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A study to determine the breath holding time, Forced Vital Capacity(FVC), And Peak Expiratory Flow Rate (PEFR) among patients with Bronchial Asthma at selected hospital, Chennai

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ABSTRACT

Asthma is one of the major health problem in the developed countries, 15 million of the affected asthmatics. Hence a study was conducted to determine the breath holding time, forced vital capacity (FVC), and peak expiratory flow rate (PEFR) among patients with bronchial asthma. A Qualitative study design was adopted and the study was conducted in Chest OPD, Sri Ramachandra Hospital. The result suggest that Breath holding time may be thought of as being relatively constant inspite of the large standard deviation. Hence the Nurses play an vital role in imparting the knowledge of complementary and alternative therapy (Yoga etc.,) to them .

Introduction

Respiration involves diffusion, perfusion and ventilation which nutrifies the cells. The human body's life sustaining gas oxygen fuel our lungs and diffuse it in to the blood stream and without the proper oxygen and carbondioxide exchange it leaves the body to suffocate.

Asthma is a reversible airway diseases in which the lung function declines with the result of excessive mucus production which is an indicator for poor control of the disease. To test their breath holding time, it's a simple procedure, and rapid helps to predict their severity of asthma.

To stress the importance of autonomic control of breathing, there is a story of German legend. Ondine was a water lymph who had an unfaithful mortal lover. The king of the water nymphs punished the lover by casting a curse upon him that took away all his autonomic functions. In this state, he could stay alive only by staying awake and remembering to breath. He eventually fell asleep from sheer exhaustion, and his respiration stopped.

Similarly breathing can be voluntarily stopped, but a person cannot suffocate himself by doing so. Subconscious mechanisms will submit to voluntary levels until oxygen levels drop or CO_2 levels rise substantially, at which point the body will reflexively take over and force him to breathe to expel $CO_2$and to inhale O_2. Breathing can be voluntarily stopped for a variable period by different individuals depending upon the lung physiology, and the development of the lung structure. The factors like age and sex have no influence on the breath holding time.

The subject holds his breath as long as he can. Normal breath holding time is 45 – 55 seconds. The breaking point at which breathing can no longer be voluntarily inhibited .

Padilla et al (1989) studied 13 patients with acute attacks of asthma to test the hypothesis that magnitude of dyspnea at rest correlate well with spirometry and with breath holding time .Nevarez- Najera et al (2000) in their studies observed that FEV_1 can be reliably estimated using breath holding time.

Hence, this study was undertaken to determine the breath holding time, forced vital capacity(FVC), and peak expiratory flow rate (PEFR) among patients with bronchial asthma and to correlate pulmonary function determined by breath holding time with that determined by spirometry.

Objectives

- Determine the breath holding time, forced vital capacity (FVC), and peak expiratory flow rate (PEFR) among patients with bronchial asthma.
- Assess the gender variations in pulmonary function determined by breath holding time and pulmonary function tests.
- Correlate pulmonary function determined by breath holding time with that determined by spirometry.

Related Review Literature

Studies related to

- Knowledge about bronchial asthma
- Breath holding time among asthmatic patients

Methodology

The research design for the study is qualitative design. The study settings is Chest and TB OPD of Sri Ramachandra Hospital, Chennai. Population of the study included are patients with mild, moderate, severe persistent asthma. The samples selected for the study were patients attending Chest OPD. Inclusion criteria included patients who belongs to the age of 20 to 60 years, who could understand Tamil or English and willing to participate. Exclusion criteria were those who were not willing to participate, or suffering from any chronic illness or disability. The sample size was 40 and the sampling technique used was convenience sampling technique.

Description of Tool

Section A : Demographic variables of the patients with bronchial asthma consist of age, education, locality, occupation, income, marital status, type of family, number of children, family history of asthma etc.

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Section B : Clinical variables such as Height, weight, BMI, Vital signs,

Section C : Pulmonary variables such as breath holding time by 40 mm Endurance test by using mercury sphygnomanometer, forced vital capacity (FVC) by means of spirometry and peak expiratory flow rate (PEFR) by mini Wright peak flow meter.

Data collection procedure

The study was conducted for a period of 4 weeks. Permission from Institutional Ethics Committee was obtained to conduct the study. Patients with bronchial asthma who met the inclusion criteria and those with the history of bronchial asthma for the period of at least one to 5 years were selected for this study. Using the tool, the data were collected from the patient to determine the breath holding time, forced vital capacity (FVC), and peak expiratory flow rate (PEFR)

Results

The major findings of the study are depicted below in tables and graphs.

Table 1: Frequency and percentage distribution of the demographic variables among patients with bronchial asthma

Demographic Variables	N=40	
	No.	%
Age (in yrs)		
a. 21-30	4	10
b.31-40	12	30
c.41-50	15	38
d.51-60	9	22
Gender		
a.Male	23	57
b.Female	17	43
Educational status		
a. No formal education	12	30
b. Primary school	10	25
c. High school	8	20
d. Higher secondary	2	5
e. Degree	8	20
Marital status		
a. Married	10	25
b. Unmarried	13	33
c. Divorced	-	-
d. Widow	17	43
Occupation		
a. Coolie	10	25
b. unskilled	7	18
c. Skilled	12	30
d. Professional	11	28
Income (in Rs.) per month		
a.≤ 5000	5	13
b.5001- 10,000	15	38
c.10,001-15,0000	6	15
d. 15,001-20,000	3	8
e.> 20,001	11	26
Residence		
a.Rural	12	30
b. Semi-urban	18	45
c. Urban	10	25
Type of family		
a. Joint	13	33
b. Nuclear	12	30
c. Extended	15	37
Smoking habit		
a. Non smoker	18	45
b. Cigaratte smoker	07	18
c. Bidi smoker	15	37
Duration of asthma (in years)		
a.<1	5	13
b. 1-2	18	45
c.3-4	10	25
d.4-5	7	17
Family history of asthma		
a. First degree relative	28	70
b. No First degree relative	12	30
Presence of co-morbid medical illness		
a. Diabetes mellitus	16	40
b. Hypertension	8	20
c. Cardiac disease	10	25
d. Bone disease	-	-
e. Gastro-intestinal disease	6	15

Table 1 depicts the frequency and percentage distribution of the demographic variables of patients with bronchial asthma. Among which 15 (38 %) of them belongs to the age group of 41-50 years and 23 (57 %) of them are male patients, and majority of 12 (30 %) had no formal education, 12 (30 %) are skilled labors with the income of Rs.5001 to 10,000 are 15 (38 %),18 (45 %) are living in the rural area, 15 (37 %) has habit of beedi smoker occasionally, 28 (70 %) had family history of first degree relative with bronchial asthma, 16 (40 %) has comorbid illness of diabetes mellitus.

Table 2. Body Mass Index among patients with bronchial asthma (N= 40)

	Male (n= 23)		Female (N= 17)		t- test
BMI	Mean	SD	Mean	SD	
	21.67	2.46	18.96	1.89	Significant (P= 0.0005)

Table 2 depicts the mean and standard deviation of the body mass index among patients with bronchial asthma for male and female is 21.67 ±2.46 ; 18.96 ±1.89 respectively.

Table 3: Breath Holding Time among patients with bronchial asthma (N= 40)

	Male (n= 23)		Female (N= 17)		t- test
BHT (Sec)	Mean	SD	Mean	SD	
	30.25	5.25	26.62	4.23	Significant (P= 0.0245)

Table 3 depicts the mean and standard deviation of breath holding time among patients with bronchial asthma for male and female is 30.25 ± 5.25 and 26.62 ± 4.23 respectively.

Table 4. 40 mm Hg Endurance test among patients with bronchial asthma (N= 40)

40 mm Hg Endurance test (Sec)	Male (n= 23)		Female (N= 17)		t- test
	Mean	SD	Mean	SD	
	36.25	3.25	28.52	2.23	Significant (P< 0.0001)

Table 4 depicts the mean and standard deviation of 40 mm Hg endurance test among patients with bronchial asthma for male and female is 36.25 ± 0.25 , 28.52 ± 2.23 respectively.

Table 5. Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR) among patients with bronchial asthma (N= 40)

	Male (n= 23)		Female (N= 17)		t- test
	Mean	SD	Mean	SD	
FVC	3.22	0.25	2.81	0.51	Significant (P< 0.0001)
PEFR	7.26	0.96	5.09	1.08	

Table 5 depicts the mean and standard deviation of FVC and PEFR among patients with bronchial asthma for male and female.

Table 6. Correlation between BHT and PEFR among patients with bronchial asthma

	Male (n= 23)		'r	Female (N= 17)		'r '
BHT	Mean	SD	0.63	Mean	SD	
	30.25	5.25		26.62	4.23	0.87
PEFR	7.26	0.96		5.09	1.08	

Table 6 depicts the positive correlation between BHT and PEFR among patients with bronchial asthma.

Discussion

With regard to the gender variations in pulmonary function , it was found to be significantly higher in males than in females at p <0.0001 level. The positive correlation was determined between the breath holding time and pulmonary function measures. There was an significant association found between the age, sex, smoking habit, anthropometric variables at the p<o.o5 level.

Based on the results, Breath holding time may be thought of as being relatively constant inspite of the large standard deviation .The breath holding time is relatively constant because forced vital capacity may be correlated with body mass index. The relative similar breath holding time is possible because lower sensitivity to hypercapnia and hypoxia or weak signals from the inspiratory effort at breaking point that inhibits voluntary breath holding. Padcilla et al and Navarez-Najera et al have shown the correlation of breath holding time with pulmonary function test.

The clinical variable such as BMI is significantly higher in males than females. This may be due to the hormonal influence, physical build, degree of physical activity. Breath holding time are significantly higher in males than in females because of larger lung volumes in males and the females are more susceptible to hypercapnia and hypoxia.

There is slightly better correlation of BHT and PFT in females than in males. Both FVC and PEFR are significantly higher in males than females, may b e due to the strength of expiratory muscles under genetic as well as hormonal influences and the larger lung volume.

Conclusion

Breath holding time is a simple, non-invasive, inexpensive test to assess pulmonary function which can provide useful information in healthy and diseased lungs. This can also be used to assess the prognosis of such respiratory diseases. There is a greater gender variability in males than in females. Females have greater sensitivity to hypercapnia and hypoxia. To breathe is to live, and without breath there is no life. Hence patients with bronchial asthma may be helped out to adapt the complementary and alternative therapy to improve their well-being and prevent from the complications.

Recommendations for future research

This study helped to provide the additional information on relationship that exists between the pulmonary function measures and breathe holding time, it also revealed areas that would benefit the further research.

The study can be done in a large scale, and can be compared the breath holding time with asthma and other respiratory disorders.

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