

Spalding's Sign in a Domestic Cat with Dystocia and Its Medical Management

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(Received: December 05, 2018 / Accepted: February 24, 2019)

Abstract : A 2-year-old female Persian cat weighing 2.95 kg was admitted for dystocia. The levels of white blood cells and thrombocytes were decreased in blood analysis. In radiography and ultrasonography, there were four fetuses with no remarkable signs of blood flow and heartbeat. In particular, one of them showed symptom of Spalding's sign, which is a rare symptom that indicated overriding of the fetal cranial bones and shrinkage of the head with a decreased volume. It was reported that Spalding's sign is one of the strong indication of fetal death in human uterus and it occurs rarely with normal fetus without apparent reason prior to labor in human. This is the first report to provide the Spalding's sign in domestic cats and this will be applied in a strong presumptive evidence that fetal death has occurred with brain disruption sequence while pregnancy in domestic animals.

Key words : cat, dystocia, cesarean section, Spalding's sign.

Introduction

Dystocia is defined as difficult to expel the fetuses through the birth canal with maternal causes (e.g. abnormality of birth canal, uterine inertia, prolonged parturition period, and abnormal physiological state) or fetal reasons (e.g. oversized fetuses, fetal malposition, presentation, posture, fetal death, and developmental abnormality) or combined origin (1-3). Whereas dystocia in the bitch is a comparatively well investigated phenomenon, there have been considerably less attention in cat for dystocia. A report suggested that dystocia in cats occurs in 3.3% to 5.8% of all parturitions (3) and is an important cause of stillbirth and early neonatal death (4). This case report describes an unusual and first case of dystocia in a queen with showing Spalding's sign in fetus, a rare symptom for overlapping of the fetal skull bones when the fetus has been dead (5). Only few veterinarians appear to have a recognition of the potential for fetal death during pregnancy with dystocia following Spalding's sign, although it is unsurprising given that this symptom in obstetrics is relatively rare in humans and domestic animals, and also has not been reported in cats yet.

Case

A 2-year-old intact female Persian cat weighing 2.95 kg was admitted with the history of labor pain from dystocia.

On physical examination, the rectal temperature of patient was 34.9°C (normal range: 37.7-39°C) and the blood pressure was scarcely detected. Complete blood count (CBC) results showed decreased white blood cells (WBC) of $3.5 \times 10^3/\mu\text{L}$ (normal range: $0.5\text{-}1.8 \times 10^4/\mu\text{L}$) and thrombocyte level of 5.6×10^4 (normal range: $1.2\text{-}5.0 \times 10^5/\mu\text{L}$). There were an increased blood urea nitrogen (BUN) level of 36.4 mg/dL (normal: 17.6-32.8 mg/dL), calcium level of 13.4 mg/dL (normal range: 8.8-11.9 mg/dL), total protein level of 9.1 g/dL (normal range: 5.7-7.8 g/dL) and albumin level of 3.7 g/dL (normal range: 2.3-3.5 g/dL) in serum chemistry. The electrolyte imbalance was indicated; Na^+ 134 mEq/L (normal range: 147-156 mEq/L), and Cl^- 103 mEq/L (normal range: 107-120 mEq/L). Color Doppler in ultrasonography examination identified that there were no remarkable signs of blood flow in heart of the fetuses. Thoracic radiographs showed that there were no remarkable findings on thoracic radiographs, however, abdominal radiographs revealed that abdominal distention and gas opacities around 4 fetuses existed (Fig 1A and 1C). Separation and overriding of the cranial bones known as Spalding's sign for one fetus in the pelvic cavity were shown (Fig 1B). It has been suggested that the Spalding's sign in skull or gas opacities around the fetus are one of the reliable indications for intrauterine fetal death (6,7).

In queens, surgical intervention is required in approximately 60% to 80% of dystocia cases (8). In this case, all kittens were dead because several days had elapsed since weak and infrequent contractions failed to produce fetuses and this made them to be decomposed in uterine. The cesarean section was considered to pull out the four decomposed fetuses and three of them showed overall ecchymosis on their whole

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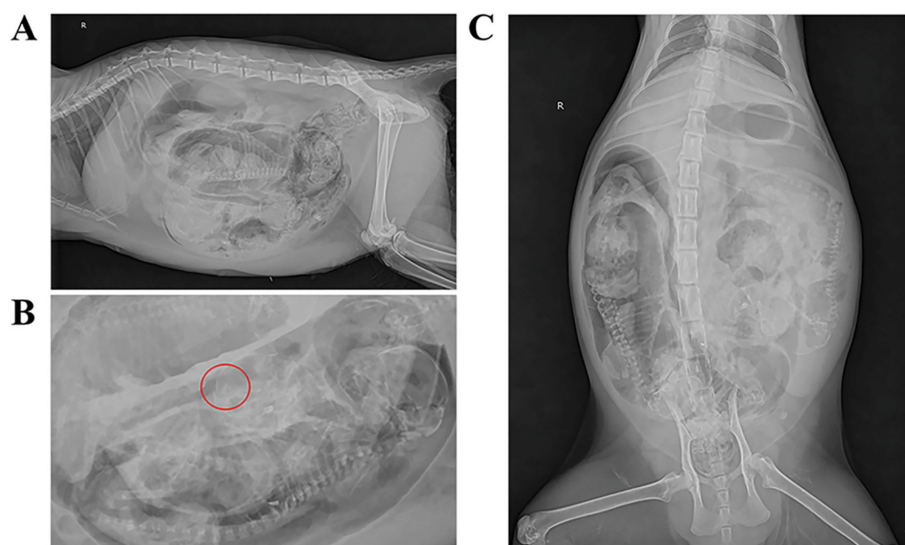


Fig 1. Radiographic images of feline fetus (A) Lateral radiographic views of abdomen. (B) Separation and overriding of the cranial bones (red circle) of one fetus in the pelvic cavity called Spalding's sign were shown. (C) Ventrodorsal radiographic views of abdomen. There are four fetuses in abdomen. Right side fetus was surrounded by gas. "R" indicates right side of abdomen.



Fig 2. The decomposed fetuses derived from cat with dystocia. Normal fetus was located in very right side and the fetus showed Spalding's sign located in the very left side.

body (Fig 2). Anesthesia was induced with propofol (6.0 mg/kg) intravenously and maintained with isoflurane in oxygen. The patient was aseptically prepared for surgery in abdominal area while in dorsal recumbency. The midline skin incision was allowed from cranial to the umbilicus to just above the pubis to approach the uterus. Both sides of uterine horns were exteriorized and uterine body incision was made to extract the decomposed fetuses. Due to the separation of placenta, intrauterine hemorrhage was observed and four dead fetuses with foul odor were taken out. Morphologically, one of them (very left side in Fig 2), suspected in Spalding's sign, had a small size of head with a broken overriding skull compared with others, and two of them had a broken skull and their brains were exposed (Fig 2). Only one fetuses had a normal shape (very right side in Fig 2). In this case, a presumptive cause for dystocia was the fetal factor; decom-

posed fetuses. Thus, many bacteria might be produced because of the decomposed fetuses, and those abnormalities led to severe sepsis in patient as well as occurrence of free gas in uterus as indicated above which caused dystocia.

Generally, many queen could deliver without any difficulty, however some queen need veterinary obstetrical assistance (9). The ultimate aim for treatment of dystocia is to minimize the morbidity of dam and maximize the live births by reducing stillbirth rate. Thus, diagnosis for dystocia in a timely fashion should be indicated and the recognition of predisposing factor for feline dystocia is necessary.

The thorough physical examination and hematologic examination considering causes of dystocia will help to determine whether medical management or surgical management for dystocia are appropriate. For treating dystocia with a medical management, oxytocin (2.0-4.0 IU intramusculaire) and calcium gluconate (0.5-1.0 mL per cat intravenously) (10) are usually indicated in cat. The medical management should be applied when the cervix is dilated enough and fetus is in good condition with no fetal stress. However, if a birth canal obstruction existed, the medical management is contraindicated because medical therapy for dystocia cause uterine myometrium contraction, thus the uterine rupture could be occurred. In addition, maternal systemic illness (sepsis, pregnancy toxemia, uterine torsion, uterine obstruction, uterine rupture, abdominal pain, and shock, etc.) or no response to medical management (i.e. oxytocin, calcium gluconate) could be considered as emergency condition. Surgical approach would be indicated in several cases for dystocia (oversized fetuses, fetal monster, and uterine inertia) if medical management were not indicated or successful (8,11), because duration of expulsion stages is the most important factor for survival of fetuses (12). In this study, cesarean section should be indicated in case of prolonged duration of parturition without any responses to medical management and there was a maternal systemic severe disorder with decomposed fetuses in uterine as indicated above.

Discussion

In this report, we first described the Spalding's sign in pregnant queen with dystocia. The Spalding's sign indicated overriding of the fetal cranial bones and shrinkage of the head with a decrease in volume which has been reported in human as one of the strong indication of fetal death in uterus (7). However, there are very few reports for this unique symptom in domestic animals, in particular, it has not been reported yet in feline species. A study demonstrated that Spalding's sign can occur rarely with normal fetus for no apparent reason and would be associated with fetal death during or just prior to labor in human. According to the research, the fetus with Spalding's sign has scanty amniotic fluid and diminished fetal vitality with microcephalic features in human (13). In line with their results, our report suggested that similar physical phenomenon was appeared including scanty amount of amniotic fluid around the fetus and disappearance of fetal vitality with microcephalic skull in fetus.

Generally, radiology signs of fetal death are divided into the head and those in the body. Particularly, the Spalding's sign is considered with the most reliable indication for fetal death (14). Normally, the cranial sutures and fontanelles allow for the growth of the fetus brain and the skull bone. The sutures and fontanelles readily become smaller as the skull bones grow until they have fused into a complete skull (15). In previous study, the abnormal sutural development has been associated with various kinds of dysmorphic syndromes including metabolic disturbances and arrest of fetal heart activity following the loss of intracranial pressure, and these disruption sequences characterized by overlapping of sutures, which called Spalding's sign (7,13). Likewise, in this study, we have postulated that Spalding's sign in queen is the consequence of events as follows: the partial destruction of the fetus brain and skull resulting in severe microencephaly, decreased intracranial pressure, and collapse of the fetal skull.

Conclusion

In line with their indication of the signs, our findings suggested that the fetus with Spalding's sign has vanished the fetal vitality with microcephalic characteristics similar with the symptoms of human's. To the authors' knowledge, we first reported the Spalding's sign in fetus cranial skull in a queen. Also, this case study support the notions that Spalding's sign could occur in feline species as well as human with similar physiologic and physical symptoms, and this unique radiographic sign would provide strong indication for fetal death during pregnancy with dystocia.

Acknowledgement

The authors would like to acknowledge the Research Institute for Veterinary Science and the BK21 plus program who provided insight and expertise that greatly assisted the research.

Conflict of Interest

None of the authors of this article has a financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper.

References

1. Humm KR, Adamantos SE, Benigni L, Armitage-Chan EA, Brockman DJ, Chan DL. Uterine rupture and septic peritonitis following dystocia and assisted delivery in a Great Dane bitch. *J Am Anim Hosp Assoc* 2010; 46: 353-357.
2. Linde Forsberg C, Persson G. A survey of dystocia in the Boxer breed. *Acta Vet Scand* 2007; 49: 8.
3. Pretzer SD. Medical management of canine and feline dystocia. *Theriogenology* 2008; 70: 332-336.
4. Gunn-Moore DA, Thrusfield MV. Feline dystocia: prevalence, and association with cranial conformation and breed. *Vet Rec* 1995; 136: 350-353.
5. Jeanty P, Dramaix-Wilmet M, Delbeke D, Rodesch F, Struyven J. Ultrasonic evaluation of fetal ventricular growth. *Neuroradiology* 1981; 21: 127-131.
6. Wicklund H. The presence of free gas in the fetal circulatory system as a pathognomonic sign of intrauterine death. *Acta Soc Med Ups* 1957; 62: 104-112.
7. Kettunen K. Fetal death diagnosed roentgenographically by the presence of gas in the fetal circulatory system; case report. *Acta Radiol* 1952; 37: 81-84.
8. Traas AM. Surgical management of canine and feline dystocia. *Theriogenology* 2008; 70: 337-342.
9. Smith FO. Guide to emergency interception during parturition in the dog and cat. *Vet Clin North Am Small Anim Pract* 2012; 42: 489-499, vi.
10. Jutkowitz LA. Reproductive emergencies. *Vet Clin North Am Small Anim Pract* 2005; 35: 397-420, vii.
11. Robbins MA, Mullen HS. En bloc ovariohysterectomy as a treatment for dystocia in dogs and cats. *Vet Surg* 1994; 23: 48-52.
12. Munnich A, Kuchenmeister U. Dystocia in numbers - evidence-based parameters for intervention in the dog: causes for dystocia and treatment recommendations. *Reprod Domest Anim* 2009; 44 Suppl 2: 141-147.
13. Thomson JL. The differential diagnosis of Spalding's sign. *Br J Radiol* 1950; 23: 122-124, illust.
14. Holm OF. Free gas in the fetal vessels as a roentgenologic sign of intra-uterine fetal death. *Acta Radiol* 1954; 42: 116-120.
15. Ellis M, Manandhar D, Costello A. 'Head growth and cranial assessment at neurological examination in infancy'. *Dev Med Child Neurol* 2003; 45: 427.