

CASE REPORT

Branislav M. Budakov,¹ M.D., Ph.D.; Milan A. Simic,¹ M.D., Ph.D.; Milos M. Tasic,¹ M.D., Ph.D.; and Djura N. Vujic,¹ B.S.

Unusual Cases of Suicide Among Health Care Workers

REFERENCE: Budakov BM, Simic MA, Tasic MM, Vujic DN. Unusual cases of suicide among health care workers. *J Forensic Sci* 2000;45(4):923–925.

ABSTRACT: We describe three unusual cases of suicide committed by health care workers. The aim of this paper was to analyze and evaluate the evidence of general diagnostic elements of poisoning in these cases.

KEYWORDS: forensic science, suicides, health care workers, death, poisoning, forensic pathology, forensic toxicology

When used properly, medications represent the basic and almost indispensable tool for physicians. However, increased exposure to medical information and accessibility to drugs, especially those affecting the central nervous system, consequently cause increased intentional and unintentional damage to health by these chemical substances. Suicidal poisonings are most frequently committed using psychopharmacological drugs, whereas misuse of drugs predominantly used in hospitals is much rarer and as a rule occurs in health workers.

Case Descriptions

Case 1

Circumstances—The authorized district court issued an order to perform an autopsy on the 23-year-old deceased, D.Z. Toxicological examination was required in order to establish the cause of death in the suspected poisoning. At the scene of the suicide, the victim's apartment, two plastic single-use syringes, an empty cartridge (400 IU) of crystal-type insulin (Inutral SPP), and three broken ampules were found and an i.v. cannula was in the left arm vein of the victim. A little package of gauze was found in the deceased's pocket and a suicide note was found on the table with the following message: "Good-bye to everyone. Love, Z." The victim had never suffered from diabetes mellitus, but two years earlier had attempted suicide with barbiturates (per os). He was a medical technician by occupation who worked in the General Hospital at the Department of Pediatric Surgery.

¹ University of Novi Sad, School of Medicine, Institute of Forensic Medicine, Department of Forensic Pathology, Hajduk Veljkova 3, 21000 Novi Sad, FR Yugoslavia.

Received 26 March 1999; and in revised form 21 Sept. 1999; accepted 27 Sept. 1999.

Autopsy Findings—Postmortem examination of the body revealed a puncture wound on the palm-side of the left hand (about 2 cm above the root of the ring finger), at the level of the venous blood vessel (v. metacarpea dorsalis) with subcutaneous hematoma and a venous wall puncture. Internal examination revealed blood-filled organs, mostly liquid and partly clotted blood, but did not reveal any characteristic organic changes. Except for hyperemia, microscopic analysis had not shown any characteristic findings in regard to histologic picture of organs and tissues.

Toxicological Results—Neither alcohol nor narcotics were found in the blood and urine samples of the victim. Toxicological analysis of blood samples resulted in more than 300 mL U/L of insulin (method: RIA—radioimmunoassay) whereas repeated analyses showed maximal values of glucose—0.4 mmol/L (system RA-XT, method hexokinase).

Case 2

Circumstances—D.B., a 46-year-old general practitioner, was found dead in his house with an injection needle in his thigh muscle. A single-use syringe and five empty ampules of Nesdonal (1 mg) were found next to the body.

Autopsy Findings—Postmortem examination of the body revealed two additional punctures. Locally, the muscle tissue was mixed, boiled-like, and blood-filled. The interfascial space was filled with water-mucous collection (a sample was taken for toxicological analysis). Internal examination revealed extensive venous hyperemia and spot-like staining bleeding on the serosa, but no changes, diseases, or injuries.

Toxicological Results—Toxicological analysis by method of GS-MSD (gas chromatography mass selective detector), revealed presence of sodium-pentothal in a concentration of 325 µg/mL in the examined blood sample.

Case 3

Circumstances—M.Z., a 41-year-old nurse-anesthetist, was found dead in her bed. A surgical glove with a piece of gauze in it was on the pillow beside the mouth and nose of the victim. The gauze smelled of acetone, or the like. An empty bottle labeled "Fluothan—inhalation anesthetic—20 mL" was found on the cupboard beside the bed.

Autopsy Findings—Autopsy revealed hyperemia of all organs and bleeding of the serosa. A lipoma, tangerine-sized, was found on the pericard, at the level of the right ventricle. No other changes or injuries have been established.

Toxicological Results—HTA analysis was performed by the GS-MSD method, establishing the presence of halothane in blood samples, cerebrospinal liquor, and tracheal air. The average concentration of halothane was 460 $\mu\text{g/mL}$ in the examined blood sample.

Discussion

Accidents occurring in therapeutic procedures with insulin, especially with medications used in anesthesia, are well known. In our practice we have met suicidal poisonings by various substances, but these are our first experiences with the use of these medications with the aim of committing suicide. According to literature data, such cases are also rare in the medical-forensic practice, and mostly involve health care workers, predominantly medical technicians.

Toxicological findings in our first case revealed an extremely high level of insulin, with extremely low, barely measurable values of glucose in blood. It has been known that certain diseases, including insulin overdose, may cause hypoglycemia, that is, values below 3.4 to 3.6 mmol/L. Increased levels of insulin decrease the level of glucose and it is transported from blood into fatty tissue and muscles, which is manifested by certain symptoms, depending on the level of hypoglycemia, and the most severe clinical form—hypoglycemic coma.

The basic pathophysiological substrate of these disorders is caused by glucose insufficiency in the brain and disturbed function of its phylogenetically related parts (cerebral cortex and some parts of cerebellum), whereas functional disorders of medulla oblongata (phylogenetically distant) occur in the terminal stage with breathing disorders and lethal outcome.

Experiences including postmortem assessment of cause of death in such cases are predominantly based on suicidal and sporadic, accidental, and iatrogenic cases. The macroscopic finding is uncharacteristic, while microscopically it is possible to establish occurrence of disseminated necrosis of the liver, myocardium, brain cortex and brain stem, but only in cases of survival lasting several hours or more. These findings can be associated with micronodular fatty infiltrations of the liver and myocardium (2).

In the aforementioned case 1, the laboratory findings revealed extremely high levels of insulin in the blood, with extremely low, barely measurable glycemia, because D.Z. intravenously administered the content of a bottle with crystal insulin "Inutral SPP," which means 10 mL, and 400 international units (IU) of crystal highly purified insulin. This neutral solution of insulin has a fast and short hypoglycemic effect starting in 30 to 60 min; its maximal effect is achieved about 5 h later, while its complete effect lasts about 10 if administered subcutaneously or in recommended doses (3). Regarding the mechanism and dynamic of action, insulin is individually dosed in treatment of diabetes mellitus, whereas daily doses are measured by single units. It is evident that intravenous administration of great quantities of crystal insulin causes fast and sudden decrease of glucose in blood, with all described effects on the function of the brain with short agony and death thereafter.

Cause of death in our second case was intramuscular administration of Nesdonal (sodium pentothal) (3,4). The victim's family denied any kind of discussion or threat of suicide, and knew no reasons for such an action. According to circumstances, accident and murder were ruled out. Sodium-pentothal is a barbiturate with ex-

tremely short action used intravenously for initial anesthesia because it causes almost immediate unconsciousness. In order to illustrate its efficacy, anesthesiologists describe its action at "arm-brain" level. The victim, being a physician, was familiar with this and probably that is why he applied the anesthetic intramuscularly, not intravenously, as usual. We can suppose, with good reason, that the victim was afraid of becoming unconscious too fast, in which case he would not have been able to apply the deadly dose of anesthetic. That is why he had chosen intramuscular application, avoiding instant action of the anesthetic. With regard to these facts, and finding less injection punctures than used ampules, it can be concluded that all ampules had been dissolved and prepared in advance, but with less water than prescribed (0.5 g in 10 mL of water), and that a few ampules had been applied using one needle.

According to literature data, therapeutic doses are 250 to 300 μg (3–5 $\mu\text{g/kg}$), whereas the minimal lethal dose is 1 g. Intake of 5 g is sufficient to cause unconsciousness, coma, and death in a very short time, because muscle tissue is a good resorbing substrate.

In the third case, suicide was committed by inhaling a general anesthetic Flouthane (Halothane) (5). This anesthetic has been successfully used in surgery since 1954, mixed with nitrogen-oxide and neuromuscular blockers in concentration 0.5 to 3%. In our case, a piece of gauze soaked with halothane was put inside a surgical glove to prevent evaporation in all directions. The nose and mouth of the victim were turned towards this opening so that the concentration in the inspired air was much higher than the therapeutic level. Unconsciousness started very fast, thus preventing any changing of the victim's mind, while the inspired and resorbed anesthetic caused a fast and fatal outcome.

The victim's family wished to present this case as an accident, because the victim had been using halothane earlier when having sleeping difficulties. On the other hand, her colleagues from work said that she had attempted suicide by drugs a few years earlier. All this points to the suicidal character of the victim, whereas frequent cardiac rhythm disorders might have been the motive. Pericardial lipoma, a pathoanatomic substrate, speaks in favor of this assumption.

Conclusion

The profession of the victims and the way of committing suicide confirm the theory that the manner and means of suicide sometimes depend on the occupation of the victim (6). All decedents were medical personnel and familiar with the drugs and the routes of administration used for their suicides. The presented case of intravenous administration of insulin is an extremely rare method of committing suicide. Data concerning suicidal circumstances, autopsy findings, and applied laboratory analyses enabled a complete diagnosis of this rare kind of suicide. Laboratory analyses seem to be of utmost importance in confirming the assumed pathophysiological mechanism and dynamics of vital organs failure. It must be pointed out that this case was the first documented and laboratory-confirmed suicide using insulin on our autopsy material.

Our previous results reveal various unexpected accidents occurring during anesthesia, including major or minor complications and consequences with corresponding forensic aspects. Individual intentional misuse of anesthetics is very rare and is most often associated with health workers, just as in our cases and in the literature.

In the cases presented herein it would have been very easy to intervene at the scene of death and eliminate certain material evidence in order to simulate natural death. In the case of unclear sudden death without adequate pathomorphological substrate, an

autopsy procedure is regarded as in complete without chemical-toxicological analysis.

References

1. Tedeschi CG, Eckert WG, Tedeschi CL. Forensic medicine. Philadelphia: Saunders Co., 1977.
2. Kutilmann JJ Jr. Two deaths involving isoflurane abuse. *J Forensic Sci* 1993;38(4):968-71.
3. Moffat AC, editor. Clarke's isolation and identification of drugs. The Pharmaceutical Press 1986;1017-8.
4. Bruce AM, Oliver JS, Smith H. A suicide by thiopentone injection. *J Forensic Sci* 1977;9:205-7.
5. Randall CB. Disposition of toxic drugs and chemicals in man. Davis, CA: Biomedical Publications, 1982;361-4.
6. Clark MA, Jones JW. Suicide by intravenous injection of a veterinary euthanasia agent: report of a case and toxicological studies. *J Forensic Sci* 1979;24:762-7.

Additional information and reprint requests:

Dr. Zoran M Budimlija
Medicinski fakultet, Institut za sudsku medicinu,
Hajduk Veljkova 3; 21000 Novi Sad, FR Yugoslavia
Phone: ++381/21/42-01-89
Fax: ++381/21/61-13-74
E-Mail: zbuda@EUnet.yu