



Echography of clinically relevant disorders in the genital tract of female dromedary camels



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ABSTRACT

The aim of this study was to characterize the clinically relevant genital tract disorders of dromedary camels. Reproductive tract examinations were performed via transrectal palpation, ultrasonography and vaginal exploration. The ultrasonic appearance of the reproductive pathology was described and compared with its morphology at laparotomy, after surgical removal, during postmortem examination or upon slaughter. Diagnosis was also confirmed by histopathology. The most frequently encountered follicular structures were larger than typical follicles (56/338, 16.6%) having three echo textures: 1) thin walls and clear hyperechogenic content (11.6%); 2) thick walls and few fibrous trabeculae (33.7%); and 3) thick walls and many echogenic transecting fibrinous strands (54.7%). Corpora lutea with non-echoic central cavity (5/31, 16.1%) were greater in diameter than those with no cavity (26/31, 83.9%) ($P = 0.03$). A granulosa cell tumor (1/338, 0.3%) was multilocular and honeycombed in shape. Presence of a large, well-demarcated, hypoechoic sac lateral to or beneath the uterine horn encasing the ovary was diagnostic for ovarian hydrobursitis (102/338, 30.2%). Hydrosalpinx and pyosalpinx (6/338, 1.8%) were beaded in appearance, with the ovary located outside these structures. Clinical endometritis/cervicitis (122, 36.1%) was characterized by changes in the homogeneity in about half of the cases. A greatly dilated uterus with clear, hypoechoic or echogenic contents with signs of hydrometra and pyometra, respectively, was another categorization of a reproductive pathology (24/338, 7.1%). Highly reflective, linear structures were observed in cases with intrauterine fetal bone retention (1/338, 0.3%). In conclusion, reproductive pathologies in dromedary camels can be efficiently imaged by use of ultrasonic technologies, thus familiarizing the practitioner with these disorders and facilitating application of these technologies so that suitable treatment can occur is important in managing reproduction of dromedary camels.

1. Introduction

There has been a rapid growth in the use of diagnostic ultrasonography for the evaluation of the reproductive tract in large animals (Ginther, 2014). In dromedary camels, ultrasonic technologies have been used for monitoring the reproductive tract (Tinson and McKinnon, 1992), studying follicular dynamics (Skidmore et al., 2009; Manjunatha et al., 2014), diagnosing pregnancy (Vyas et al., 2002; Ali et al., 2015a), monitoring fetal development and predicting gestational age and fetal sex (Ali et al., 2013, 2015a), assessing uterine involution (Derar et al., 2014) and evaluating reproductive treatment programs (Dholpuria et al., 2012) in addition

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to its use as a guide for oocyte collection (Wani and Skidmore, 2010). Ultrasonographic characterization of the reproductive pathology in camels, however, has been limited and mostly sporadic (Tibary and Anouassi, 2001; Ali et al., 2011a).

Due to anatomical, physiological and managerial specifications, the forms of reproductive disorders in female dromedaries differ largely from those observed in other animal species. In a retrospective study on 7300 barren female dromedaries, endometritis, ovarian hydrobursitis and vaginal adhesions were the main clinical findings (Ali et al., 2015a).

Diagnosis of endometritis has been hindered by shortage of a universally recognized definition of the disease and effective diagnostic techniques (Barlund et al., 2008). Ultrasonography has been used for diagnosis of endometritis in cows (Lenz et al., 2007) and mares (Adams et al., 1987; LeBlanc and Causey, 2009). The presence of purulent material inside the vagina has, however, been considered the most precise approach for the diagnosis of endometritis (LeBlanc et al., 2002; Sheldon et al., 2006).

Ovarian hydrobursitis is a long-standing infertility problem, found particularly in dromedary camels. Inflammation and adhesion of the ovarian bursa, which normally completely encircles the ovary, lead to fluid encapsulation of the ovary and fluid accumulation (Tibary and Anouassi, 2001; Ali et al., 2011a; Benaissa et al., 2014).

Vaginal and cervical adhesions are very serious problems specific to dromedaries (Ali et al., 2015b; Derar et al., 2016). Traumatic injuries and chronic inflammation of the vagina, overbreeding, aggressive mating practices, injuries during parturition, and increasing parity can lead to the formation of complete transluminal adhesions of the vagina or cervix and to the development of pyometra (Ali et al., 2015b).

Larger than typical follicles (> 2 cm in diameter) are common phenomena observed in dromedary camels (Skidmore, 2011). There is a debate concerning the pathogenicity of this disorder in camels. Tibary and Anouassi (1996) and Skidmore (2011) assumed that the term “cystic ovaries” does not always apply to camels. If the female camel is not pregnant, large numbers of follicles can develop some form of cystic ovaries, because ovulation is induced.

Ultrasonography has been used for the detection and characterization of certain pathological conditions in the genital tract of cows (Fricke, 2002; Lenz et al., 2007) and mares (Hinrichs and Hunt, 1990; Montavon, 1994; Cuervo-Arango and Newcombe, 2013). The present research addresses the echogenic characteristics of the most common clinically relevant genital tract disorders of dromedary camels.

2. Materials and methods

This study was approved by the Animal Care and Welfare Committee, Deanship of Scientific Research, Qassim University, Kingdom of Saudi Arabia.

2.1. Animals

A total of 338 female dromedary camels were examined at the Veterinary Teaching Hospital of Qassim University for reasons of failure of conception during the breeding season (September–November 2016). The animals were aged from 5 to 18 y. Their body condition scores ranged from 2.5 to 4 on a 5-point scale (Sghiri and Driancourt, 1999). The animals were came from different areas of the Qassim region, Saudi Arabia. In general, the animals were grazed on open pastures. If pasture food resources were insufficient, alfalfa (*Medicago sativa*) was provided. The owners, however, rarely supplemented the diet.

2.2. Ultrasonic examination

The reproductive tract of each animal was examined through standard transrectal palpation and by ultrasonography using Real-time, B-mode diagnostic ultrasonic equipment (Aloka SSD 500, Tokyo, Japan, and Dynamic Imaging Ltd., Scotland, UK) attached to a 5 MHz trans-rectal transducer. The examinations were performed while the females were fixed by ropes in sternal recumbence on specially equipped tractors. The transducer was placed over the relevant organ and moved slightly from one side to the other occurred to obtain full information on the examined organ. The images were frozen on the monitor of the ultrasonic scanning equipment, and the dimensions were measured at the maximum size using the electronic caliper. The ovaries were examined for structure and size. The uterus was examined for the echogenicity and contents.

Transabdominal examinations were performed when the genital tract was displaced in the abdominal cavity. The same ultrasonic equipment was used as previously described with 3.5 MHz curve-linear array transducers. The right and/or left flank areas were clipped and a gel used for ultrasonography was applied to the skin. The transducer was then placed and moved perpendicularly on the skin of the pelvic and abdominal cavities.

Vaginal examination with a gloved hand was performed to estimate the patency of the vagina and cervix and to evaluate the nature of any vaginal discharges. Clinical endometritis was considered when purulent vaginal discharges were found during examination (LeBlanc et al., 2002; Sheldon et al., 2006).

2.3. Surgical approaches

A unilateral ovariectomy was performed in the case of a large ovarian mass ($n = 1$) and for ablation of large ovarian hydrobursitis ($n = 31$) and hydrosalpinx ($n = 4$). The surgical technique has been previously described by Ali et al. (2011a). Briefly, the female was fixed in sternal recumbence, sedated intravenously by xylazine HCl (0.3 mg/kg bodyweight, bomazine 10%, BOMAC Laboratories Ltd., New Zealand). The flank region corresponding to the affected ovary/bursa/fallopian tube was prepared for

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