

## Oxygen supplementation in acute myocardial infarction: To be or not to be?

The Editor,

A 55-year-old gentleman presented with severe chest pain for 2 h. He was admitted to Intensive Care Unit. On evaluation, his heart rate was 90/min and blood pressure 130/70 mmHg. Respiratory system examination did not reveal crepitation and pulse oximetry saturation was 97% on room air. Electrocardiogram showed ST elevation in anterior leads suggestive of anterior wall ST elevation myocardial infarction (STEMI). Attending clinician-administered intravenous morphine to alleviate anxiety and pain. Oxygen by face mask was applied. Intravenous nitroglycerin infusion was started. Loading dose of antiplatelet drugs clopidogrel 600 mg and aspirin 325 mg were administered, and the patient was shifted to cardiac catheterization laboratory for coronary angiography which revealed 90% obstructive lesion in mid left anterior descending artery. Coronary angioplasty with drug-eluting stent was performed. Oxygen by face mask was continued throughout the procedure.

We all encounter such common situations in routine clinical practice. Morphine, oxygen, nitrates, antiplatelets (MONA) has become the standard treatment for acute myocardial infarction (AMI) patient. Oxygen is a lifesaving drug. Giving oxygen to patient with impending clinical emergency has become knee-jerk reflex reaction of clinician. Patient with AMI has compromised myocardial perfusion and event arises due to myocardial hypoxia. It appears quite logical and biologically plausible to give oxygen in such situations to improve the oxygenation of the ischemic myocardial tissue and decrease ischemic pain.

On the other side, oxygen may be harmful with mechanism such as paradoxical effect

of oxygen in decreasing coronary artery blood flow and increasing coronary vascular resistance, measured by intracoronary Doppler ultrasonography,<sup>[1,2]</sup> decrease in cardiac output and stroke volume,<sup>[3]</sup> hyperoxia causing increased vascular resistance, and reperfusion injury due to increased oxygen free radicals.<sup>[4]</sup>

A survey among doctors managing AMI cases showed that oxygen supplementation was given to 96% of their patients with acute coronary syndrome. About 50% of participants believed that oxygen reduces fatality, 25% thought it is helpful in decreasing pain, and 25% thought it has no effect.<sup>[5]</sup> Oxygen therapy has been used for more than 100 years unquestionably, most of the times on the basis of anecdotal evidence, expert opinion, and tradition. However, recent intriguing evidences have challenged this conventional thinking.

Nonrandomized studies by Nicholson showed oxygen can raise myocardial ischemia.<sup>[6]</sup> Beasley *et al.* gave a cautionary note on oxygen therapy.<sup>[7]</sup> Wijesinghe *et al.* in an illustrative review suggested that efficacy and safety of high flow oxygen in MI is not substantial, but the existing evidence suggests that the routine use of high flow oxygen in uncomplicated MI can cause greater infarct size and possibly increase the risk of mortality.<sup>[8]</sup> In Cochrane systemic review by Cabello *et al.*, did not find any conclusive evidence from randomized controlled trials (four parallel-design, randomized controlled trials reported between 1976 and 2012) to support the routine use of inhaled oxygen in patients with acute AMI.<sup>[9]</sup> However, poor quality of the included studies and inappropriately measured infarct size in a subset of the study population, the risk of bias was high for the outcomes. An adequately powered, definitive randomized controlled

trial is advisable to draw firm recommendations for its use in clinical practice guidelines.<sup>[9]</sup>

Recently, published Air Verses Oxygen In myocardial infarction study (AVOID Study) suggested routine oxygen supplementation to AMI patients from the ambulance through to the recovery room might actually be hurting their hearts.<sup>[10]</sup> AVOID was a randomized, controlled, multicenter trial with the aim of comparing oxygen supplementation (6–8 L/min) with no oxygen in STEMI patients with oxygen saturation in the normal range pulse oximetry saturation >94%. Study found a significant 25% increase in creatine kinase suggestive of increased myocardial injury and cardiac magnetic resonance imaging (cardiovascular magnetic resonance) at 6 months suggestive of larger infarction size with oxygen therapy. Although mortality was similar in both groups, significant increases in recurrent MI and arrhythmias were observed in the oxygen group. Even though AVOID Study used higher oxygen flow 6–8 L/min (more than usual clinical practice) and study was not powered for hard clinical end points, AVOID trial would really question the current practice of oxygen supplementation to all patients with acute myocardial ischemia and definitely to those with normoxia.

This subject is being further studied by researchers with the Swedish Coronary Angiography and Angioplasty Registry in an open-label randomized trial DETO<sub>2</sub>X-AMI (with more than 5000 enrolled patients in multi centers) with mortality as the primary endpoint. Results are awaited which may have definitive conclusive evidence.

American Heart Association Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care recommends oxygen in patients with dyspnea, hypoxemic, or with signs of heart failure and shock, based on monitoring of oxyhemoglobin saturation, to  $\geq 94\%$  (Class I, LOE C).<sup>[11]</sup> However, evidence to support oxygen use in uncomplicated acute coronary syndromes is inadequate.<sup>[11]</sup>

Oxygen overdose is not a new but the way we use oxygen in coronary emergency needs reconsideration. Changes in CPR ratios have occurred over the years as resuscitation guidelines are reviewed with credential new evidences. ABC (Airway, breathing, and compression) of resuscitation has changed to CAB (compression, airway, and breathing). Perioperative liberal fluid use has changed to restrictive fluid

strategy. Time has come to reassess oxygen treatment in acute coronary syndrome. Clinical practice should be based on proven benefits and safety, not on tradition. Oxygen is a life-saving drug and how much you give the patients depends on how much they need.

Oxygen must be administered to hypoxic patient, but in normoxia, has the time come to break up with MONA? The question remains unanswered until new strong evidence comes.

Change always comes bearing gifts. ~ Price Pritchett.

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There are no conflicts of interest.

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