Do you really need that emergency drug screen?

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Introduction. A drug screen is a frequent investigation in the emergency department. The purpose of ordering this test is to determine whether the patient’s condition is due to a drug. The purpose of this review is to address the question – do you really need that emergency drug screen? Background. A screening test is an investigation performed upon a defined population to identify subclinical disease. A diagnostic test confirms a specific disease in a particular patient who is at risk of that condition because of the medical history or physical examination. Diagnostic tests have optimal performance characteristics that differ from those of screening tests. Therefore, an optimal screening test cannot be an optimal diagnostic test. Literature review. The relevant literature was identified through electronic search augmented by subsequent search of reference lists of the primarily identified publications. Articles not dealing with emergency qualitative urine drug screening of emergency department patients were not considered. Results. There were seven retrospective case series describing 1,405 patients, one prospective case series of 196 patients, and one randomized trial of 117 patients. There were three retrospective case series describing 694 children. For patients presenting with psychiatric symptoms, there were two retrospective case series totaling 557 patients and one randomized trial of 392. There were three retrospective case series in 3,509 multiple trauma patients. There was no significant impact upon the management of these patients in the emergency department. Conclusion. The emergency drug screen is unlikely to impact significantly upon the management of the patient in the emergency department.

Keywords Urine drug screen; poisoning; Emergency department

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Drug screens are frequently ordered in the emergency department. An emergency drug screen differs from its routine counterpart in that its results are expected very early during the emergency department care. However, there is considerable evidence that questions the usefulness of this investigation in the acute management of the emergency department patient. The purpose of this review is to address the question – do you really need that emergency drug screen?

Drug screen is an unfortunate term. There are classic and distinct performance characteristics for a screening test that are quite different from those of a diagnostic test. A screening test is performed upon a population whereas a diagnostic test is performed upon an individual. In the emergency department, the drug screen is utilized as a diagnostic test.

A screening test is an investigation performed upon a defined population to identify subclinical disease. A prime example is screening all newborns for phenylketonuria. Correlates within the realm of clinical toxicology include urine drug screening within the workplace for substances of abuse or of athletes for performance-enhancing drugs. Screening tests have optimal performance characteristics regarding sensitivity, specificity, and predictive values (Table 1).1 This outcome is evaluated by the positive and negative predictive values of the test, which for a screening test are by definition unsatisfactory for its use as a diagnostic test.1 This is the fundamental reason for its poor performance as a diagnostic test and for its poor clinical utility in the emergency department.
Table 1. Performance characteristics of screening tests and diagnostic tests

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What is a drug screen?

A drug screen is a panel of laboratory tests performed upon biologic specimens to determine whether drugs or foreign chemicals are present. It does not quantify the amount; rather it identifies its presence. The preferred biologic specimen is urine because it has higher concentrations of drugs and chemicals than blood and is easier to process in the laboratory. Blood requires prior preparation because of the presence of potentially interfering endogenous compounds. This adds labor and time to the procedure. It is impossible to screen for all analytes. Clinically important poisons not identified by routine comprehensive drug screens are listed elsewhere. Drug screens performed by the clinical laboratory vary among institutions. However, with regards to recreational substance abuse, most drug screens will include cannabis metabolites, cocaine metabolites, opiate metabolites, amphetamines, and phencyclidine because these are requirements of the federal mandatory guidelines for workplace drug testing programs in the United States. This drives industry to develop efficient systems to batch test for these substances.

What is the difference between a “level” and a screen?

It is important to distinguish between a drug screen and a serum concentration of a specific drug (often called a “level”). The former is intended to determine the presence of one or more substances (or a metabolite of a foreign substance). The latter is intended to measure the concentration of a particular substance in the blood. The concentration of a substance or its metabolite in the urine does not have a relationship with its concentration at tissue receptors; however, this relationship can exist for the concentration of a substance within the blood. Therefore, a positive drug screen cannot be a diagnostic test. At best, it can support a diagnosis. A panel of specific serum concentrations performed upon a patient is not a drug screen; rather it is a series of diagnostic tests. The obtaining of a serum sodium, potassium, and chloride determination is not referred to as an “electrolyte screen.”

What are the desirable features of a drug screen?

Reliability and a rapid turnaround time are the desirable characteristics for all diagnostic interventions performed upon the acutely ill emergency department patient. For any test, reliability can be viewed as a combination of technical efficacy and clinical efficacy. Technical efficacy is defined by parameters characterizing the performance of the test, its sensitivity, and specificity. Clinical efficacy pertains to whether the test identifies a disease, the positive and negative predictive values of the test. The sensitivity of contemporary assays within the drug screen panel is very high (few false negatives), but because all potential analytes cannot be tested for the negative predictive value is suboptimal. Therefore, the urine drug screen does not reliably rule out a toxicological etiology for the patient’s condition. This is particularly unfortunate because ruling out a toxicological etiology is a common reason why an emergency physician orders a drug screen. The inability to test for all drugs reduces the negative predictive value of this test.

Since a drug screen is a qualitative test, it cannot be specific. This undermines the positive predictive value of this test. That is to say, the drug is truly present but it is not responsible for the patient’s condition because there is an insufficient concentration of the substance at the relevant tissue receptor. This is not an uncommon occurrence. There may never have been a high enough concentration at any time, for example, a chronic cocaine using patient with agitation due to encephalitis. The urine is positive because there is continued excretion during periods of subtoxic body burdens. Therefore, a drug screen cannot rule in poisoning. At best it can support the diagnosis.

Tests with prolonged turnaround times are unlikely to impact upon the acute management of ill emergency department patients. For quantitative serum toxicology tests such as acetaminophen and iron, less than 1 h is typically recommended. That would seem to be a reasonable standard for the drug screen. This can be difficult to achieve for the battery of tests included in the drug screen performed by the hospital clinical laboratory. Over the past several years, many point-of-care systems for bedside drug screening have been marketed. While this addresses the turnaround time issue, the reliability issues remain the same if not worse. Technical performance varies from device to device, and the subjective interpretations by clinical personnel are less reliable than traditional testing by dedicated personnel in a clinical laboratory.

Suboptimal reliability and less than desirable turnaround times undermine the clinical utility of drug screens in the emergency department. Oftentimes, clinical decisions are made before the drug screen is available. Most of the interventions for the acutely poisoned patient is generic supportive care with very little being specific interventions driven by
laboratory testing. For the minority of poisonings with specific managements, the intervention is often based upon clinical findings (naloxone for opioid poisoning). Indeed, when a laboratory investigation is the indication for a specific intervention in the poisoned patient, the test is typically a specific serum quantitative determination (N-acetylcysteine for acetaminophen poisoning) rather than a drug screen.

What are the types of tests that can be used?

There are several types of tests that can be used for drug screens. These include spot tests, thin layer chromatography, immunoassays, high-performance liquid chromatography, gas chromatography, and gas chromatography–mass spectroscopy. Immunoassays best fulfill the criteria for desirability – high technical efficacy and a rapid turnaround time. The long turnaround times of high-performance liquid chromatography, gas chromatography, and gas chromatography–mass spectroscopy render these tests as potentially suitable for routine but not emergency drug screening.

Spot tests are available for a very limited number of substances and their interpretation by the laboratory technologist is subjective. Thin layer chromatography can identify many substances. However, it is somewhat labor intensive and requires a moderately skilled technologist who makes a subjective interpretation of the test. Immunoassays are available for multiple substances. They can be done rapidly (laboratory turnaround of less than 1 h), do not require a highly skilled technologist, and the result is objective. They may be designed to detect a specific drug, a family of drugs, or a metabolite of the drug. High-performance liquid chromatography, gas chromatography, and gas chromatography–mass spectroscopy are more precise assays with the latter being the gold standard. However, it is labor intensive, requires skilled operators, is unlikely to be available at all hours, and has a turnaround time of several hours.

Immunoassays are typically used for many of the tests within the panel of the hospital laboratory drug screen. This is an automated procedure with a rapid laboratory turnaround time (<1 h). They do not require a highly skilled technologist and thus have the potential for an around-the-clock availability. They are highly sensitive, but there can be false positives often due to cross-reacting substances. There are many examples too numerous to catalog. However, a few of these include the report of point-of-care testing of a child’s urine in an emergency department where diphenhydramine was mistakenly identified as methadone resulting in an admission to hospital because of concern regarding the potential for child maltreatment. Two other examples are the mistaken identification of phencyclidine rather than tramadol and the identification of opiates rather than gatifloxacin. Some immunoassays detect metabolites rather than the parent drug. This undermines their positive predictive value.

What is the standard for reporting a positive result?

Drug screens can be performed for many reasons. These can include employee drug testing, participation in competitive athletics, criminal justice uses as well as in clinical medicine. The uniformly accepted standard is a two-step process of initial screening followed by a gold standard confirmatory test. An initial screen utilizes a procedure that is practical, reliable, and cost effective to eliminate negative samples. The false positives are then eliminated by a more complex, labor-intensive gold standard assay. This is the confirmatory step. The practice of confirmatory testing is not commonly followed for drug screens performed for clinical medicine indications. Furthermore, its turnaround time makes it noncontributory in the management of acutely ill emergency department patients.

What are the clinical scenarios for emergency department drug screens?

The usual reasons for obtaining a drug screen in the emergency department patient include history of overdose, altered mental status, a seizure, ataxia, acute psychiatric symptoms (psychosis, agitation, delirium), or multiple trauma.

What does the literature say?

The relevant literature was identified through electronic search of PubMed. The search term was “urine drug screen,” and the search was limited to humans and the English language. Three hundred and fifty-one citations were identified. This was augmented by subsequent search of reference lists of the primarily identified publications. Articles not dealing with emergency qualitative urine drug screening of emergency department patients were not considered.

The literature does not support an emergency drug screen as being helpful in the acute management of emergency department patients. Statements in general chapters in emergency medicine tomes reflect this opinion. “Screening results rarely change the clinical management of patients.” “The general ‘toxicology screen’ that usually contains common drugs of abuse is rarely useful and almost never contributes to patient care.” “Too much emphasis is placed on using toxicology ‘screens’ to make a diagnosis in a poisoned patient.”

Over the past three decades, many studies have been published in the peer-reviewed literature regarding the value of emergency drug screens. Some deal with the drug screen in the general emergency department patient while others are focused upon specific populations such as children, patients with psychiatric complaints, or major trauma patients. One of the earliest of these studies was published in 1974. In this study of 148 patients, there was no significant impact upon the management in the emergency department. The same finding in 235, 52, 265, 198, 400, and 107 patients was
described in studies published three, seventeen, ten, fourteen, sixteen, and twenty-seven years later.

Perhaps one of the most frequently cited studies on this topic was published by Kellerman et al. in 1987. Unlike the retrospective medical record reviews previously cited, this was a prospective cohort study asking the question “How often are drug screens associated with substantial changes in management of patients in the ED?” There were 196 subjects and changes in management were noted in 11 of these. However, five of these were based upon diagnostic serum drug concentrations available at the same time. At first blush a change in management of 6 of 196 patients would appear to support the use of emergency drug screens. However, this support is weak at best. The management changes in four of the remaining six are described but would not seem to be applicable to today’s standard. Two were admitted because tricyclic antidepressants were identified. In two others, admissions were cancelled because of negative drug screen. The indication for admission is the presence of toxicity, and its onset occurs prior to the knowledge of the results of a drug screen. The management changes for the remaining two patients were not described. Kellerman et al. specifically make the point that “no expensive or invasive test such as CT scanning or lumbar puncture was cancelled following review of drug screen results.”

Sporer and Ernst published a randomized trial in 1992 on minimally symptomatic overdose patients. There were 61 and 56 drug-screened and nonscreened patients, respectively. Their studied end points were specific interventions performed upon the patient, length of stay in the emergency department, and patient disposition (discharge home, admission to the hospital, admission to the intensive care unit, or transfer to psychiatry). They found that the drug screen had no impact upon the management or outcome of their patients. They did not perform a power analysis; therefore we are unable to confidently exclude a Type II error.

There are three studies in the pediatric population. Sugarman et al. performed a medical record review of 338 patients who had emergency department drug screens and found that three had changes in their management. All three were symptomatic with abnormal physical examinations. The change in management was admission to hospital. Each of these patients was well described and admission would seem to have been indicated without the knowledge of the drug screen results. Interestingly, the laboratory technique was gas chromatography–mass spectroscopy. This has a turnaround time of several hours further undermining that it contributed to changes in management. Belson et al. claimed that patient management was impacted in four of 122 positive urine drug screens, but they did not provide any details of these cases. They concluded, “unexpected findings on urine drug screening leading to change in management are uncommon.” In another study from this group, there were no changes in clinical management in 234 children with positive drug screens.

Drug screens are frequently ordered in patients presenting to emergency departments with acute psychiatric symptoms and signs such as agitation, delirium, or psychosis. This has become a component of “medical clearance,” the ruling out of medical disease as the etiology of the patient’s symptoms and signs. Since a drug screen is qualitative, and a positive screen does not correlate with impairment, this concept is prima facie flawed. Two retrospective medical record reviews of 345 and 212 patients found that the drug screen was not helpful in any of them. More robust evidence is provided in a randomized clinical trial of patients presenting to an urban psychiatric emergency service. The primary study question was whether a routinely ordered drug screen affected patients’ disposition from the psychiatric emergency service. There were 198 patients in the mandatory-screen group and 194 in the usual-care group. The major finding of that study was that mandatory urine drug screening did not affect the disposition of the patients.

Toxicology screening has become a standard of care for patients with major trauma. The American College of Surgeons Committee on Trauma lists the ability to do drug screening as essential for certification of level I and level II trauma centers. Three studies address the utility of this intervention. They are retrospective medical record reviews of 2,678, 177, and 654 multiple trauma patients who had toxicology screens. Positive drug screens were found in 15, 72, and 86%, respectively. In one of these studies, the detection of ethanol was not considered as an inclusion criterion for the positive drug screen group. In all of these studies, the results of drug screening did not alter the immediate management of these patients. Two of these studies also assessed whether a positive drug screen influenced inpatient management. No impact upon inpatient management was found.

What do clinical guidelines say?

A clinical guideline developed by a collaboration of U.K. clinical toxicologists and clinical laboratory scientists recommends against the availability of emergency drug screens. A guideline of the Alberta Medical Association makes the same recommendation. However, a practice guideline of the American College of Surgeons Committee on Trauma lists the ability to do drug screening as essential for certification of level I and level II trauma centers. A guideline of the Alberta Medical Association makes the same recommendation. It was authored by a panel of emergency physicians and clinical laboratory scientists. They indicate in their discussion agreement with the U.K. and Alberta guidelines that “the need for stat qualitative urine assays was questioned by many ED physicians.” Their justification for recommending immediate availability was that “the Committee is also of the opinion that few EDs and clinical laboratories will abandon their reliance on urine drug screens on the basis of its recommendations.”

Implications

A cardinal tenet of clinical medicine is do not order a test if it will not impact upon the management of the patient. Clearly,
the emergency drug screen does not impact upon patient management in the emergency department. Of course, there are situations where the drug screen may provide support for the patient’s ultimate diagnosis. In these situations, specimens can be obtained in the emergency department for the testing to be performed on a routine rather than on a rapid turnaround time. This decreases demands upon typically overburdened emergency clinical chemistry services and also provides the opportunity for confirmatory testing. This is the model for the treatment of infectious diseases. We decide upon the treatment based upon the immediately available criteria. The definitive test, the culture, becomes available days later.

There are obvious fiscal implications. It is always a challenge to quantify the costs and charges of clinical investigations because of variability among institutions. In a study regarding drug screening of major trauma patients at a single institution, the costs for screening over a 5-year period was $138,587 and the charges were $538,278 (1996 dollars). Drug screening does not obviate the need for other expensive or for invasive investigations. For significantly ill patients in the emergency department, clinical investigations addressing differential diagnostic possibilities are typically done concurrently rather than sequentially.

Drug screening has ethical implications because it has the potential to identify illicit activity, which may not be in the best interest of the patient. A fundamental requirement for tests that screen for a disease in a population is that there is an effective treatment for that disease. Outcome data for the treatment of substance abuse are very poor.

Silverstein and Boland in a general discussion on laboratory testing stated, “we need to change our clinical and laboratory practices on the basis of evidence for the effectiveness of laboratory tests in the clinical setting.” This certainly applies to the practice of obtaining emergency drug screens in the emergency department. Wiltbank et al. were one of the first to question the utility of the drug screen. They chose a provocative title for their 1974 publication: Are Emergency Toxicology Measurements Really Used. Despite many other studies with similar findings over the ensuing three decades, their title remains provocative. My answer for the title of this review is no, you do not need that emergency drug screen.

Conclusion

The emergency drug screen is unlikely to significantly impact upon the management of the patient in the emergency department.

References