Uroperitoneum Secondary to the Rupture of the Urinary Bladder in a Thoroughbred Foal

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Abstract A 13-day-old Thoroughbred female foal weighing 59 kg was referred to the Jeju National University Equine Hospital with clinical signs including depression, labored breathing, tachycardia, anorexia, and marked distended abdomen. Uroperitoneum secondary to a rupture of the urinary bladder was diagnosed based on the history, clinical signs, and ultrasound imaging. An emergency laparotomy for cystorrhaphy under inhalation anesthesia was performed, and the patient recovered uneventfully. A course of extensive supportive therapy with systemic antibiotics after surgery was carried out. The foal fully recovered and was discharged after 14 days of hospitalization. The follow-up after seven months revealed the patient to be clinically healthy. This report describes a case of uroperitoneum secondary to the rupture of the urinary bladder in a Thoroughbred foal, along with the clinical outcomes of surgical repair and intensive treatment in detail.

Key words uroperitoneum, rupture of the urinary bladder, ultrasound imaging, cystorrhaphy, Thoroughbred foal.

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Introduction

Uroperitoneum or uroabdomen is most commonly caused by a rupture of the urinary bladder in horses and is recognized primarily on male neonatal foals (7). Urachal and ureteral defects also cause uroperitoneum in horses (3,7). The clinical signs associated with a rupture of the urinary bladder in foals include depression, loss of appetite, progressive abdominal distension, dehydration, colic, pollakiuria, straining, dripping of the urine, and stretching-out stance (2,4,8,9). A diagnosis of the disease can be established based upon the history, clinical signs combined with abdominocentesis, blood analysis, cystoscopy, and ultrasonography (4,5,8,9). Uroperitoneum caused by a rupture of the urinary bladder in neonatal foals is not uncommon. Promising results can be achieved once diagnosed and treated in a timely manner (3). Clinical trials regarding this condition are extremely rare among horse owners and clinicians owing to a lack of experience, resulting in considerable economic losses to the breeders. This paper describes a case of uroperitoneum secondary to a rupture of the urinary bladder corrected surgically by cystorrhaphy via laparotomy in a Thoroughbred foal.

Case Report

A 13-day-old Thoroughbred female foal weighing 59 kg was referred to the Jeju National University Equine Hospital with the clinical signs of depression, labored breathing, tachycardia, anorexia, and marked distended abdomen (Fig. 1). Upon arrival, the foal was dull and unable to stand or walk due to systemic weakness. The patient had been out on pasture since birth, and no abnormal clinical signs were noticed according to the owner's statement. After being found recumbent on the pasture by the owner, the patient was provided intravenous catheterization for fluid therapy and medication when the patient thrashed and struggled severely. The owner stated that the foal had been on rifampin and azithromycin due to pneumonia diagnosed previously. The

body temperature was 38.5°C, the respiratory rate was 60 times/min, and the heart rate was 135 beats/min. The color of the mucous membranes of the patient was pale, and the capillary refill time (CRT) was extended beyond 1.5 seconds. The patient also showed signs of severe entropion and a resulting corneal ulcer on her oculus dexter (OD), which was assumed to have been caused by dehydration. The entropion was treated with the injection of a mixed solution of an antibiotic (PPS; Daesung), a combination of penicillin G and dihydrostreptomycin, and a 0.9% sodium chloride solution to prevent the deterioration of the corneal ulcer. Abdominal ballotement produced a fluid response. The complete blood

Fig. 1. The patient was reluctant to walk due to systemic weakness at admission. Please note the remarkably distended abdomen indicated by the red solid arrow.

Table 1. CBC results of the patient while hospitalized

Parameter	Normal values	Day 1	Day 2	Day 3	Day 4	Day 7	Day 9
PCV (%)	24-53	23.09	17.70	25.52	25.78	26.01	26.49
Hb (g/dL)	8-19	8.8	6.6	9.6	10.0	9.9	11.4
Leukocytes (K/ μ L)	5.4-14.3	2.02	1.91	3.29	5.45	8.28	9.07
Neutrophils (K/ μ L)	2.3-9.6	1.09	1.09	2.54	4.06	6.58	6.84
Lymphocytes (K/ μ L)	1.5-7.7	0.77	0.64	0.43	1.04	1.22	1.87
Monocytes (K/ μ L)	0-1.2	0.14	0.14	0.30	0.30	0.41	0.30
Platelets (K/ μ L)	90-350	125	83	120	81	147	112

count (CBC) results indicated mild anemia with a low hematocrit value of 23.09% and severe leukopenia (Table 1). The serum chemistry and blood gas analysis results revealed mild hyponatremia, hypochloremia, hyperkalemia, and azotemia with elevated BUN and creatinine concentrations consistent with uroperitoneum, as shown in Tables 2 and 3 (1). The ultrasound confirmed leakage from the defective wall on the dorsocranial aspect of the urinary bladder and the resulting accumulation of fluid in the peritoneal cavity. Leakage was observed when a sterile 0.9% sodium chloride solution was infused via a urinary catheter (Fig. 2). The abdominocentesis yielded the withdrawal of approximately five liters of dilute yellowish peritoneal fluid, which was found to be blood-tinged aseptic urine originating from the bladder. Radiology of the thorax provided evidence of existing pneumonia. After analyzing the history, clinical signs, and results of the various examinations, the patient was diagnosed with uroperitoneum secondary to a rupture of the urinary bladder requiring immediate surgical intervention. Postoperatively, the foal was given 0.05 mL/kg of antibiotic (PPS; Daesung) intramuscularly, consisting of 5,000 IU/kg of penicillin G benzathine hydrate, 7,500 IU/kg of penicillin G procaine, and 10 mg/kg of dihydrostreptomycin sulfate, along with an NSAID, flunixin meglumine (Fortis; Dongbang) at 1.1 mg/kg intravenously. An emergency laparotomy for cystorrhaphy was performed under inhalation anesthesia with the appropriate fluid thera-

py. The foal was premedicated with 10 µg/kg of detomidine (Provet Detomidin; Provet), 10 µg/kg of diazepam (Diazepam; Samjin), and 10 µg/kg of butorphanol tartrate (Butorphan; Myungmoon). Anesthesia was induced with 1.1 mg/kg of ketamine (Ketamin; Yuhan), which was maintained with isoflurane (Ifrane; Hana). The patient was placed in dorsal recumbency. The abdominal region was prepared aseptically to be operated on. A sterile urinary catheter was placed in the urethra. The skin incision was made using a No. 20 scalpel blade. Upon exposure of the bladder, a 2 cm diameter defect on the dorsocranial aspect was found with some inflammation surrounding it (Fig. 3A). In the present case, the primary cause of the uroperitoneum was a tear of the urinary bladder wall. The tear confirmed via laparotomy was approximately 2 cm long. The lesion appeared inflamed and necrotic as if it had existed for at least a few days rather than a fresh wound. As the inflamed tissue around the defective tear was fragile with the possibility of infection, a transverse incision was made distal to the defect so that the remnant of the urachus was removed to reduce the possibility of other related

Fig. 2. Ultrasound image of uroperitoneum secondary to the rupture of the urinary bladder. Please note the leakage from the defect on the wall of the urinary bladder (UB) indicated by the black solid arrow as the sterile 0.9% sodium chloride solution was infused via a urinary catheter.

Table 2. Biochemical parameters at the initial presentation

Parameter	Normal range	Value
CK (IU/L)	120-470	173
Ca ²⁺ (mg/dL)	11.5-14.2	10.5
Cre (mg/dL)	0.6-2.2	2.3
AST (IU/L)	175-340	120
TBIL (mg/dL)	0.5-2.3	2.2
GGT (IU/L)	5-24	9
Albumin (g/dL)	2.2-3.7	2.5
TP (g/dL)	5.7-8.0	5.2
Glob (g/dL)	2.7-5.0	2.6

Table 3. i-STAT EC8+ or CG8+ results of the patient while hospitalized

Parameter	Normal values	Day 1	Day 2	Day 3	Day 4	Day 7	Day 9
Glu (mg/dL)	62-134	100	74	123	142	144	133
BUN (mg/dL)	11-27	45	N/A	14	10	11	10
Na ⁺ (mmol/l)	128-142	125	146	133	135	132	130
K ⁺ (mmol/l)	1.9-4.1	4.5	2.4	3.7	3.7	4.2	4.8
C ⁻ (mmol/l)	100-111	98	N/A	92	91	93	97
TCO ₂ (mmol/l)	24-32	29	17	39	43	39	31
pH	7.35-7.45	7.323	7.226	7.305	7.344	7.395	7.400

Fig. 3. (A) Defect on the wall of the urinary bladder on the dorsocranial aspect, 2 cm in diameter. Please note the inflamed tissue around the lesion. (B) Closure of the urinary bladder was made by a two-layer inverting suture. The remnant of the urachus was resected to reduce the possibility of other related complications.

complications. The incision was then closed by a two-layer inverting suture using the size 2-0 polyglactin 910 (Vicryl; Ethicon) (Fig. 3B). The peritoneal cavity and the organs were lavaged with 3 L of sterile saline. The abdominal wall was then closed with a suture using the size 2-0 polyglactin 910 (Vicryl; Ethicon), and the skin incision was stapled (Appose; Covidien). The patient was provided with systemic fluid therapy of a warm 0.9% sodium chloride solution mixed with 5% dextrose supplemented with bicarbonate before, during, and after surgery. The recovery was smooth and uneventful. The intensive supportive therapy was continued with periodic CBC and blood gas analysis. The patient was given ceftiofur (Avante; KBNP) at 5 mg/kg to prevent sepsis along with flunixin meglumine (Fortis; Dongbang) at 1.1 mg/kg to reduce the pain and inflammation related to the surgery. The foal was nursing better postoperatively and was urinating normally. On the day after surgery, the CBC values showed a significantly low hematocrit value owing to hemodilution but started to improve gradually afterward. The foal was responsive and alert but was still not ambulatory. Three days after the surgery, the patient could walk, and the leukogram returned to normal with remarkable clinical improvement (Table 1). The patient was continued on the same treatment regimen for the next three days with ceftiofur and then was resumed on rifampin and azithromycin to treat pneumonia. The patient was discharged on the 14th day of hospitalization. The follow-up at eight months of age showed that the patient was clinically healthy and doing well.

Discussion

Uroperitoneum is a disease of neonatal foals that results

from urinary leakage at the urachus, a bladder tear, or a ureteral defect (1,3,7). The most common cause of uroabdomen is a urinary bladder rupture (3). Rupture occurs more commonly on the weaker dorsal wall of the bladder and is believed to occur at parturition if the bladder is full during passage in the pelvic inlet. This means male foals have a higher risk because of their long narrow urethra (3). Intensive treatment, including intravenous fluid therapy with struggling that was repeated for a few days before referral, was strongly suspected as the reason for the rupture of the urinary bladder. In addition, being recumbent for days along with the constant fluid therapy may also have contributed to the full urinary bladder, making the patient unable to urinate properly.

Dehydration of the patient was corrected with the systemic fluid therapy with a warm 0.9% sodium chloride solution mixed with 5% dextrose supplemented with bicarbonate, as required perioperatively. The entropion was managed successfully by injecting a mixed solution of an antibiotic and 0.9% sodium chloride solution. The immediate correction of the entropion was effective in alleviating the pain caused by the corneal ulcer of the patient. Other clinical signs, including depression, anorexia, abdominal distension, and general weakness, improved gradually after the cystorrhaphy. The patient showed a decreased PCV upon arrival, and the value was aggravated temporarily due to hemodilution but improved gradually. Alterations in the serum electrolytes were consistent with uroperitoneum, including mild hyponatremia, hypochloremia, hyperkalemia, and azotemia, which returned to normal after correcting the primary cause of the uroperitoneum along with the systemic fluid therapy.

A diagnosis of the uroperitoneum can be made based on

the history, clinical signs combined with abdominocentesis, blood analysis, cystoscopy, and ultrasonography (4,6,8,9). In the present case, the patient appeared to have spent days with the clinical signs of the uroperitoneum unnoticed because of the recumbency caused by general weakness since birth. Foals with uroabdomen can remain subclinical because the alterations in serum biochemical values may be counteracted when they are provided with fluid therapy for other diseases. Ultrasonography enabled a definite diagnosis of uroabdomen secondary to the rupture of the urinary bladder. The actual leakage from the defective wall of the urinary bladder was confirmed while a sterile 0.9% sodium chloride solution was infused via the urinary catheter by ultrasound imaging. Ultrasonography is an effective diagnostic tool when the clinical signs and other laboratory results are ambiguous.

The treatment of the uroperitoneum aims to relieve the cardiovascular and respiratory status by draining the peritoneal cavity and adjusting the electrolyte imbalances (1). Uroperitoneum is a medical emergency, and surgical intervention is indicated in most cases. In the present case, the defect on the urinary bladder wall was 2 cm in diameter, which was rather large, thereby requiring an emergency laparotomy. The defect was not fresh. Thus, the distal part of the bladder to the defect was resected, and there were no complications related to surgery. The induction and maintenance of anesthesia, surgical procedure, and recovery were all uneventful without complications.

One regret of this report is that there was no diagnostic effort to determine the causative organism of the pneumonia diagnosed previously before referral because of the urgency to manage uroperitoneum, but an established antimicrobial regimen worked successfully for this case. A bacterial culture with an antibiotic susceptibility test should be conducted in cases of pneumonia to prevent the development of drug resistance and achieve better therapeutic outcomes.

Conclusions

A patient with uroperitoneum secondary to the rupture of the urinary bladder was treated successfully with cystorhaphy via laparotomy. Seven months of follow-up revealed the patient to be clinically healthy without any unexpected sequela. There are few clinical trial-related reports on uroperitoneum secondary to a rupture of the urinary bladder

in foals among horse owners and clinicians because of the lack of experience and the high mortality of foals born weak, particularly with other complications. This is despite the fact that the condition is not uncommon and can give promising results once diagnosed and treated in a timely manner. The authors expect that the clinicians will find this report beneficial for establishing a diagnosis and treatment strategy and anticipating the prognosis of foals with uroperitoneum secondary to a rupture of the urinary bladder in the future.

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Conflicts of Interest

The authors have no conflicting interests.

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