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# Evaluation of kidney abnormalities in cows using transrectal ultrasonography and urinalysis*

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**Summary:** For this study, 100 Holstein crossbreed cows aged between 4 to 8 years, admitted to Antakya Slaughterhouse, were used. After clinical examination, urine samples were collected by catheterization from urinary bladder for urine analyses using reagent dipsticks and microscopy. In ultrasonography; abnormal appearances were observed in 18 cows, including small kidney with echogenicity in two, a hydronephrosis in one, renal calculi in two, alteration of the corticomedullary architecture in one, dilated renal pelvis and irregularly shaped kidneys with echogenic cortex in four, patchy hyperechoic cortex and poor demarcation between cortex and medulla in five, and renomegaly in three. Urinalyses revealed the presence of leukocyte, erythrocyte, phosphate and/or siliceous crystals in the 18 cows. Therefore, it is concluded that both transrectal ultrasonography and urine analysis appears to be adequate for diagnosis of renal diseases.

Key words: Cow, kidney, ultrasonography, urine analysis

## İneklerde böbrek bozukluklarının transrektal ultrasonografi ve idrar analizi ile değerlendirilmesi

**Özet:** Bu çalışmada Antakya mezbahanesine getirilen, 4-8 yaşlı, 100 Holştayn melezi inek kullanıldı. Klinik muayeneden sonra idrar kesesinden kateterle toplanan idrar örnekleri dipstik test çubukları ve mikroskobik yöntemle analiz edildi. Ultrasonografide; 2 inekte ekojenik küçük böbrek, birinde makrokist, ikisinde böbrek taşı, birinde kortikomeduller yapıda değişiklik, dördünde renal pelviste genişleme ve düzensiz yapı ile birlikte kortekste ekojenite, beşinde korteks ve medulla arasında hafif demarkasyon ve hiperekojenik korteks parçası ve üçünde renomegali olmak üzere toplam 18 hayvanda anormal görüntüler saptandı. Bu 18 ineğin idrar analizlerinde lökosit, eritrosit ve silisyum-fosfat kristalleri görüldü. Sonuçta transrektal ultrasonografi ve idrar analizlerinin birlikte böbrek hastalıklarının tanısında yeterli olabileceği kanısına varıldı.

Anahtar kelimeler: Böbrek, idrar analizi, inek, ultrasonografi

## Introduction

In small animals, ultrasound can be used to assist in the differentiation between acute and chronic renal diseases, and the renal masses caused by hematomas, cysts, abscesses or neoplasia (1,3). In large animals, application of transrectal ultrasonography has recently been used for diagnosis of some caudal abdominal abnormalities (6,7). However, in practice transrectal ultrasonography is used for diagnosis of large animal pregnancy mostly and also urolithiasis (2,4,5). The information of the kidneys and ureters obtained by ultrasonography can help the best treatment decision, or to confirm appropriateness of curative therapy (3,5,8,11). The aim of the study was to investigate the kidney lesions in cows admitted to Antakya Slaughterhouse in Hatay province, using ultrasound scanner equipped with a 6.0 MHz and 8.0 MHz transrectal transducers, and urine analyses.

## Materials and Methods

For this study, 100 Holstein crossbreed cows, aged between 4 to 8 years, admitted to Antakya Slaughterhouse, were screened in Summer 2001. They were subjected to clinical, ultrasonographical and biochemical examinations.

After clinical examination, urine samples were obtained by catheterization from urinary bladder for testing and analysed within 15 minutes after the collection using reagent dipsticks. The urine samples were centrifuged at 1500 rpm for 5 minutes. After decanting, the supernatant sediments were resuspended in physiological saline. Urine cytology was examined 10 fields using x40 lens to identify cast, cells, and crystals. Kidney function was evaluated by testing urine concentration with a veterinary refractometer.

Kidneys and ureters were examined ultrasonographically. Ultrasonographic measurements were performed

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using a scanner 100 LC Vet ultrasound machine (Pie Medical Equipment B.V., Philipsweg 6227 AJ Maastricht, The Netherlands) with a 6.0/8.0 MHz LA DF Vet TRD (401670, 401811) transrectal ultrasonic probe.

## Results

Clinical observation included weight loss, anemia, lifting their back dorsally or hypersensitivity in kidney palpation in four animals. These animals also frequently attempted to urinate, and their tails seemed to be pumping or twitching during the examination. Physical examination and rectal palpation showed no abnormalities of urethra, bladder neck, and local lymph nodes.

Mostly the left kidneys and ureters were identified as structurally involved in ultrasonographic examination. Right kidneys of the cows were too difficult to examine thoroughly, especially in huge and/or tall animals. In all the cows, the transducer of 6.0 MHz resulted in greater depth of tissue penetration, and lesser image detail in kidneys and ureters, whereas transducer of 8.0 MHz resulted in lesser depth of tissue penetration and a greater image detail. Ultrasonographic renal abnormalities were observed in 18 cows. In two of the 18 animals with lesion, the marked increase in echogenicity of the renal cortex with some degrees of acoustic shadowing and the enhanced definition of corticomedullary junction within the medulla were detected (Figure 1). In another two animals, the left kidneys were typically small (approximately 4x4.5 cm) and echogenic, with loss of definition of the corticomedullary junction (Figure 2). In the left kidney of another animal, ultrasonography revealed a hydronephrosis, about 7 cm in diameter and renomegaly (Figure 3). In four animals, an increased echogenicity of the renal cortex and medulla, dilated renal pelvis and irregularly shaped kidneys were observed (Figure 4). In the left kidneys of five animals, a patchy hyperechoic cortex and poor demarcation between cortex and medulla were observed (Figure 5). In three animals, renomegaly, increased cortical and medullar echogenicity, ill-defined areas of hyperechogenicity in the cortexis, and lack of visualization of the corticomedulary junctions were observed. The renal pelvises were dilated and mild hyperechoic debrises were present (Figure 6). In the right kidney of one animal, a dilated anechoic pelvis, an alteration of the medullary and cortical architecture, and an enlarged anechoic ureter and an anechoic structure (4 cm in diameter) were detected. Ultrasonographic examination results of 18 cows with renal abnormalities were shown in Table 1. No ultrasonographic abnormalities were detected in the rest of the animals.

Of the 100, in 18 cows, urinalysis showed the presence of leukocyte, erythrocyte, phosphate or siliceous crystals, and the affected cows excreted frequently diluted urine with densities ranging between 1005 and 1015. Analysis of urine with dipsticks of the 18 cows with kidney problems revealed existence of blood in 11, protein in 8 and glucose in 3 cows. Results of urinalyses of the 18 cows were shown in Table 1.

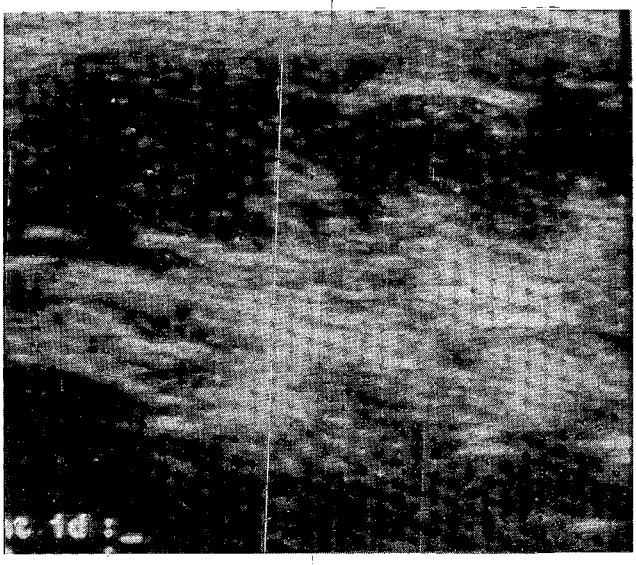

Figure 1. An ultrasonographic view shows a marked increase in echogenicity of the renal cortex and the enhanced definition of corticomedullary junction within the medulla.

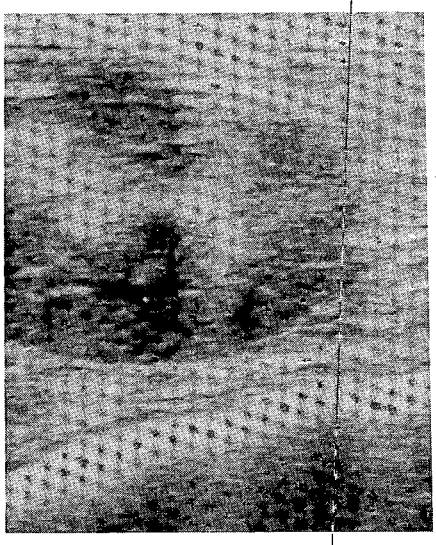

Figure 2. An ultrasonographic appearances of a kidney. Note that the kidney is small echogenic with loss of definition of the corticomedullary junction.

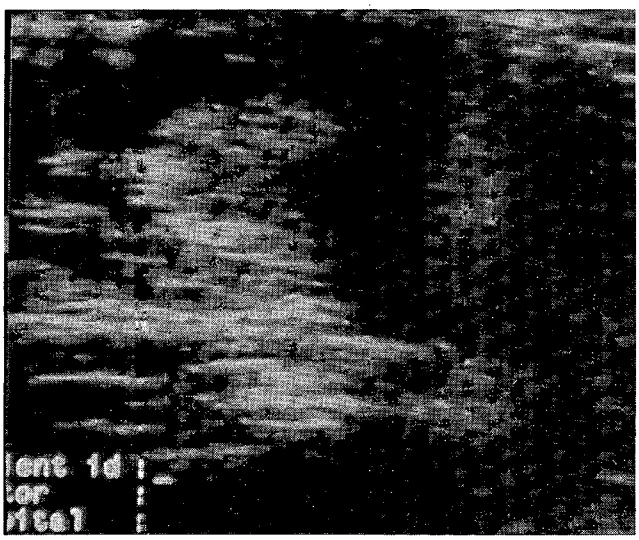

Figure 3. An ultrasonographic view of hydronephrosis in a kidney.

Figure 4. An ultrasonographic view of an increased echogenicity of renal cortex and medulla with renal pelvis. Note the irregularly shaped kidney.

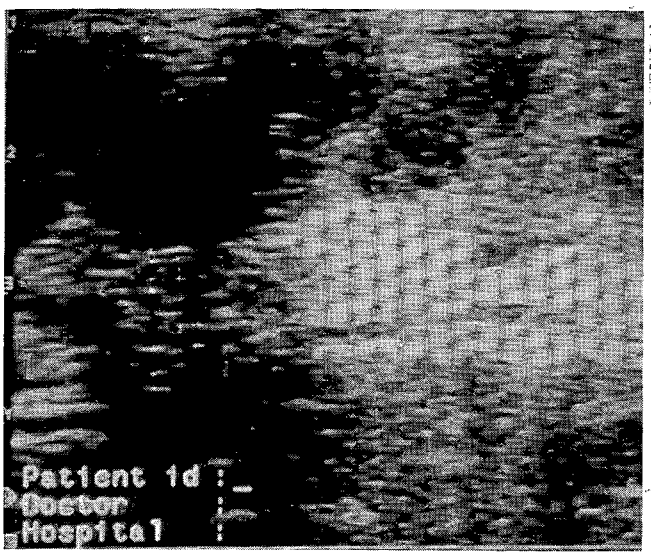


Figure 5. A patchy hyperechoic cortex and poor demarcation between cortex and medulla in ultrasonography.

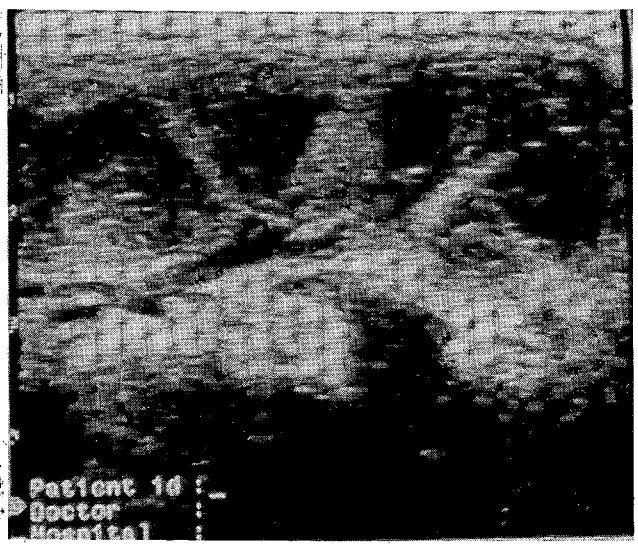

Figure 6. A view of a dilated renal pelvis in ultrasonography. Note debrises accumulated in the renal pelvis, with a mild hyperechoic appearance.

Table 1. Evaluation of ultrasonographic examination and urinalysis in 18 cows with renal lesions

| Number of cases | Ultrasonographic findings | Urinalysis |
|---|---|---|
| 2 | Echogenic renal cortex, Enhanced definition of corticomedullary junction | Amorph urate, calcium oxalate crystals, phosphate and siliceous crystals, epithelial cells, 8-10 erythrocytes |
| 2 | Echogenic small kidney, los of corticomedullary junction | Abundant Urate and uric acid crystals, 10-14 leukocytes, 7-8 erythrocytes casts |
| 1 | Renomagaly due to macrocysts | Squamous epithelial cells, triple phosphate crystals |
| 4 | Echogenic medulla and cortex, dilated renal pelvis, irregular shape of kidneys | 9-10 granular and 10-12 leukocyte casts, 4-5 leukocytes |
| 5 | Patch hyperechoic cortex, poor demarcation between cortex and medulla | 10-14 erythrocyte, 7-8 epithelial casts, |
| 3 | Renomegaly, corticomedullary echogenicity, hyperechogenic ill-defined areas in cortex, lack of visualization in the corticomedullary junction | Abundant renal epithelial cells, 20-25 erythrocytes |
| 1 | Dilated anechoic pelvis, corticomedullary alteration, enlarged anechoic ureters | Abundant transitional epithelial cells, and 9-10 leucocytes |

## Discussion and Conclusion

Ultrasonography is particularly helpful in determining the possible etiology of urinary tract disorders, such as cysts and stone formation (1-3,12). In the cattle industry, this technology is not used commonly because of the cost of the machine and the perception that rectal palpation is sufficiently reliable. Nevertheless, competent rectal palpator can simply not be accurate as a competent ultrasonographer. The extents and characteristics of lesions can be evaluated without invasion. Whereas, ability for rectal palpation to identify the pathologies is limited. In this study, ultasonography provided diagnostic information, and helped to determine the severity of renal diseases. As we did in this research, less costly portable ultrasound equipment will help to examine urinary tract in cows.

Depth of tissue penetration of sound waves and image resolution is dependent upon and inversely related to the frequency of the transducer. The study presented here, a 6.0 MHz transducer resulted in greater depth of tissue penetration and lesser image detail, whereas, 8.0 MHz transducer resulted in lesser depth of tissue penetration and a greater image detail. Thus, we believed that an ultrasound scanner equipped with a 6.0 MHz transducer appear to be more satisfactory for examining kidneys and ureters.

Results of urinalysis and sensitivity of the urine using by dipstick test stripe is helpful as far as combining with the other clinical evaluation. Casts, crystals, mucous erythrocyte can be used as indexes for damage to the kidney tubules (9-12), and the presence of renal tubular cells and/or leukocytes may indicate infection (10,11). For this reasons, in every suspected cattle urinary tract abnormalities or diseases, urinalysis should be done as a general screening to check for diagnosing early kidney disease.

The disturbance of calcium and phosphorus ratio and change in urine volume are important risk factors (5,11) for stone formation, which might account for a higher incidence of stone formation during summer in the present study. The presence of microhematuria detected by dipstick in the study presented here may imply the presence of kidney disease.

In conclusion, convincing evidence presented in this study suggests that for diagnosis, non-invasive examination methods, namely, ultrasonography and urine cytology appear to be sufficient. Therefore, examination of kidneys by ultrasonography and urinalysis has the potential to provide new perspectives on clinical diagnosis of mild to moderate renal diseases in cows.

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