Comparison of 2D and 3D ultrasonography for gestational aging in dogs

Sabina Pestelacci,[a] Nikolaos Tzanidakis,[a] Iris Reichler,[a] Orsolya Balogh[a,b]

[a]Clinic of Reproductive Medicine, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland; [b]Department of Small Animal Clinical Sciences, Virginia-Maryland College of Veterinary Medicine, Blacksburg, VA

Gestational aging in the bitch by two-dimensional (2D) ultrasonographic measurements of fetal and extra-fetal structures has been well studied. In early pregnancy, the inner chorionic cavity (ICC) diameter was the most reliable parameter, but its accuracy for parturition day prediction within 1 day error decreased from 81% in week 4 to 67.7% in week 5 of pregnancy.1 We hypothesized that three-dimensional (3D) volume ultrasonography, which has previously been studied only in a limited number of bitches, improves gestational age determination in dogs. The aim of our study was to compare embryonic vesicle measurements by 3D to 2D ultrasonography for gestational aging in early to mid-pregnant bitches. Thirty-two pregnancy examinations were performed in 25 bitches of several breeds by abdominal ultrasound between 21 and 34 days after the first mating. ICC diameter and length were measured by 2D, and ICC volume by 3D ultrasonography (Voluson® i, GE Healthcare). ICC volume was calculated using the virtual organ computer-aided analysis (VOCAL™) software with 30° rotational angle. Measurements on 2 embryonic vesicles per examinations were averaged for statistical calculations (ICC volume was available from only 1 embryo in 5 examinations). The associations between the dependent variables ICC diameter, length and volume, and the independent variable time, calculated as either 'days from ovulation' (n = 15 dogs, ovulation day based on serum progesterone concentrations) or 'days before parturition' (n = 22 dogs, planned cesarean sections or bitches under progesterone supplementation excluded) were analyzed by linear or exponential regression using IBM® SPSS® Statistics v. 26.0.0.0. Statistical significance was set at $p < 0.05$. Counting from the day of ovulation, regression lines for ICC diameter, ICC length and ICC volume had a good fit ($p < 0.001$) with our data points ($R^2 = 0.707$, $R^2 = 0.728$ and $R^2 = 0.718$, respectively). Regression curves had improved fit ($p < 0.001$) for all ICC measurements when time 'days before parturition' was used; ICC length and ICC volume gave slightly better estimates than ICC diameter ($R^2 = 0.810$, $R^2 = 0.818$ and $R^2 = 0.800$, respectively. In conclusion, regression analysis of conceptus size measured by ICC length and ICC volume were slightly more accurate to estimate conceptus age than ICC diameter. Furthermore, on the basis of ICC volume and ICC length regression curves, it is apparent that the development of canine conceptus follows an exponential growth curve already during the early stages of pregnancy that is not reflected by ICC diameter measurements. ICC length measured by 2D ultrasonography may represent a more feasible target for improving accuracy of canine parturition date prediction than 3D volume calculations, which require specialized, expensive equipment and more time to process data.

Keywords: Dog, 3D ultrasonography, embryo, pregnancy, parturition prediction

Reference

1. Beccaglia M, Luvoni GC: Prediction of parturition in dogs and cats: Accuracy at different gestational ages. Reprod Dom Anim 2012;47(Suppl. 6):194-196.

Vaginal vault diverticulum causing functional urinary obstruction in a maiden bitch

Marthina Greer

Veterinary Village/International Canine Semen Bank WI/IL/IN, Lomira, WI

A 14-month-old German Shepherd bitch presented with a bloody vaginal discharge, followed by an inability to void her bladder. Approximately 6 weeks prior, she had a dark colored vaginal discharge interpreted as her first estrus. The vaginal discharge at presentation was initially assumed to be associated with the development of a pyometra. Ultrasonography revealed normal (no fluid) uterus and an overly distended urinary bladder. Work up included comprehensive physical examination, radiographs, contrast study of her bladder and urethra, CBC, chemistry panel, urinalysis, vaginal cytology, vaginoscopy, culture of the vaginal discharge, and ultrasonography by a board-certified radiologist. No cystic calculi were detected in any imaging. Fluid was present caudal to the cervix. Her bladder required multiple episodes of catheterization to manage her functional urinary obstruction, pending surgery. Exploratory laparotomy was performed to assess the structural abnormality. The urinary bladder, uterus and ovaries were normal. No other abnormalities were observed in the abdominal cavity. A large diverticulum containing dark red blood-tinged fluid was the only structural abnormality detected at exploratory. The ventral aspect of the diverticulum was incised and evaluated. The cervix appeared ~ 4 times the size of a normal cervical os at this stage of estrus. The dorsal median fold was pronounced. The remaining vaginal vault was normal with the exception of the diameter. Redundant vaginal tissue was excised, and the vaginal vault was closed with a two-layer continuous absorbable suture. Redundant tissues were submitted for histopathology. Celiotomy incision was closed routinely after the area was explored and lavaged. Bitch recovered unremarkably and was subsequently able to void her urinary bladder voluntarily. Her uterus and ovaries were spared with the anticipated use as a brood bitch. As of this report, she remains clinically normal. She has not yet had a subsequent estrus and her reproductive future is unknown.

Keywords: Vaginal diverticulum, functional urinary obstruction, vaginal distension, excess vaginal fluid