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Urethral obstruction in a ram with a periurethral abscess: clinical findings, diagnostic imaging and pathology

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Abstract

Background Urethral obstruction is a common and life-threatening condition in male small ruminants.

Case presentation This case report describes a 3-year old 103 kg Zwartbles breeding ram, presented with the complaint of straining, suspected to have an urethral obstruction. The work-up included clinical examination, laboratory analyses, ultrasound imaging, (contrast) radiography and urine examination. At presentation, blood analysis revealed a respiratory alkalosis, hyperkalaemia and mild azotaemia. On transabdominal ultrasound an enlarged bladder (diameter 11 cm) and free fluid surrounding the right kidney were observed. Treatment of the animal included tube cystostomy, intravenous perfusion, antimicrobial treatment, ammonium chloride and NSAIDs. No indications for urolithiasis were found on ultrasound, radiography, or urine examination. As no improvement was seen despite 16 days of therapy, a contrast radiograph of the urinary tract, as well as reproductive exam were conducted. Positive anterograde urethrogram showed a contrast filled cavitary lesion at the caudal aspect of the pelvic urethra. The reproductive ultrasonography revealed the same large urethral distention or abscess compressing the pelvic urethra, as well as severe testicular degeneration in both testis. The results of the contrast radiograph and the reproductive exam lead to the decision to euthanize the animal, as the animal would not be capable of breeding. Computed tomography was performed post-mortem, which showed close relation between the cavitary lesion and the left bulbourethral gland. Pathology revealed a lymphoplasmacytic to suppurative infection at the level of the urogenital tract, chronic interstitial nephritis and a perirenal to cortical abscess of the right kidney as well as a periurethral abscess. As for the reproductive system, multifocal interstitial inflammatory infiltrates were seen on the entire system. Marked fibrosis and atrophy was seen at the level of the testes and both epididymides.

Conclusions A periurethral abscess should be included in the differential diagnosis for an urethral obstruction in small ruminants. The extensive medical imaging, together with the ante-mortem and post-mortem findings, makes this a good reference case for diagnosticians confronted with urethral problems in a ram.

Keywords Computer tomography, Urinary tract infection, Nephritis, Testicular and epididymal fibrosis

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Background

Urethral obstructions are a prevalent and a life-threatening problem in rams. This condition has a great economic impact in sheep and is difficult to treat due to the urogenital anatomy of this species [1]. The most well-known and frequent aetiology is urolithiasis [1], which primarily affects early castrated males since urethral development is testosterone dependent [2]. Next to calculi, other causes such as blood clots [3] and trauma [4] can cause urethral obstruction in sheep. In ruminants in general, congenital urethral anomalies, such as hypospadias and urethral dilatation are described, as well as acquired affections, such as urethral ruptures [5]. In non-ruminant species, differential diagnoses for urethral obstructions other than calculi include urethral strictures, urinary tract neoplasia, granulomatous/proliferative urethritis, reflex dyssynergia, prostatic neoplasia or hyperplasia, idiopathic obstruction, urethral plugs, nerve disorders and tumour/abscesses/cysts of pelvic organs [6–10].

In addition to urethral obstruction, posthitis and urinary tract infections are important urologic conditions in male small ruminants [2]. Urinary tract infections can be localized in the lower urinary tract, or ascend to the kidneys causing pyelonephritis [2].

The increasing importance of small ruminants as hobby animals results in the economic liberty to perform advanced diagnostics in these species. Although recent research describes the management of urethral obstruction, including the use of radiography (RX) and ultrasonography (US), the use of computed tomography (CT) is not mentioned [1]. Depending on the radiopacity of the uroliths, RX might give little information, and transabdominal and transrectal ultrasound has limitations due to the size and body condition of the animal [11]. Since the aetiology is not always urolithiasis and considering the limitations of RX and US, advanced diagnostics such as CT may be required. However, scant literature is available on computed tomography in farm animals [12, 13], but in sheep specifically, information is nearly absent [11, 14], making the interpretation of diagnostic imaging challenging.

In this article, we present a case of urethral obstruction caused by a periurethral abscess in a ram with ascending infection of the urinary tract and degeneration of the testes and both epididymides.

Case presentation

Ante-mortem

A 3,5-year old Zwartbles breeding ram was presented with the complaints of anuria and tenesmus, developed 2 days prior to presentation. No defaecation was seen since the beginning of the clinical signs. Treatment with hyoscine butylbromide (Buscopan® Compositum, Boehringer Ingelheim bv, Alkmaar, The Netherlands) by the referring veterinarian was conducted the day before arrival but did not improve the clinical condition. Its ration consisted mainly out of hay, maize and beet pulp. This was supplemented with grains (barley and wheat), alfalfa, brewers' spent grain, carrots, minerals and chalk. The ram had a high economic value due to his specific characteristics, genetics and use as a breeding ram. There were no reported issues of decreased reproductive performance during the prior period. Clinical examination was performed according to Stockler et al. [15]. The animal weighed 103 kg, had a good body condition of 3/5, and was slightly apathic. Clinical examination showed a body temperature of 38.8 °C (39–39.7 °C), a heart rate of 132 beats per minute (70–80 bpm) and respiratory rate of 88 breaths per minute (12–20 bpm). Mucous membranes were pink and capillary refill time was <2 s. No faeces were present. On auscultation, enhanced vesicular respiratory sounds, atony of the rumen, diminished borborygmi and sloshing sounds on the right dorsal side were heard. No other abnormalities were disclosed on clinical examination. A heparin-coated tube and serum tube were taken from the jugular vein. The venous blood-gas analysis (RAPIDPoint® 405, Siemens Healthcare, Beersel, Belgium) and biochemistry analysis (IDEXX Catalyst One Chemistry Analyser®, IDEXX Europe B.V., Hoofddorp, The Netherlands) revealed a hypochloremic (92 mmol/l, ref: 95–103) respiratory (pCO_2 27.6mmHg, ref: 30-47.5), alkalosis (pH 7.58, ref: 7.30–7.48) with hypoglycaemia (37 mg/dl, ref: 50–80) and hyperkalaemia (6.29 mmol/l, ref: 3.9–5.4), in combination with severely increased creatinine (943 µmol/l, ref: 106–168) [16, 17]. A Hemacolor (Sigma-Aldrich, St. Louis, USA) stained blood smear showed mild anisocytosis. The relative white blood cell count (100 leucocytes counted) suggested the presence of an eosinophilia (complete differential count: 38% segmental neutrophils, 37% lymphocytes, 21% eosinophils, 1% basophils and 3% monocytes). Thoracic, rectal and abdominal ultrasonography was performed with a linear 5–10 MHz transducer (Sonosite M-Turbo, Fujifilm, Washington, USA; and MyLab™SigmaVET, Esaote/Pie Medical, Maastricht, The Netherlands) as well as the 5−1 MHz phased sectorial transducer (Sonosite M-Turbo, Fujifilm, Washington, USA). Thoracic ultrasound upon arrival showed 1 cm of free fluid cranially bilaterally. On abdominal ultrasound, the forestomachs and abomasum were normal. Small intestines were hypomotile with only small amounts of content, but no free fluid was present. The liver and the left kidney did not show any abnormalities, whereas surrounding the right kidney a small amount of anechogenic free fluid was visible. The urine bladder had an anechoic content and was clearly dilated (11 cm diameter). The wall was thin, but no leakage seemed present (no free fluid around the bladder). Also the extrapelvic end of the urethra was

ultrasonographically examined for the presence of uroliths, which could not be visualised.

Taken into account the characteristic presentation, clinical and ultrasonographical examination, obstructive urolithiasis was suspected. Native radiographs were performed of the caudal abdomen and pelvic area using a Philips optimum generator (Koninklijke Philips N.V., Eindhoven, The Netherlands) and AGFA DR plates (AGFA-Gevaert N.V., Mortsel, Belgium). Although no uroliths were visible on the radiograph, radiolucent calculi could still be present. Since the urine bladder was already severely dilated and the ram was not able to urinate, the ram was referred for surgery. An amputation of the processus urethralis in combination with a temporary tube cystostomy was conducted. For the latter, a Foley catheter was inserted in the urinary bladder to guarantee urethral rest. Patency of the urethra was not checked during surgery, as this is not standard practice in our university, since cases referred for tube cystotomy are often advanced cases in which initial passage of the urethra is rarely possible. The Foley catheter was monitored for urine production every two hours to ensure patency. Post-operative management consisted of broad-spectrum antibiotic treatment, non-steroidal anti-inflammatory drugs (NSAID), IV fluid therapy, and acidification of the urine (oral ammonium chloride supplementation, 100 mg/kg) as suggested by Cook, 2023 [18]. A timeline of all the examinations and treatments throughout the 24-day hospitalization stay can be found in Fig. 1. The animal was treated with amoxicillin (15 mg/kg, I.M., EOD, Duphamox LA®, Zoetis, Louvain-la-Neuve, Belgium) for 19 days and was changed to amoxicillin-clavulanic acid (7 mg/kg+1.75 mg/kg, I.M., SID, Noroclav®, Norbrook Laboratories, Monaghan, Ireland) for 5 more days. For pain control, 3 days flunixin meglumine (2.2 mg/kg, SID, Meganyl®, Laboratorios syva, Léon, Spain) was administered intravenously. On day 17 and 20, the ram received carprofen (1.4 mg/kg, S.C., Rimadyl®, Zoetis, Louvain-la-Neuve, Belgium) and meloxicam (0.5 mg/kg, I.V., Metacam®, Boehringer Ingelheim, Rhein, Germany), respectively. Isotonic saline fluid was administered the first 8 days post-surgery, supplemented with a glucose perfusion (KELA Laboratoria N.V, Hoogstraten, Belgium) the first 3 days. On day 16 post-surgery, the urine was examined. The urine was medium yellow, had a high turbidity and a pH of 8, after which a second period of acidification (same dosage) was started. On the non-stained wet mount preparation, no crystals were present and more than 20 white blood cells were seen per high power field. A stained line smear of the urine sediment showed a pronounced neutrophilic inflammation with highly degenerated neutrophils, consistent with a bacterial cystitis. Moreover, basophilic rod-shaped bacteria were commonly seen and sperm cells were scarce. Repetitive measurements of the kidney values showed a consistent decline of 943 (day 0) to 172 µmol/l (day 8) in creatinine, and 26.3 (day 3) to 8.2 mmol/l (day 8) in urea.

10 days post-surgery, the Foley catheter was systematically closed longer to promote urination through the urinary tract. On day 16, the animal was still unable to urinate normally when the Foley catheter was occluded. Thus, a rectal ultrasound and full reproductive exam was conducted to determine the cause of the persistent obstruction. Thus, a digital palpation of the penis, testes and epididymides, and the caudal pelvic urinary and reproductive organs was performed. The scrotal circumference was classified as just satisfactory for a ram aged more than 14 months, with its 32 cm [19], but both the left and right testes were too soft on palpation and the right cauda epididymis was difficult to discern from the right testis. On digital rectal palpation a cystic enlargement, dorsal to the pelvic urethra was palpated around 6 cm into the pelvis. On testicular ultrasonography, moderate to severe testicular degeneration was apparent on both testes, with clear hyperechoic spots causing a heterogenous appearance of the testicular parenchym (Fig. 2A and B), whilst normal parenchym for young ram would be homogenous. The appearance of the left cauda

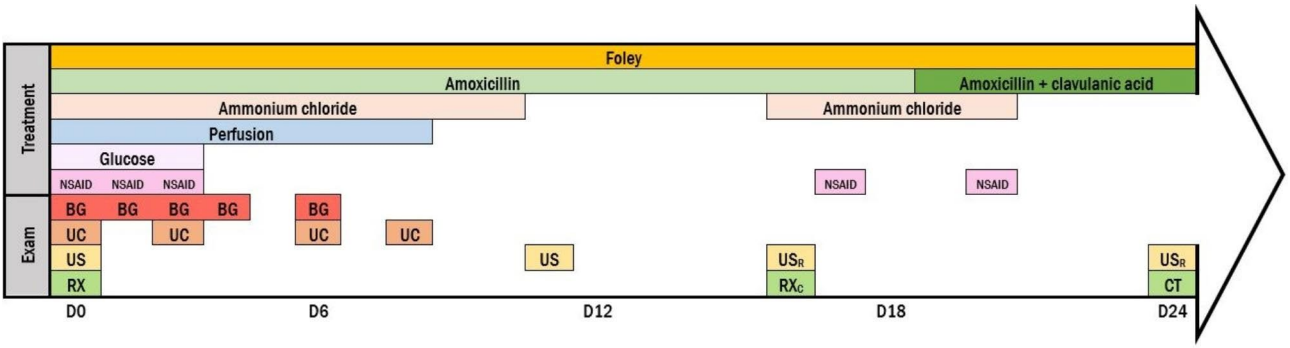

Fig. 1 Timeline including diagnostic examinations and treatment information of a 3.5-year old ram with urethral obstruction, starting from the day of presentation in the university clinic (d0) until euthanasia (d24). **Abbreviations**: NSAID, non-steroidal anti-inflammatory drug; BG, blood-gas analysis; UC, urea and creatinine measurement; US, ultrasound; USR, rectal ultrasound; RX, radiograph; RXC, contrast radiograph; CT, computer tomography; D, days

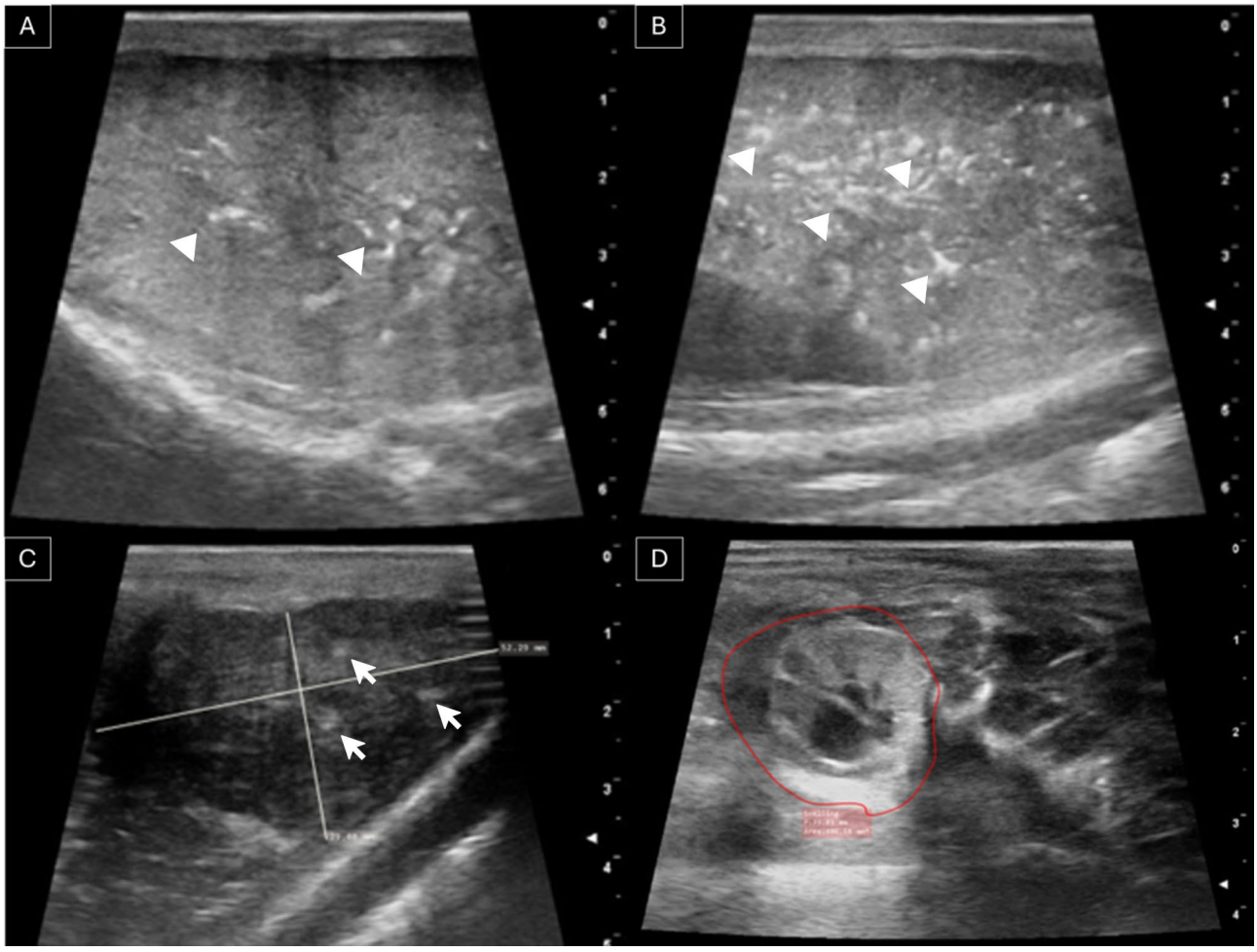

Fig. 2 Ultrasonography of the left (**A**) and right (**B**) testis, showing moderate and severe testicular fibrosis, as seen by clear hyperechoic spots causing a heterogenous appearance of the testicular parenchym (white arrowheads), respectively. Ultrasonography from the right, enlarged epididymis (**C**), which contained hyperechoic spots (white arrows). (**D**) Transrectal ultrasound of large cystic swelling (red circle) dorsal to the pelvic urethra (406.68 mm^2) (post-mortem). (MyLab™SigmaVET, Esaote/Pie Medical, Maastricht, The Netherlands)

epididymis was normal, however, the right cauda epididymis was enlarged and contained hyperechoic spots (Fig. 2C). Upon transrectal ultrasonography, the bulbourethral glands were normal. The prostate, vesicular glands and ampullae could not be visualized due to the large, cystic swelling on the pelvic urethra, caudal to the prostate (Fig. 2).

Lastly, both native and contrast radiographs were taken (Philips optimum generator, Koninklijke Philips N.V., Eindhoven, The Netherlands and AGFA DR plates, AGFA-Gevaert N.V., Mortsel, Belgium). The positive anterograde urethrography was performed by using the previously placed Foley catheter and 30 ml of 50% diluted Iomeron (Iomeprol, 300 mg/ml; Bracco, Milan, Italy). This product doesn't have a MRL, which is required for active substances administered to food producing animals [20]. However the owner didn't intend for the animal to enter the food chain. Also, with this retrograde contrast injection (as it was not administered IV, IM, SC, or orally) no systemic absorption would occur, and thus the product would be excreted through the urine. The native radiographs were unremarkable. The contrast medium at the caudal aspect of the pelvic urethra was confluent with a large well-defined outpouch of contrast medium (4,2 cm x 3,7 cm) with multiple rounded confluent heterogeneous contrast medium filling defects (Fig. 3). No significant abnormalities detected at the level of the remaining urethra. The results of the contrast radiograph and the reproductive exam lead to the decision to euthanize the animal, as the animal would not be capable of breeding anymore. The ram was euthanized with sodium pentobarbital (90 mg/kg, I.V., Release®, WDT –Wirtschaftsgenossenschaft deutscher Tierärzte eG, Garbsen, Germany).

Post-mortem

Post-mortem both a native and retrograde urethrogram was performed of the caudal abdomen and pelvic area

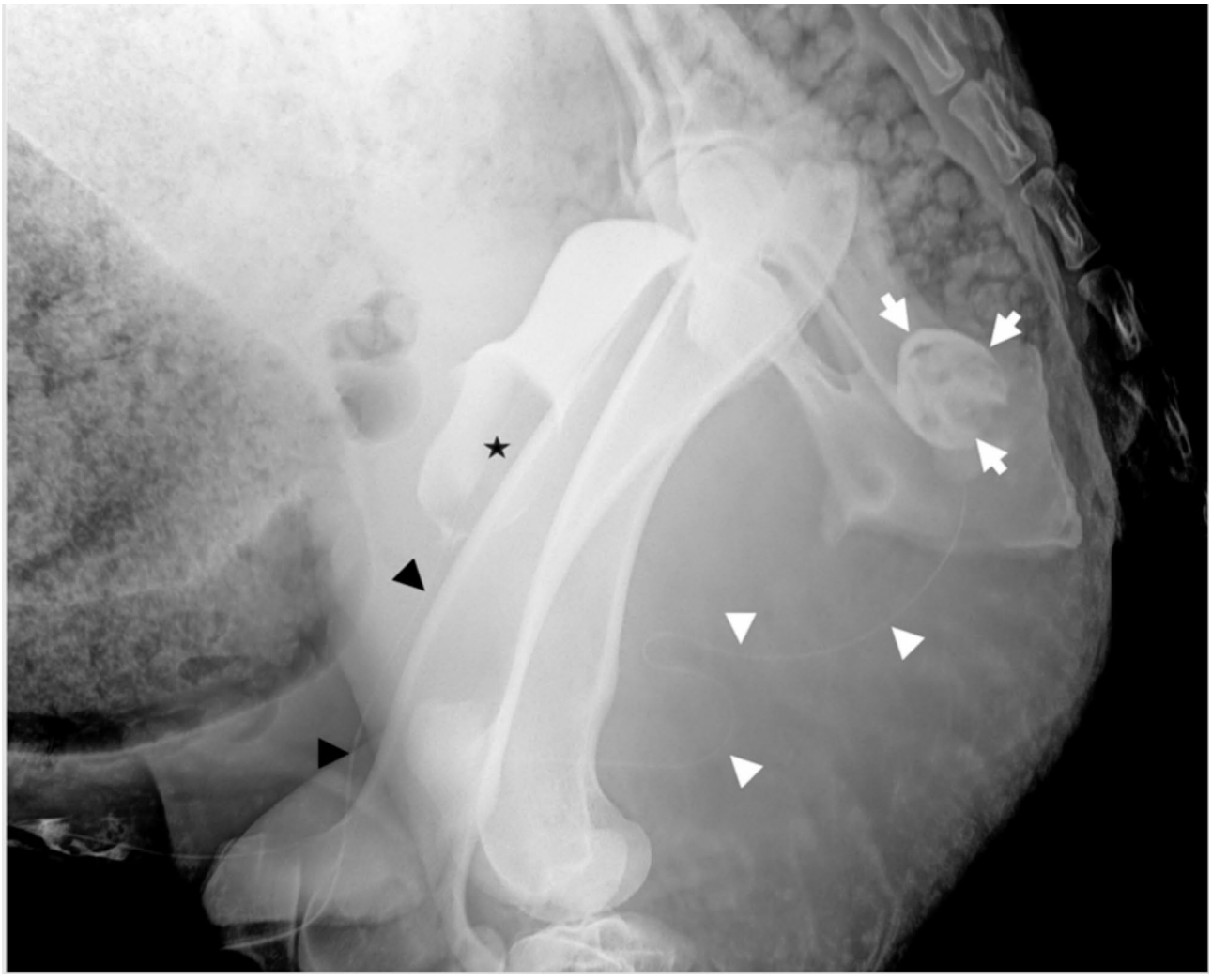

Fig. 3 Anterograde urethrogram using the Foley catheter (black arrowheads). A cavitary lesion is outlined by contrast medium (white arrows) at the caudal aspect of the pelvic urethra. The remaining urethra is within normal limits (white arrowheads). Note the filling defect in the bladder indicating the location of the Foley catheter's balloon (black star)

using a 320-row scanner (Aquilion One, Canon Medical Systems, Tokyo, Japan). The following parameters were used for the CT image acquisition depending on the body part: slice thickness 0.5 mm, rotation time 0.5 s, exposure settings of 400 mA and 135 kV, 512×512 matrix. Reconstructions were made with bone and soft tissue kernel and displayed in appropriate windowing and levelling. The positive retrograde urethrogram was performed by placement of a urinary catheter and injection of 50% diluted Iomeron (Iomeprol, 300 mg/ml; Bracco, Milan, Italy) until pressure resistance. During native CT, there is a well-defined encapsulated cavitary lesion at the left (HU +/- 28; 3,1 cm x 3,4 cm x 2,8 cm) caudodorsolateral aspect of the pelvic urethra, just cranial to the left bulbourethral gland. There was moderate surrounding steatitis. No significant abnormalities were detected at the level of the remaining urethra or prostate (Fig. 4A and B). On retrograde positive urethrogram, the described cavitary lesion was filled with contrast, with multiple heterogeneous filling defects of the contrast medium centrally (Fig. 4C and D). The cranial aspect of the left bulbourethral gland was poorly defined and in close contact with the contrast-filled cavitary lesion. The contrast medium stopped at the level of the cranial pelvic urethra but did not reach the bladder.

Full macroscopic necropsy was performed with thorough assessment of the urogenital tract, which can be found in Fig. 5A. Within the urinary tract there was a partially encapsulated abscess (12×6×6 cm) extending from the cortex of the right kidney. Additionally, both kidneys showed multiple chronic infarctions (Fig. 5B). Macroscopically it was not clear if the periurethral abscess (Fig. 5C) originated from the bulbourethral glands. The ureters, bladder and urethra were normal, except for

Fig. 4 Dorsal (**A**) and transverse (**B**) native CT images in soft tissue reconstruction; right is on the left of the image. The cavitary lesion at the left caudodorsolateral aspect of the pelvic urethra (white arrowheads) is indicated by white arrows. The urinary bladder is indicated by a black star and the prostate gland by two black arrowheads. Sagittal soft tissue reconstruction (**C**) and sagittal Maximal Intensity Projection (MIP) (**D**) of the retrograde contrast urethrogram. The image in (**C**) shows the close relation between the cavitary lesion (white arrows) and the left bulbourethral gland (black arrowheads) which has a poorly defined cranial margin. On the right (**D**), the contrast medium at the level of the urethra continues, but no contrast medium reaches the bladder

focal small zone of mucosal haemorrhage at the apex of the bladder (urinary catheter placement). Both testes and epididymides contained fibrotic tissue (Fig. 5D). The ductus deferentes, ampullae and prostate had a normal, symmetrical macroscopic appearance. The seminal vesicles were white with a firm aspect on palpation, suggesting seminal vesiculitis. In the parenchyma surrounding the urethra, at the level of the bulbourethral glands, there was a second, fully encapsulated, 6.5×6.5×3 cm abscess. Aside from the urogenital lesions, fibrinous peritonitis

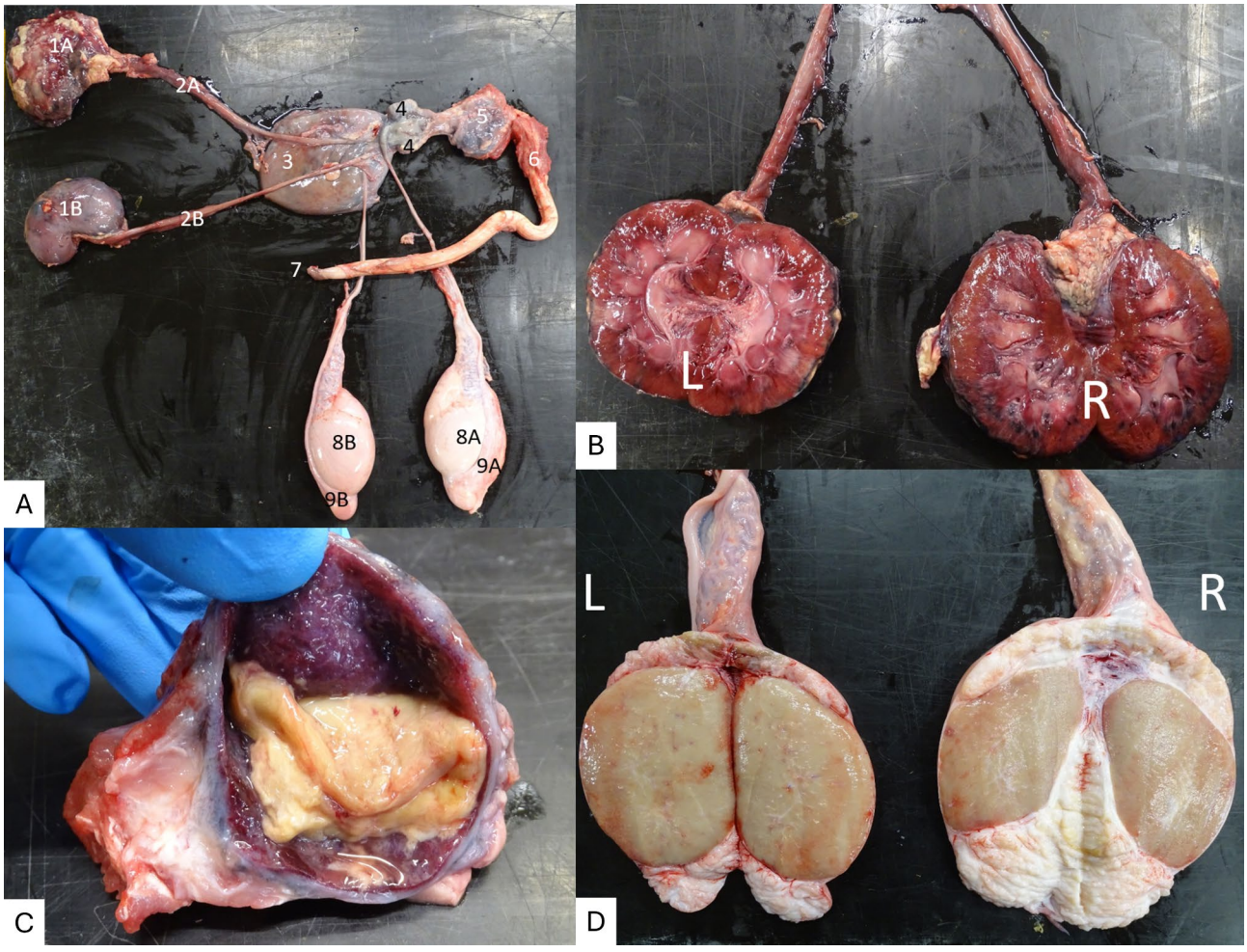

Fig. 5 (**A**) Macroscopic overview of the dissected urogenital tract: 1A; right kidney, 1B; left kidney, 2A; right ureter, 2B; left ureter, 3; urinary bladder, 4; prostate, 5; periurethral abscess, 6; proximal urethra, 7; glans penis, 8A; right testis, 8B; left testis; 9A; right epididymis, 9B; left epididymis. (**B**) Macroscopic cross section of the left (L) and right (R) kidney of a 3-year-old ram. Lesions are bilaterally present but more pronounced in the right kidney. Note the bilateral, multifocal to coalescing, dark, mildly depressed cortical areas (chronic infarcts, chronic interstitial nephritis). (**C**) Macroscopic picture of a cross section the periurethral abscess of a 3-year old ram filled with purulent content. (**D**) Macroscopic cross section of the testes of a 3-year old ram with multifocal white zones in testicular parenchyma (collagen, fibrosis). The right testis (R) is smaller compared to the left testis (L). Bilaterally, the epididymis are diffusely characterized by dense, white fibrotic tissue which is more pronounced on the right side

with fibrous adhesions between the urinary bladder, the jejunum and the ventral parietal peritoneum were found. No further significant gross lesions were seen during necropsy.

For histological examination, tissue samples of all relevant organs and structures of the urogenital tract were fixed in a 4% neutral-buffered formalin, stained with haematoxylin and eosin. Histology revealed a necrotizing and inflammatory process infiltrating the cortical parenchyma. In the remaining renal parenchyma, lymphoplasmacytic infiltrates, proliferating fibroblasts and increased amounts of collagen bundles (fibrosis, chronic infarction) were found. The abscess on the kidney contained renal cortical tissue, cellular debris and large amounts of neutrophils.

Additionally, neutrophilic infiltration was noted within the renal pelvici (pyelonephritis). The periurethral cystic mass showed similar features to the renal abscess regarding the capsule and content. Bulbourethral tissue was present in the parenchyma surrounding this abscess, but no evidence of communication was identified. The urethra and ureters were multifocally infiltrated with lymphoplasmacytic cell populations. Histopathology of the testes revealed small, empty seminiferous tubules, with nearly only Sertoli cells present, and mineralization (amorphous, basophilic material) in some tubules. No stadia of spermatogenesis could be identified. In between tubules, marked fibrosis was visible. The epididymides showed empty epididymal ducts, hyperplastic epithelium, and a large amount interstitial fibrosis (no spermatozoa).

Most other parts of the genital tract (ductus deferentes, plexi pampiniformes, ampullae and glandulae vesiculares) were characterized by marked amounts of lymphoplasmacytic interstitial inflammation and interstitial fibrosis. The lumina of the ductus deferentes were filled with eosinophilic cellular and karyorrhectic debris, mixed with neutrophils, lymphocytes, plasma cells and macrophages. The prostate showed a normal aspect.

Discussion and conclusions

This case-report provides an extensive clinical workup, laboratory results, comprehensive diagnostic imaging and pathology findings of a periurethral abscess in a ram presented with urethral obstruction. It highlights that abscesses along the urinary tract are, as in other species, an important differential diagnosis for straining in sheep. Whether or not the urethra was truly blocked by this abscess, was confirmed with the anterograde urethrogram (RX) and the retrograde contrast urethrogram (CT), since the contrast medium failed to pass alongside this structure. The abscess was likely the consequence of an ascending urogenital tract infection. Described causal pathogens for urogenital tract infections in sheep are *Corynebacterium renale*, *E.coli*, Staphylococci, Streptococci for the urinary tract, and *Actinobacillus seminis*, *Histophilus somni*, *Chlamydophila abortus*, *Trueperella pyogenes*, Leptospirosis and *Brucella* sp. as aetiologies for the reproductive tract [2, 21–24]. Considering the two latter potentially zoonotic pathogens, a microbiological examination of the urogenital tract would have been appropriate. In previous research, rams inoculated in their epididymides with *A. seminis* and *H. somni*, both opportunistic bacteria inhabiting in the prepuce, had similar changes as our ram, in the urogenital tract [25]. Specifically in cases involving *H. somni*, the kidneys and testes were occasionally affected [25], making this pathogen the primary suspect in our case. Although urolithiasis is the most common and well-known cause for straining in small ruminants, the ante-mortem exam showed no real indication for urolithiasis, only for an obstruction. Arguably, no obvious signs for a urogenital tract infection were present either, such as fever or elevated white blood cell count. As the animal was presented during a night shift, the clinician on call presumed calculi were present but radiolucent, and did not perform a proper digital palpation of the accessory glands. Also, a tube cystotomy is a reliable emergency intervention when the cause of the urethra blockage is unclear. However, a rectal palpation at the time of presentation would have resulted in a faster succession of examinations, such as additional imaging and a faster diagnosis. Nevertheless, this would unlikely have improved the outcome for the animal, as for the entire hospitalization period, the ram was treated with broad-spectrum antimicrobials (amoxicillin, without and later with clavulanic acid). Thus, unless acquired resistance was present, this antimicrobial should have been effective for all the abovementioned bacteria. Besides, as both testes were extensively atrophied and fibrosed, the ram's prospects for reproductive use were unfavourable. An important observation, in this case, is that no correct final ante-mortem diagnosis could be established, despite combining radiographs and ultrasound for diagnosis of urethral obstructions, as previously suggested [1]. Both were executed on the initial exam, and despite this, the pyelonephritis, perirenal abscess and the periurethral abscess were not recognized. Although free fluid around the right kidney was observed, the anechogenic aspect of the fluid did not suggest an infectious process. Potentially the kidney infection worsened during hospitalization, resulting in the significant damage on pathology, however the systematically declining azotaemia was somewhat contradictory for this. To diagnose the kidney pathologies, the inclusion of CT imaging would have been essential, as this was not clear on transabdominal ultrasonography. Thus, in the future, diagnosticians performing an ante mortem CT should image the entire urinary system, as the kidneys were not included in the post-mortem CT imaging in this case. For the blockage of the urethra, the contrast radiograph was informative enough, however, this information alone without knowing the severe kidney damage would give a distorted picture of the prognosis. Next to the initial lack of digital palpation and microbiological testing, another indicated examination for this case would have been a parasitological exam considering the eosinophilia might be related to endoparasites, and the periurethral abscess could be a result of migrating larvae.

In conclusion, a periurethral abscess should be included in the differential diagnosis list for an urethral obstruction in small ruminants. We suggest in cases of urethral obstruction, with strangury or dysuria, without indication for urolithiasis, digital palpation and more advanced medical imaging could be useful. The extensive ante-mortem and post-mortem material presented in this case, makes this a good reference for diagnosticians confronted with urethral problems in a ram.

Abbreviations

CT	Computer Tomography
RX	Radiography
NSAID	Non-steroidal anti-inflammatory drugs

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Author contributions

M.L.P, M.M., L.C., J.C., J.G. examined and treated the animal during presentation and hospitalization. J.C. performed cytology exam. M.L.P., B.P., J.G., M.M. interpreted and analyzed all clinical information. R.H. performed autopsy and histology, L.V. performed ante- and post-mortem medical imaging. M.L.P.

wrote the main manuscript text. M.M., R.H., L.C., L.V. co-wrote a part of the manuscript. All authors revised the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
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