



بسم الله الرحمن الرحيم



Sudan University of Science and Technology
College of Graduate Studies

*Estimation of prostate Volume Measurment in
young Adult Using Ultrasonography*

تحديد حجم البروستاتا الطبيعي لدى البالغين باستخدام التصوير

بالموجات فوق الصوتية

**Thesis Submitted For Partial Fulfillment of Rrequirement of the Degree of
Master in Medical Diagnostic Ultrasound**

By:

Nahla Mohammed khamies Hamid

Supervisor:

Dr. Asmaa Ebraheem Ahmad Alamin

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الآية

بسم الله الرحمن الرحيم

قال تعالى

قال تعالى (فَتَبَسَّمْ ضَاحِكًا مِّن قَوْلِهَا وَقَالَ رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَىٰ وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

صدق الله العظيم

سورة النمل: الآية (١٩)

Dedication

To the spirit of my beloved father.

To my dear mother who always supported me.

To the candle of my life dear husband.

To my brothers and sisters

Special dedication to my young boys.

Acknowledgment

All thanks and praise to Allah who gave hearth, patience and strength to accomplish this work.

I would like to send my regards and thanks to my supervisor Dr. Asmaa Ebraheem Ahmed and all staff at collage of Medical Radiological Science for chance that have provided to gain knowledge and experience.

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I thank everyone who contributed to success this work.

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Abbreviations

TPUS	TransPerinealUltrasonography
TRUS	Trans Rectal Ultrasonography
TAUS	TransAbdomindUltrasonography
PSA	Prostate Specific Antigen
US	Ultra Sound
BPH	Benign Prostate Hyperplasia
PZ	Peripheral Zone
CZ	Central Zone
TZ	Transistial Zone
PT	Paient
PV	Prostate Volume

Abstract

This study was carried out to determine the range of volumes of the prostate gland in adult Sudanese males using transabdominal ultrasonography, curved low frequency transducer is used, two views are taken sagittal and axial to provide acceptable range of normal prostate gland volume. A prospective random selection of fifty asymptomatic adult males was recruited and measurement of the maximum length, height and width of their prostate gland were obtained and the volume was calculated. Subjects were selected, if they had no complaints related to the urinary system or signs of urinary tract disease. The mean measurement of the three parameters length, width, and height are 2.68, 3.56 and 3.02 respectively. The mean prostate volume obtained from the above parameters was 15.24ml with standard deviation plus or minus (4.30). The results are discussed in details, from the data obtained. Finally, Prostate volume measurement was calculated by (measured height \times length in sagittal plane \times width in the axial plane and multiply by 0.52) calculation done by machine. The findings show that prostate volume increases linearly with body weight and age.

ملخص الدراسة

هذه الدراسة اجريت لتحديد مدى قياسى معين لحجم غدة البرستاتا لدى الرجال البالغين من السودانين الاصحاء فى بيئتنا المحلية وذلك باستخدام الموجات الصوتية .

استخدمت فى هذه الدراسة تقنية التصوير بالموجات فوق الصوتية فى منطقة العانة وذلك بتسليط الموجات اسفل منطقة البطن. وتم اختيار محول طاقه ذو تردد موجي قليل لاختذ مقاطع ثائيه الابعاد و بهذه الطريقة يمكن الحصول على قياسات معيارية مقبولة لحجم البروستاتا الطبيعى .

تم اختيار عينة عشوائية من ٥٠ فرداً من الرجال البالغين من السودانين الاصحاء وتم قياس الابعاد القصوى الثلاث لغدة البروستاتا وهى الطول والعرض والارتفاع . وتم القياس باخذ مقطعين للبروستاتا مقطوع طولي واخر عرضي لقياس الابعاد الثلاث

وجد أن متوسط قياس تلك الابعاد هو ٢,٦٨ سم للطول ٣,٠٢ سم للارتفاع ، و ٣,٥٦ سم للعرض، وان متوسط حجم غدة البروستاتا طبقا لهذه الابعاد ، وباستخدام معادلة الاجسام البيضاوية الشكل بضرب هذه الابعاد المذكورة فى الثابت ٠,٥٢٩ هو ١٥,٢٤ مل.

اثبتت الدراسة أن حجم البروستاتا يزيد طبقا لزيادة بعض العوامل كزيادة وزن الجسم وزيادة عمر الفرد كما أن هناك عوامل قد تأثر بطريقة غير مباشرة فى زيادة حجم البروستاتا كالحالة الاجتماعية للفرد والبيئة الحياتية..

Chapter One

Introduction

Chapter One

1-1 Introduction

Prostate is a compound tubuloalveolar exocrine gland of the male reproductive system. The function of prostate is to secrete slightly alkaline fluid, which has the characteristic of milky or white in appearance. The secretion usually constitutes 20% to 30% of the volume of the semen along with spermatozoa and seminal vesicle fluid. In medical practice, most of the prostate abnormalities are diagnosed by measuring their volume. Normally, the prostate volume range between 0.250ml at birth to 10.000 ml sized at puberty. After puberty, the prostate volume will continuously grow as the age increase for most in the male's life. A healthy human male prostate has the volume of 10.000 ml. The prostate is located above the base of the penis and below the urinary bladder and backs into the front wall of rectum. The prostate secretes some of the fluid for semen, stops urination during ejaculation, and enhances sexual pleasurable sensations (Patel, 2009).

Reliable and precise ultrasonography measurement of prostate volume (P V) is very important for the management of prostate diseases. It is crucial not only for diagnosis purposes but also in planning non-invasive treatments of prostate cancer and follow ups (Sun and Seung, 2008)

In clinical setting, measurement of prostate volume via ultrasonography is conducted in several ways, namely transperineal (TPUS), transrectal (TRUS) and transabdominal (TAUS).

Measurements of prostate volume have become very important clinically since it is associated with different diseases and variables of malignancy. The American Cancer Society found that prostate cancer is one of the most common cancer in men (Karengberg, 2009) and is getting serious attention from the world as it has become a significant cause of death every year.

A few researches reported that prostate volume highly contributes in diagnosis of prostate cancer. These studies show that large prostate volume has an increased risk of malignancy (Evelyn, 2010).

1.2 Problem of the study:

Prostate diseases nowadays was widespread even in young adult so this study try to assess the normal prostate volume, in healthy subjects using ultrasonography.

1.3 Objectives:

1.3.1 General objective

Estimation of prostate volume measurement in young Adult Using Ultrasonography.

1.3.2 Specific Objectives

- To determine the range of volumes of the prostate gland in young adult using supra-pubic ultrasonography.
- To provide acceptable range of normal prostate gland dimensions in Sudan.
- To correlate prostate volume with body mass index and age.

1.4 Overview of study:

Chapter one:

Deal with introduction, problem of the study, objectives and overview of study.

Chapter two:

Included literature review

Chapter three:

Deal with material and methods

Chapter four:

Included result presentation

Chapter five:

Deal with Discussion, Conclusion, and Recommendations.

Chapter Two

Literature Review

Chapter Two

2.1 Anatomy:

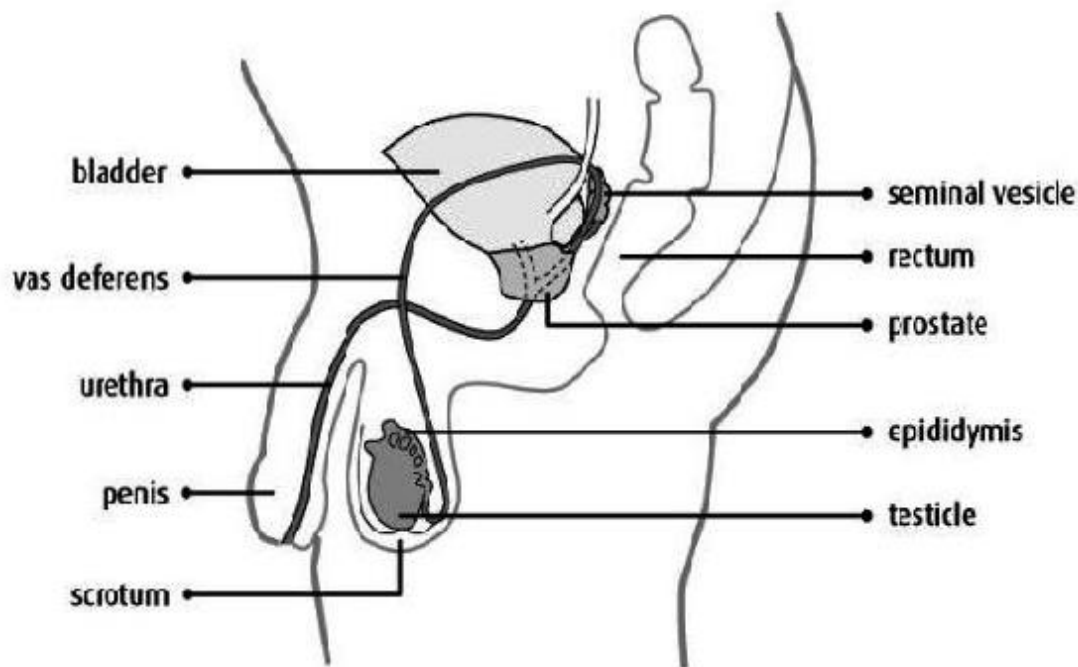
The prostate gland is small muscular rounded organ, about 4cm (1.6 in) in diameter. That surrounds the urethra at it leaves urinary bladder. Prostate gland lying immediately below the bladder. The part of the prostate above and between the ejaculatory duct is sometimes describe as the “median lobe”. (Robert P , 2000).

2-1-1 Structure:

The prostate gland is covered in a layer of connective tissue called the prostatic capsule. Prostate gland made up of different type of cells gland cells that produce the fluid portion of semen, muscle cells that control urine flow and ejaculation and fibrous cells that provide the supportive structure of the gland.

2-1-2 Structures around the prostate:

Seminal vesicles found on both side of the prostate, vas deferens to carry sperm from testicles to seminal vesicles, nerve bundles found on both side of the prostate and muscles to control urination. (Martini ,2012)



Figuer (2-1) Male reproductive system (Martini, 2012)

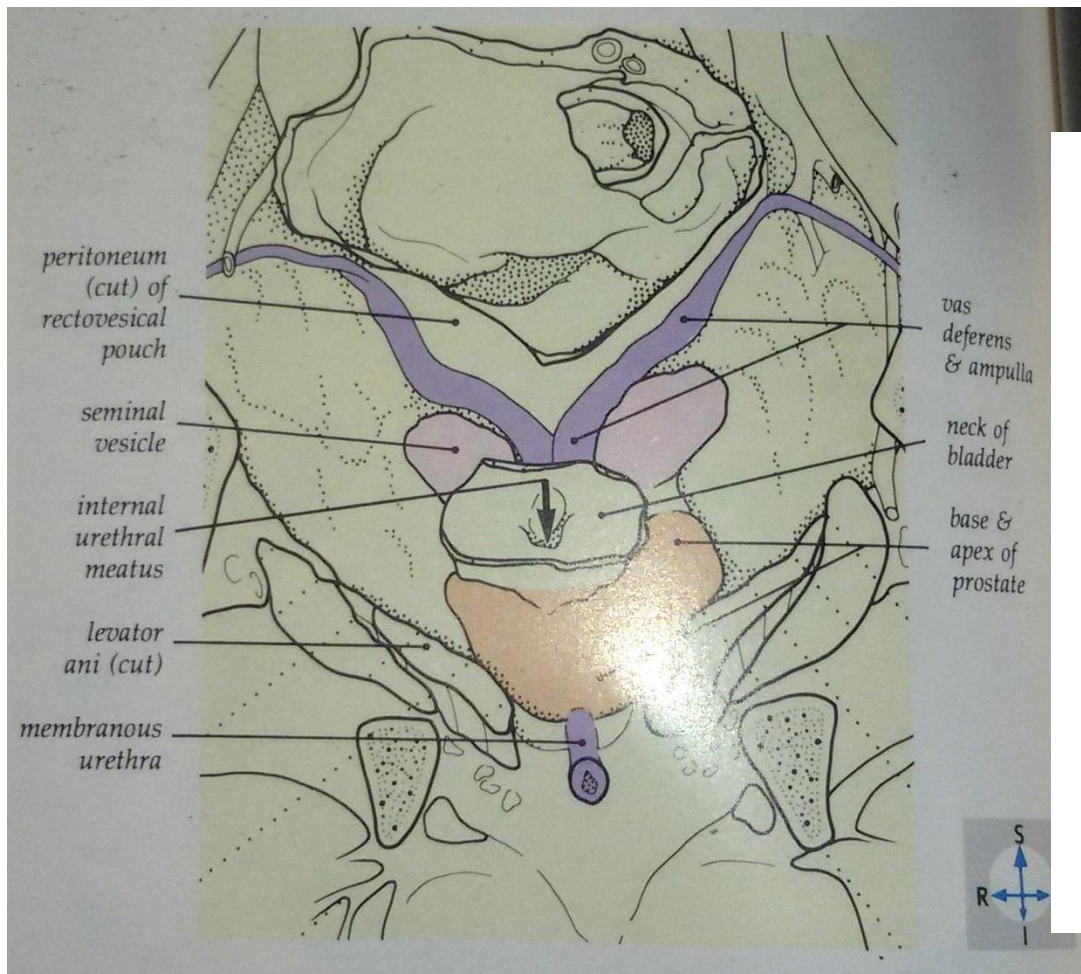


Figure (2-2) Coronal section of the pelvic walls and floor, prostate, the seminal vesicles and the vasa deferentia, (Fredric H 2000)

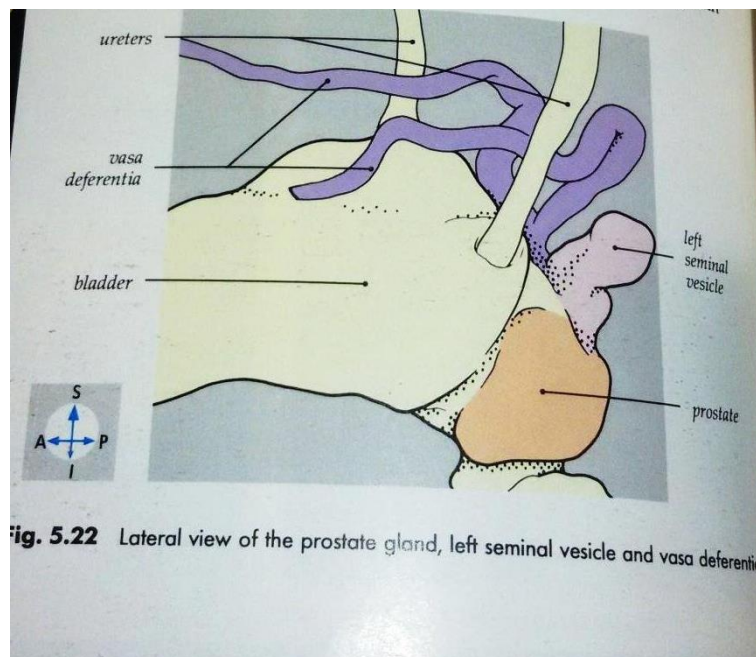


fig. 5.22 Lateral view of the prostate gland, left seminal vesicle and vasa deferentia.

Figure (2-3) lateral view of the prostate, gland, left seminal vesicle and vasa deferentia (Fredric H 2000).

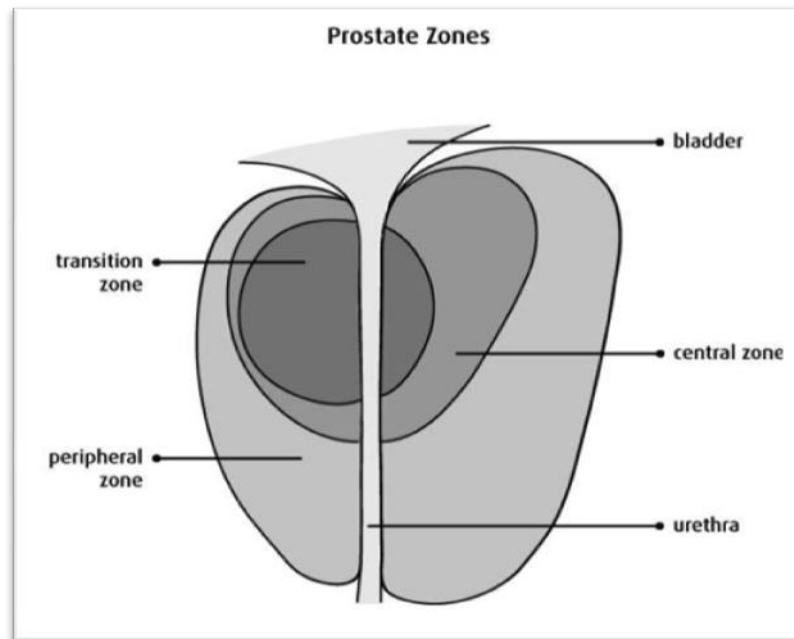
2-1-3 Zone of the prostate:

Prostate gland divided in to 3 zones.

2.1.3.1 Peripheral zone: is the area at prostate that is closest to the rectum, it is largest zone of the prostate gland. The majority of the prostate tumours are found in the peripheral zone.

2.1.3.2 Transition zone: is the middle area of the prostate, it surround the urethra as it passes through the prostate this zone makes up about 20percent of the prostate gland until age of 40years old. As men age the transition zone begins to enlarge, when this zone enlarges it pushes the peripheral zone of the prostate toward the rectum.

2.1.3.3 The central zone: the central zone is front of the transitional zone is the part of the prostate that is farthest from rectum. (Shier, D.,1998)



Figur 2.4: Prostate zone. (Shier, D.,1998)

2.2 Function of the prostate gland:

The main function of the prostate is to produce the fluid portion of semen. The gland cells within the prostate produce thin fluid rich in proteins and minerals that maintain and nourish sperm. This fluid is made continuously.

The excess passes from the body in the urine when a man is sexually aroused, the prostate produce large amount of this fluid it then mixes with sperm and is ejaculated as semen. The prostate also play part in controlling the flow of urine. The urethra runs from the bladder through the prostate and out through the penis. The muscle fibres of the prostate are wrapped around the urethra and under involuntary nervous system control. These fibres contract to slow and stop the flow of urine.(Moore et al (2008).

2.2.1 Embryology and development of the prostate gland:

During the third month of gestation, the prostate gland develops from epithelial invaginations from the posterior urogenital sinus. In order for this process to occur normally, the presence of 5α dihydrotestosterone is required. This molecule is synthesized from fetal testosterone by the action of 5α -reductase and is localized in the urogenital sinus and external genitalia of humans . Deficiencies of 5α -reductase will cause a rudimentary or undetectable prostate in addition to severe abnormalities of the external genitalia, although the epididymides, vasa deferentia, and seminal vesicles remain normal . During the prepubertal period, the constitution of the human prostate remains relatively identical; however, it undergoes morphologic changes into the adult phenotype with the beginning of puberty. Ultimately, the gland enlarges to reach the average adult weight of approximately 20 g by 25—30 years of age.(Hammerer PG, 1995).

2.2.2 Regulation:

The properly, the prostate male hormones (testosterones), which are responsible for male sex characteristics .the main hormone is testosterone, which produced mainly by the testicles. Some male hormones are produced in small amounts by the adrenal glands.However; it is dihydrotestosterone that regulates the prostate.(Moore etal 2008).

2.2.3 Male sexual response:

During male ejaculation, sperm is transmitted from the ductus deferens into the male urethra via the ejaculatory duct, which lie within the prostate gland.

2.2.4 Secretions:

Prostatic secretions vary among species. They are generally composed of simple sugar and are often slightly acidic. In prostatic the protein content is less than 1%. and includes proteolytic enzymes , (Prostatic acid phosphatase, beta – microseminoprotein, and PSA).The secretions also contains zinc. (Komisar, 2009).

2.3 Normal prostate measurement:

Since every one is different ,it should be no surprise that every mans prostate is different size .Normal prostate size is similar that of walnut or golf ball.Normal prostate size for an adult range from 10 cubic centimeter to 30 cubic centimeter according to the Urological Result Foundation in Hillsloore,Missovri.

A healthy adult prostate weight about 20-25 grams it measure 4x2x3 centimeter.(Leisner K, 1979).

2.4 Normal variations:

Knowledge of normal prostatic anatomy is paramount to understanding the pathological condition of the gland observe on ultrasound imaging.Through transverse and sagittal histological sections of normal prostates, model ultrasound images of prostate and periprostatic tissues were constructed .Various shades of gray were assigned to these structure depending upon the histological composition. We found that ultrasonic characteristics of the normal

prostate and its surrounding tissues could be predicted accurately by knowledge of the histology of these structures.(Abu-Yousef, 1982).

2.4 Imaging of the prostate gland:

2.4.1 MRI:

Preferred imaging modality:

T₁ Homogenous intermediate signal intensity.

T₂ Anterior fibro muscular stroma is low T₁w and T₂w signal.

Peripheral zone is high T₂w signal, similar to or greater than adjacent fat.

There are age related increased in T₂w signal than peripheral zone.

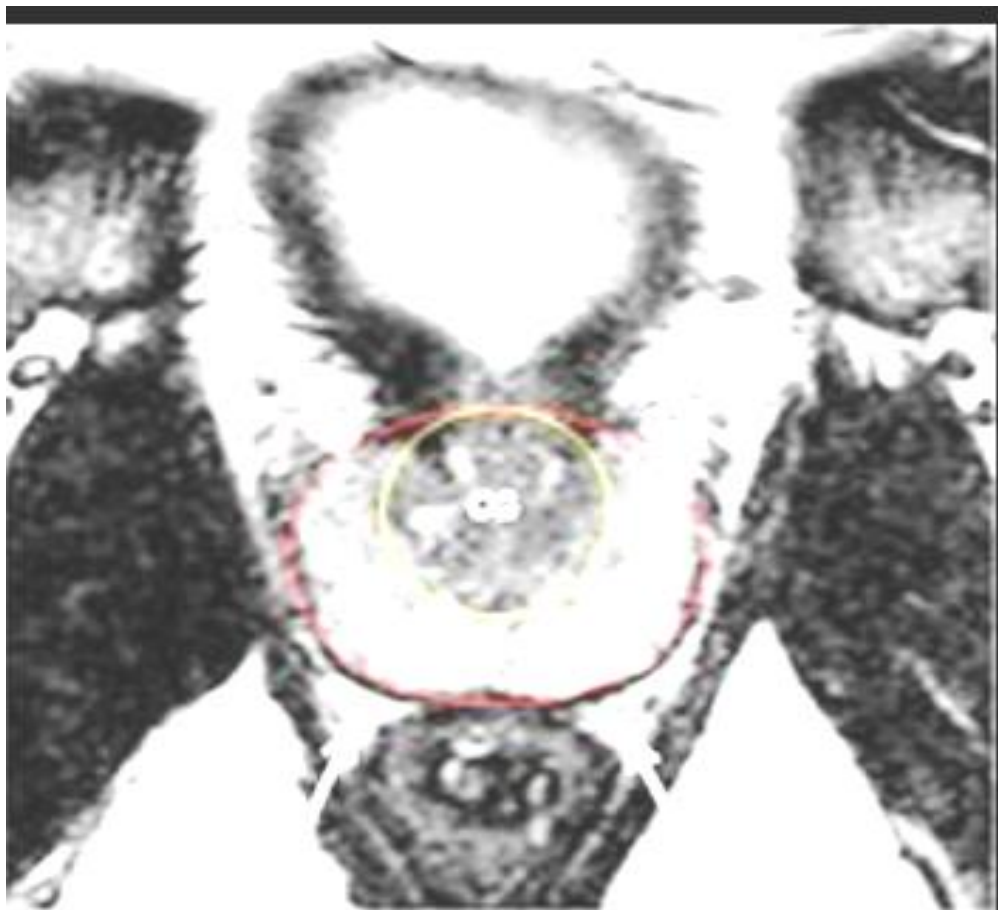


Figure (2-5) Normal prostate MRI

2.4.2 CT scan:

Poor for assessment of the prostate zonal anatomy and pathology. With adjusted window settings. Central zone appear hyper dense and Peripheral zone appear hypodense.

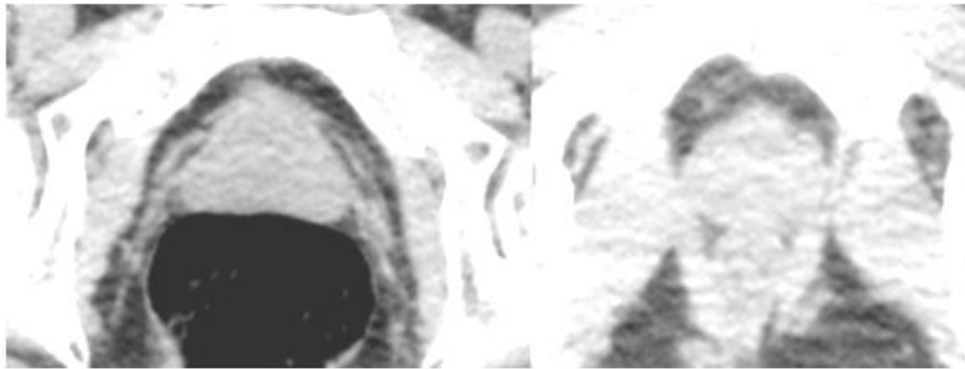


Figure (2-6) Normal CT prostate anatomy

2.4.3 Ultra Sound Imaging of the Prostate:

Ultra sound imaging is safe and painless and produce pictures of the inside of the body using sound wave ultrasound imaging also called ultra sound scanning or sonography, involves the use of small transducer (probe) and ultra sound gel placed directly on the skin. High frequency sound wave are transmitted from the probe through the gel in to the body. The transducer collects the sounds that bounce back and a computer use those sound wave to creates an image. Because the ultra sound images are captured in real-time can show the structure and movement of the body's internal organs as well as blood flowing through the blood vessels.(Rifkin, 1997).

Prostate ultrasound also called transrectalultrasound, provides images of man prostate gland and surrounding tissue.

In transrectal ultrasound the exam required insertion of an ultrasound probe in to the rectum of the patient. The probe send and receives sound wave trough the wall of the rectum into the prostate gland which is situated right in front of the

rectum. Ultrasound of the prostate gland is performed to detect disorder within the prostate, determine whether the prostate is enlarged, detect an abnormal growth within the prostate and help diagnose the cause of a man's infertility.

A transrectal ultrasound of the prostate gland is typically used to help diagnose symptoms such as: A nodule felt by a physician during a routine physical exam or prostate cancer screening exam, an elevated blood PSA test result and Difficulty urinating. (Kristal AR, 2008).

Because ultrasound provides real-time image it also can be used to guide procedures such as need biopsies in which a needle is used to sample cells (tissue) from abnormal area in the prostate gland for later laboratory testing.

2.4.3.1 Protocol of prostate ultrasound:

Transrectal ultrasound (TRUS).

Trans abdominal ultrasound (TAUS).

Visualization of the prostate using TRUS has improved the diagnostic ability of sinologist. It play an important role in most prostatic diseases.

If the PSA is elevated or increasing rapidly or there are abnormal prostate examination then TRUS may be indicated.

Some patient are not to cope with the probe inside their rectum for the duration of scan. TAUS can assess the volume of the prostate but is not reliable to diagnose carcinoma. If the PT are unable to fill their bladder with at least 60mls of fluid then an accurate volume cannot be measured using TAUS.

2.4.3.2 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 generous amount of gel is put in to sphincter before inserting the probe.

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.

2.4.3.3 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.

In TAUS 3 – 5 MHZ – 6 MHZ curved linear array probe depending on the size of the PT should be used.

2.4.3.4 Patient position:

In TRUS the PT lies in lateral decubitus position with his knee toward the chest.

In TAUS PT lies supine.

2.4.3.5 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.

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 it 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.

Look for change in the contour and the echogenicity in each zone.



Figure (2-7) Normal TRUS of the prostate

In trans abdominal 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. Volume should be measure by machine setting using length, height and width.

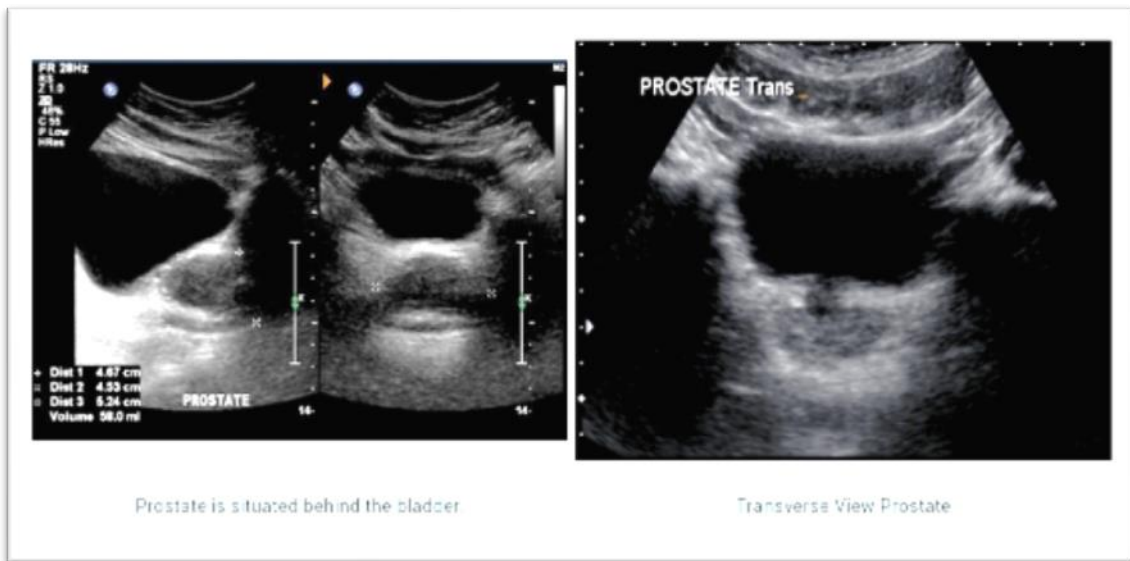


Figure (2-8)TAUS of the prostate



Figure (2-9) shows the probe position in TAUS

2.4.3.6 Sonographic anatomy of prostate gland:

Transrectal US of the prostate has revolutionized Our ability to examine this organ.

Excellent visualization of the prostate in the axial and sagittal planes. In the axial plane, Scanning Usually begins at a level just above the seminal vesicles and by sequential withdrawing of the transducer in a caudal direction, the base, mid gland and the apex is visualized. When scanning the most cephalad areas, the vas deferens will be visualized . they will appear as bilateral structures. Then the seminal Vesicles will come into view as the vas deferens join with them superior prostate. At the level of the base of the prostate the prostate appears as a Symmetrical crescent shaped with triangular postero-lateral margin. The normal Prostate will appear hyperechoic to the seminal vesicles and will have a homogenous echopattern. The CZ and TZ cannot be individually distinguished by their echogenicity. However the PZ appears more echogenic with homogenous echotexture.

In the sagittal plane scanning start in the midline where the entire prostate can be visualized in one image. The seminal vesicle will be superior and posterior to the base of the prostate and the vas deferens will be seen anterior to the seminal vesicles. The seminal vesicles will be less echogenic than the prostate and will appear rounded shape.

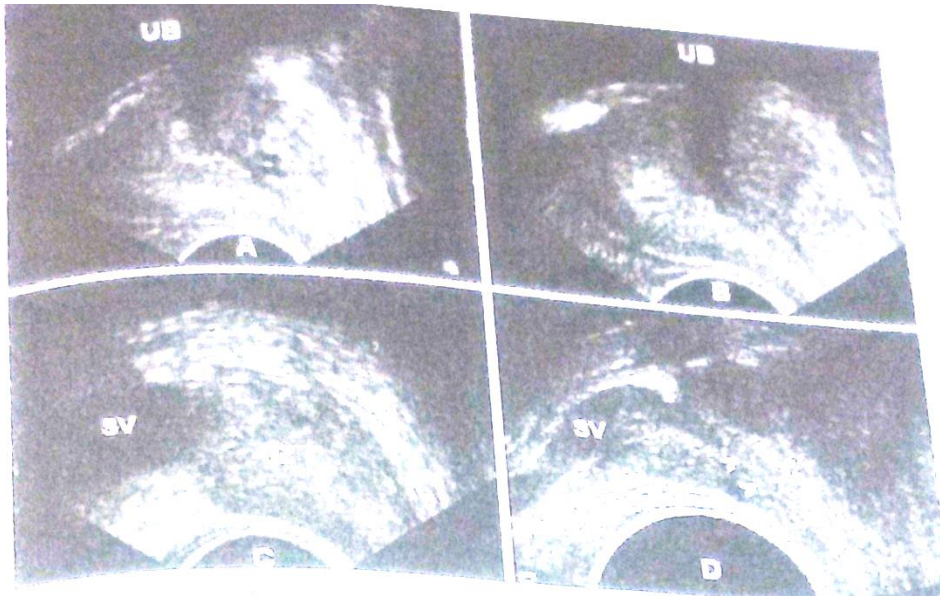


Figure (2-10)TRUSSagittal image (A) in midline(B) paramedical region(C) peripheral part of the gland which is formed mainly of peripheral zone (D)shows the confluence of vas and seminal vesicles (sv)to form the ejaculatory duct(arrowhead).

2.4.3.7Benefits of the U/S:

U/S is widely available, easy to use and less expensive than other imaging methods, U/S imaging use nonionizing radiation, U/S scanning able to give a clear picture of soft tissueU/S causes no health problem and may be repeated as often as is necessary if medically indicated andU/S provide real time imaging, making it a good tool guiding minimally invasive procedu, res such as needle biopsies and fluid aspiration.

2.4.3.8Risks:

For standard diagnostic ultrasound, there are no known harmful effect on humans.

2.5Importance of prostate volume measurements :

Measurement of prostate volume have become very important clinically since its association with different diseases and variables of malignancy .The American Cancer Society found that prostate cancer is one of the most common

cancers in men and is getting serious attention from the world as it has become a significant causes of the death every year .

A few researches reported that prostate volume highly contributes in diagnosis of prostate cancer . These studies show that large prostate volume has an increased risk of malignancy (Evelyn 2010).However another studies with the same scope concluded that prostate gland harbouring carcinoma were significantly smaller than in men without malignancy this include the most recent study on relationship between prostate volume and some histological criteria of equal to 20g harbors tumors of great malignancy while those of large volume with weight greater than 90g is more often harbors unifocal and low grade tumors .

As the critical size related to malignancy is stated concisely in this study (-20g and -90g) it is yet to determine the range of normal volume of prostate since its volume is influenced by so many factors including adiposity ,ages ,body size and frequency of sexual activity . Other than that ,previous report also shows that prostate volume may also be influenced by ethnicity and migration . Therefore ,this presents study will investigate the correlation between body weight and age to healthy multi-ethnic Sudanese population as an early baseline study .

2.6 Prostate Volume Ultrasonography Measurements:

In clinical setting, measurement of prostate volume via ultrasonography is conducted in several ways namely transperineal (TPUS), transrectal (TRUS) and transabdominal (TAUS).

Historically ,transperineal route was the first one used to reach and image prostate as it was used to guide biopsy procedure since 1950 .In transperineal ultrasound imaging ,ultrasound transducer is placed in the perineal area while the patient lies down in supine lithotomy position .Due to the position of transducer ,images of bladder and prostate are allowed to be reached since anatomically ,both structures fall within the transducer's field of view .However

,the sensitivity of TPUS in imaging clear prostate is very limited as report from previous studios showed that TPUS done by experienced sonographer can only be able to detect a very low percentage of known cancer . This is due to its restriction in visualizing abnormalities of the prostate, particularly at hyperechoic area Rajesh and Martha.1999

Transrectal ultrasound examination is a common outpatient procedure involving digital ultrasound for the assessment of prostate via rectum .The examination is performed by placing a small and lubricated intracavity probe of 7.5MHz into the rectum either for imaging or guiding biopsy .

Nowadays ,transrectal guided biopsy is a gold standard for diagnosis of prostate cancer as the combination of prostate biopsy and prostate ultrasonography yield the best diagnostic outcome of prostate cancer . The transrectal method provides a clear image of organs in the pelvis .Normally, transrectal ultrasound is used for the evaluation of the prostate gland with elevated prostate specific antigen (PSA) or prostatic nodules on digital rectal examination .Although this method is reported to give high accuracy , it usage requires high patient tolerance as it involves inserted of the intracavity probe into the rectum, another issues concern the usage of transrectal ultrasound is intraobserver variations . Depending on the sonographer's knowledge and experience, values measured by each sonographer are different resulting in low reproducibility of clinical result and causes clinical decision making to be complicated .Hence, transabdominal method has become a standard clinical tool for a rapid, simple and noninvasive screening of the prostate.

Transabdominal ultrasound use 3-5MHz transducer partially or fully filled urinary bladder with caudal angulation to send the ultrasound beam under the through a pubic arch and permit global volume measurement of the prostate.

In this method, the transmitted and reflected ultrasound waves visualize the organs through the abdominal wall.The advantage of transabdominal ultrasound

is the procedure can be performed quickly, and non-invasively (Walz, et al, 2006).

2.7 Previous Studies:

Few researches reported that prostate volume is highly contributed in diagnosis of prostate cancer. These studies show that large prostate volume has an increase risk of malignancy (Evelyn ,2010).

New results were presented on May 19th, 2014 at the annual meeting of American Urological Association held in Orlando, Florida. Prostate volume measurements can lead to large adjustments in the probability a biopsy finds prostate cancer obtained from risk calculators.

Chapter Three

Material and Methods

Chapter Three

Material And Methods

3.1 Material:

Cross -sectional study included 50 male subjects in age between 20 to 40 years old were selected to undergo transabdominal ultrasound scan.

3.1.1 patient:

The subjects were randomly selected with different status and body weight to find the correlation of these parameters to normal prostate volume .Since, this study focuses on normal prostate volume, male with history of abnormal prostate conditions were automatically excluded from this study.

3.1.2 Machine:

The prostate ultrasound scan was conducted by using Siemens Aplio MX, The device was set to a 2D mode and a convex probe with frequency of 3.5MHz to 5MHz was used for imaging from longitudinal plane measurements were conducted under general setting of the ultrasound machine.



Figure (3-1) Siemens Aplio MX US machine

3.2 Method

3.2.1 Technique

Transabdominal technique:

The patient lies supine. The patient should have a half bladder. 500 ml of water 1hr 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 position of the prostate is not obscured by the shadow artifact from the base of the bladder. Trans-abdominal Ultrasound can assess the volume of the prostate but amount of gel is poured on the anterior part of pubic region. Sagittal and transverse scanning is then performed to assess the entire prostate in many planes.

If the PSA is elevated or increasing rapidly or there is abnormal prostate examination then the transrectal ultrasound and prostate biopsy may be indicated to obtain tissue to make the diagnosis of the prostate cancer.

The subjects were first instructed to fully fill their urinary bladder by consuming water 30 minutes before the measurement. This was to ensure that the anatomy of prostate could be well-imaged and observed. The measurement was conducted by placing the transducer on the superficial of the abdominal area with subject laid in supine position during scanning.

3.2.2 Method of measurement:

Two views are taken to measure the prostate volume. Height \times length in sagittal plane \times width in axial plane multiply by 0.52 the calculation done by machine.

3.2.3 Statistical method:

Data were analyzed using SPSS. Various statistical test were use according to the type of variables to be interpreted. The data were presented in tables and figures.

3.2.4 Ethical consideration:

Patients data were requested by clinicians. The data was collected from those who had been sent to ultrasound examination or who are selected for evaluation of the prostate. No personnel data will be published.

3.3 Duration of study:

It takes three months.

3.4 Study area:

It was done in Khartoum.

Chapter Four

Results

Chapter Four

Results

Table (4-1). Shows Age groups.

Age Group	Frequency	Percentage
(20-25) yrs	11	22%
(26-30) yrs	20	40%
(31-35) yrs	7	14%
(36-40)yrs	12	24%
Total	50	100%

Table (4-1) Shows the subjects age groups, there are 11(22%) of age class (20-25) yrs, 20(40%) yrs of age class (26-30) yrs. 7(14%) of age class (31-35) yrs and 12(24%) of age class (36-40) yrs. That means the most of subjects range (26-40) yrs.

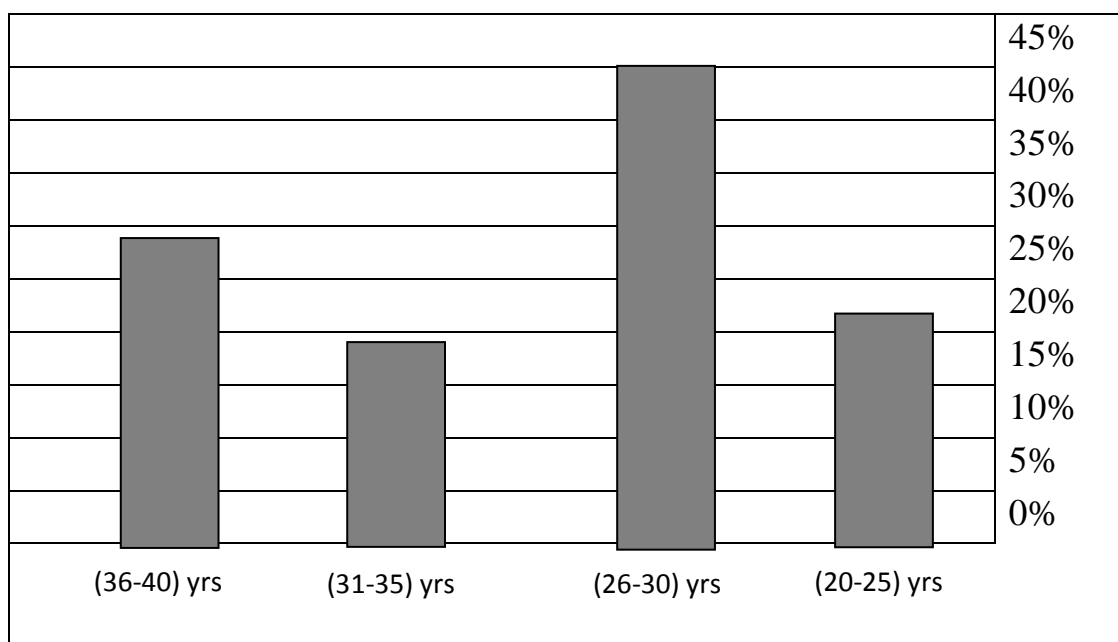


Figure (4-1) Illustration of subjects' age

There were 11(22%) of age class (20-25) years, 20(40%) years of age class (26-30) years. 7(14%) of age class (31-35) years and 12(24%) of age class (36-40) years.

Table (4-2). Subjects Marital Status.

Status	Frequency	percentage
Single	26	52%
Married	24	48%
Total	50	100%

Table (4-1) Shows the subjects marital status, there are 26(52%) of single, while 24 (48%) were married. That means most of the subjects included in this study were single. Figure2. Illustrates this graphically.

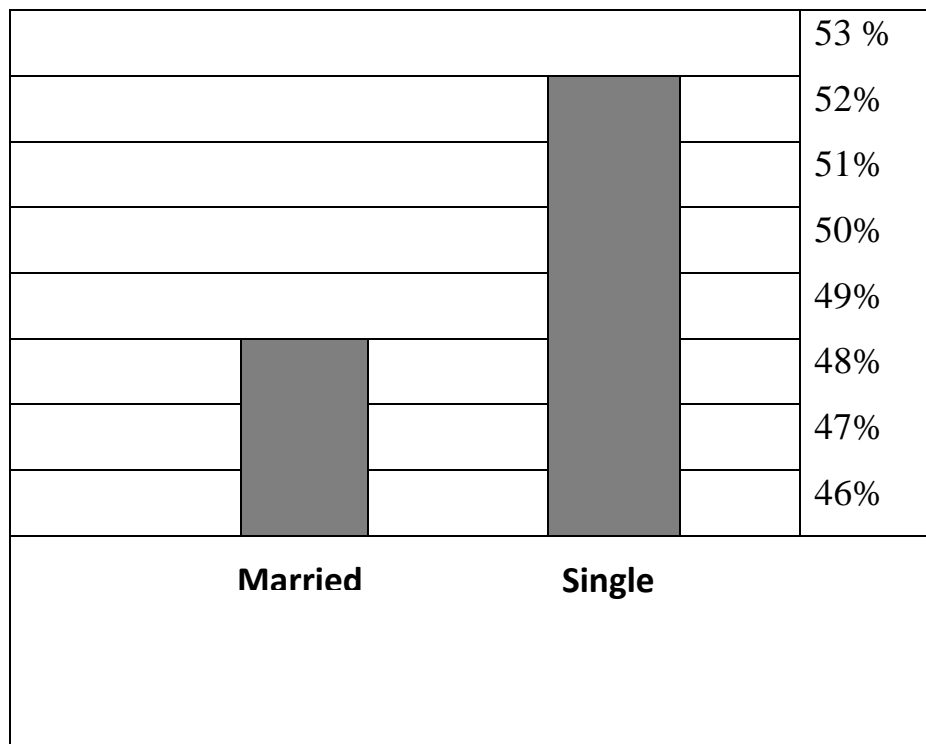


Figure (4-2) Description of subjects' marital status.

Table (4-3) Variations in subjects Weight and prostate volume.

No	Weight(kg)	Volume (cm ³) ml
1	68	14
2	85	14.4
3	62	12.8
4	58	15.9
5	55	13
6	58	16
7	68	11.3
8	57	14.2
9	80	24.4
10	61	17.1
11	78	27.4
12	75	11.6
13	73	15.3
14	75	20
15	64	17.7
16	60	18.3
17	64	17
18	60	7.8
19	58	12.4
20	65	8
21	58	7.5
22	80	18.76
23	70	8.42
24	78	19.69
25	67	15.72

No	Weight(kg)	Volume (cm ³) ml
26	69	7.83
27	63	10.9
28	58	17.6
29	70	20.87
30	63	16.35
31	62	14.16
32	67	14.42
33	63	20.8
34	67	19.69
35	62	16.2
36	57	19.1
37	80	17.01
38	59	13.83
39	70	13.75
40	56	15.48
41	65	11.59
42	75	15.62
43	78	8.36
44	60	13.48
45	67	17.92
46	62	20.14
47	75	13.71
48	70	20
48	69	10.51
50	73	13.84
Mean	66.74	15.24
St.dev	7.63	4.30

Table(4-4). Prostate volume and Age correlation

Dependent Variable Volume:							
Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
linear	0.205	12.350	1	48	0.001	10.942	0.179
The independent variable is Age.							

From the above table a linear relationship equation between Age and prostate volume can be estimated as follows:

$$PV = 0.179 A + 10.942 \quad (1)$$

Whereas ; **PV**= Prostate volume **A**= age

Table(4-5). Prostate volume and wieght correlation

Dependent Variable Volume:							
Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
linear	0.044	2.195	1	48	0.145	7.369	0.118
The independent variable is Weigh.							

From the above table a linear relationship equation between Weight and prostate volume can be estimated as follows:

$$\mathbf{PV} = 0.118 \mathbf{w} + 7.369 \text{.} \text{_____} (2)$$

Whereas ; **PV**= Prostate volume **W**= weight

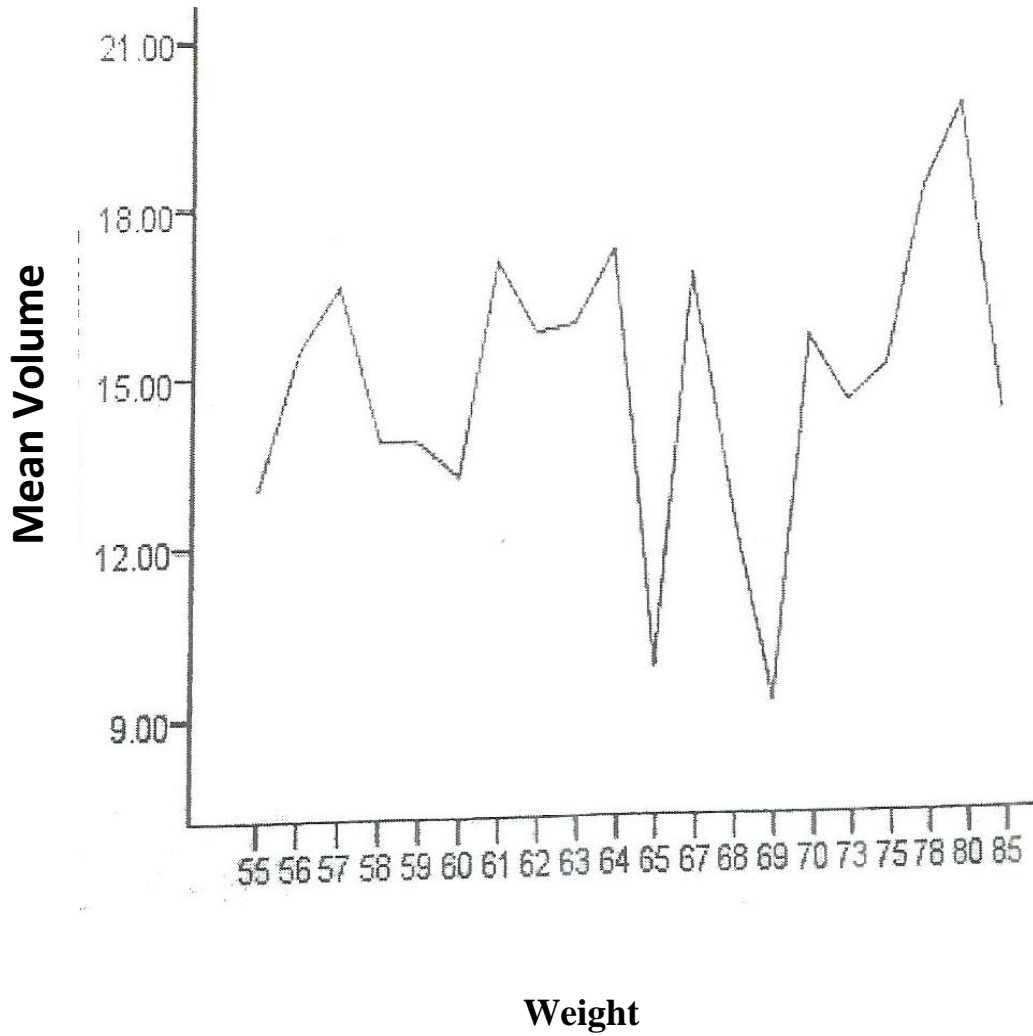


Figure (4-3). Graph of prostate volume and Body weight

Chapter Five

Discussion

Chapter five

Discussion Conclusion and Recommendation

5-1 Discussion:

The final prostate volume measurement result for each subject as the subject's weight and age is presented by table (4-3) , it is shown that the calculated volume for all participants, which is achieved from the volume of prostate's anteroposterior height, transverse width and cephalocaudal length , ranges from 7.5 ml (cm³) with mean prostate volume of 15.24 ml (cm³).The finding of prostate volume of my patients are comparable with other studies.

The collected data were plotted into graphical representation to observe the relationship of the prostate volume and body weight as shown in figure (4-3)

The graph in figure (4-3) shows a linear relationship between prostate volume and body weight increases, prostate volume is also increase. Hence , a man with heavier body weight compared to a lighter one will have a larger prostate volume. Body weight of a person reflects the level of human growth and development under the influence mostly of person's genotype and environment. Genotype and environments reflects mostly on person's ethnicity, which I believed to be the good field for the researchers to study on.

A linear relationship equation between weight and prostate volume can be estimated as follows

$$PV=0.118 W + 7.369 \text{.....} (1)$$

Were as **PV**=Prostate volume, **W** = weight.

In figure (4-1) the different age groups in which the prostate was measured can be seen. It is important to point out that the mean prostate volume in the higher percentage frequency age group (26-30) years old, which corresponding to 40% was 15.5 ml (cm³), while for the sample total the mean is 15.2 ml (cm³).

The lowest prostate volume measurement was 7.5 ml , and the highest was 27.4 ml , making the mean is 17.5 ml.

Data were analyzed using SPSS program obtaining a sample mean of 15.24 ml and standard deviation (SD) of 4.30. A 95% confidence interval was carried out. The population mean for prostate volume measured with suprapubic ultrasound in this sample was 15.24 plus or minus 4.30 ml.

5.2 Conclusion:

This study shows that using transabdominal approach is an easy simple way of prostate measurement. Hence this method can be used as a standard screening method for imaging prostate. Therefore, transrectal scanning can be used only when necessary or when ambiguity is present during transabdominal scanning.

This study also found out that prostate volume increases linearly with subject's parameters like age, weight and slightly with marital status.

There are conflicting data regarding the association between age, and obesity after adjustment for prostate volume.

There were few studies on prostate gland volume and weight in young men under the age 40 years old given that no evidence of prostatic disorders or pathology in the general population of men at this age. However prostate volume screening studies in younger men would provide measurement parameters for that age category and therefore would enhance diagnosis and treatment.

5-3 Recommendations:

From the results of this study the researcher recommended:

Further studies needed to show the relationship between prostate volume and ethnicity by categorizing each subject to their ethnicity background to observe differences of prostate Volume between Sudanese population , for example western population , northern population , eastern and median population to know the prostate volume population mean obtained from suprapubic ultrasonography in healthy males between age 20-40 years in the Sudanese country , and to identifying and documenting the ultrasound imaging findings.

All sinologists performing prostate scans should be appropriately trained and their results subjected to rigorous audit.

Performing the scan to high standard and can be demonstrate a good knowledge.

The ultra sound equipment must be good quality.

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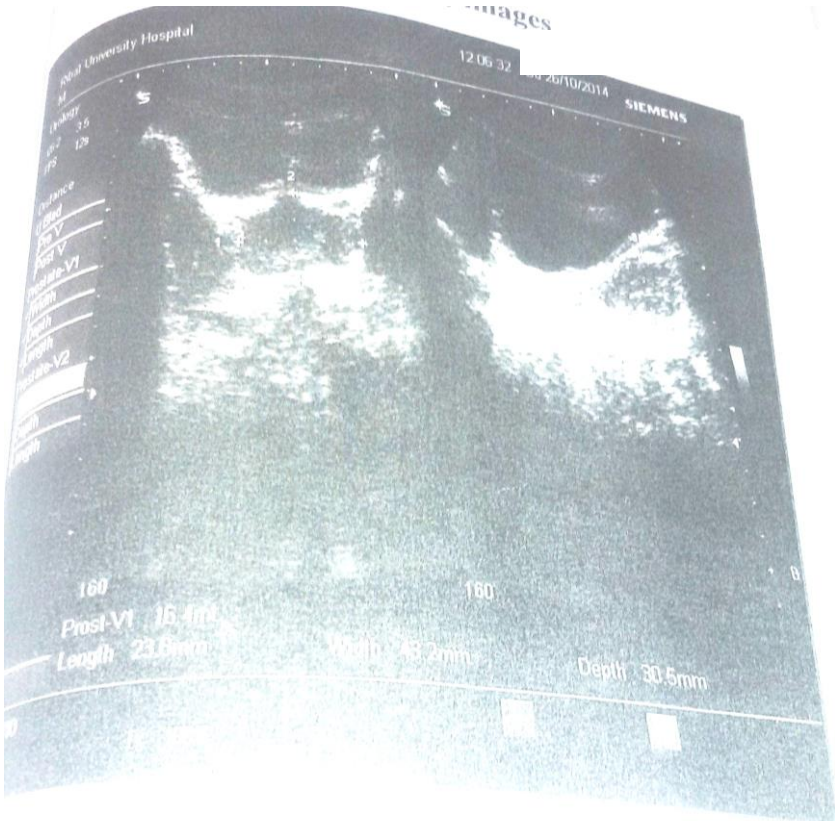
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Appendices

Apandix (1) Image



Images of the prostate gland of marriage 36 Kg male.
The volume of the prostate gland is 16.4 ml.

