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Determine the Diagnostic Yield of Ultrasound Guided Biopsy of Prostatic Lesions, Keeping Histopathology as Reference Standard, at a Tertiary Care Hospital

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Objective: To determine the diagnostic yield of ultrasound guided biopsy of prostatic lesions, keeping histopathology as reference standard at a tertiary care hospital.

Methods: All male patients above 55 years who were referred to the Radiology department of Aga Khan University Hospital, Karachi with ultrasound/MRI finding of prostate malignancy constituted the population. After taking informed written consent and history all patients underwent transrectal ultrasound. Prostate was visualized using a transrectal biplanar ultrasound probe. Subsequently, 12 core biopsies were performed by an interventional radiologist with minimum 5 years of experience and diagnostic yield of ultrasound guided biopsy of prostatic lesions was checked keeping histopathology as reference standard.

Result: Total of 116 patients with ultrasound/ MRI finding of prostatic malignancy who underwent ultrasound guided prostatic biopsy constituted the population. The mean age was 67.732+7.907 years. The diagnostic yield of ultrasound guided biopsy of prostatic lesions was 70.7%, keeping histopathology as reference standard.

Conclusion: The diagnostic yield of ultrasound guided biopsy of prostatic lesions was significantly high, keeping histopathology as reference standard. The diagnostic yield increases with the increase in age and BMI.

Introduction

Prostate cancer is the most common form of cancer experienced by men in the United States with 164,690 new cases predicted for 2018 being the second leading cause of cancer death in US men with 29,430 deaths predicted for 2018 [1]. It constitutes a diverse spectrum of disease with clinical behavior ranging from well-differentiated noninvasive tumors to high-grade metastatic cancers with significant morbidity and mortality. Prostate biopsy is the cornerstone of establishing the diagnosis of prostate cancer. Recent advances in imaging technology have led to improvements in the early detection of prostate cancer.

Prostate cancer is the most frequently diagnosed form of noncutaneous cancer in men [2]. Incidence increased dramatically after the introduction of the prostate-specific antigen (PSA) test [2, 3]. Unfortunately, urologists face the dilemma of patients with elevated and/or rising PSA levels and negative biopsy results because the serum PSA level, used for early diagnosis of prostate

cancer, is a very sensitive but unspecific test. Transrectal ultrasound (TRUS) was introduced in 1968 as a means for diagnostic imaging of prostate cancer [4]. The sensitivity of this technique for prostate cancer detection is low (20–30%) [5] because more than 40% of prostate tumors are isoechoic and only the peripheral zone can be accurately detected [6, 7]. TRUS Doppler and application of contrast agents increased the detection rate of prostate cancer to 74–98% [8-12].

Over 1.2 million prostate needle biopsies are executed every year in the United States [13]. Systematic TRUS- guided biopsy (TRUSBx) is the gold standard for detecting prostate cancer. This systematic approach is characterized by low sensitivity (39–52%) and high specificity (81–82%) [14]. In case of doubt, additional biopsy sessions are performed. In some cases, the systematic protocol is extended with additional biopsies targeting hypoechoic regions detected by TRUS, which increases the detection rate slightly [4].

Biopsy is the most successful diagnostic approach [15]. -guided biopsy provides uniform sampling of the entire prostate and a relatively high probability of clinical diagnosis [16]. However, the search for an improved biopsy technique, which includes a better diagnosis with relatively few complications, is ongoing [17]. Biopsy techniques that optimize the number of cores that are sampled, as well as their locations within the prostate gland, may be considered [18]. In this prospective analysis, we estimated the diagnostic yield of different biopsy schemes, analyzed the locations within the prostate of the carcinoma-positive cores identified during TPUS-guided extended biopsy, and evaluated the efficacy of TPUS-guided extended biopsy for detecting disease in various locations within the prostate gland.

Prostatic carcinoma is the second most common solid tumor in men and fifth most common cause of cancer mortality with an incidence of approximately 1.41 million worldwide. However, it varies with race and ethnicity [19]. Risk factors mostly include old age, overweight and obesity, smoking, alcohol consumption and genetic variability [20]. Although no recent study has been performed in Pakistan for the incidence of prostate malignancy, a study conducted in Lahore, Pakistan from 2010 to 2015 showed an incidence rate of 95/100,000 in Pakistani male population [21]. Mean age of the patient with prostatic carcinoma is 68.9 with the majority of the cases occurring in the eighth decade of life [22]. Transrectal ultrasound guided prostate biopsy has been the standard diagnostic investigation for men at risk for prostate cancer [23]. According to international guidelines, systematic 12 core biopsy is recommended in biopsy naive men with PSA serum levels of >3 ng/ml [24].

Although, sufficient number of international studies is available on this critical issue, there is a lack of rigorously carried out analytical data and reviews in this region. The main objective of this research is to estimate the diagnostic yield of ultrasound guided transrectal prostate biopsy among men in Pakistan, keeping histopathology as reference standard.

Materials and Methods

Study design and inclusion criteria

This study was conducted at the Diagnostic Radiology Department,Agha Khan University Hospital,Karachi,Pakistan. This cross sectional study was approved by the institutional review board and informed consent was waived. Total of 116 males above the age of 55 who were referred to the Radiology Department of Agha Khan University Hospital , from 14 September 2023 to 14 march 2024 with the ultrasound /MRI findings of prostate malignancy and undergoing prostate biopsy and subsequent histological examination were considered. Patients with prostatic infection, bleeding diasthesis, low platelet count or raised INR were excluded from the study as these conditions could cause complications during biopsy.

Data collection

The day before biopsy all patients were given a 5-day course of antibiotic therapy with an oral fluoroquinolone (250 mg ciprofloxacin twice daily) or an appropriate alternative antibiotic in case of fluoroquinolone allergy. In addition, every patient was given a cleansing enema a night before biopsy. All patients underwent pre-procedure blood tests to ensure there was no bleeding tendency. Patients using antiplatelet or anticoagulant treatment were required to discontinue drugs prior to undergoing biopsy For biopsy, patients were requested to assume the left lateral position. Perianal skin was prepared and disinfected. Local anesthesia was administered rectally in the form of Xylocaine gel.

Prostate was visualized using a transrectal biplanar ultrasound probe. Subsequently, 12 core biopsies were performed by an interventional radiologist with minimum 5 years of experience: six cores were taken from each side of the prostate at the base, mid, apex, upper lateral, and lower lateral regions.

Data was collected by using a pre-developed proforma. Brief history regarding demographic variables such as age, place of living, education level, smoking history, family history, employment status, PSA levels, urine frequency and urgency and histopathological results were collected and recorded.

Proforma

Diagnostic yield of ultrasound guided transrectal prostate biopsy with histopathology as reference standard.

MR No: Name:

1. Age in years:

2. Height (cm).

3. Weight (kg).

4. BMI (kg/m^2).

5. Smoking history:

o Yes

o No

6. PSA level:

7. Histopathology result (Diagnostic yield):

o Conclusive

o Inconclusive

Data Analysis

Collected data was analyzed through computer software SPSS version 26. Normality assessment was done using Shapiro Wilk test for all the quantitative variables i.e., age, PSA levels. Mean and standard deviation was calculated and reported for all normally distributed quantitative variables. Median (IQR) was calculated and reported for all non-normally distributed quantitative variables. Frequency and percentages were calculated for all qualitative variables i.e., education level, place of living, smoking history, family history, employment status, urine urgency etc. Diagnostic yield was calculated by calculating the cancer detection rate considering the histopathology result. Effect modifiers such as age, smoking history and family history were controlled through stratification. Post-stratification chi-square/ fisher exact test was applied. P-value of <0.05 was to be considered significant.

Results

A total of 116 males constituted the study population. The mean age was 67.732+7.907 years, the mean height was 165.293+8.342 cm & the mean weight was 73.784+11.321 kg. The mean BMI was 16.172+2.166 kg/m^2 & the mean PSA level was 86.323+236.520. Smoking history was seen in 66 (56.9%) patients.

In our study histopathology result (diagnostic yield) was conclusive in 82 (70.7%) & inconclusive in 34 (29.3%) patients. the diagnostic yield of ultrasound guided biopsy of prostatic lesions was 70.7%, keeping histopathology as reference standard.

The frequencies of age groups (years), BMI, smoking history & PSA level were calculated according to histopathology result (diagnostic yield). The results are presented in Table 1, Table 2 and Table 3.

	Histopathology result (Diagnostic yield)		Total	P-value
Age (years)	Yes	No		
30-55 years	3 (37.5%)	5 (62.5%)	8	0.033
56-80 years	79 (73.1%)	29 (26.9%)	108	
Total	82	34	116	

Table 1. Histopathology Result (Diagnostic yield) According to Age (years) (n=116).

Chi-square-test was applied. P-value ≤ 0.05 considered as significant. Significant at 0.05 level

	Histopathology result (Diagnostic yield)		Total	P-value
BMI (kg/m2)	Yes	No		
18-25	24 (75%)	8 (25%)	32	0.529
25.1-32	58 (69%)	26 (31%)	84	
Total	82	34	116	

Table 2. Histopathology Result (Diagnostic yield) According to BMI (kg/m2) (n=116).

Chi-square-test was applied, P-value ≤ 0.05 considered as significant. Not significant at 0.05 level

	Histopathology result (Diagnostic yield)		Total	P-value
PSA level	Yes	No		
1-1058	80 (70.2%)	34 (29.8%)	114	0.358
1059-2116	2 (100%)	0 (%)	2	

Total	82	34	116	

Table 3. Histopathology Result (Diagnostic yield) According to PSA Level (n=116).

Chi-square-test was applied, P-value ≤ 0.05 considered as significant. Not significant at 0.05 level

Discussion

Although ultrasound is a useful tool to biopsy the prostatic lesions but one of the controversial issues is whether it is necessary to take samples from a TRUS visible lesion area in addition to systematic biopsies or simply to add more biopsies to the standardized biopsy scheme in order to increase the detection rate of prostate cancer. Hypoechoic prostatic lesions are more than twice as likely to have cancer on biopsy as isoechoic prostatic tissue [25] and the average biopsy yield of a peripheral zone hypoechoic lesion is 30–50 [26].

On the contrary, hypoechoic lesions in the transition zone are less specific in terms of prostatic cancer owing to the fact that benign prostatic hyperplasia nodules may normally appear hypoechoic [27].

Earlier ultrasonic categorization of prostatic cancer (CaP) described these tumors as more hypoechoic than normal prostate However, when they enlarged, invaded other structures and developed calcifications, they became either hyperechoic, isoechoic, hypoechoic or mixed [28]. Nevertheless, in an era when tumors were notoriously larger, ultrasonographic evaluation of small cancers revealed that up to 40% were from isoechoic area [29, 30]. Ellis et al evaluated the diagnostic accuracy of PSA, DRE and TRUS for the diagnosis of CaP [30]. Although they found hypoechoic sectors more than twice as likely as isoechoic sectors of the prostate to contain malignancy on biopsy, 38% of the cancers detected in their series were from isoechoic areas. Overall, only 17% of all hypoechoic sectors contained carcinoma on biopsy and if only those lesions were sampled they would have missed the diagnosis in 25% of the cases.

In our study diagnostic yield of ultrasound guided biopsy of prostatic lesions was 70.7%, keeping histopathology as reference standard as compare to Jayarajah et al [31] study conducted in Sri Lanka where the sensitivity of ultrasound guided transrectal prostate biopsy was calculated to be 57.7%, with detection rates highest at PSA levels of 40 ng/ml.

Dyke et al studied whether there was a staging difference between hypoechoic nodule directed and randomly taken TRUS guided biopsies, and noted that random biopsy results did not alter staging [32]. In addition, random biopsy was responsible for an increased cancer yield of just 3%. Their conclusion stressed that lower grade tumors were not sensitive to TRUS unlike high grade lesions. Ohori et al examined 986 consecutive patients, and in 51% of their 241 cancer cases an ultrasonographic lesion was observed [33]. However, for impalpable cancers ultrasound results provided no additional information regarding prognosis or pathological stage.

In general, prostates with hypoechoic lesions tend to have cancers but the lesion itself may not contain the tumor. Analysis of the 4 different compartments of the prostate revealed similar cancer detection rates. Therefore, from a given area, adjacent isoechoic zones should always be sampled, because if only hypoechoic lesions are sampled, significant disease could be missed. To improve the diagnostic sensitivity of TRUS in early detection of prostate cancer, the use of different thresholds and PSA ranges has been recommended Onur et al study evaluated the rate of positive biopsy results of isoechoic or hypoechoic regions at different PSA levels. Although cancer detection rate improved with increasing levels of PSA, sensitivity of isoechoic or hypoechoic lesions to detect cancer was not different. Ito et al reported a positive predictive value and a negative predictive value for hypoechoic regions of 86% and 67%, respectively, in patients with serum PSA greater than 10 ng/ml [34]. However, when PSA was 4.0 ng/ml or less positive and negative predictive

values for such lesions ware 9.1% and 97.6%, respectively.

The limitation of our study was single center study, smaller sample size. Further studies with larger sample sizes are required.

In conclusion, the diagnostic yield of ultrasound guided biopsy of prostatic lesions was significantly high, keeping histopathology as reference standard. The diagnostic yield increases with the increase in age and BMI.

Edict clinical outcome. The results of this study indicate that both the category and grade affect the outcome independently, and the higher the grade of subcategory, the greater the chance that the ulcer will persist or that death will occur. The most important finding of this study is that the simple PEDIS score system can also predict the outcome and may be more accurate than the more widely used system the AUC value to confirm the diagnostic accuracy of the PEDIS score system to predict the outcome of DFUs. The results of this study indicate that the PEDIS score system also has excellent capacity to predict the outcome. In addition, our study shows that the PEDIS category scores can be summed into an aggregate PEDIS score, with a score of 7 or more being associated with a significantly greater probability of difficulties in healing. We believe that the PEDIS score system should be applied widely in clinical.

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