

Application of ultrasonography in Diagnosis of Experimental Hydronephrosis in Dogs

Hassan, H., S. Elballal, S. Elkhodry and M. Allaam

Faculty of Veterinary Medicine- Sadat city- Menoufia university Animal medicine and infectious diseases department Faculty of Veterinary Medicine Mansoura university Animal medicine and infectious diseases department

Abstract

This study was carried out on seven puppies which subjected to experimental surgical induced unilateral hydronephrosis. The clinical examination of puppies were inappetance, intense lumbar pain and the left kidney can be palpated externally. Sonographic examination of the affected kidney in puppies was changed with relation to hematological parameters which revealed hemoconcentration, leukocytosis and neutrophilia at 5th day and reach its maximum value at 40th day and mild anemia with lymphopenia. At this time, serum analysis indicated increase serum urea, creatinin and uric acid at 5, 10 and 15 days respectively and decreased gradually to the end of the operation. Serum total proteins and albumin decreased at 5th day of operation at 10 and 15 day respectively and increased gradually to the end of operation. Post-mortem examination of kidneys revealed dilatation of ureter and renal pelvis of the left kidney. Microscopically, examination of the affected kidneys revealed cystic dilatation of the renal tubules.

Key words. Dogs, Ultrasonographic, Hydronephrosis

Introduction

Renal disorders were common diseases of the dog that associated with other organs, not all diseases or lesions of the kidney resulting in clinical signs (Chandler et al., 1995). Clinical signs and accumulated laboratory data may not always point towards existing renal diseases. Abdominal radiography can also uncover suspected or unsuspected renal abnormalities, which can be characterized further with ultrasonography (Konde et al., 1986). Ultrasound had great value in the planning of further diagnostic and therapeutic procedures. It could be repeated without risk to patient or operator (Mwanza et al, 1996). Ultrasonography has been considered to be one of the most valuable imaging techniques for evaluation of the abdominal cavity and its organs including liver, biliary system, kidney, urinary bladder, pancreas, stomach, small intestine, uterus and prostate (Cruz and Wriggly, 2003).

Therefore, the aim of this work is to evaluate different methods used for diagnosis of hydronephrosis through the following:

- 1- Induction of some renal affection as unilateral hydronephrosis.
- 2- Recording the clinical picture, hematological and biochemical alterations changes.
- 3- Recording of an ultrasound image on the affected animal.

Materials And Methods

Seven puppies with ages ranged between (three to nine months old), weigh 4-10 kg were individually kept in steel cages and fed on a diet composed meat, bones and bread. They were subjected to complete deworming. After period of adaptation (6weeks), the puppies were subjected experimentally-induced unilateral hydronephrosis.

A-Clinical examination:-

Firstly, deworming occurred by injection of ivermectin 1 % and was repeated after 3 weeks with continues dipping in a disinfectant. During this period periodic clinical and laboratory examinations were applied. Determination of body temperature, pulse and respiratory rates as well as examination of mucous membranes, lymph nodes and abdomen were conducted according to Ke (1984).

B- Experimental work:

Experimental surgical intervention was carried acc.to Bojrab (1975).

All puppies were evaluated by clinical examination, ultrasonographic and laboratory studies before and at 5, 10, 15, 20, 25, 30, 35 and 40 days post operation.

C- Ultrasonographic examination:-According to (Barr, 1992).

D- Haematological examination:

Total erythrocytic count, total leukocytic count, haemoglobin, PCV differer leucocytic count. according to(Coles, 1986).

E- Biochemical analysis of serum:

E.1. Serum urea level (mg/dl) was determined acc. to (Patton and Crou 1977).

E.2. Serum uric acid level (mg/dl) was determined according to (Wilding Heath., 1975).

E.3. Serum creatininc level (mg/dl) was determined according to (Young , 199

E.4. Serum albumin level (g/dl) was determined according to (Drupt, 1974).

E.5. Serum total proteins level (g/dl) was determined according (Henry, 1964

E.6. Serum alanine aminotransferase (ALT) and Serum aspartate aminotransferase (AST) levels (U/L) was determined according to (Reitman Frankel, 1957).

E.7. Serum alkaline phosphatase (ALP) level (U/L) was determined according (Rec. GSCC.DGKC, 1972).

E.8. Serum gamma-glutamile transferase level (U/L) was determined according to (Persijin And Van Der Silk , 1974).

E.9. Serum total cholesterol level (mg/dl) was determined according to (R and Hall, 1972).

E.10. Serum bilirubin level (mg/dl) was determined acc.to (jendrassik et 1938).

F-Macroscopic examination of kidney of the necropsied puppies:

Kidney and liver of each necropsied puppy was carefully examined naked eye for detection of any gross lesions.

G-Pathologic studies:-

Following complete necropsy sacrificed animals, fresh renal specimens were collected and examined histopathologically according to (Culling 1983)

H-Statistical analysis:-

Data obtained were statically analyzed to illustrate the results of his study using the methods of Norman and Baily (1997).

Results

Clinical features:

Puppies showed several signs at different time intervals. These were anaphagia; sever lumber pain and mild elevation in body temperature (one week post operation). Within 2nd week all the previous clinical signs were subsided except enlarged left kidney could be palpated externally. One puppy is died after 7 days from the operation.

Sonographic examination.

Ultrasonographic appearance of the kidney before the operation showed that the renal cortex has a homogenous echogenicity and affine echo texture. The medulla was uniform in echogenicity and hypoechoic relative to the cortex. The demarcation between the cortex and the medulla was crisp, (Fig 1). At 5th day post operation scattering of the normal pelvic echoes to form an echogenic ring (Fig 2). At 10th day of operation the renal pyramids mostly destructed and the fluid increase in its size and a great acoustic enhancement was appeared, (Fig 3). At 15th and 20th day the surrounding parenchyma became compressed and lost most of normal architecture and the left kidney increased in size and also there was a great acoustic enhancement (Fig 4, 5). At 30th and 35th day of operation there was a great enlargement of the kidney and remaining a few internal structure in the kidney and also presence a great acoustic enhancement, (Fig 6, 7). At 40th of operation the kidney length and size were significantly increased and became a fluid-filled sac with only a thin outer line (fig 8).

Hematological examination:

Whole blood picture.

The mean value of PCV% and WBCs count were significantly ($P < 0.05$) increased 5th day post operation, then increased gradually to reach its maximal value highly significantly at the 40th day post operation. The mean value of Hb content and RBCs count were significantly ($P < 0.05$) decreased at 40th of the operation, (Table 1).

Leukocytic differential count.

The mean value of neutrophil % (Table 2) was significantly ($P < 0.05$) increased in the 5th day of operation then increased gradually to reach its maximal value highly significantly in the 40th day of operation. The mean value of lymphocyte% and monocyte % were significantly ($P < 0.05$) decreased in the 5th day of operation then decreased gradually highly significantly to reach its minimal value in the 40th day of operation. The mean value of eosinophil % was not significantly changed during the operation, (Table 2).

Serum analysis:

Kidney function tests.

The mean values of serum urea, creatinin and uric acid were significantly ($P < 0.05$) increased at 5th, 10th, 15th day post-operative respectively in puppies with unilateral hydronephrosis then decreased gradually but did not reach their normal values till the end of experiment. (Table 3).

Serum protein profile.

The mean values of total protein, albumin and A/G ratio, were significantly ($P<0.05$) decrease in the 5th day post-operative reaching the minimal value the 20th and 15th day respectively and then increased gradually but did not reach their normal values. (Table 4).

Liver function tests.

The mean values of ALP, GGT, ALT, AST, total cholesterol and total bilirubin were not significantly ($P<0.05$) changed post the operation (Table 5).

Macroscopic examination of kidneys of necropsied puppies:

The macroscopic examination of kidneys of dogs after 40 days post operation were revealed dilatation of ureter and renal pelvis of the left kidney. In addition, the affected left kidney was enlarged in size and filled with urine. Moreover, cut surface of the left kidney showed dilatation of renal pelvis calyces with severe atrophy of renal medulla, while the contra lateral kidney appeared normal (photo 1,2).

Histopathological examination:

The microscopic examination of the affected kidneys after 40 days post-ligation revealed destruction of the renal epithelium cells lining the proximal convoluted tubule with complete loss of their structure. The tubule appeared as cystic space filled with faint eosinophilic materials or sinus space, there was also atrophy of the glomerular tuft with enlargement or dilation of Bowman's space with interstitial lymphocyte cellular infiltration (photo 3,4).

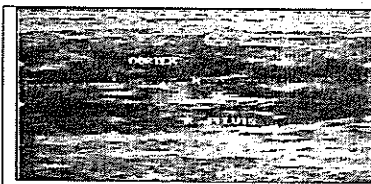


Fig (1) Ultrasonogram and schematic representation of normal left kidney. C= renal capsule, A W=abdominal wall, P=parenchyma and M=medullary pyramid.

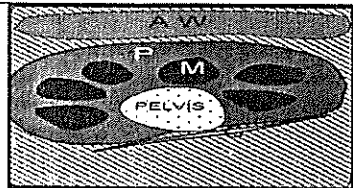


Fig (2) Ultrasonogram and schematic representation of left kidney at 5th after the operation. Scattering of the normal pelvic echoes to form an echogenic ring W=abdominal wall, R P=Renal pelvis and R M= Renal medulla and E =acoustic enhancement.



Fig (3). Ultrasonogram and schematic representation of left kidney at 10th day after the operation. The renal pyramids mostly destroyed and the fluid increase in its size W=abdominal wall, P=parenchyma, M=medullary pyramid

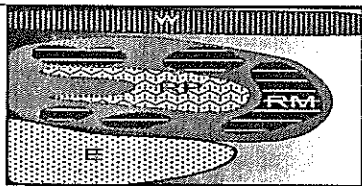
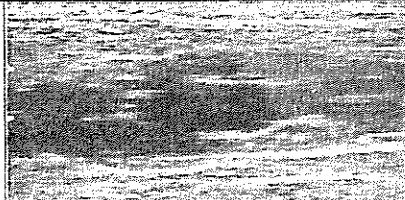
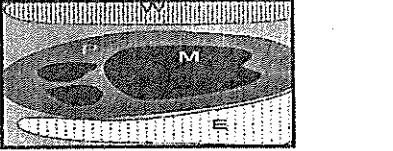
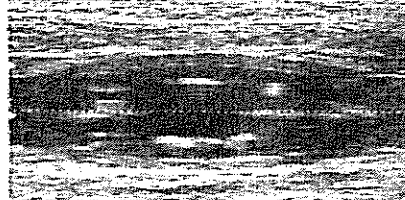
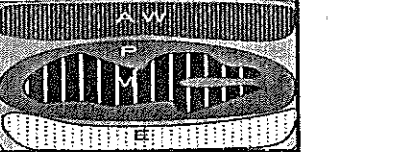
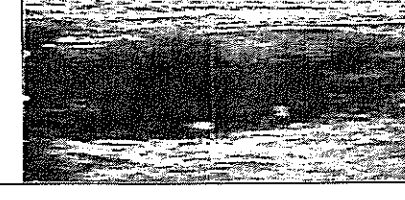


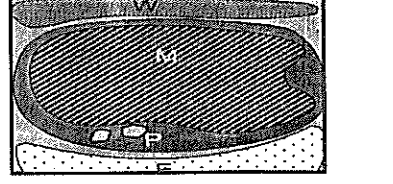


Fig (4). Ultrasonogram and schematic representation of left kidney at 15th after the operation. The surrounding parenchyma became compressed and lost most of normal architecture and the left kidney increased in size A.W=abdominal wall, P=parenchyma, M=medullary pyramid and E =acoustic enhancement.

	
<p>Fig (5). Ultrasonogram and schematic representation of left kidney at 20th after the operation. The surrounding parenchyma became compressed and lost most of normal architecture and the left kidney increased in size. W=abdominal wall ,P=parenchyma , M=medullary pyramid and E =acoustic enhancement .</p>	<p>Fig (6). Ultrasonogram and schematic representation of left kidney at 30th after the operation. The surrounding parenchyma became compressed and lost most of normal architecture and the left kidney increased in size A.W=abdominal wall ,P=parenchyma , M=medullary pyramid and E =acoustic enhancement .</p>
	
<p>Fig (7). Ultrasonogram and schematic representation of left kidney at 35th after the operation. A great enlargement of the kidney and remaining a few internal structure in the kidney W=abdominal wall, P=parenchyma , M=medullary pyramid and E =acoustic enhancement.</p>	<p>Fig (8). Ultrasonogram and schematic representation of left kidney at 40th after the operation. The kidney increased in size and became a fluid-filled sac with only a thin outer line W=abdominal wall ,P=parenchyma , M=medullary pyramid and E =acoustic enhancement.</p>
	
	

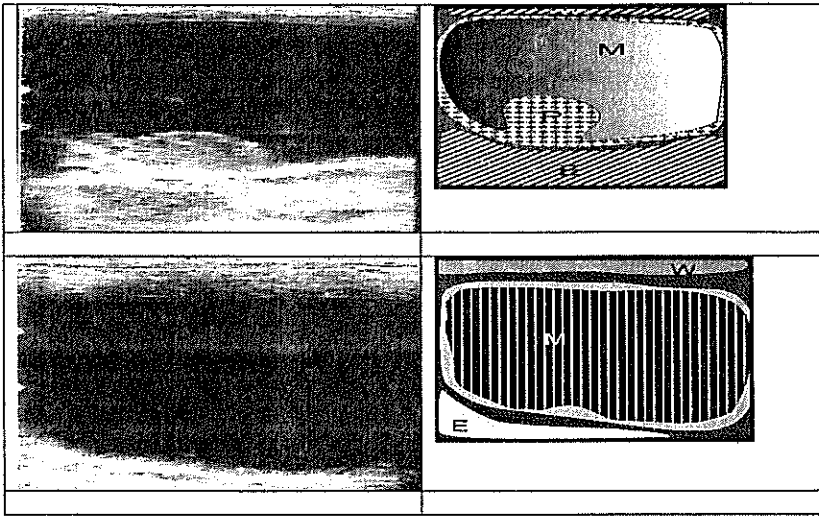


Table (1). Hematological parameters of puppies with unilateral hydronephrosis (Mean±S.E).

	PCV%	Hb g/dl	RBCs million/mm ³	WBCs Thousand/ mm ³
Before the operation	35.33±0.33 ^a	13.10±0.17 ^a	7.06±0.12 ^a	10.01±0.3 ^f
5 th post the operation	36.67±0.33 ^f	13.06±0.15 ^a	7.0±0.10 ^a	10.53±0.27 ^e
10 th post the operation	37.67±0.33 ^f	12.92±0.15 ^{ab}	6.77±0.003 ^b	10.90±0.19 ^{de}
15 th post the operation	40.0±0.0 ^c	12.71±0.18 ^a	6.63±0.003 ^{bc}	11.30±0.17 ^d
20 th post the operation	41.67±0.33 ^d	12.67±0.14 ^{abc}	6.5±0.005 ^{cd}	12.63±0.12 ^c
25 th post the operation	43.33±0.67 ^c	12.47±0.17 ^{bc}	6.37±0.008 ^{de}	13.17±0.008 ^b
30 th post the operation	44.67±0.33 ^b	12.37±0.12 ^{bcd}	6.23±0.003 ^{ef}	13.57±0.008 ^{ab}
35 th post the operation	45.33±0.33 ^{ab}	12.20±0.26 ^{cd}	6.17±0.003 ^{ef}	13.73±0.008 ^a
40 th post the operation	46.0±0.0 ^a	12.07±0.18 ^d	6.04±0.003 ^f	14.03±0.008 ^a

Means within the same column having the same letters aren't significantly different at (P<0.05).

Table (2).Leukocytic differential count of puppies with unilateral hydronephrosis (Mean±S.E).

	N%	L%	M%	E%
Before the operation	64.0±1.15 ^f	25.33±0.88 ^a	6.67±0.33 ^a	4.0±0.0 ^{ab}
5 th post the operation	67.67±1.45 ^a	22.67±1.20 ^{ab}	5.67±0.33 ^b	4.0±0.0 ^{ab}
10 th post the operation	68.67±1.86 ^{de}	22.33±1.33 ^{abc}	5.33±0.33 ^{bc}	4.0±0.0 ^{ab}
15 th post the operation	69.67±1.45 ^{cde}	21.0±1.53 ^{bcd}	5.33±0.33 ^{bc}	4.0±0.0 ^{ab}
20 th post the operation	71.67±1.45 ^{cd}	19.0±1.53 ^{cd}	4.67±0.33 ^{cd}	4.67±0.33 ^a
25 th post the operation	73.33±0.67 ^{bc}	17.67±1.20 ^{de}	4.33±0.33 ^d	4.67±0.33 ^a
30 th post the operation	76.33±0.89 ^{ab}	15.0±0.58 ^{ef}	4.33±0.33 ^d	4.67±0.33 ^a
35 th post the operation	76.67±0.67 ^{ab}	15.0±0.58 ^{ef}	4.0±0.0 ^d	4.33±0.33 ^{ab}
40 th post the operation	78.33±0.33 ^a	14.0±0.58 ^f	4.0±0.0 ^d	3.67±0.33 ^{ab}

Means within the same column having the same letters aren't significantly different at (P<0.05).

Table (3). kidney function tests of puppies with unilateral hydronephrosis (Mean±S.E).

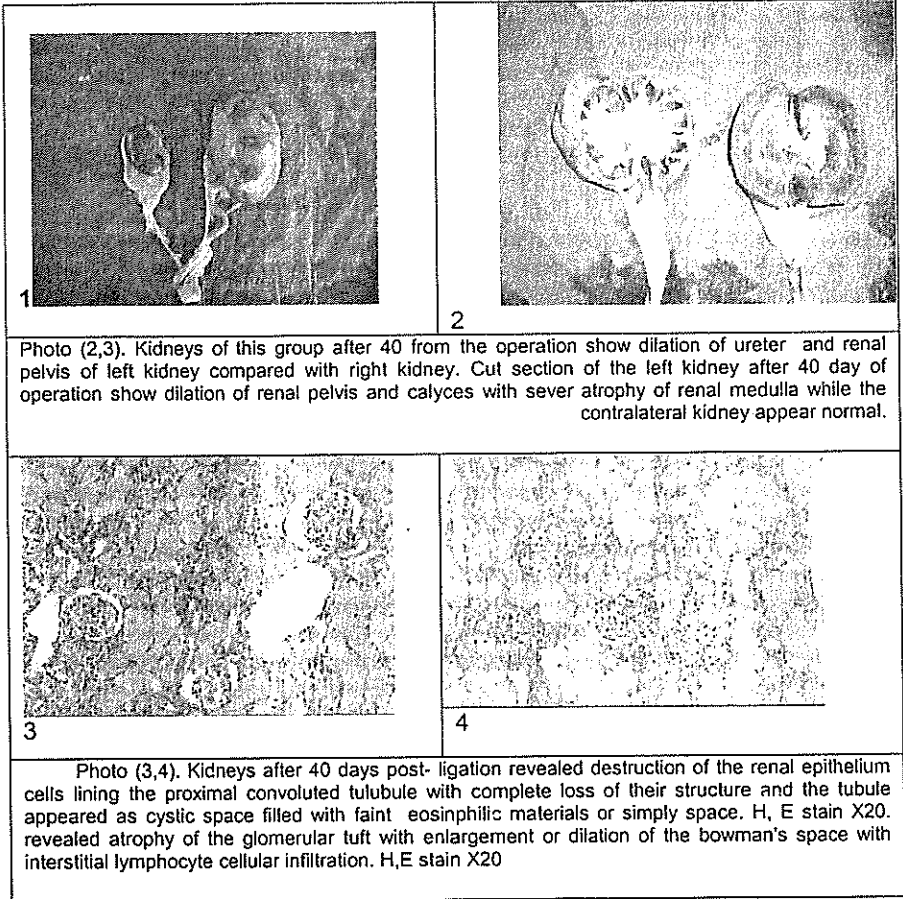
	Urea mg/dl	Creatinine mg/dl	Uric acid mg/dl
Before the operation	26.98±0.32 ^e	0.83±0.002 ^d	2.49±0.002 ^e
5 th post the operation	40.82±0.39 ^a	1.87±0.004 ^{ab}	3.20±0.009 ^b
10 th post the operation	40.55±0.12 ^{ab}	1.92±0.004 ^a	3.49±0.006 ^a
15 th post the operation	38.27±0.43 ^b	1.86±0.002 ^{ab}	3.21±0.11 ^b

20 th post the operation	37.17±1.49 ^{bc}	1.82±0.0014 ^{ab}	2.98±0.003
25 th post the operation	35.53±1.15 ^c	1.61±0.006 ^b	2.91±0.007
30 th post the operation	32.47±0.36 ^d	1.51±0.005 ^b	2.81±0.004 ^c
35 th post the operation	31.98±0.38 ^d	1.33±0.003 ^c	2.64±0.004
40 th post the operation	30.80±0.11 ^d	1.22±0.107 ^c	2.64±0.003

Means within the same column having the same letters aren't significantly different at (P<0.05).

Table (4). Serum protein profile of puppies with unilateral hydroneph (Mean±S.E).

	Total protein g/dl	Albumin g/dl	Globulin g/dl	A/G ratio %
Before the operation	6.74±0.26 ^a	3.72±0.14 ^a	3.02±0.33 ^a	1.28±0.174 ^a
5 th post the operation	6.18±0.33 ^a bc	2.77±0.24 ^{cd}	3.41±0.21 ^a	0.82±0.008 ^{bc}
10 th post the operation	5.95±0.17 ^b c	2.55±0.24 ^{cde}	3.39±0.19 ^a	0.75±0.009 ^c
15 th post the operation	5.8±0.23 ^{bc}	2.29±0.008 ^e	3.52±0.20 ^a	0.66±0.005 ^c
20 th post the operation	5.66±0.15 ^c	2.37±0.009 ^{de}	2.9±0.30 ^a	0.82±0.103 ^{bc}
25 th post the operation	5.87±0.006 ^{bc}	2.57±0.004 ^{cde}	3.3±0.001 ^a	0.78±0.003 ^c
30 th post the operation	6.13±0.12 ^a bc	2.82±0.006 ^{cd}	3.77±0.49 ^a	0.77±0.009 ^c
35 th post the operation	6.2±0.15 ^{abc}	2.94±0.003 ^{bc}	3.26±0.15 ^a	0.91±0.004 ^{bc}
40 th post the operation	6.40±0.20 ^a	3.30±0.16 ^{ab}	2.97±0.24 ^a	1.09±0.009 ^{ab}



Discussion

With regarding hydronephrotic group, puppies of this group showed several clinical signs at different time intervals. There were anaphagia, sever lumbar pain which might be attributed to acute ureteral obstruction and mild elevation of body temperature (one week post operation). Within the 2nd week of operation clinical signs were subsided except enlarged left kidney that could be palpated externally. One puppy was died after 7 days from the operation. Puppies didnt showed any observable clinical signs of renal disease due to the contra-lateral kidney was functionally normal. These signs were similar to those observed by Gruys (1983), Knottenbelt et al.(1988), Eitinger (1989), Stone (1990), Osborne and Finco (1995), Nelson and Couto (1992), Alkhoudry (2000) and Helal (2005).

Ultrasonographic appearance of renal cortex before the operation was homogenous echogenicity and affine echo-texture. The medulla was uniform echogenicity and hypo-echoic relative to the cortex. The demarcation between the cortex and the medulla was crisp. This appearance was similar to that observed by Barr (1992), Grooters and Biller (1995), Nyland and Matton (1995) and Mannion (2006). At 5th day of operation scattering of the normal pelvic echoes formed an echogenic ring. This appearance was observed also by Barr (1992), Grooters and Biller (1995), Nyland and Matton (1995) and Helal (2005) who stated that dilation of the renal pelvis was recognized with ultrasonography by separation of the normal, uniformly hyper-echoic central renal sinus echoic anechoic space. At 10th day of operation, the renal pyramids were moderately destructed and the fluid increase in its size with a great acoustic enhancement. At 15th, 20th and 25th day of operation the surrounding parenchyma became compressed and lost most of normal architecture and affected kidney increased in size and also there was a great acoustic enhancement. This appearance was similar to those observed by Barr (1992), Grooters and Biller (1995), Nyland and Matton (1995) and Helal (2005), who stated that in more advanced stages of pelvic dilation, the diagnosis was readily apparent with ultrasonography because dilated pelvic diverticula was easily visualized. At 30th and 35th day of operation there was a great enlargement of the kidney with remaining a few internal structures in the kidney and presence a great acoustic enhancement. At 40th day of operation the kidney became a fluid-filled sac with only a thin outer layer. These results were coincided with those of Gillenwater, (1992), Semieka and Al-EI-Ghaffar, (1997) and Helal (2005) who stated that complete ureter obstruction caused progressive dilatation of the renal pelvis during the few weeks. After 4 to 8 weeks, there was a decrease in parenchymal weight because the atrophy of the tissue is greater than the internal edema.

The mean value of PCV% and WBCs count were significantly increased 5th day post operation, then increased gradually to reach its maximal value at the 10th day post operation. The higher percentage in PCV% might be attributed to dehydration, Kelly, (1984) and Helal, (2005). The increase of TWBCs count might be attributed to occurrence of infection due to urine stagnation and this was agreed by Knottenbelt et al. (1988) and Helal, (2005). The mean value of RBCs count and Hb content were significantly decreased at 40th day of operation. This decrease in RBCs count and Hb content might be resulted from anorexia under nutrition that was associated with acute infection due to urine stagnation, Schalm, (1975) and Helal, (2005). The mean value of neutrophil % was gradually significantly increased beginning from the 5th day till the 40th day post operation. On the other hand the mean value of lymphocyte% and monocyte% were gradually significantly decreased beginning from the 5th day till the 40th day of operation. These results were coincided with those of Knottenbelt et al. (1988) and Helal, (2005), who recorded that in unilateral hydronephrosis, there was neutrophilia, lymphopenia and monopenia that might be attributed to occurrence of acute infection that occurred due to urine stagnation.

The mean values of serum urea, creatinin and uric acid were significantly increased at 5th, 10th, 10th day post-operative respectively in puppies with unilateral hydronephrosis then decreased gradually till the end of experiment. This agreed by Nelson and Couto, (1992) and Helal, (2005). Who reported

unilateral obstruction of the ureter often results in unilateral hydronephrosis without evidence of decreased renal function. Also Dangwoo and Chang (2001), stated that there were no significant changes of BUN, creatinin and uric acid found immediately after unilateral experimental hydronephrosis.

The mean value of total protein, albumin and A/G ratio, were significant decrease in the 5th day post-operative reaching the minimal value in the 20th, 15th and 15th day, respectively and then increased gradually but did not reach their preoperative values. These results agreed with Osborne and Finco (1995) and Helal (2005), who reported that in unilateral ureteral obstruction, the body water and electrolyte homeostasis were not compromised as long as contra lateral renal function is normal. The mean values of ALP, GGT, ALT, AST, cholesterol and total biliruben were not significantly changed during 40 days post the operation.

The macroscopic examination of kidneys of puppies after 40 days post-operation revealed dilatation of ureter and renal pelvis of the left kidney. The affected left kidney was enlarged in size and filled with urine. Moreover, cut surface of the left kidney showed dilatation of renal pelvis and calyces with severe atrophy of renal medulla, while the contra lateral kidney appeared normal. This finding was coincided with Ultrasonographic results and was similar to that observed by Hall, (1983), Semieka and Abd-El-Ghaffar, (1997) and Helal, (2005). Who stated that after ligation of one ureter, there was an increase in the ligated side kidney with marked dilation of its renal pelvis and ureter, while the contralateral kidney showed normal size and shape. The microscopic examination of the affected kidneys after 40 days post- ligation revealed destruction of the renal epithelium cells lining the proximal convoluted tubule with complete loss of their structure and the tubule appeared as cystic space filled with faint eosinophilic materials or simply space, their also atrophy of the glomerular tuft with enlargement or dilation of the Bowman's space with interstitial lymphocyte cellular infiltration. This agreed with Osborne and Finco (1995), Semieka and Abd-El-Ghaffar (1997) and Helal (2005).

References

- Alkhodry, S.A. (2000): "Ultrasound as A Diagnostic Aid in Some Urinary System Diseases in Animals." Ph. D. Thesis, Faculty of Veterinary Medicine, Tanta University.
- Barr, F. J. (1992): "Diagnostic Ultrasound in the Dog and Cat" 2nd Ed. Blackwell Sc. Publication. PP. 1-20 and 159-168.
- Bojrab, M. J.(1975): "Current Technique in Small Animal Surgery" the Kidney, Liver and Biliary Sys. Lea & Febiger, Philadelphia.
- Chandler, E. A; Thompson, D. J; Sulton, J. B. and price, C.J.(1995): "Canine Medicine and Therapeutics" 3rd ed., Black well science LTD.
- Coles, H. E. (1986): "Veterinary Clinical Pathology" 4th Ed., Philadelphia, London, Toronto, Tokyo, Sydney, Hong Kong.
- Cruz- Arambulo, P.and Wrigley, R. (2003): "Ultrasonography of the Acute Abdomen Clinical Techniques" in Small Animal Practice, 18(1):20-31
- Culling, C. F .(1983): "Handbook of Histopathological and Histochemical Techniques" 3rd Ed., Butterworth, London.
- Dongwoo, C. and Chang, D. (2001): "Transarterial Embolization of Renal Artery in Dogs with Experimental Hydronephrosis" Korean Journal of veterinary Research, 41: 437- 445.
- Drupt, F. (1974): "Colorimetric Method for Determination of Albumin" Pharm.Biol. J, 9:777-779.
- Etlinger, S. J. (1989): "Textbook of Veterinary Internal Medicine" Diseases of the Dog and Cat. Volume 2, W. B. Saunders Company. Philadelphia, London, Montreal, Sydney, Tokyo
- Gillcnwator, J. Y. (1992): "The Pathophysiological Urinary Obstruction" Campbell's urology 6th Ed. Volume II .

- Grooters, A.M. and Biller, D.S. (1995): "Ultrasonographic Findings in Renal Disease." In: *Current Veterinary Therapy XII Small Animal practice*. W.B. Saunders Company.
- Gruys, E. (1983): "Renal Pathology in Domestic Animals" in L. W. Hall: *Veterinary Nephrology*. ed. William Heinemann Medical Books Ltd. London. PP. 132.
- Helal, M. A. (2005): "Diagnosis of Experimentally-induced Kidney Affections in Dogs U Ultrasonography and Other Methods" .M.Sc. Thesis, Faculty of Veterinary Medicine, Zag University. (Banha Branch).
- Henry, R. J. (1964): "Clinical Chemistry" Herper& Row Publishers, New York, PP.181
- Jendrassik, L. et al,(1938): "Biochem" 7297:81.
- Kelly, W. R. (1984): "Veterinary Clinical Diagnosis" 3rd ed .London, U. K
- Knottenbelt, D. C.; Knottenbelt, M. K.; Moulton, J and Hill, F. W. (1988): "Unilateral Hydronephrosis in Dogs" *Australian Veterinary Journal*.1988.65:12,400-402.
- Kondc, L. J.; Park, R.D; Wrigley, R. H. and Label, J. L. (1986) "Comparision of Radiography and Ultrasonography in the Evaluation of Renal Lesions in the Dog" *JAVMA*, 188 (12):142.1420-1425
- Mannion, P. (2006): "Diagnostic Ultrasound in Small Animal Practice" 1st edition edited Blackwell publishing company
- Mwanza,T.;Miyamoto,T.;Okumuro,M.;Hogio,M.andFhjinaga, T. (1996):"Ultrasonography and Radiologic Examination of Normal Canine Liver Vessels" *Jpn. J. vet. Res.* ,44:179-188.
- Nelson, W. R. and Couto,C.G.(1992);"Essential of Small Animal Internal Medicine"1st ed most recent yearbook.pp:465
- Norman, T.J. and Baily, M.A. (1997): *Statistical Methods in Biology*. 3rd . Cambridge University Press
- Nyland, T.G. and Matton, J.S. (1995): "Ultrasonography of the Urinary Tract and Adrenal Glands" *Veterinary diagnostic ultrasound* 1st W.B.SaundersCompany.PP:95
- Osborne, C.A. and Finco, D.R. (1995): "Canine and Feline Nephrology and Urology"1st Philadelphia, willams and wilkins. U. S. PP. 889-894.
- Patton, C.J. and Crouch, S.R. (1977): "Enzymatic Determination of Urea" *Anal. Chem.* 49, 464-467
- Persijn and Van der silk(1974):"Colorimetric Determination ofGamma- Glutamyl Transferase Activity in Serum and Plasma Carboxy- Glutamate Method" *J Clin. Chem. Clin. Biochem.*,14:42
- Ratliff, C.R. and Hall, F.(1973): "Laboratory Manual of Clinical Biochemistry "Scott and Winters memorial hospital publication office.
- Reitman, S. and Frankel, S. (1957): *Am.J.Clin.Pathol.*28:56
- Semieka M.A. and Abd El- Ghaffar, S. Kh. (1997): "Studies on Experimental Compensatory Unilateral Obstruction in Dogs. *Assiut Vet.Med. J.* Vol. 37 No. 74: 96-1 16
- Stone, E.A. (1990): "The urinary system" In: *Small Animal Surgery* edited by Harvey, C. Newton, Die;Schwartz. Compere
- Wilding, P. and Heath, R. (1975): "Annals of Clinical Biochemistry "12:142.Cited by Woodward and Freeman (1982) PP. 79
- Young, D.S. (1990): "Effect of Drugs on Clinical Laboratory Tests" 3rd Ed. AACC Press Washington, D.C., 3 122-3 13 1

ملخص العربي

يت هدأ الدراسة على عدد سبعة كلاب صغيرة واثبت الفحص الاكلينيكي حدوث الدم شديد وفقدان الشبيهة حساس بالكلية اليسرى التي اجري لها العملية خارجيا وبالفحص بالموجات فوق الصوتية اظهر زيادة في حجم الكلية اليسرى والحالب الايسر وامتلاء الكلية بالبول مما ادى الى تاكل القشرة الكلوية ولب الكلى فحس صورة اظهر زيادة في تركيز خلايا الدم وزيادة في العدد الكلي لكرات الدم البيضاء وخاصة الخلايا المتعادلة ونقص خلايا الليمفاوية والهيموجلوبين والعدد الكلي لكرات الدم الحمراء وفحص مصل الدم اظهر زيادة معنوية في نوى بولينا الدم والكرياتينين وحمض اليوريك ثم بعد ذلك نقل ولكن لم تصل الى المستوى الطبيعي. ونقص في بروتينات الدم وزلاله و نسبة الزلال الى الجلوبيولين والفحص الباثولوجي اظهر زيادة في حجم الكلية اليسرى حالب الايسر اما الصورة الهستوباثولوجية فة اظهرت تمدد حويصلى فى انيبوبات الكلى والغشاء المبطن .