Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://dx.doi.org/10.21608/zumj.2020.11562.1195 Volume 28, Issue 6, November 2022(26-31) Supplement Issue.
Manuscript ID ZUMJ-1904-1195 (R1)
DOI **10.21608/zumj.2020.11562.1195**

ORIGINAL ARTICLE

Correlation between Semen Analysis and Testicular Shear-Wave Elastography in Patients with Testicular Varicocele

Lotfy Abdelatif Bendary [(1)], Aref Mohamed Maarouf[(1)], Emad Abdelhamid Salem[(1)], and Mohammed aboubakr elkabeer [(2)].
[(1)] *Professor of Urology, Faculty of Medicine - Zagazig University*
[(2)] *M.B.B.CH , Faculty of Medicine, Tripoli University, Department of Urology, Libya*

Corresponding author:
Mohammed aboubakr elkabeer M.B.B.CH , Faculty of Medicine, Tripoli University, Department of Urology, Libya
E.mail : mohammed_alkabeer@yahoo.com

submit Date 2019-12-25
Revise Date 2020-02-10
Accept Date 2020-03-30

ABSTRACT

Background: Varicocele is an abnormal dilation and tortuosity of the internal spermatic veins within the pampiniform plexus Varicocele is common among adolescents and may contribute significantly to the risk of subfertility in adulthood. They are found in about 15% of adult males and 20–40% of all infertile men.

Objective: To find correlation between shear wave elastography result and semen analysis in cases of varicocele. **Methods**: This prospective stu dy was carried out on 66 patients with primary infertility and clinically detectable varicocele who admitted to the Urology Department Andrology Unit, Zagazig University hospitals during the period from 15/3/2018 to 15/9/2018. Testicular SWE was done for all patients, computer-assisted semen analysis and duppler scrotal ultrasound.

Results: Showed that the most varicose character was bilateral grade III of testicular varicocele with primary complain. The highest SWE was 4.27and the lowest SWE was 1.84. SWE was significantly negative correlated with motility and count. On the other hand, there was a non significant negative correlation between SWE stiffness index and progress motility.

Conclusion: Our study showed that Testicular SWE is a good test easily applicable and repeatable imaging method, has the potential to be used in the assessment of male infertility with clinically detectable varicocele.

Keywords; Testicular Varicocele, Semen Analysis, Testicular Shear-Wave Elastography.

INTRODUCTION

Varicocele is an important factor that contributes in both primary and secondary male infertility. Prevalence of varicocele is varied considerably between general population and infertile men. It is important to note that not all men who have varicocele are infertile, but varicocele is more common in the men attending the infertility clinics [1].

Varicocele is found in 15% of all men worldwide. It is reported in 19–41% of men presenting with primary infertility and in 45–81% of men with secondary infertility and remains the most common cause of male infertility.[2] In the Gulf region (Qatar), 43% of infertile men were confirmed to have varicocele [3]. It has been reported in 24% of healthy young population in Turkey [4], as a similar community to Saudi Arabia.

The detrimental effect of varicocele is a well-established issue reaching up to testicular atrophy; obviously, this effect is reflected on the patient's semen analysis and may include a wide spectrum of abnormalities such as oligospermia, asthenospermia, teratospermia (oligoasthenoteratozoospermia syndrome), and even azoospermia. As a consequence, interstitial testicular fibrosis of varying degrees was described as a histopathologic effect of varicocele on testicular tissue [5].

Shear wave elastography (SWE) is a new ultrasound modality that provides quantitative information on tissues according to their stiffness. Thus, it gives information on histological changes

in tissues. The basic SWE process includes the application of an US transducer that produces acoustic push pulses to generate shear waves. The propagation velocity of shear waves depends on the tissue consistency[6].

Semen analysis is a pivotal evaluation in the diagnosis of male infertility, since a decrease in sperm number/concentration, motility, and normal morphology. Shear Waves are a type of mechanical wave which can only propagate in a solid. Shear Wave elastography techniques use dynamic excitation to generate Shear Waves in the body. The Shear Waves are monitored as they travel through tissue by a real-time imaging modality. By estimating the Shear Wave speed, the underlying tissue stiffness can be quantified. A low speed corresponds to a soft medium, while a high speed indicates a stiff medium [7].

PATIENTS AND METHODS

This prospective study was carried out on 66 patients with primary infertility and clinically detectable varicocele that admitted andrology Unit in Urology Department, Zagazig University hospitals during the period from 15/3/2018 to 15/9/2018. Their mean age was 33.95±6.6. So, assuming that rate of admission of patients with primary infertility and clinically detectable varicocele at urology department. So, sample size was calculated by open-Source Epidemiologic Statistics for Public Health EPI to be 66 cases with power level 80% and confidence level 95%.

Written informed consent was obtained from all patients, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria: Age>18 year, patients with clinically and radiologically diagnosed varicocele and male infertility.

Exclusion criteria: Past history of radiation exposure and chemotherapy, Evidence of gonadal dysfunction. Evidence of seminal vesicle obstruction. Small size testis and atrophic testis. History of previous: inguinal surgery or herniorraphy. History of testicular trauma. Or testicular infection. Recurrent varicocele. Secondary varicocele. History of drug abuse.

The diagnosis of varicocele is based on medical history and physical examination. Most patients with varicocele are asymptomatic. Other patients may palpate a scrotal thickening above the testis or complain of dull pain in the scrotum or groin, increasing during a long-lasting standing position or erection. Physical examination involves palpation and observation of the scrotum at rest and during the Valsalva maneuver. Classification proposed by Dubin and Amelar is still the most widely used system for the assessment of the severity of varicocele [8] .

Testicular SWE was done for all patients, computer-assisted semen analysis and duppler scrotal ultrasound

All Patients were subjected to:

Semen analysis: Patients were instructed to abstain from sexual activity for 72 hours and to self-collect a semen sample. The semen analysis was obtained twice from each patient and analyzed within 1 hour. The entire sample analysis was conducted by the same lab technician to avoid inter-laboratory variation. Semen volume, sperm count per milliliter (million/ml), total and progressive motility percent (%), morphology, and vitality percent (%) were measured. Semen parameters were evaluated according to the WHO criteria 2010. [9]

Radiologic investigations: The ultrasound study of the scrotum was performed with high frequency linear probes and with (Phillips IU 22100 Ultrasound system, Model IU22 with prope linear type 5-12 MHZ). Blood vessels are first studied in a grey scale and then with the colour Doppler and the pulse Doppler. For the correct detection of fluxes, CDU must be calibrated to detect a slow flow (7.5 kHz). The evaluation was performed in the supine and then the upright positions, with and without a Valsalva's manoeuvre, in order to obtain a complete evaluation of the fluxes in the seminal cord veins. A prolonged venous flow augmentation or reflux, usually evidenced by a venous rush during Valsalva's maneuver, confirms the diagnosis. [10]

Technique of shear wave elastography .

It initial delivery of a high frequency ultrasound pulse into the tissue that creating energy inside followed by a usual ultrasound pulse and measurement of the velocity of the spread of the ultrasound waves across the stimulated tissue within the region of interest. A more stiff tissue will resist the high frequency ultrasound wave and consequently show less resistance to the spread of the ultrasound waves across and shows higher values of stiffness index. A more soft tissue will be more stimulated and present more resistance to the spread of ultrasound waves and shows low values of stiffness index. The process is repeated 6 times at different areas of each testis and the mean value calculated.

Statistical analysis

All clinical and demographic data was recorded on investigative report form. These data analyzed using SPSS version 20. According to the type of data qualitative represent as number and

percentage, quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test (X^2) . Differences between quantitative independent groups by t test or Mann Whitney. P-value (level of significance): p<0.05= significant ; P<0.001= highly significant.

RESULTS

Table (1) showed that the age of studied patients ranged between 23 – 44 years with a mean age of 33.95±6.6 years. **Table (2)** showed the Varicocele characters and motility in the studied patients where the most common character was bilateral in 77.3%, Grade III in 69.7% of patients and only 33.3% of studied groups were with normal motility sperm and 66.7 were with abnormal motility sperm. **Table (3)** showed that the high SWE was 4.27±0.85 and the low was 1.84±0.69 with a mean of 2.35±0.78. **Table (4)** showed that there was non significant negative correlation between SWE stiffness index and normal form, while there was a significant negative correlation between SWE stiffness index and total motility. **Fig. (1)** showed that there was a negative correlation between SW-elastography stiffness index and both sperm count (million/ml) and total motility. On the other hand, there was no correlation between SWE stiffness index and progressive motility and grade of varicocele. **Fig. (2)** showed that at Cut off **3.07** k pascal the SWE index had sensitivity and specificity for normal motility 83.3% and 62% respectively.

Table (1) Age distribution among studied patients

	Age
Mean± SD	**33.95±6.6**
Median (median)	**35.0 (23-44)**

Table (2) Varicocele characters and motility distribution studied patients

		N	%
Laterality	Bilateral	**51**	**77.3**
	Lt	**7**	**10.6**
	Rt	**8**	**12.1**
Grade of testicular varicocele	II	**20**	**30.3**
	III	**46**	**69.7**
Complain	Asymptomatic	**10**	**15.2**
	Pain	**6**	**9**
	Abnormal semen parameter	**50**	**75.8**
	Total	**66**	**100.0**
Abnormal motility		44	66.7
normal motility		22	33.3
Total		66	100.0

Table (3) Distribution of shear wave results

	SWE mean	SWE low reading	SWE high reading
Mean± SD	**2.35**±0.78	**1.84**±0.69	**4.27**±0.85
Median (median)	**2.1 (2-4.4)**	**1.6 (1-3.2)**	**4.22 (2.8-5.6)**

Table (4) Correlations between SWE and abnormal form and total motility

		SWE high	SWE low	SWE mean
Abnormal form	r	**.281***	**.135**	**.193***
	P	**.431**	**.125**	**.080**
Total motility	r	**-.313-***	**-.196-**	**-.293-***
	P	**.011**	**.115**	**.017**

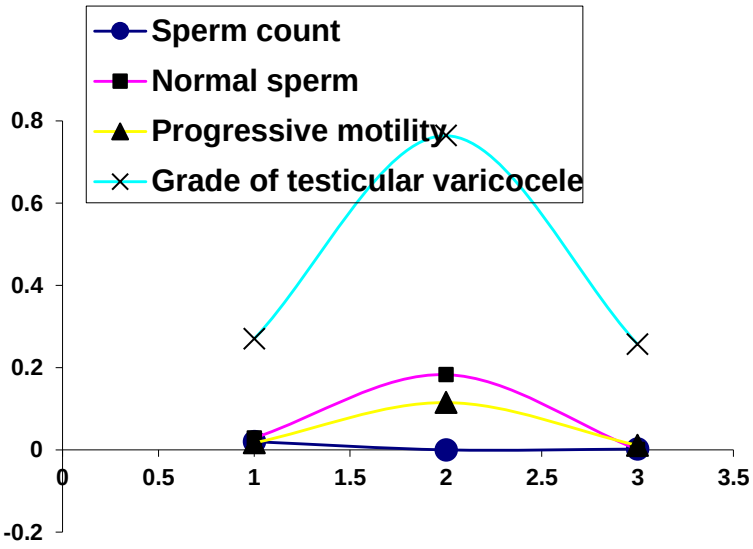

Fig. (1) Correlations between SWE and semen analysis and grade of Varicocele

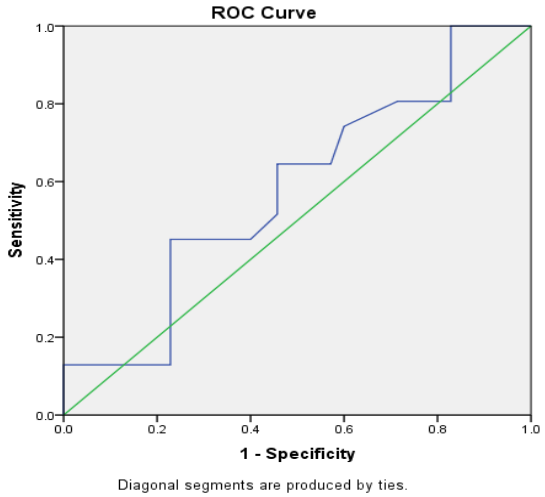

Fig. (2): Roc curve and cutoff of SWE mean regard for semen parameters.

DISCUSSION

Elastography is a relatively new imaging technology that creates images of tissue stiffness. It can be thought of as an extension to the ancient technique of palpation, but one that gives better spatial localization information and is less subjective. Two main types of elastography are currently in use. The first type is strain elastography in which tissue displacement is measured in response to applying gentle pressure. The second type is shear wave elastography (SWE) in which the machine applies shear waves that pass through tissue stiffness, which is measured [11]. Elastography has been used with impressive results to characterize various cancers in the breast, thyroid, and prostate. Recently, this technique has been applied by some researchers to scan the testes in infertile men. [12]

Nevertheless, studies evaluating varicocele-bearing testes via elastography are very limited [13]. With changes in the reference ranges and laboratory evaluation methods for human semen, there is a need to clarify the relationships between varicocele and semen parameters. [14]

Our study focused on the correlation between the changes occurring in the semen analysis in cases of varicocele and testicular elastography as we could demonstrate statistically significant negative correlation between stiffness index and both total count/ml and percentage of total motility. Insignificant correlation was correlated to the percentage of the normal forms.

The obtained results of sperm analysis revealed that, the percentage of progressive motility, percentage of normal sperm form and sperm count were (23.45%, 17.5% and ,3.2 respectively). which is lower than normal. An early study conducted by the World Health Organization involving 9034 men demonstrated that both sperm concentration

and motility were lower in men with varicocele than in men without varicocele [15].

The obtained results of SWE showed high and low values were 4.27 and 1.84, respectively. Our results were in agreement with **Dede et al., [16]** who concluded that, elastography values were found to be significantly lower in varicocele patients than in normal patients. There were negative correlations between the varicocele and elasticity of the testes.

The obtained results showed that, SWE was significantly negative correlated with a progress of motility i.e. with increasing SWE the sperm motility decrease and vice versa. Also we found that SWE was significantly negative correlated with count i.e. with increasing SWE the sperm count decrease and vice versa . SWE was non significantly correlated with Sperm shape, our results were in agreement with study conducted by **Abdelwahab et al. [13]** who reported that Correlation between different parameters of semen analysis and SWE showed a statistically significant negative correlation between SWE stiffness index and both sperm count (million/mL) and total motility.

Our study reported that At Cut off 3.07k pascal the SWE index had Sensitivity and Specificity for normal motility 83.3% and 62% respectively , for semen parameter improvement. Also at Cut off 3.19k pascal the SWE index had Sensitivity and Specificity for semen parameter improvement 90% and 88% respectively. In agreement with **Abdelwahab et al. [13]** in their results which were at a cut-off value of 4.5 K Pascal the stiffness index had a sensitivity and specificity for semen parameters improvement after varicocelectomy 86.4% and 84.2% respectively

Liu et al., [17] also who suggested that the degenerative changes in germ cells are actually related to the development of apoptosis in testes. Furthermore, varicocele is associated with a strong evidence of affecting semen parameters. The deleterious impact of varicocele includes a broad spectrum of seminal changes ranging from oligospermia to testicular atrophy.

The obtained results showed that, SWE is significantly negative correlated with a progressive of motility i.e. with increasing SWE the sperm count decrease and vice versa. Also we found that SWE was significantly negative correlated with count i.e. with increasing SWE the sperm count decrease and vice versa . SWE was non significantly correlated with Sperm shape. This coped with study conducted by **Abdelwahab et al., [13]** was directed to correlate between changes occurring in the semen analysis and the preoperative testicular elastography results as a predictor for the improvement in semen analysis parameters ,reported that Correlation between different parameters of semen analysis and SWE showed a statistically significant negative correlation between SWE stiffness index and both sperm count (million/mL) and total motility. on the other hand, a nonsignificant negative correlation was found between SWE stiffness index and percentage of normal form.

Sofikitis et al. [18] reported that SWE can be an effective method for detecting varicocele and pre-diagnosing infertility disorders and follow-up screening of testicular pathologies in male. However, elastography is not a complete alternative for semen analysis .

Also **Camoglio et al. [19]** demonstrated that sonoelastography can play a significant role in the evaluation of testicular elasticity as a predictive sign of testicular damage

Also, **Yavuz et al. [20]** concluded that SWE can be an effective method for detecting varicocele and pre-diagnosing infertility disorders and follow-up screening of testicular pathologies in male. However, elastography is not a complete alternative for semen analysis.

The limitations: One major limitation of our study was the low number of study population which prevented us from classifying patients into categories of oligozoospermia, azoospermia and teratozoospermia and to investigate their relationships with sonoelastographic findings. Besides, participants were not evaluated according to tobacco smoking, alcohol intake and any other endocrinological problems which may affect sperm characteristics. Further studies on a larger number of patients are needed to verify the current results

Conclusions: Our study showed that Testicular SWE is a good test easily applicable and repeatable imaging method, has the potential to be used in the assessment of male infertility with clinically detectable varicocele

REFERENCES

1- Shafi H, Esmaeilzadeh S, Delavar MA, Haydari FH, Mahdinejad N, Abedi S. Prevalence of varicocele among primary and secondary infertile men: Association with occupation, smoking and drinking alcohol. N Am J Med Sci. 2014; 6 (10): 532–535.

2- Pastuszak AW, Wang R. Varicocele and testicular function. Asian J Androl. 2015; 17(4):659–667.

3- Elbardisi H, Arafa M, Rengan AK, Durairajanayagam D, AlSaid SS, Khalafalla Ket al. Varicocele among infertile men in Qatar. Andrologia. 2017;49(4):e12637.

4- Soylemez H, Atar M, Ali Sancaktutar A, Bozkurt Y, Penbegul N. Varicocele among healthy young men in Turkey; prevalence and

relationship with body mass index. Int Braz J Urol. 2012; 38(1):116–121.

5- Kass EJ, Belman AB. Reversal of testicular growth failure by varicocele ligation. J Urol. 1987;137:475-476. Mar.

6- Sigrist RM, Liau J, Kaffas AE, Chammas MC, Willmann JK. Ultrasound elastography: review of techniques and clinical applications. Theranostics 2017; 7 (5): 1303–1329.

7- Sarvazyan AP, Rudenko OV, Swanson SD, Fowlkes JB, Emelianov SY. Shear wave elasticity imaging: a new ultrasonic technology of medical diagnostics. Ultrasound Med Biol. 1998 ; 24 (9) : 1419-35.

8- Dubin L, Amelar RD. Varicocele size and results of varicocelectomy in selected subfertile men with varicocele. Fertil Steril. 1970;21:606–609

9- Cooper TG, Noonan E, von Eckardstein S, et al. World Health Organization reference values for human semen characteristics. Hum Reprod Update 2010; 16:231-245.

10- Liguori, G., Trombetta, C., Garaffa, G., Bucci, S., Gattuccio, I., Salamè, L., & Belgrano, E. (2004). Color Doppler ultrasound investigation of varicocele. World J Urol. 2004; 22(5):378-381.

11- Skovoroda A, Klishko A, Gusakyan D, Mayevskii YI, Yermilova V, Oran-skaya G. Quantitative analysis of the mechanical characteristics of pathologically changed soft biological tissues. Biofizika. 1995 ; 40(6):1359-64.

12- Azizi G, Keller JM, Mayo ML, Piper K, Puett D, Earp KM. Thyroid nodules and shear wave elastography: a new tool in thyroid cancer detection. Ultrasound Med Biol. 2015; 41 (11) : 2855-65.

13- Abdelwahab K, Eliwa AM, Seleem MM, El Galaly H, Ragab A, Desoky EA. Role of preoperative testicular shear wave elastography in predicting improvement of semen parameters after varicocelectomy for male patients with primary infertility. Urology. 2017;107:103-6.

14- Agarwal A, Sharma R, Harlev A, Esteves SC. Effect of varicocele on semen characteristics according to the new 2010 World Health Organization criteria: a systematic review and meta-analysis. Asian J Androl. 2016; 18 (2) : 163.

15- Rowe PJ, Comhaire FH, Hargreave TB, Mahmoud AM. WHO manual for the standardized investigation and diagnosis of the infertile male. Cambridge University Press; 2000.

16- Dede O, Teke M, Daggulli M, Utangaç M, Baş O, Penbegül N. Elastography to assess the effect of varicoceles on testes: a prospective controlled study. Andrologia. 2016;48(3):257-61.

17- Liu JS, Jones M, Casey JT, Fuchs AB, Cashy J, Lin WW. Diagnosis of varicoceles in men undergoing vasectomy may lead to earlier detection of hypogonadism. Urology. 2014;83(6):1322-5.

18- Sofikitis N, Sotirios S, Fotios D, Panagiota T, Atsushi T. Mysteries, Facts, and Fiction in Varicocele Pathophysiology and Treatment. Eur Urol 2014; 13 (4) : 89–99.

19- Camoglio FS, Bruno C, Zambaldo S, Zampieri N. Hypospadias anatomy: elastosonographic evaluation of the normal and hypospadic penis. J Pediatr Urol. 2016; 12 (4): 199-e1

1. **20- Yavuz SK, Bedri K, Gokhan K, Tahir O, Atilla SD.** Does elasticity of Achilles tendon change after suture applications? Evaluation of repair area by acoustic radiation force impulse elastography. J Orthop Surg Res. 2018; 13 (1): 45

How to cite

Elkabeer, M., Bendary, L., Maarouf, A., Salem, E. Correlation between Semen Analysis and Testicular Shear-Wave Elastography in Patients with Testicular Varicocele. Zagazig University Medical Journal, 2022;(26-31): -. doi: 10.21608/zumj.2020.11562.1195