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Methamphetamine-related sudden death with a concentration which was of a 'toxic level'

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Abstract

We reviewed 32 cases where a forensic autopsy detected methamphetamine in the blood, and all of these autopsies were performed at two institutes between 1991 and 2003. In accordance with several criteria, the blood concentration in 11 cases was classified as above the toxic level, and 10 of these cases were diagnosed as methamphetamine poisoning. In 20 cases (62.5% of total cases), the blood concentration was of a 'toxic level', and 10, 2 and 1 of these cases were diagnosed as methamphetamine poisoning, cardiomyopathy and intracerebral hemorrhage, respectively. Since it is unclear how the effects of methamphetamine may contribute to the death of an individual, a diagnosis of the exact cause of death is often difficult to make in cases where the blood concentration of methamphetamine was of a 'toxic level'. Therefore, a diagnosis has to be carefully made in consideration of the pathological findings, the pharmacological effects of methamphetamine and the process until death in such cases. Additionally, the mechanism of methamphetamine-related death needs to be more fully studied to enable an appropriate diagnosis to be made easily.

Keywords: Methamphetamine; Sudden death; Blood concentration; Poisoning

1. Introduction

In Japan, methamphetamine (MAP) is one of the most abused drugs and it has a potent sympathomimetic activity [1]. MAP use not only causes euphoria and stimulation in humans, but also commonly results in its habitual use or abuse, with the result that the number of MAP abusers has been rapidly increasing over the last decade [1,2]. The number of arrests due to MAP abuse was about 20,000 and the quantity of seized MAP was in excess of 1000 kg in 2000 [2].

In the case of MAP-related death, a forensic autopsy is performed to investigate the cause of death, and the concentration of MAP in the blood is relevant to the diagnosis of the cause of death. There have been several criteria which classify MAP concentration in the blood into fatal, toxic and therapeutic level, however, the criteria are not definitive. Logan et al. [3] reported a survival case with a MAP concentration in the blood of 9.46 μg/ml and we have often experienced autopsy cases where the level of MAP detected in the blood was below the 'fatal level'.

For this reason, we retrospectively reviewed autopsy cases where MAP was detected in the blood, and we discuss the cause of death, especially in cases where the blood level was not high. We feel certain that the results of this study will contribute greatly towards a more accurate diagnosis in future forensic autopsy cases where MAP is detected.

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Table 1
Classification of autopsy cases by the concentration of methamphetamine in the blood

Case No.	Age/Sex	Cause of death	MAP concentration (μg/mL)	AP concentration (μg/mL)	MAP + AP (μmol/100 g)	Route of administration	Autopsy findings
1	30/M	MAP poisoning	50.5	–	33.9	p.o.	Pulmonary edema, cerebral edema
2	24/M	MAP poisoning	33.8	4.9	26.3	i.v., p.o.	Congestion of multiple organs, subendocardial hemorrhage
3	24/F	MAP poisoning	15.52	–	10.4	Unknown	Pulmonary edema and congestion
4	48/F	MAP poisoning	9.83	0.24	6.8	p.o.	Pulmonary congestion
5	30/M	MAP poisoning	8.38	0.04	5.7	i.v.	Pulmonary congestion, cardiomyopathy
6	19/F	MAP poisoning	7.06	0.35	5.0	i.v., transvaginal	Congestion of multiple organs
7	26/M	Exsanguinations	6.74	0.33	4.7	Unknown	Ischemia of multiple organs, cutting of left femoral artery
8	38/M	MAP poisoning	6.44	0.46	4.7	i.v.	Slight subdural hematoma, congestion of multiple organs
9	38/M	MAP poisoning	5.72	–	3.8	i.v.	Pulmonary edema, congestion of mutiple organs
10	30/M	MAP poisoning	5.56	0.5	4.1	i.v.	Congestion of multiple organs
11	53/M	MAP poisoning	5.06	–	3.4	p.o.	Congestion of multiple organs, multiple injuries
12	48/F	MAP poisoning	5.0	–	3.4	p.o.	Pulmonary edema and congestion, liver cirrhosis
13	22/F	MAP poisoning	3.95	0.15	2.8	p.o.	Pulmonary edema and congestion, cerebral edema
14	36/M	MAP poisoning	3.49	0.06	2.4	i.v.	Pulmonary edema, cerebral edema
15	Unknown/M	Drowning	3.44	–	2.3	Unknown	Decomposition
16	25/M	MAP poisoning	2.7	–	1.8	Unknown	Pulmonary edema
17	51/M	Cardiomyopathy	2.11	0.06	1.5	i.v.	Abnormalities of the conduction system, endocardial thickening [11]
18	34/M	Traumatic shock	2.1	–	1.4	i.v.	Multiple injuries
19	27/M	MAP poisoning	2.1	–	1.4	i.v.	Congestion of multiple organs
20	52/M	Intracerebral hemorrhage	1.94	–	1.3	i.v.	Intracerebral hemorrhage, decomposition
21	45/M	Cardiomyopathy	1.61	0.05	1.1	Unknown	Myocardial hypertrophy, cardiac fibrosis, myocardial disarrangement
22	38/M	MAP poisoning	1.44	0.06	1.0	i.v.	Congestion of multiple organs, myocardial hypertrophy
23	23/F	Traumatic shock	1.29	0.12	0.96	Unknown	Multiple injuries
24	21/M	MAP poisoning	1.28	–	0.86	i.v.	congestion of multiple organs
25	46/M	MAP poisoning	1.23	–	0.83	i.v.	Edema of multiple organs, cardiac hypertrophy
26	44/M	MAP poisoning	0.74	–	0.5	i.v.	Pulmonary edema and congestion
27	50–60/M	Hanging	0.67	0.05	0.49	Unknown	Findings of asphyxia
28	27/M	MAP poisoning	0.62	0.03	0.44	p.o.	Congestion of multiple organs
29	57/M	Exsanguination	0.61	–	0.41	Unknown	Ischemia of multiple organs, stab wound to the lung
30	32/F	Traumatic shock	0.51	0.1	0.41	i.v.	Multiple injuries