Effect of Percutaneous Coronary Intervention (PCI) upon Lung Functions among Patients with Ischemic Heart Disease at Al-Najaf Cardiac Center: Correlation Study

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Abstract

Objectives: The study objectives to detect the effect of angioplasty upon lung functions among Patients with ischemic heart disease and to find out the relationship between the patients lung functions and their demographic and clinical characteristics.

Methodology: A descriptive (correlation) design was conducted on the at Al- Najaf center for cardiac surgery and catheterization. Starting from 1st April 2019 to 1st October 2019. In order to detect the effect of angioplasty on lung function among of patient with ischemic heart disease. A non-probability (purposive) sample of (52) patients, those who admitted to angioplasty unit and coronary care unit without any respiratory diseases. Patients were ischemic heart disease. The patients' demographic and clinical data collected through the utilization the semi-structured questionnaire and by means of interview technique with the subject, while the pulmonary functions test collected by using spirometer instrument. Data was analyzed by using descriptive statistic (percentage and Frequencies) and inferential (person s correlation coefficient, independent sample t-test, and paired t-test).

Results: The results shows that there is a high significant relationship between the pulmonary functions pre and post cardiac catheterization, and most the patients with low PFTs post angioplasty.

Conclusions: The present study recommended the nurses whose work at the open Heart Center should teach the patient undergoing cardiac catheterization breathing exercises to increase the lung capacity as particular and the respiratory system as general and the patient should be given oxygen for at least 60 minutes before and after cardiac catheterization to ensure an increase in the oxygen level and perfusion in the body tissues.

Keywords: *Percutaneous Coronary Intervention, Patients, Ischemic Heart Disease.*

Introduction

Ischemic heart disease it is the most common cause of death in most western countries. Ischemia means a "reduced blood supply" [1]. The coronary arteries supply blood to the heart muscle and no alternative blood supply exists, so a blockage in the coronary arteries reduces the supply of blood to heart muscle [2]. The vascular narrowing or closure is predominantly caused by the covering of atheromatous plaques within the wall of the artery rupturing, in turn leading to a heart attack (Heart attacks caused by just artery narrowing are rare) [3]. A heart attack causes damage to heart muscle by cutting off its blood supply. Most ischemic heart disease is caused

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by atherosclerosis, usually present even when the artery lumens appear normal by angiography. Initially there is sudden severe narrowing or closure of either the large coronary arteries and/or of coronary artery end branches by debris showering downstream in the flowing blood. It is usually felt as angina, especially if a large area is affected [4]. Percutaneous coronary intervention (PCI), also known as balloon angioplasty, Angioplasty, or percutaneous transluminal angioplasty (PTA), is a minimally invasive, endovascular procedure to widen narrowed or obstructed arteries or veins, typically to treat arterial atherosclerosis [5]. A deflated balloon attached to a catheter (a balloon catheter) is passed over a guide-wire into the narrowed vessel and then inflated to a fixed size. The balloon forces expansion of the blood vessel and the surrounding muscular wall, allowing an improved blood flow [6]. A stent may be inserted at the time of ballooning to ensure the vessel remains open, and the balloon is then deflated and withdrawn. Angioplasty has come to include all manner of vascular interventions that are typically performed percutaneously [7]. Calma, (2015) reported that the angioplasty is a lower-risk option for the treatment of the conditions for which it is used, but there are unique and potentially dangerous risks and complications associated with (embolization, arterial rupture from over-inflation of a balloon catheter or the use of an inappropriately large or stiff balloon, hematoma or pseudo aneurysm formation at the access site, or radiation Injuries). Angioplasty may also provide a less durable treatment for atherosclerosis, and be more prone to restenosis, relative to passer coronary artery bypass grafting. The primary task of the lungs is to maintain oxygenation of the blood and eliminate carbon dioxide through the network of capillaries alongside alveoli. This is maintained by utilizing ventilatory reserve capacity and by changes in lung mechanics. Induction of sedation agent impairs pulmonary functions by the impaired level of consciousness, depression of reflexes, changes in rib cage and hemodynamics. The posture of the patient also leads to major changes in pulmonary functions. Analgesics and sedatives in combination may exacerbate the effects [8]. Many studies have shown the associations of reduced lung function with future risk of mortality, respiratory outcome, and cardiovascular outcomes. In current practice, forced expiratory volume in 1 s (FEV_1) is considered to be abnormal when it is lower than –2 standard deviations from the population mean for age, height, and sex. However, there is little data on whether mild abnormalities in lung function, within clinically normal range, are associated with similar increases in poor health outcomes. Furthermore, it was found that pulmonary impairment is more frequent after cardiac surgery and major cardiac procedures. Deterioration in pulmonary function is a common complication following CABG surgery and there is still speculation to the precise causative factors thereof.

Methodology

A descriptive correlation design was conducted at Al- Najaf center for cardiac surgery and catheterization. Starting from 1st April 2019 to 1 October 2019. In order to detect the effect of Percutaneous Coronary Intervention (PCI) on lung function among of patient with ischemic heart disease and find out the relationship between the patient lung function and their demographic and clinical characteristics. An official permission is approval is issued from the Ministry of Health/AL-Najaf Health Directorate \ Al- Najaf center for cardiac surgery and catheterization. The study is conducted at Al- Najaf center for cardiac surgery and catheterization. A non-probability **(**purposive**)** sample of (52) patients, those who admitted to angioplasty unit and coronary care unit without any respiratory diseases. Patients were ischemic heart disease .The pulmonary functions measures for each patients' sample pre-angioplasty and post-angioplasty. Questionnaire form was developed by the researcher to obtain appropriate answers which including Part I: demographical data include: (age, gender, smoke, occupation, residency, weight, height, body mass index), Part II: clinical data include :(diagnosis, duration, and chronic disease), and Part III: include items about pulmonary function as following: forced vital capacity (The volume of air that can be maximally forcefully exhaled), forced expiration volume (volume that has been exhaled at the end of the first second of forced expiration), peak expiration flow rate (It is the peak flow rate during expiration) and this measures by spirometer is an apparatus for measuring the volume of air inspired and expired by the lungs. It measures ventilation, the movement of air into and out of the lungs. Spirometer is the mainly piece of equipment used for basic pulmonary function tests, measuring lung function, specifically the amount and speed of air that can be inhaled and exhaled. Spirometer with flow

volume loops assesses the mechanical properties of the respiratory system by measuring the expiratory volumes and flow rates .This test requires the patient to make a maximal inspiratory & expiratory effort. The patient in a sitting position breathes into a mouth piece and nose clips are placed to prevent air leak. It is essential that the patient gives full effort during testing**.** In this study the pulmonary function test was made to each patient before entering the operating room and after leaving the operating room to comparison between two results depending on the forced vital capacity, forced expiratory volume, and peak expiratory flow. At each assessment time, spirometer was performed at least three times to be able to meet the criteria of the European Respiratory Society (ERS). The validity of an instrument concerns its ability to gather the data that it is intended to gather. Content validity for the early developed instrument is determined through the use of panel of experts (who have more than 5 years of experience at their jobs field). A preliminary copy of the questionnaire was designed and presented to (6) experts. The data were interred into Spss (version 22) in order to describe the statistical results as follow (Frequency distribution, Bar chart, and independent t-test).

Study Results

Table (1) summery statistics for the study sample demographic data

Demographic Data	Rating And Intervals	Frequency	Percent
Age / years	30-39	4	7.7
	40.00 - 49.00	11	21.2
	50.00+	37	71.2
Gender	Male	42	80.8
	Female	10	19.2
Smoking	non	28	53.8
	Past	14	26.9
	Passive	1	1.9
	Smokers	9	17.3
Occupation	Governmental	10	19.2
	Free job	6	11.5
	Retired	12	23.1
	Housewife	7	13.5
	Jobless	17	32.7
Residency	Rural	16	30.8
	Urban	36	69.2
BMI	Normal	11	21.2
	Overweight	24	46.2
	Obese	17	32.7

Table (1) shows that higher of patient are within the age interval 50 and more years old (71%) and lower ratio of patients are in the age interval about<=39 years old(7.7%), most the study sample was male (80.8%), significant of body mass index is overweight (46.2%), more than third of the study sample with jobless is (32.7%), most of patient are non-smoker (53.8%).

Table (2) distribution of the study sample by their clinical data

Clinical Data	Rating And Intervals	Frequency	Percent
Medical diagnosis	Angina	30	57.7
	Myocardial infraction	22	42.3
Duration / years	Less than 1	26	49
	1.00 - 5.00	21	41.2
	6.00 - 10.00	2	3.9
	11.00+	3	5.9
Diabetes mellitus	No	28	53.8
	Yes	24	46.2
Hypertension	No	20	38.5
	Yes	32	61.5

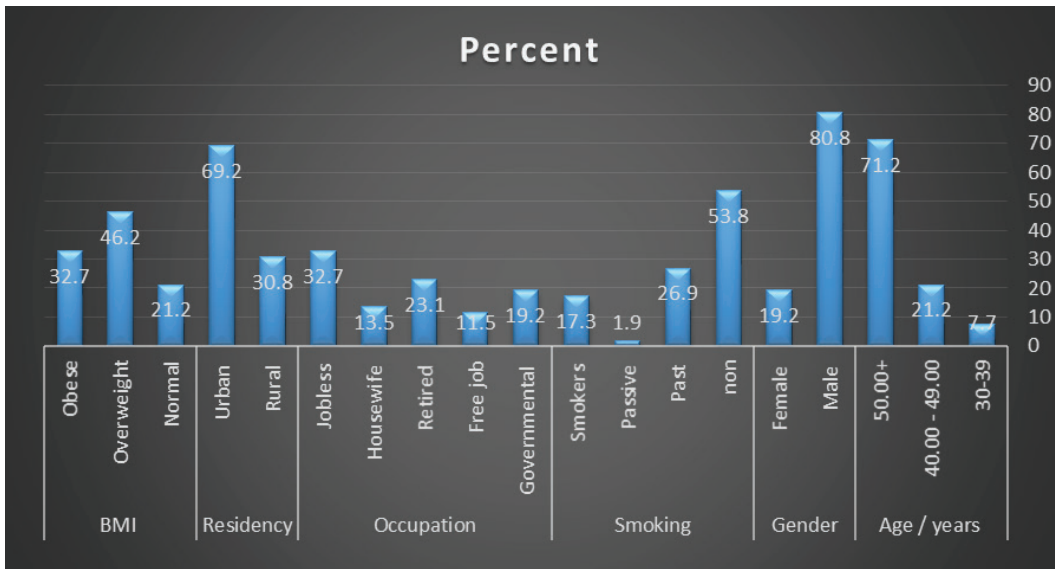

Figure (1) shows the distribution of the study sample.

This table show the more of the sample diagnosed with angina (57.7%), the duration of the ischemic heart disease for sample was less than 1 year (49%).finally, in the above table the result show the majority group of the study sample are within the hypertension (61.5%).

Table (3) Assessment of Patient's Lung Function Test Pre and Post Coronary Angioplasty

Lungs' capacities Statistics	**Post-procedure**			**Pre-procedure**		
	PEF	**FVC**	**FEV**	**PEF**	**FVC**	**FEV**
Mean	3.99	2.09	1.94	4.18	2.43	2.24
St. dev.	1.64	0.82	0.72	2.20	1.02	0.89

***PEF= peak expiratory flow (PEF), FVC= Forced expiratory volume, FEV= Forced expiratory volume, St. dev.= standard deviation**

This table shows that there is slow redaction in the mean between per and post cardiac angioplasty.

Table (4) Mean Difference of Patients Lungs' Capacities Pre and Post Coronary Angioplasty

lungs capacities	Pairs	Mean	Std. Dev.	t-value	df	p-value
FEV	Pre procedure	2.24	0.89	3.312	51	0.002 HS
	Post procedure	1.93	0.71			
FVC	Pre procedure	2.43	1.01	3.306	51	0.002 HS
	Post procedure	2.09	0.82			
PEF	Pre procedure	4.18	2.20	0.762	51	0.45 NS
	Post procedure	3.98	1.64			

*PEF= peak expiratory flow (PEF), FVC= Forced expiratory volume, FEV= Forced expiratory volume, St. dev.= standard deviation, df= degree of freedom, p-value= probability value, HS= highly significant, NS= non-significant.

This table indicate that there is high significant difference for the pulmonary functions pre and post cardiac catheterization at p value (0.05).

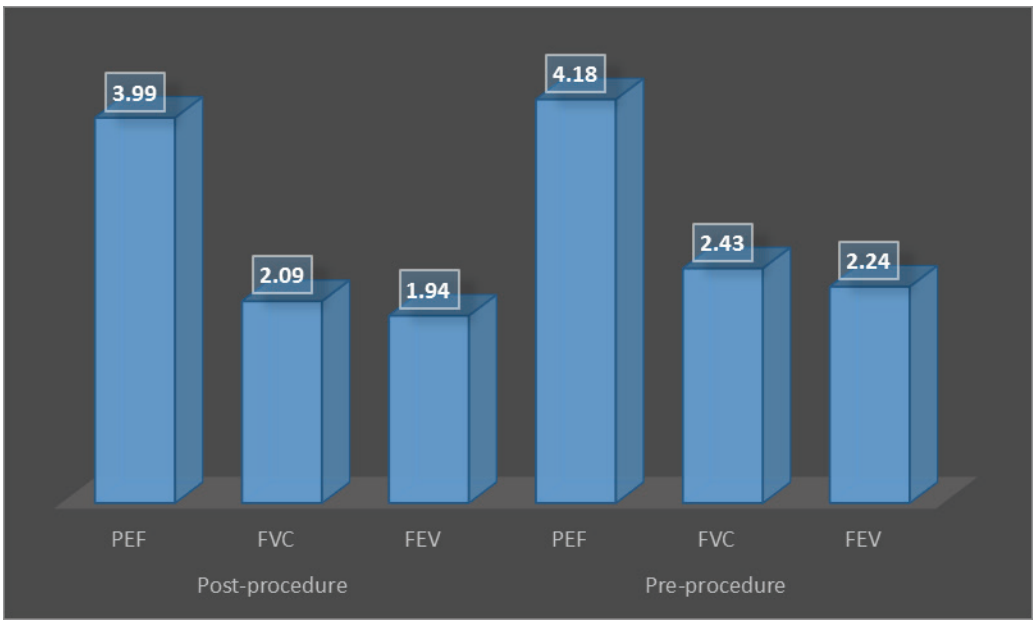

Figure (4) mean difference of patients' lungs capacities pre and post procedure

Discussion

The primary function of the lungs is to provide an adequate gas exchange for maintaining normal oxygen content in blood and eliminate carbon dioxide. This is achieved by optimizing lung volumes to meet higher metabolic demand during the peri-operative period. The factors affecting pulmonary function include loss of consciousness, mode of ventilation (spontaneous or mechanical), posture of patient, actions of anesthetic agents and drugs, used during anesthesia on respiratory smooth muscles and secretions. This study was made to describe the PFTs complications as result cardiac disease and cardiac surgery and procedures and to detect

the underlying causative factors. Spirometer test had been used as it is an objective, valid and reliable method to measure the PFTs. In addition, it is a non-invasive method that can be handled without any inconvenience to the patient especially after surgery Handojo et al. (2006) agreed with that with present study. In the table (1) and (2); the most of patient are within the age interval 50 and more years old (71%), (80.8%) were male, and the majority group of the study sample within the hypertension (61.5%). The study done by Nozari and Khazaeipour, (2012); their study results showed that the Mean age of men was 58±8.37 (35-75) years, and (48.69%) with history of hypertension. Asimakopoulos et al, (2005) reported that the range of age for patients underwent CABG procedure was between 55 to 75 years old. While other study has reported the mean of age was 57.6 years old (Reents, 2014). Marshal et Al., (2019) mentioned that the mean of age of all participants was 57.6 ± 4.6 years old. In this study, men were noted in 22 patients (62.9%) compared to 13 (37.1%) women. Majority of patients underwent CABG is men with comparison of 80% to 20% between men and women. Furthermore; table 3 & table 4 distinguished that there is high significant difference for the pulmonary functions pre and post coronary angioplasty. Which nearly similar to the results of the study done by Arabaci et al., (2003) found that after PCI the PFTs values decreased significantly in smokers and non-smokers patients but the deterioration in the smoker group was highly significant. In their study, patients in both groups developed a severe restrictive pulmonary defect after coronary artery catheterization ($P< 0.0001$ for both), but this restriction was also statistically significant in the smoking group compared to non-smokers after surgery. They applied comparison t-test between the smokers and non-smokers but did not correlate the factor of smoking habit with the pulmonary function as had been done in the current study. Önemlidir, (2018) claimed that the respiratory functions affecting morbidity and mortality in open heart surgery are the most important preoperative risk factors. After cardiopulmonary bypass, pulmonary function tests, especially in FEV1 and FVC, are reduced by 60-70 %. Impaired respiratory functions return to normal after 3-4 months. In addition to the poor pulmonary gas exchange it produces after cardiac catheterization. Chandra et al. (2006) found a significant deterioration in the pre discharge Spiro-metric values of FVC, FEV1, peak expiratory flow rate, flow rate at 25–75% of expired vital capacity.

Conclusion

The researchers are concluded that PCI and IHD result in low PFTs values of restrictive pattern. This study is documented that the patients post coronary angioplasty had lower PFTs values than pre coronary angioplasty. No definite causative factor appeared to be responsible for those results although mechanical deficiency. More comprehensive investigation is required to resolve the case.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Department of Adult nursing, College of nursing, Kufa University, Iraq and all experiments were carried out in accordance with approved guidelines.

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