



Illicit Drug Use and Endoscopy: When Do We Say No?

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Abstract

Background Illicit drug use (IDU) is often encountered in patients undergoing elective ambulatory surgical procedures such as endoscopy. Given the variety of systemic effects of these drugs, sedation and anesthetics are believed to increase the risk of cardiopulmonary complications during procedures. Procedural cancellations are common, regardless of the drug type, recency of use, and total dosage consumed. There is a lack of institutional and society recommendations regarding the optimal approach to performing outpatient endoscopy on patients with IDU.

Aim To review the literature for current recommendations regarding the optimal management of outpatient elective endoscopic procedures in patients with IDU. Secondary aim is to provide guidance for clinicians who encounter IDU in endoscopic practice.

Methods Systematic review of PubMed, CINAHL, Embase, and Google Scholar for articles presenting data on outcomes of elective procedures in patients using illicit drugs.

Results There are no clinically relevant differences in periprocedural complications or mortality in cannabis users compared to non-users. Endoscopy in patients with remote cocaine use was also found to have similar outcomes to recent use.

Conclusions Canceling endoscopic procedures in patients with recent IDU without consideration of the type of drug, dosage, and chronicity may lead to unnecessary delays in care and increased patient morbidity. Healthcare systems would benefit from additional guidelines for evaluating the patient with recent illicit drug use for acute intoxication and consider proceeding with procedures in the non-toxic population.

Keywords Illicit drugs · Endoscopy · Ambulatory surgical procedure · Appointments and schedules

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Introduction

The prevalence of illicit drug use (IDU) in the United States is increasing annually, with 20.9% of the population over age 12 years reporting IDU in 2019, an increase from 17.8% in 2015 [1]. Cocaine, marijuana, alcohol, heroin, and methamphetamines are most commonly used [2]. Given the effects that these drugs can have on the cardiopulmonary system and interactions with commonly used anesthetics, careful attention must be given when planning procedures in this population. IDU is frequently encountered in patients undergoing outpatient endoscopy, with encounters likely to increase as states continue to legalize drugs such as cannabis [3, 4]. However, there are no current guidelines regarding the optimal timing of endoscopy in patients with IDU. Additionally, there is limited guidance for safely administering sedation for outpatient endoscopic procedures in patients with a history of IDU.

Current anesthetic recommendations for IDU patients are targeted towards emergency situations where delaying the

procedure is not a viable solution [5, 6]. Studies evaluating the impact of IDU on procedural risks and outcomes primarily focus on general anesthesia and are mixed. However, multiple studies have demonstrated comparable clinical outcomes for urine drug screen (UDS) positive, non-toxic patients when compared to the general population [7–10].

Institutions and providers have widely varying practices for managing elective procedures for IDU patients [3, 7, 11]. Due to a lack of institutional guidelines, physicians often rely on cultural practices when managing these cases. A wide-ranging survey of VA Chiefs of Anesthesia found that while over half of the participating facilities treated patients with active cocaine use, only 10% of the facilities had a formal policy for management. In addition, 65% of providers reported canceling or delaying elective procedures for patients with a positive urine cocaine screen, regardless of the presence of active symptoms or intoxication [3]. 80% of respondents reported that institutional guidelines for preoperative management of this population would be beneficial.

When discussing the effect of illicit drug use during endoscopic procedures, it is important to consider the type of procedural sedation being used and the potential for interaction with commonly used anesthetics. In the United States, most endoscopies are performed under some degree of sedation [12, 13]. Specific methods differ across organizations, and there is no current consensus for sedation techniques during endoscopic procedures [14].

Common practices include moderate sedation with benzodiazepines and opioids, or deeper sedation with propofol [12, 15]. Notably, endoscopic procedures use significantly lower doses of anesthetics for procedures when compared to general anesthesia [16], and it is unknown what degree of procedural risk exists in this clinical setting.

The primary aim of our study is to review the current literature for recommendations regarding the management of outpatient elective endoscopic procedures in patients with recent use of illicit drugs. The secondary aim of the study is to provide best-practice guidance for management of IDU patients before endoscopic procedures.

Methods

A systematic literature review was performed using multiple databases from inception until January 2021, including PubMed, CINAHL, Embase, and Google Scholar. The initial search terms included “((endoscopy) or (esophagogastroduodenoscopy)) and (illicit drug use) and (procedural delays).” The search was then broadened to include commonly used drugs, including cannabis, cocaine, heroin, and methamphetamines. Inclusion criteria included English language, full-text availability, and age older than 18 years. Articles not meeting these criteria were excluded

from review. After initial collection, these databases were searched again at a follow-up date in October 2021 to include any additional publications.

Results

Figure 1 illustrates the identification and screening process for articles included in this review. In total, 1284 articles were identified (PubMed = 258, Embase = 17, CINAHL = 34, Google Scholar = 975). After screening the abstracts, six articles met the inclusion criteria and were evaluated for comparison. One article was removed due to an overlapping cohort population. The studies included a total of 363 patients. All studies were retrospective. Four of the studies compared frequent cannabis use with endoscopic outcomes [17–20], and one evaluated recent cocaine ingestion [21]. No studies assessed endoscopic outcomes in heroin, methamphetamine, or poly-substance users. Table 1 includes key findings of these studies, including drug side effects related to endoscopy, pre-operative testing, time from last use to procedure completion, and complications encountered during endoscopy.

Study Analysis

Cannabis

Imasogie, 2021

This was a single-center, case–control study completed in Ontario, Canada, in 2014–2017. Participants were selected for self-reported cannabis exposure ($n = 151$) compared to a control population with no reported exposure ($n = 167$). The

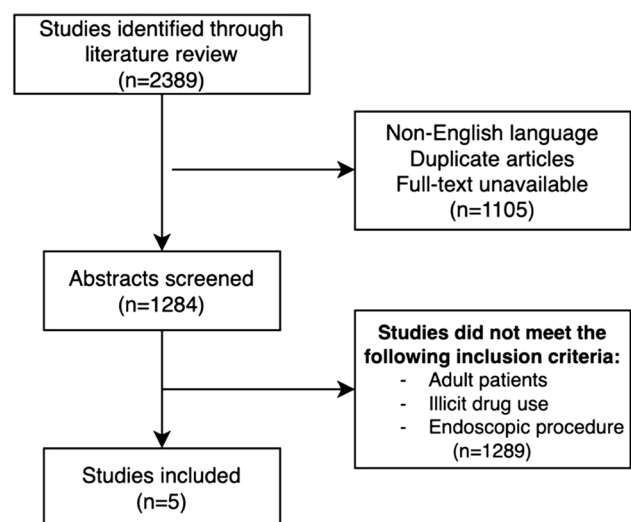


Fig. 1 Flow diagram for article screening and selection

Table 1 Study selection for IDU and endoscopic procedures

Reference	Year	Drug(s) reviewed	Drug side effects relevant to endoscopy	Pre-operative testing	Time from last use until procedure completed
Imasogie	2021	Cannabis	Propofol dose during procedure	Self-reported use	Daily, weekly, monthly, occasionally
King	2021	Cannabis	Anesthetic requirements, cardiac, respiratory events	Self-reported use	NA
Liyen Cartelle	2021	Cocaine	Peri-procedural adverse events	UDS	< 5 days
Twardowski	2019	Cannabis	Anesthetic requirements	Self-reported	Daily, weekly
Lee	2021	Cannabis	Anesthetic requirements	NA	Daily

timing of endoscopy and recency/chronicity of use were not recorded. All participants received propofol sedation.

Cannabis users were more likely to be male, young, and tobacco users. 53% reported daily use. The study found that a higher propofol dose was required to achieve sedation in patients with cannabis exposure than in those without (cases 0.33 mg/kg/min \pm 0.24, controls 0.18 mg/kg/min \pm 0.11; $p < 0.0001$). Daily cannabis users were also found to require higher average doses of propofol than weekly or monthly users. After multivariate linear regression analysis, cannabis exposure remained associated with increased propofol dose and accounted for 61% of dose variability. Three procedural complications occurred in cases with cannabis use history, where none occurred in the control group, although this was not statistically significant.

King, 2021

This was a retrospective case–control study completed at a Massachusetts community hospital in September–November 2018. Patients with self-reported cannabis use were compared to a control population of nonusers in patients undergoing endoscopy. 47 cases were identified with prior self-reported use, and 23 were cross matched with nonuser controls. The patients in this study were 78.3% female with an average age of 41.1 years. This study found no difference in the amount of propofol required in the cannabis group when compared to the control group (0.4798 mg/kg/min, 0.5023 mg/kg/min, $p = 0.70$). Fentanyl and ketamine utilization rates were also examined and found to be more frequent in patients with cannabis users than in nonusers, although this was not statistically significant (Fentanyl $p = 0.41$; Ketamine $p = 0.32$). There were no identified adverse cardiopulmonary events in either population.

Twardowski, 2019

This was a retrospective cohort study of endoscopies performed at a Level III trauma hospital in Colorado from

January 2016 to December 2017. Participants were screened for self-reported daily or weekly cannabis use ($n = 25$) and compared to a control population of non-users ($n = 225$) for periprocedural anesthetic requirements. The study found an increase in required total doses for propofol (users 44.81 mg, nonusers 13.83 mg, 220% increase, $p = 0.029$), midazolam (users 9.15 mg, nonusers 7.61 mg, 19.6% increase, $p < 0.001$), and fentanyl (users 125.93 μ g, nonusers 109.91 μ g, 14% increase, $p = 0.026$) when compared to nonusers. This association persisted with the Mann–Whitney U test. The study found that cannabis use was associated with larger doses of sedating medications, although researchers suggested patients were possibly transitioned to propofol earlier in the procedure than nonusers, resulting in much higher cumulative doses. The study did not include data on patient demographics.

Lee, 2021

This was a retrospective single-center cohort study of endoscopies performed from January–April 2018. Participants were included for self-reported daily marijuana users ($n = 267$) and compared to a control nonuser population ($n = 786$). These groups were compared for required sedation doses, procedure-related statistics, and adverse events in patients with nurse-administered propofol continuous infusion sedation (NAPCIS).

There were multiple statistically significant population differences for patients undergoing esophagogastroduodenoscopy in each group. These included mean age (marijuana 47.3, control 67.7, $p < 0.001$) and percent male (marijuana 61%, control 41.5%, $p = 0.032$). For colonoscopy, similar differences were noted, as well as an increased incidence of tobacco use in patients with marijuana use (14.6% vs 3.5%, $p < 0.001$) compared to control.

The study found that the marijuana group required increased doses of fentanyl (0.6 vs 0.4 mcg/kg, $p < 0.025$), and propofol (5.0 vs 3.2 mg/kg, $p < 0.025$) compared to

the control group. Procedural success rates were > 95% in all groups and did not differ significantly, and mean procedure and recovery times were also comparable in all groups. Adverse events related to sedation occurred in 26 total cases and did not differ significantly between populations.

Cocaine

Cartelle, 2021

This was a retrospective cohort study that examined the association between recent cocaine use and adverse events during non-emergent endoscopy at John H. Stroger, Jr. Hospital in Cook County from October 2016 to October 2018. Participants were classified as active users (UDS positive for cocaine within 5 days) and remote users (UDS positive for cocaine > 5 days but < 6 months). 23 active users were included and comprised of 83% male and 74% African American population. There were 25 remote users included in the study, with 44% female and 76% African American.

The study found multiple differences in the two populations, including fewer inpatient procedures ($p=0.024$), greater prevalence of ASA III (21 vs 14), longer admissions ($p=0.003$), and more frequent monitored anesthesia care (MAC) in the remote group (25 vs 16, $p=0.003$).

Overall, majority of the procedures were done urgently (17 active, 14 remote) and 20 adverse events occurred from the 48 procedures. Active users were found to have more procedure-related adverse events, although not statistically significant (12 active, 8 remote, $p=0.09$). The active using group was noted to have a statistically significant decrease in systolic blood pressure post-procedurally (136 to 129, $p=0.04$), as well as increase in heart rate (73 to 76, $p=0.04$). The remote using group experienced a decrease in diastolic blood pressure (80 → 74, $p=0.01$) and oxygen saturation (98 to 97, $p=0.04$) post-procedure. These findings not considered clinically significant. Dosing requirements for anesthetics was not compared between the two groups.

Discussion

Cannabis use has been associated with significantly elevated induction doses of propofol in patients undergoing general anesthesia, although the required dose widely varies by study [17, 22, 23]. This finding was also demonstrated in three of four studies evaluating cannabis use and outcomes during endoscopy [17, 18, 20]. In the study by Imasogie, 2021, cannabis users required on average

0.33 mg/kg/min of propofol compared to 0.18 mg/kg/min for non-users, with 61% of variability directly attributable to cannabis use. Anesthetic dosing was also found to be highest in daily users. Twardowski, 2019 found a 220% increase in total propofol requirements in daily and weekly cannabis users compared to non-users (44.81 mg vs 13.83 mg), as well as statistically significant increases in midazolam (19.6%) and fentanyl (19.6%) utilization in cases with cannabis exposure. Lee, 2021 demonstrated increased cumulative doses of propofol associated with self-reported daily cannabis use (5.0 vs 3.2 mg/kg) as well as increased fentanyl requirements (0.6 vs 0.4 mcg/kg) when compared to non-users. Despite these findings, these studies found no statistically significant difference in observable adverse events, procedure completion, or outcomes on follow-up. In the study by King, 2021, patients with self-reported cannabis use had no significant difference in propofol dose requirements (0.4798 vs 0.5023 mg/kg/min) or fentanyl and ketamine use during procedures.

The final study by Liyen Cartelle, 2021 compared recent and remote cocaine ingestion with sedation requirements and adverse effects, including hemodynamic changes and hypoxia. Recent use was defined as a positive UDS < 5 days prior to endoscopy and a positive UDS between 5 days and 6 months prior to procedure. Most cases were performed in an urgent setting, and there was no comparison to a non-using control population. While there was no difference in clinical outcomes in the two groups, there was an increased number of peri-procedural adverse events at 42% overall, which appears much higher than the general population. The severity of adverse events varied widely and was defined as oxygen desaturation during the procedure, use of vasopressor, rate-controlling, or anti-nausea medications. Majority of reported symptoms were nausea/vomiting in the active group (7/12), and documented hypotension in the remote group (4/8). Both populations experienced statistically significant changes in hemodynamic status after endoscopy, although this was not clinically significant and was not compared to a non-using control population.

These studies were uniformly retrospective in nature and utilized self-reported drug use or positive UDS results at specific time-points prior to endoscopy. No studies included information regarding time to endoscopy after use or specific outcomes for procedures performed on patients with signs of acute intoxication. The studies found associations between recent cannabis use and increased levels of propofol sedation, as well as increased utilization of fentanyl, midazolam, and ketamine, but there were no significant increases in procedural-related adverse events in these populations.

Overall, these represent relatively limited analyses of the complex risks when considering the effects of illicit drugs on patient hemodynamics, as well as the potential interactions with commonly used anesthetics. However, the results do suggest that recent drug use may not be inherently linked to increased risks of adverse events during procedures. Additional consideration must also be given for the increased anesthetic requirements in the study participants when planning endoscopy in patients with IDU.

Moderate sedation with propofol generally results in approximately one-tenth dosing when compared to general anesthesia, and it is associated with a relatively low risk of anesthetic-related complications. [16]. While the risk of recent drug use and interactions with anesthetics remains a concern, these studies did not find a significant change in clinical outcomes in cases with recent cannabis or cocaine use, and anesthetic requirements remained well below doses that would be generally considered toxic or those used in general anesthesia [16, 24].

Additional Anesthetic Considerations

Marijuana

Marijuana is a psychoactive drug that acts at two cannabinoid receptors (CB1 and CB2), which are G-protein-coupled receptor that inhibits adenylyl cyclase and promotes potassium conductance [25, 26]. It is commonly used in an inhaled or ingested form, and the most psychoactive compound is delta-9 tetrahydrocannabinol (THC). Physiologic signs of acute intoxication include tachycardia, hypertension, tachypnea, euphoria, conjunctival injection, and increased appetite (Table 2). Onset and duration of intoxication is typically 15 min and 3–4 h for inhaled, and variable onset with up to 12 h of intoxication for ingested formulations[26]. It is lipid soluble and can be detected on routine lab testing for up to 30 days after use [27].

The effects of cannabis vary based on timeline, route, dose, and frequency, which has made the study of this

Table 2 Duration of Urine drug screen positivity and anesthetic complications associated with commonly encountered drugs

Drug	Common effects of intoxication	Time to peak effect (minutes)	Duration of intoxication (hours)	Duration of urine positivity	Anesthetic complications with acute toxicity
Marijuana	Anxiety, somnolence, conjunctival injection, increased appetite, ataxia	Inhaled: 15–30 Ingested: 30–180	Inhaled: up to 4 Ingested: up to 12	3 days to 30 days with chronic use	Airway irritability, hypotension, Increased anesthetic requirements
Cocaine	Fever, tachycardia, hypertension, diaphoresis, pupillary dilation, rhinorrhea	Intravenous: 3–5 Intranasal: 20–30 Inhaled: 3–5 Ingested: 60–90	Intravenous: 0.5–1 Intranasal: 1–2 Inhaled: 0.5–1 Ingested: Indeterminate	1–8 days in most cases, up to 22 days reported with high-dose, chronic use (30 g/day inhaled)	Tachyarrhythmias, bronchospasm, hemodynamic instability, agitation
Methamphetamines	Tachycardia, hypertension, aggression, paranoia, pupillary dilation	Intravenous: < 15 Intranasal: < 15 Inhaled: 15–18 Ingested: 180	Indeterminate, ranges from 4 to 48 h with residual psychologic changes	1–7 days, longer in chronic use	Hemodynamic instability, myocardial ischemia, tachyarrhythmias
Heroin	Pupillary constriction, rhinorrhea, skin excoriations, somnolence, gait instability	Intravenous: < 5	0.5, up to 4–5 for active metabolites (6-monoacetylmorphine)	24–48 h	Respiratory depression, hypotension, increased sedation requirements
Ecstasy	Labile temperatures, tachycardia, hypertension, tremor, bruxism, hallucinations, euphoria	Ingested: < 180	Ingested: 4–6	48 h	Tachycardia, hypertension, hyperthermia, hyperglycemia
Phencyclidine (PCP)	Aggression, ataxia, aphasia, confusion, psychosis, pupillary dilation	Intravenous: 2–5 Intranasal: 2–5 Inhaled: 2–5 Ingestion: 90	Intravenous: 1–2 Intranasal: Indeterminate Inhaled: 1–2 Ingestion: 1–3 May experience prolonged intoxication with delayed release from adipose tissue	> 1 week	Pulmonary hypertension, tachycardia, psychosis, cerebral hemorrhage

Acute effects, time to peak, effect, and duration of intoxication vary depending on dose, route, and individual tolerance to the specific drug. All values included in the table serve as estimates for general use

substance and its anesthetic implications challenging. Nonetheless, acute intoxication can result in a variety of cardiovascular changes ranging from tachycardia, hypotension, and arrhythmias [28]. Cannabis has been implicated in coronary spasm in patients with underlying CAD and can result in a variety of malignant arrhythmias, including atrial and ventricular fibrillation as well as increased risk of myocardial ischemia [29]. As a result of these potentially devastating complications, some recommend delaying elective procedures in acutely intoxicated patients until cardiovascular symptoms resolve, particularly if there is clinically significant CAD [29].

Cannabis using patients who primarily inhale the product may also present with reactive airways and bronchospasm, which can complicate airway management. For instance, there is a causative linkage to uvular inflammation and marijuana use, which can increase airway edema and consequently cause obstruction, particularly in patients who are undergoing airway instrumentation and therefore at higher risk [28]. Cannabis use has also been shown to cause severe laryngospasm, which can cause significant hypoxemia and even death if not quickly remedied [28]. Given these potential airway reactions, some literature suggests all elective procedures be canceled if there is recent exposure to cannabis smoke, although specific timelines are not provided [28]. Nonetheless, chronic marijuana use has been found to be as equally damaging to the pulmonary system as chronic cigarette smoking, and similar considerations for patients undergoing surgery should be considered [28].

Cannabis users can also have abnormal responses to anesthetic agents, including variable responses to both inhalational and intravenous anesthetics and analgesic requirements [29, 30]. For instance, chronic marijuana users were found to require higher doses of propofol to achieve anesthesia intra-operatively as measured by proprietary EEG. These patients were also found to report higher pain scores and required more rescue analgesics for adequate pain control post-operatively [28, 30]. Other serious potential effects of cannabis include higher risk for ischemic stroke, alterations in coagulopathy that can result both in poor hemostasis as well as increased risk of thromboembolism, and worsening of perioperative hypothermia [30].

Cocaine

Cocaine is a stimulant and can be used via multiple routes, including intravenous, intranasal, and inhalation. The onset and duration of action varies by route and is estimated as <5 min to onset from all routes and 60–120 min duration, with intranasal lasting the longest [31]. The drug can also be ingested, although the duration of action in these cases is not clear.

Physiologic effects of intoxication are induced by multiple mechanisms. These include blockade of catecholamine re-uptake in the CNS and periphery, resulting in vasoconstriction and euphoric effects. Sodium channel blockade can also occur, which produces local anesthesia and the stimulation of excitatory amino acids [32, 33]. These are largely responsible for the sympathomimetic symptoms related to cocaine use, which often include hypertension, tachycardia, psychomotor agitation, and mydriasis. These sympathomimetic effects can present as profound hemodynamic lability during anesthesia, particularly for patients acutely intoxicated with cocaine. Extreme elevation in blood pressure as a result of cocaine combined with surgical stimulation can have devastating effects including malignant arrhythmias, subarachnoid hemorrhage and rupture of pre-existing aortic aneurysm [34, 35].

Acute intoxication may result in complications to multiple organ systems, some of which can be fatal. Due to noradrenergic stimulation, effects on the CNS include hyperthermia, intra-cranial hemorrhages, and seizures [36–38]. Pulmonary complications from inhalation or snorting are extensive and include thermal injuries, acute bronchospasm, pulmonary embolism, pneumothorax, eosinophilic pneumonia, and diffuse alveolar hemorrhage [39–42]. Cocaine ingestion can also result in cardiac vasomotor spasms, which may mimic or can induce cardiac ischemia.

Due to the cardiovascular stimulant properties of cocaine, acutely intoxicated patients can have both significant increases in blood pressure and heart rate as a result of stimulating surgical procedures or laryngoscopy or paradoxically, a profound decrease in blood pressure and heart rate as a result from chronic cocaine use and depletion of catecholamines [34, 43]. These patients can also present with significant agitation and can be challenging to manage under MAC or sedation [43].

Upon cessation, patients often experience psychological withdrawal symptoms, which can include severe depression, anxiety, fatigue, and insomnia-hypersomnolence. These symptoms are rarely physiologically significant and often resolve in 2–4 weeks [44, 45]. However, patients with significant agitation may be challenging to manage under sedation or MAC anesthesia, and this must be considered for patients presenting for procedures while hospitalized or at risk of cocaine withdrawal. In addition, more severe and prolonged symptoms can be suggestive of more significant use [46].

Methamphetamines

Methamphetamines are a class of sympathomimetic drugs that are ingested via smoking, intra-nasal, oral, or intravenous injection. It acts as an indirect agonist on dopamine, norepinephrine, and serotonin receptors, with the greatest

effect on norepinephrine release [47]. The time of onset and half-life of intoxication varies widely for the route of ingestion, as well as the dose and frequency of use. The time to peak plasma concentration is generally within 15 min for intravenous and intra-nasal ingestion, 18 min for smoking, and 180 min for oral formulations [48–50]. However, onset of action is faster and occurs within 30 min for all formulations. The plasma half-life is similar at 9–12 h for all forms, although detection in urine (commonly performed in the medical setting) can vary depending on dose, route, and frequency of use. Initial detection is reported at between 24 and 87 h, with maximum possible detection time ranging from 4 to 9 days with chronic use [50, 51].

Signs and symptoms of acute intoxication include euphoria, anxiety, paranoia, agitation tachycardia, tachypnea, and hypertension [50]. A range of cognitive effects also occur with lower doses, such as improved attention, focus, and motor coordination, thought largely related to dopamine receptor stimulation [52, 53]. Mental status changes are more prevalent with increasing doses, as well as agitation and acute psychosis, which can occur in 7–12% of overdose cases [50, 54, 55]. Additionally, methamphetamine use is associated with malignant hypertension, cardiac arrhythmias, a 3.7-fold increased risk of non-ischemic cardiomyopathy, and a fivefold increased risk of hemorrhagic stroke when compared to non-users [50, 56–58]. Further issues with methamphetamines include risk of rhabdomyolysis, particularly with attempts to restrain these patients, such as during procedural sedation [59]. Withdrawal symptoms include depression, irritability, impaired concentration, and insomnia, and symptoms typically peak at 2–3 days with slow improvement over 1–2 weeks [60]. However, up to 24% of patients can experience symptoms of depression for weeks to months after use [50].

Opioids

Opioids are a class of drugs that includes multiple substances, from heroin to prescription medications such as morphine and synthetic analogues such as fentanyl. They act through opioid receptors in the central and peripheral nervous system. Given the high variability in this class, as well as several options for injection (intravenous, subcutaneous, and inhaled), the onset and duration of action varies.

Patients experience the effects of intoxication from three major receptors in the central nervous system, mu, kappa, and delta. Symptoms include analgesia, euphoria, and slowed mentation. Physiologic effects include respiratory depression, miosis, and slowed gastrointestinal motility. Acute toxicity and overdose can be fatal and is typically caused by respiratory depression and hypoxemia [61].

Withdrawal symptoms usually begin within 6–10 h from last dose, with peak effects at 36–48 h, and symptoms

persisting for up to 1 week [62]. Symptoms include diaphoresis, rhinorrhea, insomnia, malaise, nausea/vomiting, akathisia, and anxiety [63].

While opioids are frequently used within the peri-procedural environment for pain management and sedation, patients presenting with illicit opioid use can be challenging to manage. For instance, these patients can often be chronically ill, with poor general medical health and higher mortality and morbidity as a result [64]. Furthermore, opioid tolerance may require very high doses for periprocedural pain management, which can lead to unintended complications, such as opioid-induced hyperalgesia [65]. These patients may also be on opioid agonist therapy, such as methadone or buprenorphine, which requires management perioperatively.

Alcohol

Excessive alcohol consumption is common, as evidenced by alcohol being a leading cause of preventable death worldwide [66]. There are a variety of postulated mechanisms thought to be responsible for the effects of alcohol, however the main effect is disruption of the balance of the inhibitory neurotransmitter GABA and its opposing excitatory counterpart, glutamate [67]. With long-term exposure, there is compensatory alterations by the brain, which result in tolerance to alcohol as well as increase excitation with cessation of alcohol consumption, leading to the signs and symptoms of alcohol withdrawal syndrome [67].

Acutely intoxicated patients may proceed to procedure if the case is urgent and there is significant risk to delaying, with consideration for administration of benzodiazepines prophylactically to prevent withdrawal seizure [68]. One of the potential complications of acute alcohol intoxication is ability to provide surgical consent, as intoxicated patients may be unable to understand the nuances of risks and benefits. Given the other risks of acute intoxication, including aspiration, confusion, and aggression, it is reasonable to delay elective procedures until the effects have abated. [69].

Chronic use is associated with significant medical complications, including cardiomyopathy, chronic liver disease, central nervous system changes. While a history of chronic alcohol use should not prompt procedural cancellation, it does require extensive pre-operative evaluation, including complete coagulation panel to rule out high risk bleeding disorders, CBC for pancytopenia and assessment of GI stability, including risk for aspiration and varices, among standard anesthetic work up for a comorbid patient [69]. A thorough history and examination even for urgent cases is necessary to avoid complications during the procedure.

Patients with alcohol use must also be managed with consideration of potential alcohol withdrawal, which can progress to seizures or delirium tremens. Symptoms of withdrawal generally peak at 48–72 h from last drink [68]. Ideally, these patients would be managed in a centre with the ability to admit and administer withdrawal protocols, such as a CIWA or phenobarbital protocol with adequate ICU monitoring, if required [68].

Summary

Cost of Delayed or Canceled Procedures

There are multiple downstream implications of canceling elective procedures for both patients and healthcare organizations. As wait times for outpatient endoscopy increase, canceled procedures may lead to diagnostic and therapeutic delays in patient care. In the era of COVID-19, patients presenting to a healthcare facility for a procedure who are subsequently turned away unnecessarily increase their risk infection, along with potential missed days from employment and the increased comorbidity of extended procedural delays. Last minute procedure cancellations result in lost resources for healthcare organizations and contribute to patient mistrust in the healthcare system [70, 71].

While these cases are deemed elective or nonurgent, that category encompasses a wide variety of indications, many of which can have time sensitive outcomes from delays and procedures. One must also consider the risk to patients needing multiple ED visits and hospitalizations due to canceled cases. Additionally, IDU is associated with lower socioeconomic status, less access to healthcare resources, and increased comorbid conditions [72]. This patient population is at higher risk for difficulties with surgical planning,

timeliness of care, and access to procedures. This is only compounded when cases are postponed or canceled due to recent IDU, which may then be ongoing at subsequent medical visits.

Guidance for Clinicians

Patients referred for outpatient endoscopy should be questioned about IDU and encouraged to stop use up to 1 week prior to a planned procedure. When presenting for endoscopy, patients with a known history of use should undergo follow-up questioning to determine recency of use and rule out signs of intoxication.

Current literature would suggest that the non-toxic patient with IDU < 2 days prior to procedure would remain a potential candidate for proceeding with endoscopy. Generalized recommendations for endoscopic timing can be found in Table 3. If high risk or acute use is suspected, pre-operative screening and consultation with anesthesia should be considered to discuss optimal procedural timing and sedation methods.

Due to the variety of drug effects and potential for interaction with common anesthetics, it is reasonable to postpone elective procedures in patients who demonstrate signs of acute intoxication with commonly used drugs. However, current practice of utilizing UDS as a standard screening tool is likely to include large numbers of patients who remain positive on UDS for days to weeks outside the window of acute intoxication (Table 2).

Cannabis

There are no standardized guidelines for cessation of cannabis prior to elective procedures. The general consensus

Table 3 Recommendations for procedural timing in patients with recent IDU

	Marijuana	Cocaine	Amphetamines	Opioids	Alcohol
Acute intoxication	Delay—increased risk of cardiovascular instability Not recommended to wean if procedure < 1 day due to risk of withdrawal	Delay—increased risk of cardiovascular instability Short half-life—can consider re-scheduling for > 8 h after initial intoxication if stable	Delay 24–48 h if acutely intoxicated given cardiovascular instability	Assess for acute intoxication or acute withdrawal—delay until stabilized	Delay— need for appropriate consent
Chronic use, non-toxic	Prepare for increased anesthetic requirements, challenging post-op pain control and reactive airways Consider weaning if procedure > 7 days in advance	Historical use with no current signs and symptoms of intoxication—f[consider proceeding Prepare for potential hemodynamic instability, CNS agitation	Prepare for altered anesthetic requirements, potential for hemodynamic instability	Prepare for multimodal pain management given tolerance Ensure appropriate management of opioid agonist therapy	Pre-operative assessment of associated chronic alcohol use comorbidities Appropriate plan for withdrawal management if required

is to wait at least 72 h until last use of cannabis prior to proceeding with anesthesia [28]. However, recent guidelines from the Perioperative Pain and Addiction Interdisciplinary Network suggest a more nuanced approach to cannabis use prior to procedures. For patients whose procedure is scheduled in more than 7 days, cannabis tapering or cessation can be considered based on amount and frequency consumed. However for patients for which surgery will occur in less than 1 day, weaning or cessation is not recommended due to risk of cannabis withdrawal and/or increased anxiety or pain [73]. In cases of intermediate use (1–6 days) non-toxic patients may be able to proceed to endoscopy on a case-by-case basis while planning for the above-mentioned considerations associated with use.

Cocaine

Most patients who use cocaine and are presenting for surgery are likely to endorse historical use of the drug, rather than to arrive acute intoxicated. Studies have shown that patients who arrive for elective surgery non-toxic but with a positive urine drug screen for cocaine have similar outcomes as drug-free counterparts [74]. However, since no clear guidelines exist, cases should be managed on an individualized basis with close monitoring post-operatively to ensure ongoing hemodynamic stability following their procedure [75]. Given the short half-life of cocaine (Table 2), one may consider proceeding with surgery within 8 h of ingestion if the patient shows hemodynamically stable vitals along with normalization of cardiovascular changes on ECG and decrease in CNS agitation [75].

Methamphetamines

The pharmacological profile of methamphetamines begets similar problems under anesthetic care as cocaine—predominantly CNS agitation that may make providing sedation challenging and cardiovascular instability that may prove further labile with surgical stimulation. Nonetheless, timing of elective surgery for patients found to be using methamphetamines lacks consistent guidelines within the anesthesia literature. A study in the trauma population showed that hemodynamic instability in patients undergoing surgery and using methamphetamines is related more to the degree of resuscitation required than simply a positive urine drug screen for the substance [76]. This may indicate patients who use methamphetamine and are undergoing minor elective procedures may proceed to the OR without issue. However, methamphetamines can cause significant catecholamine depletion, which can lead to unpredictable, refractory hypotension intraoperatively [77]. Furthermore, there is longstanding evidence that anesthetic requirements

are altered with both acute and chronic methamphetamine use, further complicating care for these patients as anesthesia providers try to find the ideal balance of anesthetized yet hemodynamically stable [77, 78]. Therefore, it is reasonable to consider a delay of 24–48 h for surgical procedures in acutely intoxicated patients, given the profound cardiovascular effects of the substance [77].

Opioids

Patients presenting with a history of recent opioid misuse should be first assessed for stability from a respiratory and CNS point of view, given the propensity for opioids to cause significant sedation and respiratory depression. Patients that are unstable upon this assessment require immediate resuscitation and delay in procedure. Chronic opioid use will present challenges with respect to anesthetic and pain management both intraoperatively and post-operatively. These patients require multimodal approaches, combining both adequately dosed opioid medications as well as non-opioid adjuncts, such as foundational analgesia, ketamine, regional blocks and psychosocial support to achieve well rounded postoperative care [79]. Patients with chronic use should also be offered addiction care, as well as opioid agonist therapy to aid with treatment of their underlying opioid use disorder prior to surgery and acute withdrawal management [80].

Conclusion

We present a review of current literature on the outcomes of patients who use illicit drugs prior to outpatient endoscopy. Using this data and physiologic understanding of commonly abused illicit drugs, we provide expert guidance for clinicians on best practices for managing patients prior to elective procedures based on the type of illicit drug, dosage, and duration of use. Elective endoscopy may be safe to perform in non-toxic patients with recent illicit drug use. These patients require careful clinical assessment in conjunction with anesthesiologists rather than immediate procedural cancellation or postponement for patients with positive urine drug screens.

Future Implications

Creating consensus organizational or institutional guidelines for managing IDU patients prior to elective endoscopy are needed to optimize patient care and avoid unnecessary procedure cancellations. To help best inform guideline development, ongoing studies are needed to maximize our understanding of the short and long-term physiologic impacts of IDU on elective procedural sedation so patient safety and health-care delivery can be optimized.

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Declarations

Conflict of interest All authors report no conflicts of interest.

Ethical approval This is an observational review of the literature. The University of Nebraska Medical Center Research Ethics Committee has confirmed that no ethical approval is required.

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