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Realtime-elastosonography of the penis in patients with Peyronie’s disease
Valentina Riversi, Valeria Tallis, Stefano Trovatelli, Arben Belia, Luca Volterrani, Francesca Iacoponi, Roberto Ponchietti
Realtime-elastosonography of the penis in patients with Peyronie’s disease

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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 = 0.333; p = 0.123) 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.

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.

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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 elastasonographic 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 elastasonography 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 elastasonographic 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 elastasonographic evaluation.

The dedicated software CAM (Combined Autocorrelation Method) ensured to obtain a fine estimation of the tissue displacement and produced the elastasonographic 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 elastasonograms 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 Elastasonography 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 elastasonographic ones to evaluate the diagnostic performance of this new imaging modality. B-Mode ultrasonographic images and elastasonograms of the penis are depicted in Figure 1.

In the healthy men the elastasonogram 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 elastasonographic 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%), elastasonography documented a larger well-defined entirely blue area indicating a dorsal plaque underestimated with conventional US because of areas of spongiosity 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 elastasonography 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 Elastasonography 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.**

<table>
<thead>
<tr>
<th>Clinical findings</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penile plaque and curvature &gt; 30°</td>
<td>8 (10.81%)</td>
<td>8 (100%)</td>
</tr>
<tr>
<td>Penile plaque</td>
<td>51 (6.89%)</td>
<td>51 (100%)</td>
</tr>
<tr>
<td>Penile curvature</td>
<td>11 (14.86%)</td>
<td>4 (36.36%)</td>
</tr>
<tr>
<td>Painful erection</td>
<td>4 (5.4%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Total</td>
<td>74 (100%)</td>
<td>64 (86.49%)</td>
</tr>
</tbody>
</table>
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 a 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 hyperechoic dorsal nodule. 
Left: at elastosonography a well-defined entirely blue area indicates a dorsal plaque underestimated with US because of lesion isoechogenity 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-
Elastosonography 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 isochogenic 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**


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