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ULTRASOUND IN THE INCIDENCE OF URINARY BLADDER DISEASES, KHARTOUM TEACHING HOSPITAL - SUDAN

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ABSTRACT
Urinary bladder diseases are a group of medical conditions that affect the bladder, an organ that stores urine. Bladder diseases can be short-term, chronic or fatal and affect people of all ages. This study was designed with the aim to find the incidence of common diseases that can affect the urinary bladder in Sudanese patients at Khartoum Teaching Hospital. In addition, create a local standard about the incidence of urinary bladder diseases, so it can be used either in the local or regional medical studies in the future, due to paucity of information in this critical area. This prospective study was conducted at Khartoum Teaching Hospital in Khartoum State- Sudan. It spanned a period of 3 years from April 2009 to April 2012, involving 250 Sudanese patients complain of urinary bladder symptoms (113; 45.2% males and 137; 54.8% females) and aged 1 to 60 years; mean age of 40 ± 1.6 years. Sonography was performed using General Electric (GE) medical system, logic-five expert fitted with 3.5 MHz convex transducer. Ultrasound findings in urinary bladder among symptomatic cases were varied and included such abnormalities; Cystitis (acute; chronic) was found in (47.6%) of cases, vesicles stones (14.4%), urine retention (12.8%), Schistosoma haematobium (8%), urinary bladder neoplasms (7.2%), urinary bladder tuberculosis (5.2%), urinary bladder diverticulum (1.6%), Neurogenic bladder (1.2%), posterior urethral valve (0.8%), urinary bladder clot (0.8%) and Urachal anomalies seen in (0.4%) in the detected cases.
Urinary bladder cystitis (acute; chronic) is the commonest pathology detected in the scanned samples and the incidence of urinary bladder pathologies found to be common in pregnant housewives.

Key Words: Cystitis, Urinary bladder, Ultrasound

INTRODUCTION
The urinary bladder is the organ that collects urine excreted by the kidneys before disposal by urination. A hollow muscular, and distensible (or elastic) organ, the bladder sits on the pelvic floor. Urine enters the bladder via the ureters and exits via the urethra (Moore and Dalley, 2006). The bladder is readily identified by ultrasound, Computed Tomography, cystography, Magnetic Resonance Image (MRI) and Cystoscopy, but Bladder ultrasound is noninvasive, readily accessible, and easy to use. It has been extensively investigated as a possible substitution for some of the more common invasive modalities used to evaluate the bladder (Stephanie *et al.,* 2010).
Since the early 1970s, occult bacteremia has been the major focus of concern for clinicians evaluating febrile patients who have no recognizable source of infection. Because the clinical presentation tends to be nonspecific in infants and reliable urine specimens for culture cannot be obtained without invasive methods; urethral catheterization or suprapubic aspiration (SPA), diagnosis and treatment may be delayed. Most experimental and clinical data support the concept that delays in the institution of appropriate treatment of pyelonephritis increase the risk of renal damage (Winter *et al.,* 1983 and Smellie *et al.,* 1994).

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The diagnosis of bladder infection may be made presumptively on the basis of clinical signs and symptoms in combination with urinalysis results. A urinalysis that reveals both bacteriuria and pyuria is considered clinically diagnostic of infection. Traditionally, confirmatory cultures have been obtained to verify the infection and identify the specific organism(s) involved (Beisel and Graves, 2002). Urinary bladder infection is considered to be the most common bacterial infection. According to the 1997 National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey, it accounted for nearly seven million office visits and one million emergency department visits, resulting in 100 000 hospitalizations. This situation is further complicated by the fact that accurate diagnosis depends on both the presence of symptoms and a positive urine culture, although in most outpatient settings this diagnosis is made without the benefit of culture. Women are significantly more likely to experience bladder symptoms than men. Nearly one in three women will have had at least one episode of bladder symptoms requiring antimicrobial therapy by the age of 24 years. Almost half of all women will experience one urine symptoms during their lifetime (Foxman, 2002). This study was designed with the aim to find out the common diseases that can affect the urinary bladder in Sudanese patients at Khartoum Teaching Hospital. In addition, create a local standard about the incidence of urinary bladder diseases, so it can be used either in the local or regional medical studies in the future, due to paucity of information in this critical area.

MATERIALS AND METHODS
Patients and Methods
Selection and description of participants
This was a prospective cohort study that spanned a 3 years period from April 2009 to April 2012, involving 250 Sudanese patients. Samples were selected from the outflow of the patients at Khartoum Teaching Hospital, Radiology and Medical Imaging Department, Khartoum- Sudan. Data were collected using patient's records, direct interviews and a pre-designed questionnaire. The questionnaire covers all the personal information, history of industrial occupation, cigarette smoking, analgesics and other medicinal drugs, and urinary bilharziasis. Demographic data as well as the presenting clinical history; symptoms and signs were also noted.

At inclusion, we included any untreated Sudanese patient who had either least one symptom or more of urinary bladder complains such as dysuria, burning with micturition, frequency of micturition, hematuria, urine incontinence, cloudy or foul smelling, nocturia, lower abdominal or pelvic discomfort, backache, fever, urine retention and urgency. The remaining patients had been treated with strong clinical suspicion alone and were, therefore, excluded from the study. An informed consent was obtained from all the subjects before scanning but, in addition, a review and authorization of the study protocols were done by the Ethical Committee of Khartoum Teaching Hospital.

Ultrasound equipment
Urinary bladder sonography was performed using General Electric (GE) medical system, logic-five expert ultrasound machine. The applied ultrasound transducer was 3.5 MHz convex transducer made by the Yokogawa medical system, Ltd. 7-127 Asahigaoka 4-chome Hino-shi Tokyo, Japan. Model 2302650 with serial number of 1028924YM7 and manufactured date of April 2005. Printing facility issued through the ultrasound digital graphic printer; (100 V; 1.5 A; and 50/60 Hz.) made by Sony Corporation- Japan, with serial number of 3-619-GBI-01.

Methodology
Before ultrasound scan start, the bladder should be full enough. It is important to have the correct degree of bladder fullness since too little fluid may not provide the window necessary for adequate pelvic scanning. A bladder that is it too full can compress or displace structures so they are not visualized. An overfull bladder can also create the disappearance of pathology. After the scans are performed, if there is any doubt about the influence of the full urinary bladder on adjacent structures, have the patient partially void and rescan the bladder. Scanning done while the patient lying relaxed, comfortable and breathing

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quietly in supine position. Lower abdomen was lubricated with coupling agent to avoid trapping of air bubbles between the skin and ultrasound transducer. The gain was set correctly to allow good visualization of the bladder and adjacent structures (Palmer, 1995).

Transverse (axial) images are obtained in the true axial plane and angled caudal to show the bladder base. Sagittal and oblique sagittal images complete the examination. In both planes, moving transducer cephalic and then steeply angling caudal are necessary to show the bladder base. Sonographically, the distended urinary bladder should have smooth, thin, medium level echogenic walls (approximately 3 mm thick) and contain no echoes, with the exception of the normal jets of urine as the ureters empty into the bladder. In the partially filled state, the bladder is collapsed. The urinary bladder cavity is not seen if it is collapsed; otherwise it appears anechoic. The bladder wall appears as a smooth, thin echogenic line. The sonographic appearances of a partially filled bladder are thickened (up to 6 mm thick), irregular walls encircling an echolucent interior. Therefore, to assess wall thickness, the bladder should be reasonably distended. The ureteral orifices are seen as elevations on the posterior portion of the bladder on longitudinal scans to each side of midline in transverse scans (Carol *et al.,* 2011). Doppler ultrasound either color or power Doppler was used to detect vasculatures of urinary bladder masses and to differentiate between masses and blood clots which is a diagnostic challenge when using brightness mode (B-mode) sonography alone.

Ultrasound images were recorded on a hard copy and the films were independently reviewed by two radiologists and the results combined therefore. However, there was no statistically significant interobserver variation.

Data Statistical analysis

The results were statistically analyzed by using Microsoft Office Excel package depends on the frequencies and the percentages of variance among the scanned samples. Results overviews in a form of tables and graphs of frequency and percentages.

RESULTS

A total of 250 Sudanese patients complains of urinary bladder symptoms either least one symptom or more where (54.8% females and 45.2% males; percentage of 1:2 among cases) aged from 1 to 60 years; mean age of 40 ± 1.6 years. Marital status of (190; 76%) were married while the rest (60; 24%) were single. Data about patients occupation was recorded because from the literature there was a strong relation between the type of occupation and the chance of developing urinary bladder complains, where (24%) were employers, housewives (20%), farmers (18%), labors (16%), students (14%), and other forms of occupations were (8%) out of scanned samples (Table 1).

Wide spectrum of clinical symptoms detected in patients with urinary bladder complains; were dysuria presents in (20.4%), (18.4%) hematuria, (17.0%) burning micturition, (9.6%) retention of urine, (8.4%) lower abdominal and pelvic pain, (8.0%) polyuria, (6.8%) urine incontinence, (6.0%) suprapubic discomfort, (2.7%) nocturia, (2.4%) urine urgency, and cloudy urine or foul smelling and fever (0.1%) (Table 2 and Figure 1).

The incidence of different forms of bladder clinical symptoms and pathologies found to be vary according to the type of occupation, where an incidence with a percentage of (43.3%) found in pregnant housewives, (26.7%) in labors, (15.4%) in farmers, (9.6%) in employers, (4.2%) in students and in other forms of occupations it was (0.8%) (Table 3).

Depending on the sonographic features and characteristics, pathological findings in the untreated urinary bladder of Sudanese subjects included such abnormalities; Cystitis (acute; chronic) was found in (47.6%) of cases, vesicles stone(s) (14.4%), urine retention (12.8%), Schistosoma haematobium (8%), urinary bladder neoplasms (7.2%), urinary bladder tuberculosis (5.2%), urinary bladder diverticulum (1.6%), Neurogenic bladder (1.2%), posterior urethral valve (0.8%), urinary bladder clot (0.8%) and Urachal anomalies seen in (0.4%) in the scanned cases (Table 4 and Figure 2).

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Table 1: Characteristics of study samples

| Parameters	No of samples (%)
Age ranges (years) 1-10 years 11-20 years 21-30 years 31-40 years 41-50 years 51-60 years	Frequency; percentage (%) (14; 5.6%) (18; 7.2%) (30; 12%) (42; 16.8%) (96; 38.4%) (50; 20%)
Gender Female Male	Frequency; percentage (%) (137; 54.8%) (113; 45.2%)
Occupation Employers Housewives Farmers Labors Students Others	Frequency; percentage (%) (60; 24%) (50; 20%) (45; 18%) (40; 16%) (35; 14%) (20; 8%)

Table 2: Clinical symptoms associated with urinary bladder complains in the study samples

Clinical features	Frequency in patients	Percentage (%)
Dysuria	51	(20.4%)
Hematuria	46	(18.4%)
Burning micturition	43	(17.0%)
Urine retention	24	(9.6%)
Lower abdominal and pelvic pain	21	(8.4%)
Polyuria; frequency of micturition	20	(8.0%)
Urine incontinence	17	(6.8%)
Suprapubic discomfort	15	(6.0%)
Nocturia	6	(2.7%)
Urine urgency	5	(2.4%)
Cloudy urine or foil smelling and fever	2	(0.1%)
Total	250	(100%)

Table 3: Incidence of urinary bladder clinical symptoms and pathologies according to samples occupation

| Occupation type	Frequency; percentage (%) of occupation in the sample	Incidence of urinary bladder clinical symptoms and pathologies
Housewives (pregnant)	(50; 20%)	(43.30%)
Labors	(40; 16%)	(26.70%)
Farmers	(45; 18%)	(15.40%)
Employers	(60; 24%)	(9.60%)
Students	(35; 14%)	(4.20%)
Other forms of occupations	(20; 8%)	(0.80%)
Total	(250; 100%)	(100%)

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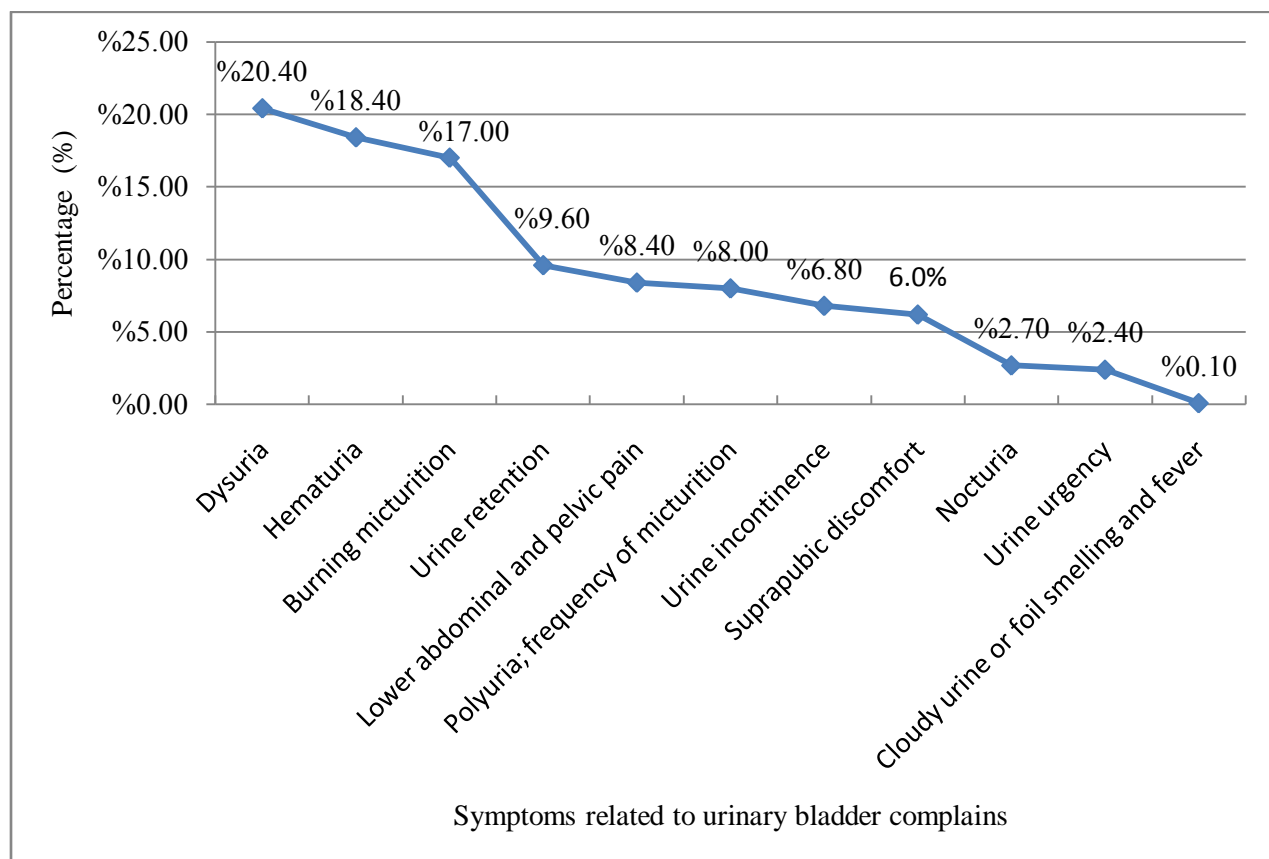
Figure 1: Clinical symptoms associated with urinary bladder complains in the study samples

Table 4: Incidence of urinary bladder pathologies in the scanned samples

Urinary bladder pathologies	Frequency in patients	Percentage (%)
Cystitis (acute; chronic)	119	(47.6%)
Vesicle stone(s)	36	(14.4%)
Urinary retention	32	(12.8%)
Schistosoma haematobium	20	(8%)
Urinary bladder neoplasms	18	(7.2%)
Urinary bladder tuberculosis	13	(5.2%)
Urinary bladder diverticulum	4	(1.6%)
Neurogenic Bladder	3	(1.2%)
Posterior ureteral valve	2	(0.8%)
Urinary bladder blood clots	2	(0.8%)
Urachal anomalies	1	(0.4%)
Total	250	(100%)

In this study the researchers follow up the treatment in all cases that proved to have urinary bladder disorders by ultrasound, and the results of this follow up showed that there is a complete resolution in the majority of conditions.

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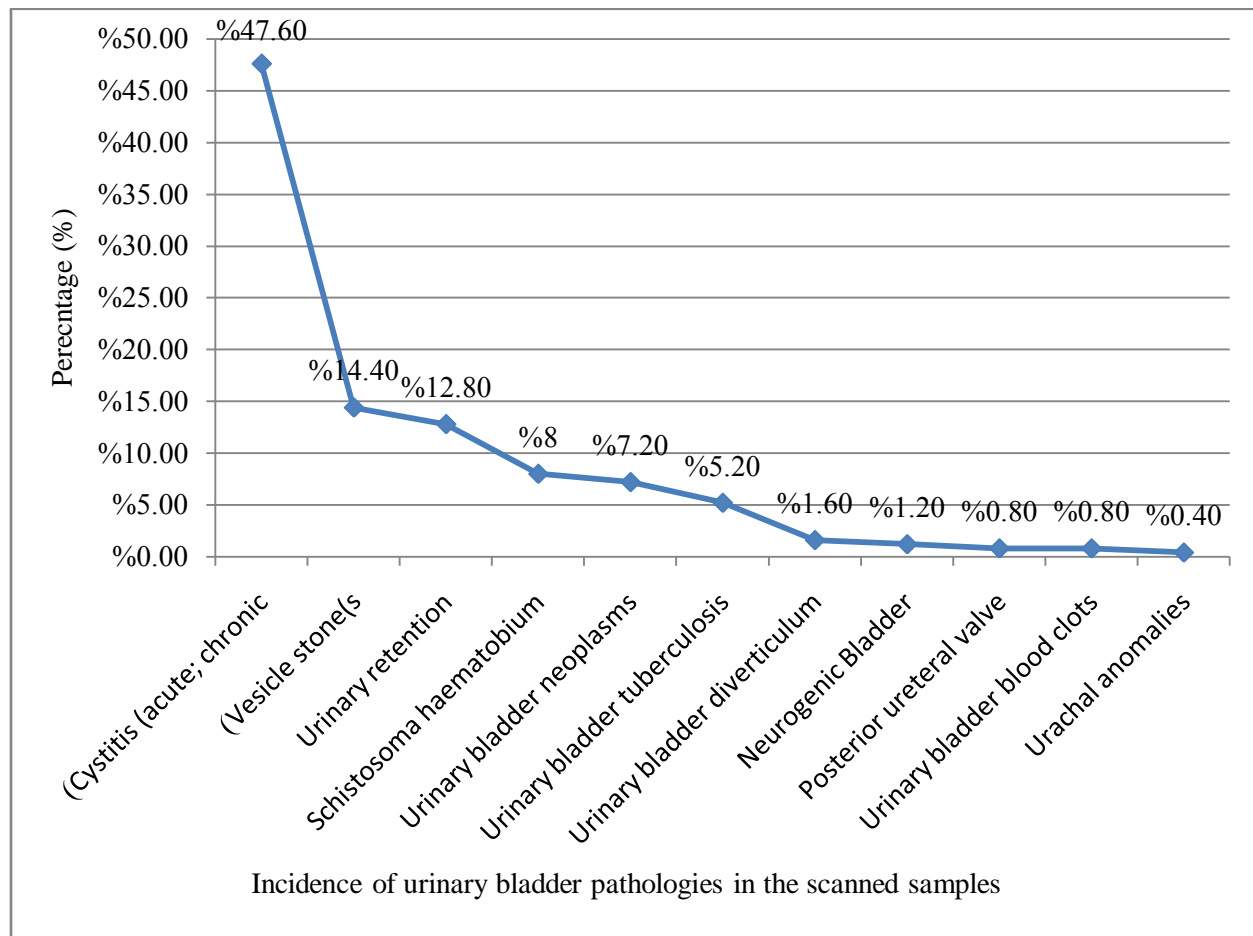
Figure 2: Incidence of urinary bladder pathologies in the scanned samples

DISCUSSION

The prevalence of urinary bladder disorders were dominant in females (113; 45.2%) rather than males (137; 54.8%) with a percentage of incidence of (2:1) such findings were supported in many studies that revealed that lower urinary tract disorders are common among females and more than in men (Singh *et al.,* 2001, Ferry *et al.,* 1987, Nurullaev 2004 and Narayan 2002). Disorders of urinary bladder in this study increase with age (mean age 40 ± 1.6 years); such result was supported in studies about The prevalence of lower urinary tract symptoms in men and women in four centres and the prevalence of lower urinary tract symptoms in women 40-60 years of age (Boyle *et al.,* 2003 and Møller et al, 2000). They reported that prevalence increases with age; in older men is about 78% have a higher incidence of bladder disorders and in women aged 40-60 years frequently have bothersome higher urinary bladder symptoms. Age, but not county residency, is an important factor associated with the occurrence of higher urinary tract symptoms.

The majority of cases diagnosed to have urinary bladder disorders been pregnant housewives between other listed occupations of the samples, where the incidence of different forms of bladder clinical symptoms and pathologies found to be with a percentage of (43.3%) in pregnant housewives, (26.7%) in labors, (15.4%) in farmers, (9.6%) in employers, (4.2%) in students and in other forms of occupations it was (0.8%). Increase incidence in pregnant housewives rather than others occupation was proved in a study of epidemiological differences of lower urinary tract symptoms among female sub populations and group level interventions where the prevalence was (43%) among pregnant housewives and working women (Avasarala *et al.,* 2008). Also pregnant women in their third trimester had the highest prevalence

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of bladder disorders (60.3%). Women with a parity range of 1-2 have the highest prevalence rate of (80%) while the least (27.3%) was found in the parity range of 0 (no previous pregnancy) when compared to other categories of occupation (Ilusanya *et al.,* 2012). Since pregnant women's internal organs are becoming more and more bunched up every day by expanding uterus, there are areas in the urinary tract that are being squished and pinched, causing urine to form pools. This stagnant urine attracts more bacteria, besides increased in the lipid peroxidation level during pregnancy causes an increased in urinary bladder pathologies at the 1st and 3rd trimester (Amadi *et al.,* 2007 and Lumbiganon *et al.,* 2010).

Dysuria was the commonest clinical signs of urinary bladder disorders as reported in the evaluation and treatment of urinary tract infections (Syed and Steven, 1998). The diagnosis of symptomatic urinary bladder disorders was based on the presence of typical clinical symptoms (dysuria, frequency, urgency, and incontinence), where dysuria is the commonest clinical symptoms detected (Raz and Stamm, 1993). Such results confirm the findings in this study where the common clinical features detected were dysuria presents in (20.4%), (18.4%) hematuria, (17.0%) burning micturition, (9.6%) retention of urine, (8.4%) lower abdominal and pelvic pain, (8.0%) polyuria, (6.8%) urine incontinence, (6.0%) suprapubic discomfort, (2.7%) nocturia, (2.4%) urine urgency, and cloudy urine or foul smelling and fever (0.1%).

Recently, however, sonography has been performed more often because it is more easily available and is economical (Das *et al.,* 1992, Premkumar *et al.,* 1987, Das *et al.,* 1993 and Schaffer *et al.,* 1983).

In this study ultrasound detected a wide spectrum of abnormalities in the untreated urinary bladder of study samples, such as cystitis (acute; chronic) which was found in (47.6%) of cases, vesicles stones (14.4%), urine retention (12.8%), schistosoma haematobium (8%), urinary bladder neoplasms (7.2%), urinary bladder tuberculosis (5.2%), urinary bladder diverticulum (1.6%), Neurogenic bladder (1.2%), posterior urethral valve (0.8%), urinary bladder clot (0.8%) and Urachal anomalies seen in (0.4%) in the detected cases. The incidence of urinary bladder anomalies in children was proved in a study that about radiological evaluation of the urinary tract in children with urinary infection where out of 42 children were picked up by ultrasound and 12 by micturition cystourethrography (MCUG). A percentage of (22.9%) of males and (15.9%) of females had anomaly of the urinary tract. Children less than 2 years had the highest incidence of anomalies (Jothilakshmi *et al.,* 2001). The value of ultrasound in diagnose bladder neoplasm was performed on 34 consecutively registered patients with bladder tumors and the findings showed that sonography can differentiate muscle-infiltrating and superficial neoplasms of the urinary bladder (Caruso *et al.,* 2010). The role of ultrasound in diagnosing vesicles stones and schistosomiasis was proved in a study of ultrasound for detecting Schistosoma haematobium urinary tract complications, where ultrasound demonstrated bladder stones as well as an X-ray (Abdel-Wahab *et al.,* 1992). Also the combination of morphological abnormalities was interpreted as being specific for urinary schistosomiasis. It is suggested that real time ultrasonography may be used to identify morphological lesions in urinary Schistosomiasis (Dittrich and Doehring, 1986). The role of ultrasound in diagnose urinary bladder tuberculosis was proved where sonographic features included parenchymal masses, cavities, mucosal thickening of the collecting system and urinary bladder, stenosis of the collecting system, a contracted urinary bladder, vesicoureteric reflux, and calcifications is a definitive proof of tuberculosis (Vijayaraghavan *et al.,* 2004).

In conclusion, urinary bladder sonography is a quick, accurate and noninvasive method to detect and diagnose urinary bladder pathologies. The incidence of bladder pathologies found to be common in pregnant housewives. Urinary bladder cystitis (acute; chronic) is the commonest pathology detected in the scanned samples.

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