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RESEARCH ARTICLE

DETERMINING THE NORMAL SIZE AND VALUES OF THE TESTICLES IN ADULT POPULATION IN THE WESTERN REGION, SAUDI ARABIA.

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Abstract

Background: The testis is an essential organ of the male reproductive system. The aim of this study is to obtain reference data for testicular volume measured by ultrasound in King Abdulaziz University Hospital patients.

Method: This was a retrospective study conducted at King Abdulaziz University Hospital, Jeddah , and included all healthy men with normal morphology and no associated clinical suspicious of orchitis or varicocele. Patients age ≥18 years who underwent a scrotal ultrasound at King Abdulaziz University Hospital from April,2014 through October, 2016.

Result: The mean age score for the 522 participants was 41.2±16.5 rang (18-89). For right testicles the mean scores of longitudinal, anterioposterior, transverse diameters and the testicular volume were respectively 4.2±0.6, 2.7±0.5, 1.9±0.4 and 12.0±5.0 respectively. While for left testicles, the mean scores of longitudinal, anteroposterior, transverse diameters and the testicular volume were respectively 4.1±0.7, 2.6±0.5, 1.9±0.4 and 11.2±4.7 respectively

Conclusion: The current study provides reference data for testicular volume measured by ultrasound in King Abdulaziz University Hospital patients. Further studies need to be conducted on multicenter bases to compare between the different methods of measurements in order to provide comprehensive description of testicular volume suitable for developing the normative assessment.

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Introduction:-

The testis is an essential organ of the male reproductive system. Testicular glands are the place where sperm and testosterone are produced. The seminiferous tubules comprise approximately 70% to 80 % of the testicular mass. [1]

Many studies have shown that reduction in testicular size is mainly caused by the decrease of the seminiferous tubules due to primary dysplasia or secondary damage and can, therefore, result in disturbed spermatogenesis. [1] So, the testicular function has a direct correlation with testicular volume. [2].

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Therefore, the accurate measurement of testicular volume is necessary to assess its function. It also helps in the evaluation of patients with diseases affecting testicular growth, development, and function. Many studies have shown that infertile men will have affected testicular volume, so our study will aid in the assessment and management of male infertility. It has a significant role in the management of adolescents varicocele and monitoring of children and adults after varicocele ablation , and orchidopexy treatment for undescended testes. [1].

Some clinical methods have been used for testicular volumes measurements such as Praderorchidometer and ultrasonography. According to the previous studies, Praderorchidometer shows significant overestimation in testicular size and the most accurate measurement tool was found to be the ultrasonography, which we have used in our research. [3].

To the authors' knowledge, There is no study conducted in Saudi Arabia that gives a reference data of normal testicular volume.

The aim of this study is to obtain reference data for testicular volume measured by ultrasound in King Abdulaziz University Hospital patients.

Normal anatomy:-

The scrotum is devided into two halves; each half contains testis and associated structure. A normal adult testis is oval shaped, measures 5x3x2 cm in size and has homogenous and intermediate echogenicity. The epididymis lies superior and is contiguous with the posterior aspect of the testis and consists of head, body, and tail. The head of the epididymis has a triangular shape with 5-12 mm in size and echogenicity similar to that of the testis, the body of epididymis measure 2-4 mm and the epididymal tail continues as vas deference in spermatic cord [16]. The testis is covered by dense fibrous capsule tunica albuginea. It is reflected inwardly to form an incomplete vertical septum called the mediastinum testis. The tunica vaginalis covers the tunica albuginea and consist of two layers visceral and parietal, generally separated by few milliliters of fluid. An inner visceral layer that applied to testis and the outer parietal layer adherent to the scrotum [5] The spermatic cord contains testicular, deferential and cremasteric arteries and pampiniform plexus of veins.

Method:-

This is a retrospective study which was conducted at King Abdulaziz University Hospital, Jeddah to determine the average size and values of the testicles in adult population in Saudi Arabia. It has been approved by the Ethics Committee of King Abdulaziz University. The study included all healthy men with normal morphology and no associated clinical suspicious of orchitis or varicocele. Patients age ≥18 years who underwent a scrotal ultrasound at King Abdulaziz University Hospital from April,2014 through October, 2016 using the imaging reports and measures of testicle size in the hospital information systems and PACS which were analyzed by the researchers.

Ultrasound protocol: The Scrotal US was performed in supine position and the scrotum supported by a towel placed between the thighs. Warm gel is used to minimize pressure on the scrotal skin and provide better image resolution. Optimal results are obtained with a 7–10-MHz high-frequency linear transducer. **(Figure 1)** The testes are examined in at least two planes, in the longitudinal and transverse axes. The size and echogenicity of each testis and the epididymis were analyzed bilaterally Color Doppler, and pulsed Doppler parameters are optimized to display low-flow velocities, to demonstrate blood flow in the testes and surrounding scrotal structures. These scans were carried out by a consultant radiologist, using a 7.5 MHz probe. The testicular volume was calculated using (a) the formula for an ellipsoid (formula 1): length (L) × width (W) × height (H) × 0.52.

There were 576 reports of men who underwent scrotal ultrasound, 54 patients were excluded from the research due to: testicular atrophy (9 patients), right or left orchidectomy (22 patients), incomplete examination or was not visualized well by ultrasound (19 patients) and epididymitis (4 patients), and 522 healthy men were included.

The recorded data included testicular volume ,longitudinal, anteroposterior and the transverse diameters for both right and left testis. All the collected data were kept in the principal author's office for confidentiality.

Figure (1):-A normal testicular volume for 37 years old man assessed by ultrasonography. 3.17 (anterior posterior A)* 1.34 (transverse B)* 1.78 (length C) cm.

Result:-

The mean age score for the 522 participants was 41.2±16.5 rang (18-89). Testicular volume including longitudinal, anteroposterior and the transverse diameters for both right and left testicular were measured. For right testicles the mean scores of longitudinal, anterioposterior, transverse diameters and the testicular volume were respectively 4.2±0.6, 2.7±0.5, 1.9±0.4 and 12.0±5.0 respectively, the results and graphs showed approximately symmetric with slightly platykurtic for longitudinal , anterioposterior and the transverse diameters, and showed moderately positive

skewed with slightly platykurtic for testicle volume. While for left testicles the mean scores of longitudinal, anteroposterior, transverse diameters and the testicular volume were respectively 4.1±0.7, 2.6±0.5, 1.9±0.4 and 11.2±4.7 respectively, the results and graphs showed approximately symmetric with slightly platykurtic for longitudinal , anterioposterior and the transverse diameters, and showed moderately positive skewed with slightly platykurtic for testicle volume. **(Table 1 & Figures 2-4)**.

Figure (2):-The measurements of both testicles (anterioposterior diameters)

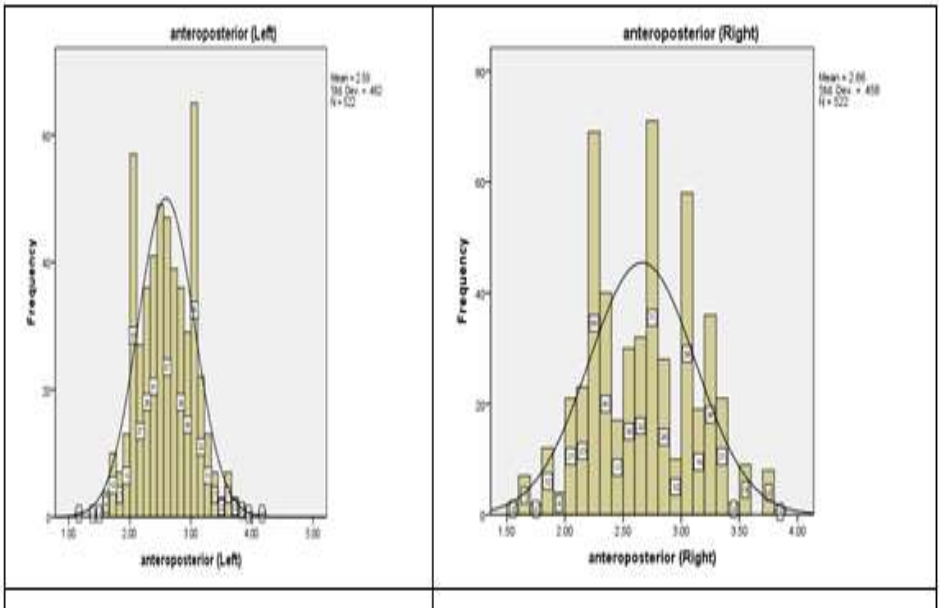

Figure (3):-The measurements of both testicles (transverse diameters)

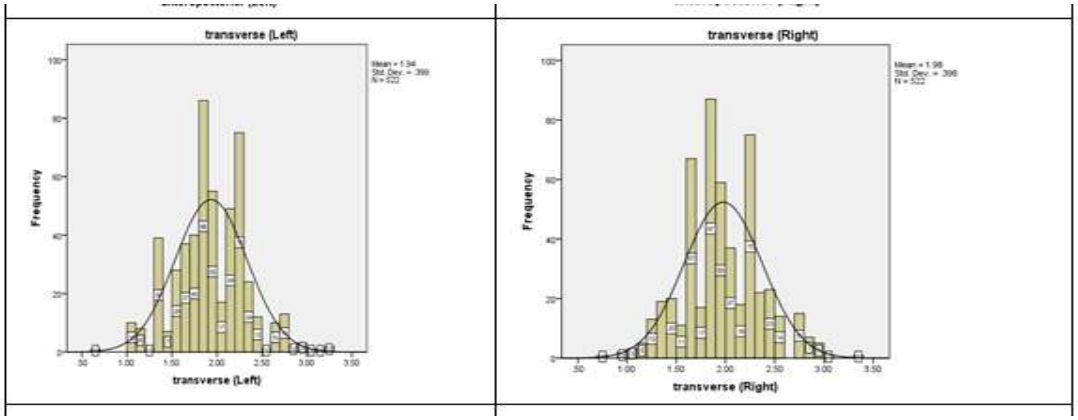

Figure (4):-The measurements of both testicles (Volume)

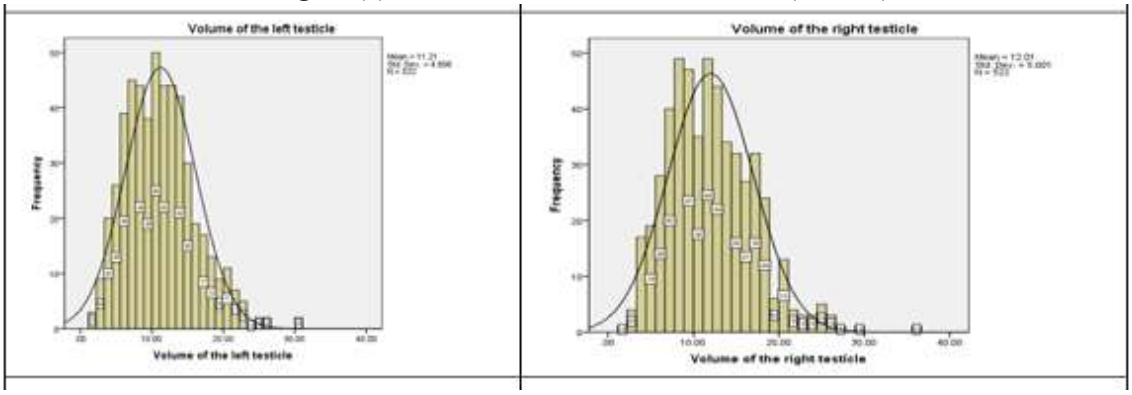

Table (1):-The measurements of both testicles

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Longitudinal (Right)	522	2.40	6.00	4.1904	.62739	-.001-	.080
Anteroposterior (Right)	522	1.50	3.90	2.6639	.45828	.088	-.422-
Transverse (Right)	522	.70	3.40	1.9770	.39753	.210	.229
Volume of the right testicle	522	2.16	35.99	12.0065	5.00053	.681	.820
Longitudinal (Left)	522	2.00	5.80	4.0718	.65797	-.093-	-.290-
Anteroposterior (Left)	522	1.19	4.20	2.5945	.46230	.138	-.026-
Transverse (Left)	522	.60	3.30	1.9353	.39949	.131	.333
Volume of the left testicle	522	1.38	30.10	11.2074	4.89615	.640	.493
Valid N (listwise)	522						

Discussion:-

The current study obtains standard values of testicular volume measured by ultrasound (US) for men from age 18-89 years who attend KAUH, which could be used as a reference for future studies. Testicles are the most important part of men reproductive system and the definition of their volumes is essential factor in determination of several disorders which could affect the growth and function of testicles , it is a major factor in pubertal development evaluating as well as a clinical indicator for puberty and in the cases of varicocele [1,2,3] Also in order to assess infertile cases where several studies demonstrated the correlation between testicular volume and its function , and also between testicular function and the semen characteristic, where several studies indicated that the total testicular volume less than 30 cm3 show sperm density of less than normal limits, less than 20 cm3 were severe oligozoospermia and less than 10 cm3 were azoospermic.[1] In Japan study, the authors reported that doctors should suspect in pathological cases if the testicle isn't homogeneous and not from the same echogenicity. [5] Retractile testis and undescended testes are the most common and unusual scrotal abnormalities, where retractile testis was defined as " testis that was located in the upper scrotum or lower inguinal canal but that could be made to descend completely into the scrotum by manual reduction and then returned to the original position by the cremasteric reflex " and undescended testes was defined as " the absence of the testicle in the scrotal position since birth ". [6,7]

Several studies conducted to compare between several ways of testicular volume measurement to determine the most accurate methods [1] and from these studies , numerous of them confirmed the accuracy of US in measuring testicular dimensions directly and demonstrate it as the standard method, where doctors are able to differentiate the testis from the adjacent soft tissues and epididymis which help in the cases of small testes and give the exact volume even its consuming times more than methods , [1,3,8] also it was found to be a valuable method in following up testicular growth and puberty development where it can expose any small biological changes in testicles . [9]

The mean age of participant (healthy men) in this study was 41.2±16.5 , this is similar to the result from West Africa where the mean age was 36.8 ±7.2, [10] in India study was 34.6±5.7, [11] and in Albania study was31.5 ±3.8 , [12] However the results from Nigeria were different and the mean age was 72.74 ±9.38 years and the participants were prostate cancer patients, where several studies reported that testicles volume influenced by age (testicles volume after 60 decreases by aging), [7,13] body mass index, illness, serum FSH and LH concentrations, race and environment such as big and small cities and different countries . [2,13]

Since the US was used in measuring the testicular volume, several equations were used to calculate the volume, one of the most common equation was formulated by Lambert 1951 (0.71 * length * width * height). [2,6,14]

Regarding the fact the cut-off point didn't determine ,previous studies showed various results in measuring testicular volume relying on the using method. [2,15] The results of the current studies showed that the mean scores of testicles volume were 12.0±5.0 for right testicular and 11.2±4.7 for left testicular, which consistent with other studies, in India studies the mean scores for right and left testicles were 11.83±3.2 and 11.08±2.8 respectively, [11] and in Albania study the mean scores were 12.8 and 12.4 for right and left testicles respectively . [12]

Limitation:-

The population of the study was from one health center (KAUH) which is not allowing authors to generalize the results on the community .

Conclusion:-

The current study provides reference data for testicular volume measured by ultrasound in King Abdulaziz University Hospital patients. Further studies need to be conducted on multicenter bases to compare between the different methods of measurements in order to provide comprehensive description of testicular volume suitable for developing the normative assessment.

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