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Transperineal ultrasonographic characteristics of the birth canal of bitches during pregnancy and dystocia

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Abstract

Investigation of canine pregnancy complications often poses a challenge to clinicians. The aim of the present study was to investigate the transperineal ultrasonographic characteristics of the birth canal of bitches during pregnancy and dystocia. Transperineal ultrasound examinations were performed on 100 pregnant bitches. In 60 apparently normal pregnant bitches, transperineal ultrasound examination of birth canal revealed mass lesion (n = 2), mild vaginal discharge (n = 5), vaginal wall hyperplasia (n = 2), and vaginal prolapse (n = 1). Forty bitches were in need of veterinary intervention in connection with parturition. The dystocia was of maternal origin in 20 cases and of fetal origin in 15 cases. The secondary uterine inertia observed to be caused by mass lesions (n = 2), vaginal prolapse (n = 1), and narrow pelvic canal (n = 1). The observed fetal causes for dystocia were malpresentation (n = 7), oversized fetus (n = 1), and fetal death (n = 10). The transperineal ultrasound can be used as a simple non-invasive diagnostic modality to evaluate the birth canal of a bitch to diagnose and plan early intervention in managing canine dystocia in clinical practice.

Key Words: birth canal, dog, dystocia, transperineal ultrasonography

1. Introduction

Investigation of pregnancy complications of bitches often poses a challenge to clinicians as clinical presentations are usually nonspecific. Dystocia is a difficult and painful abnormal birth that occurs when the parturition process ceases to progress normally²¹⁾. A veterinary practitioner is expected to diagnose the cause of dystocia and thus, appropriate measures can be taken

ensuring safe delivery of fetuses while minimizing discomfort to the dam^{5,21,24)}. Proper history taking, physical examination, vaginal examination, abdominal radiography, and abdominal ultrasonography assist the clinician in diagnosing and managing dystocia in bitches¹²⁾. The recent advancements of wellbeing assessment methods have augmented canine obstetrics, facilitating early diagnosis of abnormal pregnancy or fetal distress which enables early intervention^{4,7,18)}.

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Two-dimensional transabdominal ultrasound scanning is one of the best methods used for determining the staging of pregnancy in the bitch^{1,7,9}. The method is important to diagnose pregnancy relatively early to allow adjustments to be made in feeding and medication regimes if therapeutic agents are to be used in the bitch⁷. Ultrasound examination may be undertaken in mid-pregnancy in bitches where there is concern over fetal resorption and when it is necessary to differentiate between pregnancy and pyometra^{1,7,9,10}. In particular, the characteristics and measurement of ultrasound features of the fetus and the dam can be used to predict impending abnormalities in pregnancy and the process of parturition which are useful to manage canine pregnancy safely and effectively⁷.

Investigation in to the changes of the birth canal would be useful to identify certain abnormalities in compromised pregnancies of the bitches. However, examination of birth canal of canine patient is crucial in clinical practice. The major limitation of transabdominal ultrasound approach is that the birth canal cannot be fully visualized in the bitch. The transperineal ultrasound is an alternative approach to visualize the birth canal which has the potential to provide objective estimates of the passage. To our knowledge, there is dearth of information related to transperineal ultrasound findings of the birth canal of bitches. The aim of the present study is to investigate ultrasonographic characteristics of transperineal visualization of the birth canal of bitches during pregnancy and dystocia.

2. Material and Methods

2.1. Inclusion and exclusion criteria of animals: Ultrasound examinations were performed on 100 pregnant bitches that were presented to the Veterinary Teaching Hospital, University of Peradeniya, Sri Lanka as a prospective study. Sixty pregnant bitches were brought for pregnancy diagnosis or general health check-ups.

Bitches which were confirmed as pregnant at least 5 weeks after mating were included in to apparently normal category in the present study. The average gestation age of the bitches was calculated as 54.6 ± 8.2 days (range 35 to 66). The bitches were German shepherd (n = 7), Pomeranian (n = 4), Labrador retriever (n = 12), Golden retriever (n = 3), Pug (n = 1), Doberman (n = 3), Rottweiler (n = 7), Terrier (n = 2), Bullmastiff (n = 2), Dachshund (n = 1), and mixed breed (n = 18). There was no significant clinical abnormality detected from general clinical examination and history findings of these bitches. As described by Forsberg *et al.* 2007, 40 bitches required veterinary intervention during whelping were considered as suffering from dystocia in this study¹¹. The bitches were German shepherd (n = 6), Pomeranian (n = 1), Labrador retriever (n = 8), Ridgeback (n = 1), Doberman (n = 2), Rottweiler (n = 5), Bullmastiff (n = 1), Dachshund (n = 2), Dalmatian (n = 1), and mixed breed (n = 13). The bitches that were presented with possible neonatal death, still births, pyometra or other pregnancy complications which did not satisfy the inclusion criteria of dystocia were excluded from the study. A written consent of the owner was obtained before each ultrasound examination.

2.2. Ultrasonography procedure: Transperineal sonograms were obtained using ultrasound scanner (MyLab30vet, Esaote, Genoa, Italy) with a phased-array transducer (Esaote PA 122, Esaote, Genoa, Italy) with frequency of 7.5 MHz. Transabdominal sonograms were obtained using linear-array transducer (Esaote LA 522, Esaote, Genoa, Italy) with frequency of 5 to 7.5 MHz. Real-time images were recorded on videotape and static images were sent to a computer equipped with specialized software for storage and off-line evaluation.

2.3. Assessing the transperineal ultrasound characteristics of the birth canal of apparently normal pregnant bitches: The transducer was

positioned on the peri-vulva area with the bitch in a lateral recumbency. The transducer was positioned vertical in relation to the perineum of the bitch to obtain sagittal plane images and then a slightly tilted dorsally to obtain the maximum visual length of the birth canal during real-time ultrasound evaluation. The ultrasound features and presence of morphological changes of the birth canal and associated anatomical structures of the passage were recorded.

2.4. Assessing the transperineal ultrasound characteristics of birth canal in dystocia: As described by Forsberg *et al.* 2007, dystocia were considered with; 1) birth that does not occur within 24 hours of a sign of impending birth; 2) continuous strong contraction for more than 20 to 30 minutes with no birth; 3) active labor for more than 1 to 2 hours without a birth; 4) a resting period during labor that lasts more than 2 to 4 hours; 5) obvious illness in the mother; and or 6) abnormal discharge from the vulva¹¹. Transperineal ultrasound examination was performed on 40 bitches as described above to obtain details of the birth passage, anatomically associated structures of the passage, and the structures overlying the cervix. When the content is present in the passage, the characteristics and the quantity of the content were subjectively assessed. The classification of cause of dystocia was done according to the method described by Forsberg *et al.*, 2007¹¹. The adequate cervical dilatation was assessed in dystocia by comparing the minimum dilation of the birth canal with that of the body diameter of fetuses.

2.5. Estimating the dimensions of fetus with transabdominal ultrasonography: Transabdominal ultrasonography was performed in all the bitches that were used in the present study. In pregnant bitches, the biparietal diameter and body diameter of fetus were measured according to the method adopted by Luvoni *et al.*, 2006 and were used to assess the gestational age¹⁹. Fetal death was confirmed with the absence of fetal

movements, fetal heart beats, and fetal blood circulation with color Doppler ultrasound. Fetal maceration was ascertained by the presence of ultrasound characteristics such as disintegrated fetal structures, free gas in the fetus, and heterogeneous contents in the uterus. In fetal maceration cases, the mating history was considered to assess the gestation age.

2.6. Statistical analysis: All measurements were recorded on a Microsoft Excel spreadsheet. Descriptive statistics, such as mean, range (minimum to maximum) and standard deviations of the mean were calculated for all the measurements were obtained.

3. Results

3.1. Transperineal ultrasonographic characteristics of the birth canal of normal pregnant bitches: Although sixty bitches were subjected to transperineal ultrasonography in the apparently normal pregnant group, there were only 50 bitches without a significant lesion in the birth canal. As shown in Fig. 1A, the birth canal of normal pregnant bitches lies ventral to the distal part of the descending colon and rectum and dorsal to the pelvic urethra, muscles and connective tissues of the pelvic floor. The hypoechoic birth canal extends cranially with slight dorsal angle from the vulval opening and then slightly tilted ventrally and extends towards the cervix. The canal gets narrowed toward cranially. The hyperechoic poorly distinguished vaginal wall was closely in contact with the adjacent connective tissues. Fig. 2A and 2B represent the ultrasonographic appearance of the birth canal of 2 dogs during the normal delivering process. The normal birth canal contains hyperechoic speckles indicating the partially dissolved cervical mucus plugs just before the onset of the delivery process (Fig. 2A). As seen in the Fig. 2B, the normal birth canal can be generally seen as a clear passage for the delivery

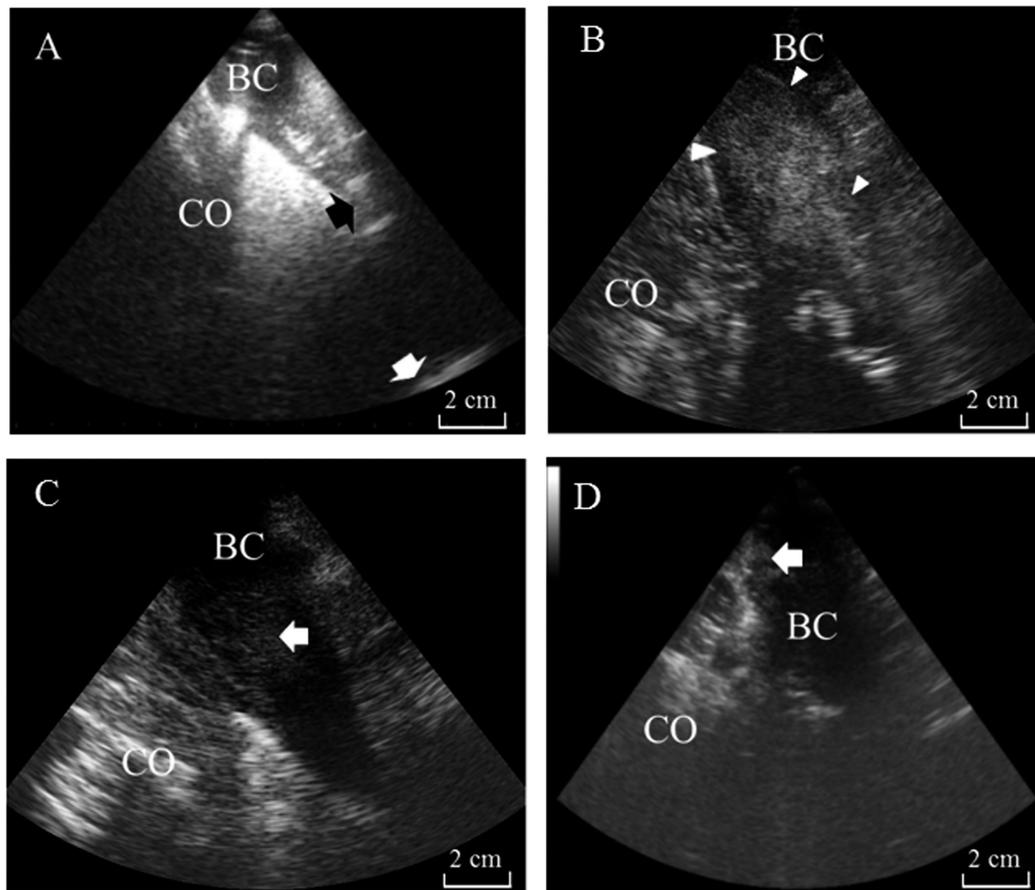


Fig. 1. Transperineal sonogram of birth canal (BC) of a (A) 2 year old pug around 61 days of pregnancy, representing animals those could not observe significant abnormality in the birth canal. The cervix is visible (black arrow) ventral to the descending colon (CO). A white arrow is directed towards the most caudally located fetus. (B) 5 years old German shepherd of around 35 days of pregnancy having heterogeneous soft tissue mass lesion (arrow heads) occluding the BC. (C) 2 years and 6 months old Rottweiler around 42 days of pregnancy with clear vaginal discharge with no other clinical abnormality. The BC contains moderate amount of heterogeneous content (arrow). (D) 5 year old mixed breed bitch with irregular thickened vaginal wall (arrow) around 56 days of pregnancy. Dorsal is to the left, ventral is to the right and cranial is to the bottom.

of consecutive pups without obstruction.

3.2. Abnormal findings in the birth canal of apparently normal pregnant bitches: The transperineal ultrasonography revealed that there were 10 bitches, with having abnormal lesions in the apparently normal group. The bitches were German shepherd (n = 1), Labrador retriever (n = 1), Rottweiler (n = 2), Dachshund (n = 1), and mixed breed (n = 5). In 2 of the 10 bitches, mild to moderate mass lesion was found in the birth canal with transperineal ultrasonography which was diagnosed as transmissible venereal tumor (Fig. 1B). Those bitches did not show

clinical signs of transmissible venereal tumor at the time of presentation. As shown in the Fig. 1C, in 5 of the 10 cases, presence of anechoic content with hyperechoic debris in the birth canal was observed suggesting mild vaginal discharge. There were 2 bitches having well demarcated, thickened, irregular, hyperechoic vaginal wall indicating vaginal wall hyperplasia (Fig. 1D). One pregnant bitch had vaginal prolapse.

3.3. Transperineal ultrasound findings of the birth canal during dystocia: Forty bitches were in need of veterinary intervention in connection with parturition. The dystocia was of maternal

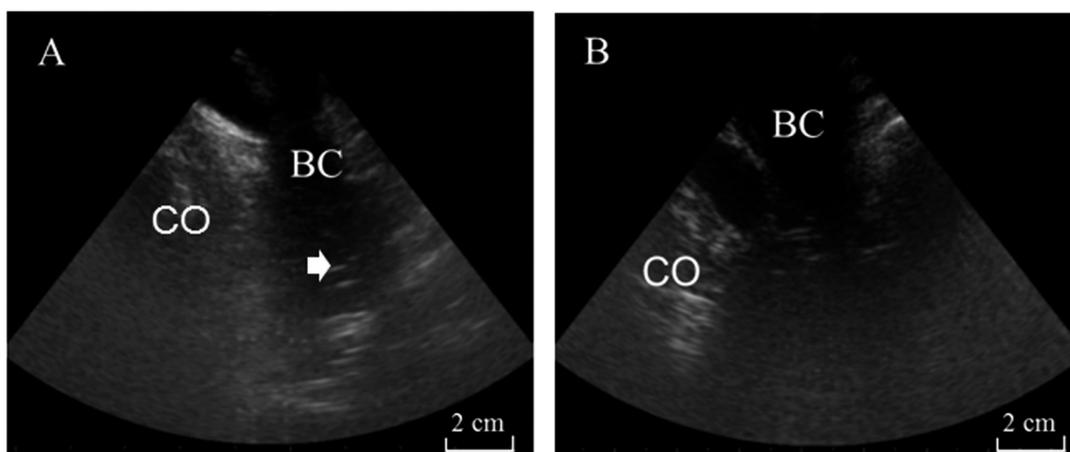


Fig. 2. Representative transperineal sonograms of the birth canal (BC) of a (A) 3 year old Labrador retriever around 63 days of pregnancy which was taken around an hour before the normal vaginal delivery. The normal birth canal contains hyperechoic speckles indicating the partially dissolved cervical mucus plugs (arrow) ventral to the descending colon (CO). (B) 2 year old mixed breed bitch between the second and the third pups. The normal birth canal can be seen as a clear passage for the delivery of the third pup without obstruction. Dorsal is to the left, ventral is to the right and cranial is to the bottom.

origin in 20 cases and of fetal origin in 15 cases. In 5 cases it was not possible to determine whether the dystocia was maternal or fetal in origin. There were 24 cases which had inadequate dilatation of the birth canal in comparison with the body diameter of the fetuses. The cervical dilatation could not be assessed in 7 bitches. It was considered that the dystocia of 16 bitches of the present study occurred due to primary uterine inertia. As shown in Fig. 3, the secondary uterine inertia observed to be caused by anatomical abnormality in birth canal were due to mass lesions ($n = 2$), vaginal prolapse ($n = 1$) and narrow pelvic canal ($n = 1$). The observed fetal causes for dystocia were malpresentations ($n = 7$), oversized fetus ($n = 1$) and fetal death ($n = 10$). As given in the Fig. 4, the fetal malpresentations encountered in the present study were fetal head engagement ($n = 3$), transverse presentation or bend fetus ($n = 2$), and neck presentation or deviation of neck ($n = 2$). Heterogeneous contents with hyperechoic debris with corresponding reverberation shadows indicating bony parts of macerated fetuses were found in the birth canals of 2 bitches.

4. Discussion

In the present study, the transperineal ultrasonographic characteristics of the birth canal during pregnancy and dystocia of bitches were investigated. Transperineal ultrasound is suitable for the detection of pathological conditions of the birth canal of pregnant bitches that can be assessed by changes in the size, shape, echogenicity, and boundaries of the passage. Ten out of 60 apparently healthy pregnant bitches examined in the present study had abnormal lesions in the birth canal which could be detected with transperineal ultrasonography. Morphological changes in the birth canal may lead to complications during delivery of fetuses at the second stage of labor. Detection of birth canal defects or lesions could be considered as predictors of adverse obstetric outcomes and it would help veterinarians to plan safe delivery procedure/s in bitches. Therefore, it could be suggested that transperineal ultrasonography of the birth canal would be an important component of the antenatal obstetrical evaluation in bitches.

Dystocia is a common small animal emergency^{12,22}. The clinician must rapidly identify

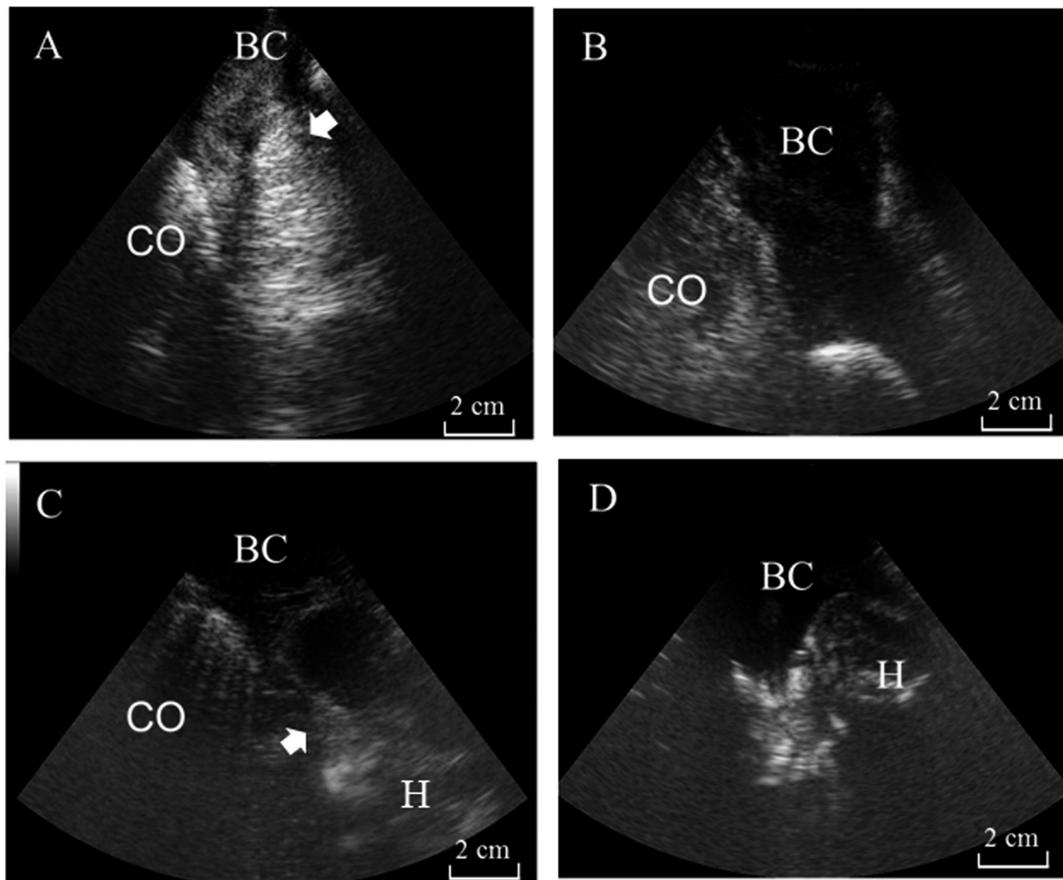


Fig. 3. Transperineal sonograms of the birth canal (BC) of a (A) 2 years old Ridgeback around 60 days of pregnancy that has been straining around 6 hours. The vaginal prolapse can be seen as a heterogeneous soft tissue lesion inside the birth canal ventral to the descending colon (CO). The arrow shows the protruded mucosal fold. Transabdominal ultrasound revealed live fetuses in the uterus. (B) 6 year old German shepherd who whelped 3 live pups, and thereafter it had been straining for more than 6 hours without progress in the delivery process. The dilated BC can be seen. Death fetuses were found with transabdominal ultrasonography. (C) 3 year old mixed breed bitch around 60 days of pregnancy. The head (H) of live fetus having reduced heart rate (80 beats/minute) is located at the inadequately dilated cervical os (arrow). (D) 2 year old Labrador retriever around 64 days of pregnancy. It had intermittent straining for 20 hours suggesting fetopelvic disproportion due to narrow birth canal. The head (H) of live fetus, having reduced heart rate (85 beats/ minute) has entered into the narrow BC. Dorsal is to the left, ventral is to the right and cranial is to the bottom.

the underlying etiology of dystocia and determine whether veterinary attention is warranted. However, differentiating normal parturition from dystocia may not always be straight forward¹²⁾. In the present study, transperineal ultrasonography directly or indirectly assisted in identifying the cause of dystocia. As observed by Romagnoli *et al.* 2004, the most common maternal cause of dystocia was uterine inertia which in turn may be classified as either primary or secondary¹²⁾. The possible causes of secondary uterine inertia which is the exhaustion of uterine musculature

after contracting against an obstruction observed were transmissible venereal tumor, vaginal prolapse, and narrow pelvic canal. The secondary uterine inertia with dorsoventral pelvic flattening and small vertical pelvic canal diameter has reported in dog breeds such as Scottish terriers and Boston terriers^{6,8)}, and similar condition was observed in a Labrador retriever in the present study. However, there were several cases in the present study which were difficult to decide the course of dystocia when fetal death was concurrently present with other abnormalities.

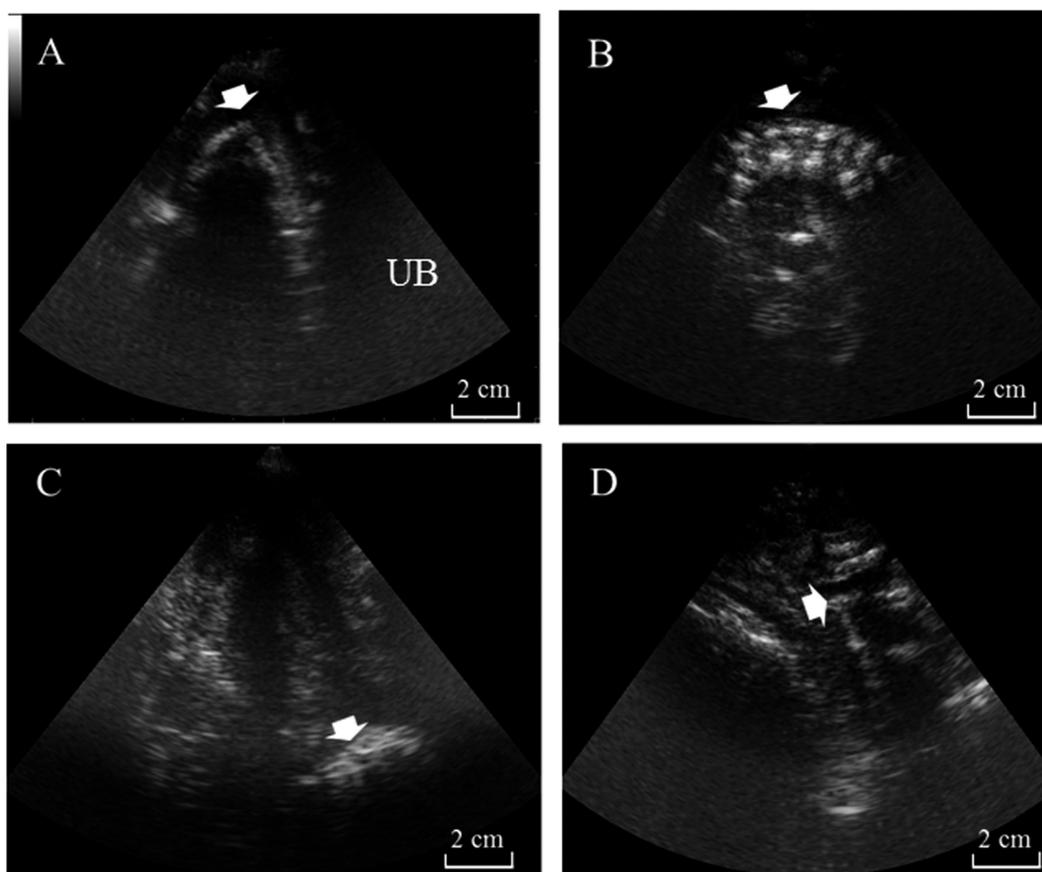


Fig. 4. Transperineal sonograms of birth canal (BC) of a (A) 4 years old German shepherd around 63 days of pregnancy, with fetal head engaging in the birth canal. Hyperechoic bony head (arrow) of the edematous fetus is visible. Severely distended urinary bladder (UB) lies ventrally. Mild hyperechoic debris present between the edematous fetus and the vaginal wall. (B) 2 years old Dalmatian around 60 days of pregnancy, with the bended fetal neck (arrow) of death fetus in the birth canal. Transabdominal ultrasonography revealed 3 fetuses with reduced heart beats. (C) 6 years old German shepherd showing extensively dilated BC with transverse presentation of death fetus. Arrow shows the back region of fetus. (D) 3 years Dachshund that has been strained more than 24 hours after 69 days of pregnancy with mild sanguineous vaginal discharge. Heterogeneous content with hyperechoic structures with underlining shadowing in the BC indicate the macerated fetuses (arrow). Dorsal is to the left, ventral is to the right and cranial is to the bottom.

In the present study, several vaginal lesions were identified with transperineal ultrasound in apparently healthy pregnant bitches which lead to dystocia. It was evident that 5 of the 60 cases of apparently normal bitches showed evidence of vaginal discharges with transperineal ultrasound. It has been reported that bitches that are in second trimester of pregnancy often have a vaginal discharge particularly due to vaginitis²⁰. However, the vaginal discharge during pregnancy of bitch would require veterinary attention due to possible reproductive complications. It has reported that excess prepartum relaxation of

pelvic ligaments combined with increased intra-abdominal pressure responsible for the vaginal prolapse occurs close to whelping as the serum progesterone declines and estrogen increases^{13,14,15,16,17}. In the contrary, vaginal prolapse may prohibit normal parturition by narrowing birth canal². In the present study, vaginal prolapse was diagnosed both in an apparently healthy pregnant bitch and in a bitch that had dystocia.

The major limitation of the transperineal approach is that the cervical os becomes obscured in several bitches. This occurs because of the

extensive shadowing from gas in the bowel or due to pelvic bones³⁾. In the present, the phased array probe was used to investigate the birth canal as the beam from the probe can be focused and swept electronically without moving the probe to have a better image of the birth canal²³⁾.

This study evaluates the transperineal ultrasonography as one of the useful diagnostic aids to visualize the birth canal in the obstetrical ultrasonographic examination of bitches. To the best of our knowledge, this is the first study to evaluate morphological characteristics of the birth canal in pregnant bitches using transperineal ultrasound. This approach provides better visualization of birth canal and is a useful, non-invasive and simple method to identify the changes and in particular cause/s of dystocia of bitches. However, transabdominal ultrasonography is often needed to augment the examination. Thus, transperineal approaches can be used interchangeably with the transabdominal assessment to increase the accuracy of diagnosis of dystocia in pregnant bitches.

In conclusion, the transperineal ultrasound can be used as a useful and simple non-invasive diagnostic modality to evaluate the birth canal of bitches to diagnose and to plan an early the course of action in managing canine dystocia in clinical practice.

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