
SOMOGYI EFFECT IN A DOG WITH TYPE I DIABETES MELLITUS - A CASE REPORT

Sindhu K. Rajan^{1*}, Usha Narayana Pillai² and Anugraha Mercy Easaw³

¹Assistant Professor; ²Professor and Head, Dept. of Veterinary Clinical Medicine, Ethics & Jurisprudence, ³PG Scholar, Dept. of Veterinary Epidemiology and Preventive Medicine, College of Veterinary and Animal Sciences, Mannuthy

*Corresponding author: sindhu.rajan@kvasu.ac.in

ABSTRACT

Somogyi effect with diabetes mellitus was diagnosed in a female Dachshund dog presented with fasting hyperglycemia. A serial blood glucose curve (BGC) was prepared in the hospital to diagnose and for further management. Insulin dose was titrated to 9.5 units as subcutaneous injection morning and evening for stabilizing blood glucose level and managed the animal without clinical symptoms.

Keywords: Somogyi, diabetes, insulin, hyperglycaemia

INTRODUCTION

One of the major challenges encountered in the management of diabetes mellitus (DM) is a complication from insulin therapy. Somogyi effect is one of the most important complications encountered during the standardisation of insulin therapy.

Literatures regarding somogyi effect in dogs with DM are very scarce. This case study presents successful management of DM associated with somogyi effect in a Dachshund dog. As of our knowledge, this is the first report of somogyi effect in a dog with DM from India.

CASE HISTORY AND OBSERVATION

A five year old female Dachshund dog weighing 7 Kg was presented with non-healing ulcerated skin lesions, polyuria, polydipsia and polyphagia, weakness and weight loss. The dog was diagnosed with Type 1 diabetes mellitus 20 days back by the veterinarian who referred the case, based on the elevated fasting blood glucose level (BGL) and glycosuria. The animal had a fasting plasma glucose of 573 mg/dL on the day of presentation at casualty section of Teaching Veterinary Clinical Complex (TVCC), Mannuthy and the lipid profile was within normal limits. Medication was



Fig. 1. Ulcer on ventral abdomen

started with a total dose of 4 units of Mixtard Insulin (30/70 combination of soluble and isophane insulins) subcutaneously before morning and evening meals. The primary care physician increased the total dose of insulin gradually to 13 units each before morning and evening meals respectively, since the fasting glucose level (544 mg/dL) did not decrease substantially. Therefore the patient was referred to the medicine section, TVCC for further evaluation and management.

Physical examination of the dog revealed chronic ulcers on skin and also severely emaciated body condition (Fig. 1). Laboratory investigations revealed mild thrombocytosis, elevated alkaline phosphatase (ALP), mild hypoalbuminemia and mildly decreased thyroxine level (Table 1). Culture and sensitivity of urine sample revealed *Staphylococcus aureus* organism sensitive to cephalixin.

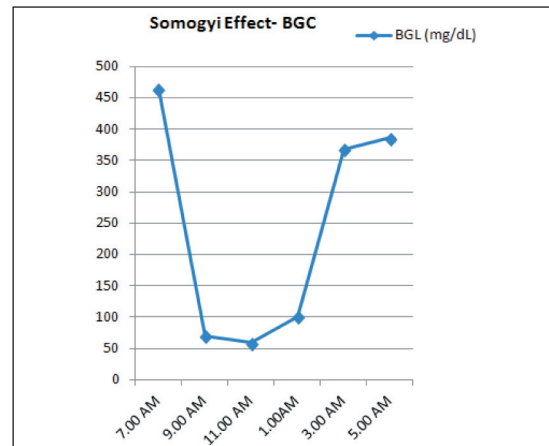


Fig. 2. Blood glucose curve at 2 hr interval when insulin @ 13 units BID

Abdominal ultrasonography revealed mild hepatomegaly. Familial history of the dog was not known. Blood glucose curve (BGC) was prepared at two hour interval for 12 hours while the dog was on 13 IU of Mixtard insulin twice daily (Fig. 2).

BGCs were prepared on subsequent days at two hour intervals for 12 hours by gradually decreasing the dose of insulin by 10-50 percent. Insulin and subsequently food were given soon after collecting blood for fasting BGL at 7 am and 7 pm. The readings for the titration of insulin dose were as shown in Table 2.

TREATMENT AND DISCUSSION

The analysis of BGC at two hour interval indicated that the animal had rebound hyperglycemia induced by hypoglycaemia when insulin was administered @ 13 units twice daily.

Table 1. Haematological and serum biochemical analysis

Parameters	Value
Platelet	575000/ μ L
Glycosylated haemoglobin (HbA1c)	6.2%
ALP	825 IU/L
Albumin	2.7g/dL
Cholesterol	213mg/dL
Thyroxine (Total T ₄)	1.21 μ g/dL

Table 2. Readings of BGC during titration of insulin dose

Period of monitoring for BGC	Blood glucose level at 2hour interval (mg/dL)							Dose of insulin injection (IU)	
	7 AM	9 AM	11 AM	1 PM	3 PM	5 PM	7 PM	Morning dose	Evening dose
Monday	464	70	59	101	368	386	410	13	13
Tuesday	448	58	61	71	99	81	286	10.5	10.5
Wednesday	348	69	55	65	128	150	172	10.5	10
Thursday	301	66	62	66	235	334	293	9.5	9
Friday	394	68	152	82	206	136	179	9.5	9.5
Saturday	287	87	87	80	169	200	297	9.5	9.5
Sunday	245	90	86	90	158	180	212	9.5	9.5

Accordingly, the dog was diagnosed as a case of Type I diabetes mellitus with somogyi effect and the treatment was modified by reducing the dose of insulin by 27 percent (9.5 units twice daily) so that the fasting BGL was maintained below 250 mg/dL. The phenomenon of Somogyi effect was first described by Somogyi (Somogyi, 1959). It was due to the rebound hyperglycaemia in response to hyper secretion of counter regulatory hormones like epinephrine, glucagon etc.

from hypoglycaemia induced by insulin overdose. It is not frequently reported in dogs.

The insulin dose should be decreased when the nadir is less than 65 mg/dL (Bonagura and Twedt, 2013). Similarly in the present case, the insulin dose was gradually reduced to 9 units twice daily by first three days since the nadir was less than 65 mg/dL. When the insulin was reduced from 9.5 units to 9 units, the fasting BGL was found significantly

higher than the previous day's BGL, indicating insufficiency of insulin. Hence, the dose was again titrated to 9.5 units twice daily and maintained the dose and noticed improvement. Our observations were in agreement with Roomp and Rand (2016) where they stated that insulin dose should be decreased by 10-50% when the nadir was <60 mg/dL. The hyperglycemic period can last from 24 to 72 hours; the diagnosis may, therefore, be missed with a single BGC and accordingly, an incorrect assumption may be arrived at that the insulin dose was too low (Feldman *et al.*, 2015). Mild thrombocytosis and elevated level of Glycosylated haemoglobin (HbA1c) reported in the present case were in accordance with Lee and Bergmier (2017) and Elliott *et al.* (1997). Low total thyroxine level observed in the present case needs further investigations because factors other than hypothyroidism shall cause low total T₄ levels. Elevated alkaline phosphatase level might be due to hepatocellular swelling by glycogen accumulation (Behrend *et al.*, 2018).

It was advised to administer Mixtard insulin (30/70) @ 9.5 units subcutaneously twice daily along with stabilized diet including complex carbohydrate containing food and supplements like vitamins with consistent routine exercise. Cephalexin tablets were prescribed @ 22 mg/kg body

weight twice daily for 14 days for treating cystitis. Clinical improvement in the physical activity of dog, and mitigation of clinical signs were noted after the correction of somogyi effect and standardisation of insulin dose. The owner was advised for regular monitoring at intervals of 14 days.

Complication of insulin therapy due to somogyi effect can be managed by preparing BGC and adopting the proper therapeutic regimen.

SUMMARY

A case of successful management of diabetes mellitus with somogyi effect in a dog was reported. Somogyi effect is one of the major challenges during insulin therapy. Preparing Blood Glucose Curves (BGC) aid in the diagnosis and further management of this condition.

ACKNOWLEDGEMENT

The authors are thankful to the Dean, College of Veterinary and Animal Sciences, Mannuthy, Kerala Veterinary and Animal Sciences University

REFERENCES

- Behrend, E., Holford, A., Lathan, P., Rucinsky, R. and Schulman, R. 2018. AAHA Diabetes management guidelines for dogs and cats *J. Am. Anim. Hosp. Assoc.* **54**(1):1-21.

- Bonagura, J.D. and Twedt, D.C. 2013. *Kirk's Current Veterinary Therapy XV* Saunders, Philadelphia, USA. p.192.
- Elliott, D.A., Nelson, R. W., Feldman, E.C. and Neal, L.A. 1997. Glycosylated hemoglobin concentrations in the blood of healthy dogs and dogs with naturally developing diabetes mellitus, pancreatic beta-cell neoplasia, hyperadrenocorticism, and anemia. *J. Am. Vet. Med. Assoc.* **211**: 723-727.
- Feldman, E.C., Nelson, R.W. and Reusch, C. E. 2015. *Canine and feline endocrinology*. Saunders, Philadelphia, USA. p.303.
- Lee, R.H. and Bergmeier, W. 2017. Sugar makes neutrophils RAGE: linking diabetes-associated hyperglycemia to thrombocytosis and platelet reactivity. *J. Clin. Invest.* **127**(6): 2040-2043.
- Roomp, K. and Rand, J. 2016. Rebound hyperglycaemia in diabetic cats. *J. Feline Med. Surg.* **18**(8): 587-589
- Somogyi, M. 1959. Exacerbation of diabetes by excess insulin action. *Am. J. Med.* **26**(2): 169-191.
-