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STUDY ON BENEFICIAL EFFECTS OF PROTOCOL BASED REHABILITATION OF PULMONARY FUNCTION FOR OPD PATIENTS WITH EARLY ANKYLOSING SPONDYLITIS

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ABSTRACT

Introduction: Rehabilitation management of Ankylosing Spondylitis (AS) focused mostly on the musculoskeletal system in majority of the centers though good numbers of sufferers have respiratory disability.

Aims & Objectives: Measurement of pulmonary functional disability in Ankylosing Spondylitis patients with pulmonary rehabilitation its role in improvement of quality of life (QoL).

Materials & Methods: More than 28% of Ankylosing Spondylitis were identified under Modified New York Criteria and selected for the prospective study and were managed by pharmacological and non pharmacological approaches considering inclusion of focused pulmonary rehabilitation protocol including home exercise schedule and the outcome were assessed by pulmonary function data (e.g.VC, TLC, FEV1, FEV1/FVC Ratio) and data of aerobic capacity (e.g. MET Score & 6-Minutes Walk Distance), disease activity (by BASDAI) and functional index (by BASFI) for Ankylosing Spondylitis, then they were evaluated FOUR TIMES like before starting treatment and at 3-months, 6-months & 9-months after.

Results: Statistically Significant improvement ($p<0.0001$) of pulmonary functional parameters & aerobic capacity had been observed in all patients. BASFI and BASDI were used to measure the improvement of functional activity and disease activity respectively and both found statistically significant ($p<0.0001$ and $p<0.001$ respectively).

Conclusions: AS specific pulmonary rehabilitation programme can improve cardio respiratory functions if added with musculo-skeletal rehabilitation protocol in AS and can improve disease activity and overall functional ability.

KEYWORDS : Ankylosing Spondylitis, Pulmonary Rehabilitation, Pulmonary Function, Quality of Life

INTRODUCTION

Ankylosing Spondylitis patients suffers from disabilities both at home and in the work place causing social and occupational handicap mostly due to limitations in physical functions from musculoskeletal and cardio respiratory systems morbidity. Newer pharmacologic agents like biologics unable to resolve these from the disability point of view and thereby non pharmacological approach like therapeutic exercises has pivotal role in disability limitation. Unfortunately in most centers rehabilitation protocols targeting the musculoskeletal system with its primary focus to preserve the spinal flexibility, to prevent postural deformity, to improve the strength and stamina and to reduce the pain, though considerable morbidity with Ankylosing Spondylitis is pulmonary complications with diminished respiratory compliance from reduced chest wall movement and diminished endurance. In AS patient's chest wall expansion was measured by the difference of chest wall circumferences in full inspiration and complete expiration in males at the level of 4th intercostals space & just below the breast at xiphisternum level in females. This parameter shows gradual reduction due to restriction of pulmonary function in AS. Therefore rehabilitation strategies for Ankylosing Spondylitis need attention on functional improvement of respiratory and cardiovascular system. Due to lack of adequate study and publications over this issue this study therefore planned and conducted with the attempt to explore such an under focused area of AS Rehabilitation, to find out the effect of pulmonary rehabilitation strategies on functional limitations due to the restrictive pulmonary disease pattern associated with Ankylosing Spondylitis.

MATERIALS & METHODS

This prospective study was conducted in the department of Physical Medicine & Rehabilitation at Two Hospitals (Sambhu Nath Pandit Hospital, India and Malda Medical College and Hospital, India) during the study period from August 2013 to September 2014. It is an OPD based day care study. After receiving the statutory approval from the institutional Ethical Committee informed consent were taken from all sixty patients in both the hospitals together (Forty-four males and sixteen females) for this study where only AS patients were considered to be included for the study in their early stages of disease with mild pulmonary functional abnormality. Those patients were presented in the Physical Medicine and Rehabilitation OPD with progression of disease into late stages or with permanent chest deformity or having history of smoking or co-morbidity like cardiac ailments for which unable to tolerate rehabilitation protocol were excluded for the study. Patients receiving medications like methotrexate and steroid also kept outside the study. For safety reason those patients who has any contraindications to therapeutic exercise were also excluded.

Patients were primarily assessed on joint flexibility as well as strength of muscles of pulmonary function and pulmonary function as a whole, subsequently pulmonary rehabilitation programme were advised as per prescribed protocol to all of them. Prescribed protocol mainly based on aerobic exercises for upper & lower limbs along with strengthening exercises of trunk muscles associated with spinal exercises & mobility programme like cervical mobility training and thoracolumbar mobility training, breathing exercises. Chest expansion training, and training of Respiratory Muscle strengthening exercises with improvement of pulmonary endurance by ventilatory muscle training are also advised and they are part of the protocol. Breathing re-education in the form of diaphragmatic breathing and purse lip breathing were trained to all of them.

All patients advised to continue the programme at home as a Home Based Exercise Programme (HBEP) Protocol with the instruction to report OPD for protocol based assessment with an exercise log to record the heart rate, respiratory rate, exercise parameters, problems encountered during exercises, if any. At the end of the study total Fifty - Five patients able to finish the study observing all guideline under the

protocol. Along with these entire endeavors an educational training for self assessment, self management and energy saving techniques also been shared and trained to all of them.

Various tools like pulmonary function parameter (e.g.VC, TLC, FEV_1, FEV_1/FVC Ratio) and aerobic capacity (e.g. MET Score & 6-Minutes Walk Distance) were used for outcome assessment for the rehabilitation both before and after the rehabilitation treatment on Day 0 then at 3-months, 6-months & 9-months after commencement of protocol for pulmonary rehabilitation .

AS Assessment tools like Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and Bath Ankylosing Spondylitis Functional Index (BASFI) also used in the same schedule of assessment of result of rehabilitation i.e. on Day-0 and at 3-months, 6-months & 9-months after commencement of rehabilitation protocol.

Results were statistically analysed using Stat Soft, Inc. (2001), STATISTICA (data analysis software system), version 6. www.statsoft.com. San Francisco, California: Graph Pad Software Inc. (2005) Graph Pad Prism version 4.

RESULTS

Parameters directly measuring the lung functions like Vital Capacity (VC) and Total Lung Capacity (TLC) showed statistically significant improvement (P <0.0001) at 3-months, 6-months & 9-months as compared to initial assessment (Day 0); at 6 & 9 months as compared to 3 & 6 months;. The improvement in chest expansion was also statistically significant (P <0.001) over a minimum period of 9 months (at 6 and 9 months as compared to Day 0; at 6 months as compared to 3 months). The observation that improvement over shorter intervals was not found to be significant is expected from clinical view point and shows the importance of long term rehabilitation.

Table-1 Vital Capacity (VC)

Tukey's Multiple Comparison Test*	Mean Diff.	q	P value	95% CI of diff
VC-Day-0 vs VC -3-Months	-1.4444	1.1054	*P* < 0.0001	-6.3072 to 3.4183
VC -Day-0 vs VC -6-Months	-5.5926	0.19841	*P* < 0.0001	-4.6035 to 5.1220
VC -Day-0 vs VC -9-Months	-6.2593	4.7902	*P*< 0.0001	-5.122 to -1.3965
VC -3-Months vs VC -6-Months	-4.7037	1.3038	*P*< 0.0001	-3.1590 to 6.5664
VC -3-Months vs VC -9-Months	-4.8148	3.6847	*P*< 0.0001	-9.6775 to 0.047899
VC -6-Months vs VC -9-Months	-5.5185	4.9886	*P*< 0.0001	-11.381 to -1.6558

P <0.0001, Number of Groups =3, F = 128.18

VC (% of Predicted) data shows statistically significant improvement over time

Table 2 Total Lung Capacity (TLC)

Tukey's Multiple Comparison Test*	Mean Diff.	q	P value	95% CI of diff
TLC-Day-0 vs TLC -3-Months	-1.8148	9.0226	*P* < 0.001	-2.5633 to -1.0663
TLC -Day-0 vs TLC -6-Months	-3.6296	18.045	*P* < 0.001	-4.3782 to -2.8811
TLC -Day-0 vs TLC -9-Months	-5.6296	27.989	*P*< 0.001	-6.3782 to -4.8811
TLC -3-Months vs TLC -6-Months	-1.8148	9.0226	*P*< 0.001	-2.5633 to -1.0663
TLC -3-Months vs TLC -9-Months	-3.8148	18.966	*P*< 0.001	-4.5633 to -3.0663
TLC -6-Months vs TLC -9-Months	-2.0000	9.9433	*P*< 0.001	-2.7485 to -1.2515

P <0.0001, Number of Groups =3, F = 144.20

TLC (% of Predicted) data shows statistically significant improvement over time

Table 3 Chest Expansion (CE)

Tukey's Multiple Comparison Test*	Mean Diff.	q	P value	95% CI of diff
CE-Day-0 vs CE -3-Months	-0.053704	1.8501	*P*> 0.05	-0.16173 to 0.054319
CE -Day-0 vs CE -6-Months	-0.17593	6.0607	*P*< 0.001	-0.28395 to -0.067904
CE -Day-0 vs CE -9-Months	-0.28333	9.7609	*P*< 0.001	-0.39136 to -0.17531
CE -3-Months vs CE -6-Months	-0.12222	4.2106	*P*< 0.05	-0.23024 to -0.014200
CE -3-Months vs CE -9-Months	-0.22963	7.9108	*P*< 0.001	-0.33765 to -0.12161
CE -6-Months vs CE -9-Months	-0.10741	3.7002	*P*> 0.05	-0.21543 to 0.00061514

P <0.0001, Number of Groups =3, F = 19.119

CHEST EXPANSION (in Centimeter) data also proven to be statistically significant in terms of improvement over time (at least 9 months)

Metabolic Equivalence (MET) Score data also showed statistically significant improvement over time (p-value < 0.001) in all comparisons (Number of Groups =4, F = 332.96). Six Minute Walking Distance (6MWD) data showed results (P <0.001, Number of Groups =4, F = 253.23) similar to MET score, another aerobic capacity parameter. Pearson's correlation coefficient (r-value) shows good correlation between VC with MET achieved and VC with 6-Minutes Walking Distance (6-MWD) at the Baseline and also in all follow-up periods i.e. in 3, 6 & 9 -months as well. BASDAI and BASFI scores also showed statistically significant improvement (P <0.001) in all observations which may be correlated with the comprehensive management instituted in the study.

DISCUSSION

It has been found in Kelly's Text Book of Rheumatology[1] that lung involvement is a rare and late manifestation of Ankylosing spondylitis and the same is characterized by slowly progressive fibrosis of the upper lobes of the lungs, appearing, on average, two decades after the onset of AS. Other evidence also found that restrictive lung disease (RLD) occurs in patients with late-stage Ankylosing spondylitis, with costovertebral and costosternal involvement that may results in to a clinical condition with limited chest expansion. There is clinical presentation of bilateral apical pulmonary fibrosis, though rarely occurs, but may be found only in the setting of severe disease[2]. But study of Sevin Baser et al[3] shows that pulmonary involvement starts in early stage of AS. Moreover study of Nils Feltelius et al[4] has shown that randomly selected patients with AS without symptoms of lung disease suffer from reduced lung volumes as defined by reduced vital capacity (VC) and reduced total lung capacity (TLC), with reduced VC, reduced TLC and normal FEV1/ FVC ratio. Thereby all these pulmonary findings are relevant and all corroborate well with restrictive type of lung problems in AS. Interestingly all these findings were well documented by I. Romagnoliet al[5] in a study on Chest wall kinematics and respiratory muscle action in Ankylosing spondylitis patients with a conclusion of diaphragm/abdomen compartment plays a prominent role in the production of chest wall tidal volume, regardless of disease severity. Therefore with all these relevant information it can be said that protocol based pulmonary rehabilitation can improve the problem with incorporation of special breathing technique in OPD care settings.

One study shows improvement of VC at the end of the protocol based pulmonary rehabilitation with various exercise programmes more particularly multimodal exercises enhance the quality of life of patients [6]. There is significant improvement of vital capacity and TLC in all follow ups in our study with corroborated improvement of QoL on multimodal exercises under the protocol.

Exercising ability and aerobic capacity can be assessed by MET Score. Protocol based pulmonary rehabilitation found to be effective in exercise endurance improvement along with quality of life on AS patients with significant restrictive lung disease[7]. RLD respond responds better after 12 weeks of regular pulmonary rehabilitation but after 24 weeks[8] the result is even better. In this study also significant improvement of exercise endurance noted as evidenced by consistent and statistically significant improvement of achieved MET score.

A short 6-minute walk distance (6MWD) can predicts morbidity and mortality from heart or Lung disease[9] Ortancil et al[10] tried to determine the effects of a 6-week home-based exercise programme on the respiratory muscle and energy cost in AS. Chest expansion, maximal inspiratory pressure, and maximal expiratory pressure values and Bath Ankylosing Spondylitis Functional Index (BASFI) scores of patients significantly increased after 6 weeks ($P < 0.001$). 6-minute walking and physiologic cost index values did not change at the end of the 6 weeks ($P > 0.05$)[11]. But our study showed statistically significant improvement ($P < 0.0001$) of distance covered in 6 minutes time along with improvement in other parameters.

BATH index like BASDI, BASFI, BAS-G etc considered to be reliable tool in Ankylosing Spondylitis patients assessment as per studies done by J. R. Gu et al[11], Jean-Marie Berthelot et al[12], A. Waldner et al[13]. E-medicine described the role of sulfasalazine in Ankylosing Spondylitis in reducing spinal stiffness and the ESR, but no evidence shows that spinal mobility or physical function is benefited. In this study there was reduced disease activity possibly due to disease modifying agents (sulfasalazine) and spontaneous course of disease. Functional status is supposed to be reduced over a time period. In our study probably due to rehabilitation protocol, there is not only statistically significant improvement of functional index (BASFI) but disease activity (BASDAI) is also significantly improved. In the study "A new approach to define disease status in Ankylosing Spondylitis: the Bath Ankylosing Spondylitis Disease Activity Index", conducted by Garrett S et al[14], p value <0.0001 of BASDAI score was found after intensive in-patient physiotherapy for the treatment of Ankylosing Spondylitis. Another study on" BASDAI-Bath Ankylosing Spondylitis Disease Activity Index" stated that, improvement of BASDAI score is statistically significant (16.4% with p value< 0.009) after 3 weeks of physiotherapy course. Present study also shows that Nonpharmacologic measures in the form of therapeutic exercise can result into improvement in disease activity as well as functional status in AS.

Therefore it can be said that our study has contributed to the increasing pool of evidences supporting the fact that pulmonary rehabilitation is efficacious not only in improving the respiratory function and aerobic capacity but can also modify the disease activity and overall functional status.

CONCLUSION

Pulmonary rehabilitation measures are beneficial not only in terms of improvement in lung function parameters and aerobic capacity & endurance, but also in terms of modification of disease activity and functional index in AS patients. The comprehensive rehabilitation with pharmacological and non pharmacological agents for AS should include specific pulmonary rehabilitation programme and it should be instituted early in all patients diagnosed with AS to optimise the potential benefit.

REFERENCES

1) Kelly's Text Book of Rheumatology, 11th edition.
2) Ankylosing Spondylitis & Undifferentiated Spondyloarthropathy-E Medicine Rheumatology
3) PULMONARY INVOLVEMENT STARTS IN EARLY STAGE OF ANKYLOSING SPONDYLITIS…(1A) : Sevin Baser MD* Sibel Cubukcu MD Sibel Ozkurt MD Nuran Sabir MD Beyza Akdag MD Erdal Diri MD Pamukkale University Medical School, Denizli, Turkey.
4) Annals of the Rheumatic Diseases 1986, 45, 736-740-Pulmonary involvement in Ankylosing spondylitis; NILS FELTELIUS, 1 HANS HEDENSTRÖM, 2 GUNNAR HILLERDAL, 3 AND ROGER HALLGREN', From the Departments of 'Internal Medicine, 2Clinical Physiology, and 3Lung Medicine, University Hospital, Uppsala, Sweden.
5) Eur Respir J 2004; 24:453-460, Copyright © ERS Journals Ltd 2004 - Chest wall kinematics and respiratory muscle action in ankylosing spondylitis patients;I. Romagnoli[1], F. Gigliotti[1], A. Galarducci[1,2], B. Lanini[1], R. Bianchi[1], D. Cammelli[2] and G. Scano, Don C. Gnocchi Foundation, Section of Respiratory Rehabilitation, Pozzolatico, and Dept of Internal Medicine,
6) Gonca Ince, Tunay Sarpel, Behice Durgun and Seref Erdogan: Research Reports: Effects of a Multimodal Exercise Program for People with Ankylosing Spondylitis; PHYS THER: Vol. 86, No. 7, July 2006, pp. 924-935.
7) J. Braun, T. Pincus: Mortality, Course of disease and prognosis of patients with Ankylosing Spondylitis:Clin Exp Rheumatol 2002; 20 (Suppl. 28):S16-S22.
8) Pulmonary Rehabilitation: eMedicine; Physical Medicine & Rehabilitation.
9) Paul L Enright MD , Dr Enright, Paul L Enright MD, : The Six-Minute Walk Test; RESPIRATORY CARE, AUGUST 2003 VOL 48 NO 8 783
10) Ortancil, Ozgur MD; Sarikaya, Selda MD; Sapmaz, Perihan MD; Basaran, Aynur MD; Ozdolap, Senay MD: The Effect(s) of a Six-Week Home-Based Exercise Program on the Respiratory Muscle and Functional Status in Ankylosing Spondylitis; JCR: Journal of Clinical Rheumatology: March 2009 - Volume 15 - Issue 2 - pp 68-70;
11) J. R. Gu, Z. T. Liao, Z. M. Lin and R. Srirajaskanthan: Quality of Life in Ankylosing Spondylitis and Undifferentiated Spondyloarthropathy: Chinese Perspectives: Hand Book of Disease Burden and Quality of Life Measure: 10.1007/978-0-387-78665-0_230:pages3955-3964.
12) Jean-Marie Berthelot, Lætitia Tortellier, Delphine Lavy-Bregeon, Benoît Le Goff and Yves Maugars: High intraindividual week-to-week variability in BASDAI and BASFI values: Are several evaluations needed before starting or stopping TNFα antagonist therapy for spondyloarthropathies? Joint Bone Spine: Volume 75, Issue 2, March 2008, Pages 167-171.
13) A. Waldner; H. Cronstedt; C. H. Stenstro Om: The Swedish version of the Bath Ankylosing Spondylitis disease activity index. Reliability and validity: Scand J Rheumatol Suppl. 1999; 111:10-6.
14) GARRETT S, JENKINSON TR, KENNEDY LG, WHITELOCK HC, GAISFORD P, CALIN A: A new approach to defining disease status in Ankylosing Spondylitis. The Bath AS disease activity index. J Rheumatol 1994; 21: 2286-91.