

CASE REPORT

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Methamphetamine Identification in Four Forensic Cases

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ABSTRACT: Specimens that tested positive for amphetamines by immunoassay were confirmed by mass spectrometry. The absence of detectable d-amphetamine (limit of detection at 50 ng/mL) with a positive methamphetamine prompted further testing by chiral derivatization. This data demonstrates that d-amphetamine need not be present in methamphetamine positive cases.

KEYWORDS: forensic science, methamphetamine, amphetamine, isomers, forensic toxicology

Our experience involved two cases in which a positive methamphetamine was being challenged by alleged experts because d-amphetamine was not detected. They were citing the Department of Health & Human Services (DHHS) requirement that 200 nanograms per milliliter (ng/mL) of d-amphetamine be detected for a positive methamphetamine report (1,2). Metabolism occurs at 4 to 7% of the d-methamphetamine dose to d-amphetamine (3).

The concern this laboratory encountered was the potential for l-methamphetamine (l-deoxyephedrine), present in "over the counter" cold medications, to be misidentified as the drug of abuse (4). The isomer identification of d or l is critical to the positive test result (8).

The data presented here demonstrates that d-methamphetamine can indeed be present even if d-amphetamine is absent in both blood and urine.

Analytical

Urine specimens were screened for amphetamines using EMIT II reagents on a Hitachi 704 with a 1000 nanogram per milliliter amphetamine cutoff concentration. Blood specimens were extracted (5) and analyzed.

Mass spectrometry was performed on a Hewlett Packard 5970 with a 5890 gas chromatograph and 7376 autosampler using the pentafluoropropionic anhydride (PFPA) derivative (6). The limit of detection by this method was 50 ng/mL and the limit of quantitation was 100 ng/mL amphetamine in urine, determined by in house testing (7).

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The d/l isomer was determined using a modified procedure (4) which quantified the relative percentages of each isomer.

Case Histories

Number 1

This individual attended the Indianapolis 500 race and was driving home. On the highway the individual veered off and struck a pedestrian fixing a flat tire. The pedestrian died at the scene. The police took a blood specimen from the defendant, which was analyzed for the presence of alcohol and other drugs. Methamphetamine was identified in the blood and quantitated at 779 ng/mL with no detectable concentration of amphetamine. The d/l analysis quantified the d-methamphetamine at 753 ng/mL and the l isomer at 23 ng/mL, for a total of 776 ng/mL. Amphetamine was not detected at 50 ng/mL.

Number 2

This individual was found by his father after the spouse failed to show up for work. There was a history of spousal abuse. A .44 magnum caliber pistol was found next to his body with a bullet hole under his chin. The spouse was found with a gunshot wound to the back. Suicide and homicide were the apparent causes of death with the husband shooting the wife. He was found to have a blood methamphetamine of 175 ng/mL and no d-amphetamine. The urine was found to have 1154 ng/mL methamphetamine and no d-amphetamine detectable. The urine was tested further and found to have 911 ng/mL of the d isomer and 243 ng/mL of the l isomer. Alcohol, at 0.135 g %, and codeine, 310 ng/mL, were also in the blood. The spouse had a blood alcohol, at 0.133 g %, and carboxy-THC in the urine.

Number 3

Two men were hunting in the woods, one was shot in the back by the other. The deceased was found to have 20 ng/mL of methamphetamine in the blood and 2980 ng/mL methamphetamine in the urine. The d-amphetamine was not detected in either specimen. The d/l isomer analysis demonstrated 2282 ng/mL d isomer and 616 ng/mL l isomer. The shooter was not tested.

Number 4

This suspect was stopped for reckless operation of a motor vehicle. A grey top tube of the suspects blood was tested and found to contain 104 ng/mL methamphetamine while detectable

d-amphetamine was absent. The urine was also tested and found to have 5288 ng/mL methamphetamine and 169 ng/mL d-amphetamine. This individual also tested positive for cocaine metabolites in both the blood and urine.

All cases are shown in Table 1.

Conclusions

D-Methamphetamine produces stimulation and possibly agitation ranging from restlessness to convulsions. Methamphetamine has been used for the treatment of narcolepsy and in weight loss programs. The increased mental alertness associated with methamphetamine has caused it to be used or abused by students, athletes and long haul truck drivers (9). The cases presented are methamphetamine related deaths.

The procedure has a limit of detection of 50 ng/mL and a limit of quantitation of 100 ng/mL for amphetamine as determined by analytical testing in urine, blood limits of detection and quantitation are 100 ng/mL. The reanalysis for the D/L isomer using chiral reagents showed excellent correlation with the original quantitation (Table 2).

While the DHHS guidelines are regulatory and not applicable to all forensic testing, it has been our experience that they have

TABLE 1—Data summary

	Blood		Urine	
	Amphetamine	Methamphetamine	Amphetamine	Methamphetamine
1	ND	779	No Specimen	
2	ND	175	ND	1154
3	ND	20	ND	2282
4	ND	104	169	5288

NOTE: ND = Not Detected at 50 nanograms per milliliter.
All concentrations are in nanograms per milliliter.

TABLE 2—Quantitation of total methamphetamine as compared to isomers.

Case #	Total Methamph	d Isomer	l Isomer	d + l Total Methamph
1	779	753	23	776
2	1154	911	243	1154
3	2980	2282	616	2898

become issues to argue for reasonable doubt in criminal cases. The absence of the metabolite is one such issue. The data from the cases presented demonstrates that d-amphetamine may not be present in all positive methamphetamine specimens, whether blood or urine (Table 1). While identification of the metabolite further supports a positive drug test, this data demonstrates that an absence of d-amphetamine should not eliminate the reporting of a positive methamphetamine.

The blood specimen has a lower probability of testing positive for the d-amphetamine as only a small percent of the methamphetamine is so metabolized. The blood specimen could not comply with DHHS guidelines. The urine would be expected to test positive for amphetamine in light of the significant concentrations of methamphetamine, but this is not the case. The majority of methamphetamine cases, as seen in this facility, do not have detectable concentrations of amphetamine. Two have tested amphetamine positive out of the last 12 methamphetamine cases and all have been the d-methamphetamine isomer.

References

- (1) Mandatory guidelines for federal workplace drug testing programs; Notice, Federal Register, 59 (110) June 9, 1994:29908-31.
- (2) Technical Advisory to all DHHS/NIDA Certified Laboratories, Dept. Health & Human Services, Technical Advisory PD 006, March 11, 1991.
- (3) Baselt RC, Cravey RH, *Disposition of Toxic Drugs and Chemicals in Man*, Third Edition, Year Book Medical Publ. Inc., Chicago; 1989:516-618.
- (4) Fitzgerald RL, Ramos JM, Bogema SC, Poklis A. Resolution of methamphetamine stereoisomers in urine drug testing: urinary excretion of R(-) methamphetamine following the use of nasal inhalers. *J Anal Tox* 1988;12:221-24.
- (5) Lewellen LJ, McCurdy HH. A novel procedure for the analysis of drugs in whole blood by homogeneous enzyme immunoassay (EMIT). *J Anal Tox* 1988;12:260-64.
- (6) Smith FP, Kidwell DA. Isomeric amphetamines—a problem for urinalysis? *Forensic Sci Int* 1991;50(2):153-65.
- (7) Armbruster DA, Tillman MD, Hubbs LM. Limit of detection (LOD)/limit of quantitation (LOQ): comparison of the empirical and the statistical methods exemplified with GC-MS assays of abused drugs. *Clin Chem* 1994;40(7):1233-38.
- (8) Court Allows Lawsuit Over Testing for Methamphetamine Isomers, *Drug Detection Report*, July 20, 1992:3-4.
- (9) Ellenhorn MJ. *Medical toxicology*, Elsevier Science Publ., New York: 1988:626-41.

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