Sudan University of Science& Technology

College of Graduate Studies

Estimation of Urinary Bladder Wall Thickness in Healty Adults Using Ulttrasonography

تقدير سمك جدار المثانة لدي البالغين الأصحاء باستخدام الموجات فوق الصوتية

A Thesis Submitted for the Requirements of **MSc** Degree in Medical Diagnostic Ultrasound

By:

Hind Sir Elkhatim Bakhet Suliman

Supervisor:

Babiker Abd Elwahab Awad Alla Awad Elseed

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Dedication

To my father…

To my mother…

To my sisters and brothers…

My husband and my daughter…

Acknowledgement

First full of thanks to Allah…

And a lot of thanks and great fullness to my supervisor

Dr. Babiker Abd Elwahab for his valuable and continuous help and guidance…

I owe my most sincere gratitude to the working team who gave me the opportunity to work with them in the department of ultrasound in al Ribat teaching hospital during the process of collection of data…

Special thanks to my little sister (shimaa) for her effort and sport in my research ..

Abstract

This is a descriptive crossectional study which was carried out during the October 2016 in al Ribat hospital in Khartoum- Sudan. The problem of the study that increase prevalence of bladder outlet obstruction and benign prostatic hyperplasia in Sudanese adult and bladder wall thickness had estimated accurate non invasive method to diagnosis it. there is no previous study in Sudanese adult in this aspect. The study aimed to estimate urinary bladder wall thickness in healthy Sudanese adults. A total of “50” patients were selected randomly; age arranged from 15 to 75 years scanning by ultrasonography and all patients were normal. Any patient with renal disorder, lower urinary tract symptoms or prostate abnormalities was excluded from this study. Data was collected using master data collection sheet which was analyzed using SPSS. The results of this study showed that the mean age of participants was 38.64 years, mean weight was 68.26 kg , mean height was 163.26 cm , mean body mass index was17.867kg/m^2 , mean posterior urinary bladder wall thickness was 2.468 mm and mean urinary bladder volume was 245.8211. In addition to that the study concluded that: the normal urinary bladder wall thickness in healthy Sudanese adults is 2.468 mm , the posterior urinary bladder wall thickness effected by urinary volume (p= 0.001) and weight (p=0.018) . Study recommended that: use the urinary bladder wall thickness routinely in diagnosis benign prostate hyperplasia and urinary bladder wall abnormalities.

المستخلص

هذه دراسة وصفية عرضية أجريت خلال أكتوبر 2016 في مستشفى الرباط في الخرطوم السودان. والهدف من هذه الدراسة هو تقدير سمك جدار المثانة البولية لدى البالغين السودانيين. تتمثل مشكلة البحث في زيادة عدد المرضي المصابين بتشوهات البروستات وانسداد منفذ المثانة البولية، ويعتبر سمك المثانة البولية هو من أفضل الطرق غير التداخلية المستخدمة في تشخيص هذه الأمراض لا توجد دراسات سابقة لحساب سمك جدار المثانة البولية لدي السودانيين. وقد تم اختيار ما مجموعه "50" من المرضي بشكل عشوائي. أعمارهم مابين 15-75 سنة . تم استبعاد أي مريض يعاني من اضطراب الكلى، وانخفاض أعراض المسالك البولية أو تشوهات البروستات من هذه الدراسة. وقد تم جمع البيانات باستخدام ورقة جمع البيانات الرئيسية حيث تم تحليلها باستخدام برنامج تحليل إحصائي . نتائج هذه الدراسة تظهر أن متوسط عمر المشاركين كان 38.64 سنة، متوسط أوزانهم 68.26 كجم، متوسط أطوالهم 163.26 سم، متوسط مؤشر كتلة الجسم 25.35 كجم/م^2، متوسط سمك جدار المثانة البوليه2.468مم ومتوسط حجم المثانة البولية 238.208 مل. وبالإضافة إلى ذلك خلصت الدراسة إلى أن: سمك جدار المثانة البولية لدى البالغين السودانيين الصحيحين هو 2.468 مم، ويتأثر بحجم المثانة (ص=0.001)، والوزن (ص=0.018).

أوصت الدراسة باستخدام قياس سمك جدار المثانة البولية بشكل روتيني في تشخيص تشوهات البروستات وتشوهات جدار المثانة البولية.

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List of Abbreviation

BMI :	Body mass index
BPH:	Benign prostate hyperplasia
BWT :	Bladder wall thickness
DWT:	Detrusor wall thickness
P – U – T :	Posterior urinary bladder wall thickness
U – V :	Urinary bladder volume
UBWT:	Urinary bladder wall thickness.
BOO:	Bladder outlet obstruction.
IPSS:	International prostate syndrome score
TCC:	Transitional cell carcinoma
BWM:	Bladder wall mass.

Chapter one

Introduction

Chapter one

1. Introduction

1.1 Introduction:

Ultrasound is a dynamic examination, with the huge benefit over other cross-sectional imaging of direct patient contact. The examination can be tailored to the patient's physical state and to their clinical problem . Ultrasound of the bladder is usually performed as part of a more comprehensive examination of the urinary

Despite dramatic improvement of MRI and CT over the past generation, sonography continuous occupy the central role in evaluation of renal, ureteral and bladder anatomy and disease process. [Rumack 2005].

Evaluating the morphology and function of bladder wall is very important because normal bladder function is necessary for micturition. Some pathological conditions such as vesicoureteral reflux [Sjöström S 2009], detrusor overactivity, dysfunctional voiding and bladder obstruction [Brierly RD 2003}, and neuropathic bladder may cause increase in bladder wall thickness (BWT). BWT is increased during urinary tract infection (UTI) [Ural Z 2008 , Tanaka H2008] chemotherapy, urinary stones, and inflammation. Most of the studies done in children [Leonardo CR2007] and school age [Uluouck N 2007] .

Internal changes in urinary bladder could be evaluated by cystoscopy or cystography, but as these tests are harmful because of their intervention or radiation, safer tests are needed such as transabdominal ultrasonography (US). US could be used as an accurate, safe, and non-interventional method.[Oelke, 2006 and Leung, 2006]

Measurement of bladder wall thickness appear to be a useful predictor of outlet obstruction with diagnostic value exceeding free uroflowmetery although it does not represent substitution to invasive urodynamic and can detect it better than post residual urine or prostate volume [Oelke, 2007].

Mean values of normal BWT were mentioned in some studies with significant differences between different races. Hekenbery reported mean bladder wall thickness (MBWT) in men of 3.3 mm and that in women of 3 mm in the adult population.[Hakenberg QW 2000] In another study, it was reported that MBWT was 4-6 mm. They reported no difference between genders and different ages.[Birang S 2006] Another study reported MBWT of 3 mm when bladder was full and 5 mm when bladder was empty.[Birang S 2006]

study is done estimate urinary bladder volume reported the mean U – V is 388 [salcen2013].

1.2 Problem of study :

Urinary bladder wall thickness is a predictive measurement for many pathological conditions , and be more accurate in diagnosis of urinary bladder outlet obstruction than uroflometery, prostate volume and residual urine. Estimate normal measurement to make a cut of value to diagnosis urinary bladder abnormality. No previous study to measure UBWT in Sudanese adult .

1.3 objectives

1.3.1 General objective:

To estimate normal urinary bladder walls thickness in Sudanese adults.

1.3.2 specific objectives :

- To measure urinary bladder wall thickness .
- To measure urinary bladder volume .
- To correlate the bladder wall thickness with age and gender.
- To correlate the bladder wall thickness with BMI .
- To correlate bladder wall thickness with urinary bladder volume .

Chapter two

Literature review

Chapter Two

Literature Review

2.1 Anatomy of the bladder :

The bladder is a hollow muscular, highly distensible, and rounded organ situated at the base of the pelvis. Urine collects in the bladder from the two ureters, which open into the bladder at its back and connect to the kidneys. Urine leaves the bladder via the urethra, a single muscular tube which ends in the urethral orifice. The bladder is situated below the peritoneal cavity near the pelvic floor. In men, it lies in front of the rectum, separated by a space. In women, it lies in front of the uterus. [Oliver 2017].

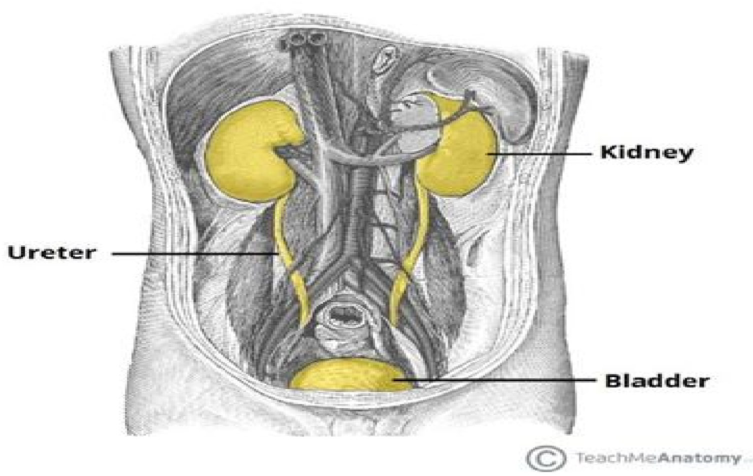

Figure 2.1 : Over view of urinary tract [Oliver 2017]

2.1. 1 Shape of urinary bladder :

The morphological appearance of the bladder varies with filling. When full, it exhibits an oval shape, and when empty it is flattened by the overlying intestines.

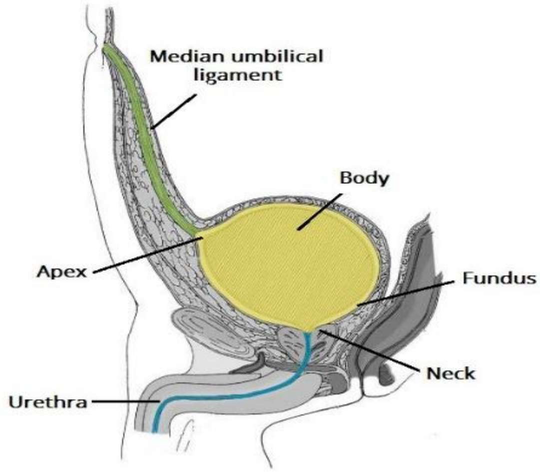

Figure 2.2 : Sagittal section of the male pelvis. The external anatomical features of the bladder. [Oliver 2017].

2.1.2 The external anatomical features of the bladder :

The urinary bladder composed from apex which it is located superiorly, pointing towards the pubic symphysis. It is connected to the umbilicus by the median umbilical ligament (a remnant of the urachus) , the body ; the main part of the bladder, located between the apex and the fundus , urinary fundus (or base) – located posteriorly. It is triangular-shaped, with the tip of the triangle pointing backwards and badder neck which formed by the convergence of the fundus and the two inferolateral surfaces. This structure joins the bladder to the urethra.

Urine enters the bladder by the left and right ureters, and exits via the urethra. Internally, these orifices are marked by the trigone – a triangular area located within the fundus. In contrast to the rest of the internal bladder, the trigone has smooth walls.

There are two sphincters controlling the outflow of urine; the internal and external urethral sphincters. The internal urethral sphincter is only present in men.[Snell 2012]

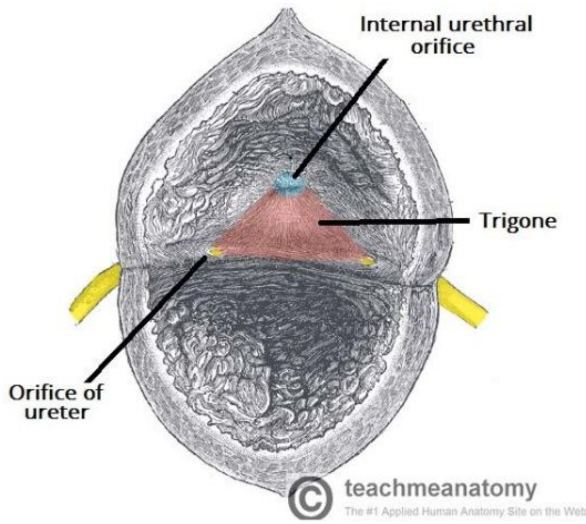

Figure 2.3 : The internal surface of the bladder, highlighting the trigone

[Oliver 2017].

2.1.3 Musculature:

The musculature of the bladder, and coordination of its action, plays a key role in the functions of the bladder.

In order to contract during micturition, the bladder wall contains specialised smooth muscle, known as **detrusor muscle**. Its fibres are orientated in three directions, thus retaining structural integrity when stretched. It receives innervation from both the sympathetic and parasympathetic nervous systems. During micturition, the detrusor muscle contracts.

There are also two muscular sphincters located in the urethral orifices: the internal urethral sphincter is located in males only. It consists of circular smooth fibres, which are under autonomic control. It is thought to prevent seminal regurgitation during ejaculation and the external urethral sphincter is present in both sexes. It is skeletal muscle, and under voluntary control. During micturition, it relaxes to allow urine flow. [Oliver 2017].

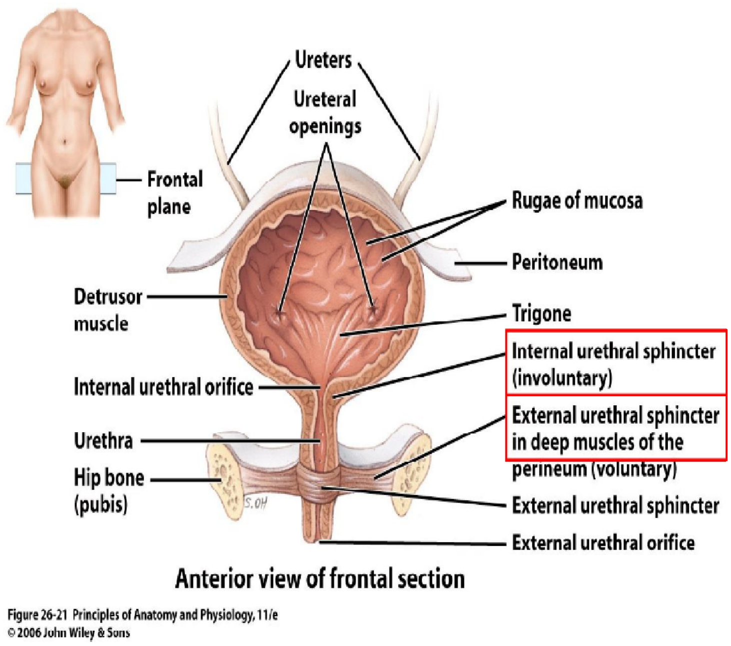

Figure 2.4 : Anatomy of urinary bladder

[Oliver 2017].

2.1.3 Vasculature

The bladder primarily receives its vasculature from the internal iliac vessels.

Arterial supply is delivered by the superior vesical branch of the internal iliac artery. In males, this is supplemented by the inferior vesical artery, and in females by the vaginal arteries. In both sexes, the obturator and inferior gluteal arteries also contribute small branches.

Venous drainage is achieved by the vesical venous plexus, which empty into the internal iliac vein (also known as the hypogastric vein).[Harlod, 2002]

2.1.3 Nervous Supply

Neurological control is complex, with the bladder receiving input from both the autonomic (sympathetic and parasympathetic) and somatic arms of the nervous system: the sympathetic nervous system communicates with the bladder via the hypogastric nerve (T12 – L2). It causes relaxation of the detrusor muscle. These functions promote urine retention. The parasympathetic nervous system communicates with the bladder via the pelvic nerve (S2-S4). Increased signals from this nerve causes contraction of the detrusor muscle. This stimulates micturition. And the somatic nervous supply gives us voluntary control over micturition. It innervates the external urethral sphincter, via the pudendal nerve (S2-S4). It can cause it to constrict (storage phase) or relax (micturition).

In addition to the efferent nerves supplying the bladder, there are sensory (afferent) nerves that report to the brain. They are found in the bladder wall and signal the need to urinate when the bladder becomes full.

Embryologically, the bladder is derived from the hindgut. [Harlod E 2002]

2.2 Function of the urinary bladder :

The bladder largely serves two functions: Temporary store of urine that bladder is a hollow organ. The walls are very distensible, with a folded internal lining (known as rugae), this allows it to hold up to 600ml and another function that it is assists in the expulsion of urine – During voiding, the musculature of the bladder contracts, and the sphincters relax.

The urinary bladder usually holds 300-350 ml of urine. As urine accumulates, the rugae flatten and the wall of the bladder thins as it stretches, allowing the bladder to store larger amounts of urine without a significant rise in internal pressure

2.3 pathology of urinary bladder :

2.3.1 Bladder Infection :

Acute cystitis more commonly affects women than men . The primary mode of infection is from periurethal ,vaginal or fecal flora. The diagnosis is made clinically. In severe cases, the three-layer sign of the bladder wall and debris in urine may be seen. Ultrasonography can diagnose predisposing factors, e.g. bladder calculi, tumors, an enlarged prostate, diverticulae, or neurogenic bladder. Female lower tract infections are more likely to be associated with functional than anatomical abnormalities. Sondgraphically the bladder wall may appear normal in early stage of inflammation , when inflammation is increase bladder wall became diffuse or non diffuse with hypoechoic thickness [Sandra L 2012][Steven M 2011]

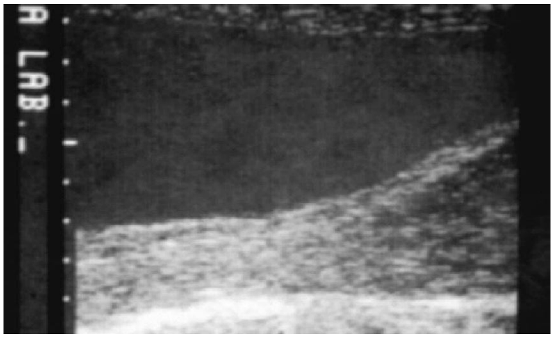

Figure 2.5 : Acute cystitis. In severe cases, the three-layer sign of the bladder wall and debris in the urine are seen.

[Trinkler FB 2013]

Figure 2.6;Recurrent cystitis..

[Trinkler FB 2013]

2.3.2 Schistosomiasis:

Schistosomiasis (also known as bilharziosis) is a parasitic infection caused by trematodes. It is an endemic disease in Africa (especially along the river Nile in Egypt), Asia, Middle East and South America. Schistosomiasis is transferred by freshwater snails who release cercariae to the water. The infection is then transmitted to humans who drink or swim in contaminated water. Cercariae may migrate through intact skin to the subcutaneous vessels. The adult worm then migrates by systemic circulation throughout the host's body and releases eggs in different organs including the bladder, where they can be seen on cystoscopy. As a result of the high antigenic character of the eggs, granuloma and fibrosis are induced. Schistosoma. haematobium is associated with an increased risk of bladder carcinoma. Sonographically appear as thick and calcified urinary bladder wall [Rumack 2005]

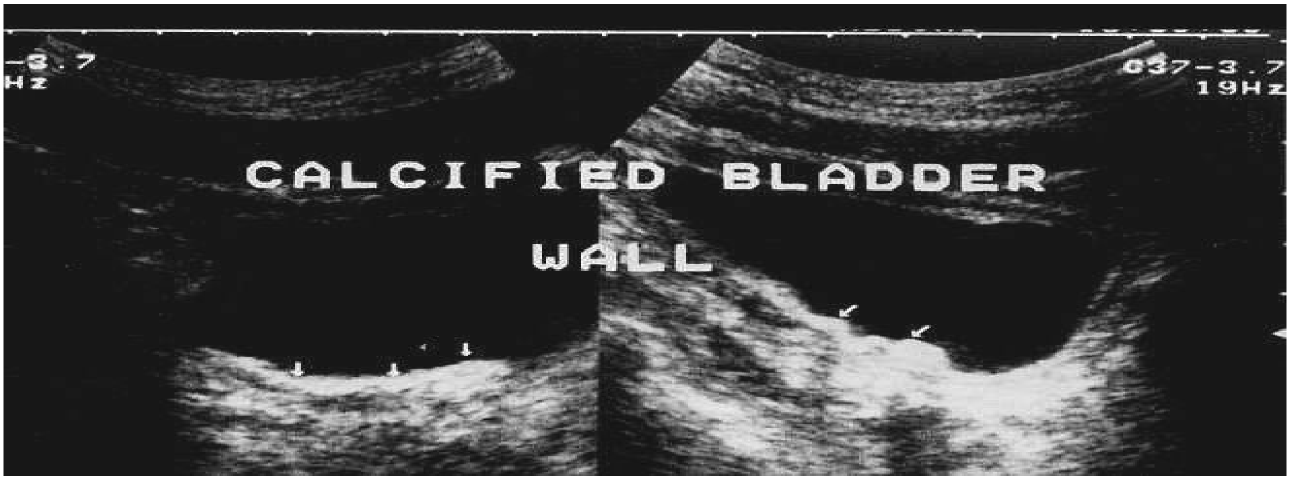

Figure 2.7 : Represent bladder Schistosomiasis

[Trinkler FB 2013]

2.3.3 Bladder Diverticula

A bladder diverticulum is an out pouching in the bladder wall. A diverticulum of the bladder may be associated with a urethral obstruction or it may be congenital . Complication of a bladder diverticulum include infection , ureteral obstruction , tumor development , and a urinary tract infection . Sonographic finding is a neck of varying size connecting the adjacent adjacent fluid filled to the bladder [Sandra L 2012]

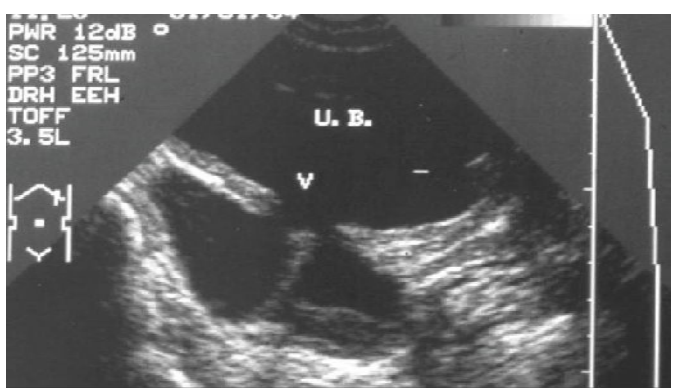

Figure 2.8 :Bladder diverticulum.

[Trinkler FB 2013]

2.3.4 Bladder Stones:

Most bladder stones are seen in men and usually are a manifestation of an underlying pathological condition, including voiding dysfunction, foreign bodies, and infections; kidney stones may pass through the ureter and come into the bladder. Bladder stones appear as highly reflective masses within the bladder, move with altered posture and cast shadows. Stones can be multiple and are always associated with outflow obstruction. Stones complicating diverticula are common. Bladder stones may occlude the bladder outlet at the internal urethral meatus. Small stones may pass through and can be lodged anywhere in the urethra.[Rumack 2005]

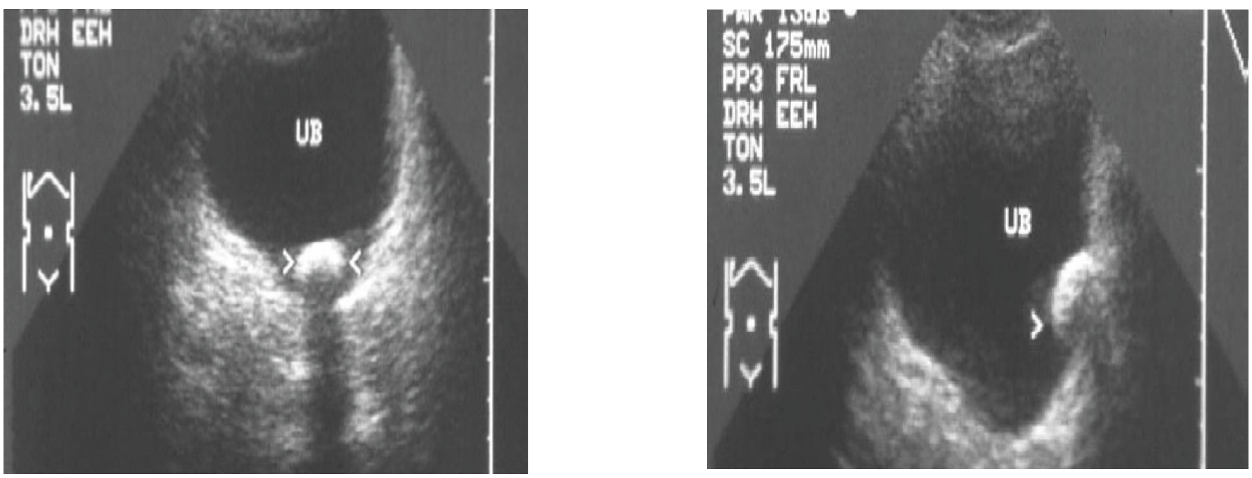

Figure 2.9 : Bladder stone. Transverse scan of the bladder.

[Trinkler FB 2013]

2.3.5 Ureterocele:

A ureterocele is a saccular protrusion of terminal part of ureter into bladder. Ectopic ureteroceles can arise anywhere in the lower urogenital tract .Ureterocele occurs seven times more often in females than in males, and approximately 10% of cases are bilateral. Ureteroceles appear as a “cyst within a cyst” They are are dynamic and gradually increase in size with accumulation of urine and then collapse. When the walls of the cystocele are very thin, they can be easily missed and careful scanning is needed.

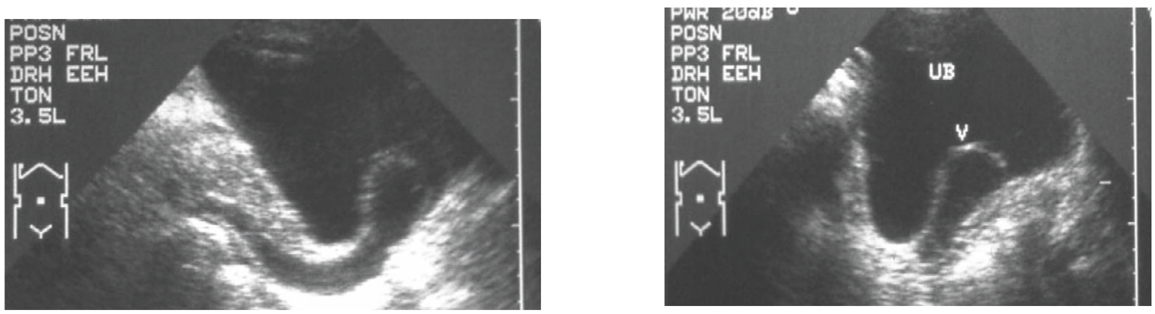

Figure 2.10 :Ureterocele. Sagittal section of the bladder showing a well-defined cystic lesion overlying the ureteric orifice. A dilated distal ureter is also seen.

[Trinkler FB 2013]

2.3.6 Blood Clots:

In patients with clots and hematuria, ultrasonography is useful for assessing how much clotting remains within the bladder. echogenic structures within the bladder without shadows and show change of position with change of body posture are typical ultrasonographic findings for blood clots . Care must be taken to differentiate a mobile intravesical clot from a sessile bladder tumor by examining the patient supine and decubitus .

Figure 2.11 :Blood clot.

[Trinkler FB 2013]

2.3.7 Foreign bodies *:*

The presence of foreign bodies causes cystitis and hematuria. Ultrasound can detect such objects. Embarrassment may cause the victim to delay medical consultation, and they are often found incidentally in the assessment of patients with hematuria or urinary tract infections.

2.3.8 Transitional cell carcinoma of the bladder :

The most common malignant tumor of the bladder is TCC. Patient typically present with gross hematuria and may pass some blood clots . The sonographic appearance of TCC within the urinary bladder is smooth or papillary hypoechoic mass that project into the lumen of the bladder [Rumack 2005]

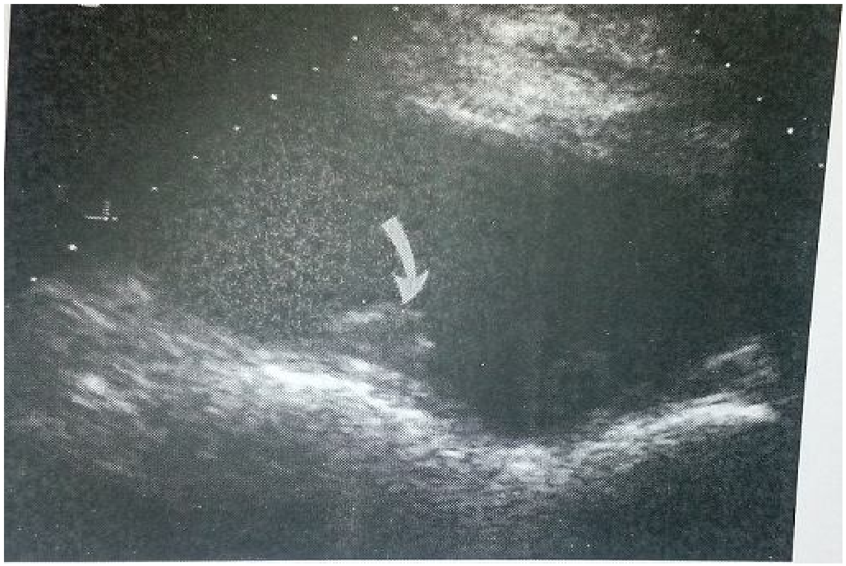

Figure 2.12 : Represent Transitional cell carcinoma of the bladder (Steven, 2011)

2.4 Urine jet*:*

Urine jet is the rhythmic expulsion of urine through the ureteral orifice (ostium) into the bladder. It can be visualised by realtime colour Doppler ultrasound of the bladder. The diagnostic role is to identify the bladder trigone and assess the ureteral function particularly for the diagnosis of ureteral obstruction. The absence of unilateral urine jet may suggest unilateral obstruction owing to urolithiasis. Urine jets are not only seen on colour Doppler, but on B-mode grey scale ultrasound if there is a difference in the specific gravity of ureteral and bladder urine.

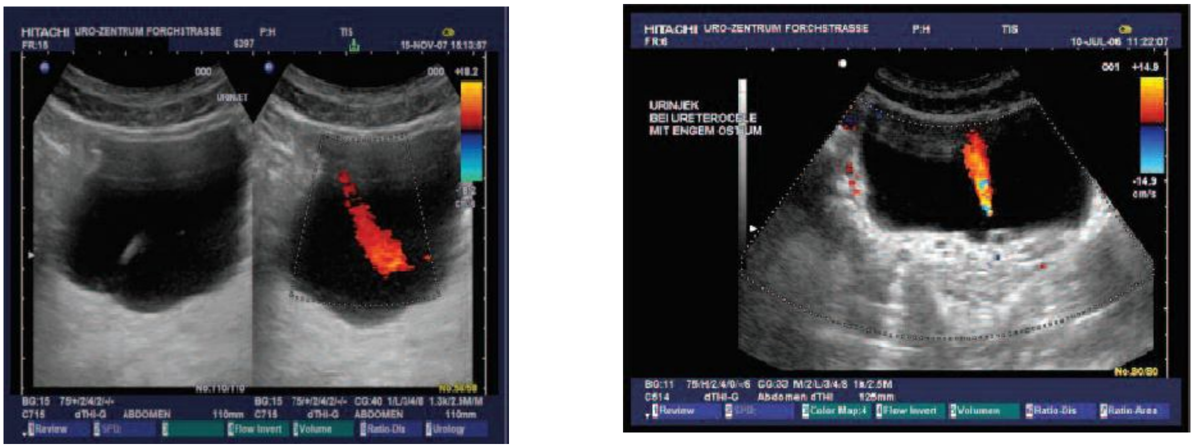

Figure 2.13 : Left image represent normal ureteric jet while Left one represent abnormal ureteric jet.

[Trinkler FB 2013]

2.5 Ultrasound of urinary bladder :

2.5.1 Role of Ultrasound:

Ultrasound is an important tool for assessing the bladder wall for wall thickening, trabeculation, masses and diverticulae. Pre and post micturition volumes. Vesico-ureteric junctions .Also can be visualised Bladder calculi and foreign bodies. Use the full bladder as an acoustic window to assess the prostate in males and gynaecological structures in females.

2.5.2 limitations

- Extensive pelvic scarring or overlyiying bowel gas will make scanning the bladder difficult.
- If the bladder is not sufficiently distended, pathology may be hidden by the folds.

2.5.3 Equipment Selection

Use of a curvilinear probe (3-5MHZ) with colour doppler.

Figure 2.14 : Curvilinear probe
[Ultrasoundpadeia 2014]

2.5.4 Patient Preparation

The patient must present with a full bladder.

- 2hrs prior to the scanning , the patient should empty their bladder.
- Over the next hour they should drink at least 1 litre of water. This allows time for the water to reach the bladder.
- Patient asked not go to the toilet until instructed by the Sonographer.

2.5.5 Scanning Technique

Patient supine with suprapubic area exposed.

- Examine the bladder sagittally in the midline. Now angle laterally & sweep the probe both left and right to check the lateral margins.[Elisabetta Buscarini 2013].

Figure 2.15 : Represent probe position of longitudinal scan (left)and ultrasonic image of section (right) [Ultrasoundpadeia 2014]

- Rotate 90degrees into the axial (transverse) plane. Sweep through from the superior dome to the bladder base. Ensure the ultrasound beam is projected as close to perpendicular to the bladder wall as possible.[Elisabetta Buscarini 2013][Betty B 2007]

Figure 2.16 : Represent probe position of transverse scan (left)and ultrasonic image of section (right). http://www.ultrasoundpaedia.com/normal-bladder.

Look for ureteric jets at the bladder base. This confirms bilateral renal function and ureteric patency. To do this, in transverse angle inferiorly using power doppler (or colour doppler with low PRF & wall filter settings). You may need to be patient to wait for the ureteric jet depending on renal function and degree of hydration. [Ultrasoundpadeia 2014]

2.5.6 Echogenicity of the bladder and bladder content:

When filled with urine the bladder content should be anechoic. Within the anechoic urine reverberation artifacts can often be seen

Figure 2.17 : Urinary bladder echogenicity

[Ultrasoundpadeia 2014]

On ultrasound the bladder wall appears as a three layer structure. The detrusor muscle is of medium homogeneous echogenicity. The outer serosa (adventita) layer and the inner mucosa (urothelial) layer are hyperechoic compared with the middle detrusor smooth muscle (muscularis propria) layer.

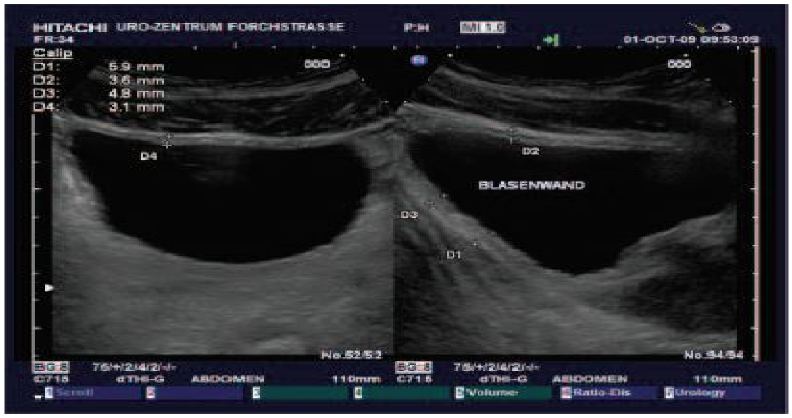

Figure 2.18 :Urinary bladder wall thickness measurement

[Trinkler FB 2013]

2.6 Urinary bladder measurement :

2.6.1 Urinary bladder volume :

Bladder volume can be calculated by scanning the bladder transversely and longitudinally and using the following ellipsoid formula:

Volume = height × width × depth × 0.5236

However, the bladder is never totally spherical, therefore volume calculations must allow for some measurement error . Ultrasound bladder volume measurement is clinically important in defining the post-void residual urine in patients with bladder voiding disorders, especially BOO. As already mentioned the BPH obstructive stage can be estimated non-invasively by IPSS, uroflowmetry and ultrasound post-void residual urine measurement.[Oelke M 2007]

2.6.2 Urinary bladder wall thickness:

Detrusor hypertrophy results in a thickening of the bladder wall and in augmentation of the bladder wall mass (BWM). Bladder wall thickness (BWT) can be directly measured with ultrasound by measuring the any one of urinary bladder wall (anterior , lateral or posterior) transabdominally with a 7.5MHz probe .

BWT was measured from the interface of urine and internal mucosal layer of bladder to outer part of hypoechogenic muscular layer, in the middle of the left or right lateral walls, and in the middle of the posterior wall to rectum.

2.7 Previous Studies:

Study of 488 adult with different sex and ages , healthy and another with prostatic benign hyperplasia and lower urinary tract symptoms was done by Hakenberg OW , et al reported that the mean BWT was 3.04 mm in healthy women, 3.33 mm in healthy men, and 3.67 mm in men with LUTS and BPE . study also reported a small increase in BWT with age for both genders ; BWT and age for both men ($r = 0.12$, $P < 0.014$) and women ($r = 0.17$, $P < 0.013$). BWT tends to be greater in men than in women. Men with LUTS and BPE show a moderate increase in BWT.

The study represent that there were a weak negative correlation with bladder volume ($r = -0.12$, $P < 0.003$) [Hakenberg OW 2000]

Another study done by BIRANG SH , et al on 212 normal adult with different sex and age ranged 12 – 70 years old by 3.5 -5 MHZ ultrasound probe at posterior lateral trigone represent the thickness of full bladder was 2.57+/0.57 mm with the range of 1.41 to 3.65 mm and the thickness of empty bladder was 5.48 +/- 0.12 mm with the range of 7.10 to 3.86 mm . He concluded the thickness to be 2-3 mm in fullness and 4-6 mm in empty status . [Birang SH 2006]

A study done in 55 healthy adult volunteers between 15 and 40 years of age, DWT was measured at the anterior bladder wall with a 7.5 MHz ultrasound probe and with a full bladder by Höfner K , et al reported men had a greater DWT compared to women (1.4 vs. 1.2 mm, $P < 0.001$). The age and BMI did not have a significant impact on DWT [Höfner K 2006].

Chapter Three

Material and method

Chapter Three

Material and Methods

3.1 Material :

Siemens with curvilinear probe 3.5 – 5 MHZ.

3.2 Design of the study:

This study is descriptive , cross sectional and analytic study.

3.3 Population of the study:

The population of this study was patient with normal, patient with renal disease , lower urinary tract symptoms and prostate abnormalities were excluded.

3.4 Sample size and type:

This study consisted of 50 patients have normal abdomino pelvis scan (24male and 26 female) .

3.4.1 Inclusion criteria :

Sudanese patient of 15 - 75 years old and admitted or volunteer one .

3.4.2 Exclusion criteria :

Any patient with renal disease, lower urinary tract symptoms and with prostate problem .

3.5 Place and duration of the study:

This study was carried out in the period from October 2016 in Khartoum state at al Ribat Teaching hospital .

3.6 Methods of data collection:

Using a special data collection sheet (questionnaire), sample of 50 healthy adults were studied by trans abdominal ultrasound scanning and data was collected using a data collecting sheet which designed to evaluate patient urinary bladder wall thickness , urinary bladder volume , patient age , sex , height , weight and calculated body mass index .

3.7 Technique*: (Imaging protocols)*

3.7.1 Trans abdominal U/S scanning:

Patient in supine position with full bladder ; all patient asked to drink sufficient water and a void from going to the micturition . The patient should lie supine . The patient should be relaxed, lying comfortably and breathing quietly, lubricates the lower abdomen with coupling agent. Hair anywhere on the abdomen will trap air bubbles so apply coupling agent generously. curve linear probe of 3.5 MHZ frequency is uses in scanning . Both transverse and longitudinal by placing probe in supra pubic area . The urinary bladder volume is calculated . The urinary bladder wall thickness is measure from the posterior wall.

Ultrasonographic sonograms took place and information of the patient was collected using special data collecting sheet .

3.7.2 Methods of analysis:

Cross tabulation , correlation , frequency , t- test analysis is applied and both Stata E and SPSS is used in the study.

3.8 Ethical approval:

The ethical approval was granted from the hospital and the radiology department; which include commitment of no disclose of any information concerning the patient identification.

Chapter four

Result

Chapter Four

Results

In this study , we included 50 adults (48% male , 52% female) . Mean age of participants was 38.64 years , mean weight was 68.26 kg , mean height was 163.26 cm , mean body mass index was 17.867 kg /m^2 , mean P – U – T was 2.468 mm and mean U – V was 245.8211 ml . Independent t-test showed that there was significant different in height , weight and P – U – T and no significant different age , BMI and U – V .

Gender based differences in age , weight , BMI , P – U – T and U – V are summarized in Table (4.1).

Table 4.1 : Mean age , height , weight , BMI , P – U – T and U – V with gender differentiation

Variable	Male	Female	P – value
Age	36.5	40.6	0.32
Height	167.3	159.4	0.002
Weight	74.04	62.9	0.0022
BMI	1.8476	1.7258	0.78
P – U – T	2.642	2.308	0.0022
U – V	255.375	236.2692	0.4196

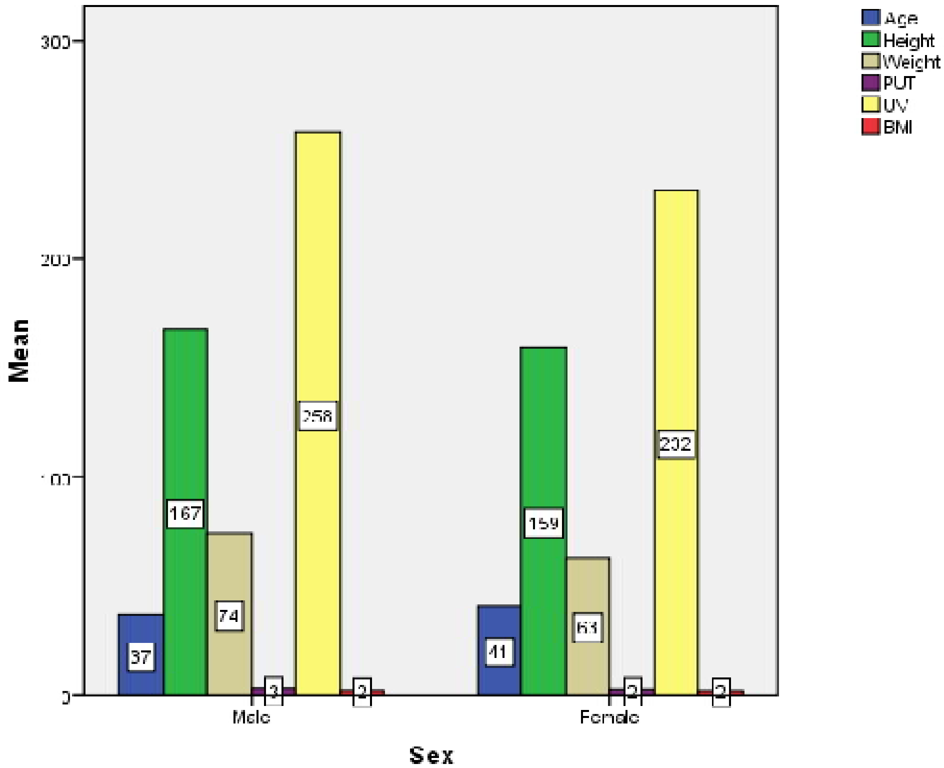

Figure 4.1: Represent mean age , height , weight , BMI , P – U – T and U – V with gender differentiation .

Table 4.2 : Frequency table represent the persent of both sex in the study

	Frequency	Percent	Valid percent	Cummlative percent
Valid Male	24	48.0	48.0	48.0
Female	26	52.0	52.0	100.0
Total	50	100.0	100.0	

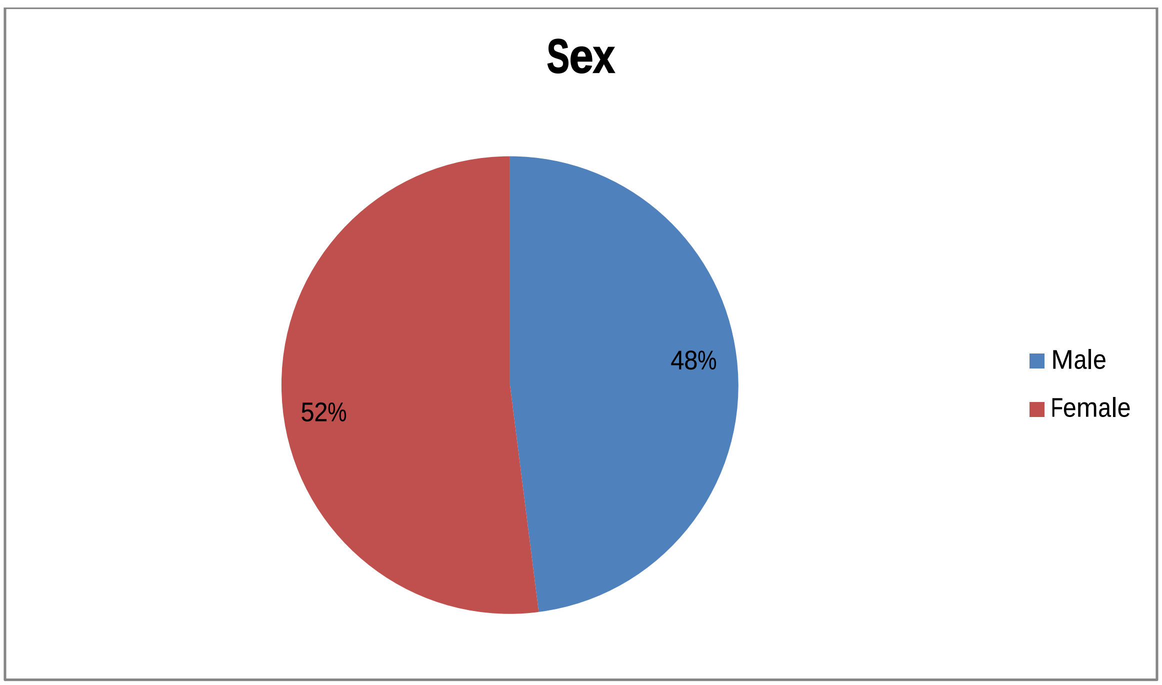

Figure 4.2 :Represent sex percent in the study

Table 4.3 : Represent frequency of different age group in the study

		Frequency	Percent	Valid Percent	Cummlative Percent
Valid	15-25	9	18.0	18.0	18.0
	26-35	16	32.0	32.0	50.0
	36-45	11	22.0	22.0	72.0
	46-55	5	10.0	10.0	82.0
	56-65	8	16.0	16.0	98.0
	66-75	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

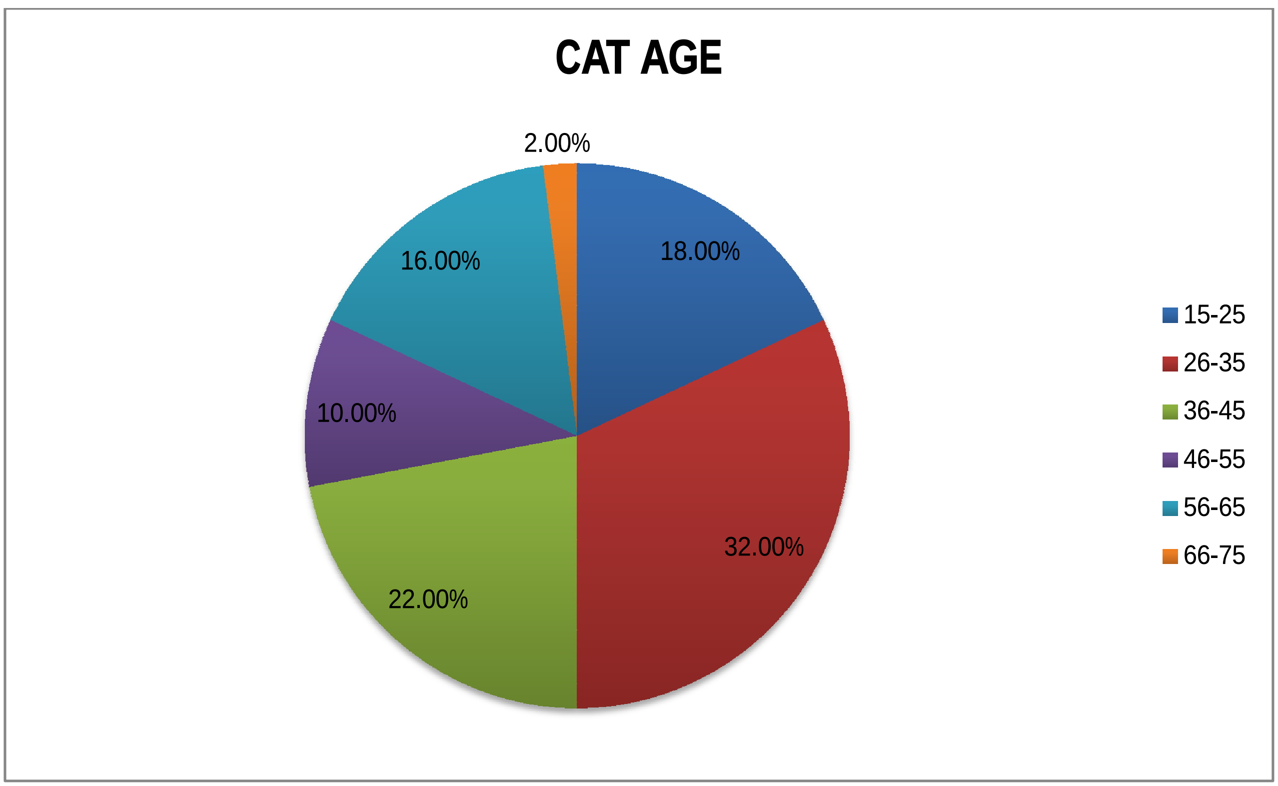

Figure 4.3 : Represent the percentage of age group

Table 4.4 : Descriptive statistic for age in the study

	N	Minimum	Maximum	Mean	Std. Deviation
Age	50	15	75	38.64	14.676
Valid N (listwise)	50				

Table4.5 : Descriptive statistic for P – U – T in the study

	N	Minimum	Maximum	Mean	Std. Deviation
PUT	50	1.5	3.6	2.468	.5316
Valid N (listwise)	50				

Table 4.6 : Cross tabulation of P – U – T with sex differentiation

		Sex		Total
		Male	Female	
CAT_PUT	1.5-2.0	5	8	13
	2.1-2.5	5	10	15
	2.6-3.0	6	7	13
	3.1-3.6	8	1	9
Total		24	26	50

P value = 0.05

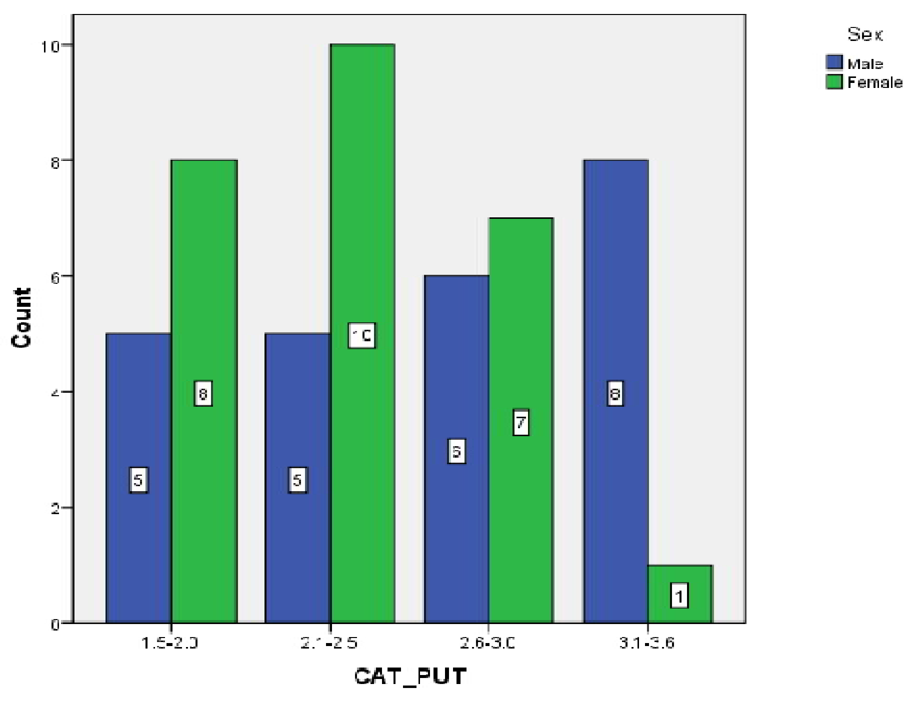

Figure 4.4 : Represent P – U – T ranges with sex differentiation

Table 4.7 :Cross tabulation for age groups with sex differentiation

		Sex		
		Male	Female	Total
CAT_AGE	15-25	4	5	9
	26-35	9	7	16
	36-45	7	4	11
	46-55	1	4	5
	56-65	3	5	8
	66-75	0	1	1
Total		24	26	50

P value =0.493

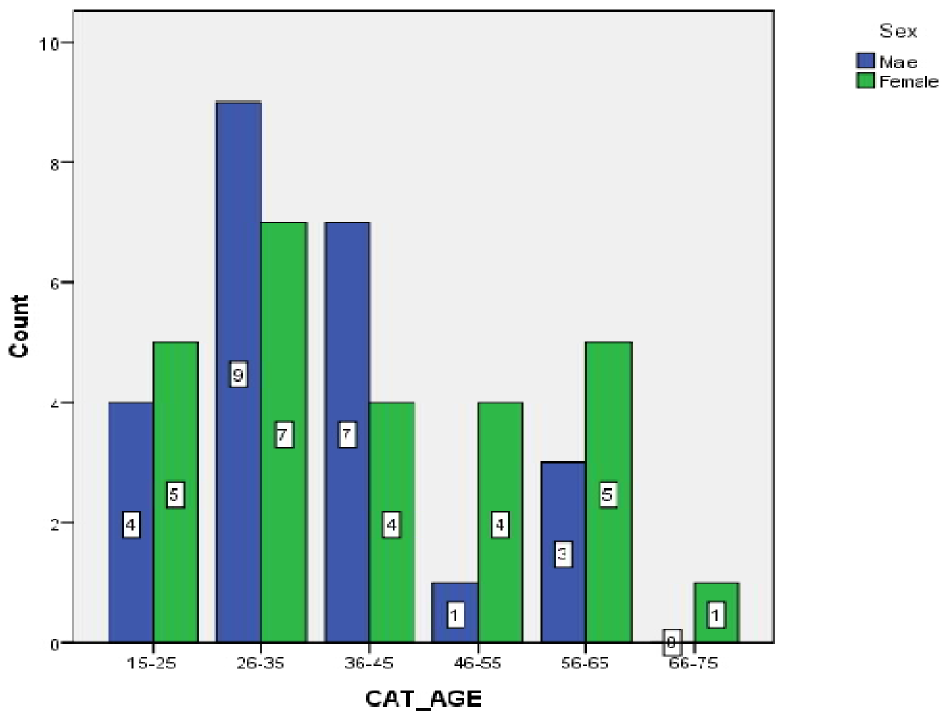

Figure 4.5 : Represent age groups with sex differentiation

Table 4.8 : Cross tabulation of P – U – T groups with age group

		CAT_AGE						Total
		15-25	26-35	36-45	46-55	56-65	66-75	
CAT_PUT	1.5-2.0	4	7	0	0	1	1	13
	2.1-2.5	3	4	6	2	0	0	15
	2.6-3.0	2	2	3	2	4	0	13
	3.1-3.6	0	3	2	1	3	0	9
Total		9	16	11	5	8	1	50

P value =0.101

Table 4.9 : Cross tabulation of P – U – T groups with height group

		CAT_HEIGHT					Total
		140-146	147-153	154-160	161-167	168-174	
CAT_PUT	1.5-2.0	1	2	5	2	3	13
	2.1-2.5	1	1	5	3	5	15
	2.6-3.0	0	1	1	8	3	13
	3.1-3.6	0	0	0	3	6	9
Total		2	4	11	16	17	50

P value = 0.116

Table 4.10 : Cross tabulation of P – U – T groups with weight group

		CAT_WEIGHT					Total
		38-48	49-59	60-70	71-81	82-90	
CAT_PUT	1.5-2.0	4	2	3	3	1	13
	2.1-2.5	1	2	10	1	1	15
	2.6-3.0	1	0	5	5	2	13
	3.1-3.6	0	0	1	4	4	9
Total		6	4	19	13	8	50

P value = 0.018

Table 4.11 : Cross tabulation of P – U – T groups with U – V group

		CAT_UV						Total
		146-205	206-265	266-325	326-385	386-446	86-145	
CAT_PUT	1.5-2.0	2	1	2	4	2	2	13
	2.1-2.5	1	6	8	0	0	0	15
	2.6-3.0	6	1	2	0	1	3	13
	3.1-3.6	5	0	3	0	0	1	9
Total		14	8	15	4	3	6	50

P value = 0.001

Table 4.12 : Cross tabulation of P – U – T groups with BMI group

		CAT_BMI				
		1.10-1.4	1.41-1.7	1.71-2.0	2.01-2.3	Total
CAT_PUT	1.5-2.0	3	2	6	2	13
	2.1-2.5	1	7	5	2	15
	2.6-3.0	1	2	7	3	13
	3.1-3.6	0	1	3	5	9
Total		5	12	21	12	50

P value = 0.131

Chapter five

Discussion,

Conclusion and recommendation

Chapter Five

Discussion

5.1 Discussion:

In this study a 50 adults of different sex (48% male and 52% female) with different age groups ranged from 15 to 75 years are included . More frequent age group 26 – 35 years (32%) . All participant were excluded renal disease , urinary bladder symptoms and prostate abnormalities . This study was accomplished in Alribat Teaching Hospital during October 2016 .

The abdomino- pelvis ultrasound was done for all participants ; longitudinal and transverse scan was a accomplished by a professional sonographer and the P – U – T is calculated from the posterior urinary bladder wall .

The mean age of participants was 38.64 years , mean weight was 68.26 kg , mean height was 163.26 cm , mean body mass index was 25.35 kg/m^2 , mean P – U – T was 2.468 mm and mean U – V was 245.8221ml . Independent t-test showed that there was significant different of different sex in height , weight and P – U – T and no significant different age , BMI and U – V (Table 4.1) .

The result of the study reported the urinary bladder wall thickness in adults equal 2.468 mm in which is agree with Birang SH , et al 2006 that the main urinary bladder wall thickness ranged 2 – 3 mm in fullness status. The two study measure the urinary bladder wall thickness from posterior urinary bladder wall thickness .

The study reported that urinary bladder wall thickness effected by urinary volume (P = 0.001) and weight (P = 0.018) which it agree with Hakenberg OW , et al 2000 that reported week negative correlation to urinary bladder volume .

The study also reported that the urinary bladder wall thickness not impact by age (P = 0.101) , height (P = 0.116) , BMI (P = 0.131) and sex (P = 0.05) which it agree with Hofner K , et al 2006 that reported the urinary bladder wall thickness not impact by age and BMI .

Different result of this study and Hofner K , et al 2006 in determination the urinary bladder wall thickness may be because the different methodology in calculation the urinary bladder wall thickness ; Hofner K , et al 2006 measure it from the anterior urinary bladder wall while we used the posterior wall.

5.2 Conclusion:

- This study was proved its hypothesis that; the ultrasound is a reliable and accurate in estimation of urinary bladder walls thickness.
- Urinary bladder wall thickness is effected by urinary bladder volume and weight .
- Urinary bladder wall thickness not impact by age , sex , height and BMI .
- The mean of urinary bladder wall thickness in Sudanese adults equal 2.468 .

5.3 Recommendations:

- Use the urinary bladder wall thickness should be measured routinely in patient with BPH because it more significant in diagnosis of BPH than the prostate volume and uroflowmetery and it significant in diagnosis o urinary bladder with abnormal walls.
- The author recommends that the Government should introduce the modern ultrasound machines and increase the training institutes of ultrasound.
- The author recommended that the government should be increasing the specialist hospitals for urinary tract diseases because they increased in Sudanese now days.
- According to the high cost of scientific research which the researcher was faced, the government should appeal universities in Sudan and companies to support the researchers in order to improve plans of treating and management of such diseases.
- Further studies should be carried out in this field on many aspects such as increasing the number of patients, to show the relation between normal urinary bladder and diseased urinary bladder walls, comparing between the role of U/S scanning and other diagnostic tools, using color Doppler ultrasonography and texture analysis.

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Appendices

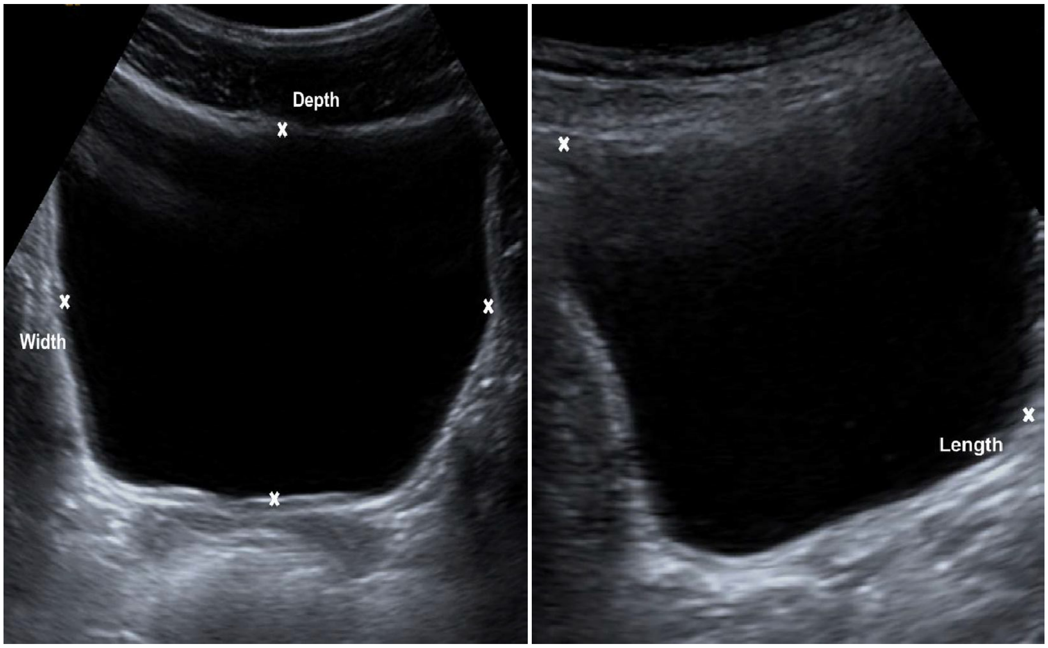

Image represent the measurement of urinary bladder volume in male 27 years old , transeverse and longitudinal section , the urinary bladder volume 273 ml

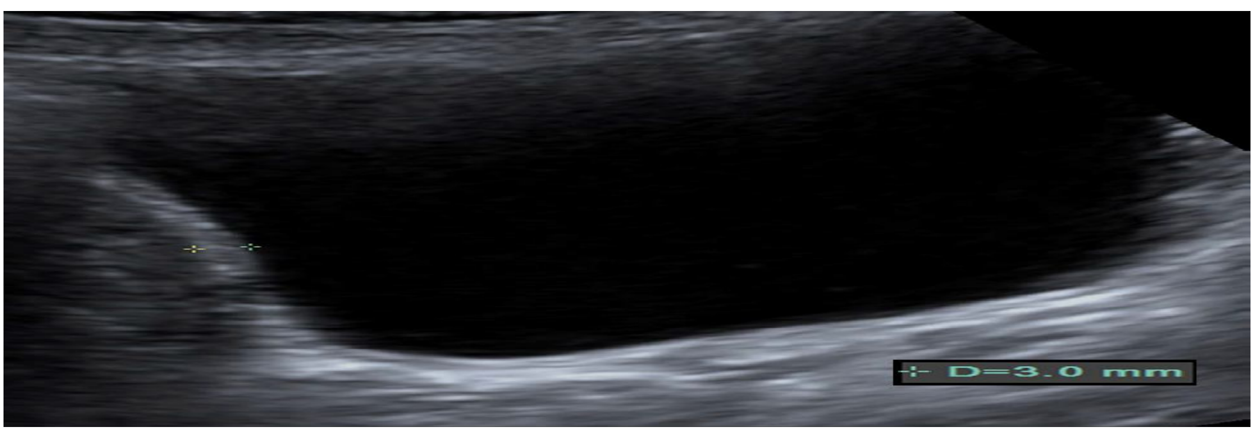

Image represent the measurement of posterior urinary bladder volume =3 mm