SHORT COMMUNICATION
Open Access

Journal of Veterinary and Animal Sciences
ISSN (Print): 0971-0701, (Online): 2582-0605
https://doi.org/10.51966/jvas.2023.54.3.850-854

Diabetes mellitus in dachshund dogs: A case report of three dogs

B. Nithin[1*], Abhinav Joy[2], V. H. Shyma[3] and O.K. Sindhu[4]
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence
College of Veterinary and Animal Sciences, Pookode, Wayanad -673 576
Kerala Veterinary and Animal Sciences University
Kerala, India

Citation: Nithin B., Joy A., Shyma V.H. and Sindhu O.K.2023. Diabetes mellitus in dachshund dogs: a case report of three dogs. *J. Vet. Anim. Sci.* **54**(3):850-854
DOI: https://doi.org/10.51966/jvas.2023.54.3.850-854

Received: 08.02.2023 *Accepted: 27.04.2023* *Published: 30.09.2023*

Abstract

Diabetes mellitus is an endocrinopathy associated with insulin insufficiency or insulin resistance. Three female middle-aged Dachshund dogs presented with clinical signs of polyuria, polydipsia, cataract and emaciation were diagnosed with diabetes mellitus using portable blood glucose monitor. One of the dogs succumbed with diabetic ketoacidosis (ketone bodies of 7.4 mmol/L) with concomitant diabetic nephropathy and hypercalcemia. Leukocytosis, elevated liver enzymes, cholesterol and glycosuria were evident in all the dogs. Blood glucose level was effectively managed with human recombinant DNA protamine zinc insulin administration twice daily for a period of six months.

Keywords: *Dachshund, diabetes mellitus, diabetic ketoacidosis, recombinant human DNA protamine zinc insulin*

Diabetes mellitus (DM) is one among the most common endocrinopathies reported in dogs and cats (Cook, 2012). It is also one of the common metabolic diseases affecting middle to old aged dogs characterised by persistent hyperglycemia resulting from defective insulin secretion or insulin resistance. The disease can be broadly classified into insulin dependent DM (Type I DM) and non-insulin dependent DM (Type II DM). Dogs are diagnosed with Type I DM characterized by permanent hypoinsulinaemia that requires exogenous insulin administration to avoid development of ketoacidosis (Gilor *et al.,* 2016). Aetiopathogenesis for DM varies between individuals with similar clinical signs such as polyuria, polydipsia and weight loss observed in most affected dogs (Mattin *et al.,* 2014). Polyuria, polydipsia, lethargy, anorexia, vomiting, emaciation, polyphagia and diarrhoea are the common clinical signs observed with DM (Hess *et al.,* 2000). Hyperglycemia, glycosuria, hypercholesteraemia and hypertriglyceridaemia progressing to

1. *MVSc Scholar*
2. *BVSc and AH Scholar*
3. *Assistant Professor, Department of Veterinary Epidemiology and Preventive Medicine*
4. *Assistant Professor, Department of Veterinary Clinical Medicine, Ethics & Jurisprudence*

**Corresponding author : nithin.b.13@gmail.com, Ph. 7760722493*

ketonaemia, ketonuria and ketoacidosis leads to higher fatalities in dogs with DM (Behrend *et al.,* 2018). Short acting insulins like beef/ pork origin and recombinant human neutral protamine Hagedorn (NPH) insulin are effective in controlling diabetes when administered twice daily (Palm *et al.,* 2009). Whereas, long acting insulin preparations like protamine zinc insulin (Maggiore *et al.,* 2012) and insulin glargine (Hess and Drobatz, 2013) were found effective in controlling diabetes in dogs as an alternative insulin preparation when administered twice a day.

Diabetic ketoacidosis (DKA) is commonly encountered in dogs and cats as a complication of uncontrolled diabetes mellitus (Thomovsky, 2017). The cellular demand for energy leads to oxidation of body fats leading to production of ketone bodies and release of hydrogen ions in the process. Thus, overproduction of ketone bodies means an overproduction of hydrogen ions which decreases the blood pH leading to life threatening acidosis (Nelson and Cox, 2012). Treatment of DKA with intravenous continuous rate infusion of lispro insulin (Sears *et al.,* 2012) or insulin aspart (Walsh *et al.,* 2016) is safe and effective in management of DKA in dogs. Insulin therapy should be done following fluid resuscitation using a balanced buffered crystalloid solution (lactated Ringer solution or plasmalyte-148) (Thomovsky, 2017).

Three Dachshund dogs presented to Teaching Veterinary Clinical Complex (TVCC), College of Veterinary and Animal Sciences, Pookode with clinical signs of anorexia, polyuria and polydipsia along with skin lesions for more than one month were subjected to blood glucose level estimation using portable blood glucose monitor (PBGM- Blood glucose monitoring system APG01, Apollo Pharmacy, Chennai, India) and diagnosed with DM. Ketone bodies were estimated from whole blood using portable blood ketone meter (Free Style Libre reader, Abbott Diabetes Care Ltd, UK).

Further, whole blood was collected in ethylene diamine tetra acetic acid (EDTA), clot activator and sodium fluoride vacutainers for enumeration of complete blood count, serum biochemistry and plasma glucose level. Urine collected via transurethral catheterization was subjected to qualitative assessment for presence of glucose using two parameter dipstick (Two parameter urinalysis strip, Mission®, China). A fully automated three-part hematology analyser (Mindray BC-2800Vet) was used for enumeration of total leucocyte count (TLC), differential leucocyte count (DLC), total erythrocyte count (TEC), haemoglobin (Hb), volume of packed red cells (VPRC) and total platelet count (PLT). Serum creatinine, blood urea nitrogen (BUN), alanine aminotransferase (ALT), cholesterol, calcium and plasma glucose were estimated using semi-automatic biochemical analyser (MISPAVIVA 2578-10/17, Agappe, Kochi, Kerala). Huminsulin 30/70 (Biphasic isophane insulin injection IP, 30% soluble and 70 % isophane insulin, Eli Lilly and Company (India) Pvt. Ltd) was administered to the dogs for control and management of hyperglycemia.

Three dachshund dogs presented with clinical signs of polyuria, polydipsia and emaciation were found to have a glucose value greater than 400 mg/dL (Table 1) confirming the diagnosis of DM. Marmor *et*

Fig. 1. Emaciation and poor skin condition

Fig. 2. Cataract in diabetic dog

al. (1982) reported a risk ratio of 5.8 for DM in dachshund dogs. Wess and Reusch (2000) reported that portable blood glucose monitors were sufficiently accurate for use in clinical practice for monitoring blood glucose in dogs. Although variation was observed in the reading of PBGM and plasma glucose level, PBGMs were clinically accepted for monitoring blood glucose (Kang *et al.,* 2016). All the three dogs presented were middle aged female dogs between the age of four to nine years which agreed with Fall *et al.* (2007) who reported a higher incidence of DM in female dogs (72 per cent). Upon clinical examination, the dogs were found to have dry, rough and scaly skin, emaciation (Fig. 1), bilateral cataract (Fig. 2) and wobbling gait. Cataract was reported in 20 per cent dogs suffering from DM (Hume *et al.,* 2006).

One of the dogs was found to have a ketone body level of 7.4 mmol/L and was diagnosed as diabetic ketoacidosis (DKA) (Table 1) showed vomiting, cachexia and recumbency. Ketosis and metabolic acidosis can lead to systemic signs like vomiting and anorexia in dogs with DM (Fleeman and Rand, 2001). The dog succumbed to death due to severe ketosis and metabolic acidosis fourth day post treatment.

The haematology of the dogs revealed leukocytosis with increased granulocyte count (Table 2) which may be attributed to increased production of chemotactic factors and secondary infections in diabetic dogs. Total leucocyte and granulocyte count were higher in diabetic dogs whereas, lymphocyte and monocyte count were lower compared to healthy dogs (Valilou and Lotfi, 2011). Lipaemia was observed in all the three dogs indicative of elevated cholesterol and triglycerides (Fig. 3). Biochemical evaluation revealed elevated levels of serum ALT, cholesterol and plasma glucose levels (Table 3). Hess *et al.* (2000) recorded high values of liver enzymes, cholesterol and triglycerides which were attributed to hepatic lipidosis in diabetic dogs. The dog diagnosed with DKA had elevated levels of serum creatinine and BUN (Table 3)

Table 1. Blood glucose and ketone bodies recorded from diabetic dogs using portable machine

Parameter	Dog 1	Dog 2	Dog 3	Reference range
Blood glucose level (mg/dL)	584	567	402	80-120
Blood ketone bodies level (mmol/L)	1.1	7.4	0.4	<0.5

Table 2. Haematological parameters recorded from diabetic dogs

Parameter	Dog 1	Dog 2	Dog 3	Reference range
TLC ($x10^3/\mu L$)	14.4	15.63	17.4	5-14.1
Granulocyte count (%)	85.9	87.43	88.3	58-85
Lymphocyte count (%)	10.2	10.17	9.1	8-21
Monocyte count (%)	3.9	2.4	2.6	2-10
TEC ($x10^6/\mu L$)	6.79	6.89	6.61	4.95-7.87
Hb (g/dL)	16.4	14.3	13.5	11.9-18.9
VPRC (%)	49.4	42.7	43.5	35-57
PLT ($x10^3/\mu L$)	240	287	224	211-621

Table 3. Serum biochemistry and plasma glucose values recorded from diabetic dogs

Parameter	Dog 1	Dog 2	Dog 3	Reference range
Creatinine (mg/dL)	0.75	2.32	0.63	0.5-1.7
BUN (mg/dL)	13.5	125.54	10.24	8-28
ALT (IU/L)	120.23	200.4	150.78	10-109
Cholesterol (mg/dL)	450.57	360.59	314.87	135-278
Calcium (mg/dL)	9.3	16.8	10.9	9.1-11.7
Plasma glucose (mg/dL)	528.76	527.88	314	76-119

Fig. 3. Lipaemia

which indicated diabetic nephropathy. The dog was also found to have hypercalcaemia (Table 3) which can be attributed to dehydration and hyperparathyroidism. Makaya *et al.* (2013) reported a case of diabetic ketoacidosis with severe hypercalcaemia in humans. Glycosuria was observed in all the three dogs which agreed with Kumar *et al.* (2014) who reported that glycosuria was clinically present in diabetic dogs when blood glucose level exceeds 180 mg/dL.

The blood glucose level was effectively managed within normal range by subcutaneous administration of Huminsulin 30/70 at dose rate of 0.5 IU/kg body weight which was gradually decreased to 0.25 IU/kg body weight twice daily with regular monitoring. Recombinant human protamine zinc insulin can be effectively used in management of diabetic dogs which respond poorly to other insulin preparations (Maggiore *et al.,* 2012).

Summary

Three dachshund dogs diagnosed with DM are described in this article. Polyuria, polydipsia, emaciation, anorexia and skin lesions were the common clinical signs. Hyperglycaemia, hypercholesteraemia, glycosuria and elevated level of serum ALT were recorded in all of the dogs. One among the three was diagnosed with severe DKA which succumbed to death on fourth day post initiation of treatment. Other two dogs were observed for six months and managed with insulin injection twice daily. Diagnosis and monitoring of DM can be effectively carried out with PBGM.

Acknowledgement

Authors are thankful to the Dean, College of Veterinary Sciences, Pookode and Director of Clinics KVASU, Pookode.

Conflict of interest

Authors declare no conflict of interest.

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