

Acute Coronary Syndrome with Persistent ST-Segment Elevation in Young Subjects Under 40 Years Old: About 17 Cases at The Montluçon Hospital Center

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Abstract

Introduction: Atherosclerosis is a dynamic process that begins in early childhood and progresses slowly, making acute coronary syndrome an unusual entity in young subjects. The aim of this study is to investigate the epidemiological, clinical, electrical, and angiocoronarographic features of acute coronary syndrome with persistent ST-segment elevation myocardial infarction (STEMI) in young subjects.

Materials and Methods: We conducted a cross-sectional, retrospective, single-center, descriptive, and analytical study over a period of 5 years from January 1, 2019, to December 31, 2023. Patients of both sexes and aged less than 40 years admitted for acute coronary syndrome with persistent ST-segment elevation were included in our study.

Results: The prevalence of STEMI was 17/374 (4.5%) with a sex ratio (M/W) of 2.4. The mean age of the patients was 36.7 ± 3.8 years (men = 37.3 ± 3.6 years; women = 35.4 ± 4.2 years). Cardiovascular risk factors were dominated by active smoking (82.3%), coronary heredity (58.8%), and overweight (41.2%). None of our patients had diabetes. Chest pain was typical in 14/17 (82.3%) patients. In 58.8% of cases, the culprit lesion was located on the proximal Left anterior descending artery (LAD), followed by the right coronary artery (RCA) and the circumflex artery (CX) in 5/17 (29.4%) and 2/17 (11.8%) cases respectively. Coronary lesions were monotruncular in most cases (12/17). The average hospital stay was 4.9 ± 2.7 days.

Conclusion: STEMI in young people under 40 years of age is much more common in males who smoke and have a coronary artery disease hereditary. The lesions are most often monotruncular, with excellent short-term prognosis. However, it is important to emphasize secondary prevention to limit complications of the dynamic process that is atherosclerosis.

Keywords

STEMI, Young subject under 40, Active smoking, Coronary heredity.

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Abbreviations

CRP:	C-Reactive Protein
CVD:	Cardiovascular Diseases
CX:	Circumflex Artery
ECG:	Electrocardiogram
ENACT:	European Network for Acute Coronary Treatment
LAD:	Left Anterior Descending artery
LDL:	Low-Density Lipoproteins
LVEF:	Left Ventricular Ejection Fraction
RCA:	Right Coronary Artery
STEMI:	ST-segment Elevation Myocardial Infarction.

Introduction

Cardiovascular diseases (CVD) are on a steady rise and remain the leading cause of mortality worldwide, accounting for approximately 17 million deaths each year [1,2]. Among these deaths, it is estimated that 7.4 million are due to coronary heart disease [1]. These coronary disorders mainly affect men over the age of 60, according to major international registries such as the European Network for Acute Coronary Treatment (ENACT) [3]. Young subjects, often smokers and without prior cardiovascular history, are not exempt. Acute coronary syndrome with persistent ST-segment elevation (STEMI) is often the clinical manifestation of coronary artery disease in these cases and results from destabilization of a single coronary lesion. It is suspected that these STEMI are related to pathophysiological mechanisms described by Virmani [4], such as plaque rupture or erosion. In the study by Collet JP et al. [5] published in 2000 concerning atherothrombotic coronary disease in young subjects, smoking (90% of patients), hypercholesterolemia (50% of patients), and a family history of coronary disease (50% of patients) were the main risk factors found, providing an almost infallible diagnostic tool. Although coronary atheroma begins early in life, acute coronary syndrome in individuals under forty (40) years of age remains rare. The objective of our study is to identify the epidemiological, clinical, electrical, and angiographic features of acute coronary syndromes with ST-segment elevation (STEMI) in young subjects under 40 years old.

Methods

We conducted a retrospective, single-center, descriptive, and analytical study over a period of 5 years, from January 1, 2019, to December 31, 2023.

Study Population

Inclusion Criteria: we included in our study:

- All patients of both sexes,
- Aged under 40 years at the time of the coronary angiography,
- and admitted for acute coronary syndrome with ST-segment elevation,
- who underwent coronary angiography.

Exclusion Criteria: we did not include in our study:

- Records that did not contain an interpretation of the electrocardiogram tracing.

- Definition of variables: the diagnosis of ST-segment elevation acute coronary syndrome (STEMI) was based on:
- Clinical presentation: the typical form involved a retrosternal, constrictive, very severe pain, radiating to the forearms and jaw, lasting more than 20 minutes, resistant to nitroglycerin, and usually occurring at rest.
- And the electrocardiogram: characterized by the presence of tall, symmetrical, peaked T waves ($> 2/3$ of R waves) very early (< 3 hours); the presence of a Pardee wave, even if only millimetric, with a mirror image; and the presence of a new onset left bundle branch block.

Data Analysis

Data was collected using a survey form, entered with Microsoft Word Office 2016, and analyzed with EPI INFO software version 7.2.1.0. Qualitative variables are presented as counts followed by percentages. Quantitative variables are presented as mean $\pm$ standard deviation.

Ethical Consideration

Data confidentiality was ensured by restricting access to records and by maintaining anonymity.

Results

Epidemiological Data

A total of 17 patients (12 men and 5 women; sex ratio (M/F) = 2.4) were included in our study. The prevalence of STEMI was 17 out of 374 (4.5%). The mean age of the patients was 36.7 ± 3.8 years (men = 37.3 ± 3.6 years; women = 35.4 ± 4.2 years), with extremes ranging from 29 to 39 years.

Clinical Data

The cardiovascular risk factors identified were mainly active smoking, a family history of coronary disease, and overweight, found respectively in 82.3%, 58.8%, and 41.2% of patients. Hypercholesterolemia was present in 3 patients (17.6%), and arterial hypertension (HTA) in 2 patients (11.7%). None of the patients had diabetes. Tobacco use was exclusively cigarettes.

Chest pain was typical in 14 out of 17 (82.3%) patients. Symptoms associated with chest pain were present in only 3 patients, consisting of digestive signs (2 out of 17) and shortness of breath (1 out of 17). Upon admission, the majority (15 patients) were in good hemodynamic condition, at stage I of the Killip classification. One patient was in cardiogenic shock (Killip IV) and another at Killip stage II.

Paraclinical Data

The electrocardiogram (ECG) showed a sinus rhythm in all patients, with no arrhythmia or conduction disorders upon admission. ST-segment elevation was most often observed in the anteroseptal and inferior territories (Table 1).

From a biological perspective, there was a predominance of leukocytosis with an average of $13,246 \pm 4,005$ neutrophil

granulocytes, ranging from 6,530 to 19,300, without a significant increase in C-Reactive Protein (CRP) levels. The average Low-Density Lipoproteins (LDL) cholesterol level was 1.3 ± 0.5 g/l, with extremes of 0.7 and 2.7 g/l. Most patients, 10 out of 17 (58.8%), had an LDL cholesterol greater than 1.10 g/l. The mean triglyceride level was 1.6 ± 0.6 g/l, with a range from 0.8 to 2.8 g/l.

Table 1: Distribution of patients according to the territory of ST-segment elevation on ECG.

Territory	n	Percentage (%)
Anteroseptal	05	29,4
Inferior	05	29,4
Circonfere ntial	02	11,8
Antero-septo-apical	02	11,8
Infero-lateral	01	05,8
Novel LBBB*	02	11,8
Total	17	100,0

LBBB* = Left bundle branch block.

On transthoracic echocardiography, the left ventricular ejection fraction (LVEF) was preserved in 14 out of 17 patients (82.3%), moderately impaired in 2 out of 17, and severely impaired in 1 out of 17. In 12 out of 17 patients (70.6%), there were segmental wall motion abnormalities corresponding to the territory of ST-segment elevation on the ECG.

Coronary Angiography Management

Coronary angiography was performed just a few minutes after the initial qualifying ECG, on average 2.5 hours after the onset of chest pain. All patients were transported by SAMU. In 58.8% (10/17) of cases, the culprit lesion was located on the proximal left anterior descending artery (LAD), followed by the right coronary artery (RCA) and the circumflex artery (CX) in 5/17 (29.4%) and 2/17 (11.8%) of cases, respectively. An occlusion of the culprit artery was observed in only 11/17 (64.7%) patients. One patient had a chronic occlusion located on the mid RCA. Most of the coronary lesions were single vessel (12/17). Triple-vessel lesions were found in one patient. Eight patients (8/17) showed a thrombotic appearance at the site of the culprit lesion. All patients underwent angioplasty to treat the culprit lesion. A repeat coronary angiography with angioplasty to treat significant, non-culprit lesions was performed in 8/17 patients.

Evolution and Complications

Complications during hospitalization were mainly arrhythmic, with ventricular tachycardia and ventricular fibrillation observed in 3 out of 17 patients. No hemorrhagic or mechanical complications were noted. The average length of hospital stay was 4.9 ± 2.7 days, ranging from 2 to 12 days.

Discussion

Acute coronary syndrome is rare in young individuals and is not widely described in the literature. The cardiovascular risk factors identified include male sex, smoking, and a family history of coronary disease [6-8]. In contrast, other "classic" risk factors such

as hypertension or diabetes are less frequently reported. Finally, other risk factors have also been noted in this population, such as low socioeconomic status, drug use (particularly cocaine, which can cause coronary spasm), hemostatic disorders (such as V Leiden Factor mutation), vascular diseases (like Kawasaki disease), and connective tissue disorders [9].

In our series, 14 out of 17 (82.3%) patients presented with typical angina-like chest pain. This confirms the importance of thorough history-taking in the etiological evaluation of chest pain, especially in young individuals where the diagnosis of acute coronary syndrome is not considered first. Any chest pain, regardless of the patient's age, should be characterized, even in very young cases, to avoid missing a critical diagnosis.

Clinically, the striking nature of chest pain, often intense, contrasted with the generally satisfactory hemodynamic status of the patients, with Killip class I observed in 15 out of 17. Arrhythmic complications were rare (2 out of 17). We did not record any conduction disorders or mechanical complications.

The electrocardiogram remains an essential diagnostic tool that points to the culprit artery. The coronary lesions were single vessels in most cases (12 out of 17), most frequently located on the left anterior descending artery (10 out of 17), followed by the right coronary artery (5 out of 17). Several authors [8-11] have reported similar results in their series.

Very few complications were observed in our series, with excellent angiographic results. Thus, the short- and medium-term prognosis for these young individuals is quite satisfactory. It is essential to follow medical prescriptions to prevent complications such as stent thrombosis or in-stent restenosis, and to prevent the progression of atherosclerosis in these young subjects through the correction of modifiable cardiovascular risk factors and a healthy lifestyle. Smoking cessation is mandatory. Therapeutic education must also target all young people with a family history of coronary disease, with the aim of promoting primary prevention. Cardiac rehabilitation is imperative.

Conclusion

In our study, it appears that STEMI in young individuals under 40 years old concerns mainly male patients who smoke and have a family history of coronary disease. These patients have no personal history of cardiovascular disease, and STEMI is the first manifestation of their coronary condition. Other major atheroma risk factors such as diabetes, hypertension, and hypercholesterolemia are less frequently observed. Lesions are most often single-vessel, located on the anterior interventricular artery, with an excellent short- and medium-term prognosis when treated with angioplasty. However, it is important to emphasize secondary prevention to limit complications from the dynamic process that is atherosclerosis. A multidisciplinary approach involving tobacco cessation specialists and nutritionists could improve disease outcomes.

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