

Gestational Diabetes in a Yorkshire Terrier Dog

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Abstract : A 3 year-old pregnant female Yorkshire terrier dog was presented with major complaints of polyuria and polydipsia. Laboratory tests found persistent hyperglycemia and glucosuria. Abdominal ultrasound study found 2 dead fetuses. Ovarian hysterectomy was performed to remove the dead fetuses. After ovarian hysterectomy, the level of blood glucose was returned to normal range. In addition, the clinical signs and urine glucose were all disappeared. Based on findings on laboratory tests and follow-up study, the case was diagnosed as gestational diabetes mellitus. To our best knowledge, this is the first case report describing a gestational diabetes mellitus of dog in Korea.

Key words : Gestational diabetes mellitus, diabetes mellitus, hyperglycemia, glucosuria, blood glucose, dog.

Introduction

Gestational diabetes mellitus (GDM) is a condition in which pregnant dogs having high glucose level without previously diagnosed diabetes mellitus (DM) and has been not rarely found in human (2-12% of all pregnancies affected; 8). However GDM has been rarely occurred in dogs (1,7). Although the pathogenesis of GDM has yet been clearly defined, the interference of insulin receptors (i.e., insulin resistance) from pregnancy-related factors (e.g., progesterone, cortisol, and placental lactogen) has been proposed to the etiology of insulin-resistance in human (10,12). Although GDM has not shown classical clinical signs of DM in human at the time of diagnosis (2,8), variable degree of clinical signs (asymptomatic to diabetic ketosis) associated with classical DM has been reported in dogs (7). This case study described a rare case of GDM in a pregnant Yorkshire terrier dog.

Case

A 3 year-old pregnant female Yorkshire terrier dog weighing 1.5 kg was presented with polyuria and polydipsia (PD/PU). According to owner, the PD/PU started from a month after mating. The bitch had 5 fetuses (3 on the right horn and 2 on the left horn) on the ultrasound study performed on 30 days after mating. At presentation, based on the assessment of fetal head diameter on the ultrasound study, the due date was expected 14.5 days after the presentation. Complete blood cell count found mild leukocytosis ($17.5 \times 10^9/L$; reference range $6-16.9 \times 10^9/L$) with segment neutrophilia (85.14%). Laboratory studies at 12 hrs fasting found hyperglycemia (308 mg/dL, reference range 77-125 mg/dL), glucosuria (2+), proteinuria (1+) and increased urine specific gravity (1.050).

Abdominal ultrasound study found two dead fetuses in the uterus (Fig 1B), although those two fetuses were survived on the ultrasound study taken at 45 days after mating (Fig 1A). No other abnormalities including adrenals were not found in the abdominal ultrasound. To discriminate hyperadrenocorticism, the low dose dexamethasone suppression test was performed and found no abnormality (pre-cortisol 1.1 ug/dL, 4-hr cortisol 1.2 ug/dL and 8-hr cortisol 1.0 ug/dl). Because of dead fetuses, ovarian hysterectomy performed with alfaxalone (1.5 mg/kg, alfaxane, Jurox, Australia) induction and isoflurane (1-5%, Forane, USA) maintenance. Pre-anesthetic test also found hyperglycemia (320 mg/dL). One day after ovarian hysterectomy, the serum biochemistry found normal range of blood glucose (84 mg/dL). The dog did not show polyuria and polydipsia after surgery. Urinalysis also found no glucosuria and proteinuria. Urine specific gravity was returned to normal range (1.025). Based on findings on laboratory tests and follow-up study, the case was diagnosed as gestational diabetes mellitus (GDM).

Discussion

Although several etiologies are involved in canine DM, it is generally divided into insulin resistance and insulin deficiency (4). Insulin-resistant DM can be occurred by certain endocrine disturbances (e.g., hyperadrenocorticism, progesterone-induced acromegaly; 6,11). Nonpregnant dog may develop a transient DM during diestrus (6). The GDM described here is closely related to insulin-resistant DM. Although the precise mechanisms associated with GDM in dogs remain unknown, the hallmark of GDM is increased insulin resistance possibly from hormones required for pregnancy. Those hormones and other factors might be the cause for interfering the bondage of insulin to the insulin receptor (3). Because the insulin enhances the entry of glucose into most cells, insulin resistance prevents glucose from entering the

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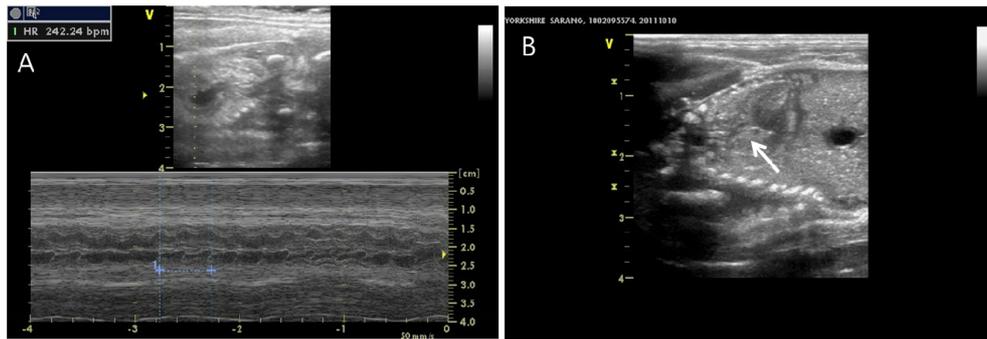


Fig 1. Abdominal ultrasound of this case. A: Taken at 45 days after mating. There was normal heart beating suggesting those two fetuses were survived. B: Taken at 55 days after mating. There was no heart beating suggesting those two fetuses were dead.

cells properly. One human study found that 1.5-2.5 times more insulin requires in a normal pregnancy, to overcome insulin resistance (3).

GDM in dogs is a rare endocrine disease and reported in few cases in veterinary literatures (1,7). One retrospective study found the GDM occurred more commonly in Nordic Spitz breeds (7). The median glucose concentration at diagnosis was 340 mg/dL (range, 203-587) in that study. The clinical signs were various from asymptomatic to ketoacidotic crisis. The DM in some dogs resolved at a median of 9 days after the end of their pregnancies without insulin therapy, although the DM in some dogs was permanent and requires insulin therapy. Furthermore puppy mortality was increased in dogs with GDM (7). Unlike dogs, the GDM in human, it rarely causes clinical signs and is most commonly diagnosed by screening during pregnancy (5), although human with unmanaged GDM can have increased risk of developing type 2 diabetes mellitus after pregnancy, as well as having a higher incidence of pre-eclampsia and Caesarean section (2).

The case described here started clinical signs (PD/PU) from 30 days after mating. Probably due to GDM, all fetuses died from about 30-55 days after mating, as described elsewhere (1), although severe clinical signs associated with DM (e.g. ketoacidosis) were not obvious in this case. Therefore the diagnosis was challenging. Pseudopregnancy (diestrual DM) and hyperadrenocorticism were listed for differential diagnosis. The pregnancy was confirmed by diagnostic imaging studies. The hyperadrenocorticism was ruled out from the low dose dexamethasone suppression test and abdominal ultrasound. The fasting blood glucose level at the first presentation and surgery was 308 mg/dL and 320 mg/dL, respectively, indicating persistent hyperglycemia. The urinalysis confirmed positive urine glucose, although the ketone was negative. The blood glucose level was similar to the median level found in one retrospective study. The blood glucose level returned to normal range after ovarian hysterectomy in this dog. Those findings strongly suggested the GDM in this dog.

Most humans can manage their blood glucose levels with a modified diet and the introduction of moderate exercise, although some require antidiabetic drugs, including insulin (2). Insulin supplementation was required to control clinical signs in dogs (7). Termination of pregnancy resulted the abolishment of insulin resistance and returned most dogs to

be normoglycemic (7,9). Therefore we believed the blood glucose level returned to normal range because of ovarian hysterectomy. On canine study found that 6/7 dogs with GDM treated with immediate termination of pregnancy and DM resolved by a median of 9 days after the end of their pregnancies (7). Immediate response on blood glucose level in this case might be from the removal of organs secreting sex hormones.

In conclusion, the case described here a rare case of canine GDM and is treated with ovarian hysterectomy. The insulin resistance is the common during pregnancy, regular screening for blood glucose level might be necessary to screen out GDM in pregnant dogs. To our best knowledge, this is the first case report describing a GDM of dog in Korea.

References

1. Armenise A, Pastorelli G, Palmisano A, Sontas HB, Romagnoli S. Gestational diabetes mellitus with diabetic ketoacidosis in a Yorkshire terrier bitch. *J Am Anim Hosp Assoc* 2011; 47: 285-289.
2. Brown F, Goldfine A. Diabetes and pregnancy. In: Kahn CR, ed. *Joslin's Diabetes Mellitus*, 14th ed. Boston, MA: Lippincott, Williams and Wilkins; 2005: 1035-1047.
3. Carr DB, Gabbe S. Gestational Diabetes; Detection, Management, and Implications. *Clin Diabetes* 1998; 16: 1-4.
4. Catchpole B, Ristic JM, Fleeman LM, Davison LJ. Canine diabetes mellitus: Can old dogs teach us new tricks? *Diabetologia* 2005; 48: 1948-1956.
5. Donovan PJ. Drugs for gestational diabetes. *Aust Prescr* 2010; 33: 141-144.
6. Eigenmann JE, Eigenmann RY, Rijnberk A, van der Gaag I, Zapf J, Froesch ER. Progesterone-controlled growth hormone overproduction and naturally occurring canine diabetes and acromegaly. *Acta Endocrinol (Copenh)* 1983; 104: 167-176.
7. Fall T, Johansson Kreuger S, Juberget A, Bergström A, Hedhammar A. Gestational diabetes mellitus in 13 dogs. *J Vet Intern Med* 2008; 22: 1296-1300.
8. Hunt KJ, Schuller KL. The increasing prevalence of diabetes in pregnancy. *Obstet Gynecol Clin North Am* 2007; 34: 173-199.
9. Johnson CA. Glucose homeostasis during canine pregnancy: Insulin resistance, ketosis, and hypoglycemia. *Theriogenology* 2008; 70: 1418-1423.
10. Kirwan JP, Hauguel-De Mouzon S, Lepercq J, Huston-Presley L, Friedman JE, Kalhan SC, Catalano PM. TNF alpha is a predictor of insulin resistance in human pregnancy.

Diabetes 2002; 51: 2207-2213.

11. Peterson ME, Altszuler N, Nichols CE. Decreased insulin sensitivity and glucose tolerance in spontaneous canine hyperadrenocorticism. Res Vet Sci 1984; 36: 177-182.

12. Ryan EA, Enns L. Role of gestational hormones in the induction of insulin resistance. J Clin Endocrinol Metab 1988; 67: 341-347.

요크셔테리어종 개에서 발생한 임신성 당뇨병

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요 약 : 3년령의 임신한 요크셔 테리어가 다음, 당뇨를 주증으로 내원하였다. 실험실적 검사를 통해 지속적인 고혈당과 당뇨를 확인하였다. 복부 초음파 검사를 통해 2마리의 죽은 태아가 관찰되었으며 난소자궁적출술을 통해 죽은 태아를 제거하였다. 난소자궁적출술 이후 혈당수치는 정상범위로 돌아왔으며 임상증상과 당뇨도 회복되었다. 실험실적 검사를 기초로 한 추가적인 연구를 통해 이 증례는 임신성 당뇨병으로 진단되었으며 국내에서 최초로 보고된 임신성 당뇨병 증례이다.

주요어 : 임신성 당뇨, 당뇨병, 고혈당, 당뇨, 혈당, 개