International Journal Of

Recent Scientific Research

ISSN: 0976-3031

Volume: 7(6) June -2016

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THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 6, pp. 12195-12200, June, 2016

International Journal of Recent Scientific Research

Research Article

EVALUATING EXERCISE TOLERANCE IN CHRONIC BRONCHITIS AND ASTHMTIC PATIENTS USING INCREMENTAL SHUTTLE WALK TEST-A COMPARITIVE STUDY

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ARTICLE INFO

Article History:

Received 05th March, 2016
Received in revised form 21st April, 2016
Accepted 06th May, 2016
Published online 28th June, 2016

Key Words:

Heart rate, Rate of perceived exertion, VO_2 max and Rate pressure product.

ABSTRACT

Background: Chronic bronchitis and asthma both are the condition with obstructive airflow limitation. The exercise tolerance in both the condition is markedly reduced. This study was conducted to compare in which of the above condition the exercise colerance is more reduced using incremental shuttle walk test.

Method: 30 patients were taken and were divided in 2 groups with 15 patients in each group. Group A consisted patients with chronic bronchitis and Group B consisted of asthmatic patients. Both the groups underwent the same test i.e. incremental shuttle walk test. Data were analyzed on the bases of HR, RPE, VO_2 max and RPP.

Outcome Measure and Its Measurement

The following outcome measures were measured before and after the test.

1. Heart rate.
2. Rate of perceived exertion
3. VO_2 max
4. Rate pressure product.

Before the test measurements were compared to after the test measurements.

Statistical Analysis

- Pre post comparison of scale is done by paired t-test
- Between group comparison are done by unpaired t-test
- P valve <0.05 is taken up for statistical significance

Results: The HR, RPE, VO_2 max and RPP values were taken in both Group A and Group B and there was no significant difference found between Group A and Group B. ($p>0.05$)
Conclusion: The results indicate that there is no significant difference in the exercise tolerance in patients with chronic bronchitis and asthma using incremental shuttle walk test.

INTRODUCTION

The most common problem encountered in cardiac and pulmonary patients, as well as patients with chronic disease is progressively reduced activity/exercise tolerance or endurance. A viscous cycle develops of inactivity reduced muscular inefficiency (i.e. deconditioning) causing increasing symptomatology and further abatement of activity in order to avoid discomfort. The ultimate result is complete disability with inability to comfortably perform even the most basic activities of daily living; fortunately most patients do not deteriorate fully to this level before death.[1]

In patients with COPD tolerance to exercise is decreased. The most important factors thought to contribute to this limitation of exercise in patients with COPD are alteration in pulmonary mechanics, abnormal gas exchange, dysfunction of respiratory muscles, and alteration in cardiac performance, malnutrition and development of dyspnea. The most severely affected patients cannot exercise to the levels at which training effect is thought to occur. Fortunately a large body of evidence support exercise training as a beneficial therapeutic tool that is useful in helping this patient achieves their full potential.[2]

It has been shown repeatedly that exercise programs, although not accompanied by measurable improvement in lung function result in increased exercise tolerance and an improved sense of well being.[4]

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Physical activity is defined as any form of muscular activity. Therefore physical activity results in the expenditure of energy proportional to muscular work and is related to physical fitness. Exercise represents a subset of physical activity that is planned with a goal of improving or maintaining fitness.[5]

Perhaps more important than the abnormalities in large airways are the change often found in small non- cartilaginous airway. However in lungs from patients with chronic obstructive lung disease which have been studied at postmortem, the major site of airflow obstruction has been shown to be in small airways.[7] From large group of patients with simple bronchitis, a smaller number develop intermittent or progressive narrowing of airways. This in turn leads to abnormalities of gas exchange and their sequel. These individuals experience intermittent appearing or progressive dyspnea and decreasing exercise tolerance.[8]

The symptoms of asthma consist of a triad of dyspnea, cough and wheezing, the last often being regarded as sine quo non. In its most typical form all three symptoms co-exist. At the onset of an attack, patients experience a sense of constriction in the chest, often with non-productive cough. Respiration becomes audibly harsh; wheezing in both phases of respiration becomes prolonged and patients frequently have tachypnea, tachycardia and mild systolic hypertension. If the attack is severe and prolonged, there may be loss of adventitial breath sounds and wheezing becomes very high pitched. [12]

The maximum VO_2 (VO_2 max) reflects the attainment of a limitation at some point(s) in the oxygen conductance pathway from lungs to the site of mitochondrial oxygen consumption at cytochrome-oxidase terminus of the electron transport chain. This, dysfunction in the responses of the convective oxygen flows into the lungs and through the vasculature and the diffusive oxygen flows across pulmonary and muscle capillary beds will be reflected in abnormally low values of VO_2 max.[14]

Maximal heart rate varies greatly among individuals during exercise testing. Therefore, it is helpful to be able to evaluate rates of perceived exertion to assess whether or not a test is truly maximal and to assess when maximum exercise is being approached. Numerous clinical studies have demonstrated that the category RPE scale is reproducible measure of exertion within a wide variety of individuals regardless of age, gender and culture. During most exercise testing, the category RPE scale is an accurate gauge of impending fatigue.[16]

This index of relative cardiac work, termed the double product or rate pressure product (RPP), relates closely to directly measure myocardial oxygen consumption and coronary blood flow in healthy subjects over a wide range of exercise intensities.

The ISWT shows a strong correlation with VO_2 max, enabling health care professionals to prescribe a level of exercise intensity appropriate to each patient.[19]

Studies are there to prove incremental shuttle walk test as the assessment tool in patients with obstructive airflow disease. The exercises prescribed for all patients with obstructive disease is the same and a common protocol is generally followed. This study will help us to evaluate both the conditions in a better way which will lead to a better understanding of the difference in the conditions and this study will help us to plan a specific exercise protocol for different kind of obstructive disease.

METHODOLOGY

Study design: A Comparative study.

Sources of data: A total of 30 patients of both the sexes fulfilling inclusion criteria were taken from Parul Sevashram Hospital. All subjects were diagnosed and referred by the physician as chronic Bronchitis and asthma. The purpose of the study was explained to all the subjects and informed consent was taken from each subject. All the subjects were assessed using a specific Performa. Two groups were taken with Group A consisting of 15 patients of chronic bronchitis and Group B consisting 15 patients of Asthma.

Inclusion Criteria

The subjects were taken if they met the following criteria.

1) Patients in age group of 30-50.
2) Both males and females.
3) Patients clinically diagnosed with chronic bronchitis and asthma.
4) Non smokers.

Exclusion Criteria

The subjects were excluded from the study if they had the following conditions.

1) Recent exacerbation.
2) Unstable angina.
3) Significant co morbidities such as stroke or carcinoma.
4) Psychiatric disorders.
5) Intermittent claudication or other mobility limiting conditions.
6) Any musculoskeletal disorders, neurologic disorders and patients having any cardiac conditions.
7) Patients who are indulge in any kind of exercise or fitness program.

Technique of Application

All provided written informed consent. Exclusion criteria were well assessed and then patients were included. An incremental, externally paced exercise capacity test was conducted according to standardized procedure. Patients were asked to walk around two cones paced at either end at 9 meter course. An audio cassette was played which has the pre recorded sounds. The walking speed was indicated by signals played from the cassette and increased every minute. The test was terminated when the patient were either too breathless to continue or could no longer keep up with the required speed. The standardized tape instrument was played to the patient prior to the test. Patients performed 2 ISWTs with a break of 30 minute between them. The results of the best were recorded as actual values.

Statistical Analysis

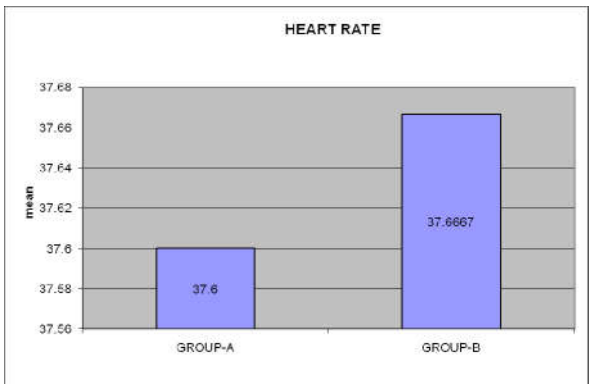
- Between group comparison were done by unpaired t-test

- Using average we can say which group shows better change if p-value is >0.05 ,we conclude it is not significant

RESULTS

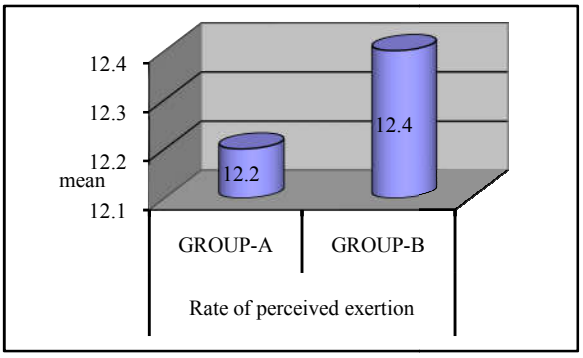
Comparison of HEART RATE between Group A and Group B

The average change in the HEART RATE of Group A was 37.60 and Group B was 37.66. The p value was 0.97 which shows p>0.05, so there is no significant difference between Group A and Group B even though there is difference in average between groups that difference is not significant.



Comparison of Rate of Perceived Exertion between Group A and Group B

The average change in RATE OF PERCEIVED EXERTION of Group A was 12.20 and that of Group B was 12.40. The p value was 0.61 which is much higher than p<0.05, so there is no significant difference between both the groups even though there is difference within the groups.

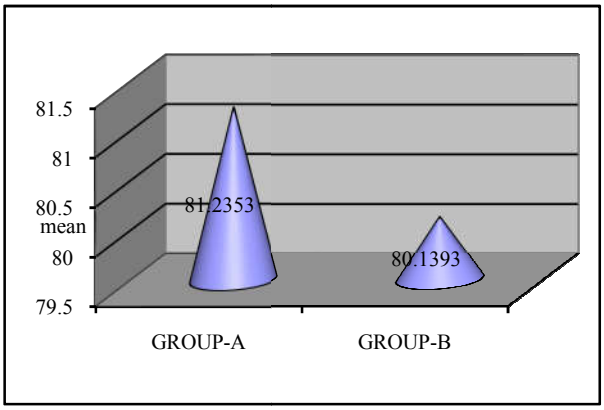


Comparison of VO_2 MAX between Group A and Group B

The VO_2 MAX of Group A was 81.23 and that of Group B was 80.13 so the p value was 0.35 which shows p>0.05 means there is no significant difference between Group A and Group B.

Comparison of Rate Pressure Product between Group A and Group B

The average improvement in RATE PRESSURE PRODUCT of Group A was 5644.86 and that of Group B was 5742.00 and the p value was 0.38 which shows that p>0.05 means there is no significant difference between Group a and Group B even though within the groups shows improvement



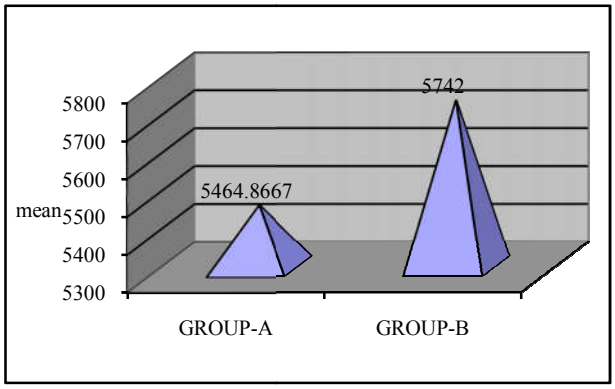


Table: Comparison of HR, RPE, VO_2 MAX, and RPP in Group A and Group B

	GROUP	Average Change	T-VALUE	P-VALUE	Result
Heart Rate	GROUP A	37.6	-0.03051	0.97588	P>.05notg
	GROUP B	37.6667			
Rate of Perceived Exertion	GROUP A	12.2	-0.51235	0.612426	P>.05notg
	GROUP B	12.4			
VO_2 MAX IN ML/KG/MIN	GROUP A	81.2353	0.944203	0.35314	P>.05notg
	GROUP B	80.1393			
Rate Pressure Product	GROUP A	5464.867	-0.87918	0.38679	P>.05notg
	GROUP B	5742			

DISCUSSION

In this study it was found that in both the groups the heart rate increases after the test but when compared between chronic bronchitis and asthma there is no significant difference between both the groups. The heart rate increases in both the groups because there is fall in vagal tone also there is rise in sympathetic activity plus adrenalin secretion in early phase of the exercise. As the exercise progresses the body temperature raises causing tachycardia.[56]

Also in this study the RPE score taken after the test using Borg's scale showed very high scores both in chronic bronchitis and asthmatic patients. But this also when compared between the groups showed no significant difference. Breathlessness was found to be that major cause of terminating ISWT. In chronic bronchitis the fundamental cause of reduced ventilator capacity and breathlessness is the limitation to expiratory airflow. Secondary to expiratory limitation, residual volume is increased, the thorax is hyper inflated and inspiratory capacity is markedly impaired in part because of compromised function of inspiratory muscle.[57] In asthma because the airways are prone to narrowing, the passage of air into the lungs is

restricted which is referred to as airway obstruction, this narrowing of airways or airflow obstruction, limits the flow of air in and out of the lungs. This in turn gives rise to symptoms such as breathlessness.[58]

The VO_2 max when compared in chronic bronchitis and asthmatic patients shows no significant difference using ISWT. This is because both the groups of patients suffer from breathlessness which in turn increases the work of breathing which increases the maximal oxygen uptake. This is because in few patients with chronic bronchitis in whom symptom airflow obstruction develops, the combination of excessive intra luminal secretions, bronchospasm and small airway leads to wide spread mismatching of ventilation to perfusion at the regional level. This in turn leads to disturbance in gas exchange with their attendant effects on the pulmonary vasculature.[59]

Airflow obstruction is the basic disruption of physiology found in the patient with asthma. It is less on inspiration then on expiration because airway caliber increases during inspiration due to radial traction and volume increases, whereas airway caliber decreases during expiration due to volume decreases and pleural pressure increases. Airway diameter is further decreased by mucosal swelling, bronco constriction and mucus plugging. The hypoxia of asthma is the result of mismatch of ventilation and perfusion in the lungs.[59]

The RPP is also increased in chronic bronchitis and asthma after this test but when compared between both the groups there is no significant difference. There is change in the RPP because as known RPP is product of HR and SBP. The HR increases after the test and also the SBP an increase which is because SBP depends more on the cardiac output and as CO rises the SBP also rises.[56]

As there is no significant change in HR, RPE, VO_2 MAX and RPP between chronic bronchitis and asthmatic patients its shows that there is no difference in the exercise tolerance of both the groups. Literature also says that in asthma there may be physiological limitation to exercise capacity similar to those in COPD.[60] The no difference between both the groups may be because both are airflow obstruction disease[59] or may be because in both the groups there is ventilation/perfusion mismatch.[59]

CONCLUSION

During this study, it has been concluded that- HR, RPE, RPP and VO_2 max are important marker of exercise tolerance in patients with chronic bronchitis and asthma. It was also found that incremental shuttle walk test can be used in patients with chronic bronchitis and asthma to assess the exercise tolerance. Study shows that the exercise tolerance is reduced in both the groups than normal but between both the groups there is no significant difference.

Limitations

- The age limit is too large.
- Only one test is used to check exercise tolerance.
- The smaller sample size and it is time bounded study.
- Weight criteria are not taken into consideration.

Future Recommendations

- Long term study with more subjects might give more lucid conclusion.
- Further studies using more tests to check exercise tolerance should be included.
- To check VO_2 max some other technique should be used.

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How to cite this article:

Didhiti S Desai.2016, Evaluating Exercise Tolerance in Chronic Bronchitis and Asthmtic Patients Using Incremental Shuttle Walk Test-A Comparitive Study. *Int J Recent Sci Res.* 7(6), pp. 12195-12200.

TSSN 0976-3031