New Strategy to Prevent Acute Myocardial Infarction by Public Education
— A Position Statement of the Committee on Public Education About Emergency Medical Care of the Japanese Circulation Society —

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Although many efforts have been made to prevent death from acute myocardial infarction (MI) by quick revascularization therapy and use of mechanical circulation support devices, and to prevent the occurrence of acute MI by optimal medical therapy, acute MI is still a leading cause of death worldwide. Because the majority of fatal MI cases occur outside hospital and death occurs so rapidly after MI onset, it is difficult to effectively prevent deaths from acute MI by improving the in-hospital treatment strategy of acute MI or by reducing the prehospital delay in the treatment. Therefore, we need a new strategy to prevent death from acute MI, mainly by preventing the occurrence of acute MI itself. In this review, we summarize the present status and propose a new strategy, the "STOP MI Campaign", to prevent acute MI by public education.

Key Words: Acute myocardial infarction; Pre-infarction angina; Prevention; Public education

Background

In-hospital mortality rate of patients with acute myocardial infarction (MI) has greatly decreased to <10% due to advanced treatment after hospital admission, including primary coronary intervention and mechanical circulation support devices. However, acute MI is still a life-threatening disease worldwide, because there are so many cases of out-of-hospital cardiac arrest and death before hospitalization caused by acute MI. Furthermore, we cannot adequately prevent the occurrence of acute MI, although many risk factors (e.g., diabetes mellitus, dyslipidemia, hypertension, obesity, and smoking) have been identified and are treated by optimal medical therapy. Although antithrombotic therapy can reduce the occurrence of acute MI to some degree, it has the limitation of increasing the incidence of bleeding events.[1,2]

Therefore, we need a new strategy to prevent deaths from acute MI, mainly by preventing the fatal event itself rather than by improving the in-hospital treatment strategy. In this review, we summarize the present status of preventing death from acute MI and propose a new strategy to prevent acute MI by public education, which is now performed by the Japanese Circulation Society as the "STOP MI Campaign" (**Figure**). This Position Statement has been reviewed and approved by the Committee on Public Education about Emergency Medical Care of the Japanese Circulation Society.
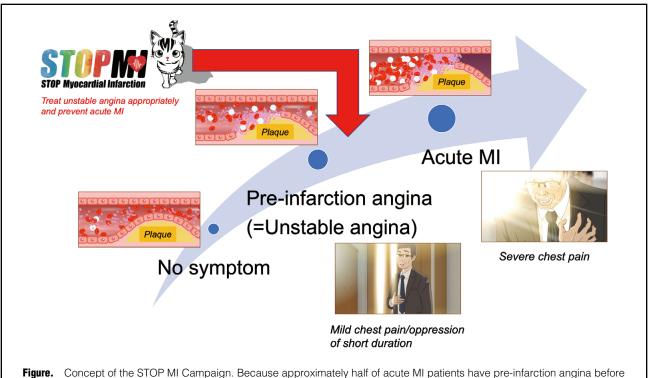
Figure. Concept of the STOP MI Campaign. Because approximately half of acute MI patients have pre-infarction angina before the onset of MI, we should be able to prevent the occurrence of MI in those patients if we can appropriately treat them. The STOP MI Campaign is the public education program of the Japanese Circulation Society to educate people about pre-infarction angina and encourage them to go to hospital at the time they have pre-infarction angina. Typical symptom of pre-infarction angina is a relatively mild chest pain/ oppression that lasts only for a few minutes to approximately 10 min. MI, myocardial infarction.

Pathophysiology of Acute MI

Plaque disruption and thrombosis is the well-known major cause of acute MI, and the process for the onset of acute MI can be divided into stages: (1) formation of vulnerable plaque, (2) disruption of vulnerable plaque, and (3) formation of occlusive thrombus on the disrupted plaque. However, many plaque disruptions that have not caused acute MI are found by intracoronary imaging and pathologic studies.[3–6] Therefore, the disruption of plaque does not always cause acute MI and probably a very low percentage of disrupted plaques would cause acute MI.[7] On the other hand, a pathological study demonstrated that the time interval from plaque rupture to onset of acute MI is <24 h in approximately half of acute MI patients, but days to weeks in the other half.[8] It is well known that it takes time for the disrupted plaques to heal, not only at the culprit lesion of acute MI but also in the non-culprit segments.[9–11] A ruptured plaque incidentally found in the left anterior descending coronary artery was reported to have caused acute coronary syndrome (ACS) 1 week later.[12]

In summary, disrupted plaques do not always cause acute MI immediately but can remain thrombogenic for a certain period, and may heal without causing an event or may cause acute MI later.

Death From Acute MI

The in-hospital mortality rate of acute MI patients has been improved to <10% recently, based on the improved in-hospital management of acute MI patients (e.g., intensive care in the coronary care unit, early reperfusion therapy by primary coronary intervention, and advanced mechanical circulation support), and the improved prehospital management by emergency medical services (e.g., reduced treatment delay by rapid transportation and applying prehospital cardiopulmonary resuscitation). However, deaths from acute MI occur mainly in out-of-hospital settings.[13–19] According to a report on 384,597 major coronary events (out-of-hospital coronary death or hospitalization for acute MI) from registry data in Sweden during 1991–2006,[16] 61.6% survived, 9.5% died within 28 days of admission, and 28.9% died out-of-hospital. The mortality rate, including both in-hospital and out-of-hospital deaths, of acute MI patients would be 38.4%. In Japan, the frequency of survival, in-hospital death, and out-of-hospital death of acute MI patients has been calculated as 68.7%, 6.4%, and 24.9%, respectively, in 2019, and 62.9%, 5.8%, and 31.3%, respectively, in 2015, from the number of patients who died of acute MI,[20] and the number of hospitalized acute MI patients and the number of those who died during hospitalization.[21] The mortality rate, including both in-hospital and out-of-hospital deaths, of acute MI patients would be 31.3% in 2019 and 37.1% in 2015.

Therefore, once a person suffers acute MI, the probability of death would be ~30–40% and the probability of dying before hospitalization would be ~25–30%. Although the mortality rate is decreasing year by year, it is still very high. Furthermore, a report suggested that 60–75% of out-of-hospital deaths occur so rapidly that their prevention by a reduction in the prehospital delay seems impossible.[22] Therefore, it seems more important to find a new strategy

to prevent the occurrence of acute MI rather than to prevent death after the occurrence of acute MI.

Pre-Infarction Angina

ACS includes both acute MI and unstable angina. Unstable angina is well known to have a high risk of progression to acute MI because it is also caused by a disrupted plaque. A disrupted plaque may heal without causing an event but it may cause ACS: acute MI or unstable angina. Furthermore, a disrupted plaque may cause unstable angina first and acute MI later. In such cases, unstable angina is called pre-infarction angina. The frequency of experiencing unstable angina (i.e., pre-infarction angina) within a month before the onset of MI has been reported as 66% among ST-elevation acute MI patients.[23] In Japan, the frequency of pre-infarction angina within 1 month before MI onset is reported to be ~50% in both Osaka and Iwate prefectures, according to the "STOP MI Campaign" of the Japanese Circulation Society.[24]

Therefore, approximately half of acute MI patients would have had unstable/pre-infarction angina before the onset of acute MI. Furthermore, the most important thing is that those patients were not treated appropriately at the time of experiencing unstable/pre-infarction angina. We may be able to prevent the occurrence of acute MI in those patients by treating unstable/pre-infarction angina appropriately, which may lead to the prevention of death from acute MI, and of heart failure among the survivors of acute MI. Although pre-infarction angina has long been discussed as a cause of preconditioning, it is a very important phenomenon that should be made known to the public in order to prevent acute MI and to save lives from MI.

Prevention of Acute MI by Treating Patients Appropriately at the Time of Pre-Infarction Angina

Because approximately half of acute MI patients have pre-infarction angina before the onset of MI, we should be able to prevent the occurrence of MI in these patients if we can appropriately treat them. The frequency of having pre-infarction angina among acute MI patients did not change from 1998 to 2012 in Osaka.[24] The reasons why those patients with pre-infarction angina do not go to hospital would be that they do not know that (1) the symptoms come from the heart, (2) the disease may become life-threatening, and/or (3) death/acute MI can be prevented by going to hospital at the time of symptoms. Some physicians who are not the specialists of ACS may not think the symptoms of pre-infarction angina are serious and may not take a rapid action to make a diagnosis and treat the disease. What we need to improve this situation is public education.

The "STOP MI Campaign" is the public education program of the Japanese Circulation Society to make the facts of acute MI well known to the public and to encourage people to go to hospital at the time they have pre-infarction angina.

(1) The mortality of acute MI is still very high.

(2) Death from acute MI occurs mainly in out-of-hospital settings.

(3) Acute MI can be prevented if patients receive appropriate treatment at the time they have pre-infarction

angina, which may often occur before the onset of acute MI.

(4) Typical symptom of pre-infarction angina is a relatively mild chest pain/oppression that lasts only for a few minutes to approximately 10 min.

The public education of STOP MI Campaign is mainly performed through the website, posters, and townhall meetings. The Campaign has a mascot cat "Mi-chan", which is a traditional name for cats in Japan and also indicates myocardial infarction by "Mi" We are now promoting the Campaign by finding partners (e.g., companies, hospitals, and local governments) that can support the Campaign.

The achievement of the Campaign can be measured by the frequency of patients who have pre-infarction angina among all hospitalized acute MI patients. If the aim of the Campaign is completely achieved, the frequency will be reduced and finally become 0%. However, to date we do not have any nationwide registry of acute MI patients in Japan that has the information of pre-infarction angina. Therefore, we still have many issues requiring solutions; however, this Campaign is very important because we can reduce the number of acute MI patients by half if the aim of the Campaign is achieved.

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