Designated fast tract improving the treatment of patients with ST elevation myocardial infarction.

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Abstract

Introduction: A fast and correct diagnosis of ST Elevation Myocardial Infarction (STEMI) in the emergency department (ED) significantly correlates with decreased morbidity and mortality. Nevertheless, delayed diagnosis still occurs in 5%-15% of the patients who were diagnosed with STEMI.

Objective: To evaluate a 'fast-track' program to reduce door-to-balloon time (DTBT) in patients with STEMI, who present to ED triage with chest pain.

Methods: A retrospective-archive study was conducted to evaluate and compare the adherence to clinical guidelines between all STEMI patients (n=140) who attended the ED before (i.e. throughout 2015, n=60) and after (i.e. throughout 2016, n=80) the intervention program was implemented. The program comprised of four steps: 1) Immediate bed rest; 2) Marking the patient chart with a dedicated sticker; 3) Assessing the time-lags according to defined clinical guidelines; and 4) Signing a dedicated sticker on the ECG by the physician.

Results: We observed a significant post-intervention improvement in adherence to clinical guidelines. While pre-intervention, an ECG was conducted within 10 minutes for only 40% (n=24) of patients, the post-intervention percentage increased to 57.5% (n=46) (P=0.04). Similarly, while 61.7% (n=37) of patients were re-perfused within 90 minutes in the catheterization coronary lab, the post-intervention percentage increased to 70% (n=56) (P=0.30). During program implementation, more patients were classified correctly in life threatening (P1) and severe (P2) categories (n=18, 30% vs. n=40, 50%; p<0.001). A logistic regression model to predict DTBT showed that the factors impacting re-perfusion within 90 minutes were morning shifts and adherence to the P scale and time to physician.

Conclusion: A 'fast-track' evaluation and treatment program for patients with chest pain enables early diagnosis of STEMI in the ED and decrease waiting times for re-perfusion catheterization. These findings have significant implications on life-saving conditions and the quality of care of patients attending at ED due to chest pain.

Keywords: STEMI, Emergency Department, Triage, Chest pain, PCI.

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Introduction

Time delay from cardiac symptoms onset to reperfusion in patients presenting with (STEMI) is a major factor for poor prognosis [1-8]. STEMI is defined as class I indication for door to balloon time (DTBT) to initiate percutaneous coronary intervention (PCI) within 90 minutes [9-12]. Customarily, patients admitted to emergency departments (ED) with chest pain should be undergone a rapid triage assessment and high-priority scoring [13-16]. However, in almost half of the cases, these patients are withholding and receiving a lower priority score, therefore delayed from STEMI diagnosis and PCI treatment on time [15,16].

Several triage classification tools are used in EDs to determine the patient urgency [15-17]. In Israel, the most common tool is the Canadian Triage and Acuity Scale (CTAS). According to CTAS, patients who were classified as P1 requires immediate treatment, while patients who were classified as P2 to P5, are expected to receive medical assessment and treatment within 15, 30, 60 and 120 minutes, respectively. Ultimately, patient with STEMI should be classified in P1 or P2 category. Few studies have further shown a significant reduction in DTBT for patients correctly classified by the nurses' triage. Yet, these studies did not assess the whole triage process which include further than patient's urgency classification, time lags to ECG, to physician and to troponin blood test results.

The American Heart Association (AHA) and the American College of Cardiology (ACC) recommended time-lags guidelines for patients presenting in the ED with symptoms suggestive for STEMI. Guidelines include obtaining Electrocardiogram (ECG) within 10 minutes; evaluating the patient by medical staff within 15 minutes; receiving troponin blood test results within 60 minutes from arrival [18-20].

Roughly, 120,000 patients with chest pain are treated annually in Israeli EDs, of 3500 (2.91%) [21]. Globally, delayed

diagnosis still occurs in 5-15% of patients who were diagnosed with STEMI [22]. The majority strategies to decrease DTBT are: 1) to activate the catheterization lab in the cardiology department, by an ED physician without consulting a cardiologist; 2) to establish a catheterization lab in the EDs; 3) to allocate a standby staff who should be arrived to the catheterization lab within 20 minutes; 4) to activate the catheterization lab while the patient is still on the way to the hospital; and 5) to assign a cardiologist on duty in the hospital [18,22]. A meta-analysis has shown a significant decreased in DTBT when implementing a combination of more than one of the abovementioned strategies.

DTBT is also known to be associated with ED setting factors including, workload, type of shift (e.g., morning, evening or night) and whether the patient attending during shift handover [23-35]. Over-crowding EDs have been thoroughly described and studied [25-29]. This issue is universal and most EDs pass over their planned maximal capacity [26-28], thus adversely impact DTBT [28]. More so, several studies have shown that workload and over-crowding in ED, as well as, evening and night shifts and shift handover may lead to error in triage classification [15-16, 30,31,36], and causes long ED waiting times [26-29]. Ample of studies showing that nurses who work night shifts or rotating shifts are more prone to on-the-job procedural and drug calculation errors [23-24]. No significant correlation in triage classification was found when comparing between weekday and weekend [15]. DTBT has found to be associated with length of stay (LOS) in hospital and higher mortality rates. Studies have shown a positive association between incorrect P classification and delay in DTBT, and between delay in DTBT and hospital LOS and mortality rates [3,4,15-17,22,36,37].

Importance: In this study, we present outcomes relating DTB 90 minutes guideline following implementing a ‘fast-track’ program. The ‘fast-track’ evaluation and treatment program for patients with chest pain in the ED enables early diagnosis of STEMI and decreases waiting times for PCI. Therefore, have significant implications on life-threatening conditions and on the quality of care of patients attending at ED due to chest pain.

Goals of this investigation

The current study aimed at evaluating a 'fast-track' program to reduce DTBT in patients diagnosed with STEMI, who were presented to ED with chest pain. Specifically, to compare the time-lags: for nursing triage, for ECG, for physician, for decision, and for DTBT, as well as LOS in hospital and mortality rates before and after the program implementation. Furthermore, to explore factors predicting DTBT namely, clinical risk factor, ED setting and ED assessment characteristics.

Methods

Study design and setting

A retrospective study was conducted from January 2015 to December 2016, in ED of a tertiary hospital, after IRB ethical approval. The ED consists of 100 beds, and about 130,000 patients over 18 years old are treated on average per year. Of these, about 5500 (5%) patients arrived with chest pain annually, of them about 80 (1.5%) are diagnosed with STEMI)21).

Participants

The study sample consisted of 60 and 80 patients who were treated at ED during 2015 and 2016, respectively, and were diagnosed with STEMI. This sample has been selected specifically to this study from a total of 335 patients (170 in 2015 and 165 in 2016) who were hospitalized with STEMI, in order to evaluate waiting times for DTBT at ED. Therefore, patients who were admitted directly to the PCI lab and not treated in the ED were excluded from the study, that is, 110 during 2015 and 85 during 2016.

Intervention and procedure

The ‘fast track’ intervention program for patients with chest pain was implemented between January and December 2016. According to the ANA and ACC (10), a set of clinical guidelines for patients with chest pain attending at ED was adjusted and implemented to include, 15’ to nursing triage, then 10’ to ECG, 40’ for physician assessment, 60’ waiting time for decision and 90’ to DTB (10,15,18). The program was comprised of four steps: Immediate bed rest; 2) Marking the patient chart with a dedicated sticker (Figure 1); 3) Assessing the time-lags according to defined clinical guidelines; and 4) Signing a dedicated sticker on the ECG by the physician (Figure 2).

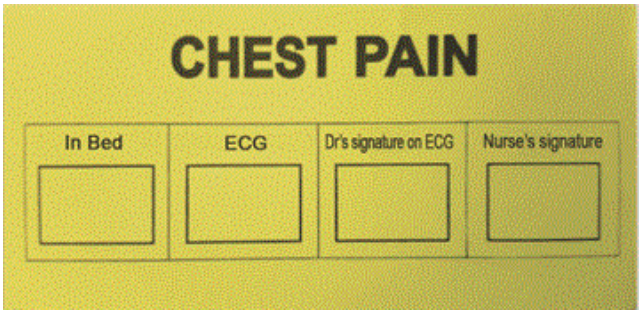

Figure 1. Marking the patient chart with a dedicated sticker.

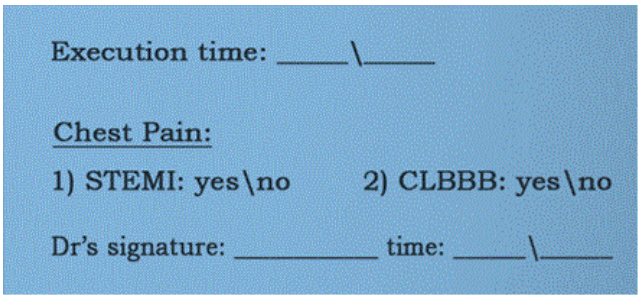

Figure 2. Signing a dedicated sticker on the ECG by the physician.

The 'fast track' intervention was conducted after a short tuition to the ED staff about the specific program aims and procedures. The staff was trained about the time lags guidelines and about the four steps of the program, in three rounds of nursing-physician meeting staff. During the first month of implementing the intervention a swift tuition was carried out and short message service (SMS) reminder was disseminated before each shift, by the first author. In addition, each month, cases that upheld the clinical guidelines were distributed to the hospital staff by internal mail list. Cases that failed to meet the criteria underwent a full inquiry by the hospital Safety and Quality Committee, which includes the involved ED staff and the cardiologic team. In the committee, every step of the patient treatment was re-evaluated and studied to rectify further cases.

All data was collected retrospectively between January and March 2017, from an electronic medical record by the first author. For each patient, we collected and measured the following variables: Outcomes variables, namely, DTBT, LOS in hospital and mortality rates; Assessment variables comprised of P scale classification, time to nursing triage, to ECG, to physician and to decision; ED setting variables included, ED workload, which determined when over 300 patients were treated in a single day, day of the week (Sunday, Monday to Thursday, and weekend), type of shift (morning, evening and night) and whether the patient attended during shift handover; and Clinical risk factors for STEMI, such as, smoking, dyslipidaemia, hypertension (HTN), diabetes mellitus (DM), numbers of previous cardiac events and family history of coronary heart disease (CHD), as well as, gender, age and ethnicity.

Data management and statistical analysis

After clearing and handling the data, all guideline variables and DTBT were cut off according the abovementioned defined time guidelines. These variables were also analysed continuously. Associations between DTBT and each of the study variables, namely, clinical risk factors, ED setting, and ED assessment characteristics were examined using $\chi 2$ tests for categorical variables and t test or One-Way ANOVA, when appropriate, for continuous variables.

To capture the contribution of each factor category, namely, the clinical risk factors, ED settings and ED assessment characteristics to DTBT, a multivariate logistic regression model was constructed, separately for pre- and for post- the program intervention. Associations with threshold level of alpha 0.25 in the univariate analysis were entered to the multivariate model (37). To test the additive effects of the ED assessment guidelines over the effects of clinical risk factors and ED setting characteristics, the dichotomy variables categories were entered to the model one after another, first the clinical risk factors followed by the ED setting characteristics and finally the ED assessment guidelines. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were estimated for each predictor. Receiver operating characteristics (ROC) model was used to examine the contribution of each category of predictors. Results were designated by C statistic measure.

The level of significance for all the statistical analyses was 5%. The data analysis was performed using the Statistical Package for Health and Welfare Science for Windows (SPSS, version 22.0, Chicago, IL, USA).

Results

A total of 140 patients who were arrived at the ED and diagnosed with STEMI at Rambam Health Care Campus, between January 2015 and December 2016 were included in the study, of these, 60 before and 80 during the program intervention.

Table 1 shows the clinical risk factors, ED setting and ED assessment characteristics, before and during the 'fast track' intervention program. No statistical differences were found in all clinical risk factors and ED setting measures, before and during the 'fast track' intervention program. About 40% of the STEMI patients arrived during the morning shift (41.7% and 40% in 2015 and 2016, respectively), only few patients were admitted during shift handover (1.7% and 5%, respectively). About half of the patients arrived in the middle of the week, both during 2015 and 2016.

Table 1. Clinical risk factors, ED setting and assessment characteristics and outcomes before and during implementing the 'fast track' program for patients with STEMI.

	Before intervention (2015) n=60	After intervention (2016) n=80	P value
Risk factors and Clinical characteristics			
Age (mean ± SD)	63.12 ± 13.16	63.99 + 13.44	0.89
Gender (n, %)			

Male	26 (56.7%)	35 (43.8%)	0.96
Female	34 (43.3%)	45 (56.2%)	
Smoking (n, %)	31 (51.7%)	33 (41.3%)	0.44
Dyslipidemia (n, %)	33 (55%)	40 (50%)	0.52
Hypertension (n, %)	27 (45%)	49 (61.3%)	0.06
Diabetes mellitus (n, %)	18 (30%)	28 (35%)	0.55
FH of CHD (n, %)	23 (38.3%)	26 (32.5%)	0.48
No. of cardiac events (mean ± SD)	1.34 ± 0.66	1.43 ± 0.84	0.2
Ethnicity (n, %)			
Jews	16 (26.7%)	27 (33.7%)	
Arabs	39 (65%)	48 (60%)	0.63
Others	5 (8.3%)	5 (6.3%)	
ED setting characteristics			
Workload (n, %)			
>300 patients at ED/day	53 (88.3%)	69 (86.3%)	0.72
Day in the week (n, %)			
Sunday	13 (21.7%)	13 (16.3%)	
Monday to Thursday	33 (55%)	42 (52.5%)	0.51
Friday and Saturday	14 (23.3)	25 (31.3%)	
Type of Shift (n, %)			
Morning (7 am-3 pm)	25 (41.7%)	32 (40%)	
Evening (3 pm-11 pm)	20 (33.3%)	27 (33.8%)	0.97
Night (11 pm-7 am)	15 (25%)	21 (26.3%)	
Arrived in shift handover (n, %)	1 (1.7%)	4 (5%)	0.29
ED assessment			
P scale (n, %)			
1	6 (10%)	9 (11.3%)	
2	12 (20%)	31 (38.8%)	
3	39 (65%)	31 (38.8%)	0.02
4	3 (5%)	6 (7.5%)	
5	0	3 (3.8%)	
P1-2	18 (30%)	40 (50%)	
P3-5	42 (70%)	40 (50%)	0.01
Time to triage (n, %)			
≤ 15'	43 (71.7%)	64 (80%)	0.25
>15'	17 (28.3%)	16 (20%)	
Mean ± SD	14.22 ± 12.79	10.21 ± 7.98	0.03
Time to ECG (n, %)			
≤ 10'	24 (40%)	46 (57.5%)	0.04

>10'	36 (60%)	34 (42.5%)	
Mean ± SD	18.48 ± 14.31	11.96 ± 8.93	<.001
Time to physician (n, %)			
≤ 40'	49 (81.7%)	66 (82.5%)	0.89
>40'	11 (18.3%)	14 (17.5%)	
Mean ± SD	33.75 ± 28.35	24.79 ± 16.92	0.03
Time to decision (n, %)			
≤ 60'	38 (63.3%)	70 (87.5%)	<.001
>60'	22 (36.7%)	10 (12.5%)	
Mean ± SD	71.95 ± 56.38	37.40 ± 19.62	<.001
Outcomes			
DTBT (n, %)			
≤ 90'	37 (61.7%)	56 (70%)	0.3
>90'	23 (38.3%)	24 (30%)	
Mean ± SD	106.32 ± 60.46	79.90 ± 38.13	<.001
LOS in hospital (Mean ± SD)	5.43 ± 3.16	5.89 ± 3.20	0.73
Mortality rates (n, %)	8 (13.3%)	6 (7.5%)	0.25
FH: Family History; CHD: Coronary Heart Disease; LOS: Length of Stay			

In 2015, only 30% (n=18) of patients were triaged according to the P scale guidelines, namely, P ≤ 2, whereas, in 2016, 50% (n=40) of patients evidently classified in the correct P scale category. This difference was statistically significant (P=0.01). While pre-intervention only 40% of the patients underwent an ECG examination within 10 minutes and 63.3% upheld in ED for decision, during the intervention the rates increased to 57.5% (p=0.04) and 87.5% (p=0.01). The 'fast track' program decreased the mean time-lags, in nurse triage guideline (10.21 ± 7.98 in 2016 compared to 14.22 ± 12.79 in 2015, p=0.03), in physician assessment guideline (24.79 ± 16.92 in 2016 and 33.75 ± 28.35 in 2015, p=0.03), in decision time (37.40 ± 19.62 in 2016 and 71.95 ± 56.38 in 2015, p<0.001) and in DTBT (79.90 ± 38.13 in 2016 and 106.32 ± 60.46 in 2015, p<0.001). No statistical differences were found in LOS post PCI and in the mortality rates before and during the program intervention.

Table 2 shows the clinical risk factors, ED setting and ED assessment characteristics, for patients that met the DTBT guideline in comparison to patients that did not met the guideline before and during the 'fast track' intervention program. Although not significant, more patients with STEMI were diagnosed at the morning shifts and during implementing the 'fast track' program, less patients exceeded the 90' guideline compared to the evening and night shifts. Furthermore, during the 'fast track' intervention program, more patients that were classified correctly in P1-2 categories also met the DTBT <90 minutes guideline (n=34, 42.5% in 2016 vs. n=14, 23.3% in 2015; p<0.001). Likewise, more patients were assessed according to 10' to ECG (n=36, 45% in 2016 vs. n=17, 28.3% in 2015; p=0.02), and to 40' to physician assessment (n=52, 65% in 2016 vs. 35, 58.3% in 2015; p<0.001) guidelines; and more patients were received a decision within 60' (n=54, 67.5% in 2016 vs. n=34, 56.7% in 2015; p<0.001). Regarding the clinical risk factors, it appears that more patients with DM (2016- n=17, 21.3% vs. 2015- n=6, 10%; p=0.01) and less patients with family history of CHD (2016- n=3, 3.7% vs. 2015- n=7, 11.7%; p=0.05) attended for PCI within 90' when implementing the 'fast track' program. Risk factors others than the abovementioned were not found to be statistically associated with DTBT.

Table 2. Clinical risk factors, ED setting and assessment characteristics and outcomes before and during implementing the 'fast track' program for patients with STEMI in relation to DTBT.

	DTBT (2015) n=60		**DTBT (2016) n=80**		
	≤ 90'	>90'	≤ 90'	>90'	P value
	n=37 (61.7)	n=23 (38.3)	n=56 (70.0)	n=24 (30.0)	

Risk factors and clinical characteristics					
Age (mean ± SD)	63.24 ± 13.21	62.91 ± 13.37	62.29 ± 12.87	67.96 ± 14.16	0.36
Gender (n, %)					
Male	18 (30.0%)	8 (13.3%)	29 (36.3%)	6 (7.5%)	0.11
Female	19 (31.7%)	15 (25%)	27 (33.7%)	18 (22.5%)	
Smoking (n, %)	20 (33.3%)	11 (18.3%)	25 (31.3%)	8 (10%)	0.35
Dyslipidemia (n, %)	18 (30.0%)	15 (25.0%)	28 (35.0%)	12 (15.0%)	0.68
Hypertension (n, %)	14 (23.3%)	13 (21.7%)	34 (42.5%)	15 (18.7%)	0.15
Diabetes mellitus (n, %)	6 (10.0%)	12 (20.0%)	17 (21.3%)	11 (13.7%)	0.01
FH of CHD (n, %)	16 (26.7%)	7 (11.7%)	23 (28.7%)	3 (3.7%)	0.05
No. of cardiac events (mean ± SD)	1.34 ± 0.53	1.35 ± 0.83	1.45 ± 0.91	1.39 ± 0.65	0.92
Ethnicity (n, %)					
Jews	13 (21.7%)	3 (5.0%)	27 (33.7%)	-	
Arabs	23 (38.3%)	16 (26.7%)	29 (36.3%)	19 (23.7%)	0
Others	1 (1.7%)	4 (6.7%)	-	5 (6.3%)	
ED setting characteristics					
Workload (n, %)					
>300 patients at ED/day	35 (58.3%)	18 (30.0%)	50 (62.5%)	19 (23.7%)	0.16
Day in the week (n, %)					
Sunday	9 (15.0%)	4 (6.7%)	10 (12.5%)	3 (3.7%)	
Monday to Thursday	20 (33.3%)	13 (21.7%)	30 (37.5%)	12 (15.0%)	0.85
Friday and Saturday	8 (13.3%)	6 (10.0%)	16 (20.0%)	9 (11.2%)	
Type of Shift (n, %)					
Morning (7 am-3 pm)	16 (26.7%)	9 (15.0%)	28 (35.0%)	4 (5.0%)	
Evening (3 pm-11 pm)	13 (21.7%)	7 (11.7%)	17 (21.3%)	10 (12.5%)	0.17
Night (11 pm-7 am)	8 (13.3%)	7 (11.7%)	11 (13.7%)	10 (12.5%)	
Arrived in shift handover (n, %)	1 (1.7%)	-	4 (5.0%)	-	0.73
ED assessment					
P scale (n, %)					
1	5 (8.3)	1 (1.7%)	7 (8.7%)	2 (2.5%)	
2	9 (15.0%)	3 (5.0%)	27 (33.7%)	4 (5.0%)	0.02
3	21 (35.0%)	18 (30.0%)	16 (20.0%)	15 (18.7%)	
4	2 (3.3%)	1 (1.7%)	4 (5.0%)	2 (2.5%)	
5	-	-	1 (1.2%)	2 (2.5%)	
P1-2	14 (23.3%)	4 (6.7%)	34 (42.5%)	6 (7.5%)	
P3-5	23 (38.3%)	19 (31.7%)	22 (27.5%)	18 (22.5%)	0
Time to triage (n, %)					
≤ 15'	30 (50.0%)	13 (21.7%)	45 (56.3%)	19 (23.7)	0.11
>15'	7 (11.7%)	10 (16.7%)	11 (13.7%)	5 (6.3%)	

Mean ± SD	37 ± 13.05	23 ± 16.09	56 ± 10.57	24 ± 9.38	0.09
Time to ECG (n, %)					
≤ 10'	17 (28.3%)	7 (11.7%)	36 (45.0%)	10 (12.5%)	0.02
>10'	20 (33.3%)	16 (26.7%)	20 (25.0%)	14 (17.5%)	
Mean ± SD	35 ± 14.77	23 ± 24.13	55 ± 10.62	15.04 ± 10.34	0
Time to physician (n, %)					
≤ 40'	35 (58.3%)	14 (23.3%)	52 (65.0%)	14 (17.5%)	0
>40'	2 (3.3%)	9 (15.0%)	4 (5.0%)	10 (12.5%)	
Mean ± SD	24.35 ± 16.17	48.7 ± 36.60	19.41 ± 11.88	37.33 ± 20.27	0
Time to decision (n, %)					
≤ 60'	34 (56.7%)	4 (6.7%)	54 (67.5%)	16 (20.0%)	0
>60'	3 (5.0%)	19 (31.7%)	2 (2.5%)	8 (10.0%)	
Mean ± SD	37 ± 47	23 ± 112.1	56 ± 31.34	24 ± 51.54	0
Outcomes					
LOS in hospital (Mean ± SD)	35 ± 1.34	23 ± 1.35	56 ± 1.45	23 ± 1.39	0.92
Mortality rates (n, %)	6 (10.0%)	2 (3.3%)	4 (5.0%)	2 (2.5%)	0.52
FH: Family History; CHD: Coronary Heart Disease					

Logistic regression model (Table 3) was performed to predict significant factors that impact DTBT guideline. After implementing the program, clinical risk factor, namely DM, were no longer constituted as significant factors in the prediction model. Notwithstanding, male gender remains a significant factor that predict DTBT. Regarding to ED setting characteristics, morning shift became the main influential factor in 2016 compared to 2015 on DTB on time (95% CI 1.274-12.667; OR 4.065). Conversely, workload has no longer constitutes as a significant factor. Results showed significant contribution of accurate P scale classification and time to physician (≤ 40) to DTBT after implanting the program intervention (95% CI .586-3.674; OR 1.467, 95% CI 1.274-12.667; OR 4.065, respectively).

A ROC model was used to determine the prominent ED factors for achieving the objective of 90' for DTB Table 3). Results indicated that the contribution of clinical risk factors decreased after implementing the program intervention (C statistics: 0.687 in 2016 compared to 0.732 in 2015). When adding the ED setting category to the model, the accumulated contribution was about 10% after implementing the program (C statistics: 0.791-0.687) compared to ~5% in 2015 (C statistics: 0.783-0.732). The most significant factor was the morning shifts (OR 4.065, 95% CI 1.274-12.667). Similarly, by entering the ED assessment category an increase of 8% in 2016 (C statistics: 0.870) and 5% in 2015 (C statistics: 0.837) were documented. Taking together, while clinical risk factors were less predictive of DTBT after implementing the 'fast track' program, the ED setting, and the ED assessment characteristics were more predictive this outcome.

Table 3. Logistic regression and ROC model for predicting adherence to D.

	2015					2016					
Characteristics	**OR**	**95% CI**		**Significance**	**Area**	**OR**		**95% CI**		**Significance**	**Area**
		Low	**High**					**Low**	**High**		
Clinical risk factors											
Male	23.411	6.278	87.295	0		10.13		3.234	31.732	0	
Hypertension	1.03	0.343	3.099	0.957		0.993		0.347	2.84	0.99	

Diabetes mellitus	0.197	0.061	0.633	0.006		0.683		0.247	1.886	0.461	
FH	0.367	0.1	1.351	0.132		1.672		0.41	6.819	0.474	
C statistics		0.631	0.904	0.001	0.732			0.733	0.923	0	0.687
ED setting											
Workload	3.957	1.204	13.012	0.024		3.151		0.921	10.777	0.067	
Morning shifts	1.467	0.586	3.674	0.413		4.065		1.274	12.667	0.018	
C statistics		0.658	0.924	0	0.783			0.779	0.954	0	0.791
ED assessment											
P scale	2.816	0.683	11.617	0.152		3.626		1.13	11.636	0.03	
Time to triage	1. 968	0.415	9.318	0.394		0.33		0.061	1.774	0.196	
Time to ECG	1.104	0.269	4.538	0.891		2.463		0.737	8.229	0.143	
Time to physician	8.001	1.41	45.408	0.019		7.955		1.722	36.759	0.008	
C statistics		0.737	0.964	0	0.837			0.863	0.991	0	0.87

Discussion

This study aimed to assess the impact of a 'fast track' program intervention on DTBT. The results revealed a significant improvement of critical indicators for quality of care, including DTBT and ED time-lags. Our intervention program was based on accumulated evidence that emphasized the urgency for rapid assessment, with defined time limits, of patients with suspected STEMI [1,8-10,14-17]. 26.42 minutes from 106.32 minutes before- to 79.90 minutes after implementing the program (Table 1). This improvement is meaningful and is added to a series of studies that investigated strategies to improve DTBT [18,22], and in line with leading countries' reports in this category, which showed that intervention in ED is a crucial junction on the track to coronary reperfusion catheterization. More specifically, our results demonstrated that accurate P scale classification in patients suspected with STEMI and ECG on time have a significant impact on DTBT. These findings are expected given the urgency to diagnose and treat patients attending with STEMI [7,15,29,38,39]. Nevertheless, half of the patients were not classified correctly. This finding is somewhat weak, yet it may reflect a 'running period'.

Using assessment measures guidelines, such as DTBT, represents health care systems efforts to standardize the management of care to decrease morbidity and mortality-related systems risk factors, especially in life threatening conditions [12,14,18,22,40]. However, this approach can concomitantly limit the weight of clinical risk factors in the assessment and scoring patients' urgency. The 'fast track' intervention reflects this gap and resulted in less contribution for the clinical risk factors (C statistics of 0.687 in 2016 vs. 0.732 in 2015) and increased contribution for the ED settings factors category (C statistics of 0.791 in 2016 vs. 0.783 in 2015) (Table 3).

Paradoxically, although not significant, during implementing the 'fast track' program more patients with STEMI were diagnosed at the morning shifts compared to evening and night shifts, and less patients exceeded the 90 minutes guideline. These results corresponded with recent findings, indicating flawed quality of care during evening and night shifts [23,31]. This is particularly noteworthy since these shifts are the lowest regarding patients' workload in the ED including the current study [15,25,2631,]. Unexpectedly, our results showed that workload was positively linked to DTB on time. This result is contrary to the accepted literature so far which holds that stress is a stratospheric component of health care workers and causes negative outcomes [25-26,28]. This finding may also be related to the availability of the catheterization team in the morning shift.

All together the adherence to DTB on time was improved from 61.7% in 2015 to 70% in 2016. These results are below the 85% accepted rates for DTBT guideline but reflect the exclusion of patients with STEMI who were directly attended the PCI lab. The rates are expected to be higher when combining between patients diagnosed with STEMI who were attending the ED and who were directly arrived at the PCI lab as most studies reported [22].

Limitations

This study has several limitations. First, the study includes only a small number of participants and one year follow up during intervention, therefore a future research would need to validate the findings in larger samples. Second, the ECG is performed after the triage P score is assigned. Therefore, the findings were not incorporated into the triage classification and may impaired accurate diagnosis. Obviously, it would be expected that for more appropriate triage score the ECG examination has been done before the triage P scale was classified, however this strategy might be extended the waiting times for the triage assessment itself. Finally, we collected the data retrospectively and examined the cases after the final diagnosis of STEMI. We could not designate those patients

who were deteriorated at the ED. Therefore, we could not follow their process sequence in ED. Also, we could not identify whether the patient had a previous evaluation, e.g., ECG, before reaching the ED.

Conclusion

The results indicated a significant improvement in critical quality indicators, namely, DTBT, time to triage and ED assessment factors. The 'fast-track' program for patients with chest pain in ED provides early diagnosis of STEMI and shortened waiting times for coronary reperfusion catheterization. These findings have prominent contribution and significant implications on the quality of care for patients with chest pain attending at ED. The findings of this research encourage further interventions of its kind and are a basis for developing tools for identifying patients attending with chest pain to achieve better outcomes in the critical ED assessment stages.

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