2022, Scienceline Publication
World's Veterinary Journal
World Vet J, 12(3): 290-295, September 25, 2022
ISSN 2322-4568

DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam

Su Thanh Long[1]*, Nguyen Thi Thu Hien[1], Phan Thi Hang[2], Nguyen Thi Hoai[2], and Pham Xuan Bach[2]

[1]*Veterinay Faculty, Vietnam National University of Agriculture, Trau Quy town, Gia Lam district, Hanoi, 100000, Vietnam*
[2]*Biodiversity Conservation and Tropical Disease Research Institute, No. 37-38, Lane 1, F361, An Duong street, Tay Ho district, Hanoi, 100000, Vietnam*

*Corresponding author's Email: sulongjp@yahoo.com

ORIGINAL ARTICLE
pii: S232245682200036-12
Received: 09 July 2022
Accepted: 01 September 2022

ABSTRACT

Dystocia is a common disorder that can cause harmful health risks to bitch and puppies. The aim of the current study was to evaluate some risk factors related to canine dystocia and the application of treatment methods to 612 diagnosed cases in Gaia Pets Clinic and Resort, Hanoi, Vietnam, from December 2013 to May 2020. The investigated factors comprised age, parity and breed size, and litter size, as well as fetal sex in relation to the proportion of dystocia in female canines. Dystocia was frequently observed in female dogs aged 1-3 years, with rates of 76.1%. The highest proportion of dystocia was found in the first litter group (80.21%). The incidence of dystocia increased as the weight of the dog decreased, and it was prevalent in the small breed (61.93%). Dystocia risk decreased as the litter size increased. The interventions used in this study were medical treatment with the hormone oxytocin (1.8%), surgical management with cesarean section (86.11%), and a combination of oxytocin and cesarean section (12.09%), with the success rates of each treatment method as 100%, 98.86%, and 100%, respectively. Some risk factors, such as age, parity, breed size, and litter size identified in the present research, could be used as prognostic indicators in the veterinary practice to optimize the survival rate of female dogs and puppies.

Keywords: Age, Breed, Dystocia, Fetus sex, Litter size, Parities

INTRODUCTION

Dystocia is one of the common problems in female dog fertility leading to the maternal inability of the dog to deliver a fetus through the birth canal (Luis and Ana, 2017; Dejneka et al., 2020). Findings from 18758 bitches in the UK veterinary clinic indicated dystocia in 701 cases (3.7%, O'Neill et al., 2017). The proportion of canine dystocia is normally below 5%; however, it may reach up to 95% in French Bull, Boston Terrier, Chihuahua, and Pug dog breeds (O'Neill et al., 2017). Some studies identified breed and maternal age as risk factors for canine dystocia (Alyssa et al., 2019; Cornelius et al., 2019). In 75% of cases, dystocia was caused by the mother, while in 25% of cases, it was caused by the fetus (Pretzer, 2008). Abnormalities in canine parturition may result in the death of a dam or stillbirth.

Dystocia is a prevalent health issue seen in Vietnamese veterinary clinics and hospitals. The owner's lack of basic knowledge about canine reproduction has resulted in some complications in canine reproductive diseases (Long and Hang, 2014). Dystocia directly impacts the health of bitch, puppies' survival, and the owner's profitability. The identification of effective causes can help in management and prevention as well as reducing the likelihood of undesirable consequences.

Therefore, the current study aimed to evaluate the risk factors associated with canine dystocia in Hanoi and peripheral areas in Vietnam. The findings of the present study might be useful in improving effective treatments as well as preventive measurements in canine dystocia.

MATERIALS AND METHODS

Ethical approval

The research was approached based on Law No. 79/2015/QH13 on Veterinary Medicine 2015 of The National Assembly of the Socialist Republic of Vietnam.

Animals

A total of 612 pregnant dogs of various ages, parities, and breeds were brought into the study to diagnose the possibility of dystocia at Gaia Pets Clinic and Resort, Hanoi, Vietnam. The investigated dogs were of the breeds of Alaskan Malamute, American Bulldog, Beagle Belgian Malinois, Boston Terrier, Boxer, Bulldog, Chihuahua, Cocker, spaniel, Corgi, Dachshund, Doberman pinscher, Dogo Argentino, French Bulldog, Japanese Shiba Inu, Labrador

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

Retriever, Maltese, Miniature Pinscher, Miniature Poodle, Papillon, Pekingese, Pomeranian, Pug, Rottweiler, Samoyed, Schnauzer, Shetland sheepdog, Shih Tzu, Siberian Husky, Toy Poodle, Vietnamese domestic dog, and Yorkshire. The body weights of these bitches were within the range of 1.5-57 kg. The data for the current retrospective study, including age, parities, fetal sex, fetal size, and therapeutic methods for canine dystocia were collected from December 2013 to November 2020.

Examination, diagnosis, and confirmation of dystocia

Dystocia was diagnosed in case the bitch had some parturition signs, such as nesting behavior, pollakiuria, swelling vulva, lactating, and anorexia from days 58 to 62 of gestation without giving birth (depending on fetal size and breed size). In addition, dystocia was confirmed when the bitches had expressions, such as strong contractions for more than 45-60 minutes without expulsion of a puppy, weak and infrequent contractions for more than 4-6 hours without expulsion of a puppy, and obvious radiographic abnormalities (malposition, fetal gas suggestive of fetal death, fetal oversize, fetal death, previous history of dystocia, and apparent illness or weakness of the bitch).

Classification of ages, parities, and bitches' breed size groups

The ages of bitches (by years) were specified based on their owners' records. Accordingly, bitches were categorized as they aged less than one year (G1), 1-2 years (G2), 2-3 years (G3), 3-4 years (G4), 4-5 years (G5), 5-6 years (G6), 6-7 years (G7), 7 years or older (G8). Parities were determined as normal births, excluding the previous abortions or stillbirths based on their history obtained from owners and Gaia Clinic pieces of document.

Canine breeds were divided into three groups based on the average body weight of the breeds as small-sized breeds (≤15 kg), medium-sized breeds (15-25 kg), and big-sized breeds (>25 kg) following a study by Mila et al. (2015).

Classification of litter size and fetal sex groups

Litter size was estimated by the ultrasonic scanner (2D Chison@ model ECO 1, China) and was confirmed after the bitch parturition. The litter size included alive and dead puppies. Ultrasonography was performed three times daily from 59 days of pregnancy in case of maternal compromise to obtain/confirm a suspected diagnosis and to assess fetal vitality.

Regarding the gender of puppies born, including alive and dead puppies for each parity, fetal sex was divided into three groups. The first named female fetus dominated, meaning that female fetuses were more than male fetuses in the same parity of bitch, while the second refers to male fetus dominated, where males were dominant. Finally, male and female were equated means that female and male fetuses were equal in the same parity of bitch.

Therapeutic methods of canine dystocia

The bitch's parturition was followed up by experienced veterinarians. When contractions were not regarded as normal or parturition did not progress as predicted, the oxytocin method to uterine stimulant would be applied. Before deciding to use oxytocin, veterinarians had to evaluate related fetal factors such as fetal size, fetal position, and also bitchs, such as previous breeding and birth history, the accident record or trauma to the pelvis, health, and uterine situation. Oxytocin (OXYTOCIN, Vemedim, Vietnam) was given at 2-10 IU/case (IM) with the specific dose depending on physical condition, body weight, and uterine contraction situation. The dam's cervix must be opened before the injection. Cesarean sections were performed when necessarily considered, and the veterinarian determined upon every individual case. Cesarean sections (CS) were operated on if the oxytocin therapy failed. In addition, for some dystocia high-risk breeds, CS was the preferred treatment method.

Prior to the operation, dams were shaved, disinfected, and injected with premedication; finally, the dogs underwent anesthesia. Anesthesia began with a pre-anesthesia injection with Atropine (ATROPIN, Vemedim, Vietnam) at the dose of 0.05 mg/kg (SC). After 10 minutes, anesthesia was proceeded using Tiletamine and Zolazepam (Zoletil® 50, Virbac, France) at the dose of 10 mg/kg (IV, Allerton, 2017).

Statistical analysis

The proportion test was performed to compare proportions. The software of MINITAB version 16 (Stat, Basic Statistics, 1P: 1 proportion) was used for data analysis. The probability level less than 0.05 was treated as the statistically significant difference.

RESULTS AND DISCUSSION

A total of 612 pregnant dogs were diagnosed with dystocia at Gaia Pets Clinic and Resort between 2013 and 2020. Table 1 shows that age significantly influenced dystocia in 569 bitches ($p < 0.05$). The G2 age group had the highest proportion of dystocia (39.54%), followed by the G3 age group (36.56%). Dystocia began to fade when bitches reached the age of three, with the dystocia rates in G4 to the G8 age group, being 17.78%, 4.39%, 1.76%, 1.58%, and 1.58%, respectively

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

(Figure 1). However, the obtained results of the current study indicated a different association between the age of dam and dystocia rate, compared to previous studies. According to Alyssa et al. (2019), dystocia risk increased as the age of the dam increased. Furthermore, it has been found that an increase in the age of bitches (over four years) enhances the risk of dystocia by 19.2% (Forsberg and Persson, 2007), with bitches aged 3.0 to 5.9 years having 3.1 times the risk of dystocia, compared to bitches younger than three years old (O'Neill et al., 2017). Moreover, older primiparous bitches had a significantly greater frequency of single fetal pregnancies, uterine abnormalities, and extended parturition, compared to younger primiparous bitches (Münnich and Küchenmeister, 2009). The dystocia may result from the characteristics and breeding habits of Vietnamese pet owners. Apart from professional dog breeder keepers, pet owners breed their dogs once or twice, with the last breeding incorporating cesarean section and ovariohysterectomy. As a result, a small number of pregnant female dogs over the age of three were brought to the clinic with dystocia evidence. The dystocia cases referred to the clinic were observed in bitches within the age range of 1-3 years old since it is the optimum breeding time.

Table 1. The effect of age on canine dystocia in dogs of Hanoi, Vietnam

Age	Number of cases	Percentage ($p \pm \sigma_p$)
G1 (<1)	16	$2.81^{d} \pm 0.69$
G2 (1 to <2)	225	$39.54^{a} \pm 2.05$
G3 (2 to <3)	208	$36.56^{a} \pm 2.02$
G4 (3 to <4)	67	$11.78^{b} \pm 1.35$
G5 (4 to <5)	25	$4.39^{c} \pm 0.86$
G6 (5 to <6)	10	$1.76^{d} \pm 0.55$
G7 (6 to <7)	9	$1.58^{d} \pm 0.52$
G8 (≥7)	9	$1.58^{d} \pm 0.52$
	N = 569	100

[a,b,c,d;] Means within a column with different superscripts differ significantly (P < 0.05).

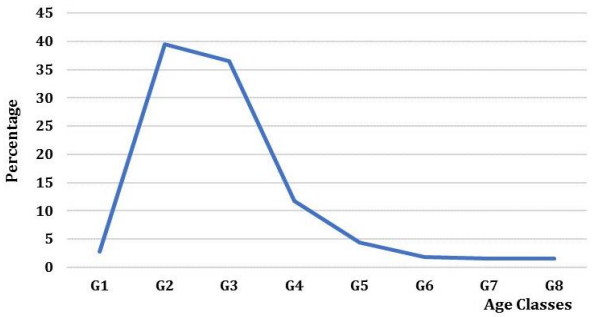

Figure 1. The relationship between age and canine dystocia G1 (Younger than a year), G2 (1-2 years), G3 (2-3 years), G4 (3-4 years), G5 (4-5 years), G6 (5-6), G7 (6-7 years), G8 (over 7 years)

Canine dystocia was also influenced by bitches' parities. The results revealed that canine dystocia is primarily focused on the first parity, which accounts for 80.21 percent of the total, and gradually decreases in the second, third, and fourth parties, which consist of 15.17%, 3.60%, and 1.03% ($p < 0.05$), respectively (Table 2). This result is consistent with previous studies that the dystocia percentage observed for bitches at the first parity was significantly higher than in other parties (Ajala and Fayemi, 2011). However, some authors concluded that there was no relationship between parity and littering in female dogs (Forsberg and Persson, 2007; Alyssa et al., 2019). Damelid and Linde-Forsberg (1994) reported that the dystocia rate of bitches with more than one parity was found to be the highest (72%), whilst the incidence for bitch in the first parity was 15%. In this study, the result given for canine dystocia of primiparous bitches was found to be the highest one because some bitches were mated at their first heat regardless of the physical underdevelopment and small pelvis which led to dystocia. In addition, female dogs had not reached the maximum fertility during the first estrus, resulting in a small litter size and large fetal size so that increasing dystocia rate. Before permitting dogs to be bred for breeding, owners should consult with veterinarians. Veterinarians also should recommend owners carefully monitor the bitch throughout late pregnancy for timely interventions in the case of the first litter.

Additionally, the incidence of dystocia is also affected by the size of the breed ($p < 0.05$, Table 3). The small-breed group had the most cases (379), accounting for 61.93% of all dystocia cases. The lowest proportion of dystocia was found in the big-sized breed group (71 cases, 11.60%). Besides, 162 cases (26.47%) of dystocia were in the medium-sized breed group. The prevalence of dystocia in the present study was mainly concentrated in some small-size and medium-size breeds. Similarly, the research of Münnich and Küchenmeister (2009) in Germany reported the highest canine dystocia rate in miniature and small breeds (59.4%). Compared to the bitch size, the fetus's relative size was larger in small breeds than in large breeds of canines (Borgea et al., 2011). In addition, the large head-to-pelvis ratio found in some certain brachycephalic breeds (Tilley and Smith, 2016) or dorso-ventrally flattened pelvic canal in Scottish terriers increased the risk of obstructive dystocia (Bergström et al., 2006), which corresponded to the dystocia risk in the present research. The majority of small and medium-size bitches that suffered from dystocia were brachycephalic breeds, such as French Bulldog, English Bulldog, and Chihuahua. Gaudet (1985) studied 128 dogs with dystocia and found that the Chihuahua, Dachshund, Pekingese, Yorkshire terrier, Miniature poodle, and Pomeranian were at a significantly higher risk than the hospital population. Pekingese and Yorkshire breeds had a lower proportion of dystocia which may be due to the unpopularity of these breeds in Vietnam.

Litter size was reported in 339 cases, with canine dystocia focusing primarily on bitches with 2-5 fetuses, accounting for 15.04% to 19.76% of all canine dystocia cases ($p < 0.05$, Table 4). Furthermore, the prevalence for cases

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

with 6 or more puppies per litter revealed a downward trend, with the incidence of dystocia reducing as the number of fetuses per litter increased (Figure 2). Alyssa et al. (2019) showed that bitches with medium litter size (from 5 to 9 puppies) have the lowest incidence of experiencing dystocia, whereas small and large litter sizes have a higher risk. Stillbirth risk is increased with ≥11 puppies' litter (Borgea et al., 2011; Alyssa et al., 2019) by extending the uterus and slowing contractions during birth (Tønnessen et al., 2012). According to Borgea et al. (2011), the breed size was also affected by the number of fetuses in litters, whereby the larger the breed size, the greater the litter size. Münnich and Küchenmeister (2009) reported that female dogs with small litters (one to three puppies) had a higher prevalence of dystocia than large breeds with high litters (>8 puppies). Interbreeding between dogs of different breeds, especially large dogs (males) and small breeds (females) leads to dystocia and, consequently, absolute fetal oversize (Ajala and Fayemi, 2011). Furthermore, litter size has been identified as a risk factor for the development of uterine inertia in dogs due to the difference in SM-γ-actin gene expression between large and small litters (Egloff et al., 2020). In the present study, some cases with a medium and large litter size of more than five puppies are also positively correlated with an increased risk of dystocia because of the prolonged parturition, exhausting the mother or two amniotic from both horns coming out at the same time would reduce the ability of the dam to labor.

Table 2. Canine dystocia rate by various parities in Hanoi, Vietnam

Parities	Number of cases	Percentage ($p \pm \sigma_p$)
1	312	$80.21^{a} \pm 2.02$
2	59	$15.17^{b} \pm 1.82$
3	14	$3.60^{c} \pm 0.94$
4	4	$1.03^{d} \pm 0.51$
	N = 389	100

[a,b,c,d;] Means within a column with different superscripts differ significantly (P < 0.05).

Table 3. Canine dystocia rate by breed sizes in dogs of Hanoi, Vietnam

Breed sizes	Number of cases	Percentage ($p \pm \sigma_p$)
Small (<15kg)	379	$61.93^{a} \pm 1.96$
Medium (15-25kg)	162	$26.47^{b} \pm 1.78$
Big (>25kg)	71	$11.60^{c} \pm 1.29$
	N = 612	100

[a,b,c;] Means within a column with different superscripts differ significantly (P < 0.05).

Table 4. Percentage of dystocia by the litter size in dogs of Hanoi, Vietnam

Litter size	Number of cases	Percentage ($p \pm \sigma_p$)
1	28	$8.26^{bc} \pm 1.50$
2	67	$19.76^{a} \pm 2.16$
3	59	$17.40^{a} \pm 2.06$
4	64	$18.88^{a} \pm 2.13$
5	51	$15.04^{ab} \pm 1.94$
6	29	$8.55^{bc} \pm 1.52$
7	20	$5.90^{bc} \pm 1.28$
8	13	$3.83^{c} \pm 1.04$
>9	8	$2.36^{c} \pm 0.82$
Total	339	100

[a,b,c,d;] Means within a column with different superscripts differ significantly (P < 0.05).

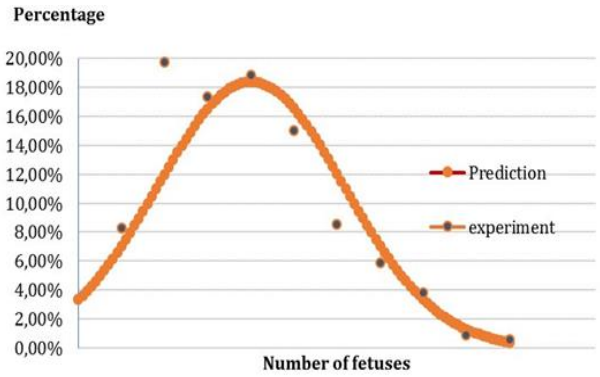

Figure 2. The correlation between the number of fetuses and the risk of dystocia in dogs

Bitches conceived in female fetuses dominated (43.75%) had a higher incidence of dystocia than bitches with male fetuses dominated (29.46%) or male and female fetuses were equated (26.79%, p < 0.05, Table 5). The dystocia rate in bitches conceived male fetus dominated was not significantly different from bitches conceived equal male and female fetuses (29.46% versus 26.79%, p > 0.05). The relationship between the gender of fetuses and canine dystocia is limited. Gram and Kowalewski (2014) revealed that the gender of puppies did not affect their birth weight. However, studies of fetal mass in horses (Elliott et al., 2009) and sheep (Gardner et al., 2007) indicated that the birth weight of male fetuses was heavier than females.

Table 6 shows that the cesarean section was the most common method (86.11%) to treat canine dystocia, followed by the combination method (12.09%) and the lowest with the oxytocin method (1.8%, Table 6). When using oxytocin techniques, surgery, or a combination of the two to treat dystocia, success rates were 100%, 98.86%, and 100%, respectively (p > 0.05). Among the CS group, there were six unsuccessful cases. In particular, one case died after the operation due to vomiting, which resulted in shock and death, two cases (one of which with a history of pneumonia) died because of the high-speed infusion of Propofol, and two cases with large litter size died because of respiratory distress, another failed case suffered from chronic kidney disease for 5-7 days after the CS, resulting in the death of the dam.

Pregnancy malpresentation, uterus problems, and prolonged parturition all resulted in significantly more litters with hypoxia and increasing stillbirth rate of the puppies (Münnich and Küchenmeister, 2009). Therefore, in order to ensure the welfare of both dam and puppies, the elective CS can be performed. The likelihood of CS did not change

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

significantly between primiparous and multiparous dystocia bitches (O'Neill et al., 2019). Cesarean section is commonly used worldwide with the application rates up to approximately 50-80% (Bergström et al., 2006; Traas, 2008) with high success and benefits of proactive in time, proactive pre-and post-operative control, and pain control when puppies gain a health assessment from a qualified doctor, which avoids complications of uterine dystocia of the dam. Knowledge and understanding of the factors related to canine dystocia would assist veterinarians in choosing appropriate therapies.

Table 5. Percentage of dystocia in dogs by fetuses' sexes in Hanoi, Vietnam

Fetuses' sex in parities of bitches (*)	Number of cases (Bitches)	Percentage ($p \pm \sigma_p$)
Female fetus dominated	49	$43.75^{a} \pm 4.69$
Male fetus dominated	33	$29.46^{b} \pm 4.31$
Male and female fetuses were equated	30	$26.79^{b} \pm 4.18$
	N = 112	100

Female fetuses dominated means that female fetuses were more than male fetuses in the same parity of bitch and vice versa. Male and female fetuses were equated means that female fetuses and male fetuses were equal in the same parity of bitch. [a,b;] Means within a column with different superscripts differ significantly ($P < 0.05$).

Table 6. The percentage of dogs applied various treatment methods in Hanoi, Vietnam

Methods	Number of cases	Percentage ($p \pm \sigma_p$)	Success treatment methods (%)
Oxytocin	11	$1.80^{c} \pm 0.54$	100.00 (11/11)
Operation (Ceasarean)	527	$86.11^{a} \pm 1.40$	98.86 (521/527)
Combination method (Oxytocin + Ceasarean)	74	$12.09^{b} \pm 1.32$	100.00 (74/74)
	N = 612	100	

[a,b,c;] Means within a column with different superscripts differ significantly ($P < 0.05$). In parentheses: proportions of success in the methods.

CONCLUSION

In conclusion, this study revealed the relationship between ages, parities, breed sizes, litter sizes, fetal sex, and canine dystocia in Vietnam. The dystocia rate was highest in dogs aged 2 years and decreased as the age of bitches increased. Bitches with first parity, small-sized breed, litter size 2-5 puppies or female fetus dominated had a higher prevalence of dystocia. The prevalent therapy method for canine dystocia was a cesarean section. Applying this knowledge may help veterinarians and owners improve efficiency in the prevention and control of dystocia in dogs. The findings will support further research into the diagnosis and treatment of dystocia in dogs.

DECLARATIONS

Acknowledgments

The authors would like faithfully to thank Gaia Pets Clinic and Resort, Vietnam, and Biodiversity Conservation and Tropical Disease Research Institute for their assistance and enthusiastic support in this research. This study was financially supported by a Research fund from Biodiversity Conservation and Tropical Disease Research Institute, Vietnam.

Authors' contribution

Su Thanh Long suggested the concept and started writing the article drafting. Su Thanh Long, Nguyen Thi Thu Hien, Phan Thi Hang, Nguyen Thi Hoai, and Pham Xuan Bach contributed to the editing and writing the final draft of the manuscript. All authors approved the analyzed data and final revised article.

Competing interests

The authors indicate that they have no conflicting interests.

Ethical consideration

Ethical issues such as plagiarism, permission to publish, misbehavior, database fabrication and/or falsification, multiple manuscript, and duplication were all examined by all authors.

REFERENCES

Ajala OO and Fayemi OE (2011). A survey on cases of dystocia in bitch at Southwestern Nigeria. Global Veterinaria, 6(1): 97-100. Available at: https://www.idosi.org/gv/gv6(1)11/13.pdf

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36

Allerton F (2017). BSAVA small animal formulary: Canine and feline. British Small Animal Veterinary Association, pp. 37-38 and 435-436. Available at: https://www.bsavalibrary.com/content/formulary/canine-and-feline

Alyssa JC, Rachel M, Jane R, Barbara H, and Soon HC (2019). Identifying risk factors for canine dystocia and stillbirths. Theriogenology, 128: 201-206. DOI: https://www.doi.org/10.1016/j.theriogenology.2019.02.009

Bergström A, Nødtvedt A, Lagerstedt A, and Egenvall A (2006). Incidence and breed predilection for dystocia and risk factors for cesarean section in a Swedish population of insured dogs. Veterinary Surgery, 35(8): 786-791. DOI: https://www.doi.org/10.1111/j.1532-950X.2006.00223.x

Borgea KS, Tønnessena R, Nødtvedta A, and Indrebø A (2011). Litter size at birth in purebred dogs - A retrospective study of 224 breeds. Theriogenology, 75(5): 911-919. DOI: https://www.doi.org/10.1016/j.theriogenology.2010.10.034

Cornelius AJ, Moxon R, Russenberger J, Havlena B, and Cheong SH (2019). Identifying risk factors for canine dystocia and stillbirths. Theriogenology, 128: 201-206. DOI: https://www.doi.org/10.1016/j.theriogenology.2019.02.009

Damelid W and Linde-Forsberg C (1994). Dystocia in the bitch: A retrospective study of 182 cases. Journal of Small Animal Practice, 35(8): 402-407. DOI: https://www.doi.org/10.1111/j.1748-5827.1994.tb03863.x

Dejneka GJ, Ochota M, Bielas W, and Niżański W (2020). Dystocia after unwanted mating as one of the risk factors in non-spayed bitches-a retrospective study. Animals, 10(9): 1697. DOI: https://www.doi.org/10.3390/ani10091697

Egloff S, Reichler IM, Kowalewski MP, Keller S, Goericke-Pesch S, and Balogh O (2020). Uterine expression of smooth muscle alpha- and gamma-actin and smooth muscle myosin in bitches diagnosed with uterine inertia and obstructive dystocia. Theriogenology, 156: 162-170. DOI: https://www.doi.org/10.1016/j.theriogenology.2020.06.033

Elliott C, Morton J, and Chopin J (2009). Factors affecting foal birth weight in Thoroughbred horses. Theriogenology, 71(4): 683-689. DOI: https://www.doi.org/10.1016/j.theriogenology.2008.09.041

Forsberg C and Persson G (2007). A survey of dystocia in the Boxer breed. Acta Veterinaria Scandinavica, 49: 8. DOI: https://www.doi.org/10.1186/1751-0147-49-8

Gardner DS, Buttery PJ, Daniel Z, and Symonds ME (2007). Factors affecting birth weight in sheep: Maternal environment. Reproduction, 133(1): 297-307. DOI: https://www.doi.org/10.1530/REP-06-0042

Gaudet DA (1985). Retrospective study of 128 cases of canine dystocia. The Journal of the American Animal Hospital Association (USA), 21(6): 813-818. Available at: https://www.agris.fao.org/agris-search/search.do?recordID=US8737213

Gram AB and Kowalewski MP (2014). Uterine and placental expression of canine oxytocin receptor during pregnancy and normal and induced parturition. Reproduction in Domestic Animals, 49(2): 41-49. DOI: https://www.doi.org/10.1111/rda.12295

Jutkowitz LA (2005). Reproductive emergencies. Veterinary Clinics: Small Animal Practice, 35(2): 397-420. DOI: https://www.doi.org/10.1016/j.cvsm.2004.10.006

Long ST and Hang TLT (2014). Application of ultrasound method for diagnosis of canine pyometra in Hanoi and its treatment. Journal of Science and Technology Development, 13(1): 23-30. Available at: http://www1.vnua.edu.vn/tapchi/Upload/2522015-tc%20so%201.2015%20(3).pdf

Luis MFM and Ana M (2017). Reproductive emergencies. In Ettinger SJ, Feldman EC (editors): Textbook of Veterinary Internal Medicine: Diseases of the Dog and the Cat. 8th Edition. Philadelphia, WB Saunders, pp. 1617-1617.

Mila H, Grellet A, Feugier A, and Chastant-Maillard S (2015). Differential impact of birth weight and early growth on neonatal mortality in puppies. Journal of Animal Science, 93(9): 4436-4442. DOI: https://www.doi.org/10.2527/jas.2015-8971

Münnich A and Küchenmeister U (2009). Dystocia in numbers-evidence-based parameters for intervention in the dog: Causes for dystocia and treatment recommendations. Reproduction in Domestic Animal, 44(2): 141-147. DOI: https://www.doi.org/10.1111/j.1439-0531.2009.01405.x

O'Neill DG, O'Sullivan AM, Manson EA, Church DB, Boag AK, McGreevy PD, and Brodbelt DC (2017). Canine dystocia in 50 UK first-opinion emergency-care veterinary practices: Prevalence and risk factors. Veterinary Record, 181(4): 88-94. DOI: https://www.doi.org/10.1136/vr.104108

O'Neill DG, O'Sullivan AM, Manson EA, Church DB, McGreevy PD, Boag AK, and Brodbelt DC (2019). Canine dystocia in 50 UK first-opinion emergency care veterinary practices: Clinical management and outcomes. Veterinary Record, 184(13): 409-417. DOI: https://www.doi.org/10.1136/vr.104944

Pretzer SD (2008). Medical management of canine and feline dystocia. Theriogenology, 70(3): 332-336. DOI: https://www.doi.org/10.1016/j.theriogenology.2008.04.031

Tilley LP and Smith FWK (2016). Dystocia. In: Blackwell's five-minute veterinary consult: Canine and feline. 6th edition. Tilley LP, Smith FWK Jr (editors). John Wiley and Sons, p. 424. Available at: https://www.wiley.com/learn/5mvc/pdf/blackwells-five-minute-veterinary-consult.pdf

Tønnessen R, Borge KS, Nødtvedt A, and Indrebø A (2012). Canine perinatal mortality: A cohort study of 224 breeds. Theriogenology, 77(9): 1788-1801. DOI: https://www.doi.org/10.1016/j.theriogenology.2011.12.023

Traas AM (2008). Surgical management of canine and feline dystocia. Theriogenology, 70(3): 337-342. DOI: https://www.doi.org/10.1016/j.theriogenology.2008.04.014

To cite this paper: Long STh, Hien NThTh, Hang PhTh, Hoai NTh, and Bach PhX (2022). Canine Dystocia: The Risk Factors and Treatment Methods in Dogs of Hanoi, Vietnam. *World Vet. J.*, 12 (3): 290-295. DOI: https://dx.doi.org/10.54203/scil.2022.wvj36