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Urine Testing for Detection of Marijuana: An Advisory

Within the past several years, two U.S. companies (SYVA Co., Palo Alto, California, and Roche Diagnostics, Nutley, New Jersey*) have introduced tests to detect traces of marijuana in urine. Concern about the effects of marijuana on a person's ability to perform such tasks as driving, flying, or operating machinery has prompted various governmental and industrial groups to establish policies about marijuana use, which often include chemical screening of biologic fluids. Until recently, testing of plasma has been the only means by which exposure to marijuana has been detected. Three years ago, however, the first urine-screening test became available to make such screening possible at moderate cost (SYVA).

The urine test is based on detection of 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid (9-carboxy-THC), a metabolite of delta-9-THC, which is the primary pharmacologically active component of marijuana. Studies involving humans indicate that 80%-90% of the total dose of delta-9-THC is excreted within 5 days--approximately 20% in urine and 65% in feces (1). Plasma concentrations of delta-9-THC peak by the time a smoked dose is completed and usually fall to approximately 2 ng/ml within 4-6 hours. 9-carboxy-THC is detectable in plasma within minutes after a dose is smoked and remains in plasma considerably longer than THC itself. Urine from marijuana users contains quantities of 9-carboxy-THC in both free and conjugated form, as well as other cannabinoids (THC and its metabolites) detectable by the test.

When the manufacturer's instructions are followed, urine samples containing at least the stated detection level of 9-carboxy-THC will test positive at least 95% of the time. In a CDC field-test survey of 64 laboratories, those using the SYVA system for urine screening for cannabinoids had an incidence of 4% false-positive results (2); whether these errors were analytical or clerical in nature was not determined. The manufacturer states that any positive test result should be confirmed by an alternative method.

Only blood-sample measurements are likely to correlate with a person's degree of exposure (3); attempts to correlate urine concentration with impairment or time of dose are complicated by variations in individual metabolism, metabolite accumulation in the chronic user, and urine volume changes due to diet, exercise, and age. Therefore, a positive result by the urine cannabinoid test indicates only the likelihood of prior use. Smoking a single marijuana cigarette produces THC metabolites that are detectable for several days with the cannabinoid assay (4). THC can accumulate in body fat, creating higher excretion concentrations and longer detectability. If an affect on performance is the main reason for screening, the urine cannabinoid test result alone cannot indicate performance impairment or assess the degree of risk associated with the person's continuing to perform tasks. If a history of marijuana use is the major reason for screening, the urine test for cannabinoids should be able to detect prior use for up to 2 weeks in the casual user and possibly longer in the chronic user.

A chain of custody for the sample must be maintained by the testing laboratory, as well as during the steps that bring the sample to the laboratory. All urine samples positive by the cannabinoid assay need to be confirmed by an alternate method that is as sensitive as the screening test, a condition not always met. Methods employed for cannabinoid confirmation are gas chromatography (5), gas chromatography/mass spectrometry (6), and high performance liquid chromatography (7). Because of costs involved in more complex confirmatory procedures, confirmatory tests have not always been conducted to verify presumed positive test results. Since the screening tests are immunologically based and measure both conjugated and free forms of THC metabolites, any confirmatory procedure should either measure both forms or should include a hydrolysis step to increase analytical sensitivity. Confirmatory techniques may be specific for a particular THC metabolite, while the screening kits react with virtually all THC metabolites, a further complication in confirming screening results. SYVA markets two different cannabinoid assay kits with a twofold to fourfold difference in the amount of THC metabolite required to produce a positive test result. Regardless of which assay kit is used, test results should be interpreted by qualified personnel and positive results verified so that there is a very limited possibility of a false-positive result. Reported by Div of Preclinical Research, Div of Epidemiology and Statistical Analysis, National Institute on Drug Abuse; Div of Technology Evaluation and Assistance, Laboratory Program Office, CDC.

Editorial Note

Editorial Note: Marijuana is the most widely used illicit drug in the United States; an estimated 50 million people have tried it at least once (8). A recent U.S. Department of Defense survey showed that chronic marijuana use exceeded 30% among some members of the Statistical Analysis, National Institute on Drug Abuse; Div of Technology Evaluation and Assistance, Laboratory Program Office, CDC. Editorial Note: Marijuana is the most widely used illicit drug in the United States; an estimated 50 million people have tried it at least once (8). A recent U.S. Department of Defense survey showed that chronic marijuana use exceeded 30% among some members of the military. Although further study is needed on the long-term health effects of marijuana use, short-term effects include impaired motor coordination and perception, as well as slowed learning and decreased short-term memory (9).

Urine cannabinoid assays permitting extension of testing to nonlaboratory settings, such as industrial sites, probation offices, and schools have been developed. The relative ease with which the test can be performed encourages its use by nontechnical personnel.

Those who interpret data from laboratory or nonlaboratory settings should be aware of possible pitfalls in such testing (10). Whether test results are used for counseling or determining compliance with orders to desist from marijuana use, the laboratory must perform the and schools have been developed. The relative ease with which the test can be performed encourages its use by nontechnical personnel.

Those who interpret data from laboratory or nonlaboratory settings should be aware of possible pitfalls in such testing (10). Whether test results are used for counseling or determining compliance with orders to desist from marijuana use, the laboratory must perform the test according to the manufacturer's recommendations, including confirmation of any positive test results. A recent report indicates that passive inhalation of marijuana smoke by a nonuser is not likely to produce a positive urine test result (11), but since some passive inhalation does occur, establishment of minimum sensitivity limits by a laboratory must be done cautiously.

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