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Original Article
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Study on Cancer Detection Rate Between Systematic (SBX) and Targeted (TGBX) Prostate Biopsy a single centre study

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Abstract

Background: *TGBX has recently emerged as a popular technique worldwide with the aid of technological advancements. Compared to SBX, this technique has been shown to provide successful outcomes in numerous studies. In this technique, unlike in SBX, biopsy cores are obtained from the suspicious lesions detected on mpMRI.*

Objective: *To compare the prostate cancer (PCa) detection rate of SBX and TGBX in biopsy naive men in Bangladesh.*

Methods: *This comparative study was done in Department of Urology, Combined Military Hospital (CMH), Dhaka during July 2022 to June 2023. A total of 178 patients of male sex, aged 41-80 years with a PSA level > 4 ng/ml and/or having abnormal DRE findings were included in this study. The data were systematically collected in data collection sheet, were analyzed, tabulated and interpreted subsequently by computer based program IBM SPSS (V. 23).*

Result: *Out of 178 study population, overall CDR was 53.4% (95/178). The yielding rate of total and clinically significant (CS) prostate cancer was better in patients who received mpMRI than in those who did not. The CDR was little higher in the targeted group than in the systematic group (55.81% vs. 48.15% respectively, p > 0.05).There was no statistically significant difference in the detection rate of CS PCa patients between systematic biopsy and targeted biopsy (40.7% vs. 48.8%, respectively, p = 0.732).The CI PCa detection rate was also similar between the two groups (6.98% vs. 7.41%, p> 0.05).*

Conclusion: *Prebiopsy mpMRI with subsequent targeted biopsies for suspicious lesions can yield a higher cancer detection than systematic biopsies.*

Keywords: Prostate cancer, PSA, mpMRI, Systematic biopsy, Targeted biopsy.

Introduction

With an estimated almost 1.4 million new cases and 375,000 deaths worldwide, prostate cancer (PCa) is the second most frequent cancer and the fifth leading cause of cancer death among men in 2020.[1] The accurate and timely diagnosis of PCa has important clinical significance for the treatment and prognosis of this fatal disease.

Since the introduction of 'Prostate Specific Antigen' (PSA) screening in the beginning of the 80's an impressive incidence rise has been observed. Fortunately, this trend was counterbalanced by a reduction in mortality since the 90's due to earlier detection and improved curative treatment. Nevertheless, mortality attributed to PCa is expected to rise in the following decades implying an expanding burden to society.[2,3]

At present, the only way to make a definitive diagnosis of PCa is considered to be the prostate biopsy (PBx)

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and the subsequent histopathological examination. For many years, the transrectal ultrasound (TRUS)-guided biopsy has been considered the gold standard in the diagnosis of prostate adenocarcinoma. This standard technique makes use of random systematic 12-core prostate biopsy (SBX) to sample the entire prostate gland.[4]

Targeted biopsy (TGBX) has recently emerged as a popular technique with the aid of technological advancements. Despite involving a more complex procedure compared to SBX, this technique has been shown to provide successful outcomes in numerous studies. In this technique, unlike in SBX, biopsy cores are obtained from the suspicious lesions detected on multiparametric magnetic resonance imaging (mpMRI).[5]

There are currently three techniques for the MRI-targeted biopsy (TGBX) : the cognitive registration, the fusion registration and the in-bore biopsy. In the cognitive registration, also known as visual registration, a prebiopsy mpMRI is performed to localize the suspicious lesions. The targeted biopsy is then performed using TRUS guidance with the objective of estimating the area where the lesion is. MRI/TRUS fusion-guided biopsy is software-assisted and not yet widely available. Whereas, In-bore biopsy technique has not been greatly adopted due to the complexity of the procedure.[4]

Studies have shown that MRI-targeted biopsies result in a higher rate of detection of high grade cancers than systematic biopsy. However, despite the improved detection of clinically significant (CS) cancers with MRI-targeted biopsies, debate persists about whether MRI-targeted biopsy should be used in place of systematic biopsy or in conjunction with it.[6]

Very recently Fletcher et al. (2023) has described regarding 'Vector Prostate Biopsy'- a novel MRI/ Ultrasound (US) image fusion TP biopsy technique using electromagnetic needle tracking under local anaesthesia. There are also some new techniques which featured in a recent European Association of Urology (EAU) meeting including, ultrasound CT with artificial intelligence (AI-US-CT) targeted biopsy, a novel robotic device – the iSR'obot Mona Lisa - to perform MR-US fusion TP PBx and the Trimodal 18F-Choline-PET / mpMRI / 3D-TRUS targeted PBx.[7] We will have to wait and see how these evolve into day-to-day clinical practice.

Nevertheless, TRUS guided biopsy is still considered the gold standard for the diagnosis of PCa in men with an elevation of the serum PSA level and/or suspected DRE. The cancer detection rate (CDR) for this technique, in the literature, ranges between 33% and 57%. A significant under detection of CS PCa has been described for standard biopsy; missing many cases. The best approach to patients with a persistent clinical suspicion of PCa after a prior negative biopsy still represents a matter of debate for urologists. mpMRI nowadays plays an increasingly important role in these patients. According to the 2019 EAU guidelines, an mpMRI evaluation should be recommended in all patients with clinical suspicion of PCa regardless of previous negative systematic biopsy. The MRI TGBX should be performed for findings with a Prostate Imaging Reporting and Data System (PI-RADS) score ≥3. Several studies report how an MRI TGBX approach improves the CDR over 12-core random biopsies, and strongly reduces the number of clinically insignificant (CI) PCa diagnosed.[8]

Many studies shows that newly emerged mpMRI and TGBX can improve the detection of significant PCa and lead to more accurate gleason score grading. Though, this procedure is still not so commonly performed technique in Bangladesh. In urology centre of CMH Dhaka, finger guided prostate biopsy was done upto the year 2018. Then we started TRUS guided biopsy since 2019. But, with the introduction of mpMRI in radiology and imaging department in 2021, we are performing both TRUS guided systematic and targeted biopsies. In this prospective study, the dilemma of superiority was addressed by comparing the detection rate of PCa by TGBX with that of SBX in the perspective of urologic practice in our country.

Materials and Methods

This is a hospital-based cross sectional study carried out in the department of Urology, CMH Dhaka. This study was carried out over a period of one year from July 2022 to June 2023. Those patients reported to urology outpatient department/center or admitted in urology ward of CMH Dhaka with suspicious findings on per rectal examination or with raised PSA level were included in this study. The patients who fulfill both the inclusion and exclusion criteria given below were enrolled only. A total number of 207 patients were studied. Patients were selected by purposive sampling basing on inclusion and exclusion criteria.Inclusion criteria werePatients suffering from LUTS and having

abnormal DRE findings, aged 41-80 years male with a PSA level > 4 ng/ml. The Exclusion criteria werePatients who underwent prior prostate biopsy/ surgery or suffering from acute prostatitis, Patients suffering from active urinary tract infection (UTI) or any painful anorectal pathology, Patients having any major psychiatric illness/dementia, Patients who have significant coagulopathy/ recent MI, severe immunosuppression or any contraindication for MRI.

Results

Table I: *Age distribution of the patients*

Age group	Frequency	Percent
41-50	4	2.2
51-60	42	23.6
61-70	76	42.7
71-80	56	31.5
Total	178	100.0
Mean±SD:	66.17±7.79(43-79)	

Table I Illustrates the demographic characteristics of the respondents. Total sample size was N=178. All the patients in this study were males (100%).

Here, minimum recorded age was 43 years, whereas maximum age was 79 years and mean age was 66.17±7.79. Again, maximum 76 (42.7%) respondents were in the age group of 61-70 years followed by 56 (31%) cases were in the age range of 71-80 years.

Table II: *Clinical presentation of the patients*

Clinical features	Frequency	Percent
Asymptomatic	37	20.8
Symptomatic	141	79.2
Total	178	100.0
LUTS		
Yes	123	69.1
No	55	30.9
Urinary retention		
Yes	57	32
No	121	68
Haematuria		
Yes	28	15.7
No	150	84.3
Associated features (e.g. Back pain)		
Yes	15	8.4
No	163	91.6

Table II describes symptoms analysis which revealed that total 37/138 (20.8%) respondents were symptomless. They were found having high PSA by routine follow up. Rest of the 141/178 (79.2%) cases presented with some symptoms. Many of them presented with more than one features simultaneously. 123/178 patients reported with lower urinary tract symptoms (LUTS), 57/178 patients had a history of urinary retention, 28/178 respondents presented with haematuria and 15/178 patients presented with associated features like back pain/bone pain.

Table III : *Characteristic findings on DRE*

DRE findings	Frequency	Percent
Suspicious, Hard prostate	44	24.7
Normal, Firm prostate	134	75.3
Total	178	100.0

Characteristics of DRE findings are presented in Table 3 In 44 cases (24.7%), we found suspicious/ hard prostate (with or without nodularity) on DRE.

Table IV: *Prostate volume (PV) analysis*

Prostate volume	Frequency	Percent
< 25 gm	16	9.0
26-50 gm	77	43.3
51-75 gm	43	24.2
76-100 gm	23	12.9
> 100 gm	19	10.7
Total	178	100.0
Mean±SD:59.59±37.10(18-236)		

Table IV indicates that prostate volume (PV) ranged from 18 gm to maximum 236 gm and mean PV was found as 59.59±37.10. Amongst all, 77/178 (43.3%) respondents had PV within the range of 26-50 gm.

Table 5.1 : *Findings of Serum PSA*

Variable	Median	IQR	95% CI
PSA	13.91	17.21	35.92-86.53

Table 5.1 and 5.2 show that PSA value ranged from 4.18 to more than 1000 ng/ml, median PSA was 13.91 ng/ml, inter quartile range (IQR) was 17.21 and 95% confidence interval (CI) for mean was 35.92-86.53.

Again, maximum 70 respondents (39.3%) had PSA value between 4-10 ng/ml, 46 patients (25.8%) were within the range of 11-20 ng/ml and rest of the 60 cases (34.8%) had PSA more than 20 ng/ml (high risk group).

Table 5.2 *Serum PSA distribution*

PSA range	Frequency	Percent
4-10 ng/ml	70	39.3
11-20 ng/ml	46	25.8
> 20 ng/ml	62	34.8
Total	178	100.0

Some respondents had very high PSA, even upto 1000 ng/ml as shown in normal Q-Q plot of PSA, which indicated abnormal distribution of values.

Here, Table 5.3 illustrates that out of total 178 respondents, 35 (19.7%) patients had PSAD less than 0.15 and maximum 143 (80.3%) cases had PSAD e" 0.15.

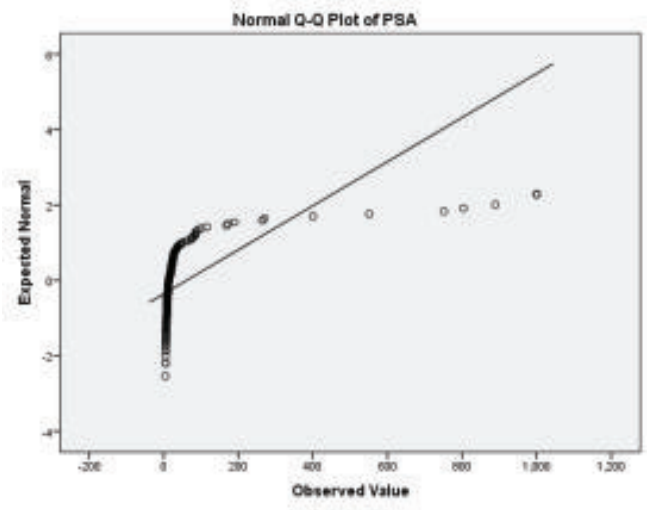

Fig 1 : *Normal Q-Q plot of PSA value.*

Table 5.3 *PSAD distribution*

PSAD range	Frequency	Percent
<0.15	35	19.7
0.15 and above	143	80.3
Total	178	100.0

Biopsy procedure

Total 178 patients were enrolled for the study. Of these, 135 cases (75.8%) underwent SBX, and TGBX was performed for rest of the 43 patients (24.2%).

Table VI: *Biopsy procedure (SBX/TGBX)*

Biopsy Group	Frequency	Percent
SBX	135	75.8
TGBX	43	24.2
Total	178	100.0

Overall cancer detection rate (CDR)

The following table shows that out of 178 study population, malignancy was detected in 95 (53.4%) cases. For rest of the 83 (46.6%) cases, benign hyperplasia/ prostatitis was fou.nd in histopathology report.

Table VII : ***Overall cancer detection*** *rate (CDR)*

Results	Frequency	Percent
Positive (malignancy is detected)	95	53.4
Negative (no malignancy is found)	83	46.6
Total	178	100.0

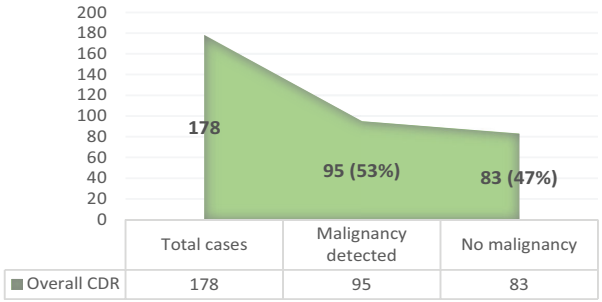

Fig 2 : *Bar diagram showing overall cancer detection.*

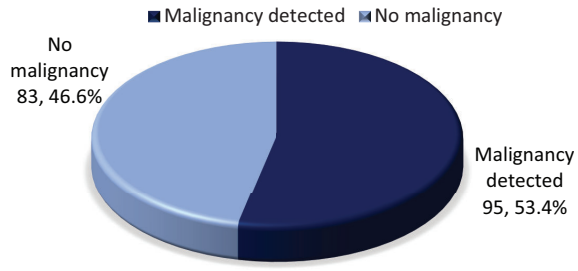

Fig 3 : *Pie chart showing overall CDR.*

Table VIII *Comparative CDR between SBX and TGBX group*

Biopsy procedure	HPR Positive, Malignancy etected.	HPR Negative No malignancy	Total
SBX	65	70	135
	48.15%	51.85%	100.0%
TGBX	24	19	43
	55.81%	44.19%	100.0%

X^2=0.77, df=1, p=0.3812

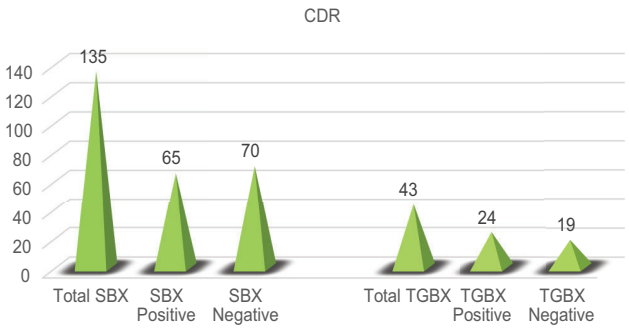

Fig 4 : *Bar diagram showing biopsy results by both SBX and TGBX.*

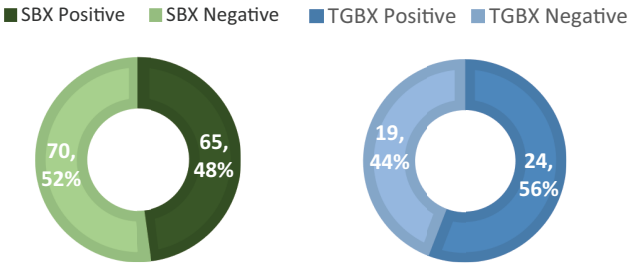

Fig 5 : *Pie diagrams showing CDR by SBX and TGBX respectively.*

Distribution of pattern of Gleason Score (GS)

Following table shows that GS 6 (3+3) occurred in 13 (13.7%) of 95 men. Whereas, GS 7(3+4) was found in only 4/95 (4.2%) cases and GS 7 (4+3) was present in 21/95 (22.1%) patients. GS 8 (4+4) was seen in 20/95 (21.1%) respondents and GS 9-10 (4+5,5+4 or 5+5) were found in 37/95 (38.9%) cases.

Table IX : *Incidence pattern of GS*

	GS	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3+3	13	7.3	13.7	13.7
	3+4	4	2.2	4.2	17.9
	4+3	21	11.8	22.1	40.0
	4+4	20	11.2	21.1	61.1
	5+4	17	9.6	17.9	78.9
	4+5	10	5.6	10.5	89.5
	5+5	10	5.6	10.5	100.0
	Total	95	53.4	100.0	
Missing	System	83	46.6		
Total		178	100.0		

Distribution of Gleason Grade Group (GGG)

Following table illustrates that GGG-1 occurred in 13/95 (13.7%) of malignancy detected men and 13/178 (7.3%) of total respondents. Whereas, GGG e" 2 was found in rest of the 82/95 (86.3%) cases.

Table X: *Incidence of GGG*

	GGG	Frequency	Percent	Valid Percent
Valid	1	13	7.3	13.7
	2	4	2.8	5.3
	3	21	11.2	21.1
	4	20	11.2	21.1
	5	37	20.8	38.9
	Total	95	53.4	100.0
Missing	System	83	46.6	
Total		178	100.0	

Comparative cancer detection rate (CDR)

Here, table 3.10 shows that CDR was little higher in the targeted group than in the systematic group (55.81% vs. 48.15% respectively, p > 0.05). In case of SBX group, 65/135 (48.15%) cases were diagnosed as adenocarcinoma. Whereas, in 24/43 (55.81%) cases, malignancy was detected by TGBX.

Overall detection rate of CS PCa

The following table shows that out of 178 study population, CS PCa was detected in 83 (41.1%) cases. CI PCa was detected in case of 13/178 (7.3%) patients. For rest of the 83/178 (46.6%) cases, malignancy was not detected.

Table X: *Overall detection rate of CS PCa*

Result	Frequency	Percent
CS PCa	82	46.1
CI PCa	13	7.3
No PCa	83	46.6
Total	178	100.0

Comparative detection rate of CS PCa

The CS PCa detection rate was higher in the TGBX group than in the SBX group (21/43, 48.8% vs. 55/135, 40.7%, respectively, p = 0.732). The CI PCa detection rate was almost similar between the two groups (3/43, 6.98% vs. 10/135, 7.41%; p > 0.05)

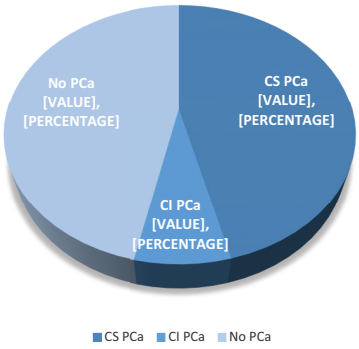

Fig 6 : *Pie chart showing overall detection rate of CS PCa and CI PCa.*

Table XII: *Detection rate of CS PCa in SBX and TGBX group*

Biopsy procedure	Outcome			Total
	CS PCa	CI PCa	No PCa	
SBX	55	10 7.41%	70 51.85	135 100.0%
TGBX	21	3	19	43
	48.84%	6.98%	44.18%	100.0%

X^2=0.1169, df=1, p=0.732

Table XIII: *Core wise comparison of SBX and TGBX*

	No. of biopsy cores by SBX	No. of involved cores by SBX	No. of biopsy cores by TGBX	No. of involved cores by TGBX	P value
Frequency	178	95	43	24	p = 0.231
Total cores	2161	626.00 (29.0%)	168	56.00 (33.0%)	

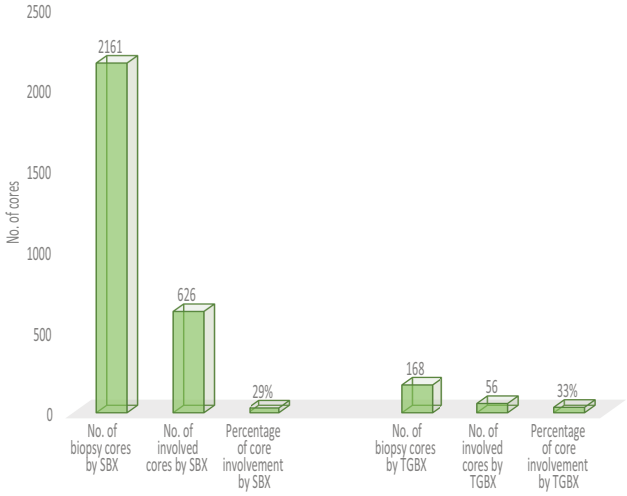

Fig.-7 : *Bar diagram shows outcome of systematic and targeted biopsy cores.*

Core wise comparison of SBX and TGBX

Table 3.13 summarizes the outcomes of the systematic and targeted cores in each group. The analysis of the cores in current study revealed that out of 2161 SBX cores, 626 cores were positive for malignancy (29%), whereas 56/168 (33%) cores were found involved by cancer cells in case of mpMRI TGBX. The rate of cancer-positive cores was higher in targeted biopsies than in systematic biopsies (33% vs. 29% respectively, p > 0.05).

Correlation between PI-RADS score and GGG

Following table shows that there was strong positive correlation between PI-RADS score and GGG ,and this was found statistically significant (r=0.759, P<0.01).

Table 14: *Correlation between PI-RADS score and GGG*

	PI-RADS Score	GGG
PI-RADS Score		
Pearson Correlation	1	.759**
Sig. (2-tailed)		.000
N	43	43
GGG		
Pearson Correlation	.759**	1
Sig. (2-tailed)	.000	
N	43	43

**. Correlation is significant at the 0.01 level (2-tailed).

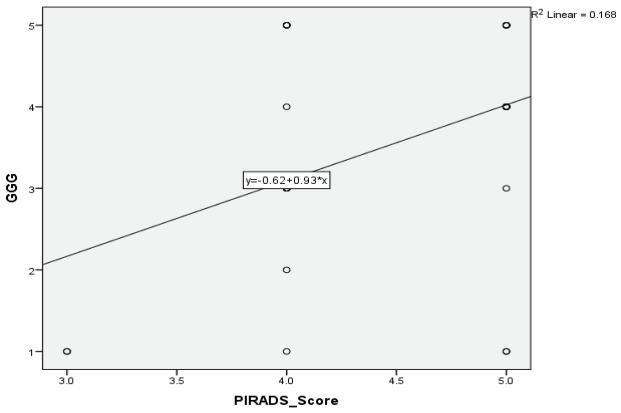

Fig 8 : *Scatter diagram showing positive correlation between PI-RADS score and GGG.*

Association between DRE findings and CDR

Table 15 shows that the prevalence of cancer was significantly higher amongst respondents with suspicious abnormal DRE than in those with normal DRE, 37/44 (84.1%) and 58/134 (43.3%) respectively (p<0.001). Only 7/44 (15.9%) respondent had suspicious DRE but detected as benign cases.

Table 15: *Association between DRE findings and CDR*

DRE Findings	HPR		Total
	Positive Malignancy detected	Negative, No malignancy	
Suspicious, Hard prostate	37	7	44
	84.1%	15.9%	100.0%
Normal, Firm prostate	58	76	134
	43.3%	56.7%	100.0%
Total	95	83	178
	53.4%	46.6%	100.0%

X^2=22.164, df=1, p < 0.001

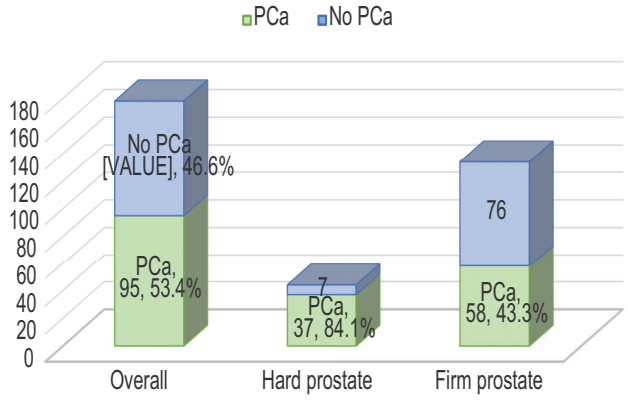

Fig 9 : *Compound bar diagram showing association between DRE findings and CDR.*

Association between PV range and CDR

The following table suggests that relationship between prostate size and the incidence of PCa was inverse. Out of total 95 detected malignancy, 58 cases (61.05%) were found positive for adenocarcinoma when prostate volume was below 50 gm, 19 cases (20.0%) were positive when prostate size ranged between 51-75 gm, 12 cases (12.63%) were positive when size was between 76-100 gm range and only 6 cases (6.32%) were found positive when prostate volume was more than 100 gm (p >0.05).

Table XVI : *Association between PV range and CDR*

PV range	HPR		Total	P value
	Positive, Malignancy detected	Negative, No malignancy		
< 25 gm	10	6	16	P = 0.08
	62.5%	37.5%	100.0%	
26-50 gm	48	29	77	
	62.3%	37.7%	100.0%	
51-75 gm	19	24	43	
	44.2%	55.8%	100.0%	
76-100 gm	12	11	23	
	52.2%	47.8%	100.0%	
> 100 gm	6	13	19	
	31.6%	68.4%	100.0%	
Total	95	83	178	
	53.4%	46.6%	100.0%	

Association between PSAD and CDR

Table 17 demonstrates that 35 patients had PSAD of < 0.15 ng/mL/cm3.Of these, only 8 (22.9%) patients were diagnosed with PCa and malignancy was not detected for rest of the 27 (77.1%) cases (p<0.001). Whereas, when PSAD was 0.15 or more (143 cases), the CDR was found as high as 60.8%.

Table XVII *Association between PSAD and CDR*

PSAD	HPR		Total
	Positive	Negative	
< 0.15	8	27	35
	22.9%	77.1%	100.0%
≥ 0.15	87	56	143
	60.8%	39.2%	100.0%
Total	95	83	178
	53.4%	46.6%	100.0%

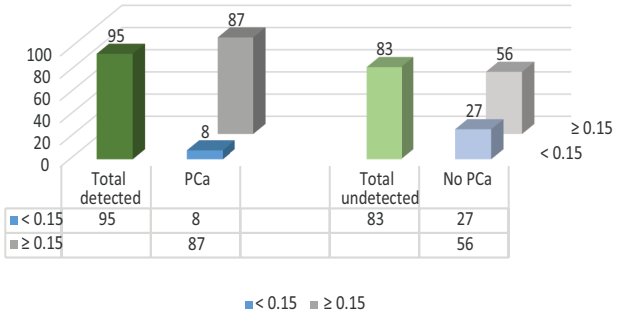

Fig 10 : *Bar chart showing relationship between PSAD and CDR.*

Discussion

This comparative study was carried out with an aim to compare the cancer detection rate by SBX and TGBX. A total of 178 male patients reported to Urology department of CMH Dhaka between July 2022 to June 2023 were included in this study. Aged 41-80 years male with a PSA level > 4 ng/ml were enrolled. Patients who underwent prior prostate biopsy/surgery or suffering from acute prostatitis, patients suffering from active UTI or any painful anorectal pathology, patients having any major psychiatric illness/ dementia, patients who have significant coagulopathy/ recent MI, severe immunosuppression or any contraindication for MRI were excluded from the study. The present study findings were discussed and compared with previously published relevant studies.

Total 194 patients reported to OPD or admitted in ward, were found suitable for our study. Amongst them, who had high serum PSA and hard/suspicious prostate on DRE were selected for SBX. In our hospital, it is practiced to advise 'mpMRI of Prostate' only to those patients who have serum PSA between 4 to 10 ng/ml with normal DRE findings. Total 55 respondents performed mpMRI and 11 men of them had PI-RADS score d" 2, whose MRI result was unlikely of harboring a malignancy. They were not offered biopsy and subsequently excluded from the study. One patient with PI-RADS score 3, went abroad to perform biopsy and therefore, not included in this research. Another patient aged above 80, having recent MI and multiple comorbidities, was excluded from the study. Three more cases having all the inclusion criteria, didn't consent for the study. Fulfilling both the inclusion and exclusion criteria, total 178 patients were enrolled for the study finally. Here, worth mentioning that using mpMRI to triage men might allow 11/55 (20%) of patients avoid a primary biopsy and subsequent over-diagnosis of clinically insignificant disease. This finding is supported by Ahmed et al. (2017) where they found that 27% cases could safely avoid biopsy and 5% fewer diagnosis of CI PCa.[33]

In this study, total sample size (n) was 178. All the respondents (100%) were male. Maximum 76 (42.7%) cases were in the age group of 61-70 years. Minimum recorded age was 43 years, whereas maximum age was 79 years and mean age was 66.17±7.79 (Table 3.1). Of these 178 respondents, 135 cases (75.8%) underwent SBX and TGBX was performed for rest of the 43

patients (24.2%) (Table 3.6). A significant difference was observed when stratifying the patients on the basis of the biopsy approach. Samples were chosen non-randomly, especially mpMRI was advised for the TGBX group following local hospital protocol and EAU guidelines. Again, as mpMRI is a costly procedure, so that we could offer this investigation for selected cases only, resulting low sample size in the targeted group.

During this study, symptoms analysis revealed that total 37/138 (20.8%) respondents were symptomless. They were found having raised PSA during routine follow up. This data indicates that many peoples of educated society are well alert about their prostate health. Rest of the 141/178 (79.2%) cases presented with some symptoms. Many of them presented with more than one clinical features simultaneously. 123/178 (69.1%) patients reported with lower urinary tract symptoms (LUTS), 57/178 (32.0%) patients had a history of urinary retention, 28/178 respondents presented with haematuria and 15/178 patients presented with associated features like back pain/bone pain (Table 3.2).

Here, in 44 cases (24.7%), we found suspicious/hard prostate (with or without nodularity) on DRE (Table 3.3). Prostate volume (PV) ranged from 18 gram to maximum 236 gram and mean PV was found as 59.59±37.10. Amongst all, 77/178 (43.3%) respondents had PV within the range of 26-50 gram (Table 4). Serum PSA value ranged from minimum 4.18 to more than 1000 ng/ml, median PSA was 13.91 ng/ml, IQR was 17.21 and 95% confidence interval for mean was 35.92-86.53 (Table 3.5.1). Maximum 70 respondents (39.3%) had PSA value between 4-10 ng/ml, 46 patients (25.8%) were within the range of 11-20 ng/ml and rest of the 60 cases (34.8%) had PSA more than 20 ng/ml (Table 3.5.2). Some respondents had abnormally high PSA, even upto 1000 ng/ml as shown in normal Q-Q plot of PSA, which indicated abnormal distribution of values (Figure 1). Out of total 178 respondents, 143 (80.3%) cases had PSAD e" 0.15 (Table 3.5.3)

In most of the cases (115/178, 64.6%) Tablet Amoxicillin plus Clavulanic acid 625 mg was used as antibiotic prophylaxis. Again, 115 (64.6%) biopsy procedures were done under surface anaesthesia. Periprostatic nerve block (PPB) was used in case of 58 (32.6%) cases. Only 5 (2.8%) patients underwent biopsy by SAB (Table is not shown).

Out of 178 study population, malignancy was detected in 95 cases. That is, overall cancer detection rate (CDR) was 53.4% (Table 3.7 and Figure 2-3). The yielding rate of total and clinically significant prostate cancer was better in patients who received prebiopsympMRI than in those who did not. The CDR was little higher in the targeted group than in the systematic group (55.81% vs. 48.15% respectively, p = 0.3812), though the difference was not statistically significant (Table 3.8 and Figure 4-5).

In this study, Gleason score - 6 (3+3) occurred in 13 (13.7%) of 95 men. Whereas, GS 7 (3+4) was found in only 4/95 (4.2%) cases and GS 7 (4+3) was present in 21/95 (22.1%) patients. GS 8 (4+4) was seen in 20/95 (21.1%) respondents and GS 9-10 (4+5, 5+4 or 5+5) were found in 37/95 (38.9%) cases (Table 3.9). Gleason grade group, GGG-1 occurred in 13/95 (13.7%) of malignancy detected men and 13/178 (7.3%) of total respondents. Whereas, GGG e" 2 was found in rest of the 82/95 (86.3%) cases (Table 3.10). Here, out of 178 study population, clinically significant (CS) PCa was diagnosed in 82 (46.1%) cases and clinically insignificant (CI) PCa was detected in case of 13/178 (7.3%) patients. For rest of the 83/178 (46.6%) cases, malignancy was not detected (Table 3.11). The CS PCa detection rate was also higher in the TGBX group than in the SBX group (48.8% vs. 40.7% ; respectively, p = 0.732). The clinically insignificant prostate cancer detection rate was similar between the two groups (6.98% vs. 7.41%; p > 0.05) (Table 3.12).

Huang et al. (2022) found little statistical difference in the detection rate of PCa patients between systematic biopsy and targeted biopsy (44.41% vs 45.6%, P>0.05), while the detection rate of targeted biopsy in CS PCa patients was slightly higher than that of systematic biopsy (40.83% vs 38.15%, P=0.033). Lee et al. (2022) conducted a study comparing the CDR from systematic and targeted cores. Of 398 men, PCa was detected in 54% (213/398), while CS PCa was detected in 42% (168/398). The detection rate of CS PCa was 21% (83/398) on systematic biopsy and 39% (155/398) on targeted biopsy. Using combined targeted and systematic biopsy, CS PCa detection rates for PI-RADS 3, 4 and 5 were 13%, 35% and 83% respectively. Kasivisvanathan et al. (2018) found that clinically significant cancer was detected in 95 men (38%) in the MRI-targeted biopsy group, as compared with 64 of 248 (26%) in the standard-biopsy group. Washino et

al. (2018) studied cancer detection rate of prebiopsy MRI with subsequent systematic and targeted biopsy. The CDR of total and clinically significant PCa was significantly higher in patients who received prebiopsympMRI than in those who did not (55.3 and 46.0% vs. 42.0 and 35.2%, respectively; p = 0.004 and p = 0.016). The clinically insignificant prostate cancer detection rate was similar between the two groups (9.3% vs. 6.8%; p = 0.32). Fourcade et al. (2018) found that overall PCa detection rate and the CS PCa detection rate were not significantly higher in TGBX alone versus SBX (44.5% vs 46.1%, p = 0.7, and 38.2% vs 33.5%, p = 0.2, respectively). All these results are closely resembled with the findings of the present study.

Table 3.13 summarizes the outcomes of the systematic and targeted cores in each group. The analysis of the cores in current study revealed that out of 2161 SBX cores, 626 cores were positive for malignancy (29%), whereas 56/168 (33%) cores were found involved by cancer cells in case of mpMRI TGBX. The rate of cancer-positive cores was higher in targeted biopsies than in systematic biopsies (33% vs. 29% respectively, p = 0.231) (Figure 3.7). Kasivisvanathan et al. (2018) found that a greater percentage of cores were positive for cancer in the MRI-targeted biopsy group (422 of 967 cores, 44%) than in the standard-biopsy group (515 of 2788, 18%).[34] Tonttila et al. study showed a SB vs mpMRI CTB cancer detection rate of 57% vs 51% (p-value of 0.9). Bansal et al. and Porpiglia et al. study showed that TB had a significantly higher cancer yield when compared with SB (Bansal et al. - SB vs TB - 16.2% vs 44.3%). Thangarasu et al. (2021) did a prospective study on the efficacy of cognitive targeted transrectal ultrasound prostate biopsy. Total MRI suspicious lesions were 163. Out of 1263 SB cores, 371 cores were positive for cancer (29.35%), and out of 326 mpMRI CTB cores, 120 were positive for cancer (36.8%) (P<0.0001). All these outcomes are comparable with the results of current study.

Here, worth mentioning that of 43 patients who underwent targeted plus systematic biopsy (combined biopsy, CBX) in the TGBX group and were diagnosed with prostate cancer, two patients were missed by systematic biopsies but detected by targeted biopsies whereas six patients were detected by addition of systematic biopsy cores. In two patients those were detected by targeted biopsy alone, the index lesions were in the right apical peripheral zone (n = 1) and right peripheral mid zone (n = 1). So, if combined systematic and targeted biopsy (CBX) were taken into consideration, overall CDR would have been increased upto 3.4%. However, according to our data, the overall detection rate of PCa improved only from 53.4% to 56.7% when an adapted systematic prostate biopsy was performed. Jiang et al. (2019) conducted a meta-analysis with 11 studies comparing cancer detection using SBX, TGBX and CBX. They summarized detection rates for all prostate cancer cases using CBX, TGBX, and SBX were 62% (95% CI, 56%-68%), 53% (95% CI, 48%-57%), and 52% (95% CI, 46%-58%), respectively. Here, a combination of systematic and targeted biopsy schemes has been suggested to provide the highest PCa detection rate, and our results are consistent with this fact. However, based on our results, adapted SBX improved the overall CDR of PCa but did not provide additional benefit for the detection of clinically significant disease. The European Association of Urology (EAU) recommends for primary patients to perform combined targeted plus systematic biopsy and targeted-only biopsy for secondary patients if their PI-RADS score is e"3, but our data suggest that only targeted biopsy could be performed safely in biopsy-naive patients with a PI-RADS score ≥3 by avoiding systematic biopsy and maintaining a optimum CS PCa detection rate.

In this current study, a strong positive correlation between the PI-RADS score and CDR was found. GGG was also found high with increased PI-RADS score which was statistically significant (r=0.759, P<0.01) (Table 3.14 and Figure 8). Washino et al. (2018) correlated between the PI-RADS-2 and prostate cancer detection rate, and found a receiver-operator curve analysis yielded an area under the curve of 0.801 (p < 0.0001). In this present study, it was found that among 55 patients done with mpMRI, 43 (79.63%) patients showed suspicious lesions (72.09% in PZ, 27.91% in TZ). In 23 cases (53.49%), lesions were in right side. Suspicious lesions were found in the mid zone in maximum 22 cases (51.16%), followed by in the apical region in 11 cases (25.58%) and in the base in 10 respondents (23.26%) (Table is not shown). These results were found similar when compared with Lee et al. (2018) who examined 460 patients. There were 109 (23.7%) patients who had no suspicious lesion in preoperative MRI and 351 (76.3%) patients with

suspicious lesion. Their study revealed that among 351 patients had suspicious DWI lesions (57.5% in PZ, 42.5% in TZ). Overall concordance rates between diffusion weighted imaging (DWI) and surgical specimen were 75.8%, significantly higher in PZ than TZ (82.2% vs. 67.1% p = 0.002).[35]

DRE remains an important and useful tool in the hand of urologists in evaluating men with prostatic diseases.[36] Abnormalities of DRE include presence of nodules, hard consistency, fixity of rectal mucosa, obliteration of the median groove and asymmetry.[37-38] This present study found a strong correlation between the DRE findings and CDR, especially in case of CS PCa. In this study, the prevalence of cancer was significantly higher amongst patients with suspicious abnormal DRE than in those with normal DRE, 84.1% and 43.3% respectively (p<0.001). Nepal et al. (2020) showed that abnormal DRE find-ings were observed in 204 patients (31.0%), among whom 150 (73.5%) had carcinoma (p<0.05).[11] Thangarasu et al. (2021) found 34.6% cases (out of 75 patients) had abnormal digital rectal examination (DRE).[15] Ojewola et al. showed that the prevalence of cancer was significantly higher amongst patients with abnormal DRE than in those with normal, 50.3% and 31.9% respectively.[36] Other large studies in referral populations have also identified an abnormal DRE to be associated with a greater risk of detecting PCa.[39-40] This emphasizes the continued relevance or usefulness of a DRE as a tool in evaluating patients with prostatic problems. Again, patients with normal DRE was associated with higher detection of benign lesion in comparison that of suspicious/equivocal DRE, 56.7% vs. 15.9% which was statistically significant (p<0.001). Conversely, presence of a normal DRE does not completely excludes PCa as 43.3% of the patients with normal DRE eventually had the diagnosis of PCa. This is not surprising as DRE palpates the posterior aspect of the prostate gland adjacent to the rectum while the anteriorly located part as well as median lobe of the prostate cannot be palpated during a DRE. Therefore, utilization of a TRUS and serum PSA estimation should be combined with a DRE in evaluating these patients.[41,42] In this current study, it was observed that relationship between prostate size and the incidence of PCa was inverse. Out of total 95 detected malignancy, 58 cases (61.05%) were found positive for adenocarcinoma when prostate volume was below 50 gm, 19 cases (20.0%) were positive when prostate size ranged between 51-75 gm, 12 cases (12.63%) were positive when size was between 76-100 gm range and only 6 cases (6.32%) were found positive when prostate volume was more than 100 gm (p >0.05) (Table 3.16). Washino et al. (2018) stated that the prostate volume is negatively associated with the cancer detection rate and suggested that prostate biopsies might not be recommended in patients with a large prostate volume and/or normal MRI.[7] Yamashiro et al (2021) systematically reviewed 41 articles and reported an inverse relationship between prostate gland volume and incidence of prostate cancer. Sample sizes ranged from 114 to 6692 patients in these single institutional and multi-institutional studies. Thirty-nine (95%) of the 41 articles showed a statistically significant inverse relationship obtained in their study.[43] Al-Azab et al assessed prostate volumes of 1796 patients using transrectal ultrasound (TRUS) and concluded that "men with a large prostate volume (larger than 72cc) had a 20.5% risk of prostate cancer on biopsies compared to men with the smallest prostate volume (less than 38cc) who had 65.8% risk of cancer" (p-value <0.001).[44] Karakiewicz et al reported, in a sample size of 1974 patients, the highest positive biopsy rate (39.6%) among prostates smaller than 20 cc, whereas the lowest positive biopsy rate (10.1%) was found in glands between 80–90 cc (p-value <0.02).[45] Al-Khalil et al. demonstrated that the incidence of PCa was reduced by 40% in larger prostates with a volume >65 cc when compared to smaller prostates with a volume <35 cc (p-value <0.05).[46] Though not statistically significant, but these results are closely resembled with the present study. An important variable, mostly overlooked over the years, is PSA density (PSAD) which is defined as the level of serum PSA divided by the prostate volume, are currently used as screening tools for detection of PCa.[47] Many publications have demonstrated a direct relationship between PSAD and PCa aggressiveness. Some investigators advocate that the higher the PSAD, the more likely it is that the PCa is clinically significant. Here, PSAD requires either a TRUS or MRI for an accurate assessment of volume. Benson et al introduced the concept of PSAD in order to correlate PSA levels in serum with the prostate volume. Several studies suggested that PSA density higher than 0.15 ng/ml/cm3 increases the cancer detection rate.[48] In addition, Radwan et al. suggested

that value of PSAD higher than 0.20 ng/ml/gr strongly correlated with the extracapsular extension of the cancer.[47] PSA density (PSAD) was useful for decision-making before a prostate biopsy. In the present study, 35 patients had PSAD of < 0.15 ng/mL/cm3.Of these, only 8 (22.9%) patients were diagnosed with PCa and malignancy was not detected for rest of the 27 (77.1%) cases(p<.001).Whereas, when PSAD was 0.15 or more (143 cases), the CDR was found as high as 60.8%. Washino et al. (2018) found that no patients with a PIRADS-2 score of d" 3 and PSA density of < 0.15 ng/mL/cm3 were diagnosed with clinically significant PCa.[12] Karademir et al. reported there was a significant relationship between the PSAD and the Gleason score in prostate cancer patients [49]. The current study also found strong correlations between PSAD and CDR with statistically significant p-value less than 0.001 that supported their results. These findings would help to predict the prognosis of prostate cancer patients.

Conclusion:

This study was undertaken to evaluate the cancer detection rate (CDR) by comparing systematic and targeted prostate biopsies. Prebiopsy mpMRI and subsequent targeted biopsy with or without standard biopsy could yield more clinically significant PCa than systematic biopsy alone. Moreover, fewer biopsy cores being taken could reduce the procedure time and decrease the risk of complications, making it a very acceptable investigation for patients. Besides, unnecessary biopsy and over-diagnosis of clinically insignificant disease can be avoided by implementing mpMRI as a triage test. So, mpMRI may be considered as a potential diagnostic tool with growing importance for PCa evaluation in the present perspective of urological practice in our country.

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