

A Retrospective Determination of the Average Testicular Volume of Pubertal and Post-pubertal Male Patients in a Tertiary Institution

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Objective: Testicular size is an important determinant of sexual maturity in males. The authors determined the average testicular volume of patients in different age groups who underwent scrotal ultrasonography at the Jose R. Reyes Memorial Medical Center (JRRMMC).

Methods: A database search was performed using the SoliPacs system from January 2016 to October 2020. Ultrasound reports including a scrotal examination were included. Testicular measurements, i.e., length, width, and height were recorded. Ultrasound reports with abnormal testes findings were excluded from the study.

Results: A total of 769 patients fulfilled the search criteria. A total of 1354 testes were included in the study after excluding 184 testes with ultrasonographic testicular abnormalities. Testicular size began increasing in size after the age of 10, starting at an average size of 1.9 ml, reaching adult size (15.1 ml) at 17 years of age. The average testicular size, around 17 ml remains the same throughout adulthood (17 to 60 years of age) and begins to decline during senescence (>60 years of age).

Conclusion: Scrotal ultrasonography is a useful and convenient tool in determining testicular volume. The results of this study demonstrate the average adult testicular volume (17 ml) among Filipinos sampled in JRRMMC, as well as the trends in volume growth and decline according to age.

Key words: Testicular volume, scrotal, ultrasonography

Introduction

Seminiferous tubules comprise more than 90% of testicular mass, thus, it is understood that testicular volume reflects spermatogenesis and male fertility.^{1,2} Consequently, measurement of testicular volume is considered an important instrument in the assessment of a patient's sexual maturity.^{1,2,3,4} In addition, it has been shown that testicular volume indirectly correlates well with semen profiles in infertile men.⁴

One of the earliest accepted methods for measuring testicular volume is the use of Prader

orchidometers. Takihara et al. also proposed a new orchidometer that consists of a series of punched-out elliptical rings representing volumes from 1 to 30 ml.^{1,10} Testicular volume can also be determined by measuring the several axes of the testis with a transparent ruler or caliper or by measuring via ultrasonography.^{6,7,8,9} Measurements obtained by the latter may be applied to a formula that best estimates testicular volume. Among these methods, several studies have found that ultrasonography is superior in estimating testicular volume.^{7,8} Another recent study in dogs determined that the formula length (L) x width (W) x height (H) x 0.71 best estimates testicular volume.¹¹

Assessment of sexual maturity by Filipino physicians is usually performed using the classification system developed by Tanner and Marshall. This was developed in the 1940s - 1960s in the England male population.^{5,12} This is considered non-ideal because anthropometric measurements vary widely between races. A study performed specific to Filipinos may shorten this gap. Determining the average testicular volume of the Filipino male population can be proven useful for future clinicians in assessing sexual maturity.

In line with this, this research aimed to determine the average testicular volume among pubertal and post-pubertal patients who came in for ultrasonography at JRRMMC.

Methods

A database search in the institution was performed from March 2016 to October 2020 using the SoliPacs System. Ultrasound reports that included a testicular study were included. Testes with abnormal findings and ultrasound reports with incomplete data were both excluded.

The axes measurements were tabulated in terms of length, width and height. The testicular volume was calculated using the formula: length x width x

height x 0.71. The range and mean values of each measurement were determined per age group: 10 to 17 years, 17 to 30 years, 30 to 60 years, 60 to 80 years, 80 years and above.

Results

A total of 769 patients, 1354 testes were included in the study. Testes with abnormal findings in 184 patients were excluded. Table 1 lists the average testicular volume of 201 testes in patients in their puberty. Table 2 shows the average testicular volume post-puberty across different age groups.

The results show that the average testicular size of Filipinos is slightly smaller than other races with previous similar studies.¹ Testicular size begins increasing in size after the age of 10, starting at an average size of 1.9 ml, reaching adult size (15.1 ml) at 17 years of age. The average testicular size, which was found to be around 17 ml, remains the same throughout adulthood (17 to 60 years of age) and begins to decline during senescence (>60 years of age). Lastly, across age groups post-puberty, the mean testicular volume measured was generally higher on the right than the left (Table 3). Figure 1 shows the relative size differences among age groups.

Table 1. Average testicular volume per year of age during the pubertal period.

Age (years)	Testicular dimensions on ultrasound (cm)			
	Length	Width	Height	Volume
10 (n=24)	1.9 ± 0.4 cm	1.3 ± 0.2 cm	1.0 ± 0.2 cm	1.9 ± 1.3 ml
11 (n=12)	2.5 ± 0.7 cm	1.8 ± 0.6 cm	1.2 ± 0.3 cm	4.5 ± 3.5 ml
12 (n=28)	3.1 ± 0.7 cm	2.1 ± 0.5 cm	1.5 ± 0.5 cm	7.6 ± 4.1 ml
13 (n=32)	3.2 ± 0.5 cm	2.4 ± 0.4 cm	1.4 ± 0.2 cm	8.0 ± 2.8 ml
14 (n=22)	3.3 ± 0.6 cm	2.4 ± 0.4 cm	1.6 ± 0.2 cm	9.0 ± 2.6 ml
15 (n=34)	3.4 ± 0.6 cm	2.5 ± 0.4 cm	1.7 ± 0.3 cm	10.8 ± 4.3 ml
16 (n=20)	3.4 ± 0.4 cm	2.5 ± 0.3 cm	1.8 ± 0.3 cm	12.0 ± 3.2 ml
17 (n=29)	3.6 ± 0.5 cm	2.6 ± 0.4 cm	1.9 ± 0.3 cm	15.1 ± 5.2 ml

Table 2. Average testicular volume of post-pubertal patients per age group.

Age group (years)	Testicular dimensions on ultrasound (cm)			
	Length	Width	Height	Volume
17 to 30 (n=281)	4.1 ± 0.5 cm	3.1 ± 0.3 cm	1.91 ± 0.4 cm	17.1 ± 2.8 ml
30 to 60 (n=553)	4.3 ± 0.5 cm	3.0 ± 0.4 cm	1.9 ± 0.8 cm	17.4 ± 3.0 ml
60 to 80 (n=293)	4.3 ± 0.5 cm	3.0 ± 0.4 cm	1.8 ± 0.6 cm	16.5 ± 3.1 ml
> 80 (n=26)	3.1 ± 0.6 cm	2.4 ± 0.4 cm	1.4 ± 0.3 cm	8.1 ± 4.1 ml

Table 3. Average testicular volume among post-pubertal patients by laterality.

Laterality	Testicular dimensions on ultrasound (cm)			
	Length	Width	Height	Volume
Right (n=583)	4.2 ± 0.6 cm	3.0 ± 0.4 cm	2.0 ± 0.3 cm	17.1 ± 3.0 ml
Left (n=570)	4.1 ± 0.4 cm	2.9 ± 0.4 cm	2.0 ± 0.3 cm	16.7 ± 3.4 ml

Discussion and Conclusion

Testicular volume is deemed to be an important basis for male reproductive health and function.^{1,2,3,4} Previous studies found that it correlates well with semen quality and fertility since seminiferous tubules and germinal elements account for more than 90% of testicular mass.^{2,4} During puberty and adolescence, it is important to evaluate testicular growth for age appropriateness and symmetry by using testicular volume.⁵

From newborn years to puberty, there is very little increase in testicular size. Studies have found that testicular volume enlargement of more than 4 cm³ is the clinical landmark for onset of puberty.^{5,12} The adult testicular size is then reached at around 17 to 18 years of age. Testicular volume is unchanged throughout adulthood until the age of senescence, around 70 to 80 years old, after which the testes purportedly decreases in size.¹³ The results in the current study corroborates these statements from reviewed literature.

Moreover, testicular volume variations by race were determined in a previous study by Takihara, et al. measurements ranged from 17.6 ml in Japanese men to 24.8 ml in New Yorkers.¹ This reinforces the necessity in determining a country-specific value for normal-sized adult testes in the region.

Collection of data is limited by the records available in the institution's database. Sexual maturity characteristics cannot be determined from the results, precluding accurate identification of puberty onset and completion. This results in choosing the pubertal age group to be 10 to 17 years largely based on previous studies that focus on sexual maturity. Age groups 60-80 and 80 years and above were based on previous studies showing acceleration of testicular volume decline in these groups. Other age groups were chosen subjectively by the authors, to determine a possible trend.

A potential source of bias includes testicular measurements being performed by different

sonographers, which could hypothetically deviate measurements from the actual value. However, this is somehow alleviated since the sonographers in this study are trained in one institution, theoretically minimizing differences during ultrasound operation.

The data obtained in this study presents the average testicular volume of Filipino male patients who underwent scrotal ultrasonography in JRRMMC. This roughly estimates the normal testicular size across different age groups. However, the varying number of samples per age group could potentially decrease accuracy in this estimation. Accurate determination of testicular volume, therefore, significantly contributes to the evaluation of patients with a variety of disorders affecting testicular growth and function.

Future Directions

This descriptive survey aims to pilot a study that will ultimately estimate the average testicular size among Filipino men. The authors aim to increase the scope of sampling, ideally from all regions of the country to get a more accurate estimate of the normal testicular size among Filipino men. These testicular volumes can be helpful in future studies determining the sexual maturity and fertility potential per age group.

Disclosure

There are no financial conflicts of interest to disclose.

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