DOPPLER ULTRASOUND FOR ERECTILE DYSFUNCTION

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ABSTRACT

OBJECTIVES:
1. To assess the value of color Doppler sonography in differentiating arterial from venous forms of vasculogenic erectile dysfunction. 2.To relate the arterial and venous forms of vasculogenic erectile dysfunction with causative factors like diabetes mellitus, hypertension, smoking and physiological conditions in ages of greater than 40 years and less than 40 years. **SETTING:** Department of Radiology, the Aga Khan University Hospital, Karachi. **DURATION OF STUDY:** From 29/05/2006 to 30/11/2006. **STUDY DESIGN:** Analytical cross-sectional study. **MATERIALS AND METHODS:** All patients who visited the department consented to participate, fulfilled the inclusion criteria underwent color Doppler ultrasonographic examination to ascertain underlying etiology of ED. Information regarding age and relevant medical and/or surgical history were also elicited through a structured proforma. **RESULTS:** Psychogenic ED was the commonest factor (57.5%) followed by smoking in 15 (37.5%), hypertension 9 (22.5%) and diabetes mellitus 7 (17.5%) patients. Association of these factors with age group (≤40 or >40 years) was insignificant i.e. psychogenic conditions (p=0.481), smoking (p=0.502), hypertension (p=0.453) and diabetes mellitus (p=0.453). Among 40 patients, 25% were suffering from venous leak, 17.5% were suffering from arterial insufficiency. **CONCLUSIONS:** The major cause of ED in our study was psychogenic disorders. This alludes to the importance of diagnostic techniques such as color ultrasound for early identification of such cases.
Keywords: Erectile dysfunction, Color Doppler sonography, Erect penis.

Introduction

Disorders of sexual functions are common among men of all ages, ethnicities and cultural backgrounds. It has been estimated that more than 152 million men worldwide experienced erectile dysfunction in 1995, and that this number will rise by 170 million, to approximately 322 million by the year 2025.[1,2,3] The National Institutes of Health (NIH) Consensus Development Conference1 advocated that "erectile dysfunction" be used instead of "impotence" to describe disorders of male sexual function and defined the new terminology as the "inability to achieve an erect penis as part of the overall multifaceted process of male sexual function." However, use of the term "erectile dysfunction" to refer to all aspects of male sexual dysfunction would be inappropriate.[4]

ED is essentially a vascular disease. It is often associated with other vascular diseases and conditions such as diabetes, hypertension, and coronary artery disease. Other conditions associated with ED include neurologic disorders, endocrinopathies, benign prostatic hyperplasia, and depression.[5,6,7] Conditions associated with reduced nerve and endothelium function, such as aging, hypertension, smoking, hypercholesterolemia, and diabetes, alter the balance between contraction and relaxation factors. These conditions cause circulatory and structural changes in penile tissues, resulting in arterial insufficiency and defective smooth muscle relaxation. In some patients, sexual dysfunction may be the presenting symptom of these disorders.[8]

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Despite high burden and huge implications of ED, research is generally lacking on this sensitive but important topic in South Asian countries including Pakistan. Even the exact prevalence of ED among male population in the United States is unknown, however, estimates range from 12% (Furlows) among males above 18 years to 25-30% (Kinsey et al) among males between 60 to 70 years. Moreover, it is even more important to distinguish ED because of organic causes from ED because of other causes.

Color Doppler evaluation of erectile dysfunction is one of the most effective methods for differentiating psychogenic and vasculogenic causes of erectile dysfunction.[9] It is used to determine the integrity of the vascular mechanism. After an intracavernosal injection of a vasodilator agent, color Doppler sonography is performed to evaluate cavernosal arteries and dorsal vessels.[10,11,12]

Color Doppler sonography is combined with spectral interrogation of the cavernosal arteries and dorsal veins to help determine peak systolic and end-diastolic velocities. Cavernosal artery size and systolic velocities help diagnose arterial insufficiency. Recent work on cavernosal artery diastolic flow and dorsal vein flow has indicated that color Doppler sonography, when correlated with cavernosographic findings, may be helpful in diagnosing venous incompetence. Temporal variations in transitions in cavernosal artery and dorsal vein flow during various stages of erection are important in the accurate diagnosis of vasogenic impotence.[13,14,15] Therefore the purpose of the our study was to assess the value of color Doppler sonography in differentiating arterial from venous forms of vasculogenic erectile dysfunction and to determine factors associated with arterial and venous forms of vasculogenic erectile dysfunction in ages of greater and less than 40 years.

Material and Methods

Forty male patients were conveniently selected referred to Radiology department, The Aga Khan University Hospital for color Doppler sonography for erectile dysfunction. The patients underwent penile color Doppler evaluation with injection Prostaglandin E1 20 microgram. Patients who are asymptomatic but seek assessment for medico legal purposes or patients already diagnosed were excluded.

Data was collected on Proforma. Medical record files and clinical laboratory results was also utilized to know the associated factors like Diabetes if RBS > 140 gm/ dl, Hypertension if systolic blood pressure was > 140 and diastolic blood pressure > 90 , History of smoking if one cigarette smoked daily for last six months and any medication for psychiatric problems. Written consent was taken from patients to enroll them in the study. Proforma was filled for every patient at the time of enrolment. During color Doppler sonography measurements of peak systolic and end diastolic velocities were obtained in each cavernosal artery at 5 minute interval for a total of 30 minutes. The study was performed on GE Logiq 500 and Aloka Prosound SSD Doppler machines with high frequency transducer and duplex and color Doppler facility.

All relevant features including patients' age, grading of erectile dysfunction, cause of ED, factors associated with ED, arterial insufficiency and venous leakage were recorded on proforma.

Data Analysis

Statistical software "SPSS version-10.0" was used for statistical data analysis.

Frequencies and percentages were computed for presentation of qualitative variables like grading of erection, causes of erectile dysfunction (ED), factors associated with ED, distribution of psychogenic conditions and organic/ non-organic causes of ED while Mean ± Standard deviation were computed for quantitative variables like age.

The age variable was categorized into two categories of age less than forty years or equal to or more than forty years. The categorical variable of age was taken as exposure and risk factors or the causative factors of ED were analyzed to determine the difference in the two age groups. Statistical testing was done using Chi-square. Where the assumptions of the Chi-square test were not met, Fisher's exact test was employed. Statistical significance was considered if $p < 0.05$. Moreover, t-test was employed to test whether the mean age of patients suffering from ED due to organic cause was different from mean age of patients with ED due to non-organic cause. The Levene's test for equality of variance was used to determine whether the variance of age among two groups was equal, an assumption of applying two independent samples t-test.

Results

DESCRIPTIVE ANALYSIS:

Of 40 male patients in this study, mean age was 36.7 ± 11.7 (Range; 16 -70) years . Full erection with unbending rigidity was found common in this study that was observed in 16 (40%) cases. Incomplete rigidity but sufficient for sexual intercourse was found in 6 (15%) cases whereas rest of the patients had either slight tumescence or almost no erection. A high proportion (55%) of patients had ED due to psychogenic or non-organic conditions and therefore diagnosed as normal. While 18 (45%) were diagnosed with organic causes. This data revealed a valuable role of color Doppler sonography for identification of organic causes.

Further analysis of causes of ED due to organic causes, venous leak was identified as a cause among 9 (50%) patient and arterial insufficiency in six (33%) patients. One patient (5.6%) each had mix picture of venous leak and arterial insufficiency, low flow priapism and peyronie's disease respectively.

Among 18 patients who were diagnosed as having ED due to organic causes, majority had smoking (83%) as associated cause. The second and third commonest causes were hypertension (50%) and diabetes (39%) respectively.

BIVARIATE ANALYSIS:

The patients on the basis of age were divided into two categories as younger (≤40 years) and older (>40 years).

While comparing psychogenic condition between the group of younger and older patients, 7 (50%) of younger and 16 (61.5%) of older group were found with psychogenic problem however, this difference was statistically insignificant (p=0.481) between two groups. Proportion of hypertension between younger and older groups was also insignificant (14.3% vs. 26.9% respectively) at p<0.05.

Only 1 (7.1%) patient of younger age group and 6 (23.1%) patients of older age group were found diabetic, but the difference was statistically insignificant. Among 14 younger patients, 4 (28.6%) were smokers and among 26 older patients, 11 (42.3%) patients were smokers. Insignificant difference of proportions of smokers between younger and older group was observed with p=0.502.

The mean age of patients with organic and non-organic causes of ED was 38.4 (±10.5) and 35.2 (±12.6). Further t-test showed insignificant results with 95% confidence interval ranging from -10.8 to 4.3. It may be noted that the two groups were significantly different with age of patients suffering from venous leak significantly lower than the age of patients suffering from arterial insufficiency.

Discussion

Despite of a macro modality, color Doppler sonography is a valuable diagnostic tool for differentiating physical or organic causes of erectile dysfunction.

The mean age of the subjects in our study was 36.7 years. Among 40 patients, 26 (65%) were aged > 40 years which is in accordance with the fact that erectile dysfunction most commonly occurs at a later age.[16,17,18]

A high proportion (55%) of patients had ED due to psychogenic or non-organic conditions and therefore diagnosed as normal. While 18 (45%) were diagnosed with organic causes. This data revealed a valuable role of color Doppler sonography for identification of organic causes. This result also supports the statement that in contrast to pudendal arteriography, duplex sonography is not invasive and can be performed in the office setting. The high resolution ultrasound probe allows the sonographer to image the individual cavernous arteries selectively and perform Doppler blood flow analysis simultaneously.

The causes of ED identified in our study were consistent with the study conducted by Karadeniz et al. reporting psychogenic causes in 53%, smoking in 21%, hypertension in 12% and diabetes as underlying cause in 5%.[19]

The results of our study showed that a high proportion of patients presenting with ED were suffering from ED due to non-organic causes. This finding concurs with the prior research.[20] However, two research studies, one in Australia[21] and other in Singapore[22] reported otherwise with frequency of ED due to organic causes more than due to non-organic causes.

The aforementioned finding, although needs to be supported by future studies, suggests that ED patients present with psychogenic causes more in Pakistani setting.

This is perhaps because of lack of education and awareness among the patients. Comprehensive educational programmes should be launched for such patients in which, when and where possible, patients' spouses should also be involved and counseled. This will not only reduce the anxiety among patients and their families but would also reduce the health care cost in resource poor countries like Pakistan.

In a local study done by Vaqar Bari et al , Vasculogenic causes were noted in 23 patients (33%), 12 (17.1%) with arterial insufficiency and 11 (15.7%) with venous leak. A normal response was noted in 45 subjects (64%) and their problem was considered to be psychogenic.

In my study, the causes of ED due to organic causes, venous leak was identified as a cause among 9 (50%) patient and arterial insufficiency in six (33%) patients. One patient (5.6%) each had mix picture of venous leak and arterial insufficiency, low flow priapism and peyronie's disease respectively. Psychogenic problem in my study was 57% that was consistent with the result of local study by Vaqar Bari at el.

Conclusions

Our results pointed out towards an important area that most patients presenting with ED in Pakistani setting are having dysfunction due to psychogenic conditions. In such situation, patient and his spouse should be counseled to improve the dysfunction. The early correct diagnosis in such cases would reduce the anxiety among patient and health care cost on the country.

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