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Spirometric Results Of Combined Obstructive – Restrictive Lung Disease In Emphysema

قياس وظائف الرئة لدى مرضى داء النفاخ

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الخلاصة
الخلفية: داء النفاخ غالبا يتسبب في اختلال وظائف الرئة الانسدادي ولكن من الممكن ان يتسبب في اختلال وظائف الرئة انسدادي – تقييدي خاصة في داء النفاخ الشديد.
الهدف من الدراسة: اجريت هذه الدراسة لمعرفة طبيعة اختلال وظائف الرئة (انسدادي او انسدادي - تقييدي) لدى المرضى المصابين بداء النفاخ.
طريقة البحث: شملت الدراسة 44 مريضا بداء النفاخ، (26 رجل و 18 امرأة) تم تجميعهم من وحدة الطوارئ و الردهات الباطنية في مدينة الصدر الطبية في النجف للفترة من آذار الى ايلول 2012. وقد تم تشخيص المرض بواسطة الفحص الاشعاعي و فحص وظائف الرئة. وتم اجراء فحص وظائف الرئة لجميع المرضى لتحديد نوع الاختلال في وظائف الرئة، انسدادي او انسدادي – تقييدي.
النتائج: اظهرت النتائج ان 31 مريضا (70.5 %) لديهم اختلال انسدادي في وظائف الرئة، و 13 مريضا (29.5 %) من المرضى كان لديهم اختلال مختلط في وظائف الرئة (انسدادي- تقييدي)، و كان هناك اثر معنوي لشدة المرض و وجود الفقاعات الهوائية في الرئة على هذا النوع من الاختلال.
الاستنتاج: اختلال وظائف الرئة الانسدادي – التقييدي لدى مرضى داء النفاخ غير شائع و لكن يمكن حدوثه في النوع الشديد من داء النفاخ ومع وجود الفقاعات الهوائية
التوصيات: دراسة وظائف الرئة لدى المرضى المصابين بداء النفاخ خاصة مع وجود الفقاعات الهوائية.

Abstract
Background: emphysema often cause obstructive pattern on spirometry, but for many reasons, it could cause obstructive and restrictive (mixed) especially in sever emphysema.
Aim of the study: is to determine the prevalence of combined obstructive and restrictive lesion in emphysema.
Patients and methods: 44 patients with emphysematous changes on CXR were enrolled in this study, from Al-Sader medical city in Al-Najaf, during the period from March to September 2012. All of them performed spirometry to determine the types of changes whether obstructive or mixed (obstructive and restrictive) pattern.
Results: thirty one patients (70.5%) had obstructive and 13 patients (29.5%) had mixed obstructive and restrictive pattern. Patients with severe emphysema, and those with bullae showed mixed types which is significant in regarding to final diagnosis, while those on steroids show no significant differences.
Conclusion: Combined obstructive-restrictive pattern in patients with emphysema is an uncommon entity, but it can occur in severe form of emphysema and in the presence of bullae.
Recommendation: Study pulmonary function tests in all patients with emphysema particularly in the presence of bullae.
Keywords: spirometry, PFTs, emphysema.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) includes emphysema and chronic bronchitis will be the third leading cause of death by 2020, is the only chronic disease with increasing morbidity and mortality rate [1]. It is estimated word wide prevalence of approximately 8.9 %[2]. Because the mortality rate of COPD is rising, early recognition and prevention of this disease are of key importance [3]. Currently, smoking cessation is the most important known intervention as it altered the progression of the disease [4, 5].

Emphysema is caused by parenchymal destruction due to alveolar detachment and decrease of elastic recoil of parenchymal structures resulting in an abnormal permanent enlargement of air spaces distal to terminal bronchioles [6, 7, and 8].

Emphysema is classified into two distinct pathological types, the most important being centriacinar and panacinar. Centriacinar emphysema, the type most frequently associated with cigarette smoking is characterized by enlarged air spaces found initially in association with respiratory bronchioles. Centriacinar emphysema is most prominent in upper lobes and superior segment of lower lobes and is often quite focal. Panacinar emphysema refers to abnormally large air spaces evenly distributed within and across acinar units. Panacinar emphysema is usually observed in patients with alpha-1 antitrypsin deficiency, which has a predilection for the lower lobes. Distinctions between centriacinar and Panacinar emphysema are interesting and may ultimately be shown to have different mechanisms of pathogenesis [9, 10].

Emphysema can be detected by pulmonary function test (PFT) which is essential for the diagnosis of obstructive pulmonary disease, for assessing its severity, and for evaluating response to therapy. In which spirometry reveals decrease forced expiratory volume in first second (FEV1), the decrease FEV1 predominates when compared with that of forced vital capacity (FVC) leading to reduction of FEV1/FVC%, a reduced FEV1 and FEV1/FVC%, is pathognomonic of air flow limitation[11]

In moderate to severe emphysema chest radiograph findings includes bilateral hyperlucent lungs of large volumes, flattened hemidiaphragms with wide costophrenic angles, horizontal ribs, and a narrow mediastinium [12]. The peripheral vascular markings are attenuated, but the markings become prominent when the patient has pulmonary hypertension and right side heart failure [13].

The causes of combined obstruction and restriction were classified as either a pulmonary parenchymal disorders or a combination of parenchymal and non-pulmonary diseases. Approximately half of all instances of combined obstruction and restriction were attributed to a combination of parenchymal and non-pulmonary diseases [14]. The most common parenchymal disease was COPD, and the most common non-parenchymal disease was congestive heart failure. In 14% of the subjects the cause of combined obstruction and restriction couldn’t be determined from the medical record [15, 16].

A pattern of obstructive airway disease was defined as an FEV1/FVC% below the 5^{th} percentile of the predicted value. A restrictive pattern was defined as plethysmographycally measured total lung capacity (TLC) below the 5^{th} percentile of the predicted value and low FVC in spirometry. A pattern of combined obstruction and restriction satisfied both the latter criteria [16, 17].

The American thoracic society estimated that combined obstruction and restriction occurs in approximately 20% of all the PFTs performed in their practice, and that pulmonary parenchymal diseases account for 35% of all instances of combined obstruction and restriction [17].

Restriction on spirometry can be related to a variety of etiologies, including interstitial lung disease, obesity, muscular weakness and small airway disease [18, 19]. The precise determination of restriction requires the measurements of TLC [17].

OBJECTIVES OF THE STUDY:

To determine the prevalence of combined obstructive and restrictive lesion in emphysema.

PATIENTS AND METHODS

Forty-four patients with emphysematous changes on CXR attended the emergency department and medical wards at Al-Sader medical city in Al-Najaf, during the period from March to September 2012 were enrolled. Twenty six patients were male and eighteen were female, aged 32-90 years with mean±SD (57.9±12.5).

Detailed history was taken including age, sex, job, smoking, past medical and drug history. All patients were sent for CXR at full inspiration with two views (postero-anterior and lateral view) by using (Fixed X-ray Shimazu 2008).

The following changes were taken in consideration hyperlucent lungs of large volumes, flattened hemidiaphragms with wide costophrenic angles, horizontal ribs, and a narrow mediastinium [(12)].

All patients performed spirometry by (spirolab III MIR) before and after 15 – 20 minutes of administration of bronchodilator (salbutamol nebulization 5 mg in 3 ml of normal saline) by asking the patient to take a maximal inspiration and then to forcefully expire air for as long as quickly as possible[(8)].

Measurements that are made include FEV1, FVC, and FEV1/FVC%. FEV1/FVC < 70%, where FEV1 is reduced more than FVC signifies an obstructive defect. FEV1/FVC > 70%, where FVC is reduced more than FEV1 is seen in restrictive defect. FEV1/FVC < 70%, where FVC is reduced more than FEV1is seen in mixed defect [(20)].

Severity of air flow obstruction based on percentage predicted forced expiratory volume in 1 second (FEV1), value more than 80% is considered mild, 50-79% moderate, 30-49% sever, and < 30% is very sever [(11)].

All patients who had irreversible airway obstruction on spirometry were included in this study. Patients were classified into the following study groups; male and female patients, sever and non-sever airway obstruction, patients on steroid for six months or not, and patients with bullae on CXR or not, for purpose of analysis. In this study patients with asthma were excluded.

Data were collected, arranged and classified using computer software (an interactive calculation tool for Chi-square test of goodness of fit and independence). P-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1. The effect of gender on the prevalence of combined obstructive-restrictive pattern (mixed).

Gender	Results of spirometry				Total
	Obstructive		Mixed		
	no of patients	percent	no of patients	percent	
Male	**18**	**69.2%**	**8**	**30.8%**	**26**
Female	**13**	**72.2%**	**5**	**27.8%**	**18**
Total	**31**	**70.5%)**	**13**	**29.5%**	**44**

p-value 0.831

Table 1 shows no significant difference between male and female on prevalence of combined obstructive-restrictive pattern (mixed).

Table 2. The effect of severity of airway obstruction on the prevalence of combined obstructive-restrictive pattern (mixed).

Severity of airway obstruction	Results of spirometry				Total
	Obstructive		Mixed		
	no of patients	percent	no of patients	percent	
Sever	2	33.3%	4	66.7%	6
Non-sever	29	76.3%	9	23.7%	38
Total	31	70.5%	13	29.5%	44

p-value 0.031

There was significant effect of the severity of airway obstruction on the prevalence of combined obstructive-restrictive (mixed) pattern as seen in table 2.

Table 3. The effect of steroid therapy on the prevalence of combined obstructive-restrictive pattern (mixed).

Steroid therapy	Results of spirometry				Total
	Obstructive		Mixed		
	no of patients	percent	no of patients	percent	
on steroid	14	66.7%	7	33.3%	21
Without steroid	17	73.9%	6	26.1%	23
Total	31	70.5%	13	29.5%	44

p-value 0.59

Table 3 reveals no significant effect of steroid therapy on the prevalence of combined obstructive-restrictive pattern (mixed).

Table 4. The effect of presence of bullae on the prevalence of combined obstructive-restrictive pattern (mixed).

Bullae	Results of spirometry				Total
	Obstructive		Mixed		
	no of patients	percent	no of patients	percent	
Present	0	0.0%	2	100%	2
Absent	31	73.8%	11	26.2%	42
Total	31	70.5%	13	29.5%	44

p-value 0.025

Table 4 shows significant effect of presence of bullae on the prevalence of combined obstructive-restrictive pattern (mixed).

DISCUSSION

In this study, 13 out of 44 patients with emphysema (29.5%), had combined obstructive-restrictive pattern on Spirometric study. Hong et al reported that physicians diagnosed combined obstructive-restrictive pattern in 11% of 681 patients with obstructive airway disease [(21)].

The American thoracic society estimated that combined obstructive-restrictive pattern occurs in approximately 20% of all PFTs performed in their practice, and that pulmonary parenchymal diseases account for 35% of all instances of combined obstructive-restrictive pattern [(17)]. Out of 26 male patients with emphysema diagnosed by CXR and spirometry, 18 patients (69.2%) had obstructive pattern, and 8 (30.8%) patients had combined obstructive-restrictive pattern. While in 18 female patients, 13 patients (72.2%) had obstructive pattern and 5 patients (27.8%) had combined obstructive-restrictive pattern, with no significant difference between male and female patients. This results is disagreed with Martinez et al and Dransfield et al who found that male patients had a greater severity of emphysema compared with female[22, 23].

Martinez et al found that men had more sever emphysema and larger emphysematous spaces on high resolution CT scan (HRCT) compared with women, whereas on histology women had disproportionally thicker airway wall [22].

In this study bullous lung disease was associated with significant increase in the prevalence of combined obstructive-restrictive pattern, this result is agreed with Pride et al, who suggested that in most subjects with bullous disease, tests of overall lung function largely reflect the state of the non-bullous lung[24].

However the present study revealed strong correlation between the severity of airway obstruction and prevalence of combined obstructive-restrictive pattern, this observation is agreed with Halber et al who published a systematic review and meta-analysis of 14 reports which confirmed the strong association between severity of COPD and biological markers of systemic inflammation which may lead to combined obstructive-restrictive pattern[2]. Finally this study showed that the patients whether on steroid or not, had no significant difference with the prevalence of combined obstructive-restrictive pattern. In comparison with Van Balcom et al, who studied the effects of long term low dose methylprednisolone on diaphragm of COPD patients, they found those patients with severe COPD may suffered from respiratory muscles weakness due to hyperinflation, malnutrition, disturbances in blood gases, and cardiac failure[25].

CONCLUSION

Combined obstructive-restrictive pattern in patients with emphysema is an uncommon entity, but it can occur in severe form of emphysema and in the presence of bullae.

RECOMMENDATION

Study pulmonary function tests in all patients with emphysema particularly in the presence of bullae.

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