

ACMT Position Statement: Interpretation of Urine for Tetrahydrocannabinol Metabolites

The position of the American College of Medical Toxicology (ACMT), endorsed by the American Academy of Clinical Toxicology, the American Academy of Emergency Medicine, the American College of Emergency Physicians, and the American Society of Addiction Medicine is as follows:

A positive test for tetrahydrocannabinol (THC) metabolite indirectly indicates that THC, a psychoactive compound in cannabis, has been present in the body. Urine THC metabolite tests are not designed to identify synthetic cannabinoids or CBD. The test results do not identify route of THC exposure, source of exposure, specific timing of exposure, dose, intentional or accidental nature of exposure, or clinical impairment.

Background

Urine cannabinoid testing has been used to improve workplace safety, although the benefit of such testing is not supported for many forensic or clinical applications. Forensic testing refers to application of an assay to answer a legal question, clinical testing refers to application of an assay to patient care. In either context, a medical toxicologist may be asked whether a positive urine test indicates impairment or whether these tests identify or exclude synthetic cannabinoid use.

Significance of Positive Test Result

A positive test for tetrahydrocannabinol (THC) metabolite indirectly indicates that THC, a psychoactive compound in cannabis, has been present in the body. The test results do not identify route of exposure, source of exposure, specific timing of exposure, dose, intentional or accidental nature of exposure. Urine THC metabolite tests are not designed to identify synthetic cannabinoids or CBD or to determine impairment clinical impairment.

The US Department of Health and Human Services (HHS), the US Department of Transportation, the Federal Aviation Administration, the Department of Defense, and other agencies have established a drug testing program to improve workplace safety. The program is mandated for use in select industries and voluntarily adopted by other employers. According to HHS, a concentration of 11-nor-9-carboxy-delta-9-tetrahydrocannabinol (THC-COOH), the

primary metabolite of THC, greater than 15 ng/mL by chromatography/spectroscopy constitutes a positive urine test result for cannabis exposure [1]. The cutoff has been determined by a scientific advisory panel to distinguish drug use from environmental exposure. Neither the HHS testing nor clinical urine drug testing can be used in isolation to establish impairment or intoxication [2].

A positive result of a drug test is reported when the analyte (drug or metabolite) concentration exceeds the established reporting threshold or cutoff. Interpretation of the analytical finding is based on the concentration of the analyte in the urine, which is affected by both the extent and duration of THC exposure, time since last exposure, hydration status of the subject, and other individual factors. If the sample is too dilute due, for example, to excess water consumption, the analyte concentration may fall below the screening reporting threshold, and a negative result may occur.

Limitations of Immunoassay Testing

HHS testing and forensic testing use chromatographic techniques, which are considered to be gold standard methods of analysis. Immunoassays are the most common drug assays used in the clinical setting. Immunoassays use antibodies chosen to detect a specific epitope of a compound. However, lack of immunoassay specificity may lead to cross-detection of other chemicals that have the same or similar epitopes, leading to false-positive results [3,4,5,6]. Positive immunoassay screening tests should be confirmed using another methodology, generally chromatographic, if desired.

Positive Drug Tests Do Not Indicate Recent Use

A positive assay result does not necessarily indicate recent use. The duration of action of delta-9-tetrahydrocannabinol (THC), the key active component in cannabis, is several hours. However, the detection interval of THC-COOH is much longer than the duration of action of THC. The most precise time frame for cannabis use to result in a urine test positive for THC-COOH varies widely depending on cannabis use history and individual characteristics (such as adiposity). In chronic heavy users, THC-COOH may be detectable for a month or longer after cannabis was last introduced into the body [7].

THC Testing Does Not Identify other Cannabinoids

Synthetic cannabinoids (SC) are a structurally diverse group of hundreds of chemicals that bind and activate the same CB1 cannabinoid receptor as THC, resulting in clinical effects that may overlap with THC [8]. Immunoassays in clinical use, which are made with antibodies directed against THC-COOH, are not designed to identify all cannabinoids whether natural or synthetic or their metabolites. The FDA-approved synthetic cannabinoid agonist dronabinol is THC (albeit synthetic), and is therefore detected [2]. If identification of a SC is desired, a reference laboratory testing panel or an assay specifically designed for the SC of interest, should be used.

Cannabidiol (CBD) is sufficiently structurally distinct from THC and is not metabolized to THC-COOH, and therefore it will not result in a positive screening immunoassay for THC metabolite. Consumption of some products sold or labeled as CBD that are derived from the cannabis plant could result in a positive test for THC-COOH if the amount of THC in the “CBD product” were sufficiently high. The consumption of hemp oil products containing <0.3% THC- a regulatory cutoff for “industrial hemp”- could result in a positive immunoassay drug test depending on the amount of THC in the particular product and the aggregate amount consumed. Despite reports of gastric acid causing conversion of CBD to THC in vitro, this phenomenon does not appear to occur in vivo [9].

Conclusion

The interpretation of drug testing results for cannabis use requires an understanding of the limitations of these assays. Urine testing for THC-COOH, particularly when confirmed by chromatography, indicates the introduction of THC into the body prior to specimen collection. Urine THC metabolite tests are not designed to identify synthetic cannabinoids or CBD or to determine impairment.

Disclaimer

While individual practices may differ, this is the position of the American College of Medical Toxicology at the time written, after a review of the issue and pertinent literature.

REFERENCES

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