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Case Report

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Ultrasonographic and clinicopathological findings in a 7-year-old mare with urine retention

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Abstract: A 7-year-old crossbreed mare presented with mild to moderate colic and a 2-day history of anuria. Clinicopathological findings revealed leukocytosis with mild neutrophilia and lymphocytosis. Urinalysis showed increased leukocytes, epithelial cells, and protein. Biochemical analysis revealed mild azotemia and hypoglycemia. Ultrasonographically, the urethra was completely blocked by echoic material. The wall of the urethra was hyperechoic and easy to distinguish from the urethralis muscle surrounding it. The urinary bladder was distended, with a rough, thick wall (9 mm). To the best of the author's knowledge, the present report is the first to describe detailed ultrasonographic and clinicopathological findings in a mare with urine retention.

Key words: Ultrasonography, clinical pathology, urine retention, mare

1. Introduction

Disorders of urine storage usually lead to urinary incontinence (1), whereas disruption of normal urination leads to incomplete evacuation and urine retention (2). Urethral obstruction is the main cause of urine retention in horses with frequent attempts at urination but urine flow that is greatly restricted; usually only drops are voided and the distended bladder can be felt on rectal examination (3). Urethral blockage, although not common in mares, occurs predominantly in male horses or geldings and has a high risk of causing rupture of the bladder (4). Ultrasonography has proven valuable for the examination of the urinary tract, including the kidneys and urinary bladder, and diagnosis of abnormalities in several animal species such as dogs and cats (5), sheep (6), cattle (7), and horses (8).

2. Case history

The patient was a 7-year-old crossbred mare. In the past, the mare was used for racing, and more recently for leisure riding. The mare was referred to the Department of Animal Medicine, Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Assiut University, for clinical evaluation. The chief complaint of the owner was that his mare had moderate colic from time to time during the entire day, as well as anuria for 2 days with stranguria, grunting and tenesmus, and the animal remained in a crouched posture with several unsuccessful attempts at urination.

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3. Results and discussion

On the basis of a general examination and just after admission, the mare was in a good body condition (body score: 4/6) (9), although she appeared depressed, exhausted, and resistant to efforts to keep her walking. She did not want to go down, however, but just rest. Temperature was normal (37.7 °C) and heart rate was slightly elevated (45 beats/min). Mucous membranes were pink, the capillary refill time was rapid (<2 s) with a strong pulse, and lymph nodes were normal. The examination of the respiratory system was within normal limits (no coughing, no nasal discharges, and respiratory rate of 15 breaths/min). Examination of the digestive system showed a normal oral cavity, dentition, mastication, and deglutition. Mild to moderate colic pain was evident about every 3 h in the form of pawing, frequent lying down, stranguria, and frequent unsuccessful attempts at urination. Defecation was normal with no abdominal distension. On auscultation of the abdomen, borborygmi were audible and frequent on both sides. Rectal examination revealed a distended urinary bladder, which extended cranially to the pelvic inlet along the ventral abdominal wall, with a thick wall. Both ureters were slightly enlarged and palpable. The mare exhibited pain during the rectal examination of the urinary bladder.

Transrectal ultrasound using a 7.5 MHz linear-array transducer (Tringa Linear, Esaote-Pie Medical, the Netherlands) was performed to evaluate the ureters, urinary bladder, and pelvic urethra. The transducer,

after coupling of gel, was introduced into the rectum and angled ventrally in the caudal abdominal region. The abdominal portion of the urinary bladder was imaged in a longitudinal plane. The urinary bladder appeared as a distended round or oval structure filled with anechoic urine (Figure 1). The wall of the bladder was hyperechoic with a rough irregular surface (Figure 2). The bladder wall thickness was relatively increased (9 mm; normal range: 1.1–5.0 mm) (8). The ureters were visualized at the trigone. They appeared as distended circular structures in a transverse plane and tubular in a longitudinal plane, with a hypoechoic wall. The urethra was imaged from the neck of the bladder caudally into the pelvis. It was completely blocked by echoic material (Figure 1). The wall of the urethra was hyperechoic and easy to distinguish from the urethralis muscle surrounding it (Figure 1). In the longitudinal plane just caudal to the neck of the bladder, the diameter of the urethra was 18.5 mm (Figure 2) (normal range: 10.0–15.5 mm) (8). Transcutaneous ultrasonography using a 3.5 MHz linear-array transducer was carried out for imaging the right and left kidneys. For this, the coat was shaved at the level of the tuber coxae, between the 14th and 17th ribs for the right kidney and the 15th and 18th ribs for the left kidney (10). The renal capsules appeared as a strongly echogenic line. The cortex had a diffuse echogenic appearance, whereas the medulla was relatively hypoechoic in comparison (Figure 3). The renal sinus of both kidneys was hyperechogenic. There was no evidence for distention of the renal pelvis, although

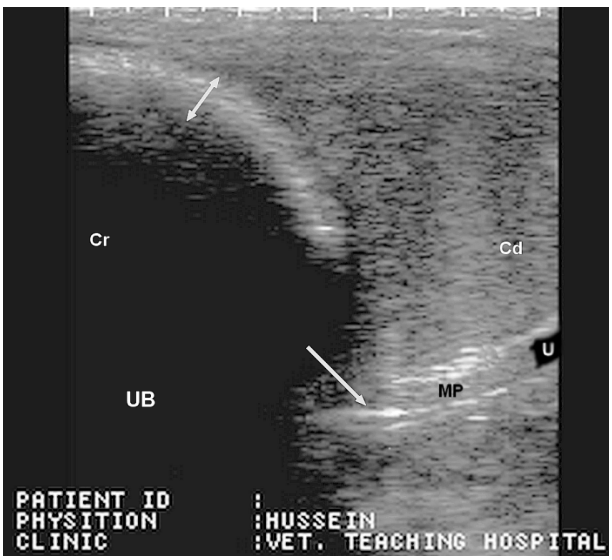

Figure 1. Transrectal longitudinal sonogram of the bladder and urethra showing overdistension of urinary bladder with anechoic urine. Note thick irregular wall (double-headed arrow) of the bladder and anechoic wall of urethra, blocked by a plug (single-headed arrow). UB: urinary bladder, MP: mucous plug, U: urethra, Cr: cranial, Cd: caudal.

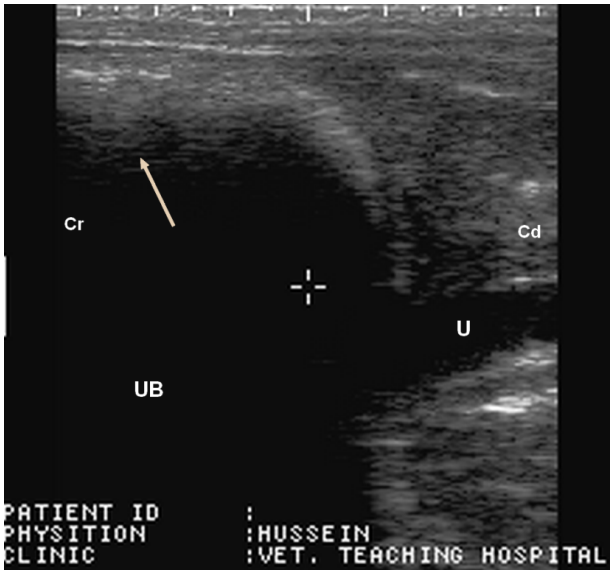

Figure 2. Transrectal longitudinal sonogram of the bladder and urethra just after catheterization, showing thick, irregular wall of the bladder (arrow) and patent urethra. UB: urinary bladder, U: urethra, Cr: cranial, Cd: caudal.

Figure 3. Transcutaneous sonogram of the left kidney, showing uniformly mottled echogenic spleen (S) and less echogenic renal parenchyma (P). MP: medullary pyramid, RS: renal sinus.

both ureters were mildly distended as their diameter ranged from 9.1 to 9.4 mm (normal range: 6.1–8.2 mm) (8), indicating a degree of hydroureter. Furthermore, the wall of both ureters was observed as a strongly echogenic structure in images made in the transverse oblique planes of both kidneys.

For bladder catheterization, the vulva was carefully wiped clean with diluted alcohol as a disinfectant. To avoid traumatization of the urinary bladder, which may be inflamed by a metal mare catheter, a plastic catheter

approximately 0.5 cm in diameter and 50 cm long was used instead. The catheter was inserted in a straightforward procedure into the bladder. No obvious obstacle was detected during catheterization. Although the catheter was lubricated with oil, the mare showed pain signs during insertion of the catheter into the urethra. Just after insertion of the catheter into the bladder, a large volume (about 1.5 L) of oily turbid urine was flushed out. Part of the urine was collected in a plastic cup for urinalysis.

At admission and before therapy, hematology results (Table 1) showed the presence of leukocytosis with mild neutrophilia, lymphocytosis, and monocytosis, consistent with chronic inflammatory processes. Blood biochemistry analysis (Table 2) revealed mild azotemia and

Table 1. Hematological findings in a mare with urine retention.

Variables	Days after initiation of therapy			Reference range*
	0 (at admission)	4th day	8th day	
Hemoglobin (g/L)	105	110	107	111–159
Red blood cells ($\times 10^{12}$/L)	7.3	7.9	7.5	6.2–10.2
Packed cell volume (%)	37	40	43	32–52
White blood cells (g/L)	14.7	11.5	7.3	6.0–10.0
Segmented neutrophils (µL)	7200	5335	4500	2700–6700
Lymphocytes (µL)	6100	5250	2220	1500–5500
Monocytes (µL)	1200	740	320	100–800
Eosinophils (µL)	150	120	185	100–925
Basophils (µL)	0	0	0	0–170
Band cells (µL)	20	50	45	0–100

*Reference range as previously given (15).

Table 2. Biochemical findings in a mare with urine retention.

Variables	Days after initiation of therapy			Reference range*
	0 (at admission)	4th day	8th day	
Blood urea nitrogen (mmol/L)	10.3	8.2	5.0	3.7–6.2
Creatinine (µmol/L)	154	150	138	87–149
Glucose (mmol/L)	2.3	4.5	4.8	4.3–5.5
Total proteins (g/L)	62	60	65	53–73
Albumin (g/L)	30	30	33	29–41
Globulins (g/L)	32	30	32	18–38
Albumin/globulin ratio	0.94	1.0	1.03	1.1–1.6
AST (U/L)	420	380	355	102–350
Total bilirubin (µmol/L)	14.5	10.8	9.5	13–34
Sodium (mmol/L)	132	133	137	134–142
Potassium (mmol/L)	2.7	3.4	3.9	3–5
Chloride (mmol/L)	93	102	104	95–103
Venous blood gas and acid-base indices				
pH	7.33	7.35	7.38	7.32–7.44
HCO_3 (mmol/L)	24	26	23	20–28
tCO_2 (mmol/L)	26	29	33	20–35
pO_2 (mmHg)	38	41	45	35–50
pCO_2 (mmHg)	35	38	37	38–46
BE (mmol/L)	2	1	3	0–5

*Reference range as previously given (15).

hypoglycemia. At admission and before therapy, urinalysis (Table 3) was positive with variable degrees for occult blood, leukocytes, and proteins, indicating the presence of inflammatory urinary tract disease. Furthermore, increased pH values and decreased values of specific gravity were also observed. In addition, the microscopic examination of urine sediment (Table 4; Figure 4) revealed increased numbers of degenerated neutrophils, indicating pyuria. Additionally, an increased number of epithelial cells per high-power field indicated an inflammatory process in the urinary tract.

According to the physical examination, clinicopathological findings, and, particularly, ultrasonographic imaging of the urinary tract, cystitis was diagnosed and urine retention as a result of urethral blockage by a mucous plug containing inflammatory tissue debris was presumptively suspected (Figure 5). The differential diagnosis included paralysis or rupture of the bladder, spasm of the neck of the bladder, and urethral obstruction by urinary calculus.

The mare was kept in the hospital under intensive clinical and medicinal observation for 8 days. A repeated treatment was carried out each day, consisting of penicillin G (22,000 IU/kg, intramuscular, every 12 h) and trimethoprim sulfamethoxazole (30 mg/kg, orally, every 12 h). Additionally, for acidification of alkaline urine, which may be favorable for infection, ammonium chloride was given orally (200 mg/kg, every 12 h). Irrigation of the bladder with large volumes of sterile saline to flush out urine sediments was carried out 2 times daily. The nature of the urine retrieved after flushing was turbid, containing mucous and sabulous debris. To combat the

Table 3. Urine strip analysis results in a mare with urine retention.

Variables	Days after initiation of therapy			Reference range*
	0 (at admission)	4th day	8th day	
pH	9.5	8.7	8.0	7.5–8.5
Blood	+	–	–	None
Leukocytes	++	+	–	None
Ketones	+	–	–	None
Glucose	–	–	–	None
Proteins	+++	++	+	Trace
Bilirubin	–	–	–	None
Urobilinogen	–	–	–	None
Nitrites	–	–	–	None
Specific gravity	1.010	1.015	1.030	1.020–1.050

*Reference range as given previously (15).

Table 4. Microscopic examination of urine sediments in a mare with urine retention.

Variables	Days after initiation of therapy			Reference range*
	0 (at admission)	4th day	8th day	
Pus cells/HPF	5–10	3–6	0– 3	None
Red blood cells/HPF	2–4	0–3	0–2	None
Epithelial cells/HPF	4–7	1–3	0–2	0–2
Calcium carbonate crystals/HPF	3–6	1–3	0–2	0–2
Renal casts/HPF	0	0	0	None

*Reference range as listed before (15). HPF: high-power field.

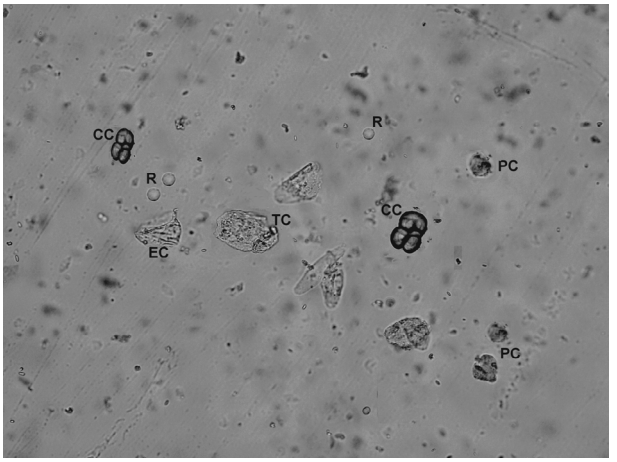

Figure 4. Microscopic urine sediment showing pus cells (PC), epithelial cells (EC), transitional cell (TC), red blood cells (R), and carbonate crystals (CC) (40×).

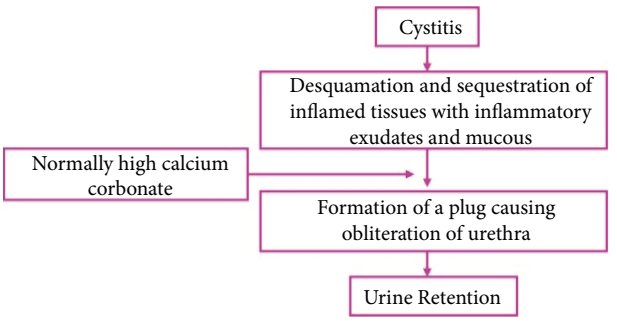

Figure 5. Presumptive pathogenesis for mucous plug urine retention.

mild to moderate colicky pain, the mare was administered flunixin meglumine (0.5 mg/kg intravenously, once a day for 3 successive days) as a nonsteroidal antiinflammatory analgesic drug.

For evaluation of therapy, the animal was examined rectally and by ultrasonography daily. Furthermore, hematology, biochemistry, and urinalysis tests were also carried out. At the 8th day of therapy, the mare exhibited no pain reaction during the rectal examination. In addition, ultrasonographic examination of the bladder revealed no distension and the wall thickness was 4 mm with evidence of little tissue debris on the floor of the bladder. Furthermore, the urethra was patent with a diameter of 11 mm (Figure 6). At the 4th day of therapy, most of the laboratory parameters were relatively improved in comparison to the admission values before therapy, and the mare began to urinate normally without stranguria. Results of the follow-up ultrasonography of the bladder, urinalysis, hematological evaluation, and serum

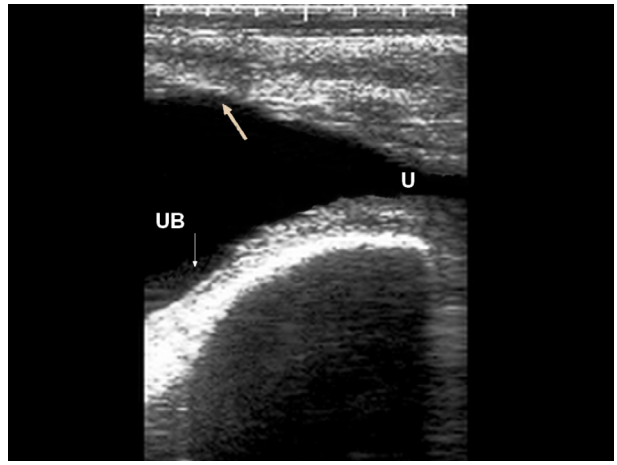

Figure 6. Transrectal sonogram after 8 days of therapy for the urinary bladder (UB) and urethra showing thin wall of bladder (thick arrow), no distention of bladder (compare with Figures 1 and 2), little echogenic tissue debris on the floor of the bladder (thin arrow), and patent urethra (U).

biochemical analysis revealed no marked abnormalities 8 days after therapy. Therefore, 1 day later, the mare was discharged from the hospital.

Disruption of normal urination causes abnormal urine storage and consequently urine retention could develop (2). In the present report, rectal and ultrasonographic examinations revealed increased thickness of the urinary bladder wall with irregular contour. A definitive cause of urine retention was not confirmed in this case; however, rectal and ultrasonographic examinations suggested cystitis to be the primary cause of urethral obstruction. In addition, increased amounts of echogenic tissue debris, leukocytes, epithelial cells, and urine protein indicated cystitis, which enhanced sequestration of inflamed tissue and increased the amount of mucous and inflammatory exudates in combination with normally high calcium carbonate crystals. All together this collected to form a plug that was lodged in the urethra, causing obstruction. Although endoscopy was not used in this case as the clinic was not fully equipped, it would be helpful in confirming such diagnosis. However, differential diagnosis was carried out to exclude other diseases with similar presentations. As mentioned before, the differential diagnosis included paralysis or rupture of the bladder, spasm of the neck of the bladder, and urethral obstruction by urinary calculus. The latter was excluded as the rectal and ultrasonographic examinations revealed no urinary calculi; furthermore, during urinary catheterization, no obvious hindrance was observed. Paralysis of the bladder was excluded as it is commonly associated with atony of the bladder and incontinence (11). Furthermore, in some cases of bladder dysfunction, incontinence is not apparent until the later

stage of the disease (12). On the other hand, ruptured urinary bladder was excluded as the cause of disease as it is commonly associated with abdominal distension, severe azotemia, and bladder catheterization that reveals no urine (13). In addition, in the present report, the diseased mare exhibited no incontinence as well as no abdominal distension.

This case report points out the ultrasonographic and clinicopathological findings in a mare with urine retention associated with urethral obstruction. To the best of the author's knowledge, this report is the first to describe a urinary bladder and urethra affected by a presumptive mucous plug in a mare by means of ultrasonography.

Ultrasonographic examination of both kidneys revealed normal echogenic patterns of the renal cortex, medulla, and pelvis. Absence of evidence for hydronephrosis or pelvis dilatation may be due to the short period for anuria (2 days). Previously, Orsini and Divers (11) stated that hydronephrosis and rupture of the urinary bladder may develop within 3–6 days after complete urine retention in horses. At admission, hematology revealed mild neutrophilia, lymphocytosis, and monocytosis, consistent with chronic inflammation (14). Blood biochemistry showed mild azotemia and electrolyte changes, indicating urine retention (15). Previously, Ragle (16) stated that horses with postrenal azotemia had decreased urine volume with variable specific gravity. In the present case, the lowered glucose level could be attributed to decreased feed intake as a result of the moderate to mild attack of colic.

There is some debate regarding the use of ammonium chloride as a urine acidifying agent, because it may be unpalatable for horses (17). In the present study, however, the course of therapy was not too long, and in cases of long-term therapy, ammonium sulfate could be used instead (1) as it is more palatable than ammonium chloride and may be used for up to 7 months with no evidence of metabolic disturbances (17).

In the present clinical case, rectal and ultrasonographic examinations suggested cystitis to be the primary cause of urethral obstruction. Presumptively, mucous plug urine retention could be a sequel for collection of sequestered inflamed tissues and increased amount of mucous and inflammatory exudates in combination with normally high carbonate crystals. The case was diagnosed through urinary catheterization and ultrasonography. Furthermore, prognosis of the case was favorable and full recovery occurred after 8 days of therapy.

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