Diastolic Function Assessment in Acute Coronary Syndrome
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Abstract

Coronary artery disease is one of the main causes of morbidity and mortality in our country; it is a cardiovascular emergency that must be globally and early managed. **Goals:** evaluate diastolic function in acute coronary syndrome. Analyze the modifying factors of its alteration, comparing two groups' one with altered diastolic function and the other with normal diastolic function. **Material and methods:** Prospective descriptive analytic study on a number of 50 patients admitted for acute coronary syndrome to the cardiology department of Mohammed VI Hospital in Marrakech. **Results:** The age of patients is between 40 and 85 years old with an average of 62.02 years. 66% of the patients are men, 54% of patients are smokers, 46% are diabetic, 42% are obese, 26% are hypertensive and 24% have dyslipidemia. At admission 92% of patients had chest pain. At echocardiography, diastolic dysfunction was reported in 68% with elevated filling pressure of the left ventricle in 10%. We found an association between diastolic dysfunction and dyslipidemia, the number of arteries with coronary angiography and the timing of the admission. **Conclusion:** Diastolic dysfunction was common in our population of coronary acute syndrome, hence the interest of an early echocardiographic assessment adapted to any coronary patient.

**Keywords:** Coronary syndrome-diastolic dysfunction-filling pressure.

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**INTRODUCTION**

Acute coronary syndrome is one of the main concerns of public health, due to its high morbidity and mortality [1], the management of which has become a subject of constant questioning and improvement. Echocardiography is the most common imaging technique for assessing systolic and diastolic function, which is determined by two main factors: Relaxation and compliance of the left ventricle (LV) [2]. Myocardial ischemia results in slower and incomplete ventricular relaxation [3,4], while scar tissue and myocardial fibrosis due to a previous infarction results in reduced ventricle compliance [5,6]. Several studies have demonstrated that the alteration in diastolic function to the question has been linked to readmission [7, 8, 9,10], to a risk of heart failure or death after a myocardial infarction at 1 year [11 , 12]. And its assessment should be part of a routine examination of any patient admitted for acute coronary syndrome.

**Goals**

- Evaluate diastolic function in acute coronary syndromes.
- Analyze the predictors of impaired diastolic function, comparing two groups: one with impaired diastolic function and the other with normal diastolic function.

**METHODS**

This is a prospective descriptive analytical study covering a period of 6 months, from January 2017 to June 2017, with a total of 50 patients admitted for acute coronary syndrome in the cardiology department of Mohammed VI hospital of Marrakech, within 36 hours.

**RESULTS**

**Epidemiological aspects**

The average age of our patients was 62.02 years (40 and 85 years), with a male predominance.
Clinical aspects

- **Cardiovascular risk factors:** Among cardiovascular risk factors (FDRCV), smoking and diabetes were the most represented risk factors.

![Diagram-2: Distribution of patients according to cardiovascular risk factors](image)

- 10% of the patients were coronary.

![Diagram-3: Distribution of patients according to the revealing symptom](image)

- Chest pain was present in 92% of patients; it was atypical in 13.04%.

![Diagram-4: Distribution according to clinical examination](image)

**Table-II: Distribution according to the general examination**

|                      | Systolic pressure | Diastolic pressure | Heart rate | Respiratory rate |
|----------------------|-------------------|--------------------|------------|-----------------|
| Average              | 126.66            | 71.76              | 81.76      | 21.1            |
| standard deviation   | 17.64             | 10.55              | 21.43      | 3.83            |
| Minimum              | 80                | 40                 | 30         | 16              |
| Maximum              | 170               | 90                 | 130        | 35              |

**Cardiovascular and pleuro-pulmonary examination**

- **Hepatomegaly**: 2%
- **Hepatocjugular reflex**: 4%
- **Turgescence of jugular vein**: 2%
- **Crepitation**: 2%

![Diagram-5: Electrocardiogram abnormalities](image)

- The topography of the electrical signs was antero-septo-apical in 42% of the cases.

**Paraclinical aspects**

The EKG showed: A regular sinus rhythm in 100% of the cases, an over-shift of the ST segment in 68% of the cases, an under-shift of the ST segment in 30% of the patients.

![Diagram-6: Distribution according to the territory reached](image)
The chest X-ray was pathological in 16% of the cases. Cardiomegaly was found in 12% of patients with an average cardio-thoracic index of 0.6, an interstitial syndrome in 8% of patients.

Troponins were raised in 100% of cases.

The evaluation of diastolic function on echocardiography shows:

- The chest X-ray was pathological in 16% of the cases. Cardiomegaly was found in 12% of patients with an average cardio-thoracic index of 0.6, an interstitial syndrome in 8% of patients.

- Troponins were raised in 100% of cases.

- The evaluation of diastolic function on echocardiography shows:

| Mitral inflow and tissue Dopplerparameters | Average |
|-----------------------------------------|---------|
| E (cm/s)                                | 70.56   |
| A (cm/s)                                | 85.18   |
| E/A                                     | 0.97    |
| Am (ms)                                 | 91.30   |
| E’                                      | 8.8     |
| E/E’                                    | 7.20    |
| TDE (ms)                                | 155     |
| IVRT (ms)                               | 78.87   |
| OG Vol (ml/ m²)                          | 24.67   |

- Diastolic dysfunction was objectified in 68% of patients, of which 54% of patients had diastolic dysfunction type 1 (28 cases), 8% had diastolic dysfunction type 2 (4 cases) and 4% had diastolic dysfunction type 3 (2 cases).

- The dilation of the left atrium was found in 8% of the patients, while 4% of the patients had an LVH (2 cases).

- The filling pressures of the left ventricle were high in 10% of the patients in this study.
Table IV: Risk factor found in patients with normal diastolic function and patients with diastolic dysfunction

| Risk factors               | Diastolic dysfunction | normal diastolic function | P     | Correlation coefficient (r) |
|---------------------------|-----------------------|----------------------------|-------|----------------------------|
| Age                       | 62.26 ans             | 61.5 ans                   | 0.803 | -0.036                     |
| HBP                       | 16%                   | 10%                        | 0.57  | -0.082                     |
| Diabetes                  | 30%                   | 16%                        | 0.704 | -0.055                     |
| Obesity                   | 28%                   | 14%                        | 0.86  | -0.024                     |
| Dyslipidemia              | 14%                   | 0%                         | 0.052 | +0.27                      |
| Coronary inheritance      | 0%                    | 0%                         | NS    | NS                         |
| Smoking                   | 38%                   | 16%                        | 0.704 | 0.055                      |

- The risk factors that represent a correlation with diastolic dysfunction is dyslipidemia with a correlation coefficient of 0.27.

Table V: Other factors found in patients with normal diastolic function and patients with diastolic dysfunction

| Other factor | Diastolic dysfunction | normal diastolic function | P     | Correlation coefficient (r) |
|--------------|-----------------------|----------------------------|-------|----------------------------|
| Heart rate   | 78.97                 | 85.81                      | 0.29  | 0.153                      |
| Systolic pressure | 123.67             | 129.87                     | 0.21  | 0.17                       |
| Diastolic pressure | 70.73               | 73.87                      | 0.33  | 0.14                       |
| Reperfusion  | 29%                   | 62%                        | 0.44  | -1.26                      |
| Num rof affected arteries | 2.55              | 1.75                       | 0.048 | 0.363                      |
| Admission (h) | 29.5                | 18.31                      | 0.064 | 0.264                      |
| EKGTopography(ASA) | 50%                 | 68%                        | 0.221 | 0.176                      |

- The other factors that represent a correlation with diastolic dysfunction are: the number of arteries affected at the coronary angiography, and the time of admission.

- The ejection fraction was more than 50% in 30% of the cases and less than 50% in 70% of the cases.

Diagram 9: Distribution of patients according to ejection fraction

- Contractility disorders were present in 82% of patients.

Table VI: Analysis of contractility

| Contractility     | cases | Percentage (%) |
|-------------------|-------|-----------------|
| Normal            | 9     | 18              |
| Akinesia          | 4     | 8               |
| Hypokinesia       | 27    | 54              |
| Both (hypo and akinesia) | 10 | 20            |
| Dyskinesia        | 0     | 0               |
The coronary angiography was done in 58% of the cases (29 patients), objectifying bi-trunk lesions in 20% of the patients. It was normal in 6% of cases.

**Table-VII: Angiographic aspects**

| Coronary artery disease | cases | Percentage (%) |
|-------------------------|-------|----------------|
| Mono-trunk              | 8     | 16             |
| Bi-trunk                | 10    | 20             |
| Tri-trunk               | 8     | 16             |
| No coronary damage      | 3     | 6              |

The affected arteries were distributed as follows:

**Table-VIII: Distribution according to the site of the lesion**

| Artery affected | Number of cases |
|-----------------|-----------------|
| Left main       | 0               |
| Interventricular artery | Proximal : 16  |
|                 | Mid : 6          |
|                 | Distal : 4       |
| Circumflex      | P : 7            |
|                 | M : 7            |
|                 | D : 3            |
| Right coronary   | 1st segment : 11 |
|                 | 2nd segment : 9  |
|                 | 3rd segment : 1  |
| Collateral      | Marginal : 1     |
|                 | Diagonal : 1     |
Therapeutic aspects:
- The patients received drug treatments, detailed in this table:

| Drug Treatments          | Cases | Percentage (%) |
|--------------------------|-------|----------------|
| Aspirin                  | 50    | 100            |
| Clopidogrel              | 49    | 98             |
| Statins                  | 47    | 94             |
| Nitro derivatives        | 4     | 8              |
| calcium blockers         | 1     | 2              |
| CEI                      | 18    | 36             |
| Diuretic                 | 7     | 14             |
| Beta-blockers            | 20    | 40             |
| Unfractionated heparin   | 2     | 4              |
| LMWH                     | 48    | 96             |
| Insulin                  | 19    | 38             |

- Angioplasty was performed in 28% of the cases (14 patients).
- Thrombolysis was performed in 6% of cases (3 patients).

Hospital complications
- Rhythm disorder in one case.
- Three patients presented a 2nd degree atroventricular block (conduction disorder).
- Four patients developed left heart failure (8%).

DISCUSSION
The average age in this study was 62 ± 9.95 years with extremes of 40 and 85 years. In the prospective Ennezat study [13], the average age of the patients was 62 ± 14 years. According to the Poulsen study [14], which is a prospective study of 63 patients, the average age was 61 ± 10 years with extremes of 40 and 75 years. In the Fujii study [15], the average age was 53 with extremes of 25 and 65. Males accounted for 66% in this study. According to Ennezat [13], 69% of the patients were male.

Data from the literature have shown that smoking is one of the main cardiovascular risk factors [16]. It remains the most significant modifiable cardiovascular risk factor in the study population (54%). Smoking was objectified in 60% of cases in Ennezat [13], 48% of cases in Jacob [17], 81% of cases in the Poulsen study [14], and 23% of cases according to Graham [18].

Extensive studies have been conducted indicating that diabetes is associated with a cardiomyopathic process and affects diastolic function, this dysfunction can occur sooner or later during diabetes [19]. In this series, diabetes represented 46% of the patients. According to Graham [18], 56% of the study population was diabetic and 28% according to Ennezat [13].

Several echocardiographic and Doppler studies have confirmed the existence in non-hypertensive obese patients of an increase in isovolumic relaxation time and an alteration of the parameters of ventricular filling, reflecting a decrease in compliance [20,21].

This can be explained by a structural adaptation of the heart (HVG and dilations of the ventricles and atria) and to functional anomalies essentially a diastolic dysfunction with conserved EF which will progress to systolic dysfunction [22]. Hypertension is a very common condition [23]. Elevated LV filling pressures have been noted in patients with a history of hypertension after a heart attack [24].

| Authors         | Ennezat[13] | Poulsen[14] | Jacob[17] | Graham[18] | Nakajima[25] | This study |
|-----------------|-------------|-------------|-----------|------------|-------------|-----------|
| Smoking (%)     | 60          | 81          | 48        | 11         | -           | 54        |
| Diabetes (%)    | 28          | 8           | 27        | 56         | -           | 46        |
| Obesity (%)     | -           | -           | 30        | -          | -           | 42        |
| HBP (%)         | 57          | 16          | 25        | 57         | -           | 26        |
| Dyslipidemia (%)| 53          | -           | -         | 42         | 74          | 24        |

In this study, chest pain was present in 92%, it was atypical in 13% of patients. In the Nakajima study [25], chest pain without dyspnea was present in 14% of patients; dyspnea without chest pain was reported in 27% of patients while chest pain and dyspnea were objectified in 14% of patients.
In this series, the rhythm was sinus in all patients, an over-shift of the ST segment in 68% of the cases, an under-shift of the ST segment in 30% of the cases and a negative T wave in 22% of the cases. According to Rogério [7], 91.4% of the patients had a sinus rhythm, an over-shift of the ST segment in 7% of the cases and a negative T wave in 14.3% of the cases. An over-shift of the ST segment was reported in 63% of cases according to Ennezat [13] and in 48% of cases according to Graham [18].

In this study, diastolic dysfunction was objectified in 68% of patients, including 54% of cases with diastolic dysfunction type I (relaxation disorders), 8% of cases with dysfunction type II (pseudo-normal) and 4% of cases with type III dysfunction (restrictive). According to Chenzbraun [26], which is a comparative study between 38 patients with myocardial infarction and 15 healthy patients. Among coronary patients, 50% had diastolic dysfunction, 37% with relaxation disorders and 13% with a restrictive profile. According to Poulsen [14], 62% of the population studied had a diastolic dysfunction, including 37% with relaxation disorders and 25% with an E-wave deceleration time <140ms which can mean pseudo-normal or restrictive filling.

A restrictive fill model is an important predictor of an adverse outcome after MI, regardless of LVEF, size of LV, and severity of heart failure [12].

We found a significant correlation between diastolic dysfunction and dyslipidemia (p = 0.052). Dyslipidemia is an important modifiable risk factor for cardiovascular disease [27], and a determinant of severity in acute coronaries [28]. We did not find a significant correlation between diastolic dysfunction and diabetes, hypertension or obesity. Joining Chenzbraun [26], no correlation was found between the filling profile of LV and diabetes or hypertension. Gule et al did not report any significant difference between left atrial diastolic function between obese and non-obese subjects [29]. In contrast, other studies have found the prevalence of LV diastolic dysfunction to be high in diabetic and hypertensive patients [30]. Bauters et al reported that hyperglycemia on admission predicted LV reshaping after a previous anterior myocardial infarction in non-diabetic patients [31]. We found a significant correlation between diastolic dysfunction and the number of arteries affected (p = 0.048), which joins a comparative study between patients with large infarctions and those with small infarctions. Patients with large infarctions had a restrictive filling [32-34]. Another study found a correlation between infarction size and diastolic function, larger infarction size was associated with reduced early filling rate [35].

The E / e ratio has been well validated to assess LV filling pressures [36, 37]. In this study, 10% of this population had high left ventricle filling pressures.

| Authors       | Ennezat[13] | Graham[18] | Chenzbraun[26] | Our study |
|---------------|-------------|------------|----------------|-----------|
| High LVFP (%) | 16.3        | 29         | 13             | 10        |

Systolic dysfunction was objectified in 70% of this population, with an average of 45.48 ± 10%, the ejection fraction was less than 40% in 24% of cases, while EF ≤40% in 29%

Only coronary angiography, to assess the number and location of hemodynamically significant stenosis. In our series, all patients received aspirin, 98% clopidogrel, 94% statins, 40% beta-blockers and 36% ACE inhibitors. Long-term treatment with trandolapril in patients with reduced left ventricular function rapidly after myocardial infarction significantly reduced the risk of overall mortality, cardiovascular mortality, sudden death and the development of severe heart failure.

This mortality was reduced in a randomized study by enrolling 25 percent of consecutive patients to encourage selective use of IEC after a myocardial infarction [38].

Angioplasty was performed in 28% of cases while thrombolysis was performed in 6% of cases. In the Graham study [18], 16% of patients underwent thrombolysis. 74% patients underwent percutaneous coronary intervention with stent and 7% bypass surgery [13].

**CONCLUSION**

Acute coronary syndrome remains a major public health issue in Morocco, given the still increasing incidence despite progress in treatment and prevention. The evaluation of diastolic function during hospitalization for myocardial infarction should be systematic since it can provide an additional stratification of the prognostic risk [11]. As a result, new public health strategies should be developed to facilitate rapid access to acute care, as well as an education information and communication strategy, particularly in patients at risk of coronary artery disease, in order to shorten the time taken for the management of coronary patients.

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