CASE REPORT

Pseudohyperglycaemia in a comatose patient after picking cherries

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SUMMARY

We report a case of pseudohyperglycaemia on a capillary blood glucose measurement taken from fingers stained with sugar (fructose). A 76-year-old patient with type 1 diabetes received emergency attention at home because of a coma. The first capillary blood glucose measurement collected from a finger revealed a concentration higher than the reference limits, misleading the clinician. After starting symptomatic treatment, a second blood glucose measurement was taken. This measurement, taken at the earlobe, revealed profound hypoglycaemia (0.89 mmol/L), which prompted the administration of appropriate treatment. The elevated initial capillary blood glucose measurement was linked to the presence of fructose on the fingers of the patient from picking cherries just before the patient fainted. After intravenous administration of glucose, the patient regained normal consciousness and had no sequelae despite the severity of the hypoglycaemia and delayed diagnosis. Pseudohyperglycaemia is rare, and delayed diagnosis frequently results in severe sequelae or death.

of trauma. Vital signs included blood pressure of 42/16 mm Hg, sinus bradycardia of 40 bpm, bradypnoea of 8 respirations/minute and oxygen saturation of 81% on room air. The patient was quiet and limp, with a Glasgow score of 5. The pupils were symmetrical, reactive and miotic bilaterally. There were no meningeal signs, stiffness or neurological localisation. However, we found bilateral decorticate posturing during painful stimulation. The ECG showed no abnormalities other than bradycardia. The first capillary blood glucose measurement taken from the left ring finger was 8.4 mmol/L, higher than the reference value concentration for a diabetic patient ($4.0 < \text{reference value} < 7.0$ mmol/L).¹

Initial management consisted of symptomatic treatment in the absence of a clear differential diagnosis. He was rapidly given a litre of intravenous saline via an intraosseous catheter for fluid resuscitation. Bradycardia was corrected with 1 mg of atropine. Oxygen desaturation and bradypnoea were corrected by mechanical ventilation after orotracheal intubation.

BACKGROUND

Symptomatic hypoglycaemia is defined as blood glucose below 3.33 mmol/L in patients with diabetes treated with insulin.¹ It is associated with highly variable neurological manifestations ranging from a simple headache to hemiplegia, convulsions or even coma. These common events among patients with diabetes may be linked to treatment errors (wrong dose, injection site or drug interactions), food or inappropriate physical activity. Often, the cause of hypoglycaemia is not found.

In the absence of glucose administration, hypoglycaemia can be fatal. This case highlights the need to repeat a blood test when there is inconsistency between the clinical condition and the test result.

The capillary blood sugar concentration is rarely questioned, as this examination is frequent and commonplace. Its normal concentration should be known by every health professional.

CASE PRESENTATION

This 76-year-old patient had a medical history of type 1 diabetes treated with insulin and myocardial infarction treated with acetylsalicylic acid, rosuvastatin and bisoprolol. His family alerted emergency services on finding him in a coma. He was last observed conscious 2 hours earlier while picking cherries. On arrival of the prehospital medical team, he was found lying in a garden under a cherry tree. Clinical examination revealed no external evidence

INVESTIGATIONS

Once the haemodynamic and ventilatory statuses were stabilised, the practitioner requested a repeat blood glucose test. The nurse found the patient's fingers dirty and chose to sample blood from the earlobe instead. The surprising result of 0.89 mmol/L was rechecked on a different device. Other checks were conducted on the patient's arrival to the emergency room. The patient's hands and fingers were re-examined. The finger from which the first sample was taken (the ring finger) appeared sticky, probably because it had been soaked with cherry juice. After waking up, the patient was rapidly extubated. He then agreed to have multiple samples taken to better understand the situation. A glucose venous reference measurement was carried out at the hospital laboratory (11.9 mmol/L). A capillary blood glucose measurement was taken on each of the other fingers before washing them with a different bedside glucometer. The blood from the ring finger used for the initial measurement indeed reported a much higher glucose concentration than did the other fingers (table 1). After handwashing, the consistency of the subsequent blood glucose measurements was verified with a final sample.

In view of the discrepancy between the original and subsequent measures, the original glucometer (bedside glucometer ACCU-CHECK Performa, Roche Diagnostics GmbH, Mannheim, Germany) was quickly checked and found to have no deficiencies with either the device or the associated test

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Table 1 Blood glucose (capillary glycaemia SI: mmol/L) according to the puncture site used

	Puncture site	Thumb	Index	Middle	Ring	Little	Earlobe	Median (IQR)	p Value
Before glucose administration	First measurement	—	—	—	8.38	—	—		
	Second measurement	—	—	—	—	—	0.89		
After glucose administration	Before finger cleaning	11.4	13.0	17.5	30.0	13.7	—	13.7 (13.0–17.5)	0.059
	After finger cleaning	12.2	13.3	10.8	11.3	11.4	—	11.4 (11.3–12.2)	

The p value was calculated with a non-parametric equality-of-medians test.² The differences between values before versus after cleaning of the fingers were close to statistical significance.

strips (general state, cleanliness, battery level, concordance of marks and storage in hermetic box of test strips). A test with the manufacturer control solution was realised and was found satisfactory.

This confirmed the hypothesis that the original blood sample was contaminated by cherry juice. Further investigation (ECG, CT scan) did not reveal any anomaly.

TREATMENT

The patient regained consciousness after intravenous administration of 40 mL of a 30% glucose solution and extubation of the patient occurred shortly after arrival at the emergency department.

OUTCOME AND FOLLOW-UP

The patient was discharged 1-day later without any neurological sequelae. Clinical assessment revealed a conscientious patient with diabetes who had no recent changes in treatment, food, lifestyle or physical activity that could have led to this hypoglycaemic event.

DISCUSSION

Cases of severe hypoglycaemia with reduced consciousness are common among patients on insulin (1–2 episodes/patient/10 months, requiring glucose administration by a third party). Episodes typically have a clear aetiology and can easily be treated with rapid intravenous glucose administration. In our patient, the practitioner did not immediately verify the blood glucose concentration because the haemodynamic and respiratory findings required immediate resuscitation and the stress induced by such a critical statement caused probably a decrease in reasoning abilities.³ Additionally, the initial blood glucose measurement was not performed on a finger previously rinsed with water as recommended by the American Diabetes Association and the glucometer manufacturer.^{4–5} Admittedly, hand washing before the measurement of blood glucose is not routinely performed either by patients or by professional rescuers.⁶ Several causes of pseudohyperglycaemia have been reported. In the event of an unexpected blood glucose result, the measurement equipment is usually implicated first. The device may have been incorrectly set or the test strips may have been oxidised due to poor storage conditions.⁷ The sampling site can also cause discordant results. Sites such as the forearms or hands may produce higher values than the fingers.⁸

Some abnormalities such as a low haematocrit or hyperoxia also can cause pseudohyperglycaemia.⁹ Interactions between glucose dehydrogenase in the test strips and peritoneal dialysis fluid (icodextrin), parenteral nutrition (maltodextrin) and galactose in a newborn with galactosemia have also led to false reports of hyperglycaemia.^{10–12}

In our patient, the presence of sugar at the sampling site was observed. Arakawa and Ebato⁶ compared the blood glucose profiles from fingers before and after touching fruit, after one to five alcohol wipes and after washing with soap and water.⁶

The risk of pseudohyperglycaemia was clearly higher when washing with soap and water was not performed beforehand. Finally, a case report has been published describing Munchausen syndrome by proxy with pseudohyperglycaemia.¹³

After our investigations, with the assistance of the hospital biologists, we modified the internal quality control of our bedside glucometers to follow-up the manufacturer's recommendations.⁴ Instead of a check every 6 months, we perform a control test at each new strip container opening. Likewise, capillary glucose check was considered as a basic skill for both nurses and physicians, no training for good medical practices was planned. Now, it has been included in one of our obligatory annual training.

These challenges describe major diagnostic traps for treatment of a common condition. Although our patient's story ended well, his prognosis was still compromised. Other pseudo episodes of hyperglycaemia reported in the literature ended in the patient's death nearly half the time. Mere knowledge of this case should be sufficient to prevent other practitioners from repeating this diagnostic error.

Patient's perspective

"Since I am diabetic despite being 19 years old, I suffered very rarely from hypoglycaemia. Doctors were not able to identify the trigger of this recent episode but I do not have sequelae of this discomfort. I have not suffered from any new severe hypoglycaemia. I readdress to you my gratitude for the care you provided to me during this event".

Learning points

- ▶ Even under critical conditions, capillary glucose measurement must be performed only on washed and dried hands.
- ▶ All diagnostic devices can generate false-positive and false-negative results. Users of point-of-care devices such as glucose meters and urine dipsticks should undergo training to ensure that they are competent to use these devices and are able to identify common causes of inaccurate results.
- ▶ The clinician's reasoning must take into account the pretest and post-test diagnostic probabilities.
- ▶ A test result should be rechecked when it is inconsistent with the clinical presentation.
- ▶ Internal and external quality control of all equipment and training through repeated and frequent diagnostic procedures are a strong way to avoid the tunnel vision caused by stressful situations.

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