

Differences in the Management and Prognosis of Patients With Non-ST Segment Elevation Acute Coronary Syndrome According to the Department of Initial Admission

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Objectives. To assess the influence of the department of initial admission on the hospital management and 3-month prognosis of patients with non-ST elevation acute coronary syndromes.

Patients and method. The data for the 4115 patients admitted to 18 hospitals in the PEPA study were compared according to the department of initial admission.

Results. Twenty-six percent of the patients were admitted to the coronary care unit, 53% to the cardiology department, 9% to the internal medicine department, and 12% were discharged from the emergency ward. The baseline risk profile was high in patients admitted to the coronary care unit and decreased progressively in patients admitted to the cardiology, internal medicine and emergency departments ($P < .00001$). The intensity of medical management was progressively lower in these departments, but not in parallel to their different baseline lower risk profile. Beta blockers were administered to 50%, 45%, 27% and 21% of the patients, respectively; an exercise test was performed in 34%, 44%, 35% and 12%; coronary angiography in 46%, 34%, 19% and 0%; and coronary revascularization in 22%, 12%, 9% and 0% ($P < .00001$). The 3-month incidence of mortality or myocardial infarction was 12.2%, 6.4%, 8.7% and 3.8%, respectively ($P < .00001$), differences that became nonsignificant after adjustment for risk profile on admission.

Conclusions. Patients with non-ST elevation acute coronary syndrome admitted to the coronary care unit or

cardiology department have a profile of higher risk on admission than patients admitted to the internal medicine department. Also, these patients more frequently receive pharmacological treatments and diagnostic and therapeutic procedures of proven efficacy but not in a manner that parallels their different risk profile on admission. However, these differences in the intensity of in-hospital management do not seem to lead to differences in the 3-month prognosis.

Key words: *Acute coronary syndrome. Myocardial infarction. Unstable angina. Prognosis.*

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Diferencias en el tratamiento y la evolución clínica de los pacientes con síndrome coronario agudo sin elevación del segmento ST en función del servicio clínico de ingreso

Objetivos. Determinar la influencia del servicio clínico de ingreso sobre el manejo hospitalario y la evolución a 3 meses de los pacientes con síndrome coronario agudo sin elevación del segmento ST.

Pacientes y método. Se compararon los datos de 4.115 pacientes ingresados en los 18 hospitales que participaron en el estudio PEPA, según el lugar de ingreso inicial.

Resultados. Un 26% ingresó en las unidades coronarias, un 53% en servicios de cardiología, un 9% en servicios de medicina interna y un 12% fue dado de alta desde urgencias. El perfil basal de riesgo fue alto entre los pacientes ingresados en las unidades coronarias y progresivamente menor entre los ingresados en servicios de cardiología, medicina interna y urgencias ($p < 0,00001$). La intensidad del tratamiento fue también progresivamente menor en estos servicios, pero no de forma paralela al perfil de riesgo; así, se administraron bloqueadores beta al 50, 45, 27 y 21%, respectivamente, se realizó una prueba de esfuerzo al 34, 44, 35 y 12%, coronariografía

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ABBREVIATIONS

AMI: acute myocardial infarction.
 CAR: cardiology department.
 CCU: coronary care unit.
 EW: emergency ward.
 IM: internal medicine department.
 NSTEMACS: non-ST segment elevation acute coronary syndrome.

al 46, 34, 19 y 0%, y revascularización coronaria al 22, 12, 9 y 0% ($p < 0,00001$). La tasa de mortalidad o infarto a 3 meses fue del 12,2, 6,4, 8,7 y 3,8%, respectivamente ($p < 0,0001$), diferencias que dejaron de ser significativas tras ajustar por el perfil clínico al ingreso.

Conclusiones. Los pacientes con síndrome coronario agudo sin elevación del ST ingresados en unidades coronarias o en servicios de cardiología tienen un perfil clínico de mayor gravedad que los ingresados en servicios de medicina interna; reciben con mayor frecuencia tratamientos y procedimientos diagnósticos y terapéuticos de eficacia probada de forma no paralela a su distinto nivel de riesgo, sin que ello llegue a determinar diferencias significativas en la evolución a 3 meses.

Palabras clave: Síndrome coronario agudo. Infarto de miocardio. Angina inestable. Pronóstico.

INTRODUCTION

Non-ST segment elevation acute coronary syndrome (NSTEMACS) is the principal cause of admission in patients with coronary heart disease.^{1,2} Numerous studies have established the efficiency of antithrombotic therapy for this condition as well as the importance of risk stratification at admission and prior to discharge.³⁻⁶ Despite this, marked differences continue to appear in the treatment and prognosis of patients with NSTEMACS according to geographical area,^{1,7} country^{2,8}, and hospital.⁹⁻¹¹

In many hospitals, 2 of the greatest impediments to the correct treatment of patients with acute coronary syndrome are the lack of beds in specialized care units and the lack of cardiologists. Consequently, patients remain in emergency wards and internal medicine departments, which can condition diagnosis and treatment as well as prognosis.¹¹⁻²⁵ The objective of this study was to analyze the influence of department of initial admission on attention received by patients and prognosis.

PATIENTS AND METHODS

We analyzed data from the PEPA study (Proyecto de Estudio del Pronóstico de la Angina) (Project for the Study of Prognosis in Angina). A total of 18 Spanish centers voluntarily contributed hospital records to this non-randomized, prospective, multicenter study that included all patients with suspected NSTEMACS presenting consecutively in emergency wards. All hospitals had a cardiology department and hemodynamic laboratory. Our methods and results have been published elsewhere.^{6,11} The study included patients presenting with chest pain or discomfort considered by a cardiologist, after initial assessment within 12 hours of admission, as probably due to ischemic heart disease. Patients with persistent ST-segment elevation were excluded as were those transferred from other centers for diagnosis or treatment.

To meet our objectives, patients were classified according to the clinical service to which they were admitted after initial exploration: coronary care unit (CCU), cardiology department (CAR), and internal medicine department (IM). A fourth group consisted of patients who remained in emergency ward (EW) until discharge.

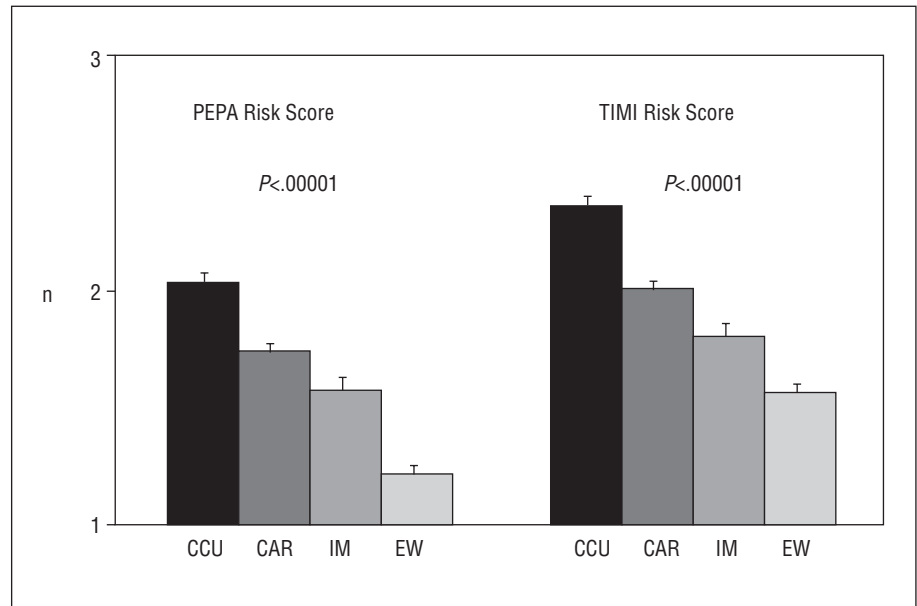
Clinical Data

All clinical definitions were listed in a protocol available to EW clinicians in participating centers. Clinical data of patients were recorded during the first 12 hours after admission using specially designed charts. In each center, final diagnosis was established from information obtained during hospitalization and patients were classified as follows: Q wave AMI (acute myocardial infarction), non-Q wave AMI, unstable angina or non-specific chest pain. A diagnosis of AMI was recorded if creatine kinase (CK) levels were more than twice the normal upper limit, together with an elevation of the MB isoform (CK-MB). Telephone follow-up was carried out at 1 and 3 months when information and current vital status were obtained for 94% of patients. An independent company (Verum Itempharma) conducted quality control and checked data of all patients with an adverse event during follow-up as well as that of a 10% random sample.

Statistical Analysis

Qualitative variables are expressed as number and percentage and quantitative variables as mean \pm standard deviation (SD) or median and interquartile interval if data did not follow normal distribution. Baseline patient characteristics and treatments received were compared by chi-square and linear regression analysis

Fig. 1. PEPA and TIMI risk scores mean (and Standard error) of the 4 groups studied. A progressive reduction in baseline risk profile occurs when comparing patients admitted to coronary care units (CCU) with those in cardiology (CAR), internal medicine (IM), and those discharged from emergency ward (EW); $P < .05$ for differences between groups.



for qualitative variables, and ANOVA or Kruskal-Wallis for quantitative variables.

Accumulated incidence of our target variable (mortality or myocardial infarction at 3 months) was calculated from Kaplan-Meier survival curves compared by log rank test. Adjustments for possible confounding factors related to initial department of admission or prognosis were analyzed using a Cox proportional hazards model. We included variables measured on admission which in binary analysis showed a value of $P < .10$ when compared by initial department of admission and by analysis of 3-month prognosis. This analysis was repeated adjusting for PEPA⁶ and TIMI⁵ risk scores. For each group we calculated the adjusted hazard ratio (HR) with a confidence interval (CI) of 95%, taking the HR of CCU inpatients as our reference. Values of $P < .05$ were considered statistically significant. Data analysis was conducted with SAS statistical software.

RESULTS

We enrolled 4115 patients during the study period: 1086 (26%) were admitted to CCU, 2181 (53%) to CAR, 364 (9%) to IM, and 482 (12%) were discharged from EW.

Clinical Characteristics

Average age was 65 ± 11 years: 33% were women, 26% had diabetes, 33% had a history of myocardial infarction, and 40% had a history of angina.

Baseline characteristics of patients in each group are compared in Tables 1 and 2.

Patients admitted to CCU had a high risk profile and those discharged from EW had a low risk profile. Patients in EW were younger with a higher frequency of women and lower frequencies of diabetes, current cigarette use and history of coronary heart disease. Moreover, presentation with typical coronary heart disease pain, heart failure, or electrocardiographic changes on admission were less frequent among EW patients, none of whom presented CK-MB elevation. In contrast, CCU inpatients had a high risk profile for these characteristics, especially frequency of diabetes (27%), prior myocardial infarction (38%), heart failure (including 2 patients in cardiogenic shock), ST-segment depression (63%), and CK-MB elevation (20%). We compared the seriousness of these characteristics on presentation among the 4 patient groups — CCU, CAR, IM and EW—and found a statistically significant trend from more serious (CCU) through less serious (EW) ($P < .001$). These baseline differences were confirmed by calculating PEPA⁶ and TIMI⁵ risk scores (Figure 1). Moreover, 20% of CCU inpatients were diagnosed with AMI versus 7% of CAR inpatients, 6% of IM, inpatients, and 0% of EW patients. Final diagnosis of noncardiac chest pain was made for 5%, 19%, 24%, and 24%, respectively ($P < .0001$).

Treatment

Treatment received and number of diagnostic tests and therapeutic procedures practiced also showed substantial differences according to department of initial admission. Patients in CCU received more intensive treatment and this diminished progressively

TABLE 1. Clinical Characteristics of Patients Studied According to Department of Initial Admission*

	Coronary Care Unit n (%)	Cardiology Department n (%)	Internal Medicine Department n (%)	Emergency Ward n (%)	P
Coronary risk factors					
Age, years	64.3±11	65.5±11	64.7±11	63.8±12	<.01
Women	293 (27)	721 (33)	135 (38)	184 (41)	<.0001
Diabetes	298 (27)	579 (27)	79 (22)	85 (19)	.001
Hypertension	564 (52)	1144 (53)	191 (54)	250 (56)	NS
Hypercholesterolemia	433 (40)	843 (39)	143 (40)	157 (35)	NS
Current cigarette use	337 (31)	482 (22)	57 (16)	104 (23)	<.0001
Family history of IHD	131 (12)	318 (15)	55 (15)	63 (14)	NS
History of cardiovascular events					
Prior angina	420 (39)	897 (42)	137 (39)	170 (38)	NS
Myocardial infarction	410 (38)	727 (34)	94 (27)	121 (27)	<.0001
Coronary angioplasty	97 (9)	227 (10)	14 (4)	29 (6)	<.0001
Heart surgery	83 (8)	166 (8)	27 (8)	23 (5)	NS
Stroke	68 (6)	118 (6)	29 (8)	27 (6)	NS
Peripheral vascular disease	138 (13)	261 (12)	53 (15)	41 (9)	.08
Kidney failure	16 (2)	34 (2)	10 (3)	8 (2)	NS

*IHD indicates ischemic heart disease; NS, non-significant.

TABLE 2. Manner of Clinical Presentation and Data Obtained on Admission for Each Patient Group*

	Coronary Care Unit n (%)	Cardiology Department n (%)	Internal Medicine Department n (%)	Emergency Ward n (%)	P
Type of pain: typical	1008 (93)	1920 (89)	306 (86)	335 (75)	<.0001
Heart failure	125 (11.5)	192 (9)	36 (9.5)	25 (6)	<.0001
Emergency ward ECG					<.0001
Normal	211 (19)	873 (40)	162 (46)	269 (60)	
ST segment changes	686 (63)	815 (38)	124 (35)	102 (23)	
Negative T waves	189 (17)	475 (22)	68 (19)	76 (17)	
Atrial fibrillation	51 (5)	117 (5)	32 (9)	38 (9)	.002
CK-MB elevation	222 (20)	144 (7)	20 (6)	0 (0)	<.0001
Diagnosis on discharge					<.0001
Unstable angina	811 (75)	1615 (75)	250 (71)	339 (76)	
Non-Q wave AMI	187 (17)	107 (5)	17 (5)	0 (0)	
Q wave AMI	35 (3)	37 (2)	3 (1)	0 (0)	
Noncardiac pain	53 (5)	404 (19)	84 (24)	108 (24)	

*CK-MB indicates MB isoform of creatine kinase.

across the other three groups. This occurred with treatments proven to reduce incidence of death or myocardial infarction in NSTEMI, such as antiplatelet agents (96%, 93%, 91%, and 89%, respectively; $P<.0001$), heparin (64%, 46%, 27%, and 9%; $P<.0001$), and beta-blockers (50%, 45%, 27%, and 21%; $P<.0001$).

We found greater differences on analyzing diagnostic and therapeutic procedures (Figure 2). Exercise tests were used with 34% of patients in CCU, 44% in CAR, 35% in IM, and 12% in EW ($P<.0001$). Coronary angiography was performed on 46%, 34%,

19%, and 0% of patients respectively ($P<.0001$), and coronary revascularization on 22%, 12%, 9%, and 0%, respectively ($P<.0001$). These differences did not parallel patient risk profiles (Figure 1).

Clinical Course

Median hospital stay was 10 days (range, 7-16) in CCU, 9 days (range, 6-14) in CAR, 7 days (range, 3-14) in IM, and 0 days (range, 0-1) in EW ($P<.0001$). In EW, 37% of patients were hospitalized for >24 hours. During hospitalization, incidence of death or

myocardial infarction was 8% in CCU, 5% in CAR, 3% in IM, and 0% in EW ($P<.0001$; Figure 3).

The number of coronary angiographies performed after discharge was the same in all 4 groups (6%). However, the rate of angioplasties was 6% in CCU, 5% in CAR, 1% in IM, and 2% in EW ($P<.0001$), whereas the rate of heart surgery was 5%, 5%, 2%, and 1%, respectively ($P<.0001$). Clinical course at 90 days paralleled risk profiles of CCU inpatients and EW patients, but not those of CAR and IM inpatients. Mortality was 7.5% among CCU inpatients, 3.5% among CAR inpatients, 5.5% among IM inpatients and 2.4% among EW patients ($P<.0001$) and mortality or AMI rates were 12% and 2% (CCU), 6% and 4% (CAR), 8% and 7% (IM), and 3% and 8% (EW) ($P<.0001$; Figure 3).

Multivariable analysis conducted after risk-adjustment for differences in profile (age, diabetes, peripheral vascular disease, 2 or more angina crises during 24 hours prior to admission, heart failure on admission, ST-segment depression, and elevated necrotic markers) did not yield significant differences among the 4 groups. Compared with CCU inpatients, hazard ratios (HR) for mortality or myocardial infarction, were: 0.84 (95% CI, 0.68-1.04) among CAR inpatients; 1.24 (95% CI, 0.90-1.66) among IM inpatients; and 0.70 (95% CI, 0.46-1.02) among EW patients. No significant changes appeared when data were adjusted for PEPA or TIMI risk scores.

Although patients with a final diagnosis of noncardiac pain were excluded, differences between those in CCU, CAR and EW were maintained and differences for patients admitted to IM increased. The 90 day mortality or AMI rate was 12.7% among CCU inpatients; 7.4% among CAR inpatients; 11.5% among IM inpatients, and 4.1% among EW patients ($P<.00001$). Compared to CCU inpatients, these differences were not statistically significant in multivariable analysis. Hazard ratios were 0.87 (95% CI, 0.70-1.09) for CAR inpatients; 1.36 (95% CI, 0.98-1.84) for IM inpatients and 0.72 (95% CI, 0.52-1.02) for EW patients.

DISCUSSION

Our study shows that department of initial admission of patients with NSTEMACS conforms adequately to baseline risk profile. However, the department does substantially influence medical management in ways that cannot be fully explained by differences in risk profile, although these differences are not significant to 3-month prognosis.

Incidence of NSTEMACS is high and it is the principal cause of admission among patients with ischemic heart disease.^{1,2} Moreover, the entity is potentially serious, prognosis is uncertain, and adequate infrastructure is needed for correct diagnosis and treatment.^{3,4} In

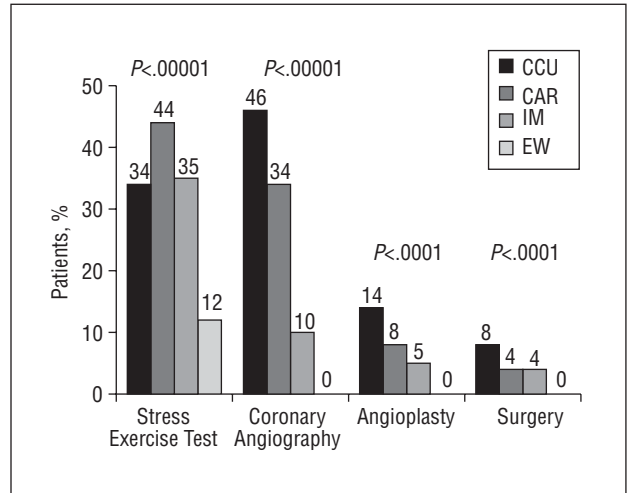


Fig. 2. Diagnostic procedures and therapies performed during hospitalization. The greatest differences appear in the performance of coronary angiographies and percutaneous revascularization. Only 12% of emergency ward patients underwent an exercise test prior to discharge. CCU indicates coronary care unit; CAR, cardiology department; IM, internal medicine department; EW, emergency ward.

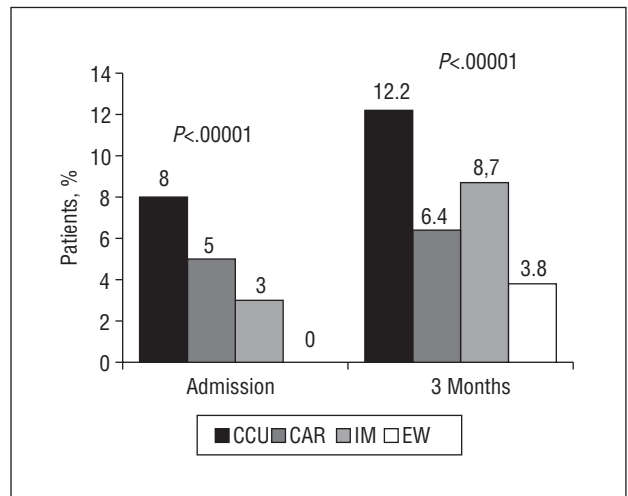


Fig. 3. Incidence of mortality or myocardial infarction on admission (left) and at 3 months (right) of the 4 groups studied. $P<.05$ for all intergroup comparisons of clinical course at 3 months except coronary care unit (CCU) versus internal medicine (IM) ($P=.08$) and IM versus cardiology department (CAR) ($P=.09$) after log rank test.

our study, 25% of patients were admitted to a coronary care unit and 50% to cardiology departments. In contrast, an earlier Spanish study²¹ found only 40% of patients with a final diagnosis of unstable angina were admitted to CCU or CAR, 42% to IM, and 17% transferred to other centers. This contrasts with data from the Euro Heart Survey of Acute Coronary Syndromes,²

which reports 50% of patients admitted to CCU and 30% to CAR. Our data reflect the lack of beds in CCUs in Spain and explain why these are reserved for high-risk patients.²²

Several publications show how clinical approaches to treating patients with NSTEMACS vary by geographical area,^{1,7} country,^{2,8} and hospital.⁹⁻¹¹ We found substantial differences in intrahospital management of patients by department of initial admission. The application of treatments of known efficacy was much more frequent in CAR and CCU than in IM and EW. Consequently, although 72% of IM and EW patients were diagnosed on discharge with unstable angina or myocardial infarction, both pharmacological treatment and clinical course and treatment were clearly less intensive than for CAR and CCU inpatients. Moreover, they did not parallel differences in risk profile and were well below clinical care guideline recommendations.

Some studies of patients with acute coronary syndrome have shown cardiologists follow clinical care guidelines more closely, administer drugs proven to be efficient in randomized clinical trials more frequently, and perform a greater number of diagnostic and therapeutic procedures.^{12-21,23} In keeping with these differences in treatment, some studies of patients with NSTEMACS^{20,24} show a comparatively better clinical course in patients treated by cardiologists. Schreiber et al²⁰ report 1.8% mortality among patients treated by cardiologists versus 4% among those treated by non-cardiologists; analysis of the American CRUSADE national registry²⁴ shows treatment by cardiologists is associated with a 25% reduction in intrahospital mortality or AMI rates, in comparison with treatment by primary care physicians or internists. However, these results were not adjusted for baseline patient characteristics. In reality, in the global population of patients with acute coronary syndrome these differences in management have not been definitively linked to substantial differences in prognosis even though it has been suggested that patients treated by non-specialist physicians tend to have a worse risk profile and greater comorbidity.^{18,19,21} The present study contradicts this as CAR or CCU inpatients had a worse risk profile than those admitted to IM and, like patients in the aforementioned studies, they were more frequently administered drugs of proven efficacy, underwent a greater number of clinical care guideline recommended diagnostic procedures and therapies, and showed a non-significant tendency to suffer fewer events during follow-up once data had been adjusted for baseline differences. However, we cannot ignore the fact that the limited number of patients admitted to departments other than cardiology and the short follow-up period may have hidden differences in clinical course.

Overcrowding in emergency wards together with the high incidence of NSTEMACS and limited availability of beds for acute patients may lead to missed diagnosis, incorrect early discharge, and outpatient treatment for patients requiring hospitalization. These are recurring problems that have received little attention. In our study, 482 patients with suspected NSTEMACS were attended and discharged from EW even though 76% had a final diagnosis of unstable angina and only 12% underwent exercise tests. Although prognosis for these patients was better than for the other groups, as would be expected from their lower risk profile, incidence of mortality or myocardial infarction at 3 months was 4%. Some studies have highlighted the high level of readmission among these patients. Pope et al²⁵ report that 50% of patients diagnosed with unstable angina and discharged from EW were readmitted within the first month. Our results confirm once more that NSTEMACS is not limited to the first 24-48 hours evolution but, rather, is of variable duration and can last 1-6 months,^{1,2,26} requiring intensive hospital treatment with adequate risk stratification on admission and prior to discharge. In this context, chest pain units have proven highly useful in diagnosis, initial risk stratification, and correct application of treatment.²⁷

Limitations of the Study

In this study, centers participated on a voluntary basis rather than being randomized, which limits the interpretation of results. All centers had a cardiology department, CCU and hemodynamic laboratory, so differences reported here might be more marked in centers that do not have this infrastructure. This study took place some years ago and did not consider troponin level measurement on admission, which could influence diagnosis and lead to improved prognostic stratification as well as conditioning the department of initial admission and management of patients. Decisions on discharge or admission in the different departments might be influenced by a multitude of factors in addition to those of a strictly medical nature. Patients who presented complications during the first hours might have been admitted to CAR and CCU, which would make the corresponding results more serious and explain the null incidence of complications in EW during hospitalization. Finally, patients discharged from EW and IM and diagnosed with NSTEMACS might have been referred to CAR as outpatients leading to changes in treatment; the number of coronary angiographies performed after discharge was identical in all 4 patient groups suggesting this may well have happened. However, the number of revascularization procedures performed was 3 times fewer among EW and IM patients than among CAR and CCU inpatients.

CONCLUSION

Patients with NSTEMI admitted to CCU or CAR have a higher risk clinical profile than those admitted to IM. They more frequently undergo treatment, diagnostic procedures and therapies of proven efficacy that do not parallel their particular level of risk, although these do not significantly determine clinical course at 3 months. More studies are needed to determine whether these differences persist now that the measurement of troponin levels in patients with chest pain has become widespread, and to identify their long term influence on clinical course differences.

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