



## Anatomical and ultrasonographic characteristics of testicular abscesses and testicular microlithiasis: a case study of 5 kazakh rams

[Características anatômicas e ultrassonográficas dos abscessos testiculares e microlitíase testicular: um estudo de caso de cinco carneiros cazaques]

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### ABSTRACT

Anatomical and ultrasonographic diagnostic work-up of testicular abscesses (n = 2) and testicular microlithiasis (n = 3) in Kazakh rams is described. For testicular abscesses, the localized symptoms include enlargement of the testicle and decreased elasticity, accompanied by varying degrees of pain and fever, abnormal behavior, walking or urinating with legs spread apart and accompanied by painful moans. Ultrasound findings: several hypoechoic or fluid dark areas with irregular morphology appear within the testicular parenchyma, with unclear borders with the surrounding normal tissues and uneven internal echogenicity. An autopsy revealed unilateral caseous necrosis with degeneration of all testicular tissues. Testicular microlithiasis does not present clinically and normal semen quality is not affected. Ultrasound findings: sparse, scattered, or dense punctate, pinpoint-like echogenic dots, some with comet tail signs and no acoustic shadow, are seen in the testicular parenchyma. The routine treatment for testicular abscesses is surgical drainage, but when degeneration and necrosis of testicular tissue occur, leading to severe systemic symptoms, the animal must be put down. Testicular microlithiasis is relatively rare and there are no effective treatments or interventions available, but it remains a potential contributor to testicular dysfunction and other secondary conditions.

Keywords: ram, ultrasonography, testicular abscesses, testicular microlithiasis

### RESUMO

Descreveu-se o diagnóstico anatômico e ultrassonográfico de abscessos testiculares (n = 2) e microlitíase testicular (n = 3) em carneiros do Cazaquistão. No caso de abscessos testiculares, os sintomas localizados incluem aumento do testículo e diminuição da elasticidade, acompanhados de vários graus de dor e febre. Observou-se comportamento anormal, com o animal andando ou urinando com as pernas abertas, acompanhado de gemidos dolorosos. Achados ultrassonográficos: várias áreas hipocogênicas ou escuras fluidas com morfologia irregular aparecem no parênquima testicular, com bordas pouco nítidas, com os tecidos normais circundantes e ecogenicidade interna irregular. Uma autópsia revelou necrose caseosa unilateral com degeneração de todos os tecidos testiculares. A microlitíase testicular não se apresenta clinicamente e a qualidade normal do sêmen não é afetada. Achados ultrassonográficos: pontos ecogênicos esparsos, dispersos ou densos, pontilhados, semelhantes a alfinetes, alguns com sinais de cauda de cometa e sem sombra acústica, são vistos no parênquima testicular. O tratamento de rotina para abscessos testiculares é a drenagem cirúrgica, mas, quando ocorre degeneração e necrose do tecido testicular, levando a sintomas sistêmicos graves, o animal deve ser eliminado. A microlitíase testicular é relativamente rara e não há tratamentos ou intervenções eficazes disponíveis, no entanto continua sendo um possível contribuinte para a disfunção testicular e outras condições secundárias.

Palavras-chave: carneiro, ultrassonografia, abscessos testiculares, microlitíase testicular

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## INTRODUCTION

A testicular abscess is an infection at the testicle or epididymis that develops into a purulent lesion. Symptoms of a testicular abscess include testicular pain, swelling, fever, and chills. If the abscess ruptures, it may lead to pus in the scrotum. The main causes of testicular abscess are bacterial infection, decreased immunity, trauma, and surgical complications. The main routes of bacterial infection are the urinary tract, blood or lymphatic vessels (Santos *et al.*, 2019; Ferreras *et al.*, 2007). In other cases, some less common surgeries, such as penile surgery and vasectomy, may also lead to testicular abscesses. When the ultrasound shows reduced testicular echogenicity, it indicates severe testicular damage.

TM is a rare testicular condition with no clinical symptoms in sheep, and can be detected incidentally during ultrasound examination for other conditions in the scrotum (Stewart and Shipley, 2021; Balara *et al.*, 2022). There is almost no research on TM in the field of animals. In human medicine, the etiology of TM is unknown and may be due to the interaction of some factors, including malnutrition, environmental stress, endocrine disruption, and genetic factors (Gonzaga-Carlos *et al.*, 2022; Galván-Montaña *et al.*, 2021). Due to the superficial location of the scrotum, clinical use of X-ray and CT examinations is less likely (Trinci *et al.*, 2020). Ultrasound examination of the testicles is easy, intuitive, and does not cause radiological damage (Murtaza *et al.*, 2019). Testicular disease is a direct threat to reproductive function and it is essential to diagnose it at an early stage. B-mode ultrasound or color Doppler ultrasound can be used to visualize the testicles in terms of size, shape, number, internal echogenicity, and blood flow (Samir *et al.*, 2021). When the testis is damaged, the degree of testicular damage can be assessed objectively by combining the sonographic features, which are mainly in the form of enlarged testes and decreased echogenicity. When the testicular peritoneum is intact, there is a hematoma under the peritoneum, the testicular parenchyma is free of fissures and a crescent-shaped or anechoic area can be observed on ultrasound (Williams *et al.*, 2010). In contrast, in a ruptured testicle the peritoneum is interrupted, and irregular areas of hemorrhage are visible

within the parenchyma. The outline of the ruptured testicle will not be well defined and the parenchymal echogenicity of the testicle will not remain homogeneous, while the peritoneal echogenicity is interrupted and there are irregular areas of high and low echogenicity (Smith *et al.*, 2009).

Ultrasonography is a non-invasive technique that is very useful in evaluating the quality of ram semen in breeding and reproductive work. This study aimed to report the anatomical and ultrasonographic features of testicular abscesses and testicular microlithiasis (TM) in rams and to provide a basis for the clinical differential diagnosis of testicular diseases and relevant information on the clinical aspects of infertility in rams.

## CASUISTRY

This study was approved by the Biology Ethics Committee of Shihezi University. The instruments used are Model 50s Tringa Vet Veterinary Portable Ultrasound with 3.5/5.0MHz inverter convex array probe and 5.0-7.5MHz inverter linear array probe, manufactured by Piemed ICAL, The Netherlands. During the implementation of a reproductive health program on some Xinjiang large-scale sheep farms, 5 *Kazakh* rams with testicular abnormalities were found, a half-grazing and half-housed feeding system.

According to the historical investigation and clinical symptoms, it was found that 2 *Kazakh* rams had abnormally enlarged testes. The clinical presentation of localized symptoms mainly includes one-sided enlargement of the testicle, and decreased elasticity, accompanied by varying degrees of pain and fever. The systemic symptoms are manifested as restlessness, coarse coat, rapid breathing, body temperature rises to above 40°C, and decreased appetite. Abnormal behavior, frequent looking after the abdomen, arching the back, and shrinking the abdomen, walking or urinating with legs spread apart and accompanied by painful moans.

Ultrasound sonograms of the testes of normal healthy sheep presents: ① Longitudinal scanning of the head of the testis on the dorsal side of the scrotum (caudal to the testis) towards the abdomen where the scrotum is attached. The

interior of the testis is homogeneous and moderately echogenic with well-defined borders and oval outline (Figure 1 A). The entire epididymis cannot be visualised on either side. The epididymis can be scanned on both sides by turning the probe placed in the middle of the scrotal base to visualize the head or tail, which has an echogenic reflection similar to that of the testes. The soft tissues of the testes have a good consistency of density structure. The stronger central echogenic reflex area is represented by the longitudinal testicular septum, with the testicular reticulum showing a bright line. ② Scanning from the dorsal side of the scrotum

towards the abdomen, parallel to the transverse axis of the caudal part of the scrotum showing the transverse image. The echogenic features of the ultrasound are also the same as above, with well-defined margins and an oval shape (Figure 1B). ③ Scanning on both sides of the scrotum, or on the vertical side of the longitudinal groove of the testicle, which is scanned parallel to the ground or parallel to the sagittal plane of the testis, showing a sagittal section image. Most of the sonograms of the two testes can be presented, with clear borders and a homogeneous, homogeneous, moderately intense internal echogenicity (Figure 1 C).

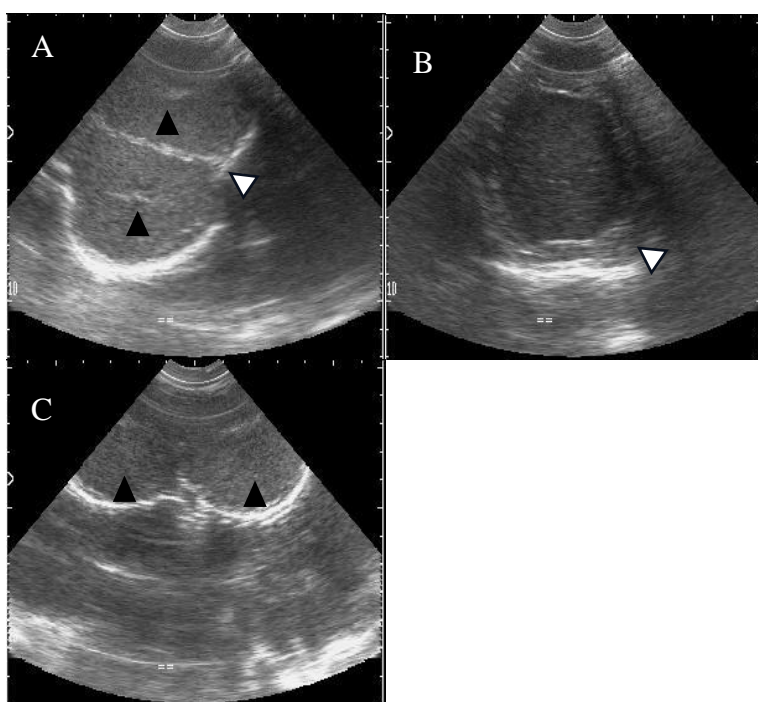


Figure 1. Ultrasound sonograms of the testes: (A) Longitudinal sonogram of the testis: The black triangles point to the mediastinum scrotum and the white triangle to the testis; (B) Transverse (unilateral) sonogram of the testis: The white triangle points to the cauda epididymis; (C) Sagittal sonogram of the testis: Black triangles point to testicular tissue.

Descriptive statistics were performed using SPSS (IBM® SPSS® Statistics 25.0) for all values expressed as mean  $\pm$  standard deviation.

## RESULTS

2 *Kazakh* rams were diagnosed with testicular abscesses by ultrasonography. The age of the sheep with testicular abscess was  $2.75 \pm 0.35$  years, weight was  $61.15 \pm 3.3\text{kg}$ , and rectal temperature was raised to  $40.85 \pm 0.49$  °C.

Ultrasonography revealed mainly a one-sided testicular abscess, which was observed to be asymmetrical on both sides of the testicle, with significant unilateral enlargement. several hypoechoic or fluid dark areas with irregular morphology appear within the testicular parenchyma, with unclear borders with the surrounding normal tissues and uneven internal echogenicity. But the abscess membrane is clearly defined by the echogenicity of the testicular tissue so that the overall outline of the

abscess echogenicity is well defined. Separate ultrasound scans of the abnormal testis were

performed, which followed the longitudinal, transverse, sagittal, and oblique. (Figure 2).

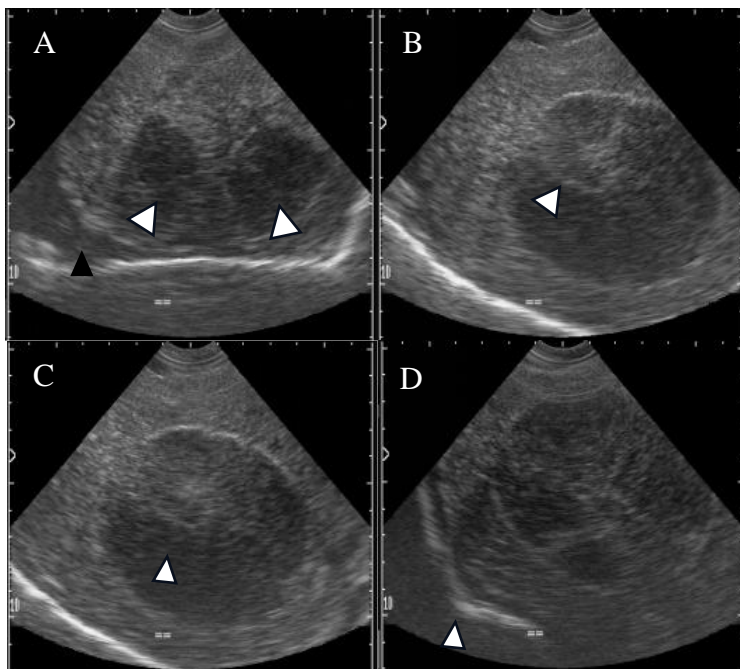


Figure 2. Ultrasound sonogram of a unilateral testicular abscess: (A) Longitudinal sonogram of the testis: White triangles point to the area of the abscess with multiple areas of scattered heterogeneous hypoechogenicity. the black triangle to the scrotal abscess with an echogenic dark area of fluid; (B) Transverse sonogram of the testis: White triangles point to multiple areas of scattered inhomogeneous hypoechogenicity are seen; (C) Oblique sonogram of the testis: Sagittal sonogram of the testis: White triangle points to the presence of a large patchy anechoic area, an area of the abscess; (D) Abscess causing irregular testicular contours (White triangle).

Sheep with mild illness have chosen a treatment plan involving surgical drainage and antibiotics. Preoperative closure of the spermatic cord was done with procaine benzylpenicillin suspensions (Inject about 1mL, 300,000 units of benzylpenicillin/mL). Positioned at the perineum on either side of the penis, 30 ml of procaine hydrochloride injection (local infiltration anesthesia, Concentration of 0.5%-1%) is injected at multiple points. Postoperative antibiotic therapy with ceftiofur sodium was chosen, which was administered at 5 mg/kg of body weight on the first day and thereafter at 3mg/kg for 5 consecutive days, all by intramuscular injection. One month later at the re-examination, the ram had normalized his spirits and appetite. Another ram with very severe clinical symptoms was eliminated and euthanized. The enlarged testis was cut open and oozed earthy yellow pus (Figure 3 A). The pus cavity was thickened with pus masses, intrinsic

sheath and pus membrane adhesions (Figure 3 B) and cleaning of the pus cavity revealed the presence of abnormal growths (Figure 3 C).

Although some rams did not have abnormal enlargement of the testes and epididymis, ultrasound showed the presence of speckles within the testes, varying in number and size, with significantly higher echogenic intensity than normal tissue (Figure 4). 3 sheep were initially diagnosed with TM. The age of the sheep was  $5.83 \pm 0.83$  years, weight was  $77.90 \pm 1.31$ kg, and rectal temperature was  $39.00 \pm 0.15$ °C. As ultrasound is only used as an aid to diagnosis, it needs to be combined with other conditions to reach a definitive diagnosis. A conservative observation strategy was adopted in consultation with the manager due to animal welfare and fertility considerations. No anatomical studies were carried out as neither semen quality nor clinical symptoms were abnormal in the rams.

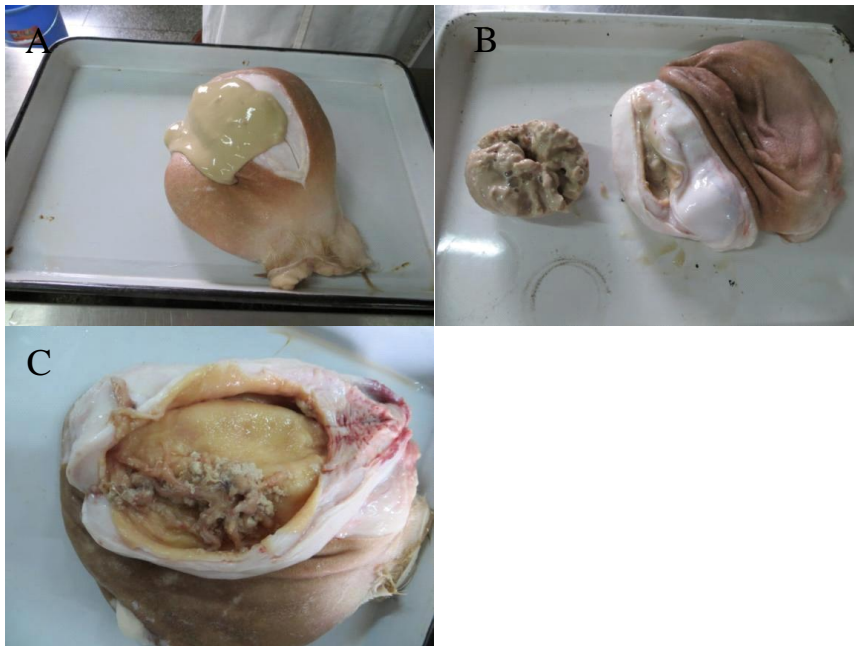


Figure 3. Anatomy of a testicular abscess: (A) Oozed earthen yellow pus; (B) The testicular tissue has degenerated and become necrotic and formed a caseous substance; (C) abnormal growths.

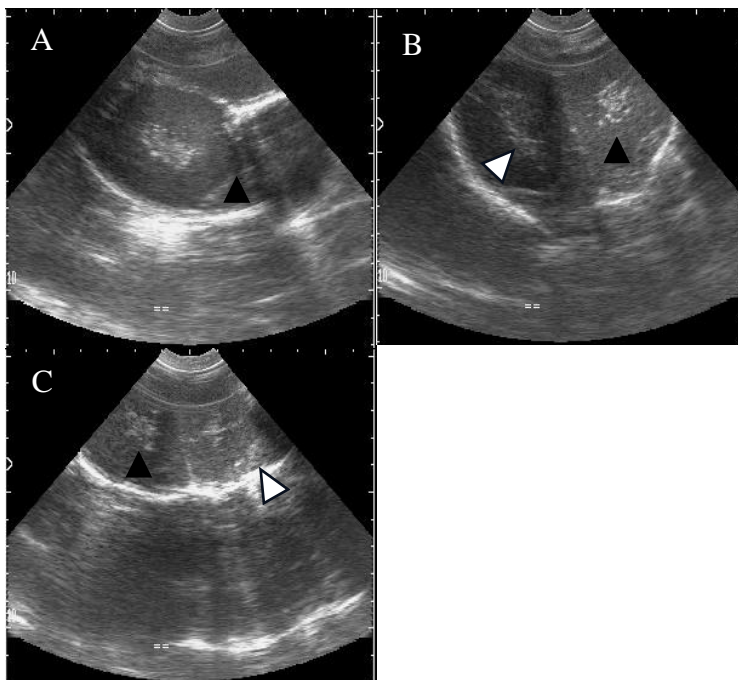


Figure 4. Ultrasound sonogram of microlithiasis of the testis: (A) Longitudinal sonogram of the testis: Dense dot-like (black triangle), pinpoint echogenic spots in the testis; (B) Transverse sonogram of the testis (both sides): The black triangle points to the lesion, which is seen as a sparse, scattered, strongly echogenic spot. The echogenicity of the testicular tissue on the other side is reduced and strong echogenicity is seen near the mediastinum, suggesting that tiny calcium crystals (white triangle) are forming; (C) Sagittal view sonogram of the testes (both sides): White triangle pointing to strong echo points scattered independently of each other. Black triangle points to dense strong echo spots.



## DISCUSSION

Through the study of the ultrasound imaging characteristics of testicles in different breeds of sheep, this research found that the main regularity is that the cross-section contour of the sonogram is clear, the border is distinct, and the internal echogenicity of the testicle and epididymis is uniformly medium-strong. A sonographic spectrum of the normal sheep testis has been established, which serves as a basis for the diagnosis of testicular disease and provides relevant information for the clinical aspects of the treatment of infertility in rams.

Kazakh rams are usually more independent, territorial, and aggressive in fighting over territory. The half-grazing, half-housed feeding system may lead to intense competition between rams, which are territorial and may clash over food and space. This competition may lead to rams' testicles being bumped or squeezed, which, if not detected in time, leads to infection and abscess formation.

Age is an important factor in the development of the TM, as the spermatogenic tubules gradually dilate with age and foci of calcification in the lumen increase, leading to the development of TM (Stang *et al.*, 2021). A review of the breeding records of the farm shows that rams are usually used for 5-6 years and have a life expectancy of 5-8 years (up to 12 years). In addition, TM may be induced by inflammation caused by different disease processes inside and outside the testicles (Dascanio *et al.*, 2019). Because of its characteristic sonogram, the diagnosis can be confirmed without invasive puncture biopsy. TM is often more closely associated with cryptorchidism, testicular tumors, varicocele, and other conditions (Bornman *et al.*, 2010).

During clinical examination, some rams are found to have diseases of the testes and epididymis, some of which can be initially diagnosed by B-mode ultrasound, such as abscesses and microliths, but there may be other diseases such as orchitis, epididymitis, hematomas, granulomas and early tumors that require other tests to be combined to confirm the diagnosis (Dascanio *et al.*, 2019). Diagnostic operations such as pathological puncture biopsies and cytological examinations can be performed

under ultrasound guidance to shorten the diagnostic time, reduce pain and pinpoint the lesion site. It also enables real-time observation of the relationship between the needle and the tissue during puncture to avoid damaging surrounding tissue or causing complications and to improve diagnostic accuracy.

The main limitation of this study is that routine analysis of blood and Routine urine test were not performed. There was no testing of white blood cell counts and classification to determine the presence or extent of spreading infection, and the assessment of the condition was not highly scientific or rigorous.

Ultrasound allows alternating or continuous dynamic observation over a short period time to assess the various phenomena of reproductive physiology and helps to obtain important morphological information. The report describes the anatomical and ultrasound features of testicular abscesses and TM in rams to provide a basis for the differential diagnosis of testicular disease. In large-scale housing sheep farms, the testicles of rams should be regularly examined by ultrasound to observe the presence of lesions inside the testicles for timely treatment or early sacrifice.

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