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Pankaj Kumar Patel
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Supriya Yadav
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Sumit Kumar
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Desh Deepak
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Bhoomika
 Division of Veterinary Public
 Health, ICAR-IVRI, Izatnagar,
 Uttar Pradesh, India

Akhilesh Kumar
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Sumit Mahajan
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

SK Dixit
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

Correspondence
SK Dixit
 Division of Medicine, ICAR-
 IVRI, Izatnagar, Uttar Pradesh,
 India

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Diagnosis and clinical management of diabetes mellitus in a German shepherd dog

Pankaj Kumar Patel, Supriya Yadav, Sumit Kumar, Desh Deepak, Bhoomika, Akhilesh Kumar, Sumit Mahajan and SK Dixit

Abstract

A male German shepherd dog, aged 3.5 years was presented to the referral Veterinary Polyclinic with the complaint of Polyurea, polyphagia, polydipsia and severe weight loss over a short period of time (one week). Physical examination of the dog revealed dull, lusterless and rough hair coat, frequent urination, rapid respiration and loss of body condition. Clinical examination of the animal showed fever, hyperglycemia of 518mg/dl with a glucometer (Accucheck) and a high specific gravity (1.07) with a strongly positive benedicts test in urine indicates the case as of Diabetes Mellitus. The case was successfully managed with Biphasic Insulin therapy along with strict dietary suggestions and continuous monitoring of glucose levels brought down the glucose level in 7 days.

Keywords: Polyurea, polydipsia, polyphagia, hyperglycemia, insulin

1. Introduction

Diabetes mellitus is a commonly found endocrine disease affecting mostly middle-aged and older in dogs in which body either has an absolute shortage of insulin (Type I or Insulin dependent) or there is an inappropriate response of beta cells to the insulin (Insulin resistance) present in the blood^[5]. These conditions will prevent the muscles and organs from converting glucose to energy and will result in excessive amounts of glucose in the blood, which is also known as hyperglycemia. As a result, the cells are not able to utilize glucose present in the blood and there is a rise in the blood sugar levels. The glucose ends up in the urine, where it interferes with the normal urine concentration and leads to an increase in urination. The pet becomes dehydrated as a result of the abnormal water loss, so there is also an increase in thirst. Treatment of DM is a combination of art and science, given part to the many factors that affect the diabetic state and the animal's response. Insulin therapy is required to maintain the glycemic balance of diabetic dogs with insulin deficiency^[4]. At the time of clinical control, hypoglycemic dogs require 1 daily NPH preparation of insulin as the mean duration of action is 24 hours for NPH preparations^[6]. Each animal needs individualized, frequent reassessment and treatment may be modified on basis of response^[12]. Better nutrition and preventive veterinary care have increased the life-span of dogs^[3]. The present study deals with the diagnosis and successful management of diabetes in the affected animal.

2. Materials and Methods

The diagnosis is based on the level of blood sugar estimated by automated glucometer (Accucheck) and compared with the fasting glucose level estimated by pathology laboratory. Also urine sample was tested for benedicts test.

2.1 Case History

A 3.5 years aged male German shepherd was presented in polyclinic with the history of progressive loss of body weight despite eating and the animal is taking very large quantities of feed and water, frequent urination and defecation, puffiness around eyes and dehydration. The dog was properly dewormed and vaccinated as per standard regimen.

2.2 Clinical examination and Laboratory findings: Clinical examination revealed pale mucous membrane, fever (103.2 F), tachycardia (110 beats per minute), tachypnoea (72 breaths per minute) and normal regional lymph nodes. Physical examination showed rough, lusterless skin and brittle hairs. All the hematological (Table. 1) parameters were within the normal range.

The diagnosis based on the positive Benedict’s test in which the colour of the solution turned from blue to brown precipitate (fig. 3) indicating the presence of sugar in the urine sample, a spiked value of blood glucose (518mg/dl) estimation done by automated glucometer (Accucheck) (fig. 1

&2) with a high specific gravity (1.07) of the urine sample. Also, the blood sample was sent to the laboratory for estimation of glucose via conventional method which yielded similar results indicated.

Table 1: The haemato-biochemical parameters of affected dog

Parameter	Reference range*	0 day	7 th day
Hb (g/dl)	11.9-18.9	12.6	13.8
PCV (%)	35-57	38	42
TEC (10 ⁶ /cmm)	4.95-7.87	6.17	5.95
TLC (10 ³ /cmm)	5.0- 14.1	9.53	8.56
Neutrophils %	58-85	77	76
Lymphocytes %	8-21	19	20
Monocytes%	2-10	1	2
Eosinophils%	0-9	3	2
Basophil%	0-1	0	0
Platelet count (10 ⁶ /cmm)	211-621	431	398
SGPT(U/L)	10-109	29	24
SGOT (U/L)	13-15	24	21
BUN (mg/dl)	8-28	21	13
Creatinine(mg/dl)	0.5-1.7	0.9	0.4
Total Protein (mg/dl)	5.4-7.5	7.0	7.1
Albumin (mg/dl)	2.3-3.1	3.0	3.5
Globulin (mg/dl)	2.7-4.4	4.0	3.6
Bood glucose (mg/dl)	76–119	581	110
Urine Specific gravity	1.016–1.060	1.07	1.03

(*Source: Merck Veterinary Manual, 11th Edition) [7].

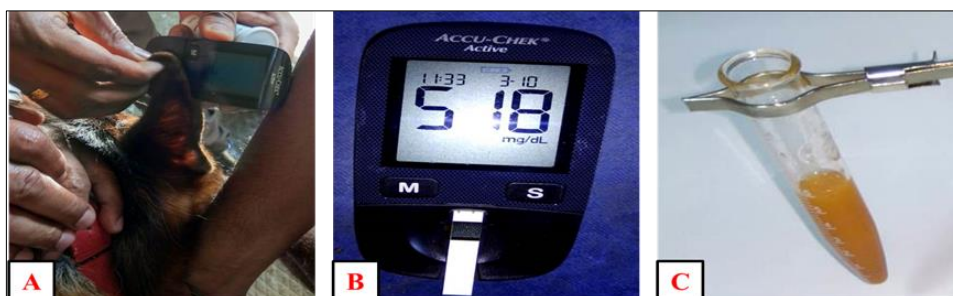


Fig 1: A: Blood glucose examination by Accu check, Fig. B: Blood glucose level reading of Accu check, Fig. C: Colour change of Benedict’s reagent

2.3 Treatment and outcomes

Following the diagnosis of the case the animal was administered a calculated dose of Isophane insulin @ 0.5 U/kg BW, SC, OD daily, Injection RL 250 ml IV OD, Inj. B-complex IV, OD, syp. Liv 52 1 tsp PO, OD and Vitamin B-complex (vitamin B12, B1, B2, B6, B3 and folic acid), Vitamin C and calcium pantothenate containing syrup (Becosule), 1 tsp PO, OD for 7 days along with continuous

monitoring of blood glucose levels so that hypoglycemia should not develop. The administration of the treatment with inj. biphasic insulin brought down the glucose level to half within 5 hours of treatment. Glucose levels were monitored at an interval of 30 minutes regularly to see if there is any response or not. Dogs should be fed within 4 hours of administration of Isophane insulin with strict dietary suggestions (Table 2).

Table 2: Dietary suggestions for the affected dog

Dietary Factor	Current suggestions
Calorie intake	Attaining and retaining of optimal body condition
Primary nutritional requirements	Palatable
	Nutritionally balanced
Other nutritional suggestions	Maintaining consistency: After each insulin injection the same food containing a standard number of calories should be fed
	Increased high insoluble fiber containing food with a complex carbohydrate content
Timing of meals	Decreased fat content, mainly in pancreatic disorder
	Postprandial period should ideally coincide with the period of maximal exogenous insulin activity
Diabetic dogs with concurrent disease	Diabetic dog is to feed two equal-sized meals per day immediately after the injection when administration of insulin twice daily
	The nutritional requirements of any concurrent disease should take precedence over the dietary therapy for diabetes
	Regardless of the diet fed, glycemic control can be managed with Exogenous insulin therapy

(Source: Fleeman and Rand, 2001) [5].

3. Discussion

In the dog, immune-mediated destruction^[2], vacuolar degeneration, exocrine pancreatitis disease^[13] lead to rapid and progressive loss of beta cells and obesity, hyperadrenocorticism, or medications (e.g. steroids, progestins) lead to the insulin-resistant effects^[12]. The pathogenesis of beta cell dysfunction/deficiency due to insulin autoantibodies also reported in some diabetic dogs^[12]. The insulin-resistance effects on intact females in the diestrus phase cause transiently diabetic condition^[12]. Australian terriers, beagles, samoyeds, Keeshonden breeds of dogs and Burmese cats are more susceptible due to genetic risk factors^[12]. The classic clinical signs of diabetic dogs are polyuria, polydipsia, polyphagia, and weight loss due to hyperglycemia and glycosuria^[12]. Decreased insulin level causes excessive fat mobilization which leads to hepatic lipidosis, hepatomegaly, hypercholesterolemia, hypertriglyceridemia, hyperketonemia, ketonuria, and ketoacidosis^[12]. To maintain glycemic control of diabetic dogs having insulin deficiency demands insulin therapy^[4]. Treatment of diabetic dogs with insuven or PZI is more likely to stimulate AIA than treatment with caninsulin, although these do not seem to be clinically significant in the majority of dogs^[4].

For diabetic dogs, three main principles of therapy are, (1) Resolution of all clinical signs (2) Prevent from insulin-induced hypoglycemia (3) Reestablishment of standard lifestyle and exercise^[5]. At the time of clinical control, hypoglycemic dogs require 1 daily NPH preparation of insulin due to the mean duration of action of 24 hours for NPH preparations^[5]. Isophane (NPH) insulin has long-acting action and more suitable for long-term diabetic management because they provide continued insulin supplementation for many hours after a single injection. If the blood glucose level is ≥ 360 mg/dL (≥ 20 mmol/L) than initial insulin dose of 0.5 U/kg BW SC should be administered and if the blood glucose level is less than is < 360 mg/dL (< 20 mmol/L), than a lower initial dose of 0.25 U/kg should be administered^[5]. The primary aim of insulin therapy of diabetic dog is avoidance of insulin-induced hypoglycemia. Insulin overdose causes severe hypoglycemia resulting in mild clinical signs such as weakness, anorexia, restlessness, pacing and diarrhea and in severe condition leading to irreversible brain damage associated signs which can progress to ataxia, blindness, seizures, coma and ultimately death^[5]. Vitamin B-complex (Vitamin B12, B1, B2, B6, B3, B12 and Folic acid) is essential for energy metabolism^[9]. Vitamin C acts as an antioxidant which prevents oxidative stress and helps in collagen production as well as tissue repair^[10, 11]. Calcium pantothenate is involved in the utilization of carbohydrates, lipids, proteins synthesis and the preservation of integrity blood vessels^[11]. The diabetic dog should eat just before the expected time of peak insulin activity. Dogs should be fed within 4 hours of administration of 1 to 8 hours after Isophane insulin. Feeding the dog immediately after the insulin injection allows good glycemic control to be readily achieved as it may provide sufficient calories to maintain optimal body condition^[5]. The somogy effect, which results in compensatory hyperglycemia caused by insulin-induced hypoglycemia, has not been revealed after high doses of insulin therapy and low blood glucose concentration is a reported complication of insulin treatment and can lead to the death of the patient^[6]. According to Nelson, (1992)^[8], feeding schedule of diabetic dogs has been designed on the basis of mainly two principles (i) The types and frequency of insulin administration should be adjusted with the feeding time of the

diabetic dog. (ii) Multiple small meals are preferred rather than one large meal, due to the fact that during several small meals (3 to 4) the period of insulin activity will help minimizing the hyperglycemic effect of each meal, thereby helping to control the fluctuations in blood glucose level^[8]. In conclusion, the Diabetes Mellitus in dogs can be successfully managed by Isophane insuline therapy along with proper dietary management.

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