Improvement of Outcomes in Acute Coronary Syndrome (ACS) by Getting with the Guidelines: From Taiwan ACS-full Spectrum Registry to Taiwan ACS-DM Registry

Kou-Gi Shyu

Division of Cardiology, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan

Abstract

Acute coronary syndrome (ACS) including ST-elevation myocardial infarction, non-ST elevation myocardial infarction and unstable angina is a life-threatening disease. To improve the clinical outcome of ACS, many cardiology societies have developed clinical guidelines to provide evidence-based therapy. To identify current management of ACS nationwideat hospital admission, during in-hospital stay and 12 months post discharge, the Taiwan Society of Cardiology (TSOC) implemented the Taiwan ACS full-spectrum registry from 2008 to 2010, ACS-stent registry from 2012 to 2015, and ACS-DM registry from 2013 to 2015. Percutaneous coronary intervention has been performed in most ACS patients in Taiwan. In the Taiwan ACS-Full Spectrum Registry, medical therapy for ACS patients according to clinical guidelines is suboptimal, although door to balloon time improved significantly after implementation of the ACS full spectrum registry. Dual antiplatelet use at patient discharge significantly improved from 74.8% to 99.6% from implementation of the ACS-full spectrum registry to the ACS-stent registry. Angiotensin converting enzyme inhibitor/angiotensin receptor blocker improved from 63.0% to 77.5%, beta-blocker from 53.4% to 71.1%, statin use from 60.5% to 81.2%. Increased adherence to the ACS guideline from ACS-Full spectrum registry to ACS-DM registry was also found. Much improvement in clinical guideline adherence was observed in the ACS-DM registry after local guideline establishment. However, a discrepancy remains between real-world and guideline directed therapy with regard to renin-angiotensin system blockade, beta-blocker and statin use. Concerted efforts are needed to continue this positive trend.

Keywords: acute coronary syndrome, registry, guideline

Introduction

Cardiovascular (CV) disease remains the leading cause of death and premature death globally,[1,2] and is among the leading causes of death in the Asia-Pacific region.[3] Acute coronary syndrome (ACS) including ST-elevation myocardial infarction (STEMI), non-ST elevation

Address for correspondence: Dr. Kou-Gi Shyu
Division of Cardiology, Shin Kong Wu Ho-Su Memorial Hospital; 95 Wen-Chang Rd., Taipei 111, Taiwan
Tel: +886-2-28332211 ext 2094; Fax: +886-2-28365775; E-mail: shyukg@ms12.hinet.net

myocardial infarction (NSTEMI) and unstable angina is a life-threatening condition of CV disease. CV events recur at a high frequency after an ACS event and lead to marked morbidity including frequent re-hospitalization and mortality.[4-6] Even after surviving discharge after ACS, one year mortality is high.[7] Many cardiology societies have developed clinical guidelines for ACS to improve outcome and care quality in ACS cases. In fact, getting with these guidelines or guideline-directed medical therapies has improved the clinical outcomes for ACS patients.[8,9]

Overall the incidence of acute myocardial infarction in Taiwan has remained constant at around 50 per 100,000 persons from 2009 to 2015.[10] However, the ratio of NSTEMI to STEMI incidence has increased from 2009 to 2015, especially in young patients under 55 years. To assess the current management of ACS nationwideat hospital admission, during in-hospital stay and 12 months post discharge, the Taiwan Society of Cardiology (TSOC) implemented the Taiwan ACS full-spectrum registry from 2008 to 2010, the ACS-stent registry from 2012 to 2015, and the ACS-DM registry from 2013 to 2015. After developing the registries, TSOC developed guidelines for the management of STEMI in 2012[11] and non-ST-segment elevation ACS in 2018.[12] In this review paper, the quality of care outcome for patients with ACS in Taiwan will be analyzed based on these three nationwide registries.

Taiwan ACS Full Spectrum registry

The objective of the Taiwan ACS Full Spectrum registry was to identify the current management of ACS nationwideat hospital admission, during in-hospital stay, at discharge and 3, 6, 9 &12 months post discharge in the period from October 2008 to January 2010. Patients with age > 20 years admitted to the hospital within 24 hours of ACS were enrolled. Presentation of ACS accompanied or precipitated by co-

morbidity such as trauma, and previous enrolment in this trial or participation in an investigational drug study, were criteria for exclusion from this registry. A total of 3183 patients with ACS were recruited in 39 medical centers and regional hospitals throughout Taiwan, including northern, central, southern and eastern areas.[13] The ACS full spectrum included STEMI, NSTEMI, and unstable angina. This registry included 53% STEMI, 34% NSTEMI, and 12% unstable angina. For patients with STEMI, primary percutaneous coronary intervention (PCI) was performed in 97% whereas thrombolytic therapy was used in 3%. The median door to balloon time (D2B) was 96 min. With regard to pharmacological therapies, discharged prescriptions of dual antiplatelet therapy (DAPT) were 74.8%, angiotensin converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) 63.0%, beta blocker 53.4%, and statin 60.5%.[13] The 1-year usage of preventive medicine prescriptions at 1-year were DAPT 24.1%, ACEI/ ARB 61.6%, beta-blocker 59%, and statin 61.1%. PCI was performed in 75% of patients with non-ST elevation ACS and was usually performed within the first 1-2 days. Bare metal stent (BMS) was used in 70.4% of STEMI patients and around 55% of non-ST elevation ACS patients. Drug-eluting stent (DES) was used in 21% of STEMI patients and 35% of non-ST elevation ACS patients.

There is an association between timely reperfusion therapy and clinical outcomes in STEMI. Primary PCI < 90 min produced better clinical outcomes, including less 30-day and 1-year mortality, less readmission for heart failure and myocardial infarction at 1 year than primary PCI > 90 min.[14] Different hospitals in Taiwan used different strategies to shorten D2B. These strategies included establishment of a regional network transfer system, a chest pain unit with an onsite cardiology team in the emergency room, direct emergency room tele-electrocardiographic triage of patients with chest pain, or a multiple-strategy approach.[15-18]

Taiwan ACS Stent registry

The objective of the Taiwan ACS Stent registry was to evaluate the practice patterns of ACS care in Taiwan from April 2012 to December 2015. The inclusion criteria were the same as the Taiwan ACS Full Spectrum registry except that only ACS patients who received PCI with stent implantation during hospitalization were included in the registry. A total of 2357 patients were recruited in 24 medical centers and regional hospitals throughout Taiwan. The registry included 54% STEMI and 46% non-ST elevation ACS. The median D2B time was 71 min in the Taiwan ACS Stent registry.[19]

As compared with the Taiwan ACS Full Spectrum registry, D2B in this registry was significantly shortened by 25 min (p < 0.0001), with a corresponding, significant increase (all p < 0.0001) in the percentage of patients with D2B < 90 min (46.7% to 63.3%, p < 0.0001) (Figure 1) between the 2 registries. With regard to pharmacological therapies, the in-hospital use of DAPT was 99.6%, ACEI / ARB 77.5%, beta blocker 71.4%, and statin 81.2%. The use of secondary prevention medications all increased significantly (all p < 0.0001) between the Taiwan ACS Full Spectrum registry and the Taiwan ACS Stent registry. For STEMI and non-ST elevation ACS in the Taiwan ACS Stent registry, ACEI/ARB were used in 77.5% and 67.6%, beta-blocker in 71.4% and 64.4%, and statin in 81.2% and 78.8%, respectively. The use of DAPT at 1-year after discharge was 34%.

PCI was performed in 100% of patients in the Taiwan ACS Stent registry. DES was used during primary PCI in 41% of STEMI patients and 62.9% of non-ST elevation ACS patients.

Taiwan ACS-DM registry

The prospective observational study of the Taiwan ACS-DM registry[20] aimed to explore the cardiovascular outcomes (including cardiovascular morbidity and mortality, non-fatal myocardial infarction, nonfatal stroke, unplanned coronary revascularization and heart failure hospitalization) in ACS patients with type 2 diabetes in Taiwan.
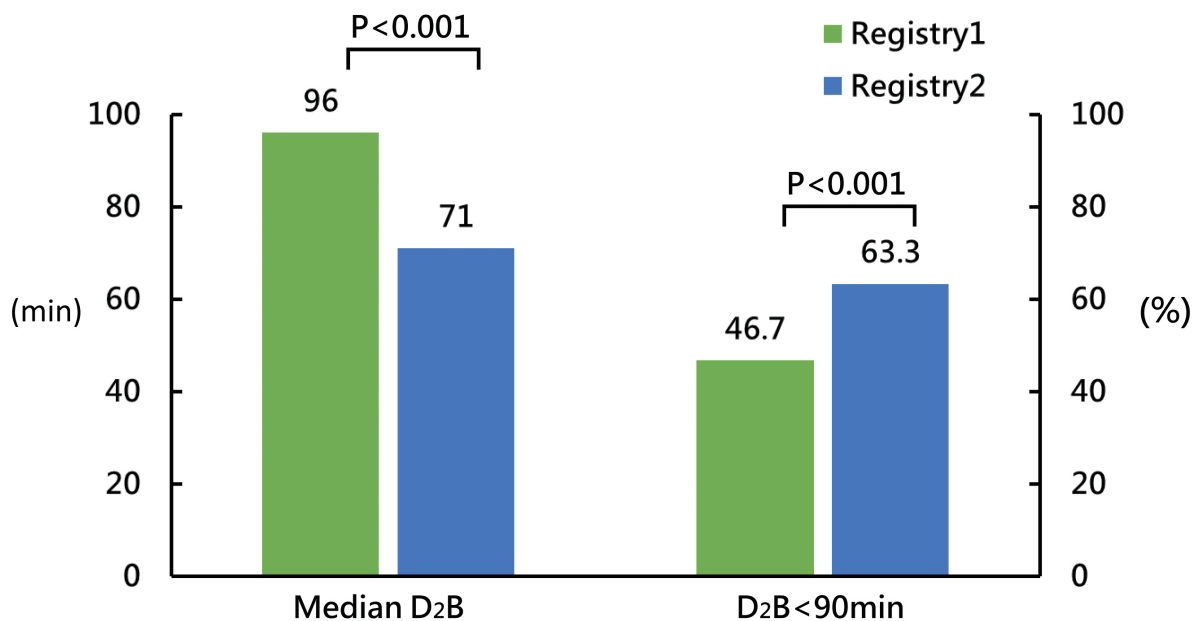

Figure 1. Comparison of median door-to-balloon time (D2B) and percentage of D2B < 90 min between the Taiwan ACS Full Spectrum registry (Registry 1) and the Taiwan ACS Stent registry (Registry 2).

Patients with a history of type 2 diabetes, confirmed on 2 occasions prior to the registry, and patients with age > 20 years who were diagnosed with ACS within 30 days of patient enrollment and type 2 diabetes (no matter whether newly or previously diagnosed) were recruited. For newly diagnosed diabetes mellitus (DM), diagnosis was based on the WHO criteria: i.e, fasting venous plasma glucose concentration > 7.0 mmol/L [126 mg/dL] or 2-hour post glucose load venous plasma glucose > 11.1 mmol/L [200 mg/dL]. This was a non-interventional prospective registry, and a total of 1534 eligible patients were enrolled from July 2013 to December 2015 in 27 medical centers and regional hospitals throughout Taiwan.

This registry included 29.5% STEMI, 48.9% NSTEMI, and 21.5% unstable angina.

In this registry, ACS with DM patients had higher prevalence of smoking, hypertension and dyslipidemia and also had higher prevalence of cardiovascular disease including prior stroke, prior MI, prior PCI, prior CABG and heart failure than patients in the Taiwan ACS Full Spectrum registry and the Taiwan ACS Stent registry (Table 1). PCI was performed in 79.6% of patients. Primary PCI was performed in 95.5% and fibrinolysis was performed in 1.8% of patients with STEMI. For NSTEMI and unstable angina, PCI was performed in 73.1% and 72.0%, respectively. With regard to pharmacological therapies, the rate of prescription at discharge of DAPT was 95.5%, ACEI/ARB 65.7%, beta blocker 64.8%, and statin 77%. The use of secondary prevention medicines in the Taiwan ACS-DM registry was similar to that in

Table 1. Clinical characteristics of three Taiwan ACS registry patients

	Registry 1 (2008-2010) (n = 3183)	Registry 2 (2012-2015) (n =2357)	Registry 3 (2013-2015) (n=1534)	P value
Age (years)	63.1 ± 13.6	60.0 ± 12.7	64.9+11.9	P<0.0001
Male, %	78.0 %	83.3%	71.3%	0.008
Risk factors				
Current smoker	42.0%	45.7%	51.6%	<0.0001
Hypertension	64.0%	63.7%	78.1%	<0.0001
Diabetes	36.0%	34.3%	100%	<0.0001
Hyperlipidemia	39.1%	44.4%	49.4%	<0.0001
Medical history				
Prior CAD	24.5%	30.8%	37.1%	<0.0001
Prior stroke	2.9%	6.0%%	10.8%	<0.0001
Prior MI	9.9%	8.2%	16.9%	<0.0001
Prior PCI	16.8%	15.7 %	26.3%	<0.0001
Prior CABG	2.7%	1.7%	5.5%	<0.0001
Prior HF	5.4%	3.3%	8.5%	<0.0001

The data were presented with mean ± standard deviation or percentages (%). Statistical analysis with ANOVA or chi-square was used.
Registry 1: Taiwan ACS Full Spectrum registry.
Registry 2: Taiwan ACS Stent registry.
Registry 3: Taiwan ACS-DM registry
CAD = coronary artery disease. MI = myocardial infarction. PCI = percutaneous coronary intervention. CABG = coronary artery bypass surgery. HF =heart failure.

the Taiwan ACS Stent registry, but was much better than that in the Taiwan ACS Full Spectrum registry (Figure 2). Medications prescribed at discharge for diabetic patients in the Taiwan ACS Full Spectrum registry showed that DAPT was 92.6%, ACEI/ARB 60.0%, beta-blocker 46.5%, and statin 49.7%. The rate of prescribed secondary preventive medicine was significantly higher in the Taiwan ACS-DM registry compared to the DM subgroup of the Taiwan ACS Full Spectrum registry.

Implications of the Taiwan nation-wide ACS registry

Reperfusion therapy and guideline-directed medical therapy significantly improved 1-year major adverse outcomes.[8,9] These three Taiwan ACS registries have demonstrated the gaps between guideline recommendations and clinical practice in the management of ACS in Taiwan.

The quality of ACS care, including primary PCI for STEMI and pharmacological therapies for ACS, has improved in Taiwan. PCI is the major revascularization strategy for ACS in Taiwan. In the United States, the median D2B in 2010 was 64 min and 91% of patients had D2B < 90 min in primary PCI.[21]

Another weak point of our ACS care is the underuse of DES which is now a standard treatment during PCI. DES was used in only about 21-30% of cases in the Taiwan ACS Full Spectrum registry and in 40-60% of Taiwan ACS Stent registry patients. New generation DES has a lower incidence of stent thrombosis and target vessel revascularization compared to bare metal stent in ACS patients.[22,23] ACEI/ARB and beta blocker were only prescribed in about 70% of STEMI patients and 60% of NSTE-ACS patients in the Taiwan ACS Stent registry and the Taiwan ACS-DM registry, ACEI/ARB, beta blockers, and statins were prescribed in 65.7%, 64.8% and 77%,
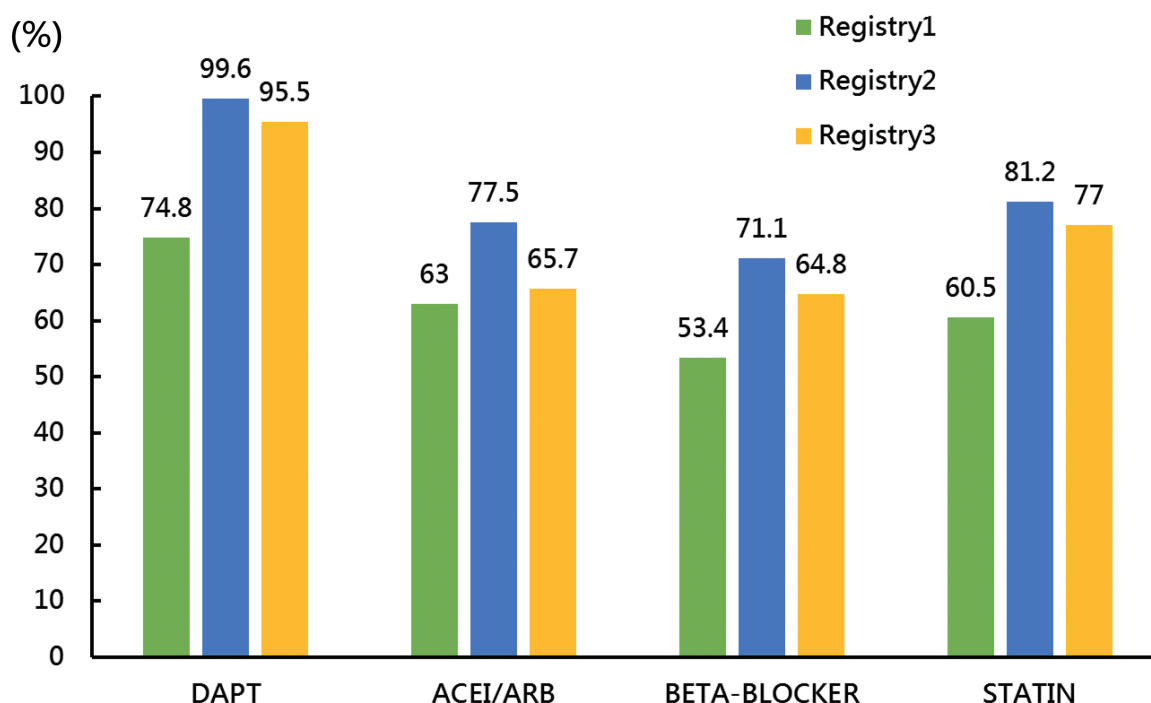

Figure 2. Rate of secondary preventive medicine used, including dual antiplatelet (DAPT), angiotensin converting enzyme inhibitor (ACEI), angiotensin receptor blocker (ARB), beta-blocker and statin in three Taiwan ACS registries following patient discharge.

respectively. The prescription rates of these drugs in Asian-American acute MI patients were usually more than 90%.[24] Adherence to therapy guidelines was also high for beta-blockers, ACEI/ARB, and statin use in patients with STEMI and NSTEMI as reported in the Get with the Guidelines-Coronary Artery Disease registry.[25] Prescription rates of these drugs should be increased to further improve patients' prognosis in Taiwan.

Conclusions

Much improvement in clinical guideline adherence has been observed in the Taiwan ACS registry after local guideline establishment. However, there remains a gap in renin-angiotensin system blockade, beta-blocker and statin use between real-world and guideline directed therapy. Concerted efforts are needed to continue this positive trend.

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