IJC Metabolic & Endocrine 14 (2017) 67–71

Contents lists available at ScienceDirect

IJC Metabolic & Endocrine

journal homepage: http://www.journals.elsevier.com/ijc-metabolic-and-endocrine

# The effect of oxygen on the outcomes of non-ST-segment elevation acute coronary syndromes☆

Fatemeh Heidari [a], Kobra Rahzani [b,*], Daryoush Iranpoor [c], Korosh Rezaee [d]

[a] MSN, School Nursing and Midwifery, Arak University of medical sciences, Arak, Iran; MSN, School Nursing and Midwifery, Bushehr University of medical sciences, Bushehr, Iran
[b] Associated professor, School Nursing and Midwifery, Arak University of medical sciences, Arak, Iran
[c] Associated professor, School of Medicine, Bushehr University of medical sciences, Bushehr, Iran
[d] Instructor, School Nursing and Midwifery, Arak University of medical sciences, Arak, Iran

ARTICLE INFO

*Article history:*
Received 5 June 2015
Received in revised form 21 September 2016
Accepted 17 December 2016
Available online 13 January 2017

*Keywords:*
Acute coronary syndromes without ST-segment elevation
Outcomes
Oxygen therapy

ABSTRACT

*Background:* This study aims to investigate the effect of oxygen in patients with non-ST-segment elevation acute coronary syndromes(NSTE-ACS) and those without hypoxia.
*Methods:* In this clinical trial, the study population includes 72 patients (41 men and 31 women) aged 18 to 84 years old who were admitted to the emergency ward, diagnosed with NSTE-ACS, and had oxygen saturation level above 90% at the time of admission. By using the random sampling methods, the patients were divided into two groups: the intervention group (36) and the control group (36). In addition to the usual treatment in the first 6 h of admission to the emergency ward, the subjects in the intervention group received oxygen with nasal cannula at a rate of 4 to 6 l per minute, whereas the control group was given the same treatment with room air. Then we compared the incidence of some outcomes in the two groups.
*Results:* The Mann–Whitney *U* test indicated no significant difference between the means of dysrhythmia ($p = 0.141$) during the first 24 h, troponin ($p = 0.911$), left ventricular ejection fraction ($p = 0.419$), frequency of angina ($p = 0.214$), and consumption of opioid analgesics ($p = 0.297$) during the second 24 h and duration of hospitalization ($p = 0.887$).
*Conclusion:* The use of supplemental oxygen ($FiO_2$: 40–45%) has no significant impact on clinical outcomes in patients with NSTE-ACS without hypoxia. Therefore, it is recommended that its routine use in patients without hypoxia be limited.


## 1. Introduction

Coronary artery disease is one of the major causes of death in the world [1]. It is estimated that cardiovascular disease caused by atherosclerosis would be on the top of all the diseases by 2020 [2]. Coronary artery diseases cause acute ischemic heart attacks [3] and a broad range of ischemic diseases. A group of these patients are those who have the acute coronary syndrome including those suffering from acute myocardial infarction with or without the ST-segment elevation in the electrocardiogram and those with unstable angina [2]. Every year, almost one million people are hospitalized due to unstable angina and myocardial infarction without the ST-segment elevation [2,4]. It was estimated that over $150 billion had been spent both directly and indirectly on the coronary artery disease in US in 2007 [5]. Pathophysiology of myocardial ischemia refers to the myocardial supply and demand. Under normal conditions, whatever the oxygen amount of myocardial requirement is, it can be supplied by the blood which is rich in oxygen. This prevents the occurrence of myocardial ischemia and infarction. A variety of factors could contribute to the decrease in the supply of blood to the myocardium with atherosclerosis as one of the most known. Under such conditions, myocardial ischemic occurs. Regarding the mentioned pathophysiology, the treatment of acute coronary syndrome includes nitrates, beta-blockers, aspirin, angiotensin converting enzyme inhibitors, and oxygen. There is a general consensus about the prescription of aspirin, nitrates, and beta-blockers to treat these patients [2], but there is controversy surrounding the use of oxygen. Over the years, experimental laboratory data have recommended the use of oxygen for patients who suffer from myocardial infarction [6–8]. The use of oxygen in patients who have hypoxia, i.e. those whose blood oxygen saturation levels are lower than 90% [4], has been accepted on the world that increases oxygen delivery to cells and improves the effects of hypoxia [1,2]. However, the value of oxygen therapy in patients with normal oxygen saturation level is unknown. Prescription of oxygen, on the one hand, could improve the oxygen supply to the myocardial ischemic tissue [7,9–13], and there is also

☆ With acknowledgement of grant support from Arak University of Medical Science and Bushehr University of Medical Science.
* Corresponding author.
*E-mail address:* dr.rahzani@arakmu.ac.ir (K. Rahzani).

http://dx.doi.org/10.1016/j.ijcme.2016.12.002

the paradoxical mechanism of oxygen, on the other hand, which could reduce the coronary arteries blood flow by increasing their resistance [8,14–17]. Moreover, raising the oxygen level in patients with normal blood oxygen levels, leads to the increase of peripheral vascular resistance and impaired reperfusion due to the increase of oxygen free radicals [7].

Therefore, the literature has largely introduced the use of oxygen, irrespective of its saturation level in the subject's blood, as one of the main elements in curing patients who suffer from acute myocardial infarction. Based on the latest treatment guidelines published by American Heart Association in 2011, it is logical to use oxygen for the subjects in the first 6 h of hospitalization. However, the same guidelines introduce the use of oxygen in patients with acute myocardial infarction at level of evidence C. In other words, there are limited clinical trial studies in this field and the existing recommendations are based on experts' agreements. Nowadays, 96% of doctors prescribe oxygen for myocardial infarction regardless of the fact that its disadvantages outweigh its advantages [18]. The last meta-analysis conducted in 2012 and entitled "Oxygen Therapy for Acute Myocardial Infarction" shows that the clinical evidence regarding these cases are limited and the existing studies are of low quality [7]. Hence, we essentially need more studies to clarify the effect of oxygen on acute myocardial infarction. The literature review revealed that none of the studies that have been done so far have specifically examined patients with unstable angina or acute myocardial infarction without ST-segment elevation. Neither have they investigated the effect of oxygen and room air in patients without hypoxia. Therefore, in light of the conflicts about the application of oxygen in patients suffering from the coronary artery disease, this study aimed to determine the effect of oxygen therapy on the outcomes of unstable angina and myocardial infarction without ST-segment elevation.

## 2. Methods

This study is a triple-blind clinical trial. After receiving the code of ethics with the license number B-93-16-7 from Bushehr University of Medical Sciences and the IRCT registration number N12014081118768, we examined 79 patients diagnosed with acute coronary syndromes without ST-segment elevation and hospitalized in the heart emergency ward between December to November 2014. The study began with convenience sampling and continued with random allocation. The patients participated in the study with informed consent and ranged from 18 to 84 years old. They did not have any clinical evidence of heart failure, chronic pulmonary disease, or respiratory problems for any reason. Prior to admission to hospital, they had not experienced cardiac arrest or cardiogenic shock, and their blood oxygen saturation level was above 90% at the time of admission. Exclusion criteria included the following: patients who required inotropic agents, incidence of acute myocardial infarction with ST-segment elevation, and experienced blood oxygen saturation levels lower than 90% during hospitalization and those transferred to other centers or discharged without order of physician, or were not unwilling to continue the study. The patients were randomly categorized into two groups: intervention (oxygen therapy) and control (room air). On arrival, the demographic information, past medical history, and oxygen saturation levels of the patients were recorded. In the first 6 h of admission, the intervention group was prescribed 4 to 6 l of oxygen per minute through nasal catheters, while the control group was given the room air in the same manner. To evaluate the incidences of dysrhythmia and hypoxia in both groups, continuous monitoring of cardiac rhythm and blood oxygen saturation levels was carried out. Necrosis cardiac biomarker (troponin I) was measured both on admission and 4 to 8 h afterward. Echocardiography was done to compare ejection fraction in both groups after the first 6 h and also during the first 24 h of hospitalization. The incidence of ventricular and atrial dysrhythmia in first 24 h, analgesics consumption, and the incidence of angina during second 24 h were recorded. The examined outcomes in this study include the number and type of dysrhythmia during the first 24 h of hospitalization, increased biomarker troponin I, left ventricular ejection fraction, chest angina, and narcotic analgesics consumption during the second 24 h and length of hospitalization. Data analysis was done using the SPSS software (ver. 19) utilizing chi-square, independent *t*-test, and Mann–Whitney *U* test.

## 3. Results

The study population include 79 subjects (40 patients in the control group and 39 patients in the intervention group). Seventy-to subjects (36 individuals in each group) completed the study, which was in accordance with the numbers calculated in statistical methods for each group. Based on the chi-square test, the groups were homogeneous in terms of gender and the major risk factors (such as diabetes, dyslipidemia, hypertension, history of coronary artery disease, and smoking) and coronary artery angiography results (Table 1). Furthermore, the independent *t*-test showed that the two groups were not significantly different in terms of age, body mass index, blood pressure (systolic and diastolic), and heart rate at the time of admission to hospital (Table 2). Based on Mann–Whitney *U* test, the groups were homogeneous in terms of the arterial oxygen saturation levels and troponin result variables on arrival at the hospital (Table 3). The Mann–Whitney *U* test was used to evaluate both groups in terms of the mean of premature atrial or ventricular contractions per hour, the frequency of atrial fibrillation, paroxysmal atrial tachycardia, couplet PVC and ventricular rhythm during the first 24 h of hospitalization, ejection fraction based on the results of transthoracic Doppler echocardiography, troponin test result for the second time, the frequency of chest pain in the second 24 h of hospitalization, and the use of narcotic analgesics, where no significant differences were observed (Table 4).

## 4. Discussion

This study was designed to investigate the influence of oxygen on the outcomes of acute coronary syndromes without ST-segment elevation in patients without hypoxia. In this regard, the results showed no difference between the intervention group (oxygen therapy with nasal cannula ($FiO_2$: 45%)) and the control group (placebo: room air with nasal cannula ($FiO_2$: 21%)) in terms of demographic variables

**Table 1**
Characteristics of patient.

| Factor | | Intervention frequency(%) | Control frequency(%) | *p*-value with chi-square test |
|---|---|---|---|---|
| Male | | 27 (67.5%) | 18 (46.2%) | 0.05 |
| Hypertension | | 22 (56.4%) | 22 (56.4%) | |
| Diabetes | | 14 (35.9%) | 18 (46.2%) | 0.36 |
| Smoking | | 15 (38.5%) | 13 (33.3%) | 0.64 |
| History of vascular disease | | 20 (51.3%) | 19 (48.7%) | 0.82 |
| Dyslipidemia | | 15 (38.5%) | 17 (43.6%) | 0.64 |
| | Irredenta | 14 (35%) | 16 (41%) | |
| | Accomplished angioplasty | 7 (17.5%) | 8 (20.5%) | |
| | Nomination for coronary bypass graft | 14 (35%) | 9 (23.1%) | |
| Angiography result | Normal coronary artery | 5 (12.5%) | 6 (15.4%) | 0.71 |