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Urolithiasis and mineral profile in Gir calves and its control measure

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Abstract
In a cattle farm, Gir male calves aged between three to six months of five numbers showed clinical signs of distended abdomen, oliguria or anuria, anorexia, kicking of abdomen, rolling, incordination, unconsciousness and death during the winter season. Clinical examination revealed well distended pear shaped acute abdomen, fluid thrill was noticed on palpation and the aspirated intraabdominal fluid revealed clear in appearance, watery consistency, transparent to yellow colour and pH of 7 to 8 indicative of urine. BUN and creatinine concentration was higher in the intraabdominal fluid than the serum. Animals were died subjected to post mortem examination, which revealed urolithiasis and cystorrhexis. The calculi were subjected to physical examination and stone analysis. The rest of the animals in the herd were treated with ammonium chloride. After treatment, urolithiasis is not recorded.

Keywords: Urolithiasis, cystorrhexis, calcium apatite and ammonium chloride

Introduction
Urolithiasis affects both sexes, but in male bovine it's a common cause of lower urinary tract obstruction [4] due to narrow urethra and sigmoid flexure at preputial opening [12]. Uroperitoneum is caused by leakage of urine from the kidneys, ureters, urinary bladder or urethra [6] or from a ruptured persistent urachus [2, 3] into the peritoneal cavity. Grunder *et al.* 2002 reported in male cattle, rupture of the urethra leads to accumulation of urine in subcutaneous space in the inguinal region which result in water belly (pitting oedema along the ventral abdominal wall) [5]. The clinical signs were pear-shaped enlargement of the abdomen, followed by gradual deterioration in demeanour, appetite and abdominocentesis yields light yellow fluid [3]. Saravanan *et al.* (2017) reported a case of uroabdomen in Kangayam bullock; BUN and creatinine concentrations of the peritoneal fluid were higher than serum [9]. Calcium carbonate and carbonate apatite were the most common types of uroliths in bovines [8]. Sahinduran *et al.* 2007 reported that the calculi collected had different shapes and composed of calcium apatite, struvite, magnesium carbonate, calcium carbonate, and calcium phosphate cystine. He concluded that higher concentrations of magnesium ion in water lead to high hardness may contribute to urolithiasis in bovines [10]. Ammonium chloride at the dose rate of 200 mg per kg body weight per day as a urinary acidifier was found beneficial for preventing recurrence of uroliths in young and adult animals [1]. The aim of the study was to find the cause of death in calves, treatment for the disease, prevention of recurrence and formulating suitable control measures.

Materials and Methods
A commercial cattle farm in Puducherry rearing 200 cattle of various types of native and exotic breeds like Gir, Sahiwal, Jersey cross and HF cross etc. Every year in winter season, one or two calves of native bred especially Gir male calves were dying in the age group of three to six months. History revealed distended abdomen, oliguria or anuria, anorexia, kicking of abdomen, rolling, incordination, unconsciousness and death. The calves were subjected to clinical examination which includes details regarding appetite, voiding habits, behavior, rectal temperature, lymph node, mucus membrane, distension of abdomen and palpation of abdomen were documented (Table 1). Abdominocentesis was done at paralumber fossa with the help of a 16 or 18 G hypodermic needle and variable amount of blood tinged or clear fluid was aspirated. The aspirated intraabdominal fluid was subjected to physical and chemical examinations which include appearance, colour, consistency, odour and pH (Table 2). BUN and creatinine concentration was estimated in the serum and aspirated intraabdominal fluid.

The prognosis was given to owner for surgical intervention. Among five calves, four were died and one was euthanized. All five animals were subjected to post mortem examination and the findings were given in the Table 3. The calculi collected from the urethra were subjected to physical examination which includes colour, size and stone analysis was done by Fourier- Transform Infrared Spectroscopy (FTIR). Based on the above examination the rest of the animals in the herd were treated with ammonium chloride at a dose rate of 200 mg per kg body weight per day orally as three divided doses.

Result:

The clinical examination of the calves showed anorexia, dull, oliguria or anuria, distended pear shaped abdomen (Fig. 1), acute abdomen and fluid thrill on palpation was given Table 1. Abdomenocentasis fluid revealed transparent to turbid appearance, transparent to yellow colour, pH of 7 to 8, uremic odour. BUN and creatinine concentration is higher in the aspirated intraperitoneal fluid compared with the serum concentration (Table 2). The post mortem examination (Table 3) revealed rupture of the urinary bladder on dorsal aspect expect in one case was lateral region (Fig. 3), around 10 to 16 liters of urine was drained out from the abdominal cavity (Fig. 2), urinary calculi obstruction was noticed at neck of the bladder and proximal to sigmoid flexure. The calculi noticed were white in colour, vary in size from sandy to small stones (Fig. 4). The mineral profile revealed 100 percent calcium apatite in all five cases. Based on the clinical examination, analysis of the intraabdominal fluid and serum analysis, post mortem findings and analysis of urinary calculi revealed the rupture of bladder occur due obstruction of calcium apatite calculi. As a precautionary measure the rest of the calves in the herd were treated with ammonium chloride at a dose rate of 200 mg per kg body weight per day orally as three divided doses for period of one month. After the ammonium chloride treatment, there is no cases with urolithiasis is recorded in the cattle farm over a period of 6 months. Ammonium chloride act as a urinary acidifier was found beneficial for preventing recurrence of uroliths (calcium apatite) in young calves

Fig 1: Distended pear shaped abdomen

Fig 2: Draining of urine from the abdomen

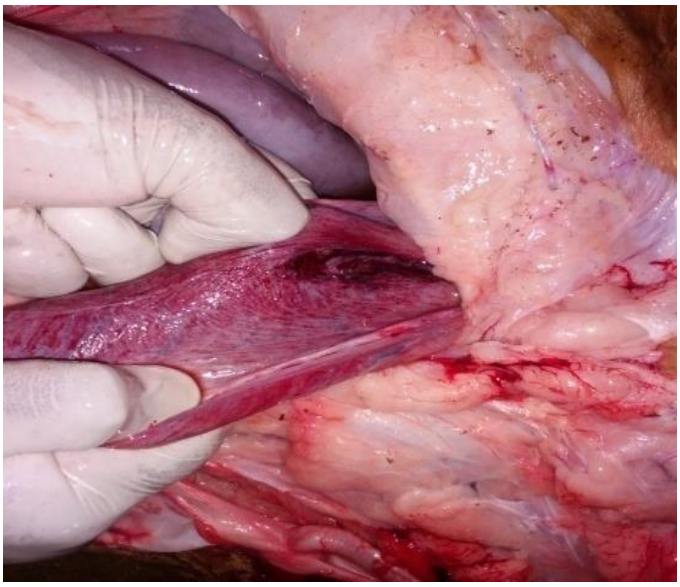

Fig 3: Rupture of urinary bladder

Fig 4: Small white colour calcium apatite calculi

Table 1: Clinical signs in Gir breed calves in urinary bladder rupture

Animal No./ Clinical signs	1	2	3	4	5
Behavior	Dull	Dull	Dull	Dull	Dull
Feeding habit	Inappentance	Anorexia	Anorexia	Anorexia	Anorexia
Voiding habit	Not voiding	Not voiding	Not voiding	Not voiding	Less amount
Urination	Oliguria	Anuria	Anuria	Anuria	Anuria
Conjunctival mucus membrane	Pink	Pale	Pale	Congested	Pale
Temperature (F°)	101.5	100.2	100.1	98.5	99.6
Distended abdomen (pear shape)	Present	Present	Present	Present	Present
Acute abdomen	Not shown	Noticed	Noticed	Noticed	Not shown
Fluid thrill on palpation	Present	Present	Present	Present	Present

Table 2: Physical and chemical examination of abdominal fluid in Gir breed calves with urinary bladder rupture

Animal No./ Parameters	1	2	3	4	5
Appearance	Clear	Clear	Clear	Clear	Mild turbid
Colour	Transparent	Transparent	Transparent	Transparent	Mild yellow
Consistency	Watery	Watery	Watery	Watery	Slimy
Odour	Uremic	Uremic	Uremic	Uremic	Uremic
pH	7	7	8	7	8
Creatinine mg/ml Blood	5.2	5.5	6.1	5.4	6.4
I/P fluid	16.4	17.4	18	16.6	18.8
Creatinine ratio (Blood : I/P fluid)	1:3.15	1:3.16	1:2.95	1:3.07	1:2.93
BUN mg/dl Blood	60.2	65.6	70.2	55.2	69.5
I/P fluid	150.2	155.8	165.4	160.1	170.6
BUN ratio (Blood : I/P fluid)	1:2.5	1:2.38	1:2.36	1:2.9	1:2.45

Table 3: Postmortem findings in Gir calves with urinary bladder rupture

Animal No./ Parameters	1	2	3	4	5
Volume of urine (liters)	10	14	13	15	16
Urinary bladder rupture (region)	Dorsal	Dorsal	Dorsal	Dorsal	Lateral
Region of calculi logged	Neck of UB	Proximal to sigmoid flexure			Neck of UB
Urolith / Urolith obstruction	Present	Present	Present	Present	Present

Discussion

Parrah *et al.* (2010) reported that the incidence of uroabdomen cases were more during the month of December to May (winter season) due to decrease water intake, can raise the relative concentration of urinary mineral solutes [7], which is concordance to the present study. Urolithiasis affects both sexes, but in male bovines is a common cause because of their anatomical structure of the lower urinary tract [4] due to narrow urethra and Sigmoid flexure at preputial opening [12] which is similar to the present study, only male calves were died of cystorrhexis due to urolithiasis. The clinical signs manifested by the uroabdomen Gir calves were distended abdomen, oliguria or anuria, anorexia, pink to pale conjunctival mucous membrane, dull, well distended pear shaped acute abdomen, fluid thrill was noticed on palpation, kicking of abdomen, rolling, incordination, unconsciousness and death, which is in accordance with the reports of Grunder *et al.* (2002) and Ueli Braun and Karl Nuss (2015) [5, 13]. Sharma *et al.* 2009 reported the common site of obstruction in small ruminants or calves are urethral process or tip of penis but in the present study, neck of the bladder and proximal to sigmoid flexure were the site of urolith obstruction [11]. In the present study the BUN and creatinine concentration was higher in the intraabdominal fluid to that of serum is similar to Saravanan *et al.* 2017 [19]. Sahinduran *et al.* 2007 and Prachi *et al.* 2017 reported calcium apatite is the most common urolith in bovines [10, 8], which is similar to the present study revealed 100 present calcium apatite calculi. Ammonium chloride used as urinary acidifier was given @ 50 mg/kg body weight orally for 60 days was found beneficial for preventing recurrence of uroliths [8] but in the present study, Ammonium chloride dose was followed as per Allen *et al.* 2016 who used @ 200mg/kg body weight orally per day as three divided dose [1].

Conclusions

Urolithiasis lead to Cystorrhexis is a common disease in winter season due to decrease intake of water. Male calves more prone due to its anatomical structure. Urolithiasis or cystorrhexix is treated surgically and can be prevented by using the urinary acidifier or even increase the salt level to 4 percent in the diet in order to stimulate the water consumption and increase urine output.

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