ORIGINAL ARTICLE

Clinical features of pericarditis with and without myocardial involvement diagnosed in the emergency department and factors associated with need for hospitalization

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Objectives. To analyze the clinical features of acute pericarditis diagnosed in the emergency department according to patient age and myocardial involvement (myopericarditis) and to determine factors associated with hospitalization.

Methods. Retrospective, descriptive, observational, single-center study of consecutive patients. We analyzed all cases of pericarditis diagnosed in the emergency department over a period of 10 years (2008–2017), reviewing clinical, electrocardiographic, and laboratory findings as well as ultrasound imaging for myocardial involvement. Characteristics were analyzed by age (under 50 years or 50 or older) and presence or not of myocardial involvement. Factors associated with hospitalization for both pericarditis and myopericarditis were identified by crude and adjusted odds ratios (ORs).

Results. A total of 983 patients were diagnosed with pericarditis (34% women, mean age, 42 years). The younger patients more often reported sharp chest pain modified by breathing or posture changes. Older patients had more concurrent cardiovascular disease and described chest pain as pressure (oppressive); acute coronary syndrome was suspected more often in the older patients. The only independent predictor of myopericarditis was a finding of electrocardiographic abnormalities, recorded in 72 cases (7%) (OR, 4.26; 95% CI, 1.89–9.59). Sixty-two patients (6%) were admitted for pericarditis. Associated factors were renal insufficiency (OR, 4.83; 95% CI, 1.66–14.05), pain modified by breathing or posture changes (OR, 0.54; 95% CI, 0.29–0.99), tachycardia (OR, 2.29; 95% CI, 1.15–4.55), and myopericarditis (OR, 8.73; 95% CI, 4.65–16.38). Admission of 24 patients (33%) for myocarditis was related to focused cardiac ultrasound findings (OR, 13.72; 95% CI, 1.80–104).

Conclusions. Age may affect the presentation of pericarditis. ST segment abnormalities on an electrocardiogram suggest myocardial involvement. Renal insufficiency, tachycardia, and myocardial involvement are the factors associated with a decision to admit patients with pericarditis. Ultrasound findings are associated with admission for myopericarditis.

Keywords: Pericarditis. Myopericarditis. Chest pain team. Emergency department. Focused ultrasound.

Características clínicas de las pericarditis y miopericarditis diagnosticadas en urgencias y factores asociados con la necesidad de hospitalización

Objetivo. Analizar los episodios de pericarditis aguda (PA) diagnosticados en urgencias en función de la edad y de la afectación miocárdica (miopericarditis, MioP), y determinar los factores asociados a hospitalización.

Método. Estudio observacional, descriptivo, unicéntrico de casos consecutivos, con análisis retrospectivo de todos los casos diagnosticados de PA en urgencias durante 10 años (2008-2017), y revisión de las características clínicas, ECG, analíticas y ecográficas (en MioP). Se compararon características clínicas según la edad (< 50 y ≥ 50 años) y existencia de MioP. Los factores asociados a hospitalización (PA y MioP) se identificaron de forma cruda y ajustada por las diferencias clínicas entre grupos.

Resultados. Se diagnosticaron 983 PA (34% mujeres, mediana de edad: 42 años). Los pacientes más jóvenes referían con mayor frecuencia dolor torácico (DT) punzante y modificable con la respiración o cambios posturales, y los más mayores tenían más comorbilidades cardiovasculares, refirieron más frecuentemente DT opresivo y generaron mayor sospecha de síndrome coronario agudo. Las alteraciones en el ECG (OR = 4,26; IC95% = 1,89-9,59) se asociaron a MioP (72 casos, 7%). Ingresaron 62 PA (6%), hecho asociado a antecedente de insuficiencia renal (OR = 4,83; IC95% = 1,66-14,05), DT que se modifica con movimientos respiratorios/posturales (OR = 0,54, IC95% = 0,29-0,99), taquicardia (OR = 2,29, IC95% = 1,15-4,55) y MioP (OR = 8,73, IC95% = 4,65-16,38). Ingresaron 24 MioP (33%), hecho asociado a alteraciones en la ecoscopia dirigida (protocolo FOCUS; OR = 13,72, IC95% = 1,80-104).

Conclusiones. La edad puede condicionar la presentación clínica en los pacientes con PA. Las alteraciones en el segmento ST en el ECG son sugestivos de implicación miocárdica. La insuficiencia renal, la taquicardia y la MioP son factores que incrementan la decisión de hospitalización en las PA; mientras que en las MioP, las alteraciones ecográficas.

Palabras clave: Pericarditis. Miopericarditis. Unidad de dolor torácico. Urgencias. FOCUS.

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Introduction

The first published cases of idiopathic acute pericarditis (AP) date from 1854 (Hodges). A review of cases documented between the 1940s and 1960s was published in 1967, describing the clinical picture we know today as suggestive of pericardial inflammatory syndrome or AP[1]. In 1966 Smith[2] suggested the term myopericarditis to designate APs with myocardial involvement. At that time, myopericarditis was diagnosed from data obtained through clinical anamnesis, physical examination and electrocardiogram (ECG), and the only enzymes analyzed at that time were aspartate and alanine aminotransferases (ASAT and ALAT, respectively). In the 1980s a number of studies appeared suggesting the serial use of cardiac enzymes in cases of suspected myopericarditis; the choice was made for MB fraction creatine kinase (CK-MB), with high concentrations in 70% of patients with AP who showed ST segment elevation on the ECG and in 10% of cases without ST segment elevation[3]. Cardiac troponins (cTn) did not begin to be used in clinical practice until the beginning of the 21st century[4,5]. Since then, different studies with different designs and diagnostic criteria have published variable ranges of myocardial involvement in the AP context. Imazio et al.[6] described the presence of myopericarditis in 40 of 247 (15%) consecutive patients diagnosed with AP in two Italian centers between 2001 and 2005; subsequently, they found a higher frequency (29% of myopericarditis, 140 of the 496 cases of AP) in a multicenter study conducted between 2007 and 2011[7]. The latest European guidelines on the management of pericardial pathology[8] establish the diagnosis of AP on the basis of clinical, electrocardiographic and ultrasound criteria; and recommend the use of biomarkers of myocardial injury (cTn of choice) to obtain the diagnosis of myopericarditis in this context of AP.

The most common symptom of AP presentation is chest pain (CP) and the main setting in which patients with AP are diagnosed is the hospital emergency department (HED). Despite this, there are few published data from studies conducted in EDs over the last decade. The main objective of the present study is to describe the clinical, electrocardiographic and ultrasound characteristics of patients attending the HED with CP and a final diagnosis of AP, with a specific analysis according to age, as well as the variables associated with the diagnosis myopericarditis. As secondary objectives, factors associated with the admission decision were investigated in the total number of patients with AP, as well as in the subgroup of patients with myopericarditis.

Method

This is a unicentric, descriptive, observational study of consecutive cases conducted at an urban tertiary level university hospital with a population of approximately 500,000 inhabitants. Non-traumatic CP consultations (NTCP) represent about 300 monthly consultations and are assessed within a structural chest pain unit (CPU) with the aim of early detection of life-threatening diseases. The structural and organizational characteristics of the unit have been described in previous works[9,10].

For this study, we retrospectively analyzed all cases with a final diagnosis of AP after receiving care at the CPU between January 2008 and December 2017 (10 years). Thirty-four independent variables were collected and classified into demographic variables, cardiovascular and non-cardiovascular comorbidities, previous medications and clinical, electrocardiographic and, in the cases of myopericarditis, ultrasound characteristics of the episode. The pending variables were the diagnosis of myopericarditis and the need for hospital admission. In addition, we followed up on ED re-consultations and 30-day mortality in the subgroup of patients diagnosed with myopericarditis by reviewing clinical records.

The diagnosis of AP was made by the healthcare practitioner, following the criteria of the European Society of Cardiology (ESC, 2015)[8]. Thus, patients had to meet at least two of the following criteria: 1) CP with characteristics suggestive of pericarditis; 2) pericardial rubbing auscultation; 3) typical ECG changes (PR segment depression or diffuse ST segment elevation); and 4) pericardial effusion (new or worsening). Those patients with diagnostic criteria of AP in which myocardial involvement was objected to by elevation of biomarkers were diagnosed with myopericarditis, following the criteria of the ESC 2015[8]. The biomarker of acute myocardial injury used was conventional cTn I with the Dimension Vista-Siemens immunoassay method.

Qualitative data were expressed as absolute values and percentages, continuous variables were expressed as mean and standard deviation (SD) or median and interquartile range (IQR). Comparisons of clinical characteristics between different subgroups of patients (< or 50 years, existence or not of myopericarditis, decision to admit or discharge from the emergency department) were made using the Chi-square test and Student t (or Mann-Whitney U test if the distribution was not normal), for categorical and continuous variables, respectively.

For the different clinical and care variables analyzed, we calculated the odds ratios (odds ratio, OR) with a 95% confidence interval (CI95%) for the existence of myopericarditis and for the decision to stay in hospital, the latter both in the total number of patients and in the subgroup of patients with myopericarditis. These data were crudely calculated and subsequently adjusted using a multivariate logistic regression model, which included all variables that had a $P < 0.10$ value in the univariate analysis. In order to avoid the loss of patients in which the value of any of the variables included in the model was missing, multiple imputation was previously performed using the modu-

le provided by the SPSS program (v 24.0) and five new data sets were generated in which there were no missing values.

In all cases, the difference between groups was considered statistically significant if the value of $p < 0.05$ or if the 95% CI of the OR did not include the value 1. All analyses were performed using the SPSS statistical package (version 24.0; IBM, New Castle, NY, USA).

The use of the clinical database was carried out with the patients coded, to prevent the identification of the patients, and was approved by the Ethics Committee of the Hospital Clínic. The study was carried out in strict compliance with the ethical principles set out in the Declaration of Helsinki.

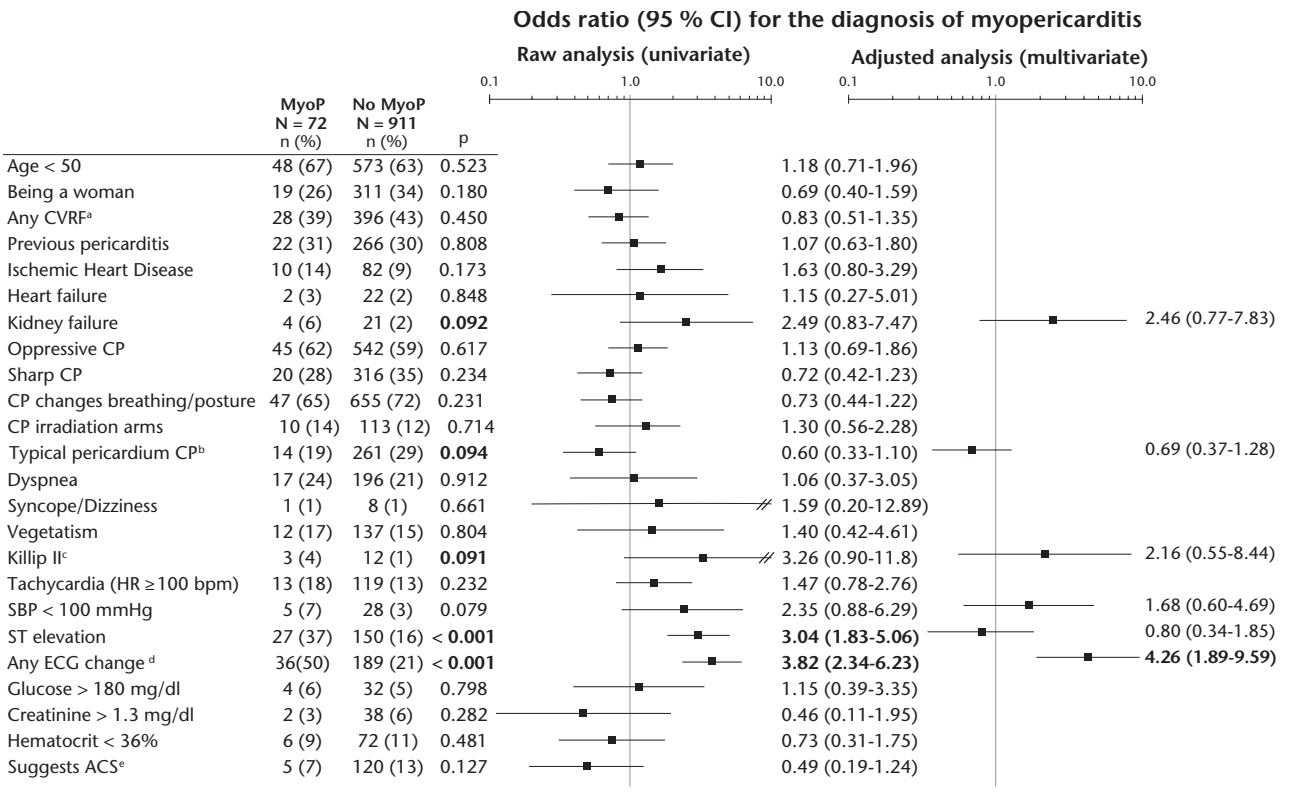
Results

During the study period, 983 episodes of AP were diagnosed, representing 2.8% of consultations for NTCPs conducted at the CPU over 10 years (34,552 visits). Thirty-four percent were women, with a median age of 42 years (IQR 30-58). Table 1 synthesizes the demographic characteristics, comorbidities, previous medication and clinical, electrocardiographic and ultrasound characteristics of the episode and compares these characteristics between patients under 50 years of age and those older. It should be noted, due to its statistical significance, that young patients more frequently presented typical clinical AP (sharp CP that worsens with respiratory movements or postural changes). The

Table 1. Characteristics of the patients included

	Total N = 983 n (%)	Age < 50 N = 621 n (%)	Age ≥ 50 N = 362 n (%)	P value
Demographic characteristics				
Age (in years) [median (IQR)	42 (30-58)	33 (26-41)	62 (56-71)	No data
Female	330 (34%)	182 (29)	148 (41)	< 0.001
Cardiovascular risk factors				
Diabetes mellitus	62 (6)	6 (1)	56 (15)	< 0.001
High blood pressure	191 (19)	33 (5)	158 (44)	< 0.001
Dyslipidemia	138 (14)	21 (3)	117 (32)	< 0.001
Obesity	85 (9)	27 (4)	58 (16)	< 0.001
Smoking	205 (21)	142(23)	63 (17)	0.042
Comorbidities				
Previous episodes of pericarditis	288 (29)	164 (26)	124 (34)	0.009
Ischemic Heart Disease	92 (9)	22 (3)	70 (19)	< 0.001
Heart failure	24 (2)	2 (0)	22 (6)	< 0.001
Chronic renal failure	25 (2)	11 (2)	14 (4)	0.044
Clinical characteristics				
Oppressive chest pain	587 (60)	349 (56)	238 (66)	0.003
Sharp chest pain	336 (34)	251 (40)	85 (23)	< 0.001
Chest pain changes with breathing/posture	702 (71)	467 (75)	235 (65)	0.001
Chest pain radiating to the arms	123 (13)	71 (11)	52 (14)	0.180
Typical pericardialdial clinic[a]	275 (28)	208 (33)	67 (18)	< 0.001
Dyspnea	213 (22)	123 (20)	90 (25)	0.064
Syncope/Dizziness	9 (1)	3 (0)	6 (2)	0.062
Vegetatism	149 (15)	87 (14)	62 (17)	0.189
Killip II[b]	15 (1)	1 (0)	14 (4)	< 0.001
Vital signs in the emergency department				
Systolic blood pressure [mean (SD)	128 (19)	125 (16)	132 (23)	< 0.001
Heart rate [mean (SD)]	80 (19)	79 (18)	82 (20)	0.030
ECG in the emergency department				
ST segment elevation	177 (18)	125 (20)	52 (14)	0.023
Any suggestive change in pericardiums[c]	225 (23)	146 (23)	79 (22)	0.544
Analysis in the emergency department				
Glucose (mg/dl) [median (IQR)][d]	104 (94-121)	100 (92-114)	116 (100-139)	< 0.001
Creatinine (mg/dl) [median (IQR)][e]	0.9 (0.7-1.0)	0.8 (0.7-1.0)	0.9 (0.7-1.0)	0.008
Haematocrit (%) [median (IQR)][f]	42 (39-45)	43 (40-46)	42 (37-44)	< 0.001
Elevated troponin (myopericarditis)	72 (7)	48 (8)	24 (7)	0.523
Initial orientation in the emergency department				
Possible acute coronary syndrome[g]	125 (13)	33 (5)	92 (25)	< 0.001

[a]Sharp chest pain that changes with breathing movements and posture.
[b]No patients were recorded with Killip III or IV.
[c]Some suggestive changes of pericarditis on the ECG include: elevation of the ST segment, depression of the ST segment and alteration of the T wave.
[d]Not available in 284 cases.
[e]Not available in 269 cases.
[f]Not available in 269 cases.
[g]The initial classification of the patient based on the clinic and the first ECG did not make it possible to initially exclude the diagnosis of acute coronary syndrome.
ECG: electrocardiogram; IQR: interquartile range; SD: standard deviation.



	MyoP N = 72 n (%)	No MyoP N = 911 n (%)	p	Raw analysis (univariate)	Adjusted analysis (multivariate)
Age < 50	48 (67)	573 (63)	0.523		1.18 (0.71-1.96)
Being a woman	19 (26)	311 (34)	0.180		0.69 (0.40-1.59)
Any CVRF[a]	28 (39)	396 (43)	0.450		0.83 (0.51-1.35)
Previous pericarditis	22 (31)	266 (30)	0.808		1.07 (0.63-1.80)
Ischemic Heart Disease	10 (14)	82 (9)	0.173		1.63 (0.80-3.29)
Heart failure	2 (3)	22 (2)	0.848		1.15 (0.27-5.01)
Kidney failure	4 (6)	21 (2)	**0.092**		2.49 (0.83-7.47)
Oppressive CP	45 (62)	542 (59)	0.617		1.13 (0.69-1.86)
Sharp CP	20 (28)	316 (35)	0.234		0.72 (0.42-1.23)
CP changes breathing/posture	47 (65)	655 (72)	0.231		0.73 (0.44-1.22)
CP irradiation arms	10 (14)	113 (12)	0.714		1.30 (0.56-2.28)
Typical pericardium CP[b]	14 (19)	261 (29)	**0.094**		0.60 (0.33-1.10)
Dyspnea	17 (24)	196 (21)	0.912		1.06 (0.37-3.05)
Syncope/Dizziness	1 (1)	8 (1)	0.661		1.59 (0.20-12.89)
Vegetatism	12 (17)	137 (15)	0.804		1.40 (0.42-4.61)
Killip II[c]	3 (4)	12 (1)	**0.091**		3.26 (0.90-11.8)
Tachycardia (HR ≥100 bpm)	13 (18)	119 (13)	0.232		1.47 (0.78-2.76)
SBP < 100 mmHg	5 (7)	28 (3)	0.079		2.35 (0.88-6.29)
ST elevation	27 (37)	150 (16)	< **0.001**		**3.04 (1.83-5.06)**
Any ECG change [d]	36(50)	189 (21)	< **0.001**		**3.82 (2.34-6.23)**
Glucose > 180 mg/dl	4 (6)	32 (5)	0.798		1.15 (0.39-3.35)
Creatinine > 1.3 mg/dl	2 (3)	38 (6)	0.282		0.46 (0.11-1.95)
Hematocrit < 36%	6 (9)	72 (11)	0.481		0.73 (0.31-1.75)
Suggests ACS[e]	5 (7)	120 (13)	0.127		0.49 (0.19-1.24)

2.46 (0.77-7.83)
0.69 (0.37-1.28)
2.16 (0.55-8.44)
1.68 (0.60-4.69)
0.80 (0.34-1.85)
4.26 (1.89-9.59)

[a]There are some cardiovascular risk factors: diabetes mellitus, high blood pressure, dyslipemia, active smoking.
[b]Sharp chest pain that changes with breathing and posture.
[c]No patients were registered with Killip III or IV.
[d]Changes in the ECG include: ST segment elevation, ST segment depression and T wave alteration.
[e]The initial classification of the patient based on the clinic and the first electrocardiogram did not allow the emergency physician to initially exclude the diagnosis of acute coronary syndrome.
CVRF: cardiovascular risk factors; CP: chest pain; SBP: systolic blood pressure; ACS: acute coronary syndrome.
P values in bold correspond to those variables introduced in the multivariate model (P < 0.10) and (95% CI) values in bold to those that were statistically significant.

Figure 1. Factors associated with presenting myocardial affectation (myopericarditis) in patients who were diagnosed with pericarditis.

group of patients aged 50 years or more, although they showed less smoking habits, had more cardiovascular comorbidities such as diabetes mellitus, high blood pressure, dyslipidemia and obesity; moreover, they more frequently referred to CP as oppressive. These patients generated among ED physicians a greater need to exclude an acute coronary syndrome (ACS), which they suspected was finally ruled out when the definitive diagnosis of AP was established.

At least one determination of cTn was performed in all patients, 7% (72 patients) showed a significant elevation of myocardial injury, being considered diagnostic criteria of myopericarditis in the clinical context of AP. In 60 of these patients a directed echography was performed (FOCUS protocol: FOcused Cardiac UltraSound), depending on the decision of the physician in charge. Contractility was altered in 8 cases (13%) and pericardial effusion in 21 cases (30%): mild in 18 and moderate-severe in 2 (1 with cardiac tamponade clinic). Among the patients with myopericarditis who presented an elevation of the ST segment (37%), 14% underwent urgent catheterization, where ACS was ruled out in all cases due to the absence of significant coronary lesions that would justify the clinical picture. In the univariate analysis, 2 variables were found to have a statistically significant relationship with the probability of presenting myocardial injury in the context of AP: some change in the ST segment on the ECG (elevation or depression of the ST segment and alteration of the T wave) and ST elevation on the ECG; but in the multivariate model the only one that showed an independent association was the presence of some change in the ECG (adjusted OR of 4.26, 95% CI 1.89-9.59, Figure 1).

Out of the total of 983 cases treated in the ED, 92% were discharged and 8% were admitted to hospital. Factors statistically significantly associated with admission were the existence of renal failure, AP-suggesting CP (inverse relationship), ED tachycardia (heart rate (HR) 100 bpm), ECG changes suggestive of AP, ST-segment elevation on the ECG and the existence of myocardial injury; although only renal failure (OR = 4.83; 1.66-14.05), AP changes with respiration and posture (OR 0.54; 0.29-0.99), tachycardia (OR 2.29; 1.15-4.55) and myopia (OR 8.73; 4.65-16.38) remained significant on multivariate analysis (Figure 2).

The percentage of hospital admissions for the 72 myopericarditis patients was 33%. The only variable independently associated with admission was the observation of alterations in contractility or moderate-severe pericardial effusion in ED-directed echography (FOCUS protocol; OR 13.7; 1.80-104) (Figure 2). The mean length of stay (LOS) in the ED of patients with myopericarditis who were discharged was 12:53 hours (SD 8:15 hours). This subgroup of patients presented 10% (5 patients) of reconsultations to the ED for a CP with final assessment of pericarditis at 30 days, but none of these reconsultations required hospital admission. On the other hand, the mean hospital ED in the subgroup with myopericarditis in which the decision to admit patients to hospital was made (10 patients transferred to an intermediate or intensive care unit and 14 in a conventional ward) was 8.66 days (SD 9.37 days). Among these patients, one case of in-hospital mortality was recorded, specifically in a 40-year-old patient with no previous cardiovascular history who was admitted to an intensive care unit for myopericarditis of viral etiology with severe left ventricular dysfunction. Thirty days after discharge, two patients returned to the ED with symptoms suggestive of pericarditis, none of whom required hospital admission. Since no follow-up is available for 4 patients, we could estimate that, in the event that all 4 patients had presented unrecorded re-consultations, the percentage of these would be 26% (with no significant differences compared to the group discharged from the ED; p = 0.088); while in the event that none of these patients had presented re-consultations, the percentage would be 9% (still with no significant differences compared to the patients discharged; p = 0.82). No deaths were observed in either of the two 30-day follow-up groups (Figure 3).

Discussion

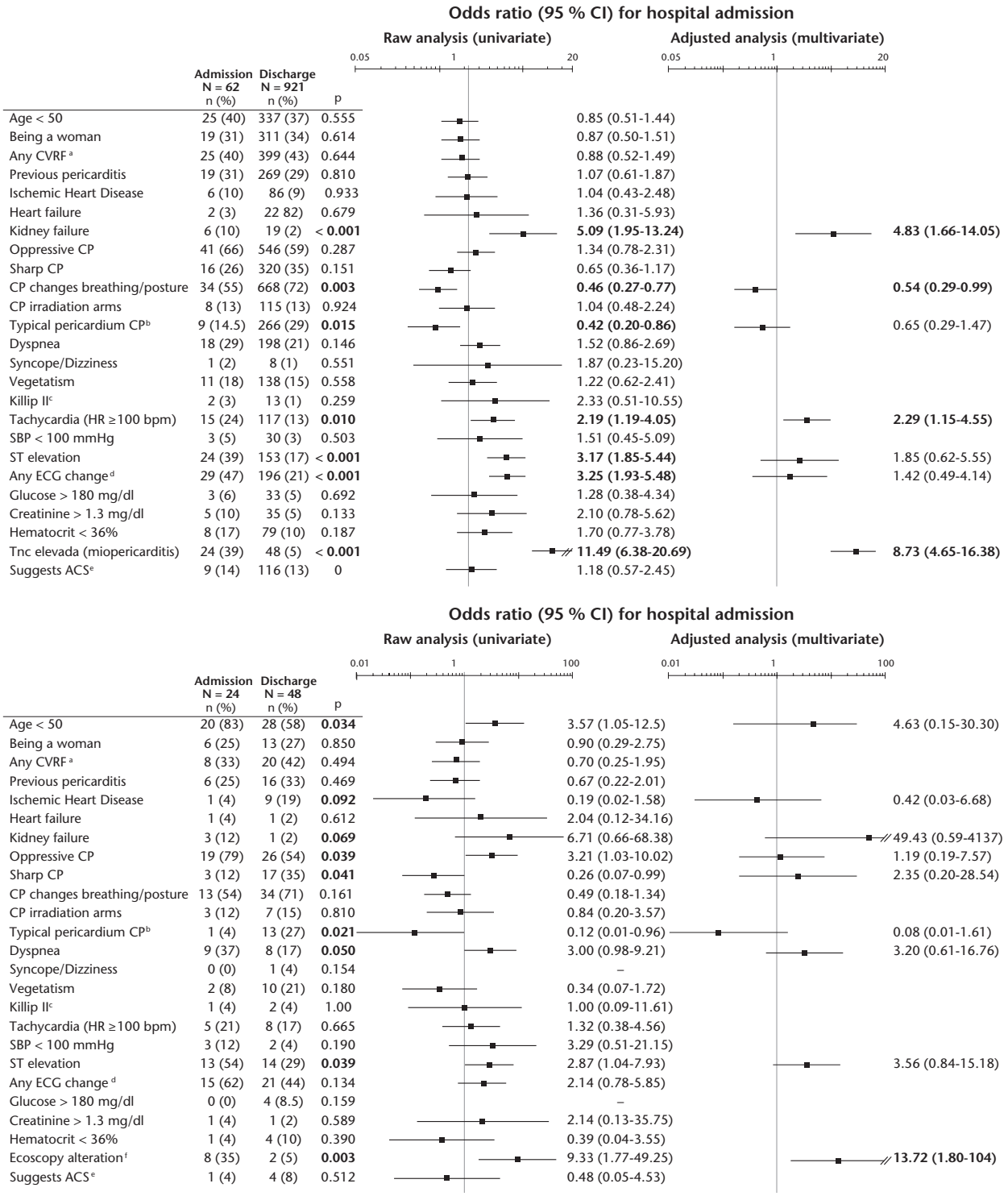
To our knowledge, the present series of consecutive cases of AP diagnosed in the ED is the longest European series published to date[6,7,11]. This has been possible by reviewing the case history of consecutive patients attended in a CPU for 10 years and in which all patients consulting in the ED for NTCP are managed. Given that CP is one of the cardinal symptoms of AP, it is plausible that the vast majority of AP patients treated in the ED have already been through a CPU. This has allowed us to estimate that the incidence of AP among patients with CP is 3%.

In this study we observed that the typical clinical picture of AP with punctured CP that worsens with respiratory movements or postural changes occurs in about 30% of cases, and this is more frequent in young patients who also have fewer cardiovascular risk factors and fewer comorbidities. Sometimes APs can simulate ACS, both by clinical presentation and electrocardiographic changes[12,13]. In a recently published series of over 2,000 patients meeting MINOCA criteria (myocardial infarction without obstructive coronary artery disease), the group of patients with a final diagnosis of AP and myopericarditis represented 22% of non-coronary cardiac causes[14]. Our results are consistent with the literature6, showing that up to 13% of patients with AP were included in the differential diagnosis of the possibility of ACS. Moreover, this suspicion is strongly linked to the age of the patient, since in those patients aged 50 years, this percentage rose to 25%. In this age group, the differential diagnosis between AP and ACS is sometimes a challenge for ED physicians. In accordance with the data presented, age is a variable that influences the recommendations for initial management of AP in current clinical guidelines. Thus, these recommendations indicate catheterization of this group of older patients with non-typical AP to rule out an ischemic cause, while in cases where the clinical presentation mimics ACS in young patients without cardiovascular risk factors, it is recommended that priority be given to non-invasive screening tests for ischemia (cardiac magnetic resonance imaging)[7,8,13].

On the other hand, in this study the only independent factor associated with myopericarditis is the presence of changes in the ECG, which can be explained by the fact that the pericardium is an electrically inert tissue. However, other factors related to myopericarditis reported in the 2008 Imazio et al. series[6], such as arrhythmias, male sex, age (more frequent in younger patients) and presenting a recent febrile syndrome, have not been found in the present study.

Most patients diagnosed with AP are discharged from the ED, as a minority require hospital admission. Since this is a management pathology mainly in the ED, there is little information in the literature about the factors associated with hospital admission. One of the important aspects of this study is to be the first to find an independent association between a greater decision to admit patients to hospital and the presence of renal failure, CP that is modified by respiratory or postural movements (inverse relationship) and tachycardia (HR 100 bpm) on arrival at the ED. The existence of myocardial involvement, which was the other factor associated with hospital admission found in our study, had been previously published[11]. Also new is our contribution about the factors associated with admission in the specific subgroup of patients with myopericarditis. In this regard, the influence of ultrasound information obtained from the FOCUS protocol on decision making by the ED physician for patients with myopericarditis seems to be decisive, since it has been the only factor associated with the decision of hospital admission in this subgroup.

All patients with MyoP and moderate-severe alterations in directed echography (alteration in contractility or moderate-severe pericardial effusion) were admitted. Those patients with elevated biomarkers, but no alteration in contractility or moderate-severe pericardial effusion, were discharged after a period of monitoring in the ED in which clinical, haemodynamic and electrocardiographic stability was observed, with no increased mortality or number of reconsultations at 30 days.



[a]There are some cardiovascular risk factors: diabetes mellitus, high blood pressure, dyslipemia, active smoking.
[b]Sharp chest pain that changes with breathing and posture.
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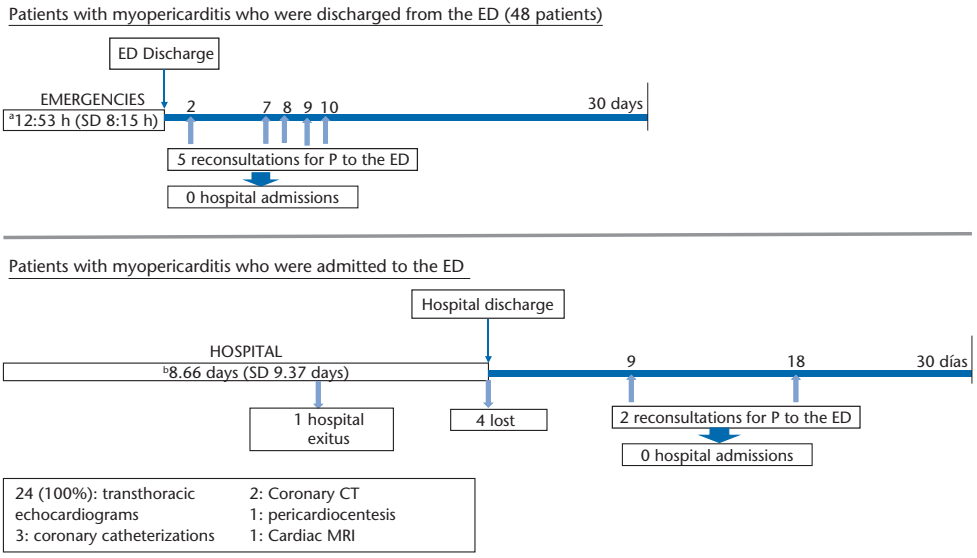
CVRF: cardiovascular risk factors; CP: chest pain; SBP: systolic blood pressure; ACS: acute coronary syndrome.
P values in bold correspond to those variables introduced in the multivariate model (P < 0.10) and (95% CI) values in bold to those that were statistically significant.

Figure 2. Analysis of factors associated with hospital admission in patients diagnosed with pericarditis (N = 983, above) and in the subgroup of patients diagnosed with myopericarditis (N = 72, below).



[a]Mean (standard deviation) length of stay in the ED
[b]Mean (standard deviation) of hospital stay
MRI: Magnetic Resonance Imaging

Figure 3. Follow-up of patients with myopericarditis (N = 72): 30 days after discharge from the hospital emergency department (ED) for patients not admitted (above) and 30 days after discharge for patients admitted (below).

There is previous work evaluating the role of echocardiography in the ED[15], notably the consensus document of the American societies of echocardiography and emergency medicine that recommend echocardiography following the FOCUS protocol for all patients with CP who consult in the ED, as it can help to obtain key data in the differential diagnosis, such as pericardial effusion, alterations in contractility, signs suggestive of increased pressure in the right cavities suggestive of pulmonary thromboembolism or signs compatible with aortic dissection[16]. However, we would like to emphasize that no previous work has focused specifically on evaluating the role of bedside ultrasound in the ED in patients suspected of myopericarditis, so this study is relevant in this regard and highlights the influence of ED-directed ultrasound in decision making in patients diagnosed with myopericarditis.

This study has a number of limitations. It is a retrospective study performed in a single centre, so it will require external validation of our results in future studies in other emergency departments. Secondly, since this is a retrospective study, we do not have information on all the variables to be studied in the total number of patients. Furthermore, since there is no clinical follow-up of the total number of patients with AP, it is not possible to analyse the evolution of these patients and therefore the prognosis and clinical impact of both the management carried out in the ED and the decision to admit them. Another limitation of this study is the possible underestimation of the diagnosis of AP (or myopericarditis) with ST-segment elevation, given that since 2009 in our setting there is an infarct code in the pre-hospital setting. This has conditioned the fact that patients with suspected ACS with ST-segment elevation are directed to the hemodynamics laboratory and are not evaluated in the ED[17,18]; as well as the possible underestimation of cases not included in the ED due to atypical clinical presentation. Some of the estimates have been made with a limited number of cases and events, and this has generated very wide confidence intervals, so that in some cases it cannot be ruled out that a beta-type statistical error has been incurred. Finally, in all the episodes, cTn were determined using the conventional method of analysis, so the detection of myocardial injury in the clinical setting suggestive of AP by means of high-sensitivity cTn (HS-cTn) could increase the number of patients classified as myopericarditis, in the same way that the introduction of these HS-cTn has already increased the percentage of diagnoses of non-ST segment elevation myocardial infarction to the detriment of unstable angina[19-21].

In conclusion, this study shows that there are differences in the clinical presentation of APs according to age, which most often lead to a differential diagnosis with ACS in patients over 50 years of age. The presence of ECG changes in the clinical scenario of AP suggests myopericarditis, which is confirmed analytically by an increase in cardiac biomarkers (cTn). This myocardial affectation, together with a history of renal failure, CP not modified by respiratory and postural movements and the presence of tachycardia on arrival at the ED are factors that condition hospital admission in patients with AP. Furthermore, the present study reveals that ultrasound guided by the FOCUS protocol significantly conditions the decision of hospital admission of patients with myopericarditis. Therefore, we propose that it should be performed in the routine assessment of patients with myopericarditis in the HED, especially in the

new era of HS-cTn where increased detection of myocardial injury in patients with AP is likely to be noticed.

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