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BRIEF REPORT
FALSE POSITIVE URINE DRUG SCREENS FROM QUININE IN TONIC WATER

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Abstract — Urine surveillance of patients is a universal procedure in drug treatment programs for monitoring frequency and type of illicit drug use. The method is also being increasingly utilized by employers to screen employees for drug use. The presence of a prescribed substance in a subject's urine is considered objective evidence of illicit drug use, and is used to confront subjects. However, studies have demonstrated that urine surveillance is not infallable. The presence of inaccuracy in urine surveillance has definite negative consequences of both individuals and the testers. In this paper, we report that a positive urine test for quinine, which may be evidence of illicit drug use, results from the consumption of the amount of tonic water present in a mixed drink. The implications of this finding are discussed.

The use of urine surveillance in ensuring treatment compliance in opioid abusers is standard procedure in drug treatment programs throughout the United States. Indeed, Federal Regulations require that patients in methadone maintenance programs undergo periodic urine screenings for opioids and other drugs of abuse (Department of Health and Human Services, 1980). Quinine is also routinely determined in most laboratory analyses, due to its presence in most samples of street heroin as an adulterant (Chrubin, 1967), and the ease of its measurement.

When urine specimens are obtained on a random basis and under direct supervision, urine surveillance provides a method of determining treatment compliance. However, the reliability of urine surveillance depends on a number of factors, including errors of sampling, the submission of false urines by patients, and the type of schedule in use (Goldstein & Brown, 1970; Harford & Kleber, 1978; Marks, Fry, Chapple, & Gray, 1969). A number of papers also have reported that laboratory analyses of urine for drugs may not be entirely reliable, with both false positive and false negative results observed (Gottheil, Caddy, & Austin, 1976; Nightengale, Michaux, & Platt, 1972). In drug treatment programs, the consequences of poor surveillance include an increase in drug use among patients and a breakdown in trust between staff and patients (Hansen, Caudill, & Boone, 1985; Harford & Kleber, 1978; Trellis, Smith, Alston, & Siassi, 1975).

In the past several years, the use of urine surveillance for drugs has increased dramatically, particularly by employers to screen current and prospective employees for drug use. This increased use, particularly by personnel who may not be experienced in the field of substance abuse, may also lead to problems in reliability of testing.

We observed consistently positive urine quinine reports over a three month period, in a 28 year old white male former opioid abuser receiving the opioid antagonist naltrexone. The dose of naltrexone was 100 mg ingested Mondays and

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Wednesdays, and 150 mg on Fridays. No other drugs were noted in his urine. The patient was confronted about the abnormal urine tests, but denied any drug abuse. Eventually, he admitted to drinking one to three "gin and tonics" per day, using quinine containing tonic water as a mixer.

METHODS

In order to test whether quinine ingested in tonic water could result in positive urine tests for quinine, we recruited eight drug-free and medication-free male volunteers between the ages of 25 and 45. Six of these were given an unlabelled 12 oz bottle of tonic water (Canada Dry Tonic Water, containing 70.7 parts per million quinine and 78.7 parts per million quinine hydrochloride; Data from Dr. Pepper Co.), to consume before retiring. The other two subjects were given an identical 12 oz bottle of carbonated water (Canada Dry Club Soda, containing no quinine), which was consumed in the same fashion. Each subject collected a first morning urine specimen, which was coded and sent to the laboratory to be analyzed blindly.

Urine quinine was analyzed qualitatively by a thin layer chromatographic method in routine use in our laboratory. Buffered urine is added to Clin Elute columns (CE #1020) and eluted with dichloromethane:isopropanol 90:10. The eluant is treated with methanolic sulfuric acid, evaporated and spotted on silica gel G thin layer chromatography plates (Whatman LK, 5D). Plates are chromatographed in ethyl acetate: methanol: water: ammonium hydroxide 85: 13.5: 1: 0.5 and quinine visualized under ultraviolet light. Limit of detection is approximately 2 micrograms quinine per ml urine. This method is similar to methods in general use in toxicology laboratories for the analysis of alkaloids in urine (Gorodetzky, 1972).

In order to determine whether naltrexone could result in a false positive test for quinine, naltrexone tablets (Trexan, Endo Laboratories) were dissolved in buffer, filtered and analyzed for quinine by the above method.

RESULTS

We found that all of the six subjects who received quinine containing tonic water had positive urine tests for quinine. None of the two subjects who ingested carbonated club soda had a positive urine test for quinine. Calculations on the experimental data to determine the diagnostic discrimination of the urine quinine test show a specificity of 100% and a sensitivity of 100% for this test.

The analyzed naltrexone tablets produced no spots visualized on the thin layer plates with the same characteristics of quinine.

DISCUSSION

When urine surveillance is used to monitor compliance in drug treatment programs, the manner in which the testing is performed has a significant effect on the compliance of subjects with treatment. Frequency of testing, randomization of collection, manner in which the urine is collected, and sensitivity and reliability of analyses, are demonstrated to be important factors which may influence successful urine surveillance (Goldstein & Brown, 1970). In particular, erroneous results in urine drug testing has been observed to lead to a breakdown in trust between client and treater in drug treatment programs (Harford & Kleber, 1978; Trellis et al., 1975).

The increasing use of urine drug screening by employers to assess employee drug use expands the interpretation of urine surveillance data to individuals who may be

unaware of concepts of test specificity; incorrect interpretation of "positive" test results may result in detrimental effects on employee relations.

Our experiment indicates that quinine ingested as tonic water appears in urine, and may result in positive urine test for quinine. The amount of tonic water (12 oz) ingested by the subjects was small, and comparable to that contained in one to two mixed drinks. Since the qualitative analysis was definitely positive in each case, it is possible that consumption of even smaller amounts of tonic water may result in a positive urine test for quinine. Quinine is also present in over-the-counter medications and the cardiac antiarrhythmic drug quinidine is a quinine isomer; the use of such agents will also produce a positive urine test. A solution obtained from naltrexone tablets did not produce a positive test for quinine using the same method of analysis. Although it is possible that a metabolite of naltrexone may produce a false positive test for quinine, we believe this is unlikely as we never observed positive urine quinine results in other patients treated with naltrexone. Tonic water also differs from club soda in containing sugar and sodium benzoate; however these substances will not alter urine analysis.

As the presence of quinine in urine is considered to be a "dirty urine" by many drug treatment programs and drug surveillance programs, subjects may be wrongly accused of illicit drug use or with non-compliance with treatment. It is therefore important to obtain additional data about beverage and medication consumption and to corroborate urine quinine data with information about the presence of morphine, cocaine, or substances found in the same urine specimen.

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