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ASSESSMENT OF RESPIRATORY MUSCLE STRENGTH USING MAXIMAL INSPIRATORY PRESSURE AND MAXIMAL EXPIRATORY PRESSURE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A STUDY ON INDIAN POPULATION

Physiology

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a common disease seen in Indian population. It is most commonly seen in the lower strata where beedi and cigarette smoking is most prevalent and starts at an early age. Smoke arising from cooking stoves during cooking is the cause of COPD in females. Though the number of males suffering from COPD is much larger than females, we observed a proportionate number of females in all age group suffering from this disease. It is the leading cause of mortality and should be studied in detail so as to avoid complications in such patients. We have studied the strength of respiratory muscles in such patients using newer techniques like Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP). Terzano et al. (2008)[7] and Khalil et al.(2014)[8] have carried out similar studies in COPD patients.

We have checked correlation between anthropometric measurements and strength of respiratory muscles, correlation between airway resistance and muscle strength and also compared the sensitivity and specificity of this technique using ROC (receiver operating Curve) as compared to the age old spirometry. These techniques may help in monitoring the status of COPD patients and assessing muscle weakness.

KEYWORDS

COPD, spirometry, Maximal Inspiratory Pressure (MIP), Maximal Expiratory Pressure (MEP)

INTRODUCTION:

Airway limitation, obstruction, dyspnoea, respiratory muscle dysfunction, hyperinflation of the lung or diaphragm flattening and shortening are some of the characteristic features of chronic obstructive pulmonary disease (COPD). Not many studies have been done in India on respiratory muscle weakness in COPD patients. MIP and MEP helps us to ascertain the condition of respiratory muscles. Ours is an attempt to study this newer technique as compare to old traditional Spirometry.

The present study aims to determine whether respiratory muscle strength (including inspiratory and expiratory muscles) decreases according to COPD stages[1] and how sensitive and specific the technique of Maximal inspiratory pressure (MIP), Maximal expiratory pressure (MEP) is as compare to spirometry.

MATERIAL AND METHOD The present work was done at the Seth G.S.Medical College and K.E.M.Hospital, Parel Mumbai. The examinations included spirometry, MIP, MEP measurements. These measurements were performed at the Pulmonary function laboratory at Department of Chest Medicine at Seth G.S.Medical College and K.E.M. Hospital in conjunction with the Department of Physiology of the same institute. The Ethics Committee of this institution had approved this study. The objectives of the study were explained to all individuals, and their written consent was obtained before their inclusion in the study.

Spirometry was performed on master screen PFT by Jaeger. All the parameters were seen on the screen and value of FVC/FEV1 (< 80%) was observed which is the parameter which decides the severity of the disease COPD. MIP and MEP was measured by Spiro air by Medisoft. The patient maintained inspiration for 1-3 seconds to measure the MIP. For MEP the patient performed a maximal inhalation followed by maximal exhalation for 1-3 seconds.

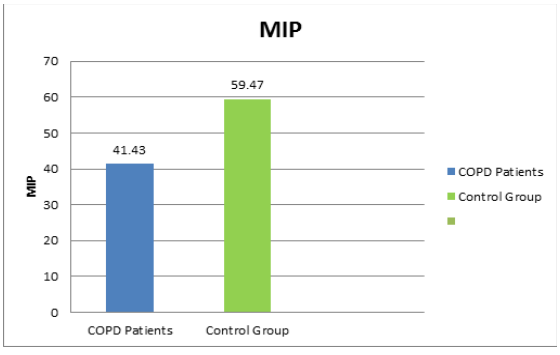
MIP-MEP technique were compared with the values of Spirometry in COPD patients and controls.

RESULTS: SPSS version 23 and Microsoft word Excel software was used for statistical analysis. Data is represented as mean+/-SD. Sensitivity and Specificity of MIP-MEP technique was calculated. Statistical analysis to calculate sensitivity and specificity was done using Receiver Operating Characteristic Curve [ROC Curve]. p value <0.05 is kept as significant for all statistical analysis**.** Sample size was calculated by using n-Master 1.0. 90 patients of COPD and same number of age matched control were included in the study.

Mean MIP of COPD and Control group was 41.43 $\pm$ 16.30 and 59.47$\pm$14.93 respectively (Table 1). Average MIP was significantly higher in control group than COPD. (z=-7.78, using unpaired z test). Mean MEP of COPD and Control group was 35.3 $\pm$ 13.22 and 58.47$\pm$11.52 respectively (Table 1). Average MEP was significantly higher in control group than COPD. (z=-12.25). Both MIP and MEP values were lower in patients with severe obstruction compared with healthy subjects (Table 1).

Table 1 : Maximal Inspiratory Pressure and Maximal Expiratory Pressure

Characteristics	COPD Patients	Control Group
MIP	41.43 + 16.30	59.47+14.93
MEP	35.3 + 13.22	58.47+11.52



Graph 1: Difference in mean of MIP

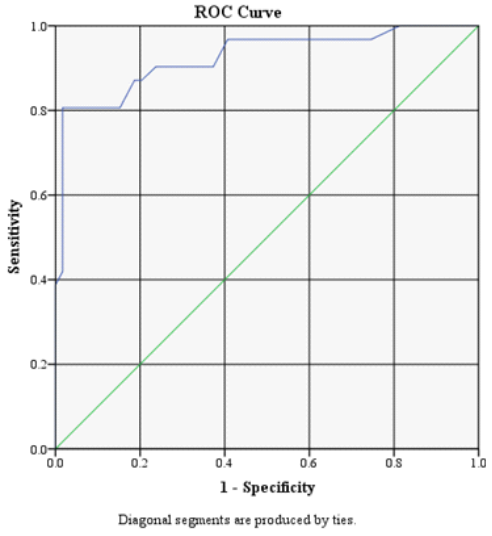
DISCUSSION:

The cut off value of MIP of 83 gives sensitivity of 80.6 % and specificity of 93.5%. The cut off value of MEP of 98 gives sensitivity of 93.5 % and specificity of 99.3%. As both sensitivity and specificity are above 80%, both MIP and MEP can be used as a diagnostic tool for assessing the respiratory muscle weakness in COPD patients. According to the literature, ROC curves with AUCs between 0.90 and

1.00 indicate high diagnostic accuracy. [2-3] In the present analysis, we considered 0.8 to be the minimum value of the AUC for adequate diagnostic accuracy. Since the AUC value is 0.92 and 0.95 for MIP and MEP respectively, these tests has a good diagnostic use. The p value is <0.05), so the result is significant. .

Table 2: Stage of COPD and Area Under Curve

Stage of COPD	Area Under Curve	
	MIP	MEP
I (FEV1≥ 80% normal)	0.510	0.452
II (FEV1 50-79% normal)	0.411	0.335
III (FEV1 30-49% normal)	0.325	0.214
IV (FEV1<30% norma)l	0.339	0.253
P value	0.6225	0.3221



Graph 2: ROC curve for MIP

We studied the MIP and MEP changes in the different stages of COPD that is mild, moderate, severe and very severe (Table 2) to understand when MIP and MEP start to decrease. The main finding of this work is that airway obstruction may be closely related to decreased respiratory pressures in patients with COPD. In fact, both MIP and MEP values were lower in patients with severe obstruction compared with healthy subjects. MIP decreased also in patient with mild and moderate COPD. This clearly explained early deterioration in the condition of respiratory muscle of COPD patients.

There is also a correlation between dimension of the thorax and anthropometric data even if some studies have obtained conflicting results with weight and height. [4]

Wilson and co-workers reported that MIP and MEP in men were significantly correlated with age and weight, whereas in women they were correlated with height and weight, while Leech et al found that age had no consistent effect on respiratory muscular strength. [5-6]. Our study did not find any correlation between MIP, MEP and weight and height, probably because most of our patients had reached approximately were older (60 years of age) with the no change in normal body weight and height.

Conclusion: The advantage of using MIP and MEP is that it generally reflects the respiratory muscle condition in COPD patients which is not possible with spirometric measurements. Spirometry only helps to decide the severity of the disease whereas these newer techniques give an insight into the condition of the ventilator apparatus.

We can use these technique as an alternative or an additional method with spirometry in PFT laboratory. This is in corroboration with the studies done by Terzano et al.[7] and Khalil et al. [8] on known COPD patients with Spirometry, Maximum inspiratory & expiratory pressures were determined. Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) are simple, convenient, and non-invasive indices of respiratory muscle strength at the mouth, but standards are not clearly established in Indian population as yet.

More studies are needed in future on a large population size first to standardise the procedure and secondly to have cut off values for Indian population.

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REFERENCES

1. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: Revised 2014. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Accessed on: 12th September 15.available at: www.goldcopd.org
2. Golpe, R, Jimenéz, A, Carpizo, R, Cifrian, JM. (1999). Utility of home oximetry as a screening test for patients with moderate and severe symptoms of obstructive sleep apnea. Sleep, Vol. 22, No. 7, pp. 932-937, ISSN: 1550-9109.
3. Swets, JA. (1988). Measuring the accuracy of diagnostic systems. Science, Vol. 240, pp. 1285–1293, ISSN: 1095-9203.
4. Bellemare JF, Cordeau MP, Leblanc P, Bellemare F: Thoracic dimension at maximum lung inflation in normal subject and in patients with obstructive and restrictive lung disease. Chest 2001, 119:376-386.
5. Wilson SH, Cooke NT, Edwards RHT, Spiro SG: Predicted normal values for maximal respiratory pressures in Caucasian adults and children. Thorax 1984, 39:535-538.
6. Leech JA, Ghezzo H, Stevens D, Becklake : Respiratory pressures and function in young adults. Am Rev Respir Dis 1983, 128:17-23.
7. Terzano C, Ceccarelli D, Conti V, Graziani E, Ricci A, Petroianni A. Maximal respiratory static pressures in patients with different stages of COPD severity. Respiratory Research 2008;9(8):1-7.
8. Khalil M., Wahih K, Mahmoud O. Evaluation of maximum inspiratory and expiratory pressure in patients with chronic obstructive pulmonary disease. Egyptian Journal of Chest Diseases and Tuberculosis. 2014; 63: 329–35.