Acute Coronary Syndrome Registry

Clinical Characteristics, Management and In-Hospital Outcomes of Patients with Acute Coronary Syndrome – Observations from the Taiwan ACS Full Spectrum Registry

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Background: Acute coronary syndrome (ACS), largely manifested as ST-segment elevation myocardial infarction (STEMI), non-STEMI and unstable angina (UA), is a life-threatening disease. ACS can be successfully managed by adherence to established clinical guidelines. This study aimed to evaluate current practices in ACS management, adherence to guidelines and in-hospital outcomes.

Methods: This observational, prospective study was conducted at 39 centers in Taiwan. Patients with ACS (≥ 20 years) who were admitted to participating hospitals within 24 hours and provided written consent, were enrolled. Disease management/outcome data was collected at admission, during the in-hospital stay, at discharge and at one year post-discharge.

Results: Of the 3183 patients enrolled, 52.3% were diagnosed with STEMI. Percutaneous coronary intervention and coronary artery bypass grafting were performed on 84.4% and 3.3% of the analyzed population, respectively. Median door-to-needle and door-to-balloon times for invasive management in the STEMI patients were 65 minutes and 96 minutes, respectively. Dual antiplatelet therapy with aspirin and clopidogrel was prescribed to 88.2% of the patients acutely and to 74.8% at discharge. At discharge, beta-blockers were prescribed to 53.4% of patients, statins to 60.5% and RAS blockers to 63.0%. Overall in-hospital mortality was 1.8% and this was higher for STEMI patients (2.3%) than for non-STEMI patients (1.0%).

Conclusion: Compared to the ACS management recommended guidelines, median door-to-needle and door-to-balloon times were higher, while secondary preventive therapy during the in-hospital stay and at discharge were suboptimal. There is a need to close the gap between the guidelines and the actual ACS clinical management in Taiwan.

Key Words: Acute coronary syndrome • Antiplatelet therapy • Door-to-balloon • Door-to-needle • Full spectrum registry • Taiwan

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INTRODUCTION

Atherosclerotic cardiovascular disease, manifested mainly as acute coronary syndrome (ACS), is one of the leading causes of morbidity and mortality worldwide.[1,2] In 2009, coronary heart disease was responsible for 15,726 deaths (10.6% of total mortality) in Taiwan, making it the second-largest killer in the country.[3] ACS presents a range of symptoms from unstable angina (UA) to ST-segment elevation myocardial infarction

(STEMI) and is a result of atherosclerotic and thrombotic processes. ACS is a common cause of emergency hospitalization and thereby presents a major burden on healthcare resources.

In recent years, the results of extensive clinical trials have demonstrated that the outcomes in patients with ACS can be improved by certain therapeutic modalities. This has resulted in the formulation of clinical guidelines for ACS management by organizations such as the American College of Cardiology (ACC)/American Heart Association (AHA)[4,5] and the European Society of Cardiology.[6] These guidelines have recently been updated by both societies[7-12] to incorporate the findings of certain trials evaluating particular antiplatelet and antithrombotic therapies. The main goal of these guidelines is to provide physicians treating ACS patients with evidence-based approaches that allow high-quality and reproducible patient care on a daily basis.

However, observations from international registries, such as the Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the ACC and AHA Guidelines[13,14] (CRUSADE), the Global Registry of Acute Coronary Events[15] (GRACE) and the Acute Coronary Syndrome Prospective Audit[16] (ACACIA) indicate that the prescribed clinical guidelines are not followed in the treatment of ACS with a significant population of patients.

Evaluation of data from the Taiwan Acute Coronary Syndrome Descriptive Registry (T-ACCORD, a registry of UA and non-STEMI cases) suggests a similar gap in between evidence-based guidelines and clinical practice in Taiwan as well.[17] Thus, there is a need for a nationwide Taiwanese registry covering the full spectrum of ACS in order to assess current clinical practices and outcomes. Consequently, the main goal of this study was to gather real-world data on ACS management at various centres throughout Taiwan, starting at the time of admission and continuing to one year post-discharge, with an intention of determining the level of concordance with established guidelines.

METHODS

Study design

The reported study was a prospective, national, multicenter, non-interventional, observational study. Each participating site recruited between 50-200 consecutive eligible patients. Site selection for the registry was done by the Scientific Committee of Taiwan Society of Cardiology to ensure good representation of the ACS population. Monitoring for source documentation and accuracy was performed in 5% of all case report forms at each recruiting site. Patient data, such as baseline characteristics; risk factors; clinical presentation; clinical diagnosis; in-hospital interventions/procedures, as well as medications prescribed, were collected from admission to discharge. Patients were followed up at months 3, 6, 9 and 12 post-discharge and data was collected on medication usage as well as clinical events, like MI, stroke, hospitalization and death.

This study was carried out in accordance with the local regulatory guidelines and international guidelines for Good Epidemiological Practice.[18] Ethics committee approval was obtained at each trial site. Written informed consent was obtained for each patient. Spontaneous reporting of adverse drug reactions was carried out in compliance with Taiwanese regulations.

Patient recruitment

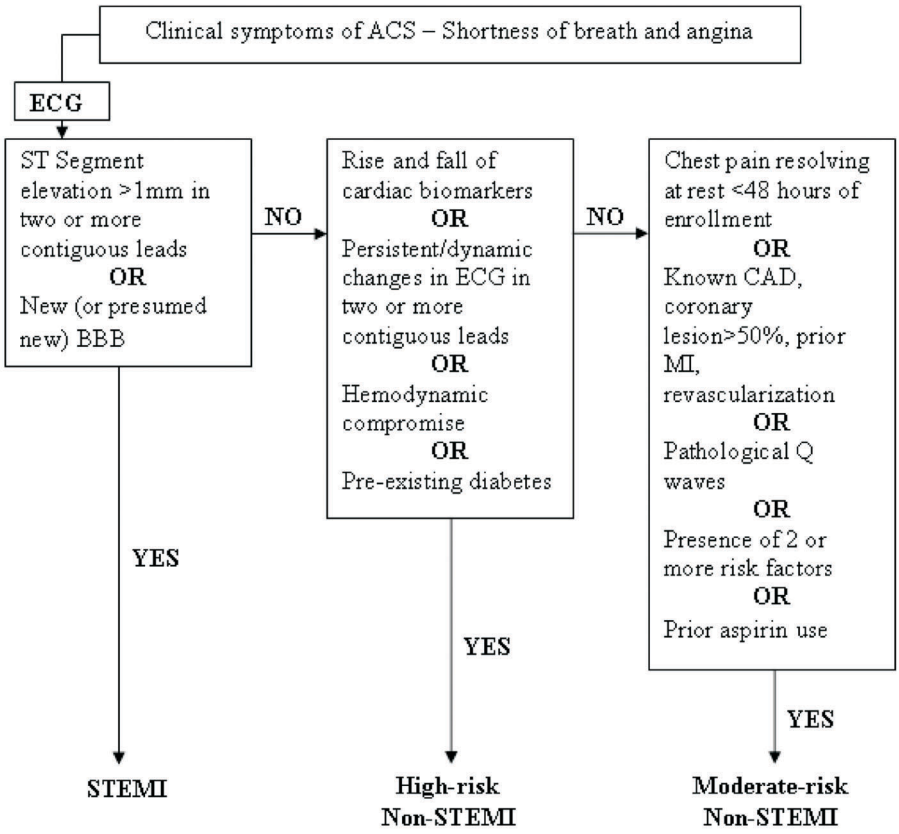
Patients who were aged 20 years or older, who were admitted within 24 hours to the hospital with symptoms of ACS, and who provided informed consent were eligible to be included in the study. Similar patients transferred in from a non-trial site were also eligible for enrolment provided they were not at the non-trial site for more than 12 hours. Presentation of ACS accompanied, precipitated by co-morbidity such as trauma, previous enrolment in this trial or participation in an investigational drug study, were used as criteria for exclusion from this study.

Definition of ACS

ACS was defined as a heterogeneous range of symptoms from STEMI to UA and non-STEMI. Figure 1 represents the flowchart used for primary diagnosis at the time of hospital admission.

Statistical analyses

The sample size for the Taiwan ACS full spectrum registry was calculated as follows. There are about 50,000 new ACS cases per year in Taiwan. Based on a



ACS, Acute Coronary Syndrome; ECG, Electrocardiogram; BBB, Bundle Branch Block; CAD, Coronary Artery Disease; MI, Myocardial Infarction; STEMI, ST-segment Elevation Myocardial Infarction

Figure 1. *Categorization of acute coronary syndromes in the emergency department at the time of hospital admission.*

known background incidence rate of 0.0025, a sample of 2395 patients would achieve 80% power to detect an additional incidence rate of 0.003 with a precision of 0.2% and a 95% confidence interval. Taking into account a dropout rate of 20%, a sample of 3,000 was considered to be adequately representative.

Parameters were summarized using mean, median, standard deviation and inter-quartile ranges where appropriate for continuous data, and counts or percentages for categorical data. For comparability between groups, a Chi-square test was used for categorical variables and analysis of variance (ANOVA) was adopted for continuous variables. Survival and "event-free survival" was analyzed by Cox proportional hazards modelling to test the impact of the clinical and demographic covariates, as well as variations in patient management. Propensity score matching was undertaken, as required, to adjust for non-randomized comparisons. All statistical analyses were performed using an α level of < 0.05 with two-sided testing and this was considered as statistically significant. Analyses were conducted as time to first event without double counting of events within analyses involving composite endpoints. Patients who were "lost to follow up" were censored at the time of last contact with their vital status deemed as alive and "event-free" at that time. Statistical analysis was performed using SAS software version 9.2 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Demographics and baseline characteristics

Between October 2008 and January 2010, a total of 3183 eligible patients were enrolled at 39 medical centers and regional hospitals in Taiwan. Table 1 features the key baseline characteristics of the study population. Recruitment of patients at medical centers resulted in more than twice the number of patients than recruitment

at regional hospitals. The registry had a strong gender bias with 78% males and the highest percentage of males was seen among the STEMI cases (84.3%). The mean age of enrolled patients was 63.1 ± 13.6 years with significantly younger age seen in the STEMI cases (61.1 vs. 65.6 and 64.7 years for non-STEMI and UA cases, $p < 0.01$). The mean body mass index was 25.4 ± 3.9 kg/m^2 and was similar among the three patient groups. The patients with UA had a lower Killip class than those with STEMI and non-STEMI. A previous history of hypertension, dyslipidemia, diabetes, coronary artery disease (CAD) and congestive heart failure was reported in 64.0%, 39.1%, 36.0%, 24.6% and 5.4% of the total patients, respectively, with their incidence being higher in the UA cases. Overall, 42% of the patients were active smokers and this incidence was higher among the STEMI cases. Of those patients who had CAD prior to enrollment, 69.4% had undergone percutaneous coronary intervention (PCI) and 11.3% had undergone coronary artery bypass grafting. More than half the patients enrolled in the registry had a discharge diagnosis of STEMI (52.3%), followed by non-STEMI and UA, which were diagnosed in 33.9% and 12.2% of cases, respectively; together, these three groups formed > 98% of the registry population.

Emergency department diagnostic examinations

At the time of measurement in the Emergency Department (ED), UA patients had a systolic blood pressure that was higher and a heart rate that was faster than STEMI and non-STEMI patients (Table 2). The average

Table 1. Baseline characteristics of patients enrolled in the registry

	Total	STEMI	Non-STEMI	UA	p-value*
Patients enrolled, n (%)	3183 (100.0)	1665 (52.3)	1079 (33.9)	387 (12.2)	
Hospital type, n (%)					
Medical centre	2181 (68.5)	1164 (69.9)	752 (69.6)	231 (59.7)	
Regional hospital	1002 (31.5)	501 (30.1)	327 (30.4)	156 (40.3)	
Age (in years), mean ± SD	63.1 ± 13.6	61.1 ± 13.6	65.6 ± 13.1	64.7 ± 12.9	< 0.01
Male, n (%)	2483 (78.0)	1403 (84.3)	772 (71.6)	275 (71.1)	< 0.01
BMI (in kg/m^2), mean ± SD	25.4 ± 3.9	25.4 ± 3.8	25.4 ± 4.1	25.8 ± 4.0	0.123
Killip class, n/N (%)					< 0.01
I	1563/2548 (61.4)	951/1559 (61.0)	477/825 (57.8)	114/133 (85.7)	
II	458/2548 (18.0)	306/1559 (19.6)	136/825 (16.5)	12/133 (9.0)	
III/IV	527/2548 (20.6)	302/1559 (19.4)	212/825 (25.7)	7/133 (5.3)	
Risk factors, n/N (%)					
Dyslipidemia	1235/3155 (39.1)	544/1646 (33.1)	475/1071 (44.3)	199/386 (51.6)	< 0.01
Hypertension	2016/3152 (64.0)	928/1648 (56.3)	755/1070 (70.6)	296/382 (77.5)	< 0.01
Diabetes	1138/3163 (36.0)	493/1653 (29.8)	471/1074 (43.9)	158/384 (41.2)	< 0.01
Current smoker	1313/3128 (42.0)	832/1640 (50.7)	360/1056 (34.1)	110/381 (28.9)	< 0.01
Family history of vascular disease	542/2397 (22.6)	294/1291 (22.8)	171/793 (21.6)	68/272 (25.0)	0.496
Known CAD	782/3183 (24.6)	233/1665 (14.0)	321/1079 (29.8)	205/387 (53.0)	< 0.01
Prior MI	315/766 (41.1)	106/226 (46.9)	148/312 (47.4)	52/205 (25.4)	< 0.01
Prior PCI	534/770 (69.4)	159/231 (68.8)	224/313 (71.6)	137/205 (66.8)	0.505
Prior CABG	87/768 (11.3)	9/225 (4.0)	43/315 (13.7)	29/205 (14.2)	< 0.01
Prior CHF	172/3183 (5.4)	40/1665 (2.4)	85/1079 (7.9)	41/387 (10.6)	< 0.01
History of AF	103/3181 (3.2)	38/1663 (2.3)	44/1079 (4.1)	15/387 (3.9)	0.019
Prior CVD	287/3183 (9.0)	107/1665 (6.4)	141/1079 (13.1)	36/387 (9.3)	< 0.01

* Comparison between STEMI, non-STEMI and UA groups. By Chi-square test for categorical variables and by ANOVA for continuous variables.

STEMI, ST-segment elevation myocardial infarction; UA, unstable angina; SD, standard deviation; BMI, body mass index; ED, emergency department; CAD, coronary artery disease; MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; CHF, congestive heart failure; AF, atrial fibrillation; CVD, cerebrovascular disease.

time spent by the patient in the ED was 5.3 hours and this duration was shorter for STEMI cases (3.2 hours); UA cases on the other hand, spent an average of 9 hours in the ED. An ECG was performed within 10 minutes of ED admission for 50.3% patients. The cardiac enzymes were less frequently measured for patients discharged with UA. ED procedures such as diagnostic angiography were more frequently used in patients discharged with STEMI in comparison to the other groups (Table 2). Angiography was performed in 97.4% of STEMI cases and the median time to carrying out this procedure from the time of ED admission was 1.6 hours. In contrast, this was done only in 89.7% and 91.7% of non-STEMI and UA cases, respectively, with a median time to angiography being > 40 hours post-admission. The STEMI patients had a higher percentage of culprit artery lesion involving the left anterior descending artery and right coronary artery. Also, the STEMI patients had a lower

Table 2. Evaluation in the ED, diagnostic and angiographic procedures

	Total	STEMI	Non-STEMI	UA	p-value*
ED presentation, mean ± SD					
SBP, mm Hg	139.3 ± 32.8	135.0 ± 32.7	144.3 ± 32.7	144.4 ± 30.1	< 0.01
DBP, mm Hg	81.6 ± 20.9	81.5 ± 21.4	82.0 ± 21.0	80.9 ± 18.1	0.652
HR, beats/min	82.3 ± 22.5	79.2 ± 21.7	86.8 ± 23.2	82.5 ± 20.6	< 0.01
ED time, hours	5.3 ± 11.0	3.2 ± 8.3	7.3 ± 12.4	9.0 ± 14.9	< 0.01
Examinations, n/N (%)					
First ECG within 10 min	1363/2708 (50.3)	833/1394 (59.8)	388/959 (40.5)	128/316 (40.5)	< 0.01
Cardiac enzymes	3109/3183 (97.7)	1646/1665 (98.9)	1070/1079 (99.2)	346/387 (89.4)	< 0.01
Cardiac angiography	2988/3183 (93.9)	1622/1665 (97.4)	968/1079 (89.7)	355/387 (91.7)	< 0.01
Median time to, hours	6.4	1.6	43.9	43.7	< 0.01
Culprit artery, %					
LM	3.2	2.0	5.2	3.1	< 0.01
LAD	44.6	52.5	35.8	38.8	< 0.01
LCx	17.8	13.8	26.2	12.7	< 0.01
RCA	32.6	39.3	27.3	20.9	< 0.01
Artery flow, %					< 0.01
TIMI 0/1	57.7	69.6	45.3	24.6	
TIMI 2	21.7	17.2	27.3	32.8	
TIMI 3	20.7	13.2	27.4	42.7	
Echocardiography	2435/3180 (76.6)	1370/1665 (82.3)	797/1077 (74.0)	238/386 (61.7)	< 0.01
Median ejection fraction, %	55.0	53.0	57.0	60.0	< 0.01
PCI, n/N (%)	2680/3177 (84.4)	1559/1664 (93.7)	817/1077 (75.9)	284/384 (74.0)	< 0.01
Performed within 48 hours	2040/2654 (76.9)	1446/1555 (93.0)	444/807 (55.0)	140/272 (51.5)	< 0.01
Median time to, hours	4.5	1.9	42.1	46.2	< 0.01
Stent type, %					< 0.01
BMS	63.8	70.4	56.7	48.7	
DES	24.9	20.1	29.7	37.1	
Both	3.0	2.5	4.1	2.9	
No. of lesions treated, mean ± SD	1.4 ± 0.8	1.3 ± 0.6	1.5 ± 0.9	1.5 ± 0.9	< 0.01
CABG, n/N (%)	106/3183 (3.3)	33/1665 (2.0)	57/1079 (5.3)	15/387 (3.9)	< 0.01
Median time to, hours	160.8	87.0	186.3	160.2	0.101

* Comparison between STEMI, non-STEMI and UA groups. By Chi-square test for categorical variables and by ANOVA for continuous variables.

ED, emergency department; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; ECG, electrocardiogram; LM, left main; LAD, left anterior descending; LCx, left circumflex; RCA, right coronary artery; TIMI, thrombolysis in myocardial infarction; PCI, percutaneous coronary intervention; BMS, bare-metal stent; DES, drug eluting stent; CABG, coronary artery bypass grafting.

percentage of Thrombolysis in Myocardial Infraction (TIMI) flow grade 0/1 than non-STEMI and UA patients. Bare metal stents were more frequently used in patients with STEMI while drug-eluting stents were more frequently used in patients with non-STEMI and UA.

Reperfusion in STEMI patients

Reperfusion therapy was carried out in 82.2% of STEMI patients at the time of ED admission, most commonly as primary PCI (Table 3). Fibrinolysis was administered in only 3.3% of the patients and had a median door-to-needle time of 65 minutes, with only 12.8% of these patients receiving fibrinolytic agents within 30 minutes. Primary angioplasty was performed in 97.4% of STEMI cases and median door-to-balloon time was 96 minutes. The salient points of STEMI management are listed in Table 3.

Pharmacological management of ACS in hospital and at discharge

Medications prescribed during the first 24 hours as well as at discharge are listed in Table 4. Aspirin was prescribed to 91.8% of the patients during the acute phase and to 80.3% of the patients at discharge. Clopidogel was prescribed in a similar fashion (94.1% and 84.6%, respectively). In contrast, dual antiplatelet therapy (aspirin + clopidogrel) was prescribed to only 88.2% of the patients during the acute phase and this reduced further to 74.8% of the patients at discharge. Antiplatelet medication usage was much lower among UA patients. GP IIb/IIIa inhibitors and heparin were administered within 24 hours of hospitalization in 16.0% and 90.6% of the total patients, respectively, and this percentage was higher among STEMI patients. Antihypertensives (beta-blocker/ACE inhibitor/ARB/RAS inhibitor) and statins were prescribed more often at the time of patient discharge than as acute use drugs during hospitalization. The trend in prescription frequency of these drugs was as seen in the case of antiplatelet agents, i.e. STEMI > non-STEMI > UA. The only exception was ARBs, which were prescribed more often to UA patients than to STEMI patients, both for acute use and at discharge.

In-hospital outcomes

In-hospital mortality was at 1.8% and this was mainly due to cardiac complications. Mortality rate was higher in STEMI cases (2.3%) in comparison to UA cases (0.5%). Other in-hospital outcomes are summarized in Table 5. Stroke was seen in 13 (0.4%) patients and was ischemic in all but one case. TIMI bleeding was experienced by 1.8% of the patients. Other significant outcomes such as acute renal failure and new onset cardiogenic shock, ventricular arrhythmia and atrial fibrillation were seen in 2.0%, 4.0%, 4.7%, and 2.8% of the patients, respectively.

DISCUSSION

This first ACS full spectrum registry in Taiwan aimed to identify current and nationwide practices in

Table 3. Reperfusion status in patients diagnosed with STEMI at the time of admission

Patients diagnosed with STEMI at hospital admission, n/N (%)	1703/3183 (53.5)
Reperfusion therapy performed, n/N (%)	1399/1703 (82.2)
Fibrinolysis	20/1399 (1.4)
Primary PCI	1335/1399 (95.4)
Fibrinolysis + Primary PCI	27/1399 (1.9)
Rescue PCI	17/1399 (1.2)
Fibrinolysis	
Median door-to-needle time, min	65.0
Door-to-needle within 30 min, n/N (%)	6/47 (12.8)
Primary angioplasty	
Median door-to-balloon time, min	96.0
Door-to-balloon within 60 min (transferred in), n/N (%)	242/417 (58.0)
Door-to-balloon within 60 min (non transferred in), n/N (%)	400/943 (42.4)

STEMI, ST-segment elevation myocardial infarction; PCI, percutaneous coronary intervention.

Table 4. Medication prescription for acute use and at patient discharge

	Total N = 3183	STEMI N = 1665	Non-STEMI N = 1079	UA N = 387	p-value*
Medication, acute use, n (%)					
Aspirin	2921 (91.8)	1594 (95.7)	971 (90.0)	309 (79.8)	< 0.01
Clopidogrel	2994 (94.1)	1619 (97.2)	1008 (93.4)	327 (84.5)	< 0.01
Aspirin + clopidogrel	2806 (88.2)	1563 (93.9)	932 (86.4)	273 (70.6)	< 0.01
GP IIb/IIIa inhibitor	510 (16.0)	403 (24.2)	99 (9.2)	6.0 (1.6)	< 0.01
Any heparin	2883 (90.6)	1604 (96.3)	976 (90.5)	274 (70.8)	< 0.01
Beta-blocker	1450 (45.6)	805 (48.4)	475 (44.0)	150 (38.8)	< 0.01
Statin	1540 (48.4)	887 (53.3)	485 (45.0)	156 (40.3)	< 0.01
ACE inhibitor	1572 (49.4)	958 (57.5)	491 (45.5)	106 (27.4)	< 0.01
ARB	384 (12.1)	132 (7.9)	163 (15.1)	78 (20.2)	< 0.01
RAS inhibitor	1872 (58.8)	1051 (63.1)	618 (57.2)	177 (45.7)	< 0.01
Medication, at discharge, n (%)					
Aspirin	2555 (80.3)	1419 (85.2)	820 (76.0)	283 (73.1)	< 0.01
Clopidogrel	2694 (84.6)	1462 (87.8)	906 (84.0)	304 (78.6)	< 0.01
Aspirin + clopidogrel	2381(74.8)	1364 (81.9)	753 (69.8)	244 (63.1)	< 0.01
Beta-blocker	1700 (53.4)	949 (57.0)	567 (52.6)	166 (42.9)	< 0.01
Statin	1924 (60.5)	1078 (64.7)	636 (58.9)	201 (51.9)	< 0.01
ACE inhibitor	1408 (44.2)	875 (52.6)	418 (38.7)	105 (27.1)	< 0.01
ARB	621 (19.5)	266 (16.0)	237 (21.9)	106 (27.4)	< 0.01
RAS inhibitor	2005 (63.0)	1126 (67.6)	648 (60.0)	209 (54.0)	< 0.01

* Comparison between STEMI, non-STEMI and UA groups. By Chi-square test for categorical variables and by ANOVA for continuous variables.

STEMI, ST-segment elevation myocardial infarction; UA, unstable angina; GP, glycoprotein; ACE, angiotensin converting enzyme; ARB, angiotensin II receptor blocker; RAS, renin-angiotensin-aldosterone system.

Table 5. In-hospital outcomes grouped by discharge diagnosis

In-hospital outcome	Total	STEMI	Non-STEMI	UA	p-value*
Death, n/N (%)	57/3183 (1.8)	38/1665 (2.3)	11/1079 (1.0)	2/387 (0.5)	< 0.01
Cardiac	47/56 (83.9)	32/37 (86.5)0	9/2 (81.8)	1/2 (50.0)	0.381
Re-MI, n/N (%)	24/3183 (0.8)	11/1665 (0.7)	12/1079 (1.1)	1/387 (0.3)	0.197
Stroke, n/N (%)	13/3183 (0.4)	4/1665 (0.2)	7/1079 (0.7)	2/387 (0.5)	0.253
Ischemic	12/13 (92.3)	4/4 (100.0)	6/7 (85.7)	2/2 (100.0)	0.629
TIMI bleeding, n/N (%)	57/3183 (1.8)	35/1665 (2.1)	21/1079 (2.0)	1/387 (0.3)	0.047
New onset, n/N (%)					
Cardiogenic shock	128/3183 (4.0)	91/1665 (5.5)	31/1079 (2.9)	6/387 (1.6)	< 0.01
Ventricular arrhythmia	151/3183 (4.7)	112/1665 (6.7)	32/1079 (3.0)	2/387 (0.5)	< 0.01
Atrial fibrillation	89/3183 (2.8)	45/1665 (2.7)	34/1079 (3.2)	8/387 (2.1)	0.518
Acute renal failure, n/N (%)	65/3183 (2.0)	31/1665 (1.9)	26/1079 (2.4)	5/387 (1.3)	0.352

* Comparison between STEMI, non-STEMI and UA groups. By Chi-square test for categorical variables and by ANOVA for continuous variables.

STEMI, ST-segment elevation myocardial infarction; UA, unstable angina; MI, myocardial infarction; TIMI, thrombolysis in myocardial infarction.

ACS management from the point of hospital admission to one year after discharge. The study also aimed to assess the adherence of these current practices to the recommended clinical guidelines, any differences between these practices based on urban or rural settings, and treatment persistence rates at various points of fol-

low-up. The scope of this publication is to report current in-hospital management of ACS across Taiwan and the outcomes at hospital discharge.

In the studied ACS population, STEMI patients were younger than non-STEMI and UA patients. The traditional risk factors such as hypertension, hyperlipidemia, and diabetes were less frequently seen in STEMI patients than in non-STEMI and UA patients. Our findings are consistent with these of previous ACS registry studies.[19,20]

Despite clinical evidence demonstrating the benefits of early invasive management, this study discovered a shift from this in actual practice during the treatment of ACS in Taiwan. For first-line diagnosis of the symptoms by ECG, only half of the patients had an ECG exam within 10 minutes. Routine angiography within 24 hours of hospital admission allows for risk stratification and subsequently a better handle on disease management in order to reduce mortality.[4] In our study, median time to cardiac angiography was > 40 hours in non-STEMI and UA cases. Subsequently, PCI was performed only in 75.9% and 74.0% of these cases and about half of these were performed after 48 hours of admission. With regards to clinical management of STEMI, one of the major goals is to reduce ischemic time and to facilitate primary PCI and/or fibrinolysis based on clinical judgment at the earliest timing.[8,21] The median door-to-balloon time was calculated as 96 minutes, which is slightly above the recommended time of 90 minutes,[8] while for pharmacological reperfusion, the observed door-to-needle time of 65 minutes was more than twice the recommended time of 30 minutes.[8] The possible reasons for not performing primary PCI in STEMI patients included an onset to ED presentation of > 12 hours, family refusal and no 24-hour availability of primary PCI in some smaller hospitals.

Evaluation of registries worldwide have identified medication usage for ACS management as one of the main areas where non-compliance with the guidelines exists.[13-17] Numerous studies in the past have demonstrated the benefits of antiplatelet therapy in management of cardiovascular diseases,[22-25] however, antiplatelet therapy is severely underutilized in the real-world setting.[26,27] International guidelines recommend early use of aspirin and clopidogrel for in-hospital management, and continuing of dual antiplatelet therapy up to 12 months in ACS patients.[7] Data from the CRUSADE registry, which mainly targeted high-risk non-STEMI and UA cases, put clopidogrel usage at 60% for acute phase and 73% at discharge.[13] The GRACE registry showed that clopidogrel (or ticlopidine) was prescribed for in-hospital use in only 30% of the ACS patients enrolled across various countries.[15] Data from the ACACIA registry proved a similar low utilization of clopidogrel existed in ACS management in Australia.[16] Similar to the patterns seen from these international registries, the use of antiplatelet medication in Taiwanese ACS patients reported from this registry was suboptimal. Only 80.3% and 84.6% of the patients were prescribed aspirin and clopidogrel, respectively, at discharge, and dual antiplatelet therapy with aspirin + clopidogrel was prescribed to only 74.8% of the patients. This pattern of non-adherence to guidelines was even more pronounced in the non-STEMI and UA cases with only 69.8% and 63.1% of them continuing on dual antiplatelet therapy at discharge.

The observed in-hospital mortality rate of 1.8% in this study was much lower than the observations from other registries like CRUSADE (4.5%)[13] but in accordance with the reported rates from other large-scale clinical trials.[28,29] This could be an artifact of selection bias during enrollment since, in some recruiting centers, patients were selected by specific investigators and therefore not all eligible ACS patients were included in the registry; this may have contributed to the selection bias.

This study, like other registries, has a limitation in being an observational, non-randomized study that allows only for establishment of association between current clinical practices and the outcome.It which does not allow causality to be examined. This registry also compares existing clinical practices in ACS management to guidelines that are based on data that is constantly evolving and hence, can only be cautiously considered as a gold standard. Nonetheless, this study provides valuable real-world data on the current practices across the full spectrum of ACS in Taiwan, which should help to improve the ACS management outcomes in this country.

In conclusion, this study demonstrates that, despite the establishment of guidelines for ACS management based on overwhelming clinical evidence, there is a lack of adherence to these in Taiwan. This is not a unique situation and follows a global pattern of discord

between guidelines and real-world practice. There could be numerous reasons for this, such as lack of physician awareness of the revised guidelines, lack of implementation of quality improvement programs, and the perceived cost versus benefit of certain recommended practices. Further analysis of this full spectrum Taiwanese registry will provide an opportunity to take adequate steps to close the gap between guidelines and clinical management of ACS patients in Taiwan.

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