

## Right Ventricular Infarction: Prevalence, Diagnostic and Therapeutic Characteristics, and Prognosis about 10 Cases

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### Abstract

**Objectives:** The objectives of this study were to evaluate the prevalence of the right ventricular infarction and its diagnostic, therapeutic and prognostic characteristics.

**Patients and methods:** A single center retrospective study was carried out between January 2011 and December 2014. Patients who were diagnosed with right ventricular infarction at electrocardiogram and echocardiography were recruited.

**Outcomes:** Among the 159 patients hospitalized for myocardial infarction, 10 had myocardial infarction extended to the right ventricle (6.3%). It occurred on an inferior infarction in 7 cases out of 35 and anterior infarction in 3 cases out of 124. The mean age was 53 years and sex ratio M/F of 2.33. All patients had at least 3 cardiovascular risk factors. Right-sided heart failure was found in 4 patients. Right ventricular infarction was associated with inferior STEMI in 7 patients, and anterior STEMI in 3 patients. Echocardiography showed right ventricular dilatation and impaired right ventricular systolic function in respectively 6 cases. Thrombolysis was performed in 7 patients and rescue angioplasty in 1 case. A regressive cardiogenic collapse was noted in 6 cases and one death in 1 case.

**Conclusion:** Right ventricular infarction is relatively rare and usually related to an extension of an inferior myocardial infarction. Hemodynamic instability is of worse prognosis.

**Keywords:** Myocardial infarction; Right ventricle; Senegal

### Introduction

Acute myocardial infarction (AMI) is a major cause of cardiovascular mortality, which is the leading cause of death in the world. Right ventricle (RV) infarction corresponds to a necrosis of its free wall following a proximal occlusion of the right coronary artery or the circumflex artery when it is dominant [1].

Its occurrence during the anterior AMI is possible and represents 5% of cases. Early diagnosis of RV infarction is important in clinical practice because it defines a high-risk sub-group in which hospital mortality and morbidity are particularly high [1].

To our knowledge, no studies have been carried out on this subject in Senegal. The objective of this work is to evaluate the prevalence of RV infarction and to study its diagnostic, therapeutic and prognostic features.

### Methodology

#### Period, framework and type of study

We carried out a retrospective and descriptive study spread over a period of 4 years, going from 1st of January 2011 to 31st of December 2014 in the cardiology department of the General Hospital of Grand Yoff in Dakar, Senegal.

#### Inclusion criteria

Diagnosis of RV infarction was based on the electrocardiogram (a significant ST-elevation in V3R-V4R or a ST-elevation in V1 associated with a sub-shift in V2) and transthoracic echocardiography (disorder of the global or segmental kinetics of RV). Male and female patients of all ages hospitalized in our cardiac department for myocardial infarction were included in the study, and then patients with electrocardiographic or echocardiographic criteria for right ventricular infarction were selected (Table 1).

Years	Total number of STEMI	Number of Inferior STEMI	Number of Inferior STEMI with RV	Number of Anterior STEMI	Number of Anterior STEMI with RV
2011	35	8	2	27	2
2012	40	10	1	30	1
2013	28	11	2	17	0
2014	56	6	2	50	0
Total	2075	35	7	124	3

STEMI=ST Elevation Myocardial Infarction; RV=Right Ventricular

**Table 1:** Distribution of STEMI according to the territory.

### Study sequence and studied parameters

Data were collected by manual analysis of records of hospitalized patients during the study period. We studied socio-demographic data (marital status, personal and family history), characteristics of chest pain (type, intensity, location, irradiation), dyspnea (according to the NYHA classification), and palpitations. Cardiovascular risk factors have been investigated, namely: the age (more than 60 years old for women and more than 50 years old for men), the masculine gender, hypertension, diabetes, dyslipidemia (defined as total hypercholesterolemia  $\geq 2$ g/L or HDL cholesterol lowering 0.4 g/L, or LDL hypercholesterolemia  $\geq 1.6$  g/L or hypertriglyceridaemia  $\geq 1.5$  g/L), psycho-social or occupational stress, obesity, active or passive smoking, sedentary lifestyle, menopause, cardiovascular inheritance and chronic renal insufficiency [2].

We studied the time to admission (time between the onset of chest pain and the patient's arrival at the cardiac intensive care unit). The general examination data were studied as well as paraclinic data including markers of myocardial ischemia (Troponin I, CPK and CPK-MB), 18-lead electrocardiogram and Doppler echocardiography. The therapeutic and evolutionary aspects were studied.

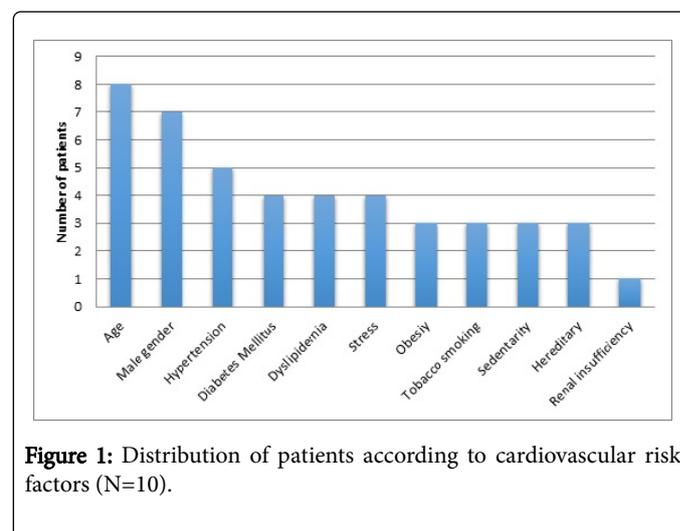
All observations were entered and coded on Windows Excel 2010 (Microsoft, USA) and analyzed using PASW Statistics 18 (IBM, Chicago, IL, USA). The descriptive statistics presented the data in tables and figures. It then summarized the qualitative variables as proportions and the quantitative variables as an average. The chi-square test was used to compare average values with a significance threshold set for  $p < 0.05$ .

### Results

During the period of our study, 2075 patients were admitted to the cardiology department of Grand Yoff General Hospital in Dakar. 159 patients had acute myocardial infarction, a hospital incidence of 7.7%. Out of these, 35 (22%) have a myocardial infarction of the lower part of the left ventricle (LV) and 124 (78%) for the higher wall part. The MI was extended to the RV on 10 patients (6.3% of all the MI. The prevalence of RV infarction in the lower LV wall infarction was 20% (7/35), whereas it was 2.4% (3/124) when the anterior wall of the LV was affected. The isolated form of RV infarction had not been found.

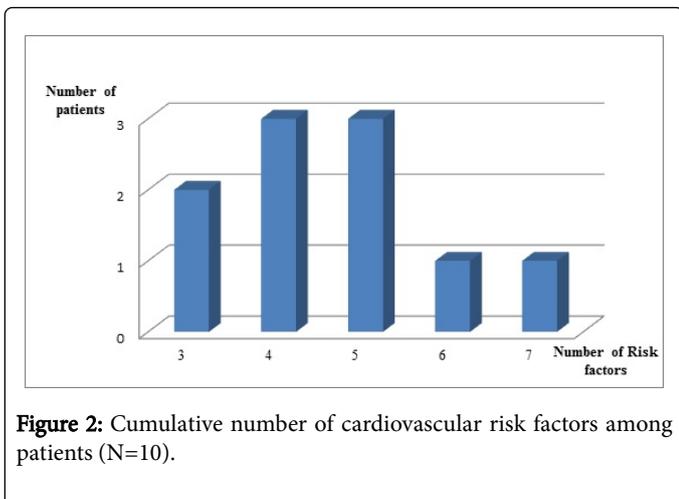
The average age of RV infarction patients was 53 years with extremes of 39 and 75 years and sex ratio of 2.33. However, there was no statistically significant difference between the incidence of RV

infarction in males and females ( $p=0.206$ ). The cardiovascular risk factors found are shown in Figure 1. All patients had at least 3 cardiovascular risk factors (Figure 2). Chest pain was present in all patients and dyspnea in 40% of cases. Other signs such as nausea, vomiting and profuse sweating were present in 50% of patients. Clinical examination at admission revealed that 40% of patients had signs of right heart failure. At the ECG, there was a significant ST elevation in V3R-V4R with a Pardee wave in DII-DIII-AVF (Figure 3) corresponding to a LV lower wall infarction with extension to RV in 7 patients, and an ST-elevation in V3R-V4R with a Pardee wave from V1 to V6 and DI-AVL corresponding to an extended anterior MI with extension to RV in 3 patients (Table 2). At biology, the dosage of troponin I was only achieved in 20% of patients and was highly positive.

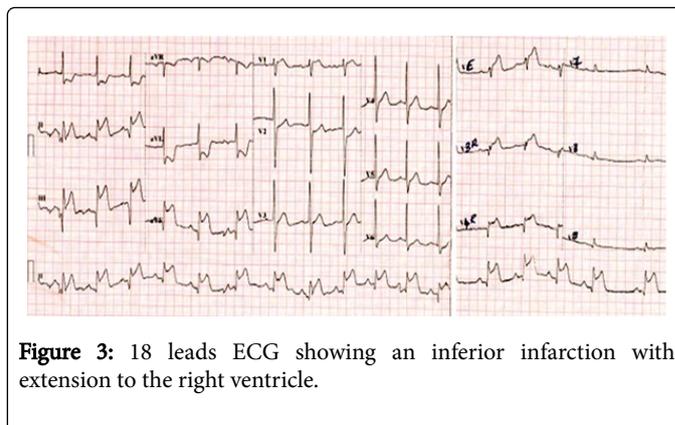


**Figure 1:** Distribution of patients according to cardiovascular risk factors (N=10).

Doppler echocardiography showed right ventricular dilatation in 6 cases, a paradoxical inter ventricular septum in 2 cases, an alteration in the longitudinal systolic function of the RV in 6 cases, and tricuspid insufficiency in 5 patients. The coronary angiography performed in a single patient showed a sub-occlusion in the segment 2 of the right coronary, a TIMI 2 flow with a dominant and atheromatous right network over the entire path.



**Figure 2:** Cumulative number of cardiovascular risk factors among patients (N=10).



**Figure 3:** 18 leads ECG showing an inferior infarction with extension to the right ventricle.

ECG abnormalities	Number of patients	Percentage
ST elevation in V3R-V4R	10	100%
ST elevation in DII-DIII-AVF	7	70%
ST elevation in V1-V6 et DI-AVL	3	30%
ST elevation in V1 + ST depression in V2	3	30%
ST elevation in DIII >> DII	4	40%
Sinus bradycardia	3	30%
Type 2 second degree AV block	2	20%
Third degree AV block	1	10%
Ventricular extrasystoles	2	20%

ECG=Electrocardiography; AV=Atrioventricular

**Table 2:** Electrocardiographic abnormalities (N=10).

Complications were the signs of right heart failure, collapse in 4 patients, and cardiogenic shock in 2 patients, one of whom died. In addition, the electrocardiogram had revealed transient conduction disorders of type of atrio-ventricular blocks 2nd degree type 2 or 3rd degree (3 patients).

Therapeutically, thrombolysis was performed in 7 patients, with an average time limit of 7.5 hours. It was successful in two cases. Coronary angioplasty rescue was performed in a single patient and allowed revascularization of the right coronary artery with the placement of an active stent. Vascular filling was reported in 4 patients with cardiovascular collapse. The use of Dobutamine was indicated in two patients in cardiogenic shock.

## Discussion

In this study, we were confronted with incomplete records, systematic non-realization of extreme ECG shunts in case of any chest pain. The dosage of myocardial markers was not always achieved because of lack of financial means. In no case did the segmental kinetics of RV be studied. The use of coronary angioplasty and angioplasty remains limited to wealthy patients.

The isolated RV infarction is described as exceptional in the various recent studies (0.5-3%) [1,3,4]. On the other hand, bi-ventricular affection is frequent, not in the anterior MI (5% of cases), but in the lower MI, where it is present in 20-50% of cases [1]. In our series, RV infarction accompanies 20% of LV lower infarction and 2.4% of anterior infarctions; Which is comparable to the various global studies [1,3].

The average age of our patients (53 years) is lower than that found by Fennira (58 years) [1]. The male predominance is slightly lower than that found by Fennira (83%) [1]. High blood pressure is closely related to the occurrence of coronary artery diseases [5]. In our study, it was observed in 50% of patients, and is slightly lower than in the CORONAFRIC survey (55.3%) [6]. Patients with diabetes have 2-3 times more incidence of atheroma-related diseases and higher mortality than the general population as shown in the United Kingdom prospective diabetes study [7]. It is established in the FRAMINGHAM study that there is a close relationship between elevations in cholesterol and the occurrence of cardiovascular complications [8]. In our series, 40% of patients had dyslipidemia. This rate is estimated in the literature between 25 and 48% [9]. Active

smoking was present in 30% of cases and all of them were male. This rate is close to that found by Ticolat et al. (41%) [6].

The ECG signs required for the diagnosis of RV infarction in our study are consistent with those described in the various studies [10,11]. The general prevalence of atrioventricular blocks is high during RV infarction ranging from 36% to 60% of cases [12]. In our series, 30% of patients presented with a regressive 2nd or 3rd degree BAV. In the case of echocardiography, several studies have reported that RV infarction is inconstantly accompanied by RV dilation (50% to 70% of cases) [1] and a paradoxical septum (28%) according to Lopez and al. [13]. In our series, the paradoxical septum was only observed in 20% of cases. TAPSE was altered in 60% of our patients whereas Alan and al. [14] showed significant alteration of TAPSE in those with ECG signs with an extension to RV.

The major complications and hospital mortality of lower infarcts are much higher in the presence of right ventricular affection [4]. During RV infarction, the incidence of collapse and cardiogenic shock are respectively 26% and 40-45% [12,15]. RV infarction is characterized by a heavy mortality of 10 to 30% [4]. In our series, this rate was 10%.

In the case of therapeutic management, early reperfusion is the appropriate treatment to reduce complications and improve prognosis [16,17]. In the Giannitsis and al. series [15], the rate of repermeability after thrombolysis is weak in the lower infarcts extended to the RV, compared with the isolated infarcts (31% vs 71%). Seven of our patients were thrombolysated and this procedure was successful only in 2 patients (28.5%); which agrees with the literature [12,18]. Only one patient out of ten had benefited from angioplasty; this is explained by the recent availability of an angioplasty room in Dakar, and by the high cost of the operation.

## Conclusion

Right ventricular infarction remains a rare entity in acute coronary syndromes. Its diagnosis is electrocardiographic. It occurs more frequently in patients with a lower infarct. Complications are frequent in the acute phase dominated by signs of right heart failure, cardiovascular collapse and atrioventricular conduction disorders. The prognosis and progression to the acute phase of RV infarction are critical and burdened with heavy mortality. Appropriately supported, it often progresses to a complete healing.

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