Retrospective Study

Safety of upper endoscopy in patients with active cocaine use

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Abstract

BACKGROUND
Cocaine is a synthetic alkaloid initially viewed as a useful local anesthetic, but which eventually fell out of favor given its high addiction potential. Its predominantly sympathetic effects raise concern for cardiovascular, respiratory, and central nervous system complications in patients undergoing procedures. Peri-procedural cocaine use, often detected via a positive urine toxicology test, has been mostly addressed in the surgical and obstetrical literature. However, there are no clear guidelines on how to effectively risk stratify patients found to be positive for cocaine in the pre-operative setting, often leading to costly procedure cancellations. Within the field of gastroenterology, there is no current data available regarding safety of performing esophagogastroduodenoscopy (EGD) in patients with recent cocaine use.

AIM
To compare the prevalence of EGD related complications between active (≤ 5 d) and remote (> 5 d) users of cocaine.

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METHODS
In total, 48 patients who underwent an EGD at John H. Stroger, Jr. Hospital of Cook County from October 2016 to October 2018 were found to have a positive urine drug screen for cocaine (23 recent and 25 remote). Descriptive statistics were compiled for patient demographics. Statistical tests used to analyze patient characteristics, procedure details, and preprocedural adverse events included t-test, chi-square, Wilcoxon rank sum, and Fisher exact test.

RESULTS
Overall, 20 periprocedural events were recorded with no statistically significant difference in distribution between the two groups (12 active vs 8 remote, \( P = 0.09 \)). Pre- and post-procedure hemodynamics demonstrated only a statistically, but not clinically significant drop in systolic blood pressure and increase in heart rate in the active user group, as well as drop in diastolic blood pressure and oxygen saturation in the remote group (\( P < 0.05 \)). There were no significant differences in overall hemodynamics between both groups.

CONCLUSION
Our study found no significant difference in the rate of periprocedural adverse events during EGD in patients with recent vs remote use of cocaine. Interestingly, there were significantly more patients (30%) with active use of cocaine that required general anesthesia as compared to remote users (0%).

Key Words: Gastrointestinal endoscopy; Cocaine-related disorders; General anesthesia; Risk factors; Local anesthetics; Retrospective studies

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INTRODUCTION
Illicit drug abuse remains an ongoing public health crisis in the United States. As of 2018, 11.7% of the population over the age of 12 were illegal drug users. Of these, 2% reported regular use of cocaine[1]. Given the self-reporting nature of these statistics, there is reasonable concern that these values may be a significant underestimation of the actual number of active cocaine users in the population[2]. In the medical literature, cocaine’s predominantly sympathetic effects have been linked to a myriad of cardiovascular, respiratory, and central nervous system complications that may compromise patient stability when undergoing a procedure. Major cardiac abnormalities such as tachycardias, hypertension, myocardial ischemia or infarction, and various arrhythmias are at the forefront of concern[3]. Pulmonary edema, pulmonary hemorrhages, and pulmonary barotrauma have been attributed to the use of smoked “crack” cocaine[4]. Lastly, cocaine has also been implicated in several neurological complications including hemorrhage, stroke, seizures, and coma[5,6].
### Table 1 Patient characteristics

|                        | Active cocaine users, \(n = 23\) | Remote cocaine users, \(n = 25\) | \(P\) value$^1$ |
|------------------------|-----------------------------------|----------------------------------|-----------------|
| Age, yr, \(n\)         | \(51.0 \pm 9.5\)                 | \(54.8 \pm 10.9\)                | 0.210$^3$       |
| Sex, \(n\)             |                                   |                                  |                 |
| Male                   | 19                                | 11                               | 0.006$^5$       |
| Female                 | 4                                 | 14                               |                 |
| Ethnicity, \(n\)       |                                   |                                  |                 |
| White                  | 1                                 | 2                                | 0.889$^6$       |
| African American       | 17                                | 19                               |                 |
| Hispanic               | 5                                 | 4                                |                 |
| EKG, \(n\)             |                                   |                                  |                 |
| Normal                 | 8                                 | 9                                | 0.757$^5$       |
| Abnormal               | 14                                | 13                               |                 |
| No EKG                 | 1                                 | 3                                |                 |
| Comorbidities, \(n\)   |                                   |                                  |                 |
| Pulmonary              | 8                                 | 8                                | 0.836$^5$       |
| Cardiac                | 4                                 | 4                                | 1.000$^8$       |
| Renal                  | 1                                 | 3                                | 0.610$^8$       |
| Liver                  | 4                                 | 12                               | 0.025$^9$       |
| Hypertension           | 7                                 | 12                               | 0.214$^3$       |
| Other drug abuse       | 12                                | 17                               | 0.263$^5$       |
| Neurologic             | 0                                 | 1                                | 1.000$^8$       |
| Obesity                | 1                                 | 2                                | 1.000$^8$       |
| Infectious             | 1                                 | 13                               | 0.0003$^3$      |
| Malignancy             | 1                                 | 3                                | 0.610$^5$       |
| Diabetes               | 1                                 | 3                                | 0.610$^5$       |
| Other                  | 3                                 | 3                                | 1.000$^8$       |

$^1$Categorical value. Presented as frequency.

$^2$Continuous variables. Presented as mean value and standard deviation.

$^3$Compared to alpha value < 0.05 for significance.

$^\text{t}$-test.

$^\chi^2$-test.

$^\text{Fisher exact test.}$

EKG: Electrocardiogram

Jeffcoat et al[7] published one of the first studies exploring the differences in common routes of administration of cocaine including intravenous injection, nasal insufflation, and smoke inhalation. From this paper, the elimination half-life of cocaine was calculated to range between 69-78 min depending on the mode of administration. Using more modern laboratory assays for detection, the plasma half-life of cocaine has been determined to range between 0.7–1.5 h while the urine detection window is typically less than 1 d[8]. Cocaine’s main inactive metabolite, benzoylecgonine, has a plasma half-life of 5.5–7.5 h and a urine drug screen (UDS) window of 1–2 d[9]. These values can vary depending on differences in renal function, and frequency of cocaine use. In fact, benzoylecgonine has been detected in the urine up to 10-14 d after heavy cocaine use[10].

Pre-procedural management of a patient with recent cocaine use, typically determined via a positive urine toxicology test detecting benzoylecgonine, has been mostly addressed in the surgical and obstetrical literature. Within these fields, only a handful of cases have been published reporting cardiac arrhythmias, hypertension, and myocardial ischemia while intoxicated with cocaine and under general anesthesia[11]. In the setting of elective surgeries, larger studies such as Hill et al[12] demonstrated no greater risk for intraprocedural complications for non-toxic cocaine users when compared to drug-free patients. Baxter and Alexandrov[13] showed statistically significantly higher baseline systolic pressure, mean arterial pressure, and heart rate differences in the cocaine-positive cohort, but ultimately these were not deemed
clinically significant values. More recently, Moon et al[14] determined that cocaine positive patients did not demonstrate significantly different medication requirements as compared to cocaine-negative patients.

Despite the existence of this data, there remains no standard for practice on how to proceed with procedures this patient population. As such, practitioner preference is often used to determine the main course of action, leading to same day cancellations of procedures, resulting in waste of clinical time and resources[15]. There have been no direct published works addressing complications encountered during gastrointestinal endoscopies in patients with positive cocaine drug screens. This retrospective, single-center study aims to determine the safety of EGD with anesthesia support in patients who abuse cocaine, both actively and remotely.

**MATERIALS AND METHODS**

Records were reviewed from patients who underwent EGD at John H. Stroger, Jr. Hospital of Cook County from October 2016 to October 2018. Those with a cocaine positive UDS within less than 6 mo were identified. Remote cocaine users were classified as individuals with positive cocaine screen > 5 d, up to 6 mo from procedure, while active cocaine users had a positive UDS within 5 d. The study was approved by the institutional review board.

Demographic data including age, ethnicity, and comorbidities (pulmonary, cardiac, renal, liver, hypertension, other drug abuse, neurologic, obesity, infectious disease, malignancy, diabetes, and other medical conditions) were recorded. Procedural details such as American Society of Anesthesiologists Classification (ASA class), urgency level of procedure, type of anesthesia, location (inpatient vs outpatient), and length of stay, were also collected. Peri-procedural adverse events such as hypotension, tachycardia, nausea/vomiting, and oxygen desaturation were recorded. The outcomes measured included hemodynamic changes in blood pressure, heart rate, respiratory rate, and oxygen saturation, pre- and post-procedure.

All patient data was analyzed using STATA/SE 12.0 and Excel version 365 (Microsoft). Several statistical tests were used to analyze patient characteristics, procedure details, and preprocedural adverse events including t-test, chi-square, Wilcoxon rank sum, and Fisher exact test. All P-values < 0.05 were considered statistically significant.

**RESULTS**

A total of 2122 patients were identified during the study period; 129 patients had a positive drug screen of which 48 were positive for cocaine. Active users (23) were predominately male (83%) and African American (74%). Remote users (25) were 44% female and predominantly African American (76%). There was a significant difference in gender predominance in the active group compared to the remote (P = 0.006). A substantial number of patients in both groups had abnormal admitting electrocardiogram (14 active vs 13 remote) and both were found to have concurrent drug abuse (12 active vs 17 remote) as their most prevalent comorbidity (Table 1). There was no significant difference between groups for both categories, although liver and infectious comorbidities were more prevalent in the remote group (P = 0.025, 0.0003).

Patients in both groups underwent urgent procedures (17 active vs 14 remote) with no statistical difference (P = 0.195); although the active group was treated more often in the inpatient setting (P = 0.024). ASA class III was most prevalent among the two groups (14 active vs 21 remote) although more predominant in the remote group (P = 0.046). Monitored anesthesia care (MAC) sedation was the preferred anesthesia support over general anesthesia (16 active vs 25 remote) (P = 0.003). Hospitalizations were longer for remote vs active patients (P = 0.003), (Table 2). Overall, 20 periprocedural adverse events occurred among the 48 patients. Although not statistically significant, active users had more events compared to remote users (12 vs 8, P = 0.09) defined as documented oxygen desaturation during the procedure, use of vasopressor, rate-controlling, or anti-nausea medications (Table 3).

Pre- and post-procedure hemodynamics demonstrated a statistically significant, but not clinically significant, drop in systolic blood pressure (136/77 pre-procedure vs 129/76 post-procedure, P = 0.03/0.64), as well as an increase in heart rate (73 pre-procedure vs 76 post-procedure, P = 0.04) in the active user group. In the remote user group, there was also a statistically significant, but not clinically significant, drop in
Table 2 Procedure details

|                      | Active cocaine users, n = 23 | Remote cocaine users, n = 25 | P value
|----------------------|------------------------------|------------------------------|----------
| Urgency, n¹          | Non-urgent 6                 | 11                           | 0.195
|                      | Urgent 17                    | 14                           |          |
| Location, n¹         | Inpatient 22                 | 17                           | 0.024
|                      | Outpatient 1                 | 8                            |          |
| ASA Class, n²        | Class II 9                   | 3                            | 0.046
|                      | Class III 14                 | 21                           |          |
|                      | Class IV 0                   | 1                            |          |
| LOS, n²              | (Avg. day ± SD) 5.4 ± 3.6    | 5.6 ± 11.9                   | 0.018
| Type of Anesthesia, n² | MAC 16                      | 25                           | 0.003
|                      | General 7                    | 0                            |          |

¹Categorical value. Presented as frequency.
²Continuous variables. Presented as mean value and standard deviation.
³Compared to alpha value < 0.05 for significance.
⁴chi-SQ.
⁵Fisher exact test.
⁶Wilcoxon rank sum test.
ASA Class: American Society of Anesthesiologists Classification; LOS: Length of stay; MAC: Monitored anesthesia care.

Table 3 Periprocedural adverse events

|                      | Active cocaine users, n = 23 | Remote cocaine users, n = 25 | P value
|----------------------|------------------------------|------------------------------|----------
| Cumulative complications, n¹ | 12                          | 8                            | 0.09
| Oxygen desaturation, n¹       | 1                            | 2                            | 1.000
| Nausea/vomiting, n¹           | 7                            | 2                            | 0.068
| Hypotension, n¹                | 4                            | 4                            | 1.000
| Tachycardia, n¹                | 0                            | 0                            | NA

¹Categorical value. Presented as frequency.
²Compared to alpha value < 0.05 for significance.
³Fisher exact test.

There were no significant differences in overall hemodynamics between both groups when compared via two-sample t-test (Table 4).

DISCUSSION

To the best of our knowledge, our project is the first retrospective, single-center study aimed at determining the safety of EGD under anesthesia in patients who have recently abused cocaine with comparison to remote users. Although cumulatively there were more reported periprocedural adverse events in patients with active cocaine use compared to patients with remote cocaine use undergoing endoscopy, the primary result of this study was that ultimately this difference was statistically insignificant. Moreover, the statistically significant differences in preprocedural and postprocedural hemodynamics both within and across groups were, much like in the Baxter et al[13] study, not deemed clinically significant[14]. There was no reported mortality in any of the groups.
Table 4 Hemodynamic outcomes

|                  | Active cocaine users, n = 23 | Remote cocaine users, n = 25 | P value<sup>1,3</sup> |
|------------------|-----------------------------|------------------------------|-----------------------|
| Blood pressure pre-procedure | 136/77 (17/13) | 130/80 (19/12) | 0.14/0.38 |
| Blood pressure post-procedure (mmHg ± SD), n<sup>1</sup> | 129/76 (15/11) | 124/74 (27/12) | 0.46/0.52 |
| Heart rate pre-procedure | 73 (12) | 78 (16) | 0.16 0.04 0.27 |
| Heart Rate post-procedure (BPM ± SD), n<sup>1</sup> | 76 (13) | 81 (16) | 0.28 |
| Respiratory rate pre-procedure | 19 (2) | 19 (4) | 0.95 0.11 0.42 |
| Respiratory rate post-procedure (BPM ± SD), n<sup>1</sup> | 18 (3) | 20 (5) | 0.10 |
| Oxygen saturation pre-procedure | 98 (2) | 98 (1) | 0.43 0.74 0.04 |
| Oxygen saturation post-procedure (% ± SD), n<sup>1</sup> | 98 (2) | 97 (3) | 0.12 |

<sup>1</sup>Continuous variables. Presented as mean value and standard deviation.<br>
<sup>2</sup>Compared to alpha value < 0.05 for significance.<br>
<sup>3</sup>t-test.

A unique component to our study, in contrast to much of the available literature, is the overwhelming preponderance of MAC used vs general anesthesia in both cohorts. MAC is a type of anesthesia commonly used in diagnostic or therapeutic procedures such as endoscopies as it can be titrated to maintain spontaneous breathing and airway reflexes<sup>[16]</sup>. For endoscopic procedures, especially in the ambulatory setting, the rapid recovery of MAC is ideal for high volume centers. In contrast, under general anesthesia, patients undergo a drug-induced loss of consciousness that prevents any ability to respond purposefully and often necessitate airway support<sup>[16]</sup>. Further analysis into the two cohorts of our study showed that active users were more likely to undergo the EGD under general anesthesia, 30%, vs remote users, 0%. Unfortunately, given the retrospective nature of the study and the small sample size, the reasoning behind this deviation in anesthesia type could not be further dissected. However, it may point to some component in the patient’s clinical status that swayed the anesthesiologist to favor one form over the other.

As previously mentioned, given the retrospective nature of this study, there are several limitations that must be addressed. Despite the two-year timespan for chart review, our total sample population of cocaine positive patients, both active and remote, remained small. This was to be expected as UDS are not part of the standard pre-procedural work up of a patient undergoing an EGD. Additionally, similarly to what was mentioned in Moon et al<sup>[14]</sup>, selection bias is likely at play in the sample population as individuals that undergo a procedure even after a positive cocaine UDS are more likely to need urgent intervention<sup>[14]</sup>. Lastly, despite the stratification of active vs remote users based off UDS timing, there are several unknown factors that could not be standardized such as the exact time span between the last drug use and the procedure date, quantity of cocaine consumed, and other confounding factors such as co-morbid polysubstance abuse. As such, the generalizability of the results of our current study is difficult to determine and larger studies are needed to corroborate our findings.

In summary, the findings of our study suggest that there are no significant differences in periprocedural adverse events or hemodynamic disturbances in active vs remote cocaine users undergoing an EGD with anesthesia support. Further investigation via larger prospective studies, containing a cocaine-negative control group, in which the type of anesthesia used can be standardized may elucidate any true difference in adverse events rates between MAC vs general anesthesia in this patient population. Additionally, given the wide range of drug agents used for MAC, other studies may be needed to identify which agents, if any, would be safer for use in cocaine positive patients or those suspected to have had recent cocaine abuse.
CONCLUSION

In conclusion, performing an EGD in patients with recent cocaine use, as evidenced by a positive UDS test, appears to be relatively safe, supporting forgoing procedure cancellation in this patient population.

ARTICLE HIGHLIGHTS

Research background
Procedure delay in patients with a recent history of cocaine use due to concerns of possible adverse events can compromise patient care and incur undue healthcare costs.

Research motivation
There is a paucity of literature available to risk stratify patients with recent cocaine use undergoing endoscopic procedures.

Research objectives
We endeavored in this study to evaluate the relative safety of performing an esophagogastroduodenoscopy (EGD) in this specific patient population.

Research methods
Pre- and post-procedure hemodynamics were recorded and as well as frequency of adverse events. Using statistical tests including t-test, chi-square, Wilcoxon rank sum, and Fisher exact test, our data analysis results suggested no statistically significant differences in periprocedural adverse events or clinically significant hemodynamic disturbances in active (< 5 d) vs remote cocaine users (> 5 d).

Research results
Our study found no significant difference in the rate of periprocedural adverse events during EGD in patients with recent vs remote use of cocaine.

Research conclusions
Performing an EGD in patients with recent cocaine use appears to be safe.

Research perspectives
Given the retrospective nature of this study, we hope our results generate more interest to explore this topic further in larger, prospective studies.

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