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Testicular Ultrasound in the Prediction of Type and Size of Testicular Tumours

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ABSTRACT

Objectives: *To study the correlation between US findings and testicular tumor type and size.*

Methods: *The study included patients who underwent orchiectomy between 2000 and 2010. Their charts were reviewed for US echogeneity, lesion size, pathological dimensions, histology, and the presence of calcifications, fibrosis, necrosis and/or intraepithelial neoplasia and were statistically compared.*

Results: *Eighty five patients fulfilled the inclusion criteria, 71 malignant (43 SGCT, 28 NSGCT) and 14 benign. Sonographic lesions were at least 20% smaller than the pathologically determined dimensions in 21 (25%) patients. The ability of US in estimating the size of malignant tumors was 71%, compared to 100% of benign tumors (p=0.03).*

Conclusions: *Testis US of malignant lesions underestimates the size in 25% of the cases, a fact that may impact on the decision of testicular sparing surgery*

KEYWORDS : Ultrasonography, Testis, Neoplasms

Introduction

Ultrasound (US) is often used for clinical investigation of testicular disease. However, it cannot reliably differentiate benign from malignant intratesticular lesions and its ability to predict the true tumor size is debatable (1-5). It has been demonstrated that cancers are hypo-echoic in relation to the surrounding parenchyma in approximately 95% of cases (6). Some studies have suggested that seminoma germ cell tumors (SGCT) are often more homogeneously hypoechoic while the more cystic nonseminomatous germ cell tumors (NSGCT) are often non homogenously hypoechoic due to areas of calcifcation and/or necrosis (1, 6, 7). Even with this noted difference, the tumor tissue type cannot be reliably differentiated solely by its ultrasonographic appearance and the general consensus is that a sonographic detection of a solid or mixed cystic lesion mass requires surgical exploration (6, 8). In these situations lesion dimensions are a crucial factor if considering testicular sparing surgery (9-12). Our major goal was to assess the ultrasound capability to distinguish benign from malignant disease and to estimate the tumor size as compared to pathological measurements.

Materials and Methods

The study included all patients who underwent an orchiectomy from 2000 to 2010 and had their preoperative sonogram and postoperative pathology available.

The patients' charts were reviewed for sonographic parameters such as echogeneity (hyper, hypo or iso), lesion size, and presence of calcifications as well as pathological parameters such as tumor dimensions (after shrinkage due to formalin fixation), histology, and the presence of fibrosis, necrosis and/or testicular intraepithelial neoplasia (TIN). We defined two sets of tumors: malignant vs. benign tumors and, within malignant tumors, SGCT vs. NSGCT. The Two-tailed Fischer exact test was applied to these sets for all the aforementioned sonographic and pathological parameters.

Results

There were 85 patients who fulfilled the inclusion criteria, 71 malignant (43 SGCT, 28 NSGCT) and 14 with benign lesions (12 Leydig cell tumor, 1 post traumatic atrophy, and 1 dermoid cyst). Therefore, in 16% of the cases, the ultrasonic lesions were eventually proven to be benign. Lesion dimensions as determined by ultrasound were at least 20% smaller (the minimum difference to be considered in size underestimation in US) than the pathologically determined dimensions in 21 (25%) patients. The results are detailed in table 1, 2, 3 and 4. Tumor dimensions measured by sonography were more accurate in benign tumors (p=0.017). The ability of US in estimating the size of malignant tumors was 71%, compared to 100% of benign tumors, with no significant difference between SGCT and NSGCT. We also confirmed that necrosis was more frequent in malignant than benign tumors (p=0.017) and that hypoechogeneity and fibrosis were more frequent in SGCT than in NSGCT (p=0.001 and 0.047 respectively)

Discussion

Testicular ultrasonography is usually performed with a high-frequency linear transducer; the echo texture of the two testicles is compared and areas of heterogeneity are searched for. Upon discovery of a lesion accurate dimensioning is crucial as clinicians must carefully consider the size of the lesion in their decision as to whether or not to perform testis preserving surgery, especially when facing a single testis (anatomical or functional) (13). General consensus is that a sonographic finding of any solid or mixed cystic lesion mass is an indication for surgical exploration (6, 8). However, there are only scant publications on the correlation between sonographic findings and type, local stage, size, and the histology of testicular tumors (TT) (8).

Most papers presented the histological subdivision of tumors without specific correlation as to the echogeneity or size (8, 14). If the size was mentioned in order to justify a partial resection, it was without correlating to the preoperative sonographic findings. Carmignani et al. (8) have outlined the relation between lesion dimensions and the presence of germ cell tumors, showing that lesions of 16-32 mm have a high relative risk for malignancy. Shilo et al. presented a larger group of 131 patients concluding that benign lesions tend to be smaller than malignant lesions (15 mm vs. 41 mm respectively) and therefore a proper sonographic estimation can lead to consideration of partial orchiectomy (15). In contrast, our study explored the ability of sonography to predict the actual pathological size in the post operative specimen and not just the correlation between size and malignancy. The few publications that relate to testicular organ sparing operation focus on the oncological point of view but some sonographic data can be retrieved from them (9-11). Heidenreich et al. presented on 73 patients (42 SGCT, 31 NSGCT). Elert et al. operated on 354 patients, revealing 317 tumors: 100 seminomas, 217 nonseminomas, and 14 Leydig cell tumors (12). This large group of patients is impressive yet

their data was not used to examine the preoperative sonographic expression and only concentrated on indications for frozen section, organ sparing surgery, and the oncological outcomes. Weissbach mentioned the limitation of size (≤20mm) as one of the indications for partial orchiectomy without estimating the sensitivity of the preoperative sonogram to give such important detail (15). Some authors attempted to test the sonographic utility by searching for a correlation between the sonogram and the postoperative results but did not consider size estimation (16). Wang used data of 59 tumors (41 seminomas, 9 non seminoma and 6 non germ cell tumors) to discuss the ability of the sonogram to differentiate between malignant and non-malignant lesions (17, 18). Ye et al. presented 16 patients with impalpable masses (diameter of 5 to 30mm) of which 15 were hypoechoic and one was hyperechoic and calcified with only 5 malignant masses (2 seminomas, 1 nonseminoma and 2 cases of lymphoma). This attempt pointed to our goal but the low power of the study precluded any conclusive deductions. Schwerk et al. (6) has reported a prospective study on 57 lesions, demonstrating a broad spectrum of texture patterns for malignancies of which 92% exhibited hypoechogeneity, but could not differentiate between the histological subtypes.

Our study provides the percentage of preoperative sonographic tumor size underestimations, an issue not yet addressed. Moreover, we attempt to support prior assumptions presented in urological literature without sufficiently solid proof regarding the ability of sonographic findings to predict testicular tumor type. More than that, we have demonstrated another preoperative tool or attempt to distinguish benign from malignant tumors aside to other characteristics that have been described by Shilo and his colleagues (13).

This new data provides help in the surgical consideration and planning of an orchiectomy, especially the consideration of a partial resection with or without a guided intraoperative biopsy. Herein we are adding another proof for the opinion that seminomas tend to be more hypoechoic than nonseminoma tumors. These facts combine to show that concentrating on the sonographic characteristics of the testicular lesion can vastly improve clinical judgment. A reason for underestimation might be that sonography only shows the centralized body of the malignancy and cannot reliably pick up tendrils that are of clinical significance.

Additionally, although our patients were heterogeneous, prior publications that contributed to our knowledge of the prevalence of different types of tumors within groups of patients lead to the conclusion that this is acceptable (20,21).

Conclusion

Sonographic measurement of malignant testicular lesions underestimates the size in 25% of the cases. This can have serious consequences, as size has an impact on the decision of testicular sparing surgery

Tables:

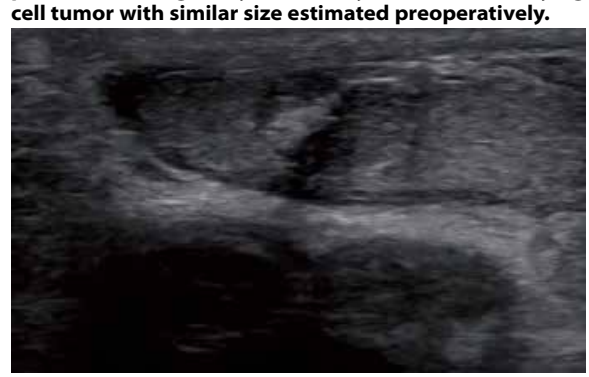
1. Collected ultrasonic results and histologic parameters divided according to the type of tumor (benign vs. malignant).

	Benign	Malignant	P Value
Number of pts.	14	71	-
US size underestimation	0	21	0.017
Hypoechogeneity	7	32	0.775
Calcifications	4	17	0.739
Histological parameters			
Fibrosis	2	17	0.726
Necrosis	0	21	0.017
TIN	N/A	34	N/A

2. Collected ultrasonic results and histological parameters divided according to the histologic malignant subtype of tumor.

	SGCT	NSGCT	P Value
Number of pts.	43	28	-
US size underestimation	11	10	0.429
Hypoechogeneity	28	7	0.001
Calcifications	13	6	0.584
Histological parameters			
Fibrosis	14	3	0.047
Necrosis	13	9	1.00
TIN	23	12	1.00

3. Leydig cell tumor - Heterogeneous mass that was suspected for malignancy eventually found to be Leydig cell tumor with similar size estimated preoperatively.



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