



**Aspetti ecografici della DE:  
l'eco-color-Doppler penieno basale,  
modalità di esecuzione,  
parametri di normalità  
e correlazioni con il rischio cardiovascolare**

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November 9,  
2017**



**siams**  
Società Italiana di Andrologia  
e Medicina della Sexualità

9-12 novembre 2017, Roma

**16° Congresso Nazionale AME**  
Associazione Medici Endocrinologi  
Joint Meeting with AACE Italian Chapter  
**Update in Endocrinologia Clinica**

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## Erectile dysfunction

**Definition:** persistent inability to achieve or maintain penile erections of sufficient value to engage in satisfactory sexual activity

NIH Consensus Conference. Impotence. NIH Consensus Development Panel on Impotence. JAMA 1993;270:83-90.

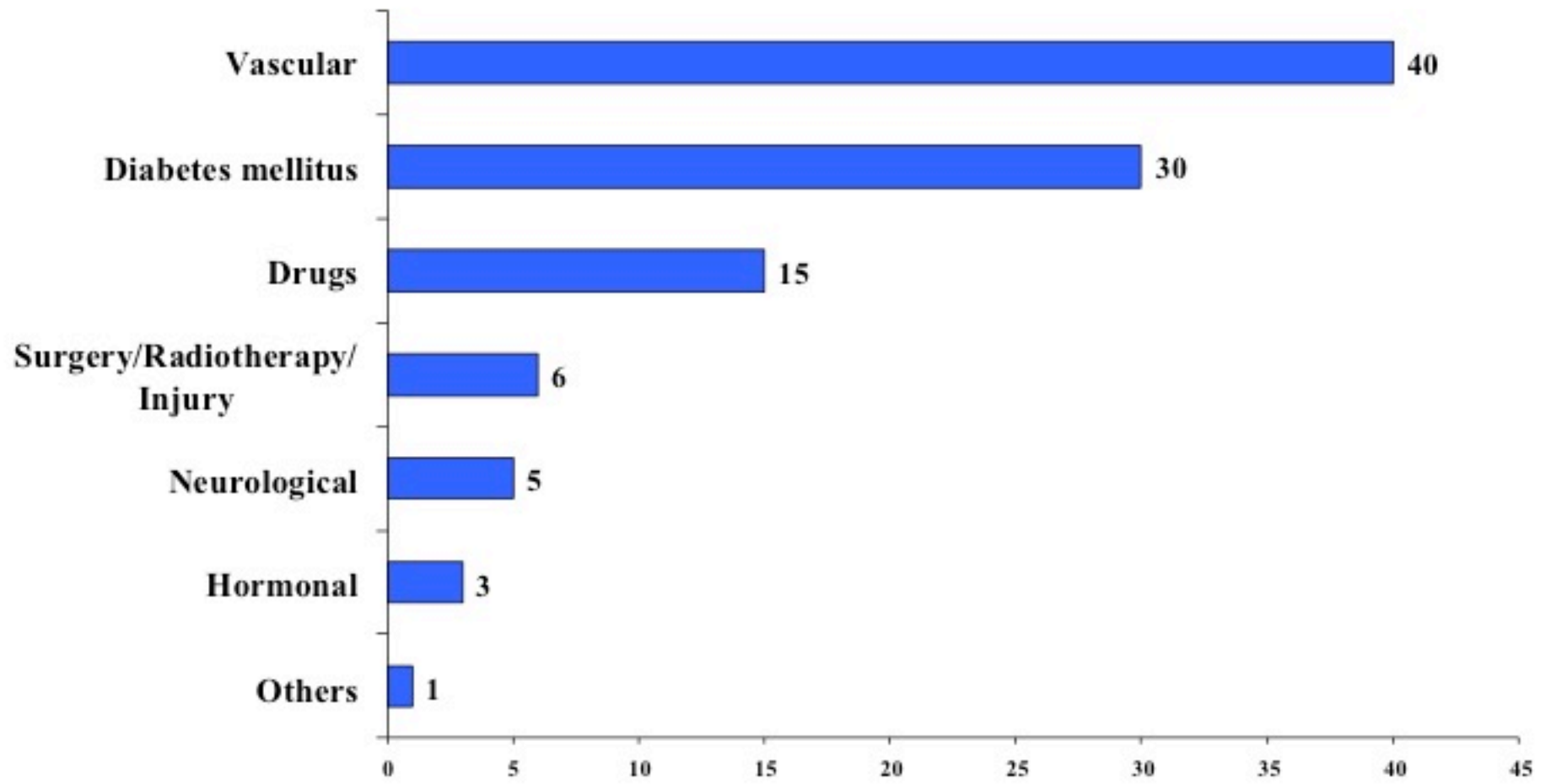
**Prevalence:** 50% of the male population between 40 and 70 years

Feldman HA, Goldstein I, Hatzichristou DG, Krane RJ, McKinlay JB. Impotence and its medical and psychosocial correlates: results of the Massachusetts Male Aging Study. J Urol 1994;151:54-61.

**GP:** 1-5 new cases per month

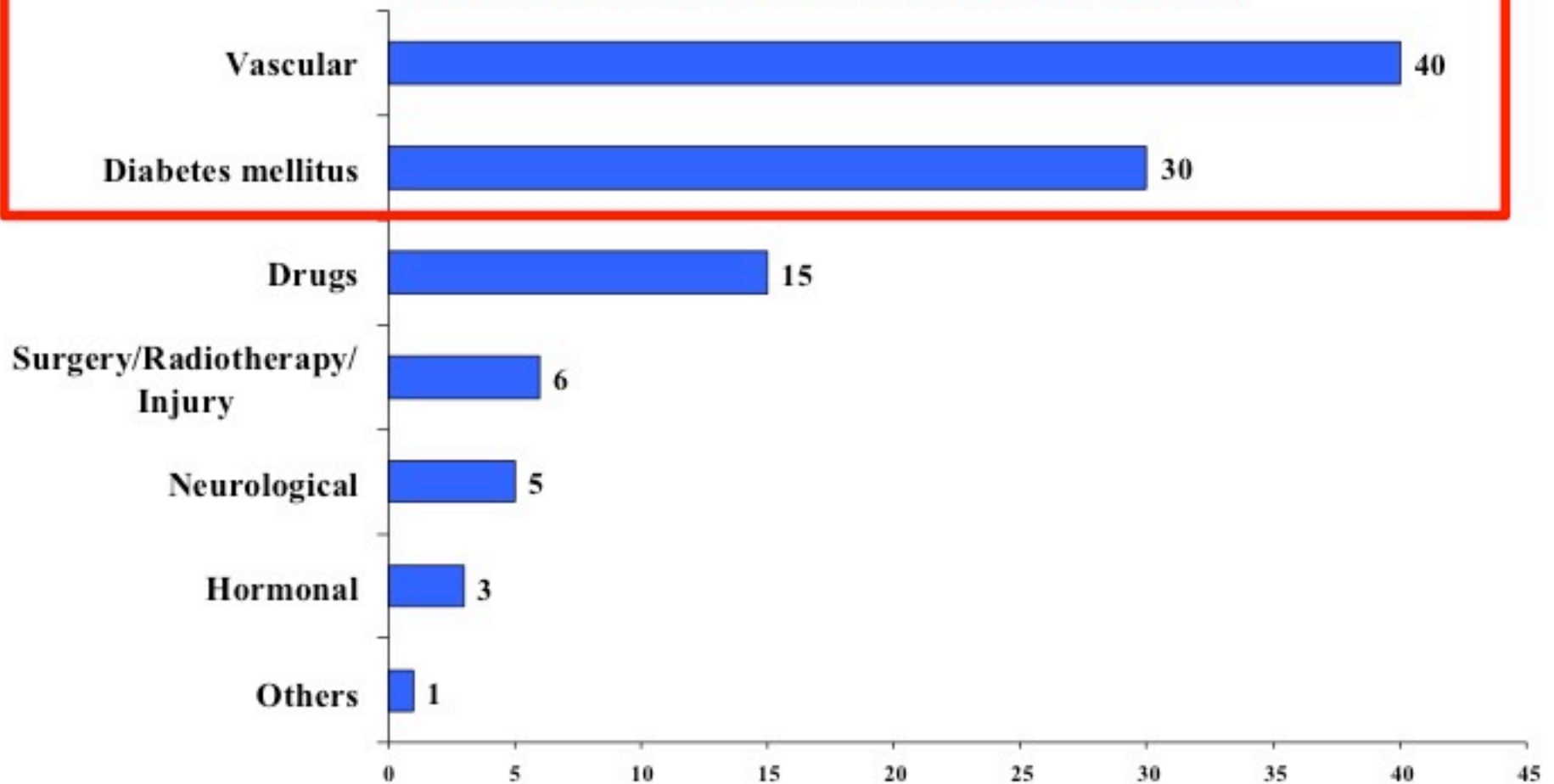
European Association of Urology. Guidelines on male sexual dysfunction: erectile dysfunction and premature ejaculation. Arnhem, Netherlands: European Association of Urology; 2009.

## Organic causes of erectile dysfunction



# Organic causes of erectile dysfunction

Mainly based upon  
**VASCULAR INSUFFICIENCY / DAMAGE**







## Penile colour-Doppler ultrasound (PCDU): ++specific diagnostic test for «primary ED»

### Diagnostic workup of male ED

#### 2.2.5 Guidelines for the diagnostic evaluation of ED

	LE	GR
Clinical use of validated questionnaire related to ED may help to assess all sexual function domains and the effect of a specific treatment modality.	3	B
Physical examination is needed in the initial assessment of men with ED to identify underlying medical conditions that may be associated with ED.	4	B
Routine laboratory tests, including glucose-lipid profile and total testosterone, are required to identify and treat any reversible risk factors and lifestyle factors that can be modified.	4	B
Specific diagnostic tests are indicated by only a few conditions.	4	B

Table 5: Indications for specific diagnostic tests

Primary ED (not caused by organic disease or psychogenic disorder).
Young patients with a history of pelvic or perineal trauma who could benefit from potentially curative vascular surgery.
Patients with penile deformities that might require surgical correction, e.g., Peyronie's disease, congenital curvature.
Patients with complex psychiatric or psychosexual disorders.
Patients with complex endocrine disorders.
Specific tests may be indicated at the request of the patient or his partner.
Medicolegal reasons, e.g., implantation of penile prosthesis, sexual abuse.

## AIUM / AUA 2011


# Ultrasound Examination in the Practice of Urology

*Guideline developed in collaboration with the American Urological Association.*

### D. Penile

#### 1. Indications

Indications for a penile ultrasound examination include but are not limited to:

- Evaluation of erectile dysfunction; 
- Evaluation of priapism;
- Evaluation of dorsal vein thrombosis;
- Evaluation of penile fibrosis and penile curvature;
- Evaluation of abnormal findings on physical examination of the phallus or urethra;
- Evaluation of penile tumors;
- Evaluation of a urethral stricture, diverticulum, or cyst;
- Evaluation of a calculus or foreign body of the phallus or urethra; and
- Evaluation of penile trauma.

**Evaluation of ED requires the use of color-Doppler imaging  
before and after pharmacostimulation**

# Which patients should be investigated?

## The Role of Penile Color-Duplex Ultrasound for the Evaluation of Erectile Dysfunction

Antonio Aversa, MD, PhD,\* and Lelio Mario Sarteschi, MD†

J Sex Med 2007;4:1437–1447

### Summary of the diagnostic utilization of PCDU

**Table 1** Frequent etiologies of ED as diagnosed by penile blood flow studies (from [8], modified)

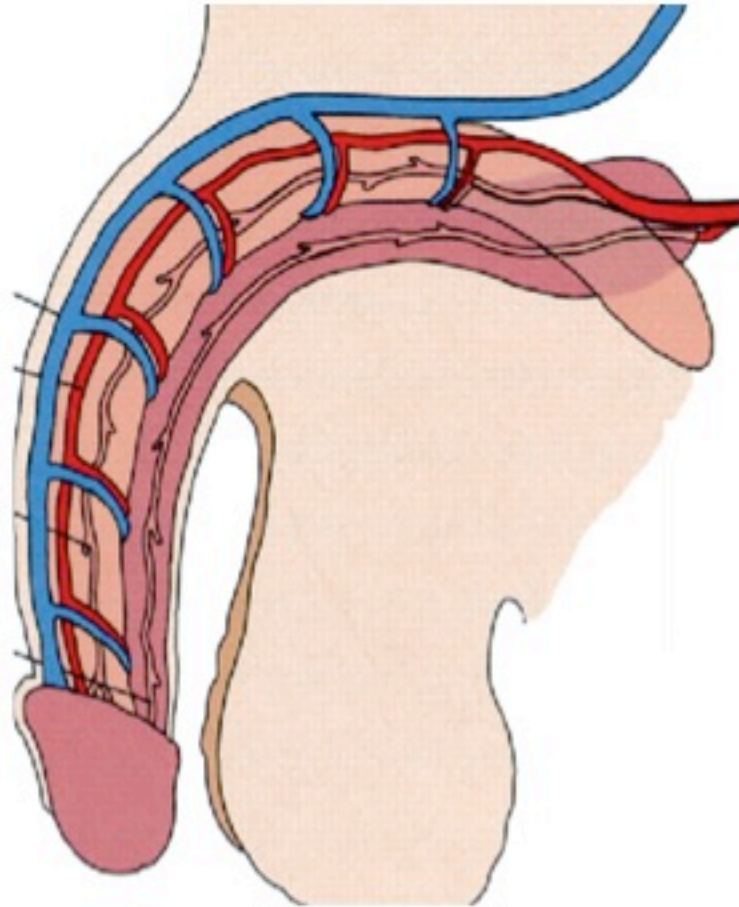
Etiology of ED	Use of D-PCDU	Reference
Arteriogenic	Y	Pescatori et al. [21]
Venogenic	Y/N*	Lue et al. [34]
Psychogenic	Y/N	Aversa et al. [32]
Neurogenic	Y	Broderick [23]
Hypogonadism	Y	Corona et al. [4]
Peyronie's disease	Y	Kendirci et al. [59]

\*Y/N means that the diagnostic utility of D-PCDU for those etiologies is not considered evidence-based.

ED = erectile dysfunction; D-PCDU = dynamic penile color-duplex ultrasound.

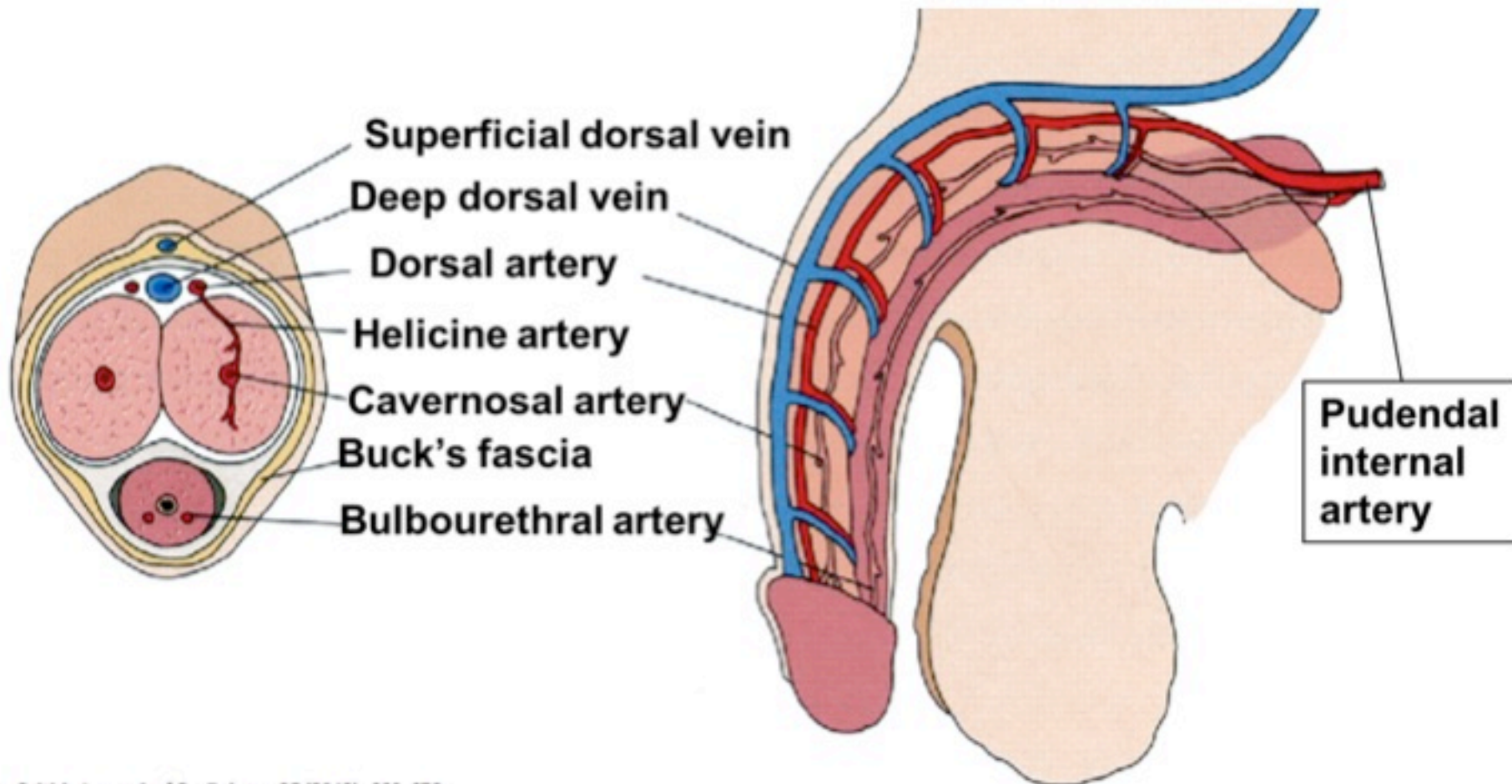


## How to perform PCDU





# Penile anatomy



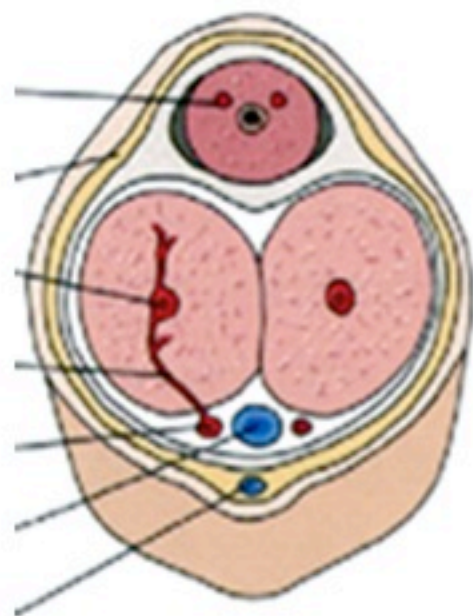
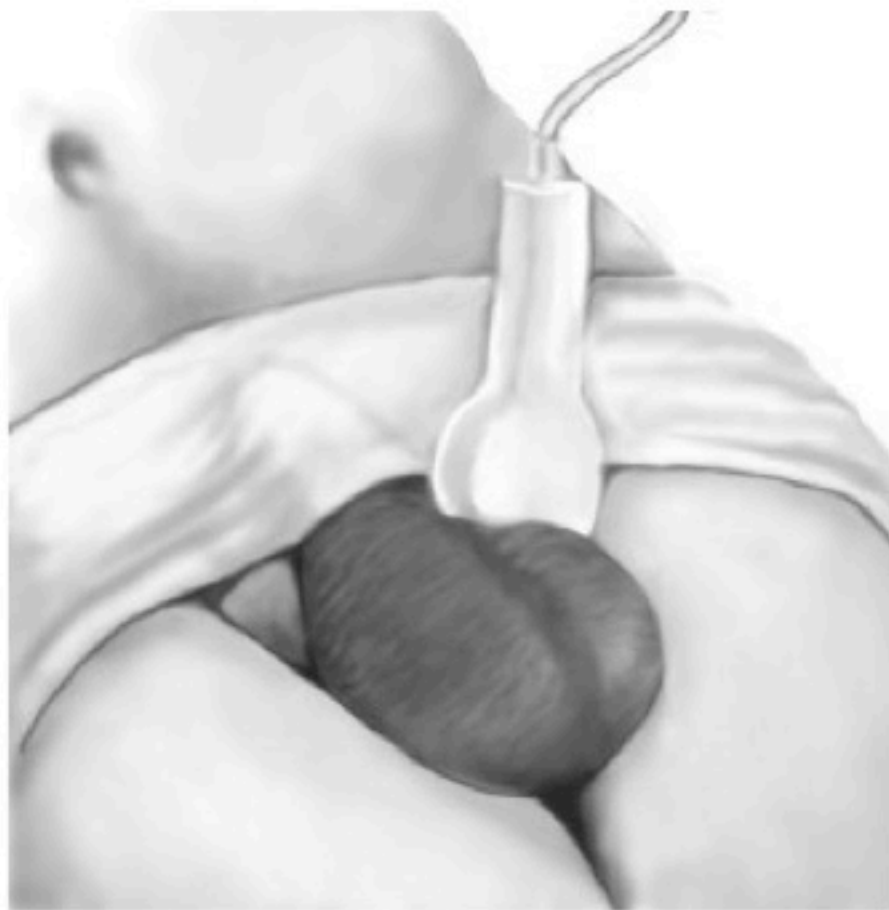
*The British Journal of Radiology*, 85 (2012), 569-578

## Investigation of erectile dysfunction

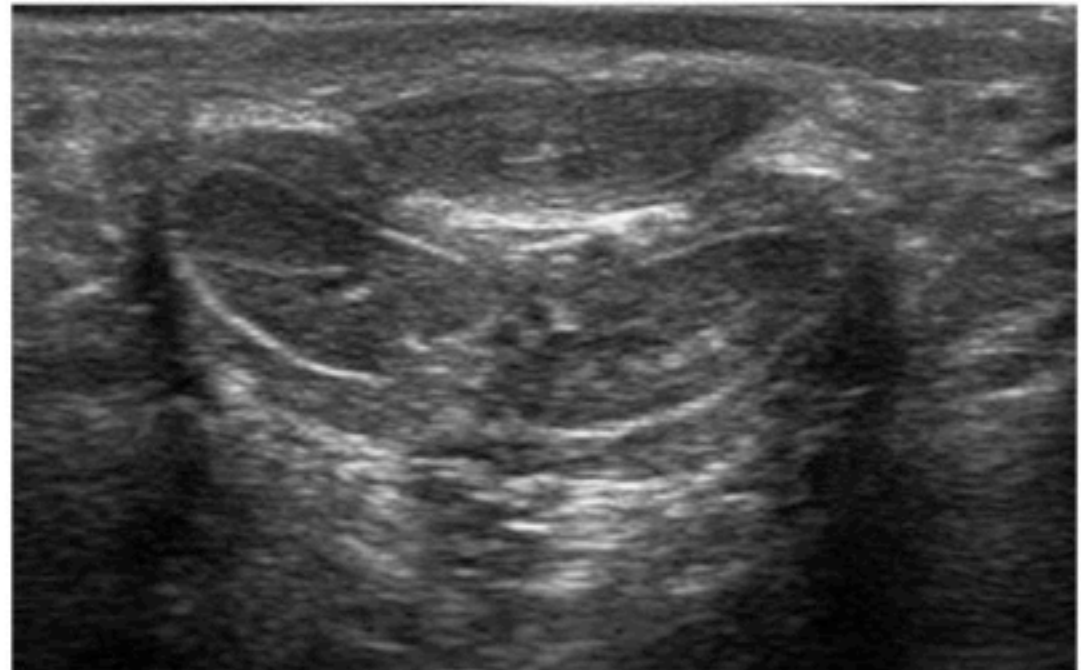
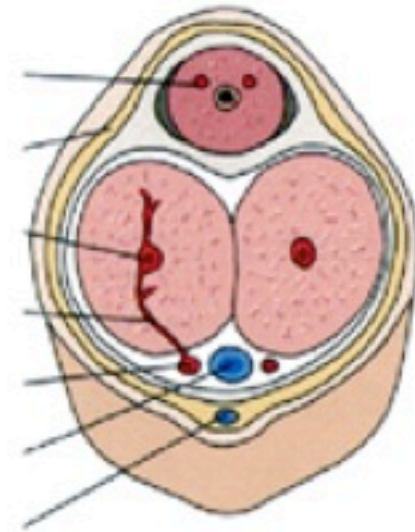
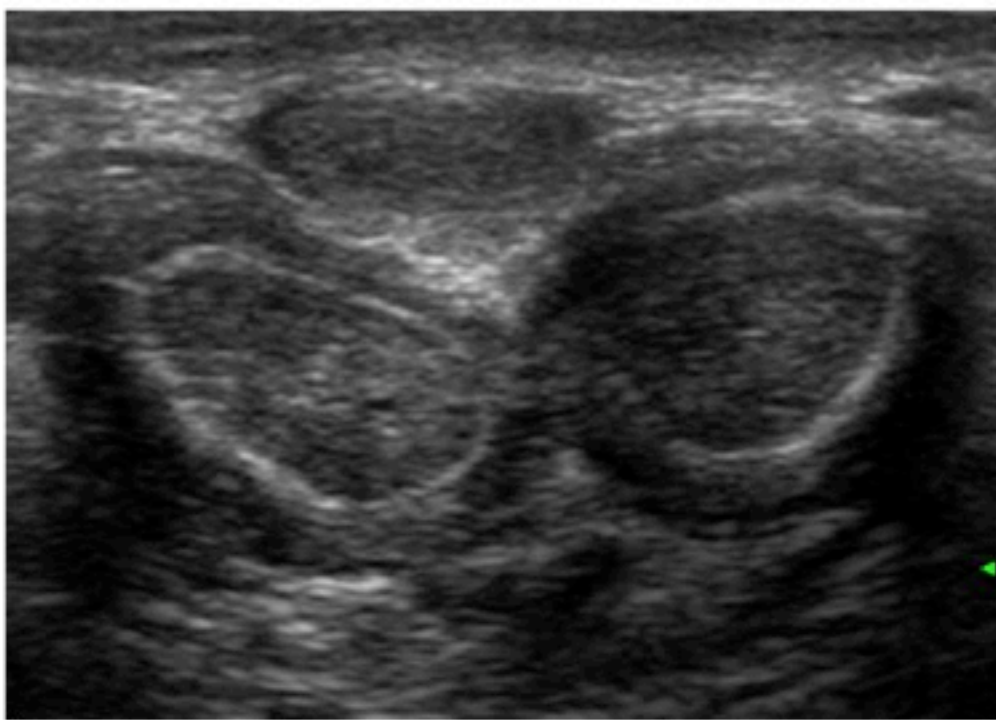
D V PATEL, MB ChB, FRCR, J HALLS, MBBS, FRCR and U PATEL, MB ChB, FRCR

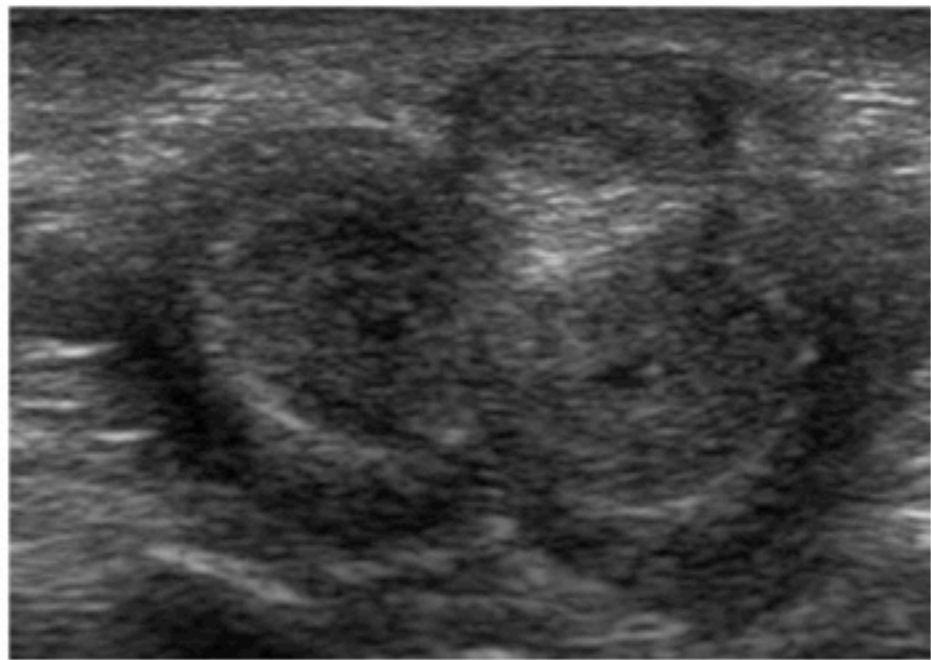
## The Role of Penile Color-Duplex Ultrasound for the Evaluation of Erectile Dysfunction

Antonio Aversa, MD, PhD,\* and Lelio Mario Sarteschi, MD†



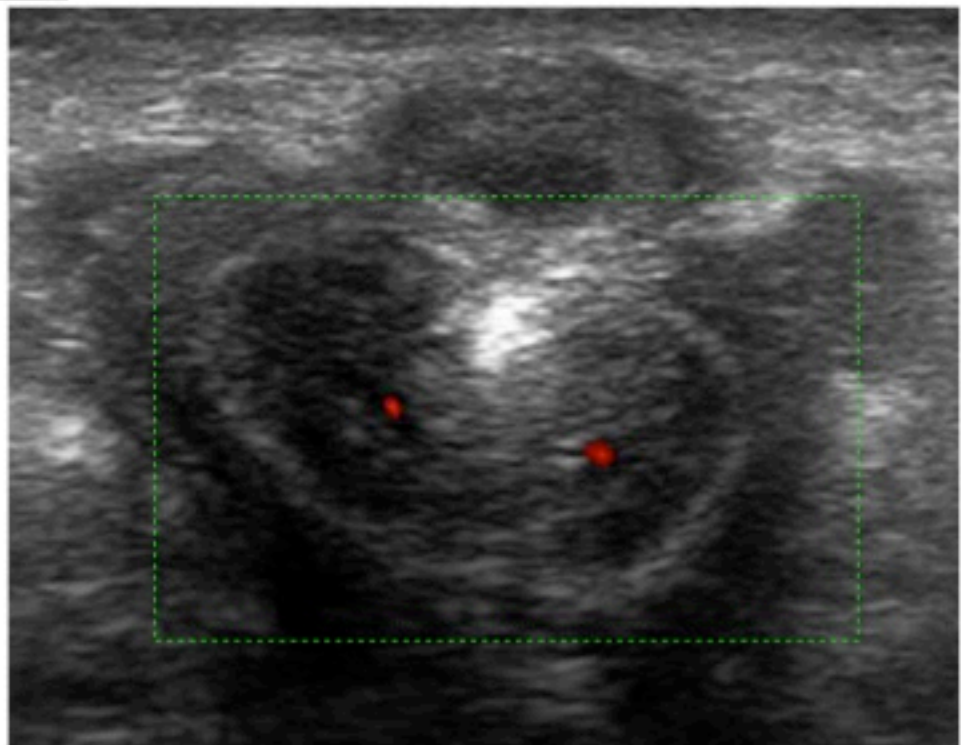
## Trasversal scan





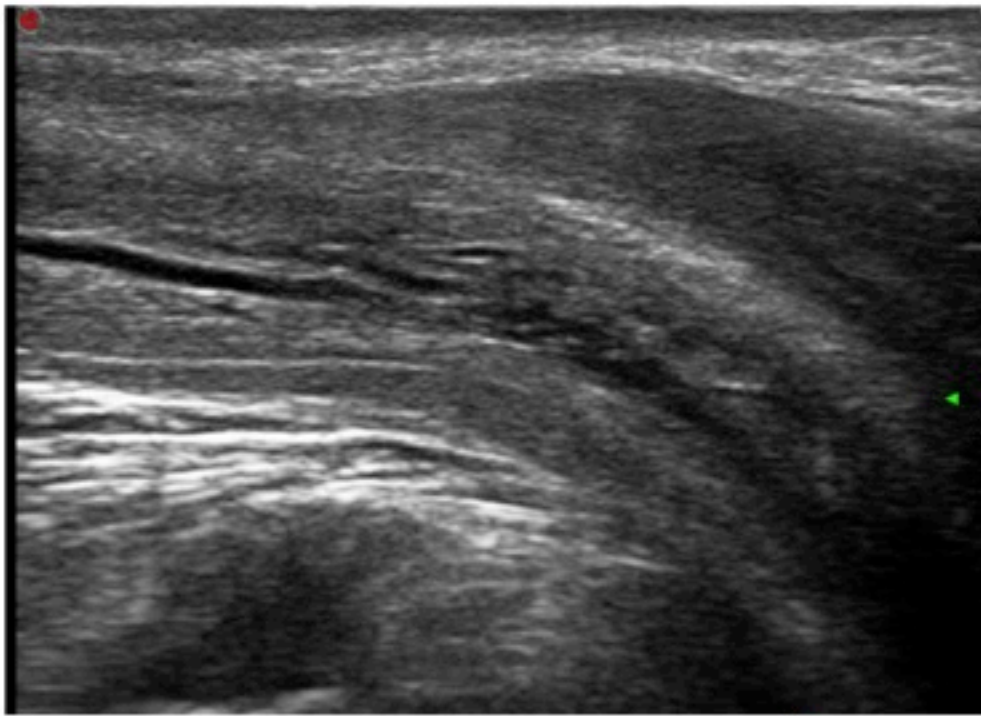
B-mode

Color-Doppler



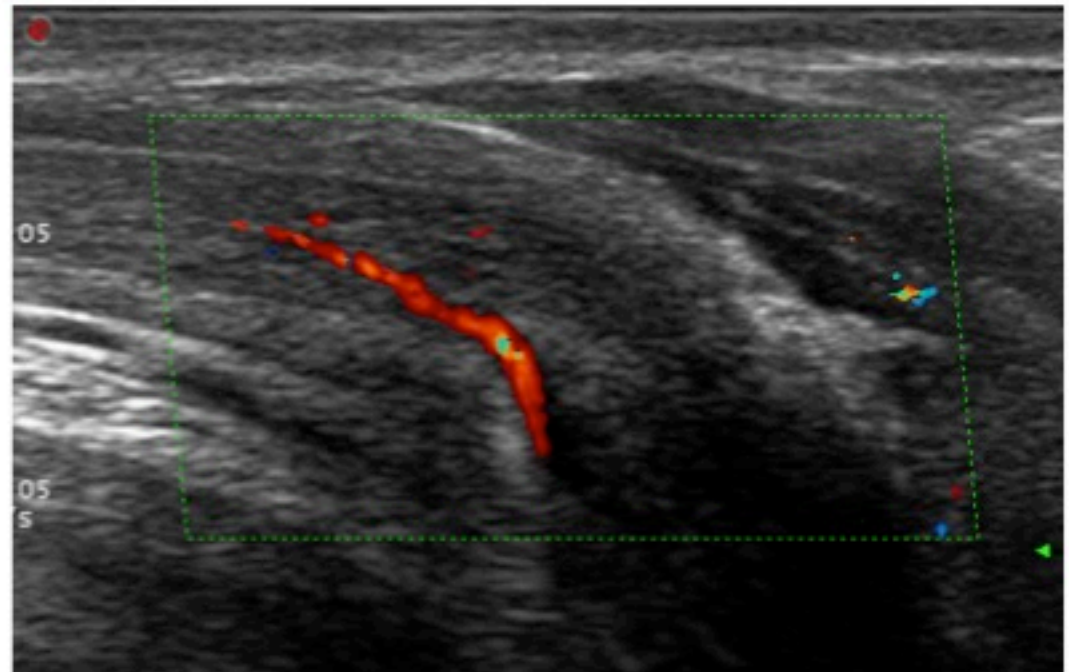


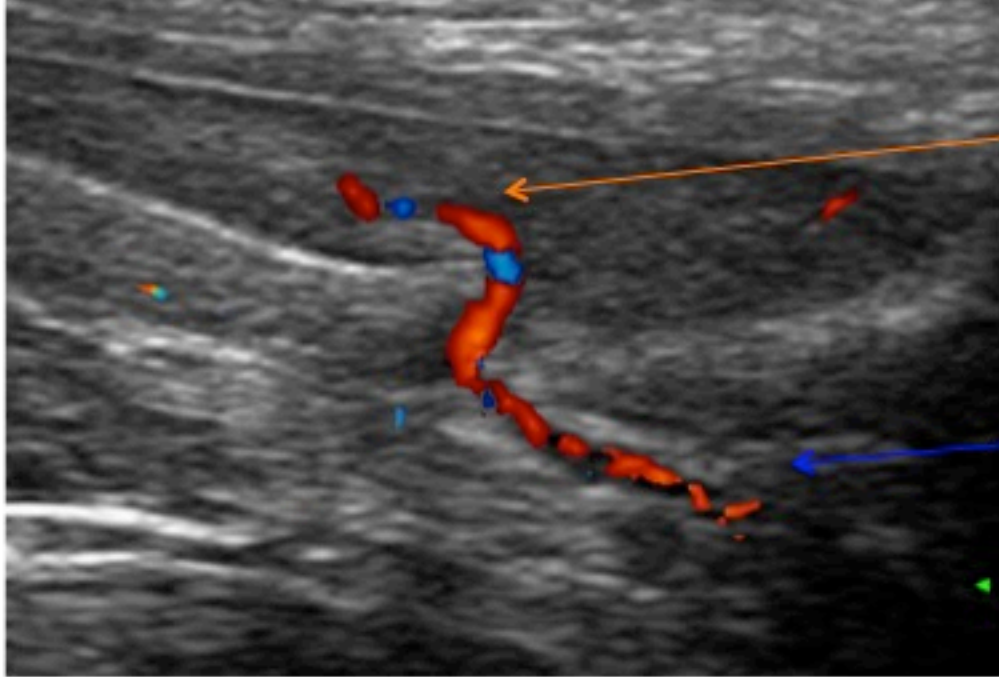
Longitudinal scan



Layers of cavernous artery

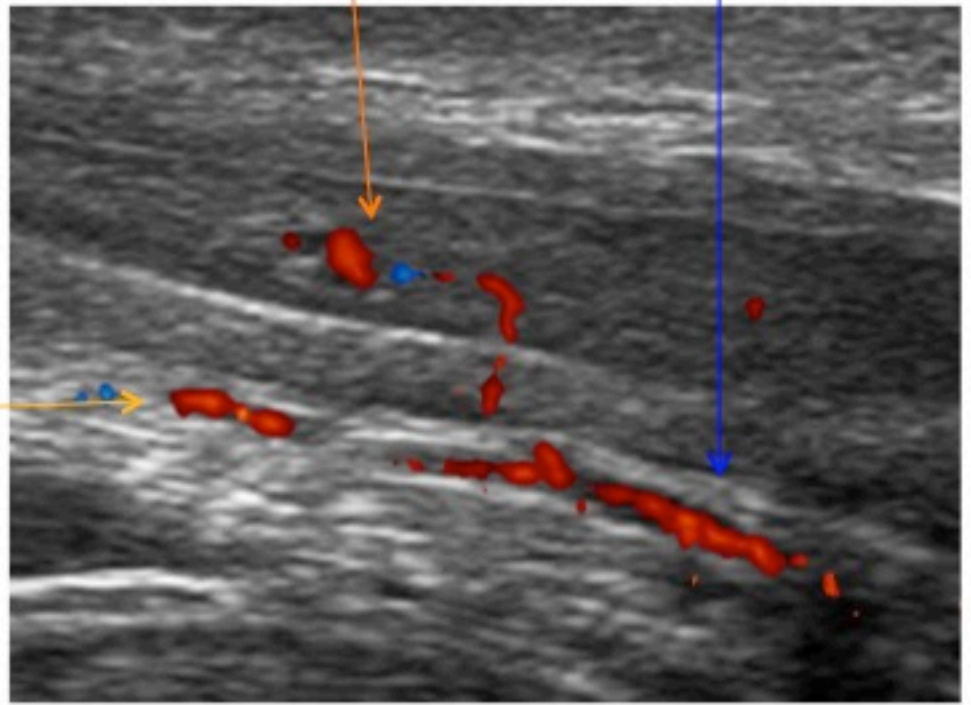
Cavernous artery



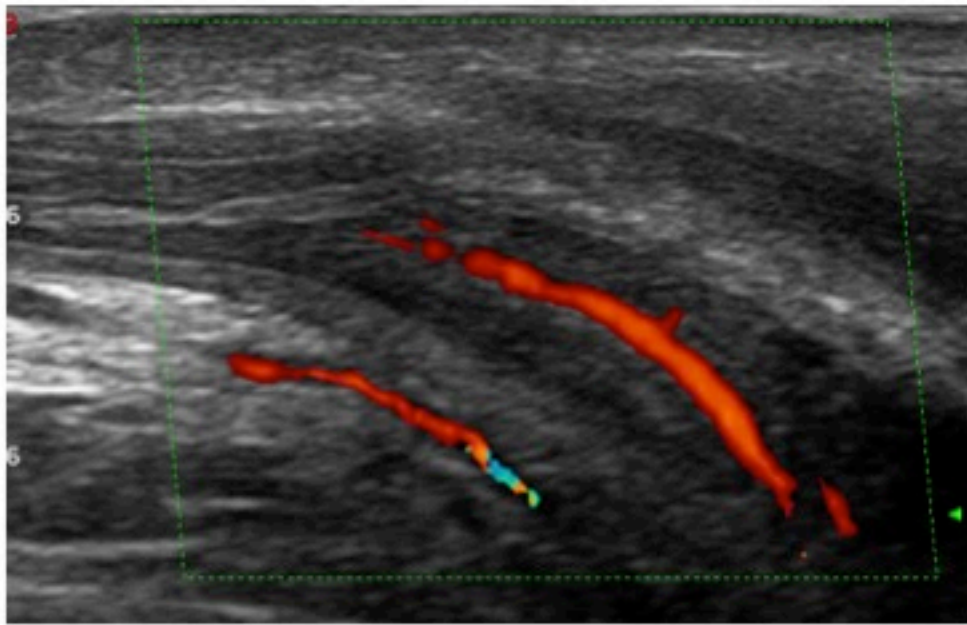


Cavernous artery

Pudendal artery

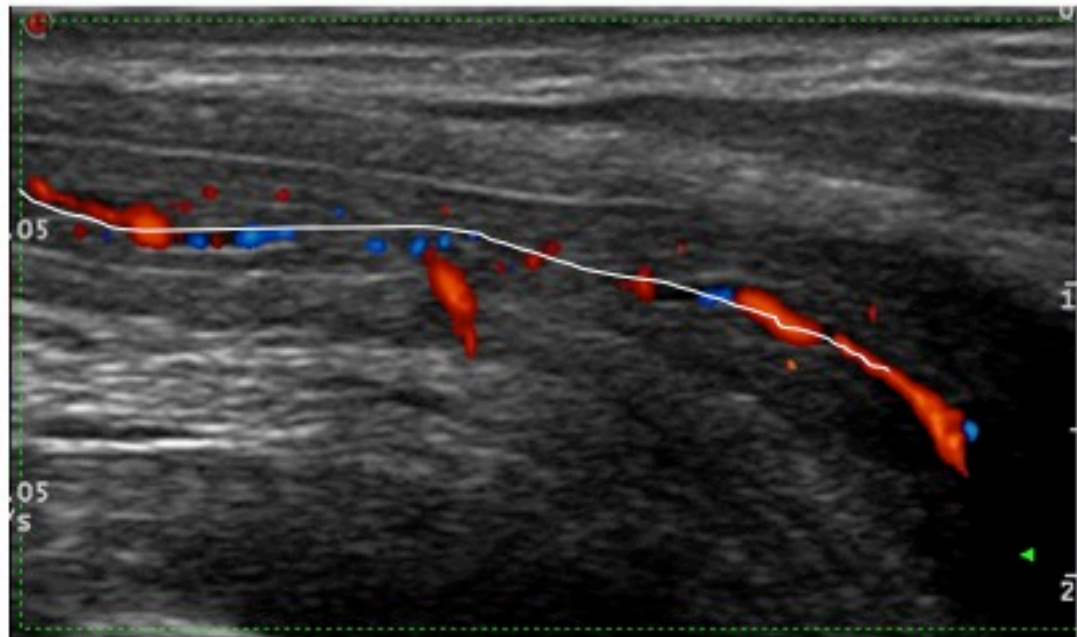


Dorsal artery



Single origin

Double origin



# How to perform PCDU

➤ **Basal**

➤ **Dynamic**

● **standard pharmacostimulation**

**Alprostadil (PGE1) 10 mcg**

● **re-dosing**

**-Trimix (Alprostadil 10 mcg + phentolamine 1 mg + papaverine 30 mg)**

**Risk of prolonged erections or priapism 10% vs 1 %**

**(Seyam et al., Int J Impot Res 2005;17:346-53)**

**-Bimix (Alprostadil 10 mcg + phentolamine 2 mg or chlorpromazine 2.5 mcg)**



# How to perform PCDU

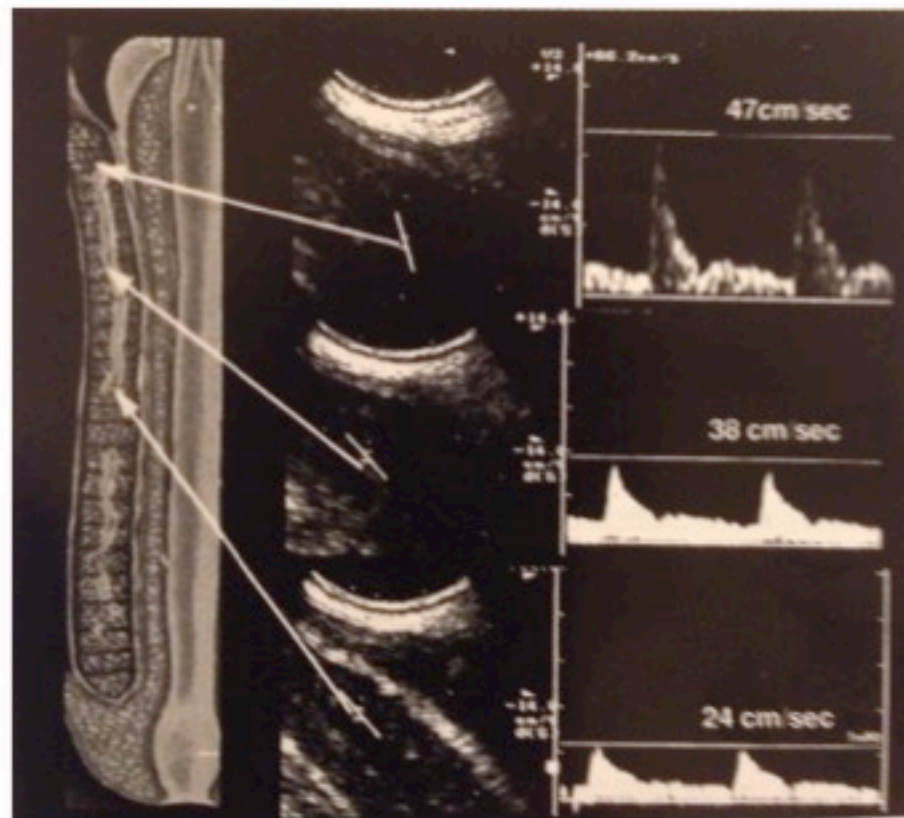
## 1. Position sample volume at the peno-scrotal junction

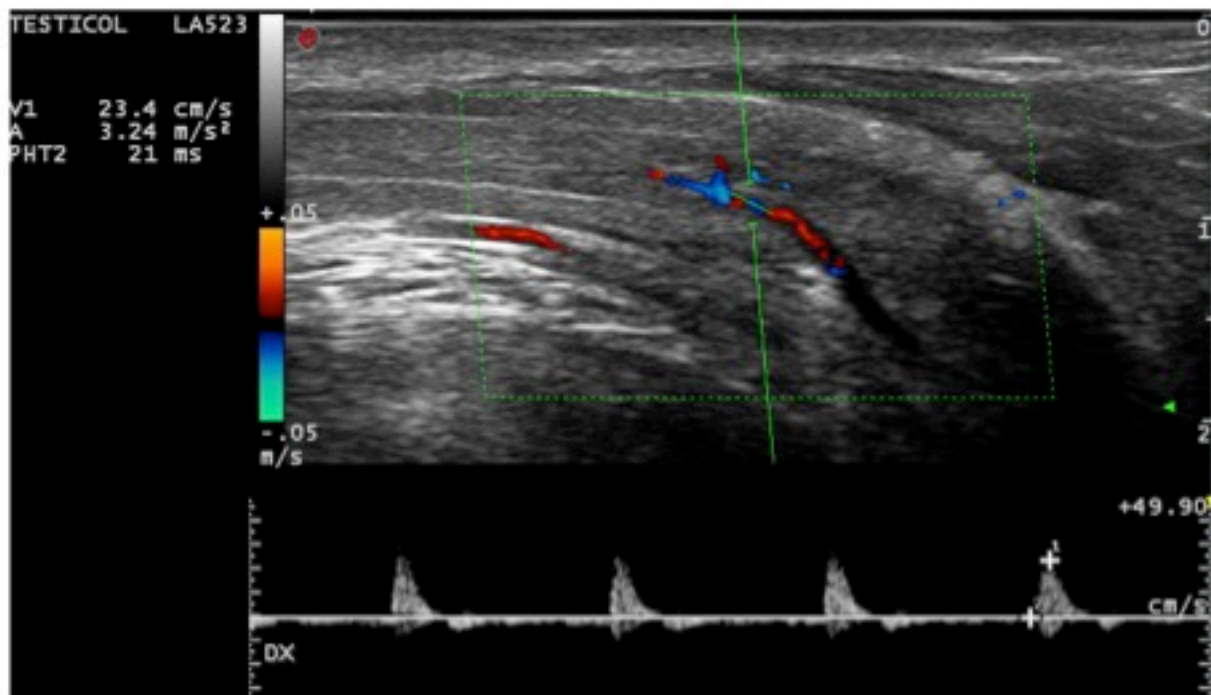
Doppler sonography of deep cavernosal artery of the penis: variation of peak systolic velocity according to sampling location. ☞

S H Kim, J S Paick, S E Lee, B I Choi, K M Yeon and M C Han

J Ultrasound Med. 1994 Aug;13(8):591-4.

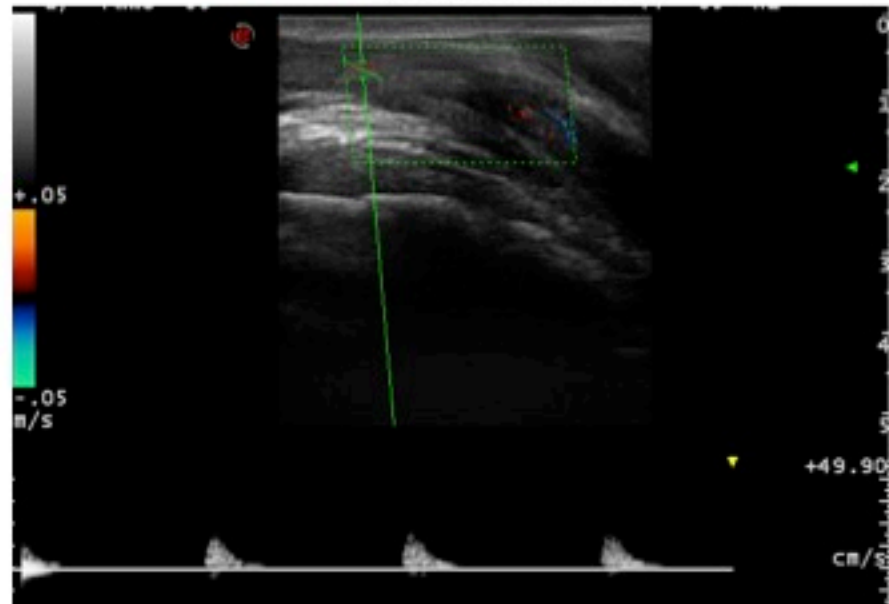
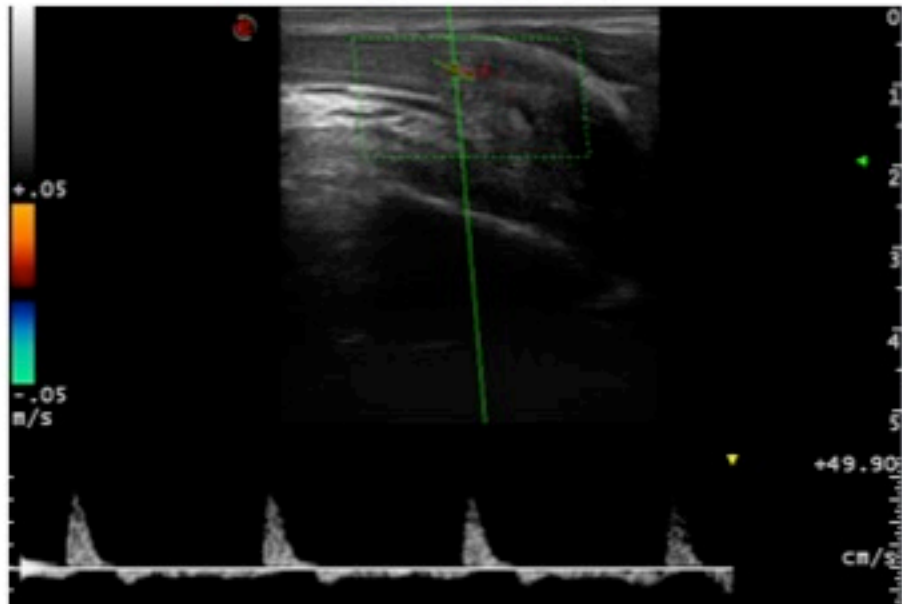
Reduction of peak systolic velocity (PSV) in distal sites, related to increase in intracavernosal pressure





Proximal: OK

Distal: NO

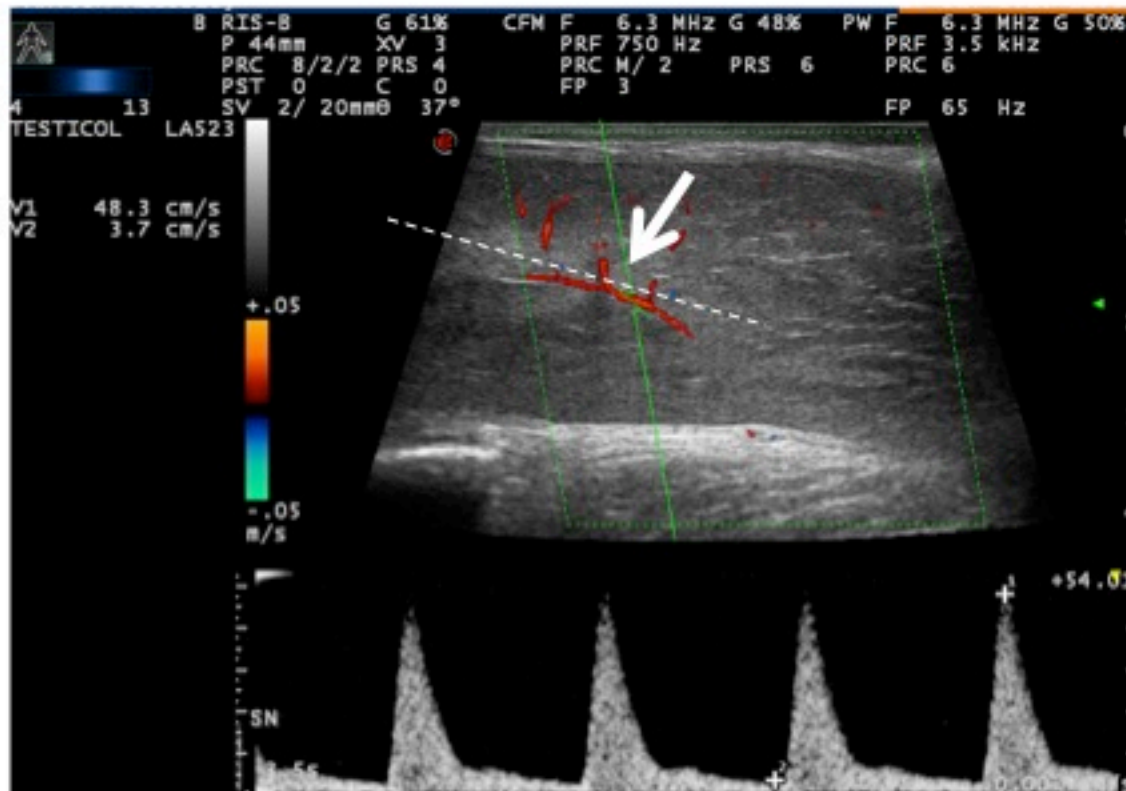


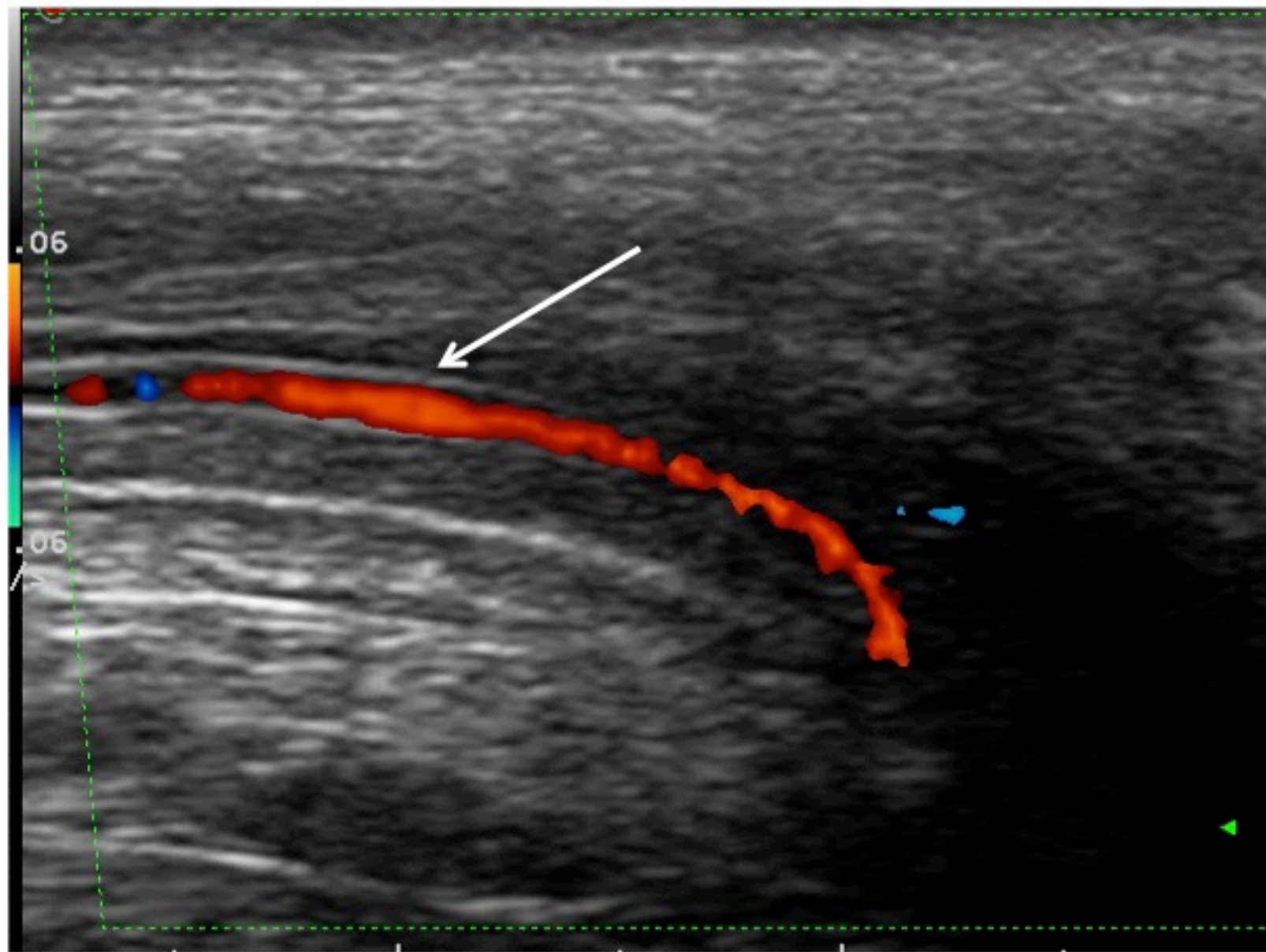
# How to perform PCDU

## 2. Position sample volume according to the flow direction

We suggest to position it in a linear part of the cavernosal artery  
(avoid “corkscrew regions”)

immediately after artery bending in the cavernous body, becoming linear







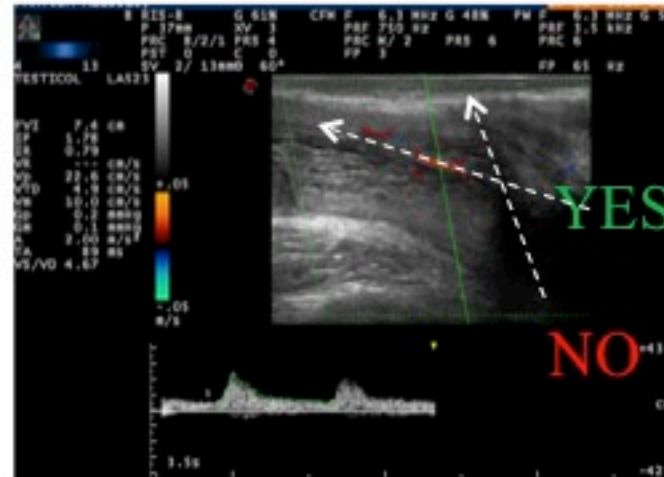
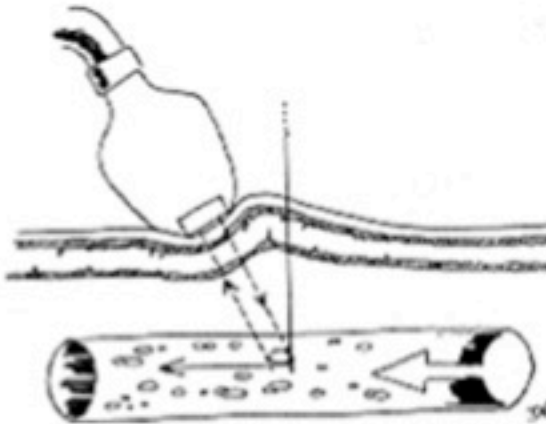
# How to perform PCDU

3. Verify sampling main penile artery  
(Avoid dorsal artery or ramifications)

Kim et al., J Ultrasound Med 1994; 13:591-4)

4. Angle of insonation  $> 40$  and  $< 60$  °

Jarow et al., Invest Radiol 1993;28:806-10  
Gill, Ultrasound Med Biol 1985; 11:625-41



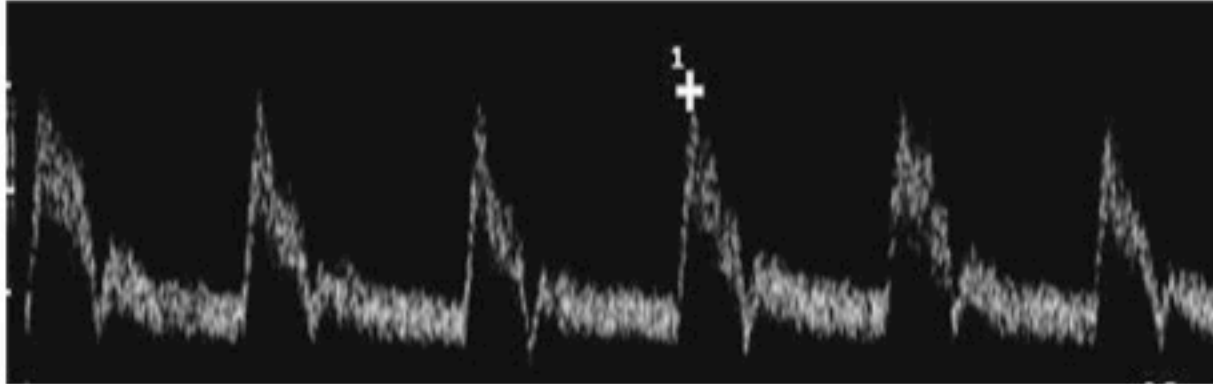
5. Monitor PSV for at least 20 minutes  
-Highest PSV after 5 minutes  
-22%  $\rightarrow$  1-18 minutes

Gill, Ultrasound Med Biol 1985; 11:625-41

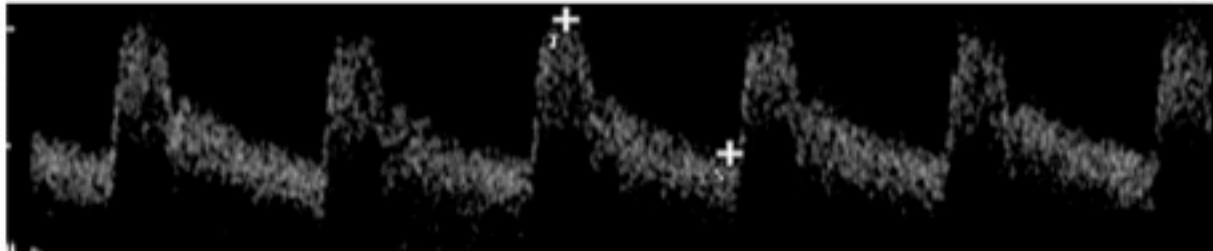
6. Avoid anxiety  $\rightarrow$  false positive

## Qualitative analysis

High resistance vessels → rest muscles (es. PCDU basale)



Low resistance vessels → afferent cerebral vessels and parenchymal organs



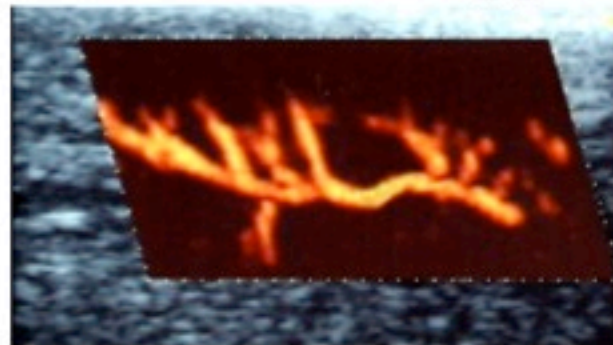
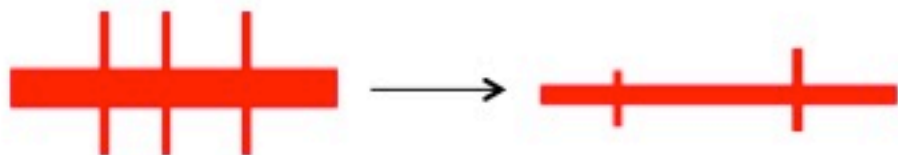
# Qualitative analysis

## 1. Evaluation of cavernosal arterial diameter

At rest 0.3-0.7 mm → After PGE1: 1 mm (Wahl et al., Int J Impot Res, 1997)

## 2. Evaluation of cavernosal artery ramifications with Power-Doppler

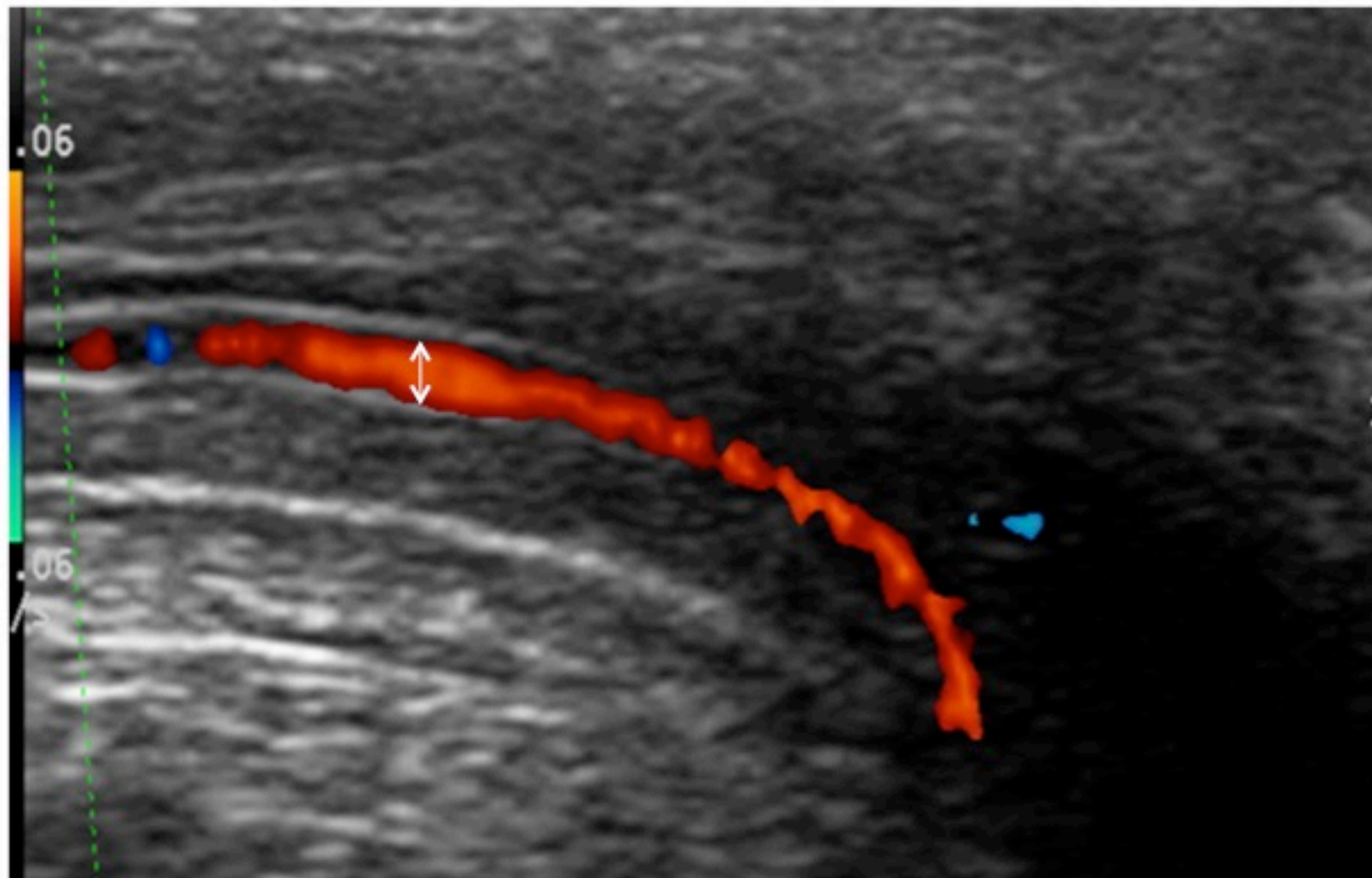
Ramification reduction: diffuse arteriolar damage



## 3. Red → blue colour shift in transversal scan

## 4. Evaluation of dynamic PCDU phases

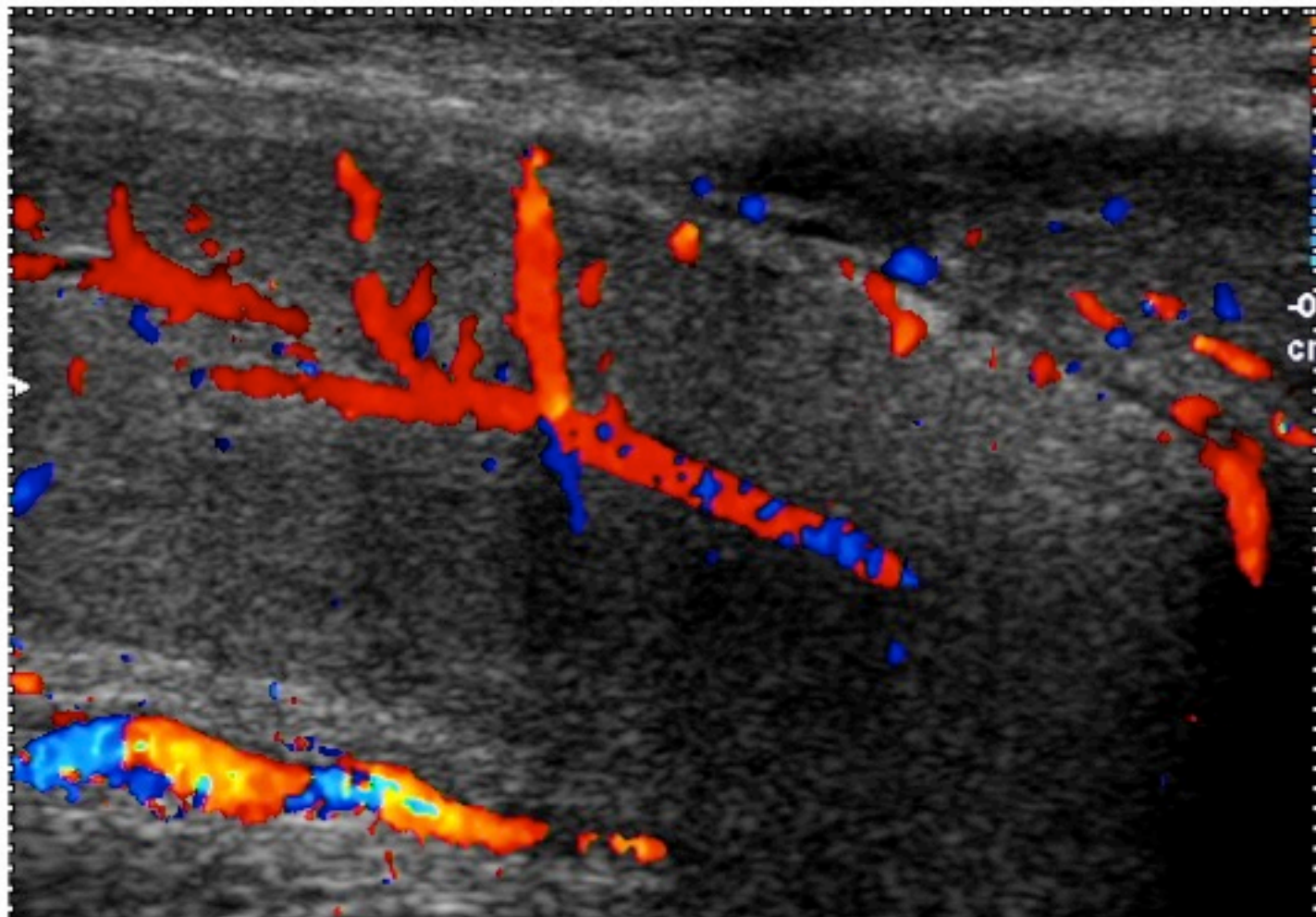
## 1.Evaluation of cavernosal arterial diameter



Reduction in CV diseases; small dilation after PGE1

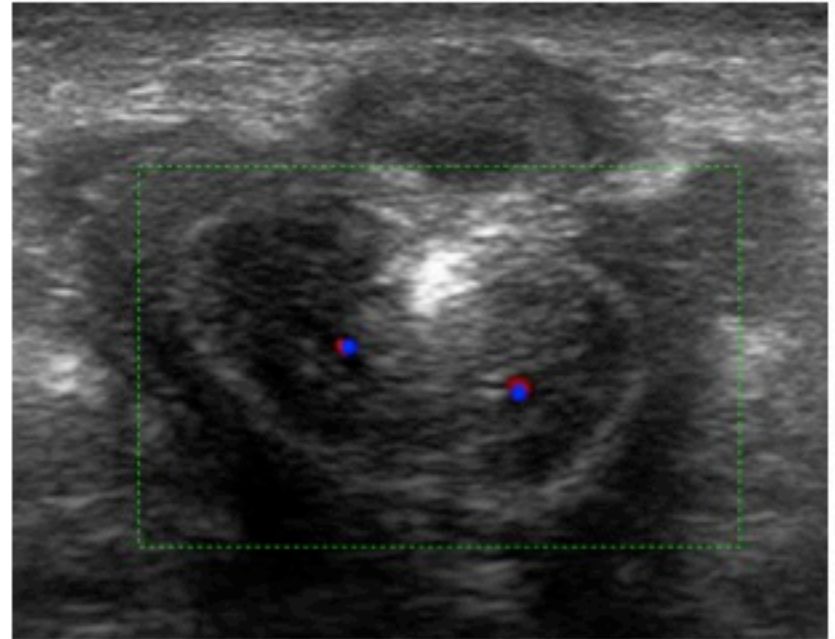
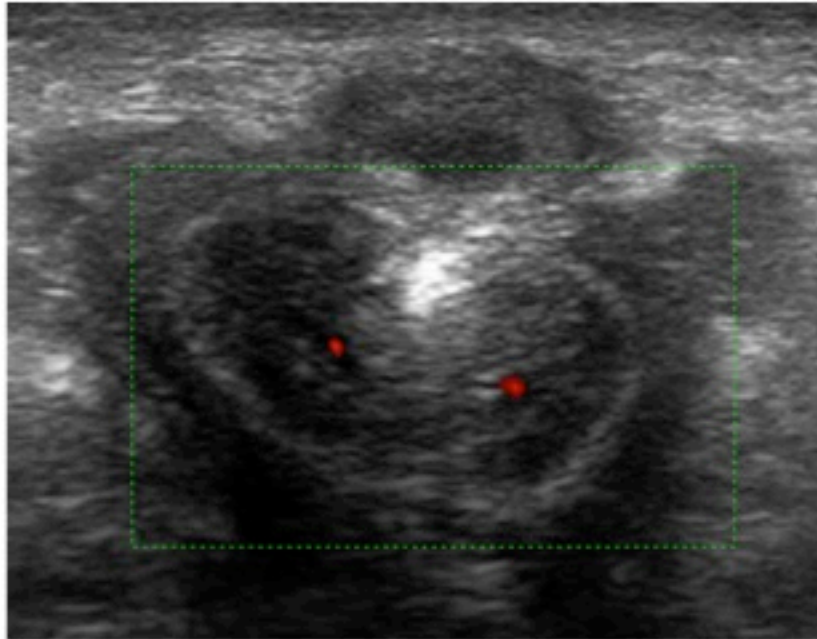


## 2.Evaluation of cavernosal artery ramifications



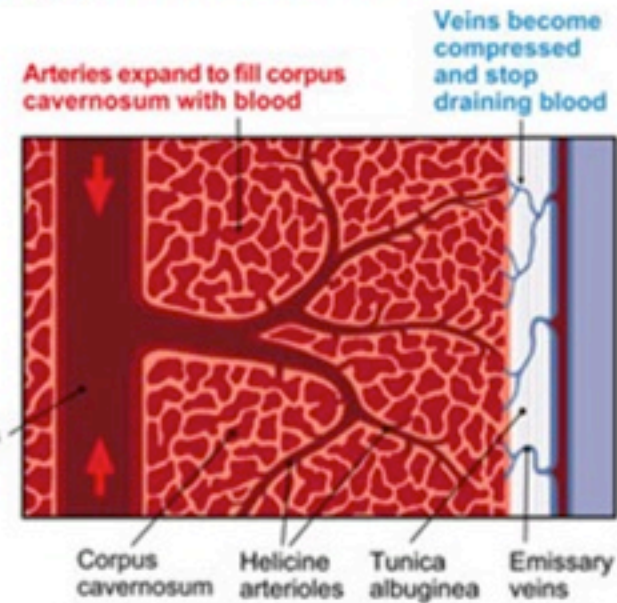
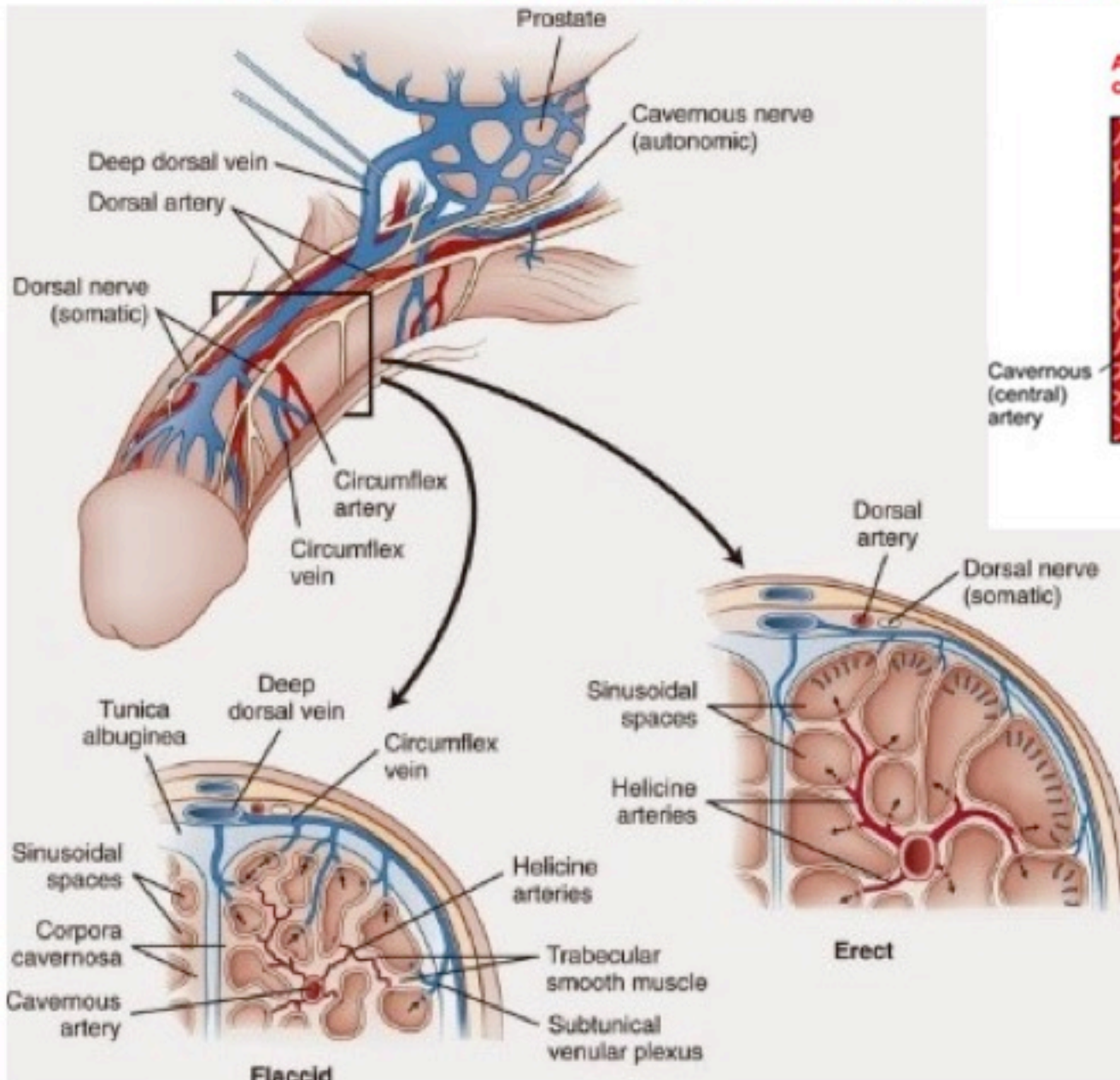
Reduction in CV diseases (e.g. diabetes)

### 3.Red →blue color shift



**Diastolic phase longer than systolic:  
After PGE1, when PSV increases and EDV decreases:  
apparent inversion of flow**

# 4. Dynamic PCDU phases: physiology of erection





# Dynamic PCDU phases

- Patel et al., BJR, 2012
- Aversa & Sarteschi, J Sex Med, 2006

1. At rest

-High resistance

(smooth muscle contraction)

-intracavernosal pressure (IP)

17-25 mmHg

2. After PGE1

-Decreasing resistance

(smooth muscle relaxation and vascular dilation)

-Increasing IP and veno-occlusive mechanism

IP ↑, << PAD

25-40 mmHg

IP ↑↑, < PAD

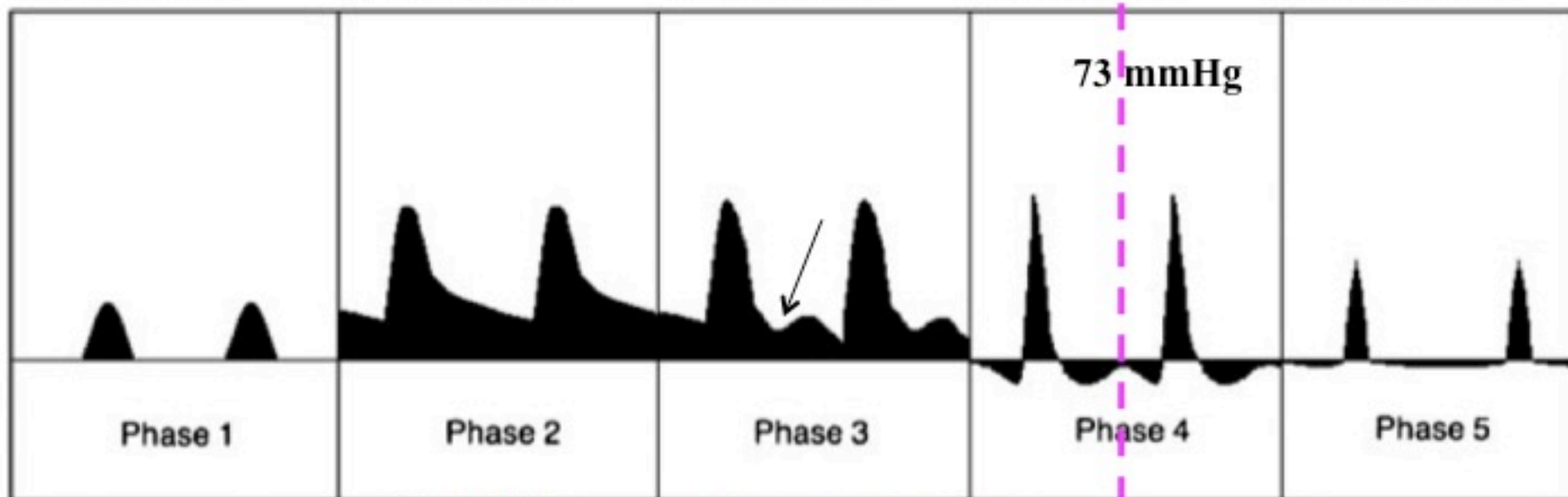
43-63 mmHg

IP > PAD

63-83 mmHg

IP > PAS

83-105 mmHg



-Turgidity

-Rigidity

→ priapism

PGE1 ↑

-Erections

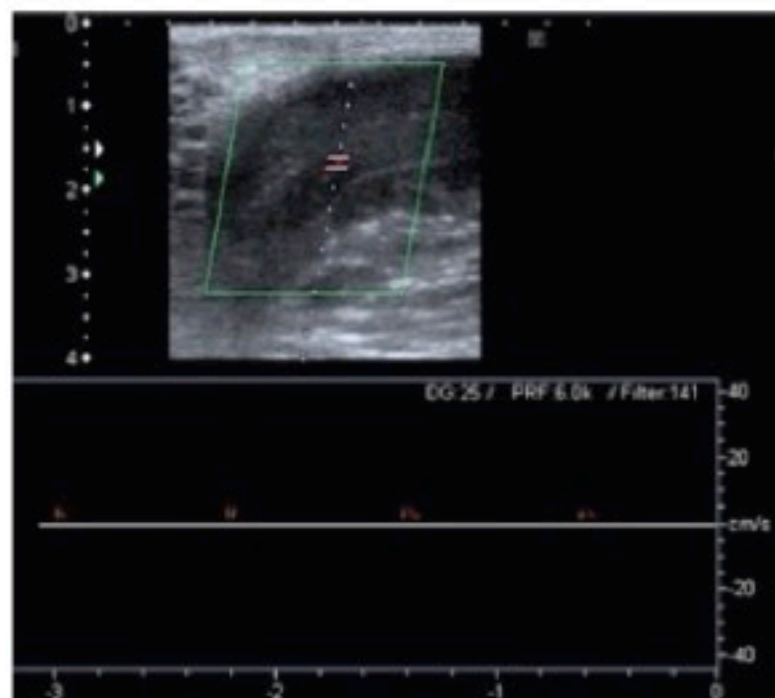
incomplete

complete

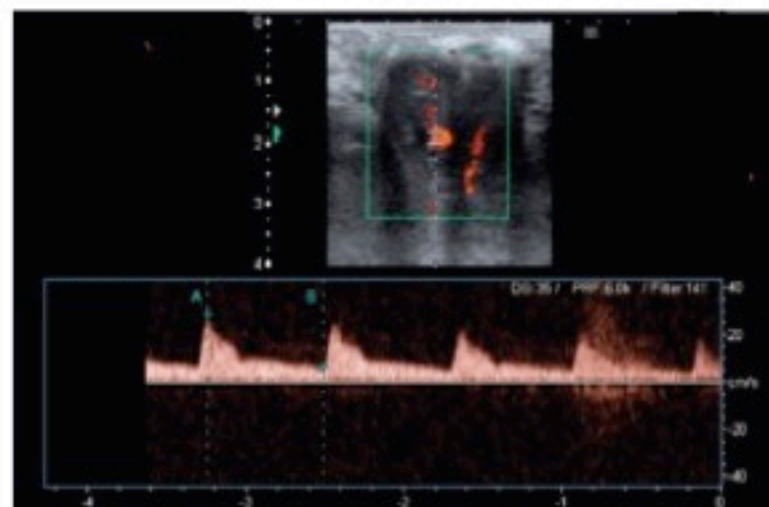


## Investigation of erectile dysfunction

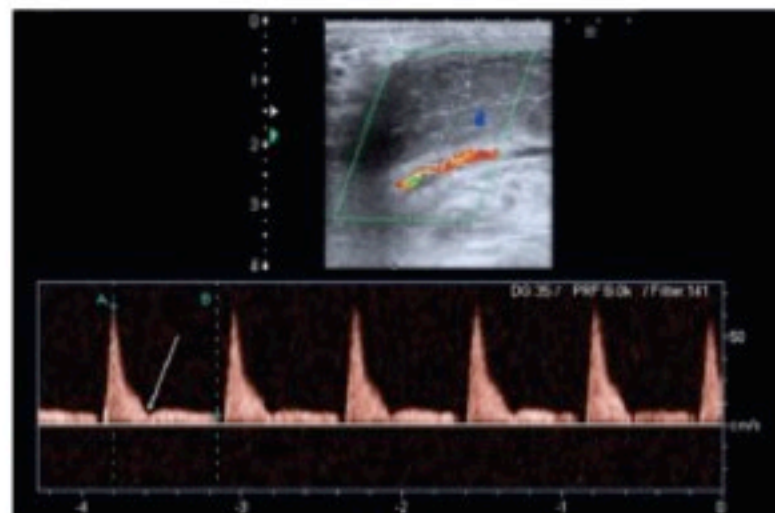
D V PATEL, MB ChB, FRCR, J HALLS, MBBS, FRCR and U PATEL, MB ChB, FRCR



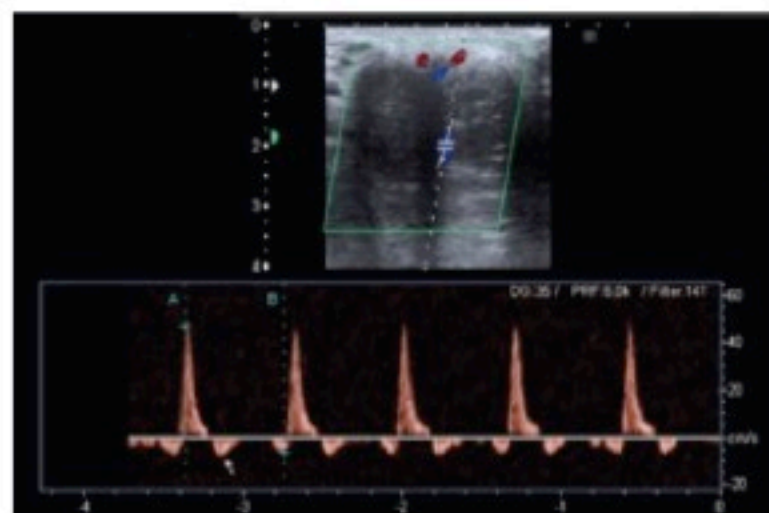
(a)



(b)



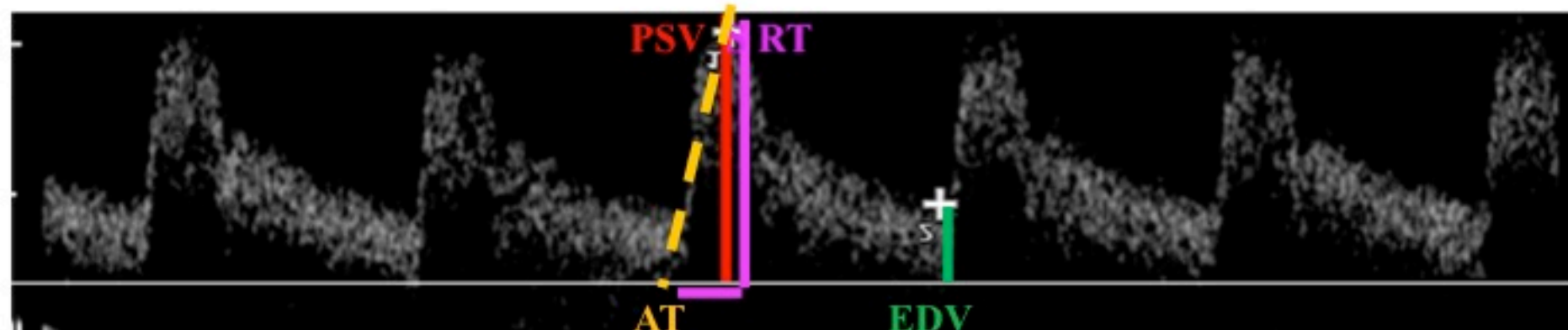
(c)



(d)

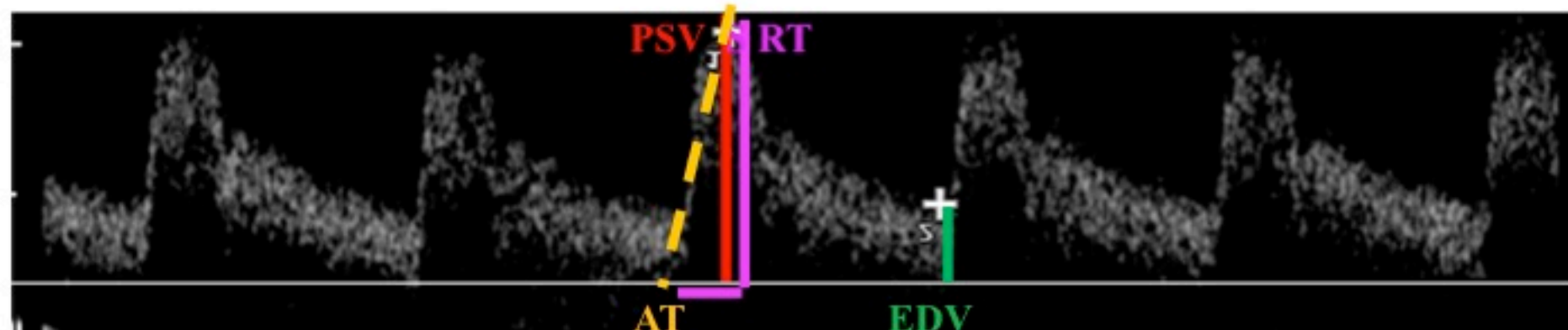
## Quantitative analysis

- Peak systolic velocity (PSV)
- End diastolic velocity (EDV)
- Systolic rise time (SRT)
- Acceleration time (AT)       $PSV-EDV/SRT$
- Resistance Index (RI)       $PSV-EDV/PSV$



# Quantitative analysis

- **Peak systolic velocity (PSV)**
- **End diastolic velocity (EDV)**
- **Systolic rise time (SRT)**
- **Acceleration time (AT)**       **$PSV-EDV/SRT$**
- **Resistance Index (RI)**       **$PSV-EDV/PSV$**



# Quantitative analysis

- **Peak systolic velocity (PSV)**

- > **35 cm/s normal arterial flow** (Wahl et al., Int J Impot Res, 1997)

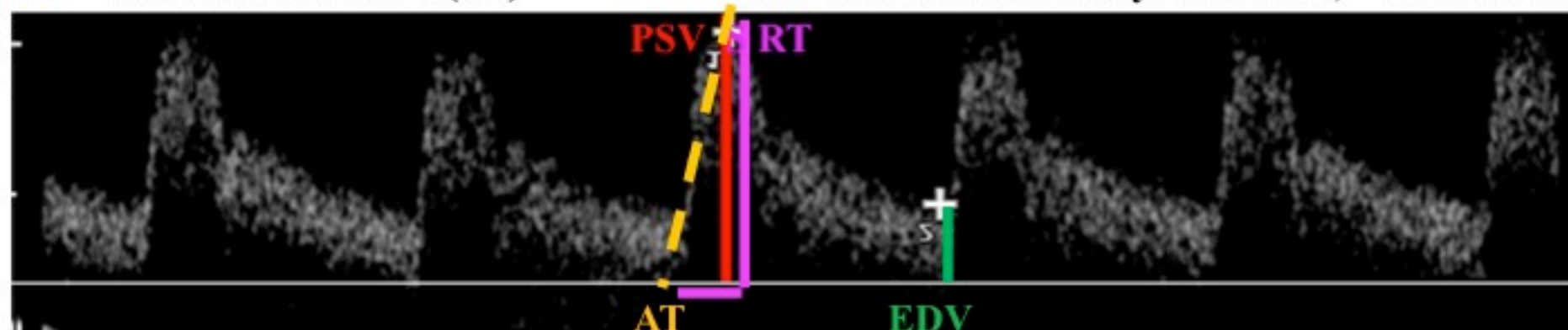
- < **25 cm/s severe arterial insufficiency** (Cornud et al., BJU Int, 2000)  
(Benson et al., AJM Am J Roent, 1993)

- **End diastolic velocity (EDV)** > **5 cm/s veno-occlusive dysfunction**

- **Systolic rise time (SRT)** > **110 msec: arteriopathy** (Oates et al., J Urol, 1995)

- **Acceleration time (AT)**

- **Resistance Index (RI)** < **0.75 veno-occlusive dysfunction; > 0.90 normal**





# Dynamic PCDU: PSV and CV risk

## Male Sexuality and Cardiovascular Risk. A Cohort Study in Patients with Erectile Dysfunction

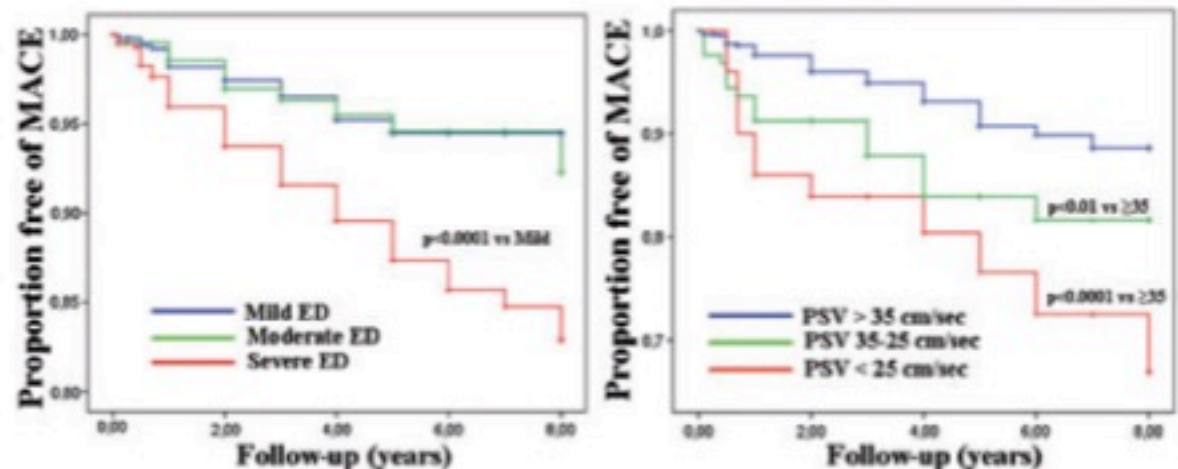
J Sex Med 2010;7:1918–1927

Giovanni Corona, MD,<sup>98</sup> Matteo Monami, MD,<sup>19</sup> Valentina Boddi,<sup>\*</sup> Michela Cameron-Smith, MD,<sup>\*</sup> Francesco Lotti, MD,<sup>\*</sup> Giulia de Vita, MD,<sup>\*</sup> Cecilia Melani, MD,<sup>2</sup> Daniela Balzi, MD,<sup>\*</sup> Alessandra Sforza, MD,<sup>5</sup> Gianni Forti, MD,<sup>\*</sup> Edoardo Mannucci, MD,<sup>1</sup> and Mario Maggi, MD<sup>\*</sup>

N = 1687 consulting for ED (age  $52.9 \pm 12.8$  years)

During a mean follow-up of  $4.3 \pm 2.6$  years, 139 MACE observed, 15 of which were fatal

**Figure 4** Risk of incident major cardiovascular events (MACE) as derived from Kaplan Mayer curves, according to erectile dysfunction (ED) severity (difficulties in achieving an erection sufficient for penetration in <50%, mild ED; 50–75%, moderate ED, and >75%, severe ED; see ref. [1]) or to different degrees of penile vascular insufficiency (dynamic peak systolic velocity PSV, >35, 35–25 or < 25 cm/second).



### 2.2.3.2 *Intracavernous injection test*

The intracavernous injection test gives limited information about vascular status. A positive test is a rigid erectile response (unable to bend the penis) that appears within 10 min after the intracavernous injection and lasts for 30 min (21). This response indicates a functional, but not necessarily normal, erection, and the erection may coexist with arterial insufficiency and/or veno-occlusive dysfunction (22). A positive test shows that a patient will respond to the intracavernous injection programme. The test is inconclusive as a diagnostic procedure and duplex Doppler study of the penis should be requested, if clinically warranted.

### 2.2.3.3 *Duplex ultrasound of the penis*

A peak systolic blood flow > 30 cm/s, an end-diastolic velocity of < 3 cm/s and a resistance index > 0.8 are generally considered normal (21). Further vascular investigation is unnecessary when a Duplex examination is normal.

# Veno-occlusive dysfunction

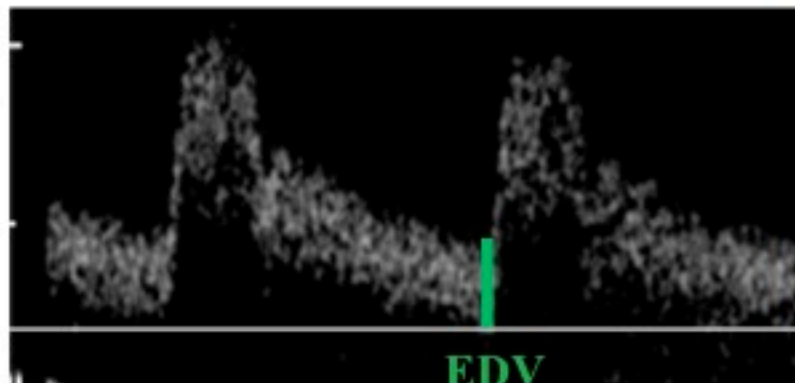
Failure of adequate venous occlusion

End diastolic velocity (EDV)  $> 5$  cm/s

**Limitation:** lack of specificity for venous leakage in presence of arterial insufficiency

Causes:

- Tunica albuginea degenerative changes (Peyronie's disease, diabetes, old age)
- Traumatic injury (penile fracture)
- Structural alterations in the fibroelastic components of the trabeculae, cavernous smooth muscle, and endothelium
- Acquired venous shunts (correction of priapism)
- Anxiety



NIH Public Access

Author Manuscript

*Urol Clin North Am.* Author manuscript; available in PMC 2006 January 25.

Published in final edited form as:

*Urol Clin North Am.* 2005 November ; 32(4): 379-v.

Physiology of Penile Erection and Pathophysiology of Erectile Dysfunction

Robert C. Dean, MD<sup>a</sup> and Tom F. Lue, MD<sup>b</sup>

# Basal PCDU

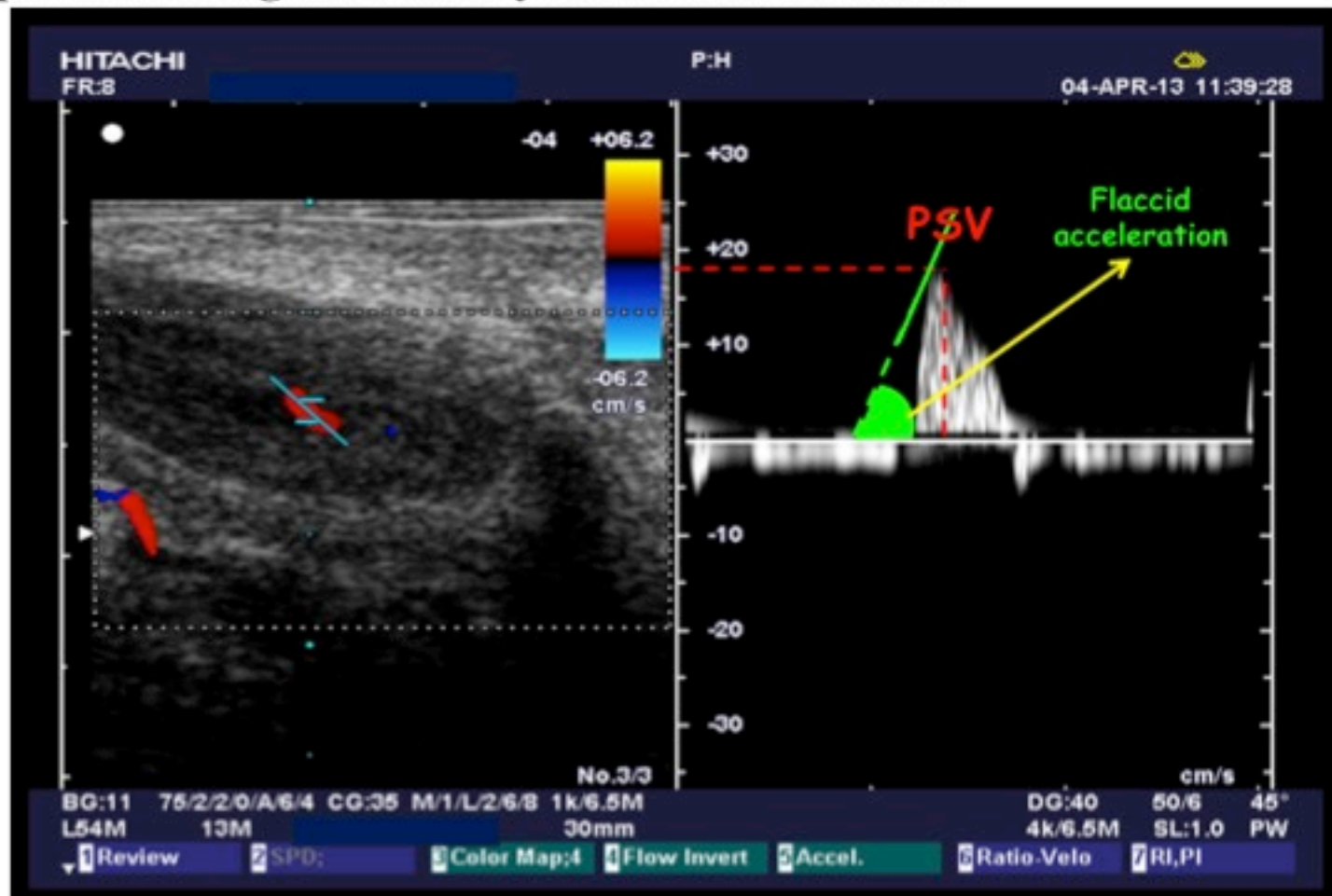


# Basal PCDU

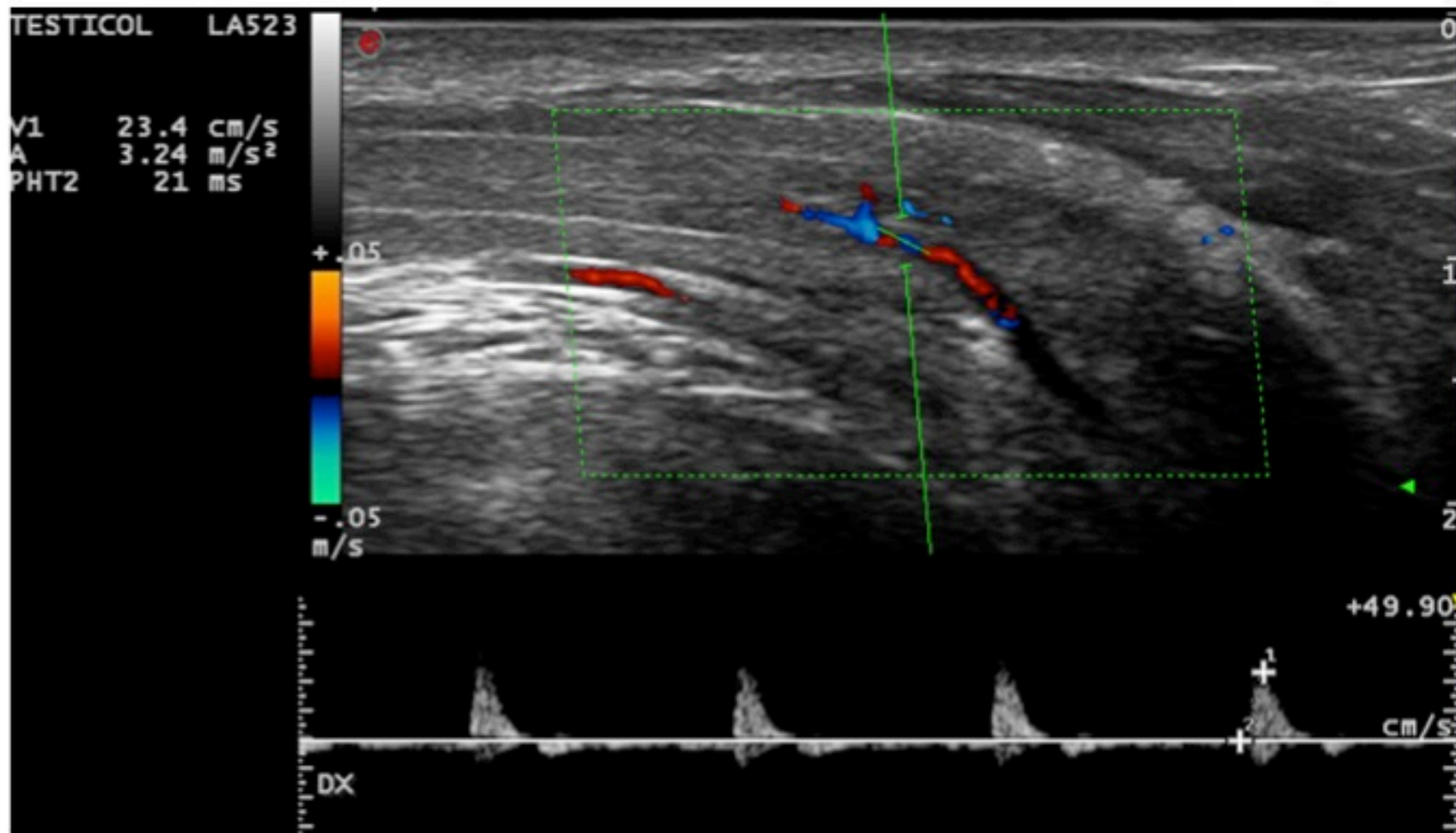
## Relevant parameters

- Flaccid peak systolic velocity (PSV)
- Flaccid acceleration  $([PSV - EDV]/SRT, m/s^2)$

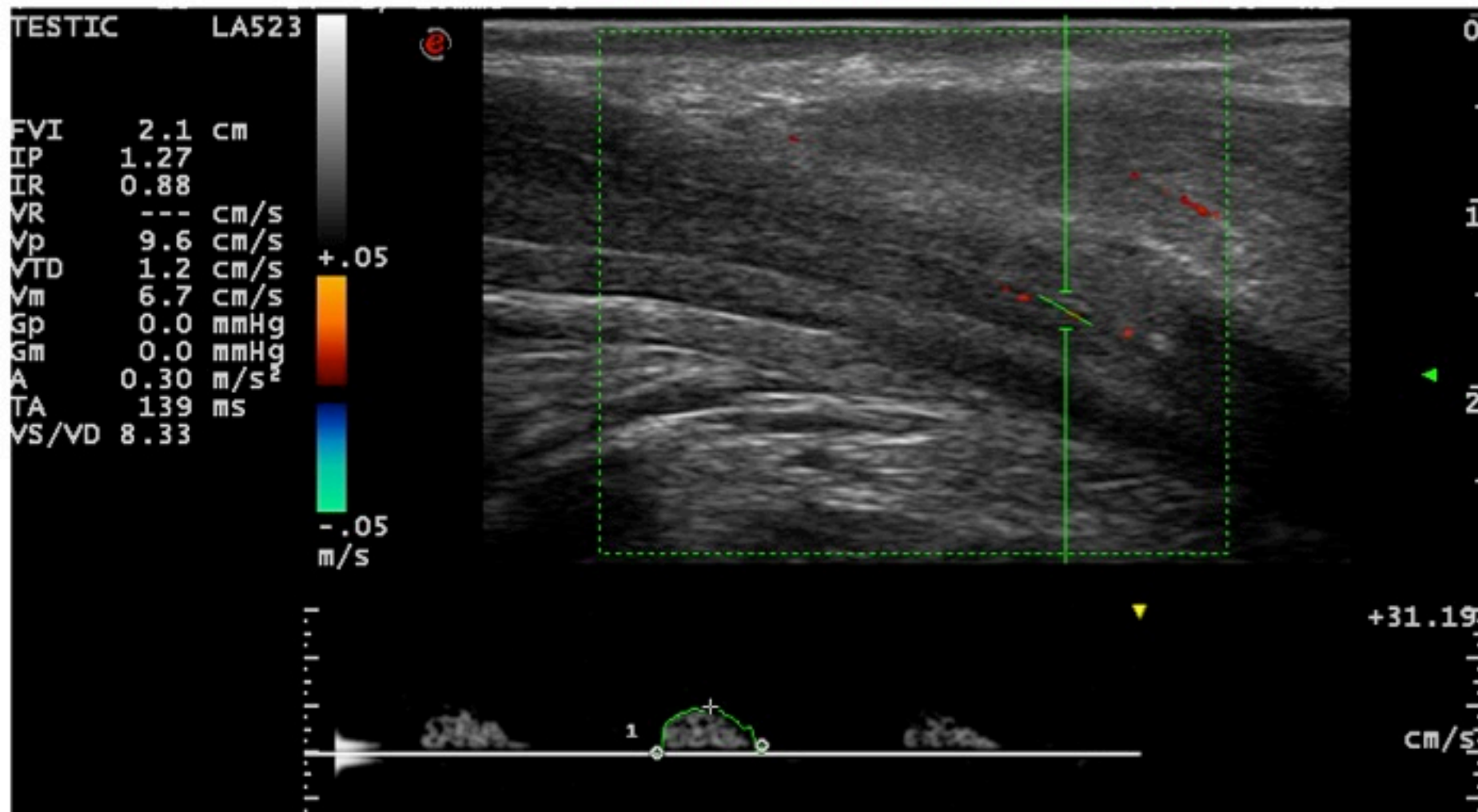
The slope of the tangent of the systolic rise waveform



# Basal PCDU: normal morphology “mountain”



# Basal PCDU: abnormal morphology “hill”



# Basal PCDU: peak systolic velocity (PSV)

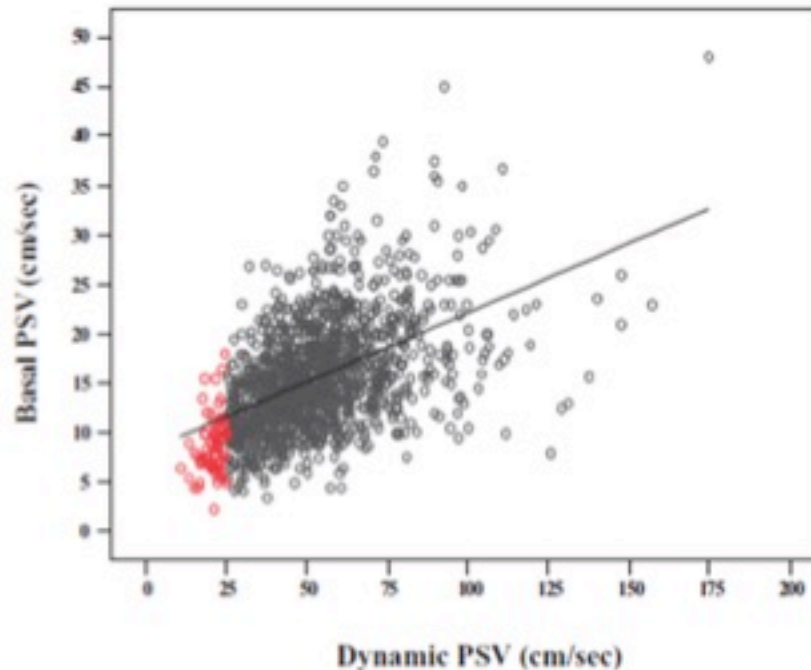
Penile Doppler Ultrasound in Patients with Erectile Dysfunction (ED): Role of Peak Systolic Velocity Measured in the Flaccid State in Predicting Arteriogenic ED and Silent Coronary Artery Disease

Giovanni Corona, MD,<sup>1\*</sup> Giorgio Fagioli, MD,<sup>2</sup> Edoardo Mannucci, MD,<sup>3</sup> Annalina Romeo, MD,<sup>2</sup> Massimiliano Rossi, MD,<sup>2</sup> Francesco Lotti, MD,<sup>4\*</sup> Alessandra Sforza, MD,<sup>7</sup> Stefano Morittu, MD,<sup>7</sup> Valerio Chiarini, MD,<sup>1</sup> Gianni Casella, MD,<sup>5</sup> Giuseppe Di Pasquale, MD,<sup>5</sup> Elisa Bandini, MD,<sup>6</sup> Gianni Forti, PhD,<sup>6\*</sup> and Mario Maggi, PhD<sup>6\*</sup>

J Sex Med 2008;5:2623–2634

N = 1346 pts consulting for ED  
(55.0±12.0 years)

**Basal PSV**



**Figure 1** Correlation between peak systolic velocity (PSV) measured both in the flaccid state and dynamic (after prostaglandin E1 stimulation) conditions at penile Doppler ultrasound ( $r = 0.513$ ;  $P < 0.0001$ ). Red circles represent values of dynamic PSV  $< 25$  cm/seconds.



# Basal PCDU: peak systolic velocity (PSV)

## Penile Doppler Ultrasound in Patients with Erectile Dysfunction (ED): Role of Peak Systolic Velocity Measured in the Flaccid State in Predicting Arteriogenic ED and Silent Coronary Artery Disease

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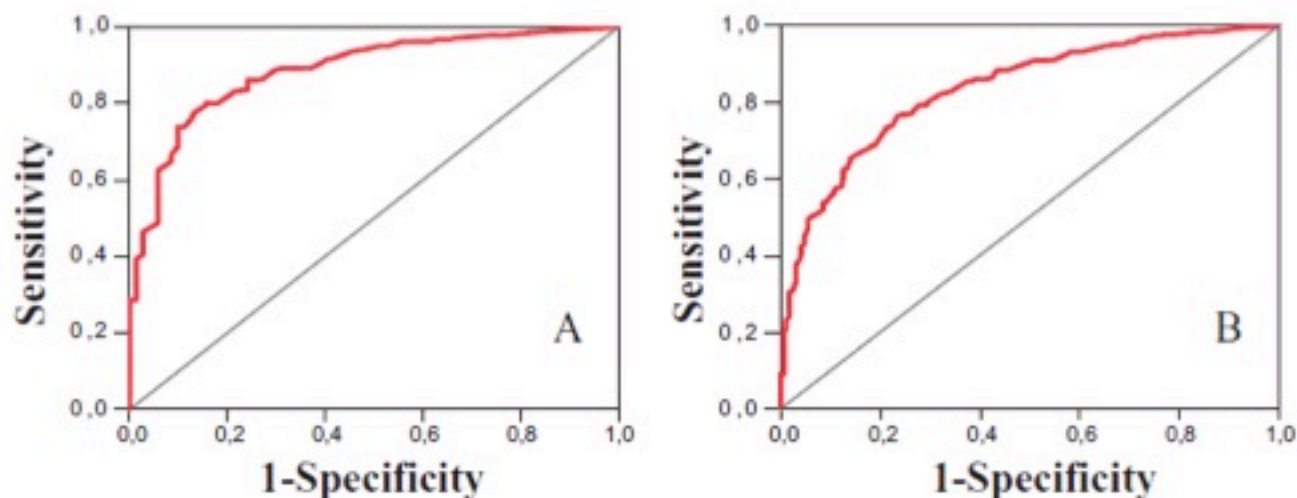
J Sex Med 2008;5:2623–2634

**Cut-off: basal PSV 13 cm/s predicts reduced dynamic PSV with accuracy > 80%**

**Table 3** Sensitivity, specificity, and accuracy for dynamic peak systolic velocity (PSV) at penile Doppler ultrasound < 25 and < 35 cm/seconds in relation to a flaccid PSV threshold of 13 cm/seconds as derived from the receiver operating characteristic curve analysis in the whole sample and considering only subjects who reported a valid-for-intromission (VFI) erection (VFI grade 2 and 3; 60.5% of the whole sample)

	Sensitivity (%)	Specificity (%)	Accuracy (%) <sup>*</sup>
Whole sample			
PSV < 25 cm/second	67	92	89 ± 2
PSV < 35 cm/second	72	75	82 ± 1
Subjects with VFI			
PSV < 25 cm/second	69	71	86 ± 6
PSV < 35 cm/second	73	83	87 ± 2

<sup>\*</sup>All  $P < 0.001$ .



**Figure 2** Receiver operating characteristic curves for pathological dynamic (after prostaglandin E1 stimulation) peak systolic velocity (A < 25 mc/seconds; B < 35 cm/seconds) at penile Doppler ultrasound in relation to peak systolic velocity measured in the flaccid state.

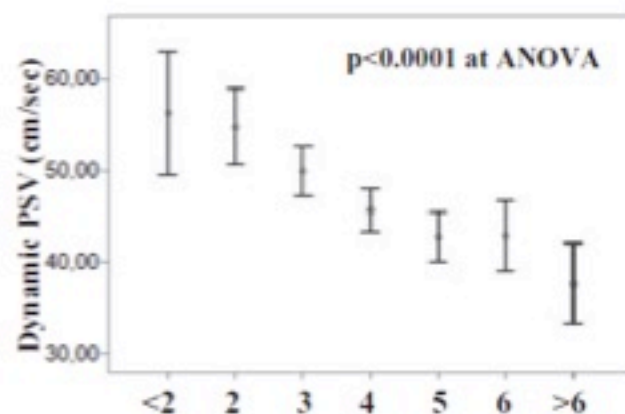
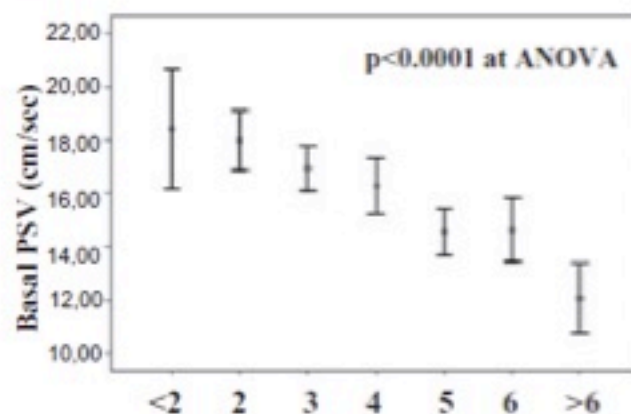
# Basal PCDU: PSV and CV risk

Penile Doppler Ultrasound in Patients with Erectile Dysfunction (ED): Role of Peak Systolic Velocity Measured in the Flaccid State in Predicting Arteriogenic ED and Silent Coronary Artery Disease

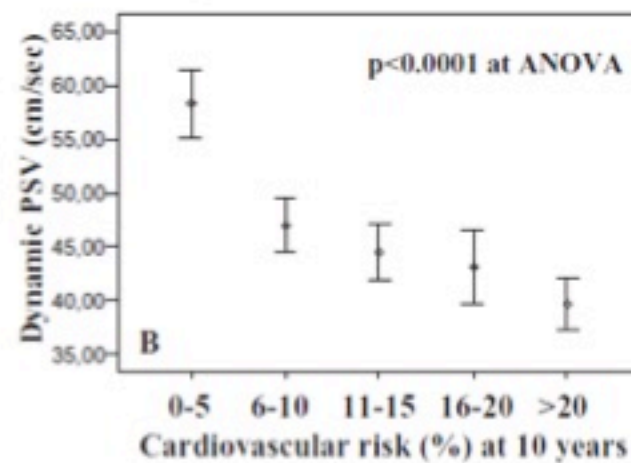
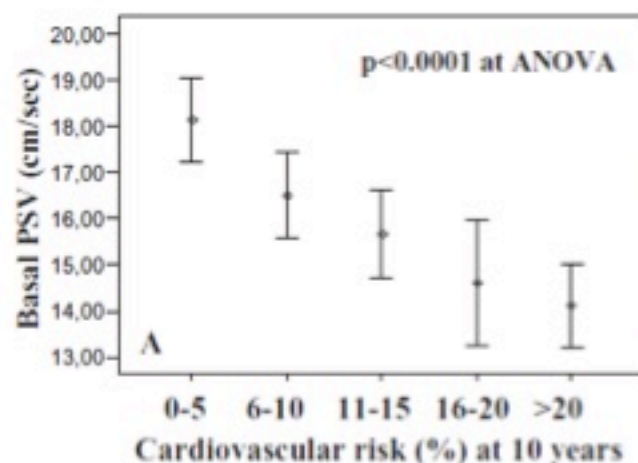
J Sex Med 2008;5:2623–2634

Giovanni Corona, MD,<sup>1\*</sup> Giorgio Fagioli, MD,<sup>2</sup> Edoardo Mannucci, MD,<sup>3</sup> Annadina Romeo, MD,<sup>2</sup> Massimiliano Rossi, MD,<sup>2</sup> Francesco Lotti, MD,<sup>\*</sup> Alessandra Sforza, MD,<sup>†</sup> Stefano Morittu, MD,<sup>†</sup> Valerio Chiarini, MD,<sup>†</sup> Gianni Casella, MD,<sup>†</sup> Giuseppe Di Pasquale, MD,<sup>†</sup> Elisa Bandini, MD,<sup>\*</sup> Gianni Forti, PhD,<sup>\*</sup> and Mario Maggi, PhD<sup>\*</sup>

# CV risk factors  
NCEP-ATP III



CV risk at 10 years  
Progetto Cuore



# Basal PCDU: PSV and CV risk

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A subset of 20 subjects with uncomplicated type 2 diabetes underwent diagnostic testing for silent coronary heart disease by means of “adenosine stress myocardial perfusion scintigraphy” (SPECT).

When the **threshold of <13 cm/s** was chosen, PSV before SPECT was **predictive of impaired coronary flow reserve with an accuracy of 80%** (area under the ROC curve =  $0.798 \pm 0.10$ ;  $p < 0.05$ ).

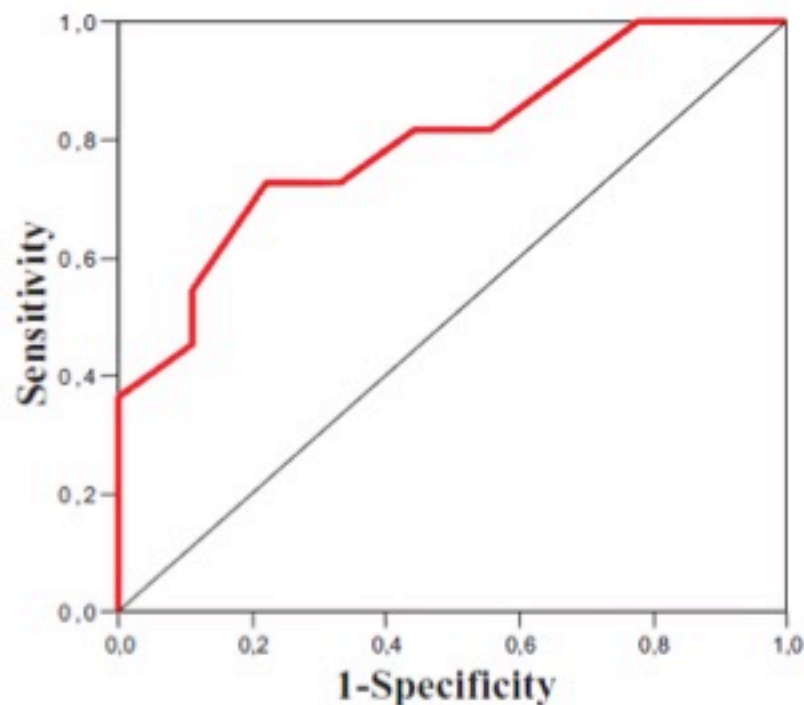


Figure 5 Receiver operating characteristic curve for impaired coronary flow reserve at myocardial perfusion scintigraphy in relation to peak systolic velocity at penile Doppler ultrasound measured before adenosine administration.



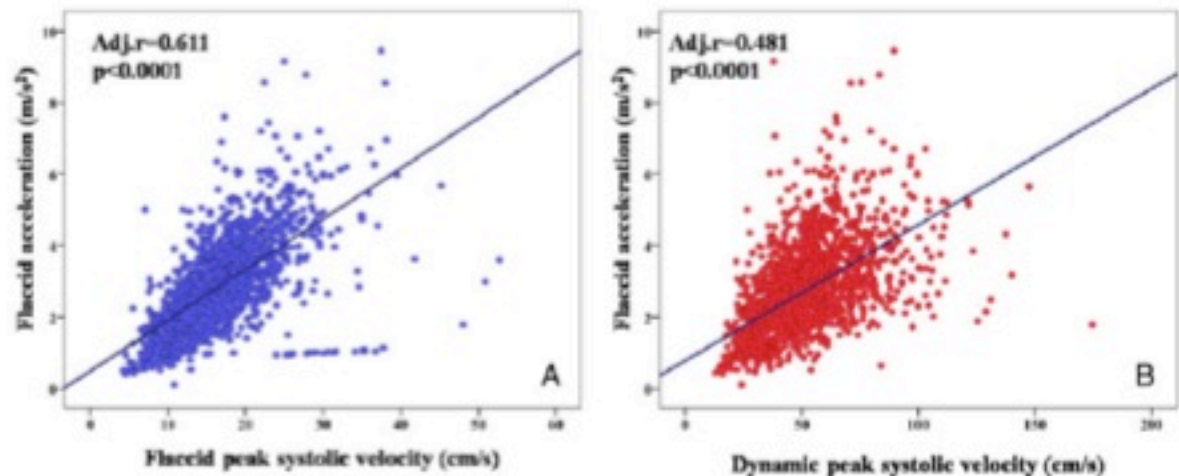
# Basal PCDU: “acceleration”

## Flaccid Penile Acceleration as a Marker of Cardiovascular Risk in Men without Classical Risk Factors

Giulia Rastrelli, MD, PhD,\* Giovanni Corona, MD, PhD,\*<sup>†</sup> Francesco Lotti, MD,\*  
Antonio Aversa, MD, PhD,<sup>‡</sup> Marco Bartolini, MD,<sup>§</sup> Mario Mancini, MD,<sup>¶</sup> Edoardo Mannucci, MD,\*\* and  
Mario Maggi, MD\*

J Sex Med 2014;11:173–186

**Figure 4** Relationship between flaccid penile acceleration and flaccid (Panel A) and dynamic (Panel B) peak systolic velocity. Insets represent the age-, smoking-, alcohol drinking-, and body mass index-adjusted data using all the data as continuous variables.





# Basal PCDU: “acceleration”

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J Sex Med 2014;11:173–186

N = 1903 pts  
with a suspected  
organic component for ED  
(54.6±11.7 years)

**Table 3** Mean values of flaccid acceleration according to the absence or presence of several risk factors

	No	Yes	<i>P</i>
Age ≥55 years	3.04 ± 1.33	2.42 ± 1.22	<0.0001
Family history of diabetes mellitus	2.74 ± 1.30	2.56 ± 1.30	0.005
Diabetes mellitus	2.82 ± 1.35	2.32 ± 1.10	<0.0001
Cardiovascular diseases	2.80 ± 1.29	2.14 ± 1.20	<0.0001
Body mass index ≥30 kg/m <sup>2</sup>	2.71 ± 1.33	2.56 ± 1.16	0.032
Blood pressure ≥130/85 or treatment	3.18 ± 1.36	2.58 ± 1.28	<0.0001
Triglycerides ≥150 mg/dL or treatment	2.79 ± 1.31	2.54 ± 1.27	<0.0001

# Basal PCDU: “acceleration” and CV risk

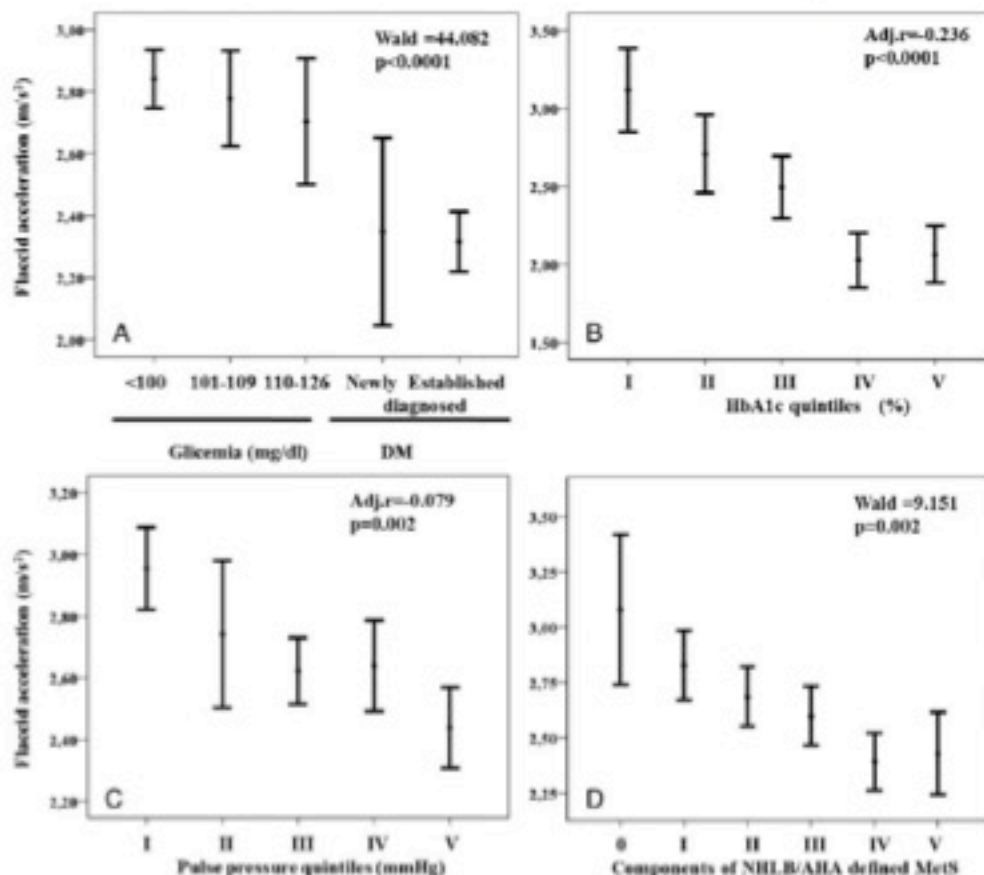
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J Sex Med 2014;11:173–186

N = 1903 pts  
with a suspected  
organic component for ED  
(54.6±11.7 years)

### Basal acceleration



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Accepted: 25-Sep-2012

doi: 10.1111/j.1365-2602.2012.00011.x

## Seminal, ultrasound and psychobiological parameters correlate with metabolic syndrome in male members of infertile couples

F. Lotti,\* G. Corona,\*† S. Degli Innocenti,\* E. Filiberti,\* V. Scognamiglio,\* L. Vignozzi,\* G. Forti\* and M. Maggi\*

\*Sexual Medicine and Andrology Unit, Department of Clinical Physiopathology, University of Florence, Florence, Italy, and †Endocrinology Unit, Maggiore-Bellaria Hospital, Bologna, Italy

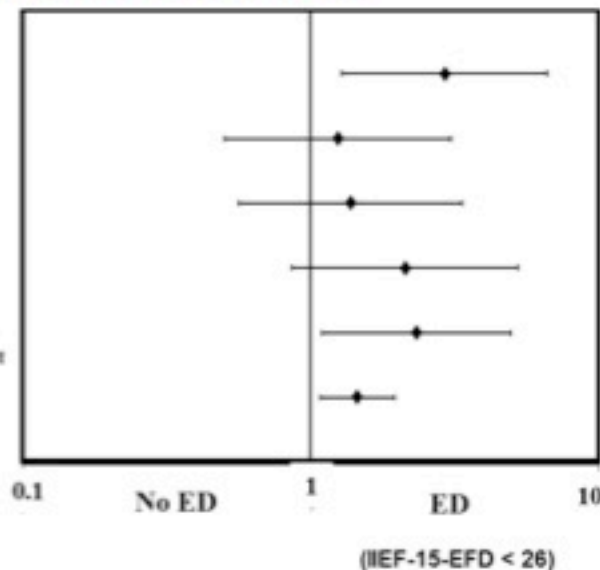
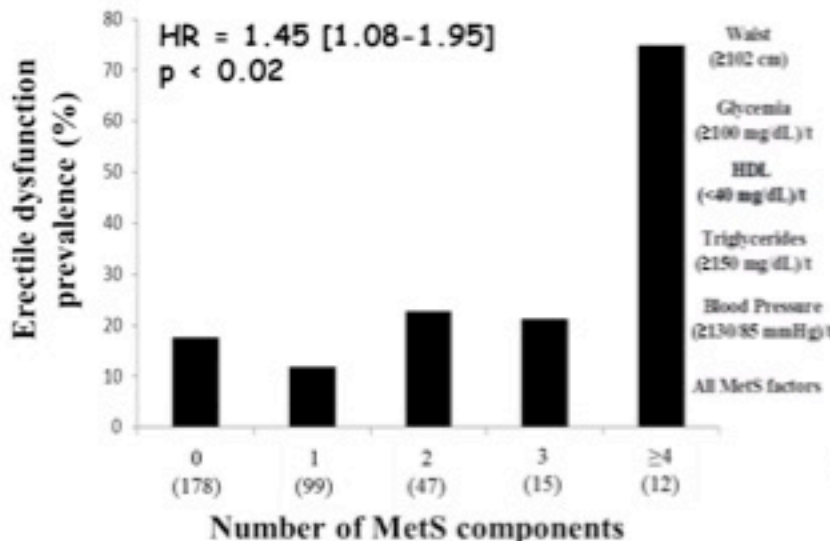
# Young subjects

**N = 361 males of infertile couples (age 36.0 ± 8.0 years)**

**ED = 19.9% → MetS = 46.2% vs No-MetS: 16.7% (p < 0.01)**

**IDF&AHA/NHLBI**  
3 or more of the following

- Central obesity (population- and country-specific definitions)
- Hypertriglyceridaemia: triglycerides ≥ 150 mg/dl (1.7 mmol/L) or treatment
- Low HDL-cholesterol: < 40 mg/dl (1.03 mmol/L) or treatment
- Hypertension: blood pressure ≥ 130/85 mmHg or treatment
- Fasting plasma glucose: ≥ 100 mg/dl (5.6 mmol/L) or treatment

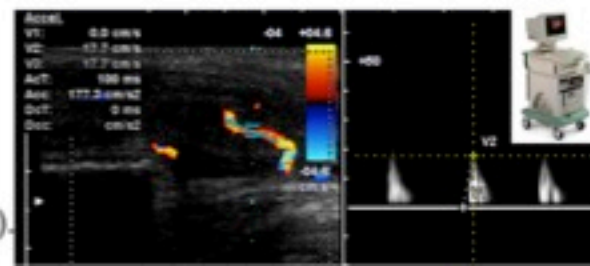


Adj. for age  
total testosterone

Penile basal CDUS:

arterial peak systolic velocity and acceleration negatively related to MetS components, even after adjusting for age and TT

(B = -0.748 ± 0.314, p < 0.02 and B = -0.201 ± 0.092, p < 0.05).

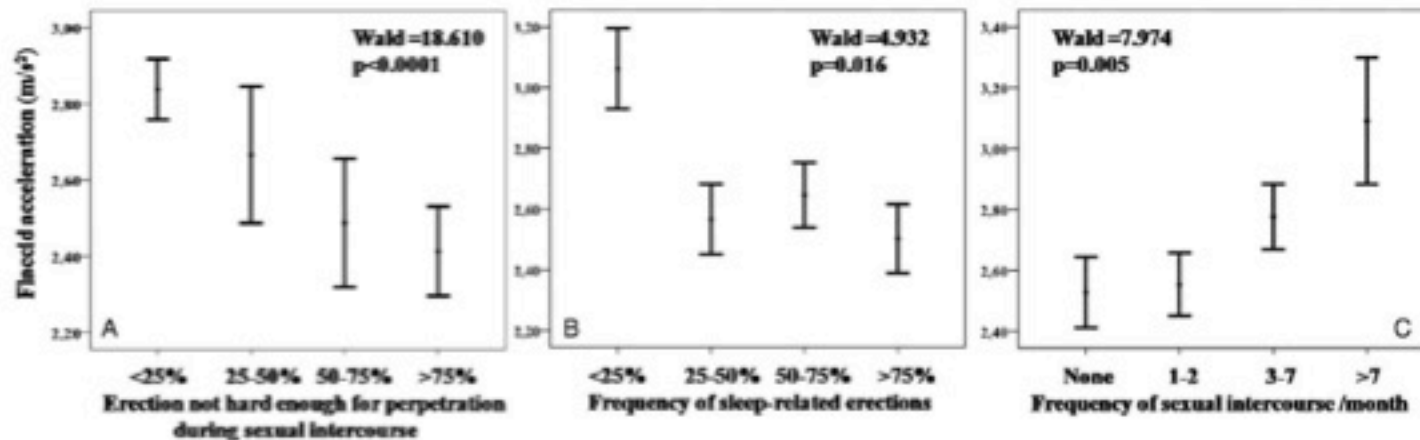


# Basal PCDU: “acceleration”, Sex and Testosterone

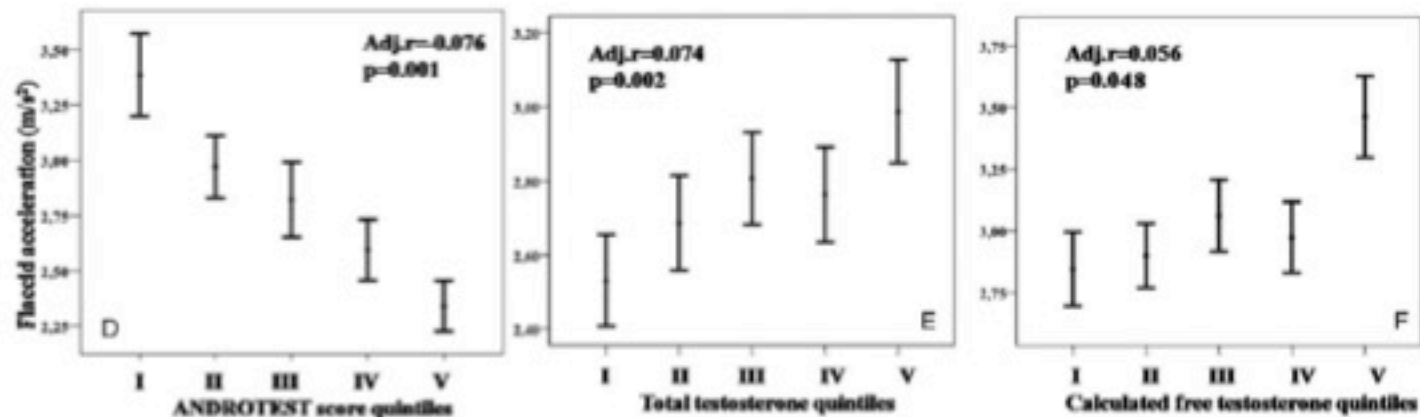
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J Sex Med 2014;11:173–186



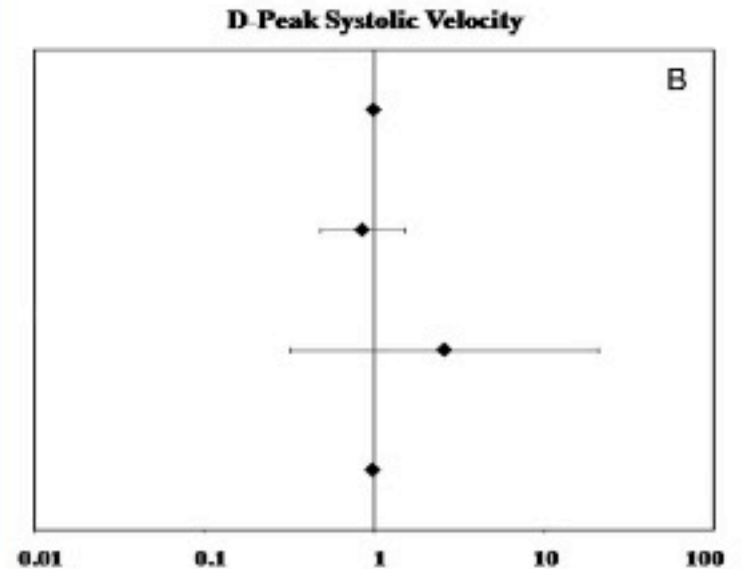
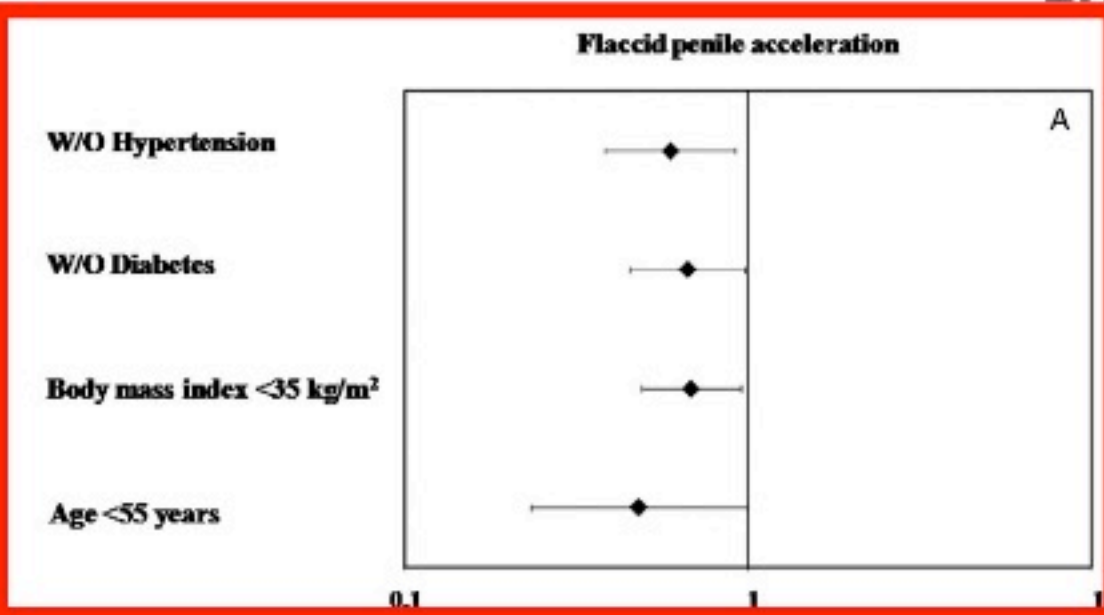
Sex



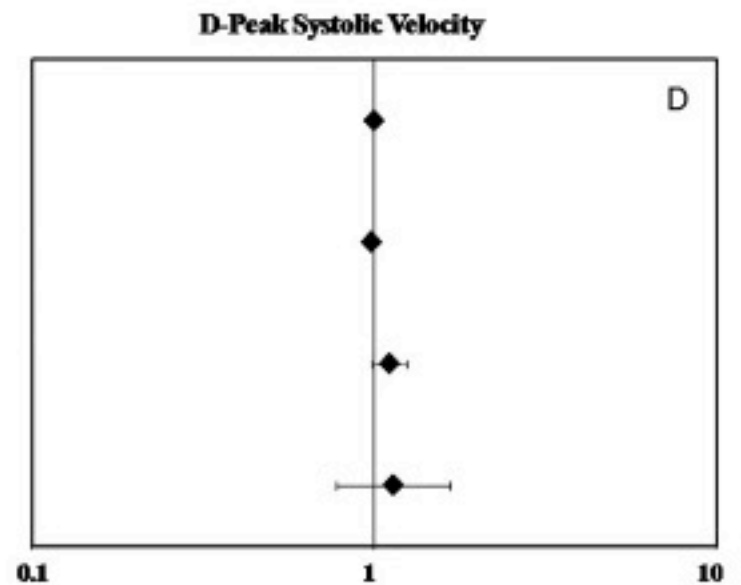
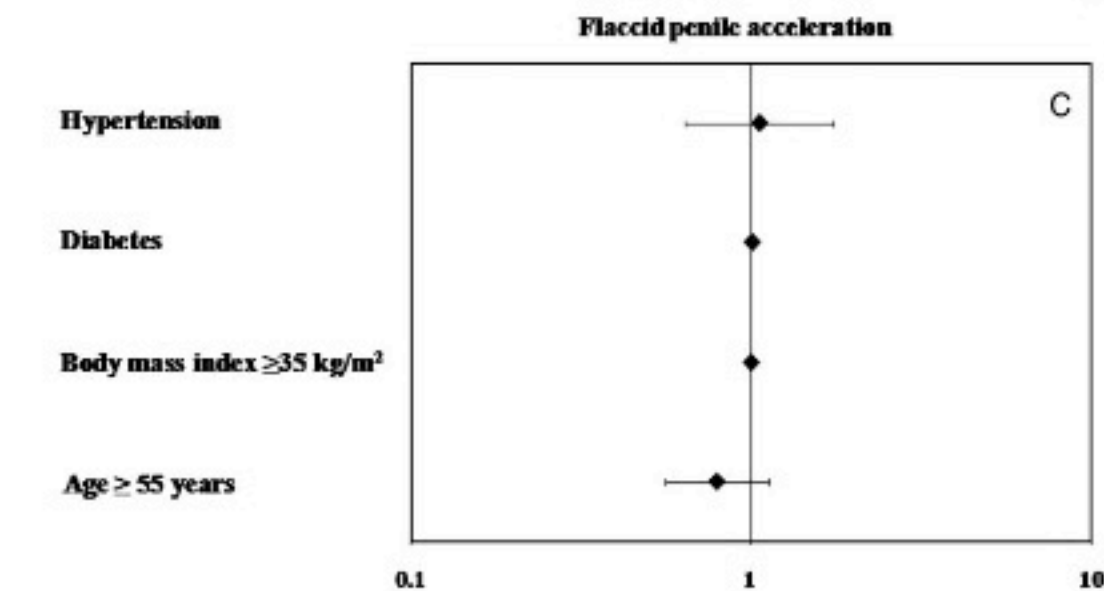
Testosterone



## Lower risk



## Higher risk

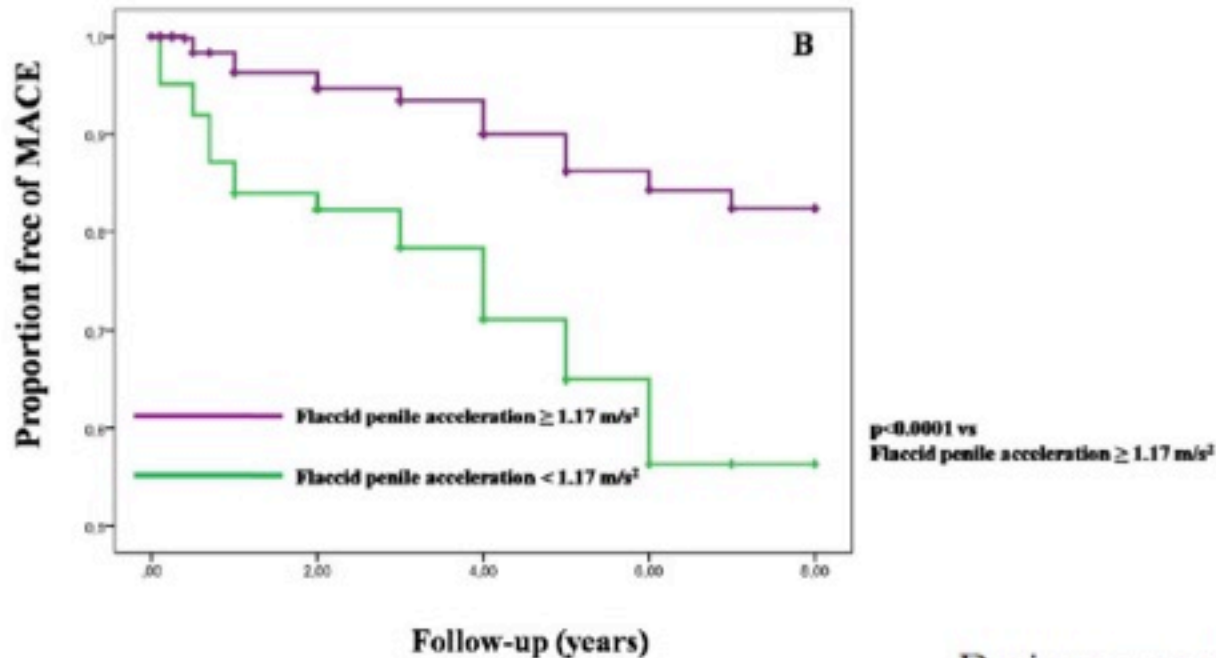


# Basal PCDU: cut-off of acceleration predictive of MACE

## Flaccid Penile Acceleration as a Marker of Cardiovascular Risk in Men without Classical Risk Factors

Giulia Rastrelli, MD, PhD,\* Giovanni Corona, MD, PhD,\*<sup>†</sup> Francesco Lotti, MD,\*  
Antonio Aversa, MD, PhD,<sup>‡</sup> Marco Bartolini, MD,<sup>§</sup> Mario Mancini, MD,<sup>¶</sup> Edoardo Mannucci, MD,\*\* and Mario Maggi, MD\*

J Sex Med 2014;11:173–186



N = 1903 pts  
with a suspected  
organic component for ED  
(54.6±11.7 years)

Subset N= 622  
in longitudinal study

During a mean follow-up of 4.1 ± 2.6 years, 126 MACE, 14 of which were fatal, were observed,

**1.17 m/s<sup>2</sup> predictive of MACE**

# Basal PCDU: cut-off for “reduced” acceleration

**N = 588 consulting for ED with previous CVD**

**Acceleration  
predicting  
PSV < 13 cm/s  
in CVD patients**

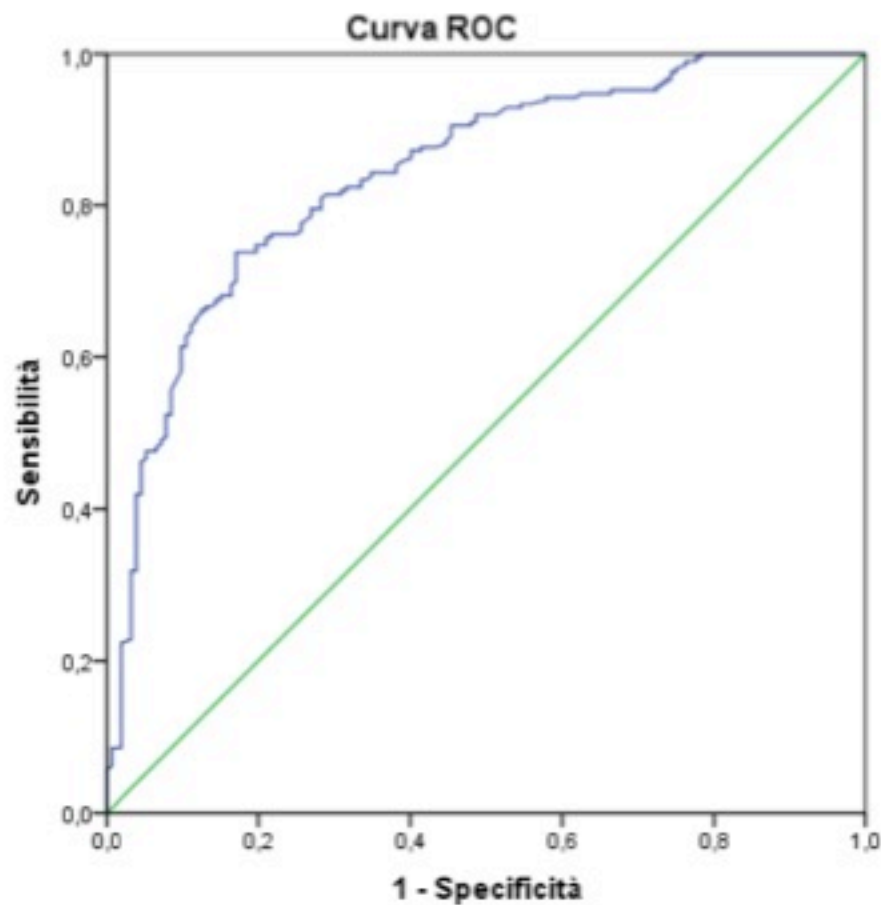
**1.90 cm/s**

**Sens. 76%**

**Spec. 77%**

**Accuracy 84.1±2.1%**

**p<0.0001**



**Summary:**  
**Basal PCDU diagnostic parameters**  
**indicative for ED**

- **PSV < 13 cm/s**
- **Acceleration < 1.90 cm/s (unpublished)**
- **Acceleration < 1.17 cm/s → predictive for MACE → stress test**



# **Basal PCDU in ED evaluation: our experience**

## **Pros**

- 1. Accuracy similar respect to dynamic PCDU in ED diagnosis**
- 2. Prediction of cardiovascular risk**
- 3. Less time consuming (no dynamic evaluation, no explanation of drugs-related risks)**
- 4. Less expensive (no use of drugs, i.e. Alprostadil)**
- 5. No drug-related injection risks (priapism, pain, emorragy, secondary Peyronie's disease)**

## **Cons**

- 1. Needs more experience**
  - small, not dilated arteries**
  - difficult to perform in subjects with severe vascular diseases (diabetes, previous MACE)**
- 2. Less qualitative information (dynamic phases, veno-occlusive dysfunction, arterial secondary ramifications, corpora cavernosa)**

# La Peyronie disease

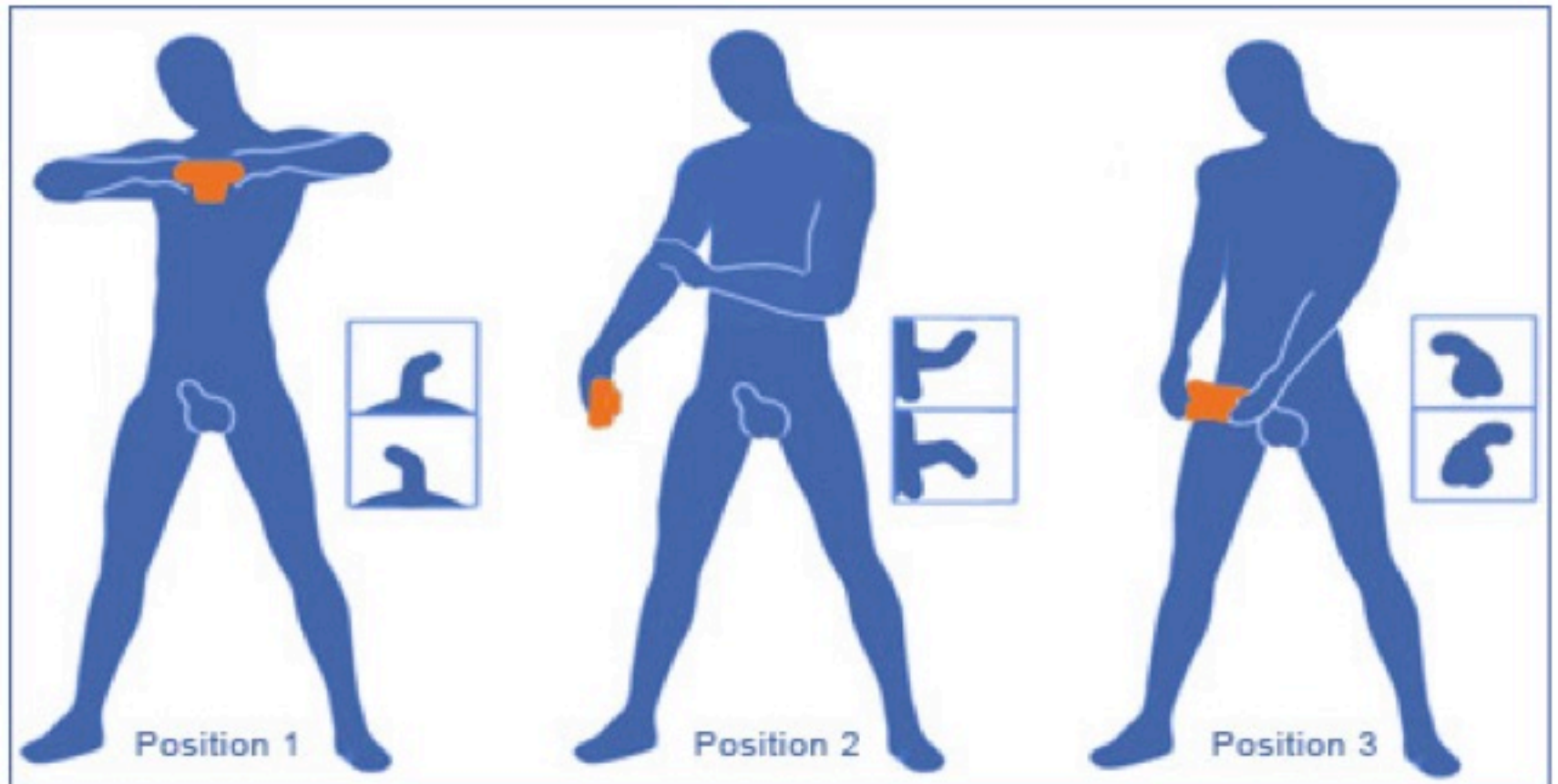
Incidence 2-3% (1.5% < 40 years)

Pain (flaccid or erection), penile bending, palpable nodule

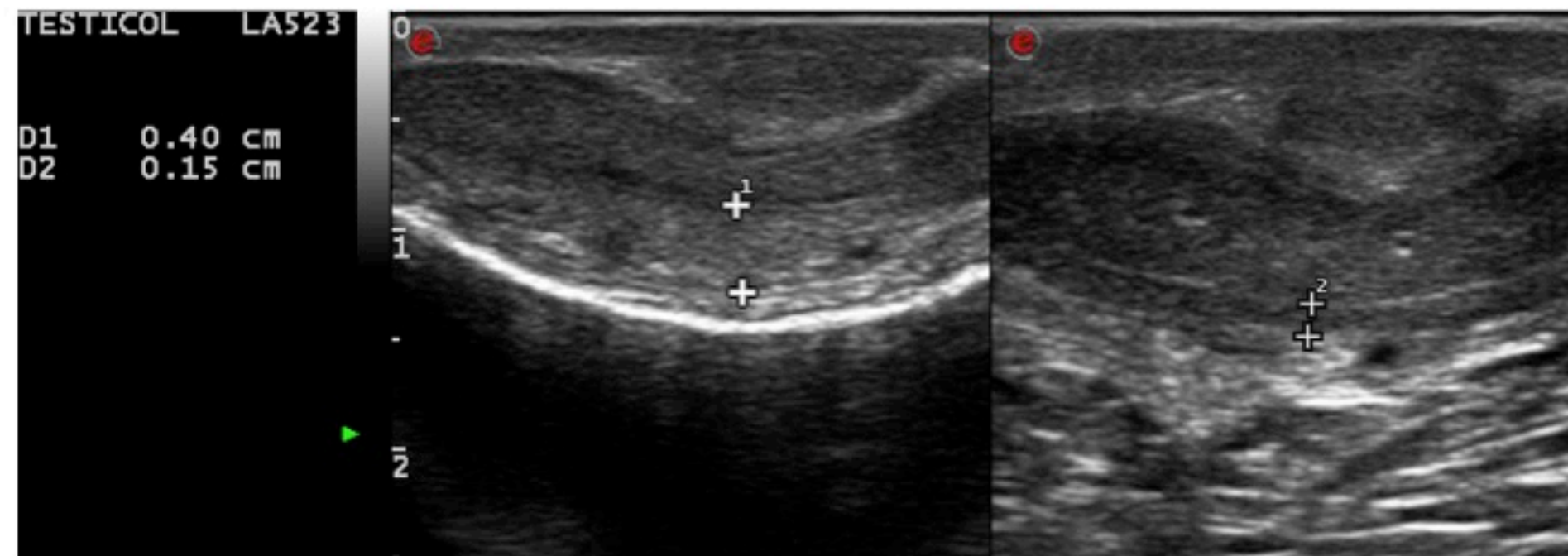
- Bending (direction, severity)
- Tunica albuginea alteration (thickness)
- Septum thickness
- Hypoechoic (activity) or hyperechoic (calcification) plaques
- Microcalcifications
- Fibrous areas of corpora cavernosa
- Penis morphology (notch, bottleneck alteration)
- Cavernosal arteries evaluation: frequently associated



# Bending evaluation

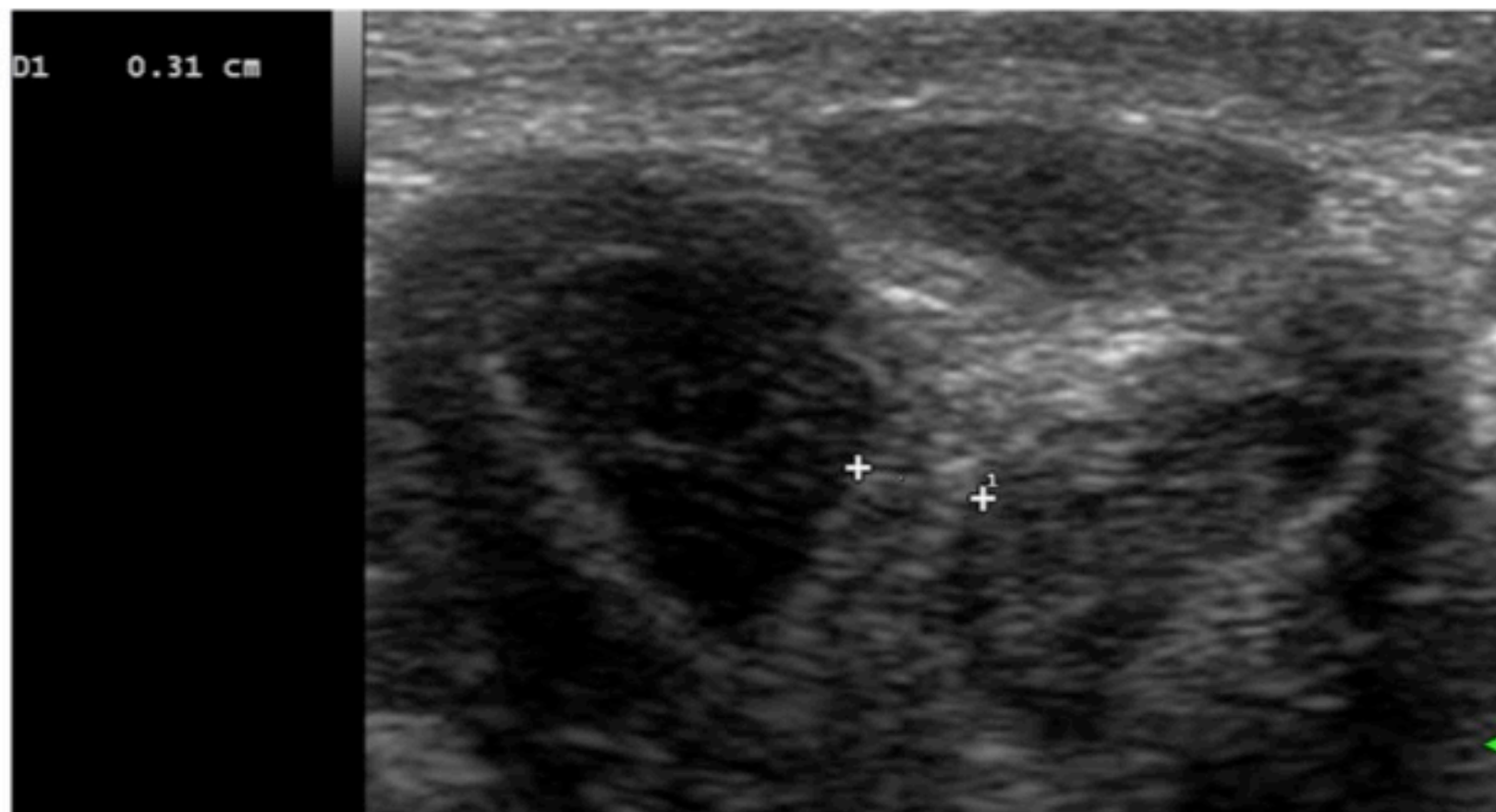


# Tunica albuginea thickness





## Septum thickness



## Hypoechoic plaque



World J Urol (2004) 22: 365–367  
DOI 10.1007/s00345-004-0424-x

### TOPIC PAPER

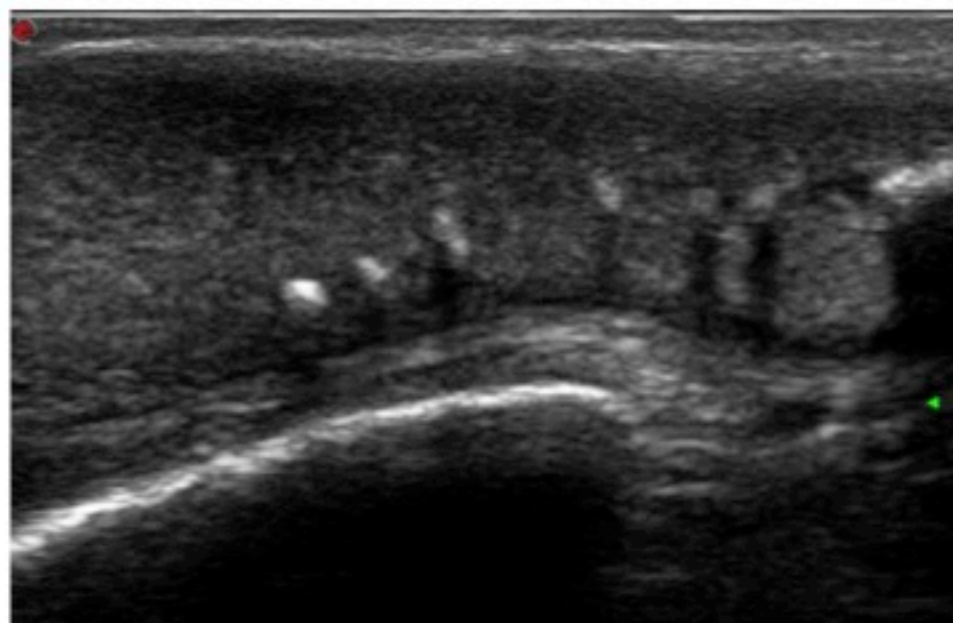
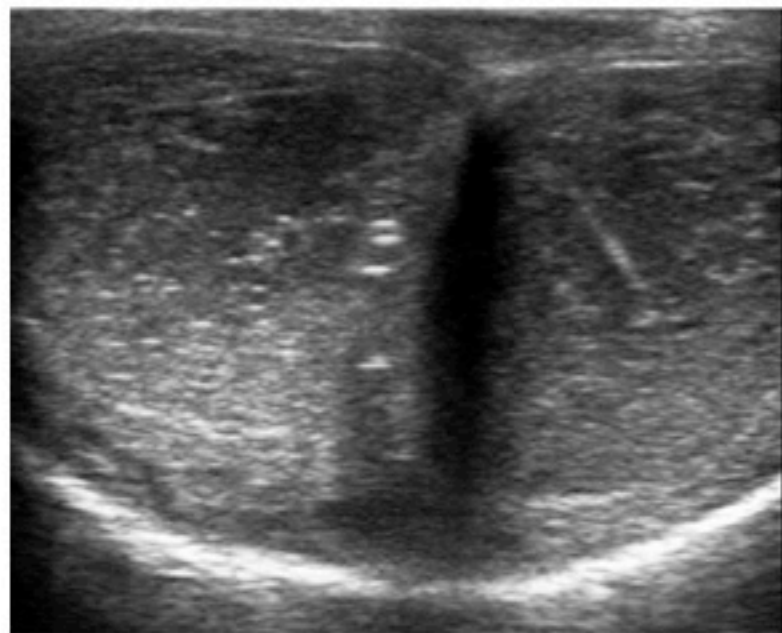
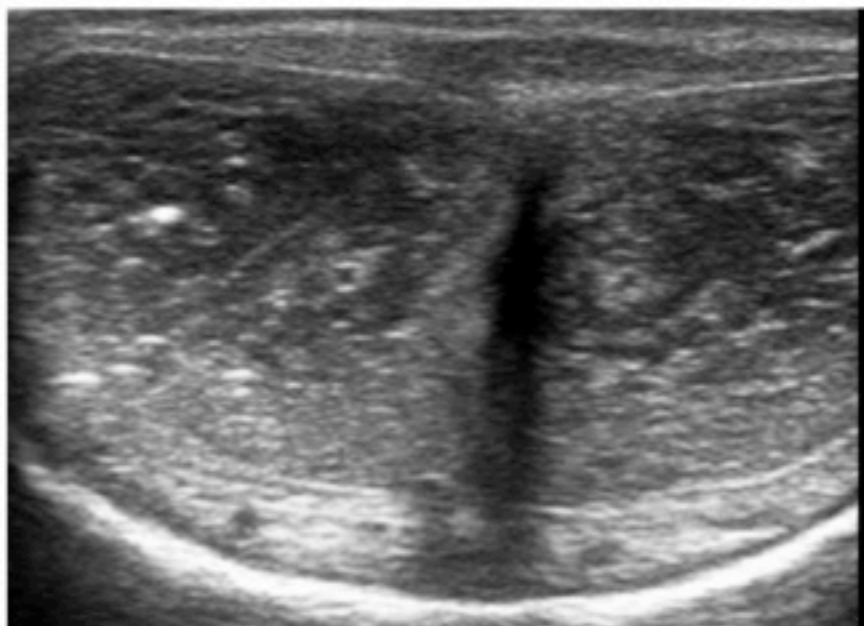
P. Fornara · H.-P. Gerbershagen

**Ultrasound in patients affected with Peyronie's disease**

## Hyperechoic plaque

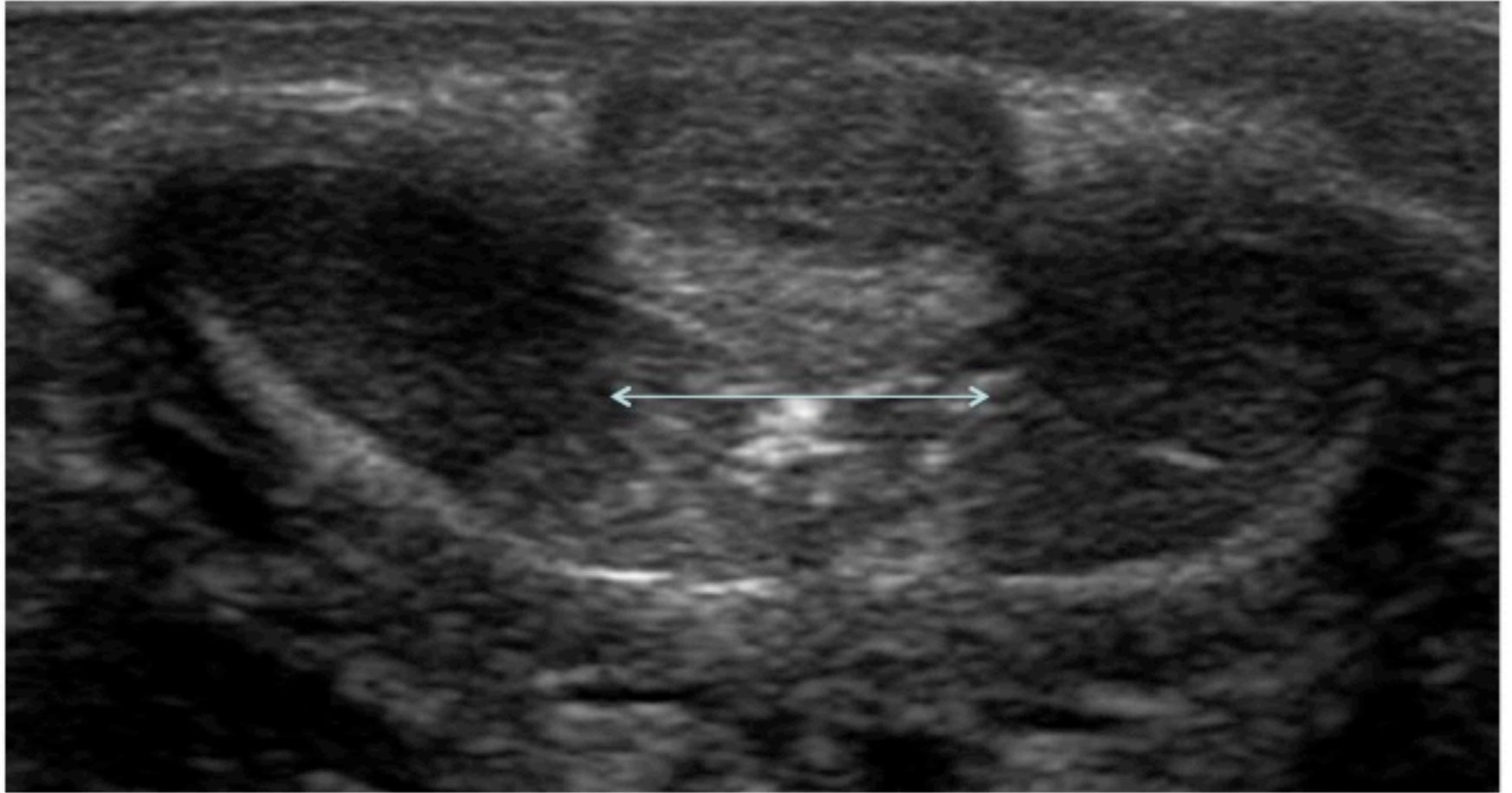


## Microcalcifications

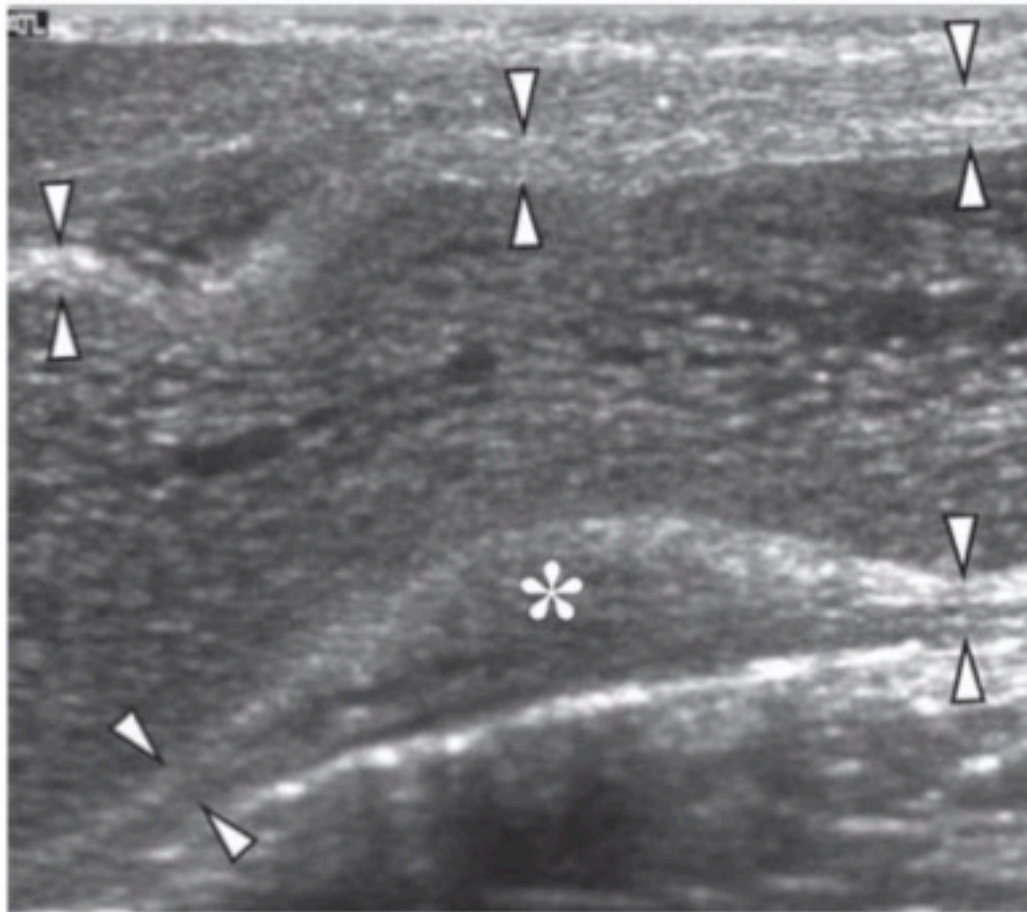




## Fibrous areas of corpora cavernosa



## Penile notch



RadioGraphics

## Painful Penile Induration: Imaging Findings and Management<sup>1</sup>

ONLINE-ONLY  
CME

*Michele Bertolotto, MD • Pietro Pavlica, MD • Giovanni Serafini, MD  
Emilio Quaia, MD • Roberta Zappetti, MD*

## Penis bottleneck morphology

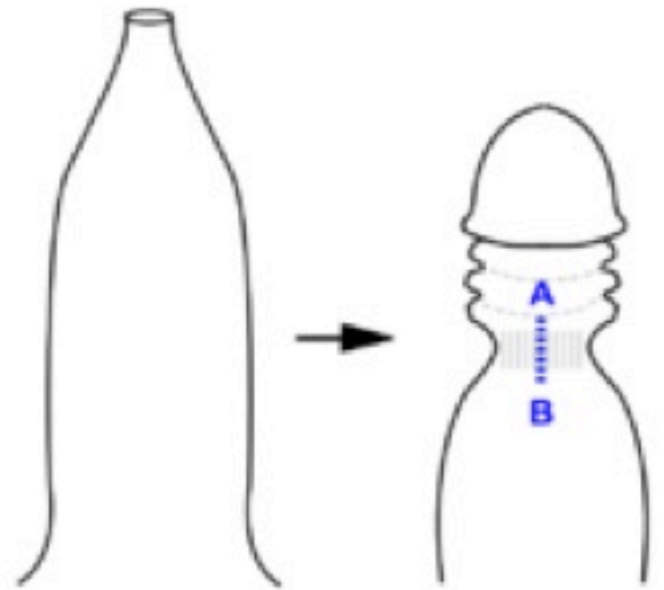
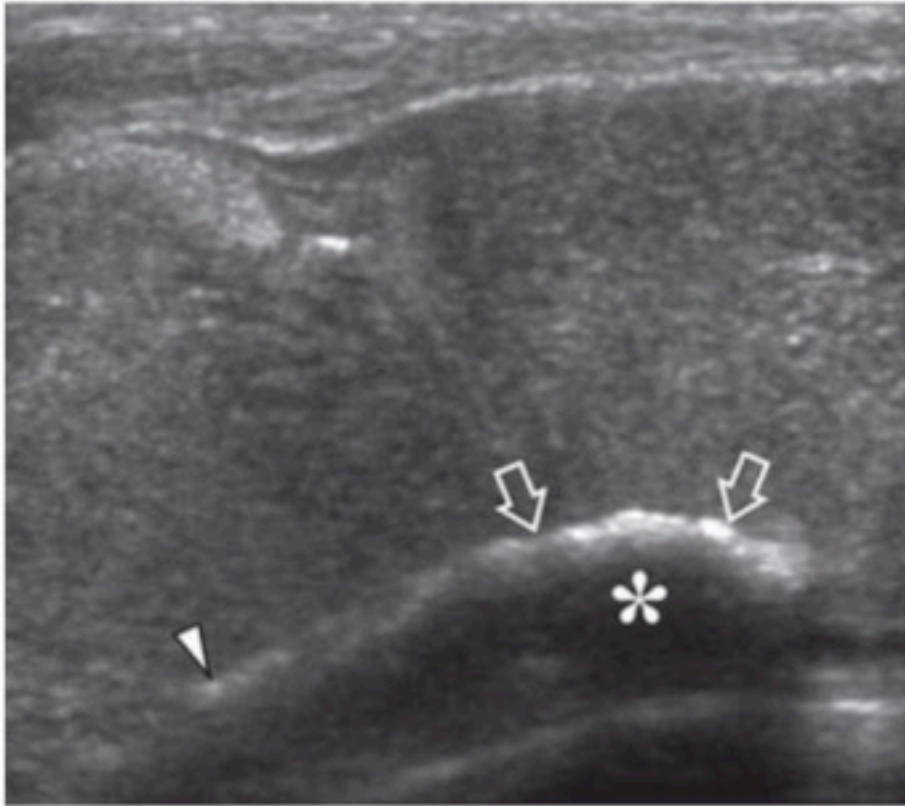


Figure 1

Figure 2



Thank you

