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OPINION REVIEW

- 451 Proposal of the term “gallstone cholangiopancreatitis” to specify gallstone pancreatitis that needs urgent endoscopic retrograde cholangiopancreatography
Isogai M

MINIREVIEWS

- 460 Endoscopic ultrasonography-guided celiac plexus neurolysis in patients with unresectable pancreatic cancer: An update
Pérez-Aguado G, de la Mata DMA, Valenciano CML, Sainz IFU
- 473 Tips and tricks for the diagnosis and management of biliary stenosis-state of the art review
Del Vecchio Blanco G, Mossa M, Troncone E, Argirò R, Anderloni A, Repici A, Paoluzi OA, Monteleone G

ORIGINAL ARTICLE**Retrospective Cohort Study**

- 491 Clinical impact of gastrointestinal endoscopy on the early detection of pharyngeal squamous cell carcinoma: A retrospective cohort study
Miyamoto H, Naoe H, Morinaga J, Sakisaka K, Tayama S, Matsuno K, Gushima R, Tateyama M, Shono T, Imuta M, Miyamaru S, Murakami D, Orita Y, Tanaka Y

Retrospective Study

- 502 Follow-up outcomes in patients with negative initial colon capsule endoscopy findings
Nakaji K, Kumamoto M, Yodozawa M, Okahara K, Suzumura S, Nakae Y
- 510 Safety of upper endoscopy in patients with active cocaine use
Liyen Cartelle A, Nguyen A, Desai PM, Kotwal V, Makhija J, Yu J, Yap JEL

Observational Study

- 518 Association between mucosal surface pattern under near focus technology and *Helicobacter pylori* infection
Fiuza F, Maluf-Filho F, Ide E, Furuya Jr CK, Fylyk SN, Ruas JN, Stabach L, Araujo GA, Matuguma SE, Uemura RS, Sakai CM, Yamazaki K, Ueda SS, Sakai P, Martins BC

CASE REPORT

- 529 Endoscopic treatment of periampullary duodenal duplication cysts in children: Four case reports and review of the literature
Bulotta AL, Stern MV, Moneghini D, Parolini F, Bondioni MP, Missale G, Boroni G, Alberti D
- 543 Small bowel perforation from a migrated biliary stent: A case report and review of literature
Zorbas KA, Ashmeade S, Lois W, Farkas DT

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The primary aim of *World Journal of Gastrointestinal Endoscopy* (WJGE, *World J Gastrointest Endosc*) is to provide scholars and readers from various fields of gastrointestinal endoscopy with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGE mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal endoscopy and covering a wide range of topics including capsule endoscopy, colonoscopy, double-balloon enteroscopy, duodenoscopy, endoscopic retrograde cholangiopancreatography, endosonography, esophagoscopy, gastrointestinal endoscopy, gastroscopy, laparoscopy, natural orifice endoscopic surgery, proctoscopy, and sigmoidoscopy.

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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.

additional data are available.

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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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Core Tip: There is no data available regarding safety of performing an esophago-gastroduodenoscopy in patients with evidence of recent cocaine use. This study compared the prevalence of procedure complications between active and remote cocaine users and found no statistically significant difference between the two groups. Pre- and post-procedure hemodynamics demonstrated only statistically, but not clinically significant changes in blood pressure, heart rate, and oxygenation. Results suggest relative safety in performing this procedure on active cocaine users. Patients in the active group required more general anesthesia; however, given nature of study, the reasoning behind this sedation choice was difficult to determine.

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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 ³
Age, yr, n ²	(Avg. ± SD)	51.0 ± 9.5	54.8 ± 10.9	0.210 ⁴
Sex, n ¹	Male	19	11	0.006 ⁵
	Female	4	14	
Ethnicity, n ¹	White	1	2	0.889 ⁶
	African American	17	19	
	Hispanic	5	4	
EKG, n ¹	Normal	8	9	0.757 ⁵
	Abnormal	14	13	
	No EKG	1	3	
Comorbidities, n ¹	Pulmonary	8	8	0.838 ⁵
	Cardiac	4	4	1.000 ⁶
	Renal	1	3	0.610 ⁶
	Liver	4	12	0.025 ⁵
	Hypertension	7	12	0.214 ⁵
	Other drug abuse	12	17	0.263 ⁵
	Neurologic	0	1	1.000 ⁶
	Obesity	1	2	1.000 ⁶
	Infectious	1	13	0.0003 ⁵
	Malignancy	1	3	0.610 ⁶
	Diabetes	1	3	0.610 ⁶
	Other	3	3	1.000 ⁶

¹Categorical value. Presented as frequency.

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

³Compared to alpha value < 0.05 for significance.

⁴t-test.

⁵chi-SQ.

⁶Fisher 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. Periprocedural 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 male 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 ³
Urgency, n ¹	Non-urgent	6	11	0.195 ⁴
	Urgent	17	14	
Location, n ¹	Inpatient	22	17	0.024 ⁵
	Outpatient	1	8	
ASA Class, n ¹	Class II	9	3	0.046 ⁵
	Class III	14	21	
	Class IV	0	1	
LOS, n ²	(Avg day ± SD)	5.4 ± 3.6	5.6 ± 11.9	0.018 ⁶
Type of Anesthesia, n ¹	MAC	16	25	0.003 ⁵
	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 ²
Cumulative complications, n ¹	12	8	0.09
Oxygen desaturation, n ¹	1	2	1.000 ³
Nausea/vomiting, n ¹	7	2	0.068 ³
Hypotension, n ¹	4	4	1.000 ³
Tachycardia, n ¹	0	0	NA

¹Categorical value. Presented as frequency.

²Compared to alpha value < 0.05 for significance.

³Fisher exact test.

diastolic blood pressure (130/80 pre-procedure *vs* 124/74 post-procedure, $P = 0.34/0.01$) and oxygen saturation (98 pre-procedure *vs* 97 post-procedure, $P = 0.04$). 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 ^{2,3}		
Blood pressure pre-procedure	136/77 (17/13)	130/80 (19/12)	0.14/0.38	Active: 0.03/0.64	Remote: 0.34/0.01
Blood pressure post-procedure (mmHg ± SD), n ¹	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 ¹	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 ¹	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 ¹	98 (2)	97 (3)	0.12		

¹Continuous variables. Presented as mean value and standard deviation.

²Compared to alpha value < 0.05 for significance.

³t-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[16]. 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[16]. 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*[14], 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[14]. 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 peri-procedural 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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