



ORIGINAL RESEARCH

Cardiology

Outcomes in patients with history of cocaine use presenting with chest pain to the emergency department: Insights from the Nationwide Emergency Department Sample 2016–2018

Farhad Sami MBBS¹  | Wan-Chi Chan MD, MPH² | Prakash Acharya MD² |
Prince Sethi MD² | Chad Cannon MD³ | Eric S. Hockstad MD² | Peter N. Tadros MD² |
Mark A. Wiley MD² | Kamal Gupta MD² 

¹ Department of Internal Medicine, University of Kansas School of Medicine, Kansas City, Kansas, USA

² Department of Cardiovascular Medicine, University of Kansas Medical Center, Kansas City, Kansas, USA

³ Department of Emergency Medicine, University of Kansas Medical Center, Kansas City, Kansas, USA

Correspondence

Kamal Gupta, MD, Department of Cardiovascular Medicine, University of Kansas Medical Center, Kansas City, Kansas, United States.
Email: kgupta@kumc.edu

Farhad Sami and Wan-Chi Chan authors contributed equally to the manuscript.

Funding and support: By *JACEP Open* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). The authors have stated that no such relationships exist.

Abstract

Objectives: Cocaine use (CU) related chest pain (CP) is a common cause of emergency department (ED) visits in the United States. However, information on disposition and outcomes in these patients is scarce. We conducted a nationwide study to assess disposition from ED, hospitalization rates, in-hospital outcomes, and health care costs in patients with history of CU who presented to the ED with CP.

Methods: We queried the Nationwide Emergency Department Sample database from 2016–2018 for adult patients with CU presenting to the ED with CP. *International Classification of Diseases, Tenth Revision* codes were used to identify study patients.

Results: We identified 149,372 patients. The majority were male (76%), presented to metropolitan centers (91.3%), and had a high prevalence of cardiovascular risk factors (48.1% with hypertension, 24.4% with coronary artery disease, 18.2% with diabetes) and psychiatric illnesses (21%). Overall, 21.4% of patients were hospitalized, 68.6% were discharged from ED and 6.6% left against medical advice. Patients requiring admission were older (51.8 vs 45.0; $P < 0.0001$) and had a higher prevalence of coronary artery disease, peripheral arterial disease, hypertension, diabetes, and chronic kidney disease. Of those admitted, 45.7% were diagnosed with myocardial infarction (MI), constituting 9.7% of the total study population. Over 80% of these patients underwent coronary angiography and 38.6% had coronary intervention. Mortality was 1.2%.

Conclusion: CU patients who present to ED are predominantly male, are from lower economic strata, and have significant comorbidity burden. One in 5 patients requires hospitalization and has more prevalent cardiovascular risk factors and comorbidities. In-hospital mortality is low, but incidence of MI and subsequent invasive procedures is high. CU may be considered a cardiac risk factor as it is associated with high rates of in-hospital MI.

Supervising Editor: Grant Lipman, MD

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. *JACEP Open* published by Wiley Periodicals LLC on behalf of American College of Emergency Physicians

KEYWORDS

chest pain, cocaine use, coronary artery disease, emergency department, myocardial infarction

1 | INTRODUCTION

1.1 | Background

Cocaine is the second most commonly illicitly used drug in the United States and is the leading cause of illicit drug-related emergency department visit.¹ Cocaine use-related chest pain (CP) is a common reason for hospital admissions.² Serious clinical manifestations include myocardial infarction, hypertensive emergency, and aortic dissection.³⁻⁵ Mechanisms for cocaine-related CP and cardiovascular complications include a hyperadrenergic state, coronary vasospasm, prothrombotic state with platelet activation, and accelerated atherosclerosis.⁶⁻⁹ The widespread illicit use of the drug and the potential to cause serious harm to patients contribute to the large economic burden associated with ED visits and subsequent hospitalizations for these patients.²

1.2 | Importance

CP is the most frequent complaint reported in patients using cocaine with reported 40% of the patients presenting with some degree of chest discomfort.¹⁰ Studies on the incidence of myocardial infarction (MI) in patients with cocaine-associated CP have reported divergent results ranging from 0.7% to 6%.¹¹⁻¹⁴ Nevertheless, considering that cocaine use has been linked with premature coronary artery disease (CAD) and MI, patients with history of cocaine use in the ED warrant careful consideration in terms of workup and disposition from the ED.^{6,15} There is a paucity of real-world information in regard to nationwide ED visits, disposition from ED, hospitalization rates, resource use, and outcomes in patients presenting to the ED with CP. Moreover, the health care cost burden from the ED visits and in-hospital costs (if admitted) is not well elucidated.

1.3 | Goals of this investigation

We used data from the National Emergency Department Sample from recent years to understand the burden of ED visits, subsequent hospital admission rates, associated health care costs, and clinical outcomes in patients who use cocaine presenting to the ED with CP.

2 | METHODS

2.1 | Study design and setting

In this descriptive retrospective study, we conducted a secondary analysis of the Nationwide Emergency Department Sample (NEDS) from the years 2016 to 2018. The NEDS is a publicly available

database from the Healthcare Cost and Utilization Project, which is sponsored by the Agency for Healthcare Research and Quality. The State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID) compose the NEDS database. The SID contains information on patients who present to the ED and are subsequently admitted. The SEDD provides information on ED visits that do not result in an admission. The NEDS has more than 100 clinical and non-clinical variables for each hospital stay. The diagnosis codes and procedure codes are included as *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) diagnosis codes and procedure codes respectively. Approximately 20% stratified sample of US hospital-owned EDs is included in the NEDS. The patient identifiers are de-identified in the database. Hence, our institution considers this study exempt from the institutional review board review.

2.2 | Selection of participants

Study subjects were identified using the ICD-10-CM Procedure Coding System (PCS). To select an eligible sample with cocaine use, ICD-10-CM codes related to cocaine abuse, cocaine dependence, and cocaine use were chosen from the secondary diagnosis to the final listed diagnosis (I10_DX2-I10_DX30 or I10_DX35). From this cocaine use sample, patients with CP or CP-related diagnosis were selected using the primary diagnosis with related ICD-10-CM codes (See appendix table 1).

Patients with non-cardiovascular potential causes of CP diagnosed in the ED, including pleuritic pain, were excluded from the study (see supplementary table). To avoid including patients with primary complaint other than CP, patients with an ED diagnosis of pulmonary embolism were also excluded. Patients with age less than 18 years or with missing information about age, gender, disposition status from ED, geographic characteristics, hospital characteristics, and change of service were excluded. Additionally, patients who died in ED, left against medical advice, or got transferred to another hospital were also excluded while classifying patients into the 2 groups (discharged-from-ED and hospitalized group).

2.3 | Baseline measures and outcomes

Baseline measures included patient characteristics, such as age, gender, comorbid conditions, primary payer, median household income for patient's ZIP code (4 quartiles), admission day (weekdays, or weekend), and disposition from ED (routine discharge, transfer, admitted to inpatient hospital, or deceased in ED, etc). Hospital characteristics

were also included such as the hospital region, hospital urban-rural designation, and teaching status of hospital.

Outcome measures were studied in patients who were discharged from ED or admitted to the hospital. Costs in ED were evaluated on discharged patients. Costs for inpatient hospital, length of hospital stay, and mortality were calculated in hospitalized patients. For those who were admitted to the hospital, we assessed for several inpatient outcomes including in-hospital mortality, incidence of MI, and cardiogenic shock. We also looked at the rates of several procedures such as percutaneous coronary intervention (PCI) (drug-eluting stents, bare-metal stents, or no stent), extracorporeal membrane oxygenation (ECMO), intra-aortic balloon pump, mechanical circulatory support (MCS), angiography, and endotracheal intubation using the relevant ICD-10-CM/PCS codes.

2.4 | Analysis

Statistical analysis was conducted using the SAS 9.4 (SAS Institute Inc, Cary, NC) software. Continuous variables are expressed as mean with confidence intervals and were compared using the 2-sample *t* test. Categorical variables are expressed as count with percentage of the total population and compared using Pearson's chi-square test. A *P* value of less than 0.05 was considered statistically significant.

3 | RESULTS

A total of 149,372 patients with history of cocaine use presented to the ED with chest pain in the years 2016–2018. Table 1 details the baseline characteristics of the overall population and the 2 groups (hospitalized or discharged from the ED). The mean age was 46.5 years and the majority were male. The major comorbidities of the study population included hypertension, CAD, diabetes mellitus, and chronic pulmonary disease. Other important comorbidities included obesity, renal failure, peripheral vascular disease, and depression. More than 50% of these patients belonged to the lowest income quartile group and one third of the total patients did not have insurance. The majority of the patients presented in large metropolitan areas with at least 1 million residents. Geographical distribution showed that patients from the Southern region of the United States comprised a larger percentage of patients in comparison to other regions.

Out of the 149,372 patients, the majority of the total patients were released from the ED without hospitalization, whereas on average 1 in 4 were admitted to the hospital. Intergroup comparison between the hospitalized group and discharged from ED group revealed similar sex distribution in both groups but the hospitalized cohort were older and had a higher prevalence of most comorbidities, including CAD, peripheral arterial disease, hypertension, chronic renal disease, diabetes, and obesity. Socioeconomic and geographical distributions were similar in both groups.

The Bottom Line

This 3-year retrospective analysis of 149,372 nationwide emergency department patients with chest pain and a history of cocaine use found 1 in 5 hospitalized, significantly more comorbidities than those discharged, and 45.7% with a myocardial infarction. As 38.6% of admitted patients had a coronary intervention, traditional cardiac risk factors with a history of cocaine use should be considered for risk stratification.

Of the patients who were discharged from the ED, the overwhelming majority were discharged to home, and the remaining patients were discharged to a facility, home health setting, or an unknown destination. Few patients left against medical advice. The mortality rate in ED was low. (Table 2)

In patients who were hospitalized, MI was diagnosed in almost half the patients. Most of the patients with MI underwent coronary angiography and 46.7% of these patients were treated with PCI. The PCI rate in overall patient population with MI was 38.6%. The occurrence of other clinical outcomes, such as cardiogenic shock and use of advanced therapies such as MCS, intra-atrial balloon pump, ECMO, and respiratory failure leading to intubation was low. In-hospital mortality was low. Table 3 lists the details of these outcomes.

Cost analysis revealed that the average cost of care in a hospitalized patient was in excess of \$50,000 and this was 6-fold higher compared to the average costs for patients discharged from ED without hospitalization (Table 3).

3.1 | Limitations

Although a large database such as the NEDS has several strengths, including a large sample size and generalizability to the national population, being an administrative database, it also has significant limitations. Errors in coding can lead to misidentification of patients and comorbidities. The database does not record the time of last cocaine intake, medications administered, the character of chest pain, or vital signs. Further, coronary anatomy, cardiac marker information is also not available. NEDS also does not capture patients who leave the ED without being seen by a physician as no ICD-10 diagnosis code is assigned to them. Another limitation of the database is lack of patient follow-up data after discharge from hospital. As such, postdischarge outcomes could not be included in the study. Because of the nature of the ICD coding system, the database does not tell us if the patient admissions were related to cocaine-associated or cocaine-caused CP. Clinician bias in whom they ask about cocaine use should also be kept in mind. Despite these limitations, we believe there is value in reporting the first nationwide study of this nature describing the

TABLE 1 Baseline characteristics of the study population

Baseline characteristic	Total	Hospitalized patients	Discharged patients	P value
Number of patients (%)	149372	31907 (21.4)	105864 (70.9)	
Mean age (year) (CI*)	46.5 (46.1-46.9)	51.8 (51.4-52.2)	45.0 (44.6-45.4)	<0.0001
Gender (%)				<0.0001
Male	113568 (76.0)	25094 (78.6)	79562 (75.2)	
Female	35805 (24.0)	6813 (21.4)	26303 (24.8)	
Comorbidities (%)				
Coronary artery disease	36431 (24.4)	16446 (51.5)	17876 (16.9)	<0.0001
Peripheral vascular disease	3554 (2.4)	1810 (5.8)	1597 (1.5)	<0.0001
Chronic pulmonary disease	28006 (18.7)	8688 (27.2)	17635 (16.7)	<0.0001
Diabetes without chronic complications	16992 (11.4)	4547 (14.3)	11116 (10.5)	<0.0001
Diabetes with chronic complications	10090 (6.8)	4890 (15.3)	4688 (4.4)	<0.0001
Hypothyroidism	2997 (2.0)	1179 (3.7)	1632 (1.5)	<0.0001
Renal failure	9909 (6.6)	4948 (15.5)	4457 (4.2)	<0.0001
Liver disease	4411 (3.0)	1950 (6.1)	2181 (2.1)	<0.0001
Obesity	10600 (7.1)	4516 (14.2)	5598 (5.3)	<0.0001
Alcohol abuse	27513 (18.4)	8366 (26.2)	17443 (16.5)	<0.0001
Drug abuse	122235 (81.8)	27239 (85.4)	85512 (80.8)	<0.0001
Psychoses	16828 (11.3)	4393 (13.8)	11219 (10.6)	<0.0001
Depression	15288 (10.2)	4687 (14.7)	9734 (9.2)	<0.0001
Hypertension	71795 (48.1)	17636 (55.3)	48898 (46.2)	<0.0001
Primary payer (%)				<0.0001
Medicare	23352 (15.6)	7219 (22.6)	14528 (13.7)	
Medicaid	57817 (38.7)	13090 (41.0)	39962 (37.7)	
Private insurance	20407 (13.7)	4047 (12.7)	14905 (14.1)	
No pay/self-pay/others	47797 (32.0)	7551 (23.7)	36469 (34.4)	
Median household income category for patients' ZIP code (%)				0.0083
0–25th percentile	82291 (55.1)	17110 (53.6)	59021 (55.8)	
26th–50th percentile (median)	34341 (23.0)	7215 (22.6)	24251 (22.9)	
51st–75th percentile	19764 (13.2)	4420 (13.9)	13761 (13.0)	
76th–100th percentile	12976 (8.7)	3163 (9.9)	8832 (8.3)	
Hospital urban-rural designation (%)				<0.0001
Large metropolitan areas with at least 1 million residents	91032 (60.9)	20338 (63.7)	63618 (60.1)	
Small metropolitan areas with less than 1 million residents	45478 (30.4)	9718 (30.5)	32700 (30.9)	
Micropolitan areas	6662 (4.5)	784.2 (2.5)	5031 (4.8)	
Not metropolitan or micropolitan (non-urban residual)	2283 (1.5)	84.2 (0.3)	1803 (1.7)	
Collapsed category of small metropolitan and micropolitan	776 (0.5)	142.0 (0.4)	573.2 (0.5)	
Metropolitan, collapsed category of large and small metropolitan	1345 (0.9)	508.1 (1.6)	778.6 (0.7)	
Non-metropolitan, collapsed category of micropolitan and non-urban	1797 (1.2)	332.7 (1.0)	1362 (1.3)	

(Continues)

TABLE 1 (Continued)

Baseline characteristic	Total	Hospitalized patients	Discharged patients	P value
Teaching status of hospital (%)				<0.0001
Metropolitan non-teaching	28903 (19.3)	5904 (18.5)	20537 (19.4)	
Metropolitan teaching	109728 (73.5)	24802 (77.7)	77132 (72.9)	
Non-metropolitan hospital	10741 (7.2)	1201 (3.8)	8196 (7.7)	
Hospital region (%)				<0.0001
Northeast	27051 (18.1)	7461 (23.4)	17321 (16.4)	
Midwest	30554 (20.5)	6086 (19.1)	22037 (20.8)	
South	84833 (56.8)	15394 (48.2)	62812 (59.3)	
West	6935 (4.6)	2965 (9.3)	3695 (3.5)	
Admission day (%)				0.8454
Weekday	105382 (70.5)	22538 (70.6)	74905 (70.8)	
Weekend	43991 (29.5)	9369 (29.4)	30959 (29.2)	

[^]Confidence intervals

TABLE 2 Disposition of patients from ED (overall N = 149,372)^{*}

N (%)	Routine discharge	Transfer to short-term hospital	Disposition to other facilities: including skilled nursing facility, intermediate care facility, and another type of facility		Home health care	Against medical advice	Admitted as an inpatient to this hospital	Died in emergency department	Not admitted to hospital; destination unknown
	102486 (68.6)	1797 (1.2)	2672 (1.8)	358 (0.2)	9792 (6.6)	31907 (21.4)	12 (0.01)	348 (0.2)	

^{*} (1) Patients counted as discharged from ED: Routine discharge, other facilities including skilled nursing facility, intermediate care facility, and another type of facility; home health care; not admitted to hospital; destination unknown.

(2) Patients counted as hospitalized: Admitted as an inpatient to this hospital.

patient population with cocaine use history that present to the ED, the disposition pattern, and in-hospital outcomes.

4 | DISCUSSION

This is the first nationwide study to describe the ED presentation and disposition of patients with cocaine use presenting with CP and then following them through hospitalization till discharge. This is also the first study that has used the nationwide emergency sample for this purpose. The study has several important findings regarding not only the demographics of these patients who present to the ED but also their disposition from ED, rate of hospitalization, and subsequent outcomes.

The demographics of these ED patients show that the majority are younger men but have a high prevalence of comorbidities. Nearly one half of patients have comorbid hypertension, 1 in 4 has CAD, and 1 in 5 patients suffers from major psychiatric illness or alcohol use disorder. The majority were in the lowest income category (0–25th per-

centile) and most patients presented to metropolitan centers. These demographics and comorbidities are similar to those reported by Singh et al. in their study of patients hospitalized with cocaine use and CP.² They reported a mean age of 44 years, with 72% being men and 45% belonging to the lowest income quartile. The prevalence of major psychiatric illness at 25% was similar to our study as well. Further, as has been previously reported for cocaine-related hospitalizations, most of the patient presentations to ED also occurred in the Southern region of the country.²

We found that in comparison to those discharged from the ED, hospitalized patients were older and had a significantly higher prevalence of underlying comorbidities including a diagnosis of CAD and diabetes, indicating that emergency physicians were able to triage a higher risk pool of CP patients for admission. This is also borne out from the finding that almost half of the admitted patients were diagnosed with an MI and these comprised only around 10% of the total patients who presented to the ED with cocaine-associated CP. Part of this finding may be attributed to using standardized risk scores in the ED, eg, HEART score

TABLE 3 Outcomes in the hospitalized patients and patients discharged from the ED

Outcome	Hospitalized patients (%)	Discharged patients
Number of patients	31907 (100)	105865
Myocardial infarction (STEMI, NSTEMI, other/unspecified) (%)	14581(45.7)	–
STEMI	4181 (13.1)	–
NSTEMI	10278 (32.2)	–
Mortality (%)	384 (1.2)	–
Mean length of hospital stay (day) (CI ^a)	3.3 (0.1)	–
Costs (\$) (mean ± 95% CI)	60511 (57378, 63643)	10220 (9690, 10750)
Coronary angiography	12035 (37.7)	–
Percutaneous coronary intervention (%)	5625 (17.6)	–
Drug-eluting stents	3618 (11.3)	–
Bare-metal stents	1283 (4.0)	–
Balloon Angioplasty	1517 (4.8)	–
ECMO ^b	22 (0.1)	–
IABP	473 (1.5)	–
Cardiogenic shock	691 (2.2)	–
Mechanical circulatory support	120 (0.4)	–
Impella	120 (0.4)	–
LVAD ^c	0 (0.0)	–
Intubation	877 (2.7)	–
Coronary artery bypass graft	891 (2.8)	–

Abbreviations: CI, confidence interval; ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump; LVAD, left ventricular assist device; NSTEMI, non-ST-segment-elevation myocardial infarction; STEMI, ST-segment-elevation myocardial infarction.

to determine the need for hospitalization, which are well validated to identify CP patients at risk of adverse cardiovascular outcomes.^{16,17} In light of our study's findings in hospitalized patients, cocaine use may be considered a cardiac risk factor as it was found to be associated with high rates of in-hospital MI.

Cocaine is a sympathomimetic drug that increases heart rate and blood pressure causing increased myocardial oxygen demand.^{18–20} In addition, it leads to coronary vasoconstriction and promotes thrombogenesis.^{21–23} These pathophysiologic properties of cocaine predispose to myocardial ischemia, leading to possible infarction. Prior studies reported the incidence of MI in cocaine-related CP in the range of 0.7% to 6%.^{11–13} The prospective COCAINE Associated CHEST PAIN (COCHPA) study and the retrospective analysis by Weber et al. reported the incidence of MI to be around 6%.¹² On the other hand, other studies including the Acute Cardiac Ischemia-Time Insensitive Predictive Instrument (ACI-TIPI) study reported lower rates of around 0.7% to 2.8%.^{13,14} These inconsistencies in results could be partly attributed to the different diagnostic criteria to define acute MI, the small or single-center nature of study, varying comorbidity profile of the sample, etc. By using a standardized method with ICD-10 coding system and a large nationwide sample, we aimed to eliminate these biases for a more accurate analysis. Our results showed an MI incidence rate of 9.7% that, albeit not drastically different, is higher than that reported in the aforementioned studies.

The higher rate of MI seen in our study could be related to multiple factors including differing patient population characteristics, varying diagnostic methods to diagnose MI (COCHPA study used creatine kinase-MB and not troponins) and exclusion of other causes of CP ED visits such as pleurisy and pulmonary embolism in our study. These findings are, however, significantly different from the nationwide study by Singh et al. that looked at hospitalized patients who had cocaine-related CP.² Their study found an incidence of 0.69% for MI. However, the study has significant methodological omissions as it did not report the ICD codes used to define the patient population, nor did it specify if CP was the primary diagnosis. Their study likely included all-cause admissions of cocaine-using patients who had CP as one of the diagnoses during hospitalization.

Another important finding of our study is that coronary angiography was performed in almost 4 of 5 MI patients and almost half of them underwent PCI. These rates of coronary intervention are lower than reported for MI patients without cocaine use but consistent with the known prevalence of occlusive CAD on angiography in cocaine use patients with CP and MI.²⁴ In a study by Hollander and Hoffman, 54 of 91 patients with cocaine-associated MI underwent coronary angiography and 34 were diagnosed with significant CAD or thrombotic occlusion.²⁵

We found that drug-eluting stents were used in 64% of patients undergoing intervention. This finding was somewhat surprising as patients with history of illicit cocaine use may be thought to have low

compliance with antiplatelet therapy in the long term and there are recommendations to consider bare-metal stents in these patients rather than drug-eluting stents for a shorter antiplatelet therapy course.²⁶ Further studies looking at the incidence of in-stent restenosis, MI, and compliance rate may help to clarify if clinical outcomes differ between the 2 types of stents.

Cocaine-associated CP is a significant burden both in the ED and in the in-patient setting. In 2011, cocaine use was responsible for 504,224 ED visits comprising 40.3% of ED visits related to illicit drug use.²⁷ Singh et al. reported in-hospital outcomes and trends in patients admitted for cocaine-related CP from 2001–2012 using a nationwide sample.² However, as the ED is the first point of contact in these patients, hospitalization rates from ED were not reported and are in general not well described in a large population. We report that the majority of patients are released from the ED, and those who are admitted have a significantly high comorbidity burden of atherosclerotic disease or associated risk factors.

Aalam et al studies nationwide trends for admissions in all patients presenting with CP to the ED.²⁸ They found that the admission rates trended down from 18% to 3.9% from 2006 to 2016. In comparison, we found significantly higher admission rates in patients with cocaine use history from ED. This likely reflects concern on the part of providers because of a higher risk profile and cocaine's known cardiovascular effects

To conclude, in a nationwide database of ED visits, we found that patients with a history of cocaine use who present with CP have a 1 in 5 chance of being admitted to the hospital, and those admitted were older and had a significantly higher comorbidity burden including major psychiatric and atherosclerotic illnesses. Among those admitted, the incidence of MI and subsequent PCI is significantly high. Our findings underscore the importance of recognizing cardiac risk factors in cocaine use patients who present to the ED with CP for better patient outcomes.

CONFLICT OF INTEREST

All authors do not have any conflicts of interest to disclose.

AUTHOR CONTRIBUTIONS

Farhad Sami conceived the study, designed the project and drafted the manuscript. Wan-Chi Chan performed statistical analysis and wrote part of the manuscript. Prakash Acharya, Prince Sethi, Chad Cannon, Eric Hockstad, Peter Tadros, Mark Wiley, and Kamal Gupta contributed substantially to manuscript revision and edits. Kamal Gupta supervised the project from start to finish.

ORCID

Farhad Sami MBBS  <https://orcid.org/0000-0001-9464-6934>

Kamal Gupta MD  <https://orcid.org/0000-0002-2440-9033>

REFERENCES

1. Administration SAaMHS. Preliminary Data from the Drug Abuse Warning Network – April 2019–October 2020. Available from:

<https://www.samhsa.gov/data/sites/default/files/reports/rpt32809/DAWN%20Profile%20Expanded.pdf>

2. Singh V, Rodriguez AP, Thakkar B, et al. Hospital admissions for chest pain associated with cocaine use in the United States. *Am J Med.* 2017;130(6):688-698. Epub 2017/01/09. PubMed PMID: 28063854.
3. Khan R, Arshed S, Jehangir W, Sen S, Yousif A. Cocaine-Induced delayed myocardial infarction complicated by apical thrombus. *J Clin Med Res.* 2016;8(1):59-61. Epub 2015/12/17. PubMed PMID: 26668686. PubMed Central PMCID. PMC64676349.
4. Schwartz BG, Rezkalla S, Kloner RA. Cardiovascular effects of cocaine. *Circulation.* 2010;122(24):2558-2569. Epub 2010/12/16. PubMed PMID: 21156654.
5. Dean JH, Woznicki EM, O'Gara P, et al. Cocaine-related aortic dissection: lessons from the International Registry of Acute Aortic Dissection. *Am J Med.* 2014;127(9):878-885. Epub 2014/05/20. PubMed PMID: 24835037.
6. Lange RA, Hillis LD. Cardiovascular complications of cocaine use. *N Engl J Med.* 2001;345(5):351-358. Epub 2001/08/04. PubMed PMID: 11484693.
7. Boehrer JD, Moliterno DJ, Willard JE, et al. Hemodynamic effects of intranasal cocaine in humans. *J Am Coll Cardiol.* 1992;20(1):90-93. Epub 1992/07/01. PubMed PMID: 1607544.
8. Mittleman MA, Mintzer D, Maclure M, Tofler GH, Sherwood JB, Muller JE. Triggering of myocardial infarction by cocaine. *Circulation.* 1999;99(21):2737-2741. Epub 1999/06/03. PubMed PMID: 10351966.
9. Turillazzi E, Bello S, Neri M, Pomara C, Riezzo I, Fineschi V. Cardiovascular effects of cocaine: cellular, ionic and molecular mechanisms. *Curr Med Chem.* 2012;19(33):5664-5676. Epub 2012/08/04. PubMed PMID: 22856657.
10. Brody SL, Slovis CM, Wrenn KD. Cocaine-related medical problems: consecutive series of 233 patients. *Am J Med.* 1990;88(4):325-331. Epub 1990/04/01. PubMed PMID: 2327419.
11. Hollander JE, Hoffman RS, Gennis P, et al. Prospective multicenter evaluation of cocaine-associated chest pain. *Acad Emerg Med.* 1994;1(4):330-339. Cocaine Associated Chest Pain (COCHPA) Study Group. Epub 1994/07/01. PubMed PMID: 7614278.
12. Weber JE, Chudnofsky CR, Boczar M, Boyer EW, Wilkerson MD, Hollander JE. Cocaine-associated chest pain: how common is myocardial infarction?. *Acad Emerg Med.* 2000;7(8):873-877. Epub 2000/08/25. PubMed PMID: 10958126.
13. Feldman JA, Fish SS, Beshansky JR, Griffith JL, Woolard RH, Selker HP. Acute cardiac ischemia in patients with cocaine-associated complaints: results of a multicenter trial. *Ann Emerg Med.* 2000;36(5):469-476. Epub 2000/10/29. PubMed PMID: 11054201.
14. Kontos MC, Schmidt KL, Nicholson CS, Ornato JP, Jesse RL, Tatum JL. Myocardial perfusion imaging with technetium-99m sestamibi in patients with cocaine-associated chest pain. *Ann Emerg Med.* 1999;33(6):639-645. Epub 1999/05/26. PubMed PMID: 10339678.
15. Benzaquen BS, Cohen V, Eisenberg MJ. Effects of cocaine on the coronary arteries. *Am Heart J.* 2001;142(3):402-410. Epub 2001/08/30. PubMed PMID: 11526352.
16. Backus BE, Six AJ, Kelder JC, et al. A prospective validation of the HEART score for chest pain patients at the emergency department. *Int J Cardiol.* 2013;168(3):2153-2158. Epub 2013/03/08. PubMed PMID: 23465250.
17. Six AJ, Backus BE, Kelder JC. Chest pain in the emergency room: value of the HEART score. *Neth Heart J.* 2008;16(6):191-196. Epub 2008/07/31. PubMed PMID: 18665203. PubMed Central PMCID. PMC64242661.
18. Havakuk O, Rezkalla SH, Kloner RA. The cardiovascular effects of cocaine. *J Am Coll Cardiol.* 2017;70(1):101-113. Epub 2017/07/01. PubMed PMID: 28662796.

19. Vongpatanasin W, Mansour Y, Chavoshan B, Arbique D, Victor RG. Cocaine stimulates the human cardiovascular system via a central mechanism of action. *Circulation*. 1999;100(5):497-502. Epub 1999/08/03. PubMed PMID: 10430763.
20. Jacobsen TN, Grayburn PA, Snyder RW, et al. Effects of intranasal cocaine on sympathetic nerve discharge in humans. *J Clin Invest*. 1997;99(4):628-634. Epub 1997/02/15. PubMed PMID: 9045864. PubMed Central PMCID. PMC507844.
21. Daniel WC, Lange RA, Landau C, Willard JE, Hillis LD. Effects of the intracoronary infusion of cocaine on coronary arterial dimensions and blood flow in humans. *Am J Cardiol*. 1996;78(3):288-291. Epub 1996/08/01. PubMed PMID: 8759806.
22. Lange RA, Cigarroa RG. Cocaine-induced coronary-artery vasoconstriction. *N Engl J Med*. 1989;321(23):1557-1562. Epub 1989/12/07. PubMed PMID: 2573838.
23. Hobbs WE, Moore EE, Penkala RA, Bolgiano DD, López JA. Cocaine and specific cocaine metabolites induce von Willebrand factor release from endothelial cells in a tissue-specific manner. *Arterioscler Thromb Vasc Biol*. 2013;33(6):1230-1237. Epub 2013/03/30. PubMed PMID: 23539221. PubMed Central PMCID. PMC3739701.
24. Kontos MC, Jesse RL, Tatum JL, Ornato JP. Coronary angiographic findings in patients with cocaine-associated chest pain. *J Emerg Med*. 2003;24(1):9-13. Epub 2003/01/30. PubMed PMID: 12554033.
25. Hollander JE, Hoffman RS. Cocaine-induced myocardial infarction: an analysis and review of the literature. *J Emerg Med*. 1992;10(2):169-177. Epub 1992/03/01. PubMed PMID: 1607624.
26. McCord J, Jneid H, Hollander JE, et al. Management of cocaine-associated chest pain and myocardial infarction: a scientific statement from the American Heart Association Acute Cardiac Care Committee of the Council on. *Clin Cardiol Circul*. 2008;117(14):1897-1907. Epub 2008/03/19. PubMed PMID: 18347214.
27. Administration SAaMHS. Drug Abuse warning network, 2011: National Estimates of Drug-Related Emergency Department Visits. 2011.
28. Aalam AA, Alsabban A, Pines JM. National trends in chest pain visits in US emergency departments (2006-2016). *Emerg Med J*. 2020;37(11):696-699. Epub 2020/09/10. PubMed PMID: 32900857.

AUTHOR BIOGRAPHY



Kamal Gupta, MD, is a Professor of Cardiovascular Medicine and Co-Director of the Multi-Specialty Complex Hypertension at The University of Kansas School of Medicine in Kansas City, Kansas.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

How to cite this article: Sami F, Chan W-C, Acharya P, et al. Outcomes in patients with history of cocaine use presenting with chest pain to the emergency department: Insights from the Nationwide Emergency Department Sample 2016–2018. *JACEP Open*. 2022;3:e12618.

<https://doi.org/10.1002/emp2.12618>