TUGAS AKHIR

MODUL KARDIOPULMONAL

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PROGRAM STUDI FISIOTERAPI S1

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RESUME JURNAL I

Judul Jurnal : Pulmonary rehabilitation and tuberculosis: a new approach for an old disease
Penulis : Beatrice Mahler, Alina Croitoru
Tahun : 2019

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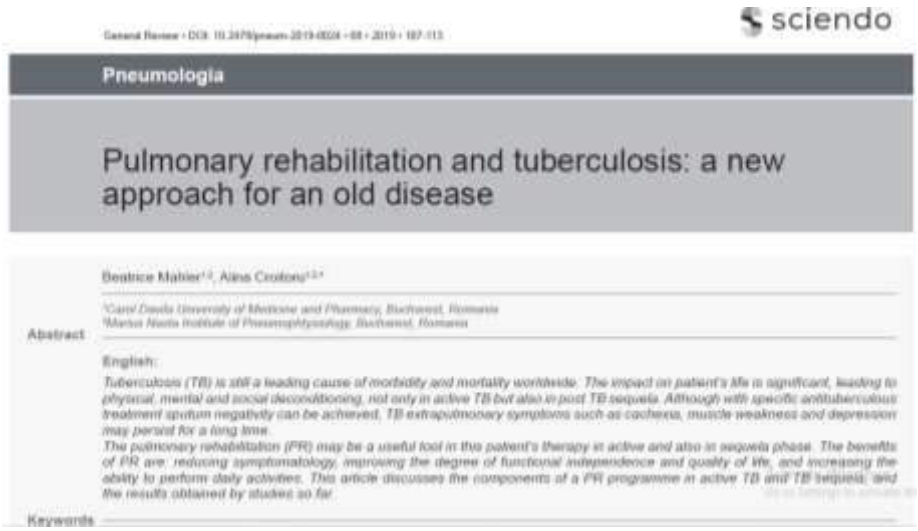
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Pneumologia

Pulmonary rehabilitation and tuberculosis: a new approach for an old disease

Beatrice Mahler, Alina Croitoru

Abstract

English:

Tuberculosis (TB) is still a leading cause of morbidity and mortality worldwide. The impact on patient's life is significant, leading to physical, mental and social deconditioning, not only in active TB but also in post TB sequela. Although with specific antituberculous treatment sputum negativity can be achieved, TB extrapulmonary symptoms such as cachexia, muscle weakness and depression may persist for a long time.

The pulmonary rehabilitation (PR) may be a useful tool in the patient's therapy in active and also in sequela phase. The benefits of PR are: reducing symptomatology, improving the degree of functional independence and quality of life, and increasing the ability to perform daily activities. This article discusses the components of a PR programme in active TB and TB sequela, and the results obtained by studies so far.

Keywords

Introduction

Tuberkulosis paru (TB) merupakan penyakit menular yang menular penyakit yang dihasilkan oleh kelompok bakteri *Mycobacterium tuberkulosis*. Merupakan masalah kesehatan masyarakat yang utama, menjadi salah satu dari 10 penyebab kematian teratas di seluruh dunia. Sekarang, Insiden TB turun dengan 2% per tahun, tapi tujuan Akhir Strategi TB adalah mencapai penurunan tahunan 4–5%. Diperkirakan 54 juta nyawa diselamatkan melalui diagnosis TB dan pengobatan antara 2000 dan 2017 (17 tahun). Meskipun pengobatan anti-TB spesifik mengarah pada penyembuhan klinis dan tidak adanya basil Koch dalam kultur sputum; di beberapa pasien, kerusakan paru-paru anatomis dapat muncul, dengan daerah fibrosis yang luas. Kerusakan pasca-TB toraks mungkin ada di bronkial jalan nafas, parenkim paru atau pleura.

Parenkim paru terkena lesi TB digantikan oleh jaringan ikat, yang mengubah arsitektur paru-paru. Konsekuensinya adalah penampilan bekas luka, rongga, biasanya dibatasi oleh waktu lama strip parenkim fibrosa dan fibrosis, atau paru-paru lengkap penghancuran. Dalam proses TB pohon bronkial dapat menyebabkan hingga perubahan struktur bronkial yang parah, ditandai oleh stenosis bronkial, bronkiektasis, fistula bronkial dan litiasis bronkial. Bronkiektasis terjadi pada sekitar 20% pasien dengan TB paru yang sembuh.

TB juga dapat mempengaruhi bagian lain dari kehidupan pasien tersebut seperti **status gizi, toleransi olahraga, kekuatan otot, status psikologis dan kualitas hidup (QOL).** Dalam grup 28 Pasien camerun dengan TB, toleransi daya tahan dinilai dengan 6 Minutes Walk Test (6MWT) menurun dibandingkan mengontrol subjek yang sehat pada fase

pertama penyakit aktif, tetapi setelah 2 bulan terapi obat TB kapasitas spesifik fisik ditingkatkan. Dampak TB pada QOL dapat dinilai dengan kuesioner berbeda : St George Respiratory Questionnaire (SGRQ), kuesioner QOL WHO, kuesioner 12v2 short (SF-12v2) dan klinis Kuesioner COPD (CCQ).

PULMONARY REHABILITATION IN TB

Pengobatan TB paru biasanya melibatkan pendekatan multidisiplin. Setelah diagnosis dan penegakan rejimen terapeutik, evolusi selanjutnya dan meningkatkan kemungkinan penyembuhan dan reintegrasi sosial dapat dilakukan dengan bantuan rehabilitasi paru (PR) dan dalam kasus tertentu dengan operasi toraks. PR adalah program multidisiplin, ditujukan kepada pasien dengan gangguan pernafasan yang memiliki gangguan klinis dan status fungsional dengan konsekuensi pada aktivitas kehidupan sehari-hari dan QOL. Terapi ini bersifat individual dan melibatkan pelatihan fisik, konseling psikologis, dukungan nutrisi, bersama dengan kepatuhan terhadap pengobatan obat TB. Pada pasien tertentu, Pada pasien tertentu, program PR memperbaiki gejala, kapasitas latihan dan integrasi social.

Pulmonary rehabilitation in the active phase of tuberculosis

Pada **fase TB aktif,** yang berakibat sindrom inflamasi kronis yang hebat dan menyebabkan pelepasan banyak sitokin, tumor necrosis factor alpha (TNFα) dan interleukin, pasien mengklaim penurunan berat badan, astenia dan *exercise dysponea*. Jadi, dimasukkannya pasien TB ke dalam Program PR diindikasikan untuk meningkatkan fisik yang tinggi dan perbaikan kondisi mental. Pemulihan medis kompleks pasien itu, bertujuan untuk mencapai tingkat maksimum kemandirian dan reintegrasi komunitas setelah keluar dari rumah sakit.

- Exercise
- Terapeutic education
- Nutrition
- Physiological support

Pulmonary rehabilitation in post tuberculosis sequelae

Tidak seperti COPD, pada gejala sisa pasca TB, ada kekurangan studi tentang efek PR. Kebanyakan terapi dalam hal ini fase kronis penyakit termasuk bronkodilator, kortikoterapi, terapi oksigen dan dalam kasus tertentu pembedahan. Namun, sejauh ini studi yang dilakukan berkaitan dengan PR pada gejala sisa TB menunjukkan hasil positif dalam toleransi olahraga, gejala dan kualitas hidup. Pada gejala sisa pasca TB, rehabilitasi menargetkan dua arah: gejala yang berhubungan dengan bronkiektasis dan kelemahan otot yang menyebabkan gangguan fungsional dan dispnea.

- Physiotherapy for bronkiektasis
- Exercise training
- Programme location

Pulmonary rehabilitation in MDR tuberculosis

Pasien TB-MDR dengan TB menghadapi banyak tantangan, terkait dengan efek destruktif penyakit pada fungsi paru-paru, *cachexia* dan ketidakmampuan fungsional, durasi pengobatan dan efek samping. Pasien-pasien ini dirawat di rumah sakit untuk waktu yang lama waktu, yang mempengaruhi dekondisi otot tetapi juga depresi, isolasi sosial dan gangguan kualitas hidup. Itu Program PR dalam kasus mereka harus dimulai segera kondisi mereka menjadi stabil dan termasuk latihan olah raga (aerobik dan ketahanan), dukungan nutrisi dan psikologis penyuluhan. Bagian yang sangat penting diwakili oleh pendidikan yang bertujuan untuk meningkatkan kepatuhan jangka panjang pengobatan dan partisipasi dalam aktivitas kehidupan sehari-hari dan sosial reintegrasi. Perawatan paliatif juga harus disertakan pasien yang sangat parah dengan MDR-TB.

Pulmonary rehabilitation in tuberculosis pleural effusion

Pada fase aktif TB radang selaput dada, fisioterapi memiliki peran pencegahan fibrosis, tetapi juga postural dan analgesik. Posisi utama akan berada di dekubitus, tetapi bergantian dengan posisi lateral dan prokubitus. Ruang lingkupnya mendukung pleura resorpsi efusi; untuk nyeri pijat bisa digunakan. Untuk memobilisasi ekspansi diafragma dan memulihkan volume cadangan paru-paru, pernapasan diafragma perut, mobilisasi toraks melawan perlawanan (secara manual, dengan karung pasir) dapat digunakan. Setelah 1 bulan, tulang rusuk mengembang latihan suspensi asimetris dapat dimulai dengan espalier, berenang (merangkak). Terkadang, ada penyembuhan yang buruk dengan fibrosis pleura dan sindrom restriktif berurutan . Dalam ini kasus, prosedur yang digunakan oleh fisioterapis yang digunakan latihan pernapasan, pelatihan olahraga, pengencangan otot dan hidroterapi.

CONCLUSIONS

Meskipun TB adalah salah satu penyakit pernapasan tertua yang diketahui, ada beberapa studi dalam literatur ilmiah tentang efeknya program rehabilitasi di TB. Namun, studi tersebut mendukung penggunaan PR dalam terapi pasien TB, dengan efek positif pada gejala, toleransi olahraga dan kualitas hidup. Indikasinya bisa berupa gejala penderita destruksi paru, penurunan fungsi paru, kelemahan otot, menurunkan toleransi latihan dan gangguan kualitas hidup. Lebih jauh lagi studi dengan jumlah pasien dan kelompok kontrol yang lebih besar dibutuhkan. Peran utama PR tampaknya dalam pengelolaan pasca TB gejala sisa, tetapi ada umpan balik positif tentang manfaatnya menggunakan rehabilitasi dari fase aktif penyakit.

Memulihkan status fisik dan fungsional pasien dengan TB, bersama dengan dukungan psikologis dapat mempersingkat masa pemulihan dan membantu kembali bekerja. Lokasi dan perkembangan program tersebut tergantung pada kemungkinan sistem perawatan kesehatan, khususnya karena tingginya insiden TB terjadi di negara dengan ekonomi tingkat rendah.

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Mahler and Croitoru. 2019. Pulmonary rehabilitation and tuberculosis: a new approach for an old disease. *General Review.DOI: 10.2478/pneum-2019-0024 .68.2019.107-113.*

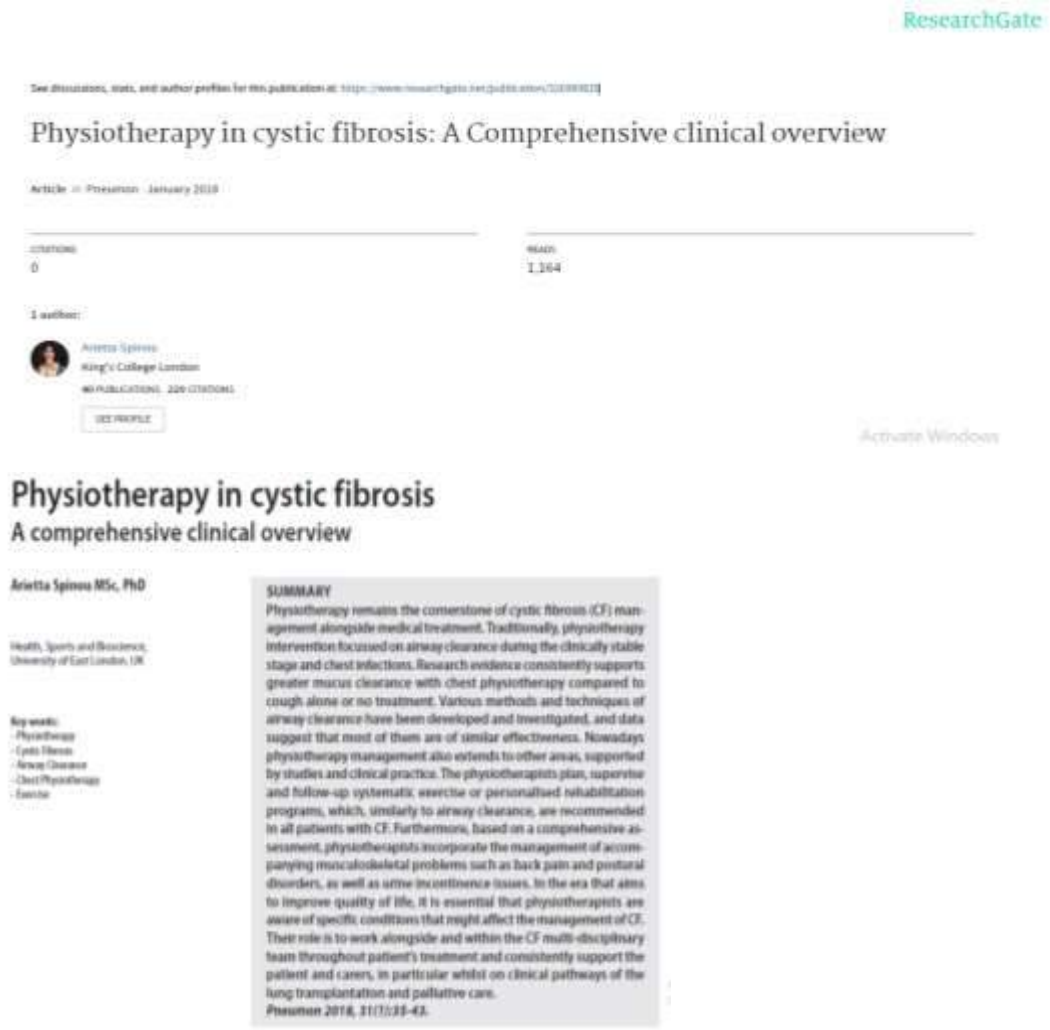
RESUME JURNAL II

Judul Jurnal : Physiotherapy in cystic fibrosis: A Comprehensive clinical overview

Penulis : Arietta Spinou

Tahun : 2018

Jurnal Research Gate



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Physiotherapy in cystic fibrosis: A Comprehensive clinical overview

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Physiotherapy in cystic fibrosis

A comprehensive clinical overview

Arietta Spinou MSc, PhD

Health, Sports and Bioscience, University of East London, UK

Key words:
- Physiotherapy
- Cystic Fibrosis
- Airway Clearance
- Chest Physiotherapy
- Exercise

SUMMARY

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

Pneumon 2018, 31(1):35-43.

Introduction

Cystic fibrosis (CF) adalah penyakit genetik resesif yang mempengaruhi pasien pada berbagai sistem, dengan manifestasi yang mendalam pada sistem pernapasan dan pencernaan. 1. Hal ini ditandai dengan mutasi dan oleh 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. Di jalan nafas pasien CF, disfungsi hasil CFTR dalam

penipisan lapisan cairan periciliary 2. Secara klinis, pasien dengan CF menunjukkan konsistensi abnormal dan volume dahak yang tinggi, batuk, dispnea, bronkiektasis, dan penurunan berat badan.

Fisioterapi merupakan bagian integral dari terapi manajemen pasien CF, baik secara klinis stabil tahap penyakit dan selama infeksi saluran pernapasan. Dalam beberapa waktu silam fisioterapi difokuskan pada pembersihan jalan napas, juga dikenal sebagai fisioterapi dada, dengan mengajar atau menerapkan metode seperti drainase postural dengan atau tanpa aplikasi tambahan teknik manual.

Drainase postural trakeobronkial menggunakan spesifik posisi gravitasi untuk membantu mobilisasi lendir ke bawah (menuju mulut) di dalam saluran udara. Teknik manual (perkusi, getaran dan / atau getar) gunakan kekuatan mekanis untuk membantu pelepasan lendir dari epitel jalan napas dan mobilisasinya. Sekarang, pilihan teknik pembersihan jalan napas telah dipilih diperluas ke metode seperti drainase otogenik, siklus aktif teknik pernapasan (ACBT), penggunaan perangkat tekanan ekspirasi positif (PEP) dengan atau tanpa osilasi, dan lainnya. Tetap saja, fisioterapi modern di CF juga mencakup penilaian kardiovaskular sistem dan peningkatan tingkat kebugaran pasien, kekuatan otot dan ketahanan melalui olahraga, juga sebagai intervensi khusus untuk memperbaiki muskuloskeletal gejala nyeri, postur tubuh dan inkontinensia.

PHYSIOTHERAPY

Airway Clearance

Pendidikan pasien, penerapan dan pemantauan teknik pembersihan jalan nafas tetap menjadi fisioterapi utama pengobatan untuk pasien dengan CF. Fisioterapis memfasilitasi pembentukan jalan napas individual pembersihan rutin dengan mendukung pasien dan keluarganya untuk menetapkan rezim reguler selama tahap stabil secara klinis dan memiliki rencana eskalasi untuk eksaserbasi penyakit. Pembersihan jalan napas biasanya dilakukan setiap hari dan sesuai kebutuhan. Metode yang dipilih diterapkan, durasi dan frekuensi setiap sesi disesuaikan dengan pasien, mereka kondisi kesehatan umum dan tingkat keparahan penyakit. Untuk Misalnya, pembersihan jalan napas menjadi lebih teratur selama eksaserbasi atau rawat inap6. Rawat inap juga memberikan kesempatan bagi fisioterapis untuk menilai ulang efektivitas pembersihan jalan napas harian dan berikan umpan balik dan panduan yang sesuai untuk meningkatkan teknik biasa pasien sebelum keluar.

TABLE 1. Common airway clearance techniques and methods.

Airway clearance techniques
• Postural drainage
• Manual techniques
• Active circle of breathing techniques (ACBT)
• Autogenous drainage (AD)
• Positive expiratory pressure (PEP) devices (PEP mask, Pari-PEP, etc)
• Positive expiratory pressure (PEP) devices with oscillation (flutter, acapella, cornet, etc.)
• Intermittent Positive Pressure Breathing (IPPB)
• High frequency chest wall oscillation (HFCWO) or vest
• Non-invasive mechanical ventilation (NIV)
• Aerobic exercise

Airway clearance adaptations
Mucolitics and other agents

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 meningkatkan karakteristik reologi sputum dan meningkatkan hidrasi epitel saluran napas.

Dornase alpha (DNase) adalah deoxyribonuclease manusia rekombinan yang mengurangi sputumviskositas dengan secara selektif menghidrolisis molekul DNA ekstraseluler besar yang terkandung dalam lendir menjadi struktur yang lebih kecil, sehingga meningkatkan potensi eliminasi. Obat ini diberikan melalui perangkat jet-nebuliser dan telah terbukti mengurangi kejadian infeksi saluran pernapasan, meningkatkan fungsi pernapasan, dan meningkatkan kualitas hidup.Berkenaan dengan waktu pemberiannya, tampaknya menggunakan Dnase sebelum atau sesudah pembersihan jalan napas tidak memiliki perbedaan dalam meningkatkan fungsi paru (FEV).dan FVC) atau kualitas hidup pasien. Dalam praktik klinis,fisioterapi sering mengikuti pedoman yang diusulkan dariperusahaan farmasi untuk melakukan pembersihan jalan udara 30 menit setelah pemberian DNase.

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

Haemoptysis
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. Hemoptisis frank aktif (> 1001000 ml hemoptisis dalam 24 jam atau 48 jam) diobati.

Pneumotoraks
Pneumotoraks spontan merupakan komplikasi umum pada pasien CF. Ini terkait dengan penurunan fungsi paru dan kemungkinan kekambuhan 50-90%. Jika pneumotoraks terjadi pertama kali dan kecil, maka dapat diobati secara konservatif dengan suplai oksigen. Pasien rawat inap yang melanjutkan pembersihan jalan napas,disarankan untuk bekerja sama dengan tim medis untuk menambahkan humidifikasi ke pasokan oksigen dan memastikan analgesia yang memadai selama sesi pengobatan.Dalam kasus pneumotoraks besar (> 2 cm antara pleura parietal dan pleura viseral) atau pneumotoraks berulang, drainase dada dilakukan dengan menggunakan kateter toraks, sementara pasien mungkin mendapatkan pleurodesis pada kasus resisten.

Exercise
Latihan merupakan bagian integral dari intervensi fisioterapi komprehensif untuk pasien dengan CF. Pedoman American College of Sports Medicine menganjurkan 3-5 sesi olahraga sedang per minggu, dengan tujuan untuk mengadopsi olahraga sebagai cara hidup. Dalam pengaturan klinis, penilaian pasien dengan CF menggunakan tes lapangan latihan sederhana dan hemat biaya, seperti tes berjalan 6 menit (6MWT) dan tes shuttlewalk tambahan (ISWT), sementara tingkat dispnea dinilai menggunakan skala Borgdyspnoea.

Exercise considerations
- Musculoskeletal and postural issues

- Urinary incontinence
- Diabetes mellitus
- Quality of life

Special considerations
Long term oxygen therapy and non-invasive ventilation
- Paediatric population
- Palliative care

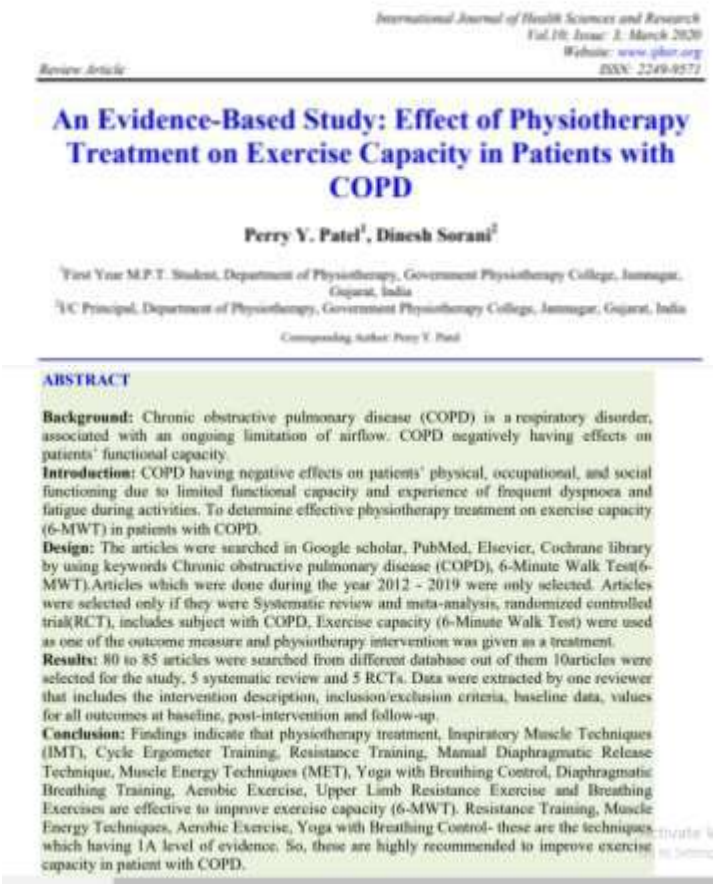
Conclusions
Penatalaksanaan CF sangat menuntut, terutama bertujuan untuk pengurangan dan pengobatan infeksi dada, peningkatan kualitas hidup dan peningkatan harapan hidup. Fisioterapi merupakan bagian integral dari rutinitas perawatan harian pasien, dan sebagai tambahan untuk pembersihan jalan napas. Pedoman klinis internasional menyarankan akses ke perawatan fisioterapi khusus selama tahap 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 mengatur waktu rencana perawatan mereka. Selama infeksi pernafasan, intervensi fisioterapi diintensifkan sesuai dengan presentasi klinis. Meskipun pembersihan jalan napas inCF adalah dasar dari 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.

Daftar Pustaka :
Spinou Arietta.2018. Physiotherapy in cystic fibrosis: A Comprehensive clinical overview. Available From https://www.researchgate.net/publication/326990820

RESUME JURNAL III

Judul Jurnal : An Evidence-Study : Effect of Physiotherapy Treatment on Exercise Capacity in Patients with COPD
Penulis : Perry Y.Patel, Dinesh Sorami
Tahun : 2020

International Journal of Health Sciences and Research (Review Articel)



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An Evidence-Based Study: Effect of Physiotherapy Treatment on Exercise Capacity in Patients with COPD

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a respiratory disorder, associated with an ongoing limitation of airflow. COPD negatively having effects on patients' functional capacity.
Introduction: COPD having negative effects on patients' physical, occupational, and social functioning due to limited functional capacity and experience of frequent dyspnoea and fatigue during activities. To determine effective physiotherapy treatment on exercise capacity (6-MWT) in patients with COPD.
Design: The articles were searched in Google scholar, PubMed, Elsevier, Cochrane library by using keywords Chronic obstructive pulmonary disease (COPD), 6-Minute Walk Test(6-MWT).Articles which were done during the year 2012 - 2019 were only selected. Articles were selected only if they were Systematic review and meta-analysis, randomized controlled trial(RCT), includes subject with COPD, Exercise capacity (6-Minute Walk Test) were used as one of the outcome measure and physiotherapy intervention was given as a treatment.
Results: 80 to 85 articles were searched from different database out of them 10articles were selected for the study, 5 systematic review and 5 RCTs. Data were extracted by one reviewer that includes the intervention description, inclusion/exclusion criteria, baseline data, values for all outcomes at baseline, post-intervention and follow-up.
Conclusion: Findings indicate that physiotherapy treatment, Inspiratory Muscle Techniques (IMT), Cycle Ergometer Training, Resistance Training, Manual Diaphragmatic Release Technique, Muscle Energy Techniques (MET), Yoga with Breathing Control, Diaphragmatic Breathing Training, Aerobic Exercise, Upper Limb Resistance Exercise and Breathing Exercises are effective to improve exercise capacity (6-MWT). Resistance Training, Muscle Energy Techniques, Aerobic Exercise, Yoga with Breathing Control- these are the techniques which having 1A level of evidence. So, these are highly recommended to improve exercise capacity in patient with COPD.

Introduction

Kronis obstruktif penyakit (COPD) adalah gangguan pernafasan, paru terkait dengan pembatasan aliran udara yang sedang berlangsung, terutama ke aliran udara ekspirasi. Penyebab PPOK bersifat kronis peradangan di paru-paru dan saluran udara sebagai respons terhadap partikel dan gas beracun. Selama aktivitas fisik, keterbatasan terkait PPOK dalam aliran udara diperburuk dan dispnea mencegah pasien untuk melanjutkan aktivitas fisik. COPD memiliki efek negatif pada fisik pasien,pekerjaan, dan sosial berfungsi karena keterbatasan kapasitas fungsional serta mengalami dispnea dan kelelahan saat beraktivitas sehari-hari.

Fisioterapi telah digunakan untuk mengurangi kapasitas olahraga. Pelatihan Otot Inspiratif (IMT), Pelatihan Ergometer Siklus (CET), rehabilitasi paru (PR), perlawanan latihan, manual teknik pelepasan diafragma, teknik energi otot (MET), Yoga, Latihan Aerobik, Diafragma Pernafasan Teknik, ekstremitas atas, dan latihan pernapasan- Semua digunakan untuk kapasitas latihan. Hasil perawatan diukur dengan 6Minute Walk Test (6-

MWT) pada awal dan pada akhir fase perawatan dan dalam beberapa studi, itu mengukur pada beberapa interval tertentu. Penelitian berbasis bukti diperlukan untuk menentukan teknik terapeutik yang efektif untuk meningkatkan kapasitas latihan (6-MWT).

Metode : Artikel-artikel tersebut dicari di Google Scholar, PubMed, Elsevier, perpustakaan Cochrane dengan menggunakan kata kunci Penyakit Paru Obstruktif Kronis (PPOK), Tes Jalan 6 Menit. Artikel yang dikerjakan selama tahun 2012 - 2019 hanya diseleksi. Kriteria inklusi artikel adalah: • Review sistematis dan meta-analisis Atau Uji Kontrol Acak (RCT). Artikel-artikel yang memuat topik-topik dengan COPD. Penggunaan intervensi fisioterapi untuk pengobatan kapasitas latihan yang berkurang. 6- MWT sebagai salah satu ukuran hasil. Seleksi Studi: 80 sampai 85 artikel dicari dari database yang berbeda dari 10 artikel yang dipilih untuk penelitian.

Intervensi :

- Pulmonary rehabilitation

Aerobic exercise, pursed lip breathing, other breathing exercises, cycling, walking session duration 30-90 menit, frekuensi : 2 atau 3/ minggu dalam jangka waktu 4-6 bulan.

- Resistance training

Leg press, knee ekstension, knee flexion, chest press, hip abduction in standing, seated row, lunges ets.

- Aerobic exercise training

Aerobic exercise training (leg exercise,cycling, free walking, treadmill walking included) durasi 4- 52 minggu 1-5 sesi per minggu waktu 15-40 menit.

- Muscle energy techique (MET)

1. RCT subjects receive MET+CPT , 2. RCT subjects receive MET, 3. RCT subjects receive MET + exercise

- Yoga

Hatha yoga, pranayama, laugher yoga, kripalu yoga, iyengar yoga etc. Durasi : 2 minggu- 9 bulan, frekuensi : 1-2/ minggu, sesi durasi : 10-90 menit.

- Diaphragmatic breathing training program
- Manual Diaprahgmatic
- Release technique
- Cycle ergometer training (CET) and Inspiratory Muscle Training (IMT)
- Upper limb exercise (Strengthening exercsies), and breathing exercises (pursed lip breathing and diapraghmatic breathing)
- Inspiratory muscle training (IMT)

Conclusions

Menurut Teknik Otot Inspiratif (IMT), Latihan Ergometer Siklus, Latihan Resistensi, Teknik Pelepasan Diafragma Manual, Teknik Energi Otot, Yoga dengan Pernafasan Kontrol, Latihan Pernapasan Diafragma, Latihan Aerobik, Latihan Resistensi Anggota Badan Atas dan Pernafasan Olahraga - Ini perawatan fisioterapi efektif untuk meningkatkan kapasitas olahraga. (6-MWT) Latihan Ketahanan, Teknik Energi Otot, Latihan Aerobik, Yoga dengan Kontrol Pernapasan- ini adalah teknik yang memiliki tingkat bukti 1A. Oleh karena itu, sangat dianjurkan untuk meningkatkan kapasitas olah raga pada penderita PPOK. Rehabilitasi paru (Aerobik Latihan pernapasan bibir, latihan pernapasan lainnya, bersepeda, jalan kaki) secara klinis tidak menunjukkan perbedaan yang signifikan dan hanya postur Yoga yang tidak membaik 6-MWT.

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Pneumologia

Pulmonary rehabilitation and tuberculosis: a new approach for an old disease

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Abstract

English:

Tuberculosis (TB) is still a leading cause of morbidity and mortality worldwide. The impact on patient's life is significant, leading to physical, mental and social deconditioning, not only in active TB but also in post TB sequela. Although with specific antituberculous treatment sputum negativity can be achieved, TB extrapulmonary symptoms such as cachexia, muscle weakness and depression may persist for a long time.
The pulmonary rehabilitation (PR) may be a useful tool in this patient's therapy in active and also in sequela phase. The benefits of PR are: reducing symptomatology, improving the degree of functional independence and quality of life, and increasing the ability to perform daily activities. This article discusses the components of a PR programme in active TB and TB sequela, and the results obtained by studies so far.

Keywords

pulmonary rehabilitation • tuberculosis • exercise

Reabilitarea pulmonară și tuberculoza: o nouă abordare a unei maladii vechi

Rezumat

Romanian:

Tuberculoza (TB) este încă o cauză principală de morbiditate și mortalitate în lume. Impactul asupra vieții pacientului este semnificativ şi are drept rezultat decondiționarea fizică, mentală și socială, în formele active de TB, dar și în sechelele post TB. Deși cu un tratament antituberculos specific poate fi obținută negativarea sputei, simptomele extrapulmonare ale tuberculozei, ca de exemplu caşexia, slăbiciunea musculară și depresia pot persista mult timp.
Reabilitarea pulmonară (RP) poate fi un instrument util în terapia acestui pacient atăt în faza activă a bolii, dar și în perioada de sechele post TB. Beneficiile RP sunt: reducerea simptomatologiei, îmbunătățirea gradului de independență funcțională și a calității vieții, creșterea capacității de a efectua activități zilnice. Acest articol discută componentele unui program de reabilitare pulmonară în TB activă și in sechelele post TB, precum și rezultatele obținute de studii până acum.

Cuvinte-cheie

reabilitare respiratorie • tuberculoză • exerciţiu

Introduction

Pulmonary tuberculosis (TB) is an infectious contagious disease produced by bacteria belonging to Mycobacterium tuberculosis group (1). It is a major public health problem, being one of the top 10 causes of death worldwide. Now, the TB incidence is falling with 2% per year, but the goal of End TB strategy is to reach a 4–5% annual decline. An estimated

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54 million lives were saved through TB diagnosis and treatment between 2000 and 2017 (17 years) (2).

Even if specific anti-TB treatment leads to clinical healing and the absence of Koch bacillus in sputum culture; in some patients, anatomical lung destructions can appear, with extensive fibrosis areas. These areas usually respect the territory of former bacillary active lesions, so the lesions can be located on the lung apex or generalized to entire lung.

Thoracic post-TB impairment may be present in the bronchial airway, lung parenchyma or pleura. Pulmonary parenchyma affected by TB lesions is replaced by connective tissue, which alters lung architecture. The consequence is the appearance of scars, resting cavities, typically delimited by long-standing fibrous parenchyma strips and fibrosis, or complete lung destruction. In the bronchial tree TB processes may lead to severe alterations of bronchial structure, characterized by bronchial stenosis, bronchiectasis, bronchial fistula and bronchial lithiasis. Bronchiectasis occurs in about 20% of patients with healed pulmonary TB. Broncholithiasis is asymptomatic, but can be clinically evident when it is complicated with broncho-pulmonary fistula. TB pleurisy, despite correct therapy, may also cure with different degrees of fibrosis, leading to pachypleuritis.

TB may also influence other parts of the patient's life such as nutritional status, exercise tolerance, muscle strength, psychological status and quality of life (QOL) (3). In a group of 28 Cameroonian patients with TB, effort tolerance assessed by 6 Minutes Walk Test (6MWT) was decreased compared to control healthy subjects in the first phase of active disease, but after 2 months of specific TB drug therapy the physical capacity improved (4).

The impact of TB on QOL can be assessed with different questionnaires: St. George Respiratory Questionnaire (SGRQ), World Health Organization QOL questionnaire (5), short-form 12v2 questionnaire (SF-12v2) (6) and clinical COPD questionnaire (CCQ) (7).

Pulmonary rehabilitation in tuberculosis

Treatment of pulmonary TB usually involves a multidisciplinary approach. After the diagnosis and establishment of the therapeutic regimen, the subsequent evolution and the increase of the chances of healing and social reintegration can be done with the help of pulmonary rehabilitation (PR) and in selected cases with thoracic surgery.

PR is a multidisciplinary programme, addressed to patients with respiratory impairment who have impaired clinical and functional status with consequences on daily life activities and QOL (8, 9). This therapy is individualized and involves physical training, psychological counselling, nutritional support, along with compliance with TB drug treatment. In selected patients, PR programmes improve symptoms, exercise capacity and social integration (8–10).

Pulmonary rehabilitation in the active phase of tuberculosis

In the active phase of TB, due to the intense chronic inflammatory syndrome that induces the release of many cytokines, tumour necrosis factor alpha (TNFα) and interleukins, patients claim weight loss, asthenia and exercise dyspnoea. Thus, inclusion of patients with TB in PR programmes is indicated due to high degree of physical and mental deconditioning. The medical recovery of these patients is complex, aiming to reach the maximum level of independence and community reintegration after hospital discharge.

Exercise

Typically, prolonged bed rest and avoidance of the exercise are recommended for patients in the active phase of TB. Although avoidance of intense exercise may be justified in some special cases (e.g. severe haemoptysis), in cases of normal TB, it may not represent an indication. It was reported, in one of the first studies in this area followed for 7 years, that 454 patients with TB placed on a programme of exercise combined with drug TB therapy. The programme consisted of exercise for arms, shoulder, elbow, knee (light and heavy exercise alternatively), bicycle exercise and occupational therapy. The results showed that early start of a complex PR programme may allow a social and work reintegration of patients with TB after hospital discharge (11).

In the active TB phase, the exercise proposed may be light in first few days, starting with passive exercise (elongations of the limbs while standing in bed), followed by active-assisted and active exercise. In physical therapy, the patient's condition will be taken into account by trying to establish a patient-friendly programme. Exercises at a slow pace will be preferred first, followed by the increase in the degree of precision and postural control. Over time, the application of motion resistance, which involves an increase in muscle strength that occurs by increasing the number of repetitions, or applying weight, will be taken into account. The exercise must target both upper and lower limbs. When the patient's status is stable, walk test may be used, in the hospital room or corridor, followed by stationary cycling and resistance training. The intensity should be progressively increased, depending on patient's individual tolerance.

Additional techniques, such as relaxation, posture and breathing education, to exercise training may be useful. For example, diaphragmatic breathing aims to improve the effectiveness of their contraction by conscious relaxation of the abdominal wall with decreased respiratory effort; it involves inspiration followed by expiration from abdominal

muscle action. Later, progressively increasing weights will be applied to the abdomen, performing the same movement.

A recently published study in Ukraine investigates the effects of a multidisciplinary rehabilitation programme on 68 newly diagnosed patients with TB. They were divided into two groups, 34 patients each: (1) a control group containing TB drug therapy + usual rehabilitation and (2) a study group receiving TB drug therapy + multidisciplinary comprehensive PR programme. The PR programme included gymnastic, therapeutical massage, physiotherapy, hydrotherapy and therapeutic education. In patients receiving a comprehensive PR programme, there was an increase in lung function, QOL questionnaire (WHOQOL-100 quality of life of the World Health Organization) and cardiovascular and respiratory system status (assessed by hypoxic samples) (5).

Nutrition

Malnutrition appears to increase the risk of TB; people with a low body mass index are more at risk of developing TB than those with a high body mass index. Moreover, the underweight patients with TB are at risk for delayed healing, TB relapses or increased mortality. The weight loss and muscular mass are associated with fatigue and decreased exercise capacity, and there is a risk for the patient to not recover the body weight at the end of drug therapy, despite receiving correct TB treatment (12).

The initial medical assessment of respiratory patients must include nutritional status, the determination of body weight and body composition. The underweight COPD patients with a BMI lower than 21 kg/m^2 have a decreased percentage of fat mass than normal-weight patients (13). In the case of TB patients, although fat-free mass (FFM) seems to be in closer relation with physical status and QOL than body weight and fat mass (FM), there is an increase of FM during the healing period (14).

Proper nutrition is an important element in all stages of TB infection. Among underweight patients at the time of diagnosis, those who gain 5% by weight in the first 2 months of treatment have low rate of recurrence than those who gain less than 5% (15). Nutritional supplementation may have a positive role in these patients recovery. Adding high-calorie supplements for patients with TB in first phase of the treatment has to be shown to have benefits on lean mass, body weight and physical function after 6 weeks (16). Trials reported that vitamins and minerals (thiamine, vitamins B6, C, E, A and zinc) were effective in improving immune response and the good response to chemotherapy (number of patients with negative sputum) (17).

Therapeutic education

TB is a contagious disease that induces fear, social isolation and need a long period of drug administration, sometimes with adverse effects. Therefore, therapeutic education is very important, which serves the purpose in explaining the patients and their family about the condition of the disease, the risks of contagiousness, the stages of treatment and prognosis. Proper medical education can influence the patient's adherence to treatment as well as improve the patient's mood and perception of the disease. The educational programme is better to be started in the hospital where it is easier to organize both individual and group trainings. For patients with TB who are active smokers, smoking cessation interventions should be initiated; these had been shown to improve the results of TB drug therapy (18).

Psychological support

Emotional support must be provided to patients with TB and their families during illness. Receiving TB diagnosis is often regarded by the patient as a real stigma which isolates him from family and society. A community-based study from the World Health Survey on 242.952 subjects showed an incidence of depressive syndrome of 23.7% in patients with TB, compared with 6.8% in the control group (19). The psychologist can support patients to help reduce misconception and to socially integrate former patients (Table 1).

Pulmonary rehabilitation in post tuberculosis sequelae

Unlike COPD, in post TB sequelae, there is a lack of studies regarding the effects of PR. Most therapies in this chronic phase of disease include bronchodilators, inhaled corticotherapy, oxygen therapy and in selected cases, surgery (20). However, the studies performed so far with regard to PR in TB sequelae showed positive results in exercise tolerance, symptoms and QOL (7, 21–23).

In post TB sequelae, the rehabilitation target two directions: the symptoms related to bronchiectasis and the muscular weakness leading to functional impairment and dyspnoea.

Physiotherapy for bronchiectasis

When the TB heals with sequelae bronchiectasis, symptoms such as bronchorrhea, respiratory infections and haemoptysis may influence the patient's QOL. In these cases, the airway

Table 1. Modalities of psychosocial support

Types of mental dysfunction	Types of intervention
Intra-psychic conflict, low self-esteem, lack of control	– group therapy, psychoanalysis – emotions management – hypnoses
Relationship with others/environment: decreases the desire for information, communication and lack of skills	– education, information – occupational therapy – communication programmes
Psychiatric acute states: panic, anxiety and depression	– stress management – relaxation techniques – hypnoses

clearance technique is an important therapeutical tool with positive effects: reduced sputum quantity, better ventilation and relief of symptoms (8, 24).

Postural drainage is considered to be the most effective means of ensuring evacuation of secretions from the bronchial tree. Its principle is based on the use of positions that create a gradient of height between the pulmonary segment loaded with secretions and the large bronchial paths and trachea; position favouring gravity action on fluid leakage. The most effective position is tattooed at first sessions with the physical therapist. Sometimes, a few degrees of torso rotation can visibly collapse the evacuation of the secretions (15). It must be done before a meal, once or several times a day, but not more than 20–30 min, during which time several positions will be used, 5–10 min each. At the end of each position period, the drained region will be tap for 1 min.

Another techniques used to diminish the sputum load are as follows: autogenic drainage, forced expiration, vibrations with special devices and manual procedures such as clapping and percussions. Now we discuss the active cycle of breathing techniques. ACBT is a simple breathing technique used to clear lung secretions, to improve cough efficiency and ventilation. It consists of deep inhalation followed by forced exhalation and cough (24, 25).

Cough education is important for patient with TB and consist of: body positioning during coughing, control of breathing in coughing (slowly nose inspiration, short apnoea and strong air expiration in 2–3 sessions). The goal is to achieve mobilization and secretions removal from the bronchial tree.

Exercise training

The post TB sequelae may have functional consequences such as obstructive or restrictive function and decreased effort tolerance; patients with frequent relapses may have cachexia, asthenia and muscle fatigue. In these cases, there is a rationale for exercise training as part of the rehabilitation programmes (26).

A Japanese study assessed effort tolerance in 10 patients with post TB sequelae by using cardiopulmonary exercise test (CPET) before and after 2 weeks of exercise training. The exercise programme consisted of daily walking in the hospital corridor, and the results were positive: increase of maximum oxygen uptake (from 13.6 ± 2.8 to 14.8 ± 2.8 ml/kg/min, $p < 0.01$) and 6 MWT distance (from 399 ± 62 to 467 ± 65 m, $p < 0.01$) (27). Although there was a small number of patients and the duration was short, this study showed how useful is walking as an exercise. Another prospective nonrandomized open trial which took place also in Japan compared the results of a nine-week outpatient PR programme in 32 post TB patients and 32 COPD patients. The positive effects were similar to the two groups, in terms of exercise tolerance (6MWT distance), dyspnoea (MRC scale) and daily activities scores (23).

A research was conducted in Colombia and assessed the PR effects on aerobic capacity and health-related QOL in eight patients with TB sequelae. It was an 8-week PR programme, including physical aerobic training, therapeutic education and activities of daily living. The sessions took place three times per week. Exercise training was aerobic, performed on a treadmill for lower limb, with training intensity starting from 60% and reaching 90% of the maximum oxygen consumption. The results were positive: increase of peak oxygen consumption (VO2) with 1.7 ml/kg/min, 6MWT distance with 63.6 m and improvement of SGRQ score with 13 points (28).

Another study performed in Uganda on 34 patients with post-tuberculous lung disorder and respiratory symptoms (mMRC dyspnoea score >2) used a 6-week PR programme, two sessions per week. The PR programme consisted of lower limb aerobic training, with intensity seat in order to reach 80% of the peak values obtained at Incremental Shuttle Walking Test (ISWT), and resistance training for upper and lower limbs (weights). Patients received also therapeutic education, regarding long-term effects of TB, self-management and nutrition. Improvements were obtained in QOL (reduction of mean CCQ score from 1.8 to 1.0), exercise tolerance (increase of ISWT distance from 299 to 377 m), diminution of chest pain (from 45% participants to 24%) and haemoptysis (from 17 to 7%) (7).

An outpatient PR programme from India searched for the effects of PR in 29 patients with chronic lung impairment from previously treated tuberculosis (CLIPTB). The PR programme had a 8-week duration, sessions three times per week, including exercise training for lower limbs (ergometry and treadmill) and upper limbs (arm ergometry and weights) and therapeutic education. The intensity of the exercises increased progressively, according to symptoms. The results were positive in terms of 6MWT distance (488 m at baseline vs. 526 m post PR intervention) and chronic respiratory questionnaire (CRQ) score (17.21 at baseline vs. 18.96 post PR) (29).

By resuming, for the evaluation of PR programmes results in patients with TB, the parameters used were as follows:

– exercise tolerance with 6MWT (22, 23, 29), ISWT (7) and CPET (28).
– QOL with SGRQ (St George Respiratory Questionnaire) (22, 28), CCQ (Clinical COPD Questionnaire) (7), WHOQOL-100 (quality of life of the World Health Organization) (5), CRQ (29).

For establishing the intensity of training, the data from exercise tests may be used, or in the absence, the symptom tolerance. In the studies published so far, programme design was almost

similar to the one recommended for COPD. The length of the PR programme varied from 2 weeks (27), 4 weeks (30), 6 weeks (7, 30) to 8 (22, 28) and 9 weeks (23).

Programme Location

The PR programme settings may differ regarding the patient's status and healthcare system possibilities. The old sanatorium providing physiotherapy for patients with TB may be transformed these days in most attractive and modern PR centres (31).

In the active phase, when the patient is contagious, the hospital PR programmes are more suitable (5, 27). In post TB sequelae, the majority of rehabilitation programmes were conducted in outpatient settings (7, 23, 29). One pilot study performed in South Africa showed the utility of a 6-week home-based PR programme, in patients with TB (30), while other programme used home-based care programme for multi drug resistant (MDR)-TB patients with TB (32).

Pulmonary rehabilitation in MDR tuberculosis

MDR-TB patients with TB face multiple challenges, related to destructive effects of the disease on lung function, cachexia and functional incapacity, treatment duration and adverse effects. These patients are hospitalized for a long period of time, which predisposes to the muscle deconditioning but also to depression (33), social isolation and impaired QOL. The PR programme in their case should be started as soon as their condition becomes stable and include exercise training (aerobic and endurance), nutrition support and psychological counselling. A very important part is represented by the education that aims to improve the long-term adherence to treatment and the participation in daily life activities and social reintegration. The palliative care should also be included in very severe patients with MDR-TB (32, 34).

An Indian research emphasized the benefits of a home-based care programme for patients with MDR-TB. The study had a control group (50 MDR-TB patients with TB who received standard drug therapy) and a study group (50 MDR-TB patients receiving standard treatment plus home-based care – rehabilitation, nutritional support and counselling). The home care group patients faced less rejection from family members (6 vs. 26%) or community rejection (10 vs. 28%) and a smaller number of them loss their job versus standard care group (5 vs. 13 patients). Regarding the treatment, in the home care group, 40.6% of patients completed the treatment and 12.5% were defaulter versus 23.6% treatment completion and 23.7% defaulter in the control group (35).

Pulmonary rehabilitation in tuberculosis pleural effusion

In the active phase of TB pleurisy, the physiotherapy has the role of fibrosis prevention, but also postural and analgesic. The major position will be in decubitus, but alternating with lateral position and procubitus. The scope is to favour pleural effusion resorption; for the pain massage can be used. In order to mobilize the diaphragm expansion and recovering the lung reserve volumes, abdominal – diaphragmatic breathing, thoracic mobilization against a resistance (manually, with sandbags) can be used. After 1 month, the rib expansion exercise can start asymmetrical suspension with the espalier, swimming (crawl) (36).

Sometimes, there is poor healing with pleural fibrosis and consecutively restrictive syndrome (34). In these cases, the procedures used by physiotherapist used are breathing education, exercise training, muscle tonifying and hydrotherapy (37).

Conclusions

Although TB is one of the oldest known respiratory diseases, there are few studies in scientific literature about the effects of rehabilitation programmes in TB. However, these studies are in favour of using PR in TB patients' therapy, with positive effects on symptoms, exercise tolerance and QOL. The indications can be symptomatic patients with lung destruction, reduced pulmonary function, muscle weakness, decrease exercise tolerance and impaired QOL. Still, further studies with larger number of patients and control groups are needed.

The main role of PR seems to be in management of post TB sequelae, but there is positive feedback about the benefits of using rehabilitation from the active phase of disease. Recovering the physical and functional status of patients with TB, together with psychological support can shorten the convalescent period and help the return to work.

The location and the development of these programmes depends on the health care system possibilities, especially since the high incidence of TB is in countries with low-economic level.

Conflict of interest

The authors have no conflict of interest.

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Review

Physiotherapy in cystic fibrosis
A comprehensive clinical overview

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Key words:
- Physiotherapy
- Cystic Fibrosis
- Airway Clearance
- Chest Physiotherapy
- Exercise

SUMMARY

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

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

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 fol-

TABLE 1. Common airway clearance techniques and methods.

Airway clearance techniques
• Postural drainage
• Manual techniques
• Active circle of breathing techniques (ACBT)
• Autogenous drainage (AD)
• Positive expiratory pressure (PEP) devices (PEP mask, Pari-PEP, etc)
• Positive expiratory pressure (PEP) devices with oscillation (flutter, acapella, cornet, etc.)
• Intermittent Positive Pressure Breathing (IPPB)
• High frequency chest wall oscillation (HFCWO) or vest
• Non-invasive mechanical ventilation (NIV)
• Aerobic exercise

lowing 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 multicentre 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 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 impor-

tant, 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 stage, if they provide comfort to the patient[85].

CONCLUSIONS

CF management is highly demanding, mainly aiming to the reduction and treatment of chest infections, improvement of quality of life and increase of life expectancy. Physiotherapy is an integral part of the patient's daily treatment routine, and additionally to airway clearance other important issues should be addressed. International clinical guidelines suggest access to specialised physiotherapy care both during a clinically stable stage of the disease and during respiratory infections. At the clinically stable stage, patients should be evaluated by physiotherapists every 3-6 months to re-evaluate and optimize their treatment plan. During respiratory infections, physiotherapy interventions are intensified according to the clinical presentation. Although in CF airway clearance is the cornerstone of physiotherapy treatment, physiotherapists work beyond the respiratory system and play an important role in the management of other issues, mainly using individualised exercise programmes. The exercise programmes need to be tailored to patient-related needs and issues, such as pain, diabetes and incontinence. This way, the patient-centred and individualised treatment follows the international standards and clinical guidelines.

CONFLICT OF INTEREST DECLARATION

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ΠΕΡΙΛΗΨΗ

Φυσικοθεραπεία στην κυστική ίνωση: Μια περιεκτική κλινική ανασκόπηση

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Η φυσικοθεραπεία παραμένει μια από τις κύριες μεθόδους διαχείρισης την κυστικής ίνωσης, σε συνδυασμό με την ιατρική θεραπεία. Παραδοσιακά, η φυσικοθεραπεία επικεντρώνονταν στον τραχειοβρογχικό καθαρισμό κατά τη διάρκεια της κλινικά σταθερής φάσης και των αναπνευστικών λοιμώξεων, με τα ερευνητικά δεδομένα να υποστηρίζουν την αποτελεσματικότητά της συγκριτικά με τον βήχα ή τη μη θεραπεία. Διάφορες μέθοδοι και τεχνικές τραχειοβρογχικού καθαρισμού έχουν αναπτυχθεί και διερευνηθεί, και τα δεδομένα προτείνουν ότι οι περισσότερες από αυτές είναι παρόμοιας αποτελεσματικότητας. Επιπλέον, σήμερα, οι έρευνες και η κλινική πρακτική επεκτείνουν τη φυσικοθεραπευτική διαχείριση πέραν του αμιγώς αναπνευστικού συστήματος. Οι φυσικοθεραπευτές σχεδιάζουν, επιβλέπουν και επανελέγχουν τη συστηματική άσκηση ή εξατομικευμένο πρόγραμμα αποκατάστασης, που ομοίως με τον τραχειοβρογχικό καθαρισμό συστήνεται σε όλους τους ασθενείς με κυστική ίνωση. Ακόμα, όταν χρειάζεται και με βάση μια ολοκληρωμένη αξιολόγηση, η φυσικοθεραπεία πραγματεύεται τη διαχείριση συνοδών μυοσκελετικών προβλημάτων όπως οσφυαλγίας, εργονομικών προβλημάτων στάσης και ακράτειας. Σε μια εποχή που στοχεύει στη βελτίωση της ποιότητας ζωής, οι φυσικοθεραπευτές είναι απαραίτητο να γνωρίζουν τις ειδικές περιπτώσεις που επηρεάζουν τη διαχείριση της κυστικής ίνωσης. Ο ρόλος τους είναι να εργάζονται σε συνεργασία με την πολύ-επιστημονική ομάδα για την υποστήριξη των ασθενών και του περιβάλλοντός τους, ιδιαίτερα όταν οι ασθενείς είναι σε αναμονή για μεταμόσχευση ή κατά την παρηγορητική φροντίδα.

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An Evidence-Based Study: Effect of Physiotherapy Treatment on Exercise Capacity in Patients with COPD

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a respiratory disorder, associated with an ongoing limitation of airflow. COPD negatively having effects on patients' functional capacity.
Introduction: COPD having negative effects on patients' physical, occupational, and social functioning due to limited functional capacity and experience of frequent dyspnoea and fatigue during activities. To determine effective physiotherapy treatment on exercise capacity (6-MWT) in patients with COPD.
Design: The articles were searched in Google scholar, PubMed, Elsevier, Cochrane library by using keywords Chronic obstructive pulmonary disease (COPD), 6-Minute Walk Test(6-MWT).Articles which were done during the year 2012 - 2019 were only selected. Articles were selected only if they were Systematic review and meta-analysis, randomized controlled trial(RCT), includes subject with COPD, Exercise capacity (6-Minute Walk Test) were used as one of the outcome measure and physiotherapy intervention was given as a treatment.
Results: 80 to 85 articles were searched from different database out of them 10articles were selected for the study, 5 systematic review and 5 RCTs. Data were extracted by one reviewer that includes the intervention description, inclusion/exclusion criteria, baseline data, values for all outcomes at baseline, post-intervention and follow-up.
Conclusion: Findings indicate that physiotherapy treatment, Inspiratory Muscle Techniques (IMT), Cycle Ergometer Training, Resistance Training, Manual Diaphragmatic Release Technique, Muscle Energy Techniques (MET), Yoga with Breathing Control, Diaphragmatic Breathing Training, Aerobic Exercise, Upper Limb Resistance Exercise and Breathing Exercises are effective to improve exercise capacity (6-MWT). Resistance Training, Muscle Energy Techniques, Aerobic Exercise, Yoga with Breathing Control- these are the techniques which having 1A level of evidence. So, these are highly recommended to improve exercise capacity in patient with COPD.

Keywords- COPD, 6-Minute Walk Test (6- MWT), Physiotherapy treatment, Inspiratory Muscle Training (IMT), Diaphragmatic Breathing Training

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a respiratory disorder, associated with an ongoing limitation of airflow, mainly to the expiratory airflow. [1,2] The cause of COPD is a chronic

inflammation in the lung and airways in response to poisonous particles and gases. During physical activity, COPD-associated limitation in the airflow is exacerbated and so dyspnoea prevents patients from continuing physical activity. [3] COPD having negative effects on patients' physical, occupational, and social functioning due to limited functional capacity and experience dyspnea and fatigue during daily activities. [4,5]

Physiotherapy has been used for reduced exercise capacity. Inspiratory Muscle Training (IMT), Cycle Ergometer Training (CET), pulmonary rehabilitation (PR), resistance training, manual diaphragmatic release technique, muscle energy technique (MET), Yoga, Aerobic Exercise, Diaphragmatic Breathing Technique, upper limb and breathing exercises- All are used for exercise capacity. Treatment Outcome are measured by 6-Minute Walk Test (6-MWT) at baseline and at end of the treatment phase and in some study, it measures at some specific interval.

Evidence based research is needed to determine effective therapeutic techniques to improve exercise capacity (6-MWT).

METHODOLOGY

Search strategy and study selection:

The articles were searched in Google scholar, PubMed, Elsevier, Cochrane library by using keywords Chronic obstructive pulmonary disease (COPD), 6-Minute Walk Test. Articles which were done during the year 2012 - 2019 were only selected.

Inclusion criteria for articles are:

- Systematic review and meta-analysis Or Randomized Control Trials (RCT).
- The articles that includes subjects with COPD.
- Use of physiotherapy intervention for treatment of reduced exercise capacity.
- 6- MWT as one of the outcome measures.

Articles were excluded if they were Cor-relational study or Case study, other than physiotherapy treatment as an intervention and reduced physical exercise due to COPD only.

Study Selection: 80 to 85 articles were searched from different database out of them 10articles were selected for the study.

Quality measurement:

Data were extracted by one reviewer that includes the intervention description, inclusion/exclusion criteria, baseline data, values for all outcomes at baseline, post-intervention and follow-up.

RESULTS

Author	Study Design	No. Of Subjects	Treatment	Intervention	Outcome measures	Results	Level of evidence
Rugbjerg M Et Al., (2015) [6]	A Systematic Review with Meta-Analysis	4 RCTs (489 Participants)	Pulmonary Rehabilitation	Aerobic exercise, Pursed lip breathing, other breathing exercises, cycling, walking session duration=30 to 90 minutes, frequency= twice/ thrice a week for 4 to 6 months.	Outcomes are Health-Related Quality of Life (HRQOL), maximal exercise capacity **(6-MWT)**, muscle strength,	Significant improvement in 6-MWT but *clinically nonsignificant* improvement in **6-MWT,**	1A
Ning LiEt Al., (2019) [7]	A Systematic Review	11 RCTs (405 Participants)	Resistance Training	Leg press, knee extension, knee flexion, chest press, seated row, and shoulder press, hip abduction in standing, seated row, lunges etc. with different-different duration, repetition and frequency	Outcome measures are **6MWT**, CWRET (constant work rate endurance test), 6PBRT(6-min pegboard and ring test) UULEX (unsupported upper limb exercise test), and CPET (cardiopulmonary exercise test)	Resistance training significantly improved 6-min walking distance **6-MWT**	1A
Paneroni M Et Al., (2017) [8]	A Systematic Review and Meta-Analysis	10 RCT (n=458)	Aerobic Exercise Training	Aerobic Exercise Training (Leg exercises, cycling, free walking, treadmill walking included) duration from 4 to 52 weeks with 1 to 5 sessions per week lasting 15 to 40 minutes each.	Outcome measures are 6-minute walking test**(6-MWT)** and/or health-related quality of life assessed by the St. George's Respiratory Questionnaire (SGRQ).	Statistically significant improvement in **6-MWT**	1A
Baxter Da Et Al., (2019)[9]	A Systematic Review	3 RCTs (90 Participants)	Muscle Energy Technique (MET)	1st RCT subjects receive MET + CPT (conventional chest physiotherapy) 2nd RCT subjects receive MET 3nd RCT subjects receive MET + exercise	Outcomes are Inspiratory Capacity, Forced Expiratory Volume in One Second (FEV1), And Forced Vital Capacity (FVC). Exercise Capacity Measured by Six-Minute Walk Test **(6MWT)**, Quality of Life or Health Status.	2 studies assessed exercise capacity using the **6MWT** individual study results showed that MET+CPT was superior to CPT alone. in the other study, MET + exercise therapy improved walking distance compared to sham-MET + exercise therapy	1A
Holger Cramer Et Al., (2019) [10]	A Systematic Review and Meta-Analysis	11 RCTs (586 Participants)	Yoga	Hatha yoga, Pranayama, laughter yoga, Kripalu yoga, Iyengar yoga etc. with conventional drug or physiotherapy as co-intervention Duration= 2 weeks to 9 months, Frequency= once/ twice daily or twice weekly, Session duration= 10-90 Minute	quality of life, dyspnea, exercise capacity**(6-MWT)**, and pulmonary function (FEV1),	Effects of yoga **with breathing** on exercise capacity **(6-MWT),** but yoga posture was not significantly affecting the 6-MWT	1A
Wellington P. Yamaguti et al., (2012) [11]	RCT	Total = 30 Treatment group= (n=15) Control group= (n=15)	Diaphragmatic breathing training program	Training group completed a 4-week supervised DBTP (3 individualized weekly sessions), while control group (CG) received their usual care.	Outcome assessed by amplitude of the rib cage to abdominal motion ratio (RC/ABD ratio) and diaphragmatic mobility, 6-minute walk test **(6-MWT)**and health related quality of life	6-MWT distance improved in treatment group.	1B
Rocha T Et Al., (2015)	RCT	Total= 20	Manual Diaphragmatic	The experimental group received six treatments with the manual diaphragm	Outcome are diaphragmatic mobility, the 6-minute walk test**(6-**	Manual Diaphragmatic Release Technique significantly improved the 6-minute walk	1B

[12]		Treatment Group (n=11) Control Group (n=9)	Release Technique	release technique on non-consecutive days within a 2-week period. The control group received sham treatments following the same regimen.	**MWT)**,maximal respiratory pressures; and abdominal and chest wall kinematics. Outcomes were measured before and after the first and sixth treatments.	**(6-MWT)** distance over the treatment course	
Wang Ket al, (2017) [13]	RCT	Total=81 CET+IMT Group (n=28) CET Group (n=27) Free Walking (n=26) Control Group	Cycle Ergometer training (CET) and Inspiratory Muscle Training (IMT)	Combined training group received 30-minute CET and 14-minute IMT three times per week for 8 weeks,IMT was given with a threshold-loaded IMT device CET group received 30-minute CET three times per week for 8 weeks, CET was performed on an electromechanically braked cycle	Respiratory muscle strength, exercise capacity**(6MWT)**, pulmonary function, dyspnea, quality of life, emotional status, nutritional status, and body mass index, airflow obstruction, and exercise capacity index were measured before and after the pulmonary rehabilitation program.	Exercise capacity **(6-MWT)** was significantly improved in group CET+IMT and CET group	1B
Yekefallah L Et Al., (2019) [14]	RCT	Total= 75 Group 1 (n= 25) Group 2 (n= 25) Group 3 (n= 25)	Upper Limb Exercise (Strengthening Exercises) And Breathing Exercises (Pursed-Lip and Diaphragmatic Breathing).	First group were performing upper limb exercises thrice weekly for one month,second group were doing pursed-lip and diaphragmatic breathing exercises four times daily for one month at their homes. however, the patients in the control group received no exercise intervention.	Six-minute walk test**(6-MWT)** was performed by each participant	Walking distance in the control group didn't change significantly, while it remarkably increased in both the upper limb exercise and the breathing exercise groups. Walking distance in the upper limb exercise group was significantly greater than the breathing exercise group and the control group however, the difference between the breathing exercise and the control groups was not statistically significant	1B
Bavarsad Mb Et Al., (2015) [15]	RCT (Single-Blind)	Total=40 Treatment Group (n=20) Control Group (n=20)	Inspiratory Muscle Training (IMT)	Treatment group received IMT with flow volumetric respiratory exerciser named (respivol), for 8 weeks (15 min/day for 6 days/week)	Each patient was assessed before and after 8 weeks of training for exercise capacity by 6-min walking test (**6MWT**)	Statistically significant increase in 6-MWT	1B

CONCLUSION

According to these articles Inspiratory Muscle Techniques (IMT), Cycle Ergometer Training, Resistance Training, Manual Diaphragmatic Release Technique, Muscle Energy Techniques, Yoga with Breathing Control, Diaphragmatic Breathing Training, Aerobic Exercise, Upper Limb Resistance Exercise and Breathing Exercise – These physiotherapy treatments are effective to improve exercise capacity. (6-MWT)

Resistance Training, Muscle Energy Techniques, Aerobic Exercise, Yoga with Breathing Control- these are the techniques which having 1A level of evidence. So, highly recommended to improve exercise capacity in patient with COPD.

Pulmonary rehabilitation (Aerobic exercise, Pursed lip breathing, other breathing exercises, cycling, walking) clinically not shows any significant difference and only Yoga posture was not improving 6-MWT.

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