type (such as allergens, viral infections, smoking, pollution …) is demonstrated (Becker and Abrams, 2017).

There are three processes that influence the pathophysiology of this disease: bronchial inflammation, allergy and bronchial hyperreactivity. In bronchial inflammation, inflammatory cells are involved (capable of causing edema and bronchoconstriction). Allergic factors include atopy and allergens. The last pathophysiological link of BA is bronchial hyperreactivity, which is defined as the tendency of the bronchial tree to react to an excessive bronchoconstrictor response to physical and chemical stimuli (Becker and Abrams, 2017).

The physiotherapy treatment aims to reduce the frequency of asthmatic spells and the intensity of symptoms.

The methods used act primarily through the education of the patient in the correct management of asthmatic spells and the improvement of lung elasticity (McCracken, Veeranki, Ameredes, and Calhoun, 2017). In addition, mechanical alterations related to respiratory muscle overload can lead to the development of musculoskeletal dysfunctions and posture alterations, so maintaining good ventilatory mechanics and preventing thoracic deformities is also an objective of physiotherapeutic interventions. During asthma attacks, the main thing is to control the symptoms, achieve good ventilation, control the respiratory rate and relax the breathing muscles (Porsbjerg and Menzies-Gow, 2017).

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Substantial advances have been made in scientific knowledge about the nature of asthma, a wide range of new medications and the understanding of important emotional, behavioral, social and administrative aspects

of BA care. However, despite these efforts, international surveys provide continuous evidence of deficiencies in asthma control and lack of adherence to existing guidelines (Becker and Abrams, 2017). Therefore, it is still necessary to address the respiratory symptoms and secondary musculoskeletal compensations of the same, which are not sensitive to medical treatment and that affect the capacity of patients in the development of daily life activities and their full socio-labor development (Porsbjerg and Menzies-Gow, 2017). Taking into account all of the above, it was considered necessary to carry out a literature review of the scientific literature published so far with the objective of evaluating the effects of physiotherapy treatments in patients with BA; to validate the hypothesis that physiotherapy techniques are able to reduce the frequency of asthmatic spells and the intensity of their symptoms.

Methods

For the systematic search of publications, the terms Medical Subject Headings (MeSH) Physical therapy modalities and Asthma were used. Given the small number of results, it was added as a Physiotherapy search descriptor. These terms were introduced in eight databases: Cinahl, Cochrane, Medline, PEDRO, Pubmed, Web of Science, SCOPUS and Directory of Open Access Journals. The search process took place throughout the month of January 2019. During the analysis of results, the following criteria were applied: inclusion of the studies from 2014 to the present, that evaluated a physiotherapy intervention and that the sample was formed by patients with BA. The PRISMA guidelines for systematic reviews of studies evaluating health care interventions was following (Moher, Liberati, Tetzlaff, and Altman, 2009). PICOS (population, interventions, comparators, outcomes, studies design) criteria were formulated a priori to guide the review's scope and the searching, selection and synthesis of the literature.

Study quality was assessed using the Jadad scale (University of Oxford, Oxford, England) for randomized, controlled trials (Jadad et al., 1996); that scoring was not used to exclude the articles. The search and selection process is detailedly explained in Figure 1.

Results

Twelve results were found: four evaluated a manual therapy intervention, five a treatment with ventilatory reeducation techniques, two explained interventions based on therapeutic exercise and one focused on a treatment with relaxation techniques. The methodological characteristics of the studies analyzed are detailedly explained in Table 1 and the characteristics of the interventions are detailed in Table 2.

Manual therapy

In the study by Löwhagen and Bergqvist (2014) they applied the Lotorp method for six weeks. A total of 29 patients from 20 to 52 years old participated in this study. The Lotorp methodwas applied to 17 of them, while the remaining 12 were instructed in an exercise program recommended by the Swedish National Board of Health and Welfare. The Lotorp method consists of performing massage and treatment of trigger points of a group of dorsal and thoracic muscles, among which are the spinal and lumbar square erectors or the pectorals and the diaphragm (Bardin, Rangaswamy, and Yo, 2018). The results showed that there was a significant reduction of the dominant symptoms both during rest and during exercise and an increase in thoracic expansion in the intervention group with the Lotorp method. The peak expiratory flow (PEF) improved significantly but the maximum volume exhaled in the first second (FEV1) and the forced vital capacity (FVC) did not improve. Finally, the symptoms of chest tightness and shortness of breath also decreased. Regarding the control group, significant improvements were observed in these same variables but to a lesser extent than in the intervention group.

Pandey and Pandey (2015) published a case study with the objective of evaluating the effects of a physiotherapy program consisting of a craniosacral therapy supplemented with intercostal release and proprioceptive neuromuscular facilitation for diaphragm relaxation in a 10-year-old child. The craniosacral fascial approach addressed three main areas: the lung tissue, the vagus nerve and the nasal sinus area. The authors considered that a healthy craniosacral cycle should be above 80 seconds, being reduced in the study patient to a time interval lower than 10 seconds. The patient received the treatment for seven 45-minute sessions over 5 weeks. The results showed that symptoms such as wheezing, dyspnea and coughing attacks decreased with the application of this therapy and the improvements were such that they allowed the withdrawal of drug treatment. On the other hand, the patient's craniosacral rhythm went from 2 seconds to 80 seconds, which are considered healthy.

In the study by Leonés-Macías et al. (2018) the effects of manual therapy on the diaphragm were evaluated by stretching the respiratory muscles in 32 asthmatic patients between 18 and 45 years of age. The intervention

consisted of applying a diaphragm stretching technique for 5–7 minutes in the intervention group while the placebo group was administered a placebo using a disconnected ultrasonic head. Data were collected before and after the intervention (immediately before the treatment and 5 and 20 minutes after it). The results

indicated that manual diaphragm stretching therapy led to an improvement in maximum inspiratory pressures, flexibility and mobility of the rib cage 5 minutes after the technique. These last two parameters also maintained improvements at 20 minutes post-intervention.

The Hupa case study (Hupa, 2015) reported on the evolution of a patient with BA for 22 years since he was diagnosed at 11 years of age. The long-term study based the evaluation of results on diagnostic methods using gasometry (through which they evaluated the pressure of oxygen, carbon dioxide, pH, bicarbonate concentration and base balance); spirometry (from which they extracted as study variables the FVC, FEV1, FEV1/FVC, PEF and forced expiratory flow); and, radiology through which they evaluated focal changes in the lung areas. The patient received pharmacological treatment and climatotherapy and a physiotherapy intervention that included postural drainage and thoracic mobility exercises. The analysis of the results led to the conclusion that the therapy applied significantly improved the patient's efficiency in controlling

Cinhal (n=12)	Cochrane (n=18)	Medline (n=36)	PEDRO (n=18)	Pubmed (n=14)	WOS (n=15)	SCOPUS (n=67)	DOAJ (n=16)

196 records
Duplicated (n=15)
54 records
Excluded after reading title and abstract (n=142):
-Did not apply a physiotherapy treatment (n=140).
-Sample not formed by BA patients (n=2).
39 records
Excluded after readind full text (n=27):
- Did not apply a physiotherapy treatment (n=24).
- Description of a protocol (n=3).
Studies included (n=12)

Figure 1. PRISMA flow diagram.

Table 1. Methodological characteristics of the studies analyzed

Authors	Design	Sample size	Inclussion criteria	JADAD Scale Randomization*	Blinding**	Withdrawals***	Final score

Abdel-basset
et al. (2018)
Randomized controlled
clinical trial
38
patients
School-aged children moderate asthmatic patients between 8 - 12 years (FEV1=60%–80%); were receiving longacting β2-agonist and corticosteroid medications; and were suffering from dyspnea or wheezing, night cough,
and airway obstruction in the last 6 months
2 1 1 4
Bruton et al.
(2018)
Randomized controlled
clinical trial
655
patients
Diagnosis of asthma, age of 16–70 years, receipt of at least one anti-asthma medication in the previous year,
and Asthma Quality of Life Questionnaire score of < 5.5
2 1 1 4
Grammatopoulou et
al. (2017)
Experimental study 24
patients
Adult mild-to-moderate asthma patients 2 1 1 4
Hupa (2015) Case study 1
patient
— 0 0 0 0
Leonés-Macías
et al. (2018)
Randomized controlled
pilot study
32
patients
Diagnosis of allergic or non-allergic asthma and age from 18 to 45 years 2 1 1 4
Löwhagen &
Bergqvist
(2014)
Controlled clinical study29
patients
Adult asthma patients (ages 20-52), all had been prescribed bronchodilators 0 0 1 1
Majewski et al.
(2015)
Experimental
study
10
patients
Adult women moderate and stable asthma patients 0 0 1 1
Mayank &
Khaund

(2014)
Experimental
study
46
patients
Adult mild asthmatic patients (ages 20-65 years) 0 0 1 1
Pandey &
Pandey
(2015)
Case study 1
patient
— 0 0 0 0
Romieu et al
(2018)
Randomized
controlled clinical
trial
74
patients
Children aged 6-17 years, who were hospitalized for an asthma attack 2 0 1 3
Shine et al.
(2016)
Experimental
study
30
patients
Moderate asthma adult patients (ages 20-40 years) with daily symptoms more than once a week, and nocturnal
symptoms more than twice a month.
0 0 1 1
Tehrany et al.
(2018)
Case study 1
patient
— 0 0 0 0
*Randomization: 1 point if randomization is mentioned; 2 points if the method of randomization is appropriate. **Blinding: 1 point if blinding is mentioned; 2 points if the method of blinding is appropriate.
***Whithdrawals: 1 point if the number and reasons in each group are stated. —: not applicable

Table 2. Characteristics of the interventions of the studies analyzed
Authors

Intervention	Time of intervention	Experimental group	Control group

	io n	gr o u p	

Number of sessions (frequency)

Improvements

Abdelbasset et al. (2018)

Moderate-intensity aerobic exercise Only pharmacological treatment 10 weeks 30 sessions (3 per week)

- Improved quality of life, pulmonary function and VO2MAX, and fatigue index.

Bruton et al. (2018)

Respiratory reeducation (self-guided by DVD or faceto-face) Only pharmacological treatment 12 months 26 sessions (1 each 2 weeks)

- Improved quality of life.

Grammatopoulou et al. (2017)

Respiratory reeducation (holistic self-control plan) Short manual with asthma information 12 months 7 sessions (all in the first month)

- Improved control of symptoms, apnea time, and FEV1.- Decreased hyperventilation, capnography, respiratory rate.

Hupa (2015) Manual therapy (thoracic mobility exercises) and postural drainage

— 22 years Not described - Improved patient's efficiency in controlling symptoms and attacks, and all spirometric values.

Leonés-Macías et al. (2018)

Manual therapy (diaphragm stretching technique) Placebo (disconnected ultrasound) 1 day 1 session - Improved PIMAX, flexibility and mobility of the rib cage.

Löwhagen & Bergqvist (2014)

Manual therapy (Lotorp method) Exercise program recommended by the Swedish National Board of Health and Welfare

6 weeks 2 sessions (one every third week)

- Improved thoracic expansion and PEF rate.
- Decreased chest tightness and shortness of breath.

Majewski et al.

(2015)			
Physical activity (home pulmonary rehabilitation program)	— 8 weeks 24 sessions (3 per week)	- Improved PIMAX, exercise tolerance, lower body flexibility, fatigue and quality of life.	
Mayank & Khaund (2014)			
Respiratory reeducation (diaphragmatic breathing exercises or Buteyko technique)	— 2 weeks 14 sessions (one per day)	- Higher improvements in FEV1, PEF, and FEV1/FVC with Buteyko technique.	
Pandey & Pandey (2015)			
Manual therapy (craniosacral therapy and propioceptive neuromuscular facilitation)	— 5 weeks 7 sessions (frequency not described)	- Decreased wheezing, dyspnea and coughing attacks.	
Romieu et al (2018)			
Relaxation technique (sophrology) and conventional treatment (pharmacological and physiotherapy treatment)	Conventional treatment (pharmacological and physiotherapy treatment)	1 day 1 session	- Higher improvements in PEF, oxygen saturation and dyspnea with sophrology technique.
Shine et al. (2016)	Respiratory reeducation (diaphragmatic breathing exercises)	Pursed-lip expiration exercise	6 weeks 60 sessions (2 sessions each day, 5 days/ week)
- Improved chest expansion and PEF rate.			
Tehrany et al. (2018)			
Respiratory reeducation	— 16 weeks 3 sessions (frequency not described)		
- Need less Salbutamol. - Improved asthma control and expiratory time. - Decreased hyperventilation, anxiety and depression levels.			

VO2MAX: maximal oxygen uptake; FEV1: Forced expiratory volume in 1 second; PIMAX: maximal inspiratory pressure; PEF: peak expiratory flow; FEV1/FVC: forced expiratory volume in 1 second/forced vital

capacity.
— not applicable

symptoms and asthmatic spells. Significant improvements were observed in all spirometry values but in gasometry, despite having compensated for metabolic acidosis, it was noted that the patient continued to present a type II respiratory insufficiency.

Respiratory reeducation

The study by Tehrany, DeVos, and Bruton (2018) aimed to prove the existence of changes in the respiratory pattern of a 57-year-old patient after a physiotherapy program. For this, they registered the respiratory patterns by means of respiratory inductive plethysmography, before and after the physiotherapy intervention. He received three face-to-face sessions: one of evaluation and awareness of the ventilatory pattern; and another two of evolution control over 16 weeks. The results showed that it reduced the use of salbutamol from 12 to 6 inhalations. In the Nijmegen questionnaire (NQ) for the assessment of hyperventilation, it went from 39/64 to 10/64, with a score of 23 or higher indicative of hyperventilation syndrome being considered on this scale. Regarding the hospital anxiety and depression scale (HADS), in which scores above 8 indicate involvement, it obtained a preintervention score of 10 in anxiety and 15 in depression. Both scores were reduced to 1 in the two subtests after the intervention. The results in the asthma control questionnaire (ACQ), indicated that it improved its score from 3.8 to 2.3. A change of 0.5 points on this scale is considered clinically important and it justifies a change in treatment. The study also found significant improvements in the PEF flow rate and a nonsignificant increase in FEV1. The carbon dioxide parameters in the gas exhaled during the respiratory cycle or oxygen saturation did not change.

Bruton et al. (2018) evaluated for 12 months the effectiveness of a virtual self-guided respiratory reeducation intervention. A total of 655 patients were assigned to three interventions, two experimental groups and one control group, all of them maintaining their usual pharmacological treatment. A total of 261 patients (40%) performed self-guided breathing exercises following the instructions contained on a DVD; 132 patients (20%) performed a face-to-face respiratory reeducation program with a physiotherapist once every two weeks for 40 minutes; and the control group, with 262 patients (40%) received exclusively the pharmacological treatment. The exercises were aimed at training patients in the automation of diaphragmatic, nasal and slow breathing in combination with relaxation exercises. The results showed that virtual and face-to-face intervention with a physical therapist

improved the quality of life in patients with BA as confirmed by the results of the asthmatic patient quality of life (AQLQ) questionnaire. However, no significant effect was found on pulmonary function values (FEV1, PEF, FVC) or inflammation of the airways by measuring the exhaled fraction of nitric oxide. In the comparison of the results of the three groups, no significant differences were found, except for a vital improvement of the depression component of the HADS scale in the virtual intervention group versus the control group. In the two experimental groups, the one that received the virtual treatment and the one that did face-to-face sessions with a physiotherapist, there were significant improvements regarding the control group on the AQLQ scale, which assesses the quality of life. The results indicated that there were no differences between the three groups in the rest of the scales (ACQ and NQ) or in the spirometry parameters (FEV1, PEF and the exhaled fraction of nitric oxide).

Grammatopoulou et al. (2017) published a study in which they evaluated the effect of a holistic BA selfcontrol plan with 24 patients admitted to the Emergency Department due to an asthma attack for 12 months. The intervention, applied to 12 patients, was carried out in four educational sessions and three individualized sessions over a month. In two of these sessions, physiotherapist applied a ventilatory reeducation program to reduce the symptoms and exacerbations of BA in daily life and encouraged physical activity. The third session was conducted by a psychologist to teach them how to effectively manage the disease. In addition, a home-based asthma self-control plan was implemented, during which the patients had to carry out the following 11 months and that included recommendations to adopt the respiratory pattern in daily life activities, proper registration of the PEF and a promotion of physical activity for 30 minutes per day, five days a week. The 12 patients in the control group were only given a brief manual with information about the BA. The self-control plan included five components: diaphragmatic breathing with gentle filling of the abdomen and relaxation of the accessory muscles of respiration; nasal breathing; brief 2–3 seconds apnea; increased apnea time; and an adoption of an adequate respiratory pattern when speaking, coughing, yawning and sighing. The evaluation methods were the following ones: the asthma control test (ACT), which was performed in order to quantify the degree of disease control; the general self-efficacy (GSE) scale to measure changes in the perception of the ability to adequately manage various stress situations; the breathing hold time (BHT), to measure the maximum apnea time; the NQ, to assess hyperventilation; capnography, to measure the variations of exhaled carbon dioxide concentration and respiratory

rate and spirometry for the measurement of FEV1. The results obtained signposted to the fact that that, all the

measured variables having been taken into the account, the experimental group obtained significant improvements while the control group did not. Furthermore, a positive interaction between intervention and time of application was detected in the ACT, GSE, BHT, NQ, carbon dioxide concentration, respiratory rate and spirometry.

Shine et al. (2016) conducted a study with the objective of demonstrating that diaphragmatic breathing exercises play an important role in the management of BA to obtain functional benefits in lung function. Thirty patients from 20 to 40 years old participated in the study. Fifteen patients in the group that performed diaphragmatic breathing received six physiotherapy sessions lasting 20 minutes each. The frequency of treatment was twice a day, five days a week. Fifteen patients who participated in the second intervention performed exercises focused on nasal inspiration and slow mouth exhalation with pursed lips with the same frequency and duration of the sessions. The study showed a statistically significant improvement in the diaphragmatic breathing group, which increased thoracic expansion by 2% and PEF by 16.9% in comparison to the puffed-out exhalation group that improved 1 and 2,2%, respectively.

Mayank and Khaund (2014) published a study in which they compared the effectiveness of the Buteyko respiratory technique while performing diaphragmatic exercises. 46 patients participated, between 20 and 65 years of age. The study was carried out over 2 weeks, and both groups performed daily sessions lasting 60–90 minutes. Half of the patients were assigned to the group that performed the Buteyko technique and the other half to the group that performed diaphragmatic exercises. The Buteyko technique aims to reeducate the respiratory rate to correct hyperventilation, by reducing the amount of inhaled air. The intervention centered on diaphragmatic exercises consisted of being in a semi-Fowler position and performing slow and deep nasal inspirations keeping the shoulders relaxed, avoiding the pattern of costal breathing and performing oral exhalations. Spirometry was used to evaluate patients, assessing FEV1, PEF and the relationship between FEV1 and forced vital capacity (FEV1/FVC). The results indicated that all participants improved in all parameters but significant improvements were noted only in the group that received the Buteyko technique.

Physical activity

Abdelbasset et al. (2018) carried out a study with the objective of evaluating the effectiveness of training with aerobic exercise in school children compared to conventional treatment for 10 weeks. 38 children of school

age
(23 boys and 15 girls) aged between 8 and 12 years participated in the training program. The participants were randomly assigned to two groups, receiving both pharmacological treatment and respiratory exercises. The experimental group also carried out a moderate intensity
exercise program simultaneously to the conventional
treatment. For the evaluation of the participants, they
measured lung function through spirometry by quantifying FEV1 and FVC; aerobic capacity through maximum
oxygen consumption (VO2Max), 6-minute walk test
(6MWT) and fatigue index; and the quality of life through
PAQLQ. The results indicated that the physical exercise
caused a significant improvement against the control
group, as reflected by the post-intervention results, of all
the parameters of pulmonary function assessment, aerobic capacity and quality of life.
Majewski, Dabrowska, Pawik, and Rozek (2015) analyzed the effectiveness of a home pulmonary rehabilitation program for the improvement of respiratory
function, inspiratory muscle strength and physical condition in older women with BA. 10 women with a mean age
of 70.8 years participated in the 8-week pulmonary rehabilitation program, which consisted of 2 home sessions and 1 supervised session per week. The main training
included eight exercises, each with a 2-minute duration.
The exercises were separated by 1-minute rest intervals.
The patients counted the number of repetitions and wrote
them down in a notebook. The home pulmonary rehabilitation program significantly improved the FVC, FEV1,
PEF and FEF as well as the values of maximum inspiratory pressure (IPMax) of the patients. The results of the HADS and the Saint George's Respiratory Questionnaire
(SGRQ) which assess the patients' quality of life, only
showed significant improvements in aspects related to
BA symptoms. The results obtained in the physical fitness
tests (Fullerton Fitness Test) and the lower body flexibility
had also improved.

Relaxation techniques

Romieu et al. (2018) compared the PEF variations
between the conventional treatment (administration of
oxygen, corticosteroids, bronchodilators and physiotherapy) and this same treatment by adding a session of sophrology. 74 children hospitalized for an BA attack
participated in this study, divided into two treatment
groups of equal size. The intervention began with
a previous fifteen-minute dialogue to create a climate of
trust. In the main part of the session, which lasted for
about thirty minutes, a slow and monotonous speech was
used that took the patient to a level between awakening

and sleep (sophroliminal level). The session ended with
a final discussion describing the sensations experienced.
The data obtained showed that PEF, SpO2 and dyspnea

improved significantly in the group that received the sophrology session in comparison to the control group, but there was no improvement in respiratory or heart rate. No improvements were found regarding the conventional treatment group in the length of hospital stay, medication consumption or quality of life measured with the pediatric quality of life questionnaire (PedsQL).

Discussion

The objective of this review was to evaluate the effects of physiotherapy treatments in patients with BA. In the light of the results obtained, to a greater or lesser extent, all physiotherapy interventions generate a positive impact on the clinical symptoms caused by BA.

Manual therapy

Talking about the interventions that applied manual therapy, the most outstanding clinical improvements were obtained after the application of craniosacral therapy (Pandey and Pandey, 2015) managing to eliminate the wheezing and cough of the patient therefore leading to a decision of his pulmonologist for the medication withdrawal. Regardless of obtaining these very positive results, it is a case study, in which the initial assessment of the patient is not clear. It does not show how these changes were evaluated and it does not take any objective action, which may detract from these results. The other intervention that showed positive results was the study that applied the Lotorp method (Löwhagen and Bergqvist, 2014). In this case, the study achieved a significant improvement in PEF but, fundamentally, it merely managed to improve the dominant symptoms (chest pressure, gasping, wheezing and dyspnea), which are for each patient those who showed a higher score on the analog visual scale.

Respiratory reeducation

Regarding ventilatory reeducation, the most effective therapy was the one that applied a reeducation of the ventilatory pattern (Tehrany, DeVos, and Bruton, 2018). With this intervention, significant improvements were achieved in the results obtained by the NQ, the ACQ, the PEF and the disappearance of anxiety and depression symptoms. Again, it is a case study, but in contrast to the Hupa study (Hupa, 2015), this time a correct recording of the variables was carried out. On the other hand, it is interesting to compare the effectiveness of different interventions as they were addressed by Mayank and Khaund (2014) in their study. In it, the two made a comparison of two respiratory techniques: Buteyko respiratory technique and diaphragmatic exercises. Although the effectiveness of respiratory techniques seems to be established, it is very important to assess which of them is the one that provides the best results. In this case, it was found that the Buteyko

technique obtained significant improvements compared to the technique of diaphragmatic exercises as far as lung function values are concerned.

Hyperventilation did not obtain improvements in the study that applied a virtual ventilatory reeducation program (Bruton et al., 2018). Reeducation therapies of the ventilatory pattern (Tehrany, DeVos, and Bruton, 2018) and the holistic plan of asthma self-control (Grammatopoulou et al., 2017), both used face-toface, did manage to reduce this symptom. These results support the need to apply face-to-face interventions since in them the physiotherapist can teach the techniques, resolve doubts, correct possible postural or execution errors, motivate the patient and, ultimately, facilitate adherence to the reeducation program. The virtual intervention sought to replace the physiotherapist's function for economic reasons but it did not pay attention to these fundamental factors in a ventilatory reeducation program and, probably, due to this phenomenon, its results were worse.

The degree of asthma control was evaluated in studies that applied ventilatory reeducation treatments. The study that applied a program of virtual ventilatory reeducation (Bruton et al., 2018), did not accomplish any improvements in the control of the disease but there were some improvements as far as the reeducation therapies of the ventilatory pattern (Tehrany, DeVos, and Bruton, 2018) and the holistic plan of selfcontrol of asthma were concerned (Grammatopoulou et al., 2017). Since the control of the symptoms of BA is an essential factor in the treatment, only three out of all the enumerated studies evaluate the impact of their interventions on this variable.

Among the studies that evaluated depression and anxiety, only those who applied a treatment based on the reeducation of the ventilatory pattern (Tehrany, DeVos, and Bruton, 2018) obtained significant improvements. This intervention describes a process of reassessment and constant discussion with the patient that could have led her to be aware that reducing her anxiety can attenuate the severity of the asthma attacks.

With the exception of the research by Leonés-Macías et al. (2018) and Pandey and Pandey (2015), all studies assessed parameters indicative of lung function. The intervention that applied kinesitherapy and postural drainage (Hupa, 2015), seemed to show the best results,

significantly improving the FVC, FEV1, PEF and FEV1 /FVC. Being a prospective case study, developed over 22 years, the improvements cannot be attributed exclusively to the intervention with physiotherapy since in such a prolonged period from childhood to adulthood, lung capacities are modified and muscle strength, as a result of muscle growth, can influence many other factors that were not taken into account. In addition, in this study, postural drainage was used, which has been shown to

have no positive results by demonstrating that the usual mechanism of secretion mobilization is antigravity (Ibarra-Cornejo et al., 2017). Another investigation that obtained great improvements was the one that developed a home pulmonary rehabilitation program (Majewski, Dabrowska, Pawik, and Rozek, 2015). In this case, the investigator discovered a viable combination of exercise with ventilatory awareness and relaxation. It seems that thanks to the multifactor approach of this study, most lung function parameters improved.

Among the studies that assessed quality of life, the intervention based on sophrology (Romieu et al., 2018), found no positive results. However, in investigations that applied a virtual and face-to-face ventilatory reeducation intervention (Tehrany, DeVos, and Bruton, 2018), a moderate intensity therapeutic exercise program (Abdelbasset et al., 2018) and a home pulmonary rehabilitation program with therapeutic exercise (Majewski, Dabrowska, Pawik, and Rozek, 2015) did show improvements in the different assessment scales. The results of these interventions, framed in respiratory reeducation and therapeutic exercise, seem to indicate that both therapies, by providing improvements in symptoms, were able to facilitate participation with fewer limitations in daily life activities, positively affecting the assessment of quality of life. This can be justified because these evaluations underline that the major part of the result lies in the limitations in daily life activities and the frequency and severity of respiratory symptoms and, to a lesser extent, in the degree of emotional involvement (in the one that focused on the intervention of sophrology).

Physical activity

Among the physiotherapy interventions that applied therapeutic exercise (Abdelbasset et al., 2018; Majewski, Dabrowska, Pawik, and Rozek, 2015), it is worth highlighting the differences between them, one being applied in pediatric patients and the other in older women; one having moderate intensity, the other, having very low intensity. Despite of this fact, both interventions yielded positive results, showing significant improvements in respiratory functions and aerobic capacity. This means that therapeutic exercise is a valuable tool that adapts to the patients' capacity and baseline state, achieving positive results in all age groups. In addition, it allows for the improvements always to be achieved to a greater or lesser extent, regardless of the degree of involvement of the patient and the level of physical condition which might be his/her point of departure (Sparling, Howard, Dunstan, and Owen, 2015). In any case, the intervention that

yielded the best results corresponds to the study that applied a program of therapeutic exercise of moderate intensity (Abdelbasset et al., 2018), in which there were also significant improvements in the life quality.

Relaxation techniques

Finally, the study that evaluated a sophrology intervention in combination with a physiotherapy program (Romieu et al., 2018), showed significant improvements in PEF, SpO2, and dyspnea. This implies the need to contemplate the inclusion of relaxation techniques in the treatment of BA since they do not seem to be widely used to address this pathology.

In the studies that included children, the parameters of respiratory function improved much more with the intervention that applied a program of therapeutic exercise of moderate intensity (Abdelbasset et al., 2018). On the other hand, in the studies with adult patients, these parameters improved to a greater extent in the study that was implemented alongside the home pulmonary rehabilitation program (Majewski, Dabrowska, Pawik, and Rozek, 2015). The two interventions belong to the group of therapies with therapeutic exercise which seems to indicate that it is the best approach for treatment in both children and adults to obtain improvements in lung function values (FEV1, PEF, FEV1/FVC).

Regarding the impact of the treatments on the patient's quality of life, the pediatric study that showed a better result is the one that applied a therapeutic exercise program of moderate intensity (Abdelbasset et al., 2018) and in the adult population, the home pulmonary rehabilitation program (Majewski, Dabrowska, Pawik, and Rozek, 2015). Both have achieved significant enhancements in the same vein as the best therapeutic option for the improvement of lung parameters; therefore, we draw the conclusion that the therapies that seem most effective are the ones that apply exercise.

On the other hand, studies seem to confirm that patient education plays a fundamental role in disease control. In the interventions, the learning of the techniques and their application in the home environment was decisive to maintain the improvements obtained. Sometimes, this educational function of the physiotherapist is intended to be

provided by offering intervention guidelines through virtual media. This trend responds to the search for a reduction in costs without taking into account the shortcomings of such treatment that strives to replace the role of the professional.

Considering the complexity of the management of the patient with BA, due to the diversity of physical, psychological, social and economic factors, it is very difficult to address the treatment of the disease from a single health discipline. Currently, in the health system, the most widespread treatment is the

pharmacological one, which only focuses on symptoms. Therefore, the multidisciplinary approach is interesting, in which the physiotherapist plays a justified role due to the results obtained from the applied therapies, achieving improvements at a physical level, life quality, disease control and also cost reduction by reducing medical visits and hospital admissions. In addition, it would be necessary to evaluate the application of physiotherapeutic intervention protocols by health institutions, so health managers should focus on this type of interventions with few or no side effects, with very low economic cost of application, high impact on life quality and high saving capacity for the health system.

These studies have methodological limitations. In the case of a disease with such a high incidence worldwide, the size of the samples used is mostly small, making it difficult to find significant relationships and extract generalizations from the existent. On the other hand, some of the studies do not clearly explain the baseline and post-treatment data of the patients, making it difficult to assess the existence of improvements. In many cases, the information was collected through surveys and questionnaires preventing it from being verified and deducted from its results. Although there are several long-term studies, most of the interventions are short, probably due to economic and time limitations of the researchers. For these reasons and for not having included only randomized controlled trials the conclusions of this review on the efficacy of physiotherapy treatment in patients with BA should be taken with caution and cannot be generalized (van Tulder, Furlan, Bombardier, and Bouter, 2003).

The analysis performed shows the need to carry out a new research, the one with a higher methodological quality that will obtain rigorous results which clarify which therapy shows a greater effectiveness in the approach of the patient with BA. It would be interesting to design studies that would be focused on patients' follow-up to assess whether the effects achieved with physiotherapy treatment are maintained in the long term and whether the patient is able to retain the techniques he/she had learned.

In conclusion, the therapeutic possibilities that physiotherapy offers in the treatment of patients with BA are numerous. Currently, research carried out so far indicates that the interventions that can benefit patients the most are techniques based on the combination of respiratory reeducation and therapeutic exercise. Regardless of the type of therapy described in the studies, all patients showed some kind of improvement, which highlights that the simple act of performing an intervention that involves the patient in their pathology in a way, parallel to the conventional treatment, is a significant improvement over the usual medical treatment.

Declaration of interest

The authors report no conflict of interest.

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JURNAL 2

Physiotherapy in cystic fibrosis: a comprehensive clinical overview

PENDAHULUAN

Cystic fibrosis (CF) adalah penyakit genetik resesif yang mempengaruhi pasien pada berbagai sistem, dengan manifestasi yang mendalam pada sistem pernapasan dan pencernaan. Ini ditandai dengan mutasi dan karena itu disfungsi gen untuk pengatur konduktansi transmembran fibrosis kistik (CFTR). Protein ini terutama berfungsi sebagai saluran ion, mengatur volume cairan pada permukaan epitel melalui sekresi klorin dan penghambatan resorpsi natrium. Pada saluran udara pasien CF, disfungsi CFTR menyebabkan penipisan lapisan cairan periciliary.

Fisioterapi merupakan bagian integral dari manajemen terapeutik pasien CF, baik pada stadium penyakit yang stabil secara klinis maupun selama infeksi saluran pernapasan. Di masa lalu, fisioterapi berfokus pada pembersihan jalan napas, juga dikenal sebagai fisioterapi dada, dengan mengajarkan atau menerapkan metode seperti drainase postural dengan atau tanpa aplikasi tambahan teknik manual. Drainase postural pohon trakeobronkial menggunakan posisi gravitasi tertentu untuk membantu mobilisasi lendir ke bawah (menuju mulut) di dalam saluran udara. Teknik manual (perkusi, getaran dan / atau getar) menggunakan kekuatan mekanis untuk membantu pelepasan lendir dari epitel saluran napas dan mobilisasinya.

FISIOTERAPI

1. pembersihan jalan napas

Edukasi pasien, penerapan dan pemantauan teknik pembersihan jalan napas tetap menjadi pengobatan fisioterapi utama untuk pasien CF. Fisioterapis memfasilitasi pembentukan rutinitas pembersihan jalan napas individual dengan mendukung pasien dan keluarga mereka untuk menetapkan aturan rutin selama tahap yang stabil secara klinis dan memiliki rencana peningkatan untuk eksaserbasi penyakit. Pembersihan jalan napas biasanya dilakukan setiap hari dan sesuai kebutuhan.

Metode yang dipilih diterapkan, durasi dan frekuensi setiap sesi disesuaikan dengan kondisi kesehatan pasien secara umum dan tingkat keparahan penyakitnya. Misalnya, pembersihan jalan napas menjadi lebih teratur selama eksaserbasi atau rawat inap. Rawat inap juga memberikan kesempatan bagi fisioterapis untuk menilai kembali efektivitas pembersihan jalan napas harian dan memberikan yang sesuai umpan balik dan panduan untuk meningkatkan teknik biasa pasien sebelum pulang. Penilaian efektivitas didasarkan pada pengukuran volume atau berat dahak, fungsi paru-paru oleh spirometri, frekuensi rawat inap dan kualitas kehidupan.

Namun pengobatan pada anak dan remaja yang diterapkan sampai satu tahun menunjukkan peningkatan 6% di FEV1 dengan menggunakan PEP. Mengenai frekuensi rawat inap, tidak ditemukan perbedaan pada mereka yang mempraktekkan teknik pernapasan siklus aktif dibandingkan dengan drainase postural dengan atau tanpa teknik manual.

Faktor penting untuk keberhasilan rencana pembersihan jalan napas yang dipilih adalah kepatuhan pengobatan dan kepuasan pasien. Faktor yang meningkatkan tingkat kepatuhan pasien baik pengetahuan tentang teknik dan keyakinan dalam penerapan, kemandirian, dan preferensinya. Bukti menunjukkan bahwa pasien yang

menerima bantuan, mereka yang menghasilkan lebih banyak dahak, dan anak-anak dengan CF yang orangtuanya percaya pada perlunya pengobatan adalah mereka yang pembersihan jalan napas.

Adaptasi pembersihan jalan nafas

Mucolitics dan agen lainnya

Pasien dengan CF sering menerima obat yang bertujuan untuk meningkatkan efektivitas pembersihan jalan napas, seperti saline hipertonik nebulised (3% sampai 7% NaCl), dornase alpha (DNase), dan manitol. Penggunaan saline hipertonik inhalasi (tekanan osmotik> 0,9% NaCl) pada pasien CF dianggap memperbaiki karakteristik reologi osputum dan meningkatkan hidrasi epitel saluran napas; dengan demikian, meningkatkan motilitas sputum dan memfasilitasi pembersihan lendir. Terdapat bukti yang baik bahwa penggunaan larutan garam hipertonik mengurangi kejadian infeksi saluran pernafasan, meningkatkan FEV1, dan meningkatkan kualitas hidup, meskipun perubahan tidak dipertahankan di rumah sakit jangka panjang (48 minggu). Selama rawat inap pasien dengan CF, larutan garam hipertonik meningkatkan kemungkinan kembalinya fungsi paru-paru dengan cepat (FEV1) ke tingkat sebelum infeksi.

Dornase alpha (DNase) adalah deoxyribonuclease manusia rekombinan yang mengurangi viskositas sputum dengan secara selektif menghidrolisis molekul DNA ekstraseluler besar yang terkandung dalam lendir menjadi struktur yang lebih kecil, sehingga meningkatkan potensi eliminasi. obatnya diberikan melalui perangkat jet-nebuliser dan telah terbukti mengurangi kejadian infeksi saluran pernafasan, meningkatkan fungsi pernafasan, dan meningkatkan kualitas hidup. Dalam praktik klinis, fisioterapi sering mengikuti pedoman yang diusulkan dari perusahaan farmasi untuk melakukan pembersihan jalan napas 30 menit setelah pemberian DNase.

Manitol yang dihirup adalah alkohol gula alami yang meningkatkan osmosis, menyebabkan hidrasi lendir. Manitol yang dihirup diberikan sebagai bubuk kering (kapsul) menggunakan inhaler. Seperti yang ditunjukkan oleh dua penelitian multi-center selama 26 minggu dengan jumlah total 600 peserta dengan CF, manitol yang dihirup meningkatkan fungsi pernapasan pasien tetapi tidak meningkatkan kualitas hidup mereka.

Hemoptisis

Hemoptisis adalah perubahan besar dalam presentasi klinis pasien dan mungkin mengancam nyawa. Penilaian fisioterapi harus mencakup pertanyaan tentang deskripsi dahak dan referensi untuk episode hemoptisis saat ini atau masa lalu. Pada hemoptisis sedang atau rendah, fisioterapis, bekerja sama dengan tim medis, memutuskan apakah tepat atau tidak untuk melanjutkan pembersihan jalan napas menggunakan penalaran klinis. Jika pengobatan sesuai dan aman untuk dilanjutkan, maka siklus aktif teknik pernapasan atau drainase otogenik sering dipilih daripada teknik lainnya.

Pneumotoraks

Pneumotoraks spontan merupakan komplikasi yang umum pada pasien CF. Ini terkait dengan penurunan fungsi paru dan kemungkinan kekambuhan 50-90%.Pada pasien yang melanjutkan pembersihan jalan napas, disarankan untuk bekerja sama dengan tim medis untuk menambahkan humidifikasi ke suplai oksigen dan memastikan analgesia yang memadai selama sesi pengobatan. Mengenai aktivitas fisik, pasien perlu melakukan aktivitas sedang tetapi harus menghindari beban beban lebih dari 2 kg atau latihan aerobik berat selama dua hingga enam minggu setelah pneumotoraks terkuras sepenuhnya.

Olahraga

Latihan merupakan bagian integral dari intervensi fisioterapi komprehensif untuk pasien CF. Pedoman American College of Sports Medicine menganjurkan 3-5 sesi olahraga sedang per minggu, dengan tujuan menerapkan olahraga sebagai cara hidup. Manfaat modalitas latihan khusus pada fibrosis kistik masih harus diidentifikasi dalam penelitian yang kuat secara metodologis. Dalam pengaturan klinis, penilaian pasien dengan CF menggunakan tes lapangan latihan yang sederhana dan hemat biaya, seperti tes berjalan 6 menit (6MWT) dan tes berjalan antar-jemput tambahan (ISWT), sementara tingkat dispnea dinilai menggunakan skala Borg dyspnea.

Latihan secara teoritis dapat membantu pembersihan jalan napas melalui gaya kinetik dan getaran yang dihasilkan di dalam saluran udara, tetapi tidak dapat menggantikan pembersihan jalan napas formal. Jika dibandingkan dengan teknik pembersihan jalan napas, latihan aerobik sedang menyebabkan lebih sedikit pengeluaran lender.

Pertimbangan latihan

Masalah muskuloskeletal dan postural Nyeri punggung dan dada sering dilaporkan pada pasien CF, meskipun tidak berpengaruh pada fungsi paru-paru. Konseling dan program latihan yang sesuai dari fisioterapis berpotensi dapat mengatasi dan memperbaiki masalah postural dan struktural ini.

Inkontinensia urin

Survei menunjukkan bahwa inkontinensia urin pada pasien CF dilaporkan pada 30% hingga 68% wanita atau anak perempuan dan 5% hingga 16% pria atau anak laki-laki. Tekanan dinamis yang diciptakan selama batuk berpotensi menjadi mekanisme kunci dari inkontinensia urin CF, meskipun ini mungkin bukan satu-satunya. Batuk, bersin, tertawa, dan spirometri adalah beberapa aktivitas yang memicu terjadinya inkontinensia urin. Menilai inkontinensia menggunakan alat skrining dan pertanyaan klarifikasi harus menjadi bagian integral dari penilaian fisioterapi CF, terlepas dari jenis kelamin. Perawatan fisioterapi untuk inkontinensia urin termasuk konseling dan pelatihan khusus yang melibatkan latihan dasar panggul, seperti senam Kegel.

Diabetes mellitus

Diabetes mellitus dikaitkan dengan CF dan merupakan komorbiditas penyakit yang paling umum, terjadi pada 20-50% pasien dewasa. Komorbiditas ini membutuhkan kerjasama dari fisioterapis dengan tim endokrin, terutama pada pasien yang membutuhkan terapi insulin. Selain itu, keberadaan diabetes mellitus perlu dipertimbangkan dalam rencana fisioterapi, terutama dalam resep dan performa olahraga. Dalam hal ini, penjadwalan waktu makan atau asupan insulin yang tepat sangat penting.

Kualitas hidup

Seiring waktu dan seiring dengan berkembangnya keparahan dan gejala CF, kualitas hidup pasien menurun. Wanita dengan CF sering melaporkan kualitas hidup yang lebih buruk dibandingkan dengan pria yang seumuran. Meskipun korelasi antara fungsi paru-paru dan kualitas hidup lemah hingga sedang, pasien dengan fungsi paru-paru yang lebih baik melaporkan kualitas hidup yang lebih tinggi.

Pertimbangan khusus

Terapi oksigen jangka panjang dan ventilasi non-invasif Tinjauan sistematis baru-baru ini pada pasien CF tidak menunjukkan manfaat jangka panjang dari terapi oksigen jangka panjang, dalam kelangsungan hidup, fungsi pernapasan, atau kesehatan kardiovaskular, meskipun hal itu menunjukkan meningkatkan tingkat kehadiran di

sekolah atau kerja. Ketika oksigen diberikan selama latihan saja, ini membantu untuk meningkatkan oksigenasi, mengurangi perasaan sesak dan meningkatkan durasi latihan. Namun, oksigen tambahan selama latihan pada pasien dengan nilai oksigen arteri yang awalnya rendah tampaknya menyebabkan hiperkapnia dalam jangka pendek (PCO_2 hingga 16 mmHg). Ventilasi non-invasif (NIV) digunakan pada pasien CF dengan gagal napas, hipoventilasi saat tidur, serta jembatan untuk transplantasi paru. Untuk pasien dengan presentasi klinis yang parah dimana pembersihan jalan nafas menyebabkan kelelahan dan tingkat dispnea yang tinggi, NIV dapat digunakan untuk membantu pembersihan jalan nafas. Penggunaan NIV selama sesi fisioterapi memudahkan pengeluaran lendir dan mengurangi sensasi dispnea selama pengobatan dibandingkan dengan teknik lain terutama untuk pasien dengan fungsi paru-paru rendah.

Populasi anak

Memilih rencana pengobatan untuk anak-anak dengan CF didasarkan pada usia, presentasi klinis dan kriteria sosial tertentu. Proposal untuk manajemen penyakit dini (pra-gejala) adalah dengan hati-hati memantau presentasi klinis anak-anak dan mengadopsi rencana pengobatan aktif setelah timbulnya gejala. Pada usia muda, di mana anak tidak dapat mengikuti instruksi dan bekerja sama, drainase otogenik bantuan atau perangkat PEP dengan masker anak dapat digunakan. Fisioterapis juga bertanggung jawab untuk mendidik orang tua atau pengasuh anak untuk mengevaluasi gejala anak dan pelaksanaan pengobatan yang sesuai sesuai kebutuhan. Drainase postural dengan kemiringan (posisi kepala menunduk) tidak lagi disarankan untuk bayi, karena telah terbukti meningkatkan gastroesophageal reflux. Menurut Cystic Fibrosis Foundation Inggris, pada usia 6 tahun atau lebih, penggunaan saline hipertonik nebulised dapat dimulai dalam kombinasi dengan pembersihan saluran napas pada semua usia, permainan aktivitas dan keterlibatan dengan olahraga didorong dan digunakan, misalnya balap, trampolin dan latihan menggunakan bola gym.

Perawatan paliatif

CF adalah penyakit yang membatasi harapan hidup dan membutuhkan disiplin dan konsistensi selama berjam-jam perawatan sehari-hari. Akibatnya, dampak psikologisnya tidak boleh diabaikan. Jika pasien mengalami gagal napas dan dalam daftar transplantasi paru, rehabilitasi paru menjadi prioritas pengobatan, di samping tujuan untuk meredakan gejala. Bekerja sesuai dengan keinginan pasien sangatlah penting, terutama selama tahap perawatan paliatif. Pembersihan jalan nafas dari partisipasi pasien yang kurang aktif (mis. Drainase postural), pijat dan beberapa posisi menghilangkan dispnea dapat diterapkan selama tahap ini, jika mereka memberikan kenyamanan bagi pasien.

KESIMPULAN

Penatalaksanaan CF sangat menuntut, terutama bertujuan untuk pengurangan dan pengobatan infeksi dada, peningkatan kualitas hidup dan peningkatan harapan hidup. Fisioterapi merupakan bagian integral dari rutinitas perawatan harian pasien, dan sebagai tambahan untuk pembersihan jalan napas, masalah penting lainnya harus ditangani. Pedoman klinis internasional menyarankan akses ke spesialis perawatan fisioterapi selama stadium penyakit yang stabil secara klinis dan selama infeksi saluran pernapasan. Pada tahap klinis yang stabil, pasien harus dievaluasi oleh fisioterapis setiap 3-6 bulan untuk mengevaluasi kembali dan mengoptimalkan rencana perawatan mereka. Selama infeksi pernafasan, intervensi fisioterapi diintensifkan sesuai dengan presentasi klinis. Meskipun dalam CF airway clearance adalah hal terpenting dalam perawatan fisioterapi, fisioterapis bekerja di luar sistem pernapasan dan memainkan peran penting dalam pengelolaan masalah lain, terutama menggunakan program latihan individual. Program latihan perlu disesuaikan dengan kebutuhan dan masalah terkait pasien,

seperti nyeri, diabetes, dan inkontinensia. Dengan cara ini, perawatan yang berpusat pada pasien dan individual mengikuti standar internasional dan pedoman klinis.

JURNAL 2

Physiotherapy in cystic fibrosis: a comprehensive clinical overview

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1 Abstract

2 Physiotherapy remains the cornerstone of cystic fibrosis (CF) management alongside medical
3 treatment. Traditionally, physiotherapy intervention focussed on airway clearance during the
4 clinically stable stage and chest infections. Research evidence consistently supports greater mucus
5 clearance with chest physiotherapy compared to cough alone or no treatment. Various methods and
6 techniques of airway clearance have been developed and investigated, and data suggest that most of
7 them are of similar effectiveness. Nowadays physiotherapy management also extends to other areas,
8 supported by studies and clinical practice. The physiotherapists plan, supervise and follow-up
9 systematic exercise or personalised rehabilitation programs, which, similarly to airway clearance,
10 are recommended in all patients with CF. Furthermore, based on a comprehensive assessment,
11 physiotherapists incorporate the management of accompanying musculoskeletal problems such as
12 back pain and postural disorders, as well as urine incontinence issues. In the era that aims to
improve
13 quality of life, it is essential that physiotherapists are aware of specific conditions that might affect
14 the management of CF. Their role is to work alongside and within the CF multi-disciplinary team
15 throughout patient's treatment and consistently support the patient and carers, in particular whilst
16 on clinical pathways of the lung transplantation and palliative care.
17
18 **Keywords:** physiotherapy, cystic fibrosis, airway clearance, chest physiotherapy, exercise.
3

19 INTRODUCTION

20 Cystic fibrosis (CF) is a recessive genetic disease that affects the patient on multiple systems, with
21 profound manifestations in the respiratory and digestive systems [1]. It is characterised by the
22 mutation and therefore dysfunction of the gene for the cystic fibrosis transmembrane conductance
23 regulator (CFTR). This protein mainly functions as an ion channel, regulating fluid volume on
24 epithelial surfaces via chlorine secretion and inhibition of sodium resorption. In the airways of the
25 patients with CF, dysfunction of the CFTR results in periciliary liquid layer depletion [2].
Clinically,

patients with CF present abnormal consistency and high volumes of sputum, cough, dyspnoea, bronchiectasis and weight loss. As the survival of these patients is increasing, it is crucial that health care professionals address symptoms and support individuals in evolving issues developed throughout their life span.

Physiotherapy is an integral part of the therapeutic management of CF patients, both at the clinically stable stage of the disease and during respiratory infections. In the past, physiotherapy was focused on airway clearance, also known as chest physiotherapy, by teaching or applying methods such as the postural drainage with or without the additional application of manual techniques [3]. Postural drainage of the tracheobronchial tree uses specific gravitational positions to assist mucus mobilisation downwards (towards the mouth) within the airways. Manual techniques (percussions, vibrations and/or shakes) use mechanical forces to assist the detachment of mucus from the airway epithelium and its mobilisation. Nowadays, the choice of airway clearance techniques has been expanded to methods such as the autogenic drainage, the active cycle of breathing techniques (ACBT), the use of positive expiratory pressure (PEP) devices with or without oscillation, and others. Still, modern physiotherapy in CF also includes the assessment of the cardiovascular system and improvement of the patient's fitness level, muscle strength and endurance through exercise, as well as specialised interventions to improve musculoskeletal symptoms of pain, posture and incontinence [4].

4

PHYSIOTHERAPY

Airway clearance

Patient education, application and monitoring of the airway clearance techniques remain the main physiotherapy treatment for patients with CF [4]. Physiotherapists facilitate the establishment of an individualised airway clearance routine by supporting patients and their families to establish regular regimes during a clinically stable stage and have an escalation plan for disease exacerbations [5]. Airway clearance is usually performed on a daily basis and as required. *The selected method applied, duration and frequency of each session are tailored to the patient, their general health condition and the severity of the disease.* For instance, airway clearance becomes more regular during exacerbations or hospitalisations [6]. Hospitalisations also provide an opportunity for physiotherapists to re-assess the effectiveness of daily airway clearance and provide appropriate feedback and guidance for improving the patient's usual technique prior to discharge.

Table 1 presents the main categories of airway clearance techniques and methods in CF. These can be used in isolation or in combination regimes. Assessment of effectiveness is based on measuring sputum volume or weight, lung function by spirometry, frequency of hospitalisations and quality of life. Airway clearance is extensively supported in the literature when compared to no airway

clearance or cough alone [4, 7-9]. A recent systematic review supported a significant increase in the amount of sputum (wet or dry) in the patient groups that applied airway clearance using postural drainage with or without the addition of manual techniques or using PEP, compared to spontaneous cough or not using any technique [7]. The weight of the sputum was higher after the application of the active cycle of breathing techniques compared to the use of the flutter (an oscillating PEP device) or high frequency chest wall oscillation (vest) [10]. The weight of the sputum expectorated was greater after using the PEP mask compared to autogenic drainage, postural drainage positions and their combination, although this difference was short-term (up to one week) [11]. On the other hand, there was no difference in the amount of the expectorated mucus after autogenic drainage compared to the flutter, or between the high frequency chest wall oscillation compared to the autogenic drainage or the PEP mask for longer time-intervals [10, 12].

Systematic reviews did not show significant differences in the lung function (FEV_1) of adult patients following the use of PEP, when assessed patients prior and immediately after a physiotherapy session or up to 3 months later [7, 10, 11, 13]. Additionally, the lung function did not change after applying the active cycle of breathing techniques in combination with the PEP mask, postural drainage with or without manual techniques, or the high frequency chest wall oscillation [12]. However, treatment in children and adolescents that was applied up to one year showed 6% increase in FEV_1 with the use of PEP [13].

Regarding the hospitalisation frequency, no differences were found for those who practiced the active cycle of breathing techniques compared to the postural drainage with or without manual techniques [12]. The number of hospitalisations, however, was lower for those who used PEP than the patients who used the flutter (5 vs 18 hospitalisations, respectively) [10]. Similarly, fewer patients used intravenous antibiotics from the group that used PEP devices, compared to the group of the high frequency chest wall oscillation [13].

For the quality of life, there is no difference amongst techniques and devices, such as the postural drainage with or without manual techniques, active cycle of breathing techniques, autogenic drainage, PEP mask, flutter, and cornet [10, 12, 13]. However, patients preferred the PEP mask for long-term use (>1 month), and also preferred seating instead of using postural drainage positions [10, 11, 13]. Autogenic drainage was preferred among children between 12-18 years old, compared to postural drainage in combination with manual techniques [14].

Important factors for the success of the selected airway clearance plan are the compliance to treatment and patient satisfaction. Factors that increase the rate of compliance are good patient

knowledge of the technique and confidence in its application, independence and preference [15, 16].
Evidence indicate that patients who receive help, those who produce more sputum, and children with CF whose parents believe in the necessity of treatment are those with higher compliance in airway clearance [17, 18].

Airway clearance adaptations

Mucolitics and other agents

Patients with CF often receive medications that aim to increase the effectiveness of airway clearance, such as nebulised hypertonic saline (3% to 7% NaCl), dornase alpha (DNase), and mannitol. The use of inhaled hypertonic saline (osmotic pressure > 0.9% NaCl) in patients with CF is considered to improve the rheological characteristics of sputum and increase the hydration of the airway epithelium; thus, increase the sputum motility and facilitate the mucus clearance [19]. There is good evidence that the use of hypertonic saline reduces the incidence of respiratory infections, increases FEV_1, and improves the quality of life, although the changes are not maintained in the long term (48 weeks) [20, 21]. During the hospitalisation of patients with CF, hypertonic saline improves the chances of quick return of the lung function (FEV_1) to pre-infectious levels [22]. With regards to timing the hypertonic saline administration, a recent systematic review supports its use before or during the performance of airway clearance, rather than its administration afterwards [23].
If the prescribed doses are two, it is recommended to administer one in the morning and one in the

evening, and if the patient receives a single dose this is given at a convenient time chosen by the patient [23].

Dornase alpha (DNase) is a recombinant human deoxyribonuclease that reduces sputum viscosity by selectively hydrolysing the large extracellular DNA molecules contained in the mucus into smaller structures, thereby increasing the potential for its elimination [24]. This drug is administered via a jet-nebuliser device and has been shown to reduce the incidence of respiratory infections, increase respiratory function, and improve quality of life [24]. With regards to timing its administration, it appears that using DNase before or after airway clearance does not have any difference in improving lung function (FEV_1 and FVC) or patient's quality of life [25, 26]. In clinical practice, physiotherapy often follows the proposed guidelines of the pharmaceutical company to perform airway clearance 30 minutes after the DNase administration [27].

Inhaled mannitol is a naturally occurring sugar alcohol which enhances osmosis, causing mucus hydration [28]. Inhaled mannitol is administered as dry powder (capsules) using an inhaler. As demonstrated by two 26-week multi-centre studies with a total number of 600 participants with CF,

inhaled mannitol improves the respiratory function of patients but does not improve their quality of life [29, 30]. Although its use usually precedes airway clearance in clinical practice, there is no research data to compare different timings of administration.

Haemoptysis

Haemoptysis is a major change in the patient's clinical presentation and may be life-threatening. The physiotherapy assessment should include questions about sputum description and reference to current or past haemoptysis episodes. Active frank haemoptysis (>100-1000 ml haemoptysis in 24 hours or 48 hours) is treated exclusively medically, e.g. with bronchial embolisation of the arteries or thoracic surgery, while the airway clearance treatment is temporarily discontinued [31, 32]. In moderate or low haemoptysis, physiotherapists, in collaboration with the medical team, decide whether or not it is appropriate to continue airway clearance using clinically reasoning. If the treatment is appropriate and safe to continue, then the active cycle of breathing techniques or autogenic drainage is often selected over other techniques.

Pneumothorax

Spontaneous pneumothorax is a common complication in patients with CF. It is associated with a reduction in pulmonary function and 50-90% chance of recurrence [32, 33]. If the pneumothorax occurs for the first time and it is small, then it can be treated conservatively with oxygen supply [34]. In patients continuing airway clearance, it is suggested to liaise with the medical team for adding humidification to the oxygen supply and ensuring adequate analgesia for the duration of the treatment sessions [35]. In the case of large pneumothorax (>2 cm between parietal pleura and visceral pleura) or recurrent pneumothorax, chest drainage is performed using thoracic catheters, while patients might get pleurodesis in resistant cases [34]. Positive pressure devices such as PEP, flutter and acapella are contraindicated in the presence of pneumothorax [34]. Regarding physical activity, patients need to be engaged with moderate activities but should avoid bearing weights over 2 kg or strenuous aerobic exercise for a period of two to six weeks after the complete drainage of the pneumothorax [34].

Exercise

Exercise is an integral part of the comprehensive physiotherapy intervention for patients with CF [36]. American College of Sports Medicine guidelines advocate 3-5 sessions of moderate exercise per week, with the aim to adopt exercise as a way of living [37]. Benefits of specific exercise modalities in cystic fibrosis are yet to be identified in methodologically strong studies [38]. Despite research interest, evidence has not established the effectiveness of inspiratory muscle training on

this group of patients, therefore this is currently not routinely incorporated in the CF treatment. In the clinical setting, the assessment of patients with CF uses simple and cost-effective exercise field tests, such as the 6-minute walk test (6MWT) and the incremental shuttle walk test (ISWT), whilst the level of dyspnoea is assessed using the Borg dyspnoea scale [39].

Exercise can theoretically assist airway clearance through the kinetic forces and vibrations generated within the airways, but it cannot substitute for the formal airway clearance [40]. When compared to airway clearance techniques, moderate aerobic exercise leads to less mucus expectoration [41]. Also, exercise as a single agent does not increase cough immediately after its completion, although it improves the subjective ease of sputum clearance [42]. Clinically, exercise is mainly used additionally to airway clearance, as a means to improve the exercise capacity of the patient and is usually performed before the implementation of airway clearance.

Exercise considerations

Musculoskeletal and postural issues

Back and thoracic pain are frequently reported in patients with CF, although they do not have an effect on lung function [43, 44]. Higher thoracic kyphosis is associated with lower lung function, but nowadays it is more uncommon compared to a few years ago [45]. Low bone density and osteopenia is also a common issue in patients with CF [46, 47]. Counselling and appropriate exercise programs from physiotherapists can potentially address and improve these postural and structural issues [36].

Urinary incontinence

Surveys show that urinary incontinence in patients with CF is reported in 30% to 68% of women or girls and 5% to 16% of men or boys [48-51]. The dynamic pressure created during coughing is potentially a key mechanism of CF urinary incontinence, although it may not be the only one [52].

Coughing, sneezing, laughing and spirometry are among the activities that trigger urinary incontinence incidents [53]. Incontinence worsens during respiratory infections and has been associated with poorer quality of life and higher anxiety and depression scores [51, 54, 55]. Assessing incontinence using screening tools and clarifying questions should be an integral part of the CF physiotherapy assessment, regardless of gender [56]. Physiotherapy treatment of urinary incontinence includes counselling and specialised training involving pelvic floor exercises, such as Kegel exercises [55, 57, 58].

Diabetes mellitus

Diabetes mellitus is associated with CF and is the most common comorbidity of the disease, occurring in up to 20-50% of adult patients [59-61]. This comorbidity requires the co-operation of the physiotherapists with the endocrine team, especially for the patients who require insulin therapy [62]. Additionally, the presence of diabetes mellitus needs to be considered in the physiotherapy plan, mainly in the exercise prescription and performance. In this case, the proper scheduling of the meal times or insulin intake is essential.

Quality of life

Over time and as the CF severity and symptoms progress, the quality of life of patients is deteriorating. Females with CF often report poorer quality of life compared to their male age-matched peers [63]. Although the correlation between lung function and quality of life is weak to moderate, patients with better lung function report higher quality of life [54]. Also, the presence of

Pseudomonas aeruginosa and frequent respiratory infections appear to have a negative impact on the quality of life of patients [54].

Researchers and clinicians can use a number of validated questionnaires for the assessment of quality of life in people with CF. Those include: generic questionnaires or questionnaires for a specific disease symptom, such as the Short Form-36 (SF-36) and the Leicester Cough Questionnaire, respectively [64, 65]; disease-specific questionnaires, such as the Manchester Questionnaire, the Cystic Fibrosis Questionnaire-Revised and the Cystic Fibrosis-Quality of Life [64, 66-69]; and questionnaires for babies and children of young age, such as the Modified Parent Cystic Fibrosis Questionnaire-Revised [70].

Special considerations

Long term oxygen therapy and non-invasive ventilation

A recent systematic review in patient with CF did not show long-term benefits from the long-term oxygen therapy, in survival, respiratory function or cardiovascular health, although it showed improved school or work attendance rates [71]. When oxygen is administered during exercise only, it helps to improve oxygenation, reduces the feeling of dyspnoea and increases the duration of the exercise [71, 72]. However, supplemental oxygen during exercise in patients with initially low arterial oxygen values appears to cause hypercapnia in the short term (PCO_2 up to 16 mmHg) [71]. Also, oxygen therapy during sleep improves oxygenation, but is accompanied by small hypercapnia [71]. The use of supplemental oxygen should follow the established clinical guidelines that are based on hypoxia ($PaO_2 \leq 55$ mmHg or 60 mmHg) and the presence of clinical symptoms [73].

Non-invasive ventilation (NIV) is used in patients with CF on respiratory failure, hypoventilation

during sleep, as well as a bridge to lung transplantation [3]. For patients with severe clinical presentation where airway clearance causes fatigue and high levels of dyspnoea, NIV can be used to assist airway clearance [74]. The use of NIV during the physiotherapy session facilitates mucus expectoration and reduces the sensation of dyspnoea during the treatment compared to other techniques particularly for patients with low lung function [75]. However, the long-term effects of NIV on airway clearance need further investigation [76].

Paediatric population

Choosing a treatment plan for children with CF is based on age, clinical presentation and certain social criteria [77]. There is no agreement on the most appropriate starting age for airway clearance.

A proposal for early disease management (pre-symptomatic) is to carefully monitor the clinical presentation of children and adopt an active treatment plan following the onset of symptoms [78]. At young ages, where the child can not follow instructions and cooperate, assisted autogenic drainage or PEP devices with a child mask can be used. Physiotherapists are also responsible for educating the child's parents or carers for appropriate evaluation of the child's symptoms and treatment implementation as required [79]. Postural drainage with tilt (head-down positions) is no longer advised for babies, as it has been shown to increase the gastroesophageal reflux [80].

As children grow older, they can more actively participate in their treatment. Children over 3 years old can also use an airway clearance game, the bubble PEP. This is a positive-pressure breathing home-made device, where children are encouraged to generate soap bubbles by breathing out through a small plastic tube and into a bottle of soapy water [81]. According to the UK Cystic Fibrosis Foundation, at the age of 6 years or more, the use of nebulised hypertonic saline can be initiated in combination with airway clearance [82]. Also, at all ages, activity games and engagement with exercise are encouraged and used, for instance racing, trampolines and exercises using a gym ball [83].

Palliative care

CF is a disease that limits life expectancy and requires discipline and consistency to many hours of daily treatment. As a result, its psychological impact should not be ignored [84]. If patients are in respiratory failure and in lung transplantation list, pulmonary rehabilitation is the treatment priority, alongside the aim to relieve symptoms. Working in line with the patient's wishes is very important, particularly during the palliative care stage. Airway clearance of less active patient participation (eg. postural drainage), massage and some dyspnoea relieving positions could be applied during this

274 stage, if they provide comfort to the patient [85].
275
276 **CONCLUSIONS**
277 CF management is highly demanding, mainly aiming to the reduction and treatment of chest
278 infections, improvement of quality of life and increase of life expectancy. Physiotherapy is an
279 integral part of the patient's daily treatment routine, and additionally to airway clearance other
280 important issues should be addressed. International clinical guidelines suggest access to specialised
281 physiotherapy care both during a clinically stable stage of the disease and during respiratory
282 infections. At the clinically stable stage, patients should be evaluated by physiotherapists every 3-6
283 months to re-evaluate and optimize their treatment plan. During respiratory infections,
284 physiotherapy interventions are intensified according to the clinical presentation. Although in CF
285 airway clearance is the cornerstone of physiotherapy treatment, physiotherapists work beyond the
286 respiratory system and play an important role in the management of other issues, mainly using
287 individualised exercise programmes. The exercise programmes need to be tailored to patient-related
288 needs and issues, such as pain, diabetes and incontinence. This way, the patient-centred and
289 individualised treatment follows the international standards and clinical guidelines.
14
Table 1. Common airway clearance techniques and methods.

ırance techniques
inage
niques
e of breathing techniques BT)
drainage (AD)
iratory pressure (PEP) ces (PEP mask, Pari-PEP, etc)
iratory pressure (PEP) ces with oscillation (flutter, ella, cornet, etc.)
Positive Pressure Breathing B)
ncy chest wall oscillation CWO) or vest
e mechanical ventilation)
rcise

15
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JURNAL 3

SHORT-TERM EFFECTS OF CHEST PHYSIOTHERAPY IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Penyakit pernafasan kronis berkontribusi 7% dari semua penyakit kronis yang akhirnya berujung pada kematian. Penyakit paru obstruktif kronik (PPOK) adalah penyebab umum dari penyakit pernafasan kronis dan adalah Penyebab kematian nomor 4 di seluruh dunia. Diperkirakan 6-7 juta penduduk Pakistan juga menderita PPOK (umumnya bronkitis kronis). Angka kematian akibat PPOK di Pakistan adalah 71 kematian per 100.000 penduduk. Teknik fisioterapi dada manual atau pasif adalah perkusi, getaran dan drainase postural sedangkan teknik aktif meliputi siklus aktif pernafasan, pengeringan otogenik dan alat flutter.

Sebelumnya penatalaksanaan fisioterapi PPOK hanya mencakup pelatihan mobilitas dan transfer sedangkan fisioterapi dada untuk perbaikan fungsi paru kurang terfokus. Teknik manual / teknik pasif dianggap kurang aman Pasien PPOK dibandingkan dengan teknik aktif karena itu efek berbahaya seperti bronkospasme, atelektasis, arteri gangguan jenuh dan hemodinamik dll Praktik fisioterapi dada pada PPOK dimulai sejak ini teknik dilaporkan aman dan efektif dalam menghilangkan sekresi dari paru-paru karena COPD.

Active Cycle of Breathing Technique (ACBT) yang merupakan salah satu bentuk dari ACT diantaranya 1) latihan pernapasan dalam, 2) latihan ekspansi toraks dan 3) ekspirasi paksa teknik. ACBT mengoreksi pola pernapasan dan memperkuat otot pernapasan dengan pembersihan jalan napas, semua kombinasi ini meningkatkan fungsi pernapasan pada pasien PPOK.

Literatur tentang penggunaan ACT dalam eksaserbasi akut PPOK mencerminkan kurangnya Uji Klinis Acak yang dirancang dengan baik, kurangnya kelompok kontrol, kegagalan untuk mendaftarkan pasien dengan sekresi dada dan penggunaan pengukuran hasil yang tidak tepat secara konsisten. Oleh karena itu, RCT dilakukan dengan pertimbangan kekurangan metodologis yang terdokumentasi sebelumnya, untuk memeriksa kemanjuran jangka pendek ACT khususnya ACBT pada fungsi paru-paru, saturasi oksigen dan tingkat sesak napas pada eksaserbasi akut PPOK pasien.

BAHAN DAN METODE

Ini adalah RCT tersamar ganda dan dilakukan pada 60 pasien dengan 30 pasien di setiap kelompok. Kedua kelompok studi menerima perawatan medis tetapi satu dari kelompok (kelompok eksperimen) menerima tambahan fisioterapi dada. Durasi percobaan adalah 2 minggu

Para pasien yang terdaftar dalam penelitian berikut ini kriteria kelayakan.

1) Pasien pria dan wanita

2) 45- 60 tahun

3) Pasien rawat inap yang didiagnosis oleh a dokter medis sebagai PPOK dengan eksaserbasi akut sebagai diagnosis primer dan bronkitis kronis sebagai diagnosis sekunder

4) Pasien dengan gejala yang jelas retensi dahak dengan batuk

5) kemampuan untuk mentolerir teknik aktif

6) pasien yang berorientasi baik.

Para pasien dikeluarkan pada kriteria berikut

1) serangan parah dengan perkiraan lama tinggal di rumah sakit sampai> 2 minggu

2) Jantung atau kondisi lain yang merupakan kontraindikasi dada fisioterapi

3) PPOK dengan diagnosis sekunder emfisema

4) patologis paru terkait lainnya kondisi

4) nyeri dengan lebih dari 2 poin pada skala analog visual saat melakukan teknik aktif

5) Pasien dengan riwayat operasi paru-paru.

Ada tiga ukuran hasil yang digunakan dalam penelitian ini. Peak Expiratory Flow Rates (PEFR) diukur dengan bantuan peak flow meter, saturasi oksigen (SaO2) diukur dengan oksimeter denyut dan tingkat sesak napas yang dievaluasi dengan Skala Analog Visual (VAS) 100 mm.

Kelompok eksperimen dirawat dengan fisioterapi dada bersama dengan perawatan medis. ACBT diberikan kepada pasien dengan posisi duduk nyaman atau setengah berbaring di ranjang rumah sakit. Teknik tersebut diterapkan dalam langkah-langkah berikut:

1. Latihan kontrol pernapasan: langkah ini terdiri dari bernapas melalui hidung dan bernapas melalui bibir yang mengerucut, sedangkan perut seharusnya bergerak ke atas dengan inspirasi dan bergerak ke bawah dengan ekspirasi. Langkah tersebut diulangi selama 8-10 kali..
2. Latihan ekspansi toraks: langkah ini terdiri dari inspirasi penuh dengan menahan udara di dalam paru-paru selama 1-3 detik dan kemudian diakhiri dengan mengerutkan bibir. Itu dilakukan 3-4 kali pada pasien.
3. Teknik ekspirasi paksa termasuk 1-2 huffs diikuti dengan batuk penuh paksa sebanyak 1 atau 2 kali. Langkah 1 dianggap sebagai teknik relaksasi dan digunakan setiap saat untuk koreksi sesak napas Total waktu yang dibutuhkan untuk keseluruhan prosedur adalah 30-40 menit dengan pengulangan.

DISKUSI

Penelitian ini dilakukan untuk memperkuat bukti mengenai efek fisioterapi dada pada eksaserbasi akut PPOK. Penelitian itu tentang efektivitas ACBT pada PPOK eksaserbasi akut. Studi ini menyimpulkan efektivitas fisioterapi dada untuk pasien PPOK yang mengalami eksaserbasi akut khususnya dalam meningkatkan laju aliran ekspirasi puncak. Smitha J dan Aggarwal R et al melakukan studi pada aspek serupa dan keduanya melaporkan peningkatan yang signifikan pada kelompok eksperimen (menerima fisioterapi dada dengan perawatan medis) pada SaO2 dan PEFR dibandingkan dengan kelompok kontrol yang hanya menerima perawatan medis.

KESIMPULAN

Fisioterapi dada lebih efektif dalam meningkatkan tingkat sesak napas, SaO2 dan laju aliran ekspirasi puncak pada eksaserbasi akut PPOK bersama dengan perawatan medis standar daripada perawatan medis saja. Perkiraan efek fisioterapi dada pada Pasien COPD sekitar tiga kali lebih parah dengan perawatan medis dibandingkan dengan perawatan medis sendirian.

JURNAL 3
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Original article
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INTRODUCTION
The chronic respiratory diseases contribute 7% of all chronic illnesses that ultimately lead to death1. Chronic obstructive pulmonary disease (COPD) is the common cause of chronic respiratory disease and is the 4th leading cause of death worldwide1-2. Estimated 6-7 millions population of Pakistan are also suffering from COPD (commonly chronic bronchitis)3. Mortality rate due to COPD in Pakistan is 71 deaths per 100,000 population4. The airflow obstruction in COPD is generally

SHORT-TERM EFFECTS OF CHEST PHYSIOTHERAPY IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT
Objective: To find out the short-term effects of chest physiotherapy in acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD)
Material and Methods: The total 60 patients suffering from Chronic obstructive Pulmonary disease were randomly allocated into two groups, experimental group (n=30) treated with active chest physiotherapy techniques along with medical treatment and control group (n=30) treated with only medical treatment. Both groups were assessed using visual analogue scale (VAS) for breathlessness, Peak Expiratory Flow Rates (PEFR) and Oxygen saturation level (SaO2) before and after 2 weeks treatment program.
Results: Patients in both the groups reported significant improvement after 2 weeks of treatment program compared to baseline on all outcome measures except PEFR that was not significantly improved in control group. Compared to control group, experimental group showed more improvement on PEFR ($P<0.05$), SaO2 ($P>0.05$) and on VAS for breathlessness ($P<0.05$). It was about three times better results over the control group.
Conclusion: Active chest physiotherapy technique along with medical treatment is more effective in acute exacerbation of COPD than medical treatment alone
Key Words: Active Chest Physiotherapy, Acute Exacerbation of COPD, Active Cycle of Breathing Technique, Visual Analogue Scale for breathlessness.
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progressive with airway reactivity some times and only partially reversible5. The acute exacerbations of COPD are characterized mainly by increased sputum volume and purulence along with Shortness of Breath (SOB), fatigue and mood disturbances6. All these changes lead to the decline in physical activities and health-related quality of life7. Due to high morbidity and high mortality associated with COPD, the management focuses not only on medical treatment but stressing healthy life styles and encouragement for physical activities alongside to enhance the functional activity level and overall health related quality8.

Chest physiotherapy is a crucial part of respiratory diseases management that facilitates removal of secretions from lungs, improving lung volumes, breathing re-education and respiratory muscle training. Chest physiotherapy includes active techniques, passive techniques and advanced techniques for improving

lung functions in many dimensions. Manual or Passive chest physiotherapy technique are percussion, vibration and postural drainage while active technique includes active cycle of breathing, autogenic draining and flutter devices9-10.

Previously the physiotherapy management of COPD only included mobility and transfer training while chest physiotherapy for improving the lung functions was less focused11. Theoretically removal of sputum from lung airways and strengthening of respiratory muscles through chest physiotherapy techniques can improve shortness of breath, oxygen saturation and overall quality of life in such patients. The practice of chest physiotherapy in COPD started since these techniques reported safe and effective in removal of secretion from lungs due to COPD12. Manual techniques/passive techniques considered less safe for COPD patients compared to active techniques due to its harmful effects like bronchospasm, atelectasis, arterial unsaturation and hemodynamic disturbances etc13.

The clinician frequently prescribes Active Chest physiotherapy Techniques (ACTs) for COPD patients on large-scale in clinical setups as reported by studies even with limited published literature about its effectiveness for COPD patients8,14. The literature proposed a need for interventional studies on effectiveness of ACTs in COPD management8,15.

Active Cycle of Breathing Technique (ACBT) which is a form of ACTs includes 1) deep breathing exercises, 2) thoracic expansion exercise and 3) forced expiratory technique. The ACBT corrects breathing pattern and it strengthen respiratory muscles with airway clearance,

these all in a combination improves respiratory functions in COPD patients7. The literature on the use of ACTs in acute exacerbation of COPD reflected the shortage of well-designed Randomized Clinical Trials (RCTs), lack of control group, failure to enroll patients with large chest secretions and consistent use of inappropriate outcome measures12,16-17.

The RCT is therefore conducted with consideration of previously documented methodological flaws, to check the short-term efficacy of ACTs specifically of ACBT on lungs functions, oxygen saturation and level of breathlessness in acute exacerbation of COPD patients.

MATERIAL AND METHODS

This was a double blinded RCT and was carried out on 60 patients with 30 patients in each group. Both of the study groups received medical treatment but one of the group (experimental group) received chest physiotherapy additionally. The trial duration was 2 weeks.

The ethical approval for the study was taken by Ethics Board of Khyber Medical University. Only those patients were enrolled who signed an informed consent, based on Helsinki ethical considerations. The data was initially taken by an independent assessor and then patients allotted by him into 2 groups randomly by making computer generated sequences. The physiotherapist only treated the patients with chest physiotherapy techniques and did not play a role in patient's assessment (for making the study blinded). The medical treatment was given independently to physiotherapy treatment.

The patients enrolled in the study on the following eligibility criteria. 1) Male and Females patients 2) 45-60 years age 3) Hospitalized patients diagnosed by a medical doctor as COPD with acute exacerbation as a primary diagnosis and chronic bronchitis as a secondary diagnosis 4) Patients with pronounced symptoms of sputum retention with coughing 5) ability to tolerate active techniques 6) well-oriented patients. The patients were excluded on following criteria 1) severe attack with longer expected hospital stay up-to >2 weeks 2) Cardiac or any other condition that contraindicated chest physiotherapy 3) COPD with secondary diagnosis of emphysema 4) any other associated lung pathological condition 4) pain with more than 2 points on visual analogue scale while doing active techniques 5) Patients with history of lung surgery.

The patients were assessed on inclusion and exclusion criteria by a medical doctor who was the part of the study. All the patients were treated at Medical wards of Fauji Foundation Hospital Peshawar. A previous medical history was taken for previous attacks of acute exacerbation and associated length of hospital stay.

There were three outcome measures used in this study. The Peak Expiratory Flow Rates (PEFR) measured with help of peak flow meter, the oxygen saturation (SaO2) measured by the pulse oximeter and breathlessness level evaluated by 100 mm Visual Analogue Scale (VAS).

The experimental group was treated with chest

physiotherapy along with medical treatment. The ACBTs was delivered to patients in the sitting comfortable position or half laying position on the hospital bed. The technique was applied in following steps:

1. Breathing control exercise: this step consisted breathe in through the nose and breathe out through pursed lips, while the abdomen was supposed to move up with inspiration and move down with expiration. The step repeated for 8-10 times.
2. Thoracic expansion exercises: this step consisted of full inspiration with holding air inside lungs for 1-3 seconds and then full end with pursed lips. It was performed 3-4 times on patients.

3. Forced expiration technique included 1-2 huffs followed by force full cough for 1 or 2 times. Step 1 was considered as a relaxation technique and used at any time for correction breathlessness.

Total time taken for the whole procedure was 30-40 minutes with repetitions for this above steps11. Both the groups received medical treatment that mainly included bronchodilators, anti-inflammatory drugs, smoking cessation and other life style and diet modification. Patients in the experimental group were unaware that physiotherapy may create significant effects to their conditions (thus they were blind to the study).

RESULTS

The Means were computed for age and previous number of acute exacerbations. Descriptive statistic: The Mean age of the subjects in group A was 53±3.7 years while in group B Mean age was 55±3.8 years. The previous number of acute exacerbations of COPD for group A was 3.0±0.84 times and in Group B it was 2.6±0.62 times. The sample constituted of n=13 men, n=17 women in group A and n=18 men, n=12 women in group B.

The baseline Means of VAS, SaO_2 and PEFR of both the groups indicates that the patients were similar on baseline. (Figure 1 and Figure 2) The within group analysis for VAS, SaO_2 and PEFR was done using paired t-test in both control and experimental group. Control group: Reported Mean difference by paired t test in control group for VAS was 0.40±0.63 with P=0.03 for PEFR 2.00±25.89 with P=0.76 and for SaO_2 -3.7±3.10 with P=0.00 using 95% CI. (Figure 1) Experimental group: Reported Mean difference by paired t test in experimental group for VAS for breathlessness was 4.78±1.12 with P=0.03 for PEFR -5.35±5.35 with P=0.02 and for SaO_2 -3.64±3.20 with P=0.01 with 95% CI. (Figure 2) Using

Independent t-test, the Mean difference for VAS, SaO2 and for PEFR between groups (group A and B) using

Figure 1: Means of VAS, PEFR and SaO2 on baseline and after treatment (Control group)

Figure 2: Means of VAS, PEFR and SaO2 on baseline and after treatment (Experimental group)

Figure 3: Means of VAS, PEFR and SaO2 post treatment for control and experimental group.

the 95% CI was 1.53, -6.7 and -25.65 respectively with statistically significant value ($p<0.05$).

DISCUSSION

The present study was conducted to strengthen the evidence regarding effects of chest physiotherapy in acute exacerbation of COPD. The research was about the effectiveness of ACBTs in COPD acute exacerbation. This study concluded for effectiveness for chest physiotherapy for COPD patients presented with acute exacerbation specially in improving peak expiratory flow rates. Smitha J and Aggarwal R et al conducted studies on similar aspect and both of them reported for significant improvement in experimental group (received chest physiotherapy with medical treatment) on SaO2 and PEFR compared to control group received medical treatment only)7,18. One of the systematic reviews agreed for use of both active and passive techniques in acute exacerbation of COPD but did not favored it on large scale19.

The inconsistent results in that area may be due to the variety of outcome measures used and their relative sensitivity differences for chest physiotherapy techniques. Some researches claimed that chest physiotherapy techniques including airway clearance devices have not been deeply studied in COPD patients, as in cystic fibrosis. The physiological improvements in SaO2 peak expiratory rates are associated with release of sputum from chest, deep penetration of alveolar air inside lungs and with correcting breathlessness and exercise endurance, these all can be carried out by chest physiotherapy techniques and these were mechanism considered for effectiveness of chest physiotherapy in cystic fibrosis20. In contrast, now there is rising evidence to support pulmonary rehabilitation during or shortly after an acute exacerbation of COPD17. A recent meta-analysis demonstrated significant evidence for improvements in exercise capacity and health related quality of life associated with chest physiotherapy after acute exacerbation of COPD. They also suggested pulmonary rehabilitation for patients who are clinically unstable21. The effective management for acute exacerbation of COPD is therefore demanded to expand the evidence with a focus on quality of life not only to recover from acute phase of the disease.

A prospective study carried out by Rosa et al

on COPD in year 200622. They followed patients for 12 months with one group received medical treatment only and another group received chest physiotherapy additionally. Their outcome measures were perception of dyspnea and chronic respiratory questionnaire. They reported that patients can achieve worthwhile benefits through physiotherapy and these benefits can persist for 2 years almost22.

Some of the study limitations were following; as the data was collected from on study site and only on mild to moderate acute exacerbation of COPD so the result cannot be generalizable to more severe or chronic phases of the disease. Also the trial used only certain specific outcome measures as used by the previous trials and was lacking objective evaluations of patient's satisfactions and treatment compliance to exercise protocol. Future studies therefore needed to have larger sample size with extensive assessment tools to consider diversity in functional abilities of COPD patients. There is need to divide COPD subjects in subgroups with different severity level so the results would be generalizable to COPD population. There is need to objectively evaluate the COPD patients for treatment satisfaction and compliance especially in case of circuit based trainings.

CONCLUSION

Chest physiotherapy is more effective in improving breathlessness level, SaO_2 and peak expiratory flow rates in acute exacerbation of COPD along with standard medical treatment than medical treatment alone. The estimated effects of chest physiotherapy in COPD patients are about three times more pronounced with medical treatment compared to medical treatment alone.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

:	and Design, Acquisition of Data, final Approval
I:	lection, Data Analysis,
M:	Review, Data Analysis

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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