Comparison between Transrectal Ultrasound Guided Prostatic Biopsy versus Multiparametric Magnetic Resonance Imaging with Subsequent Magnetic Resonance Imaging Prostatic Guided Target Biopsy in Suspected Cancer Prostate Patients

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ABSTRACT

Background: Prostate cancer (PCA) is the most frequent cancer among men. In order to overcome the practical limitations of prostate specific antigen (PSA) screening, research in recent years has focused on developing more precise imaging techniques. **Objectives:** This study aimed to determine the function of multiparametric magnetic resonance imaging (mpMRI) as a prebiopsy imaging decreasing the number of biopsies taken and role of combination of mpMRI finding with standard transrectal ultrasound (TRUS) guided biopsy findings to improve efficacy of standard TRUS biopsy. **Patients and methods:** This prospective study trial was completed on 124 patients suspicious for cancer prostate as elevated total PSA > 10 ng/ml or in grey zone and free/total ratio less than 0.18 or suspicious digital rectal examination who attended to the Urology Department of Benha University Hospital. All patients underwent mpMRI then TRUS guided systematic biopsy. Further to that, TRUS guided targeted biopsy by cognitive biopsy technique from suspicious lesions in the same session for those who had positive mpMRI finding. **Results:** Regarding the agreement and performance characteristics between combined systematic and targeted biopsy in relation to systematic biopsy alone among patients suspected of having prostate cancer, showed moderate agreement (k=0.499), with 73.2 % sensitivity, 77.3 % specificity, 80.4 % PPV, 69.4 % NPV and 75.0 % accuracy. **Conclusions:** Combined TRUS guided and Targeted biopsy improved cancer detection rate in patients with PIRADs 2, 3, 4.

Keywords: Transrectal ultrasound guided prostatic biopsy, mpMRI, Prostate cancer.

INTRODUCTION

Prostate cancer (PCa) is the most common diagnosed cancer in male around the world [1]. The classic diagnostic tools for detecting cancer prostate are prostatic specific antigen (PSA), digital rectal Examination (DRE) and transrectal ultrasound (TRUS) guided biopsy. Increasing the number of biopsies and the diagnostic rate of prostate cancer have resulted from the implementation of prostate-specific antigen (PSA) screening in standard clinical practice decades ago [2]. The standard transrectal ultrasound guided biopsy (TRUS-GB), a 12-core transrectal ultrasound-guided biopsy, is not perfect because it suffers from anatomical limitations [3], because TRUS guided biopsy alone can miss small tumors or that located anteriorly or in big glands [4]. Magnetic resonance imaging (MRI) provides superior soft tissue resolution over other imaging modalities, enabling a distinct anatomic evaluation of the prostate [5]. Prostate regions such as posterior subcapsular area, distal apical region, transition zone, and anterior prostate that are typically overlooked or difficult to access with TRUS can effectively identified and we can be targeted using combined targeted and systematic biopsy. Multiparametric magnetic resonance imaging (mpMRI) has become well-known as a significant technique during the previous several years in diagnosis of localized prostate cancer. An approach that shows promise for the diagnosis of clinically significant (CS) PCA is the cognitive technique for prostate biopsy (MRI-PB) [6, 7]. The advantage of mpMRI and MR-directed biopsy over TRUSGB has been demonstrated by numerous single- and multicentre randomized trials [8]. Furthermore, a comparison between mpMRI + MR-guided biopsy (MRGB) and TRUSGB in the same patients has not been done in many publications.

Our study aimed to determine the function of mpMRI as a prebiopsy imaging decreasing the number of biopsies taken and role of combination of mpMRI finding with TRUS finding to improve efficacy of standard TRUS biopsy.

PATIENTS AND METHODS

This prospective study trial was completed on 124 patients suspicious for cancer prostate as elevated total PSA more than 10 ng/ml or patients in grey zone and free/total ratio less than 0.18 or suspicious digital rectal examination (DRE) who attended to the Urology Department of Benha University Hospital, between September 2022 and November 2023. These findings recommend doing mpMRI.

Exclusion criteria: Patients who underwent previous prostate surgery. A prostate biopsy history taken in the previous three months. Contraindication to a transrectal US biopsy (e.g., anorectal stenosis or anal fissure). Contraindicated for MRI, due to heart pacemaker or metallic device and patients with severe claustrophobia or renal impairment.

Detailed history was taken from all patients then digital rectal examination was done carefully by senior consultant urologist has five years' experience , and then PSA, renal and liver function and necessary laboratory investigation were done. All patients underwent mpMRI. Then, those who had positive mpMRI finding underwent TRUS guided targeted biopsy by cognitive biopsy technique from suspicious lesions in addition to systematic biopsy in the same session and for those who

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had negative finding in mpMRI underwent TRUS guided systematic biopsy only.

Multiparametric magnetic resonance imaging (mpMRI) equipment: In order to reduce intestinal peristalsis, all patients were intramuscularly administered a single 10 mg dose of scopolamine butyl bromide (Buscopan®) before radiographic assessment. The study was done on closed superconductive1.5 Tesla MRI machine (MagnetomAvanto, Siemens Healthcare, Erlangen, Germany). The same mpMRI protocol was applied to every patient using ENDORECTAL coil: axial T2 weighted imaging, sagittal T2 weighted imaging, axial diffusion weighted imaging with an apparent diffusion coefficient map, coronal T2 weighted imaging, axial T2 fat-sat, coronal T1 weighted imaging and for dynamic contrast enhanced imaging-MRI a bolus injection of 0.1 mmol/kg body weight of gadolinium-based contrast agent for 2 ml/sec after which a 20 ml saline flush was administered.

Transrectal ultrasound guided biopsy (TRUS-GB):

TRUSGB was done according to international guidelines. Men having a worrisome mpMRI scan had targeted cognitive biopsy (18G needles with sample length of 17 mm), which was followed, ideally on the same day, by a 12-core systematic TRUSGB (18G needles with sampling length of 17 mm), conducted by a urologist blind to the imaging data. Only TRUSGB 12-core systematic biopsy was done on men with non-suspicious mpMRI (PI-RADS 1-2).

Histopathology: The 2014 international society of Urologic Pathology (ISUP) criteria were used to calculate the grade group and Gleason score (GS) for scores that included malignancy [19].

Ethical approval: This study was conducted according to ethical principles and the requirement of Benha University's Faculty of Medicine' Ethical Committee. Before taking part in the trial, the patients gave their written informed consents. The research was carried out in accordance with the Institutional Ethics Committee, Benha University Hospitals, Benha, Egypt(Rc. 3.8.2022). The Helsinki Declaration was observed at all stages of the study.

Statistical analysis: Utilizing SPSS V. 28.0, statistical analysis was performed. To assess if the data distribution was normally distributed, Shapiro-Wilks test was employed. The mean ± SD were utilized to display quantitative parametric data. Interquartile range (IQR) and median were utilized to display quantitative non-parametric data. Frequency and percentage (%) of qualitative characteristics were displayed. Agreement between quantitative variables was evaluated by Bland-Altman analysis. A significant p-value was defined as ≤ 0.05.

RESULTS

Regarding the patient characteristics, we comprised 124 patients in our research, their mean age was 62.94 ± 7.53 years. Median PSA level was 15.93 ng/ml, and the median PSA density was 0.3 ng/ml^2. The median prostate volume was 72.38 cm^3. There were 30 (24%) patients had familial predisposition to prostate cancer. The DRE results were positive in 70 (56.5%) patients, negative in 45 (36.2%) patients and 9 (7.3%) patients refused. Median number of cores was 12 and the median number of targeted cores was 3. Among the studied patients, 39 (31.5%) patients showed positive mpMRI with PI-RADS 3, 37 (29.8%) patients showed positive mpMRI with PI-RADS 4 and 24 (19.4%) patients showed positive mpMRI with PI-RADS 5. There were 10 (8.1%) patients had mpMRI with PI-RADS 1 and 14 (11.3%) patients had mpMRI with PI-RADS 2. A total of 100 patients underwent targeted biopsy, of them 51 (51%) patients had positive results. All of the 124 patients underwent TRUS systematic biopsy, of them 60 (48.4%) patients had positive results. These 60 patients were evaluated with GS, the mean score was 7.69 ± 1.14. 15 (21.4%) patients had score 6, 14 (20%) patients had score 7, 19 (27.1%) patients had score 8 and 22 (31.4%) patients had score 9 (Table 1).

Table (1): Patient characteristics and PI- RADS assessment categories

		n= 124
Age (years)	**Mean ± SD**	62.94 ± 7.53
PSA level (ng/ml),	**Median (IQR)**	15.93 (4-86.4)
PSA density (ng/ml^2)	**Median (IQR)**	0.3 (0.06-0.9)
Prostate volume(cm^3)	**Median (IQR)**	72.38 (26-164)
Family history of prostate cancer	**Positive**	30 (24%)
	Negative	94 (76%)
DRE	**Positive**	70 (56.5%)
	Negative	45 (36.2%)
	Refusing	9 (7.3%)
Number of cores	**Median (IQR)**	12 (10-14)
Number of targeted cores	**Median (IQR)**	3
PI- RADS assessment categories		
mpMRI positive (124)	**PI-RADS 3**	39 (31.5%)
	PI-RADS 4	37 (29.8%)
	PI-RADS 5	24 (19.4%)
No significant lesion on mpMRI	**PI-RADS 1**	10 (8.1%)
	PI-RADS 2	14 (11.3%)
Result of targeted biopsy (n = 100)	**Negative**	49(49%)
	Positive	51(51%)
TRUS biopsy result (n=124)	**Negative**	64(51.6%)
	Positive	60(48.4%)
Gleason score (n = 70)	**6**	15 (21.4%)
	7	14 (20%)
	8	19 (27.1%)
	9	22 (31.4%)
	Mean ± SD.	7.69 ± 1.14

Median and IQR: non-parametric test. SD: Standard Deviation, IQR: Interquartile Range, PSA: Prostate-Specific Antigen, PI-RADS: Prostate Imaging Reporting and Data System, DRE: Digital Rectal Examination, mpMRI: multi-parametric magnetic resonance imaging, PI-RADS: prostate imaging reporting and data system, TRUS: transrectal ultrasound.

All patients (124) underwent TRUS-GB (12 core biopsy). The outcomes of TRUS-GB (12 core biopsy) only revealed that systematic biopsy detected 12 (9.67%) out of 39 (31.5%) patients who showed PI-RADS 3 by mpMRI had positive PCa, and 20 (16.12%) out of 37 (29.8%) patients showed positive mpMRI with PI-RADS 4 had positive PCA. From 24 patients (19.4%) who showed positive mpMRI with PI-RADS, 5 had positive PCa. From 24 patients who showed negative PCa on mpMRI (PIRAD 1, 2), there was 4 (3.22%) patients had positive PCa (Figure 1).

Targeted biopsy: A hundred patients out of 124 patients underwent targeted biopsy, the results of targeted biopsy (3 core biopsy) only revealed that 10 (10%) had PIRAD 3 from 12 patients detected by systematic biopsy and 17 (17%) had PIRAD 4 out of 20 detected by systematic biopsy. The same number of patients (24) had PIRAD 5 by mpMRI and targeted biopsy (Figure 1).

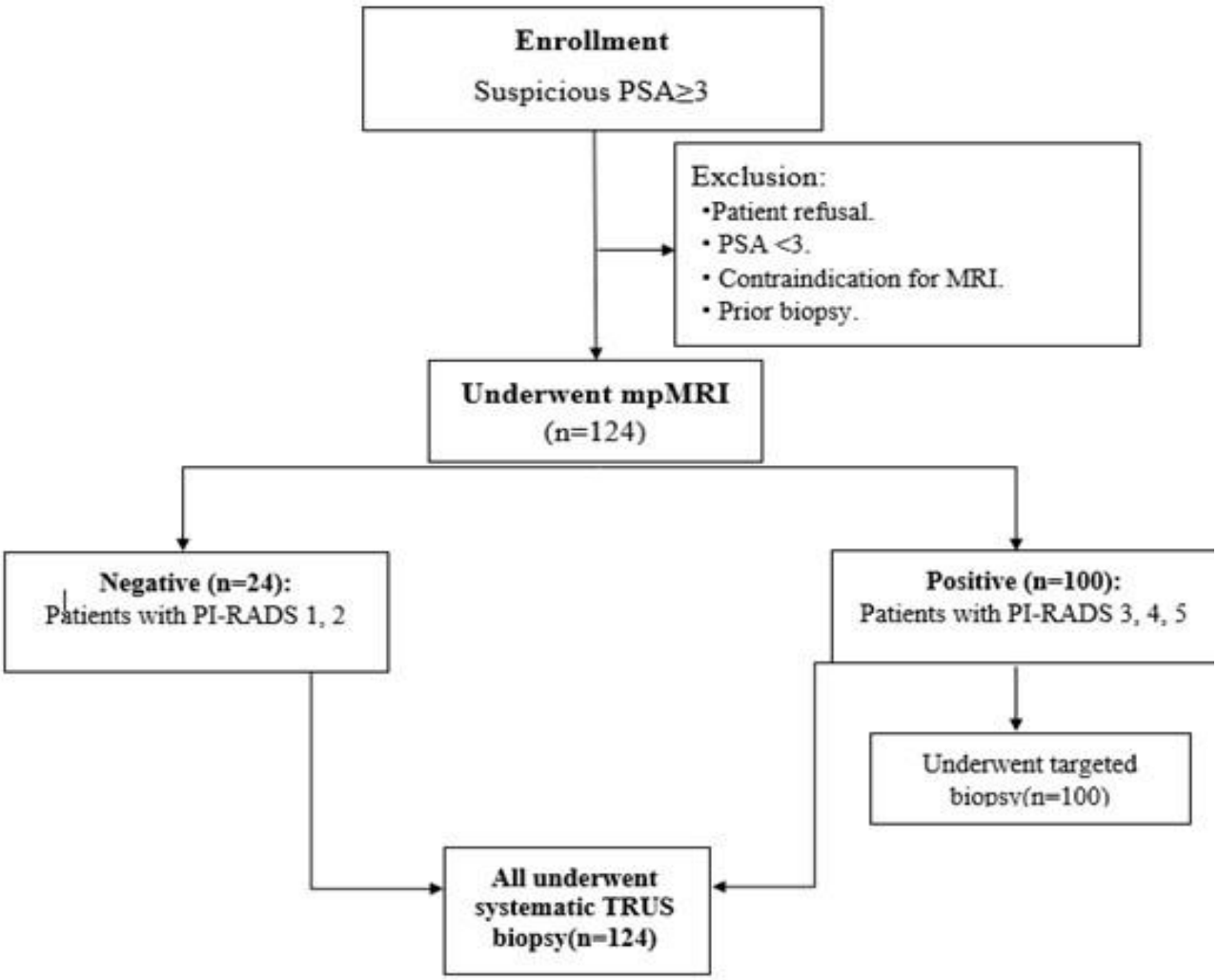

Figure (1): Algorithm of the enrolled patients.

TRUS-GB (Systematic biopsy):

Combination between TRUS biopsy and targeted biopsy: Combination between TRUS biopsy and targeted biopsy, 4 patients were identified with positive PCa and 22 (17.74%) had PIRAD 3. 37 patients had PIRAD 4 and 24 patients had PIRAD 5. A targeted biopsy alone detected 41 out of 100 (41%) cases diagnosed with cs PCa. When systematic biopsy was taken into account, the number of cs PCA cases increased to 55 out of 124 (44.4%). Consequently, relying solely on targeted biopsy would have missed 11.3% (14 out of 124) of men with suspicious lesions identified through mpMRI. On the other hand, a systematic biopsy alone detected 49 out of 124 (39.5%) cases diagnosed with cs PCA. When considering systematic biopsy alongside targeted biopsy, the number of cs PCA cases remained at 55 out of 124 (44.4%). Thus, depending solely on systematic biopsy would have missed 4% (6 out of 124) of men with suspicious lesions on mpMRI (Table 2).

Table (2): Biopsy core analysis details for TRUSGB and Targeted Biopsy, and TPUS-GB results related to targeted biopsy findings.

	Systemic Biopsy (n =124)	**Targeted Biopsy (n = 100)**	**Combined Biopsy (n = 124)**
Biopsy core analysis details for TRUSGB and Targeted Biopsy			
PIRAD 1,2	4 (3.22%)	0(0%)	4 (3.22%)
PIRAD 3	12(9.67)	10(10%)	22 (17.74%)
PIRAD 4	20(16.12%)	17(17%)	37(29.83%)
PIRAD 5	24(19.35)	24(24%)	24(19.35%)
TPUS-GB results related to targeted biopsy findings.			
PCA	60 (48.4)	51 (51)	70 (56.5)
cs PCA	49(39.5)	41 (41)	55 (44.4)
cis PCA	11 (8.9)	10 (10)	15 (12.1)
No PCA	64(51.6)	49 (49)	54(43.5)

PCA: prostate cancer, cs PCA: clinically significant prostate cancer, cis PCA: clinically insignificant prostate cancer, *: statistically significant as P value <0.05.

Table (3) presented the performance characteristics comparing MRI-targeted biopsy (TB) with transrectal ultrasound-guided biopsy (TRUS-GB) and their combined approach among patients suspected of having prostate cancer. The data showed cases' detection rates (sensitivity) and negative predictive values (NPV) for different PIRADS scores (3, 4, and 5) when using TB, TRUS-GB, and their combination. Notably, as the PIRADS score increases from 3 to 5, there was a marked improvement in the detection rates across all biopsy methods. For instance, in PIRADS 3 cases, TB and TRUS-GB showed detection rates of 25.64% and 30.76% respectively, while the combined approach increased the detection rate to 41.02%. In contrast, for PIRADS 5 cases, all methods exhibited a 100% detection rate, with TB, TRUS, and their combination showing promising results. Moreover, the negative predictive values also demonstrated a favorable trend, indicating the reliability of these methods in ruling out prostate cancer in the cases studied**.** Regarding the complications of biopsy in total, 7 (5.6%) of patients had complications: 4 (3.2%) had a complicated urinary tract infection (UTI/urosepsis) and 3 (2.41%) had other complications comprising lower urinary tract symptoms 2 (1.6%), bleeding 1 (0.80%) and vasovagal episode (Table 3).

Table (3): Performance characteristics between MRI-TB in relation to TRUS among patients suspected of having prostate cancer.

PIRADS score and PCA by biopsymethod	**Number**	**Detection rate (sensitivity)**	**NPV**
PIRADS 3 (n=39)			
TB	10	25.64%	62.8%
TRUS-GB	12	30.76%	70.57%
Combined	16	41.02%	72.44%
PIRADS 4 (n=37)			
TB	17	45.94	71.10
TRUS-GB	20	54.05	79.01
COMBINED	26	70.12	83.07
PIRADS 5(n=24)			
TB	24	100	
TRUS	24	100	---
COMBINED	24	100	

MRI: magnetic resonance imaging, TRUS: transrectal ultrasound, PPV: positive predictive value, NPV: negative predictive value.

DISCUSSION

Prostate cancer (PCA) is the most common type of cancer among males [1]. In recent years, there have been certain modifications to the approach taken when treating prostate biopsies in males when clinical suspicion of prostate cancer exists. Because PSA is now widely used as a screening test, more cases of prostate cancer have been diagnosed over the previous ten years, raising the danger of overtreatment [9]. In order to get over the practical restrictions of PSA screening, research over the last few years has concentrated on creating more precise imaging techniques [10].

PSA has many drawbacks, most notably its low specificity of 36%, which means that elevated PSA may not always indicate prostate cancer. However, many other conditions, such as an enlarged or inflamed prostate, elevation induced by DRE could falsely increase PSA levels. Therefore, it does not necessarily mean that a malignant tumour exists. Although TRUS-guided biopsy is thought to be the gold standard for diagnosing prostate cancer, it underestimates the disease's grade and breadth [11]. Because of its high sensitivity and specificity, mpMRI has become more and more popular as a PCa diagnostic tool in recent years [12].

There have been significant efforts to identify PCA in order to administer appropriate treatment. According to earlier research, mpMRI in conjunction with MRI-TB is a potentially useful technique for identifying prostate cancer. Despite these encouraging findings, mpMRI is only advised by European Association of Urology guidelines for patients with probable prostate cancer (grade B) who have previously had a negative prostate biopsy [13].

The PI-RADS grading system gave mpMRI a standardised reporting method, increasing its ability to detect PCa. Numerous studies have evaluated the effectiveness of the PIRADs V2 scoring system in assessing prostate cancer. **Patel *et al.*** [14] revealed that the sensitivity of 81.25% was achieved by incorporating lesions with PI-RADS ≥ 3, and this was corroborated by **Youn *et al.*** [15] who used a PI-RADS score of ≥ 3 and showed improved sensitivity but lower specificity.

Our research encompassed a total of 124 patients. Of the patients under investigation, 39 (31.5 %) exhibited positive mpMRI signals for PI-RADS 3, 37 (29.8 %) for PI-RADS 4, and 24 (19.4 %) for PI-RADS 5. PI-RADS 1 was present in 10 (8.1%) while PI-RADS 2 was present in 14 (11.3%) patients. When systematic biopsy was included, the number of PCa cases rose to 55/124 (44.4 %) from the 41/100 (41 %) cases that were diagnosed with targeted biopsy alone. Consequently, 3.4% (14/124) of the males with worrisome lesions on mpMRI would have gone unnoticed if a targeted biopsy had been performed alone. When systematic biopsy was taken into consideration, the number of PCa cases rose to 55/124 (44.4 %) from the 49/124 (40 %) cases that were found with systematic biopsy alone. Therefore, 4.4 % (6/124) of the males with worrisome lesions on mpMRI would have gone unnoticed if a targeted biopsy had been used alone.

The most crucial diagnostic criteria of PCa is the biopsy result, which is currently regarded as the gold standard for PCa diagnosis. Thus, an increasing number of researchers are concentrating on the sensitivity and specificity of prostate biopsies. MRI-TB and TRUS-GB coexist in clinics at the moment, however there is still debate regarding which of the two puncture techniques is preferable. A study proposed a link between the pathological grade of PCa and the choice of puncture technique [16].

Prioritizing an MRI over a prostate biopsy provides benefits, including the ability to pinpoint the lesion's site and its high sensitivity in diagnosing PCa. However, it may necessitate greater financial responsibilities for PCa-suspected patients as a new monitoring tool. In the meantime, the results of an MRI may impact the selection of the method for prostate biopsy and assist medical professionals in identifying patients whose PSA is ≥ 4 ng/mL, helping them choose the most suitable biopsy [17].

Bae *et al.* [18] shows that by advancing our knowledge of how to successfully integrate MRI-GB into standard clinical practice, MRI-TB has the potential to enhance both clinical outcomes and the identification of prostate cancer. The CDRs for the two groups (TTRUS-GB and MRI-TB with a suspicious target lesion) were 23.8 % and 47.9 %, respectively, and the rates of PCa detection were comparable (22.0 % in the TRUS-GB group and 45.1 % in the MRI-TB group). A high rate of PCa was seen in MRI-TB group with a concerning target lesion. They felt that there are significant benefits to overall CDR from mpMRI followed by MRI-TB.

EAU recommends that in prostates with a volume of around 30 cc, it is advised to do at least eight systematic (core) biopsies [19]. In bigger prostates, ten to twelve core biopsies are advised. However, more than twelve cores do not provide significantly more conclusive result. A previous study reveals significant statistical data about relation between PIRADs score and cancer detection rate and reveal best way to decrease misdiagnosed patients and decrease unnecessary biopsies [8]. The same patient is used in the screened literature for both TRUS-BT and MRI-TB procedures, with targeted biopsy being carried out initially. Even if they are blinding, needle tracks following a biopsy may increase the likelihood that TRUS-GB will pierce sample tissues in the same location as MRI-TB if MRI-TB is done first. Conversely, other studies hypothesized that the presence of suspicious lesions on MRI could improve TRUS-GB findings [16].

To our knowledge, there is no research work assess PIRADS1 patients separately. This result agreed

with **Stabile *et al.*** [20] who stated that 8% of PIRADS 2 lesions were prostate cancer. An additional investigation by **AbdulRaheem *et al.*** [21] examined whether PI-RADS 1,2 lesions detected on prebiopsy mpMRI could safely postpone a prostate biopsy. The results showed that avoiding TRUS-Biopsy after a normal or ambiguous mpMRI should be carefully considered, as 18.5 % of the group's mpMRI showed evidence of cancer, and 9.8 % of those who received a diagnosis had clinically significant cancer. These worries may be raised, and a "targeted only" approach may be supported by the high diagnosis rate of low-grade disease utilizing TRUS-GB.

Overall, our findings suggest that if an mp-MRI "targeted-only" strategy is used, the diagnostic yield of intermediate/high-grade vs. low-grade malignancies can be enhanced utilizing fewer biopsy cores.

In the current study, a targeted biopsy alone detected 41 out of 100 (41%) cases diagnosed with PCa. When systematic biopsy was taken into account, the number of PCa cases increased to 55 out of 124 (44.4%). Consequently, relying solely on targeted biopsy would have missed 11.3% (14 out of 124) of men with suspicious lesions identified through mpMRI. On the other hand, a systematic biopsy alone detected 49 out of 124 (39.5%) cases diagnosed with PCa. When considering systematic biopsy alongside targeted biopsy, the number of PCa cases remained at 55 out of 124 (44.4%). Thus, depending solely on systematic biopsy would have missed 4% (6 out of 124) of men with suspicious lesions on mpMRI.

The prospective research by **Filson *et al.*** [22] revealed findings that are in conflict with our own, concluding that the combination technique (mpMRI-TB plus TRUS-GB) produced the greatest rate of substantial cancer identification and just one extra low-risk PCA case per intermediate/high-risk PCA case. In contrast to our study, however, this one included a mixed group of patients who had undergone previous negative, positive, and biopsy-naive biopsies. Notably, when accounting for only individuals with previous negative biopsies, the number of serious tumors missed following an mp-MRI "targeted-only" strategy was dramatically reduced.

In the present study, the performance characteristics comparing MRI-targeted biopsy (TB) with TRUS-GB and their combined approach among patients suspected of having prostate cancer revealed that the detection rates (sensitivity) and NPV for different PIRADS scores (3, 4, and 5) when using TB, TRUS-GB, and their combination. Notably, as the PIRADS score increases from 3 to 5, there is a marked improvement in the detection rates across all biopsy methods. For instance, in PIRADS 3 cases, TB and TRUS-GB showed detection rates of 25.64% and 30.76% respectively, while the combined approach increases the detection rate to 41.02%. In contrast, for PIRADS 5 cases, all methods exhibited a 100% detection rate, with TB, TRUS, and their combination showing promising results. Moreover, the NPVs also demonstrated a favorable trend, indicating the reliability of these methods in ruling out prostate cancer in the cases studied. Further data supporting this decision-making are the PSA density and DRE values. But these findings conflicted with the **Junker *et al.*** [23] who demonstrated that, upon biopsy, 97% of lesions with a PI-RADS score less than three were benign. Therefore, 28% of individuals with a negative mpMRI have a tumour, which raises the question of whether all men with elevated PSA levels or a suspicious DRE but a negative mpMRI can safely undergo surveillance without having a tumour or biopsy performed. Many studies concerned with this debate and revealed that in general, prostate cancer is strongly predicted by an abnormal DRE [24]. The study of **Schröder *et al.*** [25] revealed that between 40% and 50% of all palpable abnormalities discovered with DRE were ultimately determined to be malignant. Men with an abnormal DRE should therefore definitely get a biopsy, even if imaging is unable to reveal a target.

However, **Kaufmann *et al.*** [24] revealed that men who had a negative mpMRI and had a low PSA density of less than 0.1 ng/ml^2 (9% of all men) almost all had a negative biopsy (92%), therefore they may safely avoid a prostate biopsy. Patients with PIRADs 3 and 4 show increased detection rate by 10 % and 16 % if TRUS biopsy combined with targeted biopsy as 30% and 54 to 41% and 70%. The study by **Ahdoot *et al.*** [26] showed that in males with an MRI lesion, a combined biopsy technique (12-core systematic biopsy plus targeted biopsy) increased the detection rate of prostate cancer, and in the randomised study by **Ahmed *et al.*** [27] MRI fusion targeted biopsy increased the ability to identify clinically significant PCA in males reporting a high PSA or suspected DRE, in contrast to the traditional TRUS biopsy method. **Filson *et al.*** [22] exhibited cancer detection rate by targeted biopsy of 27.8% (229/825) and an increase by 7.3% (60/825) with an additional 12 core systematic biopsy. **Oderda *et al.*** [28] exhibited an enhancement by 9% with 10–14 core systematic biopsy, while **Rouvière *et al.*** [29] could not demonstrate a discernible difference between targeted and systematic biopsies (29.9% vs. 32.3%, respectively).

The same biopsy cores were used for all of the aforementioned investigations, which were biopsied using the conventional transrectal procedure. **Klotz *et al.*** [30] study showed that when MRI and targeted biopsies are combined with systematic biopsies, the upgrading rate is not substantially higher than with systematic biopsies alone. **Haffner *et al.*** [31] and **Moore *et al.*** [32] showed that the cost of combining MRI-targeted and systematic biopsies is as follows: over-identification of cis PCA. **Zhu *et al.*** [16] in their meta-analysis findings suggest that TRUS-GB outperformed MRI-TB in diagnosing PCA according to PI-RADS 3. Additionally, TRUS-GB outperformed MRI-TB in detecting non-cs PCA according to PI-

RADS 4 or 5. All patients with PIRADs 5 showed positive biopsy for cancer prostate by both TRUS guided biopsy and targeted biopsy so, targeted biopsy is enough in such patients decreasing unnecessary biopsy. This agrees with the study of **Baco *et al.*** [33] who demonstrated that targeted biopsy possesses a similar rate of detection to 12-coreRB for cs PCA. Especially if associated with high total PSA, high PSA density, suspicious DRE, and old age patients.

Lastly, the targeted biopsy detection rate among males with lesions that show up on mpMRI may vary depending on a variety of variables, including the radiologist's experience, the biopsy systems and/or fusion techniques, or the quantity of cores obtained [34]. In a previous investigation, the mpMRI's PIRADS score was linked to the presence of cs PCA on a biopsy [35].

The advantage of this research was the statistical analysis of each PIRADs as a separate group including PIRADs 1, so more data can be used to assess the ability of mpMRI to be a triage tool, decreasing unnecessary biopsies.

The limitations include differences when defining lesions following fusion with the TRUS by various urologists with diverse levels of professional experience, as well as inter-observer variation in mpMRI assessment by different radiologists as well as another drawback of our research was the limited population, hence extensive multicentric investigations are advised to confirm our findings and finally, the inability to compare the TRUS biopsy outcomes to the final histology results of the radical prostatectomy material.

CONCLUSIONS

Combined TRUS-guided and Targeted biopsies improved incidence of cancer detection in patients with PIRADs 2, 3, 4.

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