Specific Features of Chest Pain in Young People Treated in Prehospital Care

Sondes Laajimi, Haifa bradai, nabil chebbi, dorra Loghmari, imene el kissi, naoufel chebili, rabeb mbarek

Emergency medical service department 03, University Sahloul Hospital, Sousse, Tunisia
Faculty of Medicine of Sousse, University of Sousse

Abstract

Background: Chest pain is a frequent cause of emergency department (ED) visits and prehospital interventions. While cardiovascular etiologies are prioritized, many cases have non-cardiac causes. Young patients (<45 years) represent a unique subgroup requiring targeted evaluation to optimize prehospital care.

Objective: This study describes the epidemiological, clinical, electrocardiographic, and therapeutic characteristics of patients under 45 years treated for chest pain in prehospital settings, with a focus on acute coronary syndrome (ACS).

Methods: We conducted a longitudinal observational study over six months (July–December 2022) in the Emergency Medical Services (EMS) center of Eastern Tunisia. We included patients under 45 years presenting with acute anginal chest pain requiring Emergency Medical Response Team (EMRT) intervention or managed via medical regulation. Data collection included patient demographics, pain characteristics, vital signs, ECG findings, prehospital management, and angioplasty outcomes.

Results: Among 74 cases, the mean age was 35.5 years (±8.5), with 85.1% male. First medical contact was an EMRT physician in 8.1% of cases and an ED physician in 91.9%. Typical chest pain was reported in 45.9%, predominantly retrosternal (62.2%) and radiating to the left arm (23%). ACS was more frequent in men (p=0.004), smokers (p=0.001), and those with cardiovascular risk factors (p=0.015). ACS cases had higher pain intensity (p=0.001).

Conclusion: Smoking and cardiovascular risk factors strongly predict ACS in young patients. Improved prehospital triage and risk stratification tools are needed to enhance early ACS diagnosis and management.

Keywords: Chest Pain, Acute Coronary Syndrome Prehospital Care Young Patients Risk Stratification

INTRODUCTION

Chest pain is a frequent reason for emergency department visits. It accounted for approximately 5% of annual emergency department visits in the United States in 2020 (1), making it the second most common complaint. It is also a frequent reason for calling emergency medical services (EMS), with studies reporting up to 20% of calls (2,3) and up to 16% of their intervention activities (4). Patients present with a range of signs and symptoms reflecting numerous possible etiologies. Cardiac, aortic, pulmonary, esophageal, gastric, Mediastinal, pleural, and abdominal visceral pathologies can all cause chest pain. Thus, the treating physician evaluating a patient presenting with this complaint must always consider the most fatal etiologies, primarily cardiovascular diseases, which cause approximately one-third of deaths worldwide (5),

while taking into account the patient's underlying condition. Acute coronary syndrome represents one of the most formidable cardiovascular pathologies, alone responsible for 1.8 million deaths worldwide in 2020 (5). In addition to acute coronary syndrome, other severe etiologies, such as pulmonary embolism, aortic dissection, and pneumothorax, must not be overlooked (6). These multiple and severe pathologies mean that patients suffering from chest pain tend to be systematically overestimated, increasing the use of ambulance resources and contributing to the overcrowding of emergency departments. Moreover, most patients suffering from chest pain transported by ambulance can ultimately be diagnosed with a transient non-cardiac illness. Indeed, according to studies, only 5 to 10% of patients complaining of chest pain have acute coronary syndrome (4,7,8), and up to a quarter of the population may present with non-cardiac chest pain (9). Especially in young subjects, several benign diagnoses, such as gastro-esophageal reflux disease (GERD), musculoskeletal causes, and psychiatric causes, increase the risk of non-cardiac chest pain (10).In this context, our work aims to describe the epidemiological, clinical, electrocardiographic, and therapeutic characteristics of patients treated for chest pain in Prehospital care and the particularities of chest pain related to acute coronary syndrome occurring in young subjects under 45 years of age

METHODS

Study Design: This is a descriptive longitudinal observational study conducted by the emergency medical services center in Est of Tunisia (03) over 6 months, from July 1, 2022, to December 31, 2022.

Study Population: we have included in this study, patients under than 45 years old, managed in the Prehospital setting for acute anginal chest pain requiring intervention by EMRT(Emergency Medical Response Team), either as a primary transfer(Including Prehospital interventions and those in peripheral hospitals lacking advanced technical facilities); Chest pain cases managed by the medical regulation 03 without EMRT intervention, with indication for another type of intervention and transport (civil protection, type B ambulance) due to unavailability of resources and patients who presented with acute coronary syndrome (ACS) confirmed by ECG and/or troponin assay. Exclusion Criteria was essentially secondary interventions for patients presenting with ACS.

Data Collection: This is an exhaustive study in which data collection was carried out using a pre-filled form for all patients meeting the inclusion criteria, as they were identified, based on data from the intervention and regulation forms as well as the EMS 03 chest pain registry. Follow-up until angioplasty was performed for each patient (when possible) to monitor the evolution and complete the forms. The measured variables are: General characteristics of the population, Characteristics of chest pain, Clinical data after the first examination by the EMRT or the first-contact physician (evaluation of vital signs, ECG: 12 or 17 leads, initial prehospital management, Evolution, thrombolysis (success/failure), angioplasty, and culprit artery and Complications presented by the patient.

Operational Definition of Variables (11): ST-elevation myocardial infarction (STEMI): New ST-segment elevation at the J-point in at least two contiguous leads; Non ST elevation coronary infarction, NSTEMI (Patients with NSTEMI were classified by risk stratification according to ESC 2023 recommendations) (12); STEMI equivalent (Wallens syndrome, Winter syndrome, New-onset left bundle-branch block, ST sub-shift > 1 mm in

6 or more leads with ST+ limited to RV and/or V, Atypical ST elevation); Successful thrombolysis (12) is defined as decrease in ST-segment elevation by at least 50% at 60 - 90 min of thrombolysis, occurrence of reperfusion arrhythmia and disappearance of chest pain.

Data analysis was performed using SPSS software. For descriptive study:

- The normal distribution of variables was verified by the Kolmogorov-Smirnov test.
- Continuous variables following a normal distribution are expressed as means and standard deviations.

Continuous variables not following a normal distribution are expressed as medians and interquartile ranges [25%-75%].

Discontinuons variables are presented in proportions.

For univariate analysis, means were compared using the independent samples Student's t-test.

Ethical considerations: This study was conducted in accordance with the ethical standards for research, ensuring the anonymity and confidentiality of data. The confidentiality of medical records was strictly maintained. The results of this study will be utilized solely for scientific purposes.

RESULTS

We included 74 calls and interventions by an EMRT for a young subject under 45 years old (Figure1)

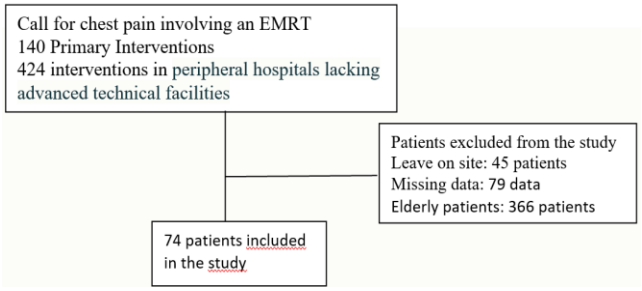

Figure 1: *Study Flowchart*

Socio-demographic characteristics: The mean age of our population was 35.5 years (±8.5), with extremes ranging from 10 to 45 years old. Among our patients, 63 (85.1%) were men, and 11 (14.9%) were women, with a male/female sex ratio of 5.7. (Figure 2)

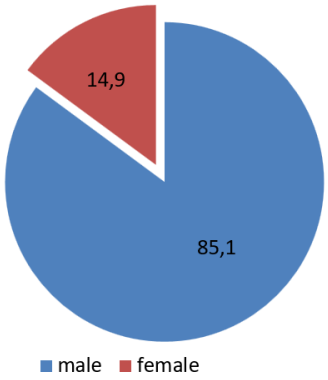

Figure 2: *Distribution of Patients by Gender*

First Contact Physician: The first contact physician with the patient presenting with chest pain was the EMRT intervention physician in 6 cases (8.1%) and the emergency department physician in a healthcare facility in 68 cases (91.9%). (Figure 3)

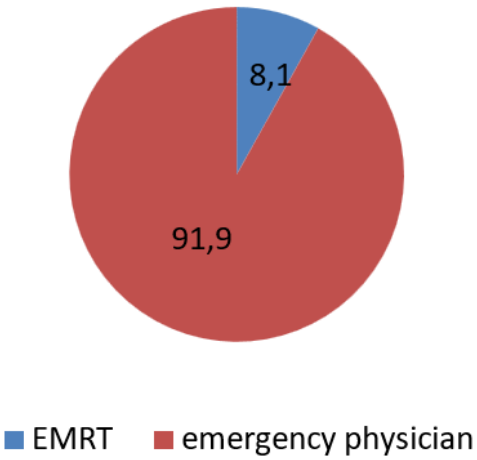

Figure 3: *First Contact Physician*

Medical History of Patients: Among our patients, 31 (41.9%) had medical histories considered cardiovascular risk factors. (Table 1)

Table 1: *Medical History of Patients*

Medical history	**N=74 (%)**
COVID19 Vaccination	11 (14.9)
Hypertension	5 (6.8)
Dyslipidémia	2 (2.7)
Diabetes	2 (2.7)
Ischemic Heart Disease	7 (9.5)
Established Vascular Disease (Stroke, PAD...)	5 (6.8)
Overweight	1 (1.4)
Active Smoking	31 (41.9)
Family History of Coronary Artery Disease	0
Sedentary Lifestyle	1 (1.4)
Pulmonary Embolism or Venous Thrombosis	1 (1.4)
Active Cancer	0
Recent Surgery or Immobilization	0
Coronary Artery Disease	6 (8.1)
Aspirin Use in the Last 7 Days	0
Heart Failure	2 (2.7)
Renal Failure	1 (1.4)
Respiratory Failure	3 (4.1)
Cardiovascular Risk	
Low	64 (86.4)
Moderate	7 (9.5)
High	2 (2.7)
Very High	1 (1,4)

Characteristics of Chest Pain: The chest pain in our study population is often typical (34; 45.9%), retrosternal (46; 62. 2%) radiating frequently to the left arm (17; 23%), described as a burning sensation (34; 44.6%), generally occurring at rest (35; 47.3%), often neglected by the patient and potentially lasting up to 15 hours. The patient is often in pain during the consultation (65; 87.8%), with persistent pain that can last up to 2 hours. Associated signs are discreet (7; 9.5%), predominantly dyspnea (3; 42.6%). The characteristics of the chest pain presented by our patients according to the age category are summarized in the following (Table 2).

Table 2: *Characteristics of Chest Pain*

Characteristics	N= 74 (%)
Chest Pain	
Typical	34 (45.9)
Atypical	40 (54.1)
Location	
Retrosternal	46 (62. 2)
Left Precordial	4 (5.4)
Right Précordiale	0
Basilar	6 (8.1)
Lateral	5 (6.8)
Epigastric	2 (2.7)
Poorly Specified	11 (14.9)
With Radiation	21 (28.4)
Radiation location	
Left Arm	17 (23)
Both upper limbs	1 (1.4)
jaw	1 (1.4)
right upper limb	1 (1.4)
scapular	1 (1.4)
Pain type	
Burning	34 (44.6)
Constricting	11 (14.9)
Oppressive	16 (21.6)
Tingling	4 (5.4)
Palpitation	9 (12.2)
Pain changes	8 (10.8)
Pain changes with	
Respiration	1 (12.5)
Palpation or Arm movement	7 (87.5)
Pain present at consultation	65 (87.8)
Onset time (hours)	15 [9 – 20]
Duration of chest pain (hours)	2 [1 – 7]
Pain onset	
At rest	35 (47.3)
On exertion	6 (8.1)
Not specified	33 (44.6)
Associated signs	7 (9.5)
Type of signs	
Sweating	1 (14.2)
Flu-like Syndrome	1 (14.2)
Dyspnea	3 (42.6)
Fever and chills	1 (14.2)
Nausea and vomiting	1 (14.2)

Clinical Parameters on Initial Examination: Patients usually present in a stable clinical state with a median VAS of 5. Table 3 summarizes the clinical parameters on the initial examination of our patients.

Table 3: Clinical parameters

Variable	N= 74, Median [IIQ]
SBP	120 [110 – 140]
DBP	70 [68 – 90]
HR	84 [78 – 97]
RR	18 [16 – 18]
SaO2	98 [98 – 99]
TRC	2 [1 – 3]
GCS	15
GAD	1.2 [1 – 1.6]
VAS	5 [3 – 8]

***SBP**: systolic blood pressure; **DBP:** diastolic blood pressure; **HR** heart rate, **RR**: respiratory rate, **TRC**: skin recolouring time**GAD**: capillary glycemia; **SaO2**: oxygen saturation**, EVA**: pain scale; **GCS:** Glasgow scale; **VAS:** Visual Analog Scale*

First ECG made: An ECG was performed in 71 (95.9%) cases, with a 12-lead ECG in 50 cases (67.6%) and a 17-lead ECG in 16 (21.6%) cases (Table 4).

***Table 4:** Characteristics of the first ECG made*

Variable	N=71 (%)
Normal ECG	10 (14)
Present Abnormality	
Repolarization	38 (53.5)
Rhythm	8 (11.2)
Conduction	7 (9.8)
Electrical Signs of ACS	36 (40.7)
STEMI	20 (55.5)
NSTEMI	10 (27.7)
STEMI Equivalent	2 (5.5)
Unstable Angina	4 (11.3)
Other Electrical Signs	
T wave Abnormalities	3 (42)
Pathological Q Waves	2 (2.8)
Benign Early Repolarization	4 (5.6)
Rhythm Disturbance	
Atrial Fibrillation	2 (28.5)
Supraventricular Tachycardia	3 (42.8)
ventricular Tachycardia	2 (28.5)
Conduction Disturbance	
Right Bundle Branch Block	5 (62.5)
Left Bundle Branch Block	3 (37.5)
Atrioventricular Block	0
Dynamic ECG changes	7 (9.8)
Repolarization changes	2 (28.5)
Rhythm changes	1 (14.2)
Normalization changes	4 (57.3)

STEMI: ST-Elevation Myocardial Infarction; ACS: Acute Coronary Syndrome; NSTEMI: nonST-Elevation Myocardial Infarction

A normal ECG is found in 10 to 14% of cases, repolarization disorders predominate (38, 53.5%), and STEMI-type (20, 55.5%).

Additional Examinations:

Troponin levels were measured in 19 (25.7%) patients, with serial measurements in 5 cases (26.3%). *(Table 5)*

***Table 5:** Troponin level*

Troponin	Young patients (N=71)
Measured	19 (25.7)
Positive Kinetics	5 (26.3)

A chest X-ray was performed in 7 (9.3%) patients. (Table 6).

***Table 6:** Frontal chest X-ray*

Variable	Young patient (N=7)
Pneumothorax	1 (14.2)
Interstitial Syndrome	1 (14.2)
Bronchial Syndrome	1 (14.2)
Normal	4 (57.1)

Etiology of Chest Pain: At the end of the emergency department evaluation, 57 (76%) of the subjects had cardiovascular etiologies for their chest pain. (Table 7)

Types and territory of ACS presented: Chest pain of cardiovascular origin is essentially related to STEMI (20, 55.6%), with the inferior territory being the most affected (11, 30.5%) (Table 8)

Risk Stratification according to ESC 2023 recommendations: Our patients were classified based on the risk established by the ESC 2023 recommendations. We found that 23 (71.9%) of the patients presenting with ACS were at very high risk, 2 (6.3%) were at high risk, and 7 (21.9%) were not classified as very high or high risk. (Table 9).

Table 7: *Etiology of chest pain*

Variable	**N=74**
Cardiovascular	59(79.7)
ACS	36 (61)
Myocarditis	3 (5)
Aortic Dissection	2 (3.3)
WPW syndrome	1 (1.7)
Supraventricular Tachycardia	1(1.7)
Atrial Fibrillation	1(1.7)
Ventricular Extrasystole	1(1.7)
acute pulmonary oedema	14 (14)
Tetralogy of Fallot	
Benign early repolarization	
Nonspecific repolarization abnormalities	
Pleuropulmonary	1 (1.4)
Pneumothorax	1 (100)
Psychiatric	5 (6.8)
Non specified	9 (12.2)

WPW: Wolff Parkinson syndrome; ACS: Acute Coronary Syndrome

Table 8: Types and territory of ACS

ACS	**(N=36)**
clinical Form	
STEMI	20 (55,6)
NSTEMI	12 (33,3)
Equivalent STEMI	2 (16,6)
Recent LBBB	1 (50)
Not specified	1 (50)
Instable Angina	4 (11,1)
Territory	
Anterior	6 (16,6)
Inferior	11 (30,5)
Lateral	1 (2,7)

LBBB: Left Bundle Branch Block; STEMI: ST-Elevation Myocardial Infarction

Complications of ACS: The main complication of the clinical presentation was the occurrence of a cardio-respiratory arrest during patient management, with 5 (13.8%) of the patients experiencing this complication. The outcome was spontaneous circulation return in 40% of cases and death despite resuscitation efforts in 60% of cases. No patient presented with Acute pulmonary edema (OAP), cardiogenic shock, or rhythm disorders

Table 9 : *Stratification du risque selon les recommandations ESC 2023*

Risk assessment	**(N=16)**
Very high risk	3 (18,8)
High risk	2 (12,5)
Not high risk	11 (68,8)

In the univariate analysis, factors associated with ACS in Young Patients Presenting with Chest Pain were as follows:

Gender: Men presenting with chest pain requiring intervention by a Mobile Emergency and Resuscitation Service (SMUR) team are at a higher risk of having an acute coronary syndrome than women for the same reason, with a statistically significant difference (55.6% vs 9.1%, p=0.004, OR=12.5).

Cardiovascular Risk Factors: Patients with known cardiovascular risk factors are more likely to have an acute coronary syndrome in the context of chest pain, with a statistically significant difference (64.5% vs 35.5%, p=0.015, OR=3.2).

Smoking: Smokers are at a higher risk of experiencing ACS in the context of chest pain, with a statistically significant difference (64.5% vs 35.5%, p=0.001, OR=9).

Characteristics of Chest Pain: Patients with typical chest pain, as assessed by the clinician, have a statistically significantly higher probability of having an acute coronary syndrome (ACS) compared to those with atypical chest pain (67.6% vs 32.4%, p=0.003, OR=4.3).

Duration of Chest Pain: The median duration of chest pain was 2 hours for patients with ACS compared to 6 hours for those without ACS, with no statistically significant difference (p=0.327).

Pain Intensity: Patients diagnosed with ACS and presenting with chest pain had a statistically higher pain intensity score on the Visual Analog

Scale (VAS) compared to those without an ACS diagnosis (7 vs 3, p=0.001).

This analysis highlights various factors associated with Acute Coronary Syndrome (ACS) in patients presenting with chest pain, emphasizing the importance of gender, cardiovascular risk factors, smoking history, and chest pain characteristics, duration of pain, and pain intensity in the evaluation and management of ACS cases. (Table 10)

Table 10: *Factors Associated with Coronary Chest Pain in Young Subjects Under 45 Years Old*

VAS: Visual Analog Scale

Variable	ACS	No ACS	P	OR
Gender			0.004	12.5
Male	35	28 (44.4)		(1.5-
Female	(55.6)	10 (90.9)		103)
	1 (9.1)			
Cardiovascular Risk			0.015	3.2 (1.2-
Factors	20	11 (35.5)		8.6)
yes	(64.5)	27 (64.3)		
No	15			
	(35.7)			
Ischemic			0.004	-
Cardiopathy	7 (100)	28 (42.4)		
yes	0	38 (57.6)		
No				
Active smoking			0.001	9 (2.1-
yes	20	11 (35.5)		38.4)
No	(64.5)	15 (83.3)		
	3 (16.7)			
Typical ischemic			0.003	4.3 (1.6-
chest pain	23	11 (32.4)		11.5)
yes	(67.6)	27 (67.5)		
No	13			
	(32.5)			
Median duration of chest pain in hours	2[1–4]	6[1–48]	0.327	
Average VAS	7[4–9]	3[1–6]	0.002	

DISCUSSION

This study demonstrates that young patients examined by a Mobile Emergency and Resuscitation Service (SMUR) team for chest pain and presenting cardiovascular risk factors have a higher risk of acute coronary syndrome (ACS) compared to those without risk factors. Similarly, smoking patients with chest pain have an increased risk of ACS compared to non-smokers. These findings are consistent with the literature; indeed, young patients with ACS often have multiple classical cardiovascular risk factors, with up to 90% of them presenting at least one risk factor (13). Other factors that may play a role, not addressed in this study, include total cholesterol levels and systolic blood pressure. However, smoking remains a significant risk factor for coronary artery disease; it is the most common and modifiable risk factor among young individuals, with a relative risk of 1.36 for a 10-cigarette per day increase (14).

Furthermore, young patients more commonly present with typical chest pain suggestive of ACS than elderly individuals (15). Several studies indicate that young subjects experience more chest pain and typical symptoms than older subjects (16), which could be explained by sensory function impairment in older individuals (17). However, the use of the term "typical" to describe chest pain depends on the semiological description of pain and the clinician's expertise in evaluating this chest pain, especially in subjects with a non-diagnostic ECG (18).

Chest pain can have various etiologies, with cardiovascular causes being the primary consideration due to their life-threatening nature. In our study, 79.7% of young subjects presenting with chest pain had cardiac etiologies, a higher percentage than reported in the literature (3). This difference could be attributed to variations in emergency medical services across countries. In the United States, the first medical contact personnel are not always physicians, and timely transport to the emergency department is crucial for a comprehensive clinical examination and definitive diagnosis (4). ACS is the primary etiology to consider in chest pain; 48.6% of subjects had ACS, with 55.5% having ST-elevation myocardial infarction (STEMI).

Reviewing the literature suggests that in young subjects with ACS, the diagnosis of STEMI is also common (19,20). These patients often have familial cardiovascular risk factors, are smokers, and have abnormal lipid profiles; the most affected territory is the anterior region, whereas it was the inferior region in our study (17).

Psychological stress is an etiology to consider as a differential diagnosis after ruling out severe conditions (10). Patients experiencing psychological distress often report more chest pain. It is important to note that the etiological diagnosis of chest pain is not always evident in the literature cited series (4).

Typically, as demonstrated, STEMI in young individuals is not high-risk; however, young subjects with ACS can be at high risk of severity or mortality, especially in the presence of risk factors such as active smoking, family history of coronary artery disease, diabetes, hypertension, and dyslipidemia, which have a cumulative effect (21).

Strengths and limitations of the study: Our study established those young patients under 45 years with cardiovascular risk factors, a history of heart disease, and smokers are at very high risk of having acute coronary syndrome as the etiology of their chest pain. Therefore, identifying these risk factors is crucial for the regulating physician and guides the decision to engage an intervention team.

However, this study is limited by its retrospective nature, which restricts data collection to what is available in the patient's medical record. The study also suffers from selection bias, as it includes patients triaged by the regulating physician, who attempts to assess urgency through telephone interrogation to justify the need for engaging a medical team to examine and treat the patient. In-hospital patient follow-up is lacking. Results of emergency department or cardiology investigations for patients transported to hospital services are not always available, preventing an analysis of angioplasty rates, culprit artery analysis in young and elderly subjects, and survival analysis with the available data. Improved data synchronization between services will enhance clinical research.

Recommendations: Based on the study's conclusion, we recommend the following measures: Comprehensive assessment of cardiovascular history and classical cardiovascular risk factors (obesity, dyslipidemia, active smoking, hypertension, etc.) should be conducted for every patient presenting with chest pain, especially when seeking assistance through the emergency number 190, for optimal cardiovascular risk stratification. A diagnostic ECG should be performed within 10 minutes for every patient presenting with chest pain. A 12-lead ECG is mandatory, with additional leads as needed. Stratifying patients into very high-risk and high-risk categories is crucial for better destination management and patient treatment. Patients classified as very high-risk should be transported within two hours to a catheterization room for primary angioplasty, following the 2023 ERC recommendations. Synchronization between pre-hospital and in-hospital medical records is essential to promote scientific research and ensure better patient care.

CONCLUSION

Chest pain in young individuals is a common reason for emergency department visits and calls to emergency medical services. Adequate management, including thorough history taking, a detailed clinical examination, and an ECG, is essential for patient risk stratification. Acute coronary syndrome, one of the most feared etiologies, is prevalent, especially in young

individuals with cardiovascular risk factors, particularly smokers. Multidisciplinary coordination between medical regulation, emergency services, and cardiologists is necessary to ensure care in line with international recommendations.

REFERENCES

1. *Cairns C, Kang K. National Hospital Ambulatory Medical Care Survey: 2020 Emergency Department Summary Tables [Internet]. National Center for Health Statistics (U.S.); 2022 Dec [cited 2023 Oct 1]. Available from: https://stacks.cdc.gov/view/cdc/121911*
2. *Møller TP, Ersbøll AK, Tolstrup JS, Østergaard D, Viereck S, Overton J, et al. Why and when citizens call for emergency help: an observational study of 211,193 medical emergency calls. Scand J Trauma Resusc Emerg Med. 2015 Nov 4;23:88.*
3. *Zègre-Hemsey JK, Asafu-Adjei J, Fernandez A, Brice J. Characteristics of Prehospital Electrocardiogram Use in North Carolina Using a Novel Linkage of Emergency Medical Services and Emergency Department Data. Prehospital Emerg Care Off J Natl Assoc EMS Physicians Natl Assoc State EMS Dir. 2019;23(6):772–9.*
4. *Pedersen CK, Stengaard C, Friesgaard K, Dodt KK, Søndergaard HM, Terkelsen CJ, et al. Chest pain in the ambulance; prevalence, causes and outcome - a retrospective cohort study. Scand J Trauma Resusc Emerg Med. 2019 Aug 29;27:84.*
5. *Bueno H. Epidemiology of acute coronary syndromes. In: Camm AJ, Lüscher TF, Maurer G, Serruys PW, James S, editors. The ESC Textbook of Cardiovascular Medicine [Internet]. Oxford University Press; 2018 [cited 2023 Oct 1]. p. 0. Available from: https://doi.org/10.1093/med/9780198784906.003.0305*
6. *Brown A, Dingle HE, Brywczynski J, McKinney JJ, Slovis CM. The 5 Deadly Causes of Chest Pain: Recognizing the potentially lethal causes other than myocardial infarction. JEMS J Emerg Med Serv. 2017 Jan;42(1):55–63.*
7. *Deakin CD, Sherwood DM, Smith A, Cassidy M. Does telephone triage of emergency (999) calls using advanced medical priority dispatch (AMPDS) with Department of Health (DH) call prioritisation effectively identify patients with an acute coronary syndrome? An audit of 42 657 emergency calls to Hampshire Ambulance Service NHS Trust. Emerg Med J EMJ. 2006 Mar;23(3):232–5.*
8. *Lindskou TA, Andersen PJ, Christensen EF, Søvsø MB. More emergency patients presenting with chest pain. PloS One. 2023;18(3):e0283454.*
9. *Fass R, Navarro-Rodriguez T. Noncardiac chest pain. J Clin Gastroenterol. 2008;42(5):636–46.*
10. *Tsai CC, Chuang SY, Hsieh IC, Ho LH, Chu PH, Jeng C. The association between psychological distress and angina pectoris: A population-based study. PloS One. 2019;14(11):e0224451.*
11. *2023 ESC Guidelines for the management of acute coronary syndromes | European Heart Journal | Oxford Academic [Internet]. [cited 2023 Oct 11]. Available from: https://academic.oup.com/eurheartj/advance-article/doi/10.1093/eurheartj/ehad191/7243210?login=true*
12. *2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure [Internet]. [cited 2023 Sep 11]. Available from: https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Focused-Update-on-Heart-Failure-Guidelines, https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Focused-Update-on-Heart-Failure-Guidelines*
13. *Rabih R Azar. Coronary artery disease and myocardial infarction in young people [Internet]. Wolters Kluwer; 2022. Available from: https://www.uptodate.com/contents/coronary-artery-disease-and-myocardial-infarction-in-young-people?source=history#H2*
14. *Navas-Nacher EL, Colangelo L, Beam C, Greenland P. Risk factors for coronary heart disease in men 18 to 39 years of age. Ann. Intern Med. 2001 Mar 20;134(6):433–9.*
15. *Dai X, Busby-Whitehead J, Alexander KP. Acute coronary syndrome in the older adults. J Geriatr Cardiol JGC. 2016 Feb;13(2):101–8.*
16. *Tungsubutra W, Tresukosol D, Buddhari W, Boonsom W, Sanguanwang S, Srichaiveth B. Acute coronary syndrome in young adults: The Thai ACS Registry. J Med Assoc Thail Chotmaihet Thangphaet. 2007 Oct 1;90 Suppl 1:81–90.*
17. *Bęćkowski M, Kowalik I, Jaworski K, Dąbrowski R, Gierlotka M, Gąsior M, et al. Differences in Symptomatology and Clinical Course of Acute Coronary Syndromes in Women ≤45 Years of Age Compared to Older Women. Curr Probl Cardiol. 2021 Mar;46(3):100508.*
18. *Carlton EW, Than M, Cullen L, Khattab A, Greaves K. 'Chest pain typicality' in suspected acute coronary syndromes and the impact of clinical experience. Am J Med. 2015 Oct;128(10):1109-1116.e2.*
19. *Obaya M, Yehia M, Hamed L, Fattah AA. Comparative study between elderly and younger patients with acute coronary syndrome. Egypt J Crit Care Med. 2015 Aug 1;3(2):69–75.*
20. *Schoenenberger AW, Radovanovic D, Stauffer JC, Windecker S, Urban P, Niedermaier G, et al. Acute coronary syndromes in young patients: Presentation, treatment and outcome. Int J Cardiol. 2011 May 5;148(3):300–4.*
21. *Le risque cardio-vasculaire chez le jeune patient présentant une cardiopathie ischémique: étude rétrospective sur 71 cas A. Samih, S. Kaddaf, S. Faid, M. Nadif, N. Mouine, I. Asfalou, M. Raissouni, Z. Lakhal, A. Benyass. Centre de Cardiologie de l'Hôpital Militaire d'Instruction Mohamed V de Rabat. - Google Search [Internet]. [cité 16 mai 2024]. Disponible sur: https://www.amcar.ma/ressources/att/posters/2020/402/402-2020-60.pdf*