## Original Article

# *A Clinical Registry Study on Acute Coronary Syndrome Patients in Cairo*

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## ABSTRACT

***Background:*** Acute coronary syndrome (ACS) is a type of coronary heart disease responsible for one-third of deaths in individuals older than 35. Registries are a powerful tool to improve patient care and research.

***Methods:*** We registered 1432 patients with ACS from 2 major tertiary healthcare institutes in Cairo from August 2019 through July 2020. ST-elevation myocardial infarction (STEMI) was reported in 50.6% of the patients, non–ST-elevation myocardial infarction (NSTEMI) in 28.9%, and unstable angina in 20.5%.

***Results:*** The mean age was 66.9 ± 11.3 years, 78.4% were male, and 56.4% were current smokers. The most frequent comorbidities were hypertension (52.2%) and diabetes mellitus (47.3%). A history of ischemic heart disease was reported in 24.2%. Both institutes are 24/7 primary percutaneous coronary intervention (PCI)-capable centers; consequently, primary PCI for STEMI patients and invasive strategies for non–ST-elevation ACS patients were done once indicated. Drug-eluting stents were used in 69.7% and bare-metal stents in 30.3% of the patients undergoing primary PCI. The rates of in-hospital major adverse cardiovascular events (MACE) and mortality were 4.8% and 0.8%, respectively. In-hospital and discharge medications were optimal. The potential of different factors as predictors of in-hospital MACE was evaluated using multivariate and univariate analyses. In-hospital MACE occurrence was more frequent in STEMI patients. The multivariate analysis showed that MACE occurred more frequently in STEMI patients with chronic kidney disease, ischemic cardiomyopathy, peripheral arterial disease, a longer door-to-balloon time, and multivessel disease.

***Conclusions:*** This registry is one of the largest ACS registries in Cairo, Egypt, covering patient characteristics, risk factors, interventional methods, and medical treatment. ***(Iranian Heart Journal 2023; 24(3): 32-44)***

**KEYWORDS:** ACS, Egypt, MACE, Registry

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Acute coronary syndrome (ACS) is a type of coronary heart disease responsible for one-third of deaths in individuals older than 35. [1] The common risk factors for coronary heart disease are smoking, hypertension, diabetes, hyperlipidemia, male gender, physical inactivity, obesity, poor nutritional practices, and a family history of premature ischemic heart disease. [2]

The underlying pathophysiology of ACS is decreased blood flow to parts of the heart musculature, which is usually secondary to plaque rupture and thrombus formation. ACS can be secondary to vasospasm with or without underlying atherosclerosis. The result is decreased blood flow to a portion of cardiac musculature, resulting in ischemia and then infarction in that part of the heart. [3]

Registries are considered a powerful tool to improve patient care and public health. Registry data contribute to the surveillance of populations, the assessment of disease burden in the general population, healthcare planning, and the identification of areas in healthcare service policies that require intervention. Registries help compare the effectiveness of various treatments and evaluate different approaches to a procedure. [4]

Hence, we aimed to register all patients with ACS admitted to our 2 large tertiary healthcare institutes, namely Ain Shams University Hospital and Dar Al Fouad Hospital, in Cairo from August 2019 through July 2020 and to analyze their demographic data, risk factors, and medications during the hospital stay and on discharge. We also sought to assess patients' related workup and interventions and their outcomes on discharge.

## METHODS

This registry is a prospective real-world registry conducted on patients presenting to the cardiology department in Ain Shams University Hospital and Dar Al Fouad Hospital in Cairo with ACS (ST-elevation myocardial infarction [STEMI], non–ST-elevation myocardial infarction [NSTEMI], or unstable angina). We included 1432 patients from August 1, 2019, through July 31, 2020, with no age or sex predilection.

We included all patients with a definite diagnosis of ACS diagnosed by ischemic symptoms, including chest pain within 24 hours alone or associated with a typical rise in the biochemical markers of myocardial necrosis, electrocardiographic (ECG) changes indicative of ischemia, imaging evidence of new loss of viable myocardium, and new regional wall motion abnormalities. [5] There were no exclusion criteria in our registry. Instead, all patients presenting with ACS were enrolled. Study enrollment was done after patients provided written informed consent. The study population underwent thorough history taking; physical examinations; 12-lead surface ECG; lab investigations, including troponin, hemoglobin, and creatinine; and echocardiography.

We assessed patients who presented to our emergency departments or outpatient clinics with typical chest pain or any other symptoms or signs that might be the first presentation of ACS and who had an ECG done within 5 to 10 minutes from the first medical contact, along with an assessment of their vital signs. These evaluations enabled us to immediately determine whether we were dealing with STEMI or non–ST-elevation acute coronary syndrome (NSTE-ACS).

STEMI patients were defined as individuals with acute symptoms suggestive of myocardial ischemia, combined with new ECG changes, consistent with STEMI criteria according to the European Society of Cardiology guidelines 2017. [6] ECG monitoring was initiated in all STEMI patients to detect life-threatening arrhythmias and allow prompt defibrillation if indicated. Pain relief and supplementary oxygen were provided if needed. [7] The loading doses of aspirin and clopidogrel or ticagrelor were

given to all STEMI patients, and an informed written consent form for primary percutaneous coronary intervention (PCI) was obtained from all the patients. [8] Initial assessment and risk stratification were conducted according to the Killip classification. [9] A direct transfer to the cardiac catheterization laboratory to undergo primary PCI was done to eliminate any delay. In our facilities, all STEMI patients undergo primary PCI as the method of reperfusion since both facilities provide 24/7 primary PCI. Thrombolysis is, therefore, not used in our facilities.

NSTE-ACS patients were defined as individuals with ECG showing no changes or ST and T-wave changes other than ST elevation and its equivalents. Cardiac enzymes and highly sensitive troponin were withdrawn for further assessment. [10] Follow-up ECG was done to detect dynamic changes, and the follow-up of highly sensitive cardiac troponin was routinely done to detect any rise or fall. Additionally, echocardiography was routinely performed on all the patients to detect new loss of viable myocardium or new regional wall motion abnormalities. [8]

Unstable angina patients with low or intermediate pretest probabilities for ischemia underwent computerized tomography coronary angiography for further anatomical evaluation of the coronary arteries. [11]

All other patients were stratified to very high-risk NSTE-ACS, high-risk NSTE-ACS, or unstable angina. [12]

Coronary angiography and procedural details, including the time of the intervention, the door-to-balloon time in STEMI patients, the time of invasive strategies in NSTEMI and unstable angina patients, and the pattern of significant lesions in the coronary arteries, were recorded. Angiographically significant lesions were defined as those with 50% stenosis or more in the left main coronary artery and 70% stenosis or more in the rest of the coronary arteries. Thrombolysis in myocardial infarction (TIMI) flow grades prior to and after the procedure and the myocardial blush grade before and following PCI were registered. Other procedural details recorded were the vascular access (the radial or femoral approach), the use of balloon predilatation, the use of thrombus aspiration or clearway catheters, the intracoronary injection of glycoprotein IIb/IIIa inhibitors, the use of stents, the type of stent, the average amount of the contrast material used, the revascularization strategy in multivessel disease patients, postprocedural complications, and temporary or permanent pacemaker implantation. Intravenous unfractionated heparin was the anticoagulation administered in PCI due to its short half-life and favorable results in some studies. The need for surgical intervention was recorded. The decision regarding the choice between PCI and coronary artery bypass graft surgery (CABG) in complex cases was taken after a heart-team discussion. [13]

In-hospital antiplatelets and anticoagulants given were recorded. Also registered was medical treatment prescribed on discharge, including antiplatelets, statins, β-blockers, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, and mineralocorticoid receptor antagonists.

Major adverse cardiovascular events (MACE), composed of death, acute heart failure, MI, cerebrovascular stroke, and malignant arrhythmias occurring during the hospital stay, were recorded. Finally, the potential of different factors as predictors of in-hospital MACE was assessed using multivariate and univariate analyses.

**Statistical Analysis**

The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences, version 28.0, IBM Corp, Chicago, USA, 2021). Quantitative data were tested for normality using the Shapiro-Wilk test. Subsequently, if the data were normally

distributed, they were described as mean ± standard deviation and the minimum and maximum of the range before they were compared using the independent *t* test. Qualitative data were described as numbers and percentages and compared using the $\chi^2$ and Fisher exact tests for variables with expected small numbers and the marginal homogeneity test (2 dependent multinomial variables). Logistic regression was used to determine factors affecting stress, depression, and anxiety. The level of significance was considered a *P* value ≤0.050.

## RESULTS

Our registry consisted of 1432 patients, more than half of whom (50.6%) presented with STEMI, 49.4% with NSTE-ACS, 28.9% with NSTEMI, and 20.5% with unstable angina.

Among the STEMI patients (n =725), 681 of them (93.9%) presented with Killip class I, 10 (1.4%) with Killip class II, 9 (1.2%) with Killip class III, and 25 (3.5%) with Killip class IV.

Among the NSTE-ACS patients (n =707), 56 of them (7.9%) presented with very high-risk NSTEMI, 357 (50.5%) with high-risk NSTEMI, and 294 (41.6%) with unstable angina.

Most of the studied cohort patients (93.7%) were over 40 years old, and the mean age was 66.9 ± 11.3 years. More than three-quarters of the patients were male. More than half of the studied patients were current smokers, and 2.6% were Hash smokers or intravenous addicts.

Hypertension (52.2%) and diabetes mellitus (47.3%) were the most frequent comorbidities and risk factors among the studied cohort. In addition, 13% of the patients were dyslipidemic, 4.6% had chronic kidney disease, and 1.3% had chronic liver disease. Further, 24.2% of the patients had a history of ischemic heart disease, 16.6% had a previous PCI, 2.9% had a previous CABG, 2.2% had ischemic cardiomyopathy, 0.5% had severe valvular heart disease, 5.6% had a previous cerebrovascular stroke, and 1% had peripheral arterial disease.

Among the studied STEMI patients, over 50% had a symptom-to-door time of less than 6 hours. Almost all the STEMI cases (96.4%) had a door-to-balloon time of less than 1 hour. The pain-to-door time and door-to-balloon time in the STEMI patients are presented in Figure 1 and Figure 2, respectively.

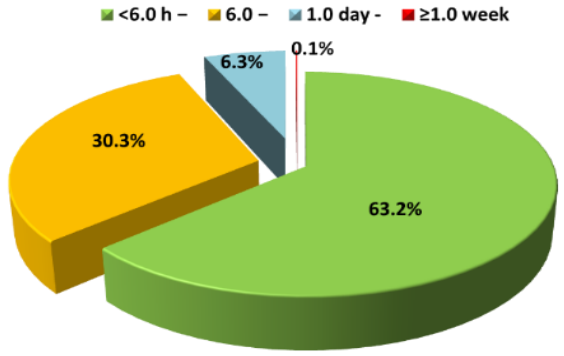


**Figure 1:** The image illustrates the symptom-to-door time among the cases with STEMI.
STEMI, ST-elevation myocardial infarction

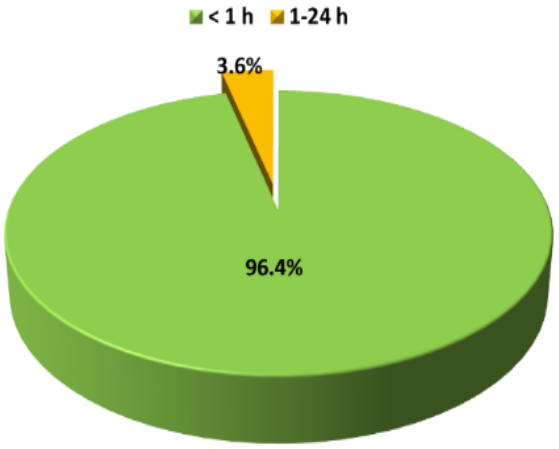


**Figure 2:** The image illustrates the door-to-balloon time among the cases with STEMI.
STEMI, ST-elevation myocardial infarction

Among the very high-risk NSTE-ACS patients, 91.1% underwent an immediate invasive strategy for revascularization (within 2 h) and 8.9% within 24 hours. In the high-risk NSTE-ACS group, 90.5%

underwent an early invasive strategy for revascularization (within 24 h) and 9.5% after 24 hours.

Regarding patients with unstable angina, 51.4% underwent revascularization within 24 hours, 37.7% underwent an elective invasive strategy (after 24 h), and 10.9% had computerized tomography coronary angiography, which showed normal coronary arteries or insignificant lesions.

Echocardiography was performed on all the studied patients. The mean ejection fraction was 50.5 ± 11.5, and 1.5% of the patients had severe valvular disease. In addition, 2.9% of the patients were candidates for computerized tomography coronary angiography. These patients had normal ECGs, normal echocardiographic findings, and normal cardiac troponin levels. They also had a low or intermediate pretest probability for ischemia. Furthermore, 78% of these patients had normal computerized tomography coronary angiography, and 22% had significant coronary lesions and underwent invasive coronary angiography and revascularization as needed.

Coronary lesions were considered angiographically significant when 50% stenosis or more in the left main coronary artery and 70% stenosis or more in the rest of the coronary arteries were detected. The left anterior descending coronary artery was the most frequently significantly affected coronary artery (71.6%), followed by the right coronary artery (54.1%) and the left circumflex coronary artery (42.9%). Moreover, 7.8% of the patients had left main disease and about half of the cases (48.8%) had multivessel disease. The findings concerning the study population's coronary arteries are shown in Figure 3.

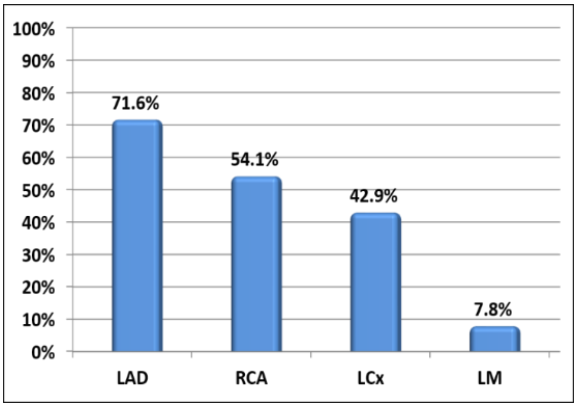


**Figure 3:** The image presents the affected coronary arteries among the studied cohort.
LAD, Left anterior descending; RCA, Right coronary artery; LCx, Left circumflex; LM, Left main

Invasive coronary angiography was performed on 73.1% of the studied patients via the femoral artery and on 26.9% through the radial artery. Most cases (98.3%) had average amounts of contrast material during coronary angiography (300 mL). Balloon pre or postdilatation was required in 45.9% of the studied patients, with an average of 2 balloons per case in almost half of them (22.3%). Percutaneous transluminal coronary angioplasty was done on only 1.3% of the included patients. PCI was performed on 80.8% of the cohort, with 1 stent in 50.3%, 2 stents in 23%, and 3 or more stents in 7.5%. The stents used were drug-eluting stents in 69.7% of the PCI cases and bare-metal stents in 30.3%. Thrombus aspiration was done on 3.6% of the patients who underwent invasive coronary angiography, and glycoprotein IIb/IIIa inhibitors were used in 18.7%. Moreover, 7.6% of the patients had coronary angiographic findings showing multivessel disease, and they were referred for CABG after a heart-team discussion. Further, 0.4% of the studied patients had severe valvular heart disease and underwent valve replacement with CABG. The procedural details and required revascularization interventions performed on the studied cohort are shown in Table 1.

The TIMI flow and myocardial blush grades significantly increased and improved after PCI in STEMI and NSTE-ACS cases.

Further, 55.8% of the patients with significant lesions in the left main coronary artery underwent CABG, and 44.2% underwent PCI for left main revascularization.

Regarding the patients with multivessel disease, the required revascularization strategy was done as follows: 58.2% underwent culprit vessel revascularization and then staged PCI, 27% had full revascularization in the same setting, and 14.7% were referred for CABG. Apropos of the revascularization strategy in the STEMI patients with multivessel disease, 70.2% underwent culprit vessel revascularization and then staged PCI, 16.2% had full revascularization in the same setting, and 13.6% were referred for CABG.

The antiplatelets and anticoagulants given during the hospital stay and the medications prescribed on discharge for the studied cohort are presented in Table 2.

In-hospital MACE and postprocedural complications happened in 9.6% of the patients. In-hospital mortality occurred in 0.8% of the study population. The in-hospital complications and MACE among the studied cases are shown in Figure 4.

MACE occurrence was significantly more frequent in our STEMI patients than in the other patients. The occurrence of MACE was more frequent in very high-risk NSTEMI patients among NSTE-ACS patients. All the studied factors correlated with MACE occurrence according to univariate (unadjusted correlations) and multivariate (adjusted correlations) analyses, statistically significant factors, and predictors of MACE are presented in Table 3.

**Table 1:** Procedural details and required revascularization interventions performed on the studied cohort

| Condition | Condition | No. | % |
|---|---|---|---|
| No. of Balloons Used | Not needed | 775 | 54.1% |
| | 1 | 294 | 20.5% |
| | 2 | 319 | 22.3% |
| | ≥3 | 44 | 3.1% |
| No. of Stents Used | Not needed | 275 | 19.2% |
| | 1 | 720 | 50.3% |
| | 2 | 330 | 23.0% |
| | ≥3 | 107 | 7.5% |
| Stent Type (total=1157) | DES | 807 | 69.7 |
| | BMS | 350 | 30.3 |
| PTCA only | | 19 | 1.3% |
| Thrombus aspiration | | 51 | 3.6% |
| GP IIb/IIIa | | 268 | 18.7% |
| CABG referral | | 109 | 7.6% |
| Valve replacement referral | | 6 | 0.4% |

Total=1432

PTCA, Percutaneous transluminal coronary angioplasty; GP, Glycoprotein; CABG, Coronary artery bypass grafting; DES, Drug-eluting stent; BMS, Bare-metal stent

**Table 2:** Antiplatelets and anticoagulants given during the hospital stay and medications prescribed on discharge among the studied cohort

| In-hospital Medication | | No. | % |
|---|---|---|---|
| *Antiplatelets* | | | |
| ASA | | 1429 | 99.8% |
| Ticagrelor | | 451 | 31.5% |
| Clopidogrel | | 979 | 68.4% |
| *Anticoagulants* | | | |
| Any of them | | 1135 | 79.3% |
| Unfractionated heparin | | 239 | 16.7% |
| LMWH | | 770 | 53.8% |
| Fondaparinux | | 126 | 8.8% |
| Medications on Discharge | | N | % |
| ASA | | 1426 | 99.6% |
| P2Y12 inhibitors | Ticagrelor | 423 | 29.5% |
| | Clopidogrel | 961 | 67.1% |
| Statins | | 1427 | 99.7% |
| Beta-blocker | | 1366 | 95.4% |
| CCB | | 2 | 0.1% |
| RAAS inhibitors | ACEIs, ARBs | 796 | 55.6% |
| | MRAs | 673 | 47% |

Total=1432

ASA, Acetyl salicylic acid; LMWH, Low-molecular-weight heparin; CCB, Calcium channel blocker; RAAS, Renin-angiotensin-aldosterone system; ACEIs, Angiotensin-converting enzyme inhibitors; ARBS, Angiotensin II receptor blockers; MRAs, Mineralocorticoid receptor antagonists

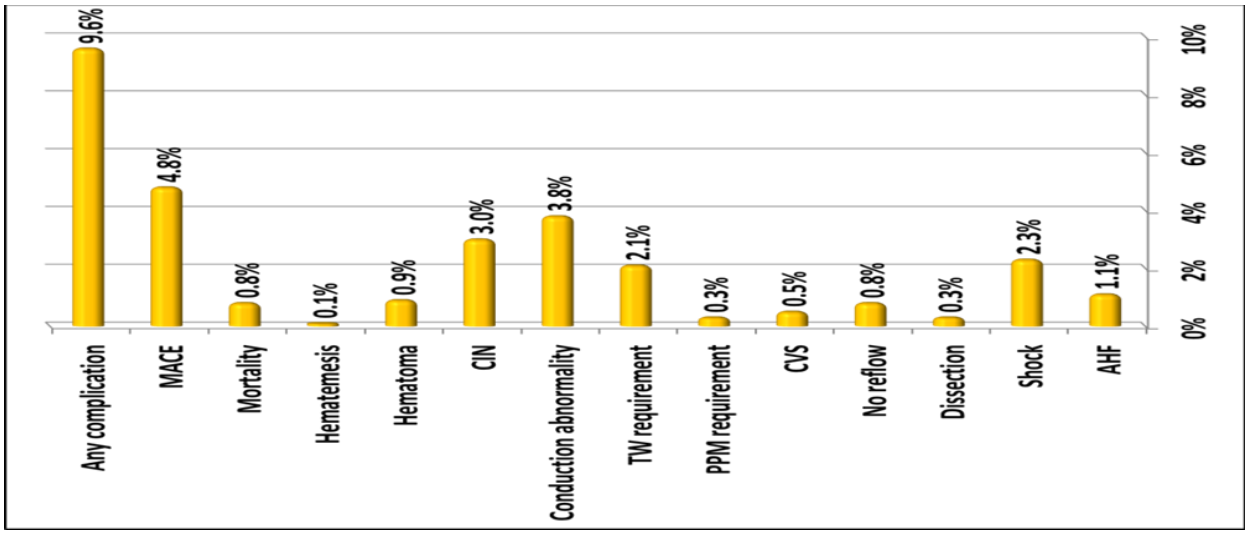


**Figure 4:** The figure depicts in-hospital complications and MACE among the studied cases.

MACE, Major adverse cardiovascular event; CIN, Contrast-induced nephropathy; TW, Transient wire; PPM, Permanent pacemaker; CVS, Cerebrovascular stroke; AHF, Acute heart failure

**Table 3:** Predictors of MACE occurrence by univariate and multivariate analyses

| *Univariate Analysis (unadjusted correlation):* | | | | | |
|---|---|---|---|---|---|
| Characteristic | | MACE | No MACE | *P* value | |
| Age, y | | 60.4±10.4 | 56.7±11.3 | ^0.007 | |
| Age Categories, y | <20 | 0 (0.0%) | 4 (0.3%) | §0.018* | |
| | 20.0− | 0 (0.0%) | 86 (6.3%) | | |
| | 40.0− | 32 (46.4%) | 695 (51.0%) | | |
| | 60.0− | 32 (46.4%) | 545 (40.0%) | | |
| | 80.0− | 5 (7.2%) | 33 (2.4%) | | |
| Smoking | Never | 41 (59.4%) | 548 (40.2%) | #0.007* | |
| | Ex | 1 (1.4%) | 35 (2.6%) | | |
| | Current | 27 (39.1%) | 780 (57.2%) | | |
| History of CKD | | 12 (17.4%) | 54 (4.0%) | §<0.001* | |
| History of ICM | | 9 (13.0%) | 22 (1.6%) | §<0.001* | |
| History of PAD | | 3 (4.3%) | 11 (0.8%) | §0.027* | |
| EF (%) by echo | | 42.2±9.1 | 51.0±11.4 | ^<0.001* | |
| Severe valve lesion in echo | | 4 (5.8%) | 17 (1.2%) | §0.016* | |
| RCA in coronary angiography | Significant lesion | 55 (79.7%) | 720 (52.8%) | #<0.001* | |
| No. of coronaries affected | None | 2 (2.9%) | 78 (5.7%) | #<0.001* | |
| | Single | 18 (26.1%) | 635 (46.6%) | | |
| | Multiple | 49 (71.0%) | 650 (47.7%) | | |
| Thrombus aspiration | | 7 (10.1%) | 44 (3.2%) | §0.009* | |
| GP IIb/IIIa | | 26 (37.7%) | 242 (17.8%) | #<0.001* | |
| *In-hospital Antiplatelets* | | | | | |
| Ticagrelor | | 12 (17.4%) | 439 (32.2%) | #0.010* | |
| Clopidogrel | | 57 (82.6%) | 922 (67.6%) | #0.009* | |
| *In-hospital Anticoagulants* | | | | | |
| Unfractionated heparin | | 27 (39.1%) | 212 (15.6%) | #<0.001* | |
| Factors specific to STEMI patients | | MACE (N=50) | No MACE (N=675) | | |
| Killip II-IV in STEMI patients | | 44 (6.1%) | 0 (0.0%) | §<0.001* | |
| PTD in STEMI Patients | <6.0 h − | 12 (24.0%) | 446 (66.1%) | §<0.001* | |
| | 6.0 − | 17 (34.0%) | 203 (30.1%) | | |
| | 1.0 d - | 20 (40.0%) | 26 (3.8%) | | |
| | ≥1.0 wk | 1 (2.0%) | 0 (0%) | | |
| DTB in STEMI patients | < 1 h | 35(70%) | 664(98.4%) | §<0.001* | |
| | 1-24 h | 15 (30%) | 11(1.6%) | | |
| | > 24 h | 0 (0%) | 0 (0%) | | |

| *Multivariate Analysis (adjusted correlation)* | | | | |
|---|---|---|---|---|
| Factors | B | SE | *P* value | Odds ratio (95% CI) |
| ICM | 2.23 | 0.47 | <0.001* | 9.34 (3.75–23.26) |
| CKD | 1.58 | 0.38 | <0.001* | 4.86 (2.30–10.25) |
| PAD | 1.58 | 0.76 | 0.037* | 4.87 (1.10–21.57) |
| DTB >1 h in STEMI patients | 1.48 | 0.31 | <0.001* | 4.39 (2.38–8.09) |
| Multivessel disease | 1.03 | 0.28 | <0.001* | 2.79 (1.61–4.84) |
| Constant | -4.85 | 0.36 | <0.001* | |

^the independent *t* test # the $\chi^2$ test § the Fisher exact test *Significant

CKD, Chronic kidney disease; ICM, Ischemic cardiomyopathy; PAD, Peripheral arterial disease; EF, Ejection fraction;

RCA, Right coronary artery; GP, Glycoprotein; STEMI, ST-elevation myocardial infarction; PTD, Pain-to-door; DTB, Door-to-balloon; MACE, Major adverse cardiovascular events

## DISCUSSION

The present registry is one of the largest ACS registries in Cairo, Egypt, since it assessed 1432 patients from 2 large tertiary healthcare institutes in Cairo over 1 year. More than half of the patients were admitted with STEMI and had higher in-hospital

MACE and mortality rates than patients with NSTEMI and unstable angina.

Almost half of our cohort presented with STEMI, the same percentage as in the other Egyptian registries but a higher percentage than in the Assiut University Registry. Concerning the registries done outside Egypt, our registry also had the same percentage of STEMI patients as the United Arab Emirates (UAE) ACS registry and a higher percentage of STEMI patients than that Saudi Project for the Assessment of Coronary Events (SPACE) Registry, the Gulf Coast Registry, and the Kerala Indian ACS Registry. [5, 14-20]

Comparisons between our registry and the other mentioned registries regarding demographic data, risk factors, and a history of ischemic conditions are shown in Table 4.

In our registry, all STEMI patients underwent primary PCI, while in other Egyptian registries, the percentage of patients who underwent primary PCI was lower because of limited public medical insurance coverage and the limited number of 24/7 catheterization laboratories with well-trained staff, especially in remote Egyptian areas. The Egypt STEMI Registry recruited patients from different areas of Egypt, whereas the other Egyptian registries mentioned nothing in this regard. [5,14-16] With respect to the registries done outside Egypt, the percentage of patients who underwent primary PCI was also lower than that in our registry, due to several factors, such as the availability of primary PCI only during the daytime hours, as was mentioned in the UAE ACS Registry. [17-20]

In our registry, almost all NSTE-ACS patients underwent revascularization according to its risk stratification as needed, which is a higher percentage than in the other Egyptian or non-Egyptian registries. The other mentioned registries failed to provide sufficient data regarding this point. [14,16,18,20]

In our registry, almost all our patients received in-hospital dual antiplatelets therapy (ASA and clopidogrel or ticagrelor), which is a higher percentage than in the other registries. Not all registries were mentioned as relevant data were scant. Ticagrelor was not used in almost all other registries since these registries had been done before the established usage of ticagrelor. Vis-à-vis parenteral anticoagulation, in our registry, more than half of the patients received low-molecular-weight heparin, similar to the Egypt STEMI Registry. In contrast, in the SPACE Saudi Registry, most of the patients received unfractionated heparin as parenteral anticoagulation, and no sufficient data were provided in the rest of the abovementioned registries. [5, 17-20]

ASA was prescribed to almost all patients in our registry and other registries except the Kerala Indian ACS Registry. [5,14,17,18,20] Clopidogrel and ticagrelor were both prescribed in our registry and in the Egypt STEMI Registry. Nonetheless, in all the other registries, clopidogrel was the main P2Y12 inhibitor prescribed to patients as ticagrelor usage was not established when these registries were done. [5,14,18,20] Statins were prescribed to almost all patients in Egyptian and non-Egyptian registries. [5,14,18,20] Beta-blockers were prescribed to most of the patients in our registry and to more than three-quarters of the patients in the other registries except for the Kerala Indian Registry, which reported less β-blocker prescription. [5,14,18,20] Angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers were prescribed to more than half of the patients in our registry, while they were prescribed to a higher percentage of patients in the other registries, except for the Kerala Indian Registry. [5,14,18,20]

The in-hospital MACE and mortality percentages in our registry compared with other registries are shown in Table 5. MACE in our registry and almost all the other registries was higher in STEMI patients than

in NSTE-ACS patients. Our registry showed that the percentages of in-hospital MACE and mortality were less than the other registries, which might be due to the revascularization strategy applied. [5,14,15,18,20]

In our registry, the univariate analysis showed that older age, a history of ischemic cardiomyopathy, peripheral arterial disease, chronic kidney disease, a longer pain-to-door time, and a lengthier door-to-balloon time, Killip class IV, very high-risk NSTEMI, significant lesions in the right coronary artery or multivessel disease in coronary angiography, lower ejection fractions or severe valvular heart disease in echocardiography, the use of thrombus aspiration or glycoprotein IIb/IIIa inhibitors in PCI, low post-PCI TIMI flow or myocardial blush grades, and the in-hospital usage of clopidogrel or unfractionated heparin were associated with higher MACE occurrence. Our multivariate analysis showed that a history of ischemic cardiomyopathy, peripheral arterial disease, chronic kidney disease, a longer door-to-balloon time, and multivessel disease in coronary angiography were associated with higher rates of MACE occurrence.

In the Kerala Indian ACS Registry, the univariate analysis showed that STEMI; NSTEMI in relation to unstable angina; a pain-to-door time exceeding 6 hours; a longer door-to-balloon time; high creatinine levels; positive troponin; Killip classes II, III, and IV; and inappropriate thrombolysis in NSTE-ACS patients were associated with a higher rate of MACE occurrence. [20] The multivariate analysis yielded the same factors in association with MACE occurrence. [20]

**Table 4:** Comparisons between our registry and other registries cited herein regarding demographic data, comorbidities, and a history of ischemic heart disease

| Registry / Demographic Data, Comorbidities, and Ischemic History | Our Registry | Egypt STEMI Registry [5] | NHI ACS Registry [14] | Assiut University Registry [15] | Al-Azhar New Damietta University Registry [16] | UAE ACS Registry [17] | Saudi SPACE Registry [18] | Gulf Coast Registry [19] | Kerala Indian ACS Registry [20] |
|---|---|---|---|---|---|---|---|---|---|
| Age, mean± SD | 66.9±11.3 | 55.4±11.3 | 54.7 | 57.8±10.7 | 55.6±11.6 | 50.8±10 | 57.1±13.6 | 60.4±12.6 | 60.4±11.1 |
| Male gender, % | 78.4% | 81.5% | 74% | 66.8% | 81.5% | 93.1% | 77% | 66.1% | 77.4% |
| Smoking, % | 56.4% | 59.05% | 54.6% | 42.3% | 46.8% | 46.4% | 39% | 23.2% | 34.4% |
| DM, % | 47.3% | 40.8% | 42.3% | 41.1% | 35.9% | 38.9% | 53% | 53.4% | 37.6% |
| HTN, % | 52.2% | 37.2% | 39.3% | 50.2% | 38% | 34.6% | 48% | 66% | 48.4% |
| Dyslipidemia, % | 13% | - | 31% | 35.5% | 2.2% | 14.3% | 31% | 55.8% | - |
| FH of premature CAD, % | 8.4% | - | 26% | 10.2% | - | 4.1% | - | - | - |
| IHD | 24.2% | 7.95% | 35% | - | - | 25.7% | 32% | 26.2% | 14.2% |
| Prior PCI | 16.6% | 7.1% | 16% | - | - | 4.1% | 12% | 21% | 0.3% |
| Prior CABG | 2.9% | 0.81% | 4.2% | 1.9% | - | 2.6% | 5% | 7.4% | |
| CVS | 5.6% | 3.9% | - | - | - | - | 4% | 6.2% | 2.5% |
| PAD | 1% | 0.89% | 5.1% | 3.8% | - | - | 2% | - | - |

DM, Diabetes mellitus; HTN, Hypertension; FH, Family history; CAD, Coronary artery disease; ACS, Acute coronary syndrome; STEMI, ST-elevation myocardial infarction; NHI, National Heart Institute; SPACE, Saudi Project for the Assessment of Coronary Events; UAE, United Arab Emirates; IHD, Ischemic heart disease; PCI, Percutaneous coronary intervention; CABG, Coronary artery bypass graft; CVS, Cerebrovascular stroke; PAD, Peripheral arterial disease

**Table 5:** Comparisons between our registry and other mentioned registries regarding in-hospital MACE and mortality

| Registry / In-hospital MACE or Mortality | Our Registry | Egypt STEMI Registry [5] | NHI ACS Registry [14] | Assiut University Registry [15] | Al-Azhar New Damietta University Registry [16] | UAE ACS Registry [17] | Saudi SPACE Registry [18] | Kerala Indian ACS Registry [20] |
|---|---|---|---|---|---|---|---|---|
| MACE | 4.8% | - | - | 16.98% | - | - | - | 5.7% |
| AHF | 1.1% | 11.14% | - | 7.9% | - | 3.3% | 11% | 1.9% |
| Re-infarction | 0% | 0.8% | - | 0.37% | - | - | - | - |
| CVS | 0.5% | 1.4% | 0.5% | - | - | - | 1% | 0.3% |
| Cardiogenic shock | 2.3% | - | - | 1.13% | | 2.2% | - | - |
| Mortality | 0.8% | 4.65% | 2.1% | 1.5% | 3.3% | 1.68% | 5% | 3.9% |

MACE, Major adverse cardiac events; AHF, Acute heart failure; CVS, Cerebrovascular stroke; ACS, Acute coronary syndrome; STEMI, ST-elevation myocardial infarction; NHI, National Heart Institute; SPACE, Saudi Project for the Assessment of Coronary Events; UAE: United Arab Emirates

## CONCLUSIONS

The present registry is one of the largest ACS registries done to date in Cairo, Egypt, providing plenty of data regarding the assessment and management of patients with ACS in Cairo. Our results show evident improvement in the management of patients with ACS in comparison with previous registries. We believe that our findings could help enhance medical services and the management of patients with ACS, resulting in improved outcomes.

### Study Limitations

This registry was from 2 institutes only with a relatively small sample size. There was no long-term follow-up of patients to detect MACE or mortality in the long term.

### Ethics Approval and Consent to Participate

The study was approved by the Research Ethics Committee (Faculty of Medicine, Ain Shams University, FMASU M D 199/2019), and all the patients signed an informed written consent form for participation in the study in accordance with the Declaration of Helsinki.

### Consent for Publication

Not applicable

### Availability of Data and Materials

The data sets used and analyzed during the current study are available from the corresponding author upon reasonable request.

**Conflict of Interest:** The authors have no conflicts of interest.

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