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CASE REPORT

A dog's detection of low blood sugar: a case report

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Abstract One of the life threatening complications of diabetes is hypoglycaemia. It is a common complication, with times of greatest risk being before meals and during the night. Symptoms usually develop when the blood glucose level falls below 3.5 mmol/l. Many patients with long-standing diabetes report loss of warning symptoms. Prevention of such hypoglycaemic attacks is highly desirable. Recently a dog's ability to detect hypoglycaemia in diabetic patients has been recorded. This is the first recorded case of hypoglycaemia in a non-diabetic patient being detected by a dog and also we believe it to be the first report of hypoglycaemia being detected by a dog in this country (Ireland).

Keywords Detection · Diabetes · Dog · Hypoglycaemia · Non-diabetics

Introduction

One of the life-threatening complications of diabetes is hypoglycaemia. It is a common complication of those treated with either insulin or sulphonylureas and particularly common with intensified insulin regimens. Times of greatest risk are before meals and during the night. Symptoms usually develop when the blood glucose level is <3.5 mmol/l and typically develop over a few minutes. Most patients experience "adrenergic" features but many patients with long-standing diabetes report loss of these warning symptoms. One in five type 1 diabetic patients will experience a hypoglycaemic coma at some stage in their lives [1]. A small minority suffer attacks that are frequent and so severe as to be virtually disabling. Prevention of such attacks is highly desirable.

Case report

A 72-year old man presented to the Accident and Emergency (A&E) department after his wife found him unconscious in bed. His wife was alerted by the man's pet King Charles spaniel bitch ("Beauty") who was barking, running in and out of the bedroom, and generally acting strangely. On admission to hospital he was hypoglycaemic, with a blood glucose level of 0.3 mmol/l, had a neutrophilia (16.85×10^9/l) and had associated hyponatraemia. His Glasgow Coma Scale was 5/15. There was a history of a weight loss of 7 kg in the preceding 6 months but no history of polyuria or polydypsia. He was not a known diabetic and of note he had only one alcoholic beverage within the preceding 24 h. He smoked 30 cigarettes a day for the last 50 years. The patient recovered fully after the administration of intravenous dextrose 50%. He has no recollection of the hours leading up to his hospital admission or his time in A&E. He has a background history of chronic obstructive airway disease and recurrent rectal polyps. Physical examination was non-contributory.

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On investigating this gentleman, a synacthen test was carried out and returned as normal. Cortisol was recorded as 325 μg/dl at baseline, 823 μg/dl at 30 min and 756 μg/dl at 60 min. A 72 h fasting test was carried out with insulin and C-peptide levels on serum analysis being 2.50 mU/l (range 2–17 mU/l) and 4.74 μg/l (range 1.15–4.5 μg/l), respectively. Post-prandial C-peptide levels were 3.54 μg/l (range 2.0–9.0 μg/l). A serum sample for insulin-like growth factor was recorded at a value within the normal range at 120 μg/l (range 70–250 μg/l). A prostate specific antigen test was returned at 12.00 μg/l (range 0–4 μg/l) and gamma GT (γGT) of 30 U/l (range 6–48 U/l). Radiological imaging of the pituitary gland and pancreas was normal.

The cause of the hypoglycaemia was undiscoved during the admission.

Six months after his initial presentation, he once more presented to the A&E department via General Practitioner (GP) referral, with an episode of hypoglycaemia. He had a 3-day history of nausea and vomiting, reduced appetite and hypoglycaemia on review by his GP. It was again described that his pet King Charles spaniel bitch was acting "strange" and "agitated" in the days prior to GP attendance.

On admission to hospital he was hypoglycaemic, with a blood glucose level of 0.6 mmol/l, and had a neutrophilia (20.56×10^9/l). His Glasgow Coma Scale was 15/15. There was no history of weight loss, polyuria, polydypsia, diarrhoea, recent alcohol intake (γGT = 35 U/l), change of medications or any thing else unusual.

The patient's hypoglycaemia was treated with intravenous dextrose 50%. Unlike the last presentation he had full recollection of the hours leading up to his hospital admission and his time in A&E.

A right sided lower lobe pneumonia was diagnosed on radiological imaging at admission and he was treated appropriately for this.

During this admission, a synacthen test and insulin-like growth factor analysis were recoded as normal. Seventy-two hour fasting insulin and C-peptide levels on serum analysis were 2.47 mU/l (range 2–17 mU/l) and 1.42 μg/l (range 1.15–4.5 μg/l), respectively. Post-prandial C-peptide levels were normal. Radialogical investigations involving imaging of the pituitary, thorax, abdomen (major focus on the pancreas) and plevis were all non-contributary.

On discharge the cause of the now recurrent hypoglycaemia still remained undiagnosed.

It is now 8 months since his last presentation and he has had no further hypoglycaemic episodes.

Discussion

Dogs have always been to the fore in diabetes care since Dr. Banting discovered the therapeutic use of insulin to treat type 1 diabetes in depancreatectomized dogs [2]. However the possibility of dogs detecting hypoglycaemic events and preventing hypoglycaemic comas adds a new dimension to the term "A mans best friend".

The only two studies found in the medical literature of pet dogs' alteration in behaviour surrounding hypoglycaemic episodes and coma were by Lim et al. (UK, 1992) [3] and Stocks AE (Australia, 2002) [4], while there have been a few case reports by Chen et al. (UK, 2000) [5] and Tauveron et al. (France, 2006) [6].

Lim et al. [3] interviewed 50 insulin treated diabetics who owned pets. Of those who were dog owners ($n = 37$), 38% reported a change in their pet's behaviour during a hypoglycaemic event. These changes included barking and fetching a neighbour.

Stocks [4] carried out a questionnaire based survey on 462 insulin-taking diabetics to determine what, if any, changes in their dog's behaviour occurred around the time of their owners impending hypoglycaemia. About 65.8% ($n = 304$) of those studied were dog owners. Of those whose dogs witnessed a hypoglycaemic event ($n = 106$), 67.9% ($n = 72$) reported altered behaviour alerting the patient or another person. Attentiveness until treatment was received and alerting patients and other people were commonly described as well as agitation, barking or growling, nuzzling, licking and biting. There was no recorded variation in perceptiveness between dogs, bitches or breed of dog.

Lim et al. [3] has also recorded that 46% of those whose pet had been ill or died, found their blood glucose levels affected.

In the three Chen et al. [5] case reports it was noted the dogs expressed altered behaviour when patients had a blood glucose concentration of 2 mmol/l or less.

This is the first recorded case of hypoglycaemia in a non-diabetic patient causing altered canine behaviour and also we believe this is the first report of hypoglycaemia being detected by a dog in this country (Ireland).

The exact method by which dogs can detect hypoglycaemia is unclear [5] but postulated theories include direct olfactory changes related to sweating, detection of muscle tremor or behavioural alterations, and a link between the vomero-nasal organ and the sense of smell [5, 6], but direct contact between the dog and patient does not appear to be necessary for detection [5]. One other possibility may be the dogs' detection, of energy wave changes in a person's electrical and/or magnetic fields during a hypoglycaemic episode. This is as yet undetermined.

Such is the belief in this non-invasive method of detecting hypoglycaemic events that recently non-profit making organisations in the UK and USA have begun to train dogs for the purpose of detecting hypoglycaemia in type 1 diabetics.

We know of the benefits of a dog in assisting the visually impaired, helping in mountain rescues, giving their owner exercise, lowering blood pressure, recognising epileptic seizures, and detecting melanoma. Are we now recognising "man's best friend" becoming a hypoglycaemic detector?

We wait in anticipation for further advances in the research of this non-invasive companion based alarm system for hypoglycaemia.

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Conflict of interest Authors declare that there are no competing interests.

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