

Inconclusive Scrotal Ultrasound Reports: The Impact of a Second Scrotal Ultrasound

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Submitted December 10, 2010 - Accepted for Publication January 26, 2011

ABSTRACT

INTRODUCTION: The purpose of this retrospective study was to determine the accuracy of repeat sonographic tests for intrascrotal pathologies that were performed when the first ultrasound (US) report was inconclusive. We also examined the consistency of the first and final diagnoses and the effect on management procedures.

METHODS: In 2008, 3049 sonograms were performed for scrotal pathology. A total of 70 sonograms (2.3%) were inconclusive and a second US was requested; these became the database for the present study. We recorded the patient's age, presenting symptoms, time span between US sessions, grade of the US operator, US results, and final histopathological or clinical diagnosis. We also examined whether or not the follow-up US led to a change in management.

RESULTS: The mean age of patients was 46 years (range, 6-85 years) at the time of the original US. Indications for the second US were pain (n = 30), the presence of an indistinct swelling (n = 19), a discrete lump (n = 11), or a combination of these (n = 10). Overall, 66 patients (94.3%) had benign pathology; 4 patients were diagnosed with cancer following histopathology tests that were conducted because of abnormal tumor markers. In 22 patients (31%) there were appreciable differences between the first and subsequent diagnoses; in 48 patients (69%) there was no appreciable difference. For 45 patients (64.3%), the follow-up US did not alter the management plan; only 2 of these patients had a change from the initial diagnosis. However, 25 patients (35.7%) had an alteration in their management after the follow-up US; 20 of these patients had a different diagnosis following the repeated US. Of the 70 patients, 61 (87%) were managed conservatively; 9 patients received surgery.

CONCLUSIONS: A second scrotal US can be an effective diagnostic tool if a prior US is inconclusive, particularly if the condition is benign. Repeat US has minimal value in detecting malignant testicular pathologies.

KEYWORDS: Repeat scrotal ultrasound; Equivocal report

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CITATION: *UroToday Int J.* 2011 Apr;4(2):art 26. doi:10.3834/uij.1944-5784.2011.04.08

Abbreviations and Acronyms

CT, computed tomography
EKUHT, East Kent University Hospitals Trust
MRI, magnetic resonance image
US, ultrasound

INTRODUCTION

Ultrasonography is the imaging modality of choice for the scrotum because it is highly accurate and readily available. Scrotal contents are superficial, enabling high-frequency ultrasound (US) probes (up to 10 MHz) to differentiate between a variety of testicular and extratesticular pathologies [1-3].

Despite its effectiveness, scrotal US is limited in determining whether a focal testicular lesion is benign or malignant [4]. As a consequence, it is not uncommon for urologists to receive inconclusive scrotal US reports. These lead to difficulties in setting an appropriate management plan. Hence, further

investigation is necessary. Typically, the follow-up examination is a second US scan, scrotal magnetic resonance image (MRI), or computed tomography (CT) image [5-7].

The value of each of the follow-up tests is not fully determined in the literature, so no gold-standard procedure exists. In this retrospective study, we sought to determine the accuracy of repeat sonographic tests for intrascrotal pathologies that were performed when the first US report was inconclusive. We also examined the consistency of the first and final diagnoses and the effect of the second US on management procedures.

METHODS

Patient Database

We conducted a retrospective review of the clinical notes and radiological records of patients from 3 hospitals within our trust: The Queen Elizabeth Queen Mother Hospital (QEQM) Margate, William Harvey Hospital (WHH) Ashford, and Kent and Canterbury Hospital (KCH) Canterbury. These hospitals together make up the East Kent University Hospitals Trust (EKUHT).

Between January 2008 and January 2009, 3049 scrotal ultrasounds were conducted across the EKUHT. From the total number, 124 (4%) were repeated. Of these, 54 sonograms were performed for a new clinical indication (eg, pain, swelling, a change in symptoms) that required further investigation. The results of the remaining 70 sonograms (2.3%) were inconclusive and a second US was requested; these became the database for the present study.

Procedures

Scrotal sonograms were requested by both general practitioners and members of the urology department for both acute complaints and chronic symptoms. All examinations were carried out by a radiologist or a fully trained ultrasonographer, using a standard technique.

All sonograms were completed using state-of-the-art equipment, with high-frequency linear transducers (7.5 -10.0 MHz or multifrequency) and associated color Doppler imaging. Three instruments were Toshiba Aplio XG (Toshiba Medical Systems Europe; Zoetermeer, Netherlands); 2 instruments were GE Logiq 9 (GE Healthcare; Chalfont St Giles, UK).

The criteria used to consider a sonogram inconclusive were: (1) the operator was unable to provide a definite diagnosis or differentiate between malignant and benign lesions; (2) a review of saved images of the first US by a panel of expert radiologists and urologists did not clarify the diagnosis. For

those investigations that were deemed inconclusive, a repeat US was either suggested by the sonographic operator, the urologist reviewing the report, or by a panel of consultant urologists.

Data Recording and Analysis

We reviewed the medical records of the 70 participants. Details recorded for all examinations included the patient's age, presenting symptoms, time span between US sessions, the grade of the US operator, ultrasonic findings, and the final histopathological or clinical diagnosis.

The final diagnoses were based on the findings of the second or final sonographic report. We noted whether the second US was consistent with the clinical impression. The *diagnostic impact* of the second scrotal US was determined by whether the management was conservative or surgical and the management was changed because of the results. Treatment was deemed to have *changed* if surgery was conducted, a new intervention (eg, embolization) was completed, or a patient was sufficiently reassured to be discharged from the clinic.

RESULTS

The mean age of the 70 patients was 46 years (range, 6-85 years) at the time of the original US. The average time span between US sessions was 3 months. We performed a total of 175 ultrasounds (70 first ultrasounds and 105 repeat ultrasounds). The mean number of repeat ultrasounds was 2.5 (range, 2-5). The most common indication for the second US was pain (n = 30), followed by the presence of an indistinct swelling (n = 19), a discrete lump (n = 11), or a combination of these (n = 10).

Final Diagnosis

Four patients were thought to have intratesticular hypoechoic lesions on their initial reports. A second US did not reveal any change in the initial diagnosis, but as a consequence of abnormal tumor markers the treatment proceeded to an orchidectomy. The delay between the original US and the orchidectomy was less than 1 week. The histological report for these 4 patients confirmed a malignancy. The final diagnoses were seminoma (n = 2), teratoma (n = 1), and mixed germ-cell tumor (n = 1).

The repeat US revealed 8 different benign diagnoses in the remaining 66 patients (Table 1). A total of 13 patients (19.7%) had testicular findings and 53 patients (80.3%) had paratesticular pathology. Overall, the 2 most common diagnoses among the 66 patients were epididymitis (n = 24) and hydrocele/hematoma (n = 13). No definitive diagnosis could be made for 7 patients with an abnormal echo pattern, despite the second US. There was no evidence to suggest that these or other patients who

Table 1. Number of Patients With Final Diagnosis of Benign Lesions (n = 66; N = 70).

doi: 10.3834/uj.1944-5784.2011.04.08t1

Final Diagnosis	n	% n
Epididymitis	24	36.4
Hematoma/Hydrocele	13	19.7
Intratesticular cyst	7	10.6
Microlithiasis	6	9.0
Epididymal cyst	5	7.6
Varicocele	3	4.5
Epididymal adenomatoid tumor	1	1.5
Abnormal echo-pattern but not typical for cancer	7	10.6

had received a benign diagnosis subsequently presented with a testicular neoplasm. It should be noted that echo-patterns may change from the first to second ultrasounds, even if the pathology is benign (see Figure 1, for example).

Microlithiasis accounted for 6 of the final diagnoses (9%). The finding of microlithiasis was once thought to be a precursor for

malignant testicular disease, but the rate of testicular cancer in individuals with microlithiasis is now known to be no different from those without any microcalcification if there is no other risk factor present [8]. This information may not have been known by referring practitioners, radiology staff, and even some urologists.

Differences in Diagnosis Between the Primary and Subsequent Ultrasounds

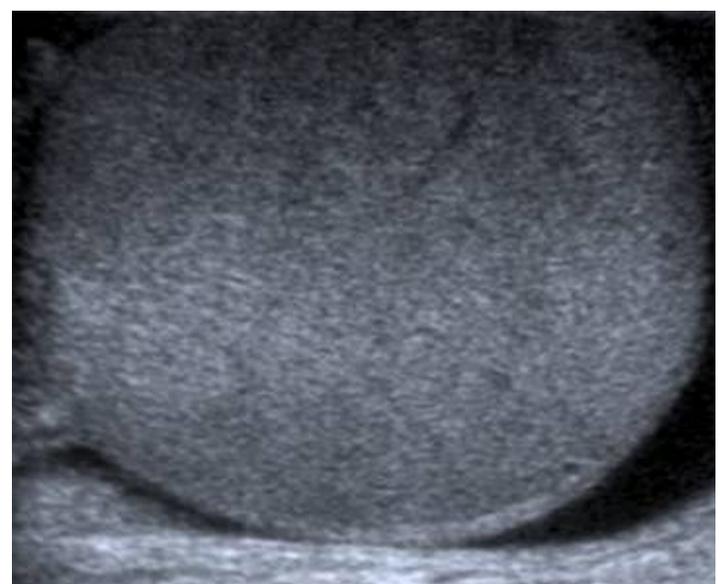
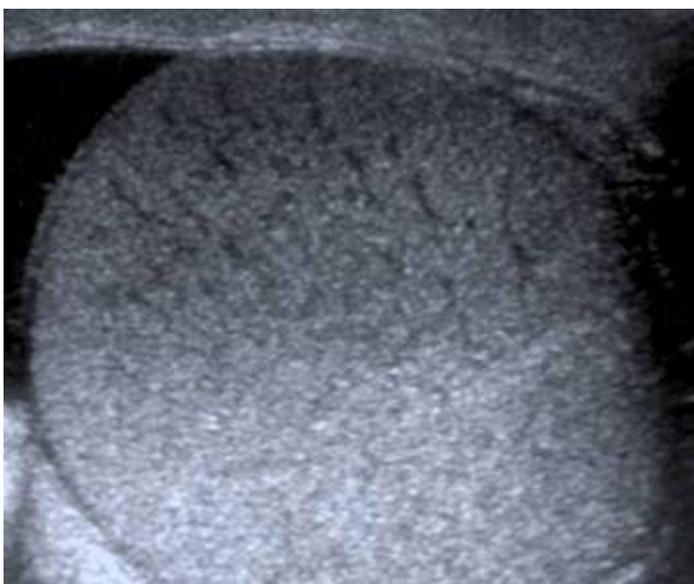
We reviewed whether or not there were differences between the first and subsequent US reports. In 22 patients (31%) there were appreciable differences in the diagnosis; in 48 patients (69%) there was no appreciable difference. Change in the status of the US operator (radiologist to sonographer or vice versa) had no effect on US findings and did not alter the final outcome.

Final Management Plan

After the final US, 61 of the 70 patients (87%) were managed conservatively; 9 patients received surgery. We reviewed the association between the repeated US report and subsequent patient management (Table 2). For 45 patients (64.3%), the follow-up US did not alter the management plan; only 2 of these patients had a change from the initial diagnosis. However, 25 patients (35.7%) had an alteration in their management after

Figure 1. Ultrasound images from a 40-year-old man who presented with a 4-day history of severe left testicular pain.

doi: 10.3834/uj.1944-5784.2011.04.08f1



An initial ultrasound was inconclusive (left) but further imaging at a later date demonstrated resolving appearances (right).

Table 2. Effect of Repeat Ultrasound on Final Patient Management Plans (N = 70).

doi: 10.3834/uij.1944-5784.2011.04.08t2

Management Plan Not Altered Following Repeat Ultrasound (n = 45; 64.3%)		Management Plan Altered Following Repeat Ultrasound (n = 25; 35.7%)	
Repeat US had Different Result	Repeat US had Same Result	Repeat US had Different Result	Repeat US had Same Result
9% (n = 2/22)	89.5% (n = 43/48)	91% (n = 20/22)	10.5% (n = 5/48)

the follow-up US; 20 of these patients had a different diagnosis following the repeated US.

DISCUSSION

The sensitivity of US in differentiating between normal and abnormal scrotal contents is well documented [9-11]. The accuracy of US in differentiating testicular from paratesticular pathologies is 99% and it is known to be effective in the detection of testicular tumors [12-14]. However, inconclusive reports are encountered and further investigation can be completed using a number of modalities. Two studies assessing the use of MRI quote rates of inconclusive ultrasounds between 1.5% and 4.5% [15,16]. The rate of inconclusive reports in the present study (2.3%) compares favorably with this reported range and corroborates the effectiveness of US as the investigation of choice for the scrotum.

Although ultrasound is known to have excellent sensitivity, its specificity is not as good [10]. In those individuals with inconclusive reports, additional information may be needed to yield a diagnosis. Some studies have assessed the role of a subsequent MRI [15,17], but none of the studies have assessed the role of a second US investigation. In the work conducted here, we demonstrated the effectiveness of a second US scan in determining a clinical diagnosis in 59 of the 70 patients (84.3%); the repeat US did not add any diagnostic information in 11 cases (15.7%) because 7 of these patients had no final differential diagnosis after the second scan and 4 patients had no difference in results between the first and second scans. In the study completed by Serra et al [15] the leading MRI diagnosis was incorrect in 3 of 34 patients (8.8%).

In 4 of the present patients (6%) a second US was ineffective in detecting malignancy, but these cases were detected in conjunction with tumor marker investigations (α -fetoprotein, β -hCG). These cases highlight the difficulty associated with the detection of testicular malignancies because they typically display a range of sonographic appearances. Current guidance from the European Association of Urology suggests the use of MRI of the scrotum because it offers a higher sensitivity and

specificity, but the guidelines also state that the high cost of MRI does not justify its use for diagnosis [18]. An alternative option in individuals where cancer is not suspected could involve repeating an interval sonogram in order to detect any changes.

A cost analysis based on these findings suggests a possible benefit of repeat ultrasounds when compared with MRI. The cost of a scrotal US performed in the National Health Service of the UK is difficult to ascertain and a PubMed (U.S. National Library of Medicine; Bethesda, MD) search using the keywords *NHS, scrotal ultrasound, scrotal MRI, and cost* did not reveal any results. The cost assessment suggested by Serra et al [15] was \$102 US dollars for a scrotal US and \$582 US dollars for a scrotal MRI, thus potentially a saving of \$400 per investigation (note that this study was published in 1998 so the current total costs would be different but the proportion may be similar).

There are a number of limitations in this study. First, a key imperfection is the fact that a second US is the basis of the final diagnosis and this diagnosis was not confirmed through another mode of investigation. This could raise the possibility that both US investigations were inaccurate. A counter to this argument is that 2 investigations with a specificity of > 90% is as effective as an MRI. Second, another limitation of this work may be that a second US was not used to assess all individuals, rather, it was only used for those with inconclusive reports. Thus, it is not known if a second US may be useful in detecting additional problems for all patients. Third, a more accurate methodology would have been to randomize individuals to either US or to MRI in order to determine the effectiveness of both investigations. This procedure would also give additional data as to the cost effectiveness of the procedures. Fourth, although most sonographers (radiographers and radiologists) receive similar training in how to complete sonography, the technique may not have been entirely similar. Finally, some sonograms were performed with machines that were more than 7 years old, but continue to be maintained and used to good effect; therefore, we believe that our results are valid.

CONCLUSION

The present study confirms ultrasound as the primary modality of choice for initial investigation of the scrotum because it yields a high degree of accuracy. This work also confirms that a second scrotal US can be an effective diagnostic tool if a prior ultrasound is inconclusive, particularly if the condition is benign. Although scrotal US is commonly preferred to MRI for the initial diagnosis because of the relative expense and convenience, further investigation is needed to determine if US could be used reliably as a follow-up test in inconclusive cases.

ACKNOWLEDGMENT

We are grateful to the professionals in the Department of Radiology at Kent & Canterbury Hospital for their cooperation in retrieving the patient data and ultrasound reports.

Conflict of Interest: none declared.

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