# Clinical Epidemiology of Acute Myocardial Infarction in Setif, Algeria: Finding from the Setif-AMI Registry

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## Abstract

**Objectives and Introduction:** According to the most recent global burden diseases study (2017), Algeria and the Middle East countries are classified as high mortality countries of acute coronary syndrome, with a 26% increase in period from 1990 to 2017. The objectives of this article are first to detail the methodology and design of the Setif-AMI registry, 4-year registration criteria for patients with STEMI (ST Elevation Myocardial Infarction) and NSTEMI (Non-ST Elevation Myocardial Infarction), to explore the different socio-demographic, clinical, therapeutic and epidemiological variables used in our database and measure the prevalence of STEMI and NSTEMI as well as the prevalence of risk factors.

**Materials and Methods:** The Setif-AMI registry was initiated in January 2015, it is located at the cardiology department of the University Hospital of Setif (UHS) with the initiative of the cardiovascular research laboratory under the supervision of the management of the health and the population of Setif. The establishment of the registry required the use of local hospitals and sources of information, the analysis of death records and records of autopsies listed. This is a prospective study over a 4-year period, 2015-2018.

**Results:** 3420 patients with the inclusion criteria were registered. Prevalence of 28.54% for men and 11.65% for women, the hospital mortality rate of 5%.

**Conclusion:** Based on data from the Setif-AMI registry, we have prevalence and a mortality rate in our population.

This experience has allowed us to demonstrate the possibility of providing useful information and little available in our country despite difficulties in data sources that needs to be improved.

**Keywords:** Myocardial infarction; Registry; Prevalence; Mortality

## Introduction

One of the most studied pathologies through the registries is Acute Coronary Syndrome (ACS), which has both management and a strong impact on public health [1]. Ischemic Heart Disease (IHD) is a global burden, alone is responsible for more than 8,931,000 deaths in 2017, an increase of 26.5% over the 1990 figures. Significant is recorded in the Middle East and North Africa [2-4].

The most recent Global Burden of Disease study 2017 identifies Ischemic Heart Disease (IHD), including Acute Myocardial Infarction (AMI), as the leading cause of years of life lost, a major causes of morbidity and mortality in Algeria, a significant and rapid evolution of mortality related to these diseases during this period where the number of deaths increased from 42,528 in 1990 to 79,389 in 2017 [2-4]. Based on the progress of population based surveys and publications for the national strategy for the control of Non-communicable Diseases (NCD), in Algeria (STEPWISE 2018) [5-8] these surveys have highlighted the emergence of atherosclerosis risk factors through a rapid epidemiological transition due to changes in lifestyle. Faced with this burden, Algeria should establish and improve information systems such as the surveillance and trend evaluation systems of major Cardiovascular Diseases (CVDs) and their risk factors to provide valid and reliable

information, accurate information for the country. Development of prevention and control policies. Thus, to overcome the shortcomings of this epidemiological data in our country on ACS, which is the most serious mode of expression of coronary disease, the priority of our research laboratory of cardiovascular diseases of the medical faculty of Setif, was to establish an AMI registry, Setif-AMI registry ST segment Elevation Mycardial Infarction (STEMI) and No ST segment Elevation Mycardial Infarction (NSTEMI). This is a prospective study whose main objective is to put in place a necessary tool in the epidemiological surveillance of CVD in the wilaya of Setif, the results of which will serve as a reference for later publications. This registry obeys the usual criteria of completeness, continuity, respect for the geographical area and definition of cases to be included.

## Materials and Methods

### Objectives of the registry

The purpose of this article is to detail the methodology, the functioning and the organization of the Setif-AMI registry, as well as to describe the prevalence of myocardial infarction and risk factors for coronary heart disease.

### Study population

The wilaya of Setif is located in eastern Algeria and in the highlands region; it covers an area estimated at 6549.64 $km^2$ and has 60 municipalities.

Its chief town, the town of Setif, which rises to 1200 m altitude, is distant from the capital Algiers of 300 km. Based on the last General Census of Population and Housing, the total population of the wilaya is estimated at 1,820,000 inhabitants, a density of more than 300 inhabitants per $km^2$ and a growth rate with a population of 2.16%, it ranks second in terms of human and socio-economic development after Algiers. The Setifian population over 20 years old in this study is estimated at 58%. In December 31, 2017, the public health sector has 12 hospitals with a capacity of nearly 3000 beds, 01 University Hospital Center (UHS), 05 Public hospitals nearby, 05 specialized hospitals. In addition to the public sector's activity in caring for citizens of the Wilaya, the private sector is strengthening medical coverage through infrastructure **(Figure 1)**.

#### Inclusion criteria

Inclusion is done consecutively in all patients aged 20 years and older, resident in the wilaya of Setif and presenting with STEMI and NSTEMI within 5 days after the onset of symptoms [9]. The diagnosis was based on symptomatology suggestive of myocardial ischemia, defined by the association of persistent retrosternal pain for at least 20 to 30 minutes with the following electrocardiographic abnormalities:

- An ST segment 2 mm offset on at least two contiguous precordial leads, or 1 mm on two adjacent frontal leads, or finally a "*de novo*" complete left branch block.

- An electrical modification accompanied by an elevation of the biomarkers of myocardial necrosis.
- Patients who died very early after admission and for whom cardiac markers were not measured were included, deaths were preceded by chest pain suggestive of an AMI warranting emergency services, patients makes a sudden death with identification of an intracranial thrombus at autopsy. Patients with stent thrombosis were included [9].

#### Exclusion criteria

- An unstable angina (ACS without elevation of cardiac markers),
- AMI after 5 days of the onset of symptoms,
- AMI occurred immediately after cardiovascular surgery,
- Diagnosis of uncertain AMI in the presence of suspicion of another diagnosis, such as acute myocarditis [9].
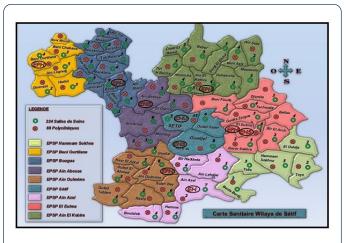


**Figure 1** Geographical and health map of Setif's Wilaya, 2017.

#### Organization of the AMI registry

The register follows methodology recommended by the WHO MONICA Project for the registration of coronary events (MONICA) (Multinational Monitoring of Trends and Determinants in Cardiovascular Disease) set up by WHO [10-12]. This definition represents a continuous and comprehensive record of STEMI and NSTEMI data in a geographically defined population for research and public health purposes. This registry proposes a global inclusion of patients on this pathology with the main public health objectives prevalence, incidence and mortality [10-12].

#### Participating hospitals

**The register (Setif-AMI):** is an Algerian population register involving the cardiology department, medical emergency department of the University Hospital of Setif (UHS) and 6 public health hospitals, without specialized doctor on cardiology (El Eulma, Ain Oulmene, Bougaa, Ain El Kebira, Ain Azel, Beni Urthilane). It should be noted that there is no local emergency medical service to start a pre-hospital thrombolysis. However general doctors practitioner practicing in the 06 public hospitals that are the first link in the care have benefited from several training on the management of SCA

which has allowed thrombolysis of these coronary patients before their transfer into the single service cardiology throughout the wilaya. Our private clinics do not support the register (Setif-AMI). The establishment of the registry required the use of several sources of information, ambulatory emergency medicine service and civil protection or firefighters. We recruited the sudden deaths whose diagnosis of AMI was retained after autopsies at the forensic services of the UHS of Setif. We recruited the sudden deaths whose diagnosis of AMI was retained after autopsies at the forensic services of the UHS.

The registry is located in the cardiology department of UHS Setif, it has 5 units, cardiological emergencies, Intensive Care Unit cardiology (ICU), hospitalization, cardiovascular exploration and a cath-Lab acquired in 2017, which we started a primary angioplasty.

Setif-AMI is a prospective registry; about 700 patients are included per year.

In addition to its primary objective, the selected indicators must also make it possible to evaluate the risk factors for atherosclerosis and hospital care.

The specific analysis will evaluate coronary reperfusion attempts in STEMI by angioplasty, and thrombolysis in the medical emergency department and in public hospitals.

## Collection, capture and control quality data

A registry team composed with a responsible cardiologist, an epidemiologist responsible for quality control for data validation, the construction of quality indicators once a year, exhaustive consultation of data sources with control of missing data, duplicates and checking for inconsistencies using the software [10-12]. The general practitioner recruited full-time to the routine activities of the active collection register using a standard pre-established survey form containing all the definitions of mandatory variables from the register of different sources of information. The active collection of the cases of the proximities hospitals is done by the resident physicians of the cardiology department.

The software used for Setif AMI registry data entry and analysis is the Statistical Package for the Social Sciences (SPSS) IBM statistical analysis software [13].

The data of our register are nominative and confidential. Our computer system is protected by a password. The data were collected using a standardized survey form for each patient, and after information about the participation in a register.

The investigator obtains as soon as possible hospital reports from these patients in order to recover hospital treatment and events, including hospital mortality. For a smooth running of the register, general practitioners practicing in local hospitals are required to provide two to three training days a month in the cardiology department with specialized doctors team.

## Statistical analysis

We performed data capture and statistical analysis on SPSS, version 21.0 (IBM Corporation, Armonk, NY, USA). For quantitative variables, means and standard deviations were calculated with their 95% confidence intervals. Discrete variables are presented in number and percentage. For all analyzes, a value of p<0.05 was considered statistically significant.

## Results

**Table 1** summarizes the general characteristics of the population from January 2015 to October 2018, 3240 new cases with the inclusion criteria are recorded and the average age of our patients was 62.7 ± 11 years (20-91 years). The representation of women was a minority in the population of the register: 29.6% or 960 women. 29 percent were over 75 years old and 5.5 percent were under 45 years old. The majority of the cases are recorded during a hospitalization in the ICU, UHS cardiac service and in the local hospitals respectively 85.1% and 9.8% of the cases, the autopsies are the source of 1.7% while the emergency services (medical, ambulance, rescue) have recovered 95 deaths by AMI or 3.4%, including 42 deaths at home.

During these four years, out of a total of 6,886 patients living in the province of Setif admitted to the cardiac department of Setif for a CVD, 2,771 had a STEMI and NSTEMI, which determines an overall hospital prevalence of 40.2%.

The antecedents and characteristics of STEMI and NSTEMI have been studied in hospitalized patients in the cardiology department. The clinical presentation was dominated by STEMI in 1454 patients (52.48%). NSTEMI accounted for 47.52% of cases (1317 patients). The rates of STEMI were 1049 patients versus 890 NSTEMI.

The analysis of the main risk factors for atherosclerosis shows that 38% of patients are hypertensive, 32% are diabetic, 24% are smokers and 6% have dyslipidemia. A sedentary lifestyle is found in 62% of cases. The socioeconomic level was average for 1,542 patients (55.6%). The hospital mortality calculated by the register is 5% (7.2% for STEMI). In men, the average age is 62 years and the median age at diagnosis is 60 years. In women, the average age is 64 years and the median age is 62 years.

**Table 1** Characteristics of hospitalized patients in the cardiology department of the UHS, 2015-2018.

|  | Total | STEMI | NSTEMI | p value |
|---|---|---|---|---|
|  | n=2771 | n=1454 | n=1317 |  |
| **Age** | 62.7 ± 12 | 63.7 ± 11.5 | 61.6 ± 11.8 | 0.13 |
| Sex (% women) | 832 (30) | 405 (28.85) | 427 (32.42) | 0.6 |
| **First contact** |  |  |  |  |

| | | | | |
|---|---|---|---|---|
| Cardiac emergencies | 385 (13.90) | 248 (17.05) | 137 (10.40) | 0.08 |
| Medical emergencies | 480 (17.30) | 304 (20.90) | 176 (13.40) | 0.48 |
| General Practitioner | 107 (3.90) | 69 (4.75) | 38 (2.90) | 0.61 |
| Private Cardiologist | 321 (11.60) | 140 (9.60) | 181 (13.74) | 0.63 |
| Public hospital nearby | 1478 (53.35) | 769 (52.90) | 709 (53.85) | 0.07 |
| **Risk factors** | | | | |
| Arterial hypertension | 1054 (38) | 481 (33.08) | 573 (43) | 0.04 |
| Diabetes | 890 (32) | 425 (29.22) | 465 (35) | 0.15 |
| Dyslipidemia | 159 (5.74) | 92 (6.33) | 67 (5.10) | 0.52 |
| Tobacco | 675 (24.36) | 497 (34.18) | 178 (13.52) | 0.29 |
| BMI kg/m$^2$ | 26.05 ± 4 | 26.2 ± 4.2 | 25.9 ± 4.8 | 0.08 |
| Sedentary lifestyle | 1740 (62.80) | 1097 (75.45) | 643 (48.80) | 0.03 |
| Cerebral vascular arterial | 28 (1.10) | 19 (1.30) | 9 (0.70) | 0.03 |
| Ischemic heart disease | 228 (8.23) | 57 (3.90) | 171 (13.00) | 0.01 |
| Familial coronaropathie | 62 (2.25) | 50 (3.45) | 12 (0.90) | 0.04 |
| Deaths | 136 (4.90) | 106 (7.2) | 30 (2.30) | 0.08 |

## Discussion

AMI is an ischemic necrosis of the heart muscle most often due to sudden occlusive thrombosis of a coronary artery. Its incidence is increasing in emerging countries. Numerous registers of SCA and myocardial infarction exist throughout the world and have provided valuable epidemiological and clinical information [14-17].

This is the first Setif-AMI population register performed in the cardiology department of (UHS), a permanent and exhaustive systematic registration of the STEMI and NSTEMI pathology of 4 years and starting in 2015.

It was set up by the laboratory of genetic and nutritional cardiovascular diseases at the Ferhat Abbas University of Setif and under the supervision of the authority health of Setif, from which official correspondence of the health authorities of the wilaya authorized us to access our different sources of information, the public health hospitals, ambulatory ambulance service and civil protection (firefighters), forensic records (sudden death).

The main objective of the Setif-AMI registry since its creation was to answer a number of questions concerning the epidemiology, management modalities and prognosis of hospitalized patients, included in our 2015-2018 databases.

The register meets the validity criteria of the international registry MONICA [10-12]. Its implementation is a useful approach from a public health perspective.

It is part of a project with a socio-economic impact aimed at determining the epidemiological parameters, studying the resources involved and their costs, and defining of quality indicators.

The majority of hospital recruitment is of the order of 94.9%, the parameters used by the registry are very varied covering the different demographic variables, clinical, biological and management of hospitalized patients, the echocardiographic and angiographic parameters were also registered in order to have a large database.

The use of data from forensic services has resulted in the recovery of 46 sudden death deaths (1.7%). In studies that have performed autopsy diagnoses, this percentage varies from 40% to 60% of deaths from IHD according to series [18-20].

The results obtained by the register, shows that the number of patients who justified a call to the urgent medical help service and the firefighters (0 living and 42 deaths taking place at home), the difficulty encountered is the absence of medical file allowing the diagnosis validation by our investigators. In addition, this number challenges us and is the subject of many reflections, The training of the medical personnel requires qualities and a high level of the offered services rendering these services of emergency medical aid more operational and effective. These services must not perform a simple task of transporting the wounded, sick or issued death certificates, but they must fit into the chain of medical emergencies by providing high quality care until hospitalization.

The analysis of the results provided by our register shows that the sociodemographic characteristics of our register are comparable to those found in most studies and registers French or African (Maghreb). The registered population is predominantly male, our average age (62.7% *vs.* 63%) is close to that of the French FAST-AMI 2010 registry [18-20], but our patients are younger, by about a decade, those included in the Sub-Saharan Africa study) (62.7% *vs.* 55%) [21,22].

**Table 2** shows an increase in the total number of all-round AMI and the incidence has increased from 590 to 821 new cases from 2016 to 2018, resulting in an increase of 231 new cases. The number of new cases of AMI increases gradually with age in both sexes. Among men, in 2018 the number has increased from 278 for the age group (45-54 years) to 596 for the age group (65-74 years) and over, as well as an increase in NSTEMI for the period 2017-2018 where the number went from 344 to 455 cases. In women, the vast majority of cases occurred after age 65. Incidence rates peak between 70-74 years for men and 68-70 years for women **(Figure 2)**.
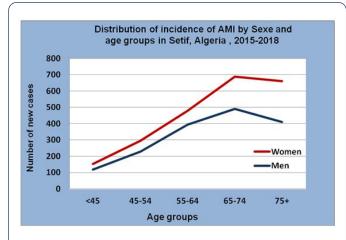
**Figure 2** Distribution of the incidence of AMI by sex and age groups in Setif, Algeria, 2015-2018.

**Table 2** Incidence (Number of new cases) of STEMI and NSTEMI by sex 2015-2018.

|  | STEMI | | NSTEMI | | Total |
|---|---|---|---|---|---|
|  | **Men** | **Women** | **Men** | **Women** | **Total** |
| 2015 | 250 | 93 | 173 | 93 | 609 |
| 2016 | 243 | 95 | 163 | 89 | 590 |
| 2017 | 301 | 106 | 218 | 126 | 751 |
| 2018 | 255 | 111 | 336 | 119 | 821 |
| Total | 1049 | 405 | 890 | 427 | 2771 |

Comparison with the emerging countries, our prevalence is significantly higher than that found in Abidjan (Ivory Coast 40.2% *vs.* 13. 5%) [21], reflecting the increase in coronary heart disease in Setif because of the progression of Cardiovascular risk factors and lack of preventive medicine. Atherosclerosis risk factors are major causes of morbidity and mortality in the world; they have their origins in the westernization of our population marked by a dietary change to the detriment of traditional diets and a decline in physical activity. In our series the prevalence of arterial hypertension at 38% is among the highest, close to that of Tunisian FAST AMI registry 38% but lower than that of France at 48% [20,23], diabetes is markedly higher 32% *vs.* 17% [20], this high prevalence of diabetes is correlated with age, Body Mass Index (BMI) and sedentary lifestyle. In contrast, the prevalence of active smoking was lower 24% *vs.* 40% and 65% of French and Tunisian data. The rate of dyslipidemia was also below the levels found, 6% *vs.* 40% and 24%. The low prevalence of dyslipidemia can be explained by the fact that high-density lipoprotein and (low-density lipoprotein) levels are not achieved in all our patients. The findings of this work underscore the growing importance of cardiovascular risk factors and encourage us to increase awareness of our population and to develop more effective strategies to combat these risks, as developed countries have done by improved prevention of eating habits and lifestyle. For Hospital

mortality, the latest FAST-MI results from 2010 [20] showed a significant decrease in mortality, from 13.7% in 1995 to 4.4% in 2010 (68% reduction) following a greater involvement of the urgent medical help service, in our case, our prevalence is 5% (7.2 for STEMI), there is a decrease in mortality especially with myocardial reperfusion by thrombolysis.

Nevertheless, we are being asked to reduce the time taken to take care of the public by raising awareness to consult soon after chest pain; and the establishment of a system of care of patients in pre-hospital [23].

## Strengths and Limitations of the Study

The strengths of this study include the large sample size of our study population as well as its representativeness and the prospective type of patient selection. Our study was conducted on the basis of a largely detailed questionnaire comprising 30 socio-demographic, clinical, epidemiological, behavioral and health-related variables. The analysis of the study has allowed us to better understand the epidemiology of AMI in our wilaya to explore the characteristics of risk factors. To our knowledge, this study is the first to calculate the prevalence of this pathology in a context of population register over a period of 4 years of registration of STEMI and NSTEMI in Algeria and aimed at identifying risk factors. Nevertheless, the study has some limitations that need to be flagged. Interesting emergency services and firefighters not only the quality of the medical record not allowing a quality control for the validation of diagnoses but also the level of knowledge of the practitioner and the availability of necessary means such as thrombolytic for a rapid and qualitative management of coronary heart disease. These issues highlight the need for an effective network with these services.

## Conclusion

The Setif-AMI register is a first experience in Algeria. It allowed us to release epidemiological data of high values; the number of new cases grows gradually because of the high prevalence of risk factors linked to the change of lifestyle. These results obtained by the registry are a starting point for monitoring ischemic heart disease in Setif. However, we are aware that the recorded incidence rates are surely below the reality, as the pathology remains very little known by the population. Finally, the evaluation of the emergency network that our center has created in collaboration with the health and population department with local hospitals reveals encouraging results, delays and efficiency, but also shortcomings for health services their involvement must be one of our priorities in a future program.

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