Int J Legal Med (2007) 121: 40–43
DOI 10.1007/s00414-005-0039-9

CASE REPORT

Kathrin Libiseller · Marion Pavlic · Petra Grubwieser · Walter Rabl

An announced suicide with ecstasy

Received: 29 November 2004 / Accepted: 18 August 2005 / Published online: 21 September 2005

Abstract Most cases of ecstasy overdose turn out to be accidental, whereas suicide attempts with designer drugs occur only sporadically. We report an announced suicide by means of a combination of 3,4-methylenedioxymethamphetamine (MDMA) and 3,4-methylenedioxyethylamphetamine (MDEA). During autopsy, sampling for toxicological investigation (peripheral blood, urine, cerebrospinal fluid, bile and gastric contents) occurred. Serum concentrations as high as 13.33 mg/l for MDMA, 7.32 mg/l for MDEA and 0.43 mg/l for 3,4-methylenedioxyamphetamine were found. Ecstasy tablets, which were confiscated by the police a few days earlier, showed also a combination of MDMA and MDEA. This fact suggests that the ingested tablets probably came from the same source as the seized pills.

Keywords Ecstasy · MDMA · MDEA · Suicide · Overdose

Introduction

Ecstasy is the popular or "street" name for the substance 3,4-methylenedioxymethamphetamine (MDMA), an amphetamine derivative that is able to produce strong euphoria and to improve communication and sociability. Sometimes the term "ecstasy" is also used for other designer drugs of the methylenedioxyphenethylamine type, such as 3,4-methylenedioxyamphetamine (MDA) or 3,4-methylenedioxyethylamphetamine (MDEA), whose biological effects are closely similar to those of MDMA [1]. At present, immunohistochemical methods are used to investigate the effects of these compounds on the brain by determination of MDMA in different brain tissues [2].

With the increasing abuse of designer drugs, especially among young people, reports of severe intoxication and even fatal complications became more frequent. Intentional overdoses of ecstasy are quite uncommon, although there are some reports of suicides or suicide attempts by means of this drug [3–8]. In general, intoxications occur accidentally, often but not necessarily, in combination with vigorous physical activity such as dance parties [9–13]. An important risk factor is the usually unknown composition of the tablets.

In the 1980s, it seems that the majority of ecstasy tablets contained MDMA as active ingredient [14]. During the 1990s, more pills contained MDA, MDEA or even other drugs, leading to a proportion of MDMA down to under 50% of the investigated tablets in some European regions [3, 15]. This is often explained by the problematical supplies of MDMA after its prohibition in most countries [16]. In recent years, the percentage of pills containing only MDMA as active ingredient seemed to have increased again [17, 18] and was set, for example, more than 83% in Austria in 2003 [19].

We report a suicide with a combination of MDMA and MDEA, a combination which occurs quite rarely in Austria.

Case history

A 24-year-old man called his brother from his mobile phone and told him of his intake of an overdose of ecstasy tablets with a suicidal purpose. A district-wide search was immediately instigated by the police. Two hours later, the person's bearings were determined by means of his mobile present in his car on a parking site. The man was lying dead on the back seat with some superficial incisions on the arms and neck. To ascertain the cause of death and exclude third-party interference, a forensic autopsy and an additional toxicological investigation were ordered by the prosecution authority.

K. Libiseller (✉) · M. Pavlic · P. Grubwieser · W. Rabl
Institute of Legal Medicine, Innsbruck Medical University,
Muellerstrasse 44,
6020 Innsbruck, Austria
e-mail: kathrin.libiseller@uibk.ac.at
Tel.: +43-512-5073326
Fax: +43-512-5072762

On the same day, the Institute of Legal Medicine in Innsbruck received a large amount of ecstasy tablets for analysis, which had been confiscated by the police a few days before.

Autopsy findings

Autopsy was performed $12\frac{1}{2}$ h after the body was found. The man weighed 70 kg and was 182 cm tall (BMI 21.1). On the right side of the neck, the skin showed several mainly superficial incisions or scratches. All were parallel and ran from right to left and from the back to the front. Only one of these injuries went deeper into the subcutaneous tissue, but deeper structures such as blood vessels were not damaged. The left wrist was covered with a blood-soaked bandage. Underneath, several incisions of the skin were found; one of them deep enough to show that a superficial tendon had been severed. On the outer side of the right forearm, there were some similar, superficial incisions (compatible with hesitation cuts or self-mutilation). The right cubital vein showed a possible puncture mark. Dissection indicates older tissue haemorrhages and some intimal puncture scars, but no signs of recent injection. Other injuries, especially defence or grip marks, were not detected.

The conjunctivae were free of petechial bleedings. The brain showed signs of oedema, a massive pulmonary oedema was found, and the lungs as well as other inner organs (heart, liver, kidney, spleen) showed signs of congestion. In addition, aspiration of vomit was found in the lungs. The right cardiac ventricle was severely dilated. Other signs of shock were a slight paleness of the kidney cortices. The liver was slightly enlarged and showed fatty degeneration. The brownish coloured stomach contents (ca. 80 ml, pH 6.0) were admixed with white flaky precipitate, therefore strongly indicating drug remnants.

Histological examination of the internal organs confirmed acute visceral congestion of the body and oedema of the brain (mainly perivascular). The lungs showed alveolar oedema and aspiration of vomit. The myocardium was slightly oedematous, dilated and showed interstitial lymphocyte infiltration. A slight fatty degeneration of the liver cells was found.

In conclusion, the autopsy findings were concordant with a cardiovascular failure, leading to hypoxic brain injury and terminal vomiting and aspiration.

Materials

Samples of femoral blood, urine, cerebrospinal fluid, bile and gastric contents were collected during autopsy and stored at −20°C. The blood sample was centrifuged immediately to obtain non-haemolytic serum. The batch of confiscated ecstasy tablets consisted of 794 beige pills (Ø 8 mm, thickness 4 mm, weight 244 mg) stamped with "MTV" and 522 blue pills (Ø 8 mm, thickness 4 mm, weight 241 mg) with the Mitsubishi logo.

Table 1 Concentrations of amphetamine derivatives in body fluids

Body fluids	MDMA (mg/l)	MDEA (mg/l)	MDA (mg/l)
Gastric content	280	161	2.40
Femoral serum	13.3	7.3	0.43
Cerebrospinal fluid	4.1	2.3	0.21
Urine	13.0	5.7	0.38
Bile	23.5	11.3	0.82

Analytical methods

Determination of ethanol, immunological analysis and gas chromatography (GC)–mass spectrometry (MS) screening was performed as described earlier [20].

The concentrations of MDMA, MDEA and MDA were determined by GC–MS (Hewlett Packard GC 6890 and MSD 5973, Agilent Technologies, Waldbronn, Germany) using MDMA-d_5, MDEA-d_6 and MDA-d_5 as internal standards (reference substances and standards: Cerilliant, Round Rock, TX, US). Each sample (100 µl) was purified by solid phase extraction (SPE-ED Scan ABN cartridges, Applied Separations, Allentown, PA, US), derivatized with pentafluoropropionic anhydride and analysed monitoring single ion traces.

Quantification of the ecstasy tablets was done by GC-NPD (Hewlett Packard 5890, Agilent Technologies). Each sample was analysed three times after dissolving in methanol and acetylation using methaqualone (Sigma-Aldrich, Vienna, Austria) as internal standard (reference substances: Cerilliant).

Toxicological results

No ethanol was found in urine, serum or cerebrospinal fluid.

Immunological screening of urine and serum yielded positive results for amphetamines but negative results for all other drugs tested (cannabinoids, benzodiazepines, cocaine, opiates, LSD, methadone).

General unknown screening yielded positive results for nicotine, cotinine and caffeine in urine and serum, and naproxen in the urine sample. Huge amounts of amphetamine derivatives were found in urine, serum and gastric contents.

Quantitative analysis showed concentrations of MDMA, MDEA and their metabolite MDA, as given in Table 1, but amphetamine and methamphetamine were not present.

Table 2 Composition of ecstasy tablets (results expressed as means±SD)

Tablet	MDMA		MDEA		
	(%)	(mg)	(%)	(mg)	MDMA/MDEA ratio
"MTV"	10.1± 0.4	24.6± 1.1	8.4± 0.3	20.4± 0.8	1.20
"Mitsubishi"	9.4± 0.3	22.6± 0.7	7.7± 0.4	18.6± 1.1	1.22

Analysis of the confiscated ecstasy tablets demonstrated a mixture of MDMA and MDEA for both pill types. The ratios of these compounds were similar, and the percentages of the single compounds were comparable (Table 2).

Discussion

The results of autopsy and toxicological analyses were in accordance with an oral consumption of a massive overdose of ecstasy tablets. Due to missing signs of third-party interference, such as defence or grip marks, and the notification of the suicidal intent per phone, self-adduction has to be assumed. The mechanism of death was substantiated as cardiopulmonary failure caused by the high concentrations of MDMA and MDEA, although hyperthermia cannot be excluded so far. Signs of shock indicate a certain time interval between ingestion of drugs and occurrence of death. Due to the fact that orally consumed ecstasy starts acting after a relatively short period of time (30–45 min) and the 2-h interval between the phone call and the discovery of the corpse, an agonal phase of few hours has to be considered, even though it is not known for sure if the phone call was made before or after drug intake.

Toxicological results confirmed a relatively short time of survival. Quite low concentrations in cerebrospinal fluid (4.1 mg/l MDMA, 2.3 mg/l MDEA) compared to serum levels (13.3 mg/l MDMA, 7.3 mg/l MDEA) indicate a non-completed resorption. The concentrations in urine (13.0 mg/l MDMA, 5.7 mg/l MDEA) were similar to those in serum and therefore suggest an early elimination phase. The measured serum concentration of 13.3 mg/l MDMA is among the highest values of a great variety of blood and serum levels mentioned in the literature. Most MDMA blood levels in cases of serious toxicity or fatality range from 0.5 to 10 mg/l [1]. To our knowledge, there are two reported cases where higher MDMA concentrations were involved, namely one fatal overdose in Belgium (13.5 mg/l) [21] and another in Singapore (18.5 mg/l) [22]. Moreover, the additional MDEA serum level of 7.3 mg/l has to be taken into account as well, which leads to an extraordinary high total amount of amphetamine derivatives in the presented case. The relative low concentrations of MDA in all tissues militate against a consumption of this compound but should be interpreted in the light of the metabolism of MDMA and MDEA. Small amounts of MDA also appear in the gastric contents after oral consumption of ecstasy [21, 23, 24] and can be explained by starting decomposition already in the stomach.

High concentrations of amphetamine derivatives were also found in the bile (23.5 mg/l MDMA, 11.3 mg/l MDEA), which is consistent with hepatic biotransformation [1] and excretion via bile. These findings are concordant with the literature where it has been reported that amphetamine derivatives accumulate in certain organs such as liver, kidneys or lungs [23–27]. Redistribution from these "depots" or from the stomach mainly to cardiac blood is observed, especially at higher post-mortem intervals [21]. As the forensic autopsy in this case took place only $12\frac{1}{2}$ h after the body was found and femoral blood was taken for analysis, it can be assumed that the measured serum concentrations of amphetamine derivatives reflect the situation at the time of death quite well.

The fact that a bulk of ecstasy tablets had been confiscated by the police in the same region a few days before the fatal incident was a coincidence. The two different types of pills contained both a mixture of MDMA and MDEA in comparable amounts. The temporally and geographically closeness of these two incidents and the same qualitative findings suggest that in the presented suicide, a mixture of different drugs was not used. It is more likely that the ingested pills contained a combination of MDMA and MDEA and may even have had the same origin as the confiscated ecstasy tablets, especially if the combination of MDMA and MDEA in ecstasy tablets showed up quite rarely in Austria over the last years.

References

1. Kalant H (2001) The pharmacology and toxicology of "ecstasy" (MDMA) and related drugs. CMAJ 165:917–928
2. De Letter EA, Espeel MF, Craeymeersch ME et al (2003) Immunohistochemical demonstration of the amphetamine derivatives 3,4-methylenedioxymethamphetamine (MDMA) and 3,4-methylenedioxyamphetamine (MDA) in human post-mortem brain tissues and the pituitary gland. Int J Legal Med 117:2–9
3. Arimany J, Medallo J, Pujol A, Vingut A, Borondo JC, Valverde JL (1998) Intentional overdose and death with 3,4-methylenedioxyethamphetamine (MDEA; "Eve"): case report. Am J Forensic Med Pathol 19:148–151
4. Hinkelbein J, Gabel A, Volz M, Ellinger K (2003) Suicide attempt with high-dose ecstasy. Anaesthesist 52:51–54
5. Karlovsek MZ, Alibegovic A, Balazic J (2005) Our experiences with fatal ecstasy abuse (two case reports). Forensic Sci Int 147 (Suppl):S77–S80
6. Kunitz O, Ince A, Kuhlen R, Rossaint R (2003) Hyperpyrexia and rhabdomyolysis after ecstasy (MDMA) intoxication. Anaesthesist 52:511–515
7. Roberts L, Wright H (1994) Survival following intentional massive overdose of 'Ecstasy'. J Accid Emerg Med 11:53–54
8. Walubo A, Seger D (1999) Fatal multi-organ failure after suicidal overdose with MDMA, 'ecstasy': case report and review of the literature. Human Exp Toxicol 18:119–125
9. Byard RW, Gilbert J, James R, Lokan RJ (1998) Amphetamine derivative fatalities in South Australia—is "Ecstasy" the culprit? Am J Forensic Med Pathol 19:261–265
10. Fineschi V, Centini F, Mazzeo E, Turillazzi E (1999) Adam (MDMA) and Eve (MDEA) misuse: an immunohistochemical study on three fatal cases. Forensic Sci Int 104:65–74
11. Garcia-Repetto R, Moreno E, Soriano T, Jurado C, Gimenez MP, Menendez M (2003) Tissue concentrations of MDMA and its metabolite MDA in three fatal cases of overdose. Forensic Sci Int 135:110–114
12. Gill JR, Hayes JA, deSouza IS, Marker E, Stajic M (2002) Ecstasy (MDMA) deaths in New York City: a case series and review of the literature. J Forensic Sci 47:121–126
13. Lora-Tamayo C, Tena T, Rodriguez A (1997) Amphetamine derivative related deaths. Forensic Sci Int 85:149–157
14. Parrott AC (2004) Is ecstasy MDMA? A review of the proportion of ecstasy tablets containing MDMA, their dosage levels, and the changing perceptions of purity. Psychopharmacology 173:234–241
15. Ramsey JD, Butcher MA, Murphy MF, Lee T, Johnston A, Holt DW (2001) A new method to monitor drugs at dance venues. BMJ 323:603

16. Dowling GP (1990) Human death and toxic reactions attributed to MDMA and MDEA. In: Peroutka SJ (ed) Ecstasy: the clinical pharmacology and neurotoxicological effects of the drug MDMA. Kluwer, New York, pp 63–75
17. Cole JC, Bailey M, Sumnall HR, Wagstaff GF, King LA (2002) The content of ecstasy tablets: implications for the study of their long-term effects. Addiction 97:1531–1536
18. Schifano F (2000) Potential human neurotoxicity of MDMA ('Ecstasy'): subjective self-reports, evidence from an Italian drug addiction centre and clinical case studies. Neuropsychobiology 42:25–33
19. ChEck IT Jahresbericht (2003) Verein Wiener Sozialprojekte: http://www.vws.or.at
20. Libiseller K, Pavlic M, Grubwieser P, Rabl W (2005) Ecstasy-deadly risk even outside rave parties. Forensic Sci Int 153(2–3): 227–230
21. De Letter EA, Bouche MP, Van Bocxlaer JF, Lambert WE, Piette MH (2004) Interpretation of a 3,4-methylenedioxymethamphetamine (MDMA) blood level: discussion by means of a distribution study in two fatalities. Forensic Sci Int 141: 85–90
22. Lo DST, Goh EWS, Yoa YJ, Wee KP (2001) The first fatal overdose with MDMA in Singapore. TIAFT Bull 31:13–14
23. De Letter EA, Clauwaert KM, Lambert WE, Van Bocxlaer JF, De Leenheer AP, Piette MH (2002) Distribution study of 3,4-methylenedioxymethamphetamine and 3,4-methylenedioxyamphetamine in a fatal overdose. J Anal Toxicol 26:113–118
24. Weinmann W, Bohnert M (1998) Lethal monointoxication by overdosage of MDEA. Forensic Sci Int 91:91–101
25. Dams R, De Letter EA, Mortier KA et al (2003) Fatality due to combined use of the designer drugs MDMA and PMA: a distribution study. J Anal Toxicol 27:318–322
26. De Letter EA, Clauwaert KM, Belpaire FM, Lambert WE, Van Bocxlaer JF, Piette MHA (2002) Post-mortem redistribution of 3,4-methylenedioxymethamphetamine (MDMA, "ecstasy") in the rabbit. Part I: experimental approach after in vivo intravenous infusion. Int J Legal Med 116:216–224
27. De Letter EA, Belpaire FM, Clauwaert KM, Lambert WE, Van Bocxlaer JF, Piette MHA (2002) Post-mortem redistribution of 3,4-methylenedioxymethamphetamine (MDMA, "ecstasy") in the rabbit. Part II: post-mortem infusion in trachea or stomach. Int J Legal Med 116:225–232