Heightened risk of cardiac events following percutaneous coronary intervention for cocaine-associated myocardial infarction

Ching Wei Russell Chen[1], Mohammed Makkiya[1], Wilbert Aronow[2], Daniel M. Spevack[2]

[1]Division of Cardiology, Department of Medicine, Montefiore Medical Centre, Albert Einstein College of Medicine, Bronx, New York, USA
[2]Division of Cardiology, Department of Medicine, Westchester Medical Centre, New York Medical College, Valhalla, New York, USA

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Corresponding author:
Daniel M. Spevack MD
Westchester Medical Centre
100 Woods Road
Valhalla
New York 10595, USA
Phone: 914-493-7199
E-mail: Daniel.spevack@wmchealth.org

Abstract

Introduction: Several works have suggested heightened risk for cardiac events in cocaine users following percutaneous coronary intervention (PCI). Such studies have generally been performed in small, poorly defined samples and have not utilised optimal control groups. We aimed to define the short-term risk for death or recurrent myocardial infarction (MI) when PCI was performed for myocardial infarction in subjects presenting with urine toxicology positive for cocaine in relation to subjects testing negative for cocaine use.

Material and methods: Our institutional electronic health record (EHR) was queried for all subjects with urine toxicology performed for cocaine exposure within 5 days before or after having elevated troponin-T assay between 1/1/08 and 12/31/13. Query results were cross-referenced with our institutional cardiology database to identify the sample who had PCI on the same admission as the cocaine test. Subsequent readmission for MI was assessed from the EHR, and deaths were identified from the National Death Index.

Results: PCI had been performed in 380 subjects who tested negative for cocaine and 44 subjects who tested positive. In the cocaine-positive group, incidences of death or MI at 30 days and 1 year were 18% and 23%, respectively. Those who tested positive for cocaine had increased odds (odds ratio (OR) = 2.3, 95% confidence interval (CI): 1.0–5.1, $p = 0.04$) for death or MI at 30 days post PCI, after adjustment for age, sex, prior MI, and comorbidity index. Although the odds for events 1-year post PCI were not increased (OR = 2.0, 95% CI: 0.9–4.3), the p-value approached significance in this small sample ($p = 0.09$).

Conclusions: This retrospective study suggests that PCI performed in cocaine-associated myocardial infarction comes with a high 30-day and one-year risk. Further prospective studies are needed to better define this risk and to lend insight into better management strategies.

Key words: percutaneous coronary intervention, cocaine, acute myocardial infarction.

Introduction

Cocaine is the recreational drug that leads to the most emergency department visits in the United States [1], and its use is associated with a number of cardiovascular emergencies, including chest pain and myo-

cardial infarctions (MI) [2–5]. Cocaine use leads to early atherosclerosis, increased coronary spasm, increased platelet aggregation, increased oxygen demand of myocardium, and severe hypertension [6–13], all of which may contribute to the pathogenesis of MI and present unique challenges for management.

Although percutaneous coronary intervention (PCI) is currently recommended as the primary treatment for acute coronary syndrome and high-risk chest pain associated with cocaine use [14], multiple studies have reported increased incidence of early stent thrombosis, and the safety of this approach has therefore been questioned [15–19]. In this study we aim to better define, as our primary outcome, the short-term (30-day) and intermediate-term (1-year) risk for death or recurrent MI when PCI was performed for patients presenting with cocaine-associated MI.

Material and methods

Our institutional electronic health record (EHR) was queried for all subjects presenting with suspected myocardial infarction between January 1, 2004 to December 31, 2013. We included only those with urine toxicology testing for cocaine exposure performed within the five days before or after myocardial infarction, as demonstrated by elevated troponin-T assay value above 0.2 ng/ml. Query results were cross-referenced with our institutional cardiology database to identify the patients who had PCI on the same admission as the cocaine test. A total of 2861 patients were identified who met the inclusion criteria, of whom 424 received PCI. Information about the type of stent implanted was extracted from each catheterisation procedure report. Patient demographics, discharge medications, and comorbidities were obtained from our EHR. These data were collected using the proprietary institution platform Clinical Looking Glass (CLG) (Montefiore-IT, Yonkers, NY), which extracts data from all inpatient and outpatient visits across a multi-hospital and complex ambulatory care network.

Patient outcomes were also assessed using CLG, which is linked to the National Death Index and also captures deaths occurring within our hospital network. Dates for re-admission occurring for MI were also queried from CLG on the basis of diagnosis coding.

We compared the incidence of recurrent MI and death within 30 days of initial MI. Subsequent readmission for MI was assessed from the EHR and defined by any admission with myocardial infarction as a diagnosis. Deaths were identified from the National Death Index. The study was approved by the Institutional Review Board of Albert Einstein College of Medicine.

Statistical analysis

Statistical analysis was done using Stata software, version 11.2 (College Station, TX). Normally distributed data were presented as the mean ± standard deviation (SD). Non-normal data were presented as the median (interquartile range (IR)). Comparison of means was performed using the two-sample *t*-test. Comparison of categorical data was performed using the χ^2 test. Comparison of medians was performed using the Mann-Whitney or Kruskal-Wallis test as appropriate. *P*-values were considered significant if < 0.05.

Multiple logistic regression was used to assess for excess risk of the primary outcome associated with cocaine exposure. Adjustments were made for age, sex, race/ethnicity, Charlson comorbidity index, prior PCI, and LV ejection fraction at presentation.

Results

PCI had been performed in 380 subjects who tested negative for cocaine and 44 subjects who tested positive. The median number of days between toxicology and PCI was 0.64 (range: –2.2, 1.2). Baseline characteristics, comorbidities, catheterisation data, and pharmacotherapy use are shown in the Table I. There were no significant differences in demographics and comorbidity compared to those who were cocaine negative. Compared to the control group, the cocaine-positive patients were less likely to have drug-eluting stents placed and were less likely to receive β-blockers. No difference was seen in the coronary territories that received PCI.

Those who tested positive for cocaine at the admission for PCI had increased odds for death or MI at 30 days post PCI (odds ratio (OR) = 2.3, 95% confidence interval (CI): 1.0–5.1, $p = 0.04$), after adjustment for age, sex, prior MI, and comorbidity index. This association remained significant after adjustment for dual antiplatelet use, β-blocker use, and/or use of drug-eluting stents. Although the odds for events 1-year post PCI were not increased (OR = 2.0, 95% CI: 0.9–4.3), the *p*-value approached significance in this small sample ($p = 0.09$).

In the group that tested negative for cocaine at the index admission for PCI, there were 16 additional subjects who tested positive for cocaine at another time, either prior to or after the index admission, resulting in 60 total subjects that ever tested positive for cocaine. These subjects had increased odds for death or MI at 30 days post PCI (OR = 2.3, 95% CI: 1.1–4.7, $p = 0.02$). This association remained significant at 1-year follow-up (OR = 2.3, 95% CI: 1.2–4.4, $p = 0.01$).

Stent thrombosis was reported to have occurred in 14 of the 56 myocardial infarctions that

Table I. Patient demographics, comorbidities and catheterization data stratified by cocaine use

Parameter	Study population	Cocaine positive	Cocaine negative	*P*-value
Number of subjects	424	44	380	
Demographics:				
Age [years]	51 ±11	53 ±9	51 ±11	0.15
Male (%)	82	85	82	0.59
BMI [kg/m^2]	29 ±5	29 ±5	29 ±5	0.85
Black (%)	24	31	23	0.21
Hispanic (%)	48	56	47	0.23
White (%)	16	10	17	0.19
Asian/other (%)	12	4	13	0.06
Comorbidities (%):				
Prior MI	3	2	3	0.69
Prior revascularization	9	13	8	0.20
Charlson comorbidity score	3.0	3.2	3.0	0.61
Diabetes	24	23	24	0.89
Hypertension	54	58	54	0.62
COPD	13	17	12	0.30
Renal disease	7	8	7	0.82
Liver disease	3	7	3	0.08
HIV	2	2	2	0.91
Psychiatric disease	9	9	9	0.81
Catheterization (%):				
Ejection fraction	49	48	49	0.53
Drug eluting stent	45	21	48	< 0.001
Bare metal stent	44	63	42	0.003
Balloon only	10	15	10	0.21
Pharmacotherapy (%):				
Dual antiplatelet	76	83	75	0.24
β-blocker	77	60	80	0.001
PCI vessels (%):				
Left anterior descending	43	45	43	0.77
Left circumflex	27	25	27	0.74
Right coronary	33	32	33	0.91
Left main	1	0	1	0.49

were seen in the first year of follow-up. At 5-year follow-up stent thrombosis was noted in 40 individuals. Amongst those who had ever tested positive for cocaine, there was increased odds for stent thrombosis at 5-year follow-up (OR = 2.6, 95% CI: 1.2–5.5, p = 0.01).

In both univariate and multivariate analyses, use of dual antiplatelet therapy was associated with reduced odds of events at 30 days, whereas use of drug-eluting stents and use of β-blockers were not associated with the event rate. Neither use of β-blockers nor use of drug-eluting stents

was associated with increased risk for events in those who tested positive for cocaine.

Discussion

The main finding of our study is that when PCI is performed in subjects with cocaine-associated myocardial infarction, the risk for recurrent infarction and death is more than 20% in the first year. In the short-term, the adjusted odds for events was more than double that of those who tested negative for cocaine. Adjustment for use of dual antiplatelet therapy did not mitigate this risk. Although we did not find a statistically significant difference in the 1-year rate of death or recurrent infarction between our study groups, we suspect that this result may be due to our small sample size because the unadjusted 1-year event rate was quite high and the *p*-value was nearing significance. It is notable that the risk for events at 30 days and 1 year were also increased for those who had ever used cocaine, even if they did not test positive for cocaine at the index admission. This suggests that risk for events is related to chronic cocaine use and is not necessarily the result of PCI being performed while cocaine was positive for cocaine.

We also found a high rate of late stent thrombosis in those who had ever tested positive for cocaine. Several prior studies have suggested increased risk of stent thrombosis in those undergoing PCI for cocaine associated coronary syndromes [15–18]. Prior works, however, have used control groups that did not necessarily test negative for cocaine. We chose a control group that tested negative for cocaine for several different reasons. Most obviously, the negative test serves as fairly good evidence that the infarction and PCI did not occur while exposed to cocaine. Another reason we chose this control group was to help adjust for hidden confounders. We suspected that those who are tested for cocaine in the first place are a fundamentally different population than those who have not been tested for cocaine at all. To that point, we did find that those in the cocaine-negative group had a 4% prevalence of prior cocaine use and 22% prevalence of prior drug abuse.

Our study found a low use of β-blockers and drug-eluting stents in the group who tested positive for cocaine. Historically, β-blockers were felt to be potentially harmful in the setting of cocaine intoxication due to the effects of blocked β-receptors and unopposed stimulated alpha receptors causing pharmacologically induced vasospasm [11]. It is likely that the low use of β-blockers was influenced by this rationale. Amongst those who tested positive for cocaine, however, we found no evidence for harm with β-blocker usage compared to those who did not receive them. The extremely low use of drug-eluting stents in the cocaine-positive group may have similarly been influenced by reports of increased stent thrombosis and risk of non-adherence to dual antiplatelet therapy amongst those with cocaine intoxication [15–18]. Similarly, we did not find evidence for either benefit or harm with use of drug-eluting stents amongst those who tested positive for cocaine.

Our study has a few important limitations. The study was retrospective and observational, using a study cohort obtained from our electronic health record. This design makes commentary on causality impossible and introduces a potential for unrecognised confounders to be responsible for our result. There are many factors that influenced the decision of our subjects to use cocaine and the decision of the treating physicians to perform PCI. These were certainly not random assignments. Adjusting for demographics and comorbidities may not be enough to account for important unrecognised factors. It is fair to suspect that those in the cocaine group may be more likely to continue cocaine use and are potentially less compliant with prescribed medications. We still do not know if performing PCI in this setting lowers or increases a patient's risk for future events. Another limitation was that the data were gathered over a 6-year period, during which there have been numerous advancements and changes to stent technology as well as antiplatelet agents. This may affect the generalisability of our results in a more modern population.

In conclusion, our retrospective data suggest that PCI performed in cocaine associated myocardial infarction comes with high short- and long-term risk. Further prospective studies are needed to better define this risk and to lend insight into better management strategies.

Conflict of interest

The authors declare no conflict of interest.

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