

# Cardiovascular repercussions in cocaine users: an integrative review

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## ABSTRACT

**Introduction:** The use of cocaine is considered an important health problem. An increasing number of patients in the emergency services report symptoms related to cardiovascular changes after its use. **Objective:** To present the cardiovascular repercussions promoted by cocaine, associating its consumption with possible fatal outcomes, besides discussing the best ways to approach the patient in the emergency. **Method:** Integrative literature review in the electronic databases LILACS, MEDLINE, IBECs, SciELO, Sao Paulo Municipal Health Department, State Health Secretariat of São Paulo, Coleção UHS, available at the VHL, as well as PubMed. **Results:** After careful analysis, 44 articles met the inclusion criteria. Studies were conducted in Europe (25%), Australia (6.82%) and the American continent (68.18%). **Discussion:** Cocaine abuse is considered an isolated risk factor for cardiovascular disease, independent of others. Therefore, young patients admitted with chest pain should be asked about the use of this drug. The treatment of AMI associated with cocaine use is similar to that performed in a non-user patient. Despite the controversy over whether or not there is a contraindication to the use of beta-blockers; several studies indicate the use of alpha and beta-blocker drugs in these patients. **Conclusion:** it was found that the main cardiovascular repercussions found in cocaine users who sought care in hospital emergencies were hypertensive emergencies/urgencies, supraventricular tachycardia, angina, acute myocardial infarction, dissection, and aortic aneurysm.

**Keywords:** Cardiovascular Diseases; Cocaine; Myocardial Infarction.

## INTRODUCTION

There has been an annual increase in the number of emergency services provided by illicit drug users, especially concerning to symptoms related to cardiovascular changes, with cocaine being the main cause of these symptoms<sup>1</sup>.

The population most in need of medical care, due to the use of this drug, are men, with a history of smoking and/or alcoholism, presenting an average age of 30 years, who, after using the drug, develop symptoms, with thoracic pain being 40% of the complaints raised. Thus, the possibility of using cocaine in these patients should always be raised<sup>2,3,4</sup>.

Currently, cocaine use is considered an important health problem. The ease of acquisition and use, whether inhaled or smoked, are among the factors that corroborate the increase in cocaine use. The main cardiovascular alterations presented are: cardiomyopathy, electrocardiographic abnormalities, left ventricular hypertrophy, arrhythmias, sudden death and acute coronary syndrome (ACS) of non-atherosclerotic etiology<sup>5,6,7,8,9</sup>.

Other cardiovascular changes were also observed in these patients, such as ischemia, acute aortic syndrome, which involves dissection and rupture of the aorta, myocarditis and coronary artery aneurysm<sup>1</sup>.

The pathophysiological mechanisms involved between cocaine use and cardiovascular changes are not fully understood and are probably multifactorial. However, it is known that the drug blocks the re-capture of dopamine and noradrenaline in the synaptic cleft, which causes an adrenergic (sympathetic) stimulation and subsequent feeling of well-being in the individual, which awakens the addiction. In addition, there is an increase in heart rate, and consequently a greater consumption of oxygen by the myocardium, associated with a decrease in blood supply (supply-demand imbalance). Some studies have also proven an initial vasodilator action and, later, coronary vasoconstrictor, in addition to an increase in platelet aggregation with consequent formation of thrombus<sup>10, 11, 12</sup>.

The relationship between cocaine use and its cardiovascular repercussions is an issue that must

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be addressed at all levels of attention due to the growing number of adults who lose their lives to drug abuse. Thus, the importance of training health professionals to raise awareness among drug users in the most affected areas and, especially, during the initial care of patients who, after intoxication, present symptoms of chest pain, palpitations, among others, is highlighted, so that they can reverse this critical condition.

Therefore, this study aims to present the cardiovascular repercussions promoted by cocaine, associating its use with possible fatal outcomes, besides discussing the best ways to approach this patient in the emergency room.

## METHODS

This study proposes a reflection on the current panorama of publications on cardiovascular repercussions on cocaine users. For its development, the assumptions of the integrative literature review were used. The guiding question was: "What are the most prevalent cardiovascular repercussions in cocaine users?".

Searches of scientific articles were carried out indexed in the following databases: Latin American and Caribbean Literature on Health Sciences (LILACS), National Library of Medicine (MEDLINE), Spanish Bibliographic Index of Health Sciences (IBECS), São Paulo Municipal Health Secretariat, São Paulo State Health Secretariat, Coleciona UHS and Scientific Electronic Library Online (SciELO), available at the Virtual Health Library - VHL (<http://www.bireme.br>), in March 2020, as well as in Pubmed in April 2020. The descriptors "acute myocardial infarction, acute myocardial infarction, myocardial infarction, heart attack, acute myocardial infarction" were combined through the "OR" connector and all these were combined with the descriptor "cocaine" through the Boolean "AND" connector.

Through the search, 350 documents were initially traced, being in the bases MEDLINE (299), LILACS (29), IBECS (12), Municipal Health Sec. SP (02), State Health Sec. SP (01), Coleciona UHS (01), Pubmed (06).

The following inclusion criteria were then used: studies covering the last ten years, published

in full text and in English, Spanish and Portuguese, leaving 68 articles identified.

From the careful reading of titles and abstracts, 24 articles were excluded for not being within the established criteria, 9 for the duplicity of articles and 15 for publications that did not meet the objective of the research.

Finally, the corpus consisted of 44 articles.

## RESULTS

At the end, 44 studies were included to integrate this review article. Of these, it was observed that the professional category with more interest in studying the subject is the physician.

It was noticed that in the last ten years the relevance for this theme has remained in evidence. From 2010 to 2014 21 articles were found (47.73%) and from 2015 to 2019, 23 (52.27%).

Of the 44 studies selected, 11 (25%) were conducted in Europe, three (6.82%) in Australia and 30 (68.18%) on the American continent, 22 (73.33%) of them in the United States and eight (26.67%) in South America. Of these, only two were Brazilian.

According to the languages used in the publications, the predominance of the English language in the articles was notorious, making a total of 34 (77.27%), while nine (20.45%) were in Spanish and one (2.27%) in Portuguese.

## DISCUSSION

From reading the articles, it was possible to define 3 thematic axes, being them the epidemiology, pathophysiology and the most appropriate conduct about the cardiovascular repercussions presented by cocaine users when going to the emergency service.

### *Epidemiology of cardiovascular repercussions caused by cocaine*

It was observed that most of these patients seek care due to the presence of chest pain, not always being asked in their anamnesis about the use of illegal drugs<sup>5, 7, 8, 13</sup>.

Since this is the main symptom, it is convenient to ask all young patients admitted with chest pain whether he/she used cocaine, including considering the collection of specific metabolites in the urine test or serum<sup>8, 14, 15, 42</sup>. Both tests were found to have similar negative predictive values, while serum has a higher positive predictive value<sup>42</sup>.

In addition, failure to investigate this issue may lead to underreporting and underestimation of prevalence, since the diagnosis of cocaine use may not have been confirmed by the analytical study, but only based on the anamnesis performed<sup>16</sup>.

The patients affected were mainly men, during the third decade of life, to whom most were smokers and alcoholics<sup>2, 17, 18, 19, 20, 21</sup>.

Among them, the largest amount did not present any previous comorbidity, indicating that cocaine abuse is considered an independent risk factor for adverse cardiovascular events<sup>19, 22, 23</sup>.

Thus, among the patients who presented acute myocardial infarction (AMI) and made previous use of cocaine, the highest percentage was of ST-segment elevation acute myocardial infarction (STEMI) and cardiogenic shock, while others manifested ST-segment elevation acute myocardial infarction (STEMI), with heart failure in its presentation<sup>19, 24, 25</sup>.

It was also observed that the risk of developing AMI during the first hour after cocaine use is 24 times higher than that of the patient who did not make this use, remaining this risk for a few hours<sup>26</sup>.

In contrast to what has been presented so far, when evaluating data on hospital admissions in the United States, Singh et al.<sup>27</sup> found that hospitalizations of patients with chest pain who used cocaine are associated with low rates of adverse outcomes, and the diagnosis of ACS largely ruled out.

### *Pathophysiology of cardiovascular repercussions caused by cocaine*

Regarding pathophysiology, cardiovascular complications associated with cocaine such as arrhythmia, AMI and sudden death are usually linked to excess catecholamine, which results in increased sympathetic activity, mediated by

the neurotransmitter noradrenaline, which acts by increasing the metabolic demand for oxygen through tachycardia, the elevation of blood pressure and hyperdynamic left ventricle. The drug presents strong arterial vasoconstrictor action by stimulating adrenergic receptors, increased production of endothelin-1 (a potent vasoconstrictor) and decreased nitric oxide<sup>10, 12, 28, 29, 30, 31</sup>.

Cocaine users are more likely to develop cardiovascular events such as angina pectoris, AMI, sudden death of cardiac origin, cerebrovascular diseases and hypertensive crises. The electrocardiogram can be a cause of confusion in the Emergency Room, since it can present itself without alteration. Furthermore, markers of myocardial necrosis, such as CK-MB, may be elevated by other causes. Thus, what is most recommended is the use of troponin as a marker. Higher troponin values were observed in patients who developed AMI after cocaine consumption compared to those who did not use illegal drugs<sup>4, 11, 32, 33, 40</sup>.

Although infrequent, cardiovascular repercussions related to the use of illicit drugs, mainly cocaine, mechanical complications such as ventricular rupture and coronary dissection were also observed<sup>6, 9, 34, 35, 36, 37</sup>.

A very interesting point mentioned by Fuenzaiida et al.<sup>38</sup> in their study was that patients who used cocaine and evolved with AMI, presented coronary arteries without significant injury and with good flow, despite a higher incidence of thrombi, i.e., the presence of more diffuse atherosclerotic disease, with more plaques, but less severe. On the other hand, these patients exhibited a worse microvascular flow.

### *More appropriate conduct/treatment of cardiovascular repercussions caused by cocaine*

For decades there have been controversies about the prescription of the beta-blocker after the use of cocaine, although this medication is considered the first line in the treatment of ACS. It is thought that beta-blocker potentiates the effect of coronary artery vasoconstriction already caused by the illicit drug, in addition to the elevation of blood pressure, a phenomenon known as

unopposed alpha stimulation, an effect mediated by the alpha receptor<sup>41, 42</sup>.

Over the years, several studies have been conducted with beta-blockers. Although some professionals contraindicate their use in the management of patients after cocaine consumption, it was found that there were no deleterious effects in many of them. The use of propranolol, esmolol or labetalol did not negatively affect the treatment of hypertension and tachycardia caused in these patients. The use of beta-blockers showed potential benefit to heart hypertrophy and cardiomyopathy caused by chronic cocaine use. However, after observing the effects of selective and non-selective beta-blockers, it was found that the most indicated for these patients is a drug that is alpha and beta-blocker<sup>42</sup>.

Thus, the guidelines of the ACC (American College of Cardiology) and AHA (American Heart Association) recommend that for patients with a systolic BP higher than 150 mmHg or sinus tachycardia (higher than 100 bpm), the combined beta-blocker (alpha and beta) should be used. However, one hour before, it is convenient to administer a vasodilator, such as nitroglycerin (NO) or calcium channel blocker (CCB)<sup>41, 42</sup>.

According to a meta-analysis and systematic analysis performed by Bryan Lo et al.<sup>43</sup>, the use of beta-blocker is not associated with adverse clinical effects in patients with chest pain from cocaine use. In addition, this study showed that labetalol showed greater evidence of safety when used.

Damodaran<sup>42</sup> understood in his article that carvedilol would be the most indicated alpha and beta-blocker for this type of patient, since it has more alpha-blocker activity than labetalol, besides vasodilator property.

However, Richards et al.<sup>44</sup>, in their study, found that both labetalol and carvedilol had no adverse events when used in these patients, indicating that either one could be administered.

For patients admitted to the emergency service with symptoms of chest pain, but did not present infarction, one can choose to remain watching the patient for nine to 12 hours, performing the pharmacological management with aspirin, benzodiazepine, nitroglycerin and CCB. Regarding the use of beta-blocker, despite

the existing controversy, it should be evaluated if the benefit is greater than the risk for the patient<sup>1, 39, 41, 42</sup>.

When there is persistence in ST segment elevation, stent angioplasty is a superior procedure to fibrinolytic therapy. Those who did not present AMI, it should be conducted as an outpatient procedure, evaluating possible coronary diseases. In addition, to encourage secondary prevention of discontinuation of illicit drug use and smoking<sup>1, 39</sup>.

In those cases where only microcirculation was found to be compromised, intracoronary thrombolysis and the use of glycoprotein IIb/IIIa inhibitors were satisfactory, when the patient presents a good flow in the epicardial arteries<sup>38</sup>.

## CONCLUSION

After careful analysis of the articles, it was found that the most prevalent cardiovascular repercussions found in patients who sought care in hospital emergencies with chest pain after cocaine use were hypertensive emergencies/urgencies, supraventricular tachycardia, AMI, angina, dissection and aortic aneurysm.

It is suggested that, when facing a young patient without cardiovascular risk factors, with chest pain in the emergency room, the health professional pay attention to the investigation of cocaine use.

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### **Conflict of interest**

There is no conflict of interest of the authors concerning this manuscript.

### **Authors's contributions:**

The authors participated effectively in the elaboration of this article under the following main aspects:

Sara Regina Pereira Pantaleão:

- Contributed to the article planning and data collection through the databases;
- Read 26 articles related to the subject studied, selecting those compatible with the object of the study;
- Collaborated with the writing of all parts of the article;
- Collaborated with the formation of the table, including the articles studied by it;
- Added the references of the articles studied by him according to the Vancouver style.
- Added the citations of the articles according to the Vancouver style.

André da Silveira Ribeiro Lins:

- Contributed to the article planning and data collection through the databases;
- Read 20 articles related to the subject studied, making the proper selection of which fit with the proposed theme;
- Collaborated with the writing of the article;
- Collaborated with the formation of the table, including the articles studied by him;
- Formatted the material elaborated in the integrative revision model, including the table;
- Added the references of the articles studied by him according to the Vancouver style.

Manoel Marques de Souto Nóbrega Filho

- Contributed to the article planning and data collection through the databases;
- Read 22 articles related to the subject studied, selecting those compatible with the objectives of the study;
- Collaborated with the writing of the article;
- Participated in the planning and formatting of the table, including all articles selected for it;
- Contributed with the elaboration of the references of the articles selected for him according to the Vancouver style.

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Received in: Aug 3, 2020

Approved in: Nov 3, 2020

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Summary of selected studies by title, author, year of publication, professional category, language, country involved, objective and outcome or outcome.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
Cocaine disorders and acute myocardial infarction, prolonged stays and excess hospital costs.	GILI, Miguel; RAMÍREZ, Gloria; BÉJAR, Luis; LÓPEZ, Julio, 2014	Doctor	Spanish/ Spain	Analyze the relationship between the prevalence of cocaine disorders and AMI in patients over 18 years of age and their influence on mortality, length of stay and costs.	A total of 5,575,325 hospitalizations were studied, including 24,126 patients with cocaine use disorder and 79,076 cases of AMI. The prevalence of AMI among patients with cocaine use disorder increased with age and was higher among 55-64 years. Cocaine disorders are more prevalent among patients with AMI and regardless of age, sex, other addictions and comorbidities. Among those with AMI, those with cocaine disorders showed no higher mortality, but undue prolongation of hospitalizations (1.5 days) and excess costs (382 euros).
Cardiovascular effects of cocaine About two cases	RENER, Andres; FIGUEROA, Sebastian, 2014	Doctor	Spanish/ Uruguay	Report the cardiovascular effects of cocaine in two clinical cases.	Cardiovascular complications of cocaine use are currently a significant cause of consultation at all levels of attention. Thoracic pain is the main cause of consultation among consumers. Therefore, in all young patients admitted with chest pain, cocaine use should be questioned, considering the determination of metabolites in urine in specific cases.
Impact of an Abbreviated Cardiac Enzyme Protocol to Aid Rapid Discharge of Patients with Cocaine-associated Chest Pain in the Clinical Decision Unit.	GUIRGIS, Faheem; GRAY-EUROM, Kelly; MAYFIELD, Teri; IMBT, David; KALYNYCH, Colleen; KRAEMER, Dale; GODWIN, Steven, 2014.	Doctor	English/ United States	Report the impact of the protocol of cardiac enzyme decrease in a patient with thoracic pain associated with the use of cocaine.	There were 111 hospitalizations in the care unit with cocaine chest pain during the study period. One patient had delta CK-MB of 1.6 ng/ml, but had troponin T negative at all times. No patient had troponin T or CK-MB positive at 0, 2, 4 or 8 h, and there was no infarction or death in 30 days. Most were discharged from hospital (103) and there were 8 hospitalizations in the CDU. Of the patients admitted, 2 had negative additional stress tests, 1 had negative markers and all 8 patients were discharged home.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
Cocaine and chest pain	CORTÉS, Dr. Luis A. et al., 2012	Doctor	Spanish/ Colombia	Effect of thoracic pain associated with cocaine	Cocaine use has increased dramatically in recent years, as well as clinical manifestations inherent to its toxicity. The cardiovascular system is vulnerable to this damage, hence the importance that the doctors responsible for caring for this population are familiar with the different clinical pictures, their diagnosis and treatment.
Acute myocardial infarction associated with cocaine: a different entity?	FUENZALIDA, Alberto; VALDEBENITO, Martín; FAJURI, Alejandro, 2014	Doctor	Spanish/ Chile	To raise questions about the pathophysiology and management of patients who are having an STEMI and who report recent cocaine use.	From the angiographic point of view, AMI associated with the use of cocaine presents coronary arteries without significant lesion, ranging from 25 to 40%, lesions in less than 3 vessels and a higher incidence of thrombi. There may be a more diffuse atherosclerotic disease, with more plaques, but less severe stenosis. Some reports with intracoronary ultrasound show more fibrous eccentric plaque. Patients using cocaine present with a greater alteration of microvascular flow, because although they present coronary arteries without significant lesions and good epicardial flow, they show worse microvascular flow. Although they report a high rate of thrombus, aspiration and intracoronary thrombolysis were underused. Thus, there are successful reports of intracoronary thrombolysis and IIB/IIIa inhibitors. The experience shows a lower rate of stent use and dilation, presumably explained by good flow of epicardial arteries. All the items above, especially the noted phenomena of thrombosis and endothelial dysfunction with greater impact on the microvascular level, raise a number of doubts regarding the pathophysiology and the way to cope with hemodynamics in patients with STEMI and recent history of cocaine consumption.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
Acute myocardial infarction in patients under 40 years of age: clinical and angiographic characteristics and therapeutic alternatives	MÉNDEZ, Manuel; MARTÍNEZ, Gonzalo; VEAS, Nicolás; PÉREZ, Osvaldo; LINDEFJELD, Dante; WINTER, José Luis; ZUÑIC, Karla; MARTÍNEZ, 2013.	Doctor	Spanish/ Chile	Comparative analysis of clinical and angiographic characteristics and the treatment used in young patients with STEMI.	Of the 613 STEMI, 40 (6.5%) cases corresponded to minors under 40 (mean age 36.6 years). Of these, seven (17.5%) were women, 32 (80%) smoked, and 17 (42.5%) reported cocaine use. Most presented high thrombotic load (TIMI Thrombus Grade 4/5 in 87.5%), but with low anatomical severity disease. 30 (75%) patients received stent angioplasty and 21 (52.5%) had thrombus aspiration. The late follow-up revealed 5 (12.5%) important events. Compared to patients over 40 years old, mortality in one year was markedly lower: 2.5% versus 12%.
Characteristics, Management, and Outcomes of Cocaine-Positive Patients With Acute Coronary Syndrome (from the National Cardiovascular Data Registry).	GUPTA, Navdeep; WASHAM, Jeffrey B.; MOUNTANTONAKIS, Stavros E.; LI, Shuang; ROE, Matthew T.; LEMOS, James A. de; ARORA, Rohit, 2014	Doctor	English/ United States	Describe characteristics and outcomes of patients with AMI and recent cocaine use.	Patients positive for cocaine were younger, male, African-American race and had lower body mass index and higher probability of being smokers. Higher percentage of STEMI and cardiogenic shock.
Cocaine use and delayed myocardial ischaemia and/or infarction. Case Reports.	PHANG, K. W.; WOOD, A., 2014.	Doctor	English/ England	Summarize the risks of myocardial ischemia and/or infarction, as well as its pathophysiology, particularly the risks of delayed reaction, observed in patients using cocaine with chest pain treated in the emergency room.	Patients with pain associated with cocaine use should stay under observation for 12 hours. Those with higher risk characteristics will require a longer monitoring period. The risk of AMI is 24 times higher for any individual during the 1h period after cocaine use and continues for several hours after.
Is Cocaine-associated Acute Myocardial Infarction the Same as Myocardial Infarction Associated With Recent Cocaine Consumption? Response.	GILI, Miguel; RAMÍREZ, Gloria; BÉJAR, Luis; LÓPEZ, Julio, 2014.	Doctor	English / Spain	Analyze whether complications in AMI are the same in cocaine use and non-use patients.	It concluded that cocaine use increased the risk of AMI by three times, in addition to hospital stay and costs. Recent cocaine use increases complications of AMI, as well as hospital mortality. Due to difficulty in detecting use on initial contact, the European Guideline on ACS recommends specific questions on cocaine use in anamnesis, in addition to measuring cocaine metabolites in urine.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
The Epidemiology of the clinical and health effects associated with cocaine. Response.	GILI, Miguel; RAMÍREZ, Gloria; BEJAR, Luis; LÓPEZ, Julio, 2014.	Doctor	English / Spain	Analyze the impact of cocaine related disorders on patients treated in the hospital's emergency departments.	The costs of care for these patients are higher than those calculated for other hospitalized patients, besides absenteeism (number of absences and duration), loss of productivity, drug addiction treatment, social assistance and others.
Cocaine-induced isolated right ventricular infarction.	SMER, Aiman; HADDAD, Toufik Mahfood; ALLA, Venkata, 2015.	Doctor	English/ United States	Report isolated case of right ventricular infarction after cocaine use in young male without previous coronary disease.	Right ventricular infarction due to cocaine use should be considered in patients with acute right heart failure. Early recognition is critical for optimal management.
Current strategies in the evaluation and management of cocaine-induced chest pain.	AGRAWAL, Pratik R. et al., 2015.	Doctor	English/ United States	Demonstrate current strategies in the evaluation and management of thoracic pain induced by cocaine use.	Real low incidence of AMI in patients with cocaine induced chest pain (0.7-6%). Observing for 9-12 h is an economical management option in low risk patients. Aspirin, BZN, NO and CCB constitute the basis of pharmacological management, while the role of beta-blockers is still uncertain. If persistent ST-segment elevation and need for revascularization, stent angioplasty is superior to fibrinolytic therapy. Those who do not develop AMI or other complications should be followed at the outpatient clinic to evaluate possible arterial coronary diseases. Emphasis on secondary prevention of discontinuation of cocaine use and modifications of risk factors, such as smoking.
Epidemiology of clinical-assistance effects associated with cocaine use	GIRONÉS-BREDY, Clara; GALICIA, Miguel; DOMÍNGUEZ-RODRÍGUEZ, Alberto; URILLO-PUTZE,Guillermo, 2014.	Doctor	Spanish/ Spain	Provide additional epidemiological data and quantify admissions and AMI due to cocaine use.	Annual cocaine admissions were 0.44% and AMI for cocaine use was 2.2%. Risk of underreporting and underestimation of prevalence, as it is not known whether the diagnosis of cocaine use was corroborated by an analytical study or based solely on the patient's anamnesis.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
Vascular damage associated with cocaine use Clinical case	MASSARDO, Teresa et al., 2012	Doctor	Spanish/ Chile	Discuss the management of complications and the pathophysiology involved in cocaine induced vascular damage.	The use of cocaine represents an important risk factor for ischemic heart and brain complications. Especially, it may be present in young adults, preferably male, without risk factors, with conventional cardiovascular presentation and ischemic vascular events or neurocognitive alterations, although initially they do not recognize the addiction.
Cocaine-Using Patients With a Normal or Nondiagnostic Electrocardiogram: Single-Photon Emission Computed Tomography Myocardial Perfusion Imaging and Outcome	HENDEL, Robert C. et al., 2012	Doctor	English/ United States	Compared the characteristics and general results of cocaine users versus non-users who present in the emergency room a normal ECG and to evaluate the resting myocardial perfusion imaging (MPI) value in these two populations.	Users of cocaine with normal ECG present low risk of cardiac events. Nevertheless, SPECT MPI remains effective in risk stratification and improves screening management decisions, resulting in lower admission rates and higher rates for home.
Assessment of myocardial infarction by CT angiography and cardiovascular MRI in patients with cocaine-associated chest pain: a pilot study	PARASCHIN, K; ANDRADE, A Guerra de; PARGA, J Rodrigues, 2012	Doctor	English/ Brazil	The objective was to evaluate the incidence of previous AMI among young people (18 to 40 years old) with chest pain associated with cocaine by the evaluation of myocardial fibrosis by cardiovascular MRI.	Cardiovascular MRI did not detect the presence of delayed enhancement indicative of myocardial fibrosis in young cocaine users with low cardiovascular index, risk of complaining of thoracic pain associated with cocaine.
Hemodynamic and Arrhythmogenic Effects of Cocaine in Hypertensive Individuals	SECEMSKY, Eric; LANGE, David; WATERS, David D.; GOLDSCHLAGER, Nora F.; HSUE, Priscilla Y., 2011	Doctor	English/ United States	The objective of this study was to characterize variations in blood pressure, heart rate and ambulatory electrocardiograms in patients with hypertension during cocaine use.	Cocaine use has resulted in marked elevations of arterial pressure in patients with hypertension taking medication. Cocaine use was also associated with increased arrhythmic activity. These findings may underlie the increased risk of AMI, aortic dissection and potentially lethal arrhythmias in patients with hypertension who use cocaine.

Article title	Authors and Year of Publication	Professional Category	Language / Country involved	Objective of the article	Result or outcome
Cocaine-induced coronary thrombosis: what is the optimal treatment strategy	RUSOVICI, Arthur; VARKEY, Santosh; SAEED, Qaisra; KLAPHOLZ, Marc; HAIDER, Bunyad; KALUSKI, Edo, 2011.	Doctor	English/ United States	Discuss treatment strategies for coronary thrombosis from cocaine abuse.	Medical therapy offers an effective alternative for reducing the thrombotic mass in cocaine users who have coronary thrombosis. However, in front of the STEMI, continuous pain or electrical instability, it is possible to resort to emergency post-cutaneous coronary intervention using conventional methodology.
Carvedilol Therapy After Cocaine-Induced Myocardial Infarction in Patients With Asthma	SELF, Timothy et al., 2011.	Pharmacist and Doctor	English/ United States	Summarizes the effects of non-cardioselective beta-blockers and considers the risk/benefit of using carvedilol in patients with asthma who had cocaine induced AMI.	Carvedilol should be avoided in asthma patients with a history of cocaine induced AMI. Cardioselective beta-blockers should be used in post-AMI patients with non-serious asthma.
Acute left main coronary artery thrombosis due to cocaine use	APOSTOLAKIS, Efstratios; TSIGKAS, Grigorios; BAIKOUSSIS, Nikolaos G; KONIARI, Ioanna; ALEXOPOULOS, Dimitrios, 2010.	Doctor	English/ Greece	Describing thrombosis in the left main coronary artery in a young cocaine user who underwent emergency CABG for persistent post-infarct angina.	It is recommended that all these patients be treated surgically, especially patients with thrombus on the left side of the main artery.
Cocaine-induced epicardial coronary artery thrombosis resulting in extensive myocardial injury assessed by cardiac magnetic resonance imaging	ROBAEI, D.; GRIEVE, S. M.; NELSON, G. C.; BHINDI, R.; FIGTREE, G. A., 2010	Doctor	English/ Australia	This report presents two cases of cocaine induced coronary artery thrombosis without underlying stenosis, resulting in myocardial injury.	In these cases, magnetic resonance imaging illustrates extensive myocardial injury resulting from cocaine induced coronary artery thrombosis without underlying coronary artery disease.
Acute myocardial infarction related to cocaine use	DANTES, Andrea Castro; et al., 2010	Doctor	Portuguese/ Brazil	Discuss the current state of the pathophysiology and treatment of AMI related to cocaine use.	There is a correlation between cocaine use and AMI. The main pathophysiological mechanisms involved are: vasospasms, formation of secondary thrombosis, mainly the higher platelet aggregation, atherosclerosis, and increased myocardial oxygen demand. The treatment is similar to that performed in a patient who does not use cocaine.



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Cocaine-induced myocardial injury seen as multiple mid-wall foci of late enhancement by contrast-enhanced cardiac magnetic resonance imaging	BUCHHOLZ, Stefan; GRIEVE, Stuart M.; MAHER, Richard; FIGTREE, Gemma A., 2010	Doctor	English/ Australia	Discuss myocardial lesions induced by cocaine seen as multiple foci of the middle wall by cardiac magnetic resonance imaging with enhanced contrast	The late myocardial enhancement detected by cardiac magnetic resonance imaging represents irreversible damage. This is most commonly secondary to coronary artery disease and related AMI, where the enhancement pattern is subendocardial in the distribution of the specific coronary artery in the territory of the artery. On the other hand, the multiple well-defined foci of the middle wall seen in this case are not restricted to a single coronary artery and probably reflect infarction secondary to cocaine induced vasoconstriction of the coronary arterioles.
Hospital Mortality in 415 798 AMI Patients: 4 Years Earlier in the Canary Islands Than in the Rest of Spain	REDONDO, Carmen Mate; RODRÍGUEZ-PÉREZ, María Cristo; COELLO, Santiago Domínguez; GARCÍA, Arturo J. Pedrero; RODRÍGUEZ, Itahisa Marcelino; FERNÁNDEZ, Francisco J. Cuevas; GONZÁLEZ, Delia Almeida; DÍAZ, Buenaventura Brito; ESTEBAN, Marcos Rodríguez; LEÓN, Antonio Cabrera de., 2019.	Doctor	Spanish/ Spain	Determine possible differences in AMI mortality during hospitalization between the Canary Islands and the rest of Spain, as well as factors associated with this mortality and the population fraction attributable to diabetes.	Patients in the Canary Islands (16,317) were younger than those living in the rest of Spain (P<0.001) and death occurred 4 years earlier in the archipelago (P<0.001). This autonomous community had the highest prevalence of smoking. Throughout Spain, AMI occurred 13 years earlier in smokers than in non-smokers. Patients in the Canary Islands had the highest mortality rates, regardless if they had diabetes (8.7%) or not (7.6%). They also showed the highest fraction of AMI mortality attributable to diabetes. After adjusting for type of AMI, diabetes, dyslipidemia, hypertension, smoking, cocaine use, renal failure, gender and age, the Canary Islands presented the highest mortality risk compared to the rest of Spain (P<0.001).

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The implications of cocaine use and associated behaviors on adverse cardiovascular outcomes among veterans: Insights from the VA Clinical Assessment, Reporting, and Tracking (CART) Program	GUNJA, Ateka et al. Published in 2018	Doctor	English/ United States	Analyze the implications of cocaine use on adverse cardiovascular outcomes.	Cocaine use is associated with adverse cardiac events in patients with coronary artery disease (CAD). Cocaine users present risk behaviors that, associated with the direct effects of cocaine, contribute to increased mortality risk. This knowledge is important in creating effective intervention programs to reduce heart events in the cocaine use population.
Cocaine and/or Marijuana Use and Myocardial Infarction	CHRÉTIEN, Basile et al. Published in 2018	Doctor	English/ France	It is a letter where the author talks about a study he has read.	An analysis of a study on the use of cocaine and marijuana in patients who had their first myocardial infarction before 50 years of age was done.
Characteristics, management, and outcomes of illicit drug consumers with acute myocardial infarction.	BARTOLUCCI, Jorge et al. Published in 2016	Doctor	Spanish/ Chile	Aims to discover the prevalence of illicit drug use in patients with AMI in the Chilean Infarction Registry (GEMI), comparing the clinical presentation, treatment and evolution of illicit drug users to non-users.	Infarction patients with associated illicit drug use are younger and present, more frequently, the ST segment superelevation with anterior wall impairment, which probably determined a more invasive management. No difference in in-hospital mortality was evidenced in patients with infarction who used illegal drugs.
Cardiac Rupture in a Young Male Cocaine User.	CONTI, Adelaide et al. Published in 2018	Doctor	English/ Italy	Case report of a 25-year-old patient found unconscious and with a history of cocaine abuse. After 2 days the patient died and a rupture was observed in the left ventricle after cadaveric evaluation.	This case report suggests, from the clinical history and histological and toxicological findings, that heart rupture may have occurred as a consequence of acute myocardial infarction triggered by cocaine abuse 48 hours before death.

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Clinical Profile, Acute Care, and Middle-Term Outcomes of Cocaine-Associated ST-Segment Elevation Myocardial Infarction in an Inner-City Community	SHITOLE, Sanyog G. et al. Published in 2016	Doctor	English/ United States	To evaluate the clinical profile, acute care and medium-term outcome of the STEMI associated with cocaine in a New York City downtown community.	The cocaine related STEMI was more common in younger male patients, lower socioeconomic level, smokers, with high alcohol consumption and seropositivity for the Human Immunodeficiency Virus (HIV). During the average time of 2.7 years the patients were followed up and no significant differences were observed in the rates of rehospitalization and death among cocaine users and non-users. It was concluded that cocaine users who had STEMI, in the low-income community studied, exhibited high-risk living habits.
Cocaine and Marijuana Use Among Young Adults With Myocardial Infarction	DEFILIPPIS, Ersilia M. et al. Published in 2018	Doctor	English/ United States	To evaluate the prevalence of cocaine and marijuana use in adults with first myocardial infarction up to 50 years of age and determine its association with long-term results.	In a total of 2,097 patients with myocardial infarction up to 50 years, the mean age was 44 years, 80.7% male and the mean follow-up was 11.2 years. Cocaine and/or marijuana use was present in 10.7% (6% using marijuana and 4.7% using cocaine). In these patients the rate of diabetes and hyperlipidemia was lower in relation to non-users, but tobacco use and mortality from all cardiovascular causes were significantly higher.
Cocaine, Tobacco, and Toxicology in Myocardial Infarction of the Young	DEFILIPPIS, Ersilia M. et al. Published in 2018	Doctor	English/ United States	Respond to letters sent with questions about the article "Cocaine and Marijuana Use Among Young Adults With Myocardial Infarction" published by the authors.	Two medical readers mentioned that the smoking habit has an important potential interaction with the use of marijuana. The authors observed that among smokers, the use of both cocaine and marijuana were associated with an increase in all cardiovascular deaths.

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Cocaine-Induced Coronary Vasospasm Using Optical Coherence Tomography Imaging to Guide Management	JACKSON, Matthew W.p.; WILLIAMS, Paul D. Published in 2016	Doctor	English/ United States	A case report on cocaine induced coronary vasospasm in a 47 year old smoking patient who presented with an acute myocardial infarction with ST-segment elevation (STEMI) 4 hours after cocaine consumption.	When performing emergency coronary angiography, a proximal obstruction of the right coronary artery was identified and an aspiration thrombectomy was performed. The flow was restored after intracoronary nitrates administration, suggesting cocaine induced vasospasm. An Optical Coherence Tomography (OCT) was performed and only a mild atheroma of the middle vessel was observed at the site of the vasospasm and an extensive proximal residual thrombus. The authors conclude that vasospasm should be considered in all cases of STEMI in which there was recent cocaine use, this being probably the main contributing factor in the presentation of the patient.
Cocaine-Related Myocardial Infarction and Ventricular Rupture	NG, Arthur F. et al. Published in 2018	Doctor	English/ United States	A case report about a young individual with limited coronary disease and habitual cocaine user who had a heart attack with ventricular rupture.	The article reminds us that it is necessary to make a careful history in search of abuse of illicit substances, especially amphetamines, in any young patient who presents with discomfort in the chest. It also says that certain subgroups of patients may be at greater risk for mechanical complications of myocardial infarction, such as heart rupture.
Comparative hazards of acute myocardial infarction among hospitalized patients with methamphetamine - or cocaine- use disorders: A retrospective cohort study	CALLAGHAN, Russell C. et al. Published in 2018.	Doctor	English/ United States	A retrospective cohort study to evaluate the comparative risks of acute myocardial infarction in hospitalized patients with methamphetamine- or cocaine use disorders.	It is suggested that people with methamphetamine (or cocaine) use disorders may have an increased risk for AMI. The authors also warn of the limitations of the study and suggest that the findings should be considered as preliminary and that the study requires replication.

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Complete Angiographic Resolution of Cocaine Induced Coronary Artery Dissection within Eight Days without Coronary Stenting - A Case Report	WICKREMAARACHCHI, Chathupa et al. Published in 2016	Doctor	English/ Australia	Case report of a 26-year-old male, Caucasian, fit and healthy, who presented with a myocardial infarction with ST supra-unleveling after inhalation of 1g of cocaine.	It is concluded from the case that percutaneous management without stent implantation associated with aggressive anticoagulation of cocaine induced coronary dissection can result in an acceptable outcome, especially in young, healthy and fit patients.
Hospital Admissions for Chest Pain Associated with Cocaine Use in the United States	SINGH, Vikas et al. Published in 2017	Doctor	English/ United States	Evaluate data on hospital admissions for chest pain associated with cocaine use in the United States.	Hospital admissions for chest pain after cocaine use are associated with low rates of adverse outcomes, especially in low-risk patients, who were largely diagnosed with acute coronary syndrome discarded.
Intravascular ultrasound in cocaine-induced myocardial infarction complicated with left coronary artery dissection	RDZANEK, Adam et al. Published in 2017	Doctor	English/ Poland	Case report of a 25-year-old woman admitted for recurrent intermittent chest pain in the last 12 hours.	Patient admitted to being a cocaine user and used it the night before. Her electrocardiogram showed STEMI on most of the precordial walls. In addition, the troponin test was positive. The authors concluded that the extent and progression of coronary artery dissection may reflect the weakening of the vessel wall in individuals who abuse cocaine, which makes them prone to this rare complication (iatrogenic coronary artery dissection) in a percutaneous procedure.
Management of Cocaine-Induced Myocardial Infarction: 4-Year Experience at an Urban Medical Center	CHIBUNGU, Abednego et al. Published in 2016	Doctor	English/ United States	To evaluate the hypothesis that patients with cocaine induced myocardial infarction (CIMI) would have a more conservative and less invasive management than patients with myocardial infarction with no history of.	Patients with CIMI represented 4.2% of those who had myocardial infarction. They were younger, predominantly African-Americans and mostly active smokers. They had a 30-day readmission rate for major adverse cardiovascular events higher than patients with myocardial infarction without cocaine use. It is concluded that patients with CIMI need a better follow-up in post hospital discharge care.

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Risk of Cardiovascular Disease Among Young Adults	RANA, Jamal S. et al. Published in 2018.	Doctor	English/ United States	Analyzing the risk of cardiovascular disease among young adults from the article by DeFillippis et al entitled "Cocaine and Marijuana Use Among Young Adults With Myocardial Infarction"	It is concluded that to evaluate the separate effects of cocaine or marijuana use, the analyses should be carried out among patients who reported the use of only marijuana or cocaine compared with those who reported no use of such substances.
The role of illicit drug use in sudden death in the young	FISCHBACH, Peter. Published in 2017	Doctor	English/ United States	Assess the correlation between illicit drug use and sudden death and young people.	The recreational use of illicit drugs is a worldwide problem and the incidence of sudden death associated with the use of these drugs varies, being rarer with the use of marijuana in relation to cocaine.
Clinical Outcomes After Treatment of Cocaine-Induced Chest Pain with Beta-Blockers: A Systematic Review and Meta-Analysis	BRYAN LO, Kevin et al., 2019	Doctor	English/ United States	To investigate the evidence regarding the use of beta-blockers in the context of cocaine related acute chest pain and its implication in clinical outcomes.	The use of beta-blocker is not associated with adverse clinical effects in patients with chest pain from cocaine use. In addition, this study showed that labetalol showed greater evidence of safety when used.
Cocaine and beta-blockers: the paradigm.	Damodaran S., 2010.	Doctor	English/ United States	Exploring the role of beta-blockers in controlling cocaine toxicity.	While there is still some uncertainty as to whether beta-blockers can be used in cocaine mediated toxicity, it seems there is a recognizable role for carvedilol, a combined alpha-beta-blocker.
β-Blockers, Cocaine, and the Unopposed α-Stimulation Phenomenon	Richards J R, Hollander J E, Ramoska E A, Fareed F N, Sand I C; Gómez M M I, Lange R A., 2016	Doctor	English/ England	Examine the evidence behind unopposed alpha stimulation, explore alternative explanations, and provide guidance on the use of beta-blockers for the cardiovascular toxicity of cocaine.	There is no single effective agent for the treatment of cardiovascular toxicity caused by cocaine. Thus, benzodiazepines, calcium channel blockers, α1-blockers, α2-agonists and NO-mediated vasodilators were more effective in treating hypertension than tachycardia. While β-blockers were more effective in the treatment of concomitant hypertension and tachycardia.
Treatment of cocaine cardiovascular toxicity: a systematic review.	Richards J R, Garber D, Laurin E G, Albertson T E, Derlet R W, Amsterdam E A, Olson K R, Ramoska E A, Lange R A., 2016	Doctor	English/ United States	Review current evidence for pharmacological treatment of cardiovascular toxicity resulting from cocaine abuse.	Benzodiazepines, calcium channel blockers, nitric oxide mediated vasodilators, blockers α and β, α2-agonists such as dexmedetomidine, antipsychotics, IV lipid emulsion and other sedatives such as propofol are much needed to better guide clinical management.