VOLUME - 15, ISSUE - 06, JUNE - 2026 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

PULMONARY FUNCTION TESTS IN OBESE PATIENTS - A HOSPITAL BASED CASE REPORT STUDY

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ABSTRACT Obesity causes major respiratory complication like elevated work of breathing, heightened demand for ventilation, diminished respiratory compliance, hypoxemia. Respiratory function test is only mildly affected by obesity except in extreme cases. Patients with obesity commonly develop hypoventilation and sleep apnoea syndromes.

KEYWORDS : Obesity, Pulmonary function test, Dyspnoea, Respiratory Physiology, FVC, FEV1, BMI

INTRODUCTION

Obesity (1) is a major growing health concern in developing countries. In India about 5% population has been affected. This may be due to sedentary life style, consuming excessive food, lack of exercise, persons with reformed smoking, with chronic mental illness, co-morbidities, genetics. Whatever the aetiologies, obesity causes increased health risk of Respiratory disorder as well as other system involvement. In order to understand the pattern of abnormalities in respiratory system due to obesity, Pulmonary Function tests of a morbid obese patient presented with dyspnoea (2) were carried out.

Health Hazards of Obesity

Obesity (11) is a global phenomenon causing increase in morbidity and reducing life expectancy. Obesity generally refers to an excess of body fat and effects of obesity on health measured by body mass index, which is calculated as weight in kilograms divided by the square of height in metre. Thus, BMI of 25 Kg/M2 to 29.9 Kg/M2 is 'overweight' while BMI (7) of 30 Kg /M2 is 'obesity'. Overweight and Obesity are the major risk factor for acute and chronic disorders, cerebrovascular, cardiovascular disorders, type 2 diabetes, it may worsen hypertension, osteoarthritis, gallstone disease, non-alcoholic steatohepatitis, risk for colonic, endometrium, breast cancer, deep vein thrombosis, CHD, stroke, gallbladder disease, osteoarthritis, sleep apnoea, exertional dyspnoea (8), respiratory problems- hypoventilation syndrome, sudden deaths.

Physiology of breathing is affected in the form of decrease in respiratory compliance due to mechanical factors such as increased weight on abdomen (4), thoracic cage. Severe obesity (Morbid obesity (12)) can lead to sleep apnoea, obesity hypoventilation syndrome, hypoxemia, decrease in total respiratory system compliance. The forced vital capacity (FVC) (10), expiratory reserved volume (ERV), forced expiratory volume in one second (FEV1) both are reduced in obese men and women. However, the total lung capacity (TLC), vital capacity (VC) are often normal.

Obesity is also now days observed in children of age group two year or more mainly in upper socioeconomic strata and they also face emotional, psychological problems.

Case Report

A 21 years old non-smoker, hypertensive patient presented with shortness of breath. His complaints of shortness of breath began 2 years prior to evaluation and have not substantially worsened. The patient associates his symptoms with a 40 kg weight increase during last two years. Forward bending and mild exercise exacerbates the dyspnoea. He has no symptoms of shortness of breath during night hours.

There is no history of underlying lung disease or coronary artery disease. Physical examination revealed an obese but otherwise healthy appearing young male. The patient is 178 cm tall, weighs 128 kg and his body Mass Index (B.M.I.) is 40.00 Kg/m^2. Lungs were normal on auscultation, cardiac examination is normal and the remainder of the physical examination is also within normal limits. The results of Pulmonary Function are given in Table

Observations

Calculation Methods & Equations:

The values above were calculated using validated multivariate regression models for the Indian population, which account for age, sex, height, weight and race

Table I

Sr. No.	Parametre	Pulm Func (Predicted)	Pulm Func (Obs)	Percentage
1	FVC	4.13 (L)	3.74 (L)	90
2	FEV1	3.60 (L)	2.92 (L)	92
3	FEV1/FVC Ratio	0.87	0.78	89
4	Exp Res Volume	-1.10-1.40		
5	Func Res Capaci	-2.80-3.20		
6	PEFR Vmax	514.9 L/min		

Estimated based on average ratios for young adults; note that high BMI (obesity) significantly reduces ERV and FRC.

1) FVC (L): (-3.704 - 0.0211({age}) + 0.0500({height}) - 0.00347({weight}) - 0.212.
2) FEV1 (L): (-2.303 - 0.021({age}) + 0.0365({height}) - 0.00109({weight}) - 0.199.
3) Vmax / PEFR (L/min): (-370.05 + 4.963({height}).

Abbreviation Used

1) FVC (L) - Forced vital Capacity in Litre
2) FEV - Forced vital Capacity in first one Second

DISCUSSION

The spirometry (5) shows restrictive pattern. The forced vital capacity (FVC) and forced expiratory volume in the first second are both well below predicted and the FEV1/FVC ratio is normal. The reduced FVC confirms the presence of a restrictive process. The Clinical examination of Respiratory system revealed normal respiratory findings. The reduced FVC shows restrictive process related to the marked obesity.

This marked restriction of FVC is because of decrease in Chest wall compliance due to obesity. In obese patient deposition of

fat over chest and abdomen restricts free expansion of chest during inspiration. Excessive deposition of fat might interfere with effective contraction of respiratory muscles during forceful expiration.

Pathological obesity (morbid) should be considered as a potential cause of the pattern of values suggesting extra parenchymal restriction. More research needs to be conducted to explain how obesity restricts lung expansion and leads to dyspnoea.

CONCLUSION (Summary)

A 21 years old morbid obese patient presented with progressive dyspnoea was undertaken for pulmonary Function tests.

The results indicate restrictive pattern (3) on spirometry, due to deposition of fat over chest, as it decreases chest wall compliance and interfere with effective contraction of the chest wall muscles. Weight reduction by diet therapy, daily physical exercises, control of blood pressure with antihypertensive drugs regularly can improve the breathlessness as well as reduce the cardiac, cerebro-vascular complications.

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