



Right Ventricular Myocardial Infarction: A Mono-Centric Retrospective Study

**Moukhtar Ben Kabbour ^{a*}, Kamel Ghanem ^a,
Mohsine Naâim ^a, Mohammed El Jamili ^a,
Saloua El Karimi ^a and Mustapha El Hattaoui ^a**

^a Department of Cardiology, Mohammed VI University Hospital, Marrakech, Morocco.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Coronary heart disease is one of the world's leading causes of morbidity and mortality. Much is known about left ventricular myocardial infarction. It was not until much later (1974) that right ventricular myocardial infarction was studied as a distinct entity [1]. Isolated VD MI is rare [2,3,4]. It is often associated with infero-posterior MI (in a third of patients) [2,5], with higher morbidity and in-hospital mortality due to hemodynamic and rhythmic complications [4]. The culprit lesion is often occlusion of the proximal right coronary artery [2,4,6,7]. However, the VD is relatively resistant to infarction and recovers even after prolonged occlusion [8]. In this work, we will study the epidemiological, clinical, electrical, echocardiographic and angiographic aspects of MDI with extension to the VD, as well as its complications and therapeutic modalities.

Keywords: Myocardial infarction; acute coronary syndrome; right ventricular.

*Corresponding author: E-mail: benkabbourmokhtar@gmail.com;

1. INTRODUCTION

Coronary heart disease is one of the world's leading causes of morbidity and mortality. Much is known about left ventricular myocardial infarction. It was not until much later (1974) that right ventricular myocardial infarction was studied as a distinct entity [1]. Isolated VD MI is rare [2,3,4]. It is often associated with infero-posterior MI (in a third of patients) [2,5], with higher morbidity and in-hospital mortality due to hemodynamic and rhythmic complications [4]. The culprit lesion is often occlusion of the proximal right coronary artery [2,4,6,7]. However, the VD is relatively resistant to infarction and recovers even after prolonged occlusion [8]. In this work, we will study the epidemiological, clinical, electrical, echocardiographic and angiographic aspects of MDI with extension to the VD, as well as its complications and therapeutic modalities [9-23].

2. MATERIALS AND METHODS

2.1 Type, Place and Period of Recruitment

This is a retrospective and descriptive monocentric study spread over a period of 01 year, covering patients hospitalized in the Cardiology A department of the "Ligue Nationale de Lutte contre les Maladies Cardiovasculaires at the Mohammed VI University Hospital Center in Marrakech, for myocardial infarction of the left heart extended to the right ventricle.

2.2 Inclusion Criteria

Patients of all ages, men and women, hospitalized for left-heart infarction, mainly of the inferior wall of the LV, with electrical or echocardiographic criteria demonstrating extension to the VD, were selected.

2.3 Exclusion Criteria

Patients with inferior LV MI without extension to the VD were excluded.

2.4 Definition of Study Parameters

a. Clinical parameters

- Smoking is defined as active or weaned smoking for less than 2 years.
- Diabetes is defined as the use of oral antidiabetics and/or insulin.

- Hypertension defined by a history of treated hypertension
- Dyslipidemia defined by a history of treated dyslipidemia
- Obesity defined by a body mass index (BMI) $\geq 30 \text{ kg/m}^2$
- A history of heart disease defined as heart failure, ischemic, valvular, rhythmic, hypertrophic, restrictive or dilated heart disease.

b. Electrical parameters :

ST-segment elevation in the right leads $\geq 1.0 \text{ mm}$ is considered a major electrical criterion for defining right ventricular infarction.

c. Echocardiographic parameters :

Echocardiographic results, performed by specialist physicians in the laboratory for the diagnosis of LV MI extended to the VD were systematically sought and reported when available:

- An impaired LVEF is less than 50%. - Impaired TAPSE is less than 16 mm
- An impaired tricuspid S wave is less than 10 cm/sec.
- Impaired VD shortening fraction is less than 35%.

2.5 Data Collection Process

For this study, a fairly exhaustive data sheet was drawn up, containing all the clinical, electrical and echocardiographic data on this pathology, as well as the treatment methods and evolution of these patients.

These data sheets were completed using patient files, which enabled us to obtain the results presented in the following chapter.

Our statistical analysis focused on descriptive statistics (frequency, percentage, mean, standard deviation).

2.6 Study Limits

Difficulties were encountered in analyzing the files, particularly those that were incomplete.

3. RESULTS

3.1 Population Description

Between January 2018 and December 2019, 65 patients were admitted to the cardiology

department for myocardial infarction of inferior topography, including 16 with extension to the right ventricle, i.e. a frequency of 26.14%. 08 of them presented to the emergency department with an acute coronary syndrome picture, while the other 09 patients arrived outside the early revascularization timescale. The age of our patients ranged from 46 to 82, with an average of 62. Peak frequency was between 60 and 70 years of age.

3.2 Breakdown by Gender

Men make up 82% of the study population, while women account for 18%, with an M/F sex ratio of 4.6.

3.3 Cardiovascular Risk Factors

The cardiovascular risk factors sought in our patients are:

- High blood pressure: 58% of patients have high blood pressure.
- Diabetes: 52% of patients have type 2 diabetes.
- Smoking: 70% of patients smoke,
- Dyslipidemia: present in 11% of patients.
- Obesity: 5% of patients have a BMI>30.
- Coronary heredity: Coronary heredity is found in 5% of patients.

3.4 Mode of Presentation of Our Patients

- 03 of our patients (17%) presented to the emergency department with ST-segment elevation acute coronary syndrome, arriving within 12 hours of the onset of their symptoms.

- 09 patients (52%) consulted 12 hours after the onset of chest pain
- 05 of our patients (29%) presented to the emergency department with non-ST-segment elevation acute coronary syndrome.

3.5 Physical Signs

Clinical examination of our patients on admission revealed that: 1 patient showed signs of right heart failure, 1 patient showed signs of left heart failure. 3 patients were admitted in shock. 13 patients had a strictly normal clinical examination.

3.6 ECG appearance of Our Patients

The ECG, performed in all patients on admission with right leads in 9 of them, showed:

- Repolarization disorders: Sus ST-segment shift in V3R and V4R (9 patients). Sus ST-segment shift in DII, DIII, AVF (12 patients). Sus ST-segment shift in V1 V2 V3 (1 patient).
- Rhythm disorders: Ventricular tachycardia (01 patient)
- Conduction disorders: 2nd degree AVB (01 patient). 3rd degree AVB (01 patient). Left bundle branch block (02 patients).

3.7 Echocardiography Profile of Our Patients

Doppler echocardiography was performed in all patients. Parameters studied: LV EF, in our series, was impaired in 8 of our patients (47%).

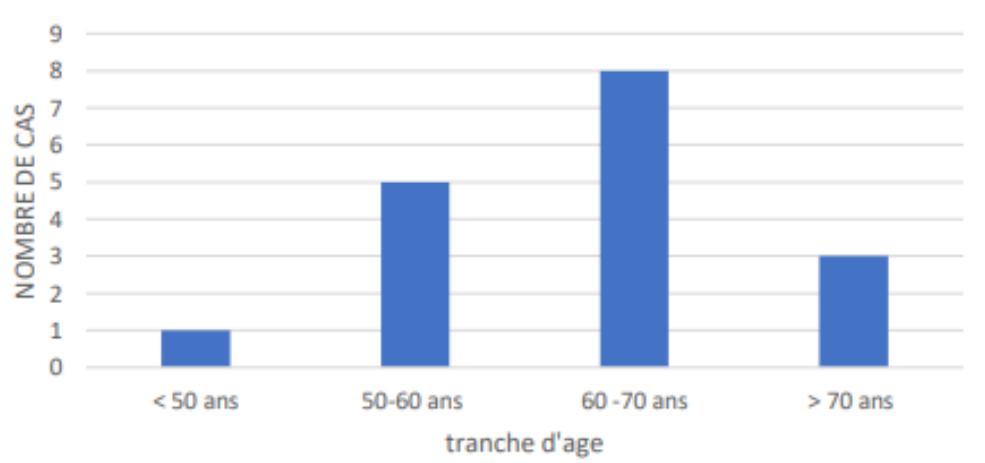


Fig. 1. Age distribution of our patients

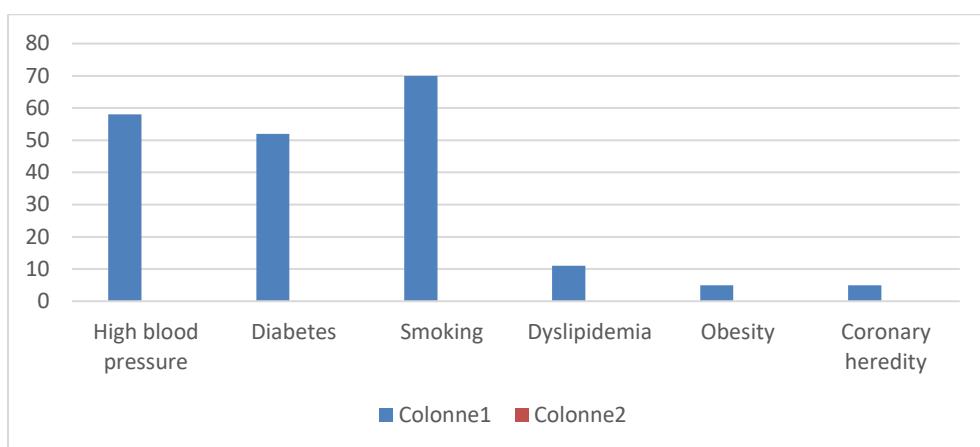


Fig. 2. Cardiovascular risk factors

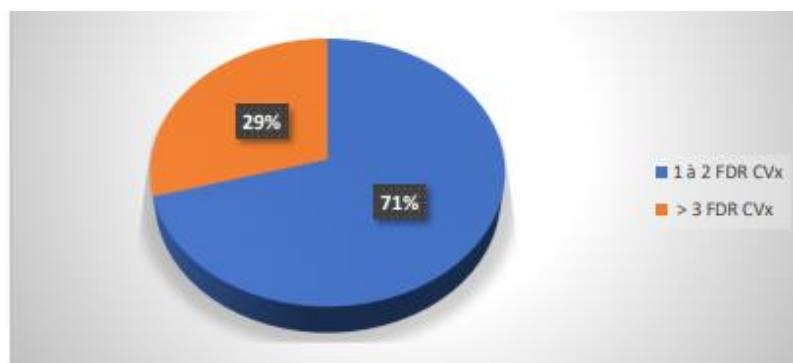


Fig. 3. Distribution of patients by number of cumulative risk factors

LV systolic function, in our study population, was impaired in 9 of our patients (52%) based mainly on TAPSE and tricuspid s-wave parameters.

Disorders of VD segmental kinetics: Akinesia of the VD lateral wall (03 patients). Akinesia of the inferior wall of the VD (01 patient). Akinesia of the anterior wall (01 patient). Pericardial effusion

was present in 01 patient. Doppler study revealed tricuspid insufficiency in 03 patients.

3.8 Angiographic Profile of Our Patients

16 patients were referred for coronary angiography. The various lesions are summarized in the following diagram:

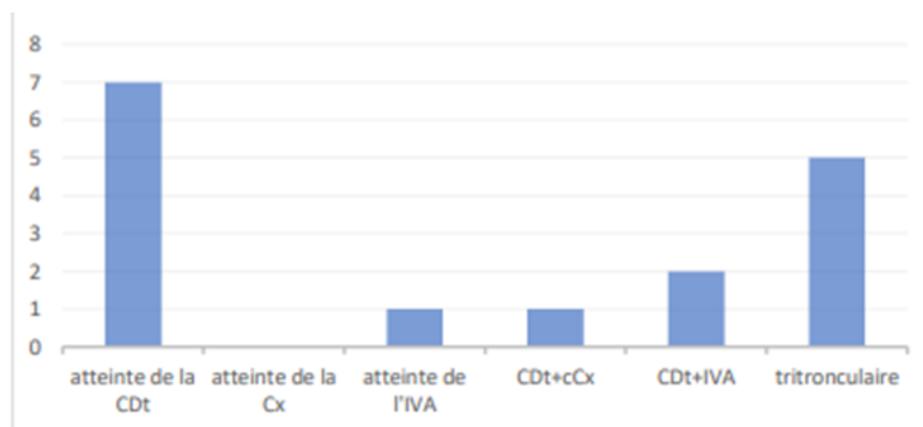


Fig. 4. Coronary angiography anomalies

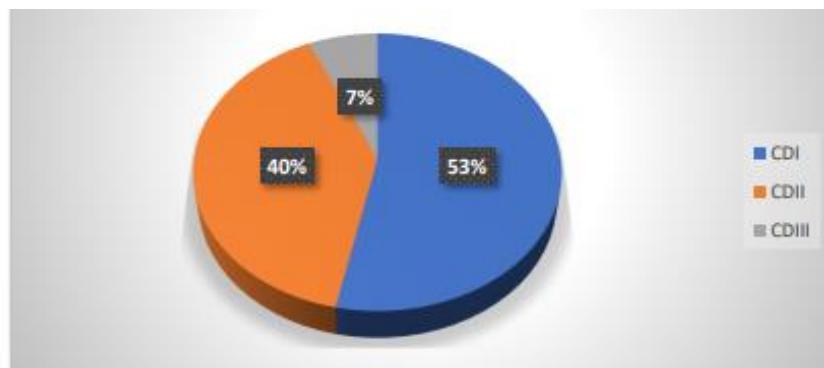


Fig. 5. Affected segment of right coronary artery

3.9 Therapeutic Management

3.9.1 Drug treatment

Thrombolysis was indicated in 03 patients by Metalysis. Aspirin and Clopidogrel were administered in all our patients. LMWH was used in all our patients. 05 patients required vascular filling. DOBUTAMINE was indicated in 03 patients. Atropine was used in 01 patients. IEC was used in 14 patients. BB was used in 10 patients. All patients received a statin.

3.9.2 Instrumental treatment

Coronary angioplasty was performed in 07 patients, following coronary angiography. Only one patient benefited from an electrosystolic pacing lead.

3.9.3 Surgical treatment

Only one patient underwent coronary artery bypass surgery.

3.10 Evolution

Only one patient died during hospitalization as a result of a high-grade conductive disorder. 03 patients presented hemodynamic instability, stabilized with drug treatment. 02 patients presented rhythmic complications.

3.11 Length of Hospital Stay

The length of hospitalization for our patients varies between 01 and 22 days, with an average of 8 days.

4. DISCUSSION

4.1 Epidemiological Profile

Isolated VD MI is exceptional (0.5-2%). On the other hand, biventricular involvement is frequent,

not in anterior MI, where it is found in only 5% of cases, but in posterior MI (inferior, inferolateral, inferobasal), where it is present in 30 to 50% of cases. In our study, biventricular involvement was present in all our patients, and no cases of isolated VD infarction were identified. We also note that VD MI accompanies around 26% of inferior LV necrosis, which is very comparable in different studies worldwide [24]. Smoking was the main cardiovascular risk factor found in our patients, followed by hypertension and diabetes, in line with the study by s. KHAN et al [25], with a clear male predominance.

4.2 Clinical Profile

The mode of onset of this combination of VD and inferior MI does not differ greatly from that of isolated inferior MI. Patients present to the emergency department with typical infarct chest pain (found in all our patients), consistent with acute coronary syndrome with or without ST elevation.

Sometimes the patient arrives at a late stage where the early reperfusion phase has been exceeded (post-MI in 52% of our patients), or even at the complication stage, as was the case in 3 of our patients who arrived in cardiogenic shock, requiring special management [26-40].

4.3 Electrical Profile

Electrical diagnosis of VD infarction is essentially based on the detection of ST-segment elevation in the right precordial leads (V3R and V4R) [41].

On the standard 12-lead ECG, less frequent and less specific electrical signs can be found. However, these may point towards extension to the VD, as described in the first theoretical section, and as seen on the ECG of one of our patients [40-53].

4.4 Echocardiography Profile

It is now the key examination for the positive diagnosis of biventricular infarction at the patient's bedside, for differential diagnosis and for the search for complications. In two-dimensional echocardiography, the signs in favor of VD infarction are [54-64]:

- Dilatation of the right cavities, with an increase in the ratio of VD diameter to VG diameter
- A disorder of segmental kinetics in the form of akinesia of one or more walls of the right ventricle (the infarcted zone is also thinned and bright at a later stage).
- Paradoxical movement of the interventricular septum.
- The inter-atrial septum may be pushed back towards the left atrium (by increasing right intra- atrial pressure).
- Inferior vena cava may be dilated (>18mm), with loss of inspiratory collapse

- Right ventricular surface shortening fraction (in apical 4-cavity section) is reduced (<50%)
- A small amount of pericardial effusion may be present. Echocardiography can also be used to detect complications and rule out differential diagnoses.

In our study, the echocardiographic signs in favor of VD infarction were essentially altered VD systolic function (09 patients) and disturbances in the segmental kinematics of the VD walls (03 patients).

4.5 Angiographic Profile

Angiographically, the right coronary artery is the culprit artery in 94% of cases (53% of lesions are located on CD I), which is comparable with the literature [7].

We also report a case of anterior MDI extended to the VD secondary to proximal IVA occlusion, considered in the literature as a rare association [7].

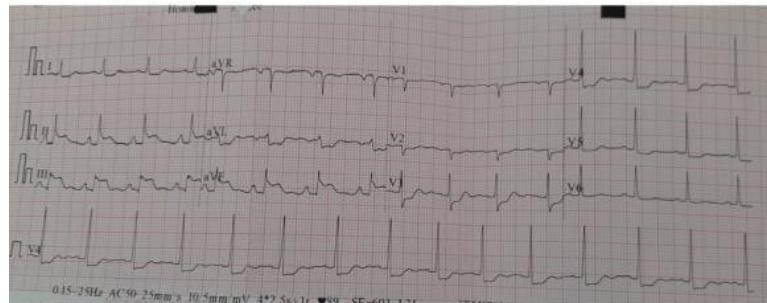


Fig. 6. ST segment hypershift in inferior leads (DII, DIII and aVF) , more marked in DIII , with mirror images in lateral leads in one of our patients

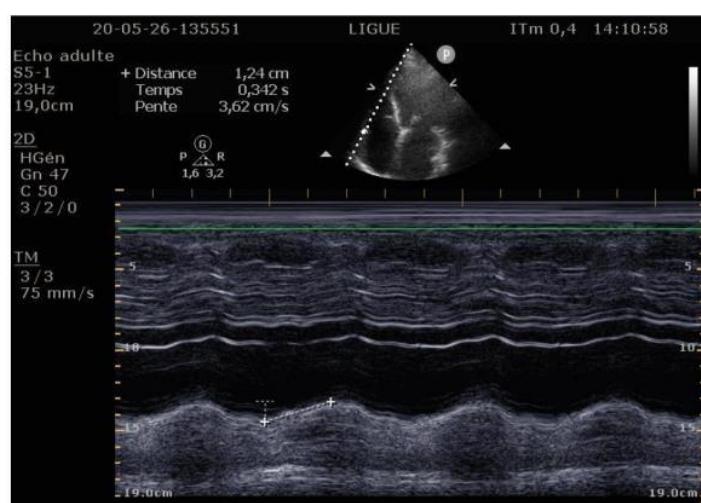


Fig. 7. Echocardiographic image showing altered TAPSE in one of our patients

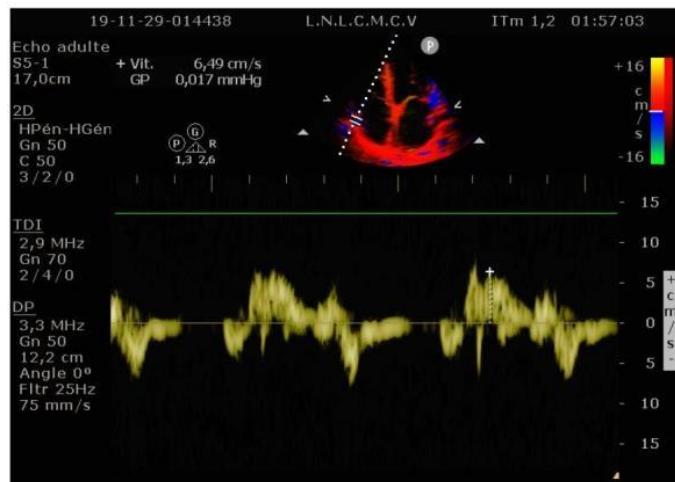


Fig. 8. Echocardiographic image showing tricuspid S wave alteration on tissue Doppler



Fig. 9. Coronary image showing a tight lesion on the right coronary in one of our patients

4.6 Therapeutic Management

VD infarction is a cause of arterial hypotension related to a sudden drop in right ventricular systolic ejection. Immediate mortality is high in the absence of adequate treatment (filling, deobstruction, etc.).

In our study, 03 patients benefited from vascular filling, which enabled them to correct their hypotension,

In addition to volume expansion, the best treatment for right ventricular infarction is the earliest possible de-clogging of the thrombosed artery, either with drugs (although the rate of re-occlusion is higher) or with instruments (primary

angioplasty). In our series, 03 patients underwent thrombolysis and 07 benefited from successful primary angioplasty.

5. CONCLUSION

One-third to one-half of patients with inferior MI are complicated by VD MI, ranging from simple, asymptomatic VD dysfunction to severe hypotension, cardiogenic shock and even sudden cardiac death.

Diagnosis of VD MI can be difficult; the 12-lead ECG with recording of additional precordial leads on the right remains the main diagnostic tool in the acute setting, but results can be transient.

The physiology of the VD makes it resistant to infarction, but acute ischemia can have serious hemodynamic consequences. Resuscitation with vascular filling to maintain an adequate preload of the VD remains the first-line treatment. Revascularization, preferably by primary percutaneous intervention, is the cornerstone in the management of VD MI.

Patients who survive the acute phase of MI have an overall favorable long-term prognosis.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

CONSENT

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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