Contemporary Management of ST-Segment Elevation Myocardial Infarction (STEMI) in Taiwan: A Highlight of 2020 Taiwan STEMI Guideline

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Abstract

Early recognition and timely treatment of acute ST-elevation myocardial infarction (STEMI) are imperative for positive patient prognosis. STEMI management is a race against time. The primary consideration is urgent reperfusion of infarct-related arteries using primary percutaneous coronary intervention (PCI). Despite recent improvements in health care quality and treatment modalities, the morbidity and mortality of STEMI remain high, especially in patients with complications of cardiogenic shock (CS). Recently, there have been updates in the scientific evidence regarding STEMI management. This article highlights the most important parts of the 2020 Taiwan STEMI Guideline and reviews the epidemiology, diagnosis, prehospital implementation, antiplatelet therapy, PCI plan, CS, and post MI care of STEMI patients in Taiwan.

Keywords: acute myocardial infarction, review, Taiwan

Introduction

In recent decades, the survival rate of ST-elevation myocardial infarction (STEMI) has been improving in Taiwan as a result of timely, appropriate use of primary percutaneous coronary intervention (PCI) and optimal guideline-directed medical therapies.[1] With more scientific evidence being published, the guidelines for management of STEMI in Taiwan have been revised recently.[2] The guidelines emphasize the importance of early STEMI detection by prehospital electrocardiography (ECG) and rapid transportation to a PCI-capable hospital as fast as possible. Three different P2Y12 inhibitors are recommended in Taiwan and the choice of which one depends on a balance between ischemia and bleeding risk. With regard to primary PCI, the important issues are duration of door-to-wire time, vascular access options and complete revascularization. There are now also some novel concepts and treatment choices for cardiogenic shock (CS) management. For STEMI patients with diabetes and hypercholesterolemia, the latest, newly developed drugs not only control sugar and cholesterol but also significantly lower

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subsequent cardiovascular events. These drugs are recommended in the guidelines and should be considered for long-term use after discharge.

Epidemiology

In Taiwan, the overall incidence of acute myocardial infarction (AMI) has progressively increased since 1999 and remained at a stable level since 2008, through the last dacade.[1] Contrasting with an increasing incidence of non ST-segment elevation myocardial infarction (NSTEMI) between 2009 and 2015, STEMI has been decreasing, with the exception of young groups under 55 years old.[1] More patients with diabetes mellitus and hypertension have suffered NSTEMI, whereas more patients with dyslipidemia have developed STEMI. In Taiwan, the treatment of patients with STEMI is mostly by primary PCI instead of by fibrinolytic therapy. The median door-to-balloon (D2B) time in Taiwan has shortened from 96 minutes (2008-2010) to 71 minutes (2012-2015) during two different periods.[3] The mortality rate of STEMI has been reduced from 9.3% in 2009 to 7.6% in 2015.[1] However, the mortality rate among STEMI patients has been higher in females than in males. The percentage of post-STEMI standard medical treatment utilization for secondary prevention has been lower in Taiwan than in Western countries.

Diagnosis

According to the Fourth Universal Definition of AMI, the diagnosis of AMI depends on the presence of acute myocardial injury, clinical evidence of ischemia, significantly elevated cardiac troponin level, and at least one of the following: Symptoms and/or signs, ECG dynamic changes or any imaging document of new regional wall motion abnormality.[4] STEMI is typically an event involving coronary plaque rupture and thrombus formation, leading to transmural myocardial injury or necrosis. A key examination which needs to be done quickly is the 12-lead ECG, and the immediate transmission of the ECG to emergency physicians or cardiologists for interpretation through any mobile messaging system facilitates early diagnosis. High-sensitivity cardiac troponin (hs-cTn) is a useful biomarker which can assist in rapidly ruling in or out AMI (Figure 1).[5] For STEMI equivalents, including posterior STEMI, left main infarction, pre-existing left bundle branch block with superimposed STEMI without typical ST segment elevation on standard ECG, the strategy of management should be the same as STEMI.

Prehospital implementation

It is crucial to enhance public alertness about the symptoms and signs of STEMI because its morbidity and mortality apparently increase with any delay in diagnosis and reperfusion.[6] It is better that STEMI patients be sent to hospital by ambulance under emergency medical technicians' (EMT) supervision, and transported to PCI-capable hospitals (Figure 2).[7] Currently, primary PCI for STEMI is the major reperfusion therapy in Taiwan, unless hindered by pandemic infectious disease or occurring on small, outlying islands where fibrinolytic therapy should be considered first.[3,8] In order to speed up transportation and overcome possible causes of delay it is important to optimize and integrate the STEMI network with the emergency medical system. Prehospital loading of dual antiplatelet therapy (DAPT) by EMT under physician's supervision may be considered.[9] If STEMI is complicated by out-of-hospital cardiac arrest, emergency PCI should be performed after re-establishment of spontaneous circulation. For comatose patients after resuscitation, targeted temperature management is suggested to improve survival rate and neurologic functional outcome.[10] Early hypothermia as a result of cooling strategy in the ambulance could cause a worse outcome and is not recommended.[11]

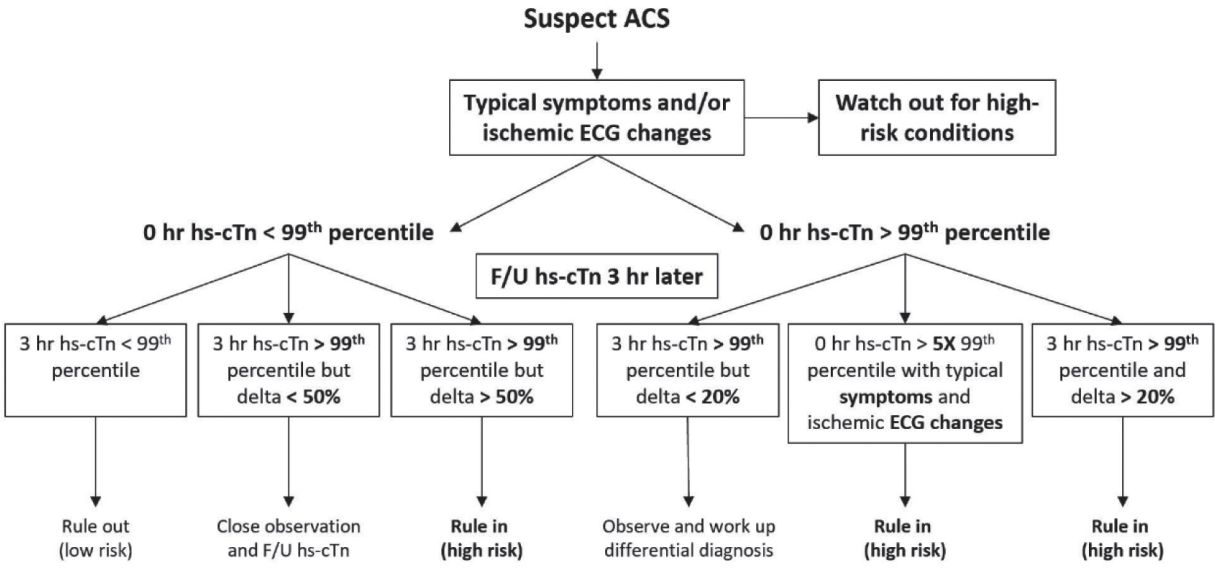

Figure 1. Recommendations for ACS rapid diagnosis with hs-cTn protocol. Delta = (3 hr – 0 hr) / 0 hr hs-cTn. Adapted from Reference 5.

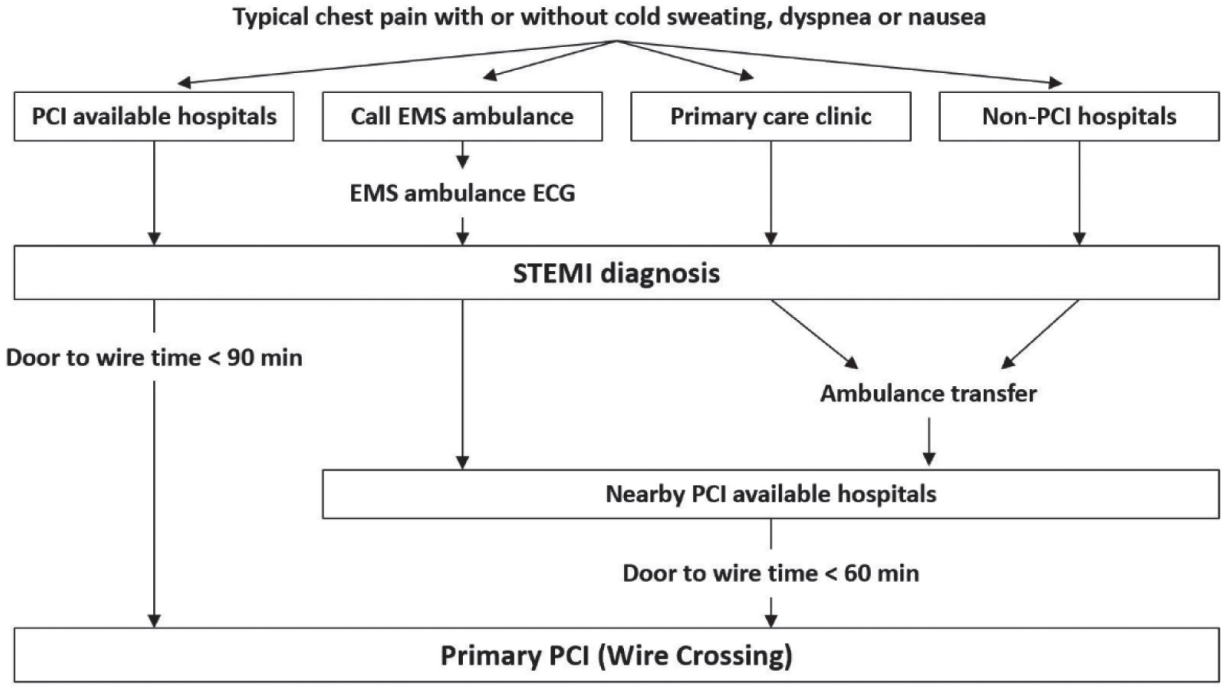

Figure 2. Summary of transportation pathways and targeted door-to-wire time for primary PCI in Taiwan, depending on location and patient distribution. Adapted from Reference 2.

Antiplatelet therapy

DAPT is one of the major therapies for STEMI. There are new-generation P2Y12 inhibitors such as prasugrel and ticagrelor which have stronger antiplatelet effects than clopidogrel, but carry higher bleeding risk. Clopidogrel (300-600 mg loading, 75 mg daily dose) has been used for STEMI for a long time in Taiwan. Slower onset and variable drug response are two disadvantages of clopidogrel, with the latter occurring more commonly in Asian populations.[12] Ticagrelor (loading dose 180 mg, maintenance dose 90 mg twice daily) was introduced in Taiwan to make up for these deficiencies, whereby clopidogrel remains available for patients with high bleeding risk factors, such as old age, renal insufficiency, anemia, lean body mass, anticoagulant medication usage, history of intracranial hemorrhage or major bleeding. Data series from Japan show that reduced dose prasugrel (loading/daily dose: 20/3.75 mg) may be another viable choice for STEMI undergoing PCI in Taiwan.[13]

PCI plan

In addition to reducing D2B time, recent studies have reinforced the importance of reducing total ischemia time by decreasing the time from symptom onset to diagnosis, and from diagnosis to reperfusion.[14] During primary PCI, balloon dilatation may not be the first step. Therefore, door-to-wire time rather than traditional D2B time has been introduced in the guidelines. A door-to-wire time ≤ 60 minutes for patients with diagnosed STEMI that are transferred in for primary PCI, and a door-to-wire time ≤ 90 minutes for fresh cases at triage are recommended. Radial access during primary PCI, by experienced operators, is preferred over femoral access in high volume centers.[15] Deployment of contemporary drug-eluting stents is suggested for STEMI cases undergoing primary PCI.[16] Since the thrombosis burden and severity varies in each case, the treatment strategy should be individualized, and the technique and procedure for thrombus aspiration is not routine.[17] In STEMI patients with multi-vessel disease (MVD), complete revascularization at the index primary PCI or in staged PCI is beneficial.[18] However, culprit lesion-only PCI is suggested during primary PCI if complicated by CS.[19]

Cardiogenic shock

A heart team approach is important for STEMI with CS, in order to manage mechanical complications and to optimize the revascularization strategy.[20] Immediate PCI may be suitable for culprit vessels in STEMI with CS.[19] It is also reasonable to perform complete revascularization for STEMI with CS and MVD before discharge.[21] In Taiwan, mechanical circulatory support, such as percutaneous cardiopulmonary support, extracorporeal membrane oxygenation, or ventricular assist device may be regarded as a bridge therapy for complicating CS, and whether intra-aortic balloon pumping is necessary or not depends on the clinical situation.[22]

Post myocardial infarction care

To optimize control of blood pressure less than 130/80 mmHg by angiotensin converting enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB), the use of long-acting beta-blocker (BB) and/or calcium channel blocker (CCB) is warranted in STEMI patients.[23] In patients with heart failure and reduced ejection fraction (HFrEF), BB, ACEI/ARB and mineralocorticoid receptor antagonists are suggested to improve outcome.[24] For all STEMI patients, ACEI/ARB and BB should be administered routinely, if there is no contraindication.[25] In STEMI with diabetes, HbA1c should be maintained < 7% in general, and could be individualized, varying from 6.5% to 8% according to the patient's condition, and hypoglycemia concerns.[26] Although metformin is

the first-line agent, sodium/glucose cotransporter 2 inhibitor (SGLT-2i) and glucagon-like peptide-1 receptor agonist are preferred due to their benefits on prognosis. SGLT-2i also improves clinical outcomes in STEMI patients with HFrEF.[27] The target of low-density lipoprotein cholesterol (LDL-C) is < 70 mg/dL in STEMI, and lowering down to 55 mg/dL may be considered.[28] The LDL-C lowering therapies include statins, ezetimibe and/or proprotein convertase subtilisin/kexin type 9 inhibitors.[29]

References

1. Lee CH, Fang CC, Tsai LM, et al. Patterns of acute myocardial infarction in Taiwan from 2009 to 2015. *Am J Cardiol* 2018;122:1996-2004.
2. Li YH, Lee CH, Huang WC, et al. 2020 Focused update of the 2012 guidelines of the Taiwan Society of Cardiology for the management of ST-segment elevation myocardial infarction. *Acta Cardiol Sin* 2020;36:285-307.
3. Li YH, Chiu YW, Cheng JJ, et al. Changing practice pattern of acute coronary syndromes in Taiwan from 2008 to 2015. *Acta Cardiol Sin* 2019;35:1-10.
4. Thygesen K, Alpert JS, Jaffe AS, et al. Fourth universal definition of myocardial infarction. *Eur Heart J* 2018;40:237-69.
5. Li YH, Wang YC, Wang YC, et al. 2018 Guidelines of the Taiwan Society of Cardiology, Taiwan Society of Emergency Medicine and Taiwan Society of Cardiovascular Interventions for the management of non ST-segment elevation acute coronary syndrome. *J Formos Med Assoc* 2018;117:766-90.
6. Birnbach B, Höpner J, Mikolajczyk R. Cardiac symptom attribution and knowledge of the symptoms of acute myocardial infarction: a systematic review. *BMC Cardiovasc Disord* 2020;20:445.
7. Gibler WB, Racadio JM, Hirsch AL, Roat TW. Continuum of care for acute coronary syndrome: Optimizing treatment for ST-elevation myocardial infarction and Non-ST-elevation acute coronary syndrome. *Crit Pathw Cardiol* 2018;17:114-38.
8. Li YH, Huang WC, Hwang JJ. No reduction of ST-segment elevation myocardial infarction admission in Taiwan during coronavirus pandemic. *Am J Cardiol* 2020;131:133-4.
9. Tan JW, Chew DP, Abdul Kader MAS, et al. 2020 Asian Pacific Society of Cardiology consensus recommendations on the use of P2Y(12) receptor antagonists in the Asia-Pacific region. *Eur Cardiol* 2021;16:e02.
10. Pareek N, Kordis P, Webb I, et al. Contemporary management of out-of-hospital cardiac arrest in the cardiac catheterisation laboratory: Current status and future directions. *Interv Cardiol* 2019;14:113-23.
11. Rasmussen TP, Bullis TC, Girotra S. Targeted temperature management for treatment of cardiac arrest. *Curr Treat Options Cardiovasc Med* 2020; 22:39.
12. Jeong HE, Lee SJ, Cha EY, et al. Development of a multiplex and cost-effective genotype test toward more personalized medicine for the antiplatelet drug clopidogrel. *Int J Mol Sci* 2014;15:7699-710.
13. Akita K, Inohara T, Yamaji K, et al. Impact of reduced-dose prasugrel vs. standard-dose clopidogrel on in-hospital outcomes of percutaneous coronary intervention in 62737 patients with acute coronary syndromes: a nationwide registry study in Japan. *Eur Heart J Cardiovasc Pharmacother* 2020;6:231-8.
14. Lai CC. Reply to the letter to the editor for the article entitled "Effects of door-to-balloon times on outcomes in Taiwanese patients receiving primary percutaneous coronary intervention: a report of Taiwan acute coronary syndrome full spectrum registry" published in the Journal of Acta Cardiologica Sinica in 2015 (2015;31:215-225). *Acta Cardiol Sin* 2016;32:516-7.
15. Dworeck C, Redfors B, Völz S, et al. Radial artery access is associated with lower mortality in patients undergoing primary PCI: a report from the SWEDEHEART registry. *Eur Heart J Acute Cardiovasc Care* 2020;9:323-32.
16. Sabaté M, Brugaletta S, Cequier A, et al. The EXAMINATION trial (Everolimus-Eluting Stents Versus Bare-Metal Stents in ST-Segment Elevation Myocardial Infarction): 2-year results from a multicenter randomized controlled trial. *JACC Cardiovasc Interv* 2014;7:64-71.
17. Kumar D, Patra S, Pande A, et al. Long-term clinical outcomes of thrombus aspiration in STEMI patients undergoing primary percutaneous coronary intervention. *Am J Cardiovasc Dis* 2020;10:117-23.
18. Mehta SR, Wood DA, Storey RF, et al. Complete revascularization with multivessel PCI for myocardial infarction. *N Engl J Med* 2019;381:1411-21.
19. Thiele H, Akin I, Sandri M, et al. One-year outcomes after PCI strategies in cardiogenic shock. *N Engl J Med* 2018;379:1699-710.
20. Tehrani BN, Truesdell AG, Sherwood MW, et al. Standardized team-based care for cardiogenic shock. *J Am Coll Cardiol* 2019;73:1659-69.
21. Lee JM, Rhee TM, Hahn JY, et al. Multivessel

percutaneous coronary intervention in patients with ST-segment elevation myocardial infarction with cardiogenic shock. *J Am Coll Cardiol* 2018;71:844-56.
22. Esposito ML, Zhang Y, Qiao X, et al. Left ventricular unloading before reperfusion promotes functional recovery after acute myocardial infarction. *J Am Coll Cardiol* 2018;72:501-14.
23. Flint AC, Conell C, Ren X, et al. Effect of systolic and diastolic blood pressure on cardiovascular outcomes. *N Engl J Med* 2019;381:243-51.
24. Lin HJ, Wang TD, Chen YU, et al. 2020 Consensus statement of the Taiwan Hypertension Society and the Taiwan Society of Cardiology on home blood pressure monitoring for the management of arterial hypertension. *Acta Cardiol Sin* 2020;36:537-61.
25. Williams B, Mancia G, Spiering W, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. *Eur Heart J* 2018;39:3021-104.
26. 6. Glycemic Targets: Standards of Medical Care in Diabetes-2020. American Diabetes Association. *Diabetes Care* 2020;43:S66-s76.
27. Zeng Q, Zhou Q, Liu W, et al. Mechanisms and perspectives of sodium-glucose co-transporter 2 inhibitors in heart failure. *Front Cardiovasc Med* 2021;8:636152.
28. Li YH, Ueng KC, Jeng JS, et al. 2017 Taiwan lipid guidelines for high risk patients. *J Formos Med Assoc* 2017;116:217-48.
29. Lin JL, Huang PH, Yeh HI, et al. Appropriate use of proprotein convertase subtilisin/kexin Type 9 (PCSK9) inhibitors for atherosclerotic cardiovascular disease: Comparison of recommendations from different guidelines or consensus around the world. *Acta Cardiol Sin* 2020;36:403-8.