

Detection of vesicoureteral reflux in healthy puppies

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Summary: The aim of this study was to determine vesicoureteral reflux (VUR) in puppies by comparing the administrations of “normal urination pressure” and “30 cm water pressure”. 2.5-3-month-old 50 mixed breed puppies were used in this study. Having drained the urine with catheterization and compression in all puppies, bladders were filled with 30-50 ml contrast medium through catheter and then the puppies were released for voluntarily urination. Abdominal radiographs were taken just after the urination and existence of VUR was determined. Three days later in the same puppies, bladders were filled with contrast medium by holding the bottle of contrast medium 30 cm above the level of pubic pelvis which means 30 cm water pressure was performed in bladder and existence of VUR was determined after having retrograde urethrocytographies. According to retrograde urethrocytographic findings, bilateral VUR was determined in 32 (64 %) puppies by the technique of “normal urination” and in 34 (68 %) puppies (the same 32 puppies and 2 additional ones) by the technique of “water pressure”, additionally unilateral VUR was diagnosed in 3 (6 %) puppies (in puppies that were not detected bilateral VUR) by both techniques. Rectal temperature in the puppies with VUR was 38.43 ± 0.17 °C, rectal temperature in the puppies without VUR was 38.26 ± 0.19 °C. In conclusion, incidence of bilateral VUR was found in 64-68 % and unilateral VUR was in 6 % of the dogs and female puppies were more susceptible than male ones.

Key words: Puppy, retrograde urethrocytography, vesicoureteral reflux

Sağlıklı yavru köpeklerde veziköüretal reflüksün belirlenmesi

Özet: Bu çalışma “normal ürinyasyon basıncı” ve “30 cm su basıncı” uygulamaları karşılaştırılarak yavru köpeklerde veziköüretal reflüksün (VUR) varlığının belirlenmesi amacıyla yapıldı. Çalışmada karışık ırktan, 2.5-3 aylık 50 köpek kullanıldı. Köpeklerin tamamının idrar keseleri kateterizasyon ve kompresyon uygulamaları ile boşaltıldıktan sonra kateterle 30-50 ml kontrast madde dolduruldu ve normal ürinyasyon yapmaları için serbest bırakıldılar. Ürinyasyondan hemen sonra retrograd üretrosistografileri çekilerek VUR varlığı araştırıldı. Bu uygulamadan üç gün sonra aynı köpeklerin idrar keselerine pubis kemiği seviyesinden 30 cm yukarıda tutulan bir serum şişesinden kese basıncı 30 cm su basıncına sabitlenene kadar kontrast madde dolduruldu ve retrograd üretrosistografileri yapılarak VUR varlığı araştırıldı. Retrograd üretrosistografi sonuçlarına göre, “normal ürinyasyon” ile 32 köpekte (% 64), ve “su basıncı” uygulaması ile yine aynı köpekler ve başka iki köpekte olmak üzere toplam 34 köpekte (% 68) bilateral VUR varlığı belirlendi, ayrıca bilateral VUR belirlenmeyen 3 köpekte (% 6) her iki teknikle de unilateral VUR varlığı saptadı. VUR olan köpeklerde rektal beden ısıları ortalama 38.43 ± 0.17 °C, olmayanlarda 38.26 ± 0.19 °C belirlendi. Sonuç olarak, yavru köpeklerde bilateral VUR insidensinin % 64-68, unilateral VUR insidensinin % 6 olduğu ve dişi köpeklerin erkeklerden daha duyarlı oldukları belirlendi.

Anahtar sözcükler: Retrograd üretrosistografi, yavru köpek, veziköüretal reflüks.

Introduction

Vesicoureteral reflux is retrograde flow of urine from bladder to ureters and renal pelvis instead of urethra. Vesicoureteral reflux first recorded in apparently normal children and infants in the 1950s to 1970s and normal prevalence was found to be 0.4 % to 1.8 % (1). However, Kollerman and Ludwing (12) found that the incidence of VUR was in 28 % of normal children under 5 years old. Moreover, VUR was detected in 25-40 % of children with acute pyelonephritis. Christie (4) studied in dogs that VUR was detected in 79 % of puppies (3-month-old), 27 % of adults (1 to 6 years old) and 10 % of old dogs (7 to older ages). Primary VUR is directly related to shortening of mucosal length tunnel and anatomical defects of valves at vesicoureteral orifice

(3,14). On the other hand, secondary VUR is related to increased pressure in bladder such as neurogenic bladder and obstruction at any part of lower urinary tract. Kiruluta et al. (11) studied in 40 puppies from birth to 6 months of age indicating the incidence of VUR was decreased dramatically as adrenergic nerve fibers began to appear. International reflux committee graded VUR in five levels (10). Grade I explains that VUR occurs at ureters without dilation; grade II explains that VUR occurs at ureters and renal pelvis without dilation; grade III explains that VUR occurs at ureters and renal pelvis with a light dilation; grade IV explains that VUR occurs at ureters and renal pelvis with an enlarged dilation; and finally grade V means that VUR occurs at ureters, renal pelvis and calices renalis with a wide angled dilation.

Vesicoureteral reflux may be resulted in either chronic renal disease such as hydronephrosis or pyelonephritis based on the presence of obstruction and contamination (2,13,14). When VUR has been diagnosed, it is preferable to ascertain whether urinary tract infection (UTI) is being present. UTI were diagnosed in the 85 % of 356 infants with VUR under a year old (9). The incidence of UTI in puppies with VUR is difficult to ascertain, but references and observations suggest that most untreated puppies do not become infected. If it is true, most of the puppies with VUR do not develop UTI or hydronephrosis. However, Sahal et al. (16) recorded a case presenting hydronephrosis and hydroureter in young German shepherd dog. Furthermore, Ozkanlar et al. (15) reported using retrograde ureterocystography that VUR was detected in 42.9 % to 57.1 % of the dogs with experimentally induced bladder infection by *Escherichia coli* and *Proteus mirabilis* respectively and the findings of pyelonephritis were proved histopathologically in the dogs with UTI and VUR afterwards. Börkür et al. (2) studied in middle aged dogs that glomerulonephritis, interstitial nephritis, nephrotic changes, and hydronephrosis were diagnosed with the presenting symptoms of renal failure at clinical and laboratory findings. The purpose of this study was to determine the incidence of VUR which may be seen in apparently normal puppies using the urethrocytographic techniques of “normal urination pressure” and “water pressure” in the diagnosis.

Materials and Methods

Two and a half to three months of age mixed breed 50 dogs, 25 male and 25 female, were used in this study. All puppies were referred to the department of internal medicine, faculty of veterinary medicine, Ankara University for general health control during 2000 and 2001. Clinical examinations were carried out and rectal temperatures were recorded before radiographic examinations. Each dog was administered gentamycin (gentamycin sulfate, 2 mg/kg i.m., Genta ampul 20 mg, İ. E. Ulagay) 2-3 hours before radiographic examination. A vaginal speculum and an illuminator were used to place the catheter through urethra in female dogs after sterilizing all equipments for each time. Before radiographies, bladders were catheterized with a catheter (Dog catheter, Veterinary Product of Protex Ltd.) through urethra and whole urine was filled out. The radio opaque contrast medium was diluted 10 % solution in saline (Urografin % 76, Diatrizoate sodium, Diatrizoate meglumine, Schering). 30-50 ml contrast medium was given based on the body weight of dogs by using catheter

which was placed in the bladder through urethra for “normal urination pressure” technique called as voiding pressure. The catheter was pulled out and dogs then released for voluntarily urination. Just after the urination, abdominal radiographies (Shimadzu, MD100P) were taken latero-laterally and ventro-dorsally. Vesicoureteral reflux was recorded if the radio opaque medium reaches the ureters and renal pelvis for normal urination technique. Three days after this application, dogs were undergone additional radiographic examination for “30 cm of water pressure” technique. This technique was used when the dog was lying on the lateral recumbency position. A regular hose of serum set was attached to the tip of the catheter which was placed in the bladder. This was then attached to the bottle of the contrast medium to provide 30 cm height from the level of pubic pelvis. A concentration of 10 % contrast medium was given to the bladders by dropping continuously in speed of 100 drop per minute until the dropping was stopped. Radiographies were taken latero-laterally and ventro-dorsally after the 30 cm pressure was fixed in bladders and voiding urine was observed around the catheter. Vesicoureteral reflux was diagnosed if the radio opaque medium reaches the ureters and renal pelvis in the dogs for water pressure technique. Findings were assessed as percentage to find out the incidence of VUR and to compare groups. The differences of rectal temperatures of puppies with VUR and puppies without VUR were sought by a One-Way ANOVA with repeated measures design and if indicated by a significant F-statistic, differences in specific means were sought by a Tukey’s post hoc test requiring a $p < 0.05$ for significance.

Results

All puppies were in normal clinical appearance. The mean of rectal temperatures in the puppies with VUR was 38.43 ± 0.17 °C and the mean of rectal temperatures in the puppies without VUR was 38.26 ± 0.19 °C. Rectal temperatures of puppies with VUR and puppies without VUR were not different from each other statistically ($p = 0.069$). Approximately 15-30 ml urine was pulled out from the bladders of dogs by catheterization.

Bilateral VUR was diagnosed in 32 puppies out of 50 (64 %) by the technique of normal urination (Figure 1), and in 34 puppies out of 50 (68 %) by the technique of water pressure (Figure 2,3). Those 32 puppies in normal urination pressure group were detected as the same of 34 puppies in water pressure group. Additionally, unilateral VUR was diagnosed in 3 puppies (6 %) by both techniques (Figure 4,5). The contrast medium left in the bladder in any of the rest of 13 dogs and it did not reach either to the ureters or renal pelvis.

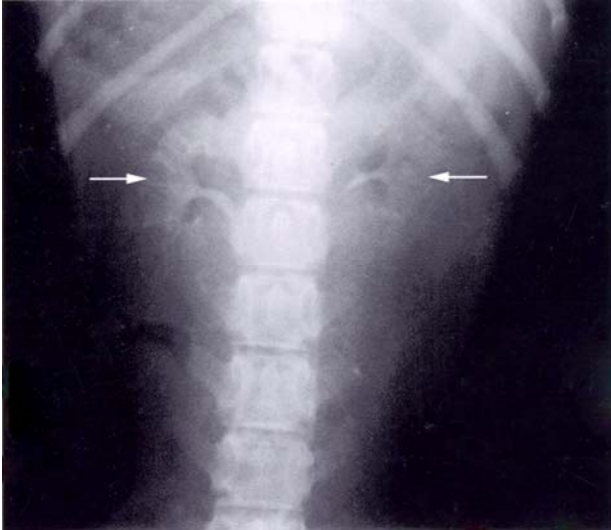


Figure 1. Radiographic appearance of bilateral VUR in a puppy at the normal urination pressure, ventro-dorsal view.

Şekil 1. Normal ürünasyon basıncı uygulanan bir köpekte bilateral VUR'un radyografik görünümü, ventro-dorsal görünüm.

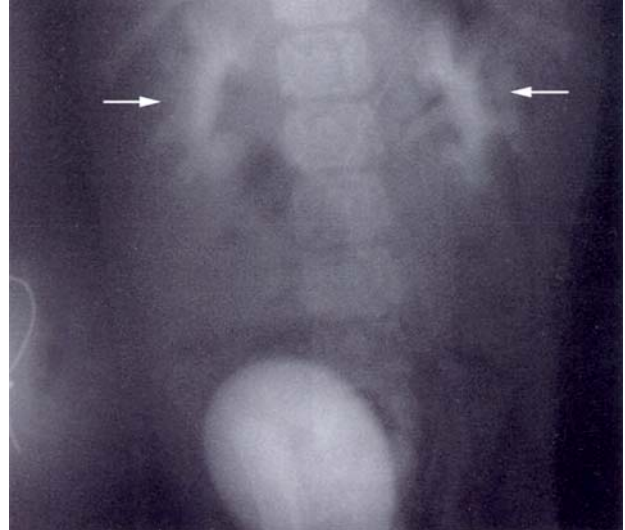


Figure 2. Radiographic appearance of bilateral VUR in a puppy at the water pressure, ventro-dorsal view.

Şekil 2. Su basıncı uygulanan bir köpekte bilateral VUR'un radyografik görünümü, ventro-dorsal görünüm.

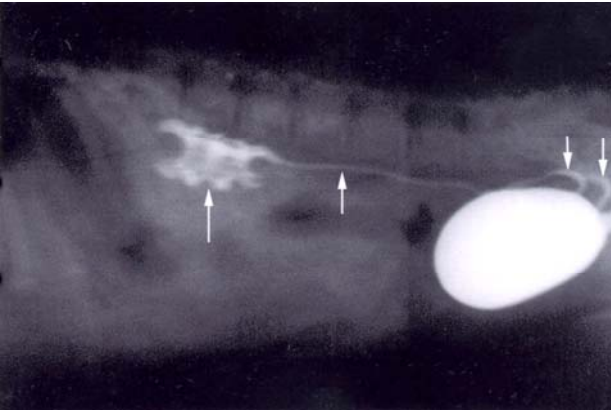


Figure 3. Radiographic appearance of bilateral VUR in a puppy at the water pressure, latero-lateral view.

Şekil 3. Su basıncı uygulanan bir köpekte bilateral VUR'un görünümü, latero-lateral görünüm.



Figure 4. Radiographic appearance of unilateral VUR in a puppy at the normal urination pressure, ventro-dorsal view.

Şekil 4. Normal ürünasyon basıncı uygulanan bir köpekte unilateral VUR'un görünümü, ventro-dorsal görünüm.

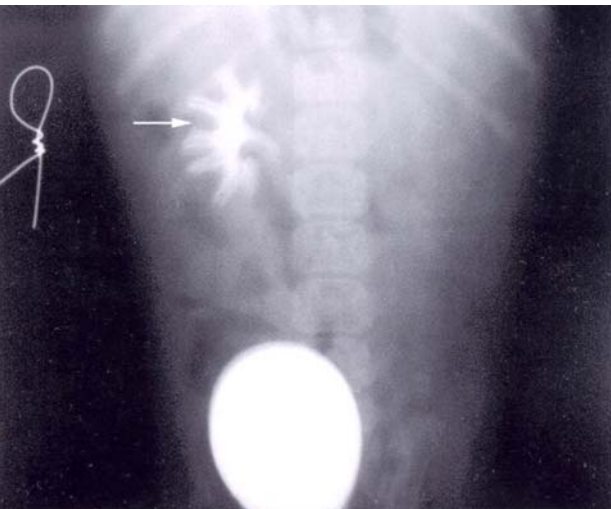


Figure 5. Radiographic appearance of unilateral VUR in a puppy at the water pressure, ventro-dorsal view.

Şekil 5. Su basıncı uygulanan bir köpekte unilateral VUR'un görünümü, ventro-dorsal görünüm.

In the 30 cm water pressure group with VUR, 20 dogs were female out of 34 (58.82 %) and 14 were male (41.18 %). In the normal urination group with VUR, 18 were female out of 32 (56.25 %) and 14 were male (43.75). In the dogs with unilateral VUR, 2 were male and 1 was female.

Discussion

The incidence of VUR is varying from puppies to adults in dogs. VUR was detected in 79 % of puppies, 27 % of adults and 10 % of old dogs (4). 1-5 % of children have VUR, which is the most common urological anomaly in children (17). Undiagnosed of VUR or untreated urodynamic problems may imperil the efficacy of medical treatment and surgical correction in man and

dogs (5,14,19). Vesicoureteral reflux is much more common in puppies and the incidence of VUR in dogs is also varying from puppies to adults. Bilateral VUR in this study was diagnosed in 64 % of puppies by the technique of normal urination, and in 68 % of puppies by the technique of water pressure. Additionally, unilateral VUR was diagnosed in 6 % of puppies by both techniques.

Chand et al. (6) reviewed if the incidence and grade of VUR differs in children based on age and gender presenting for evaluation after UTI in 15,504 patients and VUR was detected commonly in children younger than 7 years old and females were presented twice times VUR than male ones. Nakai et al. (9) found retrospectively in 356 infants with VUR that 204 cases were bilateral (57%) and 152 were unilateral (43%). In 85% of infants presenting symptom was febrile urinary tract infection. Transient febrile in children is a frequent sign for VUR with no additional clinical findings. However, high rectal temperature in puppies with VUR has not been detected. Rectal temperatures of the puppies with VUR in this study were not different comparing to the puppies without VUR statistically. Still, the mean of rectal temperatures in the puppies with VUR was 38.43 ± 0.17 °C and in the puppies without VUR was 38.26 ± 0.19 °C. It is clearly seen that the puppies with VUR have a higher temperature than the normal ones without having statistical significance ($p = 0.069$).

Radiographs were taken after the 30 cm water was fixed for "water pressure technique" in bladders and voiding urine was observed meaning receptors in the bladder wall were stimulated and contraction of detrusor muscles caused urine to be expelled around the catheter (4,7,8). Actually, this technique is very close to "normal urination technique" because detrusor muscles contraction at the normal voiding urination.

In this study, all detected VUR were graded as II degree according to international reflux committee's gradation system. This was probably related to the young age of dogs. Three months of age is early to develop abnormality at ureters, renal pelvis and calices renalis. It is detected in this study that VUR in 3-month-old puppies has primary reflux. Medical or chirurgical correction is applied to correct VUR presently. While permanent primary VUR can be correct by operation, treatment for transient primary refluks in puppies is not recommended because of common prevalence and potential disappearance in time. It is recommended for medical prevention in primary VUR in puppies and children that urine should be cultured in every six month of age and antibiotics should be administered if infection exist (10,18,20).

In conclusion, incidence of bilateral VUR was found in 64-68 % and unilateral VUR was in 6 % of the puppies. In the 30 cm water pressure group with VUR, 58.82 % of the puppies were female and 41.18 % of them were male. In the normal urination group with VUR, 56.25 % of the puppies were female and 43.75 % of them were male.

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