Original Article

Treatment Outcomes of Acute Coronary Syndrome Patients in Bangkok Dusit Medical Services (TOACS-BDMS)

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Abstract

OBJECTIVES: The research team analyzed an acute coronary syndrome (ACS) registry from a private hospital group in Thailand. We aimed to analyze patients' characteristics, treatment outcomes in ACS patients and compare the outcomes between ST segment elevation acute coronary syndrome (STE-ACS) and non-ST segment elevation acute coronary syndrome (NSTE-ACS).

MATERIALS AND METHODS: This is a multi-centered, retrospective review of an ACS registry with seven participating hospitals carried out between January 2017 to December 2020. Web-based data entry was used, and the data were centrally managed and analyzed.

RESULTS: A total of 2,024 ACS patients were included. Of these, patients were predominantly male (81.07%), NSTE-ACS 52.17% and the mean age was 62.27 ± 13.08 years. Diabetes mellitus (DM), hypertension (HT), dyslipidemia, and current smokers were observed in 25.24%,54.89%,46.64% and 30.38%, respectively. Reperfusion rate in STE-ACS was 93.20 % and 73.80% was primary percutaneous coronary intervention (PCI). STE-ACS patients were significantly younger (59.03 ± 12.27 vs. 65.24 ± 13.09 years), more current smokers (39.77% vs. 21.78%), more cardiogenic shock (15.28% vs. 3.03%) and more cardiac arrest before reperfusion therapy (9.71% vs. 1.79%). Meanwhile, NSTE-ACS patients presented significantly more DM (30.58% vs. 19.42%), HT (62.40% vs.46.69%), and dyslipidemia (53.78% vs.38.84%). In-hospital mortality rate was 2.91% and significantly higher in STE-ACS (STE-ACS 4.95% vs. NSTE-ACS 1.04%).

CONCLUSION: Treatment outcomes of ACS patients in Bangkok Dusit Medical Services revealed high reperfusion rate and resulted in low in-hospital mortality rate. STE-ACS patients were more severe and with a higher mortality rate compared to NSTE-ACS patients.

Keywords: Outcomes, acute coronary syndrome, registry, BDMS

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Acute Coronary Syndrome (ACS) usually results from the erosion and rupture of lipid laden plaque which deposits on the walls of coronary arteries. When a plaque ruptures or splits from the vascular wall, a blood clot forms and totally or partially obstructs the flow of blood entering heart muscles, resulting in a sudden lack of blood in the heart, severe myocardial ischemia, and acute myocardial infarction. However, there are other causes of ACS such as coronary spasm, spontaneous coronary artery dissection and coronary embolism. ACS is a critical health problem worldwide. There are two types of ACS, STE-ACS or ST segment elevation myocardial infarction (STEMI) and NSTE-ACS. NSTE-ACS is categorized as non-ST segment elevation myocardial infarction (NSTEMI) and Unstable Angina (UA).

In Thailand, there are two published ACS registries, the first one is Thai Acute Coronary Syndrome registry[1] (TACSR) recorded from 2002 to 2004 and the second is the Thai Registry of Acute Coronary Syndrome[2] (TRACS) recorded from 2007 and 2008. A comparison to other international registries revealed that in both registries most of the

STEMI patients were younger patients, male predominantly with more cardiogenic shock. Patients in the STEMI group had a 17% in-hospital mortality rate in the TACSR, reduced to 5.30% in the TRACS. This corresponds to a study conducted on a registered AMI patient in Korea (The Korea Acute Myocardial Infarction Registry; KAMIR) from 2005 to 2018. The result shows that the in-hospital mortality rate of STEMI patients is higher than other study groups and the rate is likely to drop from 6.20% in 2005 to 5.30% during 2018.[3] Data from the Zurich-Acute Coronary Syndrome (Z-ACS) Registry[4] between 2007 and 2010 and The Global Registry of Acute Coronary Events[5] (GRACE) study also showed that the STEMI group had a higher hospital mortality rate (5.70% and 7.00%) than the NTEMI and UA groups. The Malaysia's Annual Report of the NCVD-ACS registry 2014 to 2015[6] reported the STEMI patients' group had an in-hospital mortality rate of 10.60%. Reperfusion therapy is the cornerstone treatment of ACS especially in STE-ACS and high risk NSTE-ACS. Primary PCI within 12 hours is the recommendation for STE-ACS patients. According to the results of the two Thai Registries in ACS research papers[1,2], only 52.60% and 67.20% of STEMI patients received reperfusion treatment, respectively, while only 22.20% and 24.70% of patients received PCI.[1,2] In both of Thailand's Registries, most participating hospitals were government hospitals. In Thailand, since April 2017, the policy of universal coverage for emergency patients including ACS patients was approved to regulate all hospitals to treat emergency patients for free for the first 72 hours. Reports from TACSR come from the department of medical services, ministry of public health Thailand recruiting data from public hospitals (94.00%).[7]

Therefore, the research team analyzed data of ACS registry in Bangkok Dusit Medical Service (BDMS) which is data from a private hospital group in Thailand.

We aimed to analyze overall data and compare the results between STE-ACS and NSTE-ACS in terms of patients' characteristics, treatment and in-hospital mortality rate; seeking for any significant changes in this registry from other ACS registries.

Methods

This is a retrospective study, carried out between January 2017 to December 2020, of an ACS registry conducted at the Bangkok Heart Hospital (BHT) at Bangkok Hospital Headquarters (BHQ) and another six hospitals under BDMS. ACS Registry participating hospitals included BHT, Bangkok Pattaya Hospital, Bangkok Phuket Hospital, Bangkok Sanamchan Hospital, Phyathai 2 Hospital, Samitivej Sukhumvit Hospital and Bangkok Chiangmai Hospital. ACS patients referred to patients with angina chest pain for more than 20 minutes, typical electrocardiographic findings of STE-ACS and ST segment depression or inverted T wave as NSTE-ACS and rise of high sensitivity troponin I or troponin T above 99th percentile upper reference limit in those with suspected NSTE-ACS.

Clinical data

The data was recorded via BDMS COE web-base and analyzed after ethics approval. Patients' demographic data, coronary risk factors, medications, type of revascularization, treatment outcomes and in-hospital clinical events and mortality rate were recorded and analyzed.

Statistical analysis

According to the declaration of Helsinki, this is a retrospective study, TOACS-BDMS was approved by BHQ-Institutional Review Board (BHQ-IRB) on January 26, 2022 and certified on February 4, 2022 (COA.2022-06) by Prof. Dr. Somboon Kunathikom, Chairman of BHQ-IRB.

Ethics Approval

According to the declaration of Helsinki, this is a retrospective study, TOACS-BDMS was approved by BHQ Institutional Review Board on January 26, 2022 and certified on February 4, 2022 (COA.2022-06) by Prof. Dr. Somboon Kunathikom, Chairman of BHQ Institution Review Board.

Results

A total of 2,024 ACS patients with a mean age of 62.27 ± 13.08 years, predominately male (81.07%) were enrolled. Of these, there were 968 (47.83%) STE-ACS patients, 1,056 (52.17%) NSTE-ACS patients (Figure 1) and 819 (40.50%) foreigners. Regarding coronary risk factors (Table 1), HT was the leading factor, follow by dyslipidemia, current cigarette smoking and DM. At first medical contact, cardiogenic shock and cardiac arrest were found in 180 cases (8.89%) and 113 cases (5.58%) respectively.

Regarding baseline characteristics comparing between STE-ACS and NSTE-ACS (Table 1), NSTE-ACS patients were older, predominantly male, presenting more DM, more HT and dyslipidemia while STE-ACS comprised more current cigarette smokers. As to heart failure, cardiogenic shock, and cardiac arrest at first medical contact (Table2) in STE-ACS were reported in 110 patients (11.36%), 148 patients (15.28%) and 94 patients (9.71%) respectively, in contrast, in NSTE-ACS those events were reported in 174 patients (16.47%), 32 patients (3.03%) and 19 patients (1.79%) respectively.
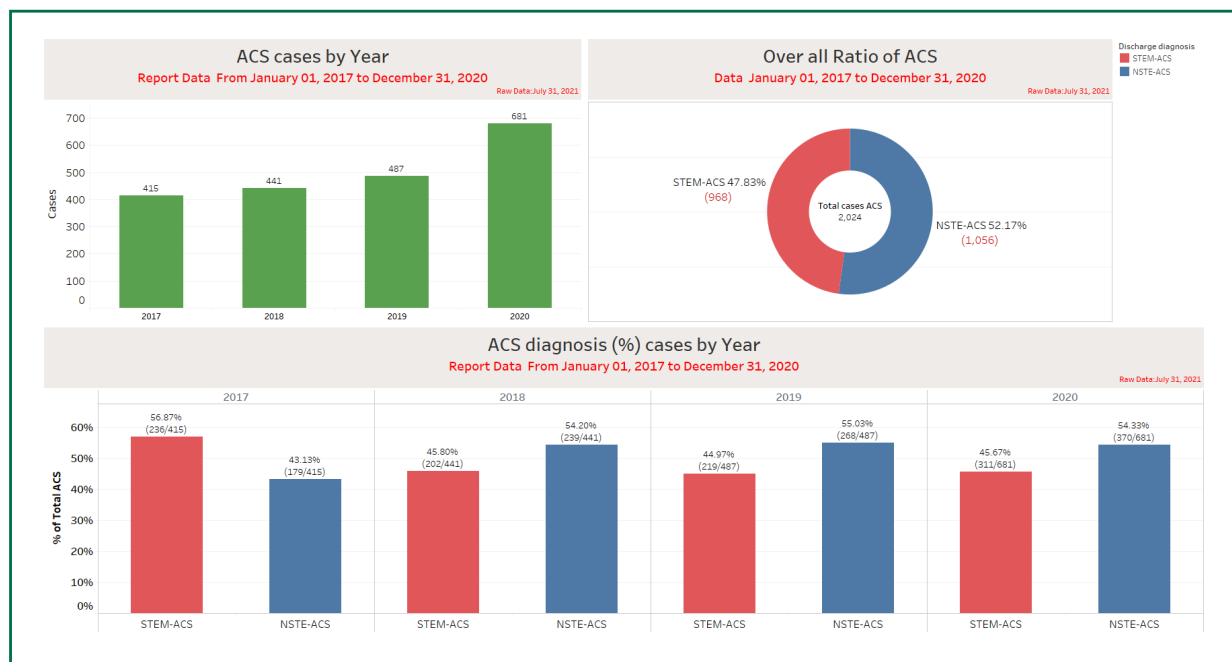
Figure 1: Numbers of ACS, STE-ACS and NSTE-ACS in overall and over all ratio by calendar years.

Table 1: Baseline characteristics of acute coronary syndrome patients

Categories Variables	STE-ACS n (%)	NSTE-ACS n (%)	Total n (%)	p (STE-ACS vs. NSTE=ACS)
Numbers	968 (47.83)	1,056 (52.17)	2,024 (100.00)	NS
Foreigners	396 (40.90)	423 (40.05)	819 (40.46)	NS
Age (years), Mean±SD	59.03 ± 12.27	65.24 ± 13.09	62.27 ± 13.08	< 0.001
Male Gender	823 (85.02)	818 (77.46)	1,641 (81.07)	< 0.001
Female Gender	145 (14.97)	238 (22.53)	383 (18.93)	< 0.001
DM	188 (19.42)	323 (30.58)	511(25.24)	< 0.001
Hypertension	452 (46.69)	659 (62.40)	1,111 (54.89)	< 0.001
Current Smokers	385 (39.77)	230 (21.78)	615 (30.38)	< 0.001
Dyslipidemia	376 (38.84)	568 (53.78)	944 (46.64)	< 0.001
Transfer cases	479 (49.48)	273 (25.85)	752 (37.15)	< 0.001

STE-ACS = ST elevation acute coronary syndrome; NSTE-ACS = non ST elevation acute coronary syndrome: DM = diabetes mellitus

Table 2: Heart failure, cardiogenic shock, and cardiac arrest before coronary angiography in ACS patients

Categories Variables	STE-ACS n (%)	NSTE-ACS n (%)	Total n (%)	p (STE-ACS vs. NSTE=ACS)
Heart failure	110 (11.36)	174 (16.47)	284 (14.03)	< 0.001
Cardiogenic Shock	148 (15.28)	32 (3.03)	180 (8.89)	< 0.001
Cardiac Arrest, pre-PCI	94 (9.71)	19 (1.79)	113 (5.58)	< 0.001

STE-ACS = ST elevation acute coronary syndrome; NSTE-ACS = non-ST elevation acute coronary syndrome; PCI = percutaneous coronary intervention

Reperfusion therapy in STE-ACS patients (Table 3, Figure 2) were PCI in 903 patients (93.28%), thrombolytic therapy in 5 patients (0.52%), and coronary artery bypass graft (CABG) in 22 patients (2.27%). In STE-ACS who underwent PCI, it was primary PCI in 714 patients (73.76%) and all the rest were transfers and delayed PCI. Primary PCI within 90 min or time to primary PCI within 90 minutes was achieved in 76.00% and the median time was 71 minutes (Figure 2). In NSTE-ACS patients, PCI, and CABG (Table 3, Figure 3) were performed in 672 patients (63.63%) and 29 patients (2.74%) respectively.
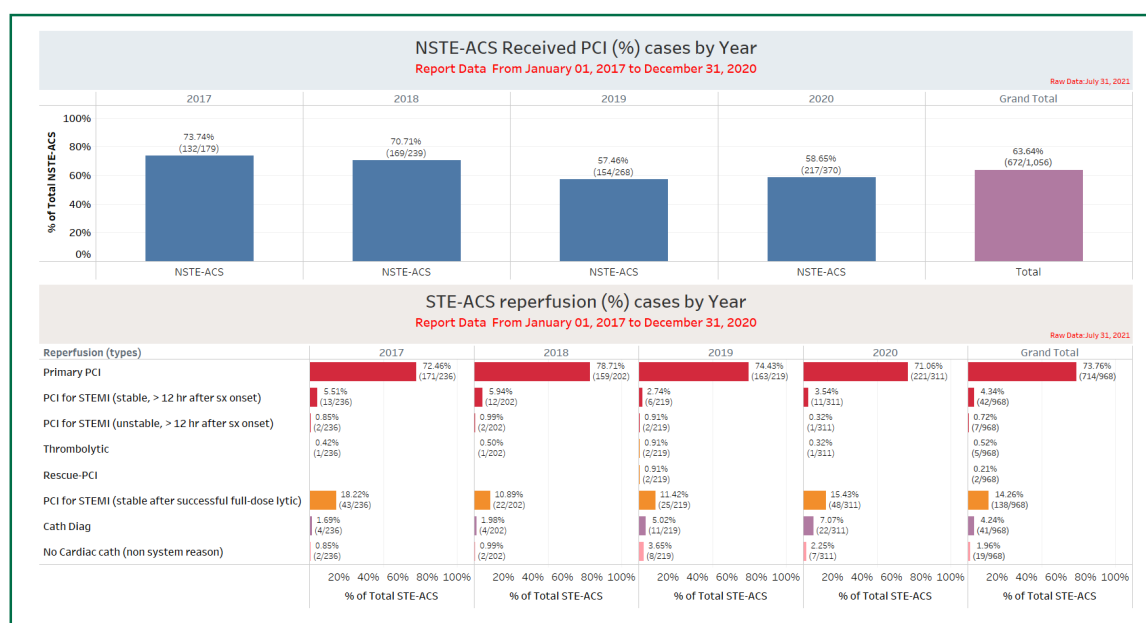
Table 3: Reperfusion therapy, mechanical circulatory support, and in-Hospital Mortality rate in ACS patients

Categories Variables	STE-ACS n (%)	NSTE-ACS n (%)	Total n (%)	p (STE-ACS vs. NSTE=ACS)
Total PCI	903 (93.28)	672 (63.63)	1,575 (77.81)	< 0.001
Total CABG	22 (2.27)	29 (2.74)	51 (2.51)	0.674
IABP	68 (7.02)	13 (1.23)	82(4.05)	< 0.001
ECMO	3 (0.30)	2 (0.18)	5 (0.24)	0.674
In-hospital mortality rate	48 (4.95)	11 (1.04)	59 (2.91)	< 0.001

STE-ACS = ST elevation acute coronary syndrome; NSTE-ACS = non-ST elevation acute coronary syndrome; PCI = percutaneous coronary intervention; CABG = coronary artery bypass graft; IABP = intra-aortic balloon pump; ECMO = extracorporeal membrane oxygenation
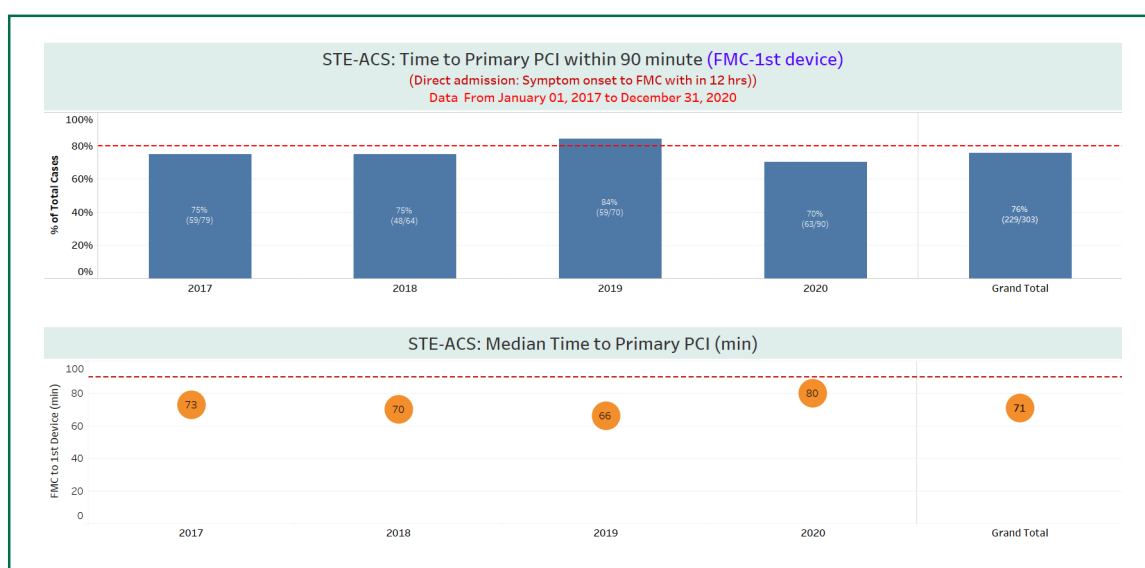
Figure 2: Graphic presenting percentage of STE-ACS patients with symptom onset to first medical contacts within 12 hours and underwent primary PCI within 90 minutes by calendar years.
FMC: first medical contact

Figure 3: Types and percentage of reperfusion therapy in STE-ACS and NSTE-ACS patients by calendar years.

As to mechanical circulatory support, IABP was inserted in 3.95% of all ACS patients, 68 cases (7.02%) of STE-ACS and 12 cases (1.13%) of NSTE-ACS, extracorporeal membrane oxygenation (ECMO) was inserted in 5 ACS patients (0.24%), 3 STE-ACS patients (0.30%) and 2 NSTE-ACS patients (0.18%).

Overall, in-hospital mortality rate in ACS patients was 2.91%, 4.95% in STE-ACS patients and 1.04 % in NSTE-ACS patients (Table 3, Figure 4). In addition, those with cardiogenic shock or cardiac arrest before coronary angiography had remarkably high mortality rates; 8.80% in cardiogenic shock and 26.50% in post cardiac arrest group (Figure 5).
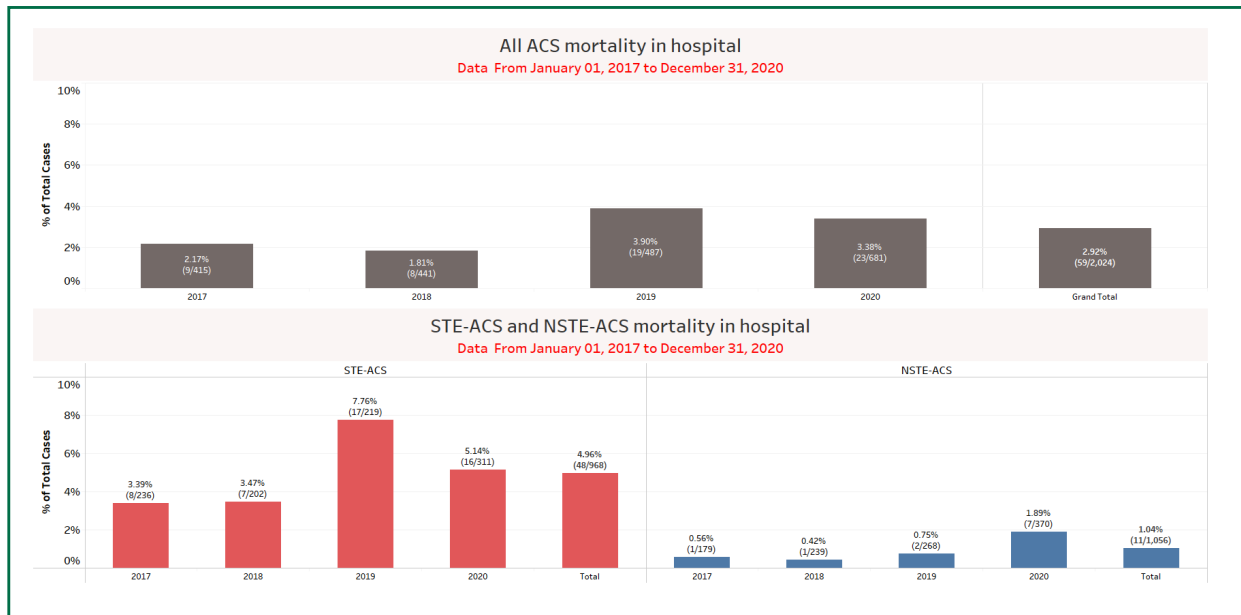

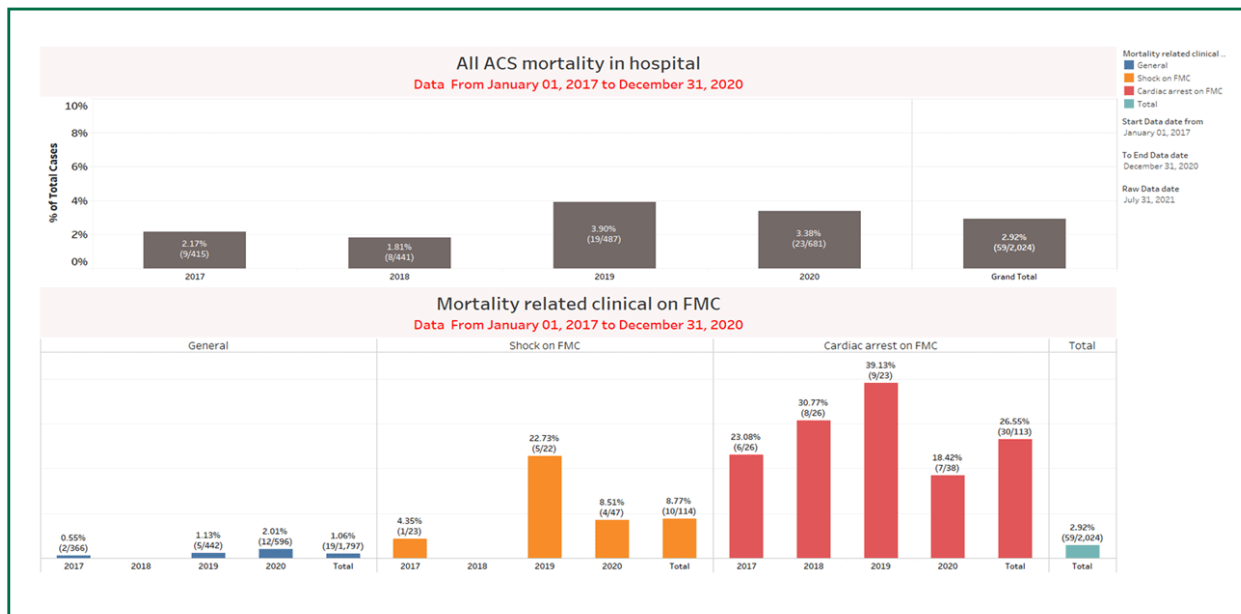**Figure 4:** In-hospital mortality rate in STE-ACS and NSTE-ACS by calendar years.

Figure 5: Comparison between ACS patients without cardiogenic shock or cardiac arrest, those with cardiogenic shock and those with cardiac arrest before coronary angiography in terms of In-hospital mortality rate. FMC: first medical contact

Discussion

TOAC-BDMS study showed ACS registry which enrolled both Thai (59.50%) and foreigners (40.50%). This is different from TACSR and the second TRACS which recruited fewer foreigners. Our data covered all regions in Thailand, in the

northern regions - Bangkok Chiangmai Hospital Bangkok; in the eastern regions- Bangkok Pattaya hospital; in the southern regions -Bangkok Phuket Hospital; in the western regions -Bangkok Sanamchan and; in the central region Phyathai 2 Hospital, Samitivej Sukhumvit Hospital and BHT. STE-ACS or STEMI and NSTE-ACS were diagnosed in 47.80% and

52.20%which was comparable to TACSR, TRACS and second Euro Heart Survey on ACS[1,2,8]

The leading coronary risk factors are hypertension and dyslipidemia which was comparable to TACSR, TRACS and the second Euro Heart Survey on ACS, while the Indian ACS registry[9] showed current cigarette smoking as the leading risk.

Heart failure at first medical contact or at admission was 14.03% in this study which was comparable to most reports revealing the incidence of heart failure in ACS varies between 11.00-13.00%.[10] NSTE-ACS patients had heart failure more than STE-ACS patients (16.47% vs. 11.36%) while many clinical trials reported more heart failure in STE-ACS patients (28.70% vs 6.60%).[10]

With regards to cardiogenic shock in ACS this was linked to high mortality found in 8.89% of ACS patients in this registry and this was close to the cardiogenic shock incidence in other studies (10.00%, ranges 4.00-15.00%).[11-15] Incidence of cardiogenic shock was higher in STE-ACS patients than NSTE-ACS patients (15.28% vs 3.03%) which was comparable to TACSR, TRACS and Indian ACS registry and NCDR registry (12.23% vs 4.31%)[16].This is because of severe myocardial ischemia or infarct in STE-ACS patients. Cardiac arrest on admission or at FMC was also higher in STE-ACS patients than in NSTE-ACS patients.

Reperfusion therapy in STE-ACS patients revealed high percentage of primary PCI 73.80% because this registry was conducted in PCI capable centers, however, the coverage was not 100% due to late presentation in 4.30%, and rescue PCI in 14.36%. However, the percentage of PCI in this study was higher than TACSR (22.30%), TRACS (24.70%) and second Euro ACS Survey (59.00%). Total PCI in STE-ACS patients was 92.40% which is higher than TACSR (45.30%), TRACS (38.00%), TACSR (2017;65.40%, 2018;67.90%, 2019;72.30%, 2020;76.67%)[1,2,7], and second Euro Heart Survey (ACS-II; 64.00%)[8], and comparable to ACS data registry in a high volume center of Central Europe (93.40%)[17]. The median time of FMC to first device time was 71 min, and 76.00% of PCI procedures can be performed within 90 minutes, this time was shorter with a higher percentage of door to balloon time within 90 min earlier than TACSR and TRACS and comparable to second Euro Heart survey on ACS (70 min)[8], and ACS data registry in a high volume center of Central Europe (63 min.).[17]

Reperfusion therapy in NSTE-ACS patients revealed a high percentage of PCI 63.60% which was higher than TACSR (51.10%), TRACS (49.40%) and second Euro ACS Survey (37.10%) and lower than ACS data registry in high volume center of Central Europe (74.50%).[17]

Coronary artery bypass graft was performed less than PCI in STE-ACS and NSTE-ACS (2.30% vs 2.80%) in contrast to second Euro ACS Survey (2.90% vs 7.40%)[8], and ACS data registry in a high volume center of Central Europe (2.00% vs 16.00%).[17]

Percutaneous mechanical circulatory support devices in this registry were IABP and Veno-arterial ECMO (V-A ECMO). There were more inserted in STE-ACS than NSTE-ACS (7.30% vs 1.30%) which was comparable to second Euro ACS Survey (2.60% vs 1.20%).[8]

In-hospital mortality rate of all ACS patients in this study was 2.91% (Slightly increased from 2018, 2017 (2.16%), 2018 (1.81%), 2019 (3.90%), 2020 (3.37%)) which was lower than TRAC (12.60%), TRAC (4.80%), second Euro ACS Survey (4.00%), non-Asian Grace population (5.00-6.00%)[18], Japanese report (7.00%)[19], and TRACS (2017 to 2020; vary from 9.63 to10.50%), STE-ACS patients had higher mortality rate than NSE-ACS (4.95% vs 1.04%) which was close to previous ACS registry. This registry showed lower mortality rate in both STE-ACS and NSTE-ACS than recent ACS data registry in a high volume center of Central Europe (STE-ACS;5.00% vs 10.90%; NSTE-ACS 1.00% vs 4.70%).[17] This can be explained by a comparable high rate of PCI, more than 90% , but recent ACS registry enrolled 11.00% STE-ACS patients with out-of-hospital cardiac arrest (OHCA), while this study enrolled 9.70% STE-ACS patients with cardiac arrest at emergency department before coronary angiography. Practice management should be considered particularly for patients in cardiac arrest groups.

For ACS patients, in-hospital mortality rate in cardiogenic shock in this registry was higher than those without CS comparable to other ACS registries. hospital mortality rate was lower than the Culprit shock trial (60.00%)[20] and close to recent study from PCI Center ACS registry in Korea (11.00%)[21], and Japan (9.20%)[22].

Conclusions

TOACS-BDMS registry revealed high reperfusion rate and resulted in low in- hospital mortality rate. STE-ACS patients were more severe with a higher mortality rate compared to NSTE-ACS patients. Best practice management for emergency areas should be considered to decrease mortality rates in STE-ACS group.

Strength and Limitations

This study was the first big data of ACS registry in a private network hospitals in Thailand, and 40.00% of enrolled patients were foreigners. There were some limitations to follow-up due to financial causes, some Thai patients would like to follow-up with government hospitals and fly-in patients returned to their countries of origin.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to privacy and ethical restrictions. A reasonable request to the corresponding author will be considered.

Acknowledgement

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