Original Research

Radiographic and Ultrasonographic Evaluation of the Urinary System Disorders in 14 Numbers of Dog

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Abstract

The present investigation was carried out to describe the complementary use of radiography and ultrasonography in the diagnosis of various urinary system disorders in dog to study the radiographic and ultrasonographic appearances of the organs. The study materials were composed of 14 dogs of different breed, age and sex having urinary system disorders. The urethral calculi were diagnosed in 5 male dogs with plain radiography. Cystic calculi could be diagnosed in 3 dogs and both radiography and ultrasonography were found equally good. Cystitis in 2 dogs could be confirmed with ultrasonography. Renal cyst in two dogs and tumour in the urinary bladder of another two dogs could be diagnosed with ultrasonography.

Key words: Calculi, Cystitis, Radiography, Renal Cyst, Ultrasonography

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Introduction

Radiography is a fascinating aspect of veterinary medicine. It literally offers insight into the internal hidden structures of an animal's body (Gillette *et al.*, 1977). It is useful for diagnosis of affections causing anatomical changes to the organs or body parts and thereby providing an abnormal image on a radiograph. However, lack of contrast between various organs limits its precision, which can be overcome by use of contrast agents that may further enhance visualization and provide with additional information regarding the functional status of some organs. Diagnostic ultrasound is an imaging modality which is useful in diagnosis of affections of internal organs. Ultrasonography provides instant information about a wide range of body systems, the dynamic functions of organs, basic living anatomy and various physiological

processes. Ultrasonography is a simple non-invasive technique helpful in early efficient diagnosis of presence of both radiopaque and radiolucent calculi in urinary system. But ultrasonographic features of any urinary disease are not very specific and therefore ultra-sonography is complementary to uro-radiography (Verma *et al.*, 2006). It determines the normal or abnormal size, shape, location, architecture and constituency of the internal organs. However, no imaging modality is complete in itself, but a planned use of various imaging techniques will enable treatment to be undertaken at an earlier stage with the potential for increased survival. Radiolucent calculi can be detected by double contrast cystogram but has limited application in critically ill patients (Bovee *et al.*, 1985). Urinary affections are common in dogs and a quite good numbers of clinical cases with such problems are presented to the Teaching Veterinary Clinical Complex, College of Veterinary Science, Khanapara, Assam Agricultural University for treatment. Appropriate diagnosis of various diseases of the urinary system is utmost necessary in providing early accurate treatment.

Materials and Methods

Plain radiography was carried out by using a Type-ME 0610M (Tech-60, KV-100) X-ray machine. The radiographic factors were determined depending on the size of the animal with kilo-voltage-potential (KVP) ranging from 45-65 and mili-amperage (mA) ranging from 10-15 and within 0.25-0.5 seconds at a constant focal spot film distance of 90 cm whereas ultrasonography was carried out using a veterinary scanner (Medison, SA 600V) with a multi frequency micro-convex transducer of 2.5-4.5 MHz capacity. The images were recorded in thermographic printing paper of UPP-110 S series with UP-895 MDW Sony Video Graphic Printer.

Results and Discussion

In case of five numbers of male dog having urethral calculi, plain radiography revealed a chain of radiopaque calculi of varying numbers in the urethra from the ischial arch to the base of the os-penis (Fig.1).

Fig. 1: Plain lateral radiograph showing chain of calculi inside the urethra

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Saini *et al.* (2000) reported a chain of stones in the urethra behind the os-penis upon plain radiography. The small calculi obstructing the urethra at the base of the os-penis could not be distinguished ultrasonographically from the image of the os penis. Kundu and Ghosh (2006) stated that urethral obstruction at the level of os-penis could not be diagnosed on ultrasonography due to presence of bone in the os-penis which reflected the echo. Krishnamurthy *et al.* (1997) reported the presence of a single irregular shaped stone in the urethra, caudal to the os-penis. Mirakhur *et al.* (1997) also reported a case of bilateral nephroliths and a calculus behind the os penis in a 4-5 years old male dog. Plain radiographic examination of the abdomen revealed large sized nephroliths in both the kidneys and a calculus behind the os penis.

During the present study, plain lateral radiographs clearly revealed radiopaque calculi of varying sizes and numbers in the urinary bladder (Fig. 2). Wakankar *et al.* (1993), Makkena *et al.* (1999) and Saini *et al.* (2000) could also radiographically visualize cystic calculi. In cystic calculi, ultrasonography revealed as hyperechoic structures inside the anechoic urine with strong distal acoustic shadows (Fig. 3). Presence of multiple small calculi was evident with multiple hyperechoic shadows of small sizes. These findings were in accordance with Kundu and Ghosh (2000) and Verma *et al.* (2006). Nyland *et al.* (1995) stated that the acoustic shadowing from cystic calculi occurs due to complete reflection of the sound waves.

Fig. 2: Radiopaque calculi inside the urinary bladder in a plain radiography

Fig. 3: Ultrasonographic image of hyperechoic cystic calculi with distal acoustic shadow

In case of cystitis, ultrasonography showed a double layered thickened appearance of the urinary bladder wall (Fig. 4) with a small amount of cellular debris indicating cystitis, whereas plain radiography failed to give a proper image of the urinary bladder. Singh *et al.* (2008) also reported similar findings in ultrasonographic study on the urinary bladder of dogs with cystitis and observed that there were severe thickening of the urinary bladder wall with thickness varied from 3-7.3 mm at moderate degree of distension of the urinary bladder. Kundu and Ghosh (2000) also stated the shape, size and location of the bladder in cystitis to be normal but the bladder wall was thickened, hyperechoic with more corrugation of uro-epithelium and presence of more hyperechoic cellular cast in lumen due to microbial activity.

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Fig. 4: Ultrasonographic image of urinary bladder in cystitis with double layered thickened wall

Presence of renal cyst in the dogs were evident with anechoic areas during ultrasonography. O'leary *et al.* (1999) reported that renal ultrasonography was the preferred method of diagnosis for polycystic kidney disease in Bull Terriers because of its high sensitivity, specificity and non-invasiveness. Ultrasonographically, cysts appeared as smooth, round, focal anechoic structures with sharply marginated walls. In case of tumour in the urinary bladder, ultrasonography of the urinary bladder revealed a lot of soft tissue masses of irregular shape and one hyperechoic mass with distinct shadow at the neck of the urinary bladder. Caswell (2011) also reported that abdominal ultrasound revealed a knobby hyperechoic mass in the trigone area of the urinary bladder of a 14 years old dog which was confirmed to be an invasive transitional cell carcinoma by histopathology following euthanasia.

The study was conducted to find out a suitable diagnostic procedure or a combination of procedures for early and accurate diagnosis of urinary system disorders in canine. Out of 14 clinical cases of urinary system disorders urethral calculi (n=5), cystic calculi (n=3), cystitis (n=2), renal cyst (n=2) and tumour in urinary bladder (n=2) were recorded. The male dogs suffered from urethral calculi of different sizes were found mostly in the pre-scrotal urethra up to the base of the os-penis. Urethral calculi could not be detected on ultrasonography as the detection of small calculi especially at the os-penis was difficult. The dogs having cystic calculi had radiographic shadows of calculi inside the urinary bladder on plain radiograph and confirmed the presence of cystic calculi inside the urinary bladder. Presence of large cystic calculi could be confirmed sonographically from the findings of one large hyperechoic mass inside the anechoic urine with strong distal acoustic shadows. The dogs having cystitis, the wall of the urinary bladder was found to be a thickened during ultrasonography indicated inflammation. In ultrasonography, the dogs having renal cyst was evident with anechoic areas with non-homogenous echotechture of the renal cortex with dilated anechoic medulary spaces in the kidney. The dogs affected with tumour in urinary bladder, ultrasonography of the urinary bladder revealed a lot of soft tissue masses of irregular shape and one hyperechoic mass with distinct shadow at the neck of the urinary bladder.

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Conclusion

From the above study it can be concluded that presence of radiopaque calculi in the urethra could be diagnosed accurately with plain radiography whereas ultrasonography and radiography were found to be equally accurate for diagnosis of cystic calculi. Ultrasonography was found to be the best for diagnosis of cystitis and renal cyst.

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