

## **ERECTILE DYSFUNCTION: A brief overview and the excellent role of Ultrasound and Duplex doppler in its diagnosis.**

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Erectile dysfunction : a brief overview

Erectile dysfunction is the inability of men to get and maintain an erection throughout the sexual activity.

Maintaining erection at times may be common, but during erectile dysfunction the symptoms are persistent and include:

- Trouble getting and maintaining erection
- Reduced sexual activity or desire.

Incidence : Very common (More than 1 crore cases per year in India)

Common for age 60 yrs or older.

We shall now study Erectile Dysfunction, in the below mentioned chronology. Our particular stress shall be upon (1) the Venous cause (the more common cause) of Erectile dysfunction and (2) The role of Ultrasound and Duplex Doppler as a dominant diagnostic tool in the diagnosis of ED.

Chronology of sections :

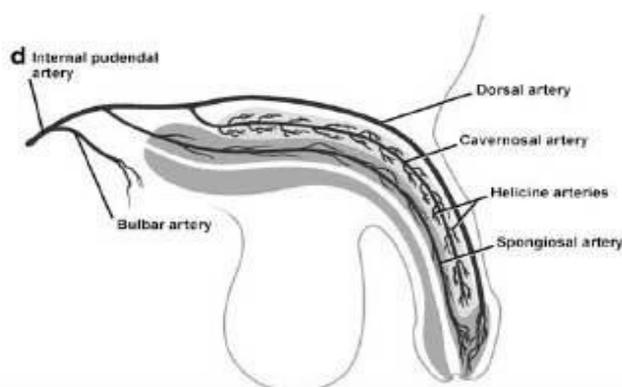
1. Erectile Dysfunction : A brief overview
2. Chronology of sections.
3. What is the mechanism of Erection?
4. Normal arterial & Venous anatomy of Penis.
5. What is Erectile dysfunction (ED). Definition.
6. What are the types of Erectile dysfunction.
7. Diagnostic tools employed for the diagnosis of Erectile dysfunction.
8. Ultrasound Duplex Doppler use in Diagnosis of ED.
9. Clinical signs of ED due to Arterial insufficiency.
10. Clinical signs of ED due to Venous leak.
11. Treatment of Venous insufficiency.
12. The Sensitivity and Specificity of Duplex doppler in diagnosing ED's causes.
13. Conclusion

### **What is the Mechanism of Erection ?**

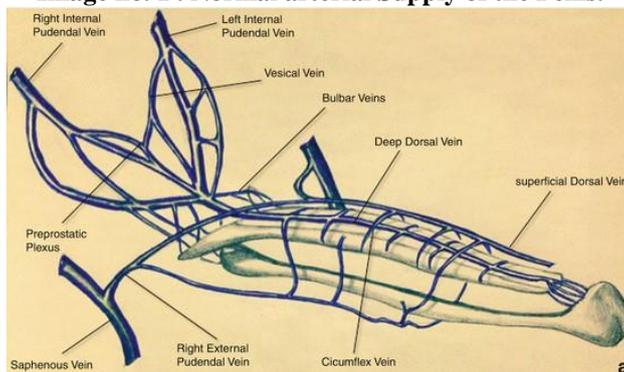
Erection starts when an autonomic neurogenic impulse relaxes the cavernosal arterioles and sinusoidal spaces. There is a marked increase in the volume of arterial inflow into the penis as the cavernous arteries dilate. This is accompanied by relaxation of the smooth muscle of the corpora cavernosa with expansion and elongation of the cavernous sinusoids as they fill with blood. Compression of the cavernous venules between the dilated cavernous sinusoids and the unyielding peripheral tunica albuginea decreases venous outflow.

This veno-occlusive mechanism (which depends on neurological stimuli, a sufficient supply of arterial blood, and normal function of the tunica albuginea) maintains sinusoidal distension and rigid erection.

Erection is thus, a sum of two variables (1) Inflow of blood into the penis and (2) Restriction of outflow of the blood from the Penis. This "accumulation" of blood in the Penis leads to "flooding and engorgement" of the Penile sinusoids and muscles, thereby leading to increase in size and stiffness of the Penis.



**Image no. 1 . Normal arterial Supply of the Penis.**



**Image No. 2 . Normal venous supply of the Penis.**

What is erectile dysfunction?. Definition.

• Erectile dysfunction is defined as the persistent inability to attain or maintain penile erection sufficient for sexual intercourse.

It was in 1992, that the National Institutes of Health Consensus Development Conference recommended use of the term "Erectile dysfunction" rather than "Impotence," because it more accurately defines the problem and has fewer disparaging connotations.

What are the Types of Erectile dysfunction?

- (1) Psychogenic Erectile Dysfunction: Excessive life stressors work, bad relationships , Poor Mental health, Depression, psychosis or anxiety disorders.
- (2) Vascular Causes of Erectile Dysfunction : (a) Arterial insufficiency (b) Venous-occlusive disorder, venous insufficiency, where the veins fail to close.
- (3) Hormonal Causes of Erectile Dysfunction : Hyperprolactinemia , Androgen deficiency etc
- (4) Neurogenic Erectile Dysfunction : Parkinson's disease, Alzheimer's disease, stroke, and spinal/cerebral trauma.
- (5) Erectile Dysfunction Due to Other Systemic Diseases and Aging : Diabetes Mellitus , Aging etc...
- (6) Drug-Induced Erectile Dysfunction : Beta blockers, Thiazide Diuretics ,Antiandrogenic effect drugs like Ketoconazole, Cyproterone acetate, Antidepressants, Antihypertensives, Anti convulsants, Antispasmodics..... Etc. Not to forget Alcohol.
- (7) Chronic renal failure....

Of the above mentioned causes, the "Psychogenic" cause is the most common and includes components like Performance anxiety, Depression, poor mental health...

Of the other "Organic causes" of Erectile Dysfunction, there are two main aspects of deficiency. They are (1) Arterial Insufficiency and (2) Venous insufficiency.

Erectile Dysfunction due to arterial insufficiency :A leading cause of erectile dysfunction is penile arterial insufficiency – meaning not enough blood flows to the inner areas of the penis, which is necessary to produce the necessary sinusoidal engorgement and sustain an erection. This condition can be caused by Arterial stenosis, Cholesterol deposits in the arteries, Endothelial injuries , Hypertension and conditions like Cigarette smoking.

Erectile dysfunction due to venous insufficiency :The maintenance mechanism that prevents blood from leaving the penis is the ‘corporo-occlusive’ mechanism within the penis that involves collagen fibers, smooth muscle, and other support structures. Venous leak refers to the failure of the corpora-occlusive mechanism within the penis to keep blood from leaving the penile shaft. Corporo-venous occlusive erectile dysfunction or veno-occlusive dysfunction can be caused by degenerative changes of tunica, changes to collagen components as a result of aging, cavernosal fibrosis/plaques, Peyronie’s disease, diabetes or penile fracture.

Diagnostic tools employed to confirm ED and its causes.

- (i)Hormone test : A blood test to measure the levels of male hormones.
- (ii)Complete blood count (CBC) : To check for heart disease, diabetes or infection causing the symptom.
- (iii)Urine test : To check for diabetes or any infections.
- (iv)Digital rectal examination : Inserting a gloved finger through the rectum to check for changes in prostate gland.
- (v)Ultrasound : Uses sound waves to get images of the penis.
- (vi)Duplex Doppler Ultrasound : to see the arterial flow and venous drainage of the Penis.
- (vii)Nocturnal penile tumescence : Using a battery-powered device to assess the quality of erections during sleep.
- (viii)Psychological examination : To assess for psychological disorders.

Ultrasound and Duplex Doppler’s use in Diagnosis of ED.

Use of Color Doppler is in assessing the blood flow of the Penis and thereby assessing whether Arterial or Venous insufficiency. In a normal person, in the flaccid state, the flow thru the cavernosal arteries of the penile arteries shows a high resistance flow which means low systolic and virtually no diastolic flow at all. On erection, the peripheral resistance decreases leading to relaxation and thereby increase in the influx of arterial flow. Hence, in an erect state, the cavernosal arteries show (1) more than doubling of the flow velocity, compared to that in a flaccid state ,and (2) more than doubling of their diameter ,compared to that in a flaccid state.

**Image No. 3 . Normal Penile Doppler study in Flaccid state and after Prosta-Glandin injection.**

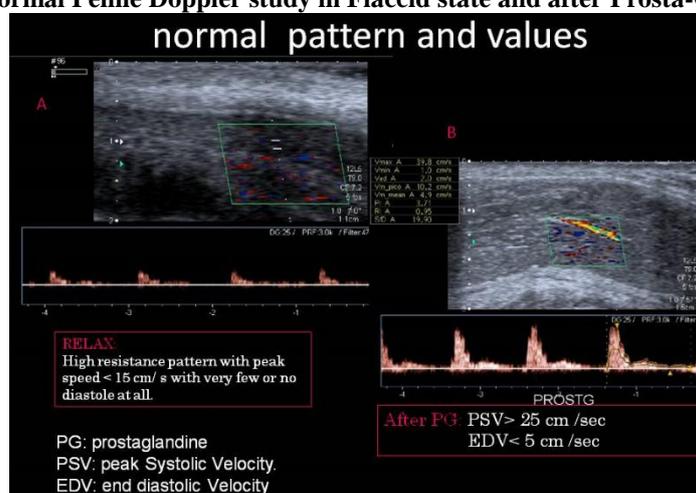


Image description :There is marked increase in the velocity of the flow thru the cavernosal artery ( 25 cm/s in erect/post medicine state, compared to only 15 cm/s in the flaccid state.

### **What are the Signs of Erectile Dysfunction due to arterial insufficiency?**

Most common sign/symptoms of erectile dysfunction caused by arterial insufficiency are very poor erection or even no initiation of erection at all.

Image no. 4 . Doppler study in case of Arterial Insufficiency.

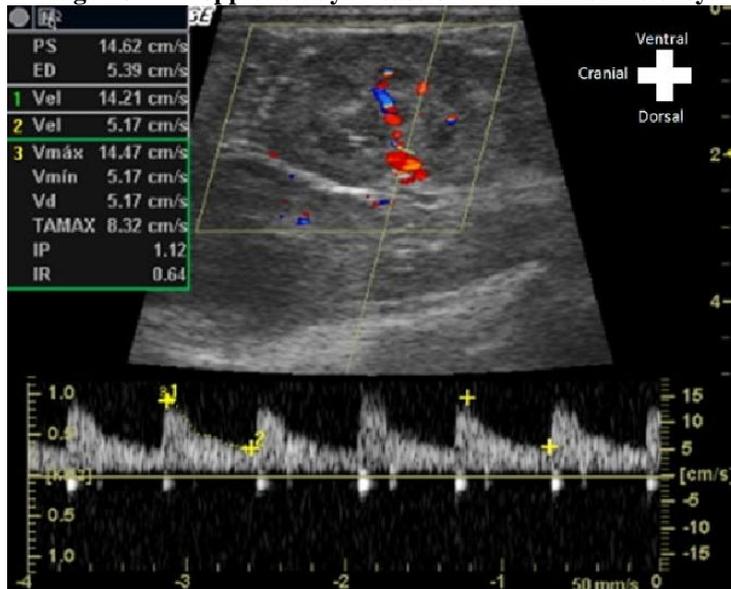


Image description : Even after drug injection there is virtually no increase in the velocity of flow thru the cavernosal arteries (14.62 cm/s only). Sign of arterial insufficiency.

#### What are the Signs of Venous Leak Erectile Dysfunction?

Most common symptoms of erectile dysfunction caused by a venous leak are erections that cannot be maintained, engorgement but no erection after taking medications such as Viagra or Cialis. It is important to understand that men without venous leak but with arterial insufficiency can also experience similar symptoms.

Image No. 5. Doppler study in the case of Venous Insufficiency.

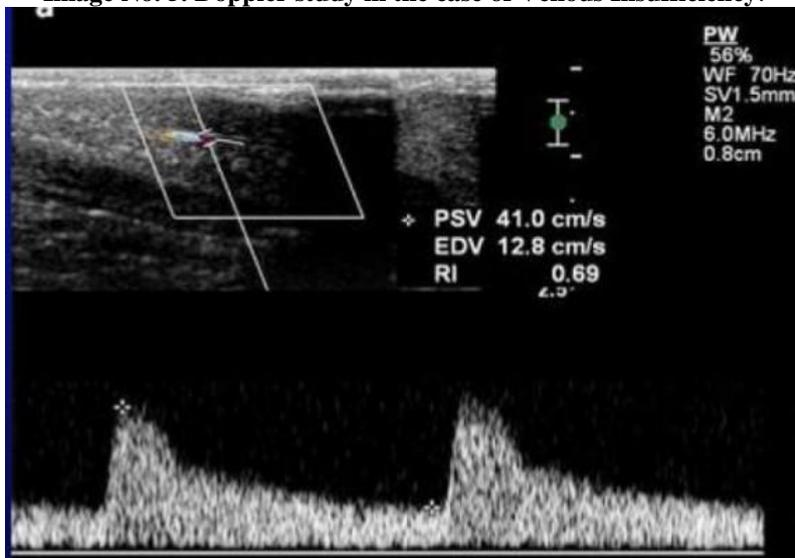
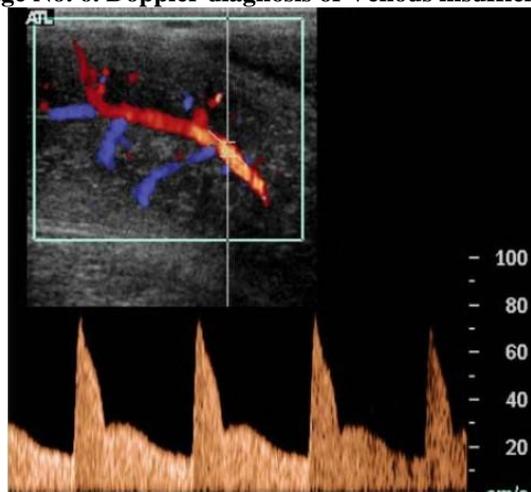


Image description : Diastolic values of over 5 cm per sec is indicative of Venous insufficiency

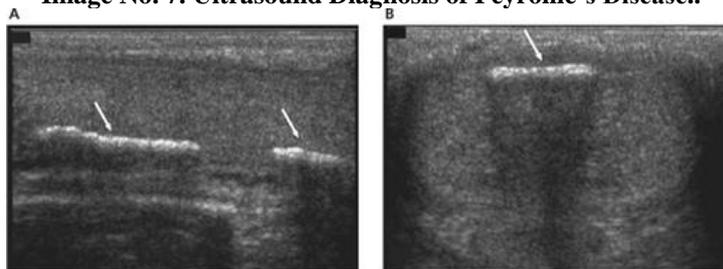
**Image No. 6. Doppler diagnosis of Venous insufficiency.**



High diastolic flow is diagnostic of venous leak. In normal cases diastolic initially becomes less than 5 cm/second and finally show reversal. EDV of above 5cm/sec is diagnostic of venous leak.

**Venous insufficiency can also arise due to changes to collagen components as a result of various conditions like Peyronie's disease.**

**Image No. 7. Ultrasound Diagnosis of Peyronie's Disease..**



Description: Calcified plaques are seen in the Cavernosal muscles and even the Tunica Albugenia.

**Image No. 8. CT correlation of the US imaging of Peyronie's disease.**



Description : A calcified plaque is clearly visualised in the mid substance of the Penis shaft.

**Treatment of venous insufficiency :**

- Seek Counselling from a Specialist.
- Lifestyle changes : The renunciation of smoking, regular exercise, only moderate amounts of alcohol and a healthy diet can prevent the development of erectile dysfunction.
- Physiotherapy (pelvic floor exercises) may show a therapeutic effect in erectile dysfunction due to mild venous insufficiency.
- The change of a medication with side effects on erectile function is a good option for improvement of ED.
- Vacuum Constriction Device for Erectile Dysfunction.

- Ligation of the Penile Veins:

#### **Vacuum Constriction Device for Erectile Dysfunction :**

- Vacuum therapy uses a plastic cylinder, which is placed over the penis and sealed at the base. By creating a vacuum with a hand pump, the penis is filled passively with blood until an erection is reached. After removal of the cylinder, the erection is maintained with the help of a penis ring at the base of the penis.
- There is good objective success rate of vacuum therapy, which can be improved with the combination of vacuum therapy with intracavernosal injections or PDE 5-inhibitors.

#### **Ligation of the Penile Veins:**

- The ligation of penile veins (most common dorsal veins of the penis) is indicated in venous insufficiency of isolated veins.
- The dorsal penile veins are exposed via an infrapubic incision and the dorsal veins are ligated at the base of the penis. Crural veins are exposed via a perineal incision.
- Due to the low morbidity, ligation of penile veins shows good results in young patients. In the older patients with veno-occlusive dysfunction, only moderate results are seen.

The Sensitivity and Specificity of Duplex doppler in diagnosing the (arterial v/s venous) causes of ED

Diagnosis of arterial insufficiency is possible with 88% sensitivity, 82% specificity and 82% positive predictive value (ROC= 0.90).”1”

Scores of the erectile maintenance can predict a diagnosis of venous leak with a 99% sensitivity, 77% specificity and 76% positive predictive value (ROC= 0.97).

### **1. Conclusion**

Erectile dysfunction is a major cause of concern in Adult males (particularly older adults). The etiology is multiple. A proper diagnosis can greatly help in the treatment. The Ultrasound, particularly Duplex Doppler can greatly help in diagnosis many causes of Erectile dysfunction. The duplex doppler study can be a Game-changer in the diagnosis and (thereby) improving the treatment outcomes.

-----The End -----

#### **REFERENCES:**

- [1]. DARAB MEHRABAN, SH Shabaninia, GH H NADERI, F Esfahani. The IRANIAN JOURNAL OF SURGERY 14 (136), 25-31, 2006
- [2]. DARAB MEHRABAN, SH Shabaninia, GH H NADERI, F Esfahani. The IRANIAN JOURNAL OF SURGERY 14 (136), 25-31, 2006

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