ULTRASONOGRAPHIC-ANATOMICAL FEATURES OF THE URINARY TRACT IN NEONATAL AND ADULT DOGS

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SUMMARY

In the present study, imaging technique of urinary tract in dogs was efficiently recognize. Dogs were examined via ultrasonography in lateral and dorsal recumbency using 5- and 7-MHz linear and convex transducers for kidney and special transrectal transducer for the urinary bladder.

Kidneys and bladder were examined for dimensions, position, shape and echointensity of various internal structures. The dimensions of right kidneys in 20 adult healthy dogs were 5.4±0.3, 3.19±0.1, 3.25±0.18, 1.12±0.12, 1.13±0.2 and 2.99 ± 0.17cm while that of left kidney were 5.1± 0.29, 3.21±0.16, 3.22±0.14, 1.13±0.13, 1.12±0.19 and 2.98±0.19cm for length, width, depth, diameter of parenchyma, diameter of renal sinus and circumference of medullary pyramids respectively. The bladder wall thickness and dimaeter of urethra were 0.31±0.22 and 0.19±0.10 cm respectively. Kidney & bladder shape varied according to the plane of examinations and also the echointensity of internal structurs varied from one to another.

Organ bath study identified the detailed structers of kidneys that were corrosponding to identified in vivo. The present study also showed variation in the diamensions and echogenicity of kidneys of neonatal and adult dogs. Examination of urinary tract via ultrasonography showed that six dogs were suffering from urinary tract affections (2 cases with acute cystitis, one case with chronic cystitis, one case with cystic calculi, one case pyelonephritis and one case cysic kidney). Ultrasonographic appearance as wall as clinicopathological picture of diseased animals were fully described.

INTRODUCTION

Renal diseases are common problem inveterinary medicine, so proper and accurate evaluation of renal size, shape and position by non-invasive techniques will enhance the diagnostic ability (Triolo and Miles, 1995). Ultrasonography can overcome many of short comings of abdominal palpation and radiographic procedures for estimation of kidney size (Abou-Zaid, 1995). Sonographic evaluation is not affected by kidney function and multidimensional measurements can be obtained easily. In addition the proplems related to kidney visualization , magnification and angle of inclination that are inherent in radiographic procedures can usually be avoided with ultrasonography (England, 1996).

The normal ultrasonographic appearance of the urinary tract as well as that of different focal and diffuse renal diseases have been reported in dogs (Gelsse et al., 1997; Churchill et al., 1999 and Mantis and Lamb, 2000);. In foals (Hoffmann et al., 2000); and in adult horses (Kiper et al., 1990). In Cattle (Braun, 1993); in sheep (Braun et al., 1992b) and in goat (Abou-Zaid, 1995 and El-Khodery, 2000).

In Egypt, to our Knowledge, the ultrasonographic anatomic studies of the urinary tract of native animals have not been described specially the neonatal and adult dog.

The objectives of this study were to describ the normal ultrasonographic appearance of the urinary tract in neonatal and adult dogs, in addition to various measurements of urinary tract assessment the efficacy of ultrasound as a diagnostic tool for diagnosing urinary tract affections in dogs.

MATERIAL AND METHODS

Animals:

A total of 31 mongrel dogs were used in this investigation . 20 dogs were adult, healthy with body weight ranged from 12-17 kgm. Fives puppies were used for follow the ultrasonographic changes associated with age progress and increased body size. Six cases showed the signs of urinary tract diseases were also included.

Clinical examination:

Competent clinical examination was carried out according to Grauer et al (1984). Animals were ensured to be clinically healthy used to establish the sonographic-anatomic features of urinary tract. Animals had signs of urinary tract affections were subjected to further clinical ultrasonographic and clinicopathological investigations.

Ultrasonographic examination of urinary tract in adult dogs:

Examination was carried out in the clinic of veterinary internal Medicine, Faculty of Veterinary Medicine, Kafr El-Sheikh according to the method described by Wood and McCarthy (1990).

Food was with held overnight and water was available adlibituam as presence of ingesta might produce poor quality images. The area from the level of the 9th intercostal space to the iliac crest on each side was prepared by clipping and shaving. Coupling gel was applied to the examined area just before each examination. Kidneys were examined by 5-and 7-MHz linear and convex transducer (Acuson 128xp/10 ultrasound system). Kidneys were examined in three planes transverse, dorsal and sagittal plane.

Transverse plane images were made in lateral recumbency with the transducer positioned on the left just behined the last rib for the left kidney and in the last intercostal space for the right kidney cross sectional width, depth, diameter of renal parenchyma and renal sinus were measured by this plane. Dorsal planes images were recorded with the same position of transverse plane sagittal plane images were made in dorsal recumbency with the transducer placed just caudal to the costal arch and angled craniodorsally in paramedian planes, bisecting the left and right kidneys respectively. In this plane length, circumference of the medullary pyramides were recorded .

Examination of urinary bladder was carried out using 5-and 7-MHz transrectal sector transducer. A 5-MHz convex transducer was used for transabdominal examination of urinary bladder. Images were obtained while the animals in dorsal recumbency. Transducer was placed in inguinal region and adjusted to obtain longitudinal and transverse planes through the urinary bladder.

Organ bath studies:

According to Wood and McCarthy (1990), ultrasonographic images were made of each of dissected kidneys and bladder of mongrel dogs cadavers. Dogs had been euthunatized by overdose with thiopental sodium (Epico Co). Each kidney were fixed from each pole with silk suture and suspended in a plastic container filled with normal saline solution (0.9% NaCl). The face of the ultrasonographic transducer was immersed in the saline solution and images were made at the level of each pair of sutures. Kidneys were examined in transverse, sagittal and dorsal planes.

Effect of age and body size

According to England (1996) the effect of age and body size on the ultrasonographic features of urinary tract five puppies at (one week-one month age) were used for this experiment. puppies were 2.2 to 2.8 kgm body weight. puppies were ultrasonographically examined every one month until 6 months. Ultrasongraphic examination was done measurements, echointensity and shape of kidneys and bladder were recorded in each occasion.

Diseased cases:

Six dogs with signs of urinary tract affection were investigated . Dogs were examined clinically , sonographically and clinicpathologically.
Clinicopathological examinations were urinalysis for pH, pyuria, hematuria and proteinuria,

Statistical analysis

Means and standard deviation of measured variables were calculated according to Petrie and Waston (1999).

RESULTS

The present investigation consists of two main parts. part I was aimed to study the ultrasonographic-anatomic features of the urinary tract in healthy neonatal and adult dogs. Part II was aimed to determine the significance of the ultrasound as a diagnostic aid in some urinary system affection in the dogs. Besides the above mentioned targets, concomitant clinical , clinicopathological changes were evaluated (Tables 5 & 6).

The animals were used for this porposes 31 mongrel dogs. The sonographic study consisted of shape, measurements and echointensity . Achived ultrasonographic measurements of urinary tract in healthy animals were shown in tables (1-4).

The normal dogs:

Shape of the kidney: it is horse shoe shape in the transverse plane (Fig.5), and bean shape in sagittal planes (figs. 1,2).

Measurements (dimensions):

The dimensions of the right kidney in the adult dog were 5.4±0.3; 3.19±0.1, 3.25±0.18; 1.12±0.12; 1.13±0.2 and 2.99±0.17 while for the left kidney were 5.1±0.29; 3.21± 0.16; 3.22±0.14; 1.13± 0.13, 1.12± 0.19 and 2.28±0.19 for length, width , depth, thickness of parenchyma, vertical diameter of renal sinus and circumference of the medullary pyramides respectively (table 1).

Echointensity:

The echointensity of normal healthy kidney varies for standard tissue (liver and spleen) (figs. 3,7). It is usually hypoechoic than them. The renal capsule appeared as echogenic line (figs.4,6). The renal cortex appeared more echogenic than medulla (figs.1,2). The medullary pyramides appeared as cone shape and hypoechoic than other parts of the kidney (figs.1,2). At hilar dorsal to ventral plane, medullary pyramides were present in the opposite poles of the kidney (fig.6). The renal sinus appeared as echogenic line area in the center of the kidney embracing the renal crest, it more obvious in transverse plane than sagittal or dorsal planes (figs.4,6) .

The interlobar blood vessels appeared echogenic circular structures between the medullary pyramids, while the arcuate blood vessels were less in size and present at the cortico- medullary junction (fig.1) The urinary bladder appeared pear shape in longitudinal plane (fig.8). The neck of the urinary bladder and the initial part of the urethera could be observed easily. The bladder wall thickness was 0.31±0.12 cm while the diameter of the urethera was 0.19±0.10 cm.

Organ bath studies:

All details of kidney were clear in sagittal and dorsal planes . The structures were similar to that present in vivo study. The renal capsule was very distinct echogenic line than in vitro (figs. 9,10). The renal pelvis was not discerned except of its distintion by urine or pus.

Effect of age and body size:

Except for measurements all features of kidney were similar to that of the adult puppies after 3 month ages. There were variation in dimensions of kidneys from month to another (figs.11-15) and (table 3,4). The kidneys were hypoechoic than that of adult dogs and there were an echogenic trabeculae within the renal medulla representing renal recesses. The cortex in puppies at one and two months appeared more echogenic than that of adults (Figs.11, 13, 15).

Diseased cases:

Acute cystitis: the urinary bladder contents appeared multiple uniformily distributed echoes. Clots of blood were echogenic structures within the bladder with no shadow (fig. 17) .

Chronic cystitis: The wall of the bladder was irregular and thick than the normal (fig.16). In the cystic kidney, there were multiple an echoic cysts within the kidney, the cysts had definite was with enhancement (figs.18, 19). Cystic calculi: Appeared echogenic structures with shadow (fig. 21). In pyelonephritis renal pelvis was dilated with presence of anechoic fluid interspersed with echogenic dots representing the pus (fig. 20)

DISCUSSION

Many authors studied the sonographic-anatomic features of kidneys in different healthy animal species. Some of them described their measurements (Felkai et al., 1992; Braun et al., 1992a and Abou – Zaid, 1995), while others didn't described their measurements (Wood & McCarthy, 1990 and Hoffmann et al., 1995). The sonographic studies of normal urinary tract focused mainly on, shape, measurements and echointensity. Measurements of the kidneys included length , width, depth, thickness of parenchyma, vertical diameter of renal sinus and circumference of the medullary pyramides. The measurements are of great importance as with age progress, the kidney parenchyma shrinks due to arterioselerotic alterations and increase the amount of peripelvic adipose tissue (Braun, 1991). In this respect, Konde (1986) and Barr, (1990) added that the measurements are very essential for comparing the normal with diseased kidney. Mean while, renal volume is more acurate for assessment of the kidney (Felkai et al., 1992).

In the present investigation, ultrasonographic anatomical features of the urinary tract of normal and diseased dogs were described. We could recognize the shape, position, dimenstion and echointensity of the kidneys, bladder and urethera in the neonatal and adult normal dogs. Appeared bean shape in sagittal plane and horse shoe shape in transverse plane, similar results were observed in sheep by Braun et al., (1992). If the ultrasonographic beam does not lie perpendicular to the kidney, the shape may be distorted (Hoffmann et al., 1995).

Konde et al., (1985) recorded that, the left kidney in the dogs is easier to image via ultrasonography than the right kidney , because the spleen serves as an ultrasound window to the left kidney. The right kidney locates dorsal to loops of small intestine that , when gas filled, served as a barrier to sound wave passage. The kidneys could be visualized through the lateral and dorsal recombency according to the plane of imaging, as reported by Konde et al, (1981) and Wood and McCarthy (1990) in the dog and by Walter et al., (1987) in the cat.

The renal cortex appeared more echogenic than the medulla that was relatively anechoic. Such difference in echogenicity is related to the histological structure of these regions. Histologically the cortex contains large number of glomeruli with hypercellularity and larger portions of the Henle's loop provide the collagen tissue interfaces, while the medulla has only thin walled collecting tubules with excreted urine. Though the medulla has homogenous echoes, it does not produce acoustic enhancement that associated with anechoic fluid filled structures. This agreed with the results obtained by Hallerr, Berdon and Friedman (1982) as they observed the renal pyramides of the premature or neonatal human after display a pseudocystic appearance that has been attributed to the more important liquid load of the neonatal tubuli.

The present study revealed that, the dimensions of the right kidney not significantly differed from that of left one. With ultrasonography it could be demonstrate the renal vasculature in the dogs as echogenic areas between the medullary pyrmides representing the pelvic recesses with interlobar arteries, this agreed with the results of Konde et al., (1984) and Barr (1990) in the dog as high echoes at the cortico medullary junction.

The urinary bladder and urethera are easily visualized through the rectum than through body wall , however the ureter could not be observed and the bladder appears pear shape with great variation in the thickness of its wall that depending apon its fullness with urine. The urethera was observed passing caudally. Fullness and distention of the bladder not indicating a disease cases . However dilatation of the urethera is usually diagnostic of uretheral obstruction, the bladder volume is essential for clinical purposes (Atlan, 1998).

Organ bath studies revealed that the kidney details similar to that observed in vivo. In both observations renal capsule and perirenal fat differed. In vitro perirenal fat tend to float away from the renal capsule and less echogenicity than present in vivo. This observation concides with that of Wood and McCarthy (1990). The renal medulla is highly hypoechoic relative to the surounding renal cortex. Presembly the renal medulla has a higher water content and relatively fewer acoustic interfaces than cortex (Marchal et al., 1986).

At the applied level and as a result of our findings we believe that the corticomedullary ratio should be thoroughly observed through hilar-ventral to lateral border dorsal plane as in this plane, medulla fused in either poles of the kidney. The medullary pyramides were clearly visible and should be not confused with the renal cysts.

The neonatal kidney images were proved to be different from that of adult normal ones, increased echogenicity of the cortex, a result in a line with that reported by Konde et al., (1984) and England (1996) in the same animals and Haller et al., (1982) in neonatal children. After one month all parameters of kidneys were similar to that of adult except the dimensions. This findings were similar to that observed by England (1996).

It is possible that renal measurements were under estimation by ultrasonography study as has been previously shown by Barr (1990) and England (1996). They added that this problem may be due to in accurate organ margins (Walter et al., 1987) and failure to image the kidney in its greatest dimensions (Rosen baum et al., 1978). Use of diagnostic ultrasonography to evaluate patholgic processes within the kidney is an established clinical procedure (Adam et al., 1989). The ultrasonographic examination of six diseased dogs revealed that, the presence of acute cystitis in two dogs, chronic cystitis in one bitch, cystic kidney in one case, pyelonephritis and cystic calculus in two cases.

The dogs with acute cystitis showed hypoechoic edametous bladder wall and the bladder contents were multiple ting uniformly echoes, similar results were observed in ram (Braun et al., 1992) and Hafez and El-Khodary, 2001).
Blood clots may be observed as echogenic particles with no shadow. In the chronic cystitis the wall of the urinary bladder appeared thick and irregular in nature.

Polycystic kidney were enlarged with hypoechoic to anechoic circular structures within the Kidney. Cystic Kidney is a heriditary disease (Barr, 1990). The cysts differed from medullary pyramides in that they were larger with distal enhancement.

Ultrasonographically, dogs with pyelonephritis showed dilated renal pelvis and ureter that had an echoic contents with multiple echoes representing the pus. Early stage of pyelonephritis usually confuses with hydronephrosis, but in pyelonephritis the fluid is more echogenic due to cellular nature (Walter et al., 1987). Stone within urinary bladder (cystic calclus) appeared as echogenic structure cresent or irregular in shape with shadow. Blood clots within in the bladder may appear as calculus but without shadowing. Calculus usually produces shadow when it is sufficient large Kremer and Pobrinski (1988), while that less than 3mm in diameter cannot produce shadow specially under field conditions (Probst and Saltzman, 1991). The urinalysis confirmed our diagnosis. This results coincide with that present in large animals (Radostis et al., 2000).

It could be concluded that, the ultrasound is efficient tool for examination and diagnosis of urinary tract affections.

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Table (1): Results of ultrasonographic examination of kidneys of adult dogs

Variable	Right kidney				Left kidney			
	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.
-Length	3.38	5.82	5.4	0.3	3.21	5.79	5.1	0.29
-Width	2.96	3.71	3.19	0.1	3.0	3.82	3.21	0.16
-Depth	2.78	3.31	3.25	0.18	2.67	3.29	3.22	0.14
-Diameter of parenchyma	1.1	1.18	1.12	0.12	1.0	1.2	1.13	0.13
-Diameter of renal sinus	1.0	1.29	1.13	0.2	1.0	1.27	1.12	0.19
-Circumference of medullary pyramides	2.34	3.51	2.99	0.17	2.36	3.54	2.98	0.19

Min.=Minimum, Max.=Maximum S.D.=Standard deviation

Table (2): Results of ultrasonographic examination of urinary bladder and urethra

Variable	Min.	Max.	Mean	± S.D.
- Bladder wall Thickness	0.21	0.41	0.31	0.22
- Diameter of urethra	0.14	0.21	0.19	0.10

Table (3): Ultrasonographic measurements of right kidney at different ages

Age/ Month	Length	Width	Depth	Diameter of parenchyma	Diameter of renal sinus	Circumference of medullary pyramids
1	2.38±0.41	2.10±0.12	1.97±0.51	0.84±0.31	0.82±0.21	1.79±0.30
2	2.89±0.2	2.31±0.11	2.13±0.24	0.87±0.41	0.86±0.23	2.19±0.31
3	3.12±0.16	2.4±0.25	2.33±0.18	0.87±0.23	0.86±0.47	2.41±0.20
4	3.52±0.15	2.79±0.31	2.84±0.11	0.90±0.12	0.88±0.27	2.41±0.11
5	3.92±0.23	2.84±0.17	2.84±0.35	0.92±0.15	0.90±0.25	2.51±0.18
6	3.96±0.1	2.86±0.14	2.84±0.46	0.93±0.71	0.98±0.24	2.65±0.51

Measurements of variables are expressed by Mean ± SD.

Table (4): Ultrasonographic measurements of left kidney at different ages

Age/ Month	Length	Width	Depth	Diameter of parenchyma	Diameter of renal sinus	Circumference of medullary pyramids
1	2.26±0.11	2.0±0.1	1.90±0.21	0.85±0.17	0.83±0.13	1.89±0.20
2	2.93±0.2	2.2±15	2.1±0.13	0.86±0.26	0.85±0.25	2.1±0.17
3	3.1±0.16	2.3±27	2.2±0.14	0.86±0.11	0.84±23	2.33±0.11
4	3.5±0.1	2.8±0.19	2.2±0.18	0.88±0.20	0.86±0.19	2.36±0.21
5	3.9±0.9	2.81±13	2.33±0.30	0.90±0.20	0.91±0.2	2.40±0.31
6	3.95±0.13	2.83±0.33	2.34±0.19	0.91±0.18	0.97±0.30	2.52±0.27

Table (5): Clinical findings in dogs with urinary tract diseases

Parameter	Acute cystitis (1)	Acute cystitis (2)	Cystic calculi	Pyelonephritis	Cystic kidney	Chronic cystitis
-Temp.	39.6	38.2	38.5	40.0	38.5	39.0
-Pulse	113	90	115	120	89	90
-Respiration	33	30	30	37	29	30
-Attitude	Depressed	Anxiety	Anxiety	Depressed	Depressed	Alert
-Appitite	Anorexia	Anorexia	Inappitant	Inappitant	Inappitant	Normal
-Posture	Arched	Arched	Arched	Arched	-	-
-Frequent urination	++	++	+++	+	-	-
-Dysuria	+	+	++	+	-	-
-Pain	++	+	+++	+	+	+

Table (6): Results of urinalysis in dogs with urinary tract diseases.

Parameter	Acute cystitis (1)	Acute cystitis (2)	Cystic calculi	Pyelonephritis	Cystic kidney	Chronic cystitis
-PH	7.1	7.2	6.9	7.5	7.0	7.6
- Hematuria	++	++	+++	++	++	+
-Pyuria	+	++	++	+++	+	+
- Proteinuria	+	+	+	+++	+	+
-Bacteria recovered	E.coli	Staph.	-	E.coli	-	Coryne. spp

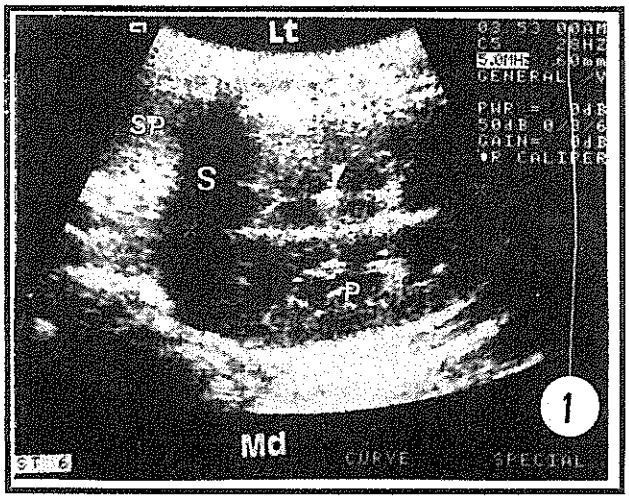

Fig.(1): Ultrasonogram(sagittal plane) of left kidney of adult dog. Sp= spleen, S = shadow of rib , arrow head = interlobar Blood vessel., P = medullary pyramids, Lt = lateral, Md. = Medial

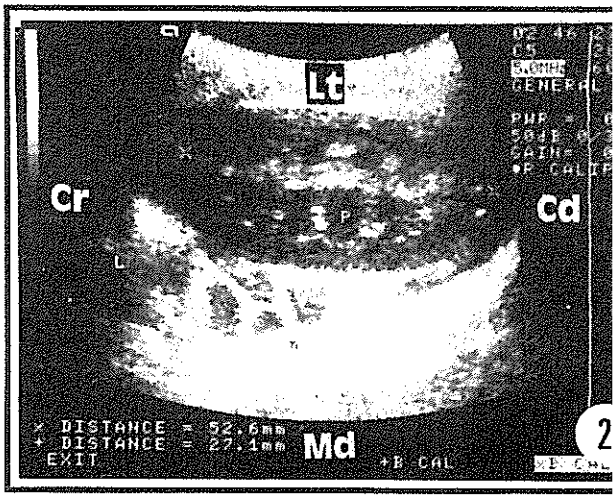

Fig.(2): Ultrasonogram of right kidney of dog . Lt.= lateral, Md = medial, Cr.= cranial , Cd = caudal, P = medullary pyramids, D = diaphragm, L= liver

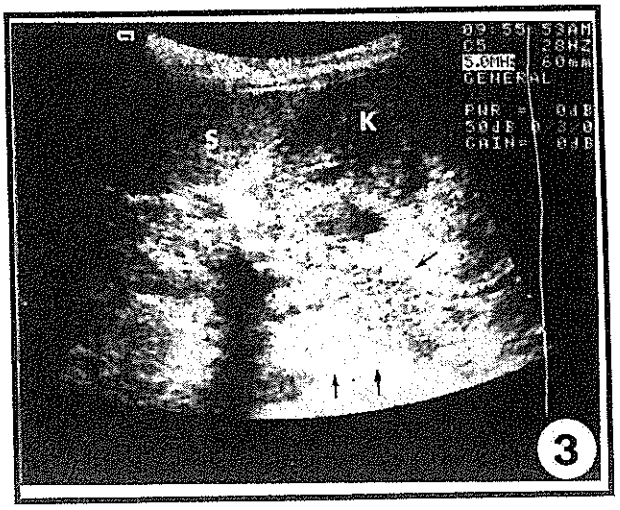

Fig.(3): Ultrasonogram of left kidney of normal adult dog. K = kidney, S = spleen, notice gas in the intestine represented by white area at the bottom of the image(arrows).

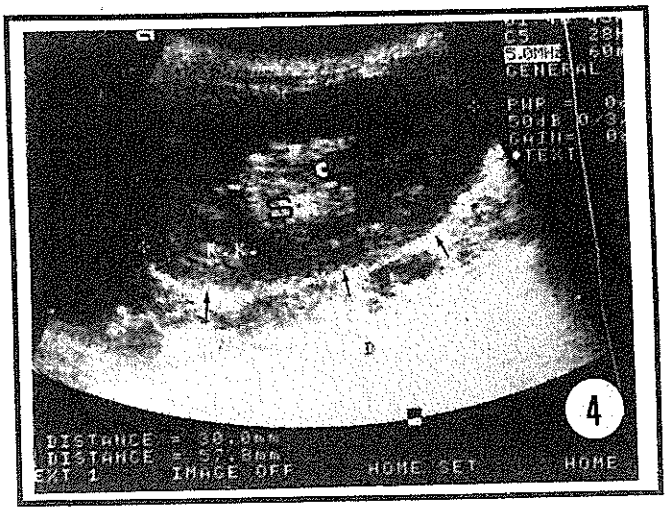

Fig.(4): Transverse plane of right kidney of dog . S = renal sinus, C = renal crest, D = diaphragm

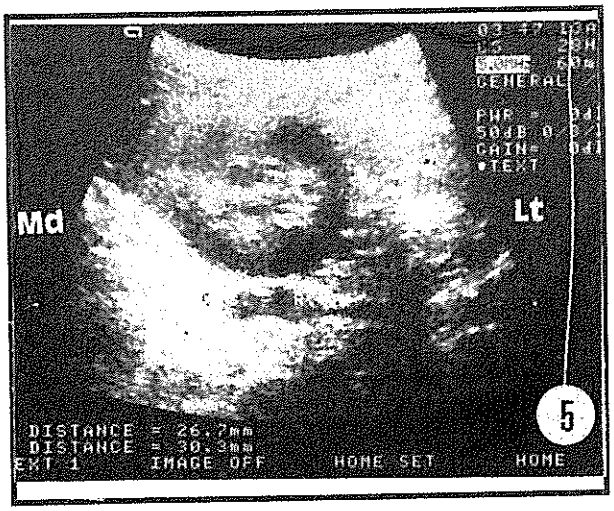

Fig.(5): Transverse plane of right kidney of dog at renal hilus. Notice horse shoe shape of the kidney. Arrow = renal hilus, Md. = medial , Lt. = lateral

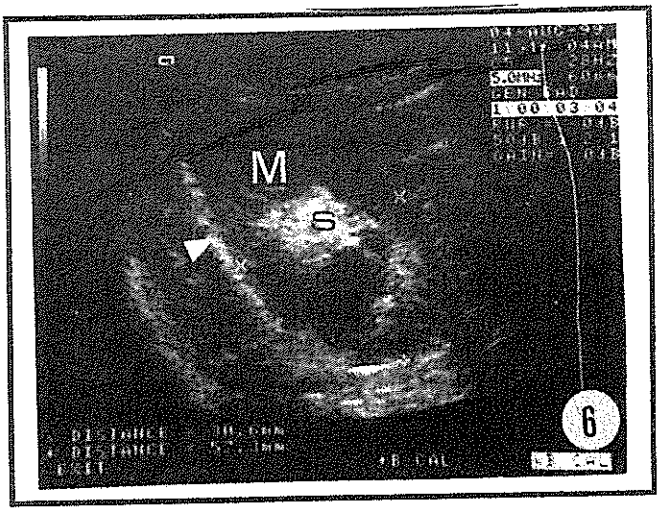

Fig.(6): Ultrasonogram of right kidney of dog showing fusion of the medullary pyramids at the 2 poles of kidney(M). S = renal sinus, arrow head = renal capsule.

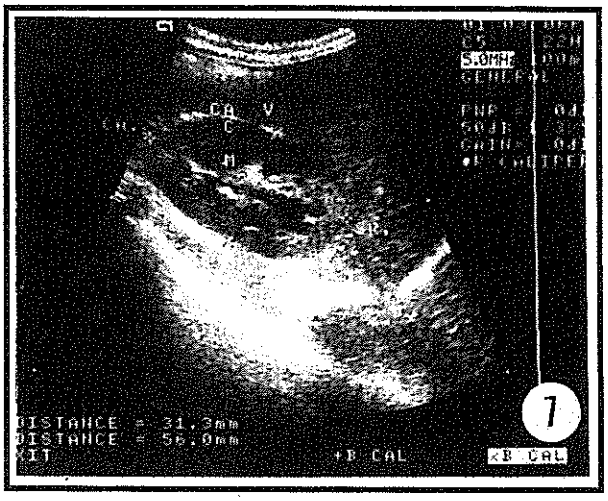

Fig.(7)): Dorsal plane of right kidney of dog. Vt = ventral, Dr = dorsal, Cr= cranial, Ca= caudal , c = capsule, M= medullary pyramids

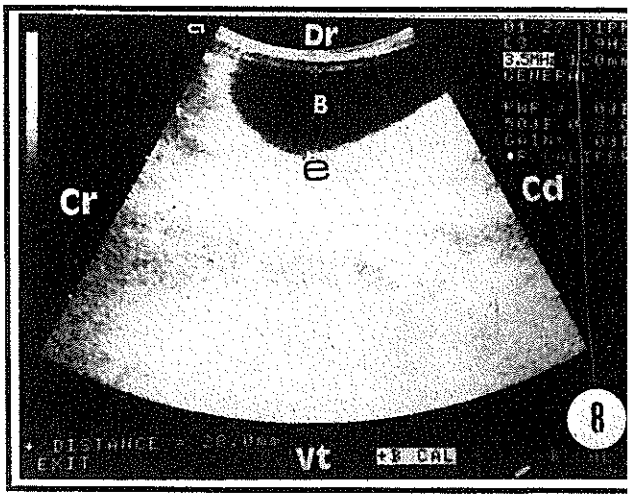

Fig.(8): Sagittal plane of the urinary bladder by transrectal examination. B = bladder, e = enhancement((white area), Cr= cranial, Cd = caudal

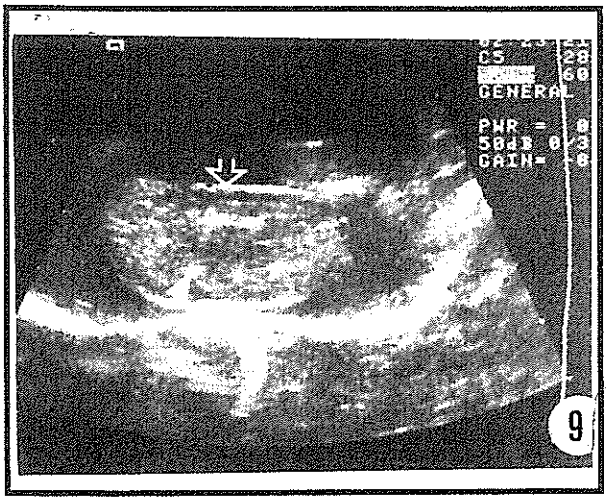

Fig.(9): Static ultrasonogram (in organ bath) of kidney of dog. Arrow = renal capsule, arrow head = interlobar blood vessle.

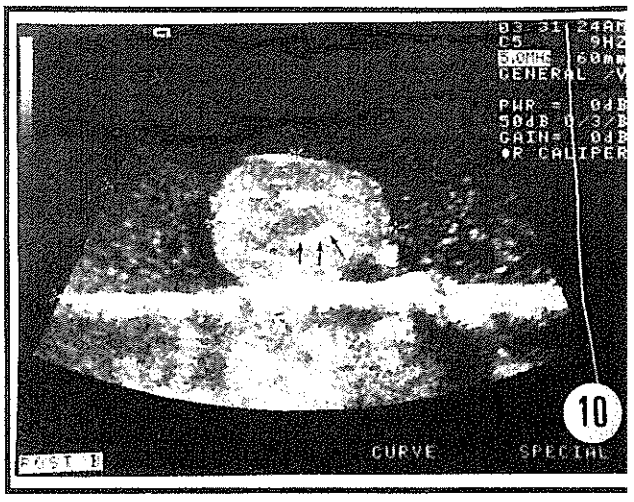

Fig.(10): Transverse plane of kidney in organ bath. Arrow show renal sinus embracing the renal crest

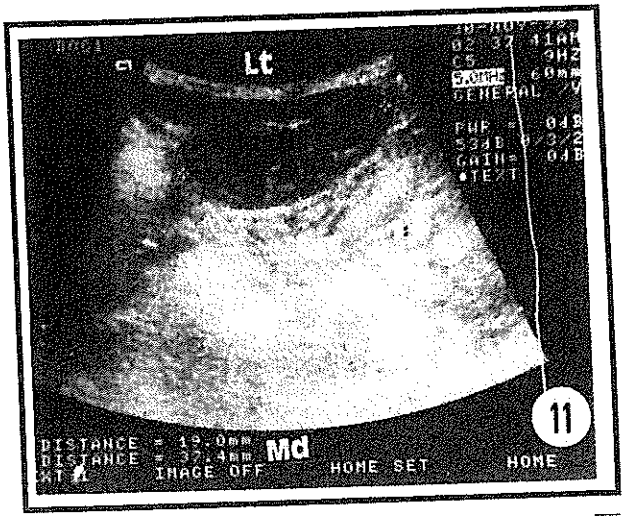

Fig.(11): Ultrasonogram of right kidney of puppy at one month age . Notice increased cortical echogenicity in relation to the renal medulla

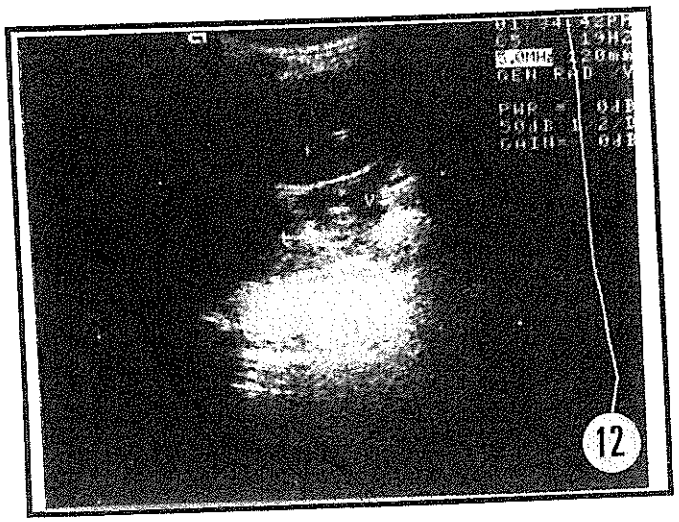

Fig.(12): Ultrasonogram of right kidney of dog at two month age . R= right kidney, V = hepatic blood vessel .

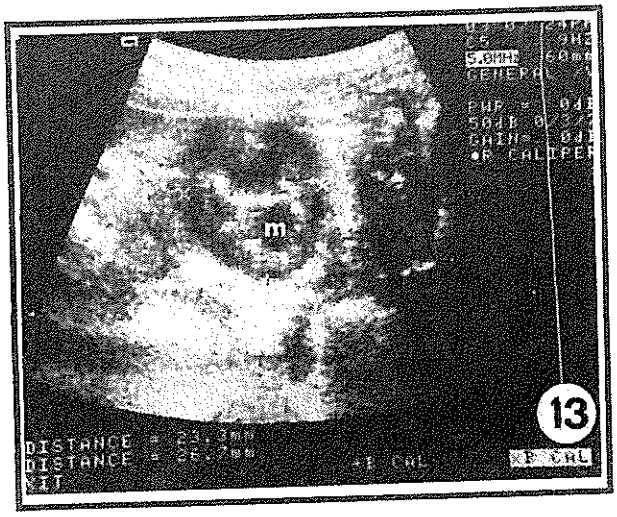

Fig.(13): Ultrasonogram of left kidney of puppy at 3 month age showing medullary pyramids at 2 poles of the kidney (m) .

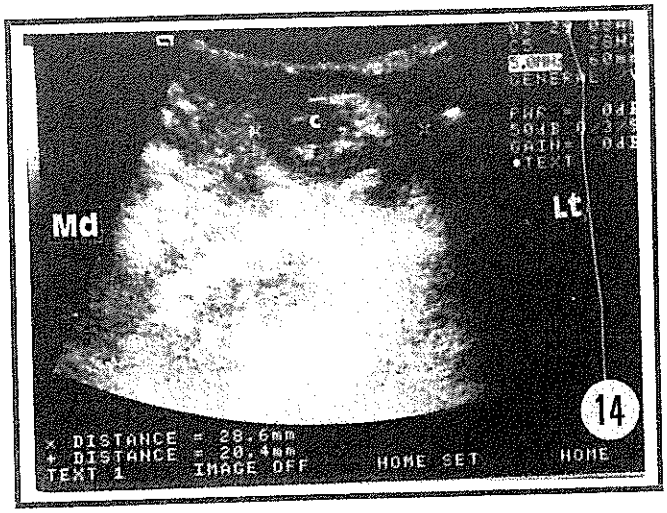

Fig.(14): transverse image of right kidney of puppy at 4 month age . C = renal crest. Md = medial, Lt = Lateral

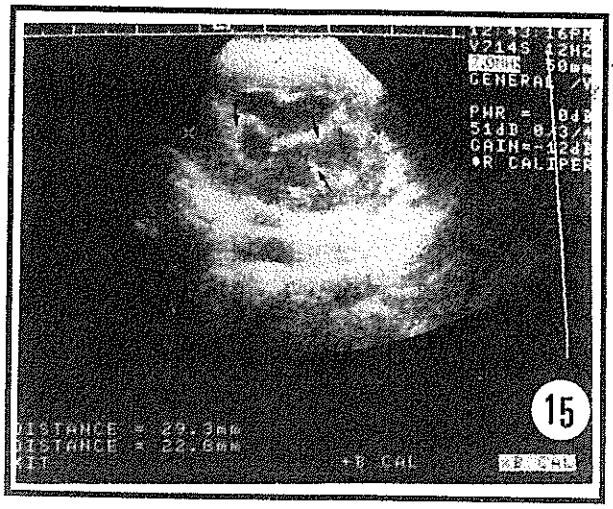

Fig.(15): Ultrasonogram of normal right kidney of puppy at 5 month age showing diverticulae representing the renal recesses(arrows).

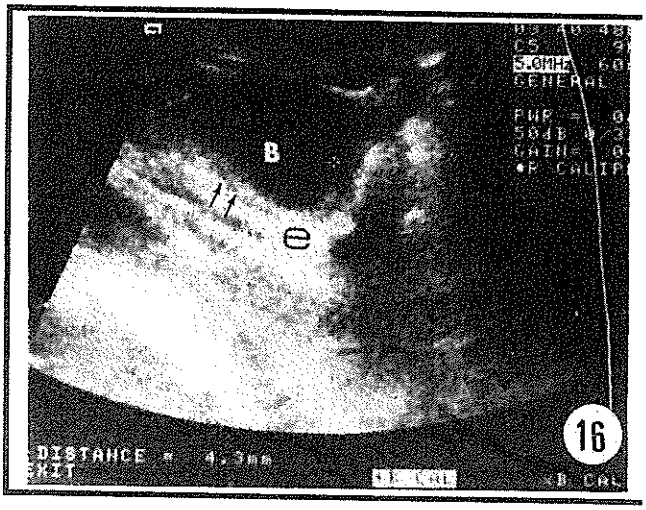

Fig.(16): Ultrasonogram of urinary bladder of dog with chronic cystitis (by transrectal transducer) show increased bladder wall thickness. B= bladder, e = enhancement.

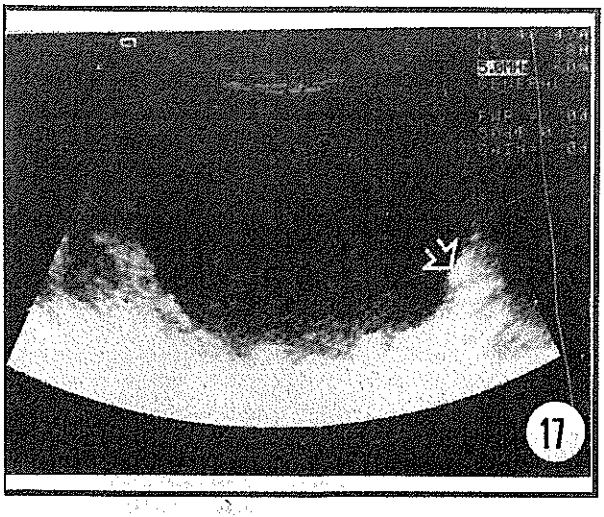

Fig.(17): Ultrasonogram of urinary bladder of dog with cystitis. Notice the contents of the bladder is multiple uniform echoes(white dots at the bottom) with blood clot (Arrow head).

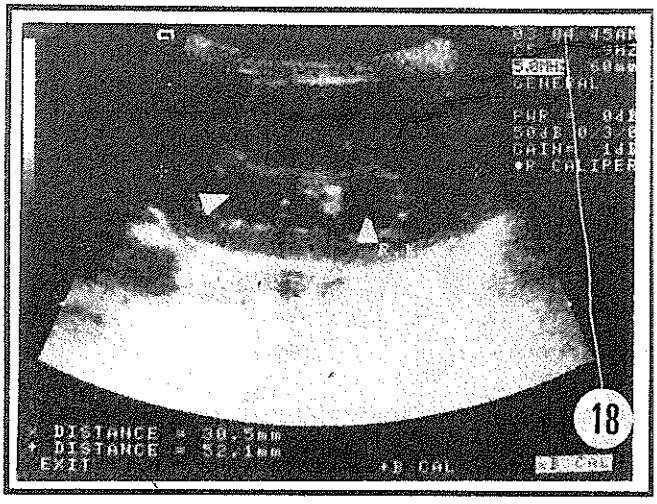

Fig.(18): Ultrasonogram of right kidney of dog with renal cyst. Arrow heads = anechoic cysts

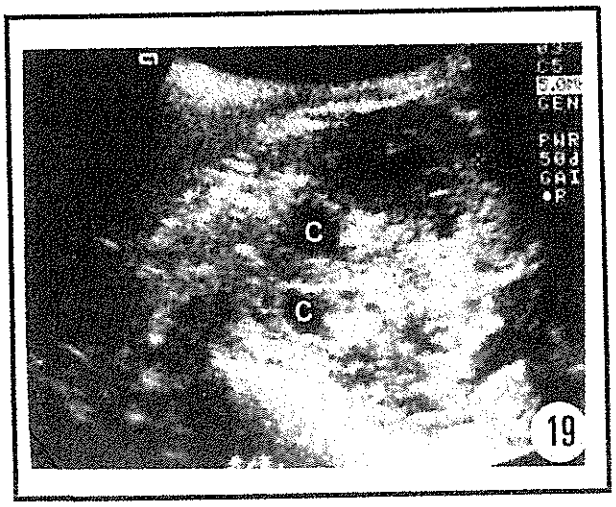

Fig.(19):Ultrasonogram of the kidney with cysts. Notice multiple anechoic structures

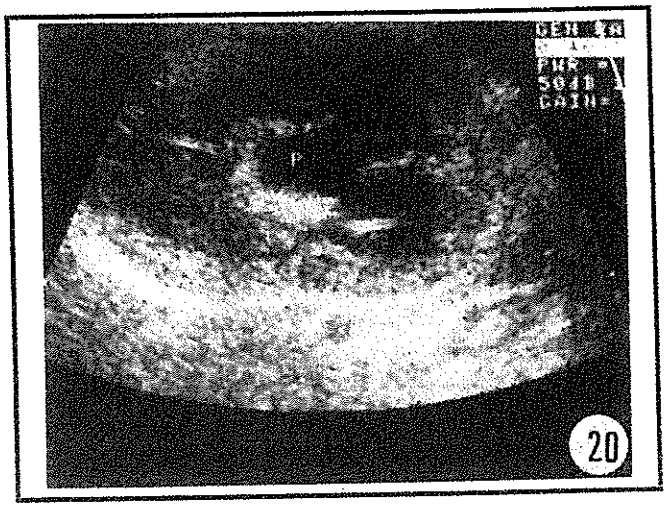

Fig.(20): Ultrasonogram of kidney of dog with pyelonephritis. P= dilated renal pelvis.

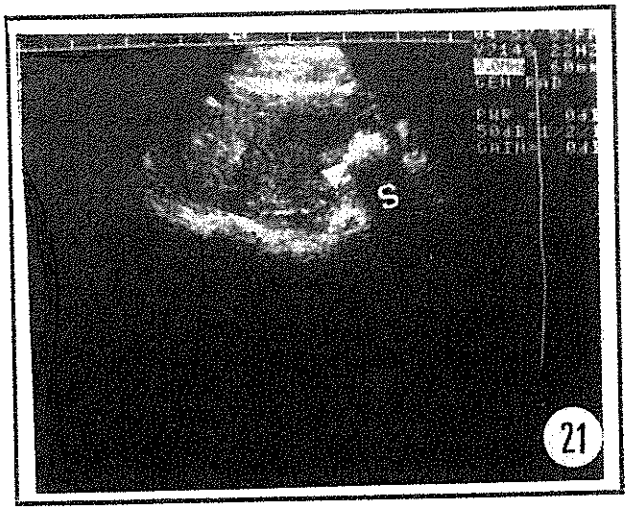

Fig.(21): Ultrasonogram of urinary bladder with cystic calculus, S = shadow. Arrow head = stone.

الملخص العربى

الخصائص التشريحية بالموجات فوق الصوتية لقناة مجرى البول فـــى الكـــــــلاب الرضيعـــة والبالغـــــة

* جـــلال أحمد يوسف - **صبرى أحمد الخضرى

فحص الجهاز البولى للكلاب الرضيعة والكبيرة بالموجات فوق الصوتية وقد فحصت الكلاب فى وضع الرقود على الجنب والظهر باستخدام مجس طولى ومقعر قـــوة ٥، ٧ ميجـــاهيرتز للكلـــى ومجس خاص يستخدم عن طريق فتحة الشرج للمسالك البولية.

كما اجريت قياسات للكلى والمثانة البولية وكذا قناة مجرى البول مع فحص الشكل والوضـــع والتركيبات الداخلية للكلى فى الكلاب الرضيعة والكبيرة.

و تم تشخيص عدد ٦ حالات تعانى من مراض الجهاز البولى وهى حالتان التهاب مثانة حاد، حالة التهاب مثانة مزمن وحالة التهاب كلى صديدى وحالة تكيس الكلى وحالة حصى بالمثانة البولية.

وقد استعرض البحث صورة الجهاز البولى بالموجات فوق الصوتية عنـــد الاصابـــة بـــهذه الأمراض وكذا الأعراض الإكلينيكية والتغيرات البيوكيميائية ومن هذا نستخلص أن الموجات فـــوق الصوتية يمكن الإعتماد عليها فى فحص وتشخيص بعض أمراض الجهاز البولى فى الكلاب.