Sudan University of Sciences and technology

College of Graduate studies

Characterization of Benign Prostatic Hyperplasia using Ultrasonography

توصيف تضخم البروستاتا الحميد باستخدام التصويربالموجات فوق الصوتيه

A Thesis submitted for Partial Fulfillment of the Requirements of M.sc. Degree in Medical Diagnostic Ultrasound

By

Mohammed Ahmed Dassogi Hassan

Supervisor

Dr. Babiker Abd ELWahab Awad Alla

2017

الايـة

قَالَ تَعَـالَىٰ:

بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

﴿ وَعَلَّمَكَ مَا لَمۡ تَكُن تَعۡلَمُۚ وَكَانَ فَضۡلُ ٱللَّهِ عَلَيۡكَ عَظِيمٗا ﴾

صدق الله العظيم

النساء 113

DEDICATION

Tomy father:

Who always supported me in every Endeavor.

To my mother:

Who is the Reason I am here all, and me who I am today.

To my wife and my kids:

If I denoted to you everything in the world is not enough to give you your right.

To my brother and sister:

For their valuable supports.

Acknowledgment

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

I thank **Dr Babiker Abdel Wahab Awad Allah**my supervisor for her help and guidance.

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 alribat university hospital and al moalim medical center for their cooperation.

Finally I would like thank my friend teacher and colleagues.

Abstract

This study was a descriptive cross sectional study which aimed to evaluate the benign prostatic hyperplasia using ultrasonography, carried out in alribat university hospital and almoalem medical center from novamber2016 to February 2017.

There were 62 males patients were scanned by ultrasound, all had patients age above 40 years, Any patient had normal prostate and prostatic cancer was excluded from this study.

All these patients were scanned trans abdominal ultrasound using Semen's and Esaote ultrasound machines to evaluate the prostate volume, out lines, internal echogenicity of prostate and any other diseases associated with BPH like (classification, cyst, diverticulum).

Data was collected using data collected sheets and analyzed using the collecting data program. Study found that the most affected age by benign prostatic hyperplasia 61 to 70 years respectively 41.9%, the prostate volume ranged from 32 to 135 ml with mean 55,6 and stander deviation 22.7, there was a linear correlation between age, number of children and prostatic volume.

The study concluded that the benign prostatic hyperplasia usually include homogenous echo pattern, regular out line, with or without presence of classification, cyst, diverticulum, and residual urine may be found or not.

Study recommended that ultrasound scanning should be done routinely for any patient with BPH, because is sheep and safety.

المستخلص

هذه الدراسة هي مقطعية وصفيةهدفت إلى تقييم تضخم البروستاتا الحميد باستخدام الموجات فوق الصوتية، التي أجريتفي مستشفى الرباط الجامعي، ومركز المعلم الطبي في الفترة مابين نوفمبر 2016الي فبراير 2017 .

وتم فحص 62مريضا من الذكور عن طريق الموجات فوق الصوتية، حيث تجاوزت اعمارهم 40 عاما،وفي هذه الدراسه تم استبعاد كل مريض لايعاني من تضخم البرستات.

كل هؤلاء المرضى تم فحصهم بالموجات فوق الصوتيه عن طريق البطن باستخدام ماسحات سيمنس واي ساوتيه، لتقييم حجم البروستاتا، والحواف الخارجية للغدة، والمظهر الداخلي للبروستاتا، وأي أمراض أخرى مرتبطة بتضخم البروستات مثل (تصنيف، والكيس، و رتج).

وجمعت البيانات باستخدام اوراق تم تحليلها فيحزمة التحليل الاحصائي في العلوم الانسانيه والاجتماعيه. ووجدت الدراسة أن اكثر الفئات العمرية تاثرا بتضخم البروستاتا الحميد 61-70 سنة بنسبة (41.9٪)، وتراوح حجم البروستاتامابين 32-135 مل، مع متوسط 55،6 مل، ومتوسط حجم الانحراف 22.7،حيث وجدت الدراسه ان هناك علاقة خطية ما بين الفئة العمرية وعدد الأطفال و حجم البروستاتا.

وخلصت الدراسة إلى أن تضخم البروستاتا الحميد عادة يتميز، بتجانس المظهر الداخلي،وبانتظام الحواف الخارجيه، مع أو عدم وجود تصنيف، تكيس، اورتج، والبول المتبقي يمكن ان يتواجد او لا.

وتوصي الدراسة أن مريض تضخم غدة البروستات يجب فحصهبالموجاتفوق الصوتيه وينبغيان يتم بشكل روتيني ،وذالك لانها امنه ورخيصة الثمن.

Table of contents

List of tables

List of figures

Abbreviations

TUPS	Transperineal ultrasonography
BMI	Body mass index
BNH	Benign nodular hyperplasia
BPH	Benign prostatic hyperplasia
CA	Cancer
KG	Kilogram
KSA	Kingdom of Saudi Arabia
MI	Milliliter
NG	Nanogram
PSA	Prostatic specific antigen
TRUS	Transrectal ultrasound
US	Ultrasound

Chapter One

Introduction

Chapter one

Introduction

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 males life.
(Ng Kent Hoo 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 micturation urine, residual urine may cause cystitis, pylonephritis, urine retention,(dilated ureter), hydronephrosis, 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 aporitially 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. (Ng Kent Hoo, 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 world as it has became significant cause of death every year. (Ng Kent Hoo 2012)

1-2 Problem:

Benign prostatic hyperplasia may be cause of some other abnormalities, early diagnosis and management may reduce this occurrence of abnormalities, and ultrasound is the best method for diagnosis of BPH.

1.3 Objectives:

1.3.1 General Objectives:

To characterize benign prostatic hyperplasia using ultrasonography

1.3.2 Specific objectives:

To assess the role of ultrasound for detection of the prostatic hyperplasia.

To measure the prostate volume when exceeded 30cm3 conceder BPH.

To demonstrate ultrasound findings in benign prostatic hypertrophy.

To correlate between age and prostatic volume and weight of patient.

1-4 Overview of the study:

This study is concerned with Characterization of benign prostatic hyperplasia using ultrasonography, it falls into five chapters. Chapter one

which include introduction, problem and study, objectives and overview of the study. While Chapter two will include a anatomy, physiology, pathology and previous studies. Chapter three deals with the methodology, where it provides an outline of material and methods used to acquire the data in this study as well as the method of analysis approach. While the results were presented in chapter four, and finally Chapter five include discussion of results, conclusion and recommendation followed by references and appendices.

Chapter Tow

Literature review and back round studies

Chapter two

Literature review

2-1 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 (Susan, 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 anteropostenor and 3 cm in its vertical diameters, and weight about 8 g in youth, but almost invariably enlarges with the development of BPH (Susan, 2008).

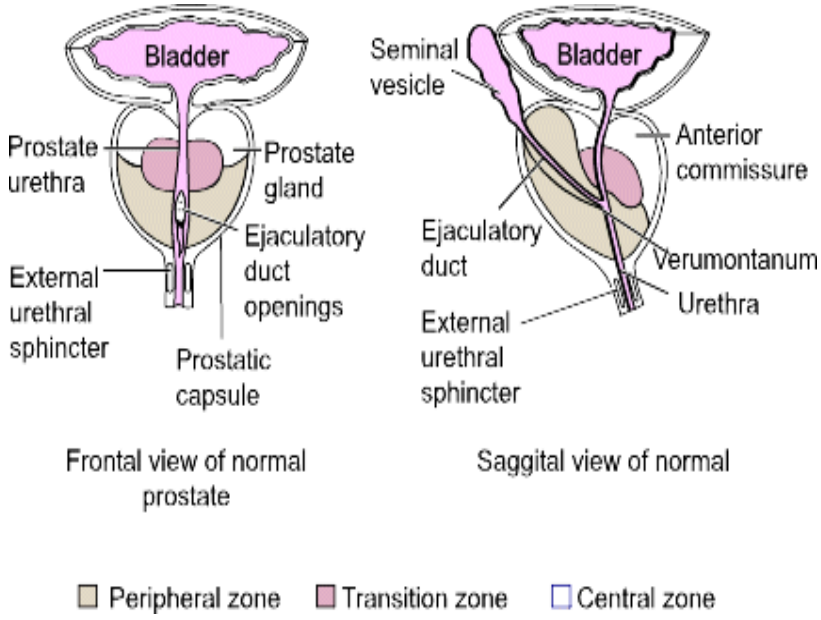


Figure (2-1).Shows frontal and sagital planes of prostate (Susan, 2008)

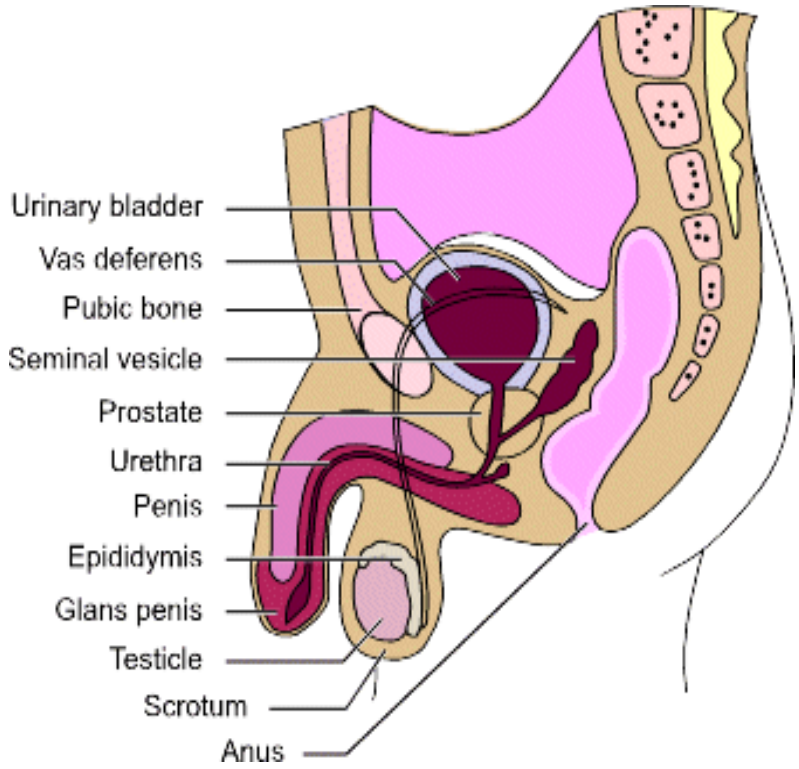


Figure (2-2). Shows male reproductive system (Susan, 2008)

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 (Susan, 2008).

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 (Susan, 2008).

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 pubourethral sling or pubourethralis. These muscles are separated from the prostate by a thin layer of connective tissue (Susan, 2008).

The posterior surface of the prostate is transversely flat and vertically convex. It is separated from prerectal fat in the prerectal 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 (Susan, 2008).

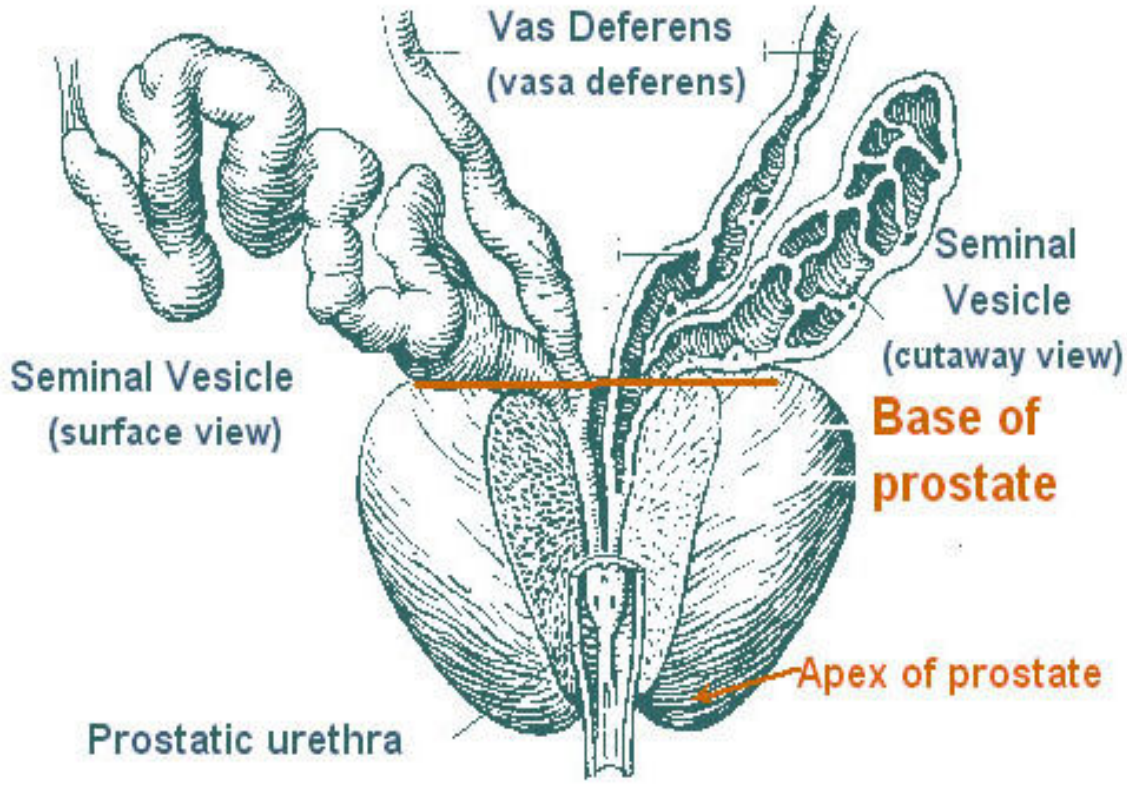


Figure (2-3). Shows the parts of the prostate (Henry Gray.1918)

2-1-1 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 in the 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 (fibromuscular 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 fibromuscular stroma. Simple mucus-secreting glands lie in the tissue around the preprostatic urethra, above the transitional zone and surrounded by the preprostatic sphincter. These simple glands are similar to those in the female urethra and unlike the glands of the prostate (Susan, 2008).

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

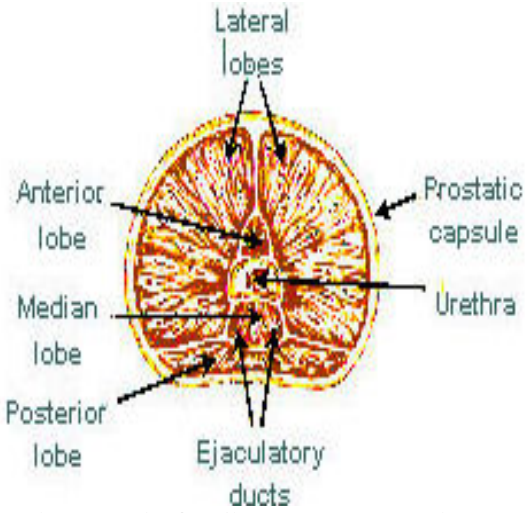


Figure (2-4). Shows prostatic lobes (Henry Gray.1918)

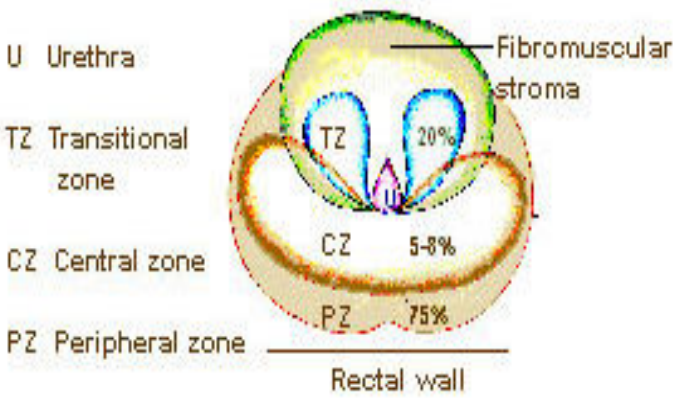


Figure (2-5) Shows Prostatic Zones (Henry Gray.1918)

2-1-2 vascular supply and lymphatic drainage.

2-1-2-1Arteries:

The prostate is supplied by branches from the interior vesical, internal pudendal and middle rectal arteries. And the inferior vesical artery often arises from the internal iliac artery with the middle rectal artery. 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 (Susan, 2008).

2-1-2-2 Lymphatic drainage:

Collecting vessels from the vas deferens drain into the external iliac nodes, while those from the seminal vesicle drain to the intemal and external iliac nodes. Prostatic vessels end mainly in internal iliac. (Susan, 2008).

2-1-2-3Innervation:

The prostate receives an abundant nerve supply from the inferior hypogastnc (pelvic) plexus. The sympathetic nerve simulates the smooth muscle of the prostate during ejaculation (Susan, 2008).

2-1-3Microstructure:

The glandular tissue consists of numerous follicles with frequent internal

papillae. Follicles open into elongated canals which join to form 12—20 main 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 predoninantly columnar, and either single-layered or pseudostratified.

Prostatic ducts open mainly into the prostatic sinuses in the floor of the prostatic urethra. They have a bilayered epithelium. The luminal layer columnar and the basal Layer is populated by small cuboidal cel. 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 phosphatase. Amylase, prostate specific antigen, fibrinolysin and zinc. Numerous neuroendocrine cells, containing neuronespecific enolase, chromogranin and serotonin, are present in the glandular epithelium: their numbers decline after middle age and their function is unknown. (Susan, 2008).

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 most characteristic of the peripheral, transition, and content zones in the normal patient. Smooth muscle muscle produse a hypoechoic appearance, although an enlaged transition zone also able to produce such echogenicity. Hyperechoec structure are most characteristic of fat corpora amylaca, or calculi. (James F, 2008).

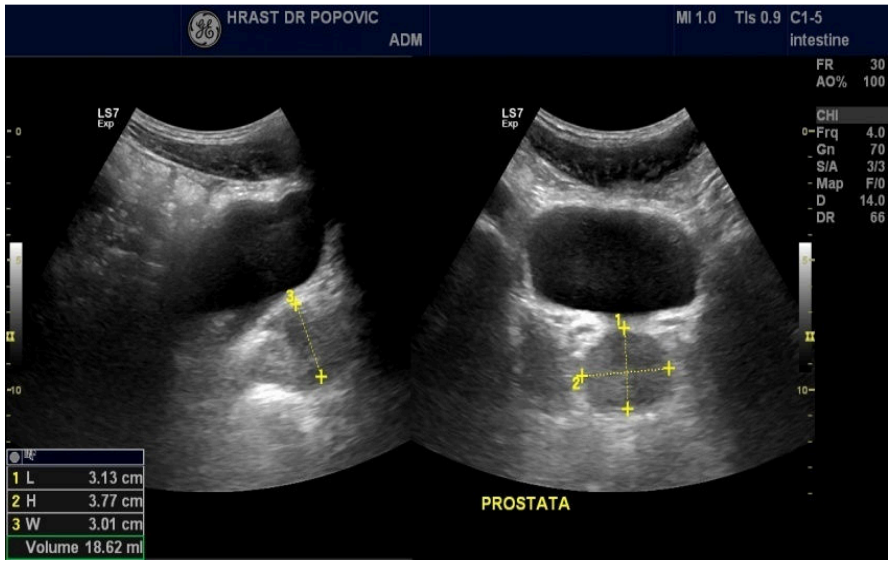


Figure (2-6) Shows a transabdominal ultrasound image of normal prostate (James F, 2008).

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 the seminalvesicles. 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 semenanl contribute to sperm motility and viability. (Gerard, 2009).

2-2-1 Bulbourethral Glands

During sexual arousal, the bulbourethral glands secrete an alkaline fluid into the urethra that protects the passing sperm by neutralizing acids from urinein the 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. (Gerard, 2009).

2-2-2 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 2.5–5 milliliter (mL), with50–150 million sperm per mL. When the number falls below20 million/mL, the male is likely to be infertile.

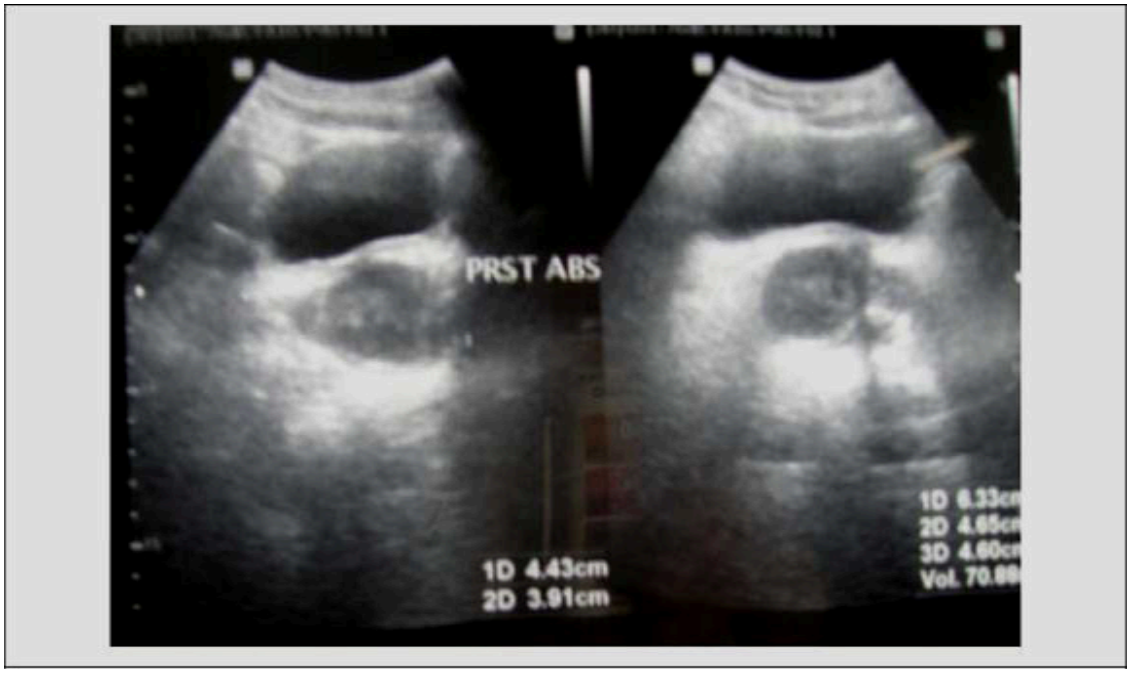
Despite the slight acidity of prostatic fluid, semen has slightly alkaline pH of 7.2–7.7 due to the higher pH and larger volume of fluid from the seminal vesicles. The prostatic secretion gives semen a milky appearance, and fluids from the seminal vesicles and bulbourethral glands give it a sticky consistency. (Gerard, 2009).

2-3 Pathology of the prostate:

2-3-1 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. (Emanuel Rubin 2000).

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 F, 2008).



Figure(2-7). Shows a transabdominal ultrasound image of acute prostatitis. (James F, 2008).

2-3-2 chronic prostatitis:

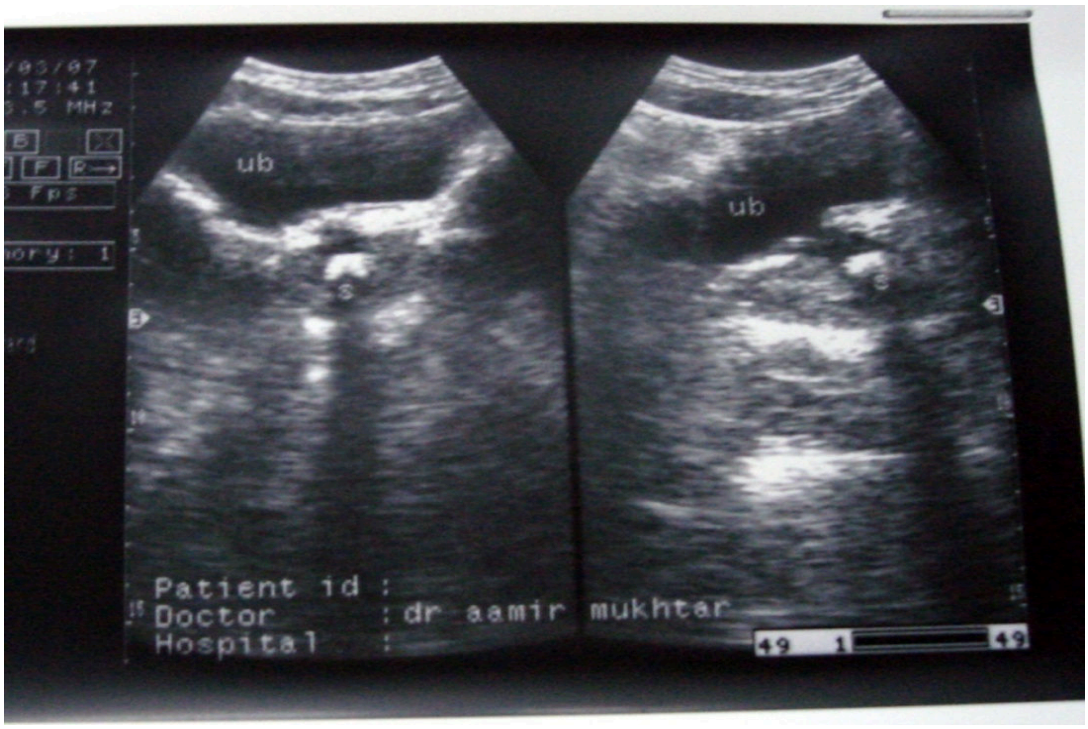
May results from an acute infections and a number of other causes. The prostate initially enlarged and tender but many eventually become fibrosed and shrunken. Urethral obstruction

Tuberculosis: of the prostate shows characteristic glaucomatous ceseating 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. . (Emanuel Rubin 2000).

Granulomatous prostatitis*:* Is a rare condition in which an inflammatory infiltrate including giant cells, is present in relation to prostate ducts and glands. It may be a reaction to retained secretion (compare granulomatous orchitis). Histologically it may mimic tuberculosis.

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. (Emanuel Rubin 2000).

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.(James F, 2008



Figure(2-8). Shows a trans abdominal ultrasound image of chronic prostititis(James F, 2008).

2-3-3 Benign Nodular Hyperplasia (BNH) (or benign prostatic hyperplasia (BPH):

This is not a neoplastic process but represents an over growth of prostatic glandular 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)(Verhamme KM, 2002)

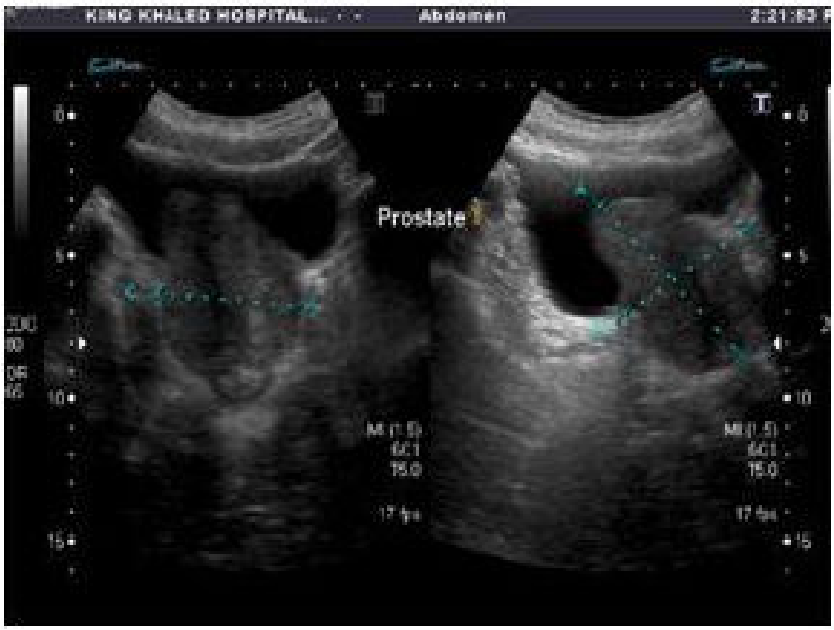
The hyper plastic tissue is usually firm, white and nodular but it may sometimes shows areas of inflammation, abscess formation or infarction. Microscopically there is an increase in both the glandular elements and the stroma. The glands are usually arranged in well defined lobules and the acini are 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 palpill form projections. Some of the acini may be dilated and small retention cysts can form. Tiny concentric concertions known as corpora amylacea, 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. Fibromuscular 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. (Verhamme KM, 2002).

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-colior mixed bacterial flora is frequently superadded ascending spread of infection resulting in pyelonephritis. (Verhamme KM, 2002).

Sonographic appearance of BPH variable depending on histopathologic changes. Diffusely enlarged transitional zone; inhomogeneous nodular texture; occational 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 corpora amylacea along surgical capsule. Hyperplastic nodules may undergo cystic degeneration forming rigged cystic masses. (James F, 2008).



Figure(29). Shows a transabdominal ultrasound image of BPH (James F, 2008).

2-3-4 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. (Rietbergen, 2001).

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 a very 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. (Rietbergen, 2001).

In ultrasound prostatic Ca appears as hypo echoic (60 – 70%), hyper echoic (1-5%), Isoechoic (30-40%) or diffusees 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. (James F, 2008).

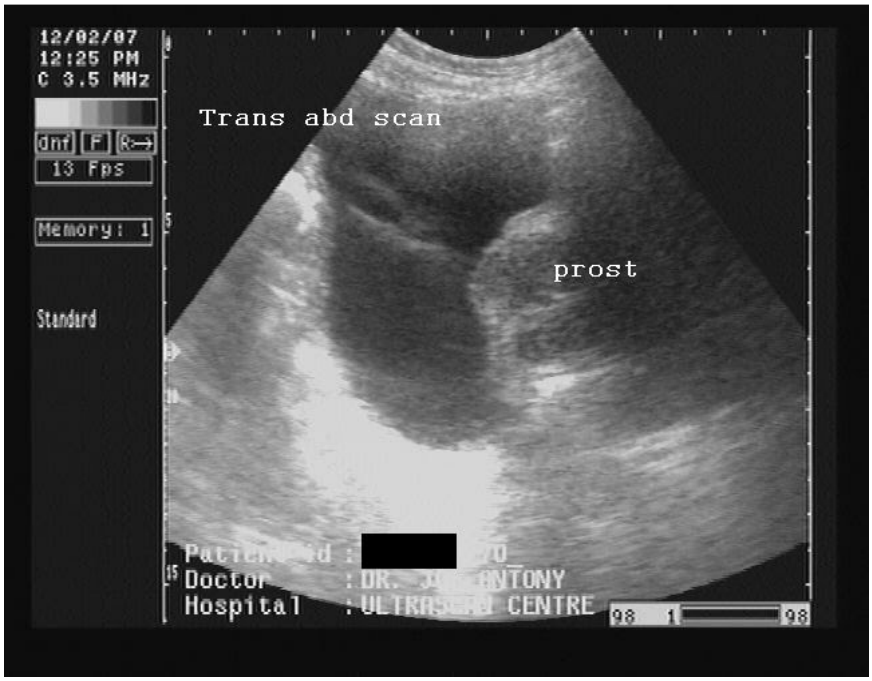


Figure (2-10). Shows a transabdominal ultrasound image of Ca prostate (James F, 2008).

2-3-5 Prostate specific antigens (PSA):

Is a protein produced by the cells of the prostate gland. PSA is present insmall quantities in the serum of normal men, and is often elevated in the presence of prostate cancer and in other prostate disorders. A blood test to measure PSA is considered the most effective test currently available for the early detection of prostate cancer, but this effectiveness has also been questioned. Rising levels of PSA over time are associated with both localized and metastatic prostate cancer (Littrup, 2000).

2-3-5-1 Prostate specific antigens density:

PSA production by benign tissue (normal and hyperplastic) is less than production by cancer. If there is an excess PSA level above that which is predicted from gland volume as measured by U/S, then there is an increased chance of cancer. PSA density is determined by (PSA/volume).

Restricting biopsy in the PSA 4 to 10 ng/ml groups to those with PSA density greater than0.12 will detect about 80% of those with cancer in this group and avoid many biopsies. This suggests that the PSA level is consistent with the prediction from gland volume and not excessive and hence, biopsy would be avoided with about 80% confidence that cancer is not present. Others have suggested PSA density ranging from 0.05 to 0.15, remember that in all cases, a proportion of cancers will be missed and these men need continued surveillance. (Littrup, 2000)

2-3-5-2 Age- Prostate specific antigens:

PSA normally increase with age. It has been suggested that by using different there should PSA levels at different ages, it may be possible to make PSA more sensitive in younger men, and less sensitive in older men. Suggested ranges are: 40 to 49 years-0.0 to 2.5 ng/ml; 50 to 59 years-0.0 to 3.5 ng/ml; 60 to 69 years-0.0 to 4.5 ng/ml; 70 to 79 years-0.0 to 6.5 ng/ml.

although PSA does increase with age, the chance is very slight. Most of the increase with age is due to the larger prostates due to BPH found in older men. Hence, age-specific PSA is really a surrogate the age specific to be useful.(Littrup, 2000).

2-3-5-3 Prostate specific antigens velocity:

PSA levels in men with cancer usually rise more rapidly than with BPH. The rate of rise over time is termed velocity. If three PSA tests are done over 2 years and the rate of rise exceeds 0.75 ng/ml/year, then this rapid change (velocity) is claimed to distinguish subjects with CA from those with BPH with a specificity of 99%. Many labs do not wait for two years and offer biopsy if there is an unexplained rise in the 4 to 10 ng/ml group of greater than 1 ng/ml between two tests less than a year apart. (D'Amico, 2004)

2-3-5-4 Prostate specific antigens test results:

PSA test results report the level of PSA detected in the blood. The test results are usually reported as nanograms of PSA per milliliter (ng/mL) of blood. In the past, most doctors considered PSA values below 4.0 ng/mL as normal. However, recent research found prostate cancer in men with PSA levels below 4.0 ng/mL.

Many doctors are now using ranges with some variation 0 to 2.5 ng/mL is low, 2.6 to 10 ng/mL is slightly to moderately elevated, 10 to 19.9 ng/mL is moderately elevated and 20 ng/mL or more is significantly elevated.

There is no specific normal or abnormal PSA level. The higher a man's PSA level, the more likely it is that cancer is present. But because various factors (such as age) can cause PSA levels to fluctuate, one abnormal PSA test does not necessarily indicate a need for other diagnostic tests. When PSA levels continue to rise over time, other tests may be needed. It should

be noted that it is common for normal PSA ranges to vary somewhat from laboratory to laboratory. (D'Amico, 2004).

2-5 Previous study:

H. Osman et.al 2005 objective to show the different ultrasound findings of prostate and detection of normal and abnormal prostatic finding and any changes in echotextures of the prostate in the Saudi population with age group ranged between 40years to 80 years old in Taif city. The data were collected from scanning patient in the duration extend from August 2015 to November 2015. A total of 100 male patients selected randomly symptomatic and asymptomatic of prostatic abnormalities came to different Hospitals and diagnostic centers in the Taif city KSA for Abdomen and pelvic ultrasound examination. Study showed that the common pathology of this study especially among the elderly population was BPH then Prostatitis, and calcification changes. They concluded that ultrasound had high accuracy in prostatic pathology especially in measuring the volume of prostate. The incidence of BPH is increase direct proportionally with age. The good quality of ultrasound machines and good preparations of the patient give better results. History, care, and good preparations of the patients, and others investigation result more important and help in diagnosis of benign prostate hypertrophy (BPH).

Study done by Ng Kent Hoo et al(2012), in Prostate Volume Measurement Using Trans abdominal Ultrasound Scanning used to diagnose the abnormalities of the prostate. In this study, 10 subjects from age of 20years old to 25 years old were selected to undergo the transabdominal scanning. The subjects were randomly selected with different heights and weights. The subjects were the students whom do not have any bad habits like smoking and drinking. The results show that ultrasound is an easy and safe way to

measure the prostate size; from the results they conclude that the size of prostate is larger for a man with larger body size. Also, it is suggested that another research is needed for computation to obtain the standard prostate size comparison which not only focuses on the age but also considers the body size of a man.

Babekir 2009 objective to discuss the evaluation of U/S Scanning and FPSA in diagnosing of the prostate disorders and differentiation between ca prostate and BPH, also to compare these tools to TPSA. Study which was done during July-2007 to September 2009 and was carried out in Sudan-Khartoum and Aljazeera, A total of "100" patients were selected randomly; all those patients have age above forty years, have signs of prostatic disorders and referred by physician. This study found that the most common pathology of prostate is BPH, CA, and Inflammation, and. Also it found that the age is a risk factor for prostatic disorders. The study concluded that the age and sexual activity are a risk factors for prostate disorders. The U/S features of BPH that; the volume of prostate is more than 30 $cm^{3,}$ diffusely hypo echoic, it is AP diameter is greater than transverse diameter, of normal shape and not usually seen nodule, but there may be multiple calcifications.

w.j. kirkels et al (1995) objectives to study the prevalence symptoms of pro-statism in the community and correlation between these symptoms and age, prostate volume, flow rate and residual urine volume, the data were collected about 502 men aged between 55 and 74 years, the result detailed 12% of men's had global perception of their voiding function and 82%had no voiding complains. The result concluded that the parameters used to characterize BPH should be considered independently because no predictions about the values of a certain parameter can be made by knowing one of the other parameter value

Chapter Three
Materials and Methods

Chapter three

Material and method

3-1 Study design:

This study is the Crossectional descriptive study, about characterization of benign prostatic hyperplasia using ultrasonography.

3-2 duration of the study:

from November 2016 to February 2017.

3-3 place of the study:

carried out in alribat teaching hospital and almolem medical center in Soudan Khartoum.

3-4 sample of the study:

they are 62 patient scanning transabdominal.

3-5 inclusive criteria:

all this patient had BPH and the age above 40 years old.

3-6 exclusive criteria:

Any patient had prostatic cancer or age less than 40 year were excluded from this study.

3-7 machines uses:

In this study using semen's (sonoline G60S)which cotain linear, curve linear and endovaginal probes and Esaote (my labe Xvision) witch contain linear, curvelinear and sectter probes.

3-8 Methodology:

3-8 -1Transabdominal technique:

The patient lies supine and should have full bladder,500 ml of water ,one hour before the scan if possible is recommended ,the probe is angled approximately 30 degrees caudal using the bladder as window .slight compression to ensure the inferior portion of the prostate is not obscure by

the shadow artifact from the base of the bladder. Transabdominal ultrasound can assess the volume of the prostate .the patient lies supine with amount of gel is poured on the anterior part of the pubic region. Segital and transverse scanning is then preformed to assess the entire prostate in many planes.

3-8-2 Measurement of the prostate volume:

Was taken by measuring transverse and depth diameter in transverse plane, in sagital plane taken longitudinal diameter.

Volume of prostate = transverse diameter depth diameter length diameter

Diameter multiply 0,52.

Normal volume of prostate = 20 to 30 cm3.

3-9 Variable of the study (data sheet):

The data of patient obtained from work sheet is used to collect on 8 variable (appendix2)(age, body length and weight(BMI),social status, measurement of prostate, prostate volume, texture, others.

3-10 Method of data collection:

Data collection according to the work sheet (appendix2) include all above variable data.

3-11 Data analysis:

The data were analyzed by using SPSS program, and excel data sheet, variable using descriptive table, frequency, percentage disterbution.

3-12 Ethical consideration:

There is no patient name or individual details all patient informed by the procedure and process of data acquisition.

Figure(3-1). Shows machine use for data collection

Chapter Four

Results

Chapter four

4-1 Result

Table (4.1) Frequency distribution of age group

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
40-50 years	5	8.1	8.1	8.1
51-60 years	13	21.0	21.0	29.0
61-70 years	26	41.9	41.9	71.0
71-80 years	14	22.6	22.6	93.5
81-90 years	4	6.5	6.5	100.0
Total	62	100.0	100.0	

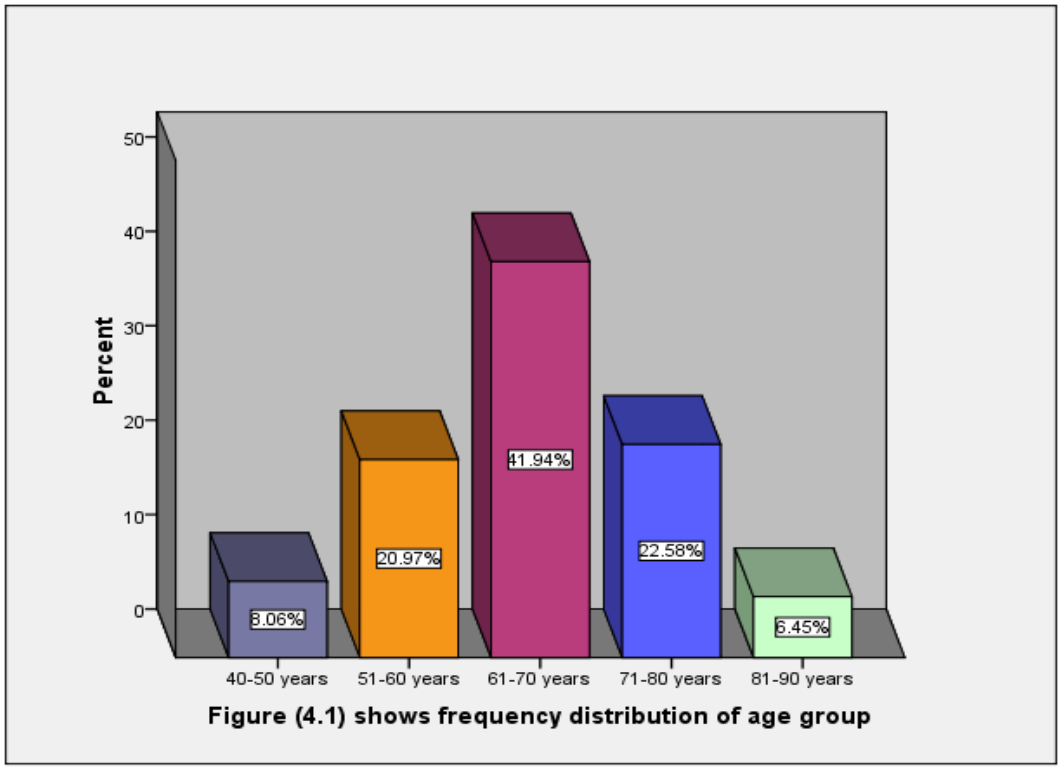


Figure (4.1) shows frequency distribution of age group

Table (4.2) Frequency distribution of patient's height

Height	Frequency	Percent	Valid Percent	Cumulative Percent
150-165 cm	15	24.2	24.2	24.2
166-180 cm	41	66.1	66.1	90.3
181-190 cm	6	9.7	9.7	100.0
Total	62	100.0	100.0	

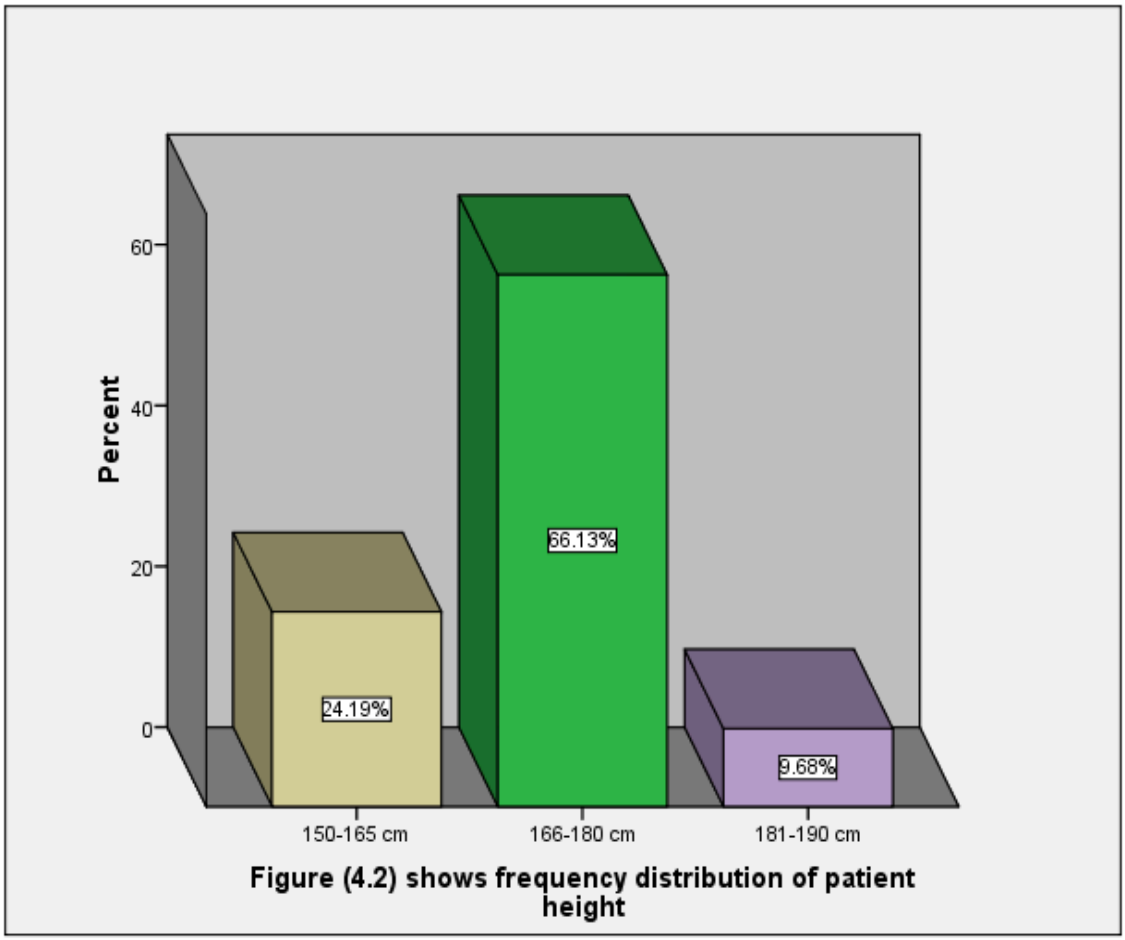


Figure (4.2) shows frequency distribution of patient height

Table (4.3) Frequency distribution of patient's weight

Height	Frequency	Percent	Valid Percent	Cumulative Percent
40-50 kg	1	1.6	1.6	1.6
51-60 kg	3	4.8	4.8	6.5
61-70 kg	21	33.9	33.9	40.3
71-80 kg	24	38.7	38.7	79.0
80- 90 kg	12	19.4	19.4	98.4
more than 90 kg	1	1.6	1.6	100.0
Total	62	100.0	100.0	

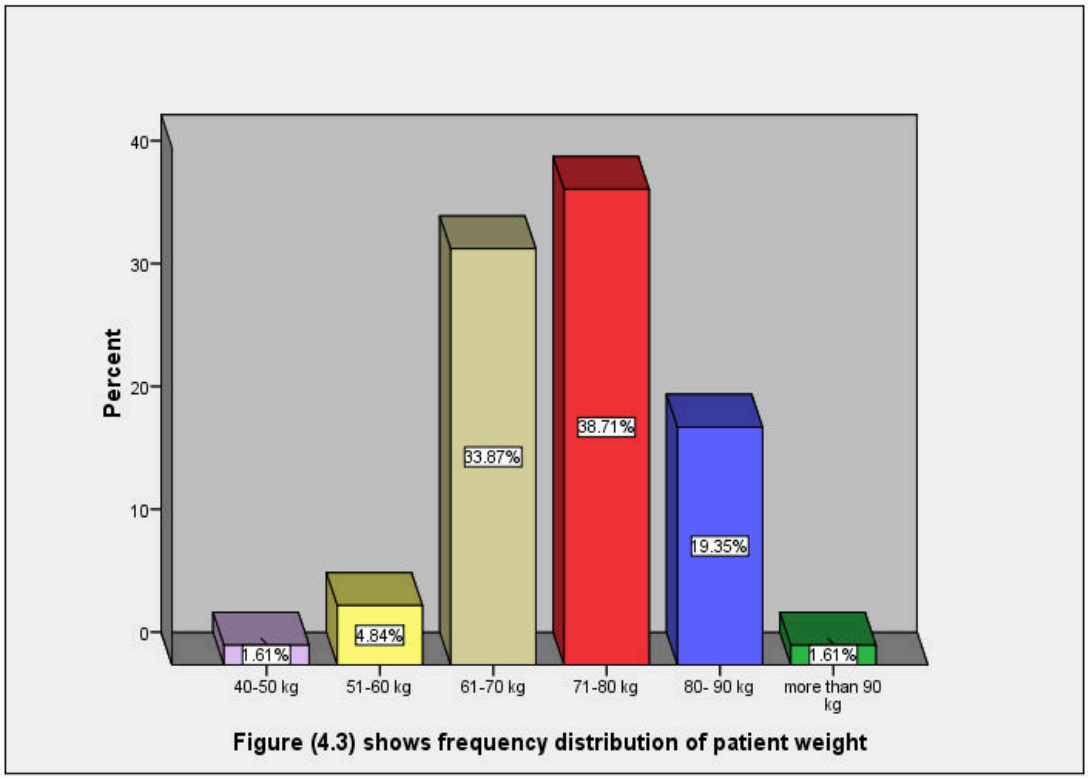


Figure (4.3) shows frequency distribution of patient weight

Table (4.4) Frequency distribution of patient's number of marrying

No of marrying	Frequency	Percent	Valid Percent	Cumulative Percent
One	34	54.8	54.8	54.8
Two	15	24.2	24.2	79.0
Three	8	12.9	12.9	91.9
Four	5	8.1	8.1	100.0
Total	62	100.0	100.0	

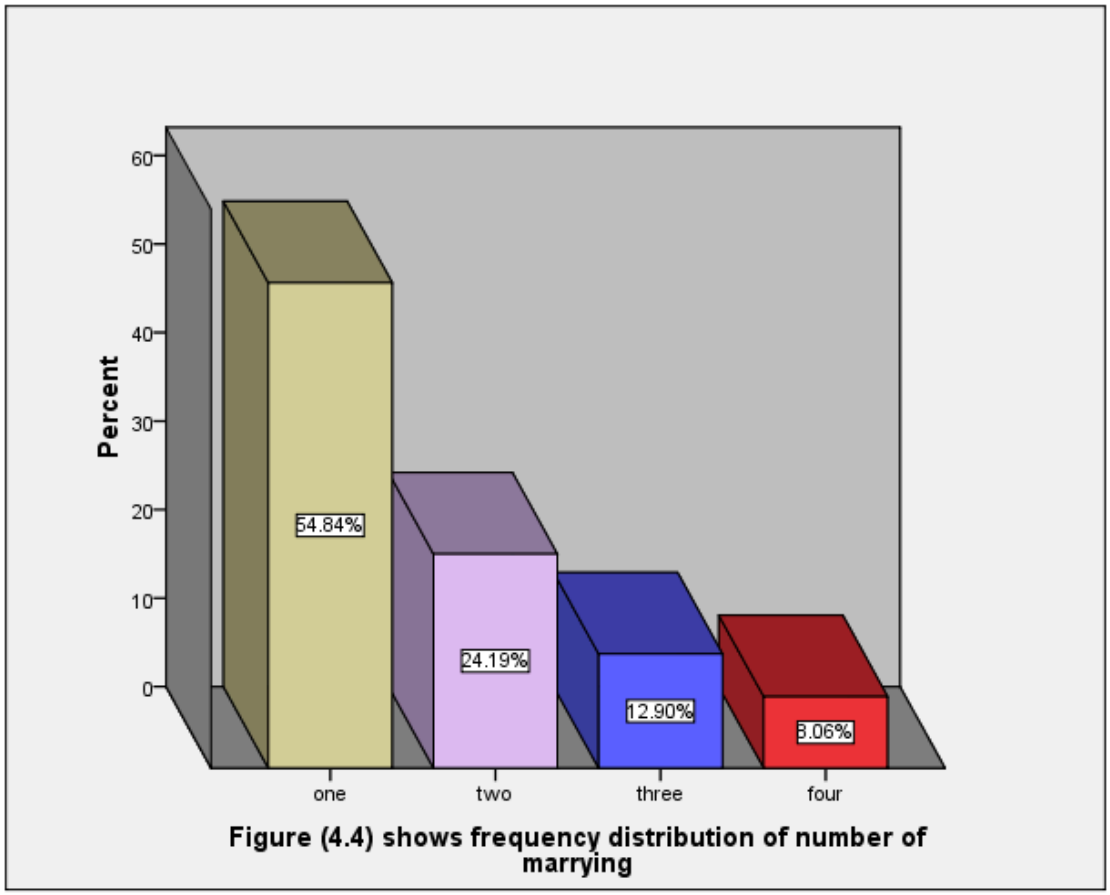


Figure (4.4) shows frequency distribution of number of marrying

Table (4.5) Frequency distribution of patient's number of children

No	Frequency	Percent	Valid Percent	Cumulative Percent
2	1	1.6	1.6	1.6
3	3	4.8	4.8	6.5
4	9	14.5	14.5	21.0
5	6	9.7	9.7	30.6
6	9	14.5	14.5	45.2
7	7	11.3	11.3	56.5
8	8	12.9	12.9	69.4
9	5	8.1	8.1	77.4
10	4	6.5	6.5	83.9
11	1	1.6	1.6	85.5
12	3	4.8	4.8	90.3
14	1	1.6	1.6	91.9
15	2	3.2	3.2	95.2
19	2	3.2	3.2	98.4
20	1	1.6	1.6	100.0
Total	62	100.0	100.0	

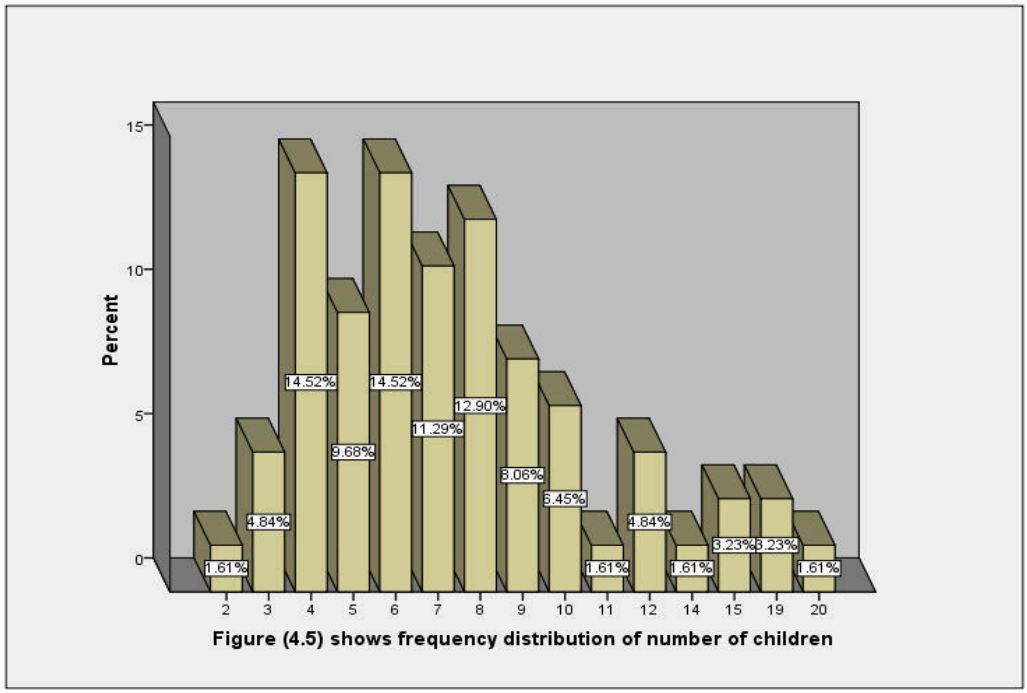


Figure (4.5) shows frequency distribution of number of children

Table (4.6) Frequency distribution of measurement of depth of prostate

Measurement	Frequency	Percent	Valid Percent	Cumulative Percent
35-50 mm	46	74.2	74.2	74.2
50.1-55 mm	8	12.9	12.9	87.1
55.1- 60mm	3	4.8	4.8	91.9
60.1-75 mm	4	6.5	6.5	98.4
less than 35mm	1	1.6	1.6	100.0
Total	62	100.0	100.0	

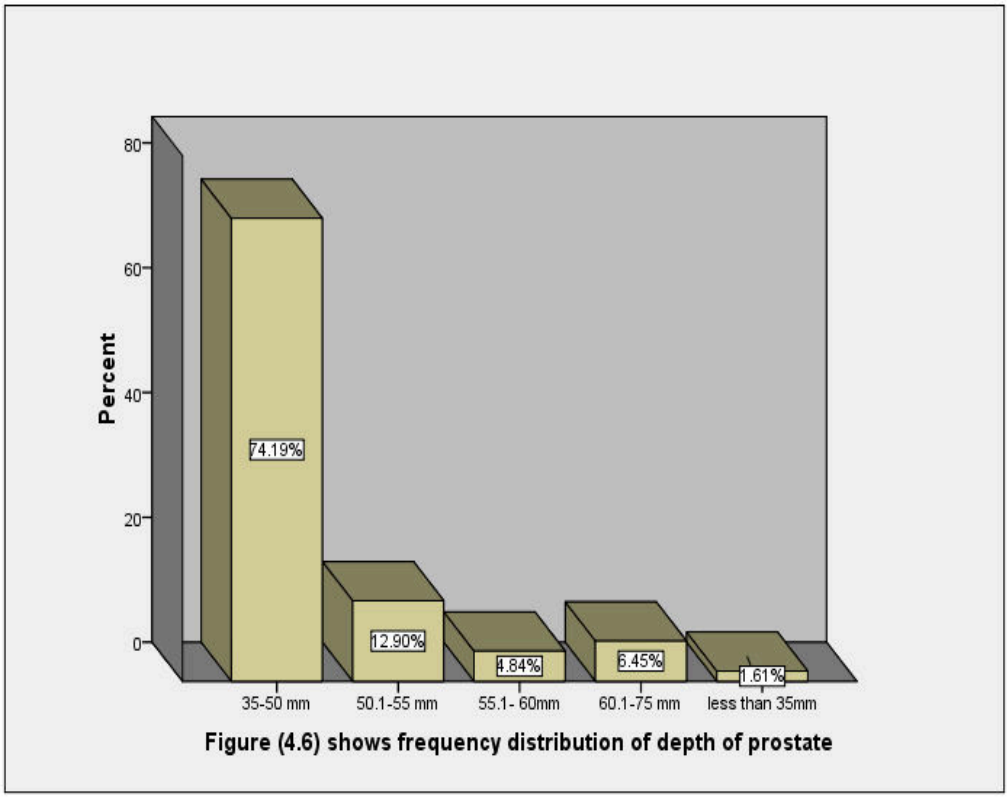


Figure (4.6) shows frequency distribution of depth of prostate

Table (4.7) Frequency distribution of measurement of width of prostate

Measurement	Frequency	Percent	Valid Percent	Cumulative Percent
35-50 mm	44	71.0	71.0	71.0
50.1-55 mm	6	9.7	9.7	80.6
55.1- 60mm	8	12.9	12.9	93.5
60.1-75 mm	3	4.8	4.8	98.4
less than 35mm	1	1.6	1.6	100.0
Total	62	100.0	100.0	

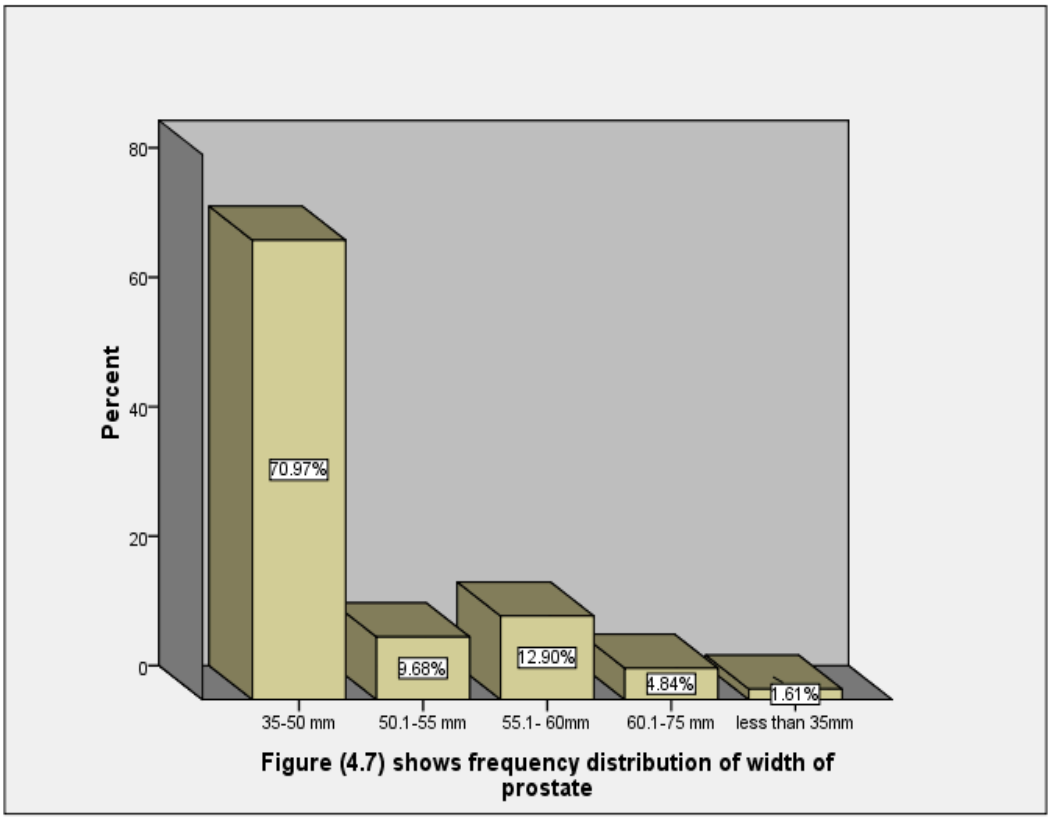
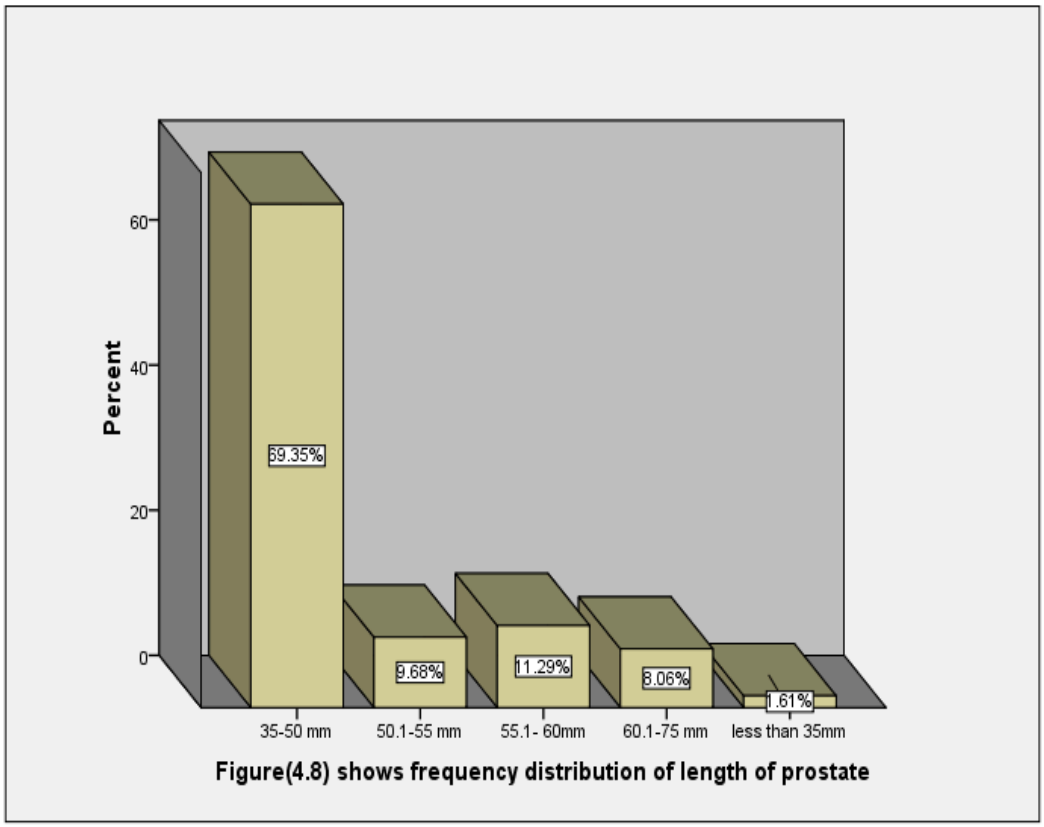


Figure (4.7) shows frequency distribution of width of prostate

Table (4.8) Frequency distribution of measurement of length of prostate

Measurement	Frequency	Percent	Valid Percent	Cumulative Percent
35-50 mm	43	69.4	69.4	69.4
50.1-55 mm	6	9.7	9.7	79.0
55.1- 60mm	7	11.3	11.3	90.3
60.1-75 mm	5	8.1	8.1	98.4
less than 35mm	1	1.6	1.6	100.0
Total	62	100.0	100.0	



Figure(4.8) shows frequency distribution of length of prostate

Table (4.9) Frequency distribution of measurement of volume of prostate

Volume	Frequency	Percent	Valid Percent	Cumulative Percent
32-50 ml	36	58.1	58.1	58.1
51-65 ml	10	16.1	16.1	74.2
66-80 ml	7	11.3	11.3	85.5
81-95 ml	5	8.1	8.1	93.5
106-120 ml	2	3.2	3.2	96.8
121-135 ml	2	3.2	3.2	100.0
Total	62	100.0	100.0	

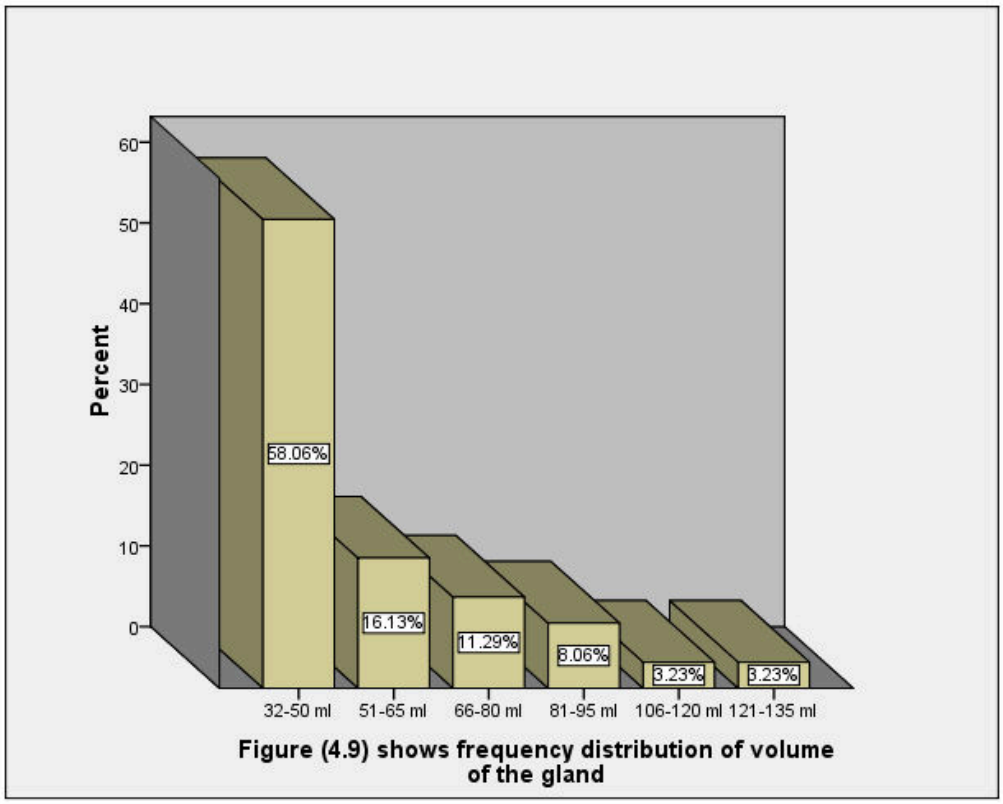


Figure (4.9) shows frequency distribution of volume of the gland

Table (4.10) minimum, maximum, mean and Std for age, Height, weight of patientsand depth, length, width and volume of prostate

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of pt	62	41	85	65.34	10.172
Height of pt	62	1.00	3.00	1.8548	.56819
Weight of pt	62	45	105	73.77	9.657
Depth of prostate	62	33.9000	63.5000	45.39355	7.6317471
Length of prostate	62	34.00	72.600	48.3661	7.63310
Width of prostate	62	33.5000	65.7000	46.85806	7.8820932
Volume	62	32.00	127.30	55.6887	22.78648
Valid N (listwise)	62				

Table (4.11) Frequency distribution of texture of prostate

Texture	Frequency	Percent	Valid Percent	Cumulative Percent
homogeneous	56	90.3	90.3	90.3
heterogeneous	6	9.7	9.7	100.0
Total	62	100.0	100.0	

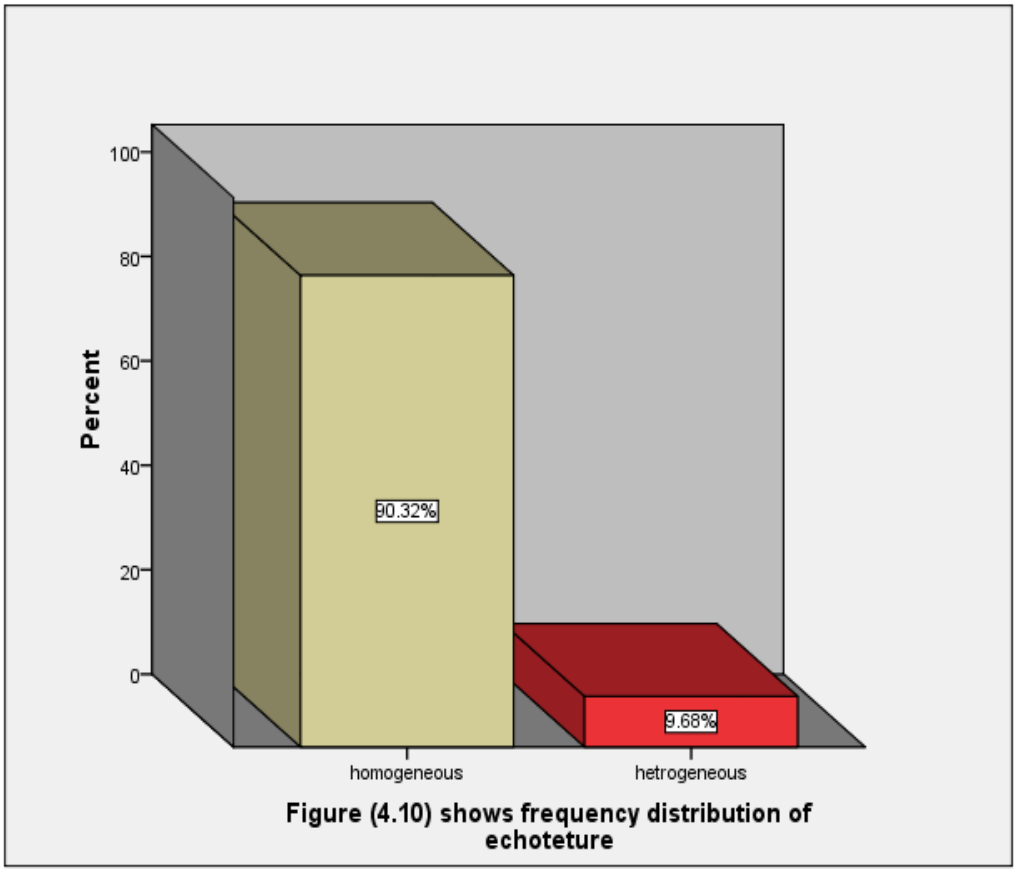


Figure (4.10) shows frequency distribution of echoteture

Table (4.12) Frequency distribution of outline of prostate

Outline	Frequency	Percent	Valid Percent	Cumulative Percent
Regular	57	91.9	91.9	91.9
Irregular	5	8.1	8.1	100.0
Total	62	100.0	100.0	

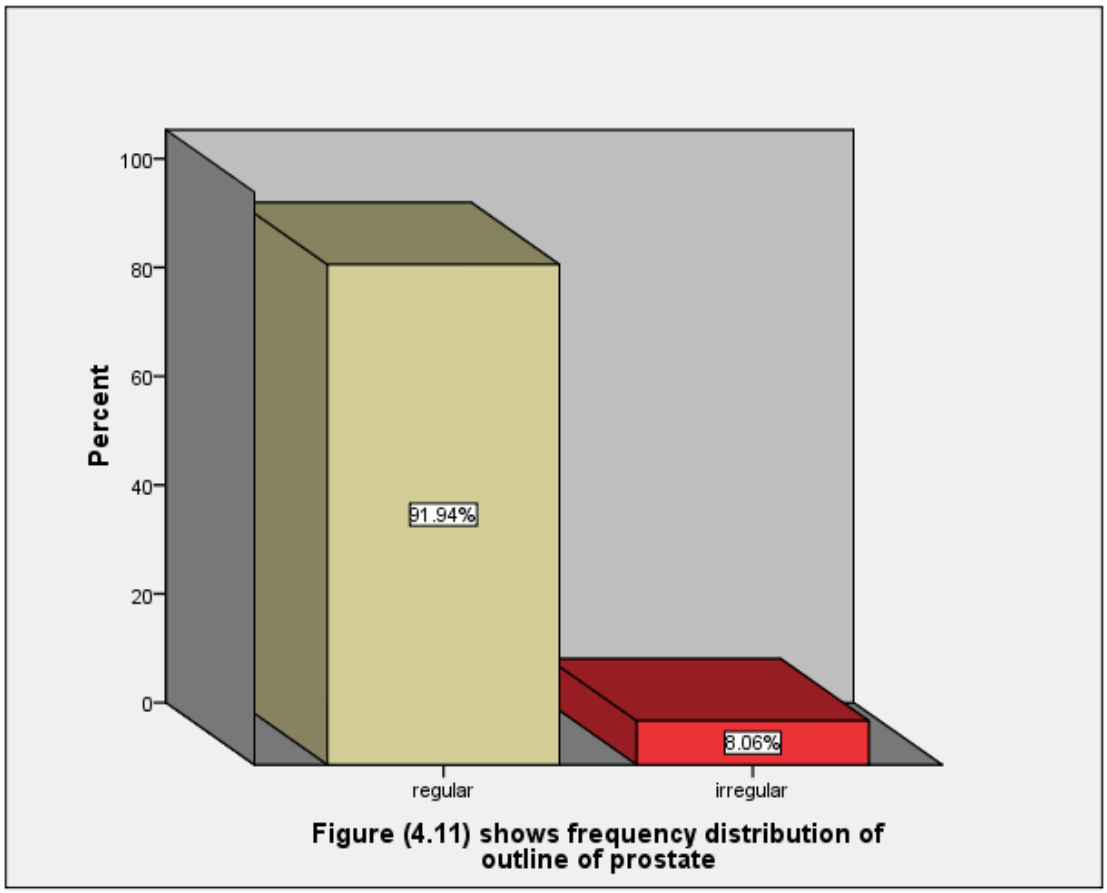


Figure (4.11) shows frequency distribution of outline of prostate

Table (4.13) Frequency distribution of residual urine associated with BPH

Residual	Frequency	Percent	Valid Percent	Cumulative Percent
No	34	54.8	54.8	54.8
Yes	28	45.2	45.2	100.0
Total	62	100.0	100.0	

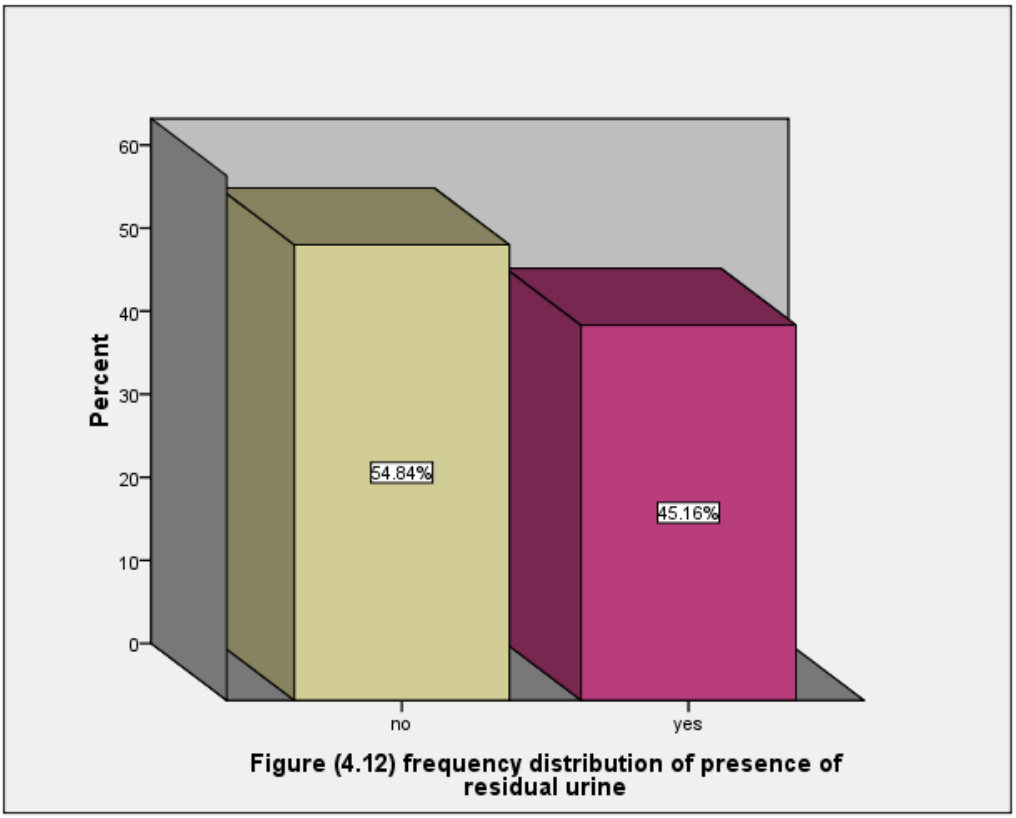


Figure (4.12) frequency distribution of presence of residual urine

Table (4.14) Frequency distribution of other finding associated with BPH

Others	Frequency	Percent	Valid Percent	Cumulative Percent
no other finding	33	53.2	53.2	53.2
Calcification	24	38.7	38.7	91.9
Diverticulum	3	4.8	4.8	96.8
Cyst	2	3.2	3.2	100.0
Total	62	100.0	100.0	

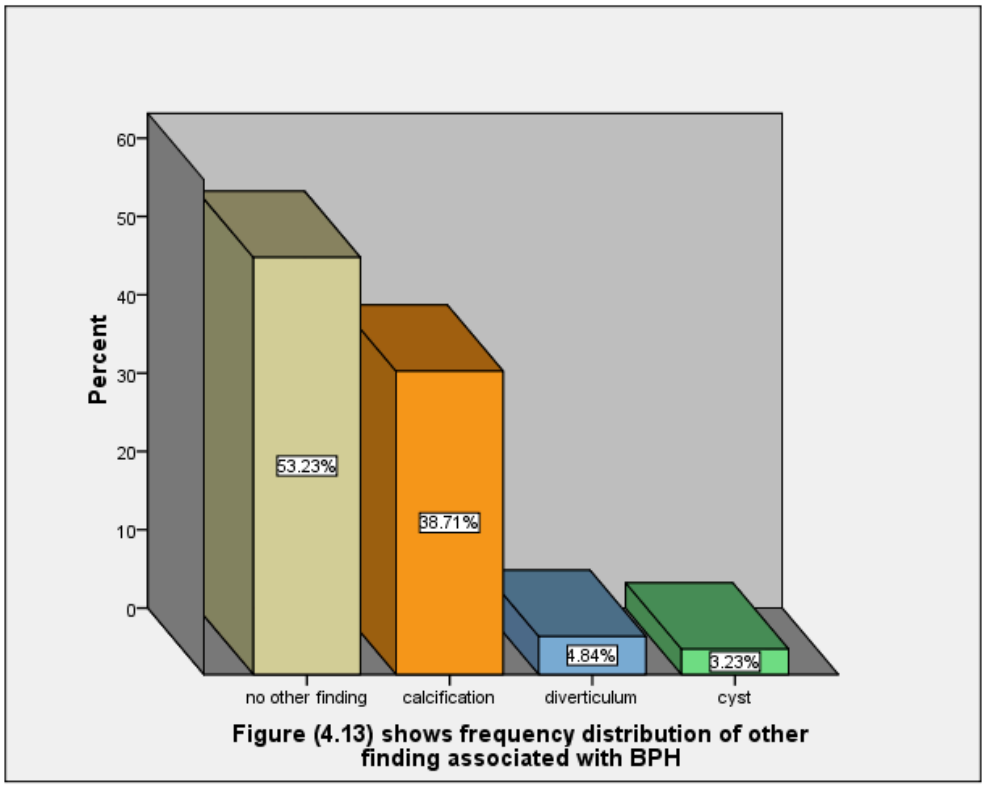


Figure (4.13) shows frequency distribution of other finding associated with BPH

Table (4.15) cross tabulation age and prostate volume

Age group	Volume						Total
	32-50 ml	51-65 ml	66-80 ml	81-95 ml	106-120 ml	121-135 ml	
40-50 years	4	1	0	0	0	0	5
51-60 years	10	2	1	0	0	0	13
61-70 years	13	5	5	2	1	0	26
71-80 years	7	2	1	3	1	0	14
81-90 years	2	0	0	0	0	2	4
Total	36	10	7	5	2	2	62
P value = 0.004							

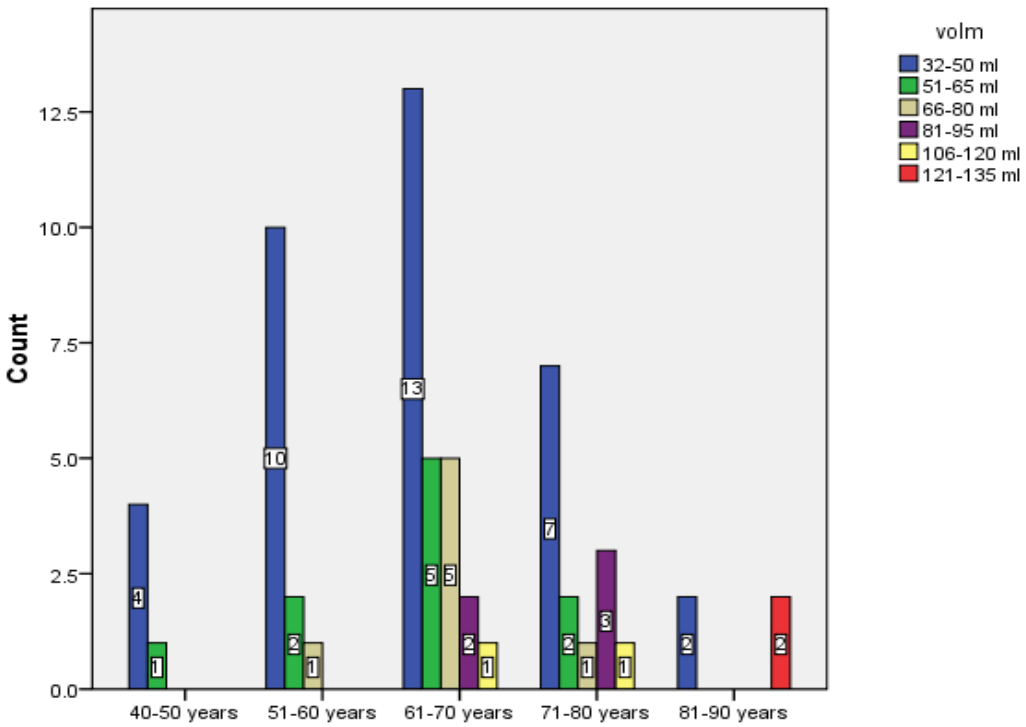


Figure (4.14) cross tabulation age group & prostate volume

Table (4.16) cross tabulation height and prostate volume

Height	Volume						Total
	32-50 ml	51-65 ml	66-80 ml	81-95 ml	106-120 ml	121-135 ml	
150-165 cm	10	2	1	1	1	0	15
166-180 cm	24	7	5	3	1	1	41
181-190 cm	2	1	1	1	0	1	6
Total	36	10	7	5	2	2	62
P value = 0.749							

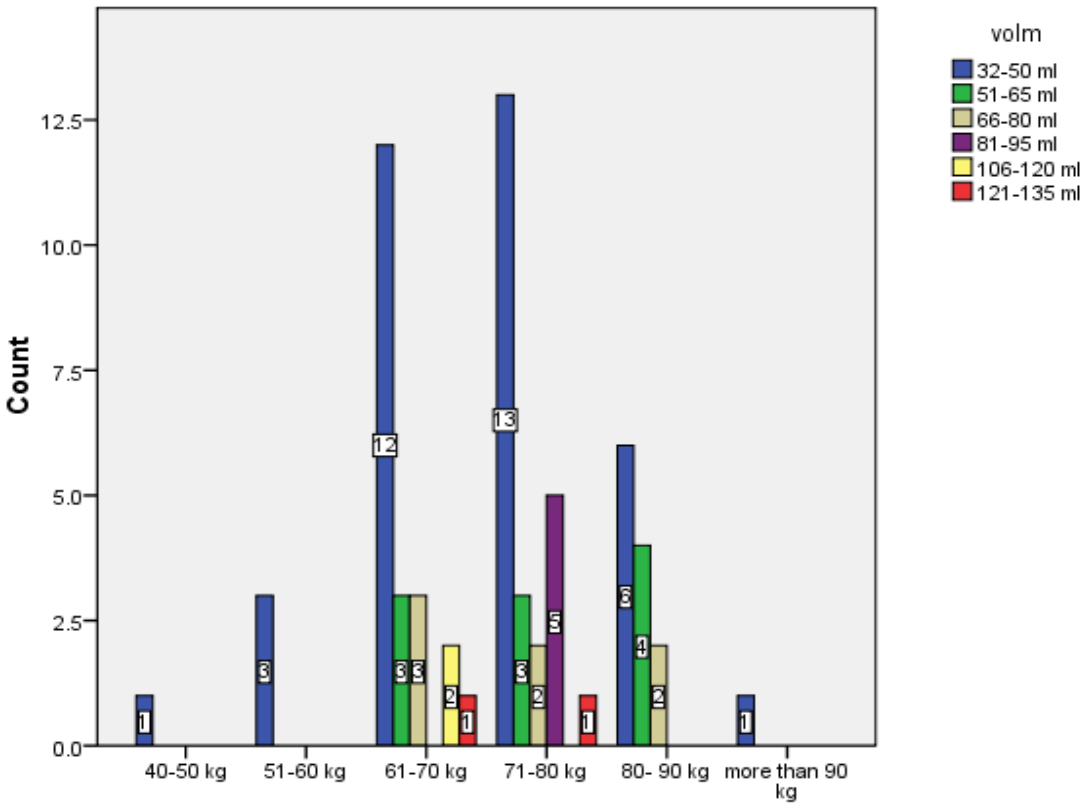


Figure (4.15) cross tabulation pt weight and prostate volume

Table (4.17) cross tabulation weight and prostate volume

Weight	Volume						Total
	32-50 ml	51-65 ml	66-80 ml	81-95 ml	106-120 ml	121-135 ml	
40-50 kg	1	0	0	0	0	0	1
51-60 kg	3	0	0	0	0	0	3
61-70 kg	12	3	3	0	2	1	21
71-80 kg	13	3	2	5	0	1	24
80- 90 kg	6	4	2	0	0	0	12
more than 90 kg	1	0	0	0	0	0	1
Total	36	10	7	5	2	2	62
P value =0.808							

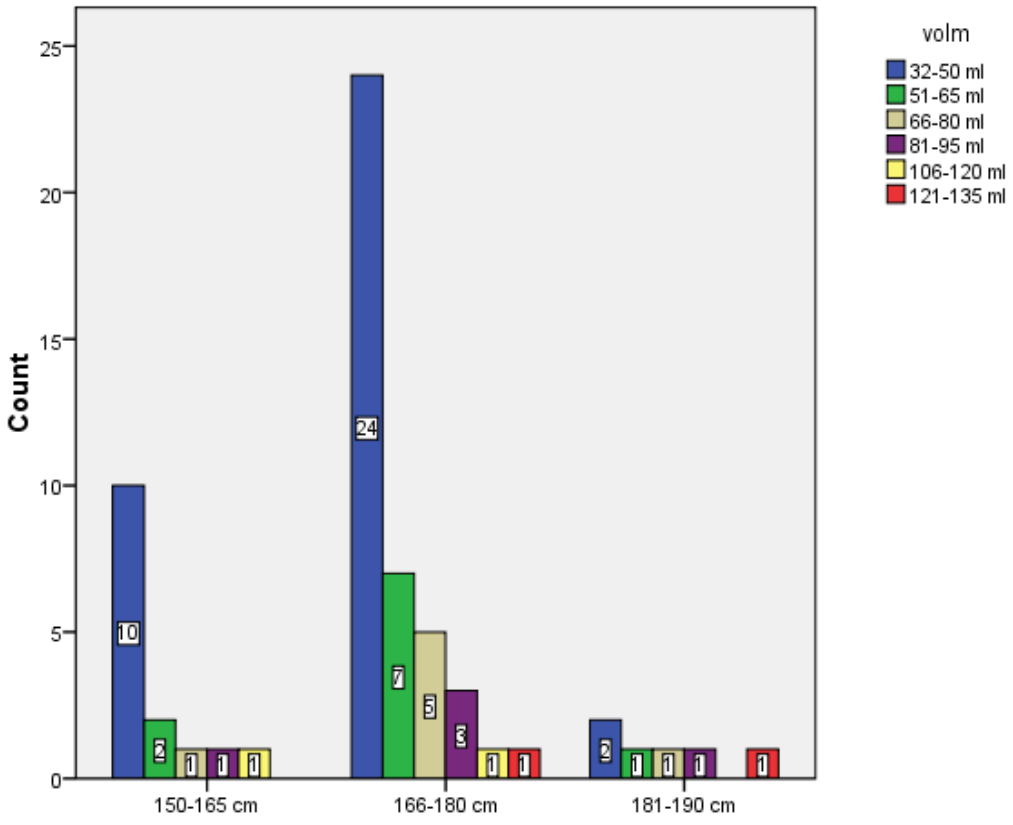
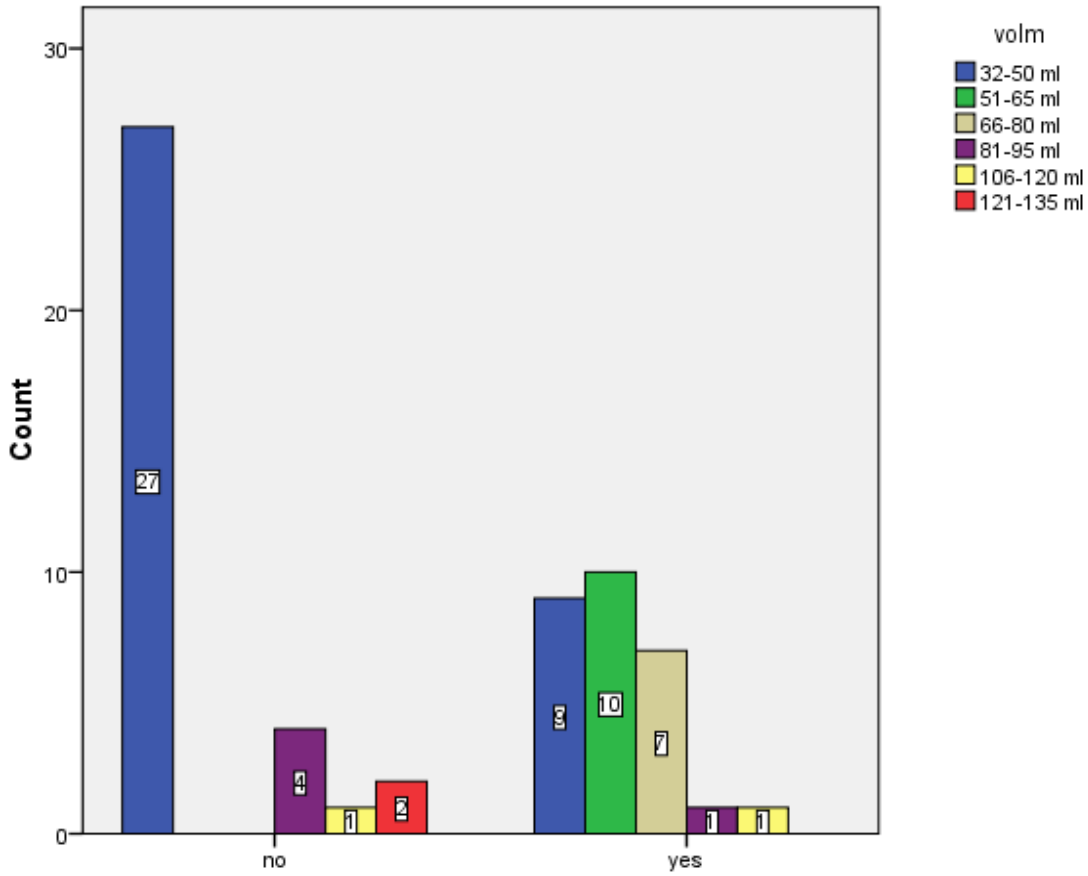


Figure (4.16) cross tabulation pt height & prostate volume

Table (4.18) cross tabulation residual urine and prostate volume

Retention	Volume						Total
	32-50 ml	51-65 ml	66-80 ml	81-95 ml	106-120 ml	121-135 ml	
No	27	0	0	4	1	2	34
Yes	9	10	7	1	1	0	28
Total	36	10	7	5	2	2	62
P value = 0.000							



Figure(4.17) cross tabulation volume and residual urine

Table (4.19) cross tabulation other finding and prostate volume

Other finding	Volume						Total
	32-50 ml	51-65 ml	66-80 ml	81-95 ml	106-120 ml	121-135 ml	
no other finding	16	7	5	2	1	2	33
Calcification	17	3	2	2	0	0	24
Diverticulum	2	0	0	0	1	0	3
Cyst	1	0	0	1	0	0	2
Total	36	10	7	5	2	2	62
P value = 0.181							

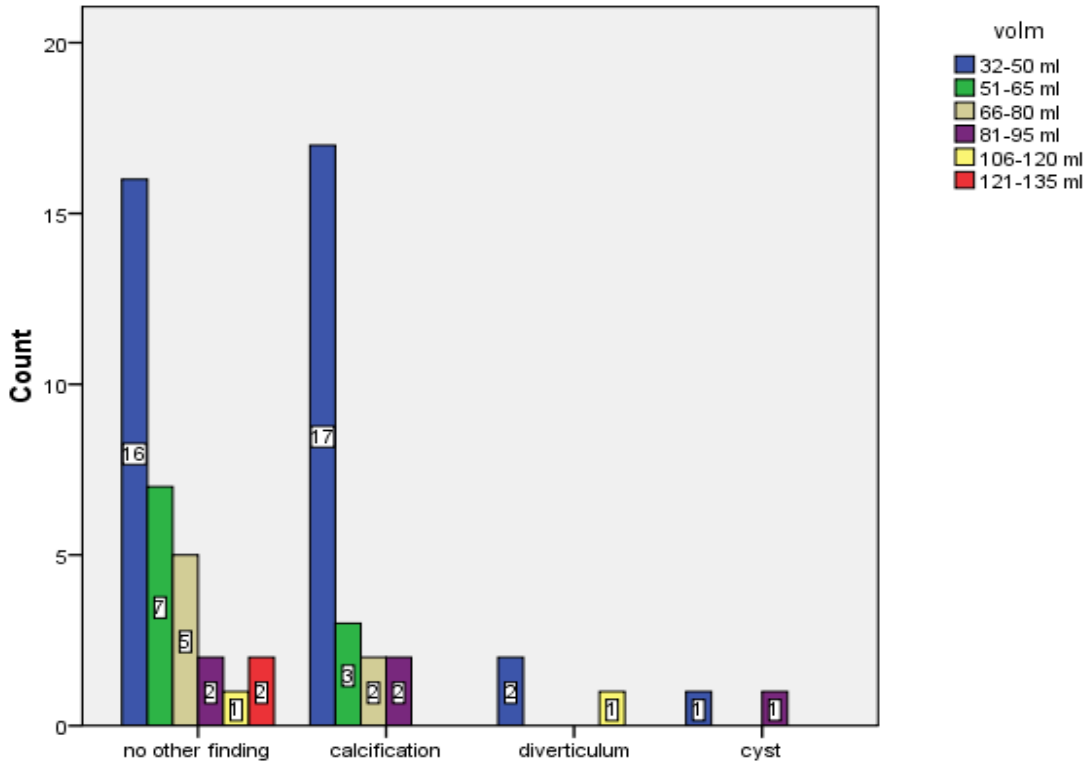


Figure (4.18) cross tabulation volume and other associted finding with BPH

Figure (4.20) scatter plot shows relation between pt weight and volume

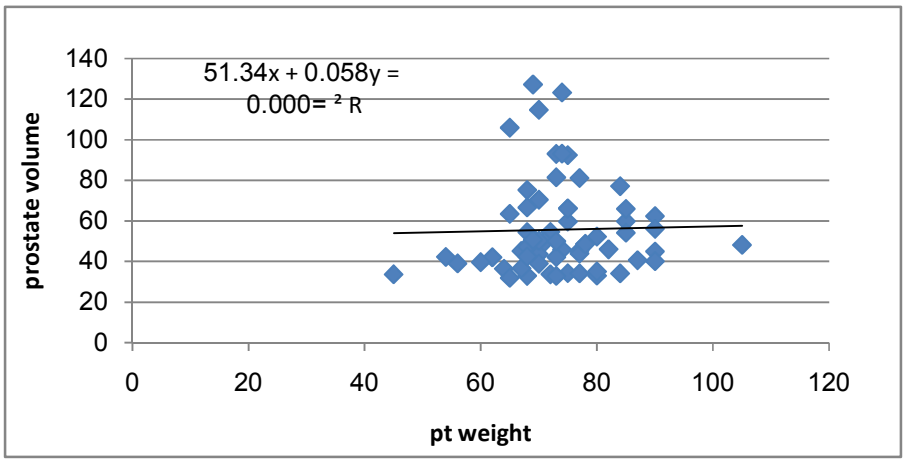


Figure (4.21) scatter plot shows relation between pt height and volume

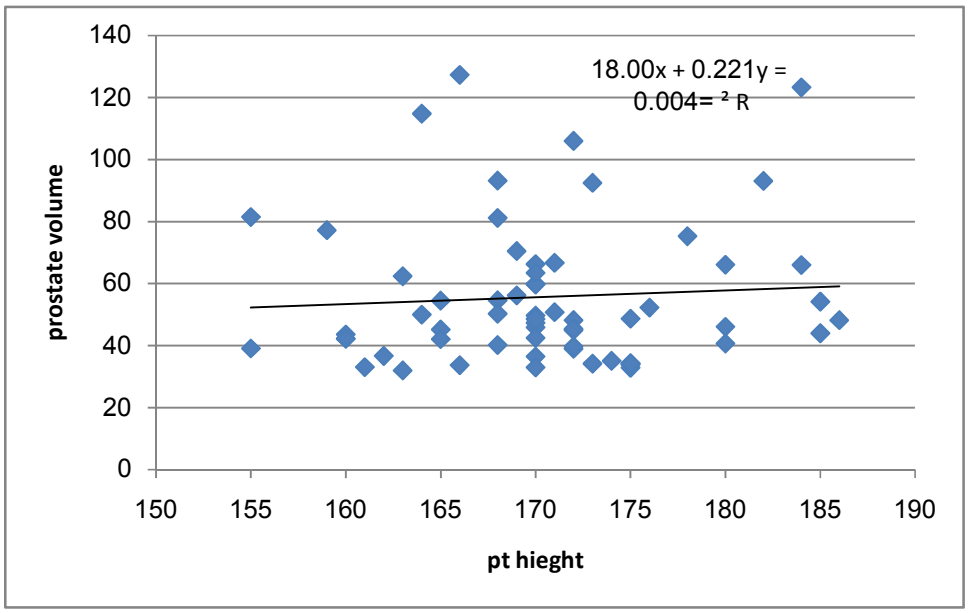


Figure (4.22) scatter plot shows relation between pt age and volume

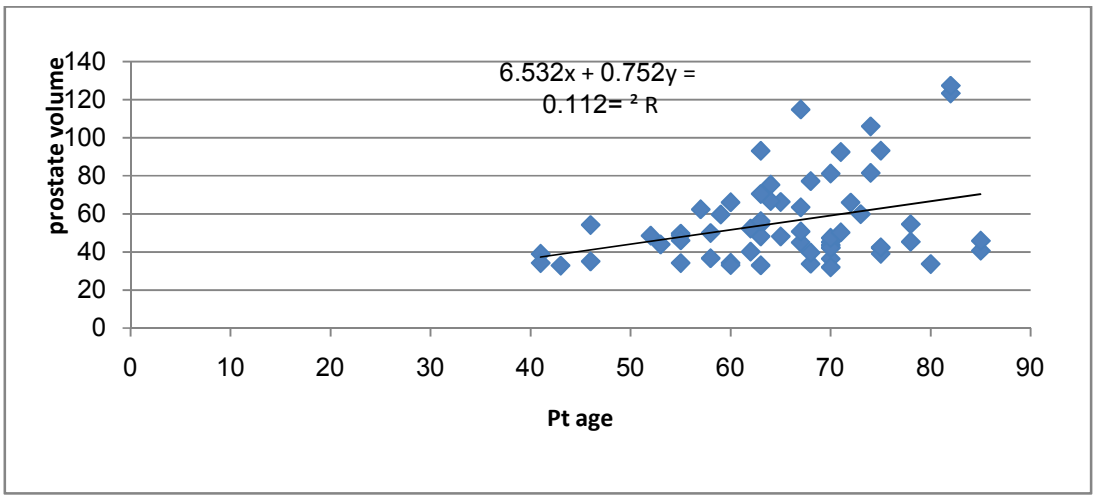
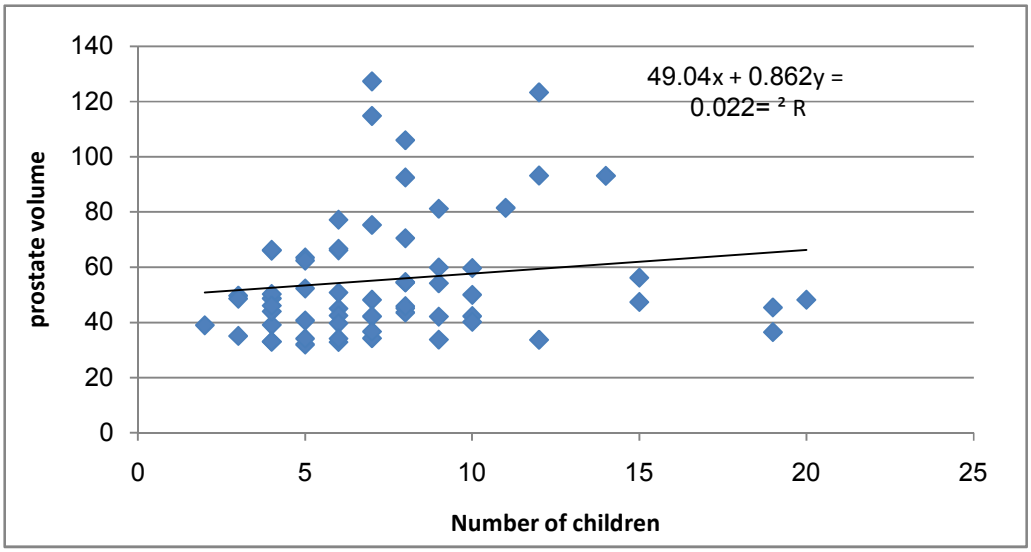


Figure (4.23) scatter plot shows relation between number of child and volume



Chapter Five

Discussion, Conclusion

Recommendations

Chapter five

Discussion, Conclusion, Recommendation

5-1 Discussion:

The result of this study showed that the means volume of prostate was 32 – 50ml table (4.9) while the mean of patient age was 61 – 70 years table (4.1). Study found that there was a positive correlation between prostate volume and patient age table (4.15) which displayed this relation prostatic volume increased with patient age. Same result achieved by (H. Osman et.al 2005).

Tables (4.2) (4.3) witch showed distribution of patients height and weight for cases under study, the means of the height was 166 – 180 ml, and means of the weight was 71-80 kg, the study not found significant correlation between body mass index and BPH (4.16)(4.17)this result was disagree with Ngken Hoo et al (2012) home state that {the prostate volume would increase if BMI was greater}.

Tables (4.4) (4.5) which showed number of married the means34(54%),and showed number of children with mean 4 and 6 child the result conclude that there is significant correlation between number of children and BPH. Same result achieved with Babiker (2009). While there is no relation between number of married and BPH.

Table (4.6)(4.7)(4.8)(4.9) show mean of Depth (AP) 46 (74.2%) with stander deviation 7.63. mean of width (thickness) 44(71%) with stander deviation 7.88. Length 43(69.4%) with stander deviation 7.63. Volume 36 (58%) 50 ml with stander deviation 22.7. Study found that the depth, width, volume had significant positive correlation between them and normal and BPH.

Table (4.11), (4.12), (4.13), showed ultrasound findings in prostatic texture, there were 56 of patient (95.3%) had homogenous echo pattern while 6 patients (9.7%) had heterogeneous echo pattern, 57 patients (91%) with

regular out lines, while 5 patients (8.1%) with irregular out line. and 34 of patients (54.8%) had residual urine which increased with prostatic volume Agree with (w.j. kirkels et al (1995)

Table (4.14) showed other findings associated with BPH, BPH without other findings 33 of patient (53.2%), BPH with classification 24 of patient (38.7%), BPH with diverticulum 3 of patient (4.8%) and BPH with cyst 2 of patient (3.2%).

All this means that ultrasound findings in cases of BPH usually include homogenous echo texture, regular out lines, with or without presence of classification, cyst, diverticulum, and residual urine may be found or not.

Babekir 2009 and w.j. kirkels et al (1995) agree with me.

5-2 Conclusion:

The ultrasound is the effective image modality in detection of prostatic disorder, and able to differentiated BPH from Ca, but other modality use to confirm the diagnosis.

The study found that there was a significant correlation between prostate volume with patient age, prostatic depth, width and number of children, while no statically correlation between BPH and other factors.

The BPH usually characterized by homogenous echo pattern, regular out line, with or without presence of classification, cyst, diverticulum, and residual urine may be found or not.

5-3 Recommendation:

From the result of the study the researcher won't like to recommend the following:

-health center and clinics must be provided height quality ultrasound machine with color Doppler.

-is important use ealastography to give final diagnosis if this BPH or Ca to prevent the patient from biopsy.

-TRUS sonography has high sensitivity and specifity in visualization of prostate volume.

-post residual scan for elder patient is important.

-clear and specific instruction must be give to patient to be full bladder for good evaluate the prostate.

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.

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

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

Verhamme KM, Dieleman JP, Bleumink GS, et al. (2002). "Incidence and prevalence of lower urinary tract symptoms suggestive of benign prostatic hyperplasia in primary care--the Triumph project". Eur. Urol. 42 (4): 323–8. Doi: 10.1016/S0302-2838(02)00354-8.

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

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

D'Amico, AV, Chen, MH, Roehl, KA, Catalona, WJ: Preoperative PSA velocity and the risk of death from prostate cancer after radical prostatectomy. N Engl J Med. 2004 Jul 8; 351(2):125-3.

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

Research Article by H. Osman et.al 2005 Songraphic finding of prostate in Saudi population.

Research done by Babiker (2009) in Sudan university. The role of ultrasound versus total and free prostate specific antigen in diagnosis of benign and malignant tumors of prostate gland.

W.j. kirkels et al (1995) the international prostate symptom score in a community-based sample of men between 55 and 74 years of age: prevalence and correlation of symptoms with age, prostate volume, flow rate and residual urine volume.

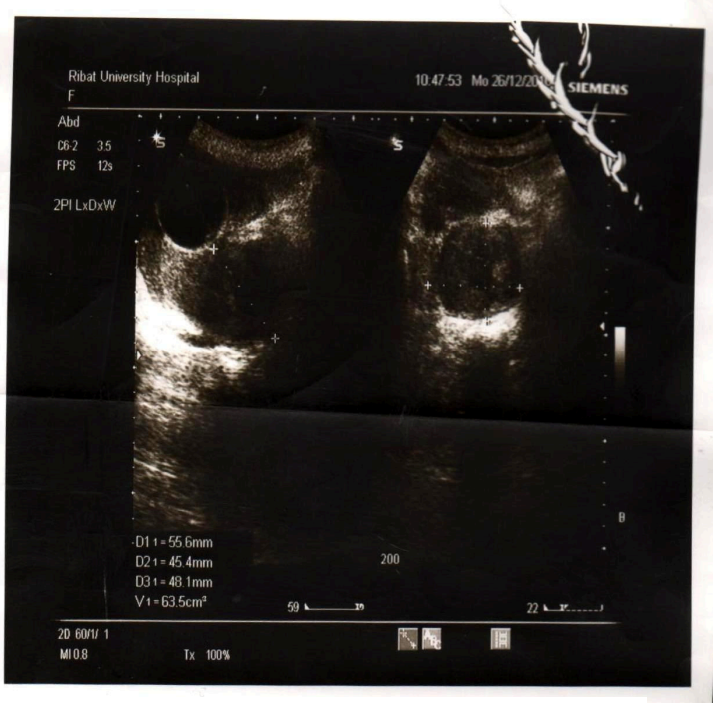
Appendices

Appendices (A)Ultrasound images of BPH

Patient age: 72 years

Patient length: 184 cm

patient weight: 65 kg



Patient age: 67 years

patient length: 170 cm

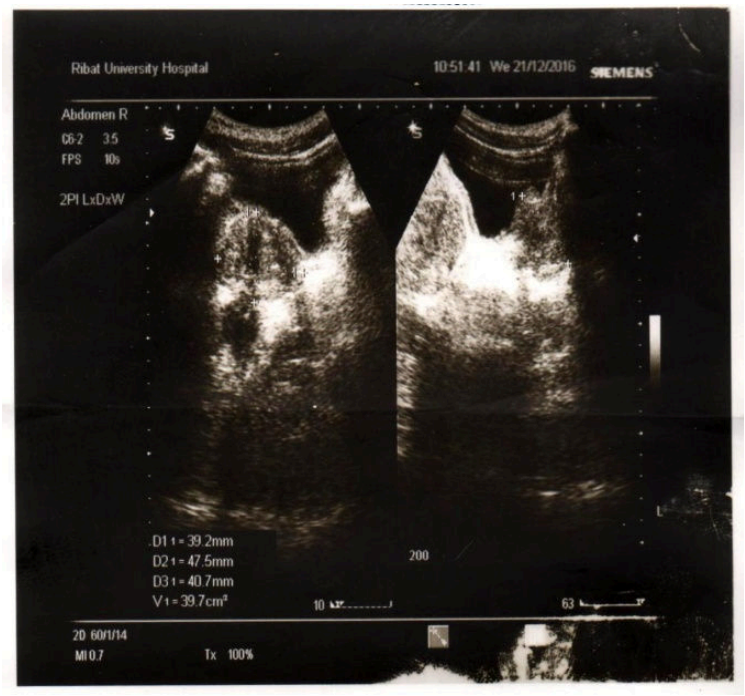
Patient weight: 85 kg

Appendices (B)Ultrasound images of BPH

Patient length: 160 cm

Patient age: 70 years

Patient weight: 73 kg



Patient age: 68 years

patient length: 172 cm

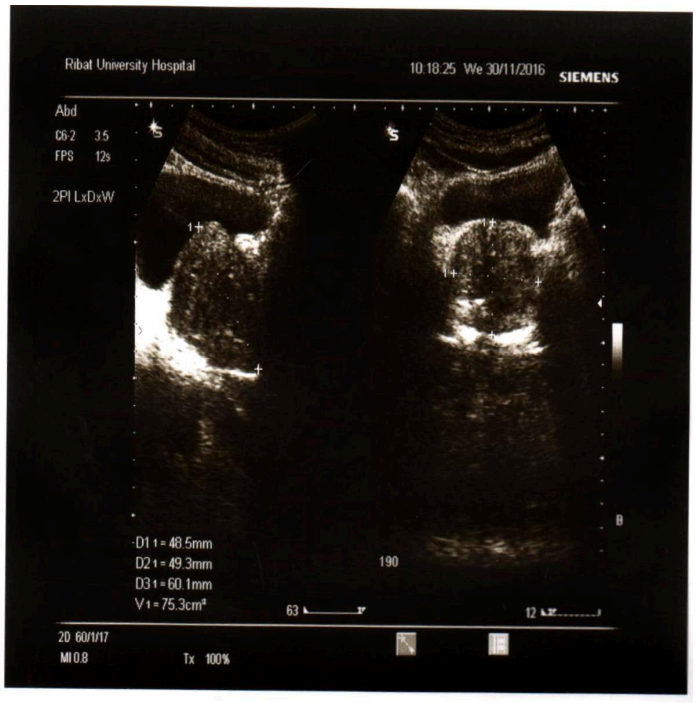
patient weight: 60 kg

Appendices (C)Ultrasound images of BPH

Patient age: 65 years

Patient length: 172 cm

Patient weight: 70 kg

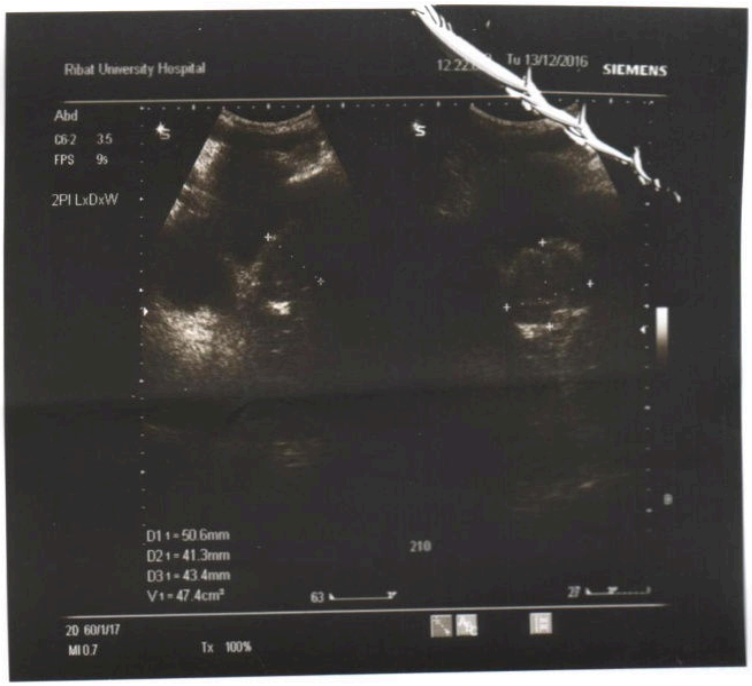


Patient age: 64 years

patient length: 178 cm

patient weight: 68 kg

Appendices (D)Ultrasound images of BPH



Patient weight: 90 kg

Patient length: 172 cm

Patient age: 67 years

Patient age: 70 years

patient length: 165 cm

patient weight: 67 kg

Appendices (E)Ultrasound images of BPH

Patient weight: 67 kg

Patient length: 165 cm

Patient age: 70 years

Patient age: 46 years

patient length: 185 cm

patient weight: 85 kg

Data sheet

No	age	BMI		Social status			Prostate measurement				texture	other
		length	Weight	single	married	children	depth	width	length	volume		