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ULTRASONOGRAPHIC DIAGNOSIS OF OBSTRUCTIVE UROLITHIASIS IN CATTLE AND BUFFALO

(With One Table and 10 Figures)

By

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تخطيط الصدى لتشخيص التحصر البولى الأنسدادى فى الأبقار والجاموس

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تهدف هذة الدراسة الي تقييم دور الموجات فوق الصوتية في تسخيص حالات انسداد مجري السبول والمثانة فى الابقار والجاموس. اجريت الدراسة على عدد ٣٠ حيوان غير مخصى (١٩ ابقار و ١١ جاموس) تعاني من انسداد مجرى البول بالحصاوي. وقد تم تسجيل التاريخ المرضى والاعراض الاكلينيكية لكل حالة. تم التأكد من التشخيص عن طريق اجراءالفحص الأشعاعى والفحص بتخطيط الصدى. امكن باستخدام تخطيط الصدى رؤية نبض مجرى البول والتمدد فية نتيجة الانسداد كذلك التغير في سمك جدار مجرى البول امام مكان الأنسداد اضافة الى التغير الحادث فى سمك جدار المثانة ووجود ترسيبات بالبول فى حالات التهابات المثانة. كذلك أمكن بأستخدام تخطيط الصدى تشخيص ١٩ حالة التهاب المثانة، ١٢ حالة انفجار المثانة وفى أربعة من هذة الحالات امكن رؤية مكان الانفجار وامكن رؤية وجود سوائل فى البطن فى ٢٠ حالة وفى ٨ حالات كان انفجار المثانة قد ألتأم زاتيا.

SUMMARY

The present study aimed to evaluate the efficacy of ultrasound in diagnosis of obstructive urolithiasis and rupture of the urinary bladder in cattle and buffalo. The study was carried out on 30 non castrated cattle and buffaloes males (19 cattle and 11 buffaloes), suffering from obstructive urolithiasis. Case history and clinical signs were recorded. Diagnosis was confirmed by radiography and surgery. Ultrasonographic examination showed urethral pulsation and urethral dilatation in front of the seat of obstruction as well as the changes in the wall thickness of the urinary bladder and urethra due to rupture, inflammation or obstruction. Ultrasound allowed diagnosis of cystitis in 19 cases, where the bladder wall was thickened, and the urine was turbid. Ruptured urinary bladder

was visible in 12 cases. The site of the rupture in the urinary bladder was visible in 4 cases. Free abdominal fluid due to rupture of the urinary bladder was visible in 20 cases. In 8 of these cases, the urinary bladder healed spontaneously after rupture and was intact and distended with urine during the ultrasound examination.

Key words: *Cattle, Buffalo, ultrasonography, obstructive urolithiasis*

INTRODUCTION

Urolithiasis is a common affection in cattle and buffalo, which leads to urinary blockage (Tantawy 1985, Payne 1989, Radostitis *et al.,* 2000, Loretti *et al.,* 2003, Misk and Semieka 2003). Urolithiasis appears to affect both sexes, but urinary blockage is an important problem mainly in males. Urinary calculi formation usually results from a combination of physiologic, nutritional and managemental factors. It is mainly attributed to excessive or unbalanced intake of minerals (Larson 1996, Lotfia *et al.,* 1999, Radostitis *et al.,* 2000).

Clinical symptoms of urinary tract obstruction may be associated with partial or complete urethral occlusion. Animals suffering from partial obstruction dribble blood-tinged urine after prolonged, painful attempts of urination. With complete obstruction, animals exhibit tenesmus, tail twitching, weight shifting, colic, inappetence, depression, and urethral pulsation ventral to the anus. The common sequela of the complete urethral obstruction is the rupture of the urinary bladder and/or the urethra resulting in death of the animal due to uremia in 5 to 7 days (Radostitis *et al.,* 2000, Loretti *et al.,* 2003).

Diagnosis of urolithiasis and rupture of the urinary bladder and urethra in cattle, sheep and goat is based mainly on the clinical symptoms, and increase in the peritoneal concentration of createnine 1.5 - 2 times than in serum. Systemic injection of dye that is eliminated by the kidneys, injection of dye into the urinary bladder followed by recovery in peritoneal fluid and injection of air in the urinary bladder during assaulting the abdomen (Cartee *et al.,* 1980) are concerned to be additional tools for diagnosis.

Imaging techniques as plain and contrast radiography are usually used in evaluation of the urinary tract lesions in dogs, cats, small and large ruminants and swine (Palmer *et al.,* 1998, Misk and Semeika 2003, Kyles *et al.,* 2005). In small animals, ultrasound examination was successfully used in diagnosis of many urinary disorders as patent

urachus, urachal sinus, cystitis, urolithiasis, tumors, and rupture of the urinary bladder (Cartee *et al.*, 1980, Le'veille' 1998, Kyles *et al.*, 2005). In ruminants, ultrasound was used in examination of the upper urinary tract as the kidney blood flow and renal function in cows (Braun 1993, Loretti *et al.*, 2003), as well as in diagnosis of urethral dilatation in calf (Geccelep and Alkan 2000).

This study aimed to evaluate the efficacy of ultrasound examination in diagnosis of urolithiasis and urinary bladder rupture in cattle and buffaloes.

MATERIALS and METHODS

The present study was carried out on 30 non castrated male animals, (19 cattle and 11 buffaloes) with age ranging from 2.5 – 18 months. The animals were submitted to the Veterinary Teaching Hospital of Assiut University with a complaint of partial or complete urine retention for a period ranging from 1- 25 days. Thirteen animals suffered from partial obstruction (9 cattle & 4 buffaloes), dribbled blood-tinged urine after prolonged painful attempts to urinate. Seventeen animals were presented with complete urethral obstruction (10 cattle & 7 buffaloes). Five of theses animals showed tenesmus, raising the tail, depression and urethral pulsation ventral to the anus. In the other 12 animals, there were no signs of colic at time of presentation but they showed ventral distention of the abdomen and anorexia. Abdominal paracentesis was made in these cases.

Plain, latero-lateral radiographic examination of the urinary bladder and the pelvic urethra was done for all cases; the animals were laid in lateral recumbency with the uppermost hind limb pulled forward. Sedation of the animals before radiography was not needed.

Ultrasound examination for the urinary bladder and the urethra was done using a real time, B-mode diagnostic ultrasound scanner (Pie-Data Medical Company, Maastricht, The Netherlands, 100 LC) equipped with linear array 6/8 MHz transducer. Transrectal examination of the urinary bladder and the urethra was done for all presented cases in standing position without sedation. The penile urethra was examined percutaneously. In the perineal and prescrotal areas copious amount of gel was needed to allow easier examination of the urethra. Diagnosis was confirmed with urethrostomy and laparotomy. The size and shape of the obtained stones were recorded.

RESULTS

Diagnosis of urolithiasis with or without rupture of the urinary bladder was based on the history, clinical signs, physical examination, radiography and ultrasound examinations. Clinical signs varied according to the duration and degree of obstruction, and the general health condition of the animal. Physical examination by palpation of the penile urethra allowed detection of the site of obstruction in the urethra in 12 cattle but not in buffalo due to the relative smaller size of the calculi in buffaloes.

Transrectal palpation could not be performed in 20 of the examined animals. The age of these animals ranged from 2.5 – 9 months. In all cases that did not suffer from ruptured bladder, urethral pulsation was felt under the anus. In cases of ruptured urinary bladder, abdominal paracentesis revealed clear yellowish fluid, which was identified by its odour as urine.

The seat of obstruction with the calculi in all cases was at the distal part of the sigmoid flexure in both animal species. In 15 examined cattle bulls, the calculus was single and pea size (Fig. 1). However, in buffaloes they were small, and multiple grapes-like sandy calculi.

Radiography was helpful in diagnosis of urethral obstruction with urethral calculi especially in cattle as the size of the urethral calculus was bigger than that in buffaloes. In 8 of the examined cases (3 cattle and 5 buffaloes), radiographic examination was not diagnostic for the presence of urethral calculi which was detected by ultrasound examination and during surgery.

In ultrasonographic examination, urethral pulsation and urethral dilatation in front of the seat of obstruction as well as the changes in the wall thickness of the urinary bladder and urethra due to rupture, inflammation or obstruction were easily seen in all cases.

The body and neck of the urinary bladder and the pelvic urethra were easily examined via transrectal ultrasound examination. The penile urethra was examined percutaneously and was difficult to be examined at the level of the sigmoid flexure caudal to the scrotum especially in fattened animals. The diameter and the wall thickness of the urinary bladder and the urethra could be measured. Cystitis was diagnosed in 19 cases, in which the wall of the bladder was thickened, and the urine was turbid (Fig. 2). Rupture of the urinary bladder was diagnosed in 12 cases (Fig. 3 & 4).

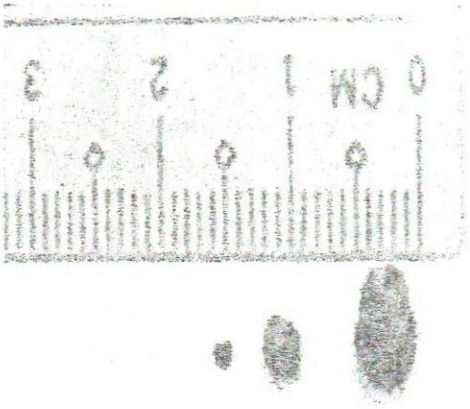
The site of rupture in the urinary bladder was visible in 4 cases using ultrasound examination. Free abdominal fluid due to rupture of the urinary bladder was visible in ultrasound examination in 20 cases (Fig. 3& 4). In 8 of these cases, the urinary bladder was intact and distended with urine.

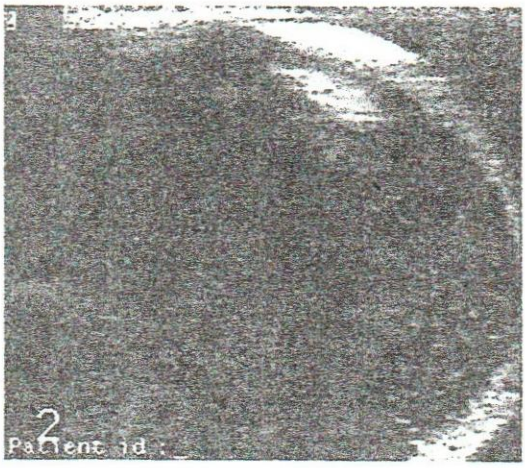
In two cases suffered from complete urine retention, radiographic examination was not diagnostic. However, ultrasonographic examination of the urinary bladder and the urethra in these two cases showed thickening in the wall of the urinary bladder and the urethra, in addition to obstruction of the pelvic urethra. This was reflected by the presence of tissue density in the lumen of the urethra and narrowing of the urethral lumen (Fig. 5 & 6). The owners of these cases reported that the animals showed for one week before presentation blood drops in the urine. During surgery of these cases the urethral lumen was dark red in colour and was filled with tissue debris (Table 1).

The stones visible via ultrasound in cattle were single, pea sized stones; 0.5- 1.5 cm in length (Fig. 7& 8), while in buffalo they were small, multiple and grapes like stones (Fig. 9). These findings were confirmed during surgery. The urethral lumen was widened before the site of obstruction and narrowed behind it (Fig. 10), the urethral pulsation due to the obstruction was also visible during the ultrasound examination.

Table 1: Affections diagnosed by ultrasonographic examination

Animal	Cystitis	Ruptured urinary bladder	urethritis	urolithiasis
Cattle	10	8	2	21
Buffalo	9	4	----	8
Total	19	12	2	29

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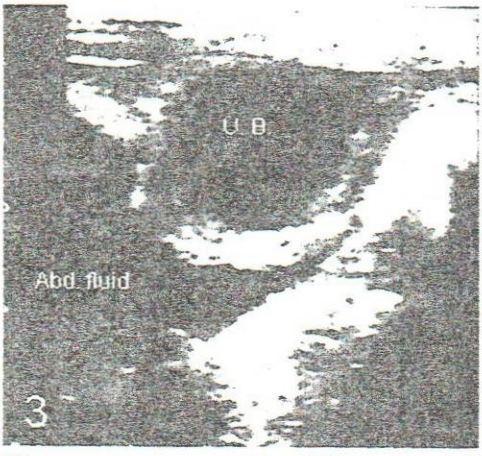
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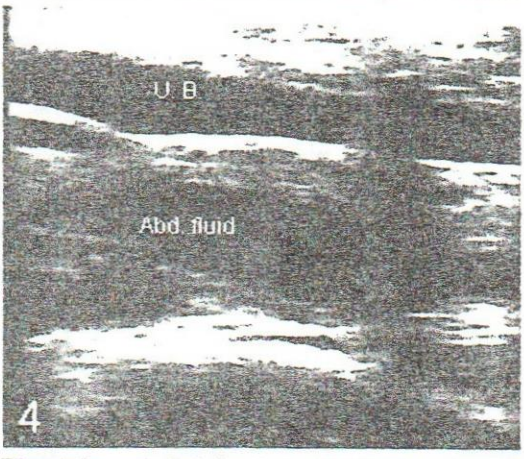
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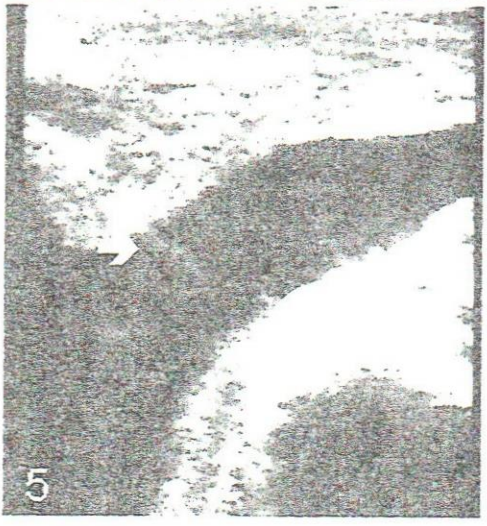
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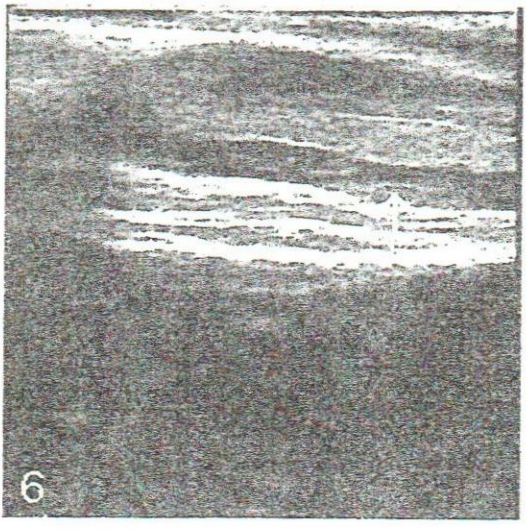
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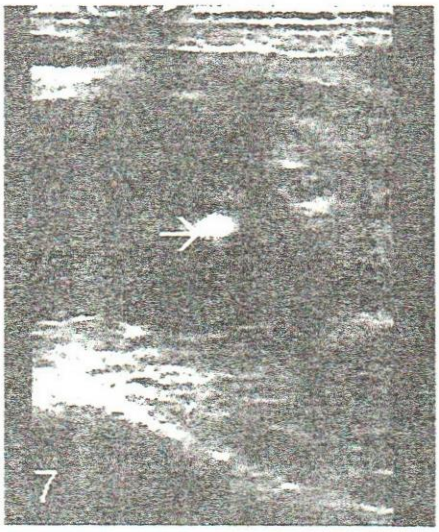
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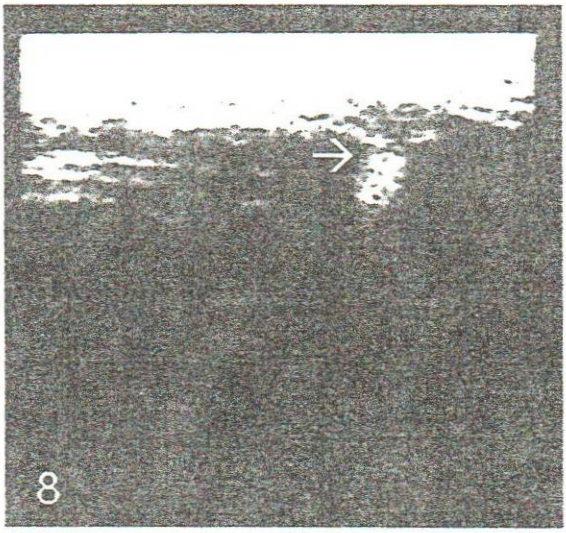
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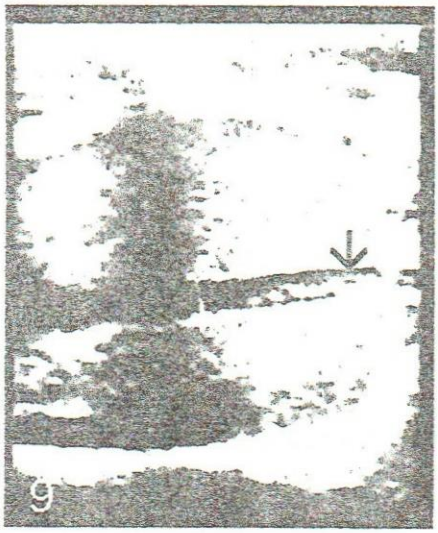
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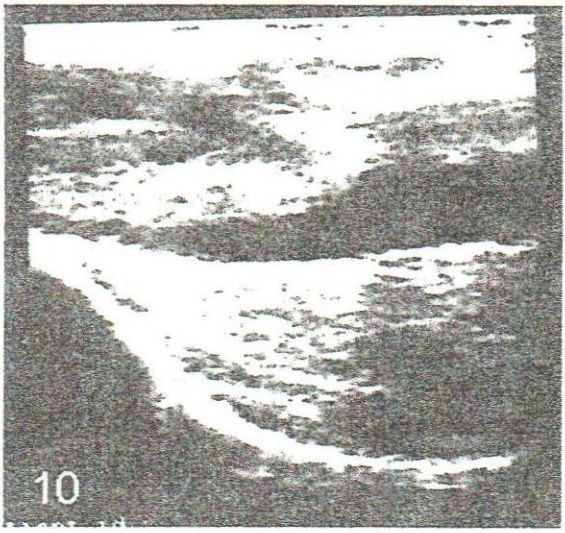
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LEGENDS OF FIGURES

Fig. 1: Shape of stones collected from the urethra of cattle

Fig. 2: Show turbidity of urine and thickening in the wall of the urinary bladder

Fig. 3&4: Rupture of the urinary bladder, with free abdominal fluid, in fig. (3) The urinary bladder appeared slightly distended, in fig. (4) It appeared completely empty and flattened

Fig. 5: Tissue density in the lumen of the neck of the urinary bladder and the pelvic urethra (white arrow)

Fig. 6: Narrowing of the urethral lumen with presence of tissue density inside the lumen of the penile urethra (white arrow)

Fig. 7& 8: The shape of the stones visible via ultrasound in cattle (pea size, single, rounded or pedunculated) (white arrow)

Fig. 9: The shape of the stones visible via ultrasound in buffalo (grapes like small sandy stones) (black arrow)

Fig. 10: Narrowing of the urethra behind the site of obstruction and widening of the lumen before the site of obstruction

DISCUSSION

Urolithiasis is an important disease throughout the world. It is more common in feeder animals but is also seen in mature breeding animals; and is often seen during winter in steers or on range during severe weather condition with limited water intake (Cartee *et al.* 1980, Walker and Vaughan 1980). In the present study the majority of animals presented were young (2.5- 18 months). It was reported that the disease affect both sexes, but obstructive urolithiasis occurs primary in males due to the anatomical differences (Hooper and Tylor 1995, Larson 1996). Castration was thought to be a predisposing cause of the disease in male animals by removing hormonal influences necessary for mature development of the penis and urethra (Khamis and Saleh 1970, Gohar 1978, Monoghan and Boy 1990, Larson 1996). This was in contrary to the present results as all examined cases were non-castrated males, but these findings were in accordance with those observed by Misk and Semeika (2003).

Diagnosis of urolithiasis in ruminants depends mainly on a history of anurea, clinical symptoms and physical examination (Radostitis *et al.* 2000 and Loretti *et al.* 2003). Rectal palpation and urethral pulsation were usually used for differential diagnosis between

cases of urethral obstruction with or without bladder rupture (Cartee *et al.*, 1980, Walker and Vaughan 1980, Misk and Semeika 2003). However, in the present study rectal palpation was not available in 18 cases because the animals were too young (2.5- 9 months). However, urethral pulsation ventral to the anus was seen in cases where the urinary bladder was not ruptured.

In contrast to Misk and Semeika (2003), that found that radiography is a highly diagnostic method in cases of urethral obstruction, Tyagi and Singh (1996) stated that attempts to locate calculi by radiographic examination is not successful. In our study, radiography failed in diagnosis of urolithiasis in 8 cases (6 buffaloes and 2 cattle).

Ultrasound offers a non invasive method for diagnosis of urolithiasis, localization of the urethral calculi, as well as diagnosis of dilated urethra, cystitis, urethritis and rupture of the urethra or the urinary bladder (Braun 1993). In the contrary to radiography, ultrasound does not involve the use of ionizing radiation as in radiography. Therefore, it is safe for the patient and operator. It is not necessary to leave the room during investigation as the case with radiography and animals can be reassured and/or restrained during the examination (Cartee *et al.*, 1980).

Braun (1993) mentioned that it is rarely necessary to anaesthetize animals for ultrasound examination. The findings of the present study match the previous suggestions because ultrasound examination was done for all cases with the animals in standing position and without sedation. Ultrasound measurements of the wall thickness of the urinary bladder and urethra has been claimed to be useful as a method of determining the increase in the wall thickness in cases of cystitis and urethritis (Braun 1993, Hoque *et al.*, 2002). In this study ultrasound examination was helpful in measuring the thickness of the urinary bladder and urethral wall in one case of cystitis and urethritis.

In contrary to our results, rupture of the urethra due to urolithiasis was reported to be more common than rupture of the urinary bladder (Walker and Vaughan 1980, Hoque *et al.*, 2002). In the present study, rupture of the urethra was diagnosed only in one case. The rupture of the urinary bladder is usually diagnosed by abdominocentesis (Cartee *et al.*, 1980, Walker and Hull 1984). However, in the present study abdominocentesis was not diagnostic for the rupture of the urinary bladder as in many cases where free abdominal fluid was visible via ultrasound examination; the urinary bladder was seen to be intact. This is of importance in decision making of laparotomy as the urinary bladder

in ruminants usually seal with fibrin or omentum in 3 to 5 days after rupture if it kept empty (Walker and Hull 1984). The site of rupture of the urinary bladder was not always visible via ultrasound, it could be determined only in four cases.

In conclusion ultrasound examination was found to be a non invasive diagnostic technique for cases of urolithiasis and rupture of the urinary bladder, as well as in diagnosis of lower urinary tract inflammatory conditions as cyctitis, and urethritis. Ultrasonography can be successfully used as an aid diagnostic technique with radiography for diagnosis of cases of urine retention due to obstructive lesions as it allows better examination of the urinary bladder and the urethra.

REFRENCES

Braun, U. (1993): Ultrasonographic examination of the left kidney, the urinary bladder, and the urethra in cows. Zentralblatt Vet. Med. 40, (1): 1-9.

Cartee, R.E.; Selcer, B.A. and Patton, C.S. (1980): Ultrasonographic diagnosis of renal disease in small animals, J. Am. Vet. Med. Assoc. 176, (5): 426-30.

Gohar, H.M. (1978): Experimental studies on some factors leading to formation of urinary calculi in sheep and goats Ph.D. Thesis; Fac. Vet. Med., Cairo University.

Geccelep, M. and Alkan, I. (2000): Congenital dilatation in a male montaphon calf, Israel Vet. Med. J.; 55, (1): 243-246.

Hooper, R.N. and Taylor, T.S. (1995): Urinary surgery, Vet. Clinic of North America, Food animal practice; 11, (1): 403-409.

Hoque, M.R.; Somvanshi, G.R. and Singh, I.V. (2002): Ultrasonographic evaluation of urinary bladder in normal, fern fed and enzootic bovine haematuria-affected cattle, J. Vet. Med. Pathol. Clin. Med.; 49, (8): 403-407.

Khamis, Y. and Saleh, M. (1970): Urolithiasis syndrome in ruminants. Egypt Vet. Med. J. 18: 242-248.

Kyles, A.E.; Hardie, E.M.; Wooden, B.G.; Adin, C.A.; Stone, E.A.; Gregory, C.R.; Mathews, K.G.; Cowgill, L.D.; Vaden, S.; Nyland, T.G. and Ling, G.V. (2005): Clinical, clinicopathologic, radiographic, and ultrasonographic abnormalities in cats with urethral calculi 163 cases (1984-2002), J. Am. Vet. Med. Assoc.; 15, (6), 932-936.

Larson, B.L. (1996): Identifying, treating, and preventing of bovine urolithiasis. Vet. Med.; (91), 366-377

Le'veille', R. (1998): Ultrasonography of urinary bladder disorders, The Vet. Clinics of North America, small animal practice; 28, (4): 799-802

Loretti, P.A.; de Oliveria, L.O.; Cruz C.F. and Driemier, D. (2003): Clinical and pathological study of an outbreak of obstructive urolithiasis in feedlot cattle in south Brazil, Pesq. Vet. Bras.; 23, (2): 233-236

Lotfia, S.F.; Khamis, Y.; Hegazy, A.A.; Gohar, H.M. and Shamaa, A.A. (1999): Effect of high dietary levels of calcium, phosphorus and magnesium on urolithiasis in sheep. J. of Egyptian Vet. Med. Assoc.; 59: 213-218

Misk, N.A. and Semieka, M.A. (2003): Clinical studies on obstructive urolithiasis in male cattle and buffaloes, Assiut Vet. Med. J.; 49, (97): 258-274

Monoghan, M.L. and Boy, M.G. (1990): Ruminant renal system, In Large Animal Internal Medicine. St. Louis, CV Mosby; 888-890.

Palmer, J.L.; Dykes, N.L.; Love, K. and Fubini, S.L. (1998): Contrast radiography of the lower urinary tract in the management of obstructive urolithiasis in small ruminants and swine. Vet. Radiol. Ultrasound; 39, (3): 175-180.

Payne, J.M. (1989): Metabolic and nutritional diseases in cattle. Blackwell, Oxford; 41-44

Radostitis, O.M.; Blood, D.C.; Gay, C.C. and Hinchey, K.W. (2000): Veterinary Medicine a textbook of the diseases of cattle, sheep, pig, goat and horse. Bailliere Tindall, London, 1877

Tantawy, M. (1985): A urethral calculus in a steer. Assiut Vet. Med. J.; 14, (27): 203-206

Tyagi, R.P. and Singh, J. (1996): Ruminant surgery. A textbook of surgical diseases of Cattle, Buffaloes, Camel, Sheep and Goat. CBS Publishers and Distributors; 263-271

Walker, D.F. and Vaughan, J.T. (1980): Bovine and equine urogenital surgery; 59-66 Philadelphia, Lea& Febiger)

Walker, D.F. and Hull, B.L. (1984): Urinary system surgery. In: Jennings PB (eds): The practice of large animal surgery; Vol. 2, 1072-1080, Philadelphia, W.B. Saunders Co.