بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sudan University of Science & Technology

College of Graduate Studies

Assessment of Residual Urine Volume in Patient with Benign Prostatic Hyperplasia Using Ultrasonography

تقييم حجم البول المتبقي لدي مرضي تضخم البروستات الحميد باستخدام الموجات فوق الصوتية

A Thesis Submitted for Partial Fulfillment for the requirement of M.Sc. Degree in Medical Diagnostic Ultrasound

By:

Mohamed Gadain Mohamed Saeed

Supervisor: -

Dr. Babekirtu Abdalwahab Awad Allah

Associated professor

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الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

{قَالُواسُبْحَانَكَ لاعِلْمَ لَنَا إِلا مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ}

الآيه 32 - سورةالبقرة

Dedication

To my mother Tomy father

To my wife and my kids

To my brothers and sisters

Acknowledgment

First of all, I thank Allah the almighty for helping me to complete this research.

My Thank extend to anyone who help me to complete this study, with his full patience cooperation.

I would like to thank also radiology staff in DR. Osman A.Wahab Clinic and Elmoallim Complex for their cooperation.

Finally, I would like thank my friend teacher and colleagues.

Abstract

The main purpose of this study was to assess the residual urine volume in patients with benign prostate hypertrophy. The data were collected by examine 50 patients at DR. Osman A.Wahab Clinic and Elmoallim Complex using an ultrasound machine (Toshiba ck1.2, with 3.5MHZ prope frequnacy)the collected data was include the age ,prostate volume,UB volume,UB wall thickness and marital status.

The results conclude that the benign prostatic hyperplasia increased with age. Benign prostatic hypertrophy had been in patient above 50years and it is most common in elderly patients 50-60years considered as 26.5% of patients .There was relationship between volume of urinary bladder pre and post micturition .This result showed significant difference between pre and post micturition urine volume relative to the BPH at p value=0.000 (CL=95%). This indicate the increment of residual urine volume due to increase of the prostate volume.

المستخلص

هدفت هذه الدراسه الي تقييم متبقي البول لدي المرضي الذين يعانون من تضخم البروستات الحميد.تم جمع البيانات لهذه الدراسه بفحص 50 مريض في كل عيادة د.عثمان عبدالوهاب ومجمع المعلم الطبي التعليمي باستخدام اجهزه الموجات الصوتيه واستماره خاصه لجمع البيانات وكانت اعمار المرضي تتراوح ما بين 29الي 79 عام.

تتخلص النتيجه في ان الاصابه بتضخم البروستات الحميد تزيد بزياده العمر وان الموجات الصوتيه هي الوسيله المستخدمه لفحص امراض البروستات كما ان المرضي يصابون بتضخم البروستات الحميد بعد من الخمسين ويكون اكثر شيوعا مابين من الخمسين والستين وذلك بنسبه 26.5% من المرضي. هناك علاقه بين متبقي البول وحجم البول في المثانه قبل التبول وبعده وقد وجدت هالدراسه ان هناك علاقه واضحة بين حجم البول قبل وبعد التبول وتضخم البروستات الحميد بدرجة حساسية = 0.000 ودرجة ثقة 95% وهذا يدل علي ان زيادة حجم متبقي البول يزيد بزيادة حجم البروستات.

Table of Contents

List of Figures

List of Tables

Chapter One

1.1 Introduction

Prostate is a compound tubuloalveoler exocrine of the male reproductive system, the prostate gland is a chestnut-size organ located in the pelvic posterior to symphysis pubic and pubic arch anterior to the rectum and just beneath the urinary Bladder. It is encircles the proximal part of urethra. Function of the prostate is to secrete slightly alkaline fluid which has to characteristic of milky or white in appearance. The secretion usually cans status 20% to 30% of volume of semen alone with spermatozoa and seminal vesicle fluid. Sin medical prostatic most of prostate abnormalities are diagnosed by measuring their volume range between 0,250 ml at the birth to the 1000 ml sized at the puberty, after puberty the prostate volume will continuously grow as the age increase for most of the male's life . Hoo et al., (2012).

Benign prostatic hyperplasia [BPH] is the medical term for the prostate enlargements, as a non-cancerous enlargement is not related to the development of prostate cancer. BPH cause pressure on the urethra sever or mild or moderate which cause obstruction complete or not, in complete one Folly's catheter indeed for micturition urine, residual urine may cause cystitis, pyelonephritis, urine retention,(dilated ureters), hydro-nephrosis, thick urine change to vesicle stone in long time of obstruction. BPH a common outpatient procedure involving digital ultrasound for the assessment of the prostate via rectum either for imaging or guiding biopsy is a gold standard for diagnosis of prostate cancer as the combination of prostate ultrasonography yield the best diagnostic outcome of prostate caser. The transrectal method provides a clear image of organs in the pelvis.Transrectal ultrasound is used for evaluation of the prostate with elevated prostate specific antigen or prostatic nodules on digital rectal examination.Trans abdominal ultrasound use 3,5mhz transducer through partially or fully filed urinary bladder with caudal angulations the sound, the ultrasound beam

under the pubic arch and permit global volume of the prostate. The advantage of transabdominal ultrasound is that procedure can be preformed quickly and non-invasively.Hoo et al., (2012).

Measurement of prostate volume have became very important clinically since it association with different disease and variable of malignancy, the American cancer society found the prostate cancer is one of the most common cancers in the men and is getting serious attention from the worlds it has became significant cause of death every year.Hoo et al., (2012).

Ultrasound is non-invasive, in expensive and repeatable modality and has-been used as important and valuable diagnostic tool for detecting prostatic diseases. An ultrasound evaluation of the BPH has been performed by assessing various ultrasound factors such as the prostate size, echogenicity, capsule irregularity and hydronephrosis. Hoo et al., (2012).

1.2 Problem of the study:

Benign Prostatic Hypertrophy is main cause of urinary bladder out let obstruction in elder men, which is differ in its degree from partial to complete according to the volume of residual urine in post-micturition status. Many tools of investigations are used to diagnose this condition. This includes clinical examination, urine investigation, ultrasonography and different types of other radiological modalities. Therefore, the ultrasound is said to be the quick and accurate diagnostic tool in assessing the abnormalities and residual volume.

1.3 Objectives of the study:

1.3.1 General objective:

The general objective of this study was to assess residual urine volume in benign prostatic hyperplasia patients using ultrasonography.

1.3.2 Specific objectives:

- To measure prostate volume
- To measure Pre-void urine and post void residual urine volume
- To correlate the prostate volume with the urine volume and patient demographic data
- To measure urinary bladder thickness.

1.4 Overview of the Study:

This study consists of five chapters. Chapter one, which was an introduction, deals with theoretical frame work of the study. It presents the statement of the of the study problems, objectives of the study, it also provides an outlines of the thesis. Chapter two includes theoretical background, and literature review (previous studies). Chapter three deals with material and method used. Chapter fours deal with (results) data presentation. Chapter five discusses the data (discussion), conclusion, and recommendations for this thesis and suggestions for future work. In addition, the reference and appendices.

Chapter Two

Literature Review and Previous Studies

2-1 Literature Review

2-1-1 Anatomy of Prostate:

The prostate is a pyramidal fibro muscular gland which surrounds the prostatic urethra from the bladder base to the membranous urethra. It has no true fibrous capsule, but is enclosed by visceral fascia containing neurovascular tissue. The muscular tissue within the prostate is mainly smooth muscle .Suzan et al,. (2008).

The prostate lies at a low level in the lesser pelvis, behind the inferior border of the symphysis pubis and pubic arch and anterior to rectourethralis and the rectal anpufla, through which it may be palpated. It presents a base or vesical aspect superiorly, an apex interiorly, and posterior, anterior and two inferolateral surfaces, the prostatic base measures about 4 cm transversely .The gland is 2 cm in anteroposterior and 3 cm in its vertical diameters, and weight about 8 g in youth, but almost invariably enlarges with the development of BPH.Suzan et al., (2008).

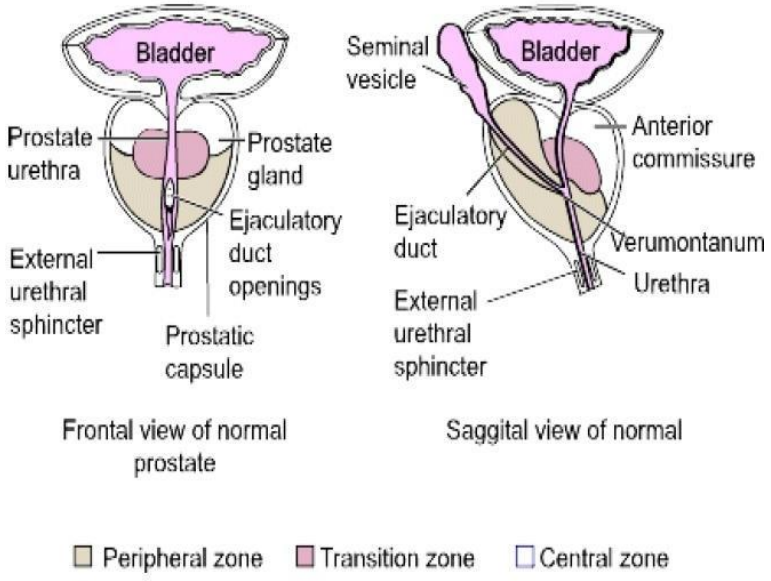


Figure (2-1)Shows frontal and sagittal planes of prostate.Suzan et al,. (2008).

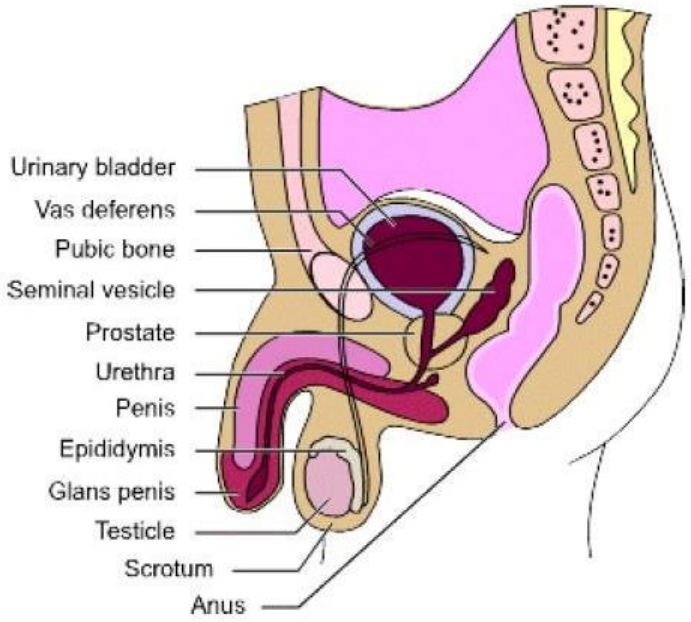


Figure (2-2) shows male reproductive system.Suzan et al,.(2008).

Superiorly the base is largely contiguous with the neck of the bladder. The apex is inferior, surrounding the junction of the prostatic and membranous parts of the posterior urethra. The apical posterior relation of the prostate and external urethral sphincter is rectourethralis Martini et al., (2012).

The anterior surface lies in the arch of the pubis, separated from it by the dorsal venous complex (Santorin's plexus) and loosely attached adipose tissue. Martini et al., (2012).

The anterior and lateral aspects of the prostate are covered by a layer of fascia derived from the endopelvic fascia on each side, called the lateral prostatic fascia. This is adherent medially to the prostate, continues posteriorly over the lateral aspect of the prostate, neurovascular bundles and rectum (lateral rectal fascia) and passes distally over the urethra. The inferolateral surfaces are related to the muscles of the pelvic sidewall. The anterior fibers of levator ani embrace the prostate in the pubourethralsling or pubourethralis. These muscles are separated from the prostate by athin layer of connective tissue ،Martini et al., (2012).

The posterior surface of the prostate is transversely flat and verticallyconvex. It is separated from perirectal fat in the peri rectal space. And rectum by Denonvillier's fascia, the prostate is traversed by the urethra and ejaculatory ducts, and contains the prostatic utricle. The urethra enters the prostate near its anterior border and usually passes between its anterior and middle thirds. The ejaculatory ducts pass anteroinferioriy through its posterior region to open into the prostatic urethra ,Martini et al., (2012).

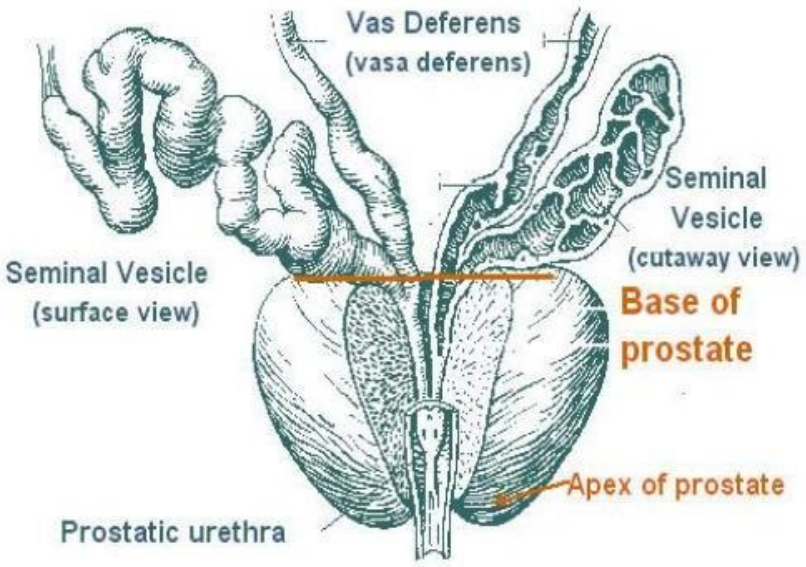


Figure (2-3). Shows the parts of the prostate Verhammeet al,.(2002).

2-1-2 Zonal anatomy of the Prostate:

The prostate gland was initially thought to be divided into five anatomical lobes, but it is now recognized that five lobes can only be distinguished inthe fetal gland prior to 20 weeks' gestation. Between then and the onset of BPH. Only three lobes are recognizable, two lateral and a median lobe.From an anatomical, and particularly from a morbid anatomical perspective,the glandular tissue may be subdivided into three distinct zones, peripheral(70% by volume), central (25% by volume), and transitional (5% by volume). Non glandular tissue (fibro muscular stoma) fills up the space

between the peripheral zones anterior to the preprostatic urethra. The central zone surrounds the ejaculatory ducts, posterior to the preprostatic urethra, and is more or less conical in shape with its apex at the verumontanum. The transitional zone lies around the distal part of the preprostatic urethra just proximal to the apex of the central zone and the ejaculatory ducts. Its ducts enter the prostatic urethra just below the preprostatic sphincter and just above the ducts of the peripheral zone. The peripheral zone is cup-shaped and encloses the central transitional zone and the preprostatic urethra except anteriorly, where the space is filled by the anterior fibro muscular stroma.Simple mucus-secreting glands lie in the tissue around the preprostaticurethra, above the transitional zone and surrounded by the preprostaticsphincter. These simple glands are similar to those in the female urethra and unlike the glands of the prostate. Suzan et al,. (2008).

The zonal anatomy of the prostate is clinically important because most carcinomas arise in the peripheral zone, whereas BPH affects the transitional zone. This may grow to form the bulk of the prostate.

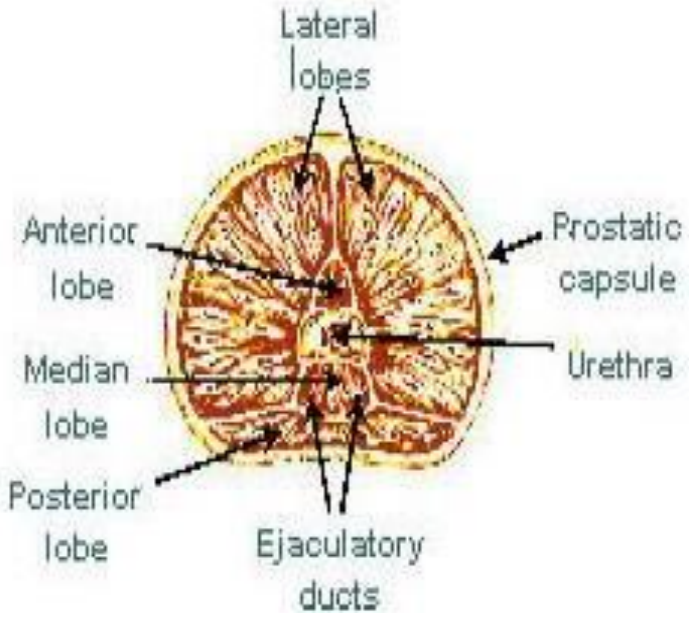


Figure (2-4) shows prostatic lobes' Martini et al., (2012).

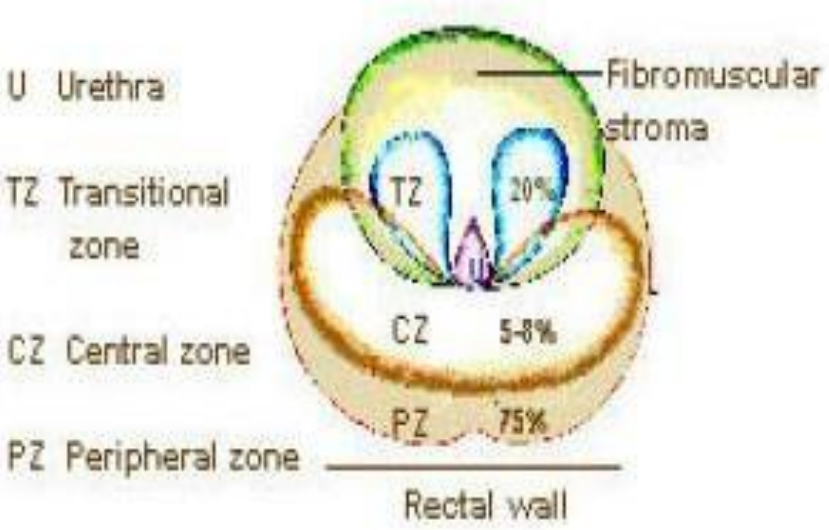


Figure (2-5) Shows Prostatic Zones,Verhammeet al,.(2002).

2-1-3 Vascular supply and lymphatic drainage.

Arteries: The prostate is supplied by branches from the interior vesical, internalpudendal and middle rectal arteries. And the inferior vesical artery often arises from the internal iliac artery with the middle rectal artery Verhammeet al,.(2002).

Veins: The veins form the prostatic venous plexus, which is between the capsule of the prostate and fibrous sheath. The prostatic plexus receives the deep dorsal vein of penis and numerous vesical veins and drains into the internal iliac veins, Suzan et al,. (2008).

Lymphatic drainage: Collecting vessels from the vas deferens drain into the external iliac nodes, while those from the seminal vesicle drain to the internal and external iliac nodes. Prostatic vessels end mainly in internal iliac, Suzan et al,. (2008).

Innervations: The prostate receives an abundant nerve supply from the inferior hypo gastric(pelvic) plexus. The sympathetic nerve simulates the smooth muscle of the prostate during ejaculation, Suzan et al,. (2008).

2-1-4Microstructure:

The glandular tissue consists of numerous follicles with frequent internal papillae. Follicles open into elongated canals which join to form 12-20main ducts. The follicles are separated by loose connective tissue, supported by extensions of the fibrous capsule and muscular stroma and enclosed in a delicate capillary plexus. Follicular epithelium is variable but predominantly columnar, and either single-layered or pseudo stratified, Suzan et al,. (2008).

Prostatic ducts open mainly into the prostatic sinuses in the floor of the prostatic urethra. They have a bi-layered epithelium. The luminal layer columnar and the basal Layer is populated by small cuboidal cell. Small colloid amyloid bodies (corpora amylacea) are frequent in the follicles.Prostatic and seminal vesicular secretions form the bulk of seminal fluid.Prostatic secretions are slightly acid, and contain acid phosphates.Amylase, prostate specific antigen, fibrinolysin and zinc. Numerousneuroendocrine cells, containing neuronespecific enolase, chromogranin and serotonin, are present in the glandular epithelium: their numbers declineafter middle age and their function is unknown' Martini et al., (2012).

In ultrasound It appears like an inverted pyramid and lies posterior to the bladder. It is base superior to it is apex, and inferior to the urinary bladder in screen, with smooth outlines. The urethra passes through the canter of the prostate before traversing to the penis. There were three echo levels are seen on prostatic sonographic examination Isoechoic, Hyperechoic and Hypoechoic.An isoechoic structure contains middle range echoes and is mostcharacteristic of the peripheral, transition, and content zones in the normalpatient. Smooth muscle muscle produse a hypoechoic appearance, although an enlarged transition zone also able to produce such echogenicity.Hyperechoec structure is most characteristic of fat corpora amylaca, orcalculi,Jameset al., (2008).

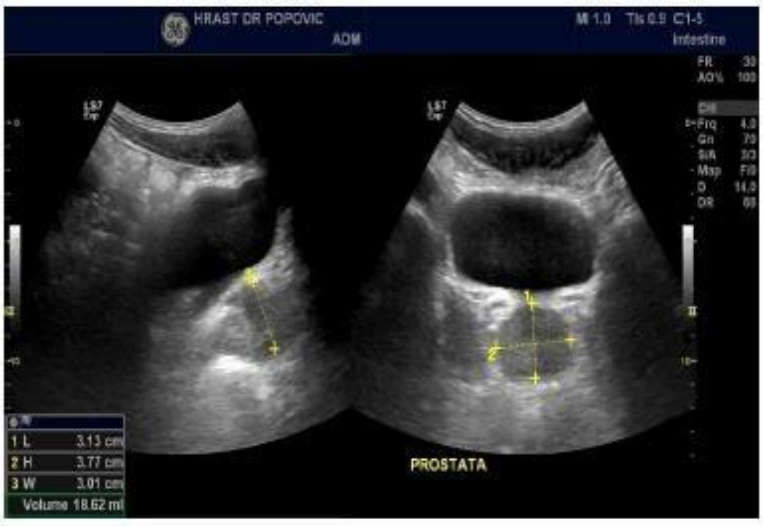


Figure (2-6) shows a transabdominal ultrasound image of normal prostate ,James et al., (2008).

2-2-2 Physiology of Prostate:

The prostate secretes a milky, slightly acidic fluid that contains several substances. Citric acid in prostatic fluid is used by sperm for ATP production via the Krebs cycle. Several proteolytic enzymes, such as prostate-specific antigen (PSA), pepsinogen, lysozyme, amylase, and hyaluronidase, eventually break down the clotting proteins from theseminalvesicles. The function of the acid phosphatase secreted by the prostate is unknown. Seminalplasmin in prostatic fluid is an antibiotic that can destroy bacteria. Prostatic secretions make up about 25% of the volume of seminal contribute to sperm motility and viability, Benson et al ., (1992).

2-1-2-1 Bulbourethral Glands:

During sexual arousal, the bulbourethral glands secrete an alkaline fluid into the urethra that protects the passing sperm by neutralizing acids from urine inthe urethra. They also secrete mucus that lubricates the end of the penis and the lining of the urethra, decreasing the number of sperm damaged during ejaculation, Benson et al., (1992).

2-1-2-2 Semen:

Semen is a mixture of sperm and seminal fluid, a liquid that consists of the secretions of the somniferous tubules, seminal vesicles, prostate, and bulbourethral glands. The volume of semen in a typical ejaculation is 2.5–5milliliter (ml), with50–150 million sperm per ml. When the number fallsbelow20 million/ml, the male is likely to be infertile. Despite the slight acidity of prostatic fluid, semen has slightly alkaline pH of7.2–7.7 due to the higher pH and larger volume of fluid from the seminal vesicles. The prostatic secretion gives semen a milky appearance, and fluids from the seminal vesicles and bulbourethral glands give it a stickyconsistency,Komisaruk, Barry et al., (2011).

2-1-3 Pathology of the prostate:

2-1-3-2 inflammatory lesions:

A part from infection, the vas deference and seminal vesicles are seldom the site of pathological changes. In gonorrhea and urinary tract infections, the organisms may cause suppuration in the seminal vesicles or prostate and spread along the vas to involve the epididymis. A cute prostatitis may also follow surgical instrumentation of the urethra or of the prostate itself. Chlamydia infections are also common but usually milder,Komisaruk, Barry et al., (2011).

Sonographical features of acute prostatitis include hypo echoic swollen gland with increase in vascularity with or without cystic areas suggestive of abscess, but most cases of acute prostatitis sonographically have normal appearance,James et al., (2008).

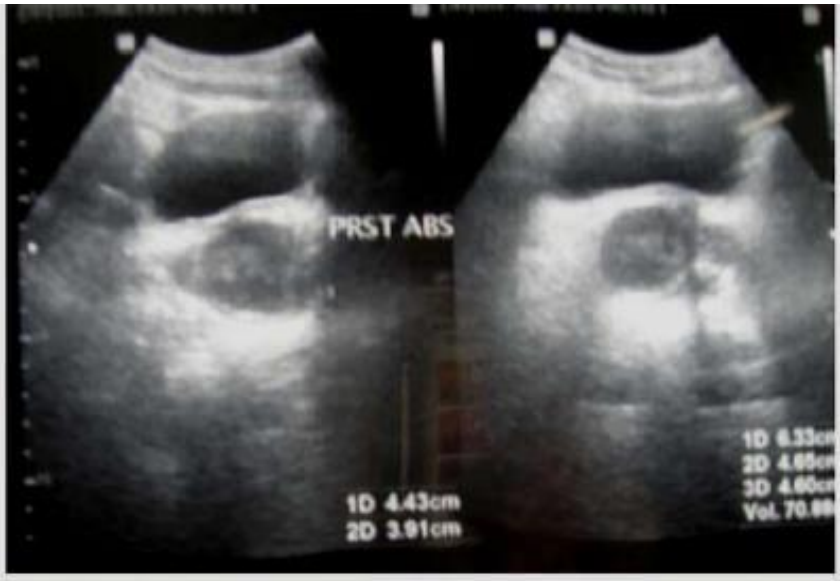


Figure (2-7). Shows a transabdominal ultrasound image of acute prostatitis' Jameset al., (2008).

2-1-3-2 Chronic prostatitis:

May results from an acute infections and a number of other causes. The prostate initially enlarged and tender but many eventually become fibrosed and shrunken. Urethral obstruction Tuberculosis: of the prostate shows characteristic glaucomatous lesions and may involve the whole gland. Tuberculosis may extend in either direction along the vas, depending on whether the initial site of infection of the genital tract was by haematogenous involvement of the epididymis, or by asetenism from the kidney to the urinary bladder and then to the prostate and vas deference, Gerard et al., (2009).

Granulomatous prostatitis infiltrate including giant cells, is present in relation to prostate ducts aglands. It may be a reaction to retained secretion (compare granulomatousorchitis). Histologically it may mimic tuberculosis.prostatitis*:* Is a rare condition in which an inflammatory ceseating and Allergic (eosinophilic) prostatitis*:* With focal necrosis and heavy infiltration with eosinophils has been associated with

allergic conditions, particularly asthma. Eosinophilic prostate may also occurs because of parasitic infestation, e. g. schistosoma haematobium, Gerard et al., (2009).

Sonographic findings of chronic prostatitis include focal masses of varying echogenicity, ejaculatory duct calcifications, capsular thickening or irregularity, irregular periurethral glandular area, dilatated periprostatic vein and distended seminal vesicles,Verhammeet al,.(2002).

Figure (2-8). Shows a transabdominal ultrasound image of chronicprostatitis,Verhammeet al,.(2002).

2-1-3-3 Benign Prostatic Hyperplasia (BPH):

This is not a neoplastic process but represents an over growth of prostaticglandular tissue and smooth muscle and is comparable to conditions such as nodular goiter and cystic hyperplasia of the breast, It is very common and the incidence with age by the age of 80 over 75% of the males are affected to some degree although only some 5% have significant symptoms. The cause is obscure but hormonal factors must be important. BNH does not occur in eunuchs or castrated men and it is not regarded as premalignant. The process starts in the periurethral prostatic glands and the growth occurs mainly on each side of the urethra (in the so- called lateral lobes), although often there is a localized hyperplasia of the tissue just behind the urethra to form a

rounded mass which projects into the bladder (the so- called Median lobe)' Emanuel Rubin et al., (2000).

The hyper plastic tissue is usually firm, white and nodular but it may sometimes shows areas of inflammation, abscess formation or infarction. Microscopically there is an increase in both the glandular elements and the stroma. The glands are usually arranged in well defined lobules and the acini are lined by tall columnar cells beneath which there is a basal cell layer the hyper plastic epithelium may extend into the Lumina of the acini forming small papilla form projections. Some of the acini may be dilated and small retention cysts can form. Tiny concentric concretions known as corporaamylacea, formed from inspissated secretion, are commonly found, and deposition of oxalates and phosphates may produce prostatic calculi. The connective tissue stroma usually contains a substantial proportion of smooth muscle fibers. Fibro muscular hyperplasia is most prominent in the earlier stages of the process but in some cases it may be predominant, forming nodules in which glandular elements are scan

' Emanuel Rubin et al., (2000).

Clinical Features*:* Prostatic hyperplasia is the most important cause of urinary obstruction and infection in older men. Although the prostatic urethra is distorted by BNH it is rarely significantly stenosed and the effects in bladder function result from a complex disturbance of the bladder sphincter mechanism by the obtruding prostate rather than by simple obstruction. Accordingly, the symptoms of prostatism are more diverse than those of simple obstruction and the severity of the symptom does not correlate closely with prostatic size. There may be acute retention of urine or chronic partial obstruction sometimes with "over flow incontinence". Acute obstruction may be precipitated by infection or acute congestion of the gland caused by ingestion of alcohol or as part of the venous congestion of cardiac failure chronic obstruction leads to hypertrophy and dilatation of the bladder, followed in time by Hydroureter and hydronephrosis. If unrelieved chronic renal failure may result. Urinary tract infection

due to Escherichia-coliormixed bacterial flora is frequently superadded ascending spread of infection resulting in pyelonephritis, Emanuel Rubin et al., (2000).

Sonographic appearance of BPH variable depending on histopathologic changes. Diffusely enlarged transitional zone; inhomogeneous nodulartexture; occasional finding of calcification and cystic change (80%).Isoechoic hyperplastic nodules with hallo may appear in peripheral zone mimicking carcinoma (20%). Delineation between peripheral zone and central zone becomes more obvious, sometimes out line by corporaamylacea along surgical capsule. Hyperplastic nodules may undergo cysticdegeneration forming rigged cystic masses,Verhammeet al,.(2002).

Figure(2-9). Shows a transabdominal ultrasound imageof BPH ,Verhammeet al,.(2002).

2-1-3-4 Carcinoma of the Prostate:

This now one of the commonest cancer of an internal organ in males in the developed countries, its mortality rate being exceeded only by carcinomas of the bronchus, stomach and large intestine. Carcinoma of the prostate has its principle incidence later in life than most other cancer and its increasing incidence over the last 20 years is

mainly attributable to the increased number of elderly men in the population,Verhammeet al,.(2002).

There are market racial and geographical variations in incidence; however American Negroes have the highest incidence in the world considerably greater than white Americans and greater than black Africans. There is avery low incidence in Chinese and Japanese. The tumor usually arises on the posterior aspect and at the periphery of the gland out with the common lesions prostatic carcinoma and BNH frequently coexist but, as already stated, there is virtually no evidence that BNH is casually related to the development of malignancy. The large majority of the prostatic carcinomas are adenocarcinomas,Verhammeet al,.(2002).

In ultrasound prostatic Ca appears as hypo echoic (60–70%), hyperechoic (1-5%), Isoechoic (30-40%) or diffuses lesions, depends on amount of stromal fibrosis. Most peripheral isoechoic lesions close to capsule cause asymmetry contour and bulging of lateral border. Isoechoic tumors identified by indirect signs: Areas of attenuation, glandular asymmetry and capsular distortion. Large diffuse tumors tend to be more echogenic. Benign nodules related to prostatitis, BPH, atrophy and infarction can mimic prostatic Ca,Verhammeet al,.(2002).

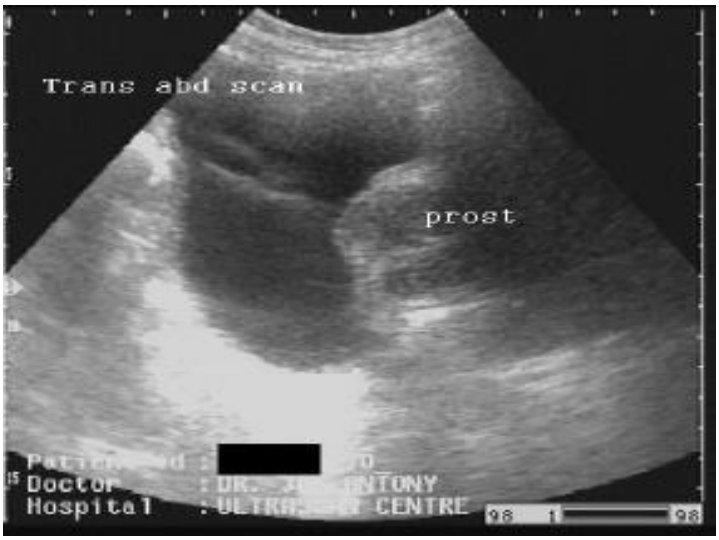


Figure (2-10). Shows a transabdominal ultrasound image of Ca prostate Verhammeet al,.(2002).

2-1-4 Techniques and approaches of prostatic ultrasonography:

Ultra sonography is firmly established diagnostic tool in prostatic imaging. Recent development in US technology has led to significant improvements in image quality, consistency and resolution. Additionally, dynamic scanners, color flow imaging and real time imaging have allowed appreciation of blood flow, reduced examination time and improved quality of the image. These advances combined with the portability, relative low cost and lack of risks of iodinated contrast media and irradiation have made US one of the most useful modality in evaluation of the prostate. Many approaches can be used to image the prostate as trans-abdominal, transurethral, trans-perineal and trans-rectal US. The common two approaches are trans-abdominal and trans-rectal ultrasound' James et al., (2008).

2-1-4-1 Patient Preparation

Transrectal ultrasound (TRUS):Rectum should be emptied prior to the scan (An enema wash may be taken 2 to 4 hours before exam to clean out the bowel).Small amount of fluid in the bladder is needed to identify the prostate. Ensure that generousamount of gel is put in to sphincter before inserting the probe'Terriset al., (1991).

Transabdominal ultrasound (TAUS):In TAUS patient come with full bladder may need to drink a lot of amount of water 30 mints before the exam. Patient wear gown during procedure. May instructed to avoid taking blood thinners such as aspirin for seven to 10 days prior to procedure if biopsy is planned' Sun Ho Kim et al., (2008).

2-1-4-2 Equipment selection: In TRUS high frequency probe is used it must have color Doppler capabilities. 3D scanning and contrast agent such as micro bubbles will improve the assessment of vascularity'Terriset al., (1991).

In TAUS 3 – 5 MHZ – 6 MHZ curved linear array probe depending on the size of the PT should be used' Sun Ho Kim et al., (2008).

2-1-4-3 Patient position:

In TRUS the PT lies in lateral decubitus position with his knee toward the chest Terris et al., (1991). In TAUS PT lies supine Sun Ho Kim et al., (2008).

2-1-4-4 Scanning technique:

TRUS Technique is ideal to have small amount of urine in the bladder .Ask the PT to try and relax and "bear down" to open the sphincter as the transducer inserted slowly. Ensure the transducer has latex free dedicated probe cover with plenty gel Terris et al., (1991).The highest frequency sector probe should be used (7–12) MHZ .The scanning begins in the axial plan. The seminal vesicles are examined initially. As the probe is angled caudally the base of the prostate is seen. Once the prostate examined in its entirety in this plane the probe is turned 90 degree in sagittal plane. The probe is angled from one side a cross to the other. The volume is taken by measuring high x length in the sagittal plane and x width in the axial plane and multiply by 0.52 Terris et al., (1991).

In transabdominal technique the PT lies supine should have a half full bladder 500mls of water 30mints before scan, the probe is angled approximately 30 degree caudal using the bladder as a window. Slight compression to ensure the inferior portion of the prostate is not obscure by shadow artifact from the base of the bladder Sun Ho Kim et al., (2008).

2-1-5 Residual Urine Determination

2-1-5-1 Indications:

Determination of residual urine

2-1-5-2 Measurement:

Calculate bladder volume using the formula for an ellipsoid

Residual urine volume (ml) = *length x depth x width x 0.52*

2-1-5-3 Procedure:

Have the patient empty the bladder completely?

Measure the residual urine volume sonographically using the formula

Volume (ml) = width (cm) x depth (cm) x length (cm) x0.52

2-2 Previous studies:

Abu-Yousef . and Narayana (1982) their study stated stresses the value of transabdominal ultrasound that utilizes basic ultrasound equipment in evaluating the size of the prostate. We performed ultrasound examinations on 43 patients with benign prostatic hyperplasia, and in 33 of these, sonography was done prior to surgery in an effort to compare the size of the prostate estimated by ultrasound with that of the postoperative specimen. In the vast majority of these patients, the difference between the estimated size and that of the specimen was insignificant. Ultrasound examination is easy, fast, noninvasive and reasonably accurate.

Roehrborn et al., (1988) Aimed to estimate the post-voiding residual (PVR) in replace catheterization? Which done in n 81 outpatients the postvoiding residualurine(PVR using realtime B-mode ultrasonography (3.5 MHz transducer(was measured. For the - calculation of the bladder volume the formula for an ellipsoid ($V = 4/3\pi \times r1 \times r2 \times r3$(was found to be most accurate in predicting the actual volume measured by in-and-out catheterization ($r = 0.982$(. Other volume formulas, using only one diameter of the bladder, were found to be much less accurate. For any arbitrary value of PVR, used in determining clinical management, the incidence of misjudgment by ultrasound was negligibly low. We conclude, that sonographic measurement of the PVR as a quick, noninvasive method, should replace catheterization, if the basic equipment is available. Additional information, e.g., prostate size, bladder configuration, iverticula, etc., can be obtained during the procedure without additional costs or loss of time. patient is described in whom a crossed kidney was found. There was doubt whether

this was due to displacement or ectopia of the kidney. A review of literatureon this subject gave no answer to our problem. Considering the embryologic development of crossed ectopic kidney and the mechanism of kidney displacement across the midline we found a simple method by which the diagnosis can be .madeAcute urinary retention in herpes genitalis infection is reported to be infrequent. We report 4 cases of acute urinary retention caused by neurologic complication of herpes infection. The uro dynamic finding and follow-up results are presented.

Chapter Three

Materials and Methods

3-1 Materials:

3-1-1 Design of the study

This was analytical case control study conducted to assess the residual volume of

3-1-2 Study population:

A total of 100 patients with benign prostatic hyperplasia.

3-1-3 Study area:

This study was done at ultrasound departments of Elmoallim complex and DR.Osman A.Wahab clinic. Hospital .

3-1-4 Inclusion criteria:

Patients with known benign prostatic hyperplasia were included to this research.

3-1-5 Exclusion criteria:

Patient with surgical intervention to any part of urinary system and other pathological conditions of prostate

3-1-6 Sample size:

The total number of patient underwent prostate volume measurement was 50 patients.

3-1-7 Equipment

Toshiba ultrasound machine (XARIO 100) and alpinion ultrasound machine (ECUBE 7) (with probe-convex 3.5 MHz) and, Ultrasound imaging system with a B mode capabilities was used. The used transducer was phased-array 3.5 MHZ. Ultrasound gel was applied to the transducer to prevent any attenuation or artifact. Thermal Paper Printer was used.

3-2 Methods:

A data collected from many hospitals to assess these volumes include patient with

mean age of 60yrs…… (29-90) where Patients was scanned in supine position, prostate volume calculated using

(Formula= width (cm) x depth (cm) x length (cm) x0.52).

3-2-1 methods of Data collection:

Data was collected by examine of the patients and data was registered at specially designed master data collection sheets including all measurement variables.

3-2-2 Methods of Data analysis:

After collecting, the data sheets were symbolized classified and analyzed using SPSS and excel Microsoft office program.

3-2-3 Ethical issue:

There was written permission to take the data and No patient identification data or detail published.

Chapter Four

Results

Table (4-1) showed the statistical measures of the research variables:

Descriptive Statistics	Range	Min	Max	Mean	Std. D	Variance
AGE	61	29	90	69.31	13.4	178.8
Prostate volume	117.0	33.0	150.0	79.5	24.9	619.479
Pre Mic Volume	2000	0	2000	401.1	525.6	276197.6
PV Volume	1318	0	1318	102.6	263.2	69230.7
UB Wall Thickness	6.0	0	6.0	3.735	1.9	3.7
No marital Status	2	1	3	1.69	0.769	0.6
Width	4	3	7	4.80	1.172	1.4
thickness	4	3	7	4.80	1.172	1.4
length	5	3	8	5.73	1.511	2.3

Pair sample t-test to test the significance difference between the bladder volumes in pre-and post micturition status at (CL=95%, P-value>0.05).

Paired Samples Statistics		Mean	N	Std. Deviation
Pair one	Pre Mic Volume	401.08	49	525.545
	PV Volume	102.57	49	263.117

Table (4-3) t-test result of the pair sample test where the p value equal to 0.000 demonstrating the significance difference between the two volumes

Paired Samples Test						
		Paired Differences		T	df	Sig. (2-tailed)
		Mean	Std. D			
Pair 1	Pre Mic Volume – PV Volume	298.5	372.4	5.6	48	0.000

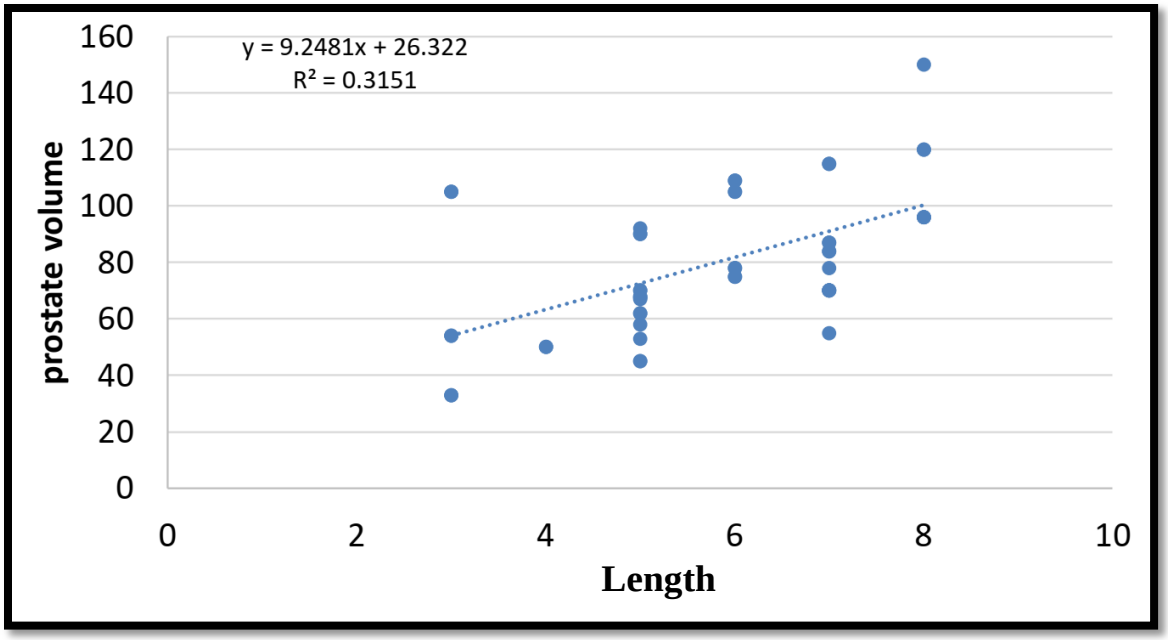


Figure (4-1) Scatter plot shows linear relationship between prostatic volume and length

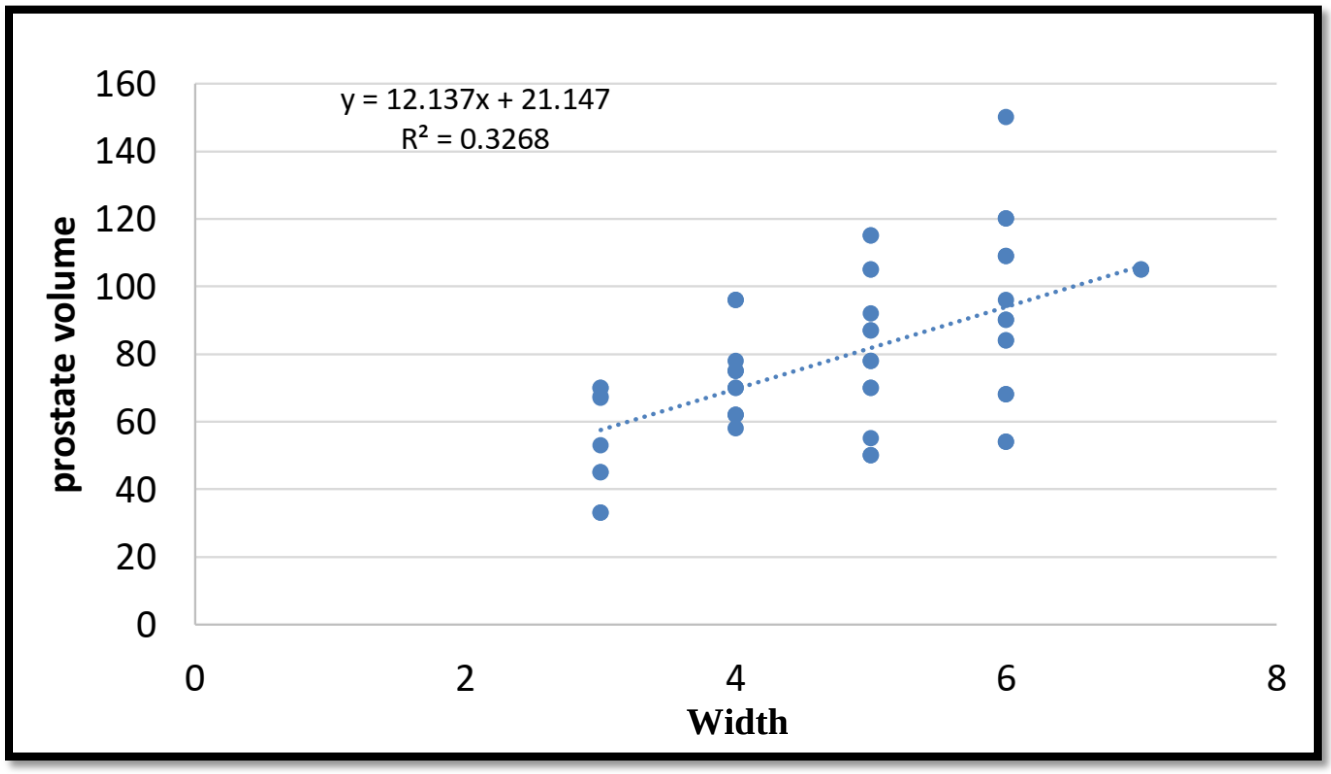


Figure (4-2) Scatter plot shows linear relationship between prostatic volume and width

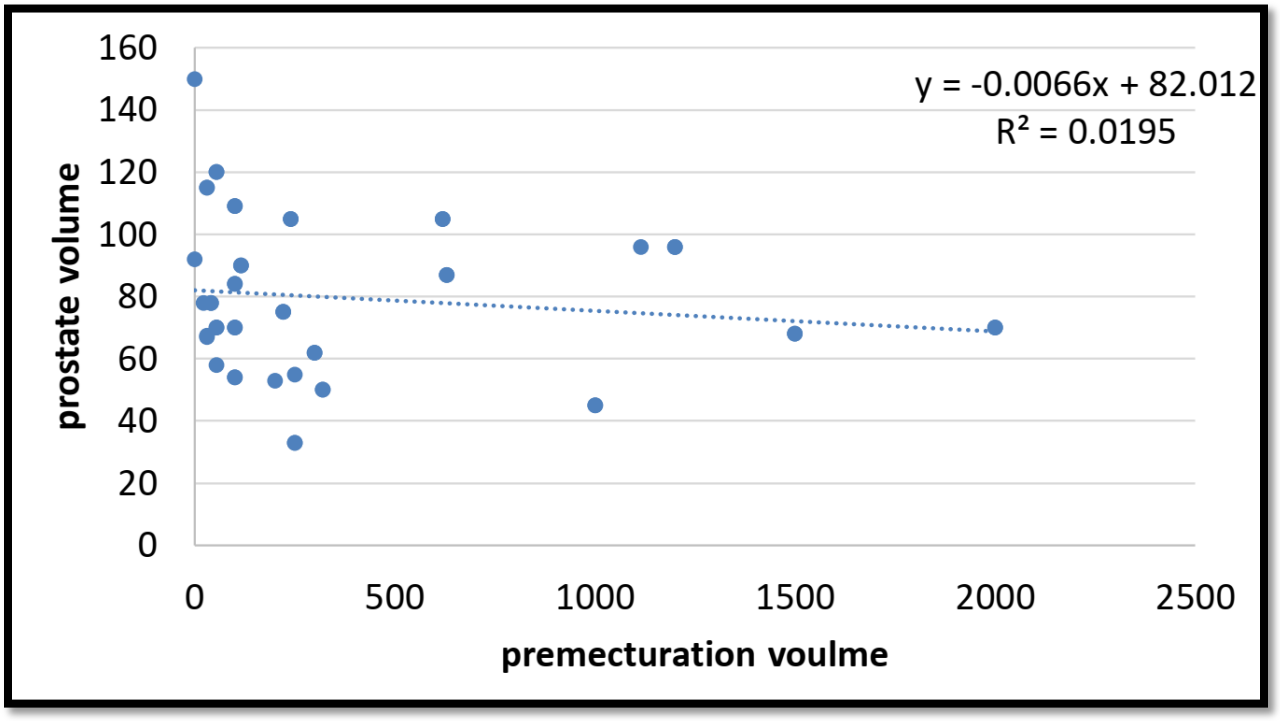


Figure (4-3) Scatter plot shows linear relationship between prostatic volume and premecturation volume

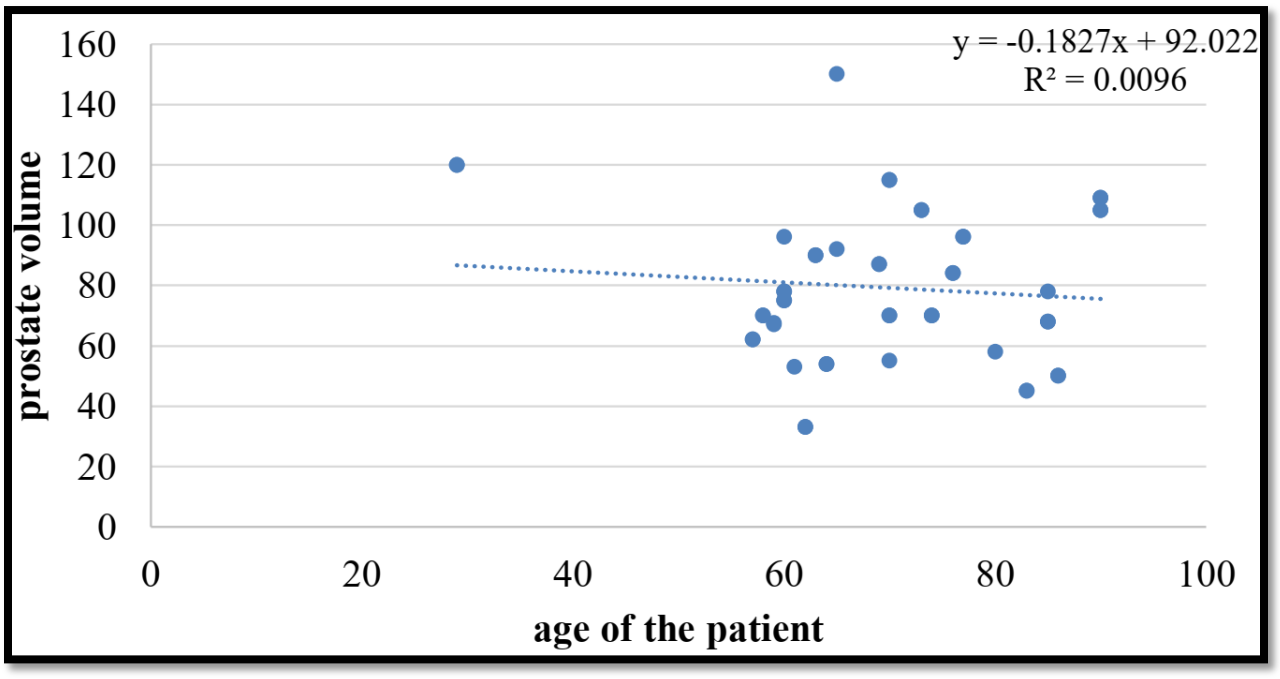


Figure (4-4) Scatter plot shows linear relationship between prostatic volume and age of the patient

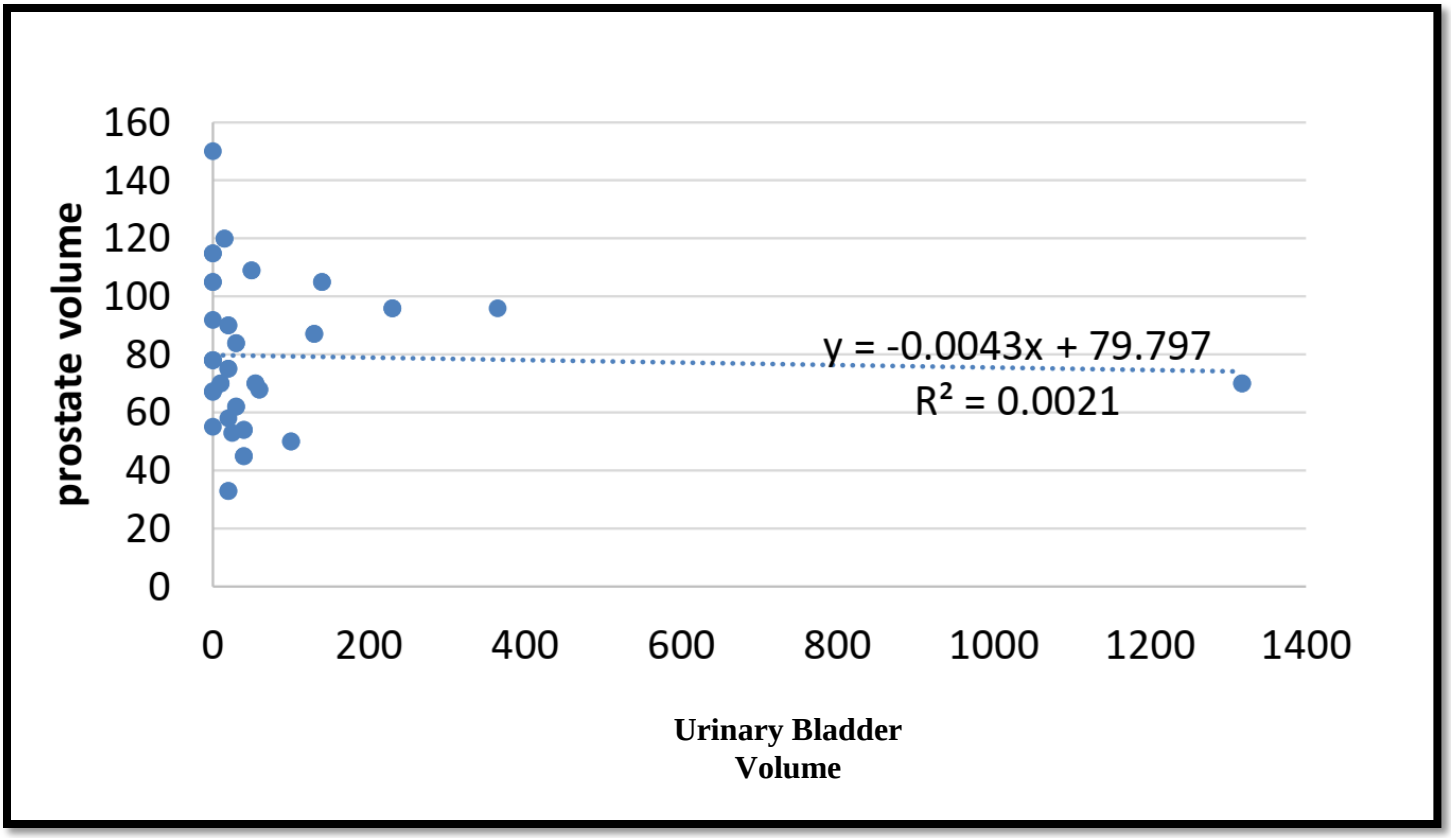


Figure (4-5) Scatter plot shows linear relationship between prostatic volume and Urinary Bladder Volume

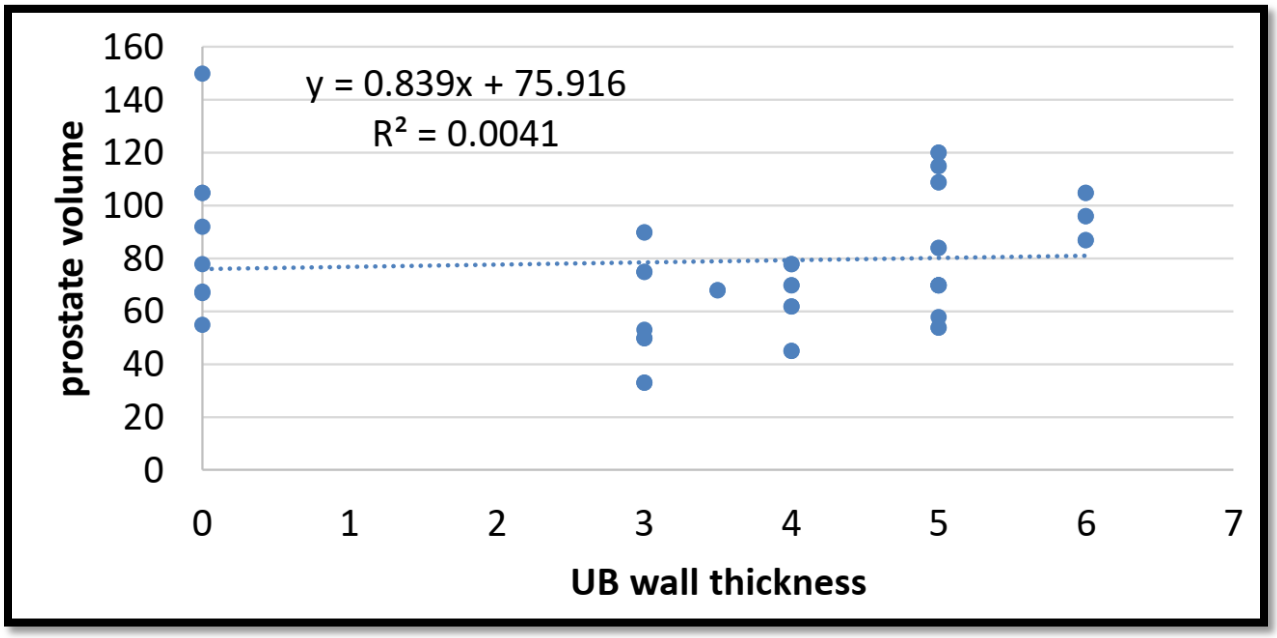


Figure (4-6) Scatter plot shows linear relationship between prostatic volume and UB wall thickness

Table (4-4) frequency distribution of patients age:

Age	Frequency	Percent
29-39	2	4.1
40-50	6	12.2
50-60	16	32.7
60-70	13	26.5
70-80	12	24.5
Total	49	100.0

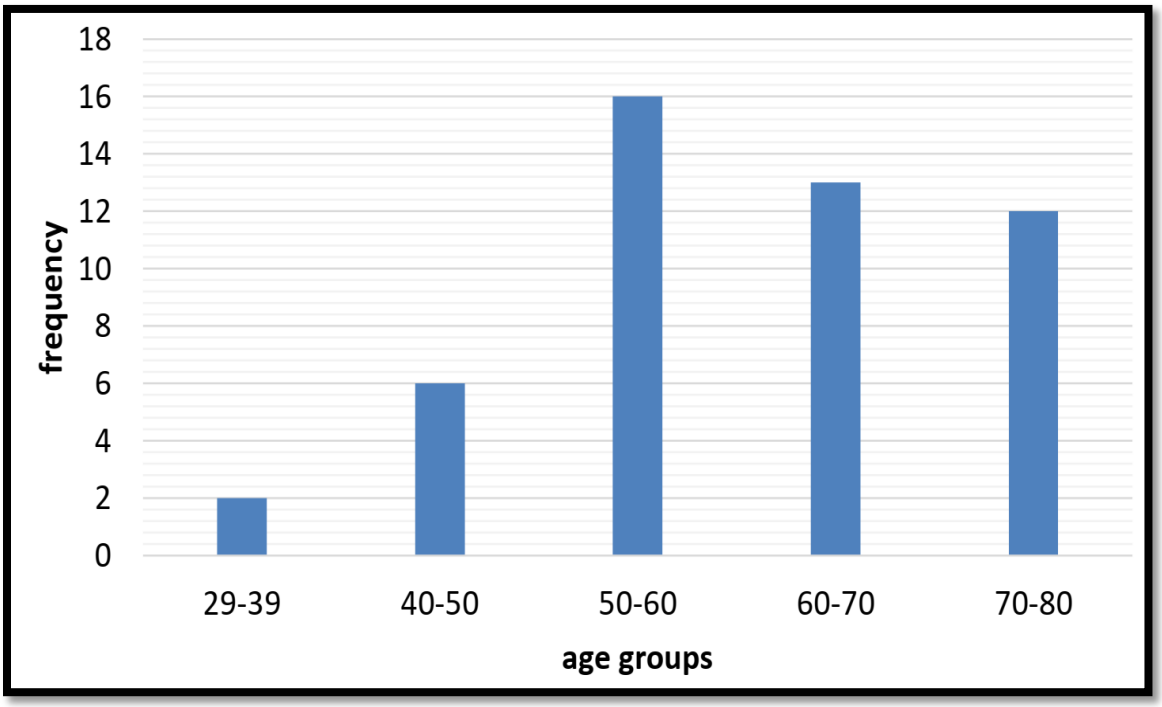


Figure (4-7) shows frequency distribution of patients age

Chapter Five

5-1 Discussion:

This study showed a linear relationship between the prostate volume and the post void residual urine, when the prostate volume increased the post void residual urine is also increased.

Also a linear relationship is noted between the pre void bladder volume and the post void residual urine, when the urinary bladder volume pre void increased the volume of post void residual urine also increased.

A linear relationship between the patient age and Prostate Volume also is demonstrated, as the age increased the prostate volume, also benign prostate hypertrophy is increased in age above of 70 years which is 42% of study sample.

Prostate calcification was presented in 38% of patient with benign prostate hyperplasia, and the bulging of the median lobe into the urinary bladder neck was found in 22% of the patients.

Main complication of increased residual urine volume found in this study is cystitis which was developed in 34% of the study sample and then vesical stone which was found in 18% of study sample.

By comparison between this study and previous studies (N.C.BIRCH,etal2008). There was variation in residual urine volume between patients and No relationship between residual urine and age.Also by comparing this study with steel G. et. Al., 2001 maximum urine flow and prostate volume in only in 26% with obstruction.

5-2 Conclusion:

- Benign prostatic hypertrophy was found in male age (50-60) followed by (60-70)
- While the men age increased Benign prostatic hypertrophy increased.
- While prostate volume increased post micturition urinary bladder volume (residual urine) increased.
- There was relationship between volume of urinary bladder pre and post void.
- Cystitis is the main complication of the post void residual urine.

5-3 Recommendations:

- Ultrasound must be done for all male patients came by symptoms of lower urinary tract symptoms which may occurs as result of BPU.
- Post void residual scan is important for patient with benign prostate hyperplasia.
- Clear and specific instruction must be given to patient to be full bladder for good evaluate the prostate, and also for voiding to evaluate the post void residual urine.
- Further study needed to assessment.

- **References:**

Ng kent hoo et al., (2012) prostatic volume measurement using transabdominal ultrasound scanning isbn 978-61804-122-7.

Susan Standring (2008). Grays Anatomy, 40th Edition PHD. DSC. FKC.Anatomy of human body.

Martini, F. H., Timmons, M. J., & Tallitsch, R. B. (2012). *Human Anatomy.* (7th Edition). San Francisco: Pearson Benjamin Cummings.

prevalence of lower urinary tract symptoms suggestive of benign prostatichyperplasia in primary care--the Triumph project". Eur. Urol. 42 (4): 323–8. Doi: 10.1016/S0302-2838(02)00354-8

James F, Griffith, MBch, FRCR; et, al (2008). Diagnostic Imaging Ultrasound. First Edition.

Benson MC, Whang IS, Pantuck A, Ring K, Kaplan SA, Olsson CA, et al (1992). Prostatespecific antigen density: a means of distinguishingbenign prostatic hypertrophyand prostate cancer. J Urol; 147:815-9.

Komisaruk, Barry R.; Whipple, Beverly; Nasserzadeh, Sara and Beyer-Flores, Carlos(2009). *The Orgasm Answer Guide*. JHU Press. pp. 108–109. ISBN 0-8018-9396-8. Retrieved6 November 2011.

Gerard J. Tortora and Bryan Derrickson (2009) Principles of Anatomy and Physiology 12th edition.

Emanuel Rubin. 2000 Essential pathology. 3rd edition USA. P 501-502-503-504-505.

Verhamme KM, Dieleman JP, Bleumink GS, et al. (2002). "Incidence and Sonographic finding of benign prostatic hyperplasia.

Terris IK, and Stamey TA (1991). Determination of prostatic volume by transrectal ultrasound. J Urol, 145: 984-987.

Sun Ho Kim and SeungHyp Kim. “Coe1atjon beeen the vious methods of estimating prostateVolume: Transabdomjnap’, Transrectal and three dimensional US. Korean 3. Radiol, 2008(9), pp. 134- 139.

Rietbergen JBW, Schroder FH: screening for prostate cancer More questionsthan answers. Acta Oncol, 1988; 37,515-532.

Littrup P Kane RA, Mellen CJ, et al; Cost effective prostate cancerdetection. Reduction of low-yield biopsies. Cancer. USA.2000; P74, 3146.

McNeill SA et al., 2001-Post void residual urine in patients with lower urinary tract symptoms suggestive of BPH-Urology, 57 (3): 459-65.

www.sciencedirect.com/.../... (utrasonography for measuring urinevolume in men with lower urinary tract problem.

Park YH, et al-2011-[Accuracy of post-void residual urine volumemeasurement using a protable ultrasound bladder scanner with realtimepre-scan imaging]-NeurourolUrodyn 30 (3): 335-8. Doi 10.1002/nau. 20977.

Appendices

Appendix 1 US images from study

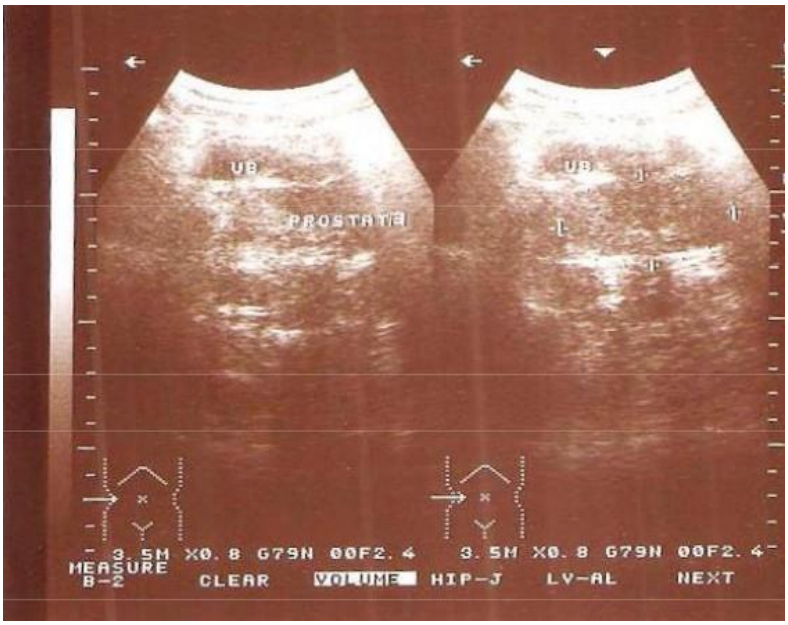


Image (1) ultrasound image of PBH in 56 years old man

Image (2) ultrasound image of PBH in 76 years old man

Image (3) ultrasound image of PBH in 62 years old man

Image (4) ultrasound image of PBH and post void residual urine in 67 years old man

Image (5) ultrasound image of PBH and post void residual urine in 64 years old man

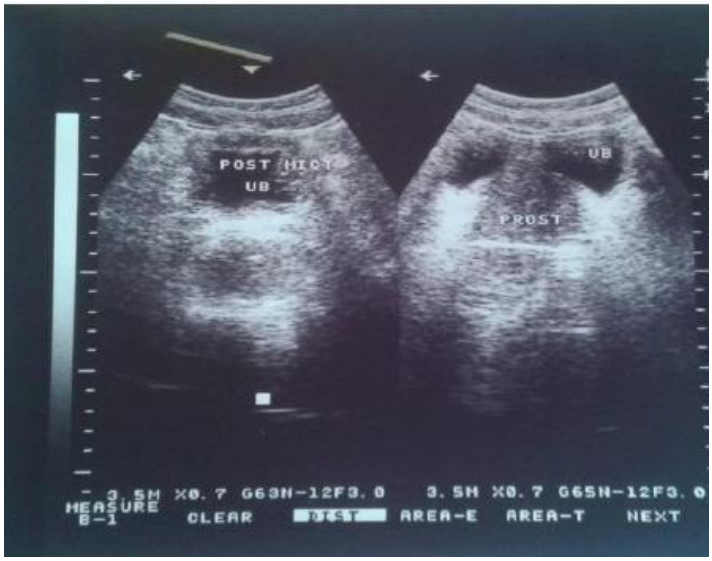


Image (6) ultrasound image of PBH cystitis and post void residual urine in 57 years old man

Image (7) ultrasound image of PBH and post void residual urine in 66 years old man

Image (8) ultrasound image of PBH and post void residual urine in 58 years old man

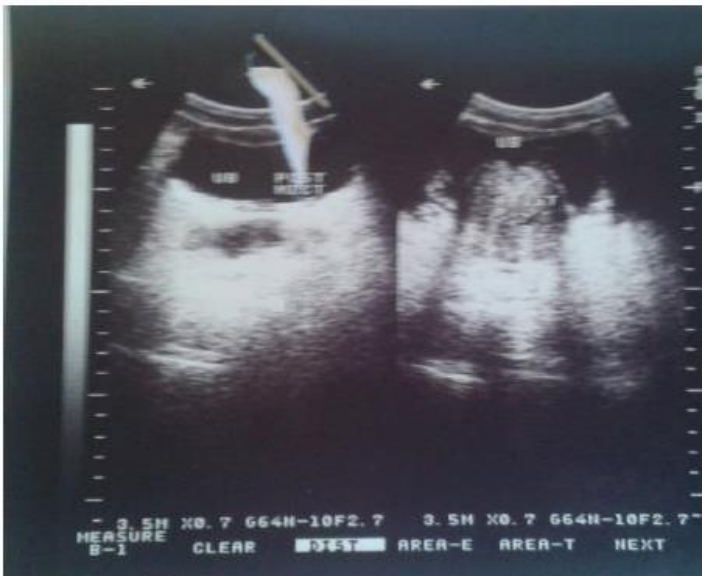
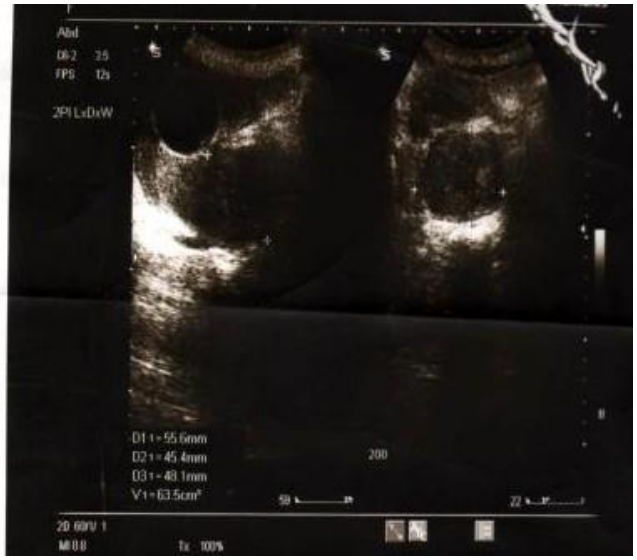


Image (9) ultrasound image of PBH and post void residual urine in 70 years old man



A: (10) ultrasound image of PBH and post void residual urine in 72 years old man

Image (11) ultrasound image of PBH and post void residual urine in 74 years old man

Image (12) ultrasound image of PBH and post void residual urine in 60 years old man

Appendix 2
Data Collection Sheet

No	Age	P. V	Pre Mic Volume	PV Volume	UB Wall Thickness	Number 0f Marital Status	X	Y*Z
1								
2								
3								
5								
5								
6								
7								
8								
9								
10								