

The Role of Power Doppler Imaging with Trans Rectal Ultrasonogram Guided Biopsy in the Detection of Prostate Cancer

P.V.S Abhishek¹, Katika Munna², B. Sachin Kumar³

¹Assistant professor, Department of Radiology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana State

^{2,3}Post Graduate, Department of Radiology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana State

Received: 25-09-2023 / Revised: 28-10-2023 / Accepted: 30-11-2023

Corresponding author: Dr. P.V.S Abhishek

Conflict of interest: Nil

Abstract:

Background: The most common cancer in men is prostate cancer after skin cancers. Prostate cancer detection and treatment are still evolving. Various additional methods have been tested in an effort to increase the detection rate with TRUS biopsies.

Aim and Objective: To assess the effectiveness of trans rectal ultrasonography using Power Doppler imaging guided biopsy with extended sextant biopsy being the reference standard.

Material and Method: In this observational study, total 65 patients, who present with LUTS with abnormal digital rectal examination and/or PSA ≥ 4 ng/ml were included over the duration of one year, in the Department of Radiodiagnosis, CAIMS, Karimnagar after following inclusion and exclusion criteria and getting approval from institutional ethical committee.

Results: Mean age group of the patients was 65.63 years. 58% of the patients found with cancer and overall sensitivity of power Doppler in the detection of prostate cancer was 88.5% and specificity was 79.8%.

Conclusion: Transrectal ultrasound with power Doppler imaging guided biopsy is more sensitive and specific compared to grey scale imaging. Power Doppler imaging guided hypervascular area directed biopsy is efficient in the detection of prostate cancer in comparison with hypoechoic nodule directed biopsy.

Keywords: LUTS, TRUS, DRE, PSA.

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Introduction

Males are more likely to develop prostate cancer than any other noncutaneous cancer.[1] 10% of male cancer-related deaths are attributable to it. Men under 50 years are rarely diagnosed with prostate cancer. Autopsies conducted after deaths from other causes also reveal prostate cancer. The incidence of this latent or postmortem cancer is significantly higher than the incidence of clinical cancer. In fact, it might reach 80% by the time a person is 80 years old. [2]

Prostate cancer detection and treatment are still developing. Prostate cancer is being discovered earlier in the course of the disease because to the introduction of PSA screening and TRUS. In today's world, rather than metastatic symptoms, most patients present because of abnormalities in Prostate Specific Antigen (PSA) levels or positive digital rectal examination (DRE) findings while being evaluated for BPH. The combination of DRE and serum PSA is the most useful first-line test for detecting prostate cancer in a person.[3] Prostate cancer, on the other hand, can be discovered by

chance when tissue is removed during transurethral resection to treat obstructive prostatic symptoms.

In comparison to digitally directed biopsy of palpable nodules and TRUS guided biopsy of particular hypoechoic lesions, the original sextant biopsy scheme (one core from the base, mid, and apex bilaterally) considerably improved cancer diagnosis. Cancer detection increased from 80% with regular sextant to 96% with the addition of laterally oriented cores from the base and mid gland bilaterally, according to Presti and colleagues. Numerous other methods have been tested in an effort to increase the detection rate with TRUS biopsies. This includes using power Doppler ultrasonography to assess neovascularity in prostate cancer patients. Doppler-targeted biopsy techniques have been demonstrated to boost cancer detection rates in numerous trials. [4]

Materials and Method

This is Descriptive observational study, conducted on patients with LUTS with abnormal digital rectal examination and/or PSA ≥ 4 ng/ml. Study included

65 Patients, presented to the Urology OPD and referred to the Department of Radiology, after getting consent from the patients, approved by institutional ethical committee and following inclusion and exclusion criteria given below for the duration of 6 months.

Inclusion criteria

- LUTS with abnormal digital rectal examination
- PSA \geq 4 ng/ml
- Age $>$ 50 Years

Exclusion criteria

- No consent for study
- Persistent urinary tract infection
- Untreated coagulopathy.
- Age $<$ 50 years.

Method:

Technique of TRUS guided prostate Biopsy

After obtaining informed consent all the patients were enrolled into the study. Routine clinical evaluation was done as per the proforma and the findings were recorded. All the patients were evaluated by TRUS. Ciprofloxacin 500mg bd and metronidazole 400 mg tds was prescribed on the day prior to the procedure, which was continued for 2 days post procedure. PC (proctoclysis) enema was given on the day of the procedure. Intravenous pethidine was given as analgesic if the patient did not tolerate pain.

PDUS was carried out with a Power Flow Unit and 7.5 MHz broadband endoluminal probe. The patients were examined in the left lateral decubitus position. All patients underwent grey scale TRUS of the entire prostate gland in the saggital plane, from the right to left lateral aspects of the gland and in the axial plane from the seminal vesicles to the apex. The size and weight of the gland were calculated from the anteroposterior, transverse and

cranio-caudal measurements ($0.52 \times D1 \times D2 \times D3$).

PDI was performed using the same ultrasound system as for conventional TRUS. The power Doppler gain was set to a point below the range at which blood flow in the neurovascular bundles was identified with no background artifact. Scanning to detect flow was continued for 10 min in each patient. The vascularization of a hypoechoic lesion in the PZ was evaluated by comparison with that of the area surrounding it. When a hypoechoic lesion contained more vessels than other PZ areas, it was defined as a hyper vascular area. Equivocal and isoechoic lesions were defined as hyper vascular area when these lesions were seen as abnormal vascular areas.

All patients underwent systematic core biopsies initially at the hyper vascular areas and hypoechoic areas if seen and then extended sextant biopsy was taken from the prostate. 18 G automatic core biopsy needles were used. Biopsy samples from each site were placed in separate containers of formalin and labeled as to the site of origin. The biopsy results were analyzed statistically to evaluate the differential efficacy of the hypoechoic nodule and hyper vascular areas.

Results

A total of 65 patients were included in the study period. 38 patients (58%) had cancer detected in the biopsy the mean age group of the patients was 65.63 years in the age range between 55 and 80 years. The most common age group involved was between 56 and 70 years involving 80% of the patients. 25 of the 65 (37%) patients had a normal DRE. The PSA value of the patients ranged from 3 ng / ml to 632 ng / ml with a mean value of 41.4 ng/ml. The mean prostate volume was 32.7ml in the range between 12 and 155ml shown in bellow table 1.

Table 1: Distribution of age group, PSA, and prostate volume among study population

Parameter	Frequency	Percentage
Age Group		
<55 Years	2	0.7
56-60 Years	16	25.5
61-65 Years	20	30.2
66-70 Years	16	25.5
71-75 Years	6	9.3
76-80 Years	5	8.8
PSA Group		
<4	1	0.7
04-10	7	10.8
11-20	18	28.6
21-50	29	44.9
>50	10	15
Prostate Volume		
<25ml	28	42.6

26-50ml	31	48
>50ml	6	9.4

Table 2: Distribution of Age group and PSA among cancer

Parameter	Cancer	
	Present	Absent
Age Group		
<55 Years	1	0
56-60 Years	7	9
61-65 Years	10	10
66-70 Years	9	7
71-75 Years	6	0
76-80 Years	4	1
PSA Group		
<4	1	0
04-10	1	6
11-20	10	8
21-50	19	10
>50	7	3

Table 3: Distribution of Hypochoic area, Hypervascularity, prostate volume, Hypervascularity in hypochoic lesion and PSA among cancer

Parameter	Cancer	
	Present	Absent
Hypochoic Area		
Yes	23	9
No	15	18
Hypervascularity		
Yes	33	6
No	5	21
Hypervascularity in hypochoic lesion		
Yes	17	1
No	20	27
Prostate Volume		
<25ml	15	13
26-50ml	19	12
>50ml	4	2
DRE		
+ve	28	12
-ve	10	15

Table 4: Statistical Comparison of parameters

	Hypervascular Area	Hypochoic Area	Hypervascularity in hypochoic area
Sensitivity	88.50%	62.70%	45.70%
Specificity	79.80%	66.70%	98%
PPV	84.60%	72.30%	97%
NPV	82.30%	56%	56.30%

Table 5: Distribution of complication among study population

Complications	Frequency
UTI	4
Retention	3
Bleeding	2

Discussion

Hypochoic area directed biopsy was the modality of diagnosis practiced in the late 1980s ⁽¹¹⁾. The hypochoic nodule directed biopsies were found to have a sensitivity of around 70% and specificity on

the range of 60%. In our study, the sensitivity was 62.7%, Specificity was 66.7%, Positive Predictive value 72.3% and Negative predictive value was 56%. This shows the poor efficacy of hypochoic nodule directed biopsy in the detection of prostate cancer.

Tumours are found to be hypervascular due to the neovascularity. Power Doppler imaging, which deciphers the tissue vascularity, may be used in the evaluation of vascularity of lesions. Biopsies directed towards the hypervascular areas were found to have a higher sensitivity of around 90% and specificity of 85% in various studies. [5, 6, 7, 8, 9] In our study, the sensitivity was 88.5% for detection of cancer in comparison with extended sextant biopsy. This shows that hypervascular area directed biopsy definitely scores over hypoechoic area directed biopsy in the detection of prostate cancer.

Overall 58% patients were detected to have cancer. It is higher when compared to the literature, which varies from 36% to 55%. The overall sensitivity of power Doppler in the detection of prostate cancer in our study was 88.5 % similar to the previous studies. The specificity of 79.8% was comparable with the world literature. The positive predictive value of 84.6% was similar to other studies. The negative predictive value of 82.3% was comparably less than the world literature which varies from 78 to 94%.

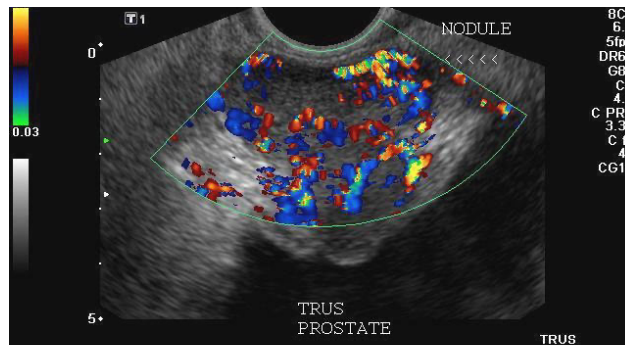


Image 1 : Hypervascularity in the hypoechoic nodule

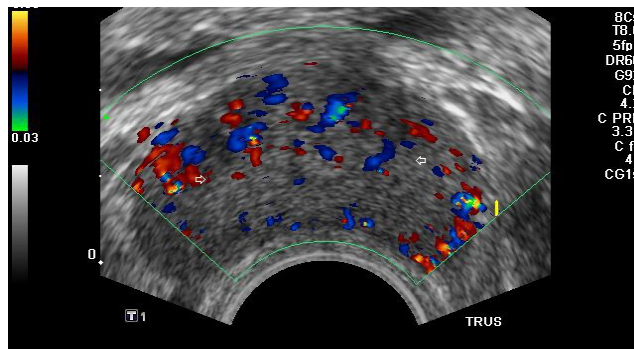


Image 2 : Hypervascularity in the enlarged prostate gland

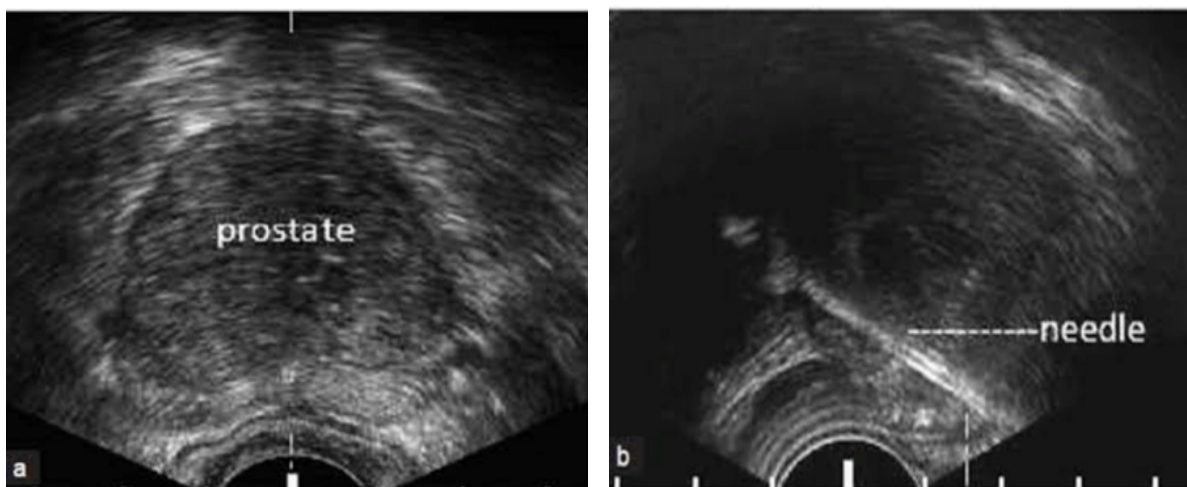


Image 3: showing biopsy needle within the prostate gland

Table 6: Comparison of studies with power Doppler

Ca (%)	No (pts)	Sensitivity	Specificity	PPV	NPV	Study
36	136	82.80%	78.80%	87.90%	89.70%	Remzi[5]
40	108	90%	90%	84%	94%	Satoru[6]
55	323	92.40%	72%	83%	80.60%	Sauvain[7]
36	36	90%	75%	82%	88%	Sakarya[8]
42	28	74%	96%	74%	78%	Franco[9]
40	108	90%	90%	84%	94%	Takahashi[10]
29	65	88.50%	79.80%	84.60%	82.30%	Present study

One important point to note in our study is that in 3 patients with carcinoma, the tumour was picked up by hypervascular area directed biopsy, but it was not diagnosed by 10 core biopsy. In all these patients the prostate volume was more than 50ml. Though the values are not statistically significant, we can advise hypervascular area directed biopsy combined with standard 10 core biopsy in patients with large prostates. This finding correlates with the study by Saturo et al where 3 patients with a negative sextant biopsy had a positive targeted biopsy [6].

On evaluating the statistical parameters using the test of proportions, the difference in sensitivity and NPV between PDI and grey scale imaging was statistically significant with p value of < 0.01. Difference in specificity and PPV had a p value of <0.05.

Conclusion

Transrectal ultrasound with power Doppler imaging guided biopsy is more sensitive and specific compared to grey scale imaging. Extended core biopsy protocol though, still remains the gold standard. We would like to recommend hypervascular area directed biopsies combined with standard extended core biopsies to increase the yield. Power Doppler imaging guided hypervascular area directed biopsy gives a better diagnostic yield there by reducing the number of repeat biopsies. Power Doppler imaging guided hypervascular area directed biopsy is efficient in the detection of prostate cancer in comparison with hypoechoic nodule directed biopsy.

References

- Okihara K, mikki t, joseph babain r et al: Clinical efficiency of prostate cancer detection using power Doppler imaging in American and Japanese men. *J clin ultrasound* 2002 May;30(4):213-21. 2006.
- Sakr WA, Haas GP, Cassin BF, et al: The frequency of carcinoma and intraepithelial neoplasia of the prostate in young male patients. *J Urol* 1993; 150(pt 1):379-385
- Chu KC, Tarone RE, Freeman HP: Trends in prostate cancer mortality among black men and white men in the United States. *Cancer* 2003; 97:1507
- Kelly IMG, Lees WR, Rickards D: Prostate cancer and the role of color Doppler US. *Radiology* 1993; 189:153-156
- Remzi M, Dobrovits M, Reissigl A. et al., Can Power Doppler enhanced transrectal ultrasound guided biopsy improve prostate cancer detection on first and repeat prostate biopsy? . *Eur Urol*. 2004 Oct; 46(4):451-6.
- Satoru Takahashi, Yukio Yamada, Yukio Homma et al, Power Doppler ultrasonography-directed prostate biopsy in men with elevated serum PSA levels: an evaluation of the clinical utility and limitations *Urology* Volume 60, Issue 2, August 2002, Pages 248- 25
- Sauvain JL, Palascak P, Bourscheid D et al., Value of power doppler and 3D vascular sonography as a method for diagnosis and staging of prostate cancer. *Eur Urol*. 2003 Jul; 44(1):21-30.
- Halpern EJ, Frauscher F, Strup SE et al., Prostate: high-frequency Doppler US imaging for cancer detection. *Radiology*. 2002 Oct; 225(1):71-7.
- Okihara K, Kojima M, Nakanouchi T, Okada K, Miki T. The role of power Doppler-guided prostatic biopsy in the diagnosis of prostate cancer. *Hinyokika Kyo*. 1999 Aug;45(8):559-63
- Takahashi S, Yamada Y, Homma Y, Horie S et al., Power Doppler ultrasonography-directed prostate biopsy in men with elevated serum PSA levels: an evaluation of the clinical utility and limitations. *Urology*. 2002 Aug;60(2):248-52
- Hodge KK, McNeal JE, Stamey TA: Ultrasound guided transrectal core biopsies of the palpably abnormal prostate. *J Urol* 1989; 142:66-70