Palestinian Medical and Pharmaceutical Journal (PMPJ). 2020; 5(1): 65-73

Recommendations for safe and effective practice of interventional cardiology during COVID-19 pandemic: Expert opinion from Jordan and Palestine

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Received: (31/3/2020), Accepted: (5/4/2020)

ABSTRACT

Corona Virus Disease 2019 (COVID-19) is a worldwide pandemic with a high mortality rate (2% to 5%) and a high infectivity compared with previous known viral respiratory illness. Data has shown that medical personnel were infected more than other people. Therefore, health care providers had to establish new protocols that balance between health care providers' protection and patients' benefit, and guarantee the availability of medical resources in cases of emergency. This article presents several recommendations and protocols for invasive management of coronary artery disease in our region during the COVID-19 pandemic especially after the recent increase in the number of cases in our region. We expect that these recommendations will help protect medical personnel in cardiology field from the high risk of infection of COVID-19, and eventually this would keep the cardiology team available in case of emergency. In addition, they will provide safe and effective management of patients with coronary artery disease during this pandemic.

Keywords: COVID-19; Coronary artery disease, acute coronary syndrome, STEMI, PCI.

INTRODUCTION

Corona Virus Disease 2019 (COVID-19) is a global pandemic that is caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)[1, 2]. It is a highly contagious virus which puts an enormous strain on the healthcare providers. The total global number of COVID-19 cases has surpassed 1 million with over 40,000 mortalities in 4 April 2020 [3]. In Palestine and Jordan, the number of cases has been increasing since the first case was confirmed in the beginning of March 2020. The total number in Palestine was over 100 cases at the time of writing this report (about 23 cases per 1 million of population), while it exceeded 250 cases in Jordan (about 26 cases per 1 million of population)[3]. Data showed that the number of health care providers who were infected by COVID-19 was higher than the number of infected workers in different sectors. For instance, 3300 health care workers in China were infected by COVID-19 by the beginning of March 2020, and 20% of health care providers were infected in Italy [4, 5].

Impact of COVID-19 on cardiovascular patients

Acute cardiac injury - which is defined as elevated troponin >99th percentile, and new abnormalities in electrocardiogram (ECG) and Echo - was found in 12-19 % of patients with COVID-19 infection. Acute cardiac injury is seen more in patients with comorbidities like hypertension (HTN), diabetes mellitus (DM), coronary heart disease (CHD) (10 % of total patients had CHD), and cerebrovascular disease (CVD). It also carries higher risk of mortality among this type of patients.[1, 6].

As COVID-19 is a highly contagious disease, invasive treatment for coronary artery disease became more risky and challeng-

ing. Therefore, cardiac societies in different regions in the world have published new recommendations for the management of coronary artery disease patients to balance between the benefit of management and the risk of COVID-19 infection [7, 8]. China and the United States published their experience in this field which mainly pointed toward the following: to avoid elective cases, to avoid entering suspected patient with COVID-19 to the catheterization laboratory as much as possible, to prepare the team with maximum personal protective equipment (PPE) when percutaneous coronary intervention (PCI) is necessary, and to perform the procedure in an isolated room. It has also been emphasized that PCI was considered only in selected cases like ST elevation myocardial infarction (STEMI) with contraindication to thrombolysis, or myocardial infarction (MI) with hemodynamic instability and fatal arrhythmia [9-11].

It should be mentioned that these recommendations were provided for countries with high prevalence of COVID-19. However, prevalence in our region is increasing day after day.

Mortality in myocardial infarction

Myocardial infarction (MI) is considered the leading cause of death worldwide.[12] However, with the improvement in the management strategies including percutaneous coronary intervention (PCI) and thrombolysis, mortality due to MI has gradually decreased over the last decades. Despite this improvement, myocardial infarction is still responsible for one third of all deaths around the world.

The reported overall 30-day mortality after myocardial infarction is around 5%.[13] Higher rate of morality was reported in STEMI (up to 10%) compared with non-ST elevation myocardial infarction (NSTEMI) (about 2%). [13, 14] The reported rate of mortality (30-day mortality rate) among patients with STEMI varies according to the type of management strategy, it is 13% with medical therapy alone, 6-7% with optimal use of thrombolysis,[15] and only 3-5 % if PCI performed according to the guidelines [16, 17].

Regarding NSTEMI patients, invasive management has almost a close rate of mortality in short and long term compared to conservative management despite the fact that invasive strategy reduced recurrent MI.[18] On the other hand, a recent meta-analysis showed that invasive management could reduce mortality in high risk NSTEMI patient.[19].

Mortality of MI According to the Infarcted Related Artery

Right coronary artery (RCA) and left circumflex artery (LCX) were the most common infarct related artery in STEMI and NSTEMI (49.9% and 48.4% respectively). The highest infarct related artery mortality was related to total occlusion of left anterior descending artery (LAD) (reached 19 % over 36 months) followed by LCX (16% over 36 months) and lastly RCA (11 % over 36 months). In patients with NSTEMI, mortality was comparable between patient with total occlusion and non-total occlusion. It was higher in LCX artery occlusion (around 16% over 36 months) followed by LAD and RCA (both around 12%) [20].

Rules for cardiac procedures and interventions in COVID-19 pandemic

As it was mentioned earlier, COVID-19 is an extremely contagious infection with serious impact on cardiovascular patients and health care workers in cardiology field. Hence, a group of interventional cardiologists, ICU specialists and internists from Palestine and Jordan have discussed this issue through the different means of social media. They came up with several recommendations based on their expertise and the review of available relevant literature in order to be sure of giving patients with coronary artery disease the benefit and best practice without compromising their safety and the safety of the hospital staff during the utilization of catheterization laboratory.

Safety Measures inside the Catheterization laboratory

1. All patients entering the catheterization laboratory should wear surgical face mask.

2. Radial approach is preferred over femoral because of longer face to radial distance and less time of staff contact for homeostasis.
3. No running nurse is needed in the catheterization laboratory to avoid the in- and out- from the catheterization laboratory, doors must be closed and no doors open between catheterization laboratory and monitoring area.
4. Cardiac catheterization laboratory staff should be divided into team A and team B to limit the number that is needed to be isolated in case of contact with COVID-19 patients.

Elective procedures

Due to SARS-CoV-2 pandemic which has placed a huge burden on the healthcare system, many hospitals around the world have decided to delay elective cardiac intervention during the COVID-19 pandemic. This step aims to save resources and to decrease the exposure of patients to the hospital environment where the chance to get infected with COVID-19 might be higher than anywhere else, in addition to decrease the risk of staff to acquire this potentially serious infection.

Therefore, we recommend the following:

1. Avoid elective procedures for patients with multiple comorbidities or patients who may require long stay in the hospital in order to maintain hospital beds available.
2. Delay the elective cardiac procedures or intervention for stable ischemic heart disease with non-life-threatening presentation. This should be based on clinical judgment to avoid any harmful effects.
3. Avoid complex intervention in patients with stable ischemic heart disease (left main, chronic total occlusion, complex bifurcation) as they may require urgent Coronary artery bypass grafting (CABG) in case of complication.
4. Delay elective structural cardiac intervention:
    a. Transcatheter aortic valve implantation (TAVI) should be delayed unless severe decompensated aortic stenosis (AS), e.g. causing severe heart failure.
    b. All Mitral Clip and Left atrial appendage closure procedures should be delayed.
5. Delay CABG surgery as it needs more staff, more ventilators and more ICU beds.
6. Transesophageal Echo (TEE) procedure should be avoided due to high risk of infected droplet exposure.

Acute Coronary Syndrome (ACS)

All Acute Coronary Syndrome (ACS) patients should be tested for COVID-19 if test is available. However, this is a debatable subject in our region since the access to rapid testing is very limited. Therefore, it requires clinical judgment that is based on clinical symptoms and epidemiological [11, 21-23] history to define patients at high risk for COVID-19 infection as clarified in Table 1.

Table (1): Patients' clinical assessment for COVID-19 infection.

A. Confirmed case of COVID-19	A confirmed case is a person **with laboratory confirmation of infection with the COVID-19 virus**, irrespective of clinical signs and symptoms.
B. Probable case of COVID-19	✓ A case for whom the report from laboratory testing for the COVID-19 virus is inconclusive.
C. High risk for COVID-19	**✓ A patient with acute respiratory illness (that is, fever and at least one sign or symptom of respiratory disease, for example, cough or shortness of breath)** **AND** **✓ No other etiology that fully explains the clinical presentation** **AND**

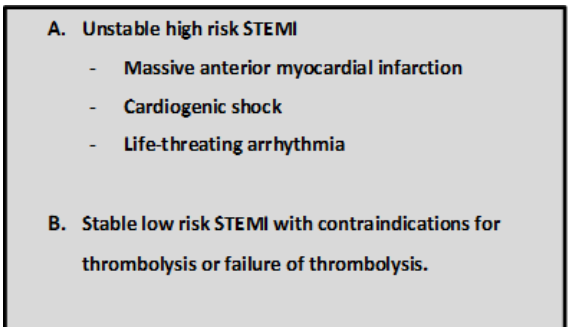
	✓ **A history of travel to or residence in a country area or territory that has reported local transmission of Corona Virus Disease-19 (COVID-19) during the last 14 days prior to symptom.**
	✓ A patient with any acute respiratory illness **AND** ✓ Who has been a contact of a confirmed or probable case of COVID-19 during the last 14 days prior to the onset of symptoms.
D. Intermediate risk for COVID-19	✓ A person with a history of travel to or residence in a country area or territory that has reported local transmission of Corona Virus Disease-19 (COVID-19) during the last 14 days. **OR** ✓ Who has been at contact with confirmed or probable case of COVID-19 during the last 14 days. **AND** ✓ No symptoms of acute Respiratory illness.
E. Low risk for COVID-19	✓ No symptoms of acute respiratory illness **AND** ✓ No history of travel to or residence in a country area or territory that has reported local transmission of Corona Virus Disease-19 (COVID-19) **AND** ✓ Contact confirmed or probable case of COVID-19 during the last 14 days.

A. ST elevation Myocardial (STEMI) patients

For patients with STEMI (Table 2), we recommend the following Figure 1:

1. All patients should have an ECG with extended leads (V7-V9, V4R-V6R) to exclude right ventricular and posterior infarction.
2. All patients with confirmed or probable COVID-19 or at high to intermediate risk for COVID-19 should be managed in a way that preserves balance between staff exposure and patients' benefit as follows:
   a. Thrombolysis is considered a good option for stable low risk STEMI patient (e.g. inferior STEMI without right ventricular involvement or lateral myocardial infarction without hemodynamic compromise) when they present within 12 hours, and no contraindication to thrombolysis.
   b. PCI is considered in certain conditions after applying maximum protection to prevent staff exposure including effective personal protective equipment (PPE). Moreover, PCI should only be performed to the culprit vessel unless a non-culprit lesion is deemed unstable or multiple culprit lesions are present.

Table (2): Conditions in which PCI is considered for patients with STEMI.



All the above recommendations are not applied if risks are more than benefits such as COVID-19 pneumonia, in this case the patient will be treated with thrombolysis in the Cardiac Care Unit (CCU). If successfully reperfused (pain relief, ST resolution > 50 %, reperfusion arrhythmia), elective PCI will be considered after recovery from COVID-19 infection. The need for terminal cleaning is highly required after procedures on suspected or known COVID-19 patients. Therefore, these cases should be done at the end of the working day if possible. Moreover, the re-

striction of cases to a dedicated cath laboratory would be of value if that is possible.

c. When thrombolysis is contraindicated or beyond reperfusion window and the PCI can't be performed due to high risk on staff, patients will be treated conservatively in the CCU (Antiplatelet, anticoagulation for 48 hrs, high intensity statin, B-Blockers/ACE-inhibitors as tolerated).

3. Patients with low risk for COVID 19 should be managed with PCI if hospital resources and capabilities allowed, otherwise thrombolysis will be considered when indicated.

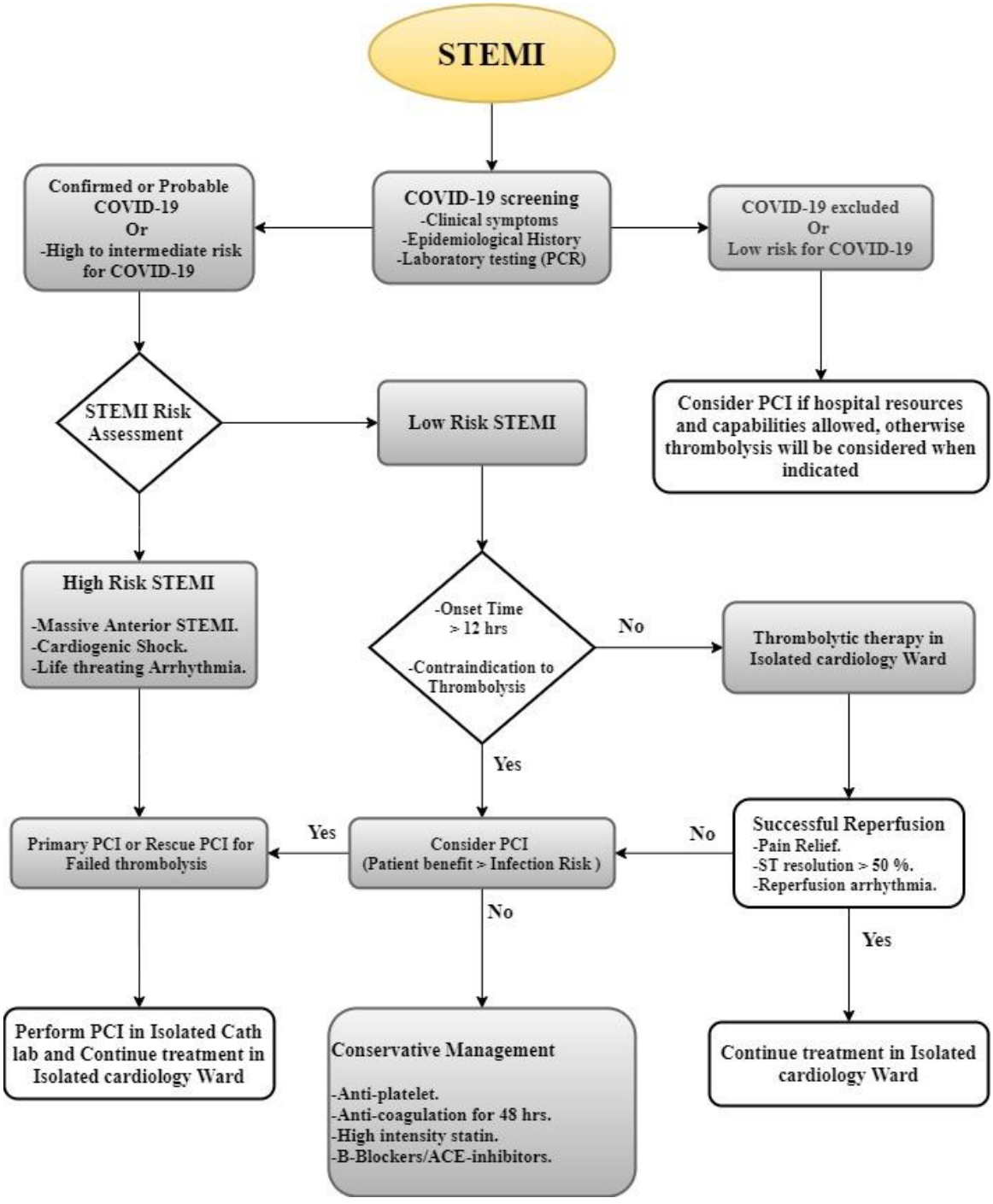


Figure (1): Management algorithm for patient with STEMI during COVID -19 pandemic. STEMI: ST segment elevation myocardial infarction, COVID-19: Corona-virus disease 2019, PCR: Polymerase chain reaction, PCI: Percutaneous coronary intervention.

B. Non ST-Elevation Acute Coronary Syndrome (NSTE-ACS)

For most patients with NSTE-ACS and suspected COVID-19, time usually allows for screening for COVID-19 before cardiac catheterization, in addition to more infection control measure that can be applied.

With respect to the above mentioned, we suggest the following (Figure 2):

1. All NSTE-ACS patients should have extended leads ECG (V7-V9) to exclude LCX occlusion.
2. Patients with confirmed or probable COVID-19 or at high to intermediate risk for COVID-19 should be managed in a way that preserves balance between staff exposure and patients' benefit as follow:
   a. A conservative management (Antiplatelet, anticoagulation for 48 hrs, high intensity statin, B-Blockers/ ACE-inhibitors) is considered a good option for the relatively stable low risk NSTE-ACS patient.
   b. Early Angiography (<2hrs) Can be considered in high risk NSTE-ACS:
      – Refractory chest pain
      – Cardiogenic Shock
      – Life threatening arrhythmia
3. Patients with low risk for COVID 19 can be managed as follow:
   a. Admit to CCU for Conservative management (Antiplatelet, anticoagulation for 48 hrs., high intensity statin, B-Blockers/ACE-inhibitors)
   b. Consider Angiography (within 24 hrs.) for high risk NSTE-ACS (GRACE score > 140, dynamic ST segment changes, significant rise and fall of troponin) if hospital resources allow.

It should be noted that patients with NSTE-ACS should be discharged immediately after angiography in order to maximize bed availability and to reduce patients' exposure within the hospital.

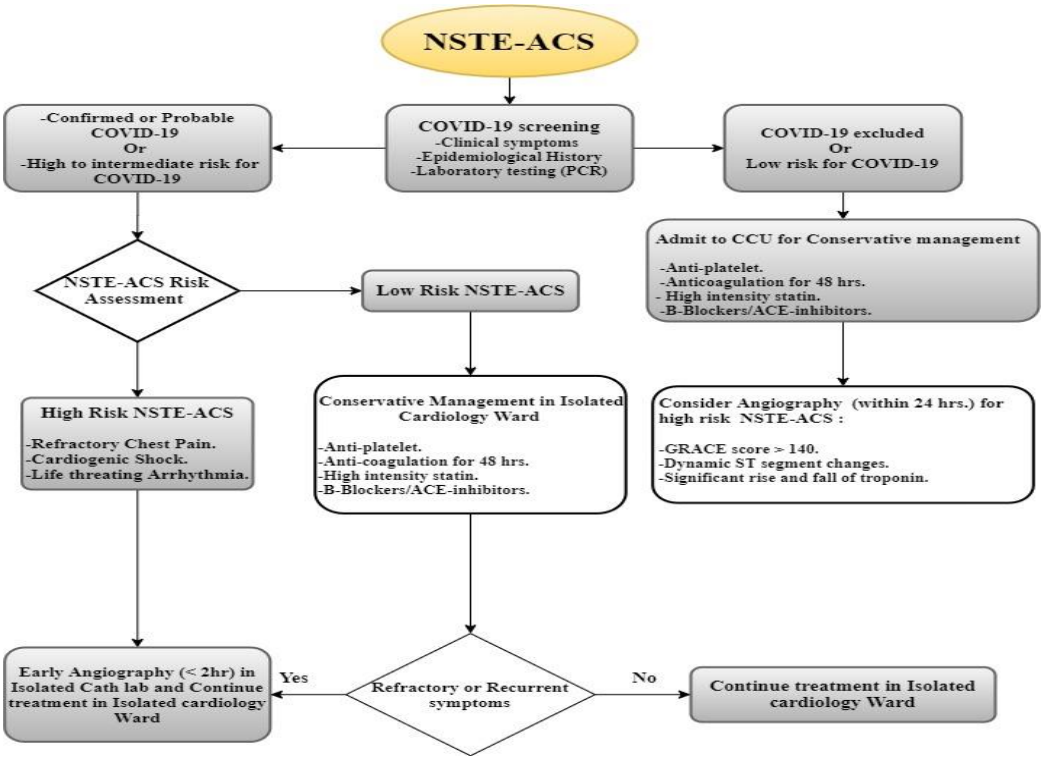


Figure (2): Management algorithm for patient with NSE-ACS during COVID -19 pandemic. NST-ACS: Non ST segment elevation acute coronary syndrome, COVID-19: Corona-virus disease 2019, PCR: Polymerase chain reaction, PCI: Percutaneous coronary intervention.

Intubation and CPR in COVID-19 patients

When dealing with cardiac arrest in patients with COVID-19, intubation and CPR will cause aerosolization of respiratory secretions. This will increase the possibility of exposure to personnel. Therefore, Intubation of patients before arrival to cardiac catheterization will reduce the risk of staff exposure to patients' secretion.

With reference to the above, in suspected or confirmed COVID-19, we recommend:

1. Intubate patients who need to be intubated before arrival to the cardiac catheterization.
2. Consider the following if intubation is a must inside the cardiac catheterization:
    a. Personnel number should be minimized in order to decrease the staff exposure.
    b. Rapid Sequence Intubation (RSI) by professional trained personnel should be done in order to improve success and decrease exposure time.
    c. Bag valve mask ventilation (BVM) should not be allowed. ET tube should be inserted quickly and successfully from the first attempt.
3. Take these recommendations into account if cardiopulmonary resuscitation (CPR) is required in COVID-19 patients:
    a. Use Personnel protective equipment (PPE) including:
        – N95 respirator, face shield, gown and gloves be used by all code responders during code events
        – Place surgical mask on the patient's face.
    b. Reduce the number of staff in the CPR proximity.
    c. An automated compression device "Lucas device" should be used if available.
    d. CPR should be done by chest compression-only without BVM ventilation until definitive airway is secured.
    e. Defibrillate as soon as possible if the patient has shockable rhythm (Ventricular Fibrillation /Ventricular tachycardia). Chest Bad should be used if available.
    f. During CPR, air way management should be done as follows:
        – Start with Rapid Sequence Intubation as soon as you can to minimize aerosolization in case the patient does not have a shockable rhythm.
        – Provide oxygen through a non-rebreather face mask at 15L/min before securing a definitive airway.
        – Reduce aerosolized virus by avoiding BVM ventilation, high-flow nasal cannula, and non-invasive ventilation (CPAP, BiPAP)
        – Put a surgical face-mask and a blanket over the patient's face before starting chest compressions if passive oxygen is not available.
        – Consider Laryngeal Mask Airway (LMA) when pauses in chest compressions are excessive and ET tube insertion is difficult.
        – Keep the Code Blue Team away from the head of the bed during the intubation.

Conclusions and Recommendations

COVID 19 is a pandemic disease with high contagious rates that affected around 1 million populations all over the world. The high contagious rates of this serious infection as well as the excessive mortality rates have overwhelmed the health care sector and have emplaced a huge burden on medical resources. This paper provides scientific evidence in addition to expert opinion on safe practice of cardiovascular medicine in Palestine and Jordan (including invasive cardiolo-

gy intervention for coronary artery disease) during the pandemic period with consideration of the prevalence of the disease in our region.

Our recommendations emphasize on testing every patient with acute coronary syndrome (ACS) for COVID-19 if possible, or categorizing patients into low, intermediate or high risk if testing is not available with specific recommendations according to each category and patients presentation. The recommendations also focus on avoiding elective procedures during the pandemic and taking specific precautions if invasive intervention is mandatory. It should be mentioned that these recommendations are time limited and only applicable to the pandemic period. The previous recommendations, however, would be applied again once the pandemic is over.

ACKNOWLEDGEMENT

The Authors acknowledge Mrs. Rawan J. Hamad for her effort in printing and editing this manuscript

COMPETING INTERESTS

The authors declare that they have no competing interests.

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