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Ultrasonographic examination of the scrotal contents in rams

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ABSTRACT

Objective of the present article is the presentation of the technique for ultrasonographic examination of the external genitalia of rams, with detailed examples in healthy animals or animals with various disorders of the genitalia. The article indicates in detail the methodology for B-mode ultrasonographic examination of the scrotum and the scrotal content (testes, epididymides, vessels). Further, it provides detailed ultrasonographic findings during the examination of healthy animals, as well as animals with various diseases of the genitalia. Finally, use of the technique within the frame of health management in flocks is discussed. It is concluded that ultrasonographic examination of scrotal content of rams can be a useful technique that may be used successfully and conveniently for diagnostic purposes of genitalia of rams, as it is an excellent ancillary test during evaluation of the reproductive ability of rams, having practical and diagnostic advantages, thus supporting veterinary work in sheep flocks.

1. Introduction

Ultrasonographic examination of the genitalia of rams can be used to complement the clinical examination of the animals, thus increasing the reliability of the findings. Ultrasonographic examination combines various general advantages: non-invasive, non-ionising, non-damaging, provision of real-time, sequential information. The technique is useful for the examination of scrotal content of rams for interpreting uncertain clinical findings, for detecting early stages of pathological processes and for monitoring changes in lesions. Objective of the present article is the presentation of the technique for ultrasonographic examination of the external genitalia of rams, with detailed examples in healthy animals or animals with various disorders of the genitalia.

2. Equipment

Ultrasonographic examination of the scrotal contents of rams may be performed with linear or convex transducers. Linear transducers are capable of emitting high frequencies that allow improved visualisation of anatomic details and resolution, but have decreased tissue penetration, whilst they may not be applied properly on the curvilinear surface of the scrotum. Ideally, a convex transducer should be used initially to scan the entire scrotal contents, to measure testicular dimensions and to compare the two sides of scrotal content between them. This can be followed by scanning by means of a linear transducer, which can be used for imaging details in the scrotal content.

3. Methodology of ultrasonographic examination and ultrasonographic findings in the genitalia of healthy animals

Ultrasonographic examination of scrotal contents should take place in a clean and dry place, where lighting is minimum. The animal should be restrained by an assistant, whom would also lift the tail; most often, use of sedatives should not be required. Scrotal hair should be trimmed, especially in animals with increased hair growth in the area. Coupling gel is applied on the scrotum, ideally 20 min before scanning. In animals, in which the area is soiled or covered by sebum, it is advisable to wash it with soap before gel application (Gouletsou et al., 2003).

3.1. B-mode ultrasonographic examination of the testes and epididymides

The testes should be pulled downwards within the scrotum and maintained in that position not by grasping, but left pending. The examiner's left hand is placed on the surface opposite to the one where the transducer is applied upon, in order to stabilise the organs (Suppl. material 1) (Gouletsou et al., 2003).

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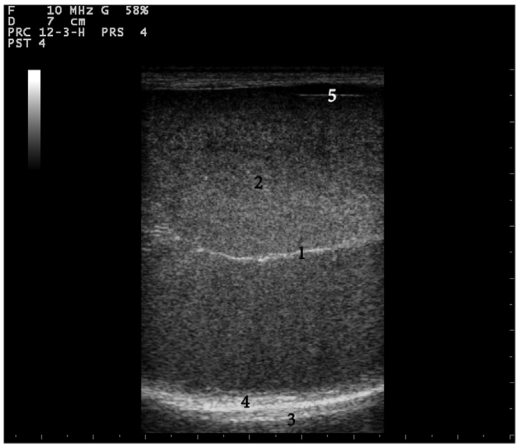

Fig. 1. Middle sagittal ultrasonographic image of testis of healthy ram, where the mediastinum testis is thin and moderately echogenic (1: mediastinum testis, 2: testicular parenchyma, 3: scrotal skin, 4: scrotal tunics, 5: tunica albuginea).

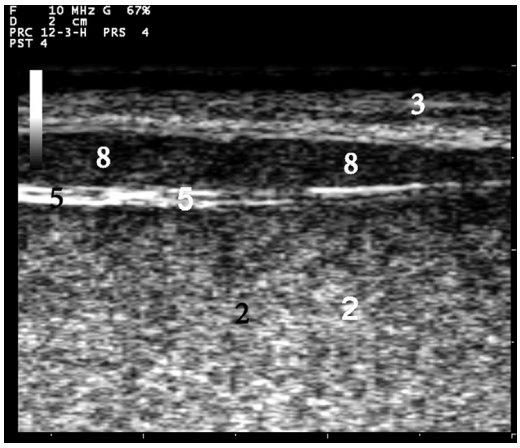

Fig. 2. Sagittal ultrasonographic image of testicular parenchyma and epididymal body of healthy ram (2: testicular parenchyma, 3: scrotal skin, 5: tunica albuginea, 8: epididymal body).

B-mode ultrasonographic examination is initially performed. The transducer is initially placed on the caudal surface of the scrotum, in the middle of the testis. Adjustments in frequency, scanning depth, focal zone, overall gain and time gain compensation (TGC) are applied, to allow the testicular parenchyma to appear homogeneously throughout. Scanning depth depends on size of the testis and size of the scrotum and may vary from 2.0 cm in newborn animals to 12.0 cm in adults. However, in pathological conditions, greater depth may be needed, as scrotum may be enlarged. Selection of optimal frequency depends on size of the organ under examination, type of the transducer employed and efficiency of the ultrasound unit. As a general rule, the higher frequency that would allow imaging at the required depth should be applied. A frequency of 5.0 MHz may be needed to image the entire scrotum, whilst a frequency as high as 12.0 MHz may be needed to examine small size testes or to focus on pathological findings.

After appropriate adjustments, the transducer is placed on the caudal surface of the testis along its longitudinal axis (sagittal plane) and is moved from left to right, in order to image the testicular parenchyma and the body of the epididymis (*corpus epididymidis*) (Suppl. material 2). Normal testicular parenchyma is imaged homogeneous, with median echogenicity (Fig. 1; Suppl. material 2–4); its appearance is not influenced from prior ejaculation (Cartee et al., 1990; Ahmad et al., 1991; Gouletsou et al., 2003; Andrande et al., 2014). When the testes are examined during the reproductive season, their echogenicity can be imaged to be slightly reduced compared to that outside the season. Further, when comparing testes of prepubertal or pubertal lambs of a similar age, there is predominance of images with decreased echogenicity in the former animals and moderate echogenicity of images in the latter ones (Andrande et al., 2014). A hyperechoic linear structure, corresponding to mediastinum testis (*mediastinum testis*), is usually imaged in the middle of each testis, occupying up to two thirds of its length (Fig. 1) (Suppl. material 3, 4). The mediastinum testis is classified as having moderate (Fig. 1; Suppl. material 4) or increased (Suppl. material 3, 4) echogenicity or being diffuse (Suppl. material 4), showing increased echogenicity and thickness in direct proportion with the animal age (Gouletsou et al., 2003; Andrande et al., 2014), whilst occasionally in pre-pubertal animals it may not be identified clearly (Suppl. material 4). The epididymal body is imaged medially to the testis, towards the scrotal septum, as a hypoechoic formation, when a high frequency probe is been used (Fig. 2; Suppl. material 5).

Variable hyperechoic flakes are occasionally observed at the sites the radiating sheets of connective tissue arising from mediastinum testis exist (Ahmad et al., 1991). The testicular dimensions can be measured by using a convex transducer and may, subsequently, be used for calculation of the testicular volume by employing the formula for calculation of the volume in ellipsoid structures ($V = 0.523 \times \text{length} \times \text{width} \times \text{height}$).

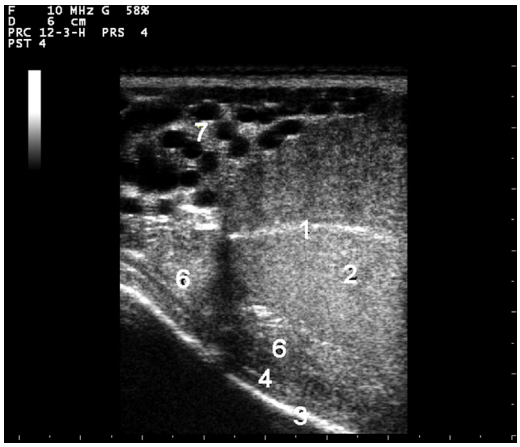

Fig. 3. Sagittal ultrasonographic image of upper testicular parenchyma, epididymal head and pampiniform plexus of healthy ram (1: mediastinum testis, 2: testicular parenchyma, 3: scrotal skin, 4: scrotal tunics, 6: epididymal head, 7: pampiniform plexus).

The transducer is moved upwards, in order to image the neck of the scrotum, the head of the epididymis (*caput epididymidis*) and the pampiniform plexus (*pampiniform plexus*) (Suppl. material 2). In order to examine the head of the epididymis, the transducer is placed at the scrotum seam and turned towards the lateral surface of the scrotum. The head of the epididymis is imaged more heterogeneous and hypoechogenic than the nearby testicular parenchyma (Fig. 3; Suppl. material 6 in sagittal plane, Suppl. material 7, 8 in dorsal plane) (Ahmad et al., 1991; Gouletsou et al., 2003). However, in younger animals, the epididymis may be isoechoic to the testicular parenchyma, which can be explained by a low echogenicity of that in such animals, which is closer of the pattern generally described for the epididymal tail (Andrande et al., 2014). The pampiniform plexus is clearly imaged above the head of the epididymis as a dome-shaped structure containing anechoic, rounded or loop-like areas, corresponding to spermatic vessels (Suppl. material 9).

Then the transducer is moved downwards again to image the lower part of the testicular parenchyma and the tail of epididymis (*cauda epididymidis*) (Suppl. material 2). In healthy animals, the tail

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