Journal of Medical Ultrasound (2015) 23, 150—153

Available online at www.sciencedirect.com

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journal homepage: www.jmu-online.com

CASE REPORT

Impalpable Testicular Seminoma Identified on Sonoelastography

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Received 28 April 2015; accepted 23 July 2015
Available online 6 September 2015

KEYWORDS
elasticity imaging techniques,
incidental findings,
seminoma,
ultrasonography

Abstract The role of sonoelastography in diagnosing cancerous masses has increased since the advent of elastography as an ultrasound modality. Its ability to display differences in the mechanical properties of cancerous masses compared to normal surrounding tissue has shown benefit in increasing the accuracy of diagnosing malignant breast and thyroid masses and has shown early potential in accomplishing better targeted prostate biopsies. To date, the literature is limited in the number of studies describing the use of sonoelastography for testicular masses. We describe a 34-year-old man who presented with an incidental finding of an impalpable hypoechoic testicular mass on grayscale ultrasound during an infertility work-up. Sonoelastography was performed displaying intermediate testicular elastic properties. Upon frozen section of the mass during surgical exploration, classic testicular seminoma was diagnosed and subsequent radical orchiectomy was performed. We would like to use this atypical presentation of testicular seminoma to review the potential role of elastography for diagnosing testicular cancer.

Introduction

Classic seminoma usually presents as a painless, hard, palpable testicular mass, making clinical evaluation the initial and most important step in diagnosis [1]. The impetus for more innovative ultrasound techniques comes as a result of the inability of conventional B-mode ultrasound to detect structural and histological characteristics of testicular tumors [2]. Sonoelastography of testicular

Conflicts of interest: All authors declare no conflicts of interest.

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http://dx.doi.org/10.1016/j.jmu.2015.07.005

masses generally demonstrates a very distinct pattern given the increased tumor stiffness compared to normal surrounding testicular tissue [3].

We present a case of testicular seminoma with an atypical presentation of a nonpalpable mass seen on ultrasound diagnosed during work up for infertility.

Case report

A 34-year-old man presented to his primary care physician with a chief complaint of inability to conceive with his wife for 6 months. The patient was otherwise healthy and exercised vigorously 3 times a week. He denied genital trauma. He reported a previously history of a sexually transmitted disease treated effectively 10 years previously. He has a 15-pack/y history of cigarette smoking and drinks 12—16 alcoholic beverages/wk. Vitals and physical examination were normal. Testicular examination demonstrated normal sized testes without tenderness and without palpable masses. Scrotal ultrasound was initially performed using real time and color Doppler imaging. Ultrasound demonstrated 20 cc testes bilaterally with a 2.5 cm $\times$ 1.1 cm $\times$ 2.5 cm irregular hypoechoic mass located in the posterior inferior aspect of the right testis, showing internal flow on color flow Doppler (Fig. 1A). Semen analysis demonstrated a markedly impaired semen quality with a volume of 3.75 ml, sperm concentration of 5.00 $\times$ 10^6/mL, total count of 18.75 $\times$ 10^6/mL, and motile sperm count 3.00 $\times$ 10^6/mL. Hormonal work up revealed follicle-stimulating hormone, luteinizing hormone, and testosterone all within normal range. Prolactin was slightly elevated at 17.45 ng/mL (normal range, 4.04—15.2 ng/mL). Given the ultrasound findings, serum testis tumor markers were obtained and found to be within the normal range (B-human chorionic gonadotropin $<$ 2 mIU/ml, α-fetoprotein = 5.6 ng/ml, and lactate dehydrogenase = 133 U/L).

Patient was referred to our institution for further evaluation. Due to the clinical presentation of an impalpable mass, unusual ultrasound findings, and negative tumor markers, the patient underwent shear wave sonoelastography to characterize the hypoechoic right testicular lesion further. The study demonstrated a heterogeneous lesion measuring 2.6 cm $\times$ 1.0 cm in the transverse plane (Fig. 1B, lower pane) and 1.8 cm $\times$ 1.1 cm in the sagittal plane with decreased vascularity and evidence of increased stiffness (intermediate stiffness; Fig. 1B, upper pane) compared to normal surrounding testicular tissue, raising concern for testicular malignancy. Subsequent computed tomography scan of chest, abdomen, and pelvis did not identify any evidence of regional or metastatic disease. The patient was counseled and consented for inguinal exploration with testicular biopsy and frozen section with plan for partial versus radical orchiectomy as determined by the histology on frozen section.

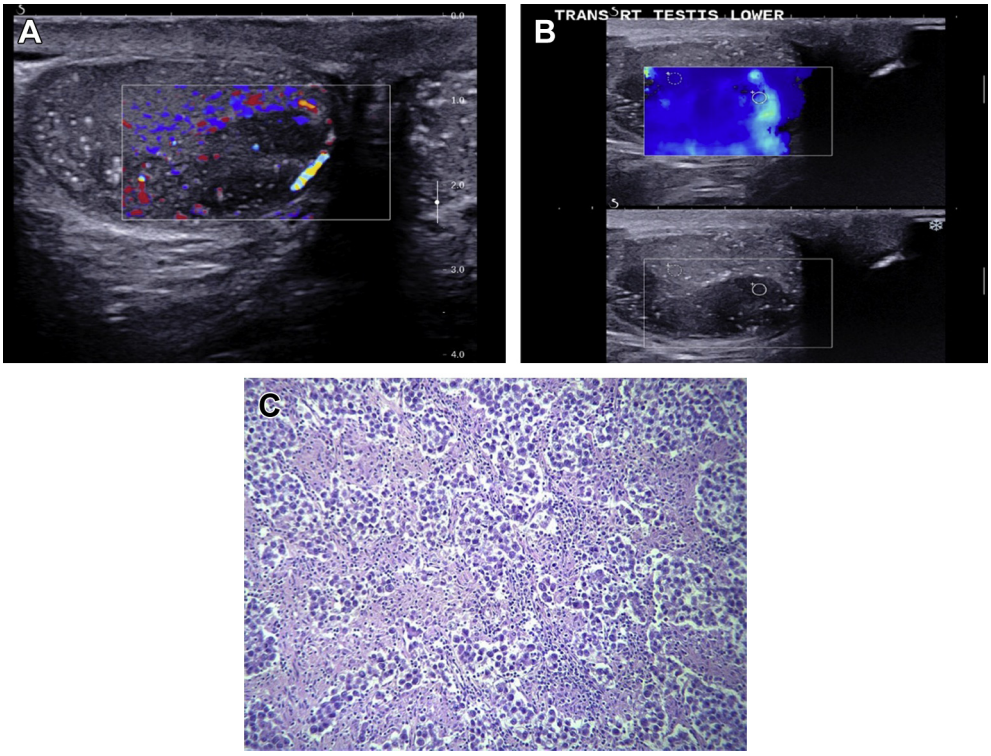

Fig. 1 Impalpable testicular mass in a 34-year-old man displayed on multiple ultrasound modalities. (A) Irregular hypoechoic mass located in the posterior inferior aspect of the right testis, measuring 2.5 cm $\times$ 1.1 cm $\times$ 2.5 cm, showing internal flow on color flow Doppler, and numerous hyperechoic spots representing microlithiasis. (B, lower pane) Hypoechoic testicular mass measuring approximately 2.5 cm on regular grayscale ultrasound. (B, upper pane) Same testicular mass on ultrasound elastography showing areas of intermediate strain represented as bright green color. (C) Histological characteristics of classic seminoma. Shows nests of proliferating neoplastic cells separated by fibrous septa with infiltrating lymphocytes within fibrous septa.

During exploration, the testicular mass could be palpated with increased tactile pressure. This palpable finding under anesthesia confirmed our sonoelastography findings. After clamping the spermatic cord, the testicular mass was identified and incisional biopsy of the right testicular mass was obtained and sent for pathologic frozen section. Histological findings were consistent with classic seminoma (Fig. 1C); therefore, radical orchiectomy was performed. Final pathology revealed a pT1a tumor limited to the testis and epididymis without lymphovascular invasion.

The American Joint Committee on Cancer stage was Ia (pT1a, N_0, M_0, S_0). The patient was counseled on management options including surveillance, single agent carboplatin, or radiotherapy for which he elected surveillance. At the most recent follow-up visit (1 year postorchiectomy), he has normal tumor markers and no evidence of recurrence on computed tomography of chest, abdomen, and pelvis.

Discussion

Ultrasound is considered the gold standard in evaluating scrotal masses due to its high sensitivity and accuracy in distinguishing intra-testicular vs. extra-testicular masses. Making this distinction with ultrasound is important as the prevalence of malignant intra-testicular masses is much higher compared to extratesticular masses [4]. On B-mode ultrasound, testicular malignancy is often a hypoechoic lesion compared to normal surrounding testicular tissue. The classic description for a seminomatous germ-cell tumor is a homogeneous, hypoechoic nodule that may range from small, sharply demarcated masses to large masses causing diffuse testicular enlargement [5]. In the majority of malignant testicular tumors, color Doppler ultrasound will demonstrate increased vascular flow [6].

A new modality of ultrasound, sonoelastography, has the capabilities to assess tissue density. In this way, physicians can see the stiffness of the suspicious lesion compared to the surrounding tissue by both a color differential and measuring the amount of pressure applied in kPa. The physics behind the technology is explained by Young's modulus, which describes how the amount of pressure applied when placing the ultrasound probe on the testis will result in a linear degree of deformation of the tissue. Sonoelastography can be useful for diagnosing testicular malignancy because the majority of malignant tissues are comprised of stiffer components compared to normal surrounding tissue. When the ultrasound probe is applied to a testis containing a malignant tumor, the degree of deformation of the tissue components of the malignant testicular mass will be less than normal surrounding tissue. Despite the increased use of sonoelastography in certain areas of oncology, its potential for improving diagnosis of testicular cancer has not been well defined.

The increased use of ultrasound for the work-up of infertility has led to an increase in the number of subclinical testicular masses. This contributes to the dilemma of being able to distinguish candidates for conservative management, such as ultrasound surveillance, to avoid adverse effects of radical orchiectomy [7]. When looking specifically at nonpalpable testicular masses in patients presenting for infertility work-up, Hopps et al [8] reported incidental findings of four nonpalpable hypoechoic testicular masses in men undergoing infertility work-up. Each mass underwent intraoperative needle localization under ultrasound guidance and microsurgical exploration. Frozen section analysis of the lesions revealed two Leydig cell tumors, one with an inconclusive pathological diagnosis and one with inflammatory changes, and two seminoma tumors, each with biopsies positive for seminoma and intra-tubular germ cell neoplasia [8]. De Stefani et al [9] reviewed clinical outcomes of 20 infertile patients with nonpalpable or small testicular masses who underwent microsurgical testis-sparing surgery. Upon excision and frozen section examination of the lesions, only two were found to be seminomas. The remaining lesions were benign [9]. Tal et al [10] reviewed the pathological findings in 11 infertile patients in whom testicular tumors were incidentally found. Out of 11 lesions in this patient population, six malignant germ cell tumors, three Leydig cell tumors, and two lesions with no histological evidence of tumor were found [10]. These studies show the lack of predictability of nonpalpable masses in patients being managed for infertility. Current management options for such lesions include conservative measures with routine follow-up ultrasound or more commonly used invasive options, which include testis-sparing surgery or radical orchiectomy depending on results of frozen section biopsy while the patient is in the operating room.

Sonoelastography has been shown to improve the detection of malignant testicular lesions. Goddi et al [3] did an extensive statistical analysis of the use of sonoelastography in assessing 144 solid testicular lesions and comparing the results with histological confirmation. Results yielded a positive predictive value and specificity of 100% for detecting testicular malignancy in masses measuring $>$ 11 mm^3 and masses measuring 5—10 mm^3. Aigner et al [11] further assessed testicular masses found in 50 patients using real-time sonoelastography. Increased stiffness of testicular masses found on real-time sonoelastography was assumed malignant as decreased stiffness or "soft" lesions on real-time sonoelastography were assumed benign. Real-time sonoelastography showed increased tissue stiffness within all malignant testicular masses (34 in total, sensitivity = 100%, negative predictive value = 100%), identified areas of tissue stiffness within three testicular masses that were found to be nontumorous (specificity = 81%, positive predictive value = 92%), and showed "soft" tissues in four testicular masses with ambiguous grayscale ultrasound and color Doppler ultrasound findings, which were found to be nontumorous [11]. Pastore et al [12] assessed 30 testicular lesions using semiquantitative sonoelastography, which calculates the strain indices by comparing strain patterns within the testicular mass to normal surrounding testicular tissue. Important findings included that the index of deformation increases with the rigidity of tissue being assessed and stiffest tissues within a malignant mass are located around the tumor's perimeter. In addition, there was an inverse relationship between the index of strain and the vascular index found upon immunohistochemistry analysis, indicating the possibility of semiquantitaive sonoelastography's

ability to detect microcirculation or neoangiogenesis [12]. The previous three studies mentioned demonstrate the ability and potential of sonoelastography in assessing testicular malignancy and helping the clinician decide whether invasive management is necessary, similar to how it was beneficial to our current case.

In the work up for infertility, benign lesions such as Leydig cell tumors are often encountered. In a series of 13 cases of benign Leydig cell tumors, five were further characterized with sonoelastography and all five displayed "harder" tissues than normal surrounding testicular tissue. Hence, it may be difficult to differentiate Leydig cell tumors from malignant lesions. Nonetheless, combining clinical and laboratory data such as precocious puberty and/or elevated serum testosterone may help differentiate between this benign lesion and those that may be malignant [13].

In conclusion, innovative sonographic modalities, such as sonoelastography, have provided advances in noninvasive identification of malignant masses for several oncologic specialties. This case highlights the potential for sonoelastography to help identify testicular lesions found incidentally.

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