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Diagnostic ultrasonography in canine: A review

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Abstract

Real-time B-mode ultrasonography has become an indispensable diagnostic tool in canine reproduction, providing a non-invasive method for evaluating the reproductive tract under both normal and pathological conditions. This review summarizes the applications of ultrasonography in assessing the uterus and ovaries, monitoring the estrous cycle, diagnosing pregnancy, estimating gestational age, evaluating fetal viability, and identifying reproductive disorders in female dogs. Characteristic ultrasonographic features of uterine abnormalities, including cystic endometrial hyperplasia, pyometra, mucometra, stump pyometra, and uterine neoplasms, are discussed. The review also highlights the role of ultrasonography in detecting gestational abnormalities, postpartum uterine involution, ovarian follicular development, ovarian cysts, and neoplasia. Advances in ultrasonographic imaging have significantly improved reproductive management by enabling early diagnosis, timely therapeutic intervention, and enhanced breeding efficiency in canine practice.

Keywords: Canine reproduction, ultrasonography, pregnancy diagnosis, uterine disorders

Introduction

Real-time ultrasonography has rapidly grown into a prominent diagnostic tool within veterinary medicine and animal science, particularly through advances in B-mode imaging of the canine reproductive tract. While ultrasound was historically used solely to confirm pregnancy, modern reproductive technologies utilize it for monitoring fetal growth, estimating gestational age, predicting delivery dates, diagnosing and managing reproductive disorders, and supporting breeding soundness evaluations. This text outlines the use of ultrasonography for evaluating both healthy reproductive organs and various reproductive abnormalities in female dogs.

Ultrasound Prerequisites

- **Preparation:** Preparing the patient requires clipping abdominal hair and applying oil or gel to the skin, though wiping and flattening hair with alcohol before applying ultrasound gel is also effective.
- **Transducer Selection:** The ability to spot developmental details depends heavily on equipment quality and transducer frequency:
 - a. **7.5 to 10 MHz:** Suitable for small dogs and cats.
 - b. **5.0 MHz:** Ideal for medium-sized dogs.
 - c. **3.0 MHz:** Required occasionally for large breeds.

The Healthy Non-Gravid Uterus

The uterine body is most easily examined through a partially filled, anechoic bladder, with the bitch positioned in standing, dorsal, or lateral recumbency. Located dorsal to the bladder, the uterine body usually sits in the midline (though it can occasionally rest laterally or obliquely).

- **Dimensions:** During anestrus, the uterine body typically measures 5 to 8 mm in diameter, though it may be smaller in pre-pubertal or non-parous young adults.
- **Sonographic Layers:** Sonograms sometimes reveal two layers: an inner hypoechoic

region (representing the endometrium and inner myometrium) surrounded by a hyperechoic layer (representing the uterine serosa)

- **Uterine Horns:** Tracing the uterine body cranially reveals the bifurcation and horns in roughly half of all bitches; in other cases, intervening small intestines obscure the view.

Uterine Changes Across the Estrous Cycle

The uterus changes appearance throughout the estrous cycle:

- **Proestrus and Estrus:** The uterus grows more hypoechoic, often developing radiating hyperechoic lines (indicating uterine edema) or faint concentric layers. Its shape may turn serpentine, and a small amount of central fluid may outline the lumen.
- **Early Metestrus (Diestrus):** Uterine diameter increases slightly during the first week or two, making it easier to identify than at other stages, though edematous signs fade as estrogen declines.
- **Pregnancy vs. Non-Pregnancy:** Uterine diameter remains comparable between pregnant and non-pregnant bitches in early metestrus until implantation occurs around Day 22 post-LH surge. Initial pregnancy is marked by detecting 2 mm anechoic fluid vesicles (gestational sacs) around Day 17 to 20 post-LH surge.

Uterine Abnormalities

Commonly diagnosed uterine conditions include:

- **Cystic Endometrial Hyperplasia (CEH):** A common condition in middle-aged breeding bitches that can cause infertility or progress to pyometra. It involves an exaggerated hyperplastic response to hormones, resulting in thickened uterine walls and multiple small, fluid-filled cystic regions (1 to 4 mm anechoic spots). It is frequently found incidentally during routine pregnancy checks.
- **Mucometra and Pyometra:** Mucometra involves significant mucoid fluid retention due to CEH, while pyometra involves pus accumulation from a bacterial infection, typically developing during the closed-cervix luteal phase. Ultrasound reveals an enlarged uterus filled with fluid (often containing movable echogenic particles) and thickened walls (7 to 10 mm). Ultrasound is also used to monitor the efficacy of medical treatments.
- **Stump Pyometra and Granuloma:** Occurs after incomplete ovariectomies or post-surgery progesterone administration. Lesions appear localized to the pelvic inlet, with granulomas showing mixed echogenicity (hypoechoic pus/edema regions alongside hyperechoic fibrous tissue).
- **Uterine Neoplasms:** Rare tumors appear as homogeneous masses attached to the wall and projecting into the lumen, potentially causing fluid accumulation, or displaying mixed echogenicity if necrotic or fibrotic.

Pregnancy Diagnosis

Accurate staging relies on timing events relative to the pre-ovulatory LH surge (Day 0), as ovulation occurs two days later and parturition follows 64 to 66 days post-LH surge.

- **Early Detection:** Implantation vesicles appear as spherical anechoic structures (1 to 2 mm) roughly 18 to 19 days post-LH surge.
- **Embryo Visibility:** By Day 22 to 23 post-LH surge (around the time of implantation), the embryo appears as a 2 to 3 mm hyperechoic structure lifting into the yolk

sac.

- **Timing Examinations:** To avoid false negatives, scanning for fetal heartbeats should be scheduled 28 to 32 days post-LH surge (or 31 to 33 days post-breeding).
- **Estimating Fetal Numbers:** Predicting exact litter sizes via ultrasound is challenging and inaccurate (highest accuracy is under 30% before Day 30), though categorizing litters as either four-or-less versus five-or-more yields higher reliability (97%).

Gestational Abnormalities

- **Embryonic Resorption:** Occurs before Day 35 without clinical discharge in some cases. Ultrasound shows reduced conceptus volume, increased fluid echogenicity, absent heartbeats, and eventual collapse of the structure.
- **Underdeveloped Fetuses:** Conceptuses failing to exhibit expected growth metrics (e.g., embryos or heartbeats appearing more than two days later than expected) usually fail and are resorbed.
- **Abortion:** Fetal deaths after Day 35 typically trigger abortion and vaginal discharge. Sonographic signs include fluid hyper-echogenicity, absent heartbeats, and thickened uterine walls.
- **Fetal Abnormalities:** Though rare due to multiple fetuses, conditions like hydrocephalus, anasarca, abdominal wall hernias, and fetal monsters can be identified by structural anatomical changes.

The Postpartum Uterus

Immediately after giving birth, the uterine body and horns remain enlarged and fluid-filled. While uterine size decreases rapidly over the first two days—displaying distinct placental enlargements during the first week—complete ultrasonographic involution takes up to 15 weeks, even though the organ may shrink to anestrus dimensions within 4 to 6 weeks.

The Ovary

Canine ovaries are small, located near the fifth lumbar vertebra and caudal kidney pole, and surrounded by a potentially fatty bursa, making them challenging to image. Scanning is best performed with the bitch standing or in dorso-lateral recumbency.

- **Follicles and Ovulation:** Small 1 to 2 mm fluid-filled follicles appear in late anestrus. Growth accelerates in proestrus, with large pre-ovulatory follicles reaching 8 to 9 mm in diameter about one day post-LH surge before disappearing or changing structure at ovulation.
- **Ovarian Cysts:** Non-functional ovarian bursa cysts are common, thin-walled, and clinically insignificant. True ovarian cysts originate from stroma or follicles, are often multiloculated, and can mimic neoplasms (frequently linked to prolonged estrus or luteal issues).
- **Ovarian Neoplasia:** Though uncommon, granulosa cell tumors can become large and cystic, often accompanied by ascitic fluid and mixed-echogenicity tissue. Other rare tumors, like adenocarcinomas, present as large, multicystic ovaries.

Conclusion

Ultrasonography is a vital technology for veterinary theriogenologists and canine practitioners. It plays a critical role in tracking normal physiological milestones, diagnosing and staging pregnancies, and identifying pathological changes in reproductive organ size, shape, and internal architecture.

Conflict of Interest

Not available

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