



Comparison of clinical response and Doppler parameters after intracorporeal injection of vasoactive agents in erectile dysfunction

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Keywords:

Doppler ultrasonography, erectile dysfunction, venous insufficiency

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Received: 11 October 2018;

Accepted: 24 November 2018

Doi: 10.15713/ins,jmrps.148

Abstract

Objective: The objective of this study was to compare the clinical response and Doppler parameters after intracorporeal injection of vasoactive agents in erectile dysfunction.

Materials and Methods: The hemodynamic function of the penis can be evaluated non-invasively by performing or power Doppler US with spectral analysis following injection of a vasoactive pharmacological agent papaverine, to induce an erection.

Results: we conclude that Doppler, color flow Doppler sonography yields a consistent waveform/pressure pattern that provides insight into the integrity of the arterial and venous sinusoidal erectile mechanisms, but it is not a sensitive tool defining the exact cause of subclinical response in a subset of cases.

Introduction

Erectile dysfunction (ED) is defined as inability to have or maintain penile erection sufficient for vaginal penetration in 50% or more attempts during sexual intercourse. The causes may be organic or psychogenic. Color Doppler after intracavernosal injection of vasoactive agents drugs (ICIVADs), such as prostaglandin E2 with papaverine, would complement the penile nocturnal tumescence test in the diagnosis, whereby, determining the cavernosal artery diameter accurately and any narrowing/atherosclerotic changes, if any, and the blood flow pattern in them. Color Doppler can give the evaluation of venous leak, if any. By all these, we can confidently differentiate vascular and neurogenic causes. In 90% of cases, an accurate working diagnosis can be reached through the use of ICIVAD in combination with proper history.

During the past decade, significant advances have been made in the understanding, evaluation, and treatment of impotence. Impotence may be the result of psychogenic, neurogenic, hormonal, or vasculogenic causes. Work by Krysiwicz and Mellinger details an algorithm for the workup of the impotent patient. Once psychogenic, neurogenic, and hormonal factors have been eliminated, the focus of the workup shifts to an investigation of possible vasculogenic factors that

may be amenable to arterial or venous reconstructive surgery, angioplasty, or venous embolization.

Aim of study

The aim of this study was to compare the clinical response and Doppler parameters after intracorporeal injection of vasoactive agents in ED.

Materials and Methods

The present prospective study was conducted at Tagore Medical College and Hospital during the period from January 2018 to February 2019. 50 patients in age groups ranging from 20 to 55 were included in the study. All patients underwent color Doppler evaluation of the penile arteries post-intracorporeal injection of vasoactive agents.

Inclusion criteria

Patients complaint of ED, abnormal RigiScan recordings over three nights and consent of the patient to undergo investigation after fully explaining the procedure.

Exclusion criteria

Peyronie's disease, diffuse atherosclerosis, trauma, and infections were excluded from the study.

Ultrasound equipment

Voluson 730 Expert GE ultrasound machine with 6–12 MHz linear probe and color doppler was used.

Pre-ICIVAD study

Cavernosal artery diameter and arterial anomalies seen with peak systolic flow velocity (cm/s) and resistive index (RI)

Dose of ICIVAD study

Triple-drug regimen phentolamine (0.025 ml) + papaverine (0.1 ml) + PGE1 (0.5 ml).

Post-ICIVAD study

2 Dimensional cavernosal artery diameter and Doppler (Recordings done at 2 min interval for a maximum period of 20 min. Peak systolic flow velocity (cm/s). Minimal end diastolic flow velocity (cm/s) and RI taken.

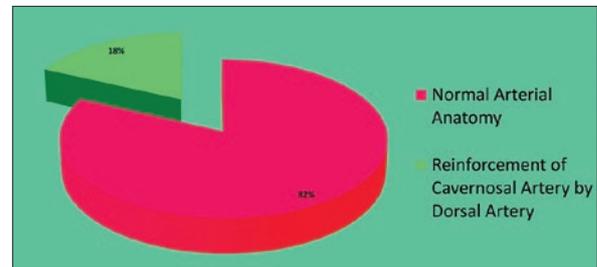
Discussion

Impotence attributable to either psychogenic or organic factors represents a serious problem. It is now believed that nearly 50% of all men will be affected at some time. Up to one-third of cases has some definable underlying organic cause, which may be pharmacologic, infectious, anatomical, vascular, neurological, and on endocrine in nature.^[1-5] Of these, anatomical and vascular causes are potentially surgically curable. Therefore, recognition and analysis are of paramount importance. Physical examination is usually diagnostic in the case of anatomic causes such as phimosis, priapism, and Peyronie disease and can be augmented by gray scale sonography in Peyronie disease, ultrasound will accurately assess the extent of the fibrous plaque as well as its proximity to the deep arteries of the corpora cavernosa.^[6] When impotence is the result of either arterial or venous insufficiency, radiographic examination is essential. Venous insufficiency can be the result of leakage caused by deterioration of the tunica albuginea, which is accelerated by repeated prolonged erections as the result of high pressure in the corpora cavernosa.^[7] Cavernosography during erection can detect and assess such leakage.^[8] Finally, since the erectile process is the result of arterial dilatation, restriction of venous outflow, and sinusoidal relaxation, normal erection requires an intact arterial system which is able to undergo vasodilatation and accommodate an increased flow rate; thus, in patients with atherosclerotic disease, including penile vascular sclerosis and generalized atherosclerosis, erection capability is diminished as the result of narrowing or occlusion of the iliac and penile arteries.^[1]

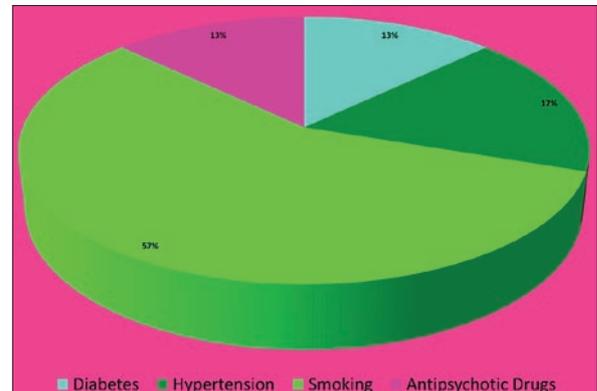
In a subset of patients, we found arterial anatomical variations. In those patients who had both the cavernosal arteries are reinforced beyond the penoscrotal junction had primary ED with Doppler in normal limits.

Different methods have been proposed for the diagnosis of arteriogenic impotence. The penile brachial index, obtained

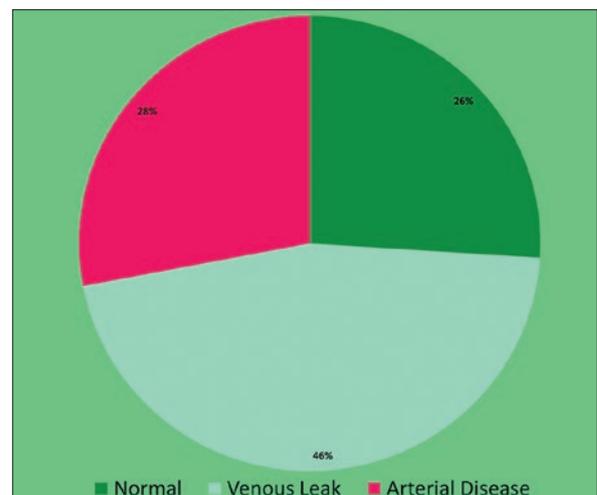
by Doppler pressure studies of the dorsal and brachial arteries, has been recommended as a screening test.^[9] While overall



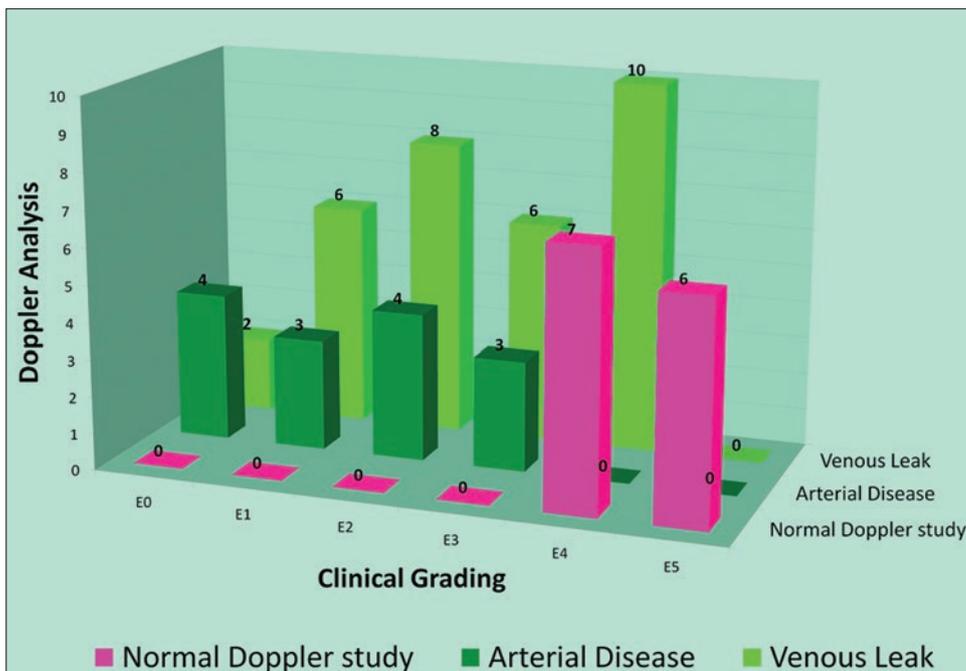
Graph 1: Association with arterial vascular anomalies. Reinforcement of cavernosal artery by dorsal artery of penis 9 (18%). Doppler findings in patients with variation in arterial anatomy, of the nine patients, four patients had normal Doppler study and normal clinical response. Four patients had normal Doppler study and subclinical response and one patient had decreased systolic velocity on Doppler and subclinical response, who was a diabetic and a smoker



Graph 2: Comorbid conditions associated. Diabetes – 15, hypertension – 10, smoking – 22, and antipsychotic drugs – 2



Graph 3: Post-intracavernosal injection of vasoactive drug analysis. Normal Doppler study – 13 (26%), arterial disease – 14 (28%), and venous leak – 23 (46%)



Graph 4: Comparison of clinical and Doppler data. Post-ICIVAD clinical grading, E0 – 6 (12%), E1 – 9 (18%), E2 – 12 (24%), E3 – 9 (18%), E4 – 8 (16%), and E5 – 6 (12%)

accuracy is good, the dorsal penile/brachial pressure ratio can decrease significantly in the absence of detectable aortoiliac disease; and conversely, patients with obvious aortoiliac disease may have normal penile hemodynamic.^[10] The peak velocity/pulse rise time ratio of the penile vessels relative to the radial arteries appears to offer more promise, as acceleration may prove to be a more reliable factor in evaluating arterial insufficiency.^[11] Blood flow into the corpora cavernosa has been measured by xenon clearance studies in normal volunteers.^[12] In the flaccid state, flow to the penis is 2.5–8.0 ml/min, while early in erection, the considerable arterial influx to the penis results in average flow rates of approximately 90 ml/min; moreover, with full erection, restriction of venous outflow increases pressure in the corpora cavernosa while the average arterial and venous flow rates are at their lowest, approximately 4 ml/min/100 g.

In evaluating vasculogenic impotence, detection of arterial insufficiency is mandatory. Arterial compliance and flow measurements can be evaluated accurately by a combination of B-mode imaging and pulsed Doppler spectrum analysis. Sonography combined with ICIVAD-induced erection allows evaluation of penile vascular anatomy and physiology and is recommended as the initial radiographic study in the evaluation of vasculogenic impotence. Arteriogenic impotence can be recognized by lack of arterial dilatation and subnormal flow velocity after ICIVAD. Since flow volume is the result of both vessel diameter and flow velocity, both should be evaluated, indicating the need for the combined use of gray scale sonography and Doppler scanning.

Arteriogenic impotence is a complex and dynamic process, encompassing a wide range of severity, and more studies are needed to determine normal values. However, anticipating a wide range of normal variation, the data should be viewed in the context of the patient’s physique and the degree and duration of erection. If the arteries dilate and demonstrate adequate flow during papaverine-induced erection, vascular cause is unlikely; however, the degree and duration of erection be less than normal, venous leakage is possible and the patient should be referred for dynamic infusion pharmaco-cavernosometry and cavernosography.^[8] The initial size of the artery is probably not a good indicator of arterial disease; arterial compliance and dilatability are more important. Furthermore, evaluation of the dorsal artery seems less significant; we have seen good and poor corporeal response. While further studies are needed, it appears that evaluation of vasculogenic impotence combining sonography and Doppler spectrum analysis has valuable diagnostic potential.

Conclusion

In our study, we found that 13 (26%) cases who had abnormal prenasal thickness (PNT) had normal Doppler study after ICIVAD [Graph 1]. This is possibly because the hospital environment made the patient more anxious and apprehensive, so as to give a false-negative PNT recording.

Comorbid conditions such as diabetes, hypertension, and smoking play a significant role in causing arteriogenic insufficiency [Graph 2].

The most common cause of ED in our study was venous leak in 46% of the patients and then was the arterial insufficiency in 28% of the patients [Graph 3].

There were 9 (18%) patients who had cavernosal artery reinforcement by dorsal artery of penis. Of these patients, 5 (10%) patients had normal Doppler study and normal clinical response to ICIVAD and 4 (8%) patients had normal Doppler study but had subclinical response (E2–E4) to ICIVAD [Graph 4]. That is in patients who had arterial anatomy variations, 44.44% of patients had subclinical response to ICIVAD. In these patients by Doppler and 2D ultrasound, no other abnormality could be made out. Hence, we believe, a larger clinical trial and magnetic resonance imaging of penis may be required to further analyze the cause of subnormal clinical response.

Hence, we conclude that Doppler, color flow Doppler sonography yields a consistent waveform/pressure pattern that provides insight into the integrity of the arterial and venous sinusoidal erectile mechanisms, but it is not a sensitive tool defining the exact cause of subclinical response in a subset of cases.

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How to cite this article: Arumugam V, Thanikavelu L. Comparison of clinical response and Doppler parameters after intracorporeal injection of vasoactive agents in erectile dysfunction. *J Med Radiol Pathol Surg* 2018;5:9-12