



ORIGINAL RESEARCH PAPER

Radiodiagnosis

ROLE OF PENILE COLOR DOPPLER IN DIFFERENTIATING VASCULOGENIC FROM NONVASCULOGENIC ERECTILE DYSFUNCTION

KEY WORDS: ED-Erectile dysfunction ,IIEF- The International Index of Erectile Function Questionnaire, PSV- Peak Systolic Velocity and EDV-End-Diastolic Velocity,RI-Resistive Index, CDU-Color Doppler Ultrasound.

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ABSTRACT

The present study was carried out on 52 patients in Department of Radiodiagnosis Gajra Raja Medical college, Gwalior to assess the role of penile color Doppler sonography in the evaluation of erectile dysfunction. It is a cross sectional study in patients of erectile dysfunction(ED) on the basis of IIEF-5 score ,patients were subjected to penile color Doppler and differentiated into vasculogenic and non vasculogenic causes of ED .The age distribution of the patients studied was from 21 to 66 years maximum number of patient 18(34.6%)were in age group 21-30 years. On penile color Doppler examination , 21(40%) patients showed abnormal color Doppler findings were vasculogenic ED patients and 31(60%) patients revealed normal penile Doppler finding were non vasculogenic ED patients. The vasculogenic cause of ED increases with age. Most common risk factors found were smoking, followed by hypertension, diabetes ,alcohol ,peyronies disease and burgers disease.

INTRODUCTION:

Erectile dysfunction (ED) or impotence is defined as inability to achieve and / or maintain an erection for satisfactory sexual intercourse.

Impotence can be classified as organic, in which a physiologic abnormality is present , or psychologic .The vast majority of patients with organic impotence have hemodynamic abnormalities, arterial insufficiency, venous incompetence or both.

The International Index of Erectile Function (IIEF) and the simplified International Index of Erectile Function (IIEF-5) are widely used, validated, self-administered questionnaires, and have been demonstrated to be high degree of sensitivity and specificity for Ed¹.

Vascular evaluation and imaging may be indicated in patients with (a) arterial/arteriolar arteriogenic dysfunction, (b) veno-occlusive disorder, (c) Peyronie's disease, (d) high-flow priapism, (e) penile trauma (fracture) and (f) in patients without symptomatic peripheral vascular disease presenting with ED^{2,3}.

MATERIAL AND METHOD:

The study consist of 52 patients of erectile dysfunction based on IIEF-5 score and were evaluated by CDU (color Doppler ultrasound) with spectral analysis following intracavernosal injection of a vasoactive pharmacological agent Papavarine (30-60mg), to induce an erection. This was a cross sectional study carried in The Department of Radiodiagnosis G.R.Medical College and Jayarogya Hospital,Gwalior using ALOKA SSD-4000 USG machine with high frequency linear probe.

Diagnosis of ED:

The International Index of Erectile Function Questionnaire (IIEF) is the most reliable measure of ED. It has 15 questions and the total score is obtained by the sum of the individual scores of each question. It addresses and quantifies five domains, namely: erection function, orgasmic (ejaculation) function, sexual desire (libido), intercourse satisfaction (ability to sustain intercourse), and overall satisfaction/premature ejaculation.

Inclusion criteria-

1. Sexually active males of more than 18 years of age.
2. Duration of competent of ED ≥6 months.
3. Consenting to participate in the study .

Exclusion criteria-

1. Patients with penile implant.

2. Patients with Multiple myeloma,leukaemia,AV Block.
3. Patients with previous history of priapism by intracavernosal papaverine injection.

Interpretation of penile color Doppler:

Normal response to pharmacostimulant injection (papaverine) causes increased arterial flow.PSV increases in most normal patients exceeding 25cm/sec with absent or even reversed end diastolic flow. Arterial insufficiency is best diagnosed using the maximum arterial PSV i.e. PSV of less than 25 cm/sec after maximum penile erection ,lower the PSV greater the degree of arterial disease^{4,5}. Presence of persistent forward diastolic flow and elevated end-diastolic velocities are indirect indicators of veno-occlusive disease provided the patient has normal PSV (≥25 cm/sec). Demonstration of dorsal venous flow is consistent with dorsal venous incompetence⁶.

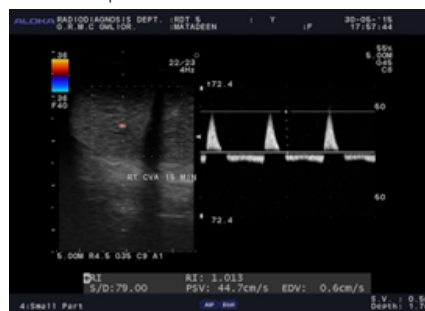


Figure-1- Showing normal hemodynamic change on spectral Doppler post papaverine injection with PSV> 25 cm/sec in right cavernosal artery.



Figure-2- Post papaverine injection on spectral Doppler ,PSV in right cavernosal artery is 15.2 cm/sec in patient with arterial insufficiency.



Figure-3- On spectral Doppler in patient with venous incompetence shows persistent forward diastolic flow in left cavernosal artery with EDV- 13.7cm/sec and RI-0.6

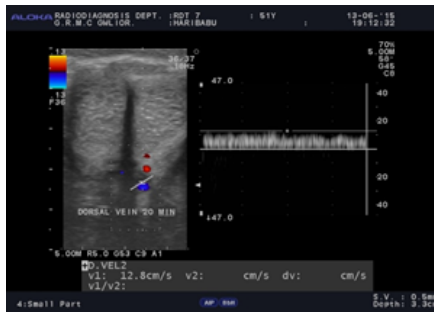


Figure:4 – Showing continuous forward flow in dorsal vein of penis in patient with venous incompetence.

OBSERVATION AND RESULT:

Table1: Distribution of ED in different age groups.

Causes of ED	21-30 In years(%)	31-40	41-50	51-60	>60	Total
Vasculogenic	3(16.6)	3(33.3)	6(54.5)	7(63.6)	2(66.6)	21
Non vasculogenic	15(83.3)	6(66.6)	5(45.4)	4(36.3)	1(33.3)	31
Total	18	9	11	11	3	52

Table2: Clinical Parameter of ED Patients.

	With vasculogenic ED N(%)	With non vasculogenic ED N(%)	P value
Smoking	8(38)	5(16)	0.42
Alcohol	6(28)	4(13)	0.51
Hypertension	6(28)	3(9.6)	0.58
Diabetis mellitus	5(23)	3(9.6)	0.61
Dyslipidimia (DL)	3(14)	1(3)	0.65
Peyronies(PYR)	4(19)	3(9.6)	0.59
Burgers disease(B)	4(19)	1(3)	0.63
Spinal trauma/ infection	2(9)	3(9.6)	0.70

Table3: Age and Specific Causes of Vasculogenic ED.

Vascular cause N(%)	21-30	31-40	41-50	51-60	>60	Total
Arteriogenic	2(13.3)	2(15.3)	5(29)	6(35)	2(13.3)	17
Venogenic	1(25)	1(25)	1(25)	1(25)	0	4
Total	3	3	6	7	2	

Chi-square :1.39, DF : 4, p-value : 0.8

Table4: Hemodynamic Parameters.

Cases (n=21)	No. of pt	Mean PSV(cm/sec)	Mean RI
Arteriogenic	17	22.5	0.96
Venoogenic	4	49.5	0.66

P=0.002

DISCUSSION:

In our study 52 (sample size) patients of erectile dysfunction on the basis of IIEF-5 score were subjected to penile color Doppler

and differentiated into vasculogenic and non vasculogenic causes of ED .The age distribution of the patients studied was from 21- 66 years maximum number of patient 18(34.6%)were in age group 21-30 years (Table:1). On penile color Doppler examination of 21(40%) patients showed abnormal color Doppler findings were vasculogenic ED patients and 31(60%) patients revealed normal penile vascular system in patients with ED by history were non vasculogenic ED patients(Table:1).The vasculogenic cause of ED increases with age, percentage distribution in different age group patient were 21-30(16.6%) ,31-40(33.3%),41-50(54.5%),51-60(63.6%),and >60 years (66.6%) .

In our study, we used the PSV as the reference standard to diagnose arteriogenic impotence out of 21 pateints of vasculogenic ED on penile color Doppler , 17(81%) patients with low PSV values (<25 cm/s) in the cavernosal artery were considered to have arterial insufficiency and 4(19%)patients with adequate arterial inflow that is, normal PSV, a short duration erection, with the persistent antegrade flow of >5 cm/s throughout all phases suggestive of venous incompetence(Venogenic ED) (Table:3).Most common risk factors found were smoking, followed by hypertension, diabetes ,alcohol ,peyronies disease and burgers disease(Table:2).

In our study we compared mean PSV and R.I in arteriogenic ED and venogenic ED patient are 22.5 cm/sec,49.5 cm/sec ,0.96 and 0.66 respectively with p-value(0.002) (Table:4) .

EDV >5 is associated with venogenic ED but can be found in patients with arteriogenic ED since arterial flow is insufficient to cause enough engorgement of sinusoids that can obstruct the venous outflow. Therefore, such threshold values for EDV can be misleading if arterial insufficiency is present.In our study Average R.I is found to be a significant indicator of differentiating arteriogenic ED avg. R.I (0.96) and venogenic ED avg. R.I (0.66) p-value(0.002).

Thus the present study provides information as to confirm that an endothelial dysfunction can manifest itself as ED, namely (arteriogenic or venogenic) based on the data provided by PSV and RI level measurements. This is in agreement with study for correlation between penile rigidity state and its hemodynamic parameters in our study with M. Ferreira COELHO, P. Bargão SANTOS⁷ M. Ferreira COELHO, P. Bargão SANTOS found 89% arteriogenic ED and 11 % patient with venogenic cause as the criteria of ED of arterial origin were the peak systolic velocity (PSV) < 30 cm/sec more then our criteria of (PSV)<25 cm/sec and the resistance index (IR) < 0.75 compare to (IR)<0.9 in our study.

Our results are also in agreement with the earlier studies of D Golijanin et al⁸ in their review article states that peak systolic flow velocity is the most accurate indicator of arterial disease. A study by Mostbeck et al⁹, has shown that there was a significant decrease in RI, as an indicator venous insufficiency, with increasing heart rate suggesting that some internal and external factors effect the results obtained by CDU⁹.

CONCLUSION:

Majority of patients who were suffering from erectile dysfunction had a vasculogenic cause for their impotence. Papavarine induced color Doppler sonography is an excellent and highly accurate means of assessing patients with erectile dysfunction. In the absence of it being an invasive test, we propose that it should replace angiography and cavernosometry as the gold standard technique for evaluating patients of erectile dysfunction.

A positive response to the pharmacoerection test in terms of rigidity and duration implies normal venoocclusive mechanisms. A duplex ultrasound of the penile arteries should be performed to provide a better selection of therapeutic options. A peak systolic blood flow higher than 25cm/s and an RI higher than 0.9 are generally considered normal.

When the result of the color Doppler ultrasound in combination with pharmacostimulation is normal, the vascular investigation is

generally completed . When it is abnormal, cavernosography, cavernosometry and arteriography should only be performed for patients who are considered potential candidates for surgical therapy.

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