BRIEF REPORT

CLINICAL AND EPIDEMIOLOGICAL CHARACTERISTICS OF ACUTE MYOCARDIAL INFARCTION IN A REFERRAL PERUVIAN HOSPITAL

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ABSTRACT

To determine the epidemiological and clinical characteristics of patients with acute myocardial infarction, a descriptive study was conducted in 175 patients in a referral hospital in Lima. The average age of the patients was 68.7 ± 10.8 years and 74.8% were male. The main reperfusion strategy used was percutaneous transluminal coronary angioplasty + stent, however, the use of primary angioplasty was low (19.5% of patients with ST elevation myocardial infarction). Time to reperfusion therapies (angioplasty or fibrinolysis) were longer than recommended and the percentage of surgical revascularization was high. Almost 60% of the patients had a length of stay longer than seven days. In-hospital mortality was 3.4%, with cardiogenic shock being the most frequent cause of death. Myocardial infarction mainly affects men over 60 years, the clinical and epidemiological variables are like other regional reports. The main reperfusion strategy is angioplasty, although the use of primary angioplasty is low. Time to performing reperfusion is longer than recommended and the percentage of surgical revascularization is high.

Keywords: Myocardial Infarction; Angioplasty; Drug-eluting Stents; Fibrinolysis; Hospitalization; Epidemiology; Latin America; Peru (source: MeSH NLM).

INTRODUCTION

Coronary heart disease is a major cause of morbidity and mortality worldwide and is the most frequent single cause of death in the world [1]. It is estimated that 500,000 deaths occur each year in the United States caused by acute myocardial infarction (AMI), and the probability of having an AMI increases with age [2].

Several studies report a decrease in mortality after acute ST-elevation myocardial infarction (STEMI), associated with an increased reperfusion therapy, primary percutaneous coronary intervention, modern antithrombotic treatment and secondary prevention [3,4]. However, mortality remains significant in 9% of patients at six months, and increases in those with risk factors [5].

In Peru, two national AMI registries have been conducted, RENIMA (National Registry of Acute Myocardial Infarction) [6] in 2006 and RENIMA II [7] in 2010, which show similar demographic results and clinical pictures to those reported in other countries. Recently, the results of the Peruvian STEMI registry (PERSTEMI) [8] were published with updated clinical and epidemiological information.

This study aims to describe the clinical and epidemiological characteristics, evolution and treatment of patients hospitalized for AMI in the coronary unit of a Peruvian referral hospital, with a follow-up of six months after discharge from hospital.

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THE STUDY

Design and population

This descriptive study was conducted at Edgardo Rebagliati Martins National Hospital (HNERM), which is a national referral Peruvian Social Security's hospital with an assigned population of approximately two million people. The Department of Cardiology handles about 400 cases of AMI each year and has a hemodynamic room available only 12 hours a day. The study included patients over 18 years old diagnosed with AMI type 1, according to the universal definition of AMI [9], and excluded patients with AMI type 2, 4 or 5, with antecedents of congenital heart disease or with valvular or pericardial disease.

Procedure

Patient information was obtained from medical records and recorded on a data collection sheet designed for the study and then anonymously transferred to an electronic database in order to protect patients' confidentiality. Three and six months after their discharge, patients who signed the informed consent (IC), received phone calls in order to follow up their situation and verify their vital status. In case there was no signature on the IC, due to refusal or impossibility of signing (death, untimely discharge, or that discharge took place on a weekend), only the hospitalization information available in the medical record was collected as data.

Variables

Age was analyzed as a quantitative variable and categorized by age groups. Blood pressure (mmHg) and cardiac frequency (beats/minute) were considered quantitative variables. Sex, background information, Killip class (10), body mass index, left ventricular ejection fraction (LVEF) (%), estimated creatinine clearance using the MDRD formula (mL/min/1.73 m^2), serum levels of glycated hemoglobin (%), total cholesterol (mg/dL) and LDL-cholesterol (mg/dL), medication received, complications, in-hospital mortality and six-month mortality were analyzed qualitatively.

Variables were evaluated according to the type of infarction —with ST-segment elevation (STEMI) or without ST-segment elevation (NSTEMI). The type of stent used was also evaluated: metal stent or drug-eluting stent (DES). The perfusion achieved after percutaneous intervention (TIMI flow) [11] and both reperfusion times: door-to-balloon (time from the patient's arrival at the hospital to the opening of the artery) and door-needle time (time from the patient's arrival at the hospital to the administration of the fibrinolytic) were also evaluated.

KEY MESSAGES

Motivation for the study: To determine the clinical and epidemiological characteristics of acute myocardial infarction (AMI) in patients hospitalized in a coronary unit of a Peruvian referral hospital

Main findings: AMI mainly affects elderly men. The most used reperfusion strategy was angioplasty + stent, although its use as a primary option turned out to be low. Carrying out reperfusion procedures takes a long time, and there is a high percentage of surgical revascularization. Likewise, hospital stay is long.

Implications: These findings indicate that improvement is needed in the care processes of patients with AMI treated at this national referral hospital.

Categorical variables were expressed as frequencies and percentages; histograms were elaborated to verify the normality of the data. Means and standard deviation were used for variables with normal distribution and for those without normal distribution, medians and interquartile range (IQR). The analysis of qualitative variables was performed through contingency tables using the chi-square test and Fisher's exact test, probability trend was analyzed using only the chi-square test. For continuous variables, we used the Student's T or Mann-Whitney's U test, and a value of $p<0.05$ was considered statistically significant. The data were analyzed in Stata version 15.0.

HNERM's research and ethics committees reviewed and approved this study. Patients signed an IC form at discharge, authorizing follow-up. Only the researchers had access to patient information.

RESULTS

Between September 2016 and June 2017, 175 patients with AMI were registered, 100 (57.1%) of them were followed for six months without loss, 75 patients (42.9%) did not sign the IC (six died during hospitalization, 50 were discharged early or during a weekend, and 19 refused to sign).

The average age of the patients was 68.7 ± 10.8 years, 62.2% were older than 65 years, 74.8% were male and the average body mass index was 26.4 ± 3.6 Kg/m2. STEMI occurred in 82 patients (46.9%) and NSTEMI in 93 patients (53.1%). The background, physical examination findings on admission, left ventricular ejection fraction (LVEF) and laboratory tests are described in Table 1.

Significant differences were found, according to the types of AMI, in patients 65 years and older. These differ-

ences were: previous history of peripheral arterial disease, obesity, chronic kidney disease (CKD) and CKD on dialysis. Likewise, systolic blood pressure was higher in those who suffered from NSTEMI. No differences were found in terms of the Killip classification.

Conduction disorders occurred in 29 cases (16.5%). From these disorders; right branch block occurred in 8.6%, left branch block in 2.8% and second, or third-degree atrioventricular block in 5.2% of patients. Basic atrial fibrillation occurred in 5.7% of patients and appeared as a complication in 6.9%. STEMI occurred in 82 patients, in whom the location of the infarction occurred in 42 cases on the diaphragmatic side (52.4%) and on the anterior side in 35 cases (42.7%).

Echocardiography was performed in 165 cases; 27 patients (16.3%) had LVEF <40%, 40 patients (24.2%) had FEVI 40-49% and 98 patients (59.4%) had LVEF ≥ 50%. 73% of patients presented type I diastolic dysfunction and 24% type II diastolic dysfunction. Moderate or severe mitral insufficiency occurred in 4.8% of patients and 8.5% presented pericardial effusion. Drug therapy is described in Table 2.

In patients with STEMI, percutaneous transluminal coronary angioplasty (primary PTCA) + stenting was performed in 16 patients (19.5%) and fibrinolysis in 19 (23.1%); a pharmaco-invasive strategy (fibrinolysis followed by angioplasty) was performed in 9 patients; PTCA was performed in 24 patients (29.2%) after 12 hours from the start of the event. Revascularization surgery was performed in 12 patients (14.6%), from these, 2 had received fibrinolysis and 2, primary PTCA. There were 15 patients (18.2%) who did not receive any reperfusion/revascularization therapy. The main artery treated by PTCA was the anterior descending artery in 30 cases (55.5%), followed by the right coronary artery in 21 patients (38.8%) and the circumflex artery in 9 patients (16.6%); no PTCA was performed on the left coronary trunk (LCT). DES was used in 40 patients (74%). TIMI III flow was obtained in 78.1% of the cases. Door-balloon time had a median of 139 minutes (IQR: 60-300) and door-needle time had a median of 84 minutes (IQR: 15-540).

In patients with STEMI, PTCA was performed in 35 patients (37.6%); 25 patients (26.8%) had aortocoronary bypass surgery, while the rest of the patients had medical treatment, which was mainly due to bad distal sites in eleven cases (11.8%) or no significant lesions in nine patients (9.6%). SLD was used in 33 patients (94.2%) undergoing PTCA. The main artery treated by PTCA was the anterior descending artery in 25 cases (71.4%).

The median time to first medical contact was three hours (IQR: 0-360), while the median time to hospital arrival was ten hours (IQR: 1-360). 53 patients (30.3%) were admitted to the coronary unit within the first 24 hours, 49 (28%) between 24 and 48 hours and 73 (41.7%) after 48 hours. Hospital stay had a median of nine days (IQR: 5-28), in 72 patients (41.1%) it was ≤ 7 days, in 63 (36%) from eight to 30 days and in 40 (22.9%) >30 days.

The most frequent cardiac complication was heart failure, observed in 35 patients (20%). Cardiogenic shock occurred in 10 cases (5.7%): one case associated with mechanical complication (rupture of interventricular septum), one case associated with complete atrioventricular block and in the remaining eight cases secondary to pump failure. The most frequent arrhythmia was atrial fibrillation, present in 12 patients (6.9%), followed by ventricular tachycardia/ventricular fibrillation, which occurred in 8 cases (4.6%).

With regard to non-cardiac complications, the most frequent was acute renal failure in 11.6%, followed by in-hospital pneumonia in 6.9% of patients (Table 3).

Six deaths (3.4%) were recorded during hospitalization, the causes of death were cardiogenic shock in four cases, in hospital pneumonia in one case and sudden death in one case. The three-month follow-up of the 100 patients who signed the IC reported one death occurring at home, and the six-month follow-up reported three re-hospitalizations and one death from cardiogenic shock.

Mortality was higher in patients with STEMI, compared to those with NSTEMI (8.6% vs. 1.1%; p=0.026). All the deceased were ≥ 65 years old and 62.5% were male. There was a significant difference, in terms of systolic blood pressure values on admission, being lower in those who died (111 ± 9 vs. 132 ± 26; p= 0.012). Likewise, among the deceased there were more patients with heart failure (p<0.001), with LVEF <40% (p=0.002) and a higher degree of Killip (p=0.006).

DISCUSSION

The present study shows that AMI occurs frequently in older men, presenting as main comorbidities high blood pressure, smoking, type 2 diabetes mellitus and dyslipidemia; these findings are similar to those described in the literature [8,12,13]. Likewise, although reperfusion was performed in a high percentage of patients, the duration times were longer than recommended [14,15].

A high frequency of NSTEMI is described in the RENIMA and RENIMA II [6,7], as well as the significantly more frequent antecedents in patients with NSTEMI (peripheral arterial disease, CKD, dialysis). These findings are different from those found in other Latin American studies [12,13].

The main revascularization strategy used in STEMI was PTCA, performed in almost 60% of cases, a figure higher than that reported in other national studies [6-8] with high

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Table 1. Baseline characteristics, physical examination, ejection fraction and laboratory tests, according to type of infarction, in patients hospitalized in the coronary unit at Edgardo Rebagliati Martins National Hospital, 2016-2017

Characteristics	Total n=175		STEMI n=82		NSTEMI n=93		p Value
	n	%	n	%	n	%	
Age (years)							0.027 [a]
≥ 65	109	62.2	44	53.6	65	69.9	
< 65	66	37.8	38	46.4	28	30.1	
Sex							0.107 [a]
Male	131	74.8	66	80.5	65	69.9	
Female	44	25.2	16	19.5	28	30.1	
Background history							
High blood pressure	102	58.2	49	60.4	53	56.9	0.640 [a]
Smoking	56	32.0	31	38.2	25	26.8	0.109 [a]
Type 2 Diabetes *mellitus*	52	29.7	25	30.8	27	29.0	0.792 [a]
Peripheral vascular disease	9	5.1	0	0.0	9	9.6	0.004 [b]
Dyslipidemia	40	22.8	19	23.4	21	22.5	0.891 [a]
COPD	3	1.7	1	1.2	2	2.1	1.000 [b]
Previous myocardial infarction	38	21.7	13	16.0	25	26.8	0.085 [a]
Atrial fibrillation	6	3.4	2	2.4	4	4.3	0.687 [b]
Previous PTCA	19	10.8	6	7.4	13	13.9	0.166 [a]
Previous ACBP	9	5.1	3	3.7	6	6.4	0.506 [b]
Previous stroke	11	6.2	4	4.9	7	7.5	0.484 [a]
Cardiac failure	4	2.2	0	0.0	4	4.3	0.124 [b]
Chronic renal failure	21	12.0	5	6.1	16	17.2	0.026 [a]
Dialysis	6	3.4	0	0.0	6	6.4	0.031 [b]
Obesity	29	16.5	20	24.6	9	9.6	0.008 [a]
Physical examination							
SBP (mm Hg), mean (SD)	131(26)		126 (22)		136 (28)		0.015 [c]
HR (bpm), mean (SD)	77 (19)		76 (17)		78 (20)		0.407 [d]
Killip class							0.639 [e]
I	146	83.5	67	81.7	79	84.9	
II	21	12.0	12	14.6	9	9.6	
III	6	3.4	1	1.2	5	5.3	
IV	2	1.1	2	2.4	0	0.0	
Body mass index ≥ 30	25	14.2	17	22.0	8	8.9	0.019 [a]
Left ventricular ejection fraction (%)	n=165		n=77		n=88		0.082 [a]
< 40	27	16.3	14	18.1	13	14.7	
40-49	40	24.2	24	31.1	16	18.1	
≥ 50	98	59.3	39	50.6	59	67.0	
Estimated creatinine clearance (mL/min/1.73 m^2)	n=174		n=81		n=93		0.046 [e]
≥60	112	64.4	59	72.8	53	57.0	
60-30	48	27.6	19	23.5	29	31.2	
<30	14	8.0	3	3.7	11	11.8	
Glycated hemoglobin (%)	n=110		n=51		n=59		0.690 [e]
< 6,5	69	62.7	33	64.7	36	61.0	
≥ 6,5	41	37.3	18	35.3	23	39.0	
Total cholesterol (mg/dL)	n=140		n=64		n=76		0.908 [e]
< 200	122	87.1	56	87.5	66	86.8	
≥ 200	18	12.9	8	12.5	10	13.2	
LDL-cholesterol (mg/dL)	n=126		n=57		n=69		0.137 [e]
<100	71	56.3	28	49.1	43	62.3	
≥ 100	55	43.7	29	50.9	26	37.7	

[a] Chi square test; [b] Fisher's exact test; [c] Student's T-test; [d] Mann Whitney test; e probability trend test.

STEMI: acute ST-elevation myocardial infarction; NSTEMI: acute non-ST-elevation myocardial infarction; PCTA: percutaneous transluminal coronary angioplasty; ACBP: aortocoronary by pass; SBP: systolic blood pressure; bpm: heartbeats per minute; SD: standard deviation; LDL: low density lipoprotein.

Table 2. Pharmacological and other therapies, according to type of heart attack, in patients hospitalized in the coronary unit at Edgardo Rebagliati Martins National Hospital, 2016-2017

Pharmacological therapy	Total n=173		STEMI n=80		NSTEMI n=93		p Value
	n	%	n	%	n	%	
Aspirin	171	98.8	78	97.5	93	100	0.125 [a]
Clopidogrel	170	98.3	78	97.5	92	98.9	0.474 [a]
Ticagrelor	2	1.2	0	0.0	2	2.2	0.187 [b]
ACEI	112	64.7	55	68.8	57	61.3	0.306 [a]
Beta-blocker	161	93.0	72	90.0	89	95.7	0.141 [a]
Spironolactone	16	9.3	7	8.8	9	9.7	0.834 [a]
Calcium antagonists	26	15.0	7	8.8	19	20.4	0.032 [a]
ARB	50	28.9	20	25.0	30	32.3	0.294 [a]
LMWH	163	92.2	73	91.3	90	96.8	0.053 [a]
Furosemide	35	20.2	15	18.8	20	21.5	0.653 [a]
Nitroglycerin	90	52.0	41	51.3	49	52.7	0.850 [a]
Statin	172	99.4	79	98.8	93	100	0.280 [a]
Amiodarone	11	6.4	3	3.8	8	8.6	0.192 [b]
Digoxin	1	0.6	1	1.3	0	0.0	0.280 [b]
Noradrenaline	9	5.2	4	5.0	5	5.4	0.912 [b]
Dobutamine	4	2.3	2	2.5	2	2.2	0.031 [b]
Levosimendan	1	0.6	0	0.0	1	1.1	0.352 [b]
NPH Insulin	13	7.5	6	7.5	7	7.5	0.995 [a]
Antibiotics	17	9.8	4	5.0	13	14.0	0.048 [b]
Other therapies							
IABP	2	1.2	2	2.5	0	0.0	0.125 [b]
Mechanical ventilation	8	4.6	2	2.5	6	6.5	0.217 [b]
Non-Invasive ventilation	4	2.3	1	1.3	3	3.2	0.389 [b]
Transient pacemaker	4	2.3	3	3.8	1	1.1	0.243 [b]
Definitive pacemaker	2	1.2	1	1.3	1	1.1	0.915 [b]

[a] Chi square test; [b] Fisher's exact test.

STEMI: acute ST-elevation myocardial infarction; NSTEMI: acute non-ST-elevation myocardial infarction; ACEI: angiotensin-converting-enzyme inhibitor; ARB: angiotensin receptor blocker; LMWH: low molecular weight heparin; IABP: Intra-aortic balloon counterpulsation.

DES usage. As for pharmacological revascularization (fibrinolysis), our percentages of use are lower than those found in the literature. On the contrary, the percentage of patients surgically revascularized is higher than that published in other series, probably due to the high prevalence of reported multi-arterial disease [6,7,13].

The percentage of primary PTCA, treatment of choice in STEMI, is low in our study. There is also a significant delay in the application of mechanical and pharmacological reperfusion therapies. These deficiencies could be explained by several factors, such as delay of the first medical contact, delay in transport, shortage of supplies or lack of availability of hemodynamic rooms [8,12,16]. Therefore, an improvement in the ambulance system (transport), a timely supply of supplies and 24-hour availability of a hemodynamic room are required.

We found that the drug therapies were in accord with current major clinical practice guidelines [14,15], with a high use (above 90%) of anti-platelet agents, anticoagulants, beta-blockers, angiotensin converting enzyme/angiotensin receptor blockers and statins.

Hospital stay was longer than reported in previous studies [8,12,13], with almost 60% of patients hospitalized for more than one week. Shortage of supplies for timely coronary angiography and surgical waiting, would be the main factors for this problem. Finally, despite the diagnostic and therapeutic advances, heart failure and cardiogenic shock presented in almost the same percentages as previously described in our coronary unit [17].

Among some limitations, it should be recognized that the study was carried out in only one center, so its results cannot be extrapolated to the health system in general. Due

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Table 3. Mortality and complications, according to type of infarction, in patients hospitalized in the coronary unit of the Edgardo Rebagliati Martins National Hospital, 2016-2017

Mortality/complication	Total n=175		STEMI n=82		NSTEMI n=93		p Value
	n	%	n	%	n	%	
In-hospital mortality	6	3.4	5	6.1	1	1.1	0.097 [c]
Six-month mortality [a]	8	4.6	7	8.6	1	1.1	0.026 [c]
Cardiac Complication							
Heart failure	35	20.0	19	23.5	16	17.2	0.305 [b]
Cardiogenic shock	10	5.7	8	9.9	2	2.2	0.047 [c]
Arrhythmia							
Atrial fibrillation	12	6.9	5	6.2	7	7.5	0.482 [c]
VT/VF	8	4.6	5	6.2	3	3.2	0.355 [c]
2° and 3°AVB	9	5.2	8	9.9	1	1.1	0.009 [c]
Mechanical							
IVS rupture	1	0.6	1	1.2	0	0.0	0.466 [c]
MI mild to severe[d]	8	4.8	3	3.9	5	5.7	0.726 [c]
Pericardial effusion	14	8.5	13	16.9	1	1.1	<0.001 [c]
Haemopericardium	2	1.2	2	2.6	0	0.0	0.127 [c]
Non-cardiac[e]							
Acute kidney failure	20	11.6	9	11.1	11	12.0	0.962 [c]
Dialysis	2	1.2	1	1.2	1	1.1	0.915 [c]
In-hospital Pneumonia	12	6.9	4	4.9	8	8.6	0.962 [c]
High digestive hemorrhage	3	1.7	3	3.7	0	0.0	0.060 [c]
Ischemic stroke	1	0.6	0	0.0	1	1.1	0.352 [c]
Acute liver failure	1	0.6	0	0.0	1	1.1	0.352 [c]

[a] Six-month follow-up was performed on only 100 patients; [b] Chi square test; [c] Fisher's exact test; [d] total sample: 165, STEMI: 77, NSTEMI: 88; [e] total sample: 173, STEMI: 81, NSTEMI: 92

STEMI: acute ST-elevation myocardial infarction; NSTEMI: acute non-ST-elevation myocardial infarction; VT/VF: ventricular tachycardia/ventricular fibrillation; AVB: atrial-ventricular block; IVS: interventricular septum; MI: mitral insufficiency.

to the delay in admission to the coronary unit, there could be a certain bias, especially with regard to complications and mortality. Also, follow-up was only performed on 57% of patients, which could have affected the frequency of mortality reported at six months.

In conclusion, myocardial infarction mainly affects males of over 60 years old, and the clinical and epidemiological characteristics are similar to other regional reports. The main reperfusion strategy is PTCA, although its primary use is low. Reperfusion times are longer than recommended and the percentage of surgical revascularization is high. Hospital stay is longer than reported in the literature.

Authorship contributions: PRN has participated in the conception, collection, analysis and interpretation of data and writing of the article; MP has participated in the conception, analysis and interpretation of data and writing of the article; JAUC has participated in the conception of the article; and FJMS has participated in the conception, analysis and interpretation of data. All authors have approved the final version of the article..

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