Testicular Doppler resistive index parameter as predictor test for male infertility

Hassan Al-Naffakh ,FIBMS,DMRD (rad.) .Lecturer in Faculty of Medicine, Kufa University, Radiologist in Al-Sadder Teaching Hospital, Najaf, Iraq.
Email:hassannafakh@yahoo.com .

الخلاصة

الهدف: دراسة دور معامل الممانعة الوعائية لفحص الدوبلر لتقييم الخصوبة لدى الرجال

الطريقة والمرضى: شملت هذه الدراسة ٨٠ شخصا (٤٠ شخص لديهم تحليل سائل منوي طبيعي و ٤٠ شخص لديهم تحليل سائل منوي غير طبيعي) وهؤلاء الأشخاص تم فحصهم بواسطة الدوبلر وتم احتساب معامل الممانعة الوعائية (RI) لكل مريض في كلتا الخصيتين في القطبين الأعلى والأسفل لكل خصية وتم معالجة النتائج إحصائيا باستخدام t-test.

النتائج: الأشخاص مع تحليل منـي طبيعـي وجد لـديهم معـدل معامـل ممانعـة (٠,٥٥٦) وبـانحراف معيـاري (٠,٠٣٤٢)، و الذين لديهم تحليل منـي غبر طبيعي وجد لديهم معدل معامل ممانعة اعلى(٠,٦٧٣) وبانحراف معياري (٠,٠٩٣)وكانت ال P-value معتبرة.

الاستنتاج: هذه النتائج تبين إمكانية استخدام معامل الممانعة الوعائية لفحص الدوبلر كفحص أمين وسريع وبسيط وغير تداخلي لتقييم الخصوبة لدى الرجال.

Abstract:

Aim

To assess the role of color doppler ultrasonography (CDUS) resistive index (RI) parameter as a predictor test for spermatogenesis and infertility.

Patients and Methods:

This is a prostpective study done on 80 patients,40 individuals with normal sperm counts, the other 40 individuals with abnormal pathologic sperm counts , those individuals examined by CDUS ,RI were calculated on both sides using two parenchymal arteries at upper &lower pole of testes the data were analyzed statistically by SPSS soft ware using t-test at level of significance $P<0.05$.

Results:

Individuals with normal sperm counts had mean(SD) RI = 0.566(0.0342),those with abnormal pathological sperm counts had mean(SD) RI =0.673(0.093). Statistical analysis show significant difference between the two groups P=0.002

Conclusion :

These results suggest that CDUS RI parameter can be used as a simple, safe, rapid and non invasive predictor test for spermatogenesis and infertility .

Key words: doppler US, resistive index, infertility.

Introduction:

Spermatogenesis is the process by which male primary germ cells undergone division, and produce a number of cells termed spermatogonia, from which the primary spermatocytes are derived[1]. Each primary spermatocyte divides into two secondary spermatocytes, and each secondary spermatocyte into two spermatids or young spermatozoa. These develop into mature spermatozoa, also known as sperm cells. Thus, the primary spermatocyte gives rise to two cells, the secondary spermatocytes, and the two secondary spermatocytes by their subdivision produce four spermatozoa[1]. These steps of cells division happen in the male testes ,blood supply to testes is derived from testicular arteries which arise from aorta ,other source of blood supply include the deferential artery which supply epidydemis and vas deferens and the cremasteric artery

supplies the peritesticular tissues, venous out flow via pampiniform plexus which empties in to testicular veins[2].

Ultrasonography & CDUS is widely used and well tolerated imaging modality for evaluation of pathologic conditions of testes ,one of the important indices used in CDUS is resistive index(RI) or pourcelot[3] index is popular parameter for characterizing the arterial wave form at doppler ultrasonography .The resistive index is defined as (S-D)/S where S is height of systolic peak and D is height of end diastolic trough in vitro[4,5] and in vivo[6] studies had show the RI to be related to vascular resistance.

Ronald O. et al see that vascular compliance (defined as the change in volume of vessel with change in pressure) is also critical factor affecting the RI[7].

Increased RI & PI of capsular branches of testicular arteries on unenhanced CDUS examination may be an indicator of impaired testicular microcirculation in patient with clinical varicocele, testicular arterial blood flow was found to be significantly decreased in men with varicocele ,this may be a reflection to the impaired microcirculation. Following decreased testicular arterial flow impaired spermatogenesis may results from defective energy metabolism in the microcirculatory bed[8] .

In the study done by Mapozor et al measuring doppler indices of 41 stallions (82 testes)that appear free form pathology concluded useful reference values for clinical evaluation. Evaluation of 11 cases with testicular pathology suggested further investigation of possible effect of various conditions on testicular blood flow and testicular function[9].

Methods and patients:

This prospective study includes 80 age-matched individuals, their ages range between 20-50 years ,40 individuals have normal sperm count, the other 40 individuals with pathological sperm count, patients included in this study having primary infertility after 12-24 months of unprotected sexual intercourse, seminal fluid analysis were done according to WHO guidelines in 2010 using samples after 2-5 days of sexual abstinence, normal sperm count where defined by sperm concentration more than 15.000.000 sperm/ml[10,11,),the control group includes 40 aged-matched men had normal sperm analysis and paternity 3-15 months before recruitment, all patients assessed clinically for history of cryptorchydism, genital tract infection, trauma, physical examination, seminal fluid analysis, scrotal ultrasound & CDUS examination.Patients with history of trauma to testicles, varicocele ,surgery or clinically detectable diseases where excluded from the study.

Scrotal ultrasound and CDUS done in warm room with patient lying supine, penis resting over lower abdomen, Doppler flow were measured in each testes using trans-scrotal approach with 7.5 mega-hertz linear array superficial probe using testicular examination software available on Siemens Accuson X500 ultrasound machine in Al-Sadr medical city in Najaf . Doppler indices PSV, EDV & RI were calculated by machine and recorded for both testicles for each patient expressed in m/second, two measurements of RI were made on each testes at upper and lower pole levels. Statistical analysis include comparison of RI between individuals with normal & pathological sperm counts using SPASS soft ware at level of significant ($p<0.05$).

Results:

Scrotal CDUS with RI measurement were done successfully in all 80 aged matched control and infertile patients(table 1) ,the 40 individuals with normal sperm count have mean(SD) of RI =0.566 (0.0342) as shown in figure 1 below:

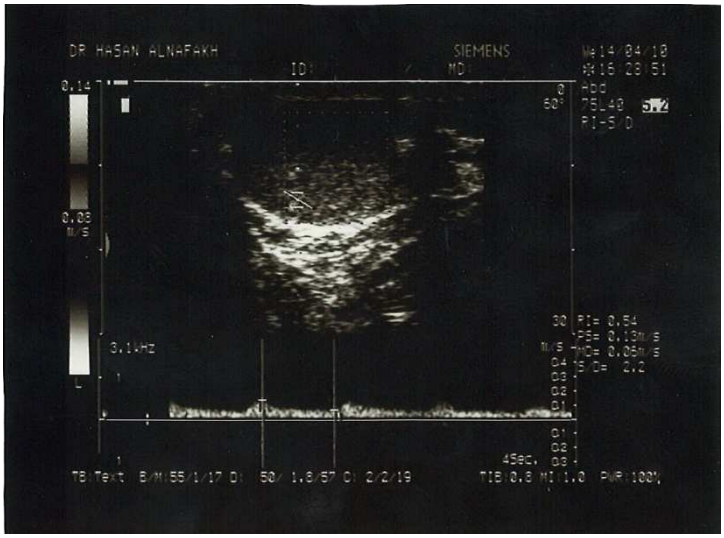

Figure 1: show CDUS with normal sperm count

The other 40 patients with abnormal sperm count having mean(SD) of RI =0.673 (0.093) as shown in figure 2:

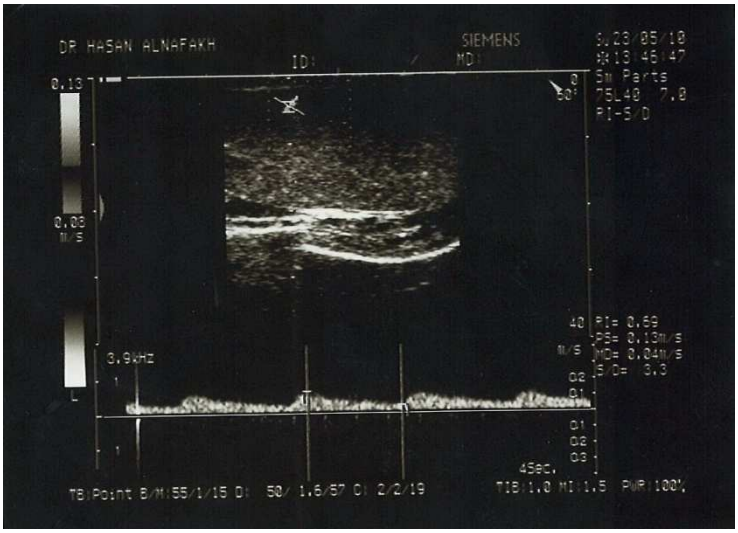

figure 2 : show CDUS with abnormal sperm count

The RI was significantly higher with abnormal pathological sperm count than those with normal count (p=<0.002).

Table-1: show mean (SD) RI values for age matched patient with normal &pathologic sperm count.

Age of patient	Normal sperm count	Pathologic sperm count
20-30	15	15
30-40	17	17
40-50	8	8
TOTAL	40	40
RI(SD)	0.566(0.0342)	0.673(0.093)

P=<0.002

Discussion:

The testes receive its blood supply from internal spermatic arteries through spermatic cord to testes[12], they form anastomosis with cremasteric and deferential arteries, the testes requires adequate blood supply for spermatogenesis, decreasing blood supply may cause ischemic damage. CDUS is one of the most reliable and rapid methods of measuring blood flow,combining anatomical and velocity data, and providing a rapid assessment in routine studies[13,14]. doppler indices have been used to obtain information about blood flow and vascular impedance that cannot be obtained from velocity information alone .These indices depend on measurement of peak systolic volume(PSV), end diastolic volume (EDV) and mean velocity. Two widely used indices are the pulsatility index (PI) & RI. For the measurement of intra-testicular blood flow, the RI has been used to date in both animals and humans[15].

The results of this study showed that the RI is significantly different between those who have normal sperm count and those with abnormal sperm count and this indicate its importance as predictive parameter for spermatogenesis in the study by Ghazy H. et al[16] , they found that RI could be used as an indicator for spermatogenesis.

Gumbsch et al[17] used color coded duplex ultrasound to examine the testes of 42 dogs which were normal on clinical examinations and defined normative value of testicular blood flow using RI . Tarhan et al[18] examined the effect of unilateral testicular torsion on the blood flow of contra-lateral testes including RI measurement in experimental study on 14 dogs and concluded that unilateral testicular torsion does not decrease contra-lateral testicular blood flow as shown by CDUS . Study done by lefort et al[19] concluded that elevated RI is suggestive for ischemia to testes. The following studies done on individuals with normal sperm count measuring RI, the results of these studies were Joe et al[9] found that RI= 0.5, in the study by Atilla et al[13] RI≥0.5, study of Biagiotti et al[20] RI≥0.5 & Pinggera et al[15] RI=0.54 , these results nearly similar to our results . The study done by Pinggera et al[15] found that (RI >0.6; P<0.001) in oligospermic patients .

There is currently no published explanation for the significant positive relationship between resistive index and sperm count/spermatogenesis, testicular arteries are target organs for androgen and in infertile men testicular arteries have narrow lumen caused by enlarged endothelial cells, a thickened sub-endothelial layer and an abundant adventitia rich in connective tissue fibers and ground substance. The implication is that the anatomical patterns of testicular arteries related to spermatogenesis ,thus confirming that the spectral color doppler traces from the intra-testicular artery can be considered as a marker of spermatogenesis[13]

Conclusion:

From the previous data, we can conclude that the use of CDUS as a non invasive, simple, outpatient procedure for measuring resistive index (RI) parameter of intra-testicular artery branches can be used as a good predictor for spermatogenesis. Further more sophisticated measures suggested with individuals who have high resistive indices [RI(SD)>0.67(0.093)].

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