STUDIES ON HAEMATOLOGICAL AND BIOCHEMICAL CHANGES IN URAEMIA AFTER URETHRAL OBSTRUCTION AND ITS SURGICAL MANAGEMENT IN BUFFALO CALVES (*Bubalus bubalis*)

M.V.Sc THESIS

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By

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C E R T I F I C A T E - I

This is to certify that the thesis entitled " STUDIES ON HAEMATOLOGICAL AND BIOCHEMICAL CHANGES IN URAEMIA AFTER URETHRAL OBSTRUCTION AND ITS SURGICAL MANAGEMENT IN BUFFALO CALVES (*Bubalus bubalis*) " submitted in partial fulfilment of the requirement for the Degree of Master of Veterinary Science (Veterinary Surgery and Radiology) of the faculty of Post-graduate studies. Rajendra Agricultural University, Bihar is the record of bonafide research carried out by Dr. Navin Kumar Arya under my supervision and guidance. No part of the thesis has been submitted for any other Degree.

It is further certified that such help or informations received during the course of this investigation and preparation of the thesis have been duly acknowledged.

(K. B. P. Agrawal)
Head of the department
Dept. of Surgery & Radiology

C E R T I F I C A T E - I I

We the undersigned, Members of the Advisory Committee of Dr. Navin Kumar Arya a candidate for the Degree of Master of Veterinary sciencé with major in Veterinary Surgery and Radiology have gone through manuscript of the thesis and agree that the thesis entities STUDIES ON HAEMATOLOGICAL AND BIOCHEMICAL CHANGES IN URAEMIA AFTER URETHRAL OBSTRUCTION AND ITS SURGICAL MANAGEMENT IN BUFFALO CALVES (*Bubalus bubalis*) may be submitted by Dr. Navin Kumar Arya in partial fulfilment of the requirement for the Degree.

K. B. P. Agrawal
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Members of the Advisory Committee

1. D. P. Singh
2. M. K. Roy
3. L. N. Prasad
4. Md. Murtaza

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NAVIN KUMAR ARYA

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Introduction

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Uraemic syndrome is a complex pathophysiologic state of animals, suffering from diseases of vital organs. In bovines, usually urethral obstruction and its related pathologic process is the chief cause of uraemia, due to its progressively narrowed, extra-large penile urethra and S-Shaped sigmoid flexure. The pathogenesis of urolithiasis in large animals is observed when migratory calculi impact the urethra and lead to anurea (Blood and Raddoititis, 1989). The clinical menifestations synchronous with the systemic changes in blood picture and blood chemistry reveal the composite picture of uraemia.

The incidence of urolithiasis in bovines is very high and it exhibits relation with species, age, sex and diets of animals. There is regional prevalence of the condition. It has been observed that after 44-74 hours of complete urethral obstruction, the urinary bladder generally gets ruptured (Gera and Nigam, 1980). For treating an established case of urethral obstruction, medicinal treatment has no place in-view of modern developments in surgery. Vask and Keeler (1962) stated that there are well established surgical operations for the removal of calculi of man and

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domestic animals. Surgical maneuvers for removal of urethral calculi comprise of urethrotomies at different positions.

Inspite of vast studies on clinical menifestations of urethral obstruction, it is very difficult to judge the duration of occurrence. Thus, each case of urethral obstruction presents special problem in treatment and recovery. Besides urethrotomy, drainage of urine from peritoneal cavity and cystorrhaphy are performed in cases of bladder rupture. Success is dependent on the severity of clinical conditions of the animals. Hence an early diagonosis and rectification of the malady enhances the success rate in surgery. Various clinico-physiological alterations in blood constituents such as increase in blood urea nitrogen, increase/decrease in serum electrolytes depict the stages of uraemia after urethral obstruction and rupture of urinary bladder.

Gera and Nigam (1980) reported that haemoglobin % progressively increased in buffalo calves from pre ligation mean value of 9.20 gm% to 12.85 gm% at the time of death. They also reported significant increase in mean haematocrit value at 12 hours post ligation and no differences in the value at 24 and 36 hours of post ligation till the terminal stage. Jadon,

et al. (1987) reported progressive significant increase in neutrophils during the course of experimental urethral obstruction in buffalo claves. Pandey, et al. (1986) recorded highly significant rise in blood urea nitrogen in buffalo calves when compared between after ligation and post release of urethral obstruction in different groups of experimental urethral obstruction. Gangwar, et al. (1990) noted 10 fold increase in serum creatinine value following urethral obstruction in calves, there was highly significant diffrences during the course of complete urethral obstruction from pre obstruction values. Pandey, et al. (1986) noted highly significant rise in potassium content of serum in buffalo calves on 3rd day post obstruction.

These observations reflect variable changes in blood picture and blood chemistry. Moreover the picture of experimental uraemia approximately tally with clinical cases of uraemia. Considering these factors the study has been planned to investigate haematological and biochemical changes with their associated clinical manifestations following experimental uraemia created with a method simulating clinical development of uraemia and its surgical management.

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Review of Literature

REVIEW OF LITERATURE

In the present studies effort has been made to cite some important works on Urolithiasis, a very ancient malade, found even in the fossils of man and animals. Different types of treatment for stones in the kidneys or in the bladder, were discussed in a Veterinary text for the first time in 1667. Bristol, et al. (1961) reported the history of urolithiasis according to cattle doctor dates back to 1880 A.D.

2.1 ETIOLOGY OF UROLITHIASIS

William (1955) reported that castration adversely affected the normal development of urethra due to lack of testosterone, which in due course caused decrease of hydrophillic colloids in urine. Such conditions following castration predisposed the animal to calculus formation.

Castration at a very young age predisposed the obstructive urolithiasis in bovines (Marsh and Safford, 1957).

Connel, et al. (1959) indicated that Silica-calculi occurred in cattle, drinking both hard and soft water.

Udall (1962) reported that feeding

certain amount of sodium chloride helped to prevent calculus formation by decreasing the rate of deposition of Magnesium and Phosphate around the nidus of calculus.

Romanowski (1965) showed that infection was one of the factor responsible for formation of uroliths possibly due to increased urinary pH. He also stated that renal damage might also play some role as large protein molecules would be permitted in the urine for micturition.

Crookshank, et al. (1967) found that the dietary ratio between calcium and phosphorus might play role in calulus formation. Increase in the phosphorus concentration in diet increased the incidence.

King (1967) reported that the pH of the urine of an animal determined the salts that were to precipitate. He further reported that the urine with pH below 5.0 precipitated uric acid, from 5.0 to 6.5 oxalates and above 7.0 phosphates.

Hoar, et al. (1969) observed that a low calcium ratio in the ration did not lead to the formation of urinary calculi, unless the phosphorus content was high (around 0.55%). When sodium bicarbonate, which increased urine alkalinity was added to a concentration of 2% to a high phosphorus ratio, the incidence of calculi shot up from 85 to 88% in lambs.

The rice straw rich in soluble oxalates had been thought to responsible for oxalates calculi. Kataria and Rao (1969) showed that excessive wheat bran feeding to buffaloes was responsible for higher incidence of phosphatic calculi.

Vasudevan and Dutt (1969) maintained eight calves 3-4$^{1}/_{2}$ months old and two yearling heifers or a low carotene diet for 6-20 months four calves suffered from urolithiasis. The calculi on analysis were found to be composed of protein, xanthine pigment and phosphates and oxalates of calcium. They concluded that a diet deficient in Vitamin - A predisposed young calves to the formation of renal calculi.

Schechter (1970) opined that bacteria were not the primary causal agents in cystitis and urolithiasis.

When high concentration of phosphorus was given in the diet of ewelambs, there was marked reduction in weight gain and food consumption. With the addition of high potassium with extra calcium in the diet such effects were controlled. No obstructive calculi were seen in the high potassium and extra calcium were seen in the high potassium and extra calcium fed ewelambs. However the 55 - 57% of ewelambs presented obstructed urinary calculi, were fed with high

phosphorus and low calcium. The animals maintained with extra potassium presented larger deposits. The prevalence was reducted to 17% by feeding high concentration of calcium [Hoar, et al, 1970].

Grunberg (1971) calculated the solubility of calcite in urine after the model of an aqueous solution of electrolyte to interpret the conditions of formation of carbonate stones. It was found that magnesium calcium relationship and the pH of the urine were important factors in the formation of carbonate stones.

Kaushal, et al. (1972) concluded that high urinary phosphorus excretion and reduced urinary calcium and magnesium excretion increased susceptibility to the formation of phosphatic calculi.

In areas with chalky soil higher incidence of urolithiasis was reported by Bhatt. et al. (1973).

Clark (1974) isolated 34 strains of Staphylococci from the urinary tract of dogs with calculi studied. 31 produced coagulase while 33 were able to produce urease and phosphates. Bacterial urease could increase the ammonium ion concentration and the urinary pH by breaking down urea, while phosphates by its action on organic phosphates increased the

concentration of the inorganic form. Though the amount of inorganic phosphate in canine urine was small it might not be important in calculus formation.

Munakata, et al. (1974) found that when concentrates ratio was increased to 2% - 2.5% of body weight. The Urolithiasis syndrome appeared within two months but when the concentrate ratio was restricted to 1% and roughages allowed adlib, no urinary sediment appeared during 3 months of observation.

Infection with phosphate calculi present in 13 of dogs was associated with a variety of bacteria. Weaver and Pillinger (1975) found that bacterial infections were present in urine and the interior of calculi. This might have some relationship to urolithiasis.

Studies in range calves in Southern Alberta showed that siliceous calculi were formed in the sixty dogs of the pre weaning period. Bailey (1967) stated that if at this time the feed was supplimented with 12% salt and the water turnover was increased, these would be reduced the calculus formation. A supplement containing 20% salt was less effective.

Sorensen (1980) stated that feed supplement of stilboesterol led to calculus formation.

North American cattle on pastures

containing high level of silica were found to be more prone to urolithiasis (Bailey, 1981).

Huntington and Emerick (1984) indicated more calculi formation in steers feeding of 0.6% calcium increased bone resorption in low concentration of calcium caused increased plasma hydroxy proline, an oxalates precursor, which could be the source of oxalate calculi.

Singh, et al. (1985) found that feeding of paddy straw and leguminous feed in bullocks might lead to oxalates uroliths.

Zimmerman and Witte (1988) showed the cause of majority of losses due to diseases of urinary tract in milk pulps in the post weaning period was the development of urolithiasis in juvenile male. The juvenile males was followed by infection with strains of *Staphylococcus intermedius* which were considered to be part of the normal body flora of the mink. Congulase negative staphylococci were found in urine samples from clinically healthy mink, but these are believed to be of no importance in the pathogenesis of urolothiasis.

Zamir, et al. (1989) provided a ration containing 60% palm kernel meal (PKM) and 30% palm oil meal effulent to six, four month old Dorset cross lambs. All were also given molasses (8.5%) limestones and

Vitamin-A (1.5%). Three sheep died after 4 months and had urolithiasis, causing haemorrhgic cystitis hydronephrosis and ascites. Uroliths in the bladder were triple phosphate crystals.

Stewart, et al. (1990) showed that high silica diet having high dietary calcium to phosphorus ratio and alkali forming potential contribute to Silica urolithiasis in sheep.

Erturk, et al. (1991) fed pelleted drinking water to the 4 groups each of thirty housed male Merino lambs, Groups I were given a pelleted concentrate ration for 12 weeks. Group II received vitamin-A injections, Group III alkaline drinking water and group IV both Vitamin A injection and alkaline drinking water. Histograms of the results of quantitive analysis of urine samples showed increase of calcium Phosphate, uric acid ammonia and cystine in all groups.

Ultrasonic examination of the right kidney of 125 grassfed dairy cows detected calculi in 43 (93%) of the 46 tried in stalls, 34 (83%) of the 41 in loose housing and 25 (63%) of the 41 at pasture. calculi of 5-10 mm diameter were found in 19(44%),6(15%) and 3(7%) respectively. Yamada, et al. (1991) concluded that adequate exercise is necessary to prevent urolithiasis in cattle.

Grude (1992) reported that among 20 male lambs in a small flock in the Jaeren region (Norway) that were fed concentrates during winter, 5 cases of urotithiasis occured. In Norway concentrate feeding of lambs had not been an usual practice. It was suggested that if a change to this merhod of feeding was made urotithiasis could be a wide spread problem.

Buffington, et al. (1994) compared the effect of albumin and Tamm Harsfall protein (THP) on crystal growth in sample wells with that in control wells. Without protein addition in the same plate, crystal growth was assessed by determination of number of crystals and supersaturation index, a scale of crystal habit at different dgree of supersaturation by use of visual examination. It was concluded that THP significantly promoted growth of struvite crystals in feline urine and thus might have a role in struvite urolithiasis and struvite urethral plug formation.

2.2 BIOPHYSIOLOGICAL CHANGES

Finco and Duncan (1976) studied eighty seven dogs and twenty four cats, and grossly assumed azotemia if blood urea nitrogen (BUN) was more than 35 mg/100 ml or if serum creatinine (SC) was more than 1.5 mg/100 ml, regardless of species. All cases were of

naturally ocurring azotemia except 8 cats which had induced urethral obstruction. They assumed postrenal azotemia, if outflow obstruction was present. There was no evidence of renal diseases if BUN and SC returned to normal after removing their obstruction. They concluded that differentiation of renal from extra-renal azotaemia was not possible from the BUN : SC ratio, BUN and SC should be regarded as crude indices of renal function; single determination provide no basis for prognosis.

Urethral obstruction induced in adult male cat caused clinical signs indentical with those observed in naturally occurring disease. Central nervous depression, anorexia, dehydration, vomitting, muscles weakness and hypothermia occurred. Weight loss due to water loss and catabolism, metabolic acidosis, mild hyponatraemia, hyperkalaemia, hypermagnesaemia, hypocalcamia, azotaemia and hyperproteinaemia were noted by Finco and Cornelius (1977).

Gera and Nigam (1980) studied clinical, haematological and biochemical changes of urethral ligation in calves. After two hours of ligation, animals were showing micturition reflexes and after 12 hours, signs of colic were observed. There was progressive increase of haemoglobin, haematocrit, total erythrocyte and leucocytic count post ligation. There was no

significant different between the values of erythrocyte sementation rate at different intervals. There was initial increase in BUN , creatinine and inorganic phosphorus, the values declined after 36 hours post ligation and again there was progressive increase in these values upto the terminal stages. There was a gradual increase of plasma potassium during this study.

Gera, et al. (1980) studied biochemical changes following transplantaion of preserved bladder allografts in buffalo calves. They found significant increase in BUN value to a mean value of 38.03 mg/100 ml after 24 hours of urethral ligation. The value further increased to 41.05 mg percent at the interval of 24 hours post cystoplasty and decreased afterwards and returned to within normal limits at 120 hours post Cystoplasty. Creatinine levels ranged between 2.00 to 4.00 mg/100 ml after 24 hours of urethral ligation, continuously decreased afterwards. The values were not significantly different from the preligation values at 48 hour post cystoplasty. Inorganic phosphorus increased to a mean value of 6.20 mg% after 24 hours of ligation and became normal after 48 hours of cystoplasty. Potassium level significantly increased to 8.0 mEq/L after urethral ligation from pre ligation values and come within normal limits at an interval of 24 hours

postcystoplasty. Sodium values fluctuated within normal range throughout the experiment.

A study was undertaken to evalute biochemical and haematological alterations following retention of urine due to urolithiasis in bullocks. Gera and Nigam (1981) found increase in the following values : haemoglobin 14.5 - 18.2 gm%, haematocrit 43 - 62 vol%, total leucocytes count 4400 - 8750 / Cu mm (7200 normal mean values), total erythrocytes count 10.88millions/Cu mm, differential leucocytes count : neutrophils 50.4%, blood urea nitrogen 181.96 mg%, creatinine 3.5-10.18mg%, Inorganic phosphorus 9.40 mEq/L. Potassium 7.9 mEq/L. Sodium values were normal and calcium values reduced.

On biochemical examination of blood in clinical cases of bovine urolithiasis Singh, et al. (1981) showed significant increase in the levels of blood urea nitrogen, creatinine , inorganic phosphorus, Magnesium and Potassium when compared to normal ones. During postobstruction period these levels decreased progressively. Haemoglobin slightly increased and clotting time prolonged.

Amer, et al. (1982) studied clinico-pathological picture after urethral obstruction in rams. Surgical occlusion of the urethra was carried out in four rams and blood samples collected at different

intervals after the operation. Progressive increase occurred in blood urea nitrogen, blood non preoteinous nitrogen, serum creatinine, serum potassium and serum inorganic phosphorus. Gross and histopathological lesions characteristics of uraemia were observed.

To study pathologicaly changes in bovine uraemia. Sharma, et al. (1982) produced experimental uraemia in bovine male calves by urethral obstruction with *Laminaria digitata*. Severe uraemia was menifest with severe stasis, prostration, laboured breathing, coldness of extremities, significant decline in ESR and significant increase in blood urea nitrogen and serum potassium level with evidence of alkalosis. Respiratory failure preceded cardiac arrest in all the animals. On the basis of functional damage and histopathological observation, kidney, liver, lungs and heart were considered in that order to be the target organs in bovine uraemia.

Singh, et al. (1983) studied the biochmical alteration in plasma and urine of 12 urolithiasis-affected bullocks. They showed slight decrease in plasma calcium levels. Plasma inorganic phosphorus was higher and tended toward normal on the 18th post operative day. The concentration of sodium was unaltered. Plasma Potassium and Plasma creatinine both

were significantly higher in these cases which returned to normal on the 8th day post opearation.

Singh, et al. (1983) studied different biochemical parameters during peritoneal dialysis in experimentally induced urethral obstruction of buffalo calves. BUN values and creatinine level increased 24 hours after urethral ligation but decreased significantly after peritoneal dialysis and returned to near normal level by 48 hours. Inorganic phosphorus value significantly increased after 24 hours of urethral ligation and returned to near normal after the dialysis. There was no significant difference between calcium level after urethral ligation and peritoneal dialysis. The potassium level increased significantly but also decreased significantly after peritoneal dialysis and remianed near normal afterward.

Changes in the serum constituents were recorded during and after release of urethral ligation of buffalo calves. Pandey, et al (1986) found highly significant changes in the the values of blood urea nitrogen. The rise in creatinine value during urethral ligation was also highly significant and the value declined when ligature was taken out. The serum iorganic phosphorus decreased progressively. With the increase in ligation period there was progressive increase in

Sodium, Potassium & Calcium contents.

Jadon, et al. (1987) recorded the clinico-haematological changes in buffalo calves during experimentally produced urethral obstruction, within 4-8 hours of urethral obstruction, the micturition reflexes were shown as contraction of abdominal muscles. progreesive increase in TEC, TLC, PVC and haemoglobin percentage,decrease in ESR, neutrophillia and lymphopenia were obseved.

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Joshi, et al. (1988) observed the effect of administration of cystone on pH and electrolyte level in bullocks. Out of hundred animal two were screened for potential stone formers by crystallization technique. Ther were treated with cystone tablets @ of 20 tabs for 15 days.

The urological and biochemical changes in urethral obstruction by clamping the urethral catheter of five male buffaloe were observed by Jadon, et al. (1989). Blood urea nitrogen increased greatly as did

sialic acid. Globulins increased while total protein remained more or less unchanged.

Partial obstruction for eighteen days followed by compelete urethral obatructin in six he-goats by ligating the urethra in the post scortal region with four other goas as control was there with progressive development of uraemia, animals showed depression in addition to intense micturition reflexes. There was slight decrease in PCV,TEC, blood glucose and inorganic phosphorus in affected goats. The level of serum urea nitrogen and creatinie increased progressively with the develoment of uraemia. creatinine was found to be more diagnostic value than blood urea nitrogen during the terminal stage of uraemia [Pandey and Singh, 1989]

Barua, et al (1990) studied certain blood biochemical parameters of cow calves due following experimental rupture and repair of the urinary bladder. There was elevation of bicarbonates at 48 hours following ligation of urethra but it declined slowly to almost normal limits within 108 hours following repair of bladder. There was significant increase in blood urea nitrogen and creatinine values following 48 hours of urethral ligation. With treatment these values gradually declined and reached almost normal at 108 hours of

repair of urinary bladder.

Betinell and Nuss (1990) found a case of a 3 month old calf with anurea, ascites and high levels of blood urea.

During examining the sediment formed at the bottom of test-tube after 1ml of urine and 1ml of the ammonium hydroxide were mixed and allowed to stand at room temparature for 1 hour. Deore et al. (1990) observed that all of the 6 samples of urolithiasis were positive for this reaction, Biochemically they showed more phosphorus and magnesium in the urine samples.

Partial obstruction for 15 days followed by comple urethral obstruction was maintained. Gangwar, et al. (1990) noted increased micturition reflexes, difficult urination and partial anorexia following partial obstruction. These signs were more severe during compelete urethral obstruction with colic. There was significant increase in haemoglobin % and PVC. Leukogram remained normal but there was significant eosinopenia. The survival time of the animals after compelete urethral obstruction was found to be 104.32 $\pm$ 20.6 hours.

Kumar, et al (1990) noted some enzymatic changes following obstructive urolithiasis in bullocks. It causes marked increase in serum creatinine

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Singh, et al. (1987) studied the effect of bilateral ureter obstructin. The mean rise in blood urea nitrogen was found to be 9.84m.moles/L/days. Development of Matabolic alkalosis, hyperchloraemia occurred with significant decrease in PCV, heamoglobin and plasma total protein.

Joshi, et al. (1988) observed the effect of administration of cystone on pH and electrolyte level in bullocks. Out of hundred animal two were screened for potential stone formers by crystallization technique. Ther were treated with cystone tablets @ of 20 tabs for 15 days.

The urological and biochemical changes in urethral obstruction by clamping the urethral catheter of five male buffaloe were observed by Jadon, et al. (1989). Blood urea nitrogen increased greatly as did

sialic acid. Globulins increased while total protein remained more or less unchanged.

Partial obstruction for eighteen days followed by compelete urethral obatructin in six he-goats by ligating the urethra in the post scortal region with four other goas as control was there with progressive development of uraemia, animals showed depression in addition to intense micturition reflexes. There was slight decrease in PCV,TEC, blood glucose and inorganic phosphorus in affected goats. The level of serum urea nitrogen and creatinie increased progressively with the develoment of uraemia. creatinine was found to be more diagnostic value than blood urea nitrogen during the terminal stage of uraemia [Pandey and Singh, 1989]

Barua, et al (1990) studied certain blood biochemical parameters of cow calves due following experimental rupture and repair of the urinary bladder. There was elevation of bicarbonates at 48 hours following ligation of urethra but it declined slowly to almost normal limits within 108 hours following repair of bladder. There was significant increase in blood urea nitrogen and creatinine values following 48 hours of urethral ligation. With treatment these values gradually declined and reached almost normal at 108 hours of

repair of urinary bladder.

Betinell and Nuss (1990) found a case of a 3 month old calf with anurea, ascites and high levels of blood urea.

During examining the sediment formed at the bottom of test-tube after 1ml of urine and 1ml of the ammcnium hydroxide were mixed and allowed to stand at room temparature for 1 hour. Deore et al. (1990) observed that all of the 6 samples of urolithiasis were positive for this reaction, Biochemically they showed more phosphorus and magnesium in the urine samples.

Partial obstruction for 15 days followed by comple urethral obstruction was maintained. Gangwar, et al. (1990) noted increased micturition reflexes, difficult urination and partial anorexia following partial obstruction. These signs were more severe during compelete urethral obstruction with colic. There was significant increase in haemoglobin % and PVC. Leukogram remained normal but there was significant eosinopenia. The survival time of the animals after compelete urethral obstruction was found to be 104.32 $\pm$ 20.6 hours.

Kumar, et al (1990) noted some enzymatic changes following obstructive urolithiasis in bullocks. It causes marked increase in serum creatinine

phosphokinase (Cpk) and leucocytic alkaline phosphotase activity without significant changes in serum lactate dehydrogenase (LDH). Serum Cpk and leucocytic alkaline phosphatase activities were higher at 24 hours after surgical correction and then values gradually declined towards normal. Bullocks which could not survive even after surgical correction were found to have higher serum Cpk and leucocytic alkaline phosphotase activity till the end.

With artificial urethral obstruction in 4 male goats Tsuchiya and Sato (1990) observed increase in blood urea nitrogen and serum creatinine at constant rate (mean 29.1mg/dl/day and 1.6mg/dl/day respectively). The serum Sodium and Chloride values decreased gradually after urethral obsrtruction was noted. The potassium values increased remarkably later than in the intermediate stage. Rupture of bladder caused severe dehydration.

Pathological changes in different organs of ten male crossbred calves during uraemia of postrenal origin induced srgically by partial urethral obstruction by compelete urethral obstruction 15 days later were studied. The histopathological changes in kidney, lungs, brain, heart and urinary bladder included congenstion and mild to moderate degeneration and

necrotic changes (Gangwar, et al. 1991)

Gangwar, et al. (1991) observed biochemical profile in experimental uraemia after urethral obstruction in crossbred calves. They found a more pronounced and consistent increase in serum creatinine level during the terminal stage of uraemia. Serum creatinine had almost ten fold increased (10-20) ± 3.22 mg/dl) where as serum urea nitrogen increased by only a little over 4-fold (52.75 ± 0.34 mg/dl). The levels of serum iorganic phosphorus did nor change significantly though there was significant reduction in serum Calcium.

Kumar, et al. (1991) observed that obstructive urolithiasis in bullocks was associated with marked increase in heart rate, respiratory rate, haemoglobin, packed cell volume, total erythrocytic count, blood urea nitrogen, serum creatinine and potassium significant decrease in these values during post-operative period was noted Serum sodium level was subnormal to normal. There was hypochloremia and mixed acidosis or alkalosis.

Singh and Sahu (1995) created artificial urethral obstruction in buffalo calves and clinical, haematological as well as biochemical parameters were studied following obstruction till the development of symptoms of uraemia and during treatment with peritoneal

lavage. The respiration rate and temparature declined significantly during 96 hours of treatment period. Progressive decreases in BUN throughout the treatment period, was noted though it increased during period of obstruction. Haematological studies revealed that there was signicicantly decrease in PCV (40.46 ± 1.68 to 29.29 ± 1.84%), Hb (14.46 ± 0.74 to 10.89 ± 0.87 g %), TEC (10.17 ± 0.71 to 5.89 ± 0.78 mill. per cu. mm) and TLC (7874.33 ± 6.91 to 5417.19 ± 7.57/cu mm) during the entire period of treatment. They inferred that BUN values following treatment decreased.

Singh, et al. (1995) performed left prepubic paramedian cystorrgaphy with perineal urethrotomy for removing numerous calculi lodged in the sigmoid flexure and corrected the rupture of bladder in ram with the history of anuria inappetence, laboured breathing, restlessness, dehydration, kicking at the ventral abdomen and vocalization associated with urination attempts. Clinical examination revealed bilateral distension of abdomen and elevated heart rate. Blood urea nitrogen and serum, creatinine levels were significantly higher. Fluid thrill was also evident in the ventral aspect of the abdomen and exploratory puncture had revealed the presence of urine in the abdominal cavity.

Bhikane, et al. (1996) reported a case of pyelonephritis in a Deoni Calf. Clinical examination revealed dehydration, characterised by sunken eyes and rough skin coat. The body temparaure was 100°F while respiration rate was 42 per minute. On examination, haematological picture revealed haemoglobin 16.8 gm% PCV-50%, TLC-13.5 x 10^3/lil ; Differential leucocytic count, Neutrophil-65, Lymphocyte-28. Monocyte -5 and Eosinophil-2, Biochemical estimation showed plasma urea nitrogen to be 90 mg/dl and creatinine 8.2 mg/dl. Post mortem examination showed four to five times enlargement of both the kidneys with necrotic focci and haemorrhages therein.

2.3 SURGICAL MANAGEMENT OF UROLITHIASIS

Surgical removal of calculi is the most common cure of urolithiasis .A number of surgical techniques have been evolved and practised by diffrent workers from time to time .

Fleming (1902) outlined the present day Ischial and Post-scrotal urethrotomy in male bovines. He advised Ischial urethrotomy when the bladder would be in danger of rupture or when the calculi would not to be located and advocated pre or post scrotal urethrotomy to extract out the culculi from the definite place of

urethra. He left the urethral wound to heal spontaneously without suturing urethra and skin etc.

Wanger (1924) used a lead flexible sound as an aid in urethrotomy operation. It also helped in locating the site of lodgment of calculi.

O'conner (1950) suggested suturing of urethra in order to prevent urine infiltration and subsequent complications.

Kingery (1956) found that a routine urethrotomy of three animals for repair of urinary bladder were usually attended by a poor prognosis. Spontaneous healing of the bladder might be an accidental feature. The defect of the bladder closed surgically showed encouraging results. The initial precedure was paracentesis to remove the accumulated urine from the abdominal cavity accompanied with ischial urethrotomy to facilitate urinary flow and finally repaired the bladder through ventral abdominal approach in prepubic region just lateral to the penis. It was performed under 2-4% procaine hydrochloride infiltration at the preposed line of incision. The operation was relatively simple.

To detect the stricture & urethral obstruction in bulls, Kiesel (1956) used a sound prepared from .114 inches speedometer cable about 1/8

inches in diameter. This cable was very strong, more flexible and passed up the urethra with greater ease without causing any damage to it.

Scheel, et al. (1960) stated that urethrotomy was performed in case of distended urinary bladder with urethral occulsion in steers, although there was condiderable inflammatory changes in the urethra and even after surgery, urination was often difficult. They further stated that urethrotomy did not constitute complication in treatment. Even then animals might show the signs of stranguria.

Carey (1961) followed sub ischial urethrotomy when there was complete stoppage of urine and the bladder was in danger of rupture. He sutured the urethral lip along the margins of the wound on each side and allowed the wound to heal spontaneously and to form a permanent urinary fistula.

Whitehead (1961) for first time, used polythene tube in feline urethral surgery. He suggested prepubic urethrostomy, employing a permanent indwelling polythene tube for more obstinate cases of feline urolithiasis.

Vasko, et al. (1962) experimentally produced bladder calculi in steer calves and then performed Supra pubic cystotomy. In all such cases

bladder healed up without infection.

Mohanty et al. (1963) used catheter in five clinical bovine urolithiasis cases. After performing laparocystomy the catherter was introduced into the urethra through the bladder and was taken outside form the post scrotal urethrotomy site.

Khan (1963), reproted the treatment of twelve clinical cases of urethral calculi. He adopted different surgical techniques viz post scrotal urethrotomy,ischial urerthrotomy first time with polythene tube, manual removal of calculi, dilatation of the urethra and laparocystotomy with ischial urethrotomy using a polythin tube, for the treatment all those cases. He concluded that in case of rupture of the bladder with or without cystic calculi, laparocystotomy with ischial urethrotomy would be indicated.

Frank (1964) performed urethrotomy at the actual site of the calculi. For advanced cases and in case of urethral rupture, he advised post scortal approach. He amputated the panis in case of extensively damaged urethra. In case of ruptured bladder,he performed urethrotomy along with laprotomy for repair of the bladder. He used lead sound to locate urinary calculi.

Metcalf (1965) evolved a non suture

technique for closure of the urethral wound in cattle. He employed "Methyl-2, cyanoacylate" monomer for closure of urethral incision. It was adhesive in nature and produced a strong band between the tissues. He found urine leakage often occurred around the sutures and when sutures were not used, infiltration of urine was found in the surrounding tissues resulting into necrosis, scar formation and stricture formed.

Oehme and Tillman (1905) reported the cases of ruptured urinary bladder in ruminants. Following urethrotomy and drainage of accumulated urine after performing cystotomy and catheterisation, they observed spontaneous healing of the bladder in fifty percent cases.

Sharma, et al. (1966) successfully performed prepubic cystotomy and ischial urethrotomy in which he used a rubber caatheter for treating a male calf with ruptured urinary bladder.

Anjaria (1969) recommended post scrotal urethrotomy in bullocks for removal of urethral calculi.

Bone (1969) indwelled catheter (a piece of intra-venous tube) following urethrostomy in male cats to reduce effectively the incidence of post surgical blockage during the healing process. His idea was to maintain normal potency of the urethra following

urethrostomy. The catheter was removed after 10-14 days post operatively.

Narsima, et al. (1970) reported the repair of ruptured bladder in a stud bull in standing position through vertical posterior left flank incision.

Prasad et al. (1978) treated twety bullocks with ruptured urinary bladder with clinical symptoms of uraemia, with the help of modified left flank laparotomy along the upper margin of obliquous abdominis internus muscle, facilitating better approach to handling of bladder for cystorrhaphy.

Kulkarni and Bhokre(1985) studied paranal posterior flank and prepubic paramaedian aproaches of repair of urinary bladder, showed maximum visibility and exteriorisation of the bladder and catheterisation of urethra was easier in paraanal approach.

Barua, et al. (1988) done comparative study for finding best surgical technique for repair of urinary bladder, menifested healing proliferation of fiberous connective tissue. In unsutured urinary bladder, the union of wound was effected by proliferation of trasitional epithelium, fiberous connective tissue and mesothelial cells respectively.

Gasthuys, et al. (1993) treated 85 male cattle with urethral obstruction due to urolithiasis by

surgery. In most cases local anaesthetic techniques combined with sedation were applied to the dorsally reecumbent animals. The penis was transected and transposed in animals with ruptured urethra. A ruptured bladder was repaired by a para-median abdominal approach. The bladder was fistulated through the ventral abdominal wall, when no alternative treatment was possible.

Ashtrukar (1994) trated twenty three cases of bullocks from urolithiasis. The eight bullocks having parentral obstruction were simply subjected to post scrotal urethrotomy. Another six cases of subcutaneous infiltration of urine, were successfuly treated by paracentasis of urine and excising the necrosed tissues. Panectomy was carried out in five cases of urinary obstruction and phimosis of penis. Post scortal urethrotomy and repair of urinary bladder was carried out in rest four cases.

Mohanty, et al. (1995) comparatively studied the repair of the urinary bladder in male bovines. The study was based on the advantages and disadvantages of paramedian and left lower flank approaches, and it suggested that both paramedian and left flank approaches were suitable for bladder manipulation. It was easier to repair bladder through

paramedian approach. The left flank approach is better when the rupture was on the dorsal vertex.

Mohindra, et al. (1996) have made comparison of healing and degree of stricture in nonsutured (5 dogs) and non sutured with amniotic casing (7 dogs) of pre scortal incisions. Healing was also compared between the urethral incision sutured by 4/0 chromic catgut (3 dogs) and 4.0 polyglactin 910 (2 dogs). In dogs where urethral incision were not sutured (with or without casing) marked imflamation was followed by fibrous and 2nd intention healing. In dogs, where urethral incisions were sutured, degree of inflammation and intensity of fibrosis were relatively less and incision healed by 1st intention, chromic catgut showed mre cellular reaction than polyglaction - 910.

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Materials and Methods

MATERIALS AND METHODS

The present studies were conducted on eighteen clinically healthy male buffalo calves. They were randomly divided into three groups of five animals each and a control group of three animals.

(i) Group I : In animal no. 1 to 5, experimental urethral blockade was induced and maintained till death.

(ii) Group II : In animal no. 6 to 10, induced urethral obstruction was removed surgically on 3rd post obstruction day.

(iii) Group III : In animal no 11 to 15, urethral blockade was removed surgically on 5th post obstruction day.

(iv) Group IV : In animal no. 16 to 18, only urethrotomy was performed and maintained as " Control for the experiment.

3.1 CREATION OF EXPERIMENTAL URETHRAL BLOCKADE

In animals of group I, II and III urethral blockade was created after performing " Post scrotal urethrotomy " and using " Cea Tangle Tent* " A day before the urethral blockade, the area behind the scrotum of animals was shaved, scrubbed with carbolic soap 5% and lukewarm water for several times. The area was painted with 2 % spirituous mercurochrome

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* M/s Synthochem, Barielly, generally used intracervial for expulsion of undesired conception in women.

Food and water was withheld twelve hours before operation for urethral blockade. After restraining the animals in lateral recumbency, the operative site was washed with carbolic soap and lukewarm water before operation. The area was flushed with excess of 70% alcohal and 2% Xylocaine* local anaesthetic was used as linear infiltration for line of incision.

A 5 inches long skin incision was made behind the scrotum over median raphe. The fascia underneath were cleared and penile body was pulled out after straightening the sigmoid flexor. A longitudinal incision was made on the ventral aspect of penile body at the proximal bend of sigmoid flexor and urethra was exposed. A piece of Cea Tangle Tent** was inserted into the urethra upward above the upper end of urethral incision. The urethra was placed in position. Neosporine Powder*** was sprinkled over wound after mopping of blood. The skin with substaneous tissue was sutured in Halstead fashion. A protective bandage soaked with Tincture Bezoin was applied over the line of incision. Similar operation was performed in the animals of Group IV without any urethral blockade.

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* M/s Synthochem, Barielly.
** M/s Astra, IDL, Bangalore.
*** M/s Burrough and Wellcome, Bombay.

All the animals were placed in clean and dry stall and provide with sufficient bedding, Food and grasses were given to them. 1.5 gm. Streptopencillins were injected intramascularily every day for five consecutive days. Water was also allowed ad libitum.

3.2 POST URETHRAL OBSTRUCTION SURGICAL MANAGEMENT.

The animals of group I was maintained till death and animals of group II and group III were surgically managed on 3rd and 5th post obstruction day respectively for clinical recovery.

For the release of urethral blockade, the animals were restrained in lateral recumbency, the area behind scrotum was cleaned with spirit and 2% Xylocaine* was infittrated about the line of incision linearly. The sutures were removed. The lips of skin wound were separated and penis was pulled out. An artery forcep with the concavity of jaw downward was glided across the penis. The Cea Tangle Tent** was taken out from urethral gently. It was swellon and became translucent. The penile urethra was catherized with glycerine smeared polythene tube of an appropriate outer diameter 2.5 to 3.5 mm. One end of polythene tube was moved upward toward urinary bladder and other end towards external urethral orifice. The tube end taken out from external

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* M/s Astra - IDL, Bangalore.
** M/s Synthochem, Barielly.

orifice was bifurcated and suture with prepuce. At the post scrotal site, urethral wound was sutured using 2/0 chronic catgut in simple interrupted fashion. Protective bandage was applied over line of incision and soaked with Tincture Benzoine.

The animals having rupture of urinary bladder Pre-pubic paramedian cystorrhaphy was performed. They were restrained in dorsal recumbency and hairs of ventral area infront of pubis and paralled to sheath on left side were clipped. The area was shaved, surgically scrubbed with carbolic soap 5% and then flushed with rectified spirit. A ring block was made infiltrating 20-25ml of 2% Xylocaine* locally around the site of operation. A 6-8 inches long paramedian incision was made just infront pubic bone on the left side of sheath. The subcutaneous fascia and muscle were incised. The muscles were reflected with two pairs of Allis tissue forceps and a small niche was applied on the peritoneum. The urine accumulated in the abdomen gushed out. Left over urine in the peritoneal cavity was soaked with towel and squeezed out. The peritoneal cavity was lavaged with 1000 ml of physiological saline solution. The urinary bladder was palpatated, drawn out gently and held with Allis tissue forceps.

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* M/s Astra - IDL, Bangalore.

In animal no. 11, 13 and 15 the site of rupture was on Ventral side of urinary bladder where in animal no. 9 and 12 it was on lateral side of bladder but in animal no. 14 it was on vertex of urinary bladder. Both the traumatised lips of bladder were placed in apposition to each other after shaping their irregular edges. They were sutured with 2/0 chromic catgut in Czerney fashion. The urinary bladder was placed in its position in the abdomen and peritoneum was sutured with 2/0 chromic catgut. The abdominal wall was sutured with braided silk ligature No. 2 in simple interrupted fashion. The skin was closed with Halstead stiches and protective bandage was applied over skin incision and soaked with Tincture benzoine.

3.3 CLINICAL OBSERVATION

All the animals were watched from two days before the application of urethral obstruction daily till the end of experiment for these clinical observation. Their temparature, pulse and respiration were recorded daily in morning for abovesaid period. The rumination, digestion, urination and defaecation were noted. The change in alertness, gait, gesture and appearance were also noted. The ascultation and percussion of different abdominal organs were made and changes about them were noted.

3.4 HAEMATOLOGICAL AND BIOCHEMICAL ESTIMATION

The blood samples were collected daily from two day prior to urethral obstruction till death or recovery of animals for the haematological and biochemical estimations . The estimation of Haemoglobin percentage, Haematocrit value, Total erythrocytic count, Total leucocytic count. Differential leucocytic count and Erythrocytic sedimentation rate were carried out as method suggested by Schalm, et al. (1975). Blood urea nitrogen was estimated as per methods suggested by Wybenga, et al.(1971). Serum creatinine were estimated as method recommended by Broda and Sirota (1948). Inorganic phosphorus estimation was carried out by method of Fiske and Subharow (1925). The method adopted for Calcium value estimation was Titration method of Clark and Collip (1925). The Sodium and Potassium values were determined by Flame photometry, as described by Hawk, et al. (1965). The Chloride value estimated as method recommended by Schales and Schales (1941). Blood Urea Nitrogen (BUN) was estimated from blood collected in sodium citrate containing sterile tube after complete mixing. Rest of biochemical estimation were performed from serum separated from collected blood samples in a sterile tube, keeping the tube in slant position for

half-an-hour, pipetting the supernatant fluid and placing it in sterile vial.

3.5 HISTOPATHOLOGICAL EXAMINATION

After death of animals Group I tissue from liver, kidney and pancreas were collected. Paraffin blocks were made from these materials after complete processing of tissues. Histological slides were prepared and stained in Haematoxin Eosin stain. These slides were seen for their histopathological changes and changes were noted. The method of slide preparation and staining was adopted from Luna, (1968).

3.6 STATISTICAL ANALYSIS OF DATA

Statistical analysis of data obtained in the present study were carried out as per method recommended by Snedecor and Cochran (1967) and for knowing the measure of different parameters the techniques of analysis of variance was done as method, suggested by Snedecor and Conchran (1967).

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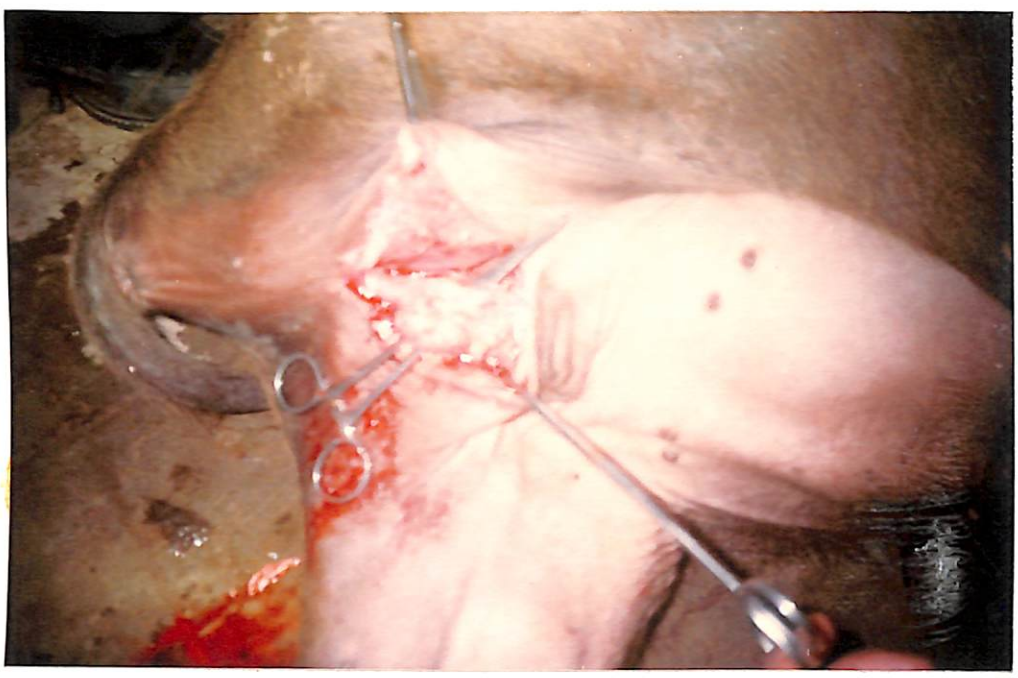

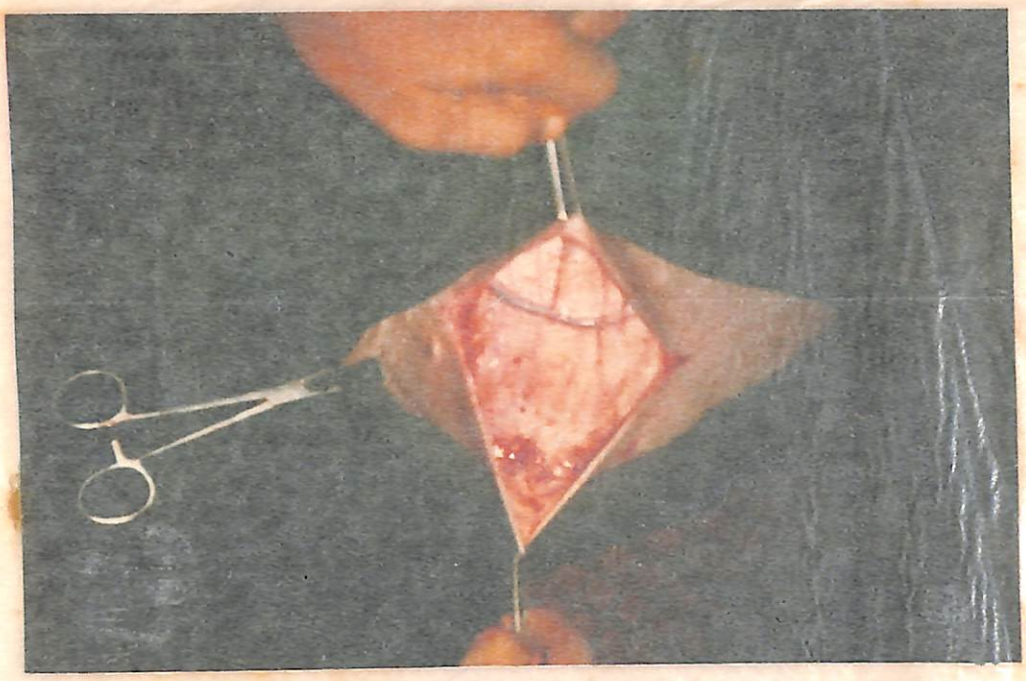

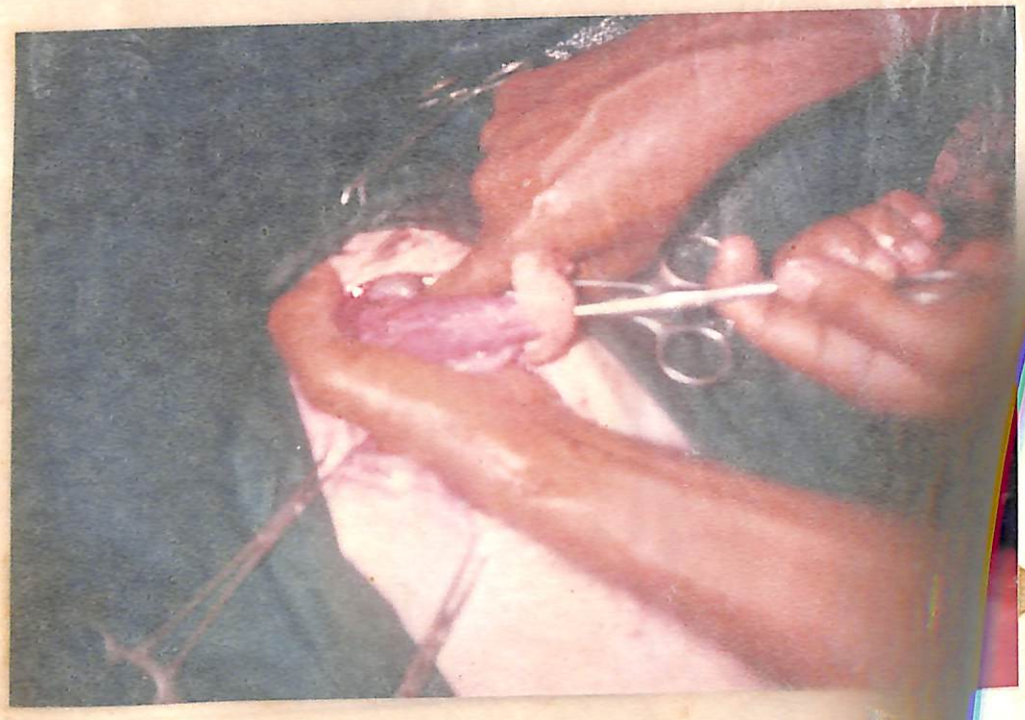

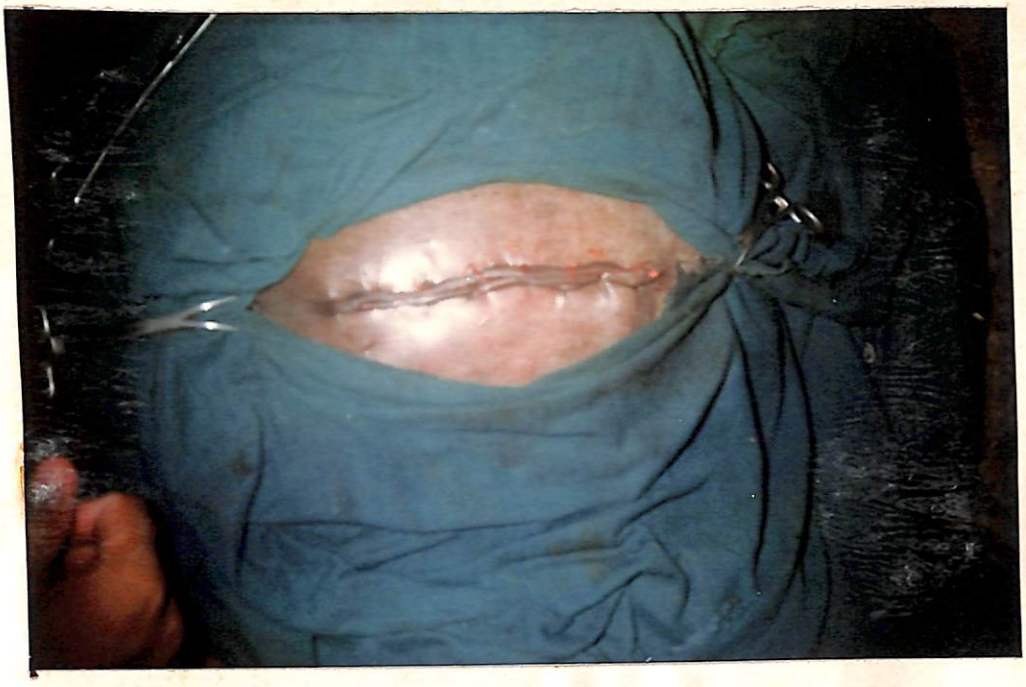

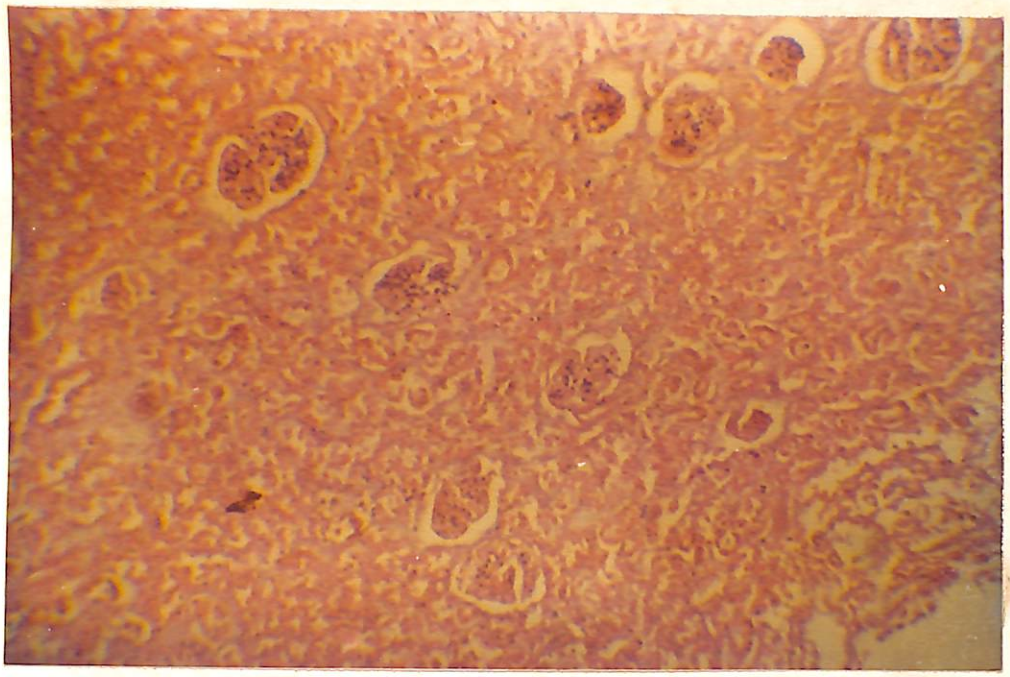

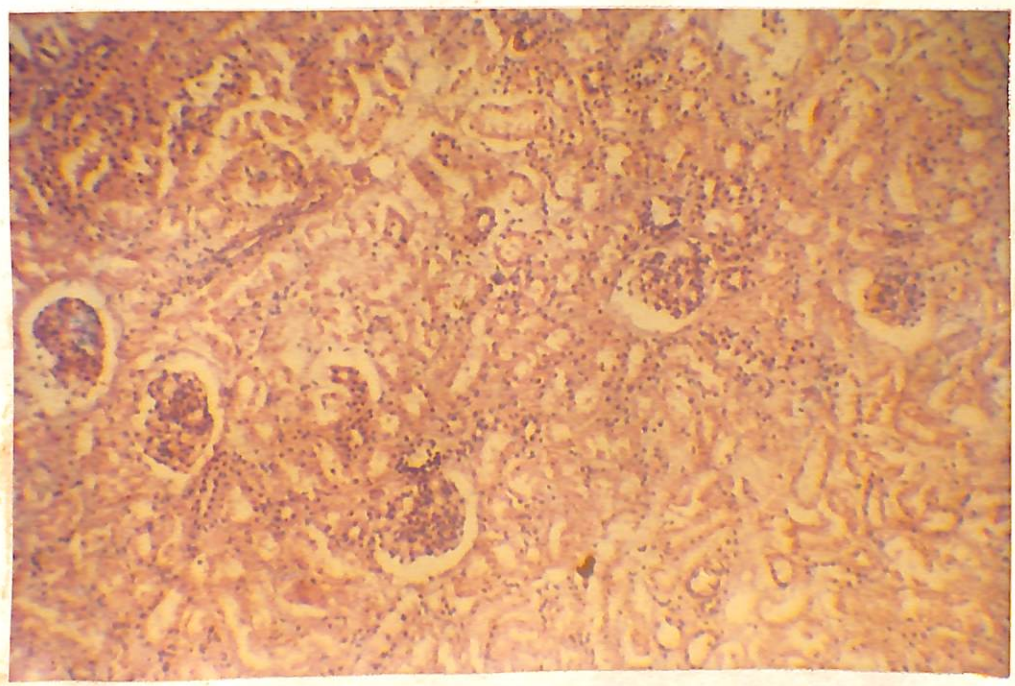

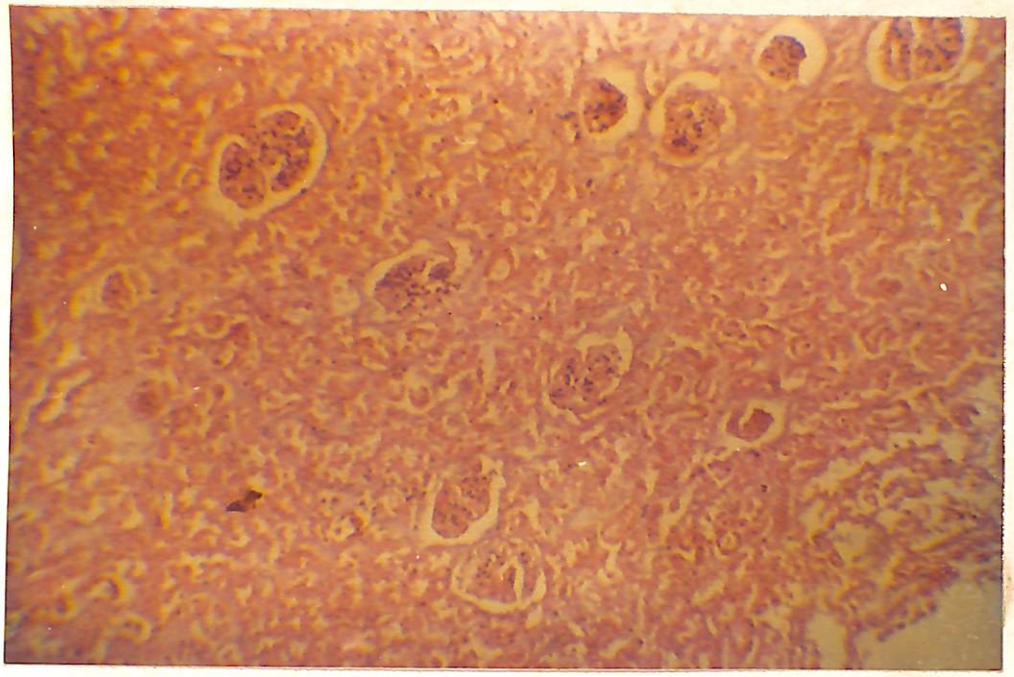

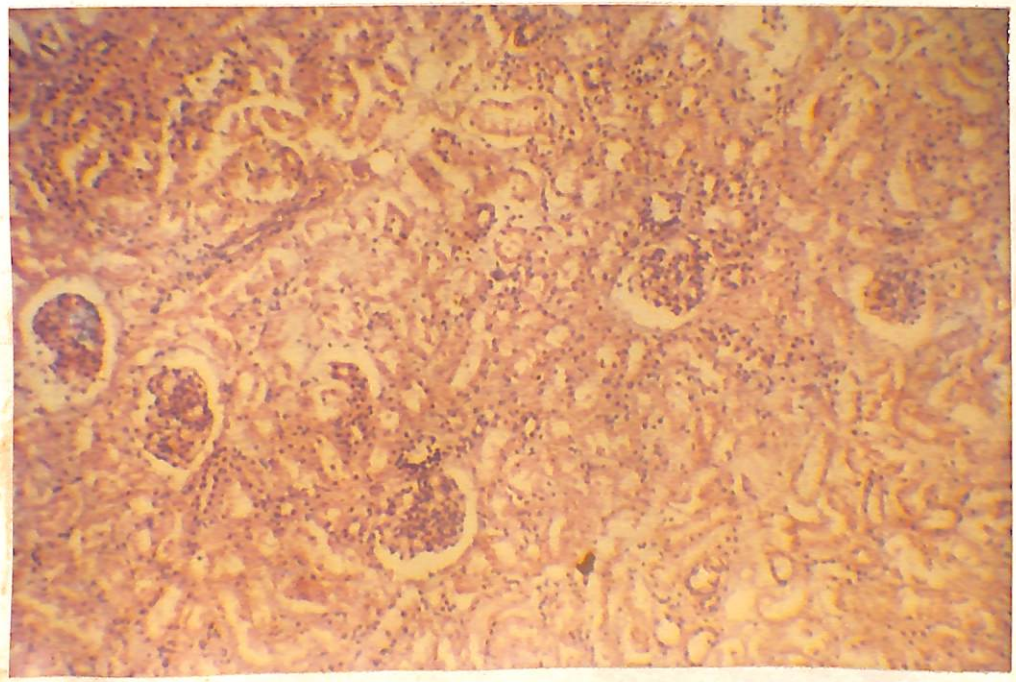

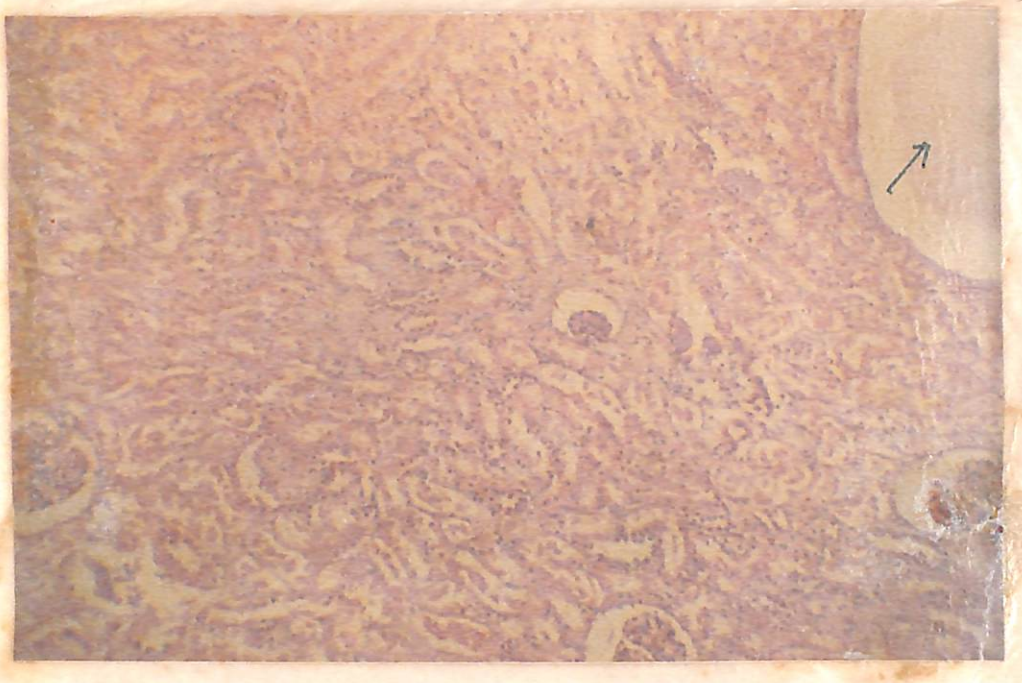

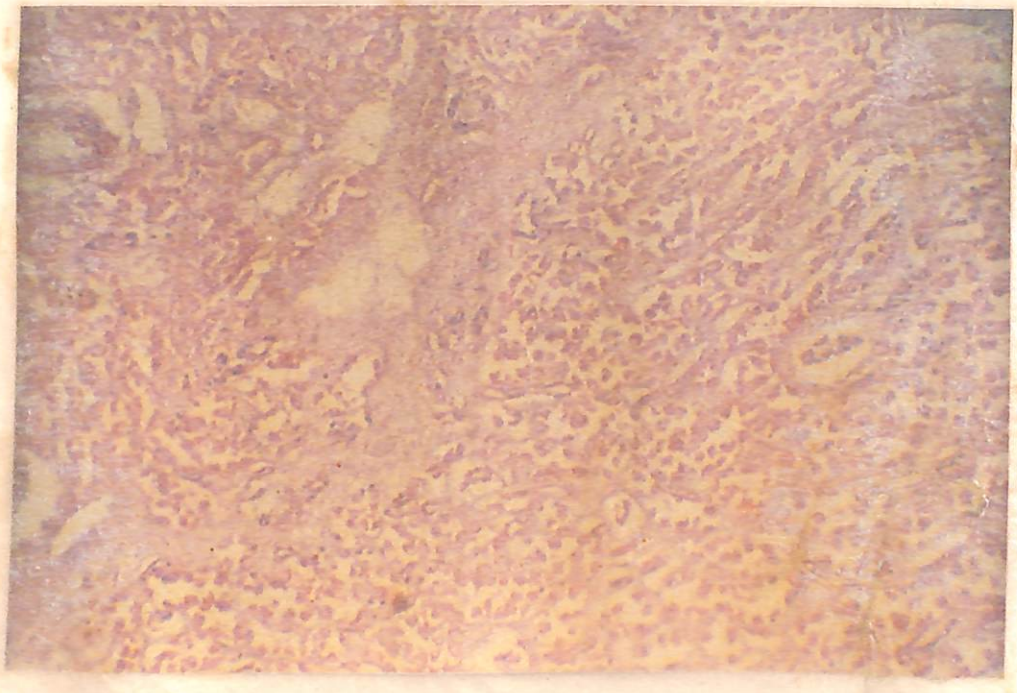

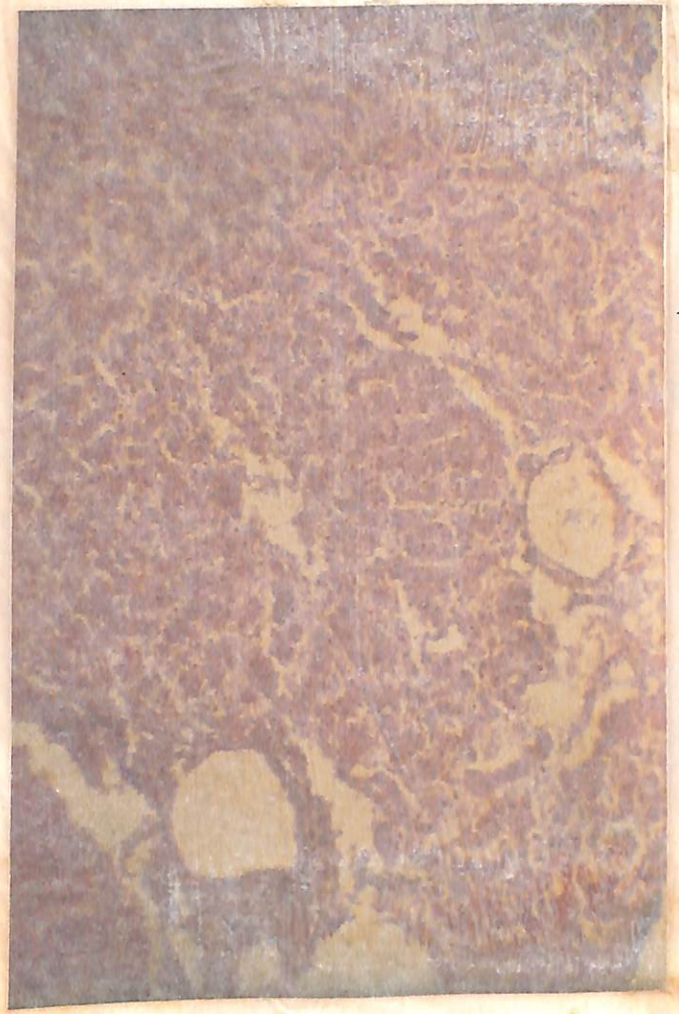

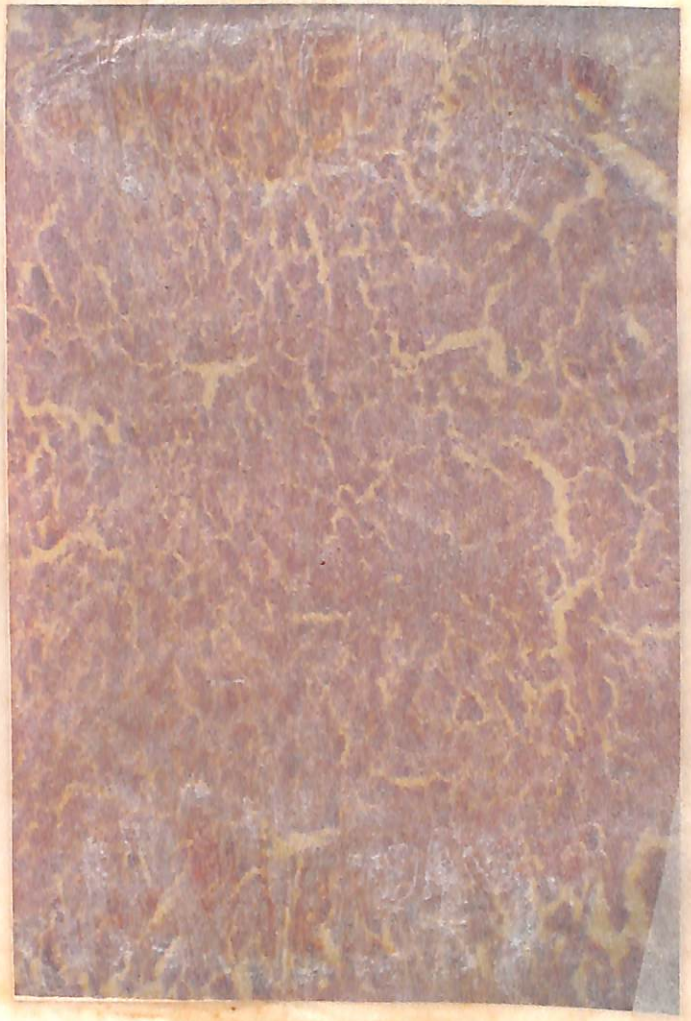

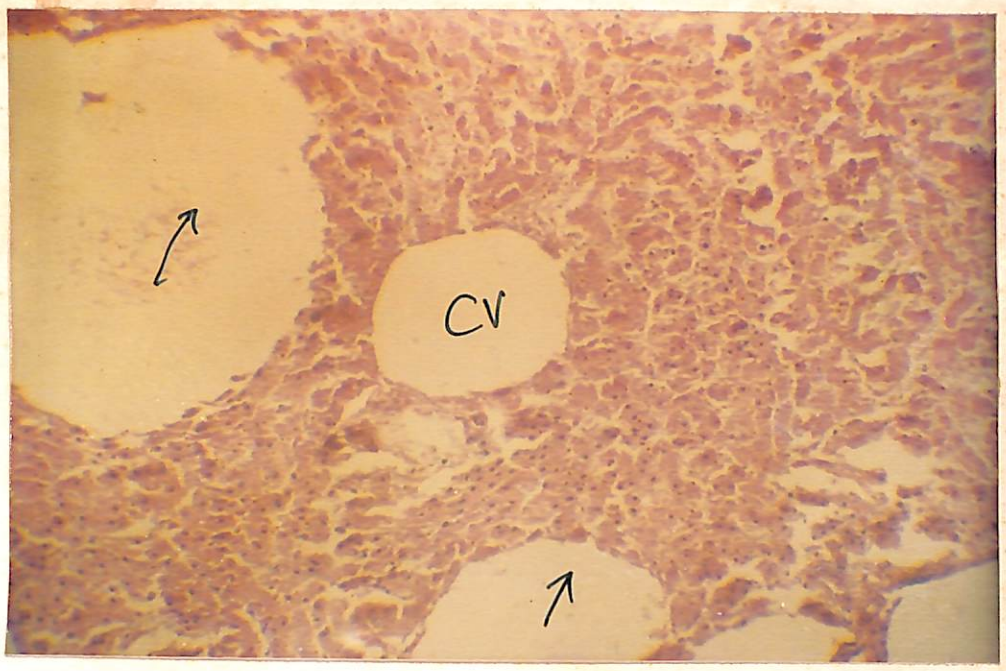
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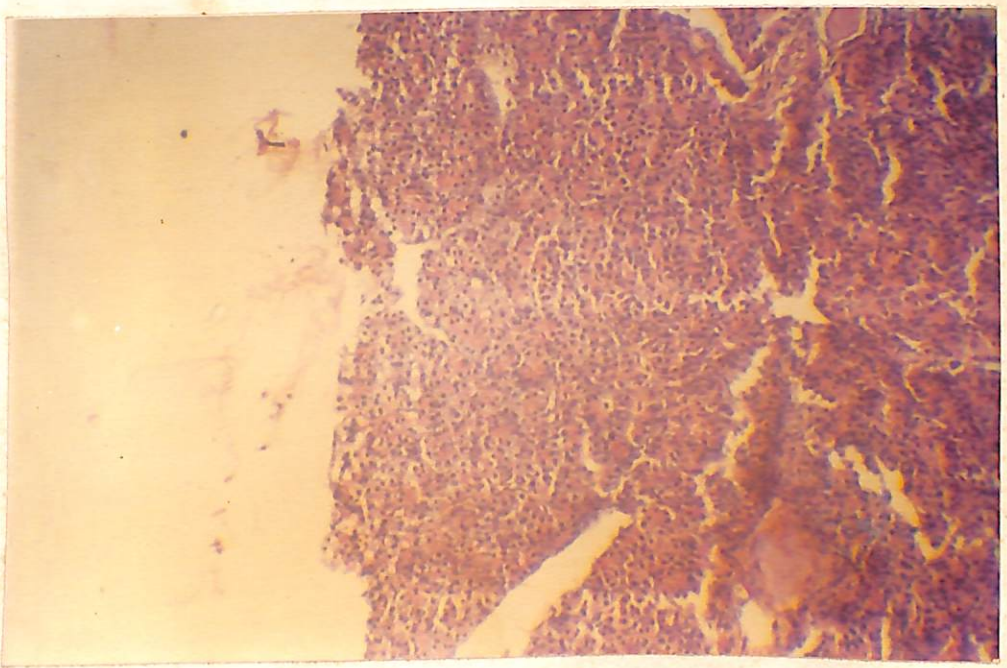

Table - 1 : Showing Mean ± S.E of TEMPARATURE (in ^{0}F) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

GR.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	99.20^a ±0.26 (5)	99.66^a ±0.08 (5)	99.46^a ±0.09 (5)	101.70^a ±0.94 (5)	102.06^a ±0.43 (5)	101.30^a ±0.82 (5)	100.90^a ±0.45 (5)	100.46^a ±0.39 (5)	99.90^a ±0.25 (5)	99.68^a ±0.20 (5)	98.86^a ±0.25 (5)	97.60^a ±0.38 (2)	97.40 ±0.00 (1)	97.20 ±0.00 (1)	------
II	99.54^a ±0.24 (5)	99.92^a ±0.25 (5)	99.70^a ±0.25 (5)	102.60^a ±0.71 (5)	102.20^a ±0.23 (5)	100.64^a ±0.31 (5)❁	99.80^a ±0.30 (5)	98.84^a ±0.21 (5)	98.81^a ±0.26 (5)	99.02^a ±0.42 (5)	99.00^a ±0.18 (5)	99.24^a ±0.20 (5)	99.44^a ±0.15 (5)	99.40^a ±0.21 (5)	99.16^a ±0.23 (5)
III	99.24^a ±0.27 (5)	99.66^a ±0.08 (5)	99.58^a ±0.14 (5)	102.18^a ±0.41 (5)	101.50^a ±0.42 (5)	100.84^a ±0.43 (5)	99.14^a ±0.21 (5)	98.72^a ±0.21 (5)❁	98.94^a ±0.39 (5)	99.96^a ±0.62 (5)	99.76^a ±0.20 (5)	99.30^a ±0.19 (5)	99.02^a ±0.20 (5)	98.80^a ±0.17 (5)	98.56^a ±0.17 (5)
IV	99.00^a ±0.18 (3)	100.27^a ±0.36 (3)	100.40^a ±0.31 (3)	101.42^a ±0.40 (3)	100.40^a ±0.37 (3)	99.57^a ±0.11 (3)	99.57^a ±0.11 (3)	100.20^a ±0.43 (3)	99.83^a ±0.39 (3)	99.80^a ±0.76 (3)	99.67^a ±0.57 (3)	99.17^a ±0.36 (3)	99.90^a ±0.32 (3)	99.60^a ±0.48 (3)	99.97^a ±0.49 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%).

Figure in Parenthesis indicates number of observation.

Table - 2 : Analysis of Variance for Table - 1

Sources of Variations	df	MS
Between groups	3	15.98 N.S
Berween days	14	24.65 **
Between groups x days	42	18.87 **
Errors	194	11.37
Total	253	

Table - 3 : Showing Mean ± S.E of estimated PULSE RATE (per minute) for experimental groups of buffalo - calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 52.80 ± 2.06 (5)	ap 52.80 ± 1.02 (5)	ap 53.60 ± 1.33 (5)	ap 54.40 ± 1.17 (5)	ap 58.40 ± 1.33 (5)	ap 56.40 ± 0.75 (5)	ap 54.80 ± 1.02 (5)	ap 54.40 ± 0.75 (5)	ap 54.40 ± 0.75 (5)	ap 64.80 ± 1.62 (5)	bp 68.40 ± 2.23 (5)	bp 73.00 ± 1.00 (2)	76.00 ± 0.00 (1)	78.00 ± 0.00 (1)	--------
II	ap 53.20 ± 1.62 (5)	ap 52.80 ± 1.85 (5)	ap 52.40 ± 1.72 (5)	ap 53.20 ± 1.62 (5)	ap 58.00 ± 2.00 (5)	ap 62.40 ± 1.72 (5)❖	ap 58.40 ± 1.72 (5)	ap 53.60 ± 1.33 (5)	ap 51.60 ± 1.33 (5)	ap 53.20 ± 1.02 (5)	aqr 53.60 ± 1.47 (5)	aq 53.60 ± 1.47 (5)	ap 52.00 ± 1.67 (5)	ap 50.80 ± 1.62 (5)	ap 50.80 ± 1.63 (5)
III	ap 57.20 ± 1.02 (5)	ap 55.20 ± 1.02 (5)	ap 53.60 ± 1.33 (5)	ap 58.20 ± 1.50 (5)	ap 61.20 ± 1.02 (5)	ap 58.20 ± 1.41 (5)	ap 55.60 ± 1.72 (5)	ap 54.40 ± 1.17 (5)❖	ap 64.80 ± 1.50 (5)	ap 60.00 ± 1.09 (5)	apr 57.60 ± 1.17 (5)	aq 56.40 ± 1.17 (5)	ap 56.00 ± 1.41 (5)	ap 55.20 ± 0.80 (5)	ap 55.20 ± 0.80 (5)
IV	ap 52.67 ± 1.37 (3)	ap 53.33 ± 0.67 (3)	ap 53.33 ± 0.67 (3)	ap 58.67 ± 0.67 (3)	ap 56.00 ± 0.89 (3)	ap 54.00 ± 1.15 (3)	ap 54.00 ± 1.15 (3)	ap 54.00 ± 1.15 (3)	ap 54.00 ± 1.15 (3)	ap 55.30 ± 0.58 (3)	aqr 50.67 ± 1.33 (3)	aq 49.33 ± 1.33 (3)	ap 50.67 ± 1.86 (3)	ap 50.00 ± 1.55 (3)	ap 50.00 ± 1.55 (3)

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 4 : Analysis of Variance for Table - 3

Sources of Variations	df	MS
Between groups	3	1478.59 **
Berween days	14	2241.82 **
Between groups x days	42	14.58 **
Errors	194	106.17
Total	253	

Table - 5 : Showing Mean ± S.E of RESPIRATION RATE (per minute) for experimental groups of buffalo - calves following urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 24.80 ± 1.02 (5)	acp 25.20 ± 1.02 (5)	acep 24.00 ± 0.89 (5)	bdfp 28.80 ± 1.02 (5)	bdfp 28.90 ± 0.63 (5)	bdfp 27.60 ± 0.75 (5)	bcfp 27.40 ± 0.75 (5)	acfp 27.00 ± 0.63 (5)	acep 24.40 ± 0.75 (5)	bdfp 20.00 ± 0.63 (5)	bdfp 16.80 ± 1.02 (5)	bdfp 11.50 ± 0.41 (2)	12.00 ± 0.00 (1)	12.00 ± 0.00 (1)	--------
II	ap 24.60 ± 1.08 (5)	ap 24.80 ± 1.02 (5)	ap 24.80 ± 1.08 (5)	bp 27.60 ± 0.75 (5)	bpr 30.40 ± 0.75 (5)	bpq 28.60 ± 1.33 (5)❁	bpq 27.20 ± 1.62 (5)	bpq 28.00 ± 1.41 (5)	bpr 25.60 ± 1.17 (5)	aq 25.20 ± 1.02 (5)	aq 24.80 ± 1.02 (5)	aq 24.60 ± 0.89 (5)	ap 24.80 ± 1.02 (5)	ap 24.40 ± 1.32 (5)	ap 24.40 ± 1.17 (5)
III	ap 25.60 ± 1.17 (5)	acp 26.40 ± 1.17 (5)	acep 24.80 ± 0.89 (5)	bdfp 31.40 ± 0.60 (5)	bdfpr 29.20 ± 1.02 (5)	bcfpq 28.60 ± 0.89 (5)	bcfpq 28.20 ± 1.09 (5)	bcfpq 28.00 ± 0.63 (5)❁	acfqr 27.20 ± 1.02 (5)	aceq 25.60 ± 1.17 (5)	qceq 25.60 ± 0.89 (5)	qceq 24.00 ± 0.89 (5)	qcep 24.00 ± 0.89 (5)	acep 24.00 ± 0.63 (5)	acep 24.40 ± 0.74 (5)
IV	ap 26.00 ± 0.89 (3)	ap 26.70 ± 0.58 (3)	ap 26.00 ± 0.89 (3)	ap 26.00 ± 0.89 (3)	aps 26.00 ± 0.89 (3)	apr 24.67 ± 0.52 (3)	apr 24.67 ± 0.52 (3)	apr 25.33 ± 0.52 (3)	apr 26.67 ± 0.52 (3)	aq 26.00 ± 0.89 (3)	aq 25.67 ± 0.54 (3)	aq 25.67 ± 0.82 (3)	ap 24.67 ± 0.52 (3)	ap 24.67 ± 0.62 (3)	ap 24.33 ± 1.03 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 6 : Analysis of Variance for Table - 5

Sources of Variations	df	MS
Between groups	3	104.13 **
Berween days	14	121.97 **
Between groups x days	42	12.40 **
Errors	194	3.44
Total	253	

Table - 7 : Showing Mean ± S.E of HAEMOGLOBIN PERCENTAGE (gm %) for experimental groups of buffalo calves before and after Uraemia following urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION VALUES			POST OBSTRUCTION VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	^{ap} 10.28 ± 0.22 (5)	^{ap} 10.06 ± 0.17 (5)	^{ap} 10.14 ± 0.22 (5)	^{ap} 11.78 ± 0.31 (5)	^{ap} 13.38 ± 0.28 (5)	^{bp} 14.46 ± 0.34 (5)	^{bp} 15.26 ± 0.23 (5)	^{bp} 16.18 ± 0.27 (5)	^{bp} 17.44 ± 0.19 (5)	^{bp} 18.38 ± 0.29 (5)	^{bp} 19.44 ± 0.24 (5)	^{bp} 19.90 ± 0.09 (2)	19.90 ± 0.00 (1)	20.40 ± 0.00 (1)	------
II	^{ap} 10.82 ± 0.22 (5)	^{ap} 10.72 ± 0.37 (5)	^{ap} 10.72 ± 0.31 (5)	^{ap} 13.56 ± 0.20 (5)	^{ap} 15.50 ± 0.51 (5)	^{apr} 17.94 ± 0.40 (5)❁	^{aq} 17.22 ± 0.25 (5)	^{aq} 17.04 ± 0.24 (5)	^{aq} 16.72 ± 0.26 (5)	^{aq} 15.62 ± 0.24 (5)	^{aq} 13.70 ± 0.32 (5)	^{aq} 12.82 ± 0.32 (5)	^{ap} 10.28 ± 0.31 (5)	^{ap} 10.41 ± 0.31 (5)	^{ap} 10.32 ± 0.32 (5)
III	^{ap} 10.40 ± 0.34 (5)	^{ap} 10.64 ± 0.46 (5)	^{ap} 9.96 ± 0.32 (5)	^{ap} 12.72 ± 0.33 (5)	^{ap} 13.98 ± 0.09 (5)	^{bpr} 1512 ± 0.14 (5)	^{bp} 16.14 ± 0.29 (5)	^{bp} 17.20 ± 0.27 (5)❁	^{bp} 18.64 ± 0.28 (5)	^{br} 17.28 ± 0.20 (5)	^{br} 15.28 ± 0.24 (5)	^{br} 13.02 ± 0.31 (5)	^{aq} 10.22 ± 0.34 (5)	^{aqr} 9.86 ± 0.22 (5)	^{ap} 9.82 ± 0.18 (5)
IV	^{ap} 10.50 ± 0.12 (3)	^{ap} 10.77 ± 0.11 (3)	^{ap} 11.13 ± 0.12 (3)	^{ap} 11.40 ± 0.12 (3)	^{ap} 12.37 ± 0.12 (3)	^{aqr} 12.47 ± 0.07 (3)	^{aq} 12.47 ± 0.20 (3)	^{aq} 12.30 ± 0.22 (3)	^{aq} 11.67 ± 0.24 (3)	^{aq} 12.10 ± 0.09 (3)	^{aq} 11.67 ± 0.07 (3)	^{aq} 11.63 ± 0.14 (3)	^{ap} 10.63 ± 0.12 (3)	^{apr} 10.33 ± 0.10 (3)	^{ap} 10.57 ± 0.12 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Table - 8 : Analysis of Variance for Table - 7

Sources of Variations	df	MS
Between groups	3	366.43 **
Berween days	14	106.65 **
Between groups x days	42	1.47 **
Error$	194	20.41
Total	253	

Table - 9 : Showing Mean ± S.E of HEMATOCRIT VALUE (Vol. %) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	^{ap} 34.2 ± 0.80 (5)	^{ap} 34.8 ± 0.66 (5)	^{ap} 35.8 ± 0.66 (5)	^{ap} 39.4 ± 1.12 (5)	^{bp} 41.6 ± 0.75 (5)	^{bp} 44.2 ± 0.74 (5)	^{bp} 46.4 ± 0.68 (5)	^{bp} 47.2 ± 0.58 (5)	^{bp} 48.6 ± 0.81 (5)	^{bp} 4.94 ± 0.93 (5)	^{bp} 50.0 ± 0.82 (5)	^{bp} 50.5 ± 0.95 (2)	50.2 ± 0.00 (1)	50.6 ± 0.00 (1)	------
II	^{ap} 36.2 ± 1.28 (5)	^{ap} 35.0 ± 1.09 (5)	^{ap} 37.2 ± 1.24 (5)	^{bp} 40.4 ± 1.33 (5)	^{bp} 43.0 ± 1.41 (5)	^{bp} 45.0 ± 1.30 (5)❖	^{bp} 46.0 ± 1.30 (5)	^{bp} 45.0 ± 1.41 (5)	^{bq} 44.6 ± 1.21 (5)	^{bqr} 44.6 ± 0.75 (5)	^{bqr} 43.6 ± 0.75 (5)	^{bqr} 41.6 ± 0.75 (5)	^{ap} 37.8 ± 0.97 (5)	^{ap} 36.2 ± 1.07 (5)	^{ap} 35.2 ± 1.32 (5)
III	^{ap} 35.6 ± 1.08 (5)	^{ap} 35.0 ± 0.89 (5)	^{ap} 35.2 ± 1.02 (5)	^{bp} 39.2 ± 1.36 (5)	^{bp} 41.6 ± 1.44 (5)	^{bpr} 42.0 ± 1.30 (5)	^{bp} 44.2 ± 1.39 (5)	^{bp} 46.4 ± 1.08 (5)❖	^{bp} 47.0 ± 2.00 (5)	^{bqr} 45.4 ± 0.87 (5)	^{bqr} 43.2 ± 0.66 (5)	^{bqr} 41.4 ± 0.51 (5)	^{ap} 37.6 ± 0.51 (5)	^{ap} 34.8 ± 0.86 (5)	^{ap} 33.0 ± 0.84 (5)
IV	^{ap} 36.7 ± 1.86 (3)	^{ap} 38.0 ± 2.08 (3)	^{ap} 37.3 ± 2.19 (3)	^{ap} 39.7 ± 1.86 (3)	^{ap} 39.3 ± 1.76 (3)	^{aqr} 39.0 ± 1.53 (3)	^{aq} 39.3 ± 1.76 (3)	^{aq} 38.7 ± 1.45 (3)	^{aq} 38.7 ± 2.03 (3)	^{aqs} 38.3 ± 1.76 (3)	^{aqs} 38.0 ± 1.53 (3)	^{aqs} 37.7 ± 1.86 (3)	^{ap} 37.3 ± 1.76 (3)	^{ap} 36.3 ± 2.19 (3)	^{ap} 36.3 ± 2.19 (3)

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 10 : Analysis of Variance for Table - 9

Sources of Variations	df	MS
Between groups	3	569.68 **
Berween days	14	964.20 **
Between groups x days	42	5.92 NS
Errors	194	6.17
Total	253	

Table - 11 : Showing Mean ± S.E of TOTAL ERYTHROCYTIC COUNT (mill./cu mm) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

GROUP	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	^{ap} 6.96 ± 0.16 (5)	^{ap} 7.03 ± 0.12 (5)	^{ap} 7.09 ± 0.11 (5)	^{ap} 7.32 ± 0.13 (5)	^{ap} 7.66 ± 0.12 (5)	^{ap} 7.84 ± 0.10 (5)	^{ap} 8.09 ± 0.12 (5)	^{ap} 8.34 ± 0.04 (5)	^{ap} 8.43 ± 0.08 (5)	^{bp} 8.93 ± 0.10 (5)	^{bp} 8.98 ± 0.03 (5)	^{bp} 9.00 ± 0.05 (2)	9.13 ± 0.00 (1)	9.12 ± 0.00 (1)	------
II	^{ap} 6.71 ± 0.16 (5)	^{ap} 6.98 ± 0.09 (5)	^{ap} 6.93 ± 0.12 (5)	^{ap} 7.42 ± 0.10 (5)	^{ap} 7.73 ± 0.09 (5)	^{ap} 7.97 ± 0.07 (5)❁	^{ap} 7.91 ± 0.10 (5)	^{ap} 7.84 ± 0.10 (5)	^{ap} 7.79 ± 0.16 (5)	^{ap} 7.63 ± 0.19 (5)	^{aqr} 7.46 ± 0.28 (5)	^{apr} 7.06 ± 0.12 (5)	^{ap} 7.04 ± 0.13 (5)	^{ap} 6.98 ± 0.10 (5)	^{ap} 6.88 ± 0.14 (5)
III	^{ap} 6.85 ± 0.07 (5)	^{ap} 6.87 ± 0.05 (5)	^{ap} 6.93 ± 0.07 (5)	^{ap} 7.21 ± 0.09 (5)	^{ap} 7.65 ± 0.07 (5)	^{ap} 7.92 ± 0.05 (5)	^{ap} 8.15 ± 0.05 (5)	^{ap} 8.23 ± 0.04 (5)❁	^{ap} 8.16 ± 0.06 (5)	^{ap} 8.04 ± 0.07 (5)	^{apr} 8.00 ± 0.12 (5)	^{apr} 7.71 ± 0.13 (5)	^{ap} 7.38 ± 0.10 (5)	^{ap} 6.97 ± 0.09 (5)	^{ap} 6.86 ± 0.07 (5)
IV	^{ap} 7.03 ± 0.15 (3)	^{ap} 6.96 ± 0.15 (3)	^{ap} 7.02 ± 0.12 (3)	^{ap} 7.20 ± 0.09 (3)	^{ap} 7.36 ± 0.09 (3)	^{ap} 7.39 ± 0.09 (3)	^{ap} 7.38 ± 0.06 (3)	^{ap} 7.37 ± 0.06 (3)	^{ap} 7.25 ± 0.03 (3)	^{ap} 7.33 ± 0.07 (3)	^{apr} 7.24 ± 0.06 (3)	^{aqr} 7.25 ± 0.03 (3)	^{ap} 7.26 ± 0.06 (3)	^{ap} 7.27 ± 0.06 (3)	^{ap} 7.18 ± 0.03 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 12 : Analysis of Variance for Table - 11

Sources of Variations	df	MS
Between groups	3	5.72 **
Berween days	14	8.31 **
Between groups x days	42	2.20 **
Errors	194	1.49
Total	253	

Table - 13 : Showing Mean ± S.E of TOTAL LEUCOCYTIC COUNT (thousand/Cu mm) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

GR.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	8.34 ± 0.08 (5)	8.30 ± 0.16 (5)	8.22 ± 0.12 (5)	8.72 ± 1.30 (5)	8.88 ± 0.13 (5)	9.02 ± 0.06 (5)	9.04 ± 0.06 (5)	9.16 ± 0.05 (5)	9.26 ± 0.04 (5)	9.32 ± 0.04 (5)	9.34 ± 0.06 (5)	9.38 ± 0.04 (2)	9.45 ± 0.00 (1)	9.48 ± 0.00 (1)	------
II	8.02 ± 0.12 (5)	8.10 ± 0.11 (5)	8.00 ± 0.08 (5)	8.52 ± 0.07 (5)	8.68 ± 0.08 (5)	8.96 ± 0.08 (5)❋	9.00 ± 0.07 (5)	8.90 ± 0.10 (5)	8.80 ± 0.10 (5)	8.70 ± 0.12 (5)	8.52 ± 0.12 (5)	8.30 ± 0.17 (5)	8.16 ± 0.14 (5)	8.06 ± 0.17 (5)	8.06 ± 0.14 (5)
III	7.98 ± 0.06 (5)	7.94 ± 0.13 (5)	7.96 ± 0.10 (5)	8.40 ± 0.07 (5)	8.58 ± 0.06 (5)	8.74 ± 0.07 (5)	8.84 ± 0.11 (5)	9.02 ± 0.10 (5)❋	9.06 ± 0.07 (5)	8.90 ± 0.07 (5)	8.78 ± 0.06 (5)	8.56 ± 0.09 (5)	8.44 ± 0.10 (5)	8.14 ± 0.09 (5)	7.98 ± 0.08 (5)
IV	7.60 ± 0.17 (3)	7.47 ± 0.14 (3)	7.47 ± 0.19 (3)	7.77 ± 0.13 (3)	7.97 ± 0.19 (3)	7.97 ± 0.19 (3)	7.93 ± 0.17 (3)	7.87 ± 0.19 (3)	7.90 ± 0.21 (3)	7.93 ± 0.22 (3)	7.93 ± 0.22 (3)	7.83 ± 0.22 (3)	7.83 ± 0.22 (3)	7.83 ± 0.22 (3)	7.83 ± 0.22 (3)

❋ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of obsevation.

Table - 14 : Analysis of Variance for Table - 13

Sources of Variations	df	MS
Between groups	3	3.52 N.S
Berween days	14	2.02 N.S
Between groups x days	42	4.22**
Errors	194	1.70
Total	253	

Table - 15 : Showing Mean ± S.E of NEUTROPHILS VALUE (% of DLC) for experimental groups of buffalo calves following uraemia after urethral obstruction and its surgical management.

Gr	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	^{ap} 36.4 ± 1.21 (5)	^{ap} 37.2 ± 1.16 (5)	^{ap} 37.1 ± 1.50 (5)	^{ap} 37.6 ± 1.34 (5)	^{ap} 38.2 ± 1.07 (5)	^{bp} 41.6 ± 0.86 (5)	^{bp} 44.2 ± 0.73 (5)	^{bp} 48.6 ± 0.60 (5)	^{bp} 50.4 ± 0.51 (5)	^{bp} 51.8 ± 0.80 (5)	^{bp} 54.0 ± 1.10 (5)	^{bp} 56.0 ± 3.50 (2)	57.0 ± 0.00 (1)	63.0 ± 0.00 (1)	------
II	^{ap} 35.6 ± 1.78 (5)	^{ap} 34.8 ± 0.54 (5)	^{ap} 35.4 ± 1.03 (5)	^{ap} 36.9 ± 0.92 (5)	^{ap} 37.2 ± 1.11 (5)	^{apr} 38.4 ± 1.02 (5)❖	^{aq} 37.8 ± 0.66 (5)	^{aq} 37.8 ± 0.86 (5)	^{aq} 36.4 ± 1.03 (5)	^{aq} 35.6 ± 0.93 (5)	^{aq} 35.2 ± 1.24 (5)	^{aq} 34.6 ± 1.03 (5)	^{ap} 33.8 ± 1.24 (5)	^{ap} 33.2 ± 1.24 (5)	^{ap} 32.8 ± 1.24 (5)
III	^{ap} 36.2 ± 1.65 (5)	^{ap} 36.8 ± 1.51 (5)	^{ap} 37.2 ± 1.68 (5)	^{ap} 37.8 ± 0.86 (5)	^{ap} 38.0 ± 0.71 (5)	^{bpr} 40.8 ± 0.80 (5)	^{bp} 43.8 ± 0.73 (5)	^{bp} 47.6 ± 0.51 (5)❖	^{bp} 47.2 ± 0.73 (5)	^{br} 45.2 ± 0.97 (5)	^{br} 44.2 ± 1.39 (5)	^{br} 41.7 ± 1.69 (5)	^{aq} 39.0 ± 2.50 (5)	^{aqr} 37.6 ± 2.04 (5)	^{ap} 35.0 ± 2.00 (5)
IV	^{ap} 36.7 ± 1.76 (3)	^{ap} 35.7 ± 2.19 (3)	^{ap} 36.4 ± 0.88 (3)	^{ap} 36.7 ± 0.67 (3)	^{ap} 37.0 ± 1.53 (3)	^{aqr} 37.2 ± 1.73 (3)	^{aq} 36.8 ± 1.33 (3)	^{aq} 36.2 ± 0.88 (3)	^{aq} 36.3 ± 1.20 (3)	^{aq} 36.1 ± 1.67 (3)	^{aq} 36.0 ± 2.52 (3)	^{aq} 35.9 ± 2.33 (3)	^{ap} 36.0 ± 1.53 (3)	^{apr} 35.8 ± 2.00 (3)	^{ap} 35.3 ± 2.33 (3)

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observation.

Table - 16 : Analysis of Variance for Table - 15

Sources of Variations	df	MS
Between groups	3	1329.39 **
Berween days	14	225.95 **
Between groups x days	42	38.58 **
Errors	194	9.05
Total	253	

Table - 17 : Showing Mean ± S.E of LYMPHOCYTIC COUNT (% of DLC) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	59.0 ± 1.34 (5)	58.6 ± 1.08 (5)	59.0 ± 0.58 (5)	56.6 ± 1.36 (5)	53.2 ± 1.24 (5)	50.4 ± 1.54 (5)	45.4 ± 1.21 (5)	42.0 ± 1.22 (5)	41.0 ± 1.70 (5)	38.2 ± 1.07 (5)	36.2 ± 1.44 (5)	33.0 ± 1.32 (2)	32.0 ± 0.00 (1)	29.0 ± 0.00 (1)	------
II	63.6 ± 1.72 (5)	62.8 ± 1.85 (5)	63.2 ± 0.86 (5)	62.4 ± 0.86 (5)	59.6 ± 1.26 (5)	54.6 ± 1.54 (5)❁	54.2 ± 0.86 (5)	55.4 ± 0.68 (5)	57.2 ± 0.73 (5)	58.4 ± 0.81 (5)	59.2 ± 1.24 (5)	60.0 ± 1.09 (5)	62.0 ± 0.87 (5)	62.8 ± 1.06 (5)	64.4 ± 1.36 (5)
III	61.8 ± 2.27 (5)	60.6 ± 2.18 (5)	60.8 ± 1.65 (5)	59.4 ± 0.97 (5)	56.6 ± 0.75 (5)	52.2 ± 1.24 (5)	47.0 ± 0.54 (5)	44.8 ± 1.06 (5)❁	44.6 ± 1.25 (5)	47.2 ± 1.68 (5)	47.8 ± 1.82 (5)	51.8 ± 2.18 (5)	55.6 ± 3.57 (5)	58.0 ± 2.51 (5)	62.2 ± 2.08 (5)
IV	60.7 ± 2.40 (3)	60.0 ± 2.08 (3)	58.6 ± 0.58 (3)	56.7 ± 1.53 (3)	54.7 ± 2.19 (3)	56.3 ± 1.76 (3)	55.3 ± 1.67 (3)	55.0 ± 1.15 (3)	55.3 ± 1.20 (3)	57.0 ± 2.52 (3)	57.0 ± 2.08 (3)	57.0 ± 2.00 (3)	56.7 ± 1.86 (3)	58.6 ± 2.00 (3)	57.7 ± 2.86 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%).

Figure in parenthesis indicates number of observation.

Table - 18 : Analysis of Variance for Table - 17

Sources of Variations	df	MS
Between groups	3	1402.57 **
Berween days	14	35.41 **
Between groups x days	42	285.26 **
Errors	194	41.24
Total	253	

Table - 19 : Showing Mean ± S.E of EOSINOPHIL COUNT (with Arc-sin√ percentage transformation) for experimental groups of buffalo calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION VALUES			POST OBSTRUCTION VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	a 6.70 ± 0.58 (5) 1.34	a 6.70 ± 0.58 (5) 1.34	a 6.70 ± 0.58 (5) 1.34	a 9.55 ± 0.65 (5) 2.73	a 9.75 ± 1.06 (5) 2.18	b 11.78 ± 0.46 (5) 4.14	b 10.92 ± 0.54 (5) 3.58	a 10.23 ± 0.63 (5) 3.17	a 9.76 ±1.17 (5) 2.18	a 9.55 ± 0.65 (5) 2.73	a 9.35 ± 1.18 (5) 2.64	a 8.39 ± 0.78 (2) 2.12	5.74 ± 0.00 (1) 1.00	5.74 ± 0.00 (1) 1.00	-------
II	a 6.22 ± 0.47 (5) 1.19	a 6.22 ± 0.47 (5) 1.19	a 6.22 ± 0.47 (5) 1.19	a 7.17 ± 0.58 (5) 1.80	a 9.56 ± 0.46 (5) 2.73	b 12.34 ± 0.53 (5)❖ 4.58	b 10.60 ± 0.38 (5) 3.38	a 8.28 ± 1.04 (5) 2.08	a 8.39 ± 0.96 (5) 2.12	a 8.50 ± 0.37 (5) 2.16	a 8.87 ± 0.45 (5) 2.37	a 8.13 ± 0.00 (5) 2.00	a 7.54 ± 0.81 (5) 1.71	a 6.69 ± 0.58 (5) 1.36	a 6.69 ± 0.58 (5) 1.36
III	a 7.17 ± 0.58 (5) 1.56	a 6.22 ± 0.48 (5) 1.19	a 7.17 ± 0.58 (5) 1.56	a 9.07 ± 0.99 (5) 2.49	a 9.96 ± 1.26 (5) 2.99	a 12.03 ± 0.71 (5) 4.31	b 10.03 ± 1.20 (5) 3.06	b 8.91 ± 0.95 (5) 2.40	b 8.02 ± 0.67 (5) 1.99	a 8.02 ± 0.67 (5) 1.99	a 7.91 ± 0.95 (5) 1.89	a 7,07 ± 0.86 (5) 1.51	a 7.54 ± 0.81 (5) 1.71	a 6.22 ± 0.48 (5) 1.16	a 7.17 ± 0.58 (5) 1.50
IV	a 8.74 ± 0.62 (3) 2.31	a 8.13 ± 0.00 (3) 2.00	a 9.36 ± 0.62 (3) 2.61	a 8.75 ± 0.62 (3) 2.31	a 9.36 ± 0.62 (3) 2.62	a 8.75 ± 0.62 (3) 2.31	a 8.75 ± 0.62 (3) 2.31	a 7.33 ± 0.80 (3) 1.64	a 7.95 ± 1.23 (3) 1.94	a 7.95 ± 1.23 (3) 1.94	a 7.95 ± 1.23 (3) 1.94	a 8.75 ± 0.62 (3) 2.31	a 7.33 ± 0.80 (3) 1.64	a 8.36 ± 0.62 (3) 2.14	a 7.54 ± 0.96 (3) 1.71

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%).

Figure in parenthesis indicates number of observations.

Figures below parenthesis value indicates percentage monocytes corresponding to Arc-sin√ percentage.

Table - 20 : Analysis of Variance for Table - 19

Sources of Variations	df	MS
Between groups	3	21.67 NS
Between days	14	27.68 **
Between groups x days	42	9.38 NS
Errors	194	12.40
	256	

Table - 21 : Showing Mean ± S.E of estimated MONOCYTE COUNT (with Arc-sin pecentage transformation) for experimental groups of buffalo calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 10.23 ± 0.63 (5) 3.14	ap 8.76 ± 0.84 (5) 2.32	ap 8.87 ± 0.45 (5) 2.39	ap 9.55 ± 0.65 (5) 2.74	ap 8.50 ± 0.37 (5) 2.19	ap 8.87 ± 0.45 (5) 2.33	bp 12.31 ± 0.72 (5) 4.54	bp 14.36 ± 0.69 (5) 6.16	bp 14.84 ±0.60 (5) 6.59	bp 15.54 ± 0.42 (5) 7.19	bp 15.78 ± 0.27 (5) 7.39	bp 15.78 ± 0.27 (2) 7.39	bp 16.43 ± 0.00 (1) 8.00	bp 15.34 ± 0.00 (1) 7.00	------
II	ap 9.24 ± 0.45 (5) 2.57	acp 8.54 ± 0.81 (5) 2.21	acdp 8.87 ± 0.45 (5) 2.39	dcdp 8.50 ± 0.58 (5) 2.17	dcdp 8.50 ± 0.37 (5) 2.17	dcdp 9.92 ± 0.54 (5)❖ 2.97	bp 12.06 ± 0.58 (5) 4.39	bq 12.09 ± 0.34 (5) 4.39	bq 11.50 ± 0.46 (5) 3.99	aq 11.19 ± 0.55 (5) 3.76	adq 10.60 ± 0.38 (5) 3.37	adq 10.60 ± 0.38 (5) 3.37	acdp 9.24 ± 0.45 (5) 2.56	acdp 9.24 ± 0.45 (5) 2.56	acdp 9.24 ± 0.45 (5) 2.56
III	ap 8.70 ± 0.98 (5) 2.29	ap 7.91 ± 0.95 (5) 1.90	ap 8.87 ± 0.45 (5) 2.39	ap 9.07 ± 0.99 (5) 2.50	ap 8.50 ± 0.37 (5) 2.19	ap 8.87 ± 0.45 (5) 2.39	bp 12.37 ± 0.34 (5) 4.59	bp 13.36 ± 0.77 (5) 4.59	bp 14.61 ± 0.59 (5) 6.39	bp 14.08 ± 0.86 (5) 5.97	br 13.61 ± 0.75 (5) 5.58	bq 12.79 ± 0.95 (5) 4.90	bp 11.99 ± 0.85 (5) 4.31	ap 9.55 ± 0.63 (5) 2.75	ap 9.55 ± 0.65 (5) 2.75
IV	ap 9.36 ± 0.36 (3) 2.67	ap 9.36 ± 0.36 (3) 2.67	ap 8.75 ± 0.46 (3) 2.31	ap 11.02 ± 0.36 (3) 3.69	aq 11.02 ± 0.40 (3) 3.69	aq 10.50 ± 0.40 (3) 3.31	ap 10.50 ± 0.40 (3) 3.31	ar 8.75 ± 0.48 (3) 2.32	ar 8.75 ± 0.48 (3) 2.32	ar 7.33 ± 0.62 (3) 1.64	as 7.95 ± 0.95 (3) 1.93	ar 7.95 ± 0.95 (3) 1.93	ap 8.75 ± 0.48 (3) 2.32	ap 7.33 ± 0.62 (3) 1.64	ap 9.36 ± 0.62 (3) 2.64

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%).

Figure in parenthesis indicates number of observations.

Figures below parenthesis value indicates percentage monocytes corresponding to Arc-sin Percentage.

Table - 38 : Analysis of Variance for Table - 37

Sources of Variations	df	MS
Between groups	3	78.3 **
Between days	14	33.02 **
Between groups x days	42	7.30 **
Errors	194	2.47
	256	

Table - 23 : Showing Mean ± S.E of ERYTHROCYTIC SEDIMENTATION RATE (mm) for experimental groups of buffalo calves before and after Uraemia following urethral obstruction and its surgical Management.

GR.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	5.40 ± 1.59 (5)	45.46 ± 1.60 (5)	47.60 ± 0.93 (5)	48.20 ± 1.03 (5)	50.82 ± 1.10 (5)	51.20 ± 0.80 (5)	52.80 ± 1.02 (5)	53.20 ± 1.16 (5)	54.20 ± 1.02 (5)	54.60 ± 0.86 (5)	55.50 ± 0.81 (5)	56.00 ± 1.26 (2)	58.00 ± 0.00 (1)	± 0.00 (1)	-----
II	43.60 ± 2.01 (5)	42.20 ± 2.22 (5)	43.20 ± 2.03 (5)	45.60 ± 1.91 (5)	48.80 ± 2.09 (5)	49.70 ± 1.82 (5)❁	48.40 ± 1.79 (5)	46.40 ± 1.72 (5)	45.40 ± 2.09 (5)	44.60 ± 1.72 (5)	43.40 ± 1.94 (5)	42.60 ± 2.01 (5)	42.20 ± 2.19 (5)	41.20 ± 2.03 (5)	41.28 ± 2.23 (5)
III	43.00 ± 2.07 (5)	44.20 ± 1.98 (5)	43.60 ± 1.08 (5)	45.60 ± 1.08 (5)	49.00 ± 1.18 (5)	50.00 ± 0.89 (5)	51.20 ± 1.02 (5)	52.20 ± 1.02 (5)❁	51.20 ± 0.93 (5)	49.80 ± 1.36 (5)	49.20 ± 1.46 (5)	47.20 ± 2.01 (5)	45.60 ± 1.63 (5)	43.86 ± 1.27 (5)	43.23 ± 1.85 (5)
IV	43.30 ± 1.73 (3)	43.80 ± 1.15 (3)	44.20 ± 1.45 (3)	45.30 ± 1.45 (3)	44.30 ± 1.20 (3)	44.00 ± 1.15 (3)	43.80 ± 1.20 (3).	43.30 ± 1.00 (3)	43.40 ± 1.53 (3)	43.60 ± 1.53 (3)	43.00 ± 1.53 (3)	43.24 ± 1.00 (3)	43.32 ± 0.88 (3)	43.30 ± 0.58 (3)	42.70 ± 0.33 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observation.

Table - 24 : Analysis of Variance for Table - 23

Sources of Variations	df	MS
Between groups	3	547.49 N.S
Berween days	14	88.78 **
Between groups x days	42	19.90 **
Errors	194	14.83
Total	253	

Table - 25 : Showing Mean ± S.E of estimated BLOOD UREA NITROGEN (mg/100ml) for considered groups of buffalo - calves following ureamia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 20.70 ± 0.72 (5)	ap 19.32 ± 0.26 (5)	ap 19.72 ± 0.29 (5)	bp 35.22 ± 1.17 (5)	bp 65.38 ± 1.48 (5)	bp 77.96 ± 2.16 (5)	bp 84.86 ± 9.19 (5)	bp 72.98 ± 2.55 (5)	bp 65.40 ± 2.66 (5)	bp 74.78 ± 3.88 (5)	bp 79.20 ± 2.25 (5)	bp 85.65 ± 6.95 (2)	bp 98.20 ± 0.00 (1)	bp 107.20 ± 0.00 (1)	-------
II	ap 19.30 ± 0.83 (5)	ap 19.26 ± 1.03 (5)	ap 19.64 ± 0.99 (5)	bp 32.56 ± 1.90 (5)	bq 47.40 ± 3.73 (5)	bp 72.56 ± 2.54 (5)❁	bq 46.40 ± 8.83 (5)	bqr 34.40 ± 2.57 (5)	bqr 27.48 ± 1.36 (5)	aqr 24.82 ± 1.50 (5)	aqr 23.00 ± 1.40 (5)	aqr 21.88 ± 0.96 (5)	ap 20.58 ± 0.70 (5)	ap 19.69 ± 0.83 (5)	ap 18.96 ± 0.72 (5)
III	ap 18.82 ± 0.40 (5)	ap 19.00 ± 0.37 (5)	ap 19.16 ± 0.25 (5)	ap 30.44 ± 1.78 (5)	ap 57.48 ± 1.43 (5)	bpr 83.90 ± 2.73 (5)	bp 110.80 ± 1.70 (5)	bp 77.62 ± 3.13 (5)❁	bp 66.42 ± 2.35 (5)	br 45.80 ± 1.63 (5)	br 33.44 ± 0.90 (5)	br 28.44 ± 0.73 (5)	aq 24.36 ± 0.12 (5)	aqr 19.70 ± 0.13 (5)	ap 18.62 ± 0.21 (5)
IV	ap 18.02 ± 0.63 (3)	ap 20.67 ± 0.14 (3)	ap 20.03 ± 0.34 (3)	ap 25.40 ± 0.74 (3)	ap 23.80 ± 0.95 (3)	aqr 22.93 ± 0.75 (3)	aq 21.40 ± 0.66 (3)	aq 19.67 ± 0.35 (3)	aq 20.37 ± 0.18 (3)	aq 20.27 ± 0.09 (3)	aq 20.43 ± 0.09 (3)	aq 20.63 ± 0.18 (3)	ap 20.93 ± 0.27 (3)	apr 21.57 ± 0.18 (3)	ap 21.33 ± 0.50 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 26 : Analysis of Variance for Table - 25

Sources of Variations	df	MS
Between groups	3	2049.80 **
Berween days	14	4287.70 **
Between groups x days	42	701.44 **
Errors	194	24.81
Total	253	

Table - 27 : Showing Mean ± S.E of SERUM CREATININE (mg/100ml) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th.	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 1.44 ± 0.07 (5)	ap 1.42 ± 0.09 (5)	ap 1.42 ± 0.08 (5)	ap 2.68 ± 0.27 (5)	bp 3.68 ± 0.26 (5)	bp 4.30 ± 0.20 (5)	bp 5.02 ± 0.13 (5)	bp 5.64 ± 0.18 (5)	bp 6.56 ± 0.16 (5)	bp 7.44 ± 0.07 (5)	bp 7.96 ± 0.14 (5)	bp 8.45 ± 0.71 (2)	8.48 ± 0.00 (1)	8.60 ± 0.00 (1)	-----
II	ap 1.44 ± 0.05 (5)	ap 1.54 ± 0.05 (5)	ap 1.42 ± 0.06 (5)	bpq 3.44 ± 0.14 (5)	bqr 5.28 ± 0.11 (5)	bp 5.70 ± 0.09 (5)❁	bp 6.42 ± 0.20 (5)	bp 5.48 ± 0.11 (5)	bqr 4.64 ± 0.13 (5)	bqr 3.63 ± 0.11 (5)	aqr 2.78 ± 0.05 (5)	aqr 1.58 ± 0.09 (5)	ap 1.48 ± 0.07 (5)	ap 1.48 ± 0.07 (5)	ap 1.48 ± 0.06 (5)
III	ap 1.40 ± 0.07 (5)	ap 1.36 ± 0.09 (5)	ap 1.36 ± 0.11 (5)	bpq 2.96 ± 0.13 (5)	bpr 4.52 ± 0.22 (5)	bp 5.72 ± 0.06 (5)	bqr 6.46 ± 0.11 (5)	bqr 7.60 ± 0.07 (5)❁	bqst 8.36 ± 0.08 (5)	bps 6.76 ± 0.19 (5)	bqs 5.86 ± 0.23 (5)	bqs 4.98 ± 0.18 (5)	bq 2.96 ± 0.23 (5)	ap 1.86 ± 0.17 (5)	ap 1.85 ± 0.10 (5)
IV	ap 1.53 ± 0.10 (3)	ap 1.43 ± 0.09 (3)	ap 1.33 ± 0.12 (3)	apr 1.47 ± 0.05 (3)	aqs 1.43 ± 0.57 (3)	aq 1.47 ± 0.07 (3)	aqs 1.60 ± 0.09 (3)	aqs 1.67 ± 0.10 (3)	aqs 1.50 ± 0.09 (3)	aqs 1.40 ± 0.12 (3)	aqt 1.43 ± 0.05 (3)	aqt 1.50 ± 0.05 (3)	ap 1.33 ± 0.03 (3)	ap 1.33 ± 0.03 (3)	ap 1.36 ± 0.15 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values control value shows no significant diffrence between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 28 : Analysis of Variance for Table - 27

Sources of Variations	df	MS
Between groups	3	35.39 **
Berween days	14	46.77 **
Between groups x days	42	8.16 **
Errors	194	1.33
Total	253	

Table - 29 : Showing Mean ± S.E of estimated INORGANIC PHOSPHORUS (mg/100ml) for experimental groups of buffalo - calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	^{ap}5.02 ± 0.17 (5)	^{ap}5.04 ± 0.17 (5)	^{ap}4.88 ± 0.22 (5)	^{bp}6.66 ± 0.38 (5)	^{bp}7.42 ± 0.17 (5)	^{bp}9.34 ± 0.33 (5)	^{bp}11.16 ± 0.69 (5)	^{bp}10.06 ± 1.28 (5)	^{bp}10.80 ± 1.04 (5)	^{bp}10.33 ± 0.85 (5)	^{bp}12.66 ± 0.29 (5)	^{bp}13.25 ± 0.65 (2)	^{bp}13.60 ± 0.00 (1)	^{bp}14.80 ± 0.00 (1)	--------
II	^{ap}4.88 ± 0.13 (5)	^{ap}4.94 ± 0.12 (5)	^{ap}5.02 ± 0.09 (5)	^{ap}5.76 ± 0.27 (5)	^{bp}7.82 ± 0.23 (5)	^{bp}8.78 ± 0.45 (5)❁	^{bqr}6.60 ± 0.27 (5)	^{bq}6.36 ± 0.07 (5)	^{bqr}6.10 ± 0.10 (5)	^{aqr}5.76 ± 0.17 (5)	^{aq}5.30 ± 0.20 (5)	^{aq}5.10 ± 0.22 (5)	^{ap}4.84 ± 0.19 (5)	^{ap}4.84 ± 0.18 (5)	^{ap}4.82 ± 0.09 (5)
III	^{ap}4.92 ± 0.16 (5)	^{ap}4.94 ± 0.09 (5)	^{ap}4.90 ± 0.10 (5)	^{ap}5.66 ± 0.11 (5)	^{bp}6.42 ± 0.17 (5)	^{bqr}7.34 ± 0.17 (5)	^{bqs}8.24 ± 0.12 (5)	^{bp}9.24 ± 0.12 (5)❁	^{bqs}8.76 ± 0.18 (5)	^{bqs}7.74 ± 0.22 (5)	^{bq}6.58 ± 0.14 (5)	^{aq}5.66 ± 0.26 (5)	^{ap}5.44 ± 0.13 (5)	^{ap}5.22 ± 0.20 (5)	^{ap}5.04 ± 0.15 (5)
IV	^{ap}4.60 ± 0.17 (3)	^{ap}4.54 ± 0.12 (3)	^{ap}4.47 ± 0.12 (3)	^{ap}5.53 ± 0.17 (3)	^{aq}5.40 ± 0.11 (3)	^{aq}5.43 ± 0.13 (3)	^{aqt}5.27 ± 0.03 (3)	^{aq}5.13 ± 0.02 (3)	^{aqt}5.13 ± 0.06 (3)	^{aq}5.03 ± 0.07 (3)	^{aq}5.00 ± 0.10 (3)	^{aq}4.90 ± 0.15 (3)	^{ap}4.87 ± 0.18 (3)	^{ap}4.70 ± 0.23 (3)	^{ap}4.63 ± 0.20 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 30 : Analysis of Variance for Table - 29

Sources of Variations	df	MS
Between groups	3	39.34 **
Berween days	14	25.02 **
Between groups x days	42	9.58 **
Errors	194	1.13
Total	253	

Table - 31 : Showing Mean ± S.E of estimated CALCIUM (mg/100ml) for experimental groups of buffalo - calves following urethral obstruction and its surgical management.

	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES										
	2nd	1st	7th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 10.72 ± 0.28 (5)	ap 10.82 ± 0.30 (5)	ap 11.04 ± 0.22 (5)	bp 12.86 ± 0.27 (5)	bp 12.84 ± 0.34 (5)	bp 12.32 ± 0.38 (5)	bp 12.74 ± 0.34 (5)	bp 12.34 ± 0.30 (5)	bp 12.20 ± 0.20 (5)	bp 12.40 ± 0.67 (5)	bp 12.68 ± 0.58 (5)	bp 12.25 ± 0.35 (2)	bp 12.35 ± 0.00 (1)	bp 12.64 ± 0.00 (1)	-------
II	ap 10.50 ± 0.28 (5)	acp 10.32 ± 0.20 (5)	acp 10.32 ± 0.26 (5)	bdp 13.50 ± 0.33 (5)	bdp 12.88 ± 0.28 (5)	bdp 12.30 ± 0.31 (5)❖	bdp 12.26 ± 0.45 (5)	bdp 12.54 ± 0.64 (5)	bdpr 12.34 ± 0.71 (5)	adpr 11.66 ± 0.44 (5)	bdpr 11.78 ± 0.58 (5)	adpr 11.54 ± 0.51 (5)	acp 10.66 ± 0.28 (5)	acp 10.02 ± 0.26 (5)	acp 9.94 ± 0.47 (5)
III	ap 10.64 ± 0.21 (5)	ap 10.70 ± 0.13 (5)	ap 11.28 ± 0.19 (5)	bp 12.62 ± 0.73 (5)	bp 13.10 ± 0.27 (5)	bp 13.42 ± 0.36 (5)	bp 12.28 ± 0.73 (5)	bp 13.40 ± 0.98 (5)❖	bqrs 13.48 ± 0.99 (5)	bprs 12.64 ± 0.79 (5)	bpr 12.58 ± 0.48 (5)	apr 11.32 ± 0.42 (5)	ap 10.24 ± 0.17 (5)	ap 10.20 ± 0.37 (5)	ap 9.76 ± 0.21 (5)
IV	ap 10.27 ± 0.32 (3)	ap 10.30 ± 0.21 (3)	ap 10.07 ± 0.11 (3)	aq 10.17 ± 0.20 (3)	aq 11.53 ± 0.43 (3)	aq 11.40 ± 0.22 (3)	aq 11.34 ± 0.05 (3)	aq 11.13 ± 0.26 (3)	aqrt 11.40 ± 0.25 (3)	aqrt 11.00 ± 0.42 (3)	aqr 11.17 ± 0.48 (3)	aqr 11.00 ± 0.61 (3)	ap 10.03 ± 0.22 (3)	ap 9.93 ± 0.32 (3)	ap 9.67 ± 0.21 (3)

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 32 : Analysis of Variance for Table - 31

Sources of Variations	df	MS
Between groups	3	6.77 **
Berween days	14	20.42 **
Between groups x days	42	0.21 **
Errors	194	0.96
Total	253	

Table - 33 : Showing Mean ± S.E of estimated SODIUM (mEq/L) for experimental groups of buffalo - calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	ap 144.14 ± 1.51 (5)	ap 143.76 ± 2.04 (5)	ap 144.56 ± 1.79 (5)	ap 149.54 ± 0.70 (5)	ap 146.70 ± 0.81 (5)	ap 144.10 ± 1.22 (5)	ap 140.54 ± 1.43 (5)	ap 136.42 ± 1.60 (5)	aq 133.92 ± 1.49 (5)	bp 130.56 ± 2.17 (5)	bp 127.38 ± 1.59 (5)	bp 126.30 ± 2.40 (2)	122.8 ± 0.00 (1)	120.1 ± 0.00 (1)	--------
II	ap 141.48 ± 1.79 (5)	ap 141.64 ± 1.67 (5)	ap 142.26 ± 1.94 (5)	ap 145.20 ± 1.27 (5)	ap 142.72 ± 1.31 (5)	ap 141.86 ± 1.43 (5)❁	ap 141.02 ± 1.68 (5)	ap 141.30 ± 1.40 (5)	ap 141.62 ± 1.60 (5)	ap 141.18 ± 1.64 (5)	aq 141.48 ± 1.68 (5)	aq 141.12 ± 1.76 (5)	ap 141.18 ± 1.84 (5)	ap 140.98 ± 1.80 (5)	ap 140.98 ± 1.78 (5)
III	ap 146.88 ± 1.37 (5)	ap 147.08 ± 1.15 (5)	ap 148.36 ± 1.58 (5)	ap 152.80 ± 1.86 (5)	ap 150.32 ± 1.18 (5)	ap 147.98 ± 1.24 (5)	ap 144.76 ± 1.78 (5)	ap 143.08 ± 2.10 (5)❁	ap 142.98 ± 1.47 (5)	ap 143.26 ± 1.59 (5)	aq 143.38 ± 1.64 (5)	aq 143.90 ± 1.42 (5)	ap 145.64 ± 0.93 (5)	ap 145.14 ± 0.85 (5)	ap 146.38 ± 0.90 (5)
IV	ap 142.97 ± 1.88 (3)	ap 142.20 ± 1.87 (3)	ap 142.93 ± 1.36 (3)	ap 142.43 ± 0.33 (3)	ap 140.43 ± 0.98 (3)	ap 139.73 ± 1.77 (3)	ap 140.00 ± 1.14 (3)	ap 140.10 ± 1.25 (3)	ap 140.83 ± 1.56 (3)	aq 142.20 ± 1.06 (3)	aq 142.67 ± 0.99 (3)	aq 143.03 ± 0.96 (3)	ap 144.53 ± 1.09 (3)	ap 144.07 ± 1.07 (3)	ap 144.27 ± 0.83 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 34 : Analysis of Variance for Table - 33

Sources of Variations	df	MS
Between groups	3	946.13 **
Berween days	14	264.71 **
Between groups x days	42	131.23 **
Errors	194	83.04
Total	253	

Table - 35 : Showing Mean ± S.E of estimated POTASSIUM (mEq/L) for experimental groups of buffalo - calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	4.04 ap ± 0.09 (5)	4.20 acp ± 0.15 (5)	4.14 acep ± 0.19 (5)	4.78 acep ± 0.06 (5)	5.24 acep ± 0.10 (5)	5.44 bcep ± 0.12 (5)	5.76 bdfp ± 0.13 (5)	5.98 bdfp ± 0.09 (5)	6.22 bdfp ± 0.13 (5)	6.44 bdfp ± 0.16 (5)	6.78 bdfp ± 0.10 (5)	7.00 bdfp ± 0.10 (2)	7.10 ± 0.00 (1)	7.12 ± 0.00 (1)	--------
II	4.02 ap ± 0.05 (5)	4.10 ap ± 0.07 (5)	3.98 abp ± 0.10 (5)	4.60 abp ± 0.08 (5)	4.96 abp ± 0.09 (5)	5.36 ap ± 0.09 (5)❁	4.86 abpr ± 0.20 (5)	4.52 abq ± 0.18 (5)	4.38 abq ± 0.13 (5)	4.32 abq ± 0.11 (5)	4.16 abq ± 0.06 (5)	4.06 abq ± 0.04 (5)	4.02 abp ± 0.37 (5)	4.02 abp ± 0.06 (5)	3.94 abp ± 0.07 (5)
III	4.28 ap ± 0.11 (5)	4.24 ap ± 0.10 (5)	4.32 ap ± 0.16 (5)	4.90 ap ± 0.13 (5)	5.20 ap ± 0.12 (5)	5.64 bp ± 0.10 (5)	5.96 bps ± 0.07 (5)	6.32 bp ± 0.11 (5)❁	5.88 ap ± 0.08 (5)	5.00 aq ± 0.11 (5)	4.72 aq ± 0.11 (5)	4.46 aq ± 0.12 (5)	4.32 ap ± 0.12 (5)	4.30 ap ± 0.13 (5)	4.24 ap ± 0.12 (5)
IV	4.40 ap ± 0.09 (3)	4.27 ap ± 0.14 (3)	4.37 ap ± 0.14 (3)	4.50 ap ± 0.09 (3)	4.53 ap ± 0.09 (3)	4.50 aqr ± 0.06 (3)	4.50 aq ± 0.06 (3)	4.36 aq ± 0.14 (3)	4.40 aq ± 0.15 (3)	4.36 aq ± 0.12 (3)	4.36 aq ± 0.12 (3)	4.30 aq ± 0.12 (3)	4.27 ap ± 0.12 (3)	4.27 ap ± 0.12 (3)	4.23 ap ± 0.09 (3)

❁ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 36 : Analysis of Variance for Table - 35

Sources of Variations	df	MS
Between groups	3	28.03 **
Berween days	14	14.48 **
Between groups x days	42	20.39 **
Errors	194	1.03
Total	253	

Table - 37 : Showing Mean ± S.E of estimated SERUM CHLORIDE (mEq/L) for experimental groups of buffalo calves following uraemia after urethral obstruction and its surgical management.

Gr.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	106.06[a] ± 1.05 (5)	104.68[ac] ± 0.54 (5)	106.02[ace] ± 0.74 (5)	109.10[ace] ± 0.37 (5)	106.76[ace] ± 0.97 (5)	102.86[ade] ± 0.92 (5)	99.44[ace] ± 0.33 (5)	97.66[ace] ± 1.15 (5)	96.14[bdf] ± 1.43 (5)	95.84[bdf] ± 0.88 (5)	94.98[bdf] ± 0.87 (5)	94.70[bdf] ± 1.10 (2)	94.28 ± 0.00 (1)	94.23 ± 0.00 (1)	--------
II	103.92[a] ± 1.91 (5)	104.16[a] ± 1.65 (5)	103.30[a] ± 1.70 (5)	105.12[a] ± 1.67 (5)	106.18[a] ± 1.95 (5)	103.28[a] ± 1.64 (5)❖	100.78[a] ± 1.29 (5)	99.86[a] ± 1.21 (5)	100.36[a] ± 1.21 (5)	100.84[a] ± 1.49 (5)	101.30[a] ± 1.63 (5)	101.84[a] ± 1.84 (5)	102.60[a] ± 1.37 (5)	102.84[a] ± 1.79 (5)	103.60[a] ± 1.82 (5)
III	104.42[a] ± 2.24 (5)	103.38[a] ± 1.78 (5)	103.60[a] ± 2.13 (5)	106.52[a] ± 1.97 (5)	103.68[a] ± 2.26 (5)	101.10[a] ± 1.41 (5)	99.16[a] ± 1.00 (5)	97.22[a] ± 1.10 (5)❖	98.12[a] ± 1.06 (5)	98.44[a] ± 1.24 (5)	99.88[a] ± 1.40 (5)	100.82[a] ± 1.34 (5)	101.48[a] ± 1.45 (5)	101.76[a] ± 1.43 (5)	102.56[a] ± 1.57 (5)
IV	105.23[a] ± 0.58 (3)	104.57[a] ± 0.44 (3)	104.70[a] ± 0.60 (3)	105.26[a] ± 0.73 (3)	102.73[a] ± 0.18 (3)	102.53[a] ± 0.18 (3)	102.30[a] ± 0.36 (3)	102.37[a] ± 0.30 (3)	102.60[a] ± 0.36 (3)	103.00[a] ± 0.15 (3)	102.67[a] ± 0.14 (3)	103.03[a] ± 0.40 (3)	102.83[a] ± 0.74 (3)	103.07[a] ± 0.75 (3)	103.37[a] ± 0.82 (3)

❖ - day of release of urethral obstruction following surgical management.

Similar Superscripts of Post Obstruction Values with Pre obstruction values as well as corresponding day control values show no significance difference between them at 5% level of significance (P<0.05%)

Figure in parenthesis indicates number of observations.

Table - 38 : Analysis of Variance for Table - 37

Sources of Variations	df	MS
Between groups	3	103.40 **
Berween days	14	102.96 **
Between groups x days	42	40.71 NS
Errors	194	48.80
Total	253	

Results and Observation

RESULTS AND OBSERVATION

Following creation of urethral obstruction and its surgical managements, the findings of all animals were recorded and presented under the subheads :

1. Clinical observations
2. Haematological findings
3. Blood biochemistry
4. Microscopic changes

GROUP - I

4.1.1 CLINICAL OBSERVATIONS

Within 30 minutes of urethral blockade there was increased micturition reflexes with dribbling of scanty urine. The animals took feed and water and grazed as usual. The rumination and ruminal movements were normal. There was gradual increase in micturition reflexes after 4-8 hours of urethral obstruction. The complete urethral obstruction was marked after 8-10 hours of urethral obstruction with anurea in all animals. With increase in micturition reflexes, the animals seemed anxious, although appetite and thirst were normal. After 12 hours of urethral obstruction, the animals exhibited frequent straining with futile attempts to urinate. There was symptom of colic which

later pronounced. Per-rectal examination revealed distended urinary bladder with urethral pulsation at sub-ischial line. There was increase in uneasiness and discomfort.

A day after urethral obstruction, the micturition reflexes were depressed to a considerable extent. The animal were partially off-feed but accepted water as usual. Rumination and ruminal movements were depressed. Later animals became restless with greater distention of urinary bladder. From 36 hours of urethral blockade and onwards, there was gradual increase in dullness and depression. Animal lost their interest in feed and thirst. The eyes were injected, muzzles dried and body hairs erect. There was uraemic odour from the mouth. After 48 hours of urethral blockade, there was increased depression, falique and anorexia. There was complete absence of thirst. Animals preferred to lie down. The eyes were suncken, muzzles dried and body coat roughened. There was constipation but later animals passed hard dung. On rectal examination urinary bladder was found completely distended.

On 3rd day, following urethral obstruction, the urinary bladder of animal no. 1,3,4 and 5 was not palpable on rectal examination. However, these animals had little rumination from evening of the 3rd

post obstruction day and took grasses and water from 4th post obstruction day. The animals felt relief and exhibited some brightness. The urinary bladder of animal no. 2 ws not detected on rectal examination on 4th post obstruction day and the animals started rumination from late afternoon. The coliky symptom decreased from 4th post obstruction day and onwards in all animals. The gait and movements were normal. There was some improvement in general conditions on 5th day post obstruction. There was better appearance of the eyes and body coat. Thereafter on 4th post obstruction day and onwards. The abdomen was found gradualy distended which on palpation and percussion yielded high pitch fluid sound. The ruminal movements were irregular which ceased later.

Body temperature of the buffalo calves initially increased during the period of urethral obstruction but the rise was non significant when compared with their preobstruction values as well as control group values. From 3rd post obstruction day, temperature gradully declined. It further declined below normal value from 7th post obstruction day and onwards. Initially there was significant rise of respiration rate following urethral obstruction in respect of their pre obstruction values and control group values. Later it

was gradually decreased and became normal on 6th post obstruction day. From 7th day post obstruction and onwards, the respiration was laboured, irregular and further decreased below normal. Pulse rate of these animals showed gradual increase and at the terminal stage, it was significantly raised when compared with its pre obstruction values as well as corresponding day control group value. Animals showed gradual detoriation in their healths. There was water-belly appearance on account of intra abdominal urine. Later the animal became prostrate with neck turned towards chest. The extremities of animal became cool and animals became apparently calm. Animal no. 1, 2, 3, 4 and 5 died on 180 hours, 266 hours. 201 hours, 246 hours and 195 hours following urethral obstruction respectively.

4.1.2 HAEMATOLOGICAL FINDINGS

Haemoglobin percentage of the animals gradually increased following urethral obstruction, ranging from 11.78 ± 0.31 to 19.90 ± 0.09 gm %. There was significant rise from 16.18 ± 0.27 to 19.90 ± 0.09 gm % on 5th post obstruction day and onwards, when compared with their pre obstruction values (table-7). The Hb% was also significantly raised on 8th day post obstruction and onwards ranging from 19.44 ± 0.24 to 19.90 ± 0.09 gm % from its corresponding day control

group value. Haematocrit value progressively increased significantly from 39.4 ± 1.12 to 50.5 ± 0.95 vol. % after urethral obstruction when compared with its pre obstruction values (table-9). From 3rd post obstruction day and onwards the rise in haematocrit value was significant from corresponding day control value.

Total erythrocytic count of this group progressively increased non-significantly with the progress of uraemia up to 6th post obstruction day ranging from 7.32 ± 0.31 to 8.43 ± 0.08 millions/Cumm as compared with its pre obstruction values. On 7th post obstruction day and onwards, there was significant increase from 8.93 ± 0.10 to 9.00 ± 0.05 millions per cu. mm. as compared with its pre obstruction values (table-11). There was no significant difference between each of post obstruction and corresponding day control group TEC value. Total leucocytic count progressively increased but the rise was non-significant when compared with its pre obstruction and control group TLC value.

The neutrophil count initially increased non significantly which became significant from 3rd post obstruction day till death of animals ranging from 41.6 ± 0.86 to 56.0 ± 0.80 % as compared with its pre obstruction values as well as control group (table-15).

Lymphocytic count initially decreased nonsignificantly but later gradually decreased significantly ranging from 50.4 ± 1.54 to 33.0 ± 1.32 as compared to its pre obstruction as well as control group value.

Eosinophil count of the animals was initially increased and there was significant difference on 3rd and 4th day post obstruction but the values later decreased non-significantly from their pre obstruction values (table-19). There was no significant diffrence from that of control group value. Monocytes were significantly increased when compared with its pre obstruction values and that of control group value except at the initial stage (table-21).

Erythrocytic sedimentation rate increased gradually which became significant on 3rd day post obstruction and onwards ranging from 50.82 ± 0.80 to 55.50 ± 1.26 mm at end of 1 hour, when compared with its pre obstruction as well as that of control group value (table-23).

4.1.3 BLOOD BIOCHEMISTRY

Blood urea nitrogen (BUN) increased significantly after urethral obstruction ranging from 35.22 ± 1.17 to 85.65 ± 6.95 mg/100ml as compared with its pre-obstruction values as well as that day control value (table-25). Serum creatinine was also gradually

rising significantly following urethral obstruction ranging 2.68 ± 0.27 to 8.45 ± 0.14 mg/100 ml as compared with its pre obstruction and corresponding day control value.

Inorganic phosphorus showed significant increase to a mean value 6.60 ± 0.38 mg/100ml after 24 hours of urethral obstruction and further increased to 13.25 ± 0.65 mg/100 ml at the time of death of animals as compared with pre obstruction values as well as that of control value. Calcium value increased significantly 12.86 ± 0.27 mg/100ml after 24 hours of urethral obstruction and varried slightly and reached to 12.25 ± 0.35 mg/100ml at the time of death.

Sodium value slightly increased to 149.54 ± 0.70 mEq/L after 24 hours of urethral obstruction then decreased gradually to 126.30 ± 2.40 mEq/L at the time of death. The decrease on 7th, 8th and 9th day post obstruction was significantly lower that its pre obstruction values. The 8th and 9th day post obstruction values were also significantly lower that that day control value. Serum-potassium of buffalo calves progressively increased significantly from 4.78 ± 0.06 to 7.00 ± 0.10 mEq/L at the time of death as compared with its pre obstruction value as well as corresponding day control value. Serum chloride value of the buffalo

calves increased to 109.10 ± 0.37 mEq/L after 24 hours of urethral blockade but decreased later gradually to 94.70 ± 1.10 mEq/L. The decrease was significant towards terminal stage of the animals from pre-obstruction values. There was no significant difference between post obstruction between value of postassium to that of control group value (table-38).

4.1.4 MICROSCOPIC LESIONS

Liver sections showed the changes of hepatitis. Majority of hepatic cells were either necrosed or degenerated. Several cystic spaces of various sizes were found present. Cystic spaces were filled with pink colour oedematous fluid. Central veins were dilated and here also pink colour fluid were present.

Kidney sections presented the changes of hydronephrosis, in which renal parenchyma were severely damaged. Several cystic spaces of various sizes were found present in both cortex and medulla. These cystic spaces were lined by single layer cells. Due to formation of cystic spaces, neighbouring tubules and glomeruli were atrophied. Lining epithelial cells of tubules were degenerated or necrosed. Oedematous fluid was found present around the golmeruli at several

places. Some of the tubules had became homogenous or hyalinised.

Pancreas section showed sign of oedema of its parenchyma. There was oedamatous fluid present in their parenchyma. The exocrine and endocrine structures were normal.

G R O U P I I

4.2.1 CLINICAL OBSERVATIONS

The animals of this group exhibited similar clinical manifestations after urethral obstruction as in Group-I. On 3rd post obstruction day, urethral obstruction of all the animals were removed surgically and subsequent clinical symptoms noted. All the animals had disteded bladder before surgical management but the urinary bladder of animal no. 9 could not be palpated as it was already ruptured. These animals showed dullness and depression after surgical mangement. However free flow of urine started after removal of urethral blockade in 4 animals; and rumination reappeared. They started grazing, feeding and drinking water. The eyes exhibited brightness and muzzles moistened on 2nd post operation day. The inflammation at the site of incision of animal no. 9 was mild with no exudation.

On 3rd day post operation, the appetite and thirst were restored. There was free flow of urine in all animals. They exhibited comfort and easiness. Defaecation of the animals became normal. There was progressive improvement in their health. On 8th day post operation, sutures were removed and polythene tube was withdrawn. The line of incision showed healing with first intension. Both the lines of incision of animal no. 9 health with 1st intension and the animals recovered well.

Body temparature of these animals initially increased non-significantly following urethral blockade as compared with its pre obstruction values and corresponding day control value (table - 1). After release of urethral obstruction on 3rd post obstruction day, the body temparature decreased and maintained as normal onwards with slight variations. There was significant rise in respiration rate during initial stage of urethral obstruction from its pre obstruction values as well as corresponding day control value. After release of obstruction, the values declined gradually and maintained as normal on 5th day after surgical management and onwards. The pulse rate showed progressive increase but the value decreased following release of urethral blockade and maintained as normal on

2nd day after surgical management and onwards.

4.2.2 HAEMATOLOGICAL FINDINGS

Haemoglobin precentage of these animals gradually increased non-significantly following urethral obstruction up to 2nd post obstruction day, ranging from 13.56 ± 0.20 to 15.50 ± 0.51 gm% as compared to its pre obstruction values and corresponding day control value. On 3rd post obstruction the Hb value increased to 17.94 ± 0.41 gm%, which was significantly higher that its pre obstruction values. After release of urethral obstruction on 3rd post obstruction day, the values declined gradually but remained significantly higher from its pre obstruction values up to 3rd day following surgical mangement, ranging from 17.22 ± 0.25 to 16.72 ± 0.26 gm%. Later the values became non significant from its pre obstruction values. There was no significant difference between each of post operation day value and that of control value.

There was significant rise in haematocrit values from its pre obstruction values, ranging from 40.4 ± 1.33 to 46.0 ± 1.30 vol%. The values declined on 2nd day after surgical management but remained significant up to 6th post operation day from pre obstruction values ranging from 45.0 ± 1.41 to 41.6 ± 0.75 vol%. The haematocrit values on 3rd day post

obstruction i.e. day of surgical management to 6th post operation day also remained significantly higher from corresponding day control value.

Total erythrocytic count gradually increased non significantly up to 3rd post obstruction day, ranging from 7.42 ± 0.10 to 7.94 ± 0.07 mill. per Cu.mm. as compared to its pre obstruction values. After surgical management, the values declined and ranged from 7.91 ± 0.10 to 7.04 ± 0.13 millions up to 7th post operation day. Later it became normal. There was no significant difference between each day TEC values and that day control value. There was non significant rise in " total leucocytic count ", ranging from 8.52 ± 0.07 to 9.00 ± 0.07 thousands per cu. mm. The values declined gradually from 2nd day onwards following surgical management and became normal on 7th post surgical day.

Neutrophils count increased non significantly during the period of urethral obstruction, ranging from 36.9 ± 0.92 to 37.8 ± 0.66 %. After release of obstruction, the values declined and became normal on 4th post surgical day and onwards. Lymphocytes count gradually decreased significantly, ranging from 62.4 ± 0.86 to 54.2 ± 0.86 %. A day after surgical management the value progressively increased and became normal on 7th day following surgical management. There

was gradual increase in eosinophils count significantly from pre obstruction values. After surgical management, the values declined and became normal on 8th post surgical day. Monocytes count decreased initially then following surgical management the values increased significantly from its pre obstruction values up to 3rd post surgical day then decreased and normalised on 8th day post operation. The monocytes count was significantly higher on day of surgical management to the 6th post surgical day when compared with corresponding day control value.

The Erythrocytic sedimentation rate significantly increased ranging from 45.60 ± 1.91 to 49.70 ± 1.82, when compared to its pre obstruction values. After release of obstruction, the value declined gradually and became normal on 5th day following surgical management. The ESR value of day of surgical management and a day after surgical management was significantly higher than corresponding day control value.

4.2.3 BLOOD BIOCHEMISTRY

Blood urea nitrogen (BUN) increased significantly from its pre obstruction value as well as corresponding day control value, ranging from 32.56 ± 1.90 to 72.56 ± 2.54 mg/100ml. The values declined on

2nd day after surgical management but remained significantly higher than its pre obstruction values and corresponding day control value up to 5th post surgical day. Thereafter the BUN values normalised (table-25). Serum creatinine also gradually increased significantly with the progress of uraemia ranging from 3.44 ± 0.14 to 6.42 ± 0.20 mg/100ml. Following surgical management, the value declined gradually but remained significantly higher up to 4th post surgical day from the pre obstruction values. The creatinine value of each day from 2nd post obstruction day to the 6th post surgical day was significantly higher than corresponding day control value (table-27).

There was significant increase in inorganic phosphorus ranging from 5.76 ± 0.27 to 8.78 ± 0.45 mg/100ml as compared with its pre obstruction values and corresponding day control value. The value declined gradually following surgical management but remained significantly higher up to 3rd post surgical day as compared with the pre obstruction values as well as corresponding day control value (table - 29). Serum calcium value increased to 13.50 ± 0.33 mg/100ml after 24 hours of urethral obstruction then gradually declined which further continued after surgical management on 3rd post obstruction day. The value ranged from 12.88 ± 0.28

to 12.34 ± 0.64 mg/100ml which were significantly higher than the pre obstruction values up to 3rd day following surgical management and also from corresponding day control value. The calcium value became normal on 7th post surgical day and on wards.

Serum-sodium initially increased to 145.20 ± 1.27 mEq/L after 24 hours of urethral obstruction then it gradually declined but it was non significantly higher from pre obstruction values as well as corresponding day control value. After removal of obstruction, the value became normal with slight variations. Potassium value gradually increased with the progress of uraemia which ranged from 4.60 ± 0.08 to 5.36 ± 0.09 mEq/L. The 3rd post obstruction day value was significantly higher than its pre obstruction value. After removal of obstruction, the values declined gradually and became normal on 6th day after their surgical management. The serum chloride value initially increased non-significantly to 106.18 ± 1.95 mEq/L then declined gradually. After release of urethral obstruction the chloride value increased from 4th day after surgical management and reached to normal on 7th day following surgical management and onwards.

GROUP III

4.3.1 CLINICAL OBSERVATIONS

All animals of this group exhibited similar menifestations after urethral obstruction as that of group I and subjected to surgical management on 5th post obstruction day. The urinary bladder of animal no. 11, 12 and 14 was not palpable on 3rd post obstruction day, and the bladder of animal no. 13 and 15 was not palpated on 4th day post obstruction. On day of surgical management, all animals showed dullness and depression. They showed least interest in food and water. However, the rumination and ruminal movements were prsent. From 1st day after surgical management, the animals started taking feed and water. The eyes were brightened and muzzle moistened. The animal urinated in evening of 1st day post operation. Inflammation of suturelines gradually subsided up to 7th day after surgical management and healed with 1st intension. Defaecation of animals became normal and they urinated without any difficulties. The appetite and thirst became normal and animals became alert having improved health.

The body temparature values were progressively increased initially but later decreased and maintained as normal onwards. Initially the respiration rate increased significantly but later

decreased and became normal on 3rd day following surgical management and onwards. The pulserate showed gradual rise at initial stage then declined. There was again rise in pulse rate on 1st day after surgical management and became normal onwards.

4.3.2 HAEMATOLOGICAL FINDINGS

There was gradual rise in haemoglobin percentage with the progress of uraemia ranging from 12.72 ± 0.33 to 18.64 ± 0.28 gm%. It was significantly higher from pre obstruction values on 4th and 5th day post obstruction as well as 1st and 2nd day after surgical management. After surgical management on 5th post obstruction day, the value declined from 2nd post operation day and became normal on 5th day after surgical management and onwards. The Hb% on each day after surgical management was significantly higher than that day control value (table-7). Haematocrit values significantly increased from its pre obstruction values ranging from 39.2 ± 1.36 to 47.0 ± 2.00 Vol. %. After surgical management, the values declined gradually and became normal on 5th post operation day and onwards. 4th and 5th day post obstruction day as well as 1st, 2nd, 3rd & 4th after surgical management value was significantly higher than corresponding day control value.

Total erythrocytic count was non significantly increased gradually with the progress of uraemia ranging froom 7.21 ± 0.09 to 8.23 ± 0.04 millions/Cu.mm. After surgical management the value declind and became normal on 6th day after operation (table-11). There was gradual non significant rise in total leucocytic count ranging from 8.40 ± 0.07 to 9.06± 0.07 thousands/Cu.mm .After operation for surgical management the TLC value declined and became normal on 6th day after operation and onwards (Table-13).

Neutrophils value was increased significant from 3rd post opstruction day and onwards ranging from 37.8 ± 0.86 to 47.6 ± 0.51% as compared with its pre obstruction value . After surgical management of these animals the value declined gradually and became normal on 6th post operation day and onwards. The value on 4th and 5th day post obstruction as well as a day after surgical management to 4th day post operation was significantly higher than that day control value (table-15).

Lymphocyte count decreased significantly from 3rd post obstruction day and onwards as compared with its pre obstruction values ranging from 59.4± 0.97 to 44.6± 1.25%. After operation of surgical management the value increased gradually and became normal on 6th

day post operation and onwards. The value on 4th and 5th day post obstruction and a day after surgical management to 4th optation day was significantly higher than corresponding day control value (table-17).

Eosinophil value increased initially then decreased gradually. The 3rd and 4th post obstruction value was singnificantly higher than pre obstruction values .After operation for surgical management, the value maintained their decreasing trend and became normal on 9th post operation day. Monocytic count gradually singnificantly increased with the progress of uraemia from its pre obstruction values as well as corrosponding day control value. After surgical management the value declined gradually and became normal on 6th post operation day and onwards .The value on 4th and 5th post obstruction day and 1st day to 5th post operation day was significantly higher than its pre obstruction values as well as corresponding day control value (table-21).

Erythrocytic sedimentation rates increased significantly from its pre obstruction values ranging from 45.60 ± 1.08 to 52.20±1.02 mm. After operation for surgical management of buffalo calves,the value declined and became normal on 6th and 7th post operation day. The each of 2nd to 5th day post

obstruction values, and 1st to 4th post operation day valuse was significantly higher than corresponding day control value (table-23).

4.3.3 BLOOD BIOCHEMISTRY

Blood urea nitrogen value significantly increased with the progress of uraemia after urethral obstruction ranging from 30.44 ± 1.78 to 100.80 ± 1.70 mg/100ml, as compared with its pre obstruction values. After surgical management the values declined gradually and became normal on 5th day following surgical management. The each of 1st to 5th day post obstruction values were significantly higher than corresponding day control value (table-25). Serum creatinine gradually increased significantly after urethral obstruction from its pre obstruction values as well as control value ranging from 2.96 ± 0.13 to 8.36 ± 0.08 mg/100ml. Following surgical management the value declined progressively and became nromal on 7th post operation day and onwards. There was significant rise in value on each of the day after surgical management to 5th day post operation from corresponding day control value (table-27).

The serum inorganic phosphorus was significantly increased from its pre obstruction values as well as corresponding day control value ranging from

5.66 ± 0.11 to 9.24 ± 0.12 mg/100ml. After surgical management of animals, the value declined gradually and became normal on 7th post operation day and onwards. On the day after surgical management and 2nd day post operation value of inorganic phosphorus was significantly higher than corresponding day control value (table-29). Serum calcium value was also significantly increased from its pre obnstruction values as well as control value ranging from 12.62 ± 0.73 to 13.48 ± 0.99 mg/100ml. After operation for surgical management the values declined gradually and became normal on 5th day following operation and onwards. The each value on day after surgical management, to 3rd post operation day value was significantly higher than that of control value (table-31).

There was rise in sodium value to 152.80 ± 1.86 mEq/L after 24 hours of urethral obstruction then the values declined gradually ranging from 150.32 ± 1.18 to 142.98 ± 1.47 mEq/L. After surgical management on 5th post obstruction day increased and became normal on 5th post operation day (table - 33). The serum potassium values significantly increased after urethral obstruction rnaging from 4.90 ± 0.13 to 6.32 ± 0.07 mEq/L as compared to its pre obstruction values. After surgical management on 5th post obstruction day the

values declined gradually and became normal on 5th post operation day and onward. There was significant diffrence between the values on 4th, 5th day post obstruction and day after surgical management and corresponding day control value (table - 35). Serum chloride level increased to 106.52 ± 1.97 mEq/L after 24 hours of urethral obstruction and then gradually decreased rnaging from 103.68 ± 2.26 to 97.22 ± 1.10 mEq/L. After surgical management, the value increased progressively and became normal on 7th day post operation and onwards (table-37).

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Discussion

D I S C U S S I O N

The present experiment was carried out to study the complex phenomena of bovine uraemia following urethral blockade and its corrective measures on eighteen clinically healthy buffalo calves. Surgical creation of urethral obstruction by insertion of Cea tangle tent at the proximal bend of sigmoid flexure was successful and simulated the condition of clinical urethral obstruction because the Cea tangle tent gradually absorbed water and fitted snugly in the urethra. It was noted that within 30 minutes of urethral blockade, there was micturition reflexes which increased gradually after 4-8 hours of urethral obstruction showing urethral pulsation on sub ischial line. Gera and Nigam (1980) however, observed the micturition reflexes with urethral pulsation at sub ischial line within two hours of urethral obstruction, Jadon, et al. (1987) reported micturition reflexes with urethral pulsation within 4-8 hours of urethral obstruction and Gangwar, et al. (1990) noted micturition reflexes within 30 minutes of urethral obstruction which later increased gradually. This variation might be due to difference in the methods of creation of urethral obstruction.

After 8-10 hours of urethral obstruction anurea with increased micturition reflexes and restlessness was consider to be due to complete occlusion of the urethra. These observations corroborate with findings of Gera and Nigam (1980), Sharma, et al. (1982), Jadon, et al. (1987) and Gangwar, et al. (1990).

Frequent straining with futile attempts to urinate after 12 hours of urethral obstruction was marked with coliky symptoms. Similar observations were recorded by Gera and Nigam, (1980), Sharma, et al. (1982), Jadon, et al. (1987) and Gangwar, et al. (1990). Such symptoms might be due to overdistention and reflex muscular contraction of urinary bladder.

Subsequently the micturition reflexes were depressed to a considerable extent after a day. Probably this has resulted due to the loss of contractile power of the bladder musculature due to over stretching. Gera and Nigam (1980), also observed reduced micturition reflexes after 12 to 18 hours of urethral ligation in the buffalo calves, later being absent.

There was progressive dullness and depression from 36 hours and onwards of urethral obstruction in all animals. Gera and Nigam (1980) however, observed dullness and depression after 24 hours following urethral ligation and Jadon, et al. (1987),

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There was progressive dullness and depression from 36 hours and onwards of urethral obstruction in all animals. Gera and Nigam (1980) however, observed dullness and depression after 24 hours following urethral ligation and Jadon, et al. (1987),

noticed after 36 hours of experimental urethral obstructions. Thus this symptoms seem to be apparent due to progressive development of uraemia.

The conjunctiva of the animals were injected, muzzles dried and body hairs erect with uraemia odour from the mouth. Sharma, et al. (1982) and Jadon, et al. (1987) also found similar symptoms following experimental obstruction. The haemoglobin percentage gradually increased significantly and progressively decreased after surgical management. Gangwar, et al. (1990), noted significant rise in the value following urethral obstruction. However, Gera and Nigam (1980), Jadon, et al. (1987) found gradual non significant increase in Hb% in experimental urethral obstruction in bovines. Singh, et al. (1987) and Kumar et al. (1991) recorded higher value of Hb% in clinical cases which declined progressively following surgery for their cure. The increase in Hb% showed severe dehydration which might be reason for injected conjunctiva, dried muzzles and erect body hairs.

After 48 hours of urethral obstruction, there was complete absence of appetite and thirst. Gera and Nigam, (1980), Sharma, et al. (1982), Jadon, et al. (1987) and Gangwar, et al. (1990) observed inappetance and loss of thirst during initial stage of urethral

obstruction. The rumination and ruminal movements were normal upto 24 hours of urethral obstruction, thereafter decreased gradually and ceased after 48 hours of urethral obstruction. Gera and Nigam (1980), Sharma, et al. (1982) and Jadon, et al. (1987) also recorded similar observation. Characteristically this could be due to progress of uraemia and surgical stress. The urinary bladder of nine animals were neither distended nor palpable following 72 hours of urethral blockade indicating the rupture of bladder. Gera and Nigam (1980) observed rupture of bladder between 44-74 hours of urethral ligation. Sharma, et al. (1982) found that the rupture of bladder occurred following 24-70 hours of urethral obstruction. Gangwar, et al. (1990) also noted that rupture happened after 30-80 hours complete urethral obstruction. Variation in the time of rupture of urinary bladder might have resulted due to different methods of creation of urethral obstruction employed by different workers.

Animals felt relief and exhibited some brightness after 6-8 hours of bladder rupture. Similar observations were made by Sharma, et al. (1982) and Gangwar, et al. (1990).

In group I on 4th day of post obstruction and onwards animals gradually became depressed and

prostrate with water belly condition which was observed by Gera and Nigam (1980) after 60 hours urethral ligation. Probably method of urethral ligation was more traumatic leading severe accute symptoms of uraemia quickly.

Body temperature of the buffalo calves initially increased non significantly during the period of urethral obstruction in all experimental groups which declined gradually after 3rd post obstruction day. Gera and Nigam (1980), Jadon, et al. (1987) and Gangwar, et al. (1987) found similar observation after experimental bovine urethral obstruction. The initial rise might be due to inflammatory reactions.

There was gradual significant rise in respiration rate following urethral obstruction which later gradually declined and became irregular and laboured at the terminal stage in group I. Jadon, et al. (1987) observed a significant progressive increase in respiration rate following experimental urethral obstruction. However, Gangwar, et al. (1990) and Kumar, et al. (1991) noted higher respiration rate in experimental and clinical cases of urethral obstruction.

The haematocrit value also gradually increased significantly ranging from 39.4 ± 1.12 to 50.5 ± 0.95 vol%. After surgical management the value

progressively declined. Gera and Nigam (1980) and Jadon, et al. (1987) noted significant increase in the value however, Gangwar, et al. (1990) found significant rise only in 2-3 animals after complete urethral obstruction in bovines. This significant rise could be due to dehydration and pain reflexes.

There was gradual increase in total erythrocytic count ranging from 7.21 ± 0.09 to 9.00 ± 0.05 mill./Cu mm. The value significantly increased at the terminal stage but progressively decreased following surgical managment. However, Gera and Nigam (1980), Jadon, et al. (1987) and Gangwar, et al. (1990) observed gradual increasing trend after experimental bovine urethral obstruction. Kumar, et al. (1991) noted higher TEC value in bovine obstructive urolithiasis which declined following operation for its cure. These might be due to intense sympathetic stimulation during uraemic stages and increased permeability of vascular membrane leading to plasma loss.

Total leucocytic count (TLC) gradually increased non significantly ranging from 8.40 ± 0.07 to 9.38 ± 0.04 thousand per Cu mm. After surgical managment the value declined progressively. Jadon, et al. (1987) and Gangwar et al. (1990) found slight increase in value where Gera and Nigam (1980) and Gera and Nigam (1981)

recorded significant increase in the value in experimental and clinical cases. These differences might be due to different surgical operation for creation of urethral obstruction.

Neutrophils count increased significantly ranging from 36.9 ± 0.96 to 56.0 ± 3.50% which declined gradually following surgical management. Similarly, Gera and Nigam (1981) and Jadon, et al. (1987) observed significant increase in the neutrophils in clinical and experimental cases of urethral obstruction. Where as, Gera and Nigam (1980). Gangwar, et al. (1990) noted non significant increase in the value in experimental obstruction of urethra. The increase might be due to stress and severe inflammatory reactions.

Lymphocytic value decreased significantly ranging from 62.4 ± 0.86 to 33.0 ± 1.32 % which increased gradually following surgical management. Gera and Nigam (1981) and Jadon, et al. (1987) found similar results in clinical and induced bovine urethral obstruction. Gera and Nigam (1980) and Gangwar, et al. (1990) also recorded non significant decrease of lymphocytes in experimental cases. The difference might be due to different methods employed for creation of urethral obstruction but the trend is similar.

Initially the eosinophil significantly

increased up to 3rd day post obstruction then value gradually declined. Gera and Nigam (1980) and Jadon, et al. (1987) observed non significant decrease in the value. However, Gangwar, et al. (1990) noted significant lowering of the value in experimental cases. This might be due to toxaemia during later stages of urethral obstruction.

The monocyte count also gradually increased significantly at the later stage which declined and became normal after surgical management. However, Jadon, et al. (1987) and and Gangwar, et al. (1990) showed gradual non significant rise after urethral obstruction. Gera and Nigam (1980) reported slight decrease in the value after ligation of urethra which is in contradiction to the observations of the present studies. However, the increase in monocytes count might be due to progressive uraemia, the correction of which brought the monocyte count to the normal level.

Significant rise in blood urea nitrogen (BUN) was recorded which ranged from 35.22 ± 1.17 to 85.65 ± 6.95 mg/100ml. The value progressively declined after surgical management. The findings are in consonance with the observations of Gera and Nigam (1980), Gera, et al. (1980) , Singh, et al. (1983),

Pandey, et al. (1986) and Gangwar, et al. (1990) in experimental cases of urethral obstruction. The increased in BUN was certainly due to the stoppage of urinary flow, and effect of accumulating urine of renal filtration and cyclic resorption of BUN in blood.

Serum creatinine significantly increased following urethral obstruction ranging from 2.68 ± 0.27 to 8.45 ± 0.71 mg/100 ml. After surgical management of group II and III animals, the value progressively declined. Similar results were obtained by Gera and Nigam (1980), Singh, et al. (1983), Pandey, et al. (1986) and Gangwar, et al. (1990), although the method of urethral obstruction differed. The increase in creatinine level might be due to decreased glomerular filtration rate and constant production of creatinine from the muscle metabolism.

There was significant increasing trend in serum inorganic phosphorus value, ranging from 6.60 ± 0.38 to 13.25 ± 0.65 mg/100 ml. After surgical management the value declined progressively. Significant higher value was reported in clincal bovine cases by Gera and Nigam (1981) however, Gera and Nigam (1980) had recorded increased inorganic phosphorus after experimental urethral obstruction. Contrarily Pandey, et al. (1988) and Gangwar, et al. (1990) found decreased value of phosphorus after experimental urethral

obstruction, the increase in the value might be due to depressed glomerular filtration following urethral obstruction and resorption in blood from accumulation of urine in peritoneal cavity following rupture of urinary bladder.

Initially there was significant increase in serum calcium value which after 24 hour decreased to the normal range. Singh, et al. (1980) and Singh, et al. (1983) noted no marked changes in clinical cases of obstructive urolithiasis. Gera and Nigam (1980) and Pandey et al. (1986) reported non-significant increase in the value following urethral ligation. However, Gangwar, et al. (1990) noted significant decrease in value after experimental urethral obstruction.

The serum sodium value gradually decreased and became significantly lower to 126.30 ± 2.40 mEq/L at the terminal stage which progressively increased towards normaly after surgical management. Gera and Nigam (1980), reported decreased sodium value after urethral ligation. Singh, et al. (1981), Singh, et al. (1983) and Kumar, et al. (1991) found slight variation in the value in clinical cases of obstructive bovine urolithiasis. However, Sharma, et al. (1982) and Pandey, et al. (1986) found slight elevation in the value following experimental urethral obstruction. Such

changes are imminent in order to maintain homeostasis of blood in stress condition.

There was singificant gradual increase in potassium content of serum ranging from 4.78 ± 7.00 ± 0.06 to 7.00 ± 0.10 mEq/L at the terminal stage following urethral obstruction which corroborates with the findings of Gera and Nigam (1980), Gera, et al., Sharma, et al. (1982), Singh, et al. (1983), Pandey, et al. (1986) and Kumar, et al. (1991) in experimental and clinical obstructive urolithiasis. The increase in serum potassium could be due to alimentary stasis following urethral obstruction. The increase value of present studies progressively decreased after surgical management towards normalcy. The similar decreasing trend was observed by Singh, et al. (1983) and Kumar, et al. (1991).

Serum chloride increased after 24 hours of urethral obstruction but later decreased significnatly to 94.70 ± 1.10 mEq/L at the terminal stage. In the cases of surgical management, the value progressively increased towards normal. Sharma, et al. (1982) reported no change in the value of serum chloride but Kumar, et al. (1991) observed non-singnificant decrease of the value in clinical cases of obstructive bovine urolithiasis which progressively increased after

surgery to the normal level.

In the present studies liver sections showed the changes of hepatitis with necrosed or degenerated liver cells. Several cystic spaces were found with pink colour oedematous fluid. The central veins were dilated with pink colour fluid. Gangwar, et al. (1990) reported varying degree of degenerative or necrotic changes in the hepatocytes along with mild to moderate engorgement of central veins, sinusoid and blood vessels in the portal area of liver.

Sections from kidneys presented the chages of hydronephrosis with severe damage of renal parenchyma. There was cystic spaces in cortex and medulla with atrophied neighbouring tubules and glomeruli. Oedematous fluid was found at several places around the glomeruli. Sharma, et al. (1982) found congestion, haemorrhage and necrosis in the tubules of renal medulla indicating degeneration. Sub acute interstitial nephritis and replacement of some glomeruli by hyalinised mass were also observed. Gangwar, et al. (1990) found mild to moderate nephrotic changes in the glomeruli and kidney tubules. Foci of interstitial nephritis and hydronephrotic changes were seen in kidney.

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Summary and Conclusion

SUMMARY AND CONCLUSIONS

Studies on Haematological and biochemical changes following experimental urethral obstruction and its surgical management at different stages were carried out on 18 clinically healthy buffalo calves. Urethral obstruction was produced by insertion of Cea tangle tent in the urethra following post scortal urethrotomy in group I, II and III each of five animals each. Three animals served as control where urothrotomy was performed without application of Cea tangle tent. Cea tangle tent served as good material for creation of urethral blockade. The animals in group I were maintained till death and group II and III animals were surgically managed on 3rd and 5th post obstruction day respectively.

The clinical features included increased micturition reflexes within 30 minutes, anurea after 8-10 hours of urethral obstruction and frequent straining with futile attempts to urinate and colicky symptoms appeared after 12 hours which later pronounced a day after urethral obstruction. A day after urethral obstruction, the micturition reflexes depressed to a considerable extent. From 36 hours and onwards of urethral obstruction there was progressive dullness and depression. The conjunctiva of the animals were

injected, muzzle dried and body hairs erect with uraemic odour from the mouth. After 48 hours of urethral obstruction, there was complete absence of the appetite and thirst. The rumination and ruminal movements were normal up to 24 hours of urethral obstruction, thereafter decreased gradually and lost following 48 hours of urethral obstruction. There was constipation after 24 hours of urethral obstruction but on 2nd post obstruction day the animals passed hard dung.

After 72 hours of urethral obstruction, the urinary bladder of nine animals ruptured and the animals exhibited some brightness after 6-8 hours of rupture of bladder but later developed water belly conditions and depression. There was gradual significant rise in respiration rate following urethral obstruction which later decreased and became irregular and laboured at terminal stage in group I. Pulse rate of these animal showed gradual increase which became significantly higher at the termianl stage in group I. The pulse rate became normal after surgical management in group II and III. The animals of group I died after 180 to 266 hours following urethral obstruction. The animals of group II and III showed gradual improvement of their health after surgical management.

The haemoglobin percentage of the animals

gradually increased following urethral obstruction which declined after surgical management on 3rd and 5th post obstruction day being normal by 5th post operation day and onwards. The haemotocrit value also exhibited similar trend.

The increased value of total erythrocytic count (TEC) declined after surgical management and became normal on 8th and 6th post operation day and onwards in group II and III respectively. Total leucocytic count (TLC) also progressively declined following surgical management in group II and III animals. The neutrophil value initially increased non significantly but from 3rd post obstruction day it increased to significant ranging from 41.6 ± 0.86 to 56.0 ± 0.80 %. It decreased gradually following surgical management and became normal on 4th post surgical day onwards. Lympho cytic cout gradually decreased significantly ranging from 50.4 ± 1.54 to 30.0 ± 1.32 %. The value progressively increased and became normal on 7th and 6th day following surgical management in group II and III respectively. The increased eosinophil and monocyte progressively declined following surgical management.

The blood urea nitrogen and serum creatinine both significantly increased ranging from

35.22 ± 1.17 to 85.65 ± 6.95 mg/100ml and 2.68 ± 0.27 to 8.45 ± 0.71 mg/100ml. After surgical management these values gradually declined towards normal.

There was gradual significant increase in sodium inorganic phosphorus following urethral obstruction ranging from '6.60 ± 0.38 to 13.25 ± 0.65 mg/100 from pre obstruction values and corresponding day control value. The value declined gradually and became normal on 4th and 7th post operation day following surgical management in group II and III repsectively. The calcium value increased significantly to 12.86 ± 0.27 mg/100ml after 24 hours of urethral obstruction and varried slightly throughout the period of obstruction in group I. The increased value declined progressively after surgical management and became normal on 7th and 5th post surgical day group II and III respectively.

There was slight increase in sodium value to 149.54 ± 0.70 mEq/L after 24 hour of uraemia then it significant gradually to 126.30 ± 0.30 mEq/L at the terminal stage. The declined value progressively increased and became normal after surgical management in group II and III. The potassium lavel gradually increased significantly from 4.78 ± 0.06 to 7.00 ± 0.10 mEq/L at the termial stage in group I which normalised on 6th and 5th post operation day following surgical

management in group II and III respectively. Serum chloride increased to 109.10 ± 0.37 mEq/L after 24 hours of urethral obstruction but later significantly decreased gradually toward terminal stage in group I. The decreased value progressively increased after surgical management and became normal on 7th post operation day onward in group II and III.

Histopathological examination of liver showed the changes of hepatitis, where majority of hepatic cells were either necrosed or degenerated. Several cystic spaces with pink colour oedematous fluid were present. Central veins were dilated with lodgement of pink colour fluid. Kidney section presented the changes of hydronephrosis in which renal parenchyma were severely damaged. Cystic spaces with single layers cellular living were presented in both cortex and medulla. Lining epithelial cells of renal tubules were degenerated or necrosed. Oedematous fluid was present around the glomeruli at several places. Section from pancreas showed sign of oedema with lodgment of oedmatous fluied in their parenchyma, the exocrine and endocrine structures were found normal.

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Table - 1 : Showing Mean ± S.E of TEMPARATURE (in ^{0}F) for experimental groups of buffalo calves following Uraemia after urethral obstruction and its surgical management.

GR.	PRE OBSTRUCTION DAY VALUES			POST OBSTRUCTION DAY VALUES											
	2nd	1st	0th	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
I	99.20^a ± 0.26 (5)	99.66^a ± 0.08 (5)	99.46^a ± 0.09 (5)	101.70^a ± 0.94 (5)	102.06^a ± 0.43 (5)	101.30^a ± 0.82 (5)	100.90^a ± 0.45 (5)	100.46^a ± 0.39 (5)	99.90^a ± 0.25 (5)	99.68^a ± 0.20 (5)	98.86^a ± 0.25 (5)	97.60^a ± 0.38 (2)	97.40 ± 0.00 (1)	97.20 ± 0.00 (1)	------

obstruction, the increase in the value might be due to depressed glomerular filtration following urethral obstruction and resorption in blood from accumulation of urine in peritoneal cavity following rupture of urinary bladder.

Initially there was significant increase in serum calcium value which after 24 hour decreased to the normal range. Singh, et al. (1980) and Singh, et al. (1983) noted no marked changes in clinical cases of obstructive urolithiasis. Gera and Nigam (1980) and Pandey et al. (1986) reported non-significant increase in the value following urethral ligation. However, Gangwar, et al. (1990) noted significant decrease in value after experimental urethral obstruction.

The serum sodium value gradually decreased and became significantly lower to 126.30 ± 2.40 mEq/L at the terminal stage which progressively increased towards normaly after surgical management. Gera and Nigam (1980), reported decreased sodium value after urethral ligation. Singh, et al. (1981), Singh, et al. (1983) and Kumar, et al. (1991) found slight variation in the value in clinical cases of obstructive bovine urolithiasis. However, Sharma, et al. (1982) and Pandey, et al. (1986) found slight elevation in the value following experimental urethral obstruction. Such

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