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RESEARCH PAPER (ORIGINAL)
ARTIGO DE INVESTIGAÇÃO (ORIGINAL)

Acute myocardial infarction patients in the emergency department: factors influencing door-to-treatment time

A pessoa com enfarte agudo do miocárdio no serviço de urgência: fatores que influenciam o tempo de atendimento

La persona con infarto agudo de miocardio en urgencias: factores que influyen en el tiempo de atención

Sónia Oliveira de Matos Soares*; Paulo Alexandre Carvalho Ferreira**

Abstract

Context: In the context of acute myocardial infarction (AMI) management, mortality and morbidity rates increase as the symptom-onset-to-balloon time increases.
Objective: To analyze the door-to-treatment time (DTt) of AMI patients at the emergency department (ED) and to identify factors influencing DTt.
Methodology: Retrospective, quantitative, descriptive, correlational study. The medical records of 412 people who were admitted to the ED in 2014 and 2015 were analyzed.
Results: The results showed that 65% of patients had non-ST-segment elevation myocardial infarction (NSTEMI) and 35% of them had ST-segment elevation myocardial infarction (STEMI). Door-to-electrocardiogram time was on average 1h40. Of the 126 STEMI patients, 114 underwent primary percutaneous coronary intervention (PCI), with an average DTt of 7h19, and 12 underwent fibrinolysis, with an average DTt of 1h19.
Conclusion: Age, smoking, absence of diabetes, type of transport, and period of admission to the ED were identified as factors influencing DTt.

Keywords: myocardial infarction; urgent care; nursing

Resumo

Enquadramento: No tratamento do enfarte agudo do miocárdio (EAM) à medida que o tempo entre o início dos sintomas e a reperfusão aumenta, a mortalidade e morbilidade também aumentam.
Objetivo: Analisar os tempos de atendimentos (TAtd) das pessoas com EAM que recorreram aos serviços de urgência (SU) e identificar fatores que influenciem esses tempos.
Metodologia: Estudo retrospetivo, quantitativo, descritivo e correlacional. Foram analisados os processos clínicos de 412 pessoas, admitidas no SU em 2014 e 2015.
Resultados: Obtivemos 65% de pessoas com EAM sem supra desnivelamento do segmento ST (EAMSST) e 35% com supra desnivelamento do segmento ST (EAMCST). O tempo entre a admissão da pessoa e a realização de eletrocardiograma (ECG) foi em média de 1h40. Das 126 pessoas com EAMCST, 114 realizaram intervenção coronária percutânea (ICP) primária com um tempo médio de 7h19 e 12 realizaram fibrinólise com média de 1h19.
Conclusão: A idade, a presença de tabagismo, a ausência de diabetes, o tipo de transporte e o período de admissão no SU mostraram influência nos TAtd.

Palavras-chave: enfarte agudo do miocárdio; atendimento de urgência; enfermagem

*MSc., RN, Hospital Center of Leiria - District Hospital of Pombal, 3100-462, Pombal, Portugal [soniasoares013@gmail.com]. Contribution to the article: literature search, data collection, data treatment, analysis, and discussion, and article writing. Address for correspondence: Rua Vale da Bica, nº30, Carrascos, 3100-462, Pombal, Portugal.
**Ph.D., Professor, Nursing School of Coimbra, 3046-851, Coimbra, Portugal. Contribution to the article: literature search, data discussion, content revision.

Resumen

Marco contextual: En el tratamiento del infarto agudo de miocardio (EAM, en portugués), a medida que el tiempo entre el inicio de los síntomas y la reperfusión aumenta, la mortalidad y la morbilidad también aumentan.
Objetivo: Analizar los tiempos de atención (TAtd) de las personas con EAM que recurrieron a los servicios de urgencias (SU) e identificar los factores que influyen en esos tiempos.
Metodología: Estudio retrospectivo, cuantitativo, descriptivo y correlacional. Se analizaron los procesos clínicos de 412 personas, admitidas en el SU en 2014 y 2015.
Resultados: Se obtuvo el 65 % de personas con EAM sin elevación del segmento ST (EAMSST) y el 35 % con elevación del segmento ST (EAMCST). El tiempo entre la admisión de la persona y la realización del electrocardiograma (ECG) fue, de media, 1h40m. De las 126 personas con EAMCST, 114 se sometieron a una intervención coronaria percutánea (ICP) primaria con un tiempo medio de 7h19m, y 12 a una fibrinólisis con una media de 1h19m.
Conclusión: La edad, la presencia de tabaquismo, la ausencia de diabetes, el tipo de transporte y el período de admisión en el SU mostraron una influencia en los TAtd.

Palabras clave: infarto agudo de miocardio; atención de urgencia; enfermería

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Introduction

Acute myocardial infarction (AMI) is one of the most prevalent cardiovascular diseases (CVDs). It is fatal in approximately one-third of the patients and half of the deaths occur in the first hours after symptom onset (American College of Cardiology Foundation [ACCF] / American Heart Association [AHA], 2013). The European Society of Cardiology (ESC, 2012) recommends the implementation of a structured network based on pre-hospital diagnosis and rapid transport to a hospital with availability to perform primary percutaneous coronary intervention (PCI) since this is the ideal reperfusion strategy in case of ST-segment elevation myocardial infarction (STEMI), provided that it can be done expeditiously.

Accordingly, several organizations have been developing efforts with the purpose of identifying the main barriers and strategies to achieve a shorter intra-hospital response time. In view of this situation, the following objectives were set out: to analyze patients' sociodemographic and clinical characteristics and identify factors that influence the time elapsed between admission and diagnosis in AMI patients; to identify factors that influence the time elapsed between admission and treatment with primary PCI or fibrinolysis in STEMI patients.

Background

The number of people with AMI symptoms who use the Emergency Department (ED) every day varies. The same happens with the door-to-treatment time (DTt), which can be influenced by multiple factors. Carapeto (2012) confirmed that the type of transport used to go to the ED influences DTt, showing that people who were transported by National Institute for Medical Emergencies (INEM, *Instituto Nacional de Emergência Médica*) ambulances received treatment quicker than other patients. DTt is also influenced by the period of the day and week when the person is admitted to the ED. DTt is longer at night (Magid et al., 2005) and during the weekend, which are times associated with increased mortality and a lower use of invasive cardiac procedures (Kostis et al., 2007).

In addition, epidemiological data on the last 50 years show a strong connection between CVDs and cardiovascular risk factors (CVRFs). Age and gender are the most analyzed non-modifiable CVRFs in the literature concerning their association with AMI. The Portuguese Directorate-General for Health reports that this disease mostly affects male patients aged 65 to 79 years. It also considers high blood pressure (HBP) as the non-modifiable CVRF with the strongest association with CVDs (Direção-Geral da Saúde, 2014). In a study conducted in Wisconsin (USA), Kanth, Ittaman, and Rezkalla (2013) concluded that the most common CVRF was HBP, followed by smoking and diabetes *mellitus*. However, no studies were found in the analyzed literature showing an association between CVRF and DTt, so this is a pioneer study in this area.

Research question/Hypotheses

What are the factors influencing DTt of AMI patients at the ED, from admission to primary PCI?

H1 - There is an association between gender, age, and the time elapsed between admission and the ED and ECG;

H2 - There is an association between the presence of CVRFs (smoking, diabetes *mellitus*, HBP, dyslipidemia, overweight), cardiac history, and the time elapsed between admission to the ED and ECG;

H3 - There is an association between the period of the day/weekday of admission to the ED and the time elapsed until ECG;

H4 - There is an association between the type of transport to the ED and the time elapsed between admission and the ECG;

H5 - There is an association between the period of the day/weekday and the time elapsed between admission to the ED and the performance of primary PCI in STEMI patients.

Methodology

In view of the above, a retrospective, quantitative and descriptive-correlational study was conducted.

The selected population includes all patients diagnosed with AMI who were hospitalized in a hospital in the Center region of Portugal in 2014 and 2015. The following inclusion criteria were applied: patients aged over 18 years; the first visit to a hospital ED in this event; and patients admitted with a primary diagnosis of AMI. The following exclusion criteria were applied: patients who died at the ED before hospitalization; patients with secondary diagnosis of AMI; patients transferred from another hospital; patients referred by the urgent patient guidance center (*Centro de Orientação de Doentes Urgentes*, CODU), sent directly to the hemodynamics unit (*Via Verde Coronária*); patients who suffered AMI during hospitalization. The study population was composed of 639 people, with 412 people being eligible for the sample. The sample was subdivided into NSTEMI (n = 266) and STEMI (n = 146) patients. With regard to the STEMI subsample, 12 people were treated with fibrinolysis, 114 with primary PCI, and the remaining patients were treated with conventional therapy or Coronary Artery Bypass Graft (CABG).

The data collection process involved the consultation of three software programs: Aplimed® for collecting information on the emergency episode, SISCLI® for collecting information on the discharge note, and CardioBase® for collecting data on primary PCI.

Data were collected on patients' sociodemographic characteristics, including: age and gender; presence of CVRFs (smoking - current smoker, former smoker; alcohol consumption, diabetes *mellitus* - treated with oral anti-diabetic drugs [OADs] or insulin-treated patients; HBP, dyslipidemia, overweight); cardiac history (AMI, revascularized coronary disease, non-revascularized coronary disease, CABG, heart valve surgery, pacemaker); date and time of chest pain onset (in the past 24 hours); type of transport to the ED (INEM ambulance, medical emergency and resuscitation vehicle [*Viatura Médica de Emergência e Reanimação*, VMER]/ immediate life support [*Suporte Imediato de Vida*, ILS] ambulance, or own transport); date and time of admission to the ED; admission to the ED on Saturdays and Sundays; season of the year in which the patient was admitted to the ED (considering Winter between 22 December and 20 March, Spring between 21 March and 20 June, Summer between 21 June and 21 October, and Autumn between 22 October and 21 December); in which the patient was admitted to the ED (divided according to nursing shifts: night [0H00-7H59], morning [8h00-15h59], and afternoon [16h00-23h59]); period of the day (divided into day period: 8h00-20h00 [period of permanence of the cardiopulmonary technician at the ED] and night period: 20H01-7H59); date and time of triage; presentational flowchart and triage priority (using the Manchester triage system); date and time of the first ECG at the ED; diagnosis (classification in the discharge note, divided into STEMI and NSTEMI); type of treatment (divided into primary PCI, fibrinolysis, and conventional therapy or CABG); date and time of fibrinolysis; date and time of primary PCI.

It should be noted that, since this is a retrospective study, not all of these aspects were recorded in every episode, leading to variations in the number of sampled patients, depending on the variable under analysis.

Data were exported to a database and statistically processed in Microsoft Office Excel®. This database was subsequently transferred to a database in IBM® SPSS® (Statistical Package for the Social Sciences), version 20.0 for Macintosh®. This software was used for descriptive and inferential statistics, in which non-parametric tests were applied. In relation to univariate statistics, the Mann-Whitney U test and the Kruskal-Wallis H test were used. Significance values were considered statistically significant at $p < 0.05$.

All formal and ethical principles were met. Authorization was obtained from the Board of Directors of the hospital unit for conducting the study. Furthermore, the Ethics Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra (UICISA:E) also gave a favorable opinion (Opinion no. 294-06/2015).

Results

Characterization of the sample

The sample was composed of 412 people: 65% with NSTEMI and 35% with STEMI. Patients were aged 29 to 97 years, with a mean age (standard deviation) of 68.4 (13.7). Most of the sampled patients (68.9%) were men (Table 1).

Table 1

Absolute and percent distribution according to age and gender (n = 412)

Sociodemographic characteristics	STEMI *n* = 146	NSTEMI *n* = 266	Total *n* = 412
Age, years, mean (*SD*) [Min-Max]	64.6 (13.7) [29 - 94]	70.5 (13.3) [35 - 97]	68.4 (13.7) [29 - 97]
≤ 40 years, *n* (%)	3 (2.1)	5 (1.9)	8 (1.9)
41 - 50 years, *n* (%)	28 (19.2)	16 (6.0)	44 (10.7)
51 - 60 years, *n* (%)	21 (14.4)	45 (16.9)	66 (16.0)
61 - 70 years, *n* (%)	44 (30.1)	56 (21.1)	100 (24.3)
71 - 80 years, *n* (%)	29 (19.9)	73 (27.4)	102 (24.8)
≥ 81 years, *n* (%)	21 (14.4)	71 (26.7)	92 (22.3)
Male gender, *n* (%)	113 (77.4)	171 (64.3)	284 (68.9)

Note. *SD* = standard deviation; *n* = sample; Min = minimum; Max = maximum.

With regard to risk factors, Table 2 shows that the most prevalent factor is HBP (68.7%), followed by dyslipidemia (57.3%). Table 2 also shows that 41.5% of patients were current or former smokers. As regards the cardiac history, 25.5% of the patients had cardiac history, with AMI (15.9%) being the most prevalent condition.

Table 2

Absolute and percent distribution of the clinical characteristics (n = 412)

Clinical characteristics	STEMI *n* = 146	NSTEMI *n* = 266	Total *n* = 412
Risk factors, *n* (%)			
Current smoker	50 (34.2)	52 (19.5)	102 (24.8)
Former smoker	24 (16.4)	45 (16.9)	69 (16.7)
Drinks alcohol	16 (11.0)	41 (15.4)	57 (13.8)
Diabetic	33 (22.6)	94 (35.3)	127 (30.8)
Treated with OADs	30 (91.0)	69 (73.4)	99 (78.0)
Insulin-treated	3 (9.0)	25 (26.6)	28 (22.0)
Hypertensive (HBP)	88 (60.3)	195 (73.3)	283 (68.7)
Dyslipidemia	82 (56.2)	154 (57.9)	236 (57.3)
Overweight	29 (19.9)	61 (22.9)	90 (21.8)
Clinical history, *n* (%)			
Patients with cardiac history	23 (15.8)	82 (30.8)	105 (25.5)
AMI	15 (3.6)	51 (12.3)	66 (15.9)
Revascularized coronary disease	2 (0.5)	7 (1.7)	9 (2.2)
Non-revascularized coronary disease	2 (0.5)	4 (0.9)	6 (1.5)
CABG	0 (0.0)	12 (2.9)	12 (2.9)
Heart valve surgery	3 (0.7)	4 (1.0)	7 (1.7)
Pacemaker	1 (0.2)	10 (2.5)	11 (2.7)

Note. *n* = sample.

In relation to the transport used to get to the ED, only 69.9% of the files included this information. The majority of patients were transported by INEM (36.2%). As regards the period of admission to the ED, most patients were admitted during the morning period (42.7%). In relation to the season of the year, the distribution was balanced, with a slight increase in winter (Table 3).

Table 3
Absolute and percent distribution of assistance characteristics (n = 412)

Assistance characteristics	STEMI *n* = 146	NSTEMI *n* = 266	Total *n* = 412
Transport, *n* (%)			
INEM	41 (28.1)	108 (40.6)	149 (36.2)
Own transport	30 (20.5)	40 (15.0)	70 (17.0)
ILS + VMER	31 (21.3)	35 (13.2)	66 (16.0)
Undetermined			127 (30.8)
Period of the day/weekday, *n* (%)			
Night (0h00-7h59)	34 (23.3)	70 (26.3)	104 (25.2)
Morning (8h00-15h59)	72 (49.3)	104 (39.1)	176 (42.7)
Afternoon (16h00-23h59)	40 (27.4)	92 (34.6)	132 (32.1)
Weekend	35 (24.0)	79 (29.7)	114 (27.7)
Day period (8h00-20h00)	94 (64.4)	154 (57.9)	248 (60.2)
Season of the year, *n* (%)			
Winter	31 (21.2)	89 (33.5)	120 (29.1)
Spring	38 (26.0)	53 (19.9)	91 (22.1)
Summer	35 (24.0)	62 (23.3)	97 (23.5)
Autumn	42 (28.8)	62 (23.3)	104 (25.2)

Note. n = sample.

Table 4 shows that the vast majority of patients (76.0%) was triaged by chest pain flowchart, followed by the shortness of breath (10.7%) and unwell adult flowcharts (7.3%). In relation to patients' priority in triage, very urgent/orange was the most common (59.5%), followed by urgent/yellow (30.9%). Together, these priorities account for 90.4% of the total number of triaged patients.

Table 4
Absolute and percent distribution according to triage (n = 412)

Triage	STEMI *n* = 146	NSTEMI *n* = 266	Total *n* = 412
Presentational Flowchart, *n* (%)			
Chest pain	115 (78.8)	198 (74.4)	313 (76.0)
Abdominal pain	2 (1.4)	6 (2.3)	8 (1.9)
Shortness of breath	11 (7.5)	33 (12.4)	44 (10.7)
Diabetes	1 (0.7)	2 (0.8)	3 (0.7)
Unwell adult	10 (6.8)	20 (7.5)	30 (7.3)
Collapsed adult	2 (1.4)	4 (1.5)	6 (1.5)
Behaving strangely	4 (2.7)	2 (0.8)	6 (1.5)

Limb problems	0 (0.0)	1 (0.4)	1 (0.2)
Vomiting	1 (0.7)	0 (0.0)	1 (0.2)
Priority (triage), *n* (%)			
Immediate/red	3 (2.1)	6 (2.3)	9 (2.2)
Very urgent/orange	101 (69.2)	144 (54.1)	245 (59.5)
Urgent/yellow	35 (24.0)	92 (34.6)	127 (30.9)
Standard/green	6 (4.1)	23 (8.6)	29 (7.0)
Non-urgent/blue	1 (0.7)	1 (0.4)	2 (0.4)

Note: *n* = sample.

Table 5 shows a mean time of 3h47 between symptom onset and the admission to the ED, with a minimum of 0h06 and a maximum of 23h15. The mean time elapsed between admission and ECG was of 1h40, with a minimum of 0h01 and a maximum of 15h04, being lower in STEMI patients, with a mean difference of 0h38. Only 12 people underwent fibrinolysis, with a mean time of 1h19, a minimum of 0h37 and a maximum of 2h24. The mean door-to-balloon time (primary PCI) was of 7h19, with a minimum of 0h37 and a maximum of almost 2 days.

Table 5
Measures of central tendency and dispersion concerning AMI patients' DTt

Time	Group	Mean (±*SD*)	Min	Max
Symptoms-admission	NSTEMI (*n* =213)	3h49 (±4h02)	0h15	23h15
	STEMI (*n* = 127)	3h43 (±4h10)	0h06	23h15
	Total (*n* = 340)	3h47 (±4h04)	0h06	23h15
Admission-ECG	NSTEMI (*n* = 265)	2h00 (±2h36)	0h01	15h04
	STEMI (*n* = 139)	1h02 (±1h26)	0h02	9h51
	Total (*n* = 404)	1h40 (±2h18)	0h01	15h04
Admission-fibrinolysis	STEMI (*n* = 12)	1h19 (±0h40)	0h37	2h24
Admission-Primary PCI	STEMI (*n* = 114)	7h19 (±8h20)	0h37	1d + 23h21

Note. SD = standard deviation; *n* = sample; Min = minimum; Max = maximum.

Table 6 shows the results of the Mann-Whitney *U* test for comparison of the time elapsed between admission and ECG according to gender, period of the day, and weekday. Only statistically significant differences ($p < 0.05$) were found in the subsample of NSTEMI patients, namely that the men underwent ECG monitoring 0h38 sooner than women.

Table 6
Results of the Mann-Whitney U test for comparison between the time elapsed between admission and ECG according to gender, period of the day, weekday, and type of AMI

Admission - *ECG*		Mean (± *SD*)	Median	X^2	*p*
NSTEMI (*n* = 265)	Men (*n* = 170)	1h46 ± 2h24	0h49	9.435.5	0.023
	Women (*n* = 95)	2h24 ± 2h52	1h21		

STEMI (n = 139)	Men (n = 106)	1h00 ± 1h29	0h31	1.909.5	0.427
	Women (n = 33)	1h08 ± 1h17	0h42		
NSTEMI (n = 265)	Day (n = 154)	1h33 ± 1h36	0h56	7.806.0	0.229
	Night (n = 111)	2h36 ± 3h27	0h50		
STEMI (n = 139)	Day (n = 91)	1h04 ± 1h27	0h31	2.287.5	0.647
	Night (n = 48)	0h58 ± 1h25	0h33		
NSTEMI (n = 265)	Weekend (n = 79)	1h46 ± 2h00	0h58	7.338.0	0.987
	Week (n = 186)	2h05 ± 2h48	0h52		
STEMI (n = 139)	Weekend (n = 35)	0h58 ± 1h11	0h31	1.854.0	0.869
	Week (n = 104)	1h03 ± 1h31	0h33		

Note. SD = standard deviation; n = sample; X^2 = chi-square test.

In relation to age and the type of transport and their association with the time elapsed between admission to the ED and ECG, Table 7 shows that, on average, NSTEMI patients aged [61 - 70] years performed the ECG 1h19 sooner than patients aged ≥ 81 years, whereas STEMI patients aged ≤ 50 years and [51 - 60] years perform the ECG sooner than patients aged ≥ 81 years. In relation to the type of transport, statistically significant differences ($p < 0.05$) were found in both subsamples, with patients transported by ILS/VMER performing the ECG sooner.

Table 7
Results of the Kruskal-Wallis test for comparison of the DTt between admission and ECG according to the age group, type of transport, and type of AMI

Admission - ECG		Mean (± *SD*)	Median	Comp.	X^2	p
NSTEMI (n = 265)	a) ≤ 50 years (n = 21)	2h01 ± 3h08	0h44	--	10.117	0.039
	b) 51 - 60 years (n = 45)	1h56 ± 2h14	1h02	--		
	c) 61 - 70 years (n = 56)	1h12 ± 1h23	0h33	c < e		
	d) 71 - 80 years (n = 73)	2h08 ± 2h39	0h53	--		
	e) ≥ 81 years (n = 70)	2h31 ± 3h10	1h10	e > c		

STEMI (n = 139)	a) ≤ 50 years (n = 29)	0h49 ± 1h13	0h31	a < e	11.547	0.021
	b) 51 - 60 years (n = 21)	0h36 ± 0h37	0h21	b < e		
	c) 61 - 70 years (n = 41)	1h02 ± 1h27	0h31	--		
	d) 71 - 80 years (n = 27)	0h59 ± 1h09	0h27	--		
	e) ≥ 81 years (n = 21)	1h51 ± 2h13	1h03	e > b e > a		
NSTEMI (n = 182)	a) INEM (n = 108)	2h17 ± 2h46	1h08	a > c	15.601	<0.001
	b) Own transport (n = 40)	1h43 ± 1h50	0h55	b > c		
	c) ILS/VMER (n = 34)	1h50 ± 3h51	0h18	c < a c < b		
STEMI (n = 95)	a) INEM (n = 41)	0h49 ± 0h52	0h33	a > c	19.426	<0.001
	b) Own transport (n = 30)	0h55 ± 1h11	0h28	b > c		
	c) ILS/VMER (n = 24)	0h15 ± 0h17	0h10	c < a c < b		

Note. SD = standard deviation; n = sample; Comp. = pairwise multiple comparison tests; X^2 = chi-square test.

With regard to the association between the presence of CVRFs and cardiac history and the time elapsed between admission and ECG (Table 8), only statistical significant differences ($p < 0.05$) were found in the sample of smokers and former smokers who underwent ECG on average 0h18 sooner than non-smokers. On the contrary, diabetic STEMI patients performed the ECG later than non-diabetic patients.

Table 8

Results of the Mann-Whitney U-test for comparison of the DTt between admission and ECG according to the presence of risk factors, cardiac history, and type of AMI

	Sample	Presence	Mean (± *SD*)	Median	X^2	Sig.
Smoking	*NSTEMI* (*n* = 265)	Yes (*n* = 97)	2h01 ± 2h47	0h51	7.836.5	0.604
		No (*n* = 168)	1h59 ± 2h29	1h02		
	STEMI (*n* = 139)	Yes (*n* = 68)	0h44 ± 0h54	0h26	1.971.5	0.062
		No (*n* = 71)	1h19 ± 1h46	0h39		
	Total (*n* = 404)	Yes (*n* = 165)	1h29 ± 2h18	0h40	17.265.5	0.033
		No (*n* = 239)	1h47 ± 2h19	0h52		
Diabetes *mellitus*	*NSTEMI* (*n* = 265)	Yes (*n* = 94)	2h11 ± 3h07	0h52	8.012.5	0.967
		No (*n* = 171)	1h53 ± 2h16	0h56		
	STEMI (*n* = 139)	Yes (*n* = 32)	1h02 ± 0h46	0h58	2.168.5	0.022
		No (*n* = 107)	1h02±1h35	0h26		
	Total (*n* = 404)	Yes (*n* = 126)	1h53 ± 2h45	0h54	19.247.5	0.111
		No (*n* = 278)	1h34 ± 2h04	0h44		
HBP	*NSTEMI* (*n* = 265)	Yes (*n* = 194)	2h00 ± 2h36	0h52	6.769.0	0.831
		No (*n* = 71)	2h00 ± 2h35	1h01		
	STEMI (*n* = 139)	Yes (*n* = 82)	1h00 ± 1h26	0h31	2.316.0	0.928
		No (*n* = 57)	1h04 ± 1h26	0h33		
	Total (*n* = 404)	Yes (*n* = 276)	1h42 ± 2h21	0h45	18.154.5	0.653
		No (*n* = 128)	1h35 ± 2h12	0h49		
Dyslipidemia	*NSTEMI* (*n* = 265)	Yes (*n* = 153)	1h48 ± 2h25	0h51	7.466.5	0.074
		No (*n* = 112)	2h16±2h49	1h04		
	STEMI (*n* = 139)	Yes (*n* = 78)	1h02 ± 1h12	0h39	2.789.0	0.082
		No (*n* = 61)	1h02 ± 1h42	0h24		
	Total (*n* = 404)	Yes (*n* = 231)	1h32 ± 2h07	0h46	19.458.0	0.652
		No (*n* = 173)	1h50 ± 2h32	0h44		
Overweight	*NSTEMI* (*n* = 265)	Yes (*n* = 61)	2h01 ± 2h11	1h07	6.798.5	0.272
		No (*n* = 204)	1h59 ± 2h42	0h52		
	STEMI (*n* = 139)	Yes (*n* = 26)	1h23 ± 2h10	0h33	1.648.0	0.334
		No (*n* = 113)	0h57 ± 1h12	0h31		
	Total (*n* = 404)	Yes (*n* = 87)	1h49 ± 2h11	0h56	15.428.0	0.089
		No (*n* = 317)	1h37 ± 2h20	0h44		
Cardiac history	*NSTEMI* (*n* = 265)	Yes (*n* = 82)	2h01 ± 3h12	0h45	6.427.5	0.062
		No (*n* = 183)	1h59 ± 2h17	1h05		
	STEMI (*n* = 139)	Yes (*n* = 21)	1h18 ± 2h23	0h28	1.140.0	0.560
		No (*n* = 118)	0h59 ± 1h12	0h33		
	Total (*n* = 404)	Yes (*n* = 103)	1h52 ± 3h03	0h44	14.438.5	0.229
		No (*n* = 301)	1h36 ± 1h59	0h50		

Note. SD = standard deviation; *n* = sample; X^2 = chi-square test; Sig. = significance.

Table 9 shows the comparison of the time elapsed between admission and primary PCI based on the period of the day and weekday. Statistically significant differences ($p < 0.05$) were found in patients who used the ED during the day period, as they were treated on average of 2h37 sooner than those who used the ED in the night period.

Table 9

Results of the Mann-Whitney U-test for comparison of STEMI patients' door-to-balloon time (time elapsed between admission and primary PCI) according to the period of the day/weekday

Admission-primary PCI	Mean (± *SD*)	Median	X^2	Sig.
Day period (*n* = 79)	6h31 ± 8h55	3h04	830.500	0.001
Night period (*n* = 35)	9h08 ± 7h30	8h01		
Weekend (*n* = 31)	7h29 ± 8h17	3h34	1.380.0	0.552
Week (*n* = 83)	7h16 ± 8h43	3h25		

Note. SD = standard deviation; *n* = sample; X^2 = chi-square test; Sig. = significance.

Discussion

This study included 412 people, mostly men (68.9%), aged 29 to 97 years, with a mean age of 68.4 years. However, the analysis of the subsamples showed that the largest number of STEMI cases were found in the [61 - 70] age group (30.1%), while the largest number of NSTEMI cases were found in the [71 - 80] age group (27.4%). The data obtained are consistent with the European reality. In 2014 around 1.4 million people aged less than 75 years die from CVDs (Sousa, 2015).

The mean time elapsed between symptom onset and admission to the ED was of 3h47, which is a result that meets the current standards. In a study conducted in 2010 and 2011, Carapeto (2012) obtained a mean DTt (time elapsed between symptom onset and first medical observation) of 1h55 in 2011 and 2h16 in 2012.

As regards the time elapsed between admission to the ED and ECG, the mean time was 1h40. In NSTEMI patients, the mean time increases to 2h00, whereas in STEMI patients it decreases to 1h02. Other authors conducted similar studies and obtained better results, namely Gouvêa, Reis, Gouvêa, Lima, and Abuabara (2015) who measured the time elapsed between admission to the ED and triage and between triage and ECG and obtained a mean time of 0h37.

Therefore, this study aimed to identify the factors reducing this time and found that, on average, only male NSTEMI patients undergo an ECG 0h38 sooner than female patients. With regard to age, it was clear that, on average, NSTEMI patients in the [61 - 70] age range undergo an ECG 1h19 sooner than patients aged ≥ 81years, as well as STEMI patients aged ≤ 50 years (1h02) and [51 - 60] years (1h15), when compared to the other patients aged ≥ 81years.

In Portugal, in 2012, of the people under the age of 65 years who died of ischemic heart disease, 81% were men and only 19% were women, and of those under the age 70 years, 77.6% were men and 22.4% were women. In addition, the mean age of death from CVD is 78 years in men and 83 years in women (Instituto Nacional de Estatística [INE], 2014). Therefore, it is likely that male patients use the ED earlier in life, a fact which, together with health professionals' awareness of male patients' higher risk level, can contribute to reduce the DTt in men.

This study also aimed to identify the association between the door-to-ECG time and the variables CVRFs and cardiac history. This study found that the time only reduced significantly (on average 0h18) in smokers or former smokers when compared to people who never smoked. The analysis of the subsamples only showed a statistically significant

difference in diabetic STEMI patients, with an increased time elapsed between admission and ECG. The period of the day and weekday in which the person used the ED was also compared with the time elapsed between admission and ECG, but no statistically significant difference was observed.
The transport used to get to the ED also influenced the time elapsed between admission and ECG, since patients transported by ILS/VMER underwent an ECG sooner in both subsamples. These results were expected, since people transported by ILS/VMER are directly admitted to the ED and, consequently, they are immediately triaged and observed.
In this study, the mean door-to-balloon time (primary PCI), which was another research focus, was of 7h19. In a study conducted on this topic between July 2005 and June 2009 in the United States, Menees et al. (2013) concluded that the mean time decreased from 1h23 in 2005 to 1h07 in 2009. In 2010, Carapeto (2012) reported door-to-balloon times between 0h46 and 8h44. The author also compared the people who were transported by INEM to the ED and those who used other means of transport and found that the door-to-balloon time of patients transported by INEM was 0h59 and that of the other patients was 2h30. Similarly, in 2011, the mean time of patients transported by INEM to the ED was of 1h09 and that of those who arrived by other means of transport was of 2h13. These studies found lower door-to-balloon times than this study; however, this study did not include people who were referred by CODU (*via verde coronária*), because the time would certainly be lower if these patients were included.
As regards the factors involved in reducing the door-to-balloon time (primary PCI), this study only showed statistically significant differences in the day period, when patients were examined on average 2h37 sooner than during the night period. Other authors have studied the association between DTt and the period of the day and obtained similar results, namely, Magid et al. (2005) who concluded that the DTt is longer between 17h00 and 7h00. The time elapsed between admission and fibrinolysis could not be analyzed due to the small sample size.

Conclusion

The data collected in this study are in line with the current situation of CVDs, both in Portugal and in Europe. This study found that 65% of the patients had NSTEMI and 35% of them had STEMI. A total of 49.1% of patients were in the age range [61 - 80] years, with a predominance of male patients (68.9%). The most prevalent CVRFs was HBP (68.7%) and the most relevant cardiac history was AMI (16%).
In the total sample, the factors influencing the reduction of the time elapsed between admission and ECG were the smoking history and the transport by ILS/VMER. In the subsample of NSTEMI patients, the time was lower in male patients and in those aged [61 - 70] years. In the subsample of STEMI patients, the time was lower in non-diabetic patients and in those aged [29 - 60] years. The time elapsed between admission and primary PCI was only influenced by the day period variable.
The fact that this study was a retrospective study has limited the analysis of other variables that could influence DTt. However, it showed the reality experienced in this ED, thus allowing to identify limitations and intervene to overcome them.
Therefore, multidisciplinary teams should reflect on and further analyze professional practices of caring for AMI patients and, consequently, implement the necessary changes, particularly through the introduction of protocols to quickly identify and treat STEMI patients at the ED. In addition, professionals should promote the development of more studies in this area, preferably after the changes have been implemented, with the purpose of identifying the benefits achieved.

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