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Variation of Recognizing Atypical ECG Patterns of Occlusion Myocardial Infarction among Emergency Physicians in Egypt

[1]Omneya Mohamed Raafat , [2] Mohamed Ahmed Elheniedy, [3] Raghda Ghonimy Elsheikh, [4] Mona Adel Elsaidy, [5] Mohamed Ezzat Nasreddin,

[1] Emergency Medicine and Traumatology Department, Faculty of Medicine, Tanta University, Tanta, Egypt, 31511

[2]Vascular Diseases and Emergency Medicine Department, Faculty of Medicine, Tanta University, Tanta, Egypt, 31511

[3]Cardiovascular Diseases Department, Faculty of Medicine, Tanta University, Tanta, Egypt, 31511

[4]Cardiovascular Diseases Department, Faculty of Medicine, Tanta University, Tanta, Egypt, 31511

[5]Emergency Medicine and Traumatology Department, Faculty of Medicine, Tanta University, Tanta, Egypt, 31511

Abstract:

Background: Therefore, electrocardiogram (ECG) findings can identify occlusion myocardial infarction (OMI) sooner and more accurately for emergent reperfusion The aim of this work was to identify the degree of familiarity of Egyptian emergency physicians with different levels of training and experience with atypical ECG patterns associated with OMI not meeting classic ST elevation myocardial infarction (MI) criteria. **Methods:** This cross-sectional survey screening study was carried out on 301 physicians dealing with patients presenting by chest pain in particular Emergency physicians, specialities, both sexes, with varying levels of experience and post-graduate clinical training: Bachelor's degree, Master's degree, Egyptian fellowship, Arab Board, and Medical doctorate. Main bulk of our survey questionnaire included 10 ECG patterns, classified into 4 main groups. All participants subjected to: questionnaire generated using Google form was anonymous. **Results:** Graduates of Yemeni medical school scored less than their Egyptian counterparts (P= 0.03). However, all other nationalities didn't show any differences. A cardiologist scored 0.91 higher than an emergency

medicine physician (P < 0.01). However, all other specialities scored the same as the emergency medicine physician. A physician with a medical doctorate scored higher than MBBCH (P < 0.01). **Conclusions:** Our study showed results like other published international studies as regards the difficult interpreting ECGs. Cardiologists with long years of experience and/or candidates who had medical doctorate degree were the most who truly recognized the ECG patterns with OMI.

Keywords: ECG Patterns; Occlusion Myocardial Infarction; Emergency Physicians; Percutaneous Coronary Intervention

1. Introduction:

The primary percutaneous coronary intervention (PCI) is recommended for the treatment of STEMI with a door-to-balloon time of less than 90 minutes in the ST-segment elevation myocardial infarction (STEMI) guidelines of the American College of Cardiology/American Heart Association [1]. Consequently, the timely and accurate diagnosis of STEMI is a critical concern. In the diagnosis of STEMI, the 12-lead electrocardiogram (ECG) is an essential diagnostic tool that guides the emergent management of patients with acute STEMI. Nevertheless, ST-segment elevation on the ECG can be caused by a variety of conditions other than STEMI [2, 3].

Without reperfusion, acute coronary occlusions that do not meet ST elevation criteria experience a twofold increase in mortality. Consequently, ECG findings that are not limited to ST elevation criteria can be used to more accurately and promptly diagnose occlusion myocardial infarction (OMI) in order to facilitate emergent reperfusion [4].

The ACS Spectrum in the Context of the OMI vs NOMI Paradigm [5]. STEMI is defined as an acute myocardial infarction (AMI) with ECG findings that satisfy the STEMI criteria in the fourth universal definition of myocardial infarction (MI). STEMI (+) OMI is a true positive. STEMI - Refers to patients who have ECG features that meet formal STEMI criteria and are diagnosed with OMI as the cause of the STE and AMI. OMI: Refers to OMI in which the ECG does not meet the STEMI criteria (NSTEMI with occlusion).

Under the STEMI/NSTEMI paradigm, clinicians do not overlook MI; rather, they overlook acute occlusions that respond to reperfusion therapy. Despite the fact that these patients frequently receive intervention at a later stage (24-72 hours) upon admission, it is typically too late to salvage ischemic or infarcted tissue, and

they are subject to significant increases in morbidity and mortality [4].

As ECG findings can evolve over a brief period of time (typically 5-15 minutes), the changes in ECG can prevent the omission of an obvious OMI. The patient's need for emergent catheterization does not cease due to the absence of changes. Therefore, providers are able to anticipate potential changes by obtaining an ECG prior to administration. It is feasible that the changes were resolved prior to the emergency department ECG as a result of pre-hospital treatment or spontaneous improvement. In order to challenge the binary notion that ST elevation is the sole indicator of acute coronary occlusion. Until otherwise demonstrated, patients who exhibit symptoms of ACS are presumed to have acute coronary artery occlusion. Serial ECGs and bedside echocardiography can be implemented to enhance the evaluation process. The ECG is one of numerous diagnostic tools employed to diagnose OMI, and the astute clinician must be capable of identifying ECG indicators of OMI that are not consistent with conventional STEMI guidelines [6].

The purpose of this trail was to identify the degree of familiarity of Egyptian emergency physicians with different levels of training and experience with atypical electrocardiogram (ECG) patterns associated with OMI not meeting classic ST elevation MI criteria.

2. Subjects and Methods:

This cross-sectional survey screening trail was carried out on 301 physicians dealing with patients presenting by chest pain in particular Emergency physicians, also other specialities as Cardiologists, Internal medicine / Acute medicine, General Practice or Family medicine, Anaesthesia and Intensive care physicians, both sexes, with varying levels of experience and post-graduate clinical training: Bachelor's degree (MBBCH), Master’s degree (MSc) ,Egyptian fellowship, Arab Board, and Medical doctorate with different postgraduate clinical work experience.

All candidates were allowed to reflect on the quality of their pre and postgraduate education / training on identifying various OMI ECG patterns, on their confidence level in recognising various ECG patterns of OMI, and in different workplaces: Ministry of health general hospitals, University hospitals and private sector.

The participants provided written consent that was informed. The study was conducted with the approval of the Ethical Committee of Tanta University Hospitals.

Main bulk of our survey questionnaire included 10 ECG patterns, classified into 4 main groups; Group1: ECGs meeting typical standard voltage criteria of STEMI

(ECG1: inferior STEMI showing ST segment elevation in lead 2, 3, AVF), group2: ECGs not meeting typical standard voltage criteria of STEMI, provided to have OMI by catheterization: ECG 2: Small HATW seen in V2, V3 and V4, ECG 3: Isolated post MI, ECG 4: De -winter (2 ML upsloping ST segment depression at the j point in leads V1 to V6), ECG 5: Subtle ST elevation in lead 2, 3, AVF with reciprocal depression in V1 to V, and ECG 6: Sgarbossa lateral MI (ST segment depression of 1 mm in lead V1,V2 and V3, group 3: ECG showing non-specific ST and T wave changes either ischemic or non-ischemic in origin: ECG 8: acute pulmonary embolism (Sinus tachycardia with inverted T-wave in the precordial leads), ECG 9: acute pericarditis (diffuse ST elevation with PR depression in lead 1,2 AVL and precordial leads), and ECG 10: non-stemi (inverted T wave and St depression from V1 to v4), and group 4: normal ECG as control (ECG 7).

All participants subjected to: questionnaire generated using Google form was anonymous, including personal/ academic / work experience data about the physician as follows: gender, age, current specialty, workplace, highest achieved medical / academic / training degree, number of years of postgraduate clinical work experience : (in numbers), a linear scale to rate the confidence level of the candidate in recognizing various ECG patterns of OMI, a linear scale to rate the quality of their pre and postgraduate education/ training on identifying various patterns of occlusive MI (OMI) ECG patterns, then, 10 clear ECGs were recruited retrospectively from cardiology department, with definite final diagnosis, asking the candidate for yes/no if the ECG qualified for immediate cardiac cath lab (PCI) activation.

After generation of the questionnaire, validation was activated through 2 steps: Initially, the questionnaire was reviewed by 2 experts cardiologists supervising this thesis to guarantee its consistency and validity. Then, the questionnaire was exposed to small pilot study including limited number of emergency physicians to test its clarification, then it was edited and modified, final form was disseminated among groups of target population digitally and responses were collected automatically and anonymously, responses were collected, and multiple responses were not allowed, after submission of the survey, candidates don't receive feedback for answers, and copy of the survey is attached (digital screen and link of survey) https://docs.google.com/forms/d/1P0ptOSJUzg9R37lEgoLCtlX7Tm-uDWJaN7_6QL_zoFY/viewform?ts=63811a01&edit_requested=true

3. Statistical analysis:

SPSS v28 (IBM©, Armonk, NY, USA) was employed to conduct the statistical analysis. The normality of the data distribution was assessed using the Shapiro-Wilks test and histograms. The quantitative parametric data were analyzed using an unpaired student t-test and presented as the mean and standard deviation (SD). The Mann Whitney-test was employed to analyze quantitative non-parametric data, which were presented as the median and interquartile range (IQR). The Chi-square test or Fisher's exact test was employed to analyze qualitative variables, which were presented as frequency and percentage (%) when appropriate. Additionally, univariate logistic regression was implemented to ascertain the correlation between a single dependent variable. Statistical significance was defined as a two-tailed P value that was less than 0.05.

4. Results:

Regarding gender distribution, 170 (56.5%) males, and 131 (43.5%) females. The male to female ratio was 1.3:1. Regarding undergraduate education, 296 (98.3%) physicians completed their undergraduate degrees from Egypt, whereas five (1.7%) physicians graduated outside Egypt, including Yemen two candidates (0.7%), Eswatini one candidate (0.3%), Saudi Arabia one candidate (0.3%), and Sudan one candidate (0.3%). A total of 200 (66.4%) physicians were actively enrolled in a training program at time of survey, whereas 101 (33.6%) were not, either have not started their training yet (6.6%), or already completed their specialty training (26.9%).

Regarding postgraduate training, 258 (85.6%) physicians completed a postgraduate training programme in Egypt. On the other hand, 43 (14.3%) physicians have not completed a postgraduate speciality training programme yet. Regarding participants' specialty, 255 (84.7%) physicians were specialized, whereas 46 (15.3%) physicians were not. Six different specialities were identified, including emergency medicine 161 candidates (53.5%), cardiology 55 candidates (18.3%), intensive care 17 candidates (17%), internal medicine/acute medicine 13 candidates (4.3%), general medicine/family medicine 7 candidates (2.3%), and anaesthesiology 2 candidates (0.7%). Regarding professional academic qualifications, 142 (47.2%) physicians had only a MBBCH, 64 (21.3%) had an Egyptian fellowship, 64 (21.3%) had a MSc, 20 (6.6%) had obtained a medical doctorate and 11 (3.7%) were Arab-board certified. The mean number of years of experience was 4.94 ± 5.22. The mean confidence score about recognition of various ECG patterns of OMI was 6.68 ±

2.44. The mean training quality self-assessment score of postgraduate training/education on identifying various ECG patterns of OMI was 6.45 ± 2.46. **Table 1**

Table 1: Participants characteristics of the studied individuals (n = 301)

		N = 301
Sex	**Male**	131 (43.5%)
	Female	170 (56.5%)
Country of Practice (Egypt)		301 (100%)
Country of Undergraduate Education	**Egypt**	296 (98.3%)
	Yemen	2 (0.7%)
	Eswatini	1 (0.3%)
	Saudi Arabia	1 (0.3%)
	Sudan	1 (0.3%)
Country of Postgraduate Education	**Egypt**	258 (85.6%)
	No completed training	43 (14.3%)
Training Status	**Yes**	200 (66.4%)
	Didn't start training	20 (6.6%)
	Completed specialization	81 (26.9%)
Specialty	**Emergency medicine**	161 (53.5%)
	Cardiology	55 (18.3%)
	No specialized yet	46 (15.3%)
	Intensive care	17 (5.6%)
	Internal medicine / Acute medicine	13 (4.3%)
	General Practice / Family medicine	7 (2.3%)
	Anaesthesia	2 (0.7%)
Degree	**MBBCH**	142 (47.2%)
	MSc	64 (21.3%)
	Egyptian Fellowship	64 (21.3%)
	Arab Board	11 (3.7%)
	Medical Doctorate (MD/PhD)	20 (6.6%)
Years of Experience	**Mean ± SD**	4.94 ± 5.22
	Median [Min, Max]	3.00 [1.00, 38.0]
Confidence Level	**Mean ± SD**	6.68 ±2.44
	Median [Min, Max]	7.00 [1.00, 10.0]
Quality of Training	**Mean ± SD)**	6.45 ± 2.46
	Median [Min, Max]	7.00 [1.00, 10.0]

Data are presented as frequency (%), mean ± SD or median. MSc: Master's degree, MBBCH: Bachelor's degree.

In the first 6 ECGs strips, representing stemi positive and negative OMI, candidates who decided to activate immediate cath lab, choosing (yes) answer, are considered true recognition.

But on the other hand, in the following 4 ECGs, representing either normal or non-ischemic ECG changes, candidates who chose (yes) answer are considered false recognition. Generally, ECG 1 which was inferior wall MI was the most recognised in occlusive MI patterns (94.4%), followed by ECG 2 (small hyperacute T-wave) by (73.4%), followed by ECG 4 (De Winter T Wave) by (72.1%)), followed by ECG 6 (Sgarbossa lateral MI) by (58.5%), followed by ECG 5 (Subtle inferio-posterior wall ST elevation with reciprocal depression) by (51.8%) and followed by ECG 3 (Isolated Posterior MI) by (32.2%). Whereas ECG 7 (normal ECG) was the most recognised in non-occlusive MI patterns by (90.0%), followed by ECG 8(pulmonary embolism) by (65.8%), followed by ECG 10 (Non-STEMI) by (62.5%) and followed by ECG 9 (acute pericarditis) by (38.9%). Finally, we can conclude that the most recognized ECG strip in the first 4 ECGs was ECG 1 (inferior STEMI), and the least recognized ECG strip in the control group was ECG 9 (acute pericarditis). The average score of recognition of the total 10 ECG patterns was 6.40± 1.6. The average score of true recognition of the first 6 ECG patterns, which means PCI activation, was 3.82± 1.33. In the other hand, the average score of true recognition of the last 4 ECG patterns, which means not to initiate PCI activation, was 2.57± 1.03. **Table 2**

Table 2: ECG recognition patterns and average score of recognition of all ECG patterns

		Overall (n = 301)
ECG recognition patterns		
ECG1 (inferior wall MI)	**Correct (initiate PCI)**	284 (94.4%)
	Incorrect (do not initiate PCI)	17 (5.6%)
ECG2 (small hyperacute T-wave)	**Correct (initiate PCI)**	221 (73.4%)
	Incorrect (do not initiate PCI)	80 (26.6%)
ECG3 (isolated posterior MI)	**Correct (initiate PCI)**	97 (32.2%)
	Incorrect (do not initiate PCI)	204 (67.8%)
ECG4 (De-winter)	**Correct (initiate PCI)**	217 (72.1%)
	Incorrect (do not initiate PCI)	84 (27.9%)
ECG5 (subtle ST elevation with reciprocal depression)	**Correct (initiate PCI)**	156 (51.8%)
	Incorrect (do not initiate PCI)	145 (48.2%)
ECG6 (sgarbossa lateral MI)	**Correct (initiate PCI)**	176 (58.5%)
	Incorrect (do not initiate PCI)	125 (41.5%)
ECG7 (normal ECG)	**Correct (initiate PCI)**	271 (90.0%)
	Incorrect (do not initiate PCI)	30 (10.0%)
ECG8 (acute pulmonary embolism)	**Correct (initiate PCI)**	198 (65.8%)
	Incorrect (do not initiate PCI)	103 (34.2%)
ECG9 (acute pericarditis)	**Correct (initiate PCI)**	117 (38.9%)
	Incorrect (do not initiate PCI)	184 (61.1%)
ECG10 (non-STEMI)	**Correct (initiate PCI)**	188 (62.5%)
	Incorrect (do not initiate PCI)	113 (37.5%)
Average score		
ECG1to6 total for correct action (PCI yes)	**Mean ± SD**	3.82 ± 1.33
	Median [Min, Max]	4.00 [1.00, 6.00]
ECG7to10	**Mean ± SD**	2.57 ± 1.03
	Median [Min, Max]	3.00 [0, 4.00]
ECG. Total	**Mean ± SD**	6.40 ± 1.62
	Median [Min, Max]	6.00 [2.00, 10.0]

Data are presented as frequency (%), mean ± SD or median. ECG: electrocardiogram, STEMI: ST-segment elevation myocardial infarction, PCI: percutaneous coronary intervention.

Table 3 revealed that graduates of Yemeni medical school scored less than their Egyptian counterparts (P= 0.03). However, all other nationalities didn't show any differences. A cardiologist scored 0.91 higher than an emergency medicine physician (P < 0.01). However, all other specialities scored the same as the emergency medicine physician. A physician with a medical doctorate scored higher than MBBCH (P < 0.01). However, all other degrees had the same score as the emergency medicine had non statistically significant association was found between MI recognition and gender, country of postgraduate training, training level, years of experience, confidence level, or training postgraduate quality self-assessment. Then, univariable linear regression of individual ECG was done but with no statistical significance for any factors. A multivariable linear regression was not done for this study due to the low number of significant values observed in the univariable analysis.

Table 3: Univariable linear regression for factors affecting recognition of MI in ECG

Variables		Estimate (B)	P value
Gender	**Female**	Reference	-
	Male	0.19	0.29
Country of Undergraduate Education	**Egypt**	Reference	-
	Yemen	-2.4	**0.03***
Country of Postgraduate Education (Egypt)		Reference	-
Training Status	**Yes**	Reference	-
	Didn't start training	-0.46	0.22
	Completed specialization	-0.12	0.55
Specialty	**Emergency medicine**	Reference	-
	Anaesthesia	-0.81	0.46
	Cardiology	0.91	**<0.01***
	General Practice / Family medicine	-0.60	0.32
	Intensive care	-0.08	0.83
	Internal medicine / Acute medicine	-0.85	0.06
	No specialized yet	-0.18	0.48
Degree	**MBBCH**	Reference	
	American Board	-0.32	0.77
	Arab Board	-0.67	0.24
	Egyptian Fellowship	0.33	0.16
	MSc	0.43	0.07
	Medical Doctorate (MD/PhD)	1.02	**<0.01***
	Membership of the UK Royal College	0.82	0.61
Years of Experience		0.01	0.3
Confidence Level		0.03	0.38
Quality of Training		0.01	0.61

*MSc: Master's degree, MBBCH: Bachelor's degree, *: significant P value as < 0.05.*

5. Discussion:

In the realm of clinical practice, acute STEMI is a severe condition. The rapid and precise diagnosis of this critical illness can result in prompt reperfusion, which in turn reduces cardiac ischemic damage and leads to improved later outcomes. The benefits are further enhanced by a shorter time to reperfusion [7].

Regarding undergraduate education, 296 (98.3%) physicians completed their undergraduate degrees from Egypt, whereas five (1.7%) physicians graduated outside Egypt, including Yemen (0.7%), Eswatini (0.3%), Saudi Arabia (0.3%), and Sudan (0.3%), this represents one of the good factors in our study as Multinational.

A total of 200 (66.4%) physicians were actively enrolled in a training program at time of survey, whereas 101 (33.6%) were not, either have not started their training yet (6.6%), or already completed their specialty training (26.9%).

Regarding postgraduate training, 258 (85.6%) physicians completed a postgraduate training programme in Egypt. On the other hand, 43 (14.3%) physicians have not completed a postgraduate speciality training programme yet.

Regarding participants' specialty, 255 (55.3%) physicians were specialized, whereas 46 (15.3%) physicians were not. Six different specialities were identified, including emergency medicine (53.5%), cardiology (18.3%), intensive care (17%), internal medicine/acute medicine (4.3%), general medicine/family medicine (2.3%), and anaesthesiology (0.7%).

Regarding professional qualifications, 142 (47.2%) physicians had only a MBBCH, 64 (21.3%) had an Egyptian fellowship, 64 (21.3%) had a MSc, 20 (6.6%) had obtained a medical doctorate and eleven (3.7%) were Arab-board certified.

The mean number of years of experience was 4.94 ± 5.22. The mean confidence score was 6.68 ± 2.44. The mean training quality score was 6.45 ± 2.46.

As we aimed in this study to be presented by doctors with different experiences, postgraduate levels, and specialities.

Based on the results, we found that there were 4 ECGs with conflict regarding the decision to take. We will discuss them according to the clinical priority and percentage of misdiagnosis.

Starting with ECG 3 (Isolated Posterior MI), only 32% of the participating doctors diagnosed the ECG and gave the correct decision to do PCI, they were cardiologists and/or having medical doctorate degree, while 67% mis diagnosed with wrong decision.

Posterior STEMI is distinctive in that it is the sole type of STEMI that does not result in ST elevation on the standard 12-lead ECG. Reciprocal ST segment depression in

leads V1-V4 will be observed in posterior MI, as previously mentioned. The ST elevation from an isolated posterior MI will only be observed when the 15-lead ECG is employed, which includes leads V7-V9. The extra leads are positioned on the fifth intercostal space; V7 is located at the posterior axillary line, V8 is at the scapular tip, and V9 is at the left paraspinal border. The criterion for posterior MI in these leads is a mere 1 mm of ST elevation, as opposed to the 2 mm required in precordial leads. Some have even proposed that the sensitivity be enhanced by elevating the ST by 0.5 mm [8].

Posterior MIs are far more prevalent than other STEMIs, accounting for only 3-8% of STEMIs [9]. The ECG pattern may resemble that of anterior ischemia, and, as anticipated, posterior MIs are missed at a significantly higher rate than other STEMIs. Nevertheless, upon closer examination, the anterior ST segment depression in posterior MI is frequently upward sloping in contrast to the downward sloping segments in anterior ischemia. Typically, posterior MI is accompanied by an upright R wave and an upright T wave, while anterior ischemia frequently results in a flipped T wave [9].

Regarding ECG 5 (Subtle inferior-posterior wall ST elevation with reciprocal depression), was diagnosed correctly by 51% of the participating physician which were mostly cardiologists and/or having medical doctorate degree.

Consequently, the diagnosis of right ventricle MI is verified by obtaining a right-sided electrocardiogram (ECG) and identifying ST elevation in the fourth ventricular region (V4R). ST elevation in V4R has a sensitivity and specificity of over 90% for right ventricle infarctions [10].

The detection of inferior STEMI can be challenging due to the fact that the degree of ST elevation can range from 8 mm to a mere 1 mm. These subtle changes may be emphasized by comparing them to old ECGs when available. Additionally, serial ECGs can be obtained more frequently (every 10-15 minutes) to monitor the progression of these findings to more obvious STEMI findings.

Lance Brown [11] reported comparable outcomes for acute IPMI that did not exhibit ST elevation on the 12-lead ECG or tall R waves in V1 or V2. ST depressions were observed in V1 and V2, as well as an upright T wave in V2. ST elevations were exclusively observed in leads V8 and V9. The actual prevalence of IPMI is unknown; however, it has been reported to occur in 7% (3 of 46), 18 0% (0 of 13), 9 12% (4 of 34), 6 4% (23 of 544), and 3% (7 of 210) of patients with acute MI when posterior leads V7 through V9 were obtained.

Our study revealed that ECG 6 (Sgarbossa lateral MI) 58 % diagnosed it correctly despite the availability of sgarbossa criteria to diagnose LBBB with MI.

Such results are consistent with the findings of those who have shown that MI in the presence of LBBB is a well-known example of a challenging ECG diagnosis. The incidence of LBBBs increases with age, and approximately 6-9% of acute MI patients will have LBBBs, despite the fact that they are observed in only about 1% of the general population.The presence of acute MI is typically concealed or mimicked by ST-T wave changes that are naturally produced by 24 LBBB. Nevertheless, the Sgarbossa criteria can still be used to detect STEMI in certain instances [12].

The Sgarbossa criteria are three ECG findings that are employed to identify STEMI in the presence of LBBB. In order of decreasing sensitivity, they are as follows: ST elevation of > 1 mm in more than one lead concordant (in the same direction) with the QRS complex; ST depression of > 1 mm in leads V1-V3; and ST elevation of > 5 mm discordant with the QRS complex. (Refer to Figure 6.) Concordant ST elevation should be observed in the leads where the QRS is predominantly positive, which are typically leads V5, V6, I, II, and aVL. Discordant 5 mm ST elevation was observed in only 26% of patients with acute MI in more recent studies, and this finding may not be useful in isolation [13]. Nevertheless, the other two Sgarbossa criteria were still effective in a recent meta-analysis [14, 15].

In addition, ECG 9 (acute pericarditis) was the least recognized in non-occlusive MI in our study, with 38.9% of cases misdiagnosed as OMI.

In the same vein, Sharkey et al. discovered that the patients were not subjected to significant, unnecessary therapeutic maneuvers as a result of the incorrect diagnosis of benign early repolarization (BER) as pericarditis, despite the fact that the error was troublesome [16, 17].

Furthermore, 40 patients (16.8%) with acute pericarditis underwent coronary angiography, as reported. It was performed five times more frequently in patients with ST-segment elevation than in those without (24.7% vs 4.3%; P<.001). Before being transferred to our institution, seven patients (4.8%) with ST-segment elevation received thrombolytics at another facility (compared to none of the patients without ST-segment elevation; P=.05) [17].

They found that coronary angiography was a common diagnostic modality; it was performed in 16.8% of patients presenting at the center with acute viral or idiopathic pericarditis. Among this relatively young group of patients, 1 in 4 who presented with ST-segment elevation had undergone the

procedure, 35% of whom had concomitant coronary artery disease.

Both patients with MI and patients with pericarditis can present with ST-segment elevation, and in many cases the pattern of ST-segment elevation can help distinguish pericarditis from acute MI. However, there may be overlap in history, symptoms, and even laboratory findings between these conditions, and ECG findings may be ambiguous [18].

In accordance, it was noted that 14% of these patients had no culprit coronary lesion at the time of coronary angiography. Individuals later diagnosed with pericarditis or myocarditis represented 18.7% of these patients, underscoring that in many cases these diseases can mimic MI [19].

Similarly, it was demonstrated that although differentiating acute pericarditis from MI can be difficult, several key distinctions can be made between the ECG findings. Recognizing ST-segment elevations of acute pericarditis and differentiating them from those of MI are critical being concave upward with depressed PR segment [2].

The present study revealed that ECG 8 (pulmonary embolism) was misdiagnosed as OMI by (65.8%) of the candidates.

Similarly, [20] reported in his study the fact that some of the false negative cases can be explained by the fact that in 41 percent of the false negatives the PE was an accessory finding, as compared to only 28 percent in the confirmed positive group [20].

A cardiologist scored 0.91 higher than an emergency medicine physician ($P < 0.01$). A physician with a medical doctorate scored higher than MBBCH ($P < 0.01$).

Limitations: Unique History: ECG only to diagnose ACS sometimes difficult as the history was the same for all clinical presentations, as we know detailed history taking is very important to make an accurate diagnosis and differentiating other causes of chest pain, fewer doctors were from outside Egypt, no serial ECGs and cardiac enzymes were applied in our study, and examination findings: pericarditis can be diagnosed with pericardial rub sound auscultation, also murmur can give a clue of underlying MI.

ECHO is now available in most of emergency department (ED) and many ED doctors are being trained to use it to do bedside ECHO as a part of POCUS, so unavailability of ECHO pictures may consider as a weak point as it gives more clue about the presence of MI or not.

6. Conclusions:

Our study showed results similar to other published international studies as regards the difficult interpreting ECGs (Posterior, Inferior-Posterior, MI with LBBB and Pericarditis). Cardiologists with long years

of experience and/or candidates who had medical doctorate degree were the most who truly recognized the ECG patterns with OMI. Finally, we can state that the good points in our research were that it was national research, with different medical experiences with different specialties, a large scale of participants and variability of presentations.

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