REFERENCES

1. de Graaf C, Beesems SG, Koster RW. Time of on-scene resuscitation in out of-hospital cardiac arrest patients transported without return of spontaneous circulation. *Resuscitation.* 2019;138:235–242.
2. Ballesteros-Peña S, Jiménez-Mercado ME, Fernández-Aedo I. Survival after out-of-hospital cardiopulmonary resuscitation before ambulance arrival in the Basque Country. *Rev Esp Cardiol.* 2022;75:848–850.
3. Salhi RA, Hammond S, Lehrich JL, et al. The association of fire or police first responder initiated interventions with out of hospital cardiac arrest survival. *Resuscitation.* 2022;174:9–15.
4. Carcedo Argüelles L, Pérez Regueiro I, García Fernández JA, Lana A. Formación y conocimientos sobre Soporte Vital Básico de la Civil Guard. *Rev Esp Salud Publica.* 2021;95:e202104069.
5. Becker L, Husain S, Kudenchuk P, Doll A, Rea T, Eisenberg M. Treatment of cardiac arrest with rapid defibrillation by police in King County. *Washington Prehosp Emerg Care.* 2014;18:22–27.
6. Husain S, Eisenberg M. Police AED programs: a systematic review and meta-analysis. *Resuscitation.* 2013;84:1184–1191.

https://doi.org/10.1016/j.rec.2023.04.013

STEMI code cancelation after telematic assessment: patient characteristics and prognosis

Pacientes con cancelación del código infarto tras valoración telemática: características y pronóstico

To the Editor,

The use of new technologies in ST-segment elevation myocardial infarction (STEMI) networks has been shown to shorten time to reperfusion by improving communication and coordination between physicians responsible for the diagnosis, transfer, and treatment of patients.[1] Technologies such as mobile apps offer several advantages, including a reduction in the number of unnecessary transfers.[1]

The aim of this study was to compare clinical characteristics, electrocardiogram (ECG) patterns triggering infarction code activation, final diagnoses, clinical outcomes, and in-hospital mortality between 2 groups of patients: those who were transferred for emergent percutaneous coronary intervention (PCI) and those whose transfer was canceled. We prospectively analyzed all infarction codes activated in 2022. During these activations, the first medical contact, along with the on-call cardiologist and interventional cardiologist, shared clinical data and ECG results through the ODISEA[2] mobile app. The study was approved by the ethics committee at our hospital; prior informed consent was obtained from all patients involved.

A total of 406 codes were activated through ODISEA during the study period; 284 transfers (70%) were completed (transfer group) and 122 (30%) were canceled (cancellation group). The decision to cancel a transfer was made jointly by the on-call cardiology team and the first medical contact.

The characteristics of the cancellation and transfer groups are summarized in table 1. Patients whose transfers were canceled were more likely to be women (38.5% vs 24%, $P = .004$) and to have a history of hypertension (70% vs 55%, $P = .003$), dyslipidemia (54.1% vs 39.1%, $P = .005$), and previous ischemic heart disease (21.3% vs 10.9%, $P = .006$).

The ECG patterns for patients in the cancellation group are shown in figure 1A. The most common patterns were ST-segment depression and intraventricular conduction disorders (complete left bundle branch block, complete right bundle branch block, and pacemaker rhythms).

All patients in the cancellation group were transferred to a regional or tertiary care hospital. The choice of hospital was agreed on by the parties involved and determined by the perceived severity. Almost half of these patients (46%) were discharged directly from the emergency department. Of those admitted to hospital, one-third were scheduled for PCI. Coronary artery lesions were more common in this group than in the emergent PCI group (31.7% vs 9.6%, $P = .001$).

Most patients (90.5%) who underwent emergent PCI were diagnosed with acute coronary syndrome (ACS) (83.5% had STEMI, 6.3% non–ST-elevation myocardial infarction [NSTEMI], and 0.7% unstable angina). Just 32.8% of patients in the cancellation group had a final diagnosis of ACS (2.5% were diagnosed with STEMI, 27% with NSTEMI, and 3.3% with unstable angina). The final diagnoses of patients whose transfers were canceled are shown in figure 1B. The most common diagnoses were ACS (32.8%) and nonspecific chest pain (22.9%).

In-hospital mortality varied significantly between the groups, with a higher percentage of deaths occurring in the cancellation group (11.4% vs 4.2% in the transfer group, $P = .001$). Most deaths in patients with canceled transfers (79%) were due to nonischemic causes: sepsis (26.6%), aortic dissection (17.7%), pulmonary thromboembolism (17.7%), neurologic disorders (17.7%), and cancer (17.7%).

We have described the characteristics and clinical outcomes of patients with suspected STEMI whose transfer was canceled by the care team members based on information transmitted through the mobile ODISEA app.

The cancellation rate in our series was high (30%), which is consistent with previously reported rates.[3,4] Pretransfer cancellation is common in clinical practice but requires the use of a communication platform that meets a series of requisites: the ability to share information quickly in compliance with data protection laws, a feature enabling the parties involved to agree on the cancellation (chat box), and the capability to record case information for subsequent follow-up. All these features are included in the ODISEA app, allowing us to integrate a STEMI communication platform into our infarction code program for the first time and enabling the characterization of patients with canceled transfers.

Rates of inappropriate cancellations (corresponding to patients with acute occlusion of the culprit artery) are seldom reported in clinical trials, despite the importance of this information. The cancellation rate in our series was 2.5% (3 patients, all with difficult-to-interpret ECG patterns). Although cancellation of activations deemed inappropriate is common practice, there is a risk that a small proportion of patients will have an actual STEMI. In a report on 886 cardiac catheterization laboratory cancellations, Lange et al.[4] detected 9 inappropriate cancellations (1%), all in patients with an acute occlusion subsequently detected by PCI. Promising results have been reported for machine learning algorithms that can predict STEMI on ECG.[5] This technology could help reduce human error.

The cancellation group was characterized by high comorbidity, perceived severity, difficult-to-interpret ECGs, and heterogeneous final diagnoses, ranging from nonserious conditions to conditions with high in-hospital mortality. The in-hospital mortality rate in our series was 11.4%. Similarly high short- and long-term rates have been described in other reports of canceled activations.[3,4]

Table 1
Comparison of patients with suspected STEMI in the transfer group (transferred for PCI) and cancellation group (transfer canceled)

Baseline characteristic	All patients (n = 406)	Patients with canceled transfers (n = 122)	Patients who were transferred (n = 284)	*P*
Age, y	67 (13.9)	69 (15.9)	66 (12.8)	.05
Women	116 (28.6)	47 (38.5)	69 (24.3)	.004
Smokers	135 (33.3)	24 (19.7)	111 (39.1)	< .001
Hypertension	242 (59.6)	86 (70.5)	156 (54.9)	.003
Diabetes mellitus	115 (28.3)	37 (30.3)	78 (27.5)	.5
Dyslipidemia	177 (43.6)	66 (54.1)	111 (39.1)	.005
Previous stroke/TIA	21 (5.2)	11 (9)	10 (3.5)	.02
Previous AMI	57 (14)	26 (21.3)	31 (10.9)	.006
Previous PCI	47 (11.6)	18 (14.8)	29 (10.2)	.19
Previous surgical revascularization	9 (2.2)	3 (2.5)	6 (2.1)	.82
Survival after sudden cardiac arrest	16 (3.9)	5 (4.1)	11 (3.9)	.9
First medical contact				
Emergency medical services	141 (34.7)	51 (41.8)	90 (31.7)	.04
Primary care	88 (21.7)	18 (14.8)	70 (24.6)	
Hospital without interventional cardiologist	177 (43.6)	53 (43.4)	124 (43.7)	
Diagnostic ECG pattern				< .001
ST-segment elevation	279 (68.7)	26 (21.3)	253 (89.1)	
ST-segment depression	36 (8.8)	28 (23)	8 (2.8)	
LBBB	26 (6.4)	17 (13.9)	9 (3.2)	
RBBB	9 (2.2)	6 (4.9)	3 (1.1)	
Pacemaker rhythm	6 (1.5)	5 (4.1)	1 (0.4)	
Other	50 (12.4)	40 (32.8)	10 (3.4)	
Hospital admission	63 (15.5)	56 (46)	7 (2.4)	< .001
PCI	323 (79.6)	41 (33.6)	282 (99.3)	< .001
Final diagnosis of ACS	297 (73.2)	40 (32.8)	257 (90.5)	< .001
Final diagnosis				< .001
STEMI	240 (59.1)	3 (2.5)	237 (83.5)	
NSTEMI	51 (12.6)	33 (27)	18 (6.3)	
Unstable angina	6 (1.5)	4 (3.3)	2 (0.7)	
Other	109 (26.8)	82 (67.2)	27 (9.5)	
PCI findings				< .001
Single-vessel disease	185 (57.3)	15 (36.6)	170 (60.3)	
Double-vessel disease	53 (16.4)	4 (9.8)	49 (17.4)	
Triple-vessel disease	45 (13.9)	9 (22)	36 (12.8)	
Coronary arteries without lesions	40 (12.4)	13 (31.7)	27 (9.6)	
Truncus arteriosus	15 (4.6)	0	15 (5.3)	.13
Percutaneous revascularization	250 (77.4)	18 (43.9)	232 (82.3)	< .001
In-hospital mortality	27 (6.7)	14 (11.4)	12 (4.2)	.003

ACS, acute coronary syndrome; AMI, acute myocardial infarction; LBBB, left branch bundle block; NSTEMI, non–ST-elevation myocardial infarction; PCI, percutaneous coronary intervention; RBBB, right branch bundle block; STEMI, ST-elevation myocardial infarction; TIA, transient ischemic attack.
Values are expressed as mean ± SD or No. (%).

The main limitations of this study are its small sample size and single-center design. More research is needed to confirm our findings and explore their generalizability to other health care regions.

In conclusion, patients with suspected STEMI whose transfers are canceled account for a significant proportion of infarction code activations. These patients have multiple comorbidities, unusual ECG patterns, and high in-hospital mortality. Although diagnosis is challenging, use of new technologies such as mobile apps could lead to improved management.

FUNDING

Training and research grant from Asociación de Cardiopatía Isquémica y Cuidados Críticos Cardiológicos (SECACIC-FOR-NAC 22/002). Grant from Sociedad Española de Cardiología, Spain.

AUTHORS' CONTRIBUTIONS

Design: C. Martín Domínguez and J. Aboal Viñas. Field work: C. Martín Domínguez, B. Herrera Martínez, and V. Agudelo Montañez.

Figure 1. A, ECG patterns in patients whose transfer was canceled following infarction code activation. B, Final diagnoses in these patients. The pie chart on the right shows a breakdown of all diagnoses. The most common acute coronary syndrome diagnoses are shown in the pie chart on the left. ECG, electrocardiogram; STEMI, ST-segment elevation myocardial infarction; NSTEMI, non–ST-segment elevation myocardial infarction.

Statistical analysis: J. Aboal Viñas. Manuscript draft and formatting: C. Martín Domínguez, J. Aboal Viñas, and P. Loma-Osorio Rincón. All authors contributed to drafting and revising the paper, and they all read and approved the final version.

CONFLICTS OF INTEREST

None declared.

Carmen Martín Domínguez,[a,*] Jaime Aboal Viñas,[a,b] Pablo Loma-Osorio Rincón,[a] Blanca Herrera Martínez,[a] Víctor Agudelo Montañez,[a] and Ramón Brugada Terradellas[a,b]

[a]*Servicio de Cardiología, Hospital Universitario Josep Trueta, Girona, Spain*
[b]*Instituto de Investigación Biomédica de Girona (idIBGi), Girona, Spain*

[*] Corresponding author.
E-mail address: carmen_md92@outlook.es (C. Martín Domínguez).
@UCCHJT

Available online 26 July 2023

REFERENCES

1. Studencan M, Alusik D, Plachy L, et al. Significant benefits of new communication technology for time delay management in STEMI patients. *PLoS One.* 2018;13:e0205832.
2. Aboal J, Ramos R, Boada I, Agudelo V, Palacios J, Pérez V. Use of new technologies in the transfer of patients with STEMI. Results from the pilot test ODISEA APP. *REC Interv Cardiol.* 2023;5:66–68.
3. Faour A, Pahn R, Cherrett C, et al. Late Outcomes of Patients with Prehospital ST-segment Elevation and Appropriate Cardiac Catheterization Laboratory Nonactivation. *J Am Heart Assoc.* 2022;11:e025602.
4. Lange DC, Conte S, Pappas-Block E, et al. Cancellation of the Cardiac Catheterization Lab after Activation for ST-segment-Elevation Myocardial Infarction. *Circ Cardiovasc Qual Outcomes.* 2018;11:e004464.
5. Chen KW, Wang YC, Liu MH, et al. Artificial intelligence-assisted remote detection of ST-elevation myocardial infarction using a mini-12-lead electrocardiogram device in prehospital ambulance care. *Front Cardiovasc Med.* 2022;9:1001982.

https://doi.org/10.1016/j.rec.2023.04.010
1885-5857/Published by Elsevier España, S.L.U. on behalf of Sociedad Española de Cardiología.