THE USE OF BIOCHEMICAL MARKERS IN THE FOLLOW UP OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. It is considered the fourth leading cause of death worldwide. It is associated with a large number of comorbidities.

Objective: to evaluate the important role of the biochemical investigations and shed light on smoking as environmental factor on COPD patients and passive smokers.

Patients and Methods: The study conducted on 27 healthy controls, 40 passive smokers and 40 COPD patients selected by using easy sampling method in Ain Shams University Hospitals. All individuals were subjected to: thorough history taking, clinical examination, Pulmonary function tests(FEV1&FEV1/FVC), arterial blood gases analysis (ABG) and biochemical blood analysis such asCBC, ESR, alpha one antitrypsin (A1AT), C-reactive protein (CRP), serum & sputum nitric oxide (NO),fibrinogen, other liver function tests (ALT, AST&ALB)and kidneyfunction tests (BUN & Creatinine)

Results: FEV1&FEV1/FVC significantly lowerin COPD patients than in passive smokers and controls. ABG analysis (Pco2) significantly higher but Po2 significantly lowers in COPD patients than in passive smokers and controls. Biochemical blood analysis for serum A1AT, NO, ALB, Hb & PLT significantly lower in COPD patients than in passive smokers and controls.

Levels of plasma fibrinogen, CRP, sputum NO, (ALT & AST), (BUN & Creatinine) and (ESR, WBC & NE%) significantly higher in COPD patients than in passive smokers and controls. These results concluded reduction in FEV1&FEV1/FVC, Po2, serum A1AT, NO, ALB, Hb & PLT in COPD patients < passive smokers. Increase values of Pco2 plasma fibrinogen, serum CRP, sputum NO, (ALT &AST), (BUN & Creatinine) and (ESR, WBC &NE%) in COPD patients > passive smokers.
Key Words: COPD, A1AT, NO

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major epidemic disease in the world affecting 5 to 8% of all adults over the age of 40 years. It represents the fifth and the sixth cause of death in high and low income countries respectively (Mehrotra *et al*., 2009).The Global Burden of Disease Study has projected that COPD, will become the third leading cause of death worldwide by 2020. This increased mortality is mainly driven by the expanding epidemic of smoking, reduced mortality from other common causes of death (e.g. ischemic heart disease and infectious diseases) as well as due to aging of the world population (GOLD, 2011).

Chronic obstructive pulmonary disease is a progressively disabling disease characterized by airflow obstruction that interferes with normal breathing. The most common cause is smoking which accounts for approximately 80% of COPD cases. Other causes include exposure to occupational hazards, air pollution and secondhand smoke (Fishwick *et al*., 2015).COPD is strongly associated with occupational exposures during construction work and confirmed the increased COPD risk associated with exposures to asbestos, welding, silica, and cement dust. Other agents

significantly associated with the risk of COPD included engine exhausts, acids, caustics, metal cutting and grinding aerosols, isocyanides, organic solvents, wood dust, molds and spores (John *et al*., 2015).Wood, animal dung, crop residues, and coal, typically burned in open fires or poorly functioning stoves, may lead to very high levels of indoor air pollution. Evidence continues to grow that indoor pollution from biomass cooking and heating in poorly ventilated dwellings is an important risk factor for COPD (Boman *et al*., 2006). Almost 3 billion people worldwide use biomass and coal as their main source of energy for cooking, heating, and other household needs, so the population at risk worldwide is very large (Oroczo-Levi *et al*., 2006;Torres-Duque *et al*., 2008).The genetic risk factor that is best documented is a severe hereditary deficiency of alpha-1 antitrypsin, a major circulating inhibitor of serine proteases. This rare recessive trait is most commonly seen in individuals of Northern European origin (Blanco *et al*., 2006). Genetic associationstudieshave implicated a variety of genes in COPD pathogenesis, including transforming growth factor beta 1 (TGF-β1), microsomal epoxide hydrolase 1 (mEPHX1) and tumor necrosis factor alpha (TNF-α) (Wu *et al*., 2004), However, the results of these genetic association studies have been largely inconsistent, and functional genetic variants influencing the development of COPD (other than alpha-1 antitrypsin deficiency) have not been definitively identified (Rabe *et al*., 2007).Some patients develop COPD without smoking, but the nature of the inflammatory response in these patients is unknown. In addition to inflammation, two other processes thought to be important in the pathogenesis of COPD are an imbalance of proteases and antiproteases in the lung and oxidative

stress.Oxidants, generated either endogenously from phagocytes and other cell types or exogenously from air pollutants or cigarette smoke as well as intracellular oxidants, an imbalance between oxidants and antioxidants is considered to play a role in the pathogenesis of COPD (MacNee, 2005).Protease mediated destruction of elastin, a major connective tissue component in lung parenchyma, is an important feature of emphysema and is likely to be irreversible (GOLD, 2011).

Second-hand tobacco smoke is also referred as 'environmental tobacco smoke', 'passive smoking' or 'involuntary smoking' which can take place in the home, the workplace or other environments that are accessible to the public. (IARC, 2004; Matt *et al*., 2004).

COPD is the seventh most frequent chronic disease and is expected to rank fourth by 2020. It is associated with several comorbidities, but it is unknown to which extent it is associated with chronic renal failure. It was diagnosed based on serum creatinine (Rabe *et al*., 2007).

PATIENTS AND METHODS

Patients: The study included 107 subjects their ages ranged from 50 to 65 included 80 patients and 27 apparently healthy control subjects. All our subjects were males. The patients were selected from the respiratory intensive care unit (RICU), Chest Department and Chest Clinic at Ain Shams University Hospitals – Cairo – Egypt in the period from November 2013 to November 2015. The subjects were classified into three groups:

Patients Group: 40 Smokers COPD male patients, their ages ranged from 50 – 65 years, were clinically diagnosed with mild COPD stage (18 patients) their ages ranged from 50 – 59 years, and moderate COPD stage (22 patients) their ages ranged from 57 – 65 years (total 40 COPD patients) according to (ATS/ERS, 2002) and (GOLD, 2008) criteria as follows:

- FEV1/FVC > 0.7 and FEV1 < 70 %: mild.
- FEV1/FVC > 0.7 and 50 % > FEV1 > 70 %: moderate.

Passive smokers group: 40 individuals in this group were nonsmoker males their ages ranged from 50 – 63 years, and were selected with no history or symptoms of COPD or any other chronic respiratory disease but they were exposed to fumes, gases, dust and smoking (40 passive smokers).

Control Group: 27 volunteers in this group were normal healthy nonsmoker males; their ages ranged from 51 – 64 years, and were selected with no history or symptoms of COPD or any other chronic respiratory disease (27 controls).

Methods: all patients and control were subjected to the following:

- Thorough history taking, clinical examination, chest X-ray (postero-anterior and lateral views).
- Pulmonary function tests are FEV1: forced expiratory volume in first second, FVC: forced vital capacity and FEV1/FVC ratio % pred: percent predicted(Ranu et al., 2011).
- Arterial blood gases analysis (ABG):pH level of blood, partial pressure of carbon dioxide (Pco2) and partial pressure of oxygen (Po2) in arterial blood by using blood gas analyzer.

- Biochemical blood analysis such as CBC, ESR, alpha one antitrypsin (A1AT), C-reactive protein (CRP), serum & sputum nitric oxide (NO),fibrinogen, other liver function tests (ALT, AST&ALB)and kidneyfunction tests (BUN & Creatinine) (Ward and Cooper, 1975).
- Statistical analysis: the results were expressed as arithmetic means ± standard deviation (SD). Differences between means were tested by one way ANOVA for the three groups. In order to evaluate the correlation between parametric variables, the Pearson's correlation test was utilized. Data analysis was performed using SPSS version 20 software. P< 0.01 and p< 0.05 were considered statistically significant.

RESULTS

Results: in this study 40 COPD patients, 40 passive smokers and 27 healthy controls. All individuals were males.

Table (1): FEV1 and FEV1/FVC in the three studied groups.

Groups / Variables		Control Group	Passive Smokers Group	COPD Patients Group
FEV1	Mean ± SD	97.04 ± 8.05	76.10 ± 2.37 a	66.50 ± 9.24 ab
% Pred	Range	84 – 109	72 - 80	50 - 79
FEV1/FVC	Mean ± SD	79.26 ± 4.97	60.83 ± 9.40 a	54.65 ± 6.54 ab
% Pred	Range	71 – 87	45 - 77	45 - 67

The results revealed that FEV1 and FEV1/FVC were decreased significantly in COPD patients > passive smokers > control group.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table (2): Statistical signal of pH, Pco2 and Po2 blood gases in different studied groups.

Variables \ Groups		Control Group	Passive Smokers Group	COPD Patients Group
pH	Mean ± SD	7.00 ± 0.00	7.00 ± 0.00	7.00 ± 0.00
mmHg	Range	7 – 7	7 - 7	7 - 7
Pco2	Mean ± SD	42.52 ± 1.60	46.48 ± 0.96 a	65.28 ± 8.58 ab
mmHg	Min - Max	40 – 45	45 - 48	51 - 80
Po2	Mean ± SD	97.48 ± 1.60	92.10 ± 1.24 a	55.50 ± 5.84 ab
mmHg	Range	95 – 100	90 - 94	46 - 65

The results showed that pH level of ABG was the same in all groups with non-significant differences between all the three groups, while arterial carbon dioxide level of blood (Pco2) increased and arterial oxygen level of blood (PO2) decreased significantly inCOPD patients > passive smokers > control group.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table (3): Serum kidney function tests (BUN and Creatinine) in differentstudied groups.

Variables \ Groups		Control Group	Passive Smokers Group	COPD Patients Group
BUN	Mean ± SD	36.93 ± 8.19	40.03 ± 7.20	50.08 ± 10.01 ab
mg/dl	Range	20 – 52	25 - 52	35 - 69
Creatinine	Mean ± SD	0.98 ± 0.25	0.94 ± 0.25	1.21 ± 0.33 ab
mg/dl	Range	0.6 - 1.4	0.5 - 1.4	0.7 - 1.8

The results showed that levels of kidney function tests were increased significantly in COPD patients as compared to passive smokers and control groups.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table(4): Statisticalanalysis of Liver function tests(ALT, AST, ALB and Fibrinogen) in Serum of different studied groups.

Variables \ Groups		Control Group	Passive Smokers Group	COPD Patients Group
ALT	Mean ± SD	31.93 ± 6.69	34.73 ± 6.93	52.88 ± 5.84 ab
IU/L	Range	20 – 43	23 - 44	44 - 66
AST	Mean ± SD	32.41 ± 6.34	33.65 ± 6.67	48.80 ± 8.16 ab
IU/L	Range	20 – 43	20 - 43	34 - 67
ALB	Mean ± SD	4.68 ± 0.49	4.57 ± 0.66	3.43 ± 0.41 ab
g/dl	Range	4 – 6	4 - 6	3 - 4
Fibrinogen	Mean ± SD	0.22 ± 0.07	0.38 ± 0.04 a	0.59 ± 0.10 ab
g/dl	Range	0.16 - 0.40	0.32 - 0.47	0.47 - 0.78

The results showed that levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were increased significantly in COPD patients as compared to passive smokers and control. Also serum albumin (ALB) levels decreased significantly in COPD patients as compared to passive smokers and control. While fibrinogen increased significantly in passive smokers compared to control group and also in COPD patients as compared to passive smokers and control groups.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table (5): ESR, Hb, PLT, RBC, WBC and NE in differentstudied groups.

Variables \ Groups		Control Group	Passive Smokers Group	COPD Patients Group
ESR	Mean ± SD	17.33 ± 3.69	23.68 ± 3.87 a	31.28 ± 3.26 ab
mm/hr	Range	10 – 25	15 - 29	25 - 39
Hb	Mean ± SD	14.09 ± 0.89	13.91 ± 1.04	13.01 ± 0.72 ab
g/dl	Range	12.8 - 16.0	12.5 - 16.0	11.5 - 14.3
PLT	Mean ± SD	299.44 ± 68.24	309.43 ± 92.37	264.38 ± 93.09 b
103/µl	Range	165 – 414	150 - 466	101 - 450
RBC	Mean ± SD	5.05 ± 0.26	4.97 ± 0.45	4.93 ± 0.42
106µl	Range	4.6 - 5.5	4.2 - 5.8	4.4 - 5.9
WBC	Mean ± SD	6.82 ± 2.05	7.48 ± 1.82	9.77 ± 2.56 ab
103/µl	Range	4.2 - 11.0	4.2 - 11.0	6.4 - 16.0
NE	Mean ± SD	43.37 ± 14.90	59.70 ± 14.78 a	74.85 ± 12.33 ab
%	Range	25 – 70	27 - 78	42 - 95

The results showed that ESR, NE%, and WBC were increased significantlyin COPD patients > passive smokers > control group. RBC was non-significant difference between all three groups, while Hb and PLT were decreased significantly in COPD patients > passive smokers > control group.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table(6): Serum (CRP, A1AT andNO), and sputum NO in different studied groups.

Variables \ Groups		Control Group	Passive Smokers Group	COPD Patients Group
CRP	Mean ± SD	3.46 ± 0.66	14.90 ± 4.91 a	38.70 ± 7.72 ab
mg/l	Range	2 – 5	7 - 23	24 – 50
A1AT	Mean ± SD	162.56 ± 24.67	74.53 ± 9.05 a	47.08 ± 7.05 ab
mg/l	Range	119 – 200	60 - 88	37 – 60
Serum NO	Mean ± SD	3.03 ± 0.54	1.87 ± 0.28 a	1.25 ± 0.36 ab
µmol/L	Range	2.10 - 3.90	1.00 - 2.20	0.60 - 1.90
Sputum NO	Mean ± SD	25.23 ± 2.55	31.76 ± 2.81 a	38.77 ± 1.70 ab
µmol/L	Range	20.20 - 28.50	27.00 - 36.00	36.00 - 42.00

The results indicated that levels of serum alpha one antitrypsin (A1AT) and serum nitric oxide (serum NO) were decreased significantly in passive smokers compared to control group and also in COPD patients as compared to passive smokers and control groups. While Serum C-reactive protein level (CRP) and Sputum nitric oxide (Sputum NO) were increased significantly in passive smokers compared to control group and also in COPD patients as compared to passive smokers and control groups.

Results were expressed as means ± Standard Deviation (SD)

The level of significance was accepted at $P < 0.05$

a = Statistical difference compared to control group at $P < 0.05$

b = Statistical difference compared to passive smokers at $P < 0.05$

Table(7): Correlation analysis between all parameters

	fev1	fvc	fev1 / fvc	PCO2	PO2	N.E %	N.E	N.E ABS	CRP	NO_ Sputum	Fibri-nogen	A1AT	NO_ Serum
fev1	1												
Fvc	.053	1											
fev1 / fvc	.902**	-.376**	1										
PCO2	-.771**	-.188	-.663**	1**									
PO2	.730**	.182	.624**	-.956**	1								
N.E %	-.543**	-.225**	-.420**	.645**	-.639**	1							
N.E	-.456**	-.115	-.387**	.556**	-.615**	.782**	1						
N.E ABS	-.253**	-.014	-.243**	.362**	-.468**	.454**	.745	1**					
CRP	-.785**	-.099	-.704**	.856**	-.913**	.602**	.581	.463**	1				
Fibrin-ogen	-.832**	-.066	-.753**	.804**	-.842**	.598**	.567	.434**	.849	1**			
A1AT	.831**	-.010	.769**	-.690**	.714**	-.619**	-.528	-.335**	-.777	-.773**	1		
NO Serum	.778**	-.024	.729**	-.651**	.705**	-.502**	-.486	-.380**	-.764	-.757**	.832	1**	
NO Sputum	-.812**	-.078**	-.724**	.780**	-.838**	.557**	.539**	.376**	.858	.813**	-.831**	-.824**	1**

Chronic obstructive pulmonary disease (COPD) is the end result of a complex set of interactions between the environment and the genetic background of the individual (Alvar *et al*., 2016).

In our population FEV1 and FEV1/FVC were decreased significantly in passive smokers compared to control group and also in COPD patients as compared to passive smokers and control groups. Mukadder *et al*. (2002) found decreased levels of FEV1/FVC ratio and FEV1 in COPD patients rather than passive smokers and controls due to air way obstruction. This may be due to overlay variation in the true prevalence of airway obstruction and differences in the level of FEV1/FVC were the most clinically relevant diagnostic criterion for COPD. Decrease in FEV1 increase mortality due to cardiovascular complication which increased in patients with COPD agreeing with Swanney *et al*. (2008) (Sunil and Mansi 2010) and Wouter *et al.* (2015).

In our study a significant increase in the partial pressure of arterial carbon dioxide (Pco2) and a significant decrease in the partial pressure of arterial oxygen (Po2) in COPD patients compared to passive smokers and controls. This finding was in line with Ahmet *et al.*(2006) and (Jindal, 2008) who found that decreased (Po2) produced hypoxemia at decreased ventilation of lungs or in the case of extensive pathological processes in respiratory system leading to alveolo-capillary blockage. At reduced oxygen tension in pulmonary capillaries hemoglobin in red cells cannot fully saturated with oxygen and therefore hypoxemia develops.

The results of the present study illustrated a significant increase in serum BUN and creatinine in COPD patients when compared to passive smokers and controls as reported by Tozawa *et al.* (2002) and Satarug *et al*. (2004).

This may be explained by the presence of both nicotine and selected heavy metals as lead and cadmium, which are components of smoke, are risk factors for chronic renal failure. They cause nephrotoxicity in the form of tubular proteinuria and glomerular dysfunction evidenced by an increased excretion of high molecular weight proteins and increased levels of creatinine in plasma, and giving rise to a glomerular type proteinuria agreeing with Gjerde *et al*. (2012) and Chandra *et al*. (2012).

In the present study a significant increase in levels of transaminases (ALT and AST) in COPD patients as compared to passive smokers and controls. This may be due to A1AT deficiency agreeing with Morisco *et al.* (2008) and (Silverman and Sandhaus, 2009).

In our work a significant decrease in serum albumin level in COPD patients when compared to passive smokers and controls. This finding was in accordance with Gunen *et al*. (2005), who found that low albumin levels, considered to be part of the acute phase protein response. Low levels of this protein reflect a deterioration of clinical status or increased persistent inflammation during acute exacerbations of COPD.Hypoalbuminemia is a strong prognostic risk factor for acute respiratory failure and malnutrition in COPD as reported by Zaky *et al*. (2014).

Our study agreed with that of Marie *et al*.(2012), a significant increase in serum fibrinogen level in COPD patients compared to passive smokers and controls. This was also suggested by the studies of Pertseva *et al*. (2013),

Yoko *et al*. (2013) and Sofie *et al*. (2014), who explained that plasma levels of fibrinogen were higher in COPD patients compared to controls and these levels were associated with a degree of airflow limitation, which is one of the parameters used to assess the severity of COPD. Higher fibrinogen levels were associated with the rate of decline in the pulmonary functions FEV1/FVC in COPD patients and suggest that plasma fibrinogen may be a potent biomarker for pulmonary dysfunction.

The results of the present study represented significant increase in erythrocyte sedimentation rate (ESR) in COPD patients when compared to passive smokers and controls. These findings were compatible with Gulfidan *et al*. (2009), Krzysztof *et al.* (2011) and (Behzad, 2012), who explained that causes of increased ESR are anemia, macrocytosis, increased number of high molecular weight proteins in the blood, elevating plasma viscosity and thus would raise the ESR. Also fibrinogen, the most abundant acute phase proteins reactant, has the greatest effect on the elevation of ESR.

The present study showed that a significant decrease in Hb of patients with COPD compared to passive smokers and controls. This finding was in line with Davood *et al*. (2009). This may reflect the balance between the stimulation of erythropoiesis by hypoxia and its depression by inflammation agreeing with (Abebaw and William, 2011). Therefore hypoxia occurs when the oxygen pressure in blood going to the tissues is too low to saturate the hemoglobin. It is characterized by a lack of oxygen entering the blood and the inability to diffuse the oxygen across the lungs as reported by Tsui *et al.* (2011).

The present study showed that a significant decrease in platelet count of COPD patients as compared to passive smokers. These findings are consistent with Wang *et al*. (2013). This may be due to the consumption of platelets under high-grade inflammatory conditions. Increased levels of inflammatory proteins such as CRP, fibrinogen, and proinflammatory cytokines observed in COPD may be associated with decreased platelets.

The results of the present study showed that a significant increase in levels of white blood cell count (WBC) of COPD patients as compared to passive smokers and control as reported by Brüske *et al*. (2010), Fattouh and Alkady, (2014) and Karimil *et al*. (2014)who found that white blood cell count was significantly higher both in smokers and in COPD patients compared to never smokers. Patients with a chronic pulmonary disease might have reacted particularly sensitive to the effects of air pollution episodes. Thismay be due to the increase of particulate and gaseous air pollution with increased white blood cell count, reflect their different functions in the immune response and related with the decline in lung function.

The present study demonstrated that a significant increase in the percentage of neutrophils in COPD patients when compared to passive smokers and controls. This finding was in line with Sevinc *et al*. (2012), who proved that cigarette smoking by itself increase neutrophil chemotactic activity and increased systemic inflammation. The neutrophil count was also increased with the fall in FEV1. It is well known that neutrophils play a crucial role in the pathophysiology of COPD, as they release multiple mediators and tissue degrading enzymes such as elastases that orchestrate tissue destruction and chronic inflammation. In COPD the neutrophilic

inflammatory response dominates. Neutrophil count in increased severity may indicate the presence of respiratory infection and use of steroids for treatment as severity of functional lung impairment increases according to Ashem*et al*. (2014).

The results of the present study illustrated a significant increase in serum CRP level in COPD patients when compared to passive smokers and controls. This agreed with Agarwal *et al.* (2013) and Montano *et al.* (2014), who proved that the elevated levels of CRP in COPD patients suggest that systemic inflammation stimulates CRP synthesis. Also as reported by Zhang *et al*. (2012).Theelevated levels of CRP in COPD patients may result from chronic hypoxia, hypermetabolism, malnutrition, skeletal muscle fiber-type shifting and endocrine disorder.

Our results agreed with that of Panchal *et al*. (2014), who found that a significant decrease in serum A1AT level in COPD patients when compared to passive smokers and controls. This may be due the result of direct oxidation of its reactive center by free radicals in the smoke and also by oxygen radicals released from the activated leucocyte. This increased production of elastase, together with a decrease in its inhibitory activity, results in an attack on the lower respiratory tract and the development of emphysema.

In the present study, there was a significant decrease in serum NO level and increase in sputum NO level of COPD patients when compared to passive smokers and controls. This may be explained by the unstable structure of NO and reactions between NO and toxic oxygen anion radicals (O2-) to form

peroxynitrite (ONOO-) and decays to OH• also react with ubiquitous CO2forming an unstable nitrosoperoxycarbonate anion thereby lowering serum NO. This compound is responsible for the cytotoxic effects of NO and is very harmful to cells and tissues. The other view is that cigarette smoking increased NO level in sputum via oxidative stress pathway,by theformation of stable powerful oxidizing, nitrating actions and reactive nitrogen species leading to hypernitrosopnea, increased tracheobronchial secretion and increased airway inflammation agreeing with Mukadder *et al*. (2002), Ziora *et al.* (2007) and Teyfik *et al*. (2014).

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استخدام تقنيات بيوكيميائيه حديثة لمتابعة تطور مرض السده الرئويه المزمنه

[٢]

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المستخلص

يتصف مرض السده الرئويه المزمنه بضيق الشعب الهوائيه وعدم الاستجابه الكليه للعلاج بموسعات الشعب الهوائية. ولهذا المرض مضاعفات شديده كالتهابات في الممرات الهوائية، تدمير وتضخم الحويصلات الهوائية، مما يؤدي إلي ضعف تبادل الغازات وسعال وضيق بالتنفس.

هدفت هذه الدراسه الى دور التقنيات الكيميائيهالحيويه الحديثه لمتابعة تطور مرض السده الرئويه المزمنه وتسليط الضوء على التدخين كعامل بيئى خطير ومؤثر على مرضى السده الرئويه المزمنه والمدخنين السلبيين.

أجريت هذه الدراسه على عدد١٠٧شخص تم تقسيمهم إلى الآتى: ٤٠ من مرضى السده الرئويه المزمنه، و٤٠ من المدخنين السلبيين، و٢٧ من الاصحاء (مجموعة ضابطه) – وقد تم جمع هذه العينات من أشخاص ومرضى من المترددين على القسم والرعاية والعياده الخارجيه للصدر وقد اجريت لهم عدة فحوصات بعدإختيار الحالات والفحص الإكلينيكى للأشخاص – مع عمل أشعه سينيه على الصدر (خلفى أمامى) .قياس وظائف التنفس وغازات الدم الشريانى كما تم قياس نسبة ألفا١ أنتى تريبسين– سى رياكتف بروتين– الفيبرينوجين– إنزيمات الكبد (الترانس أمينات) والالبيومين ووظائف الكلى (اليوريا والكرياتينين)، كما تم قياس نسبة أكسيد النيتريك فى الدم والبصاق.

أيضا تم عد كرات الدم البيضاء والصفائح الدمويه في الدم وقياس نسبة الهيموجلوبين والنسبة المئويه لخلايا النيتروفيل ومعدل سرعة الترسيب.

النتائج: بقياس وظائف التنفس التى تشمل حجم الزفير القسرى فى الثانيه الاولى وأيضانسبته على القدره الحيويه القسريه وجد أن كلاهما يتناقص ومستوى النقصان ذو دلاله إحصائيه فى مجموعة المرض بمقارنة بمجموعة المدخنين السلبيين والأصحاء.

وبقياس غازات الدم الشريانى وجد ارتفاع الضغط الجزئى لغاز ثانى أكسيد الكربون فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء – على العكس وجد انخفاض بالنسبه للضغط الجزئى لغاز الاكسجين فى الدم الشريانى. ولهذه النتائج دلاله إحصائيه.

وبالنسبه لقياس مستوى ألفا١ أنتى تريبسين والالبيومين وأكسيد النيتريك فى الدم منخفضه فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء؛ بينما مستوى أكسيد النيتريك فى البصاق مرتفعه فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء وأيضا وجد أن كلا من نسبة الارتفاع والانخفاض ذو دلاله إحصائيه.

كما وجد إرتفاع ذو دلاله إحصائيه فى كلا من نسبة السى رياكتف بروتين ووظائف الكلى (اليوريا والكرياتينين) في الدم فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء.

كذالك أظهرت النتائج وجود إرتفاع فى مستوى الفيبرينوجين وإنزيمات الكبد (الترانس أمينات) فى الدم فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء وهذا الارتفاع يمثل دلاله إحصائيه.

كذالك وجد إرتفاع ذو دلاله إحصائيه فى كلا من عدد كرات الدم البيضاء والنسبه المئويه لخلايا النيتروفيل ومعدل ترسيب خلايا الإريثروسيت فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء_على العكس وجد إنخفاض ذو دلاله إحصائيه فى كلا من نسبة الهيموجلوبين وعدد الصفائح الدمويه فى مجموعة المرضى مقارنة بمجموعة المدخنين السلبيين والأصحاء.

تشير النتائج إلى أن التقنيات الكيميائية الحيويه الحديثه مثل الفا ١انتيتربسين، أكسيد النيتريكفى الدم وفى البصاق والفيبرينوجينفي البلازما هي مؤشرات جيدة لتأكيد تشخيص ومتابعة مرضى السده الرئويه المزمنه؛ بينما سى رياكتف بروتين، وظائف الكبد (الترانس أمينات) ووظائف الكلى (اليوريا والكرياتينين) تستخدم لمتابعة المرضى ومدى تأثير السده الرئويه المزمنه على باقى أجهزة الجسم لطول فترة المرض.