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Cross-sectional Study

Color doppler ultrasound for diagnosis of testicular carcinoma: A comparison with gold standard histopathology

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ABSTRACT

Introduction: Testicular carcinoma is the most common cancer among males aged 15–34 years. The known risk factors for testicular cancer include undescended testis (cryptorchidism), testicular dysfunction, perinatal factors and prior history of cancer in one testis. We aimed to determine the diagnostic accuracy of color doppler ultrasound in diagnosis of testicular carcinoma using histopathology as GOLD STANDARD.

Method: ology: A cross sectional study was conducted from July 2015 to Feb 2016 at the Department of Radiology, Jinnah Post Graduate Medical Center, Karachi. 311 subjects were selected through inpatient/outpatient or emergency department. Patients were evaluated for testicular carcinoma by color doppler ultrasound on Toshiba nemio. Finding of color doppler ultrasound was compared with histopathology. True positive, true negative, false positive, false negative as per operational definition was determined.

Results: Mean age of the patients of the study was 41.76 ± 8.11 (30–50) and mean and SD of Duration of symptoms was 5.5 ± 3.5 (4–15) months. Of 175(56.27%) subjects diagnosed as testicular carcinoma on CDUS, only 160(48.55%) were subsequently found to have testicular carcinoma. sensitivity of CDUS in diagnosing scrotal diseases was 88.8% while specificity was 78.1%.

Conclusion: We conclude that CDUS is an excellent, safe, and reliable method for evaluating patients with testicular carcinoma. It helps to improve patient's management, especially by preventing unnecessary surgical exploration. It is also convenient and easy to perform. But it has its own limitations, and requires adequate expertise and experience. Its results are also equipment dependent.

1. Introduction

Testicular carcinoma is the most common cancer among males aged 15–34 years [1]. The known risk factors for testicular cancer include undescended testis (cryptorchidism), testicular dysfunction, perinatal factors, prior history of cancer in one testis (the opposite testis is at increased risk) and family history of testicular cancer [2].

Testicular tumors are the most common malignant tumors encountered in men 25–35 years of age. Histologic classification of these tumors is complex, and includes seminomas, non seminomatous germ cell tumors and teratomas. Most palpable testicular tumors in adults are malignant; 80% of nonpalpable testicular lesions are benign [3]. Children with testicular tumors are more likely to have benign lesions, with 20–40% being benign [4,5]. On examination, the testis is enlarged, nontender, has a firm consistency, and does not transilluminate. In seminomas, the testicular surface is smooth and the consistency is uniform, whereas teratomas may be more irregular. Urgent evaluation and referral are indicated [6–9].

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Scrotal masses can represent a wide range of medical issues, from benign congenital conditions to life-threatening malignancies· Different types of testicular tumors are treated differently, with an overall very high cure rate with proper management. Pathologists must, therefore, be familiar with important diagnostic pitfalls in testicular pathology, particularly those that result in different treatments or prognoses [10].

Color Doppler ultrasonography (CDUS) is an important tool for diagnosis of scrotal diseases because of its ability to depict anatomy and perfusion in real time. It helps to improve patient's management, especially by preventing unnecessary surgical exploration. Grey scale ultrasonography is a well-established modality for diagnosis of scrotal diseases [11]. Derouet and coworkers observed ultrasonography to be 90% sensitive and 55% specific in detection of testicular neoplasms [12]. With rare exceptions, any solid intratesticular lesion with an increase in color Doppler flow should be considered suspicious for malignancy. However, this is not without limitations, as small testicular tumors may appear avascular on the CDUS examination [13].

The rational of this study is to diagnosis a fatal disease by low cost, easily accessible, less time consuming, lack of ionizing radiation modality which can help in early and accurate detection of testicular carcinoma and will help in minimizing the delay in treatment and will improve prognosis and significantly reduces the mortality and morbidity by taking histopathology as gold standard.

2. Methods

A cross-sectional study was conducted at the Radiology Department of the Jinnah Post Graduate.

Medical Center in Karachi from July 2015 to Feb 2016. The sampling was done using a nonprobability consecutive sampling approach. Considering the following information: 90% sensitivity, 12% specificity, 7.8% incidence, 0.1 sensitivity precision, 0.13 specificity precision, 95% confidence interval, and 0.1 precision. The study's sample consisted of 311 people.

2.1. Inclusion & exclusion criteria

A color doppler ultrasound scan of the painless testicular swelling for more than 3 months with the patient detecting a progressive development in size was ordered for all male patients between the ages of 30 and 50 who were referred to the radiology department of Jinnah Post Graduate Medical Center were included in our study. Patients who consciously refuse to give their consent, those whose histology results are unclear, and testicular cancer cases that have already been identified were excluded from our study.

2.2. Data collection

After gaining approval from the College of Physicians and Surgeons of Pakistan & participants gave their informed consent, data collecting commenced. This study covered both inpatients and outpatients. The 311 participants were drawn from the Jinnah Post Graduate Medical Center's radiology inpatient, outpatient, and emergency departments in Karachi. All referred patients who met the trial's inclusion criteria were considered for participation.

In accordance with the STROCSS 2021 recommendations [14], we conducted this study. As an added bonus, a detailed STROCSS 2021 check list may be found in the supplemental materials. UIN researchregistry8250 [15]. identifies our study in Research Registry. Our research adheres to the principles outlined in the Helsinki Declaration.

A Toshiba Nemio 5 was utilized to perform a color doppler ultrasonography on patients to check for testicular cancer. All of the images were examined by a consultant radiologist with more than five years of experience. Histopathology samples were later acquired. Results from color doppler ultrasound and histopathology were compared.

2.3. Data analysis

The statistical analysis was done using SPSS Version 21. The mean and standard deviation were used in the descriptive analysis for continuous variables such as age and the length of the symptoms. The diagnostic accuracy, positive and negative predictive values, sensitivity, and

specificity of color doppler ultrasound in the detection of testicular cancer were calculated using a 2/2 table. Effect modifiers were managed using age and illness duration stratification to evaluate how they affected the outcome variable. The chi-square test was applied, with a significance level of P 0.05.

3. Results

311 subjects were selected from the Radiology inpatient, outpatient, or emergency departments at Jinnah Post Graduate Medical Center Karachi. Participants in the study had an average age of 41.76 ± 8.11 years.

The distribution of age groups is displayed in Table 1. The average age of the patients was between 30 and 40 for 174 (54.95%), and 41 to 50 for 137 (44.05%).

When assessed in terms of the mean and standard deviation, the average length of the symptoms was 5.5 3.5 (4–15) months. 135(43.4%) patients were having symptoms for the last 6 months and 176(66.6%) were having symptoms for more than 6 months, as shown in Table 2.

175(56.27%) study subjects found positive testicular carcinoma and 135(43.73%) have symptoms without having carcinoma. distribution of Histopathology findings showed that 160(51.45%) study subjects found positive testicular carcinoma and 151(48.55%) have symptoms without having carcinoma. Diagnostic accuracy was calculated for CDUS, Sensitivity.

(88.8%), Specificity (78.1%), Positive predictive values (81.1%), Negative predictive values.

(86.8%), Diagnostic accuracy (83.6%) as shown in Table 3.

Stratification of CDUS and histopathology findings were done with respect to age having p value 0.01. Sensitivity was 90.5%, Specificity 81.2%, Positive predictive values 88%, Negative predictive values 84.8% and Diagnostic accuracy 86.8% of age group 30–40 years. Sensitivity of patients having age group 41–50 years was calculated as 85.5%, Specificity 75.6%, Positive predictive values 70.1%, Negative predictive values 88.6% and Diagnostic accuracy 79.6%, as shown in Table 4.

Duration of symptoms were stratified with diagnostic accuracy and a significant p value of 0.001 was observed. In patients having symptoms less than 6 months Sensitivity was calculated as 93.4%, Specificity = 87.2%, Positive predictive values = 89.5%, Negative predictive values = 91.9% and Diagnostic accuracy = 90.5%, as shown in Table 5.

4. Discussion

In men aged 14–45, testicular cancer has been on the rise, making it the most prevalent malignancy. Despite its inability to tell benign from malignant tumors, ultrasound is often used as a first diagnostic tool. Grayscale ultrasonography also fails to reliably distinguish between testicular torsion and epididymis-orchitis in cases with scrotal discomfort [1–3].

EAU guidelines from 2020 suggest the use of color doppler to

Table 1
Distribution of age groups.

Age Group	Frequency	Percent
30–40 years	174	55.95%
41–50 years	137	44.05%
Total	311	100.0

Table 2
Distribution of duration of symptoms.

Duration of symptoms	Frequency	Percent
6 or less than 6 months	135	43.4%
More than 6 months	176	66.6%
Total	311	100.0

Table 3
Diagnostic accuracy of color Doppler USG with histopathology.

CDUS	HISTOPATHOLOGY		Total
	Testicular carcinoma Present	Testicular carcinoma Absent	
Testicular carcinoma Present	142	33	175
Testicular carcinoma Absent	18	118	135
Total	160	151	311

Table 4
Stratification of diagnostic accuracy with regards to age.

CDUS	HISTOPATHOLOGY		Total
	Testicular carcinoma Present	Testicular carcinoma Absent	
30–40 years			
Testicular carcinoma Present	95	13	108
Testicular carcinoma Absent	10	56	66
41-50 years			
Testicular carcinoma Present	47	20	67
Testicular carcinoma Absent	8	62	70

Table 5
Stratification of diagnostic accuracy with regards to duration of symptoms.

CDUS	HISTOPATHOLOGY		Total
	Testicular carcinoma Present	Testicular carcinoma Absent	
Symptoms (<6 months)			
Testicular carcinoma Present	85	10	95
Testicular carcinoma Absent	6	68	74
Symptoms (>6 months)			
Testicular carcinoma Present	57	23	80
Testicular carcinoma Absent	12	50	62

determine the location i.e., intra or extra testicular, determine the volume and characterize the contralateral testes to rule out other lesions [13]. High-resolution sonography determines the testicular perfusion which aids to reach the specific diagnosis and color. Doppler flow imaging could constantly define the morphological features and vascularity of scrotal lesions. The use of Color doppler ultrasound along with tissue elastography can however increase the diagnostic accuracy reaching almost 100%. The study done by Naeem et al. the sensitivity, specificity, positive and negative predictive values were 70.49%, 73.75%, 67.19% and 76.62% respectively [11,12].

In our study, color doppler ultrasound showed sensitivity and specificity of 88.8% and 78.1%, respectively, in diagnosing testicular carcinoma in all male patients (age range 30–50 years) who were referred to Jinnah Postgraduate Medical Center Radiology Department for a color doppler ultrasound scan of the painless testicular swelling for more than 3 months with noticeable gradual increase in size by the patient. Therefore, our findings are consistent with earlier research. However, CDUS has its share of difficulties.

Almassry, Hosam Nabil et al. analyzed in their study that the sensitivity and specificity of grayscale and color Doppler ultrasound for diagnosing scrotal tumors were 84.6% and 76.2%, respectively [8]. In a research study, CDUS demonstrated an 87.5% sensitivity and a 66.7% specificity for the identification of testicular neoplasms, which is consistent with the Derouet and associate's investigation. In contrast to normal testicular tissue, 90% of the seminomas in our series were solid, homogenous, hypoechoic, and hyper vascular lesions. In our investigation, all cases of varicocele were correctly identified, and one patient who initially came with infertility but showed no signs of the condition during a clinical examination had varicocele [16].

When ultrasonography is unsuccessful, other tests, such as magnetic resonance imaging, can be used. Although its application in scrotal disorders is expanding [17], it is more expensive and occasionally unavailable.

Nuclear scintigraphy is unusual because to its excellent accuracy and sensitivity in discriminating ischemia from infarction, but it is unable to separate ischemia from diseases like hydrocele,

spermatocele, and inguinal hernia. Scrotal Swellings and Ultrasonography —Rizvi et al., Urology Journal, Vol. 8, No. 1, Winter 2011, p. 65 of CDUS (6) The EAU guidelines suggest using ultrasound even if the testicular lump is palpable as this will help determine the location, volume and the contralateral testes [18] Therefore, the most crucial examination for the identification of scrotal disorders is CDUS due to its great sensitivity and specificity.

Seventeen of the patients in this study were between the ages of 10 and 15. (38%). The surgery department at the SMHS hospital in Srinagar saw 1.10/1000 individuals with acute scrotum between October 2009 and September 2011. These patients ranged in age from 1 day to 25 years. Patients with acute scrotum most commonly exhibited scrotal pain (98%), as well as enlargement of the afflicted hemiscrotum. Scrotal and hemi scrotal discomfort was the most often reported clinical symptom of acute scrotum (94%). Scrotal erythema was observed in 39 patients (78%) [19]. Our study results are consistent with the findings of Moslemi MK., who studied 87 patients with acute scrotum in the age range of 25 years of age. In their study, it was discovered that Doppler ultrasound had a sensitivity and specificity of 87.9% and 93.3%, respectively. Hod et al. reported that DUS for testicular torsion has an 86% sensitivity and a 95% specificity [20].

5. Conclusion

We arrive at the conclusion that CDUS is a remarkable, secure and trustworthy approach for assessing patients with testicular cancer. It aids in better patient management, particularly by avoiding unnecessary surgical investigation. Additionally, it is quick and simple to perform.

However, it has its own restraints and calls for appropriate training and experience. Results also rely on the equipment used.

Ethical approval

After gaining approval from the College of Physicians and Surgeons of Pakistan & participants gave their informed consent, data collecting commenced.

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Author contribution

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: Kamran fazal, Adnan Fazal
2. Drafting the work or revising it critically for important intellectual content: Irfan siddiqui
3. Final approval of the version to be published: Hassan Mumtaz, Abdul Basir, Muhammad Meezan Butt, Muhammad Aman, Faheemullah Khan, Izaz Ahmad,
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Mehak Mukhtar, Amraha Zubair

Registration of research studies

1. Name of the registry: Research registry
2. Unique Identifying number or registration ID: researchregistry8250 Browse the Registry - Research Registry

Guarantor

Kamran fazal, Adnan Fazal.

Consent

The informed consent from the patients was obtained considering Helsinki's Declaration.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

Nill.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.104938.

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