Introduction

Since the introduction of ultrasonography to veterinary medicine in the early 1980’s for examining the reproductive status of mares it has gained wide acceptance as the method of choice for examining the genital tract of many species, including camels. It can be used to monitor follicular dynamics in the ovaries and for early detection of pregnancy as well as detection and diagnosis of genital tract disease. Ultrasonography of the genital tract can be carried out per rectum, per vaginam, or via the abdominal wall. In practice, examination per rectum is most widely used in camels, with vaginal ultrasonography used only for aspiration of follicles for ovum pick-up. To examine the camel using ultrasonography per rectum the camel has to be restrained either in stocks or in the sitting position. The rectum is then evacuated of faeces before the transducer is introduced and rotated in the rectum over the ovaries and uterus. Retraction of the uterus is not necessary in camels and the probe is always maintained within the hand of the operator with the crystals facing ventrally. Thorough examination requires the transducer to be in close contact with the rectal mucosa so that the image is very clear; to acquire this the probe has to be well lubricated before insertion into the rectum. Follicular development, early pregnancies and genital tract abnormalities can then be easily visualized.

Examination for Reproductive Soundness

Ultrasonography can be used to examine the reproductive tract of female camels to identify any pathological or abnormal changes. These can include inactive ovaries, ovarian hydrobursitis, uterine cysts, or pyometra.

Inactive ovaries are generally found in camels in poor condition and can be hard to identify for the untrained operator. In general the echotexture of the ovary is very characteristic as it is more echogenic than the surrounding tissue and appears elliptical in shape, but if it is inactive there are no follicles visible. Ovarian hydrobursitis is a particular affliction of the ovarian bursa which is characterized by the accumulation of varying amounts of fluid in the ovarian bursa and encapsulation of the ovary. This can easily be visualized using ultrasonography as the ovary is seen to be floating within a black bag of fluid. The only treatment for uni- laterally affected animals is the surgical removal of the affected bursa. Bilaterally affected animals are more of a problem as you cannot remove both ovaries and restore fertility. The bursa of the affected ovary is drained using a transvaginal needle but this can only be used if there is not a huge amount of fluid accumulated, and generally the bursa refills at a later date so it has not been regarded as a successful method of treatment.

Multiple or single uterine cysts are readily diagnosed with ultrasonography. They appear as ‘black holes’ varying in size from 2 mm up to 4-5 cm in diameter within the uterus, and can be differentiated from pregnancies as they tend to be slow developing and remain well circumscribed. If large, these cysts can affect fertility by limiting the placental development of the conceptus and they are also a sign of increased degenerative changes with the endometrium of the uterus. Cysts can also be found in the broad ligament but usually these have no effect on fertility if they are limited in size. Pyometra is characterized by accumulation of fluid within the uterus which can vary from a few millilitres to several litres.

In general both uterine horns are enlarged and contain fluid which can vary in ultrasonographic appearance from non-echoic to slightly echoic with the presence of cellular debris. In these cases the uterus has to be flushed with normal saline until the recovered fluid from the uterus runs clear and then antibiotics infused (1).

Examination of follicular dynamics

Camels are seasonal breeders (October – March), showing increased ovarian activity during the cooler winter months of the season. Several people have described signs of sexual receptivity or oestrous behaviour in camels; however, all of these signs are variable in duration and intensity and are therefore unreliable for the detection of oestrus. Transrectal ultrasonography is therefore the most reliable, and thus the method of choice for monitoring the follicular dynamics in camels. As camels are induced ovulators, ovulating only when mated, the follicles have periods of growth, maturity and regression during the breeding season. It is therefore more accurate to describe the cyclical ovarian changes in the camel as a follicular wave pattern rather than an oestrous cycle.
The ovarian cycle starts with the growth phase where a cohort of small follicles develop until they reach approximately 0.9 cm in diameter, then one or two follicles become dominant and continue to grow to sizes of 1.3-1.8 cm in diameter. Using ultrasound these fluid-filled follicles are easily distinguishable as spherical, non-echogenic ‘black holes’ developing on the periphery of the well demarcated, echogenic ovary. Hence it is easy to count the number and sizes of all follicles in an ovary. Ovulation occurs 28 – 38 hrs after mating or induction of ovulation using human Chorionic Gonadotrophin (hCG) or Gonadotrophin Releasing Hormone (GnRH). Detection of ovulation using ultrasonography is very difficult unless the ovaries are scanned frequently, but is usually suspected if the dominant follicle suddenly disappears after mating (or treatment with hCG or GnRH). Sometimes, however, the wall of the follicle appears collapsed with a small, central, irregular hypoechoic area. After ovulation the first visualization of the corpus luteum (CL) is possible within 3-5 days, although it is generally not fully visible until day 5 in dromedaries. The CL is less echogenic than the ovarian stroma and appears as a protruding round structure, sometimes with a fluid filled central cavity. The luteal lifespan in camels is relatively short in comparison with other domestic species as the CL generally reaches its maximum diameter of between 1.3 and 2.0 cm by day 8 and has completely regressed by day 12–14 after ovulation. If mating or ovulation does not occur the mature follicle undergoes a period of regression lasting approximately 12 days. However, in about 50% of cases instead of regressing the follicle continues to grow to reach diameters as large as 4.0-6.0 cm. During the regression phase of these oversized follicles the follicular fluid becomes more echogenic owing to the development of free floating echogenic strands, which later become more organized into transecting fibrous bands. These over-large follicles do not, however, inhibit the growth of other follicles in the same or contralateral ovary, which can mature and ovulate if the appropriate stimulus is applied (2).

**Pregnancy diagnosis**

In managing any camel herd efficiently there is a definite need to diagnose pregnancy as accurately and as soon as possible after mating. Several methods have been described, such as rectal palpation, changes in cervical mucus and ‘tail cocking’, but ultrasonography is the most accurate for early pregnancy diagnosis. Pregnancy can be suspected as early as 15 days of gestation if a functional CL can be visualized in one of the ovaries, and then confirmed between days 17 – 18 by visualization of the embryonic vesicle. At 17-18 days of gestation the conceptus appears as a small, star shaped accumulation of fluid almost always within the uterine lumen of the left horn. Depending upon the angle of contact of the ultrasound beam with the uterus, it can appear discrete and roughy spherical in cross section or it can be irregular and elongated when the ultrasound beam transects the uterine horn tangentially. By day 20-21 the conceptus has elongated and appears as a discrete and easily recognisable accumulation of conceptus fluids, the diameter and outline of which can vary appreciably in different parts of the uterine horn. These changes are caused mainly by the endometrial folds indenting the conceptus at odd places and by movement of fluid within the conceptus while carrying out the examination. The fetus itself is first recognisable at this stage as a small echogenic ‘blob’ in the central region of the conceptus, apparently attached closely to the endometrium in the ventral region of the uterus. The fetal heartbeat can be discerned around day 25 as a rapid fluttering movement in the centre of the echogenic foetus.

Between days 20-30 the diameter of the non-echogenic conceptus fluid accumulation in the left uterine horn increases to around 20-40 mm and the echogenic foetus becomes more prominent as it enlarges steadily and appears to detach itself from the uterine wall. By day 30 a short umbilical stalk can sometimes be visible and the beating heart is easily discernible. Between days 30-40 the overall diameter of the conceptus increases more rapidly due to accumulation of foetal fluids and a clear division can be seen between the amniotic fluid surrounding the foetus and the much larger volume of allantoic fluid external to this. Beyond day 40 the diameter of the conceptus continues to increase rapidly, and by day 55 the head, neck, abdomen and individual limb buds of the foetus can be easily identified. Beyond day 60 the foetal fluids have increased to such an extent that the foetus can no longer be viewed easily as it is generally lying beyond the penetration range of a 5 MHz transrectal probe (3).

**In Conclusion**

Ultrasonography provides non-invasive and accurate visualisation and diagnosis of reproductive disorders, follicular dynamics and early pregnancy in camels and it has immediate practical application to the commercial breeding of this species.

**References;**

