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CASE REPORT

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# Suicide of a diabetic by inducing hyperglycemic coma

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**Abstract** Deaths due to hyperglycemic and hyperosmolar coma in diabetics are usually disease-related. In the exceptional case reported here there was evidence for an intentional ingestion of a sugar solution, the person was a diabetic and known to be depressive suggesting a suicidal intention. The autopsy findings were inconspicuous and only further laboratory findings led to the final diagnosis.

**Key words** Diabetes mellitus · Hyperglycemia

## Introduction

Suicides of diabetics [1–3] and non-diabetics [3–5] by misuse of insulin or oral antidiabetics [6] to induce fatal hypoglycemia have been reported. Alternatively, hyperglycemic coma can occur as a first manifestation of the disease or as a result of insufficient therapy and the mortality rate is in excess of 50% [7].

At autopsy both forms of metabolic dysregulation are difficult to diagnose. Indications which may lead to the diagnosis are e.g. ketocemic odour, stiffness of the brain tissue, xanthochromia, fatty degeneration of the liver, adiposity, chronic pancreatitis and Kimmelstiel-Wilson disease. Non-specific indications of an acute dysregulation may be brain oedema, signs of central death, pneumonia, erosions of the gastric mucosa and swollen kidneys [8].

Ketoacidosis may also occur in chronic alcoholics and its origin can be differentiated from the hyperglycemic disorder by determining the free acetone in cerebrospinal fluid [9] or vitreous humour. Biochemical analysis of different body fluids can confirm the diagnosis [9, 10] where the postmortem equivalent of the glucose concentration is expressed by Traub's sum value [11]. Additionally, the glycosylated forms of albumin and haemoglobin A1 and A1c may be determined reflecting the glucose levels of the last 2–8 weeks ante mortem [7].

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## Case report

A 65-year-old woman was found dead laying naked on her bed and was last seen 4 days previously. A diabetes mellitus was known but she was trained in self-therapy with insulin. After the death of her partner she had repeatedly talked about suicide. Because of a negligent diet the blood glucose levels were usually raised and she had already developed secondary diseases (retinopathy, nephropathy, polyneuropathy). An empty jug (volume 1000 ml) was found next to her bed containing a sticky sediment. On the kitchen table two half-empty 1 kg packages of sugar (saccharose) were found.

### Autopsy findings

Signs of an extended agony period with extensive clots and massive oedema of the brain were found. A purulent, abscess-forming pyelonephritis, stenosing coronary atherosclerosis and hypoplasia of the pancreas were also found. The quick test for glucose performed using cerebrospinal fluid and urine gave strongly positive results. Purulent abscesses in both kidneys and mild Kimmelstiel-Wilson disease were observed histologically. So-called Armanni-Ebstein vacuoles (extensive glycogen deposits in the loops of Henle) could not be detected. The test for glycogen (carmine red BEST) was negative. All other organs (brain, heart, lungs, liver) were without relevant findings but the pancreas showed advanced autolysis. The biochemical analyses indicated severe hyperosmolar diabetic dysregulation together with mild renal failure. Full toxicological analyses gave negative results also for acetone. The examination of the cup sediment resulted in the proof of saccharose.

## Discussion

In the case presented an insulin-dependent diabetes mellitus was known with negligent treatment because of non-compliance of the patient. As a consequence, the patient had developed related tissue alterations such as mild Kimmelstiel-Wilson nephropathy or fatty degeneration of the liver (the negative result of glycogen in the kidneys could have been due to putrefaction and fixation). Also, indicat-

**Table 1** Results of the chemical investigations of the body fluids. Reference values are given in parentheses; neg.=negative

| | Serum | Liquor | Urine |
|---|---|---|---|
| Glucose mg/dl | 1164 (80–140) | 804 | 1000 |
| Lactate mmol/l | 43.2 (1.0–1.2) | 43.5 | 10.8 |
| mg/dl | 384 | 387 | 96 |
| Traub's sum | | 1191.5 (> 415 mg/dl, [13]) | |
| Acetone | neg. | neg. | neg. |
| | Serum | | |
| HbA1 (%) | 14.5 (4–8) | | |
| HbA1c (%) | 12.5 (2.7–6.6) | | |
| Fructosamine µmol/l | 692 (< 285) | | |
| Urea mg/dl | 92 (0–24) | | |
| Creatinine mg/dl | 4.0 (0–1.2) | | |

ing negligent treatment during the past weeks, increased levels of glycosylated forms of plasma proteins could be detected [7]. The only finding relevant to the cause of death was the extremely high glucose level in different body fluids. The glucose levels were around one order of magnitude higher than normal. This corresponds to levels and concentrations as found in hyperosmolaric hyperglycaemic coma [12] and would sufficiently explain the cause of death [13]. Because of the findings of the death scene the case was interpreted as a suicidal ingestion of saccharose.

Hyperosmolaric coma is normally a complication of the non-insulin-dependent diabetes. The major sign is a massive hyperglycaemia with glucose levels in the serum which could be twice as high when compared to the ketoacidotic type. Hyperglycaemia leads to hyperosmolarity and dehydration combined with central nervous symptoms. The mortality could be higher than 50% [7]. In the reported case of the suicidal ingestion of a sugar solution, the osmolarity of the blood increases rapidly [7]. The electrolyte concentration could therefore be rapidly and strongly influenced so that death could also have been the result of changed electrolyte concentrations.

As far as could be seen from the literature, the suicidal intention as a cause of fatal hyperglycemia seems to be unique (medline 1966-11/1998). We suggest that for general diagnostic reasons, glucose determination during autopsy should become a compulsory test [10]. This diagnosis cannot be made without an extensive toxicological analysis. It is essential in cases of self-induced hyper- and hypoglycaemia as well as in diabetics and non-diabetics because of additional effects and interference of prior administered drugs leading to an increase or decrease of blood sugar levels.

## References


1. Martin FI, Hansen N, Warne GL (1977) Attempted suicide by insulin overdose in insulin-requiring diabetics. Med J Aust 1:58–60
2. Hambrecht M, Kuchenhoff B (1989) Suicide attempts in diabetic patients with insulin and their neuropsychiatric sequelae. Nervenarzt 60:367–369
3. Kernbach-Wighton G, Püschel K (1998) On the phenomenology of lethal applications of insulin. Forensic Sci Int 93:61–73
4. Patel F (1992) Fatal self-induced hyperinsulinaemia: a delayed post-mortem analytical detection. Med Sci Law 32:151–159
5. Patel F (1995) Successful suicide by insulin injection in a non-diabetic. Med Sci Law 35:181–182
6. Barracca A, Ledda O, Michittu B, Pili GF, Manca O, Pani A, Altieri P (1998) Acute renal failure after massive ingestion of gliclazide in a suicide attempt. Ren Fail 20:533–537
7. Foster D (1995) Diabetes mellitus. In: Schmailzl KJG (ed) Harrisons Innere Medizin 2, 13th edn. Blackwell, Berlin Vienna Oxford, pp 2314–2338
8. Püschel K, Beckmann R, Kernbach G, Brinkmann B (1984) Differentialdiagnose und Beweis des Coma diabeticum an der Leiche. Beitr Gerichtl Med 42:315–318
9. Brinkmann B, Fechner G, Karger B, Du Chesne A (1998) Ketoacidosis and lactic acidosis – frequent causes of death in chronic alcoholics? Int J Legal Med 111:115–119
10. Sippel H, Möttönen M (1982) Combined glucose and lactate values in vitreous humour for postmortem diagnosis of diabetes mellitus. Forensic Sci Int 19:217–222
11. Traub F (1969) Methode zur Erkennung von tödlichen Zuckerstoffwechselstörungen an der Leiche (Diabetes mellitus und Hypoglykämie). Zentralbl Allg Pathol 112:390–399
12. Kernbach G, Koops E, Brinkmann B (1984) Biochemische Parameter bei 31 tödlichen diabetischen Stoffwechselentgleisungen. Beitr Gerichtl Med 42:301–306
13. Kernbach G, Püschel K, Brinkmann B (1986) Die biochemischen Meßgrößen des Glucosestoffwechsels in Abhängigkeit von der Todesart und postmortalen Einflüssen. Z Rechtsmed 96:199–213