

ARCHIVIO ITALIANO DI UROLOGIA E ANDROLOGIA  
**ARCH ITAL UROL ANDROL**

ARCHIVES OF ITALIAN UROLOGY AND ANDROLOGY

Vol. 84; n. 3, September 2012

Indexed in: Medline/Index Medicus, EMBASE/Excerpta Medica, Medbase/Current Opinion, SIIC Data Base, SCOPUS

**Urological complications following inguinal hernioplasty**

Gaetano Gulino, Michele Antonucci, Giuseppe Palermo, Francesco Sasso, Daniele Tienforti, Alessandro D'Addessi, Pier Francesco Bassi

**Prostate cancer: What are the news in hormonal therapy? The role of GnRH antagonists**

Filiberto Zattoni

**Observational Database Serenoa Repens (DOSSER): Overview, analysis and results**

Alessandro Bertaccini, Marco Giampaoli, Riccardo Cividini, Gian Luca Gattoni, Roberto Sanseverino, Tommaso Realfonso, Giorgio Napodano, Andrea Fandella, Elisa Guidoni, Domenico Prezioso, Raffaele Galasso, Carmine Cicalese, Vincenzo Scattoni, Angelo Armenio, Giario Conti, Matteo Corinti, Roberta Spasciani, Giovanni Liguori, Nikolitsa Lampropoulou, Giuseppe Martorana

**Problematics of open prostatectomy in an Ivorian District Hospital setting**

Anthony Chukwura Mgbakor

**Comparison of TVT, TVT-O/TOT and mini slings for the treatment of female stress urinary incontinence: 30 months follow up in 531 patients**

Charalambous Stavros, Vouros Ioannis, Sakalis I. Vasileios, Anastasia Ch. Gkotsi, Salpiggidis Georgios, Athanasios Papatthanasiou, Vasileios Rombis

**Prospective open-label study on the efficacy and tolerability of a combination of nutritional supplements in primary infertile patients with idiopathic astenoteratozoospermia**

Gian Maria Busetto, Aleardo Koverech, Masa Messano, Gabriele Antonini, Ettore De Berardinis, Vincenzo Gentile

**Pre-treatment and post-treatment fertility in young male patients affected by Hodgkin and non-Hodgkin lymphoma**

Nicolò de Luyk, Gabriele Pozzato, Giuseppe Ricci, Paolo Tamaro, Massimo Manno, Francesco Tomei, Carlo Trombetta

**Nephron-sparing surgery for giant angiomyolipomas of kidney**

Giampaolo Siena, Andrea Minervini, Agostino Tuccio, Gianni Vittori, Matteo Salvi, Arcangelo Sebastianelli, Omar Saleh, Alberto Lapini, Sergio Serni, Marco Carini

**The role of the elastography in the diagnosis of prostate cancer: A retrospective study on 460 patients**

Emilio Pozzi, Guglielmo Mantica, Christian Gastaldi, Marco Berardinelli, Dimitrios Choussos, Carlo Maria Bianchi, Alberto Roggia

**Role of urethral constrictor in male urinary incontinence after surgery**

Luciano De Giovanni, Marco Stefanucci, Paolo Menchinelli

**Hemangiopericytoma of kidney: Case report and review of the literature**

Muhsin Balaban, Cihangir Cetinel, Rahim Horuz, Cemal Goktas, Onder Canguven

**The potential role of transrectal ultrasound as a tool for diagnosis or recurrence detection in bladder cancer. Two cases report**

Andrea Fabiani, Alessandra Filosa, Mara Piergallina, Lucilla Servi, Gabriele Mammana

**A case of angiomyolipoma of the spermatic cord and testicle**

Roberto Giulianelli, Luca Albanesi, Francesco Attisani, Stefano Brunori, Barbara Cristina Gentile, Luca Mavilla, Gabriella Mirabile, Francesco Pisanti, Giorgio Vincenti, Teuta Shestani, Manlio Schettini

**Neoadjuvant chemotherapy for invasive bladder cancer: An interesting case report**

Davide Abed El Rahman, Victor Matei Deliu, Gennaro Musi, Danilo Bottero, Antonio Brescia, Giacomo Galasso, Federica Mazzoleni, Ottavio De Cobelli

**Robot-assisted laproscopic removal of perirenal lymphangioma: A case report**

Marco Finamanti, Alessandro Antonelli, Lorenzo Gatti, Angelo Peroni, Claudio Simeone

**Realtime-elastosonography of the penis in patients with Peyronie's disease**

Valentina Riversi, Valeria Tallis, Stefano Trovatelli, Arben Belba, Luca Volterrani, Francesca Iacoponi, Roberto Ponchiatti

Official Journal  
of the SIEUN



Società  
Italiana di  
Ecografia  
Urologica  
Andrologica  
Nefrologica

Official Journal  
of the SIURo



Società Italiana di  
Urologia Oncologica

Official Journal  
of the UrOP



Urologi  
Ospedalità  
Gestione Privata



# Realtime-elastosonography of the penis in patients with Peyronie's disease

Valentina Riversi<sup>1</sup>, Valeria Tallis<sup>2</sup>, Stefano Trovatelli<sup>2</sup>, Arben Belba<sup>2</sup>, Luca Volterrani<sup>1</sup>, Francesca Iacoponi<sup>3</sup>, Roberto Ponchietti<sup>2</sup>

<sup>1</sup> Imaging Department AOUS of Siena, Siena, Italy

<sup>2</sup> Department of Urology University of Siena, Siena, Italy

<sup>3</sup> Department of Biomedical Sciences, Applied Biology Section, University of Siena, Siena, Italy

## Summary

**Objective:** To evaluate the performance of real time elastosonography (RTE) in the identification of different types of penile lesions in patients with Peyronie's disease.

**Materials and methods:** Seventy four consecutive patients with complaints of Peyronie's disease underwent B-Mode ultrasonography (US) and RTE of the penis in the same sitting. In each patient all sequences of elastosonography and B-Mode US were recorded and

compared to evaluate the diagnostic performance of the new imaging technique.

**Results:** B-Mode US detected penile plaques in 64 patients (86.41%) and elastosonography confirmed these data. In the remaining 10 patients elastosonography documented, in five of them, areas of reducing elasticity suggesting the presence of initial fibrosis. Cohen's K was used to evaluate the discordances between B-Mode US and Elastosonography scan. A  $p$  value  $< 0.05$  (two tailed) was considered statistically significant. The penile curvature ( $K = 0.353$ ;  $p = 0.125$ ) and the painful erection ( $K = 0.500$ ;  $p = 0.248$ ) evaluations were discordant: the B-mode US underestimated the positive cases. Instead the penile plaque and curvature  $> 30^\circ$ , and the penile plaque evaluations were completely concordant.

**Conclusions:** RTE is a simple, non invasive, rapid complementary imaging technique that may improve the accuracy of B-Mode US in detecting penile lesions in patients with Peyronie's disease.

**KEY WORDS:** Real time elastosonography; B-Mode ultrasonography; Penile plaques; Peyronie's disease.

Submitted 26 June 2012; Accepted 15 July 2012

## INTRODUCTION

Peyronie's disease is a well recognized but not clearly understood condition generally afflicting men in their 50s and it is characterized by thickening, calcifications, septal fibrosis and plaques in the tunica albuginea resulting in penile deformity making intercourse difficult if not impossible.

Diagnosis rests upon medical history and clinical examination of the penis. Among the imaging modalities available, ultrasonography (US) is the modality of choice to assess the size and location of the plaques, to establish disease severity and to monitor progression and response to therapy.

Real time elastosonography (RTE) is a newly developed dynamic technique, based upon the principle that, under

compression by an external force, the softer parts of a tissue deform easier than the harder ones.

Elastosonography has been employed to differentiate cancers from benign lesions in prostate (1, 2) lymph nodes (3), breast (4) thyroid (5, 6) uterus (7) and testis (8) and the set of diagnoses that can benefit from an assessment by means of this new imaging modality is expanding. Peyronie's disease induces considerable changes in the soft tissue structure of the penis modifying its elastic properties and leading to increased firmness; this reduced elasticity can be assessed by measuring the degree of distortion of the US beam under the application of an external force during the examination.

**MATERIALS AND METHODS**

The present study was carried out in two phases. Initially a group of 15 healthy volunteers (age 20-76 yr, mean 49.1 yr) underwent B-Mode US and RTE of the penis to establish a basic elastosonographic semiological pattern because these data have not been reported in the literature.

Subsequently, we studied a group of consecutive 74 males (age 31-78 yr, mean 55.8 yr) attending at our Institution with complaints (painful and/or impaired erection, penile curvature > 30°) suggesting *Peyronie's disease*. The diagnostic assessment was carried out according to *European Association of Urology (EAU) Guidelines on Male Sexual Dysfunction*.

According to the current privacy law, all patients were guaranteed privacy protection and a proper use of personal data; oral informed consent was obtained from them.

We performed elastosonography of the penis as complementary imaging study in the diagnostic evaluation of our patients.

Conventional US and RTE of the penis were performed and evaluated by two experienced radiologists (VR and LV) at the same sitting using digital *US scanning Hitachi EUB 8500 Logos (Hitachi Medical System, Tokyo, Japan)* and high frequency linear array transducer (14-6 MHz *EUP-L53 Hitachi Medical System, Tokyo, Japan*).

We performed real time freehand US elastosonographic measurements using the same real time instrument and the same probe with a flat base applied to the probe to achieve optimal adherence to the penis as well as uniform application of the compression to the region of interest. The freehand compression applied to the penis was standardized by real time measurement displayed on numeric scale (graded 1-5) to maintain an intermediate level optimal for elastosonographic evaluation.

The dedicated software CAM (*Combined Autocorrelation Method*) ensured to obtain a fine estimation of the tissue displacement and produced the elastosonographic images. The calculated elasticity values were then color coded corresponding to the tissue elasticity, the color scale elasticity ranged from red (elastic tissue) to blue (anelastic tissue); the components with average strain are displayed as green. These elastosonograms were superimposed on the translucent corresponding the B-Mode scan to correlate the strain distribution to the B mode image.

**Statistical analysis**

Data were reported as absolute frequencies and percentages (%). Cohen's K was used to evaluate the discordances between B-Mode US and Elastosonography scan. A p value < 0.05 (two tailed) was considered statistically significant. All analyses were performed by SPSS v.16 for *Windows (SPSS Inc., Chicago, IL, USA)*.

**RESULTS**

In each patient his echosonographic images of the penis were compared to his elastosonographic ones to evaluate the diagnostic performance of this new imaging modality. B-Mode ultrasonographic images and elastosonograms of the penis are depicted in Figure 1.

In the healthy men the elastosonogram of the penis is characterized by a relatively uniform green light of the region of interest as in the surrounding tissue (Figure 1A). Out of 74 patients with complaints of *Peyronie's disease* B-Mode US detected the presence of penile plaques in 64 (86.49%); on elastosonographic evaluation these plaques appear as blue zones (anelastic tissue) surrounded by green and red softer tissue (Figure 1B).

Moreover in 7 of these 64 patients (10.94%), elastosonography documented a larger well-defined entirely blue area indicating a dorsal plaque underestimated with conventional US because of areas of isoechogenity to tunica albuginea (Figure 1C).

In the remaining 10 patients with complaints of *Peyronie's disease*, no evidence of penile plaque or thickening of the tunica albuginea was detected at B-Mode US, nevertheless the elastosonography documented in five of them a large and defined area with a relevant presence of blue color suggesting an area of reduced elasticity of the tissue as in the presence of fibrosis (Figure 1D).

In Table 1 were reported the frequencies related of B-Mode US and Elastosonography concerning some clinical findings: penile plaques and curvature > 30°, penile plaques, penile curvatures and painful erection.

The penile curvature (K = 0.353; p = 0.125) and the painful erection (K = 0.500; p = 0.248) evaluations were discordant: the B-mode US underestimated the positive cases. Instead the penile plaque and curvature > 30°, and the penile plaque evaluations were completely concordant.

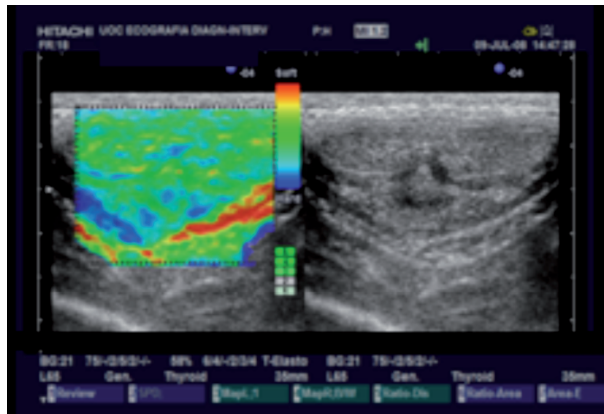
**Table 1.**

*Frequencies of some clinical findings of the 74 studied patients.*

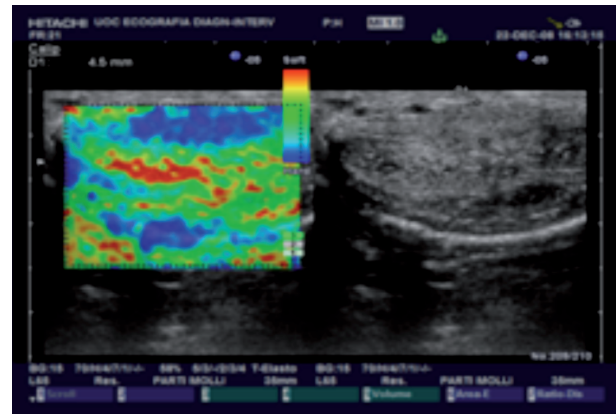
Clinical findings	N° cases	Positive		Negative
		B-Mode	Elastosonography	B-Mode and Elastosonography
Penile plaque and curvature > 30°	8 (10.81%)	8 (100%)	8 (100%)	0
Penile plaque	51 (6.89%)	51 (100%)	51 (100%)	0
Penile curvature	11 (14.86%)	4 (36.36%)	8 (72.72%)	3 (27.27%)
Painful erection	4 (5.4%)	1 (25%)	2 (50%)	2 (50%)
Total	74 (100%)	64 (86.49%)	69 (93.24%)	5 (6.76%)

**Figure 1.**

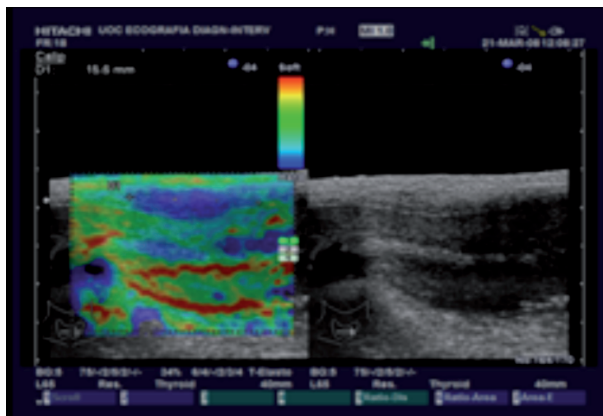
Conventional B-Mode and elastosonogram of the penis in controls and patients with Peyronie's diseases.



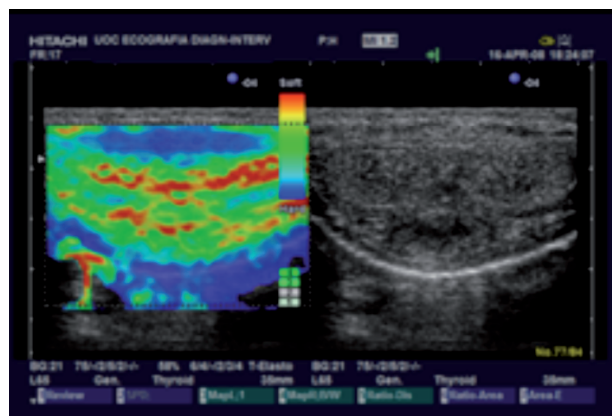
**A. Right:** conventional B-Mode of normal penis.  
**Left:** the elastosonogram of healthy man is characterized by a relatively uniform green light as in the surrounding tissue.



**B. Right:** conventional B-Mode image of hyperechoic dorsal nodule.  
**Left:** the hard (blue) plaque can be displayed in comparison to the surrounding softer (red and green) tissue.



**C. Right:** conventional B-Mode of hypoechoic dorsal nodule.  
**Left:** at elastosonography a well-defined entirely blue area indicates a dorsal plaque underestimated with US because of lesion isoechogenicity to tunica albuginea.



**D. Right:** conventional B-Mode: no evidence of penile plaque or thickening of the tunica albuginea.  
**Left:** at elastosonography, a large and defined dorsal area with relevant presence of the blue colour discloses an area of reduced elasticity.

## DISCUSSION

Peyronie's disease is well recognized clinical problem affecting middle aged and older men characterized by painful erection, penile plaques and deformities and erectile dysfunction.

The pathogenesis of Peyronie's plaques formation is still obscure; it is currently considered a wound healing disorder occurring in genetically susceptible subjects to form localized fibrosis as a response to repeated microtraumas of the tunica albuginea (9-12).

Diagnosis and characterization of penile plaques are based on physical examination and B-Mode US. Penile ultrasound is the imaging modality of choice to assess size, location of penile plaques and often is demonstrative of septal fibrosis and intracavernosal fibrosis among men who have not palpable plaques (13).

RTE is a newly developed dynamic technique based upon the principle that, under compression by an external force, the softer parts of a tissue deform easier than the harder ones. This elasticity can be assessed by measuring

the degree of distortion of the US beam under application of an external force on the structure examined (14). Some pathologic conditions (cancer, fibrosis, scars) induce considerable changes in the soft tissue structure modifying its elastic properties and leading to increased firmness and reduced strain of the tissue.

RTE is a safe, noninvasive, easy to perform technique and the skill needed to acquire adequate images is similar for conventional US and elastosonography. In our opinion elastosonography may represent a new powerful tool in the management of patients with complaints of *Peyronie's disease*.

In fact *Peyronie's disease* induces considerable changes in the soft tissue structure of the penis modifying its elastic properties and leading to increased firmness and, from a diagnostic point of view, the penis is well positioned for elastosonographic evaluation and can be easily assessed and efficiently compressed with a probe.

In patients with US visualized penile plaques, elas-

tosonography has the potential to better identify and characterize these penile lesions and the involvement of the surrounding tissues and to help us in monitoring the progression of the disease and the response to therapy. In patients with no US detectable penile plaques elastosonography can allow us to detect the early stage of the disease (areas of reduced elasticity) and to initiate a timely treatment with better outcome and quality of life. In the present study elastosonography of the penis confirmed the B-Mode ultrasound findings of penile plaques in 64 patients with complaints of *Peyronie's disease* and in 7 cases provided additional information in the characterization of isoechogenic lesions underestimated by conventional US.

In 10 cases, penile plaques were not detected by conventional US, nevertheless elastosonographic evaluation revealed in five patients areas of reduced elasticity of the tissues suggesting the presence of fibrosis.

## CONCLUSIONS

These preliminary data suggest that RTE is a new dynamic noninvasive technique that may represent a simple, rapid and complementary method to B-Mode US in the identification and differentiation of penile plaques in patients with *Peyronie's disease*, moreover it may represent a useful tool to identify areas of reduced tissue softness even in the absence of penile plaque.

Larger prospective studies are necessary to confirm these results and to ascertain the diagnostic accuracy and the clinical usefulness of this imaging technique.

## REFERENCES

1. Konig K, Scheipers U, Pesavento A, et al. Initial experience with real time elastography guided biopsies of the prostate. *J Urol* 2005; 17:115-57.
2. Ferrari FS, Scorzelli A, Megliola A, et al. Real time elastography in the diagnosis of prostate cancer. *J Ultrasound* 2009; 12:22-31.
3. Lyshchik A, Higashi T, Asato R, et al. Cervical lymph node metastases. Diagnosis at elastosonography. *Radiology* 2007; 237:202-11.
4. Ito A, Ueno E, Tohno E, et al. Breast disease: clinical application of US elastography for diagnosis. *Radiology* 2006; 239:341-50.
5. Rago T, Vitti P. Potential value of elastosonography in the diagnosis of malignancy in thyroid nodules. *Q J Nucl Med Mol Imaging* 2009; 53:455-64.
6. Rubaltelli L, Corradin S, Dorigo A, et al. Differential diagnosis of benign and malignant thyroid nodules at elastosonography. *Ultraschall Med* 2009; 30:175-9.
7. Ami O, Lamazou F, Levalliant JM, et al. Real time transvaginal elastosonography of uterine fibroid. *Ultrasound Obstet Gynecol* 2009; 34:486-8.
8. Grasso M, Bianco S, Nespola L. Elasto-sonography of the testis: preliminary experience. *Arch Ital Urol Androl* 2010; 82:160-3.
9. Devine CJ jr, Somers KD, Jordan GH, Schlossberg SM. Proposal trauma as the cause of the *Peyronie's* lesion. *J Urol* 1997; 157:285-290.
10. el Sakka AI, Hassoba HM, Pillarisetty RJ, et al. *Peyronie's* disease is associated with an increase in transforming growth factor-beta protein expression. *J Urol* 1977; 158:1391-4.

11. Noss MB, Day NS, Christ GJ, Melman A. The genetics and immunology of *Peyronie's* disease. *Int J Impot Res* 2000; 12:127-32.

12. Gonzalez Cadavid NF. Mechanism of penile fibrosis. *J Sex Med* 2009; 6:353-62.

13. Smith JF, Brant WO, Fradet V, et al. Penile sonographic and clinical characteristics in men with *Peyronie's* disease. *J Sex Med* 2009; 6:2858-67.

14. Ophir J, Alam SK, Garra B, et al. Elastosonography: ultrasonic estimation and imaging of the elastic properties of tissues. *Proc Inst Mech Eng* 1999; 213:203-233.

## Correspondence

Valentina Riversi, MD  
Imaging Department AOUS, Siena, Italy  
riversivalentina@libero.it

Valeria Tallis, MD  
Department of Urology - University of Siena  
Viale Bracci 16 - 53100 Siena, Italy  
blierius@yahoo.it

Stefano Trovattelli, MD  
Department of Urology - University of Siena  
Viale Bracci 16 - 53100 Siena, Italy  
stephanosque@gmail.com

Arben Belba, MD  
Department of Urology-University of Siena  
Viale Bracci 16 - 53100 Siena (Italy)  
arbenbelba@libero.it

Luca Volterrani, MD  
Imaging Department - University of Siena, Siena, Italy  
luca.volterrani@unisi.it

Francesca Iacoponi, MD  
Department of Biomedical Sciences-Applied Biology Section  
University of Siena, Siena, Italy  
francesca\_iacoponi@yahoo.it

Roberto Ponchietti, MD  
Department of Urology - University of Siena  
Viale Bracci 16 - 53100 Siena, Italy  
roberto.ponchietti@unisi.it