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Intraoperative scrotal duplex in assessment of varicocele

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Abstract
Background and Aim: Varicocele represents a major reversible cause of male infertility and the most prevalent and recognized cause. Varicocele results in testicular atrophy, poor sperm production, diminished fertility and scrotal discomfort. The sonographic assessment and Scrotal duplex became the modality of choice of evaluating and grading varicocele. The approach helps in assessing testicular dimensions, retrograde flow, diameters of dilated veins, and arterial flow parameters. We aimed to compare between pre and intraoperative scrotal duplex to detect the accuracy of the intraoperative scrotal duplex in the assessment of varicocele.
Patients and Methods: Our study is a prospective Cohort study that carried out on 20 male patients were scheduled for subinguinal varicocelectomy. The study was conducted at Dermatology and andrology department in Azhar-Assiut university hospital (tertiary care hospital) It carried out from March 2020 to March 2021.using Grey-Scale US and Doppler US, we did compare between the intraoperative duplex and Preoperative duplex to detect the accuracy of the intraoperative scrotal duplex in the assessment of the degree of the varicocele and tesiticular volume.
Results: We found that there was a significant increase in veins number and testicular volume during intra-operative varicocelectomcomparedng to preoperative duplex. There was no significant differnce in vein diameter pre and intra-operative. There was no significant differnce in venous reflux pre and intra-operative.
Conclusion: The Intraoperative scrotal duplex US is good and accurate method in assessment of grading of varicocele.

Keywords: infertility, varicocele, varicocelectomy, scrotal duplex US

Introduction

Varicocele is abnormal enlargement and dilation of scrotal venous pampiniform plexus that drains blood from both testecles. Varicoceles are clinically important, they are the most prevalent cause of abnormal semen analysis, decreased sperm motility, abnormal sperm shapes and low number of sperms [1]. Varicocele is a prevalent problem in the field of reproductive medicine practice, it affect about 15 % of healthy men and up to 35% of men with primary subfertility. About 75% of men with secondary infertility are affected [2].

The clear cause of varicoceles is not yet established, they may be caused by retrograde venous blood flow in the internal spermatic vein which causes swollen veins that can be detected on scrotal palpation [3]. Typically, Varicoceles are asymptomatic soft swelling on the left side of the scrotum. If big enough, the patient may describe it as a‘bag of worms. Varicoceles on the left side of the scrotum are may occurs. Patients may experience heaviness or discomfort in the scrotum. Varicoceles are typically identified during infertility workup. [4].

Large varicoceles have a‘bag of worms ‘appearance and easily identified with simple inspection. Medium varicoceles are palpable with bearing down by the patient. Small varicoceles are detected with powerful Valsalva [5]. Following physical examination, Varicocele can be confirmed by Duplex US that shows show pampiniform plexus of veins dilatation, (with diameter typically greater than 3 mm [6].

Ultrasonography (US) is the examination of choice for investigating Varicoceles, it is considered most practical and the most accurate noninvasive technique that permits precise diagnosis of Varicoceles (even subclinical varicocele). Duplex ultrasound (DUS) can be performed at rest and during the Valsalva maneuver [7]. The scrotal vessels degree of dilatation, direction and augmentation of flow during Valsalva and duration of reflux are evaluated. By this way, CDU is useful in identifying patients for varicocele surgery [8].

Varicocele can be evaluated as follows: grade 1, mild reflux (<2s) during Valsalva maneuver; grade 2, reflux (>2s) during Valsalva, but no continuous reflux during the maneuver; and grade 3, reflux in rest during normal respiration or continuously during the entire Valsalva maneuver [9].

According to Sarteschi *et al*., Varicocele can be categorized into 5 classes based on characters of the refulx and its duration as well as alteration during the Valsalva: Grade 1 is distinguished by detecting a prolonged reflux in the blood vessels of the inguinal canal that occurs just during Valsalva‘s maneuver, whereas scrotal varicose

veins are not clear during the previous grey-scale study. Grade 2 is characterized by a modest posterior varicosity that reaches the testicular superior pole and whose diameter increases after performing the Valsalva‘s maneuver. The Colored DU evaluation demonstrates the presence of a venous reflux in the supra testicular region only during Valsalva‘s maneuver. Grade 3 is characterized by vessels that appears dilated to the testicular inferior pole while the patient is in upright position, but no ectasia is found when the patient was in the supine position. CDU shows a accurate venous reflux only during Valsalva‘s maneuver. Grade 4 is determined when vessels are tortious and dilated, regardless the patient position since dilatation increases in the upright position and during Valsalva‘s. Venous reflux enhancement after Valsalva‘s maneuver is the criteria that distinguish grade 4 from te grade 2 and grade 5. At this stage, Testicular hypotrophy is prevalent. Grade 5 is marked by obvious venous ectasia when the patient is in the upright position. CDU demonstrates significant basal venous reflux that does not rise after performing Valsalva‘s maneuver [10].

This work aimed to compare between pre and operative scrotal duplex to detect accuracy of scrotal duplex in assessment of varicocele.

Patients and methods

That study was carried out after approval by the local Ethics Committee at Faculty of Medicine (Al-azhar University, Assiut, Egypt), informed written consent was obtained from the patients. The study was conducted by Helsinki standerds as revised in 2013.

That was a prospective Cohort study that carried out on 20 male patients were scheduled for subinguinal varicocelectomy. It was conducted at Dermatology and andrology department in Azhar-Assiut university hospital (tertiary care hospital). It carried out from March 2020 to March 2021.

All patients were subjected to comperhensive medical history taking include: Personal history: such as name, age, marital status, address, employment, number of children and Smoking index; History of medical diseases (e.g. DM), drug intake, trauma or surgical operation.

All patients were subjected to general and local examination that performed in a room with suitable temperature, the patient did the valsalva maneuver while standing. varicocele severity was categozied as grade I (palpable just during Valsalva maneuver), grade II (palpable in standing position), and grade III (varicocele detectable by visual scrutiny alone). **[11]**

Cincially, we obtained the testicular volumes after stretching the skin of the scrotum in a warm room by comparin the testes with 12 solid ellipsoid models (Prader orchidometer and) varying in volume 1 - 25 cm3 (1 to 6, 10, 12,15, 20, and 25 cm3). **[12].**

As regard Sonographic Technique & Analysis, Firstly, we calculated the testicular volume according to prolate ellipsoid formula (A x B x C x.5233), expressed in cubic centimeters,

For volume compution and statistical analysis the greatest obtinable measurement for each testicular dimension was employed. Morphological evaluation was performed of both testes, epididymis, spermatic cord, scrotal wall, pampiniform plexus of veins; as regard: number of veins, maximum diameter of dilated veins. Secondly, venous component was performed to all patients including the diameter of the biggest vein of the pampiniform plexus, the retrograde flow in both the relaxed state and during the Valsalva [13].

All patients conducted to varicocelectomy operation. First we prepared the Duplex for the operation (we used ultrasound probe cover that was filled with gel to prevent direct contact between probe and examined parts and to avoid infection). After adequate spinal anesthesia induction, we place the patient on in the supine position. We marked the external inguinal ring site on the skin. We started with a 3 cm oblique skin incision centered over the external inguinal ring. an artery was used to widen the incision, which was subsquently deepened through Camper's and Scarpa's fascia and the spermatic cord was then grasped with a Babcock clamp, delivered and placed over a wet dressing and the testis was pulled out from the scrotum and placed over same wet dressing [14].The internal and external spermatic fascia are incised and the structures of the cord are examined using Grey-Scale US and Doppler US to Detect number of veins, venous reflux, vein diameter and testicular volume [13].

Statistical methods

SPSS (Statistical Package for Social Sciences) version 23.0 program for windows was used for data processing. Continuous variable presented as mean ± standard deviation (SD), and had been compared using student's Test. Categorical factors presented as frequencies and percentages and had been compared using Person's Chi-square test. P-values less than 0.05 considered significant.

Results

The study was carried out 20 patients complaining of varicocele, their ages ranged from 23-45 years with a mean of 34.60 ± 8.28 years, 6 (30%) patients presented with primary infertility and 14 (70%) patients with secondary infertility, 17 (85%) patients had bilateral varicocele while 3 (15%) patients had unilateral varicocele. Grade II varicocele was present in 6 (30%) patients and Grade III varicocele was present in 14 (70%) patients, as shown in (Table 1).

There was significant increase in testicular volume as well, in number of veins, pre and intra-operative varicocelectomy ($p < 0.005$), on the other hand, there was no significant difference in vein diameter pre and intra-operative varicocelectomy ($p > 0.005$), as shown in (Table 2).

As regard venous reflux, there was no significant difference in venous reflux pre and intra-operative on both sides, as shown in (Table 3).

Table 1: Demographic characteristics of the studied patients

Age of patients (Years)	
(Range) Mean ± SD	(23-45) 33.8± 8.28
Type of infertility: n (%)	
Primary	6 (30)
Secondary	14 (70)
Side of varicocele: n (%)	
Unilateral	3 (15)
Bilateral	17 (85)
Grade of varicocele: n (%)	
Grade II	6 (30)
Grade III	14 (70)

Table 2: Change in testicular and venous parameters pre and intra-operative

	Pre-operative	**Intra-operative**	**p. value**
	(Range) Mean ± SD		
Testicular volume			
Right testes	(8-18) 12.23 ± 1.62	(9-20) 14.83 ± 1.93	0.002*
Left testes	(7-16) 12.01 ± 1.95	(7-15) 13.95 ± 1.96	0.001*
Number of veins			
Right testes	(0-5) 3.75 ± 1.48	(3-7) 4.50 ± 1.0	0.003*
Left testes	(4-10) 5.35 ± 1.56	(5-10) 6.65 ± 1.22	0.020*
Vein diameter			
Right testes	(1.2-3.8) 2.52 ±0.63	(2-4) 2.63 ± 0.56	0.342
Left testes	(2.7-5.7) 3.95 ± 0.79	(3-6) 4.09 ± 0.80	0.415

Independent Samples T-test was used
Data expressed as (Range) Mean ± SD.
P. value>0.05 is insignificant.

Table 3: Change in venous reflux pre and intra-operative

	Pre-operative	**Intra-operative**	**p. value**
	n (%)		
Right side			
Sever reflux	1 (5)	0 (0)	0.113
Moderate reflux	7 (35)	8 (40)	
Minimal reflux	4 (20)	3 (15)	
no reflux	8 (40)	9 (45)	
Left side			
Sever reflux	15 (75)	14 (70)	0.129
Moderate reflux	5 (25)	6 (30)	
Minimal reflux	0 (0)	0 (0)	
no reflux	0 (0)	0 (0)	

Chi square test was used
Data expressed as n (%).
P. value>0.05 is insignificant

Table 4: comparison between testicular volume clinical, pre and intra-operative

	Pre-operative	**Intra-operative**
left side		
Small T.V(<10ml)	2	4
Moderate T.V (10 -15 ml)	8	9
Normal T.V (>15ml)	10	7
Right side		
Small T.V(<10ml)	3	4
Moderate T.V (10 -15 ml)	9	9
Normal T.V (>15ml)	8	7

Table 5: comparison between venous reflux clinical, pre and intra-operative

	Pre-operative	Intra-operative
right side		
Sever reflux	1	0
Moderate reflux	7	8
Minimal reflux	4	3
no reflux	8	9
left side		
Sever reflux	15	14
Moderate reflux	5	6
Minimal reflux	0	0
no reflux	0	0

Discussion

To date, there are lack or few published studies that concerned with the Benefit of intraoperative Doppler US in reassessment of grading of varicocele.

Ultrasonography considered to be the most accurate and useful technique for diagnosing varicocele. The existence of veins greater than 2 millimeter in diameter is an established US diagnostic criteria in varicocele [13].

Numerous studies have compared varicocele grading on physical examination and veins diameter to the venous reflux detected by color Doppler, using a variety of assessment criteria.

Gonda *et al*. [15], found a sensitivity of 95% with 2-mm vein diameters limit. Veins diameters only are not sufficient for the diagnosis of varicocele [15]. As well, Chiou *et al*. [16], reported a sensitivity of 93% and 85% specificity for US using new criteria (a combination of vein diameter, duration and velocity of Valsalva induced reflux) in comparison to physical examination [16].

Kocakoc *et al* [17], mentioned that, measurement of flow volume of reflux, which represents vein diameters, reflux duration and velocity has been considered a more valuable than measuring of venous diameters alone with no significant correlation was found between reflux time and vein diameters [16].

In this study, we found that there was no significant difference in veins diameter nor venous reflux pre and during intra-operative varicocelectomy by Duplex, meanwhile we noticed a significant increase in number of veins testicular volume during intra-operative varicocelectomy comparing to preoperative.

In Özkaptan *et al*. [18], study they reported strong correlation between the usage of Doppler US and number of veins in their study. The findings of the prior study support our results. These researchers detected more veins with the guidance of Doppler US [17].

Intraoperative Doppler ultrasonography enable us to identify small-sized veins more precisely. During varicocelectomy, more veins of dense complex of adherent veins around the artery can be efficiently removed under the guidance of Doppler US [19]. In Lorenc *et al*. [20] study, they found that more spermatic veins are ligated when using the Doppler US that would be due to greater confidence during dissection of thick network of adherent veins that surround the artery in about 95% of patients during the sub-inguinal surgery.

Clinically; Testicular volume can be measured with different methods such as orchidmeters, calipers and rulers or by US measurements to measure the testicular length, width and height, followed by multiplication by a constant. However the method of measuring the testicular volume is judged to be most accurate is still being on debate, there are many who believe that US gives an excellent assessment of the testicular volume [21].

In numerous number of studies, US was proposed to be a credible approach measuring the size of the testes, it would give more accurate volumes than orchidometer [22].

Numerous researches [23] compared different clinical parameters to US testicular size measurements as the gold standard [23]. It is believed that US gives an excellent assessment of the testicular volume which is accurate. reproducible, and objective [24].

In Paltiel *et al*. [21], study, they showed that using three formulas were more accurate than Prader orchid meters in measuring testicular volume. In the same study, (L x W x H x 0.71) was the best accurate formula for calculating the testicular volume using US [21].

Rivkees *et al*. [25] showed that Prader orchid meter overestimates the exact testicular volume by about 30% whereas the actual volume varied from 1 to 15 cm3, and US was more accurate and reproducibe than orchid meter [25].

Theoretically, US is better than orchidometry because the examiner can identify the testis from the neighboring soft tissues and epididymis with the US but not with the orchid meter.US is the most accurae method but controversy remains [25, 26]. Depending on the formulae employed, previous studies have demonstrated that Ultrasonography assessment are highly variable [24]. The testicular volume measurement accuracy by orchidometer and US depend more on examiners experience [24, 26]. In our study, we found a significant change in testicular volume pre- and intra-operative during varicocelectomy which correlate with those studies.

Conclusion

Using Doppler US intraoperatively revealed non-significant change in veins' diameter nor venous reflux compared to preoperative duplex. However, it revealed a significant increase in number of veins and testicular

volume comparing to preoperative duplex result thus the intraoperative scrotal duplex US is good and accurate method for assessment of grading of varicocele however more experience is needed to assess testicular volume and number of veins.

Clinical trial registration number: ??

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Conflicts of interest: We declare that we have not any conflict of interest.

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