



Ultrasonographic examination of the uterus of ewes during the post-partum period



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ABSTRACT

Objective of this article is to review use of ultrasonographic examination in the uterus of ewes during the post-partum period. The technique has been employed for elucidating the process of uterine involution in that species, as well as in the diagnosis of various clinical entities. In general, there is a progressive, significant reduction in the size of the uterus, especially during the first week after lambing, in the size of the uterine lumen and the size of the caruncles of the endometrium. In cases of post-partum metritis, principal uterine characteristics that can be assessed by means of ultrasonographic examination for diagnosis and evaluation of the disorder are uterine distention, asymmetry of the organ, distention of uterine lumen, presence, quantity and texture of uterine content, thickness of uterine wall, localisation of inflammatory foci on the uterine wall, texture of uterine wall, alterations in uterine wall vascularisation and confirmation of uterine involution completion. The technique may also be applied for evaluation of the effect of treatment in cases of the disease.

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1. Introduction

The puerperium is the period after completion of parturition. The period includes many progressive changes in the genital tract for returning to normal pre-gravid state. According to Noakes (2001), the reduction of the size of the genital tract occurs at logarithmic scale, especially during the first week after lambing. In intensively managed flocks (European Food Safety Authority, 2014), where three lambings may take place every two years (or even more frequently), a normal post-partum period, with normal uterine involution is important for effective reproductive function.

In ewes, the puerperium often coincides with the anoestrous period. Even in geographic parts where the reproductive season has a long duration (e.g., in para-Mediterranean countries), the post-partum period, especially in ewes that had been mated late in the reproductive season, would coincide with the anoestrous season. Animals that lamb within the reproductive season, are likely to show reproductive activity soon after lambing. In contrast, animals that lamb outside the reproductive period only occasionally would show reproductive activity. This would lead to differences in the process of post-partum uterine involution between the two categories of sheep (Noakes, 2001).

During the 3rd to 10th day post-partum, a rapid reduction in the size of the uterus occurs, which coincides with decrease in frequency and duration of uterine contractions (Noakes, 2001) (Figs. 1 and 2). By the end of that period, weight of the uterus would have decreased by as much as 70% of that on the day of lambing. The reduction in the size of the uterus is reverse to the process of increase of tissue collagen concentration in the organ (in the endometrium: 7- to 8-fold). At that time, the endometrium restoration takes place in a sequel of procedures: 16 days are needed for degeneration of the surface of the caruncles and removal of the surface of the uterus (Noakes, 2001); lochia, in various colours and reducing volumes, but, during normal involution non-malodorous, are present at that time in the uterus (Tzora et al., 2002). Regeneration of the superficial layer of the endometrium is considered to be complete by the 28th day post-partum.

Various techniques have been proposed for the study of uterine involution in ewes, e.g., hormone measurement (Ishwar, 1995; Degefa, 2003), radiographic imaging (Tian and Noakes, 1991; Goddard, 1995), laparoscopic investigation (Ishwar, 1995) or post-mortem examination (Rubianes and Ungerfeld, 1993; Ababneh and Degefa, 2005; Degefa et al., 2006). Some of the disadvantages of the above techniques include invasiveness, reduced accuracy, difficulty to apply in clinical conditions and need to sacrifice the experimental animals.

Ultrasonographic examination is a technique that lacks those limiting factors. Actually, it is the only non-invasive techniques that

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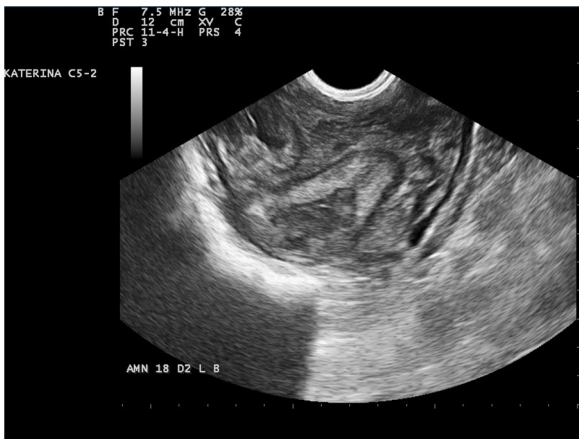


Fig. 1. B-mode ultrasonographic presentation of uterus during post-partum involution; longitudinal section taken on the 2nd day post-partum during transcutaneous examination at the inguinal area. Image taken and processed on a MyLab® 30 ultrasonography system (ESAOTE SpA, Genova, Italy) with convex transducer, imaging frequency: 7.5 MHz—scanning depth: 120 mm.



Fig. 2. B-mode ultrasonographic presentation of uterus during post-partum involution; transverse imaging taken on the 10th day post-partum during transcutaneous examination at the inguinal area. Image taken and processed on a MyLab® 30 ultrasonography system (ESAOTE SpA, Genova, Italy) with convex transducer, imaging frequency: 7.5 MHz—scanning depth: 120 mm.



Fig. 3. B-mode ultrasonographic presentation of uterine horns during post-partum involution; longitudinal section of the horns taken on the 7th day post-partum during transcutaneous examination at the right lateral abdominal area. Image taken and processed on a MyLab® 30 ultrasonography system (ESAOTE SpA, Genova, Italy) with convex transducer, imaging frequency: 7.5 MHz—scanning depth: 100 mm.

may reveal details of the progressive changes in the uterus of ewes. Various authors have reported extensive studies of the genital system during the post-partum period in other animal species: cows (e.g., Okano and Tomizuka, 1987), mares (e.g., Griffin and Ginther, 1991), sows (e.g., Irie, 1987), bitches (e.g., Yeager and Concannon, 1990; Pharr and Post, 1992; Orfanou, 2012) and queen cats (e.g., Ferretti et al., 2000).

Objective of this article is to review use of ultrasonographic examination in the uterus of ewes during the post-partum period. The technique has been employed for elucidating the process of uterine involution in that species, as well as in the diagnosis of various clinical entities.

2. Methodology of ultrasonographic examination

2.1. Equipment

A real-time B-mode ultrasound, with various multi-frequency transducers is best for use. Convex transducers with 2.5–7.5 MHz frequency and linear transducers with 7.5–12.0 MHz frequency for examination by the transcutaneous technique, as well as transducers for examination by the transrectal technique (frequency: 5.0–7.5 MHz) would cover most requirements. A higher frequency during imaging would provide improved image quality, but would reduce scanning depth of the procedure. Reduced frequency (3.0 MHz) can be used for deep, intra-uterine imaging, mid-range frequency (5.0 MHz) for general use and increased frequency (≥ 7.5 MHz) for detailed scanning structures in short distance from the transducer (Buckrell, 1988).

2.2. Examination technique

2.2.1. B-mode examination

Examination of the genital system can be performed by the transcutaneous or the transrectal technique. During the examination, longitudinal or transverse images of the uterus can be taken.

For examination by the transcutaneous technique, hair in the abdomen should be fully clipped and coupling gel should be applied thereupon. The ewe is examined in the standing position, inside a crate or a box, which would reduce her ability to move and increase comfort of the examiner, or in the cast position with the forelimbs held by an assistant. During the examination, the transducer is placed on the abdominal wall, immediately in front of the udder, with caudal direction. Imaging starts by locating the bladder (*vesica urinaria*), which can be used as an acoustic window, to facilitate examination at longitudinal or transverse planes, especially after the first week post-partum. Alternatively, the transducer can be placed on the inguinal area and moved from lateral to ventral and from caudal to cranial direction. The uterus (*uterus*) is located ventrally to the rectum (*rectum*) and laterally or dorsally to the bladder. The probe is moved cranially, in order to image the uterine horn bifurcation; then, it is moved laterally to ventrally and caudally to cranially, in order to image the uterine horns (*cornu uteri*). Images are obtained on the longitudinal and the transverse ultrasonographic planes. Ideally, a 90–100 mm scanning depth is used (Figs. 3 and 4). Immediately after parturition, especially up to the 2nd day after lambing, the mass of the uterus can be particularly pronounced, hence a scanning depth of 120–150 mm might be necessary during that period for optimal imaging (Figs. 5 and 6). During the examination, echogenicity of the uterus, number of layers in the uterine wall: perimetrium (*tunica serosa, perimetrium*), myometrium (*tunica muscularis, myometrium*) and endometrium (*tunica mucosa, endometrium*), presence of content in the uterine lumen (*cavum uteri*) and width of uterine body (*corpus uteri*) and

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