Ahead of Print

Turk J Urol 2018 • DOI: 10.5152/tud.2018.91586

TURKISH JOURNAL OF UROLOGY

ANDROLOGY

Original Article

Scrotal ultrasonographic findings in obese infertile patients and their correlations to semen and hormonal profile

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Cite this article as: Taha EA, Algahny H, Zidan M, Hafez A, Farag FF. Scrotal ultrasonographic findings in obese infertile patients and their correlations to semen and hormonal profile. Turk J Urol 2018. DOI: 10.5152/tud.2018.91586.

ABSTRACT

Objective: The aim of this prospective study was to compare scrotal ultrasonographic findings in obese and normal weight infertile men and correlate these findings with semen parameters and hormonal profile.

Material and methods: A total of 188 men presented for infertility evaluation were included in this study. They were divided according to body mass indices into obese (n=96) and normal weight infertile patients (n=92). Basic infertility evaluation, semen analysis and scrotal duplex ultrasound examination in addition to measurement of serum levels of follicular stimulating hormone, testosterone and estradiol were done for all cases. The ratio between testicular size measured by scrotal ultrasound and body mass index were calculated.

Results: Any significant differences were not observed in semen parameters, serum levels of follicular stimulating hormone and testosterone between obese and normal weight infertile men. Serum estradiol level was significantly higher in obese than normal weight infertile men. There is significant increase in subclinical varicocele, hydrocele and testicular microlithiasis detected by scrotal ultrasound in obese infertile men than nonobese patients. Despite having comparable testicular size detected on scrotal ultrasound, infertile obese men had significantly lower total testicular volume to body mass index ratio and this ratio correlated positively with semen volume, sperm concentration, total sperm count and serum testosterone but negatively with serum follicular stimulating hormone and estradiol levels.

Conclusion: We therefore conclude that the incidence of subclinical varicocele, hydrocele and testicular microlithiasis was higher in obese infertile patients and the ratio between testicular volume assessed by scrotal ultrasound and body mass index may be a new parameter that correlates with subfertility status in these men.

Keywords: Body mass index; infertility; ultrasound

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Submitted:
05.05.2018

Accepted:
30.05.2018

Available Online Date:
31.08.2018

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Introduction

Obesity has become an epidemic in many countries. The world's overweight population is already greater than its underweight population and the number of overweight individuals are rapidly on the increase.[1] Body mass index (BMI) is a simple method to estimate body fat and define obesity, and BMIs greater than 25 kg/m^2 and 30 kg/m^2 are considered overweight and obese, respectively.[2] A strong body of evidence is accumulating about relationship between obesity and subfertility.[3,4] Obese males usually express a characteristic hormonal profile described as "hyperestrogenic hypogonadotropic hypogonadism.[5] Numerous studies about impaired reproduction in obese men focused on changes in semen parameters, endocrine abnormalities and sexual dysfunction with variable results.[3,6-8] About two thirds of scrotal pathologies may not be detected by clinical examination of infertile men.[9]

Scrotal ultrasound (US) is an important noninvasive investigation that should be

Turk J Urol 2018
DOI:10.5152/tud.2018.91586

applied routinely in evaluation of men attending infertility clinics.[10] US is a widely used and well-tolerated imaging modality for the evaluation of pathologic conditions in male factor infertility.[11] Most of the studies using scrotal US in obese men focused only on prevalence and grade of varicocele and little is published about other genital ultrasonographic findings in obese men and the relation of these findings with other factors as BMI, semen parameters and hormonal profile.[12]

The aim of the present study was to compare scrotal US findings between obese and nonobese infertile men and its correlation with semen parameters and hormonal profile.

Material and methods

This prospective study included 188 infertile men who attended the Andrology and Urology clinics of Assiut University Hospitals for infertility evaluation during the period from October 2014 to November 2015. The local institutional ethics committee approved the study and all patients were provided an informed written consent before enrolment. Exclusion criteria included undescended testis, testicular atrophy, azoospermia, genital tract infections, chronic severe debilitating medical illness, and use of systemic medication.

The patients were evaluated by taking complete medical history, thorough general and genital examination and semen analysis in compliance with WHO guidelines, 2010.

The weight and height of the patients were recorded, and BMI was calculated using the standard formula [BMI equals to weight in kilogram/height in meter square (kg/m^2)]. According to BMI, the patients were divided into categories of obese (BMI: ≥30 kg/m^2), overweight (BMI: 25-29.9 kg/m^2), normal weight (BMI: 18.5-24.9 kg/m^2) and underweight (BMI: <18.5 kg/m^2) (WHO, 2004). The patients were divided into 2 groups according to BMI. Group 1 included 96 infertile obese men (BMI >30 kg/m^2), Group 2 included 92 infertile nonobese men (BMI <25 kg/m^2 and >19 kg/m^2).

Blood samples (5 mL) were obtained at 8:00–10:00 AM, and their centrifuged sera were preserved at-4^C. Serum follicular stimulating hormone (FSH) levels were estimated by the ELISA method (Diagnostics Systems Laboratories, Webster, TX, USA). Serum total testosterone (T) and estradiol (E2) levels were aalyzed using enzyme immunoassay method (Diagnostics Systems Laboratories).

Scrotal US examination was performed using a 7.5-MHz, high-resolution, linear array transducer (Sonoline Versa Plus, Seimens Medical System, Erlangen, Germany) with pulsed and color Doppler capabilities. The patient was placed first in the supine position, the scrotum was elevated with a towel draped over the thighs and the penis placed on the patient's abdomen and covered with a towel. Acoustic gel was used. The testes were examined for their size, volume, echogenicity, and perfusion. The testicular volumes were calculated using the US formula, length × width × height × 0.71, and expressed in milliliters.[13] The total testicular volume was calculated by summing the volumes of the 2 testes and was considered subnormal if <20 mL.[14] The presence of any paratesticular anechoic, tortuous tubular structures [i.e. widened spermatic veins] was reported. Next, the patient was examined in the standing position, and color mode was used to evaluate the testicular veins. The veins were examined before, during, and after the Valsalva maneuver for their size and the occurrence of reflux. Spectral analysis was used to detect venous reflux and to determine its duration. Varicocele was diagnosed by US demonstration of veins with a maximal diameter of >3mm and reflux>2 second.[15] The ratio between testicular size and BMI was calculated.

Table 1. Age, semen parameters and hormonal profiles in obese versus nonobese infertile patients

Variables	Obese infertile patients (n=96)	Nonobese infertile patients (n=92)	p
Age (years)	35±6.54	36.5±7.1	NS
Semen volume (mL)	2.1±0.8	2.2±0.8	NS
Sperm Concentration (10^6/mL)			
Mean±SD (SE)	29.98±35.9 (5.1)	27.8±26.4 (3.8)	
Median	15	16	
Range	2-205	5-100	NS**
Sperm Count (10^6/ejaculate)			
Mean±SD (SE)	58.5±56.7 (8.1)	71.6±86.3 (12.7)	
Median	35	37	
Range	3-275	7.5-320	NS**
Normal sperm morphology, %			
Mean±SD	16.7±7.2	14.4±6.4	NS
Progressive sperm motility %			
Mean±SD	21.2±6.2	21.4±7.9	NS
Sperm viability (HOS) %			
Mean±SD	41.9±10.9	41.5±11.9	NS
Serum FSH (mIU/mL)			
Mean±SD	12.6±8.5	9.7±6.1	NS
Serum T (ng/mL)			
Mean±SD	3.6±0.6	3.4±0.7	NS
Serum E2 (pg/mL)			
Mean±SD	34.6±13.7	25.4±8.7*	<0.001

*Significant (p<0.05), **Nonparametric test. NS: non-significant; SD: standard deviation; SE: standard error

Statistical analysis

Data were analyzed and expressed as mean values ± standard deviations (SD). IBM Statistical Package for the Social Sciences version 21 program (IBM SPSS Corp.; Armonk, NY, USA) was used for data processing. Unpaired t-test has been used in comparison of numerical parametric data between both groups and Mann-Whitney U test was used in comparison of numerical non-parametric data. Fischer exact test was used to compare prevalence of sonographic findings between both groups. Pearson correlation test was applied to analyze correlations between different quantitative variables. Values were considered significant when P values were equal or less than 0.05.

Results

As shown in Table 1, No significant differences were observed between semen parameters, serum FSH and serum T levels in obese and nonobese infertile men (p>0.05 for each). There was

Table 2. Scrotal US findings in obese and nonobese infertile patients

Scrotal US finding	Obese infertile patients (n=96)	Normal weight infertile patients (n=92)	p
Testis			
Total testicular size (mL) (Mean±SD)	24.83±6.29	24.43±7.78	N.S
Subnormal testicular size (n, %)	26 (27.1)	29 (31.6)	N.S
Intratesticular varicocele (n, %)	5 (5.2)	6 (6.5)	N.S
Testicular microcalcification (n, %)	13 (13.5)	6 (6.5)	<0.05
Epididymis			
Epididymitis (n, %)	14 (14.6)	18 (19.6)	N.S
Spermatocele & epididymal cysts (n, %)	26 (27.1)	24 (26.1)	N.S
Efferent duct ectasia (n, %)	1 (1)	2 (3.2)	N.S
Tunica			
Hydrocele (n, %)	30 (31.2)	14 (15.2)	<0.05
Spermatic cord			
Clinical varicocele (n, %)	24 (25)	26 (28.3)	N.S
Subclinical varicocele (n, %)	34 (35.4)	8 (8.7)	<0.01

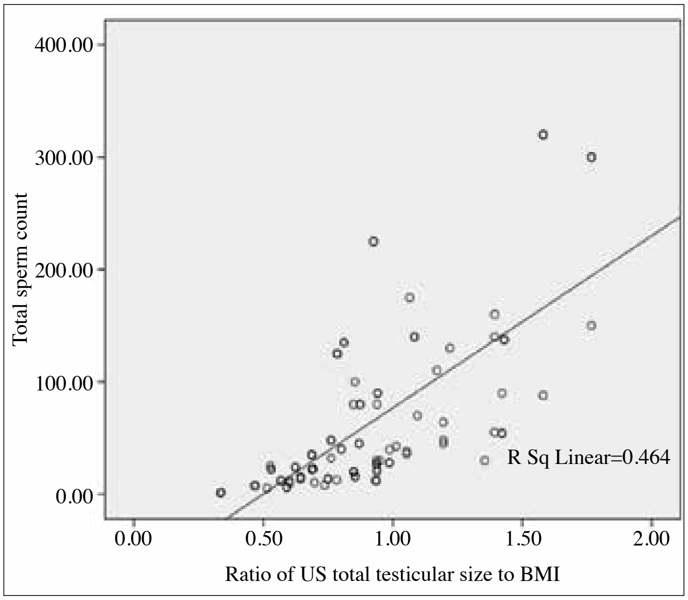

Figure 1. Correlation between testicular size/BMI ratio and total sperm count

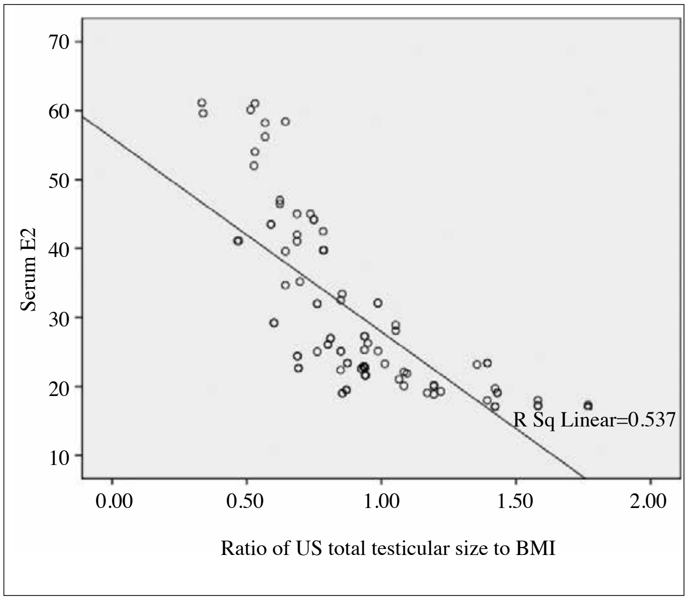

Figure 2. Correlation between testicular size/BMI ratio and serum E2

a significant increase in serum E2 levels in obese patients compared with non-obese patients (p<0.001).

There was a significant increase in subclinical testicular microlithiasis, hydrocele and varicocele detected by scrotal ultrasound in obese infertile men than nonobese patients (13.5% vs. 6.5%; 35.4 vs. 8.7; 31.2 vs. 15.2) (p<0.05) (Table 2).

The mean ratio between total testicular volume in ml measured by scrotal US and BMI was compared between 2 groups and it was significantly higher in infertile obese men (0.78±0.28) than nonobese men (1.07±0.36) (p<0.001).

Significant positive correlations were observed between both groups as for testicular size/BMI ratio and semen volume (r=0.48, p<0.001), sperm concentration (r=0.5, p<0.001), total sperm count (r=0.68, p<0.001) and serum T (r=0.29, p<0.01), and significant negative correlations with respect to serum FSH (r=-0.57, p<0.001) and serum E2 (r=-0.73, p<0.001) levels (Figure 1, 2).

Discussion

Obesity is a common health hazard all over the world with increasing prevalence in men of reproductive age, which necessitates the conduction of comparative studies using different noninvasive tools evaluating reproductive capacity of obese men.[16] Scrotal US is an important and noninvasive investigation method that is widely applied in the evaluation of infertile men.[10]

In our study prevalence of clinical varicocele was the same in both obese and nonobese men. However the prevalence of subclinical varicocele was significantly higher in obese men which may be due to relative difficulty in clinical assessment of reflux by Valsalva maneuver in obese men.[17] Our results are in contradiction to the results shown by Walters et al.[12] who found that obese patients have a lower prevalence of varicoceles detected by ultrasound regardless of physical examination results. Similarly, Soylemez et al.[18] stated lower prevalence rate of varicocele with increase in BMI. On the other hand, Umul et al.[19] reported a significant correlation between the presence and grade of varicocele as detected by scrotal Doppler US, BMI and amount of retroperitoneal fat.

In our study both hydrocele and testicular microlithiasis were commoner in obese infertile men than nonobese infertile men but their presence was not correlated with semen abnormalities or other testicular pathologies. The prevalence of microlithiasis was variable among published studies and generally was commoner in infertile men population.[20,21] Contradictory results have been published about the relation between hydrocele and microlithiasis to semen abnormalities in the literature.[22-24]

In our study, the ratio between sonographic total testicular size and BMI correlated positively with semen volume, sperm count and T, while negatively with serum FSH and E2. Sonographic testicular size was strongly associated with both sperm and hormonal parameters in numerous published studies.[25]

Little is published about genital ultrasonographic findings in obese men and its relation to other factors as BMI, semen parameters and hormonal profile.[12] In a study, Lotti et al.[26] 2011 found that higher BMI was significantly related to higher prostate volume and several colour Doppler US abnormalities in prostate, including macrocalcifications, inhomogeneity, higher arterial peak systolic velocity, but not with abnormalities of testis, epididymis, seminal vesicles. Furthermore, higher BMI was significantly related to higher levels of seminal interleukin-8, an inflammatory marker with prostatitis without a reflection on clinical or conventional semen parameters.

One of the limitations of our study was the small number of patients included. Larger studies are required to validate our findings.

In conclusion, some radiological findings as subclinical varicocele, testicular microlithiasis and hydrocele seem to be more frequently seen in infertile obese men than nonobese infertile men However, these findings weren't associated with significant changes in semen or hormonal parameters, the ratio between testicular volume and BMI correlated with important semen and hormonal parameters and may be a new diagnostic and prognostic value that is linked to subfertility status in obese men.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Faculty of Medicine, Assiut University.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – E.T.; Design – E.T.; Supervision – A.A.; Resources – E.T., H.A., M.Z.; Materials – E.T., H.A., M.Z.; Data Collection and/or Processing – E.T., H.A., M.Z.; Analysis and/or Interpretation – E.T., F.F., A.A.; Literature Search – E.T., F.F., A.A.; Writing Manuscript – E.T., M.Z., H.A.; Critical Review – F.F., A.A.

Conflict of Interest: Authors have no conflicts of interest to declare.
Financial Disclosure: The authors have declared that they did not receive any financial support for the study.

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