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Ultrasonographic imaging of early fetal development in Black-Bengal goats

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ABSTRACT

B-mode real-time ultrasonography of five Black-Bengal goats was undertaken to assess serial development of kids *in utero*. The scanning at various stages of gestation revealed various features of development of kids. Fetus changed its shape from C-shape to oblong. The amnion appeared as dotted echoic membrane. Amnion appeared to make a sac like formation enclosing fluid inside. The full fetal images were obtained on day 46, while cotyledons on day 53. The resting on neck on back on day 63 was another important observation. On day 63 full view of placentomes was also observed. Opening of mouth and taking of fetal fluid inside was also observed during this study. The study will help the practitioners or sonographers to differentiate normal and abnormal development of early kids *in utero* in this species.

Key words : Ultrasonography, pregnancy, goat, fetal development

The ultrasonography is first replacing the age-old procedure of rectal palpation of genital tract for pregnancy diagnosis (Pieterse *et al.*, 1990). Being non-invasive, this technique allows to view and study basic anatomy of developing same fetus, *in utero*, which was not possible, previously (Buckrell, 1988). Present study was undertaken to obtain serial ultrascan images of developing fetus(es) *in utero* in five goats with a broader aim of developing a database of normal pregnancy.

MATERIALS AND METHODS

Five Black Bengal goats were scanned twice weekly from day 18 till day 63 of reported mated day. For this purpose, a linear scanner of switchabe frequency between 5 and 7.5 MHz and a ultrasound machine (Scanner 200; Pie Medical, Netherlands) was used. The goats were prepared for transrectal ultrasonography. Animals were lightly restrained by an attendant, while rectum was evacuated using fingers and small amount of gel was infused into the rectum. The scanner was fixed on a PVC pipe for the manipulation from outside. A lubricated transducer was introduced into the rectum and urinary bladder was taken as landmark for identification of early pregnancy. Four, known, non-pregnant goats were also scanned to compare the early changes in pregnant genitalia. The images of interests were recorded on video cassettes using a multipurpose VCR (Sharp, India). A print out of these images was also obtained on a printer (Sony, Japan).

RESULTS AND DISCUSSION

The non-pregnant genitalia appeared homogenous coarsely echoic without accumulation of fluid in longitudinal and cross section of scanning. Similar findings have been observed in other breeds of goat (Kahn, 1994).

On day 18, in the saggital section of the uterus, multiple fluid pockets (Fig. 1 shown by arrows) were visible inside the lumen of the uterus immediately cranial to urinary bladder (UB) with 7.5 MHz transducer. Comparative observations are not available in goats, but in sheep (Buckrell, 1988) accumulation of fluid was observed on day 16 to 17 in some cases, while in all cases by day 20 and later on. On day 23, the echoic conceptus was seen surrounded by anechoic conceptual fluid with same probe (marked by arrow, Fig.2). The early conceptus appeared as a long streak. Schrick and Inskeep (1993) got about 6 mm long image of developing conceptus in sheep.

On day 26, scanning showed amniotic membrane attached to the somewhat rounded shape conceptus (shown by arrow and C in Fig. 3). The amount of conceptual fluid increased as compared to previous scanning. On this day,

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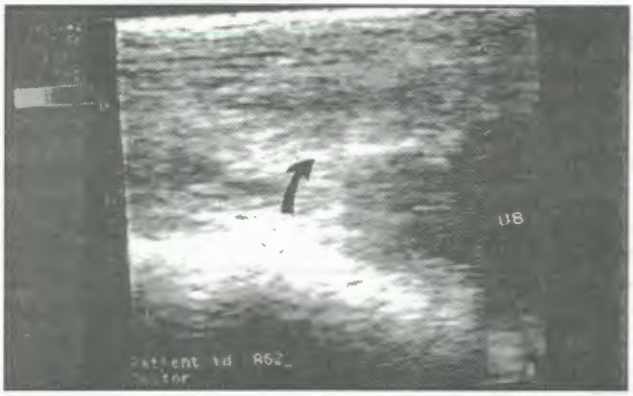

Fig.1. Saggital section through the uterus on day 18 of pregnancy with 7.5 MHz. Multiple fluid pockets (arrows) are visible inside the lumen of the uterus immediately cranial to urinary bladder (UB).

Fig.2. Uterus on day 23 of pregnancy with transrectal scanning with 7.5 MHz transducer. Echoic conceptus (C) lies in the centre of fluid in the form of elongated streak (shown by arrow).

Fig.3. Scanning on day 26 with 7.5 MHz. The rounded conceptus (C) is suspended in the centre of fluid. the amniotic membrane (arrow) forms a hyperechoic structure which extends from the conceptus into the lumen of uterus.

Fig.4. Scanning on day 32 with 7.5 MHz. Conceptus (C) in the lower third of the fluid. The amniotic membrane (AM) in the form of hyperechoic dotted line encircling the conceptus.

Fig.5. Image with 5.0 MHz transducer on day 50. Ribs (Rb) i.e. bony cage of fetus is visible.

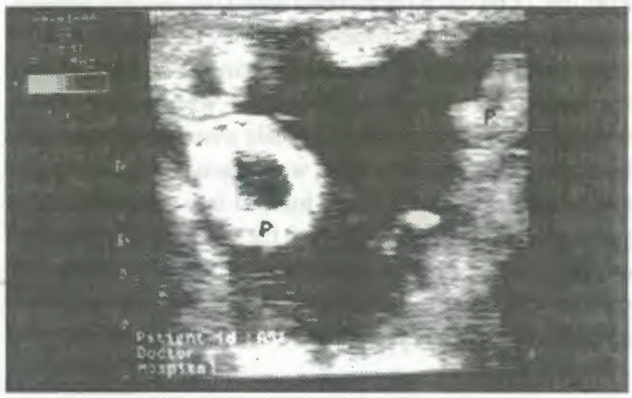

Fig.6. Image of fetus with 5.0 MHz transducer on day 60. The scan is showing two lobes of brain (arrows) and half moon shaped plaentomes 9P) facing towards the fetus.

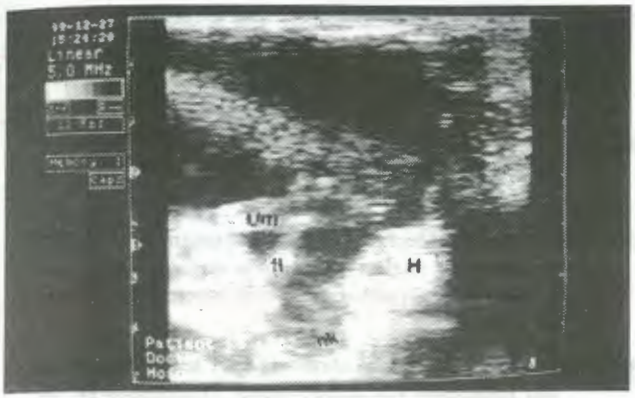

Fig.7 Image of fetus with 5.0 MHz transducer on day 63. The scan is sowing a fluid filled cavity (shown by black arrow) inside the fetal body cavity in the abdominal region.

Fig.8 Image of fetus with 5.0 MHz transducer on day 63. In the scan fetus showed bending of beck (nk) and resting its head (h) on the trunk (T). Mouth opening (shown by arrow) is clearly visible.

heartbeat was also observed. Such observations are available in sheep (Buckrell, 1988).

On day 32, oblong kind of conceptus (C) was recorded with hyperechoic dotted lines of amniotic membrane (Am : Fig. 4) with 7.5 MHz frequency. The location of conceptus was in lower portion of the image. The various shape of conceptus has been defined in cattle (Pierson and Ginther, 1984). On day 40, two divisions of the fetus with thinning in the middle and images of developing (budding) fetal limbs were seen with 7.5 MHz frequency. From the current imaging of the Black-Bengal goat, it appeared that the development is slow till day 40 as only budding was observed, whereas in sheep, Garcia *et al.* (1993) observed udding on day 35. On day 43, fetal umbilicus and head (H), trunk and optic area was recorded with 7.5 MHz. Fetus fluid was imaged on the top, while fetus on the lower side of the transducer transrectal-image. On this day, one interesting finding about sac formation by amnion was observed. It appeared that a branch of amnion enclosing fluid exists. No information exists in the literature about this, therefore, it is presumed that this might be a reserved fetal fluid. Similar sac formation has also been observed in cattle (Bhatia, 2001). On this day 5.0 MHz frequency was also used and with that endometrial folds were visible, while fetus (F) showed two-divisions of the body. The thick markings on amnion were possibly, amniotic plaques as suggested previously in ruminants (Arthur *et al.*, 1996). On day 46, scanning with 5.0 MHz transducer showed good resolution of head along with clear optic area. In another scan, full-length view of limbs along with bifurcation of hooves was observed. On this day, a clear image of full fetus was possible and it appeared that full fetus developed by tis time in this breed of goat. Haibel (1988) identified fetal head on day 46 and measured biparital diameter an indicator of fetal age.

On day 50, bony rib-cage developed as recorded with 5.0 MHz transducer (Fig. 5). The fetus increased lengthwise and it became difficult to get full length of the fetus, however, a good view of fetus was possible during bending of head towards trunk. Enlargement of fetal head with 7.5 MHz showed opening of mouth and taking of fetal fluid inside. The observations about bony cage and vertebrae have been used in the past to estimate gestational stage in ewes (Gonzalez de Bulnes *et al.*, 1998). On day 53, scanning with 5.0 MHz transducer, revealed formation of echoic area within eye. It was also possible to get a good scan of head with clear identification of mouth parts. In one scanning, it appeared that the kid opened mouth and took fetal fluid inside. Spinal vertebrae were also seen on this day. Half moon shaped, cotyledons were also identifiable on this day, while full view of cotyledons was taken later on. The placentomes were observed earlier on day 40 in one animals, but a good shape and clear image was possible on this day. Gonzalez de Bulnes *et al.* (1998) reported a great variation in the size of placentomes in ewes. Continuous measurements on the placentomes might be helpful in estimating placental growth (Doize *et al.*, 1997). On day 55, a pulsating umbilicus was observed in addition to other parts of fetus with 5.0 MHz transducer. Such observation is helpful in detecting viability of the developing kids.

On day 60, scanning on the head, showed two lobes of brain of fetus in the cranial cavity (Fig. 6). From this observation it appeared that further studies are possible of study development of cranial cavity and brain. On day 63, the fetus enlarged in size and it was not possible to get all parts of fetus in one scan. Full lenght view of forelimb, thorax and head (Fig. 7) were recorded. It was interesting to see that the fetus turned its neck and put on the trunk. Due to limitation of transducer full view of this action could not be photographed in one picture, but a turned neck resting on thorax is shown in Fig. 8. From this observation it appeared that fetus turned its neck and rest like a kid does after birth.

It is concluded that the B-mode real time ultrasonography can be employed to develop database of fetal development in goats, which can serve as reference value for detecting any abnormal development of kids *in utero*.

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