Fatality after intake of methylone, MDMA and amphetamine: a case report

Andreas Bauer[1], Jutta Schöpfer[1], Hans Sachs[2], Matthias Graw[1], Gabriele Roider[1]

[1]Institute of Forensic Medicine, Munich
[2]Forensisch Toxikologisches Centrum, Munich

Abstract

Aims: The designer drug methylone (3,4-methylendioxy-N-methylcathinone) is the β-keto derivative of MDMA (3,4-methylendioxy-N-methamphetamin). It is sold under the brand name "Explosion" or as "bath salt" mainly on the internet and has become widely common in Germany until it was subjected to Regulations of the German Narcotics Law (BtMG) in May 2012.

Case report: We present a fatality of a 32-year old woman involving methylone, MDMA and amphetamine. The woman developed severe symptoms associated with stimulant abuse, especially hyperthermia (up to 42 °C) and seizures. She died approximately 10 hours after the first severe side effects were reported. During post mortem examination shock necrosis of the liver, kidney shock marks and excessive subendocardial bleedings as sign for a prolonging agony could be found.

Methods: After extraction and further sample preparation concentrations of methylone MDMA, MDA and amphetamine were determined in femoral blood. Methylone was measured via GC-MS; amphetamine, MDMA and MDA were analyzed by LC-MS/MS. An additional screening of urine and stomach contents was performed.

Results and Discussion: In femoral blood the following concentrations were found: 126 µg/L methylone, 42 µg/L MDMA, 8.0 µg/L MDA and 23 µg/L amphetamine. Urine analysis showed higher concentrations of methylone and MDMA in urine than in the femoral blood sample. The measured concentrations of methylone, MDMA, MDA and amphetamine did not show acute toxic levels. Considering the findings at autopsy, the toxicological results as well as the chronological course of events (persistent agony for several hours) death can be attributed to hyperthermia and seizures, caused by the uptake of methylone and other stimulants.

Conclusion: The low blood concentrations of methylone, MDMA, MDA and amphetamine measured for the time of death show that there is no direct connection between drug concentrations in blood and the possibility of fatal adverse effects like in this case hyperthermia.

1. Introduction

The designer drug methylone (3,4-methylendioxy-N-methylcathinone) is the β-keto derivative of MDMA (3,4-methylendioxy-N-methamphetamine).

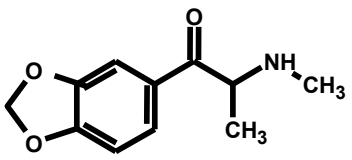

Fig. 1. Structure of methylone.

Methylone belongs to the cathinone derivatives. Cathinone (2-Amino-1-phenyl-1-propanon) is a stimulant substance that is found in the leaves of the khat bush (catha edulis).

In East Africa the leaves of the khat bush are chewed for their stimulant effects [1]. In Europe synthetic cathinone derivatives are used to circumvent existing legal regulations. Methylone is sold under the brand name"Explosion“ or as "bath salt" mainly on the internet and had become widely common in Germany until it was subjected to Regulations of the German Narcotics Law (BtMG) in May 2012.

2. Case Report

We present a fatality of a woman in her early thirties involving methylone, MDMA and amphetamine. The young mother had been to a techno event in a club at the weekend. After leaving the club, probably in the early morning, she developed movement disorders and a sensation of heat as first signs of adverse effects which can be associated with stimulant abuse.

Hours after leaving the club witnesses report about hyperthermia with up to 42 °C and raising seizures. Approximately 10 hours after the first severe side effects had been reported the young woman died at home. A reanimation performed by the called paramedics was unsuccessful.

3. Material and Methods

A qualitative urine test for common addictive and narcotic drugs carried out during autopsy showed positivity for amphetamine and methamphetamine as well as for MDMA.

Toxicological samples were obtained and a routine toxicological screening (urine, stomach contents and femoral blood) by GS-MS and LC-MS/MS was performed. Concentrations of methylone, MDMA, MDA and amphetamine were quantified in femoral blood after solid phase extraction.

Methylone was measured via GC-MS (Agilent 5973); amphetamine, MDMA and MDA were analyzed by both GC-MS and LC-MS/MS (AB Sciex API 4000).

4. Results and Discussion

Methylone, MDMA, MDA and amphetamine were detected in femoral blood, stomach content and urine.

In femoral blood the following concentrations were quantified: 126 µg/L methylone, 42 µg/L MDMA, 8.0 µg/L MDA and 23 µg/L amphetamine. Urine analysis showed higher concentrations of methylone and MDMA in urine than in the femoral blood sample. Other drugs of abuse could not be found during post mortem analysis; in particular there were no indications for a further intake of other amphetamine-derived designer drugs.

Post mortem alcohol analysis showed no relevant concentrations of alcohol in femoral blood (0,00 ‰) and urine (0,07 ‰).

Common oral doses of methylone are reported between 100-250 mg but vary individually [2]. Methylone as a cathinone derivate is consumed for its positive effects as feelings of love and empathy, euphoria, increased awakeness and general happiness. Adverse effects are nausea, vomiting, sweating, hyperthermia, tachycardia, hypertension, insomnia, fear and paranoia [2,3].

To our knowledge reliable blood or plasma concentrations of methylone in recreational users are not yet reported. On the other hand fatal cases involving methylone are described in literature. Pearson et al. reported three fatal intoxications due to methylone where methylone concentrations of 560 µg/L, 840 µg/L and 3300 µg/L were found [4].

The methylone concentration in the presented case with 126 µg/L is clearly below other reported methylone concentrations in fatal cases, therefore death cannot be attributed to an acute intoxication but rather to adverse effects like hyperthermia.

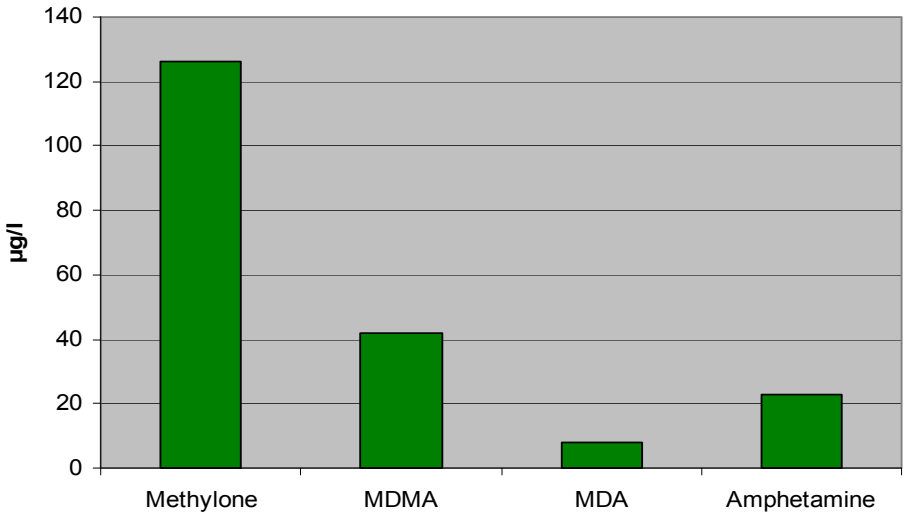

Fig. 2. Concentrations of methylone, MDMA, MDA, and amphetamine in femoral blood.

It also shows that between appearance of the first serious adverse effects (early morning) and death (late afternoon) a rather long time can elapse. The findings during post mortem examination as shock necrosis of the liver and kidneys, massive intracranial pressure and excessive subendocardial bleedings can be seen as signs for an agony lasting several hours before death.

5. Conclusions

The measured concentrations of methylone, MDMA, MDA and amphetamine did not show acute toxic levels. Considering the findings at autopsy as well as the toxicological results and the chronological course of events (persistent agony for several hours) death can be attributed to hyperthermia and seizures caused by the intake of methylone and other stimulants.

6. References

[1] Brenneisen R, Fisch H-U, Koelbin U, Geisshusler S, Kalix P. Amphetamine-like effects in humans of the khat alkaloid cathinone, Br J Clin Pharmac 1990;30:825-828.

[2] http://www.erowid.org/chemicals/methylone/methylone_dose.shtml; last request 2.8.2013

[3] Baselt R.C.: Disposition of Toxic Drugs and Chemicals in Man. 9th ed., Biomedical Publications, Seal Beach California, 2011.

[4] Pearson JM, Hargraves TL, Hair LS et al. Three fatal intoxications due to methylone. J Anal Toxicol 2012;36:444-451.