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16. Abstract

Isopropyl alcohol swabs taken from the oral cavities of pilots killed in general aviation accidents were analyzed for marijuana by the modified Duquenois-Levine test. During the 2-year period from October 1982 through September 1984, 289 pilot fatalities (of 809 sampled for other toxicological reasons) were sampled for marijuana; a positive test indicated the recent use of marijuana. Six of the pilots' samples (2.1 percent) were positive.

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DRUGS OF ABUSE IN AVIATION FATALITIES: 1. MARIJUANA

INTRODUCTION.

The indiscriminate use of drugs, both legal and illegal, can have an unfavorable effect on a pilot's ability to think and perform in a manner consistent with safe and successful flying. Medical certification by the Federal Aviation Administration (FAA) is necessary before a pilot's license can be obtained and maintained, and many medical conditions requiring the use of drugs are disqualifying for certification. However, the ready availability of stimulants, sedatives, tranquilizers, hypnotics, and hallucinogens has led to their abuse by a significant segment of the population. Toxicological analyses of body tissues and fluids from over 5,000 pilots killed in general aviation accidents during the time period 1968-1984 have revealed the use of compounds from each of the aforementioned groups. The role of the legal drug ethyl alcohol in aviation fatalities has been reported previously (3).

In 1982, the FAA undertook a project to determine the number of private pilots involved in fatal aviation accidents who used marijuana. The project was carried out as an addendum to the usual postaccident toxicology analysis done on victims of fatal accidents. Kits for the collection of samples from fatalities are maintained at select FAA, National Transportation Safety Board (NTSB), state and local medical examiners', and aviation medical examiners' (AME) offices. The usual supplies in these kits were supplemented with isopropyl alcohol swabs in snap-cap vials; instructions for swabbing the fingers and oral cavity were provided. The alcohol swab technique for marijuana detection was chosen because of the ready availability of sealed test packets; in contrast, petroleum ether is utilized by most laboratories. Although solubility of marijuana is high in both solvents, the ease of distributing the collection media dictated our choice.

METHODS.

In an extensive review that encompassed 400 herbally derived and botanical materials, Bailey (1) stated, "There is no published report of an obviously botanical material apart from cannabis that gives a positive Duquenois-Levine test." Because of the highly selective nature of this test, it was chosen for this study rather than thin-layer chromatography, which yields some 3 percent false positives.

The marijuana-containing swabs were extracted with petroleum ether, and the extract was evaporated to dryness; this residue was then reacted with the Duquenois reagent. One minute later, concentrated hydrochloric acid is added to the reaction mixture; this mixture is subsequently extracted with chloroform. If marijuana is present, a blue-purple color is seen in the acid phase and a violet hue is transferred to the chloroform layer.

1 Air pilots - Diseases & hygiene
Accidents
Marihuana - Air pilots - Drug use
690 Aviation - Accidents

Although field investigators were asked to obtain samples on all pilot fatalities, only 35.7 percent (or 289 of the 809 pilots killed who were sampled for other toxicological reasons) were sampled for marijuana in the 2-year period of October 1982 through September 1984.

FINDINGS.

Six (2.1 percent) of the 289 samples yielded a positive test for marijuana. Supplemental verification that the positive tests corresponded to recent marijuana use was obtained from relatives or business associates in five of the cases. Although a large amount of marijuana was found in the wreckage of the sixth case, associates were advised by counsel not to discuss the pilot's habits.

DISCUSSION.

The finding of cannabinoids in finger and mouth washings cannot be used as evidence that the individual was under the influence of the drug, but only indicates a relatively recent use of marijuana. Although sensitive immunological techniques are available for urine metabolites, past use cannot be determined more specifically than 1 hour to possibly as long as several weeks prior to testing because of the relatively long detection period of cannabinoid metabolites in urine; but since tetrahydrocannabinol (THC) does not traverse the blood-saliva barrier, that found in mouth washings was sequestered during smoking (2,4). Depending on food and drink intake, THC is not detectable after about 12 hours in saliva.

To this point in our routine toxicological screening, we have not quantified THC or its metabolites in the blood, but three techniques are available for the quantitation of THC and the two important metabolites 9-carboxy-THC and 11-hydroxy-THC in blood and urine. Gas chromatography, high-performance liquid chromatography, and mass spectrometry are all capable of measuring in the low nanogram-per-milliliter range under optimum operating conditions.

In spite of the technical capability to measure THC, 9-COOH-THC, and 11-OH-THC, a controversy persists amoung workers in the field of marijuana detection as to the meaning of levels usually seen. The half-life of THC is about 10 minutes in the blood; thus, 88 percent will have disappeared by the time of maximal psychological effect, assumed to be approximately one-half hour after initiation of smoking THC. A plasma level of 10 ng/mL is probably still indicative of "under the influence," and 20 ng/mL is accepted as "intoxication." A great deal of work remains to be done before the meanings of specific levels of THC are clear and any given level may be related to the performance of a pilot in any specific accident. As part of an expanded profile of testing for drugs of abuse, we will be adding qualitative and quantitative blood and urine marijuana determinations to the future toxicological screening profile, and we may be able to contribute data to the relevance of specific marijuana levels in aviation accident causation.

REFERENCES

1. Bailey K. The value of the Duquenois test for cannabis, a survey. J. Forensic Sci. 1979; 24(4):817-41.

2. Hawks R. The constituents of cannabis and the disposition and metabolism of cannabinoids. In: Hawks RL, ed. The analysis of cannabinoids in biological fluids. NIDA Research Monograph 42:125-37. National Institute of Drug Abuse, Rockville, MD, 1982.

3. Lacefield DJ, Roberts PA, Blossom CW. Agricultural aviation versus other general aviation: toxicological findings in fatal accidents. Report No. FAA-AM-78-31. Washington, DC: Federal Aviation Administration, Office of Aviation Medicine, 1978.

4. Schwartz RH, Hawks RL. Laboratory detection of marijuana use. J. Am. Med. Assoc. 1985; 254:788-92.