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KEY POINTS

- Cocaine has a biological half-life of 60-90 minutes and can cause hypertension, coronary ischemia, arrhythmias, and aortic dissection
- Standard urine toxicology tests, which test for an inactive metabolite of cocaine called benzoylecgonine, are poor indicators of acute cocaine intoxication
- Patients who have a positive urine toxicology but show no signs or symptoms of cocaine intoxication may be able to safely undergo surgery
- More prospective studies are necessary to evaluate the effect of recent cocaine use on intraoperative hemodynamics, anesthetic requirements, and postoperative outcomes.

Since the 'crack' epidemic of the 1980s, cocaine has experienced widespread use around the world. In the United States, cocaine use has risen to new levels with an increase from 1.5 million regular users in 2014 to almost 1.9 million users in 2015 [1]. The most recent data from the Substance Abuse and Mental Health Services Administration reports that nearly one in twenty adults between the ages of 18-25 admits to using cocaine in the preceding year, as determined by in-person interviews [1]. The true prevalence of cocaine use may be even higher, as many of these statistics come from self-reported use and respondents have been shown to under-report in many circumstances [2].

Cocaine use represents a public health epidemic - not only is it widely used, but its use transcends socioeconomic boundaries. "Crack," the free base form of cocaine, is the most addictive form of cocaine and is aptly named for the cracking sound made when the rocks are heated and smoked [3]. Cocaine hydrochloride, the powder form, is typically insufflated through the nose, or "snorted." For public county hospitals serving large metropolitan areas, patients who present with a positive cocaine urine toxicology ("positive utox") are a common occurrence in the emergency department and operating room. Indeed, cocaine positive individuals represent up to 1% of the elective surgical population and 38% of major trauma victims [4, 5]. It is likely that cocaine use will increase even further in the coming years, making knowledge of the clinical presentation of cocaine use and its associated comorbidities critical to the proper perioperative management of this patient population.



While recreational cocaine use is unequivocally discouraged by medical professionals, its use during the perioperative period is of particular concern due to the risks it presents. Acute cocaine use increases myocardial oxygen demand and can result in acute cardiovascular dysfunction with a concomitant increase in the frequency of adverse cardiovascular effects such as chest pain, hypertension, arrhythmia, aortic dissection, and myocardial infarction [6-10]. These effects on the cardiovascular system are a consequence of the ability of cocaine to interact with a variety of cardiac sodium, calcium, and potassium channels while simultaneously increasing circulating catecholamine levels [11].

Long-term use of cocaine has also been associated with accelerated atherosclerosis as well as the development of left ventricular hypertrophy and dilated cardiomyopathy [12-14]. Evidence indicates that cocaine users experience an increased incidence of left ventricular dysfunction, and that the likelihood of dysfunction is associated with the duration of use [13]. Among a cohort of chronic cocaine users who experienced a ST-elevation myocardial infarction, there was a higher prevalence of multi-vessel disease and increased number of coronary artery lesions compared to non-regular users [13]. In addition to the cardiovascular effects, cocaine use has been attributed to detrimental end-organ effects in nearly every organ system, such as "crack lung" and "crack ulcers" [15-17].

As a consequence of the aforementioned effects, physicians are often reluctant to proceed with non-emergent surgery in cocaine positive individuals. However, many of the effects of acute cocaine use are short-lived, since the biological half-life of cocaine is 60-90 minutes [18]. Whereas acute cocaine intoxication is a definite contraindication to non-emergent surgery, the effects of recent cocaine use are less well studied and have been largely generalized based on historical precedent. 'Recent cocaine use' is defined as a positive urine cocaine toxicology



test in the absence of the clinical signs and symptomatology of acute cocaine intoxication.

The distinction between 'acute cocaine intoxication' and 'recent cocaine use' is meaningful because the cocaine urine toxicology test, which measures the cocaine metabolite benzoylecgonine, is a poor indicator of acute cocaine intoxication. In contrast to cocaine, benzoylecgonine is biologically inactive, but can persist in the urine for up to a week following cocaine use, perhaps longer in heavy, chronic users [19, 20]. Few institutions endorse a formal policy to guide physicians on the management of cocaine positive patients who present for elective surgery [21]. As a consequence, the decision is left to individual physician preference and, at many institutions, the historical precedent has been to cancel any cocaine positive patient presenting for non-emergent surgery with the operation deferred until a later date when the patient would be presumed to be cocaine negative.

In practice, this can result in significant wastage of operation room resources, personnel, and time as serial cancellations occur when patients are unable to abstain from cocaine use for a sufficient duration to achieve a negative cocaine urine toxicology. Chronic cocaine use results in numerous alterations in brain function including deficits in risk-reward behavior, which may make the road to abstinence particularly challenging [22]. Given the high frequency of relapse in drug addiction (estimated to be between 40-60%) and alteration of neurological function, many medical professionals argue that drug addiction is best treated akin to other chronic diseases such as diabetes or hypertension [23].

Recent research supports the safety of cautiously proceeding with surgery in cocaine positive patients who do not show signs or symptoms of acute cocaine intoxication for both elective and trauma surgery. Hill et al. demonstrated in a prospective study that patients who presented as cocaine positive by urine toxicology, but appeared non-toxic and had normal EKG results, could proceed with elective surgery at no greater



risk compared to cocaine negative controls of a comparable age and ASA status [4]. Compared to the cocaine negative controls, the cocaine positive group had the same incidence of cardiac arrhythmias such as ventricular tachycardia, premature ventricular beats, and torsades de pointes [4]. Other retrospective studies that have assessed the elective surgical population also support these conclusions [24]. Likewise, multiple retrospective studies in trauma patients showed comparable rates of mortality and length of stay between cocaine positive and cocaine negative patients [25, 26].

Current literature provides enough evidence to suggest that the practice of routine cancellation of cocaine positive individuals is not justified. A detailed history and physical examination should be done to assess for signs and symptoms of acute intoxication, as well as other cardiovascular comorbidities. After evaluation, it may be deemed that cancellation and further workup are indicated, but the automatic cancellation of all cocaine positive surgical patients is unwarranted. Cocaine use may need to be treated as another chronic disease or risk factor that warrants specific considerations in the perioperative period, much like diabetes, coronary artery disease, and hypertension.

In the past, anesthesiologists have acted out of good will towards their patients under the assumption that recent cocaine use presents a non-negligible degree of risk that could be mitigated by delaying surgery. However, with the presence of new data, we must now attempt to quantify that risk and weigh it against potential harms, namely the delay to definitive treatment for the patient and wastage of operating room resources. Thus, new research is needed in this field seeking to address the proper perioperative management of this patient population.

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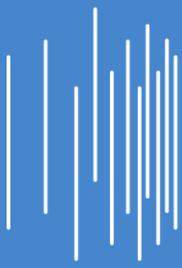
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