Lesson 293: PreAnesthetic Assessment of the Drug Abuser: Value of Urine Drug Screening

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Read this article, reflect on the information presented, then go online and complete the lesson post-test and course evaluation before the termination date below. (CME credit is not valid past this date.) You must achieve a score of 80% or better to earn CME credit.

TIME TO COMPLETE ACTIVITY: 2 hours
RELEASE DATE: August 1, 2011
TERMINATION DATE: August 31, 2012

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Needs statement

Nearly 9% of the population over the age of 12 report active use of at least one illicit substance. Anesthesia in the context of recent illicit drug use may lead to excess morbidity and mortality, due in part to drug interaction. Urine drug screening before surgery is one approach available for detecting recent drug abuse. However, the test itself has limitations, including the potential to generate false-positive and false-negative results. Moreover, some illicit substances are not detected in the urine. Anesthesiologists should have a basic understanding of how urine drug screening is performed in order to best use and interpret this test in clinical practice. The topic has received considerable attention in the media, and has been identified by committee as necessary information for clinical anesthesiologists.
Learning Objectives

At the end of this activity, the participant should be able to:

1. Discuss the epidemiology of substance abuse in the United States.
2. Explain the general purpose and performance characteristics of a screening or diagnostic test.
3. Describe the methodology of urine drug screening, and the drugs typically screened.
4. Identify circumstances that may lead to false-positive or false-negative results from a urine drug screen.
5. Interpret the positive results of a urine drug screen with respect to the timing of most recent drug ingestion.
6. List methods by which urine samples may be adulterated in order to interfere with the accuracy of drug screening.
7. Describe how to validate a urine specimen to identify suspected adulteration.
8. Identify methods available for confirming the results of an initial urine drug test.
9. Summarize the potential risks of administering anesthetics to a patient who admits acute drug abuse.
10. Develop an informed approach to the use of urine drug screening, preoperatively.

Case History

A 36-year-old man was scheduled for left inguinal hernia repair. His medical history was significant for hypertension, chronic low back pain, and depression. He also gave a history of illicit substance abuse, including intermittent marijuana, cocaine, and heroin. He had smoked approximately one pack of cigarettes per day since age 17, but denied using alcohol. His current prescription medications included metoprolol and bupropion. In the preoperative area, the patient appeared somewhat anxious, but was otherwise alert and appropriate. His vital signs were blood pressure, 130/82 mm Hg; heart rate, 76 beats per minute; respiratory rate, 10 breaths per minute; oxygen saturation, 99% on room air; temperature, 37.2°C. The surgical resident informed the anesthesiologist that a urine drug screen, ordered for the morning of surgery, was positive for amphetamines, cannabinoids, and cocaine. Upon questioning, the patient admitted to smoking marijuana daily, but otherwise insisted he had been taking only his prescribed medications. He said he stopped using IV drugs more than 13 months previously, and had never abused amphetamines.

Based on data from the 2009 US National Survey on Drug Use and Health, about 8.7% of the population at least 12 years old (21.8 million people) are actively involved in the use of at least one illicit substance. The most popular illicit drugs of abuse are marijuana (16.7 million; 6.6%), cocaine (1.6 million; 0.7%), and hallucinogens (1.3 million; 0.5%). In recent years, the nonmedical use of prescription psychotherapeutic drugs has risen dramatically. These include pain-killers, stimulants, sedatives, and tranquilizers. In 2009, 7 million people (2.8% of the population) at least 12 years old reported abusing any of these agents in the previous 30 days.1

Among patients presenting to the emergency department, the estimated prevalence of illicit substance abuse is significantly higher than in the general population.2 In one study, 38% of trauma patients
tested positive for cocaine abuse when admitted to the hospital. At another major hospital center, health care workers estimated that 0.5% to 1% of patients presenting for elective surgery exhibited evidence of cocaine abuse, based on positive results from urine drug testing (UDT) for cocaine metabolites.²

Current evidence suggests that anesthesiologists greatly underestimate the prevalence of illicit substance abuse among patients undergoing preoperative visits. In a recent study conducted in Germany, patients presenting for elective surgery were asked to complete a computer-based survey on illicit substance abuse. An anesthesiologist then interviewed the same patients. Data from 2,938 patients were analyzed retrospectively. The investigators found that 7.5% of the patients voluntarily reported illicit substance abuse within the previous 12 months of the survey. However, in 2 out of 3 patients, the anesthesiologist’s interview failed to elicit this information.³

**Urine Drug Screening**

A drug screen is a panel of laboratory tests performed on a biologic specimen to identify evidence of specific drugs or chemicals. Drug screening can be performed using several bodily fluids, including blood, saliva, and hair; however, urine is the preferred sample because it has higher concentrations of identifiable metabolites and is easily obtained and processed in a laboratory.

There is no uniformity among institutions as to which drugs are tested in routine UDT. Most drug screens include testing for 5 substances (known as the “NIDA 5”) mandated by the National Institute on Drug Abuse (NIDA) to be included in federal workplace drug testing:

1. cannabinoids (tetrahydrocannabinol)
2. cocaine (benzoylcegonine)
3. opiates (morphine and codeine)
4. amphetamines (including methamphetamine)
5. phencyclidine.⁴

In hospitals and chronic pain centers, urine drug screening frequently includes testing for additional commonly abused agents, including barbiturates, benzodiazepines, methadone, and propoxyphene. However, even these more comprehensive panels are by no means all-inclusive. They fail in particular to detect new and emerging substances of abuse, particularly synthetic cannabinoids, stimulants, and hallucinogens.⁵,⁶ A recent example is that of a “spice product” popularly marketed under the brand names K2 and Spice. These products emerged in the European market in the early 2000s, and rapidly gained worldwide favor fueled in part by Internet retailers. It was not until 2008 that the active ingredients were discovered to be novel synthetic chemicals active at cannabinoid receptors.⁷ Following a growing number of alerts from hospitals and poison control centers that reported adverse reactions, including psychosis, hallucinations, and seizures, as well as several deaths associated with use of these substances, the US Drug Enforcement Administration took emergency measures and classified synthetic cannabinoids as Schedule I drugs under the Controlled Substances Act, making their use illegal in all states as of March 2011.⁸

There are several methods for identifying drugs or drug metabolites in urine. The most commonly used are chromatography, mass spectroscopy, and immunoassay. Gas chromatography–mass spectroscopy is considered the “gold standard” among testing methods based on its superior accuracy profile.
However, because of cost and turnaround time, most laboratories use immunoassay techniques for drug screening. Routine urine drug screening by immunoassay costs approximately $11 in the author’s institution, and results are typically available in less than 60 minutes. Immunoassays rely on competitive binding between a drug that is chemically labeled with an enzyme, radioisotope, or fluorophore, and a drug present in a biologic specimen. The degree to which labeled drug and drug in a sample compete for binding sites is used to quantify the drug in the sample and provide a qualitative assessment of the presence or absence of the substance of interest.

**Performance Characteristics of Screening/Diagnostic Tests**

The technical efficacy of any test is characterized by 2 intrinsic properties: sensitivity and specificity. Sensitivity refers to the ability of the test to correctly recognize the presence of a condition when in fact it exists. Specificity describes the ability of the test to correctly identify the absence of a condition when that condition is indeed absent.

As a preventive health tool, screening tests are usually employed for conditions in which early detection leads to meaningful improvement in survival outcomes. As such, they are applied to a population at risk but with no overt evidence of illness. The general consensus is to avoid a failure to diagnose (false-negative) and, therefore, high-sensitivity testing methods are favored. A certain percentage of positive screening tests will yield false-positive results, which is acceptable because in usual practice a positive screening test is followed up with a confirmatory test that has high specificity (few false-positives); the confirmatory test results drive further intervention and treatment decisions. The sequential application of a high-sensitivity test and another with high specificity provides maximal diagnostic accuracy.

In clinical practice, definitive evidence of the presence or absence of a condition is unknown. The intent of the test is to help answer this question. Therefore, the relevant characteristics of a diagnostic test from the clinician’s point of view are not sensitivity and specificity, but are instead its predictive values. The positive predictive value of a test is defined as the proportion of patients with a positive test result who are correctly diagnosed; the negative predictive value describes the proportion of patients with a negative test result who are in fact disease-free—or, in this case, drug-free (Table 1).

<table>
<thead>
<tr>
<th>Disease/Condition (as determined by gold standard)</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Result</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>TP</td>
<td>PP</td>
</tr>
<tr>
<td>Negative</td>
<td>FN</td>
<td>TN</td>
</tr>
<tr>
<td>↓ Sensitivity = TP/(TP+FN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>↓ Specificity = TN/(FP+TN)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*FN, false-negative; FP, false-positive; NPV, negative predictive value; PPV, positive predictive value; TN, true-negative; TP, true-positive. The performance of any test with 2 unique results (positive/negative) is described by 4 parameters: sensitivity, specificity, PPV, and NPV. Sensitivity is defined as the ability of a test to correctly identify disease-positive patients. Specificity is defined as the ability of the test to correctly identify disease-negative patients. PPV is defined as the proportion of patients with a positive test result who are in fact disease-positive. NPV is defined as the proportion of patients with a negative test result who are in fact disease-negative.*
Unlike sensitivity and specificity, the predictive values of any given test vary based on the population prevalence (also called pretest probability) of the condition in which the test is being applied. When applied to a population in which the condition of interest is very common, the positive predictive value of a screening test is high. When it is used in a population in which the condition is rare, however, the positive predictive value falls dramatically. Furthermore, holding prevalence constant, positive and negative predictive values vary inversely. That is, as the positive predictive value of a test rises, its negative predictive value falls. Understanding these relationships is critical to the appropriate application and interpretation of any screening or diagnostic test. Table 2 illustrates the influence of drug prevalence on the likelihood that positive UDT is false, using an estimated test sensitivity of 80% and specificity of 98%.9

**Interpretation of Urine Drug Screening Results**

The potential that any test result obtained in clinical practice may be incorrect is appreciated in theory, but often forgotten in practice. This is perhaps particularly true in the case of urine drug screening because of physicians' lack of familiarity with this testing method and its several limitations.

Over the years, the accuracy of urine drug screening has been a cause for concern. In the mid-1980s, the Centers for Disease Control and Prevention (CDC) reported the results of an evaluation of 13 laboratories performing urine drug screening tests for 262 methadone treatment facilities. The CDC found that average rates of false-negatives were 59% for barbiturates, 69% for amphetamines, 12% for methadone, 64% for cocaine, and 62% for morphine. Mean false-positive rates were much better—less than 3% for most drugs, but averaging as high as 12% for methadone.10 By the late 1980s, the accuracy of UDT laboratories had improved sharply. Three independent studies using blinded controls found false-negative rates ranging from 20% to 31%, and false-positive rates from 0% to 2%.11

The performance of UDT in clinical practice is likely to differ from that found in experimental evaluations. For example, owing to cross-reactivity between metabolites of abused substances and legitimately prescribed medications as well as some over-the-counter (OTC) drugs, it is likely that false-positive rates are higher than those reported using controlled samples. Other potential reasons for variability in performance between institutions are differences in the immunoassay techniques used, the values chosen as cutoffs, whether confirmatory tests are routinely performed before releasing results, and whether sample validation techniques are used. And, as mentioned previously, the predictive value of urine drug screening is critically linked to the a priori likelihood of drug use (pretest probability) in the population to which it is being applied.

Many clinicians are unfamiliar with the circumstances that may produce inaccurate results of a urine drug screen. There are numerous reports in the literature of prescription and OTC medications that
may cause false-positive urine drug screens. The results of a recent study at a university hospital revealed that 25 of 116 (21.5%) formulary medications could lead to false-positive results in urine drug screening, including medications from the following drug classes: antibiotics, antidepressants, antihistamines, antipsychotics, and decongestants. Specific examples are summarized in Table 3.

Ingestion of certain foods containing poppy seeds also can produce false-positive urine drug screens for both morphine and codeine. As a result, in 1998 the US Department of Health and Human Services changed the opiate screening cutoff level from 300 to 2,000 ng/mL. By contrast, experiments have evaluated the possibility of testing positive for cannabinoids by passive inhalation of marijuana smoke. This research supports the conclusion that although measurable cannabinoid concentrations can be detected after high-volume exposures, these concentrations are well below those considered positive using conventional cutoffs.

Compounding the problem of false-positives and false-negatives is evidence of a lack of proficiency by physicians when interpreting results—even truly accurate ones. For example, the urine drug screen for a patient with a valid prescription for acetaminophen and codeine (Tylenol No. 3, McNeil-PPC, Inc) would be expected to be positive for codeine, but also for morphine as a result of metabolic conversion of the former compound to the latter. A lack of awareness of UDT methods and drug pharmacology may therefore lead to false accusations. On the other hand, heroin abuse may go undetected in a patient being treated with extended-release morphine because the tested urine metabolite is the same for both drugs. Heroin undergoes rapid conversion to morphine, 6-monomorphine, and morphine glucuronide. Conventional immunoassay techniques test only for morphine. Gas chromatography–mass spectroscopy is necessary to detect 6-monomorphine, which is a product of heroin metabolism, but not of codeine or morphine (Figure). Similarly, identifying abuse of synthetic opioids such as oxycodone, hydrocodone, oxymorphone, and fentanyl requires special testing because these agents do not produce the metabolites commonly assayed in opiate drug screening tests.

### Table 3. Medications Associated With False-Positive Urine Drug Screens Using Immunoassay Techniques

<table>
<thead>
<tr>
<th>Medications</th>
<th>False-Positive Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotics</strong></td>
<td></td>
</tr>
<tr>
<td>Quinolones (ciprofloxacin, gatifloxacin)</td>
<td>x</td>
</tr>
<tr>
<td>Rifampin</td>
<td>x</td>
</tr>
<tr>
<td><strong>Antidepressants</strong></td>
<td></td>
</tr>
<tr>
<td>Bupropion</td>
<td>x</td>
</tr>
<tr>
<td>Sertraline</td>
<td>x</td>
</tr>
<tr>
<td>Trazodone</td>
<td>x</td>
</tr>
<tr>
<td>Venlafaxine</td>
<td>x</td>
</tr>
<tr>
<td><strong>Antihistamines/decongestants</strong></td>
<td></td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>x</td>
</tr>
<tr>
<td>Phenylpropanolamine</td>
<td>x</td>
</tr>
<tr>
<td><strong>Antipsychotics</strong></td>
<td></td>
</tr>
<tr>
<td>Chlorpromazine</td>
<td>x</td>
</tr>
<tr>
<td>Promethazine</td>
<td>x</td>
</tr>
<tr>
<td>Quetiapine</td>
<td>x</td>
</tr>
<tr>
<td>Thioridazine</td>
<td>x</td>
</tr>
<tr>
<td><strong>Other agents</strong></td>
<td></td>
</tr>
<tr>
<td>Dextromethorphan</td>
<td>x</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>x</td>
</tr>
<tr>
<td>Verapamil</td>
<td>x</td>
</tr>
</tbody>
</table>

*Several prescription and over-the-counter drugs have been reported to produce false-positive urine drug screening results. The likelihood of obtaining a false-positive result depends on the drug class and type of immunoassay used for testing. Adapted from reference 12.*
Urine Specimen Validation and Adulteration Techniques

The motivated individual may employ several techniques to avoid detection of illicit substances in urine drug screening, including dilution of the sample with water or other substances, substitution with a “clean” urine specimen, or adulteration with chemicals that interfere with drug screening methods. Even a cursory search of the Internet will return an impressive array of adulterants, kits, and advice aimed at facilitating the interested reader’s evasion of UDT. Although laboratory testing methods have caught up with some of the oldest of these tricks, several of the newer techniques available live up to their promise whereby illicit substances are likely to go undetected unless clinical suspicion is high.

When urine drug screening is performed in the federal workplace, mandatory procedures for specimen testing and verification must be strictly followed, including measurement of creatinine concentration, specific gravity, pH, and temperature. Validity testing for common adulterants also is included. These procedures may not be uniformly applied in other settings. Therefore, when there is a strong clinical suspicion of substance abuse, specimen validation and confirmatory testing should be considered to guide decision making. Characteristics suggestive of an unadulterated urine specimen are summarized in Table 4.15

![Figure](image-url)
Risks of Anesthesia in Patients With Substance Abuse

Little is known about the risks associated with performing elective surgery on patients with clear indicators of acute substance abuse. Even less is known about the subset of patients who are clinically “nontoxic” and mentally appropriate, but in whom there is evidence of recent illicit substance use based on urine drug screening.

Several factors affect the length of time a drug can be detected in a urine specimen. These include variables intrinsic to testing (eg, assay method, chosen cutoff value), and the pharmacokinetics of the substance in question. Additionally, patient variables such as body mass, co-ingestions, and urine pH influence drug metabolism and, therefore, duration of detection.16 Table 5 summarizes the current data on duration of detection for common drugs of abuse in urine specimens.15

It is important to note that there is no direct relationship between the length of time drug metabolites may be detected in a urine specimen, and the concentration of active drug at relevant tissue receptors. Thus, the clinical significance of a positive urine drug screen in the absence of symptoms of intoxication is a matter for debate.

Among the illicit drugs most commonly abused, cocaine is probably of most concern to the anesthesiologist, primarily because of the potential for significant cardiovascular complications. It has been estimated that there is a 24-fold increase in the risk for acute myocardial infarction during the first 60 minutes after cocaine use.18 Multiple mechanisms are responsible for this effect. Cocaine inhibits norepinephrine, dopamine, and serotonin reuptake and enhances release of norepinephrine and epinephrine from the adrenal medulla. Cocaine also induces vascular endothelial dysfunction, which reduces prostacyclin synthesis and promotes vasoconstriction and coronary artery vasospasm. It also may independently promote platelet aggregation and thrombosis and lead to early atherosclerosis.18

Cocaine blocks sodium channels on cardiac myocytes, which slows repolarization and prolongs the corrected QT interval (QTC), predisposing patients to cardiac dysrhythmias.2 Cocaine-related myocardial irritability in combination with ischemia-induced ventricular dysfunction results in an increased risk for potentially fatal cardiac complications. The fact that anesthesia and the stress of surgery may exacerbate these effects, and that the preferred treatment of cocaine-induced chest pain and arrhythmia remains somewhat controversial, is more likely to deter many anesthesiologists from proceeding with elective procedures in patients with evidence of recent cocaine use.

**Table 5. Detection Times for Drugs Of Abuse in Urine Specimens**

<table>
<thead>
<tr>
<th>Drug/Drug Class</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamines/Methamphetamine</td>
<td>48 h</td>
</tr>
<tr>
<td>Barbiturates</td>
<td></td>
</tr>
<tr>
<td>Short-acting</td>
<td>24 h</td>
</tr>
<tr>
<td>Long-acting</td>
<td>3 wk</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td></td>
</tr>
<tr>
<td>Short-acting</td>
<td>3 d</td>
</tr>
<tr>
<td>Long-acting</td>
<td>30 d</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2-4 d</td>
</tr>
<tr>
<td>Marijuana</td>
<td></td>
</tr>
<tr>
<td>Single use</td>
<td>3 d</td>
</tr>
<tr>
<td>Daily use</td>
<td>10-15 d</td>
</tr>
<tr>
<td>Opioids</td>
<td></td>
</tr>
<tr>
<td>Codeine</td>
<td>48 h</td>
</tr>
<tr>
<td>Heroin</td>
<td>48 h</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>2-4 d</td>
</tr>
<tr>
<td>Methadone</td>
<td>3 d</td>
</tr>
<tr>
<td>Morphine</td>
<td>48-72 h</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>2-4 d</td>
</tr>
<tr>
<td>Propoxyphene</td>
<td>6-48 h</td>
</tr>
<tr>
<td>Phencyclidine</td>
<td>3-8 d</td>
</tr>
</tbody>
</table>

* The length of time that drug metabolites may be detected in a urine specimen is variable, depending in part on amount and route of ingestion, genetic variations in drug metabolism, and test method of detection. Adapted from reference 15.
Nevertheless, the physiologic impact of cocaine is rapid and short-lived. The majority of patients who present to the emergency room with cocaine-related complaints do so within the first 3 hours of use. Peak plasma concentrations of cocaine occur within 1 to 60 minutes, depending on route of administration. The half-life of IV cocaine is approximately 30 minutes; for inhalational cocaine it is about 45 to 90 minutes. Plasma and liver esterases account for the rapid hydrolysis of cocaine into inactive metabolites, including ecgonine methyl ester and benzoylecgonine. The biologic half-lives of these metabolites are 6 and 8 hours, respectively. Therefore, the significance of the presence of cocaine metabolites in the urine of a patient with no overt evidence of cocaine intoxication is questionable.

In a prospective, nonrandomized blinded study, Hill et al compared the intraoperative and immediate postoperative course of 40 patients who tested positive for cocaine metabolites but had no signs of acute intoxication (defined by normal blood pressure, heart rate, temperature, and electrocardiogram—including QTC <500 milliseconds) with an equal number of drug-free controls. No differences in intraoperative mean end-tidal concentration of sevoflurane, total fentanyl dose, duration of anesthesia, or postanesthesia recovery time were found between the groups. Furthermore, the cocaine-positive patients exhibited no increased risk for hemodynamic instability (measured as a drop in mean arterial blood pressure >40% of baseline); there also was no evidence of ST segment changes in either group.

In contrast to cocaine, it is likely that many anesthesiologists would be relatively unfazed by urine drug screen evidence of recent opiate or benzodiazepine ingestion; clinicians are relatively familiar with the clinical effects of these drugs, their common use perioperatively, and the availability of reversal agents. The clinician’s reaction to toxicologic evidence of stimulants and psychotropic agents, such as amphetamines, hallucinogens, and cannabis, is perhaps most likely to lie in between these 2 extremes. In general, decisions to proceed with elective surgery are likely to be heavily influenced by the patient’s demeanor and vital signs at the time of presentation. Medicolegal concerns such as the ability to obtain informed consent might also be a factor. To obtain informed consent, the patient’s decision-making capacity must be intact. Biochemical detection of an illicit drug in a urine specimen does not imply a priori intoxication or lack of capacity. However, the patient should be able to understand the diagnosis, recommended intervention including its risks and benefits, and available treatment alternatives. In the case of a solely elective procedure, if there is any doubt about the patient’s capacity, the case should be postponed.

**Practical Application of Preoperative Urine Drug Screening**

In recognition of the controversy that surrounds decisions to delay surgery in patients with evidence of recent drug abuse, Granite et al conducted a survey of oral and maxillofacial surgery and anesthesiology training programs in the United States to determine practice standards on cocaine screening and management of patients presenting with traumatic maxillofacial injuries in need of surgical treatment. Based on 114 completed surveys, the researchers discovered that 10% of hospitals had a policy requiring the cancellation of urgent cases if patients tested positive for cocaine. However, 45% of hospitals had policies requiring the cancellation or delay of elective surgery for facial trauma in the event of a cocaine-positive urine drug screen. Among these, the most common delay interval reported was 2 days or less (54%), with 30% waiting 3 to 5 days, and a small fraction waiting even longer. Nevertheless, 40% of respondents indicated that they allowed surgery (either elective or urgent) to proceed in the face of cocaine-positive results as long as the patient was hemodynamically
stable. Based on a half-life of cocaine of 60 to 90 minutes and an elimination time of approximately 5 half-lives, the authors recommended that an 8-hour delay should be sufficient time in the vast majority of patients.\textsuperscript{23}

**Management of the Case Presented**

The initial surgery was cancelled on the basis of the urine drug screen results. The anesthesiologist did not request confirmatory UDT. The patient was counseled about the importance of abstaining from illicit substances, and the surgical service was advised to schedule the case no sooner than 48 hours later. The patient was extremely agitated by the decision and left the hospital without discharge instructions. He has not returned for rescheduling since the event. Could this case have been better managed?

**Summary**

In the absence of strong guidelines or robust clinical evidence, the use of preoperative urine drug screening in patients with a history of substance abuse is likely to remain variable among institutions and practitioners. More research is needed to understand whether recent substance abuse in clinically nontoxic patients affects intraoperative stability or postoperative outcomes.

Physicians should become more informed about the intended purpose, limitations, and interpretations of UDTs so that these tools may be applied in clinical situations in which the results will be most likely to provide predictive value. Implementation of institutional policies on preoperative urine drug screening also might be advisable to avoid provider-based variations that may be perceived as an indication of patient bias or inconsistent practice standards.

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REFERENCES


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**Post-test**

1. The prevalence of illicit substance abuse in the population of the United States aged 12 years and older is approximately:
   a. 1%
   b. 5%
   c. 10%
   d. 20%

2. What is the most common laboratory method for routine screening of drugs in the urine?
   a. Gas chromatography
   b. Mass spectroscopy
   c. Liquid chromatography
   d. Immunoassay

3. Which of the following terms denotes the ability of a test to detect a condition when the condition is in fact present?
   a. Sensitivity
   b. Specificity
   c. Positive predictive value
   d. Negative predictive value

4. A patient being treated for chronic back pain is taking acetaminophen with codeine as prescribed; which drug(s) would be expected to be detected in a urine drug screen?
   a. Codeine
   b. Morphine
   c. Oxycodone
   d. Codeine and morphine

5. Which of the following test results would be most likely to raise suspicion of urine specimen tampering?
   a. pH is 6.7.
   b. Temperature is 28°C.
   c. Specific gravity is 1.01.
   d. Nitrite concentration is 50 mcg/mL.
6. Except for _______, metabolic conversion of the following agents results in at least one shared metabolite.
   a. Codeine
   b. Heroin
   c. Morphine
   d. Oxycodone

7. After cocaine is taken, its metabolites typically are present in the urine for:
   a. 6 hours
   b. 24 hours
   c. 3 days
   d. 6 days

8. Depending on the route of administration of cocaine, its half-life in plasma is approximately:
   a. 0-15 minutes
   b. 15-30 minutes
   c. 30-90 minutes
   d. 90-120 minutes

9. Which substance(s) would likely be detected in the urine of a patient using heroin?
   a. Heroin
   b. Hydromorphone
   c. Morphine
   d. Heroin and morphine

10. Cocaine increases the synthesis or plasma concentration of all of the following, except:
    a. Dopamine
    b. Epinephrine
    c. Norepinephrine
    d. Prostacyclin