Hyperglycaemic Hyperosmolar Non-Ketotic Coma in a Non-diabetic Child

Dear Sir,

In a recent review article [1], Bratusch-Marrain pointed out that adrenaline is the most potent diabetogenic hormone. We wish to report our experience with a non-diabetic child who survived an episode of hyperglycaemic non-ketotic coma following adrenaline treatment for asthma.

A 10-year-old girl had symptoms of an upper respiratory infection for 2 days prior to being seen in the clinic. On examination she was pyrexial (37.8°C) and wheezing. An SC injection of 0.2 ml of 1:1,000 aqueous adrenaline was given. Twenty minutes later, 0.1 ml of 1:1,000 aqueous adrenaline was administered. Ten minutes after the second injection, she developed a sense of urgency, became incontinent and confused. Twenty minutes later, she continued to wheeze, and an IV infusion of 250 mg of aminophylline in 500 ml of 5% glucose and 0.45% saline was started. Within 5–10 min, and after 50 ml of the solution had been infused, she had a generalized convulsion. She had no history of abdominal pain, convulsions, polyuria, or weight loss and no history of trauma, drug ingestion, or unusual diet. Her family history was unremarkable.

Examination at the referral hospital showed a comatose girl with shallow, but spontaneous respirations. The axillary temperature was 37.3°C; pulse 120 beats/min and blood pressure 90/60 mmHg. Her height was 130 cm and weight 26 kg, with no evidence of dehydration. The pupils were symmetrical, 8 mm in diameter, and sluggishly reactive to light. Deep tendon reflexes were symmetrically diminished. The remainder of the examination was unremarkable other than minimal rhonchi.

Laboratory values obtained 30–40 min after the first seizure and prior to starting further IV fluids were: normal haemoglobin and white blood count; serum urea 0.18 mmol/l; serum Na⁺ 128 mmol/l; K⁺ 3.9 mmol/l; Cl⁻ 90 mmol/l; HCO₃⁻ 20 mmol/l; and serum pH 7.32. Blood glucose was 71 mmol/l; serum ketones were negative; and serum osmolality was 350 mOsm/l; urinalysis showed 5% glucose with negative ketones and protein. Plasma insulin level was 12 mU/l; serum theophylline <1.0 µg/ml; salicylate level 0.41 mmol/l; serum amylase was 60 IU/l (normal 50–200); and AST was 18 mU/l. A toxicology screen was negative. Cerebral spinal fluid contained glucose 6.7 mmol/l, protein 11 mg/dl, and was negative for cytology and culture. An EEG revealed diffuse disturbance of cerebral function, but without focal features or seizure patterns; a CT brain scan was normal.

A chest X-ray showed slightly hyper-expanded lungs. Urinary noradrenaline and adrenaline were 28 µg and 13 µg/24 h, respectively; serum thyroxine was 123 nmol/l.

Recurrent seizure activity required general anaesthesia. Her hyperglycaemia responded to IV fluid and 3 units of SC crystalline insulin. She had a blood glucose of 11.4 mmol/l at 12 h. However, she remained comatose for 96 h and regained consciousness on the fifth hospital day. She then experienced difficulty in both receptive and expressive language, and had brief, transient episodes of confusion. Ten days after admission, her mental state returned to normal, although there was some decrease in fine motor coordination. Four-hour urine fractionals from day 2 in hospital until discharge on day 12 revealed no glycosuria. Fasting and 2 h post-prandial blood glucoses, 7 days after admission, were 3.9 and 5.5 mmol/l, with plasma insulin values of 15 and 60 mU/l, respectively. The child was discharged without insulin therapy. On follow-up, at ages 13 and 16 years, the child was in good health, and glucose, C-peptide, insulin and glucagon responses to glucose and arginine tolerance tests were normal.

We have no definite explanation for this potentially catastrophic event [2]. However, adrenaline's effect on pancreatic A and B cell function is well known, with suppression of insulin release and stimulation of glucagon via the α and β adrenergic systems. Although we have no proof of hyperglucagonaemia, the inappropriately low serum insulin was involved in producing the hyperosmolar state. Subsequent glucose and arginine tolerance tests gave no indication of pancreatic A or B cell dysfunction. Nevertheless, a latent defect in B, and possibly A cell function secondary to an adrenergic imbalance could be postulated. Adrenergic influence on basal and stimulated insulin secretion has been well documented in man, and precedence for the clinical relevance of adrenergic imbalance are reports by Robertson et al. [3] and Podolsky and Pattavina [4]. It is important to note that our patient had a rapid onset as opposed to the more usual insidious development [5]. The facts that symptoms occurred before the administration of aminophylline, that the quantity of aminophylline received was limited and that aminophylline does not alter blood glucose levels in man [6], suggest that aminophylline toxicity did not play a role in this child's hyperosmolar state or seizure activity [7].

This case extends the suggestion of a previous report [4] that an adrenergic imbalance plays a role in some cases of hyperglycaemic hyperosmolar non-ketotic coma, that the diabetogenic effect of adrenaline may be significantly enhanced in certain individuals with adrenergic imbalance, and that severe impairment of carbohydrate metabolism can occur in a child without evidence of residual glucose intolerance.

Yours sincerely,

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References

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