

UROLITHIASIS SYNDROM AS A PROBLEM AMONG FATTENING BUFFALOE-CALVES IN EASTERN DELTA

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ABSTRACT

Urolithiasis syndrome as a field problem was recognized and investigated in male buffalo calves were raised among flock in reclaimed and desert area just eastern of Nile delta, usually stall-fed a hay and untraditional ration with an excess of water from under ground source. The clinical cases, showed restlessness, colicky pain, straining with unsuccessful passage of urine. Calculus material composed mainly of magnesium, ammonium phosphate. Urine analysis showed remarkable increase in urinary sediments, pH and specific gravity. Phosphorus and magnesium concentration increased greatly, while calcium value was less. Biochemical investigation revealed increase in blood urea nitrogen, serum creatinine, total protein, phosphorus and magnesium concentrations. Vit. A and Beta carotene as well as calcium values were decreased. RBCs, Hb, PCV and total WBCs were increased with neutrophilia.

Pathological examination of urinary organs showed deposition of microcalculi in renal tissues and pelvis as well as urethra. Microscopically, coagulative necrosis of renal tubules and chronic interstitial nephritis were demonstrated in the affected kidney.

INTRODUCTION

Urolithiasis syndrome in ruminants constitutes one of the problems facing fattening animals industry and deserves serious consideration. It occurs commonly through the formation of calculi in the kidney, bladder and urethra. Clinically animals exhibited characteristic symptoms as anorexia, dysuria, stranguria and severe colicky pain. In severe cases where calculi are lodged in the urethra, complete obstruction occur to this portion leading to retention of urine, uremia or rupture of the urinary bladder (El-Kabbani et al. 1984). Death losses have been estimated to be as high as 10-30% in feedlot cattle in severe cases (Emerick 1938).

The etiology of urolithiasis remains at present uncertain, although metabolic and nutritional factors are mainly incriminated (Sockett et al. 1986 and Radostitis et al. 1995). Many dietary factors have been reported to influence the onset of metabolic disorders, but mineral imbalance seems logically the most important, of which calcium, phosphorus and magnesium are of especial importance (Ahmed et al. 1989 ; Stewered et al. 1990 ; Radwan and Ali 1999).

A search of literature revealed that the formation of urinary calculi requires: a nucleation center on which it forms, calculi-forming minerals at a high concentration enough to be deposited on a nidus, the proper pH for crystallization of these minerals to occur and certain time, which is also necessary (Radostitis et al. 1995 and Smith, 1996).

Other possible causative factors beside diet such as low water intake or heavy water loss, excessive mineral intake of highly mineralized artesian water as well as deficiency of vitamin A have been proved to be incriminated in such condition (Church 1991).

For all these considerations, the present study deal with urolithiasis syndrome caused by urethral obstruction in fattening calves with respect to clinical symptoms as well as the alteration in haematological values and biochemical parameter of blood sera. Attention was also directed to study the chemical analysis of urinary calculi as well as histopathological changes of urinary organs in affected calves.

MATERIAL AND METHODS

The study was carried out in the period from January to August 1999. A total of 36 buffalo calves (4-10) months old suffering from urine retention were examined. These animals were raised among a large feedlot flock in reclaimed and desert area just eastern of Nile Delta, and usually stall-fed on yellow corn, wheat bran, hay and untraditional ration (agro-industrial by products including date seeds, olive pulp, sunflower pulp plus molasses and common salts) with an excess of water from under ground source. The affected animals were admitted to veterinary clinic of faculty of Vet. Med. Zagazig University, as stationary patients. They were send by veterinary practitioners to the clinic of Vet. Med. for achieving of etologic diagnosis as well as for treatment. Immediate retention of urine was the main history and complain.

After taking complete case history, a thorough examination was performed for each case-special emphasis was given up on used diet, drinking water, clinical signs, urethral pulsation and palpation of bladder. At the same time, ten clinically healthy buffalo-calves proved by clinical and laboratory examination were used as control.

Urine analysis : Urine analysis was performed on the urine samples collected when possible

or were drawn directly from the urine residue in the bladder after slaughtering by means of Comber 9 strip test, (Boehringer, Mannheim Germany). For quantitative analysis of urine, inorganic phosphorus, calcium and magnesium content were measured according to **Fiske and Subbarow (1925)**; **Gindler and King (1972)** and **Neil and Nelly (1956)** respectively. Urinary sediment was examined microscopically.

Blood Examination : Two blood samples were obtained by jugular vein puncture from each examined animal in dry centrifuge tubes. The first blood sample was collected on heparin, for haemogram (**Coles, 1986**), the second one was collected without anticoagulant, the sera were separated and analyzed for serum urea nitrogen by **Patton and Crouch (1977)**, serum creatinine by **Husdan and Rapaport (1968)**, serum Beta caroten and vit. A determined by **Kaser and Steko (1943)** blood serum total protein by **Peters (1968)**. Serum phosphorus, calcium and magnesium concentration were determined by methods as applied to the urine samples.

Examination of calculi : Calculous materials of different size were collected from urinary organs of calves and analyzed chemically by (**King and Wotton 1959**).

Analysis of feed stuffs : Diet which offer to the affected animals were analyzed chemically for its contents of crude ash, crude protein, inorganic phosphorus, magnesium and calcium by the methods recommended by association of official agricultural chemist (**A.O.A.C 1980**).

Water analysis : Five water samples were collected from under ground and tap water, each sample was half liter for chemical analysis in central lab., Faculty of Veterinary Medicine Zagazig University.

Pathological Examination : The gross findings in emergency slaughtered animals as well as the microscopical examination of the tissue specimen collected from the urinary organs were described. The collected specimens were fixed 10% formalin solution and the thickness were stained for haematoxylin and eosin by **Bancroft et al (1990)**.

Statistical analysis of data were performed according to **Snedecor and Cochran (1980)**.

RESULTS

The observed clinical signs of the investigated animals were more or less severe and consequently were suggestion of the presence of urolithic problem in diseased animals. The symptoms however varied according to the severity of affection. Anorexia and depression were the first symptoms recognized in the early stage of affection. In advanced stage, the affected animals became restless, swishing of the tail and strained in an attempt to pass a small amount of blood stained urine. A heavy precipitate of grayish white crystals is often visible on the perpetual hair.

where this precipitation occurs as a result of the evaporation of urine that keeps this area wet. In this stage, the prepuce was noticed to be inflamed and swollen. In severe cases, colicky-pains developed, the animal kicks its abdomen, badling with hind feet and occasionally lie down and rise frequently with repeated twitching of the penis. The animals might make strenuous efforts to urinate, accompanied by straining grunting and grating of the teeth with unsuccessful passage of urine. In this stage deep palpation of the penis, around the sigmoid flexure revealed hypersensitivity in this area with palpated obstruction.

The collected calculi showed brown coloration with rough or smooth surface and it was varies in diameter from 0.5-0.75 cm and ranged from 2-5 gm. In weight, Chemical analysis of calculus are shown in table (3).

Urine analysis as well as haemogram and biochemical changes in clinical cases as compared with control are illustrated in tables (2,3,4,5) Tables (6 and 7) shows chemical analysis of offered diet and under ground water.

Pathological changes: Grossly, the kidney was enlarged and firm in consistency. On cross section the parenchyma was grayish in colour with the impeded microcalculi in the medulla and pelvis. The urinary bladder was distended with urine, the lining mucosa was congested and edematous. The urethra was inflamed with swelling mucous membrane. The sites of obstruction were found in the sigmoid flexure of the urethra. Microscopical finding of the kidney showed leucocytic infiltration of lymphocytes and macrophages in the cortex. Coagulative necrosis and degeneration were found in convoluted and collecting tubules, (Fig. 1, 2,3).

DISCUSSION

Urolithiasis syndrome is considered as an economic problem in ruminants under feedlot conditions as well as in certain problem areas where the pasture and diet have a high content of calculogenic components.

Based on the results obtained in tables (1, 5, 6, 7), it appears that the chemical composition of urinary calculi depend largely on a dietary intake of individual element. Phosphorus and magnesium salts were the principal ingredients in the chemical composition of the urinary calculi, while calcium and ammonia were relatively less table (1). These results are typical of that found among steer and lambs utilizing ration of high phosphorus content **El-Kabbani (1984)** and **El-Sayed (1996)**.

The observed clinical signs among the urolithic animals in this study as well as necropsy findings in slaughtered one proved to be typical subsequent cases of acute urethral obstruction by a

calculus. Restlessness, abdominal pain with kicking at the belly, treading with the hind feet and swishing of the tail, repeated twitching of the penis, sufficient to shake the prepuce, as well as unsuccessful trial to urinate were the most characteristic syndrome in affected animals. Concerning rupture bladder, agony, depression, apathy and gradual distension of the abdomen were already remarkable. The conjunctiva was intensely congestive. The pulse raised rapidly and the temperature decreased below the normal. These findings were common parallel with those mentioned previously by (El-Kabbani 1984; Cockcroft 1993 and Radostitis et al. 1995).

Concerning physico-chemical findings of urine, table (2) seemed that the urine was strongly alkaline due to the nature of utilized ration and water table (6 & 7). The obtained result are coincided with those reported by Kienzle and Schuknecht, (1993) who mentioned that there are a highly significant correlation between excess of base in the food and urine pH. Meanwhile, it is speculated, that not only increase intake of dietary minerals increases the concentration of urinary solutes, thereby promoting the process of crystallization and precipitation but also in ruminant feeding high concentrate, low roughage diet increases levels of urinary mucoproteins (Radostitis et al. 1995). This observation explained why the formed calculi were mostly phosphate in nature. Solubility of the magnesium phosphate decreased with increasing the urine pH, thereby creating conditions favorable for the deposition of uroliths. (Jenson and Mackey 1965 ; El-Attar et al 1989 and El Sayed 1996). An obvious increase of urinary sediment was microscopically apparent in all cases. Such urine sediment consisted mainly of triple and amorphous phosphate in the form of elongated coffin-lid crystals, calcium oxalate and calcium carbonate with increased amounts of RBCs, pus cells and abundant desquamated epithelial cells. These findings were similar to those observed by Cornelius et al. (1959) and Nasr, et al (1994) in fattening lambs and sheep with urolithic syndrome.

Proteinuria and haemoglobinuria were observed in most of the clinical cases, which are always a pathological findings during renal diseases. The nitrite, glucose, ketone, urobilinogen and bilirubin were negative. With respect chemical constituents of urine table (5) phosphorus and magnesium values showed marked elevation, when compared with their corresponding values in healthy animals. These result runs in the same way as that mentioned by Hoar et al, (1970) ; El-Kabbani et al. (1984) and El-Sayed (1996) in their experimental studies for the etiology of phosphatic uroliths in fattening lambs and cattle. A fact which is in agreement with Board and Peter (1976) who concluded that high urinary phosphorus levels, whether promoted by high dietary phosphorus levels or by factors increasing availability and alkali forming effects of the diet continue to be the most important factors elucidated as far as causes of phosphatic urinary calculi.

Regarding haematological investigation (table 3) revealed generally a marked elevation in

erythrocytic count, hemoglobin concentration and packed cell volume which may be attributed to a decrease in plasma volume as reported by **Boyed et al (1974)**. These results are in accordance with those recorded by **Mohanty, (1973)** ; **Ogaa, (1985)** ; **Gangwar et al (1990)** and **Kumar et al, (1991)** after experimental ligation of the urethra in calves. Such elevation may be as the result of dehydration, as the owners of the animals usually withheld water to avoid the rupture of the urinary bladder.

Leucocytosis with marked neutrophilia, lymphopenia, eosinopenia and monocytopenia were evident in diseased calves when compared with corresponding values in healthy calves. Such variation was explained by **Coles (1986)** who attributed these picture to effect of stress (pain) which led to release of cortisone. **Gangwar et al., (1990)** found only eosinopenia and explicated it to toxemia of uremia.

Furthermore, regarding the blood biochemical aspects of urethral obstruction among buffalo calves in the present study is a drastic elevation of blood urea nitrogen and creatinine levels specially in late stage of the obstruction Table (4). It could be consider as an indicators to involvement of the kidney in the pathogenesis of the urolithiasis syndrome. This expectation agree with the previous reports (**Coles 1986 and Radostitis et al. 1995**).

Meanwhile a significant increase in serum total protein level (table 4) was detected in the affected calves if compared with those in control ones. The obtained results may be attributed to severe dehydration which is judged by high environmental temperature in the studied area, excessive water losses and water deprivation among calves. The obtained results were agree with those previously reported by (**Abd El-Aal, 1988 and El-Sayed 1996**).

It was quite clear from table (4) that vitamin A and Beta carotene decreased remarkable in the serum of all cases. These changes had been already recorded by **Khamis and Saleh (1970)** in their study on urolithiasis syndrome in Egyptian cattle, the author explained that deficiency of vit A plays an important role in the formation of calculi due to insufficient carotene intake in summer period.

With regarding to mineral status, serum phosphorus and magnesium Table (5) seemed to be significant increase in buffalo calves with urethral obstruction. This is probably due to high phosphorus intake Table (6 and 7). In the same time calcium level tend to decrease when compared with the control values. The occurrence of hypocalcemia is thought to be related to the presence of hyperphosphataemia, although the exact pathophysiological relationship has not been established. Imbalance of the normal calcium: phosphorus ratio, excretion of abnormal quantities of phosphorus into the intestine with resultant formation of non absorbable calcium salts, and impaired utilization of vit. D have all been incriminated as factors which play a causative

role in the hypocalcemia following nephrolithiasis (Bushman et al., 1965a). This result agree with those of the experiment performed previously by Hoar et al. (1970); El Kabbani et al. (1984) and Agag et al., (1988) to study the etiology of phosphatic urolithiasis in fattening lamb. The author demonstrated that the serum and urine-on calculi provoking diet, were characterized by high serum magnesium, phosphorus, high concentration of urinary magnesium and low serum calcium, a phenomenon which coincide the result of the present study.

The treatment of urethral obstruction depends largely upon the severity of the clinical cases and the existing complication. However in this study it was evident that improvement resulted from both conservative and surgical methods of treatment, (urothrectomy). This results coincide with that reported by Oehme and Tillman (1965); Goalar (1978) and Abd-El-Aal (1988) who mentioned that medicinal treatment of complete urethral obstruction is frequently unsuccessful and is usually directed toward surgical intervention.

It is worthy to mentioned that the histopathological examination revealed tubular degeneration, variable degree of interstitial nephritis as well as marked presence of microcalculi in the medulla and renal pelvis (Fig. 1, 2, 3) this parallel to Agag et al (1988). Such pathological changes might precedes the migration of urinary calculi to the urethra and appearance of clinical signs of urine retention in affected calves.

Finally the study declared that, urolithiasis is multifactorial problem, and dietary factors has been implicated as being of etiological significance in feedlot calves. Although animals fed untraditional rations assumed body weight like animals fed traditional ration, but the mineral imbalance in agro-industrial byproducts had bad effect on the kidney where formed microcalculi and consequent where used on the long run led to microcalculi.

Hence our attention must be given to fattening calves feeding on adequate balanced mineral content beside certain good managemental factors may reduce the risk of calculi.

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Table 1 : Analysis of urinary calculi .

Organic matter	Inorganic matter	Phosphorus	Ammonium	Calcium	Magnesium	Carbonate
-	+	+++	+	+	+++	-

Table 2 : Urine analysis of 36 buffalo-calves affected with urolithiasis syndrome and controle.

Animals	Specific gravity	pH	Turbidy	Albumin-urea	Haemoglobin in urea	Urine sediment	Urine casts	Desquamate-d EP. cells
Affected (36)	1.035-1.045	7.9 - 8.2	+	++	+	++	+	+
Control (10)	1.020+1.025	7.2 - 7.8	Transparent	Nil	Nil	Traces	Nil	Few

Table 3 : Complete haemogram of 36 buffalo-calves affected with urolithiasis syndrome and control.

Animals		Hb gm/100	PCV %	R.Bcs x 10 ⁶	WBCs x 10 ³	Differential leucocytic count				
						Neut.	lymph	Eos.	Bas.	Mon
Affected (36)	mean	13.42**	37.5*	9.65**	15.42	58.73	40.1	0.35	0.05	0.15
	S.D	± 2.95	± 8.33	± 2.21	± 0.95	± 7.40	± 7.02	± 0.60	± 0.67	± 0.93
Control (10)	mean	9.84	28.78	6.05	9.5	46.21	52.0	0.80	0.9	1.05
	S.D	± 1.96	± 3.96	± 0.62	± 2.5	± 5.4	± 7.7	± 0.74	± 1.3	± 1.84

** Highly significant at P<0.01.

* Significant at P<0.05.

Table 4 : Some biochemical blood values of 36 buffalo-calves affected with urolithiasis syndrome and control.

Animals		T. P. gm%	S. urea nitrogen mg/JL	Creatinine mg/dL	Caroten µg/dL	Vit. "A" I. U/dL
Affected (36)	mean	7.99	74.83**	3.41	51.42**	32.57**
	S.D	± 2.50	± 24.9	± 1.85	± 18.02	± 14.00
Control (10)	mean	5.8	18.10	1.11	172	55.90
	S.D	± 1.90	± 6.7	± 0.39	± 39.50	± 9.5

** Highly significant at P<0.01.

* Significant at P<0.05.

Table 5 : Inorganic phosphorus (I.P), magnesium (Mg), calcium (Ca), levels in serum and urine of 36 buffalo-calves affected with urolithiasis syndrome and control.

Organic matter		Serum			Urine		
		I. P. mg/dL	Mg mg/dL	Ca mg/dL	I. P. mg/dL	Mg mg/dL	Ca mg/dL
Affected (36)	mean	8.81**	2.32*	9.27	47.77**	55.40**	3.63**
	S.D	± 3.70	± 0.31	± 0.96	± 32.71	± 21.82	± 3.33
Control (10)	mean	4.91	1.88	11.35	25.90	24.29	5.43
	S.D	± 0.85	± 0.32	± 1.00	± 12.0	± 7.09	± 0.76

** Highly significant at P < 0.01 * Significant at P < 0.05.

Table 6 : Chemical composition of consumed ration.

Chemical composition	Dietary ration %	Hay %
Crude protein	17.50	13
Ash	7.30	4.9
Calcium	0.49	1.3
Phosphorus	0.73	0.95
Magnesium	0.34	0.4

N. B. Unblanced ration containing lower calcium : phosphorus ratio.

Table 7 : Analysis of under ground and tap water.

Chemical composition	Under ground water	Tap water
Total soluble salts ppm	2210.0**	496.0
Bicarb mEq/L	3.20	2.10
Chloride mEq/L	20.10	5.11
Sulphate mEq/L	11.55	0.91
Calcium mEq/L	9.60	2.00
Magn mEq/L	6.00	1.70
Phosp. mEq/L	0.9*	0.71

N. B. Under ground water have high soluble salts and phosphorus.

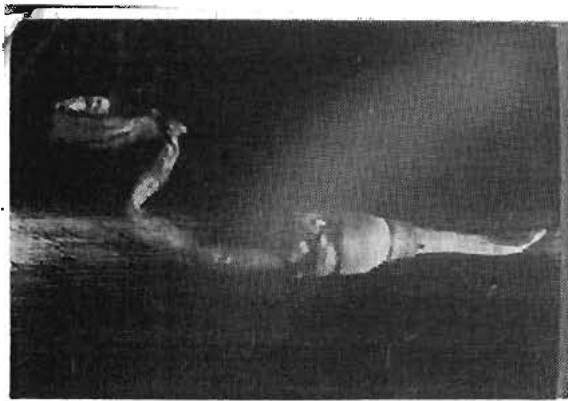


Fig. 1 : The sigmoid flexure occluding in it the calculus.

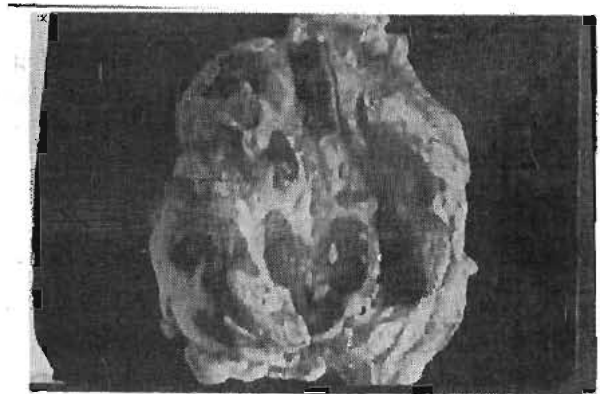


Fig. 2 : Part of kidney showing the slit of micro calculi.

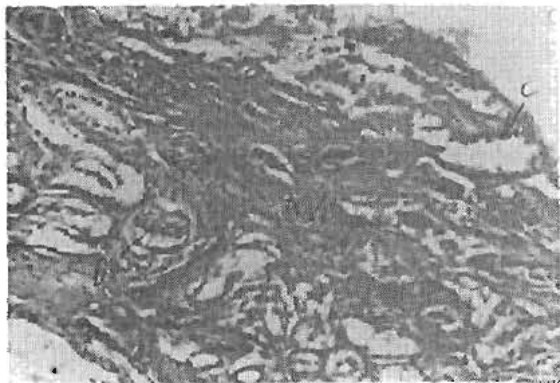


Fig. 3 : Kidney showing chronic interstitial nephritis represented by fibrous tissue, proliferation (A) among the necrosed and desquamated renal tubules (B) with leukocytic infiltration and cystic dilation of some renal tubules (C) (H&E x 150).

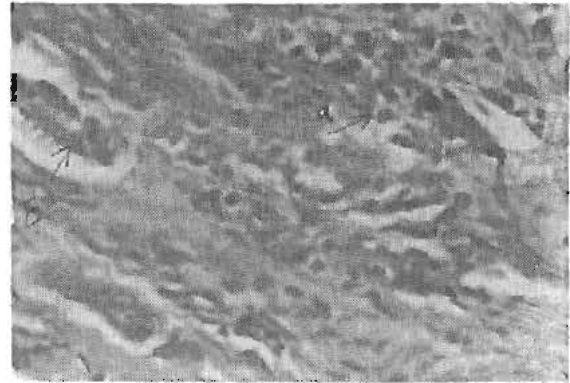


Fig. 4 : Kidney showing fibrous tissue round cells (d) and desquamation of lining epithelial cells from basement membrane of the renal tubules (E) (H&E x 150).

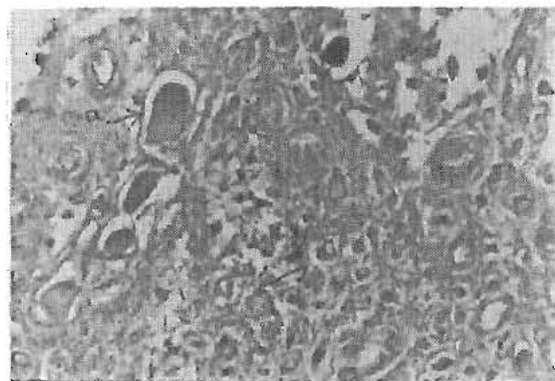


Fig. 5 : Kidney showing necrosis and pressure atrophy of renal tubules due to pressure of fibrous tissue proliferation (B) and hyaline cast in some renal tubules (a) (H&E x 150).

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الملخص العربى

ظاهرة حدوث حصوات المجارى البولية كمشكلة لدى

عجول التسمين الجاموسى فى شرق الدلتا

المشركون فى البحث

مهجه شوكت زكى عبدالرازق

إبتسام محمد جمال الدين

أحمد محمود وصفى القبانى

أجريت هذه الدراسة على عدد ٣٦ عجل جاموسى تابعة لإحدى قطعان التسمين القائمة بالمناطق الصحراوية المستصلحة حديثة فى شرق الدلتا - تعانى من إحتباس البول - وتعتمد فى تغذيتها على العلائق الغير تقليدية والدريس معاً - وتستخدم مياه الآبار كمصدر لمياه الشرب، بالإضافة إلى عدد ١٠ عجول جاموسى سليمة إكلينيكية وتتغذى على العلائق المركزة، جمعت من المزارع المجاورة وأستخدمت كمجموعة ضابطة، هذا وقد فحصت الحيوانات عند وصولها إلى مستشفى كلية الطب البيطرى إكلينيكيأ بعد أخذ عينات من البول والدم وكذلك العليقة ومياه الشرب المقدمة للحيوانات.

وتمثلت الأعراض الإكلينيكية فى وجود مغص وآلام مستمرة بالبطن وإمتناع عن تناول العليقة مع خمول - وكان هناك بذل جهد أثناء التبول مع إنثناء متكرر بالقضيب لم يسفر عن مرور البول كما أوضحت نتائج تحليل البول للحالات المصابة بارتفاع درجة الأيون الهيدروجينى (قلوى) والكثافة النوعية، كما أوضحت النتائج أيضاً إرتفاع نسبة الفوسفور والمغنسيوم مع وجود كرات دم حمراء وخلايا صديدية وكذلك خلايا طلائية متهتكة بالبول.

وتحليل مصل دم العجول المصابة باحتباس البول بمقارنتها بالسليمة اتضح وجد زيادة معنوية فى البروتين الكلى واليوريا نيتروجين والكرباتينين وعنصر الفوسفور والمغنسيوم - كذلك سجل نقص معنوى فى كل من فيتامين أ والبيتا كاروتين وعنصر الكالسيوم.

كما أوضحت صورة الدم إرتفاع فى نسبة كرات الدم الحمراء وهيموجلوبين الدم وزيادة فى حجم كرات الدم المسطحة وتحليل الحصوات التى جمعت من أعضاء الجهاز البولى وجد أنها تتكون من ترسيبات من أملاح الماغنسيوم والفوسفور والأمونيوم، وهذا وقد تم العلاج بالتدخل الجراحى.