



Positive pre-biopsy MRI: are systematic biopsies still useful in addition to targeted biopsies?

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Abstract

Purpose The diagnostic strategy implementing multiparametric magnet resonance tomography (mpMRI) and targeted biopsies (TB) improves the detection and characterization of significant prostate cancer (PCa). We aimed to assess the clinical usefulness of systematic biopsies (SB) in the setting of patients having a pre-biopsy positive MRI.

Methods A review of the literature was performed in March 2018. All studies investigating the performance of SB in addition to TB (all techniques) were assessed, both in the biopsy-naïve and repeat biopsy setting.

Results Evidence demonstrates that TB improves the detection of index-significant PCa compared with SB alone, in both initial and repeat biopsy settings. However, the combination of both TB and SB improved the overall (around 30%) and significant (around 10%) PCa detection rates as compared with TB alone. Significant differences between both biopsy approaches exist regarding cancer location favoring SB for the far lateral sampling, and TB for the anterior zone. Main current pitfalls of pure TB strategy are the learning curve and experience required for mpMRI reading and biopsy targeting, as well as the precision assessment in TB techniques.

Conclusion A pure TB strategy omitting SB leads to the risk of missing up to 15% of significant cancer, due to limitations of mpMRI performance/reading and of precision during lesion targeting. SB remain necessary, in addition to the TB, to obtain the most accurate assessment of the entire prostate gland in this sub-group of patients at risk of significant disease.

Keywords Prostate cancer · Detection · Biopsy · Fusion · Targeted · Magnetic resonance imaging

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Introduction

Evidence suggests that multiparametric magnetic resonance imaging (mpMRI) combined with targeted biopsies (TB) performs particularly well for the detection of high-grade prostate cancer (PCa) [1, 2]. The scheme including pre-biopsy MRI and TB aimed at reducing by one-third the number of men biopsied overall, at increasing the detection of clinically significant PCa, and at not detecting 10% of clinically insignificant PCa and thus reducing overdiagnosis often associated with overtreatment [3–5]. Proponents of pure TB schemes highlight that the majority of tumors not seen on MRI are low-grade organ-confined lesions, and therefore, systematic sampling of prostate gland not involved by mpMRI-suspicious lesions may be omitted when performing biopsy. Abandonment of systematic biopsies would be possible if mpMRI would be able to visualize all significant lesions of PCa and that these lesions could be perfectly targeted by mpMRI-directed cores. If not, avoiding SB leads to the risks of missing significant PCa and misclassification of disease.

Herein, we aimed to assess the clinical usefulness of additional systematic biopsy SB in the setting of biopsy-naïve patients having a pre-biopsy-positive MRI and undergoing TB.

Materials and methods

We performed a review of the literature in March 2018 (starting in 2000) using the PubMed, Web of Sciences and Embase Databases, peer-reviewed articles. The search results were restricted to English language, following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement using the following keywords: MRI, fusion, biopsy, targeted biopsies, systematic biopsies, and random biopsies. All papers were assessed based on full text and excluded with reasons when appropriate. Additional references were identified from the reference list of each article. Two reviewers (GP, RvdB) carried out this process independently and assessed clinical relevance of the studies and included this review. Disagreement was solved by a final consensus on the articles included in the analysis. The primary outcome was the detection rate of clinically significant PCa by TB and SB, both in the biopsy-naïve and repeat biopsy setting. We selected retrospective and prospective (randomized or not) studies with comparative analysis of PCa detection rate. Single-arm studies with patients serving as their own control and comparative two-arm studies were included. The definition of significant PCa was variable among studies.

Secondary outcomes were the overall PCa detection rate, diagnostic performance and complications. A total of 739 articles were identified (Fig. 1). After abstracts and title reading, 184 papers were selected for full-text assessment of eligibility. After exclusion of duplicates, case reports, editorials and papers with topics that were not specific for this review, 23 clinical studies were included for the assessment of studied outcomes.

Results

Negative predictive value of MRI for PCa detection

Evidence suggests that mpMRI negative predictive values ranges from 63 to 91% for PCa detection on a per-patient basis [1–5]. It has been reported that from one to two-thirds of the missed tumors on mpMRI are low-grade disease [1]. A recent systematic review assessing 48 high-quality studies demonstrated a negative median predictive value of 82% for overall PCa detection and of 88% for clinically significant PCa detection [6]. However, it is worthy to note that this performance highly depended on MRI definitions, study design, and cancer prevalence in the evaluated cohorts.

The PCa detection rate on mpMRI also depends on both tumor grade and size. Thus, the main clinical issue remains the detection of small foci of high-grade disease that needs to be treated and may be missed by imaging. Moreover, the majority of studies assessing the negative predictive value of mpMRI only included biopsy (extended or saturation schemes) as control tool. The recent PROMIS trial assessed MRI as triage test before biopsies, the authors chose a transperineal template prostate mapping biopsy as reference test [7]. The negative predictive value of MRI was significantly

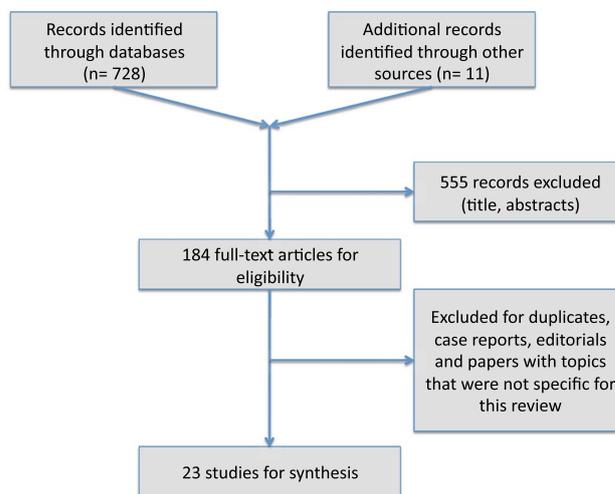


Fig. 1 PRISMA flow diagram

superior to that reported by SB, and varied according to the definition of high-grade PCa used. It ranged from 89% when only PCa with Gleason score 4 + 3 or higher or cancer length > 6 mm were included, to 76% when taking into account any Gleason score 3 + 4 or higher PCa. In case of negative MRI (27.4% of cases), only 10.7% patients harbored a significant PCa on template biopsies. Conversely, 50.9% of patients with positive MRI (PIRADS score 3–5) had a significant PCa on biopsies.

Since the negative predictive value of mpMRI is not always 100%, inevitably also high-grade significant PCa are missed by mpMRI, and could be sampled using the standard extended scheme in addition to targeted biopsies. Up to 20% of men with no suspicious lesions or negative MRI-targeted biopsies harbor clinically significant PCa detected on random cores when analyses were done on a per-lesion basis [8–13]. When considering whole-mount section of radical prostatectomy specimens as control, about 30% of both high-grade tumors and lesion > 1 cm in diameter were missed by mpMRI on a per-lesion basis [10].

In routine practice, the distinction between significant and insignificant PCa is clinically relevant. PCa screening is associated with detection of more localized stages and might reduce mortality but it is also associated with potential overtreatment due to a detection increase of insignificant PCa which would not become symptomatic during the patient's lifetime if left untreated. An accurate imaging test that is incorporated prior biopsy decision-making may have potential benefits by adding information to the established clinical parameters for early detection of clinically significant PC and reduce overdetection of indolent disease.

Globally, mpMRI demonstrates a high negative predictive value for detecting clinically significant PCa on a per-patient

basis, and the presence of significant PCa is directly related to MRI findings. The imaging performance remains influenced by the radiologist experience, the tumor volume and its grade [14]. Thus, in spite of this accuracy, a non-negligible proportion of significant PCa (10–20%) may be missed, particularly in case of low-volume foci.

Risk of missing PCa (significant or of any grade) using TB alone

Biopsy as reference test

Several retrospective and prospective studies have compared the performance of TB and SB in the positive MRI setting. The following chapter has been divided between prospective series in which patients served as their own control and randomized studies [12, 15–23].

Single-arm series (Table 1) One of the most important articles published in the previous years is the prospective trial led by Siddiqui et al. [15]: more than one thousand of men ($n = 1003$) at risk of PCa and with positive pre-biopsy MRI have been included and underwent both transrectal TB and SB. The primary objective was to compare both biopsy procedures for detecting high-grade (Gleason score 4 + 3 or higher) PCa. The overall PCa detection rate was similar between both biopsy schemes ($n = 461$ and 469). However, TB significantly increased the detection rate of high-grade PC compared with SB (173 vs 122 cases, $p < 0.001$). The addition of SB to TB detected 22% of additional cases that were low-risk PCa in 83% of cases. Using only a TB approach would miss 103 PCa (intermediate risk: 11%; high risk: 5%), whereas using only a SB approach would

Table 1 Main prospective single-arm studies comparing TB and SB in which patients served as their own control [2, 3, 12, 15, 21]

	<i>N</i> (biopsy naïve)	CS PCa definition	Biopsy	MRI lesion > 3/5	Detection rate (%)	<i>p</i>
Filson [12]	1042 (328)	>3 + 3	TB	All	27.8	<0.05
			SB		24.1	
			TB + SB		35.0	
Siddiqui [15]	1003 (196)	High volume 3 + 4 and > 3 + 4 4 + 3 or more	TB	All	24.9	<0.05
			SB		21.0	
			TB		17.2	
Delongchamps [21]	108 (108)	>3 + 3 or > 5 mm	SB		12.2	0.69
			TB	All	46.2	
Pokorny [3]	223 (223)	High volume 3 + 4 and > 3 + 4	SB		48.1	<0.05
			TB	64%	41.7	
Rastinehad [2]	105	>3 + 3 or > 50%/core or > 2 positive cores	SB		35.4	<0.05
			TB	All	92	
			SB		67	

CS PCa clinically significant PCa, SB systematic biopsies, TB targeted biopsies

miss 95 cases including 27% of high-risk cancers. Interestingly, the confirmation of the superiority of TB for detecting high grade has been obtained by assessing the whole-gland pathology in a subset of 170 men undergoing radical prostatectomy. The sensitivity of TB to predict final pathology was superior to SB (77 vs 53%, respectively).

Nevertheless, in the Siddiqui study, more than 40% of men had previously undergone a set of SB, meaning that in more than 40% of cases, at least one set of SB already failed to detect any PCa. This selection bias may explain, at least for a part, the difference of detection rate between both biopsy techniques. When considering the difference in terms of number of men needed to biopsy one high-grade PC, difference was not frank between TB and SB in the first-line biopsy setting. Another interesting analysis is the stratification by the MRI suspicion score [16]. Thereby, these post hoc analyses emphasized the importance of SB in the selected settings of first biopsies and of low-suspicion score MRI lesion.

Filson et al. also published another large prospective trial comparing TB and 12-core SB among 1042 patients [12]. Overall, 825 patients had a positive pre-biopsy MRI (suspicion score 3–5). Among patients with non-suspicious MRI, 16% were found to have clinically significant PCa on SB. The TB approach detected more Gleason score 7–10 PCa cases compared with the SB approach ($p < 0.001$). Nevertheless, the addition of SB to TB increased the detection of Gleason score > 6 PCa by 26%, and the detection of Gleason score 8–10 PCa by 20%. Omitting SB would have missed 60 cases of Gleason score 7–10 cases.

The MURIELLE study is a prospective, multicentre, controlled trial assessing the noninferiority of 3 TB cores using an elastic fusion system, as compared with SB [21]. All patients underwent both SB and TB and served as their own control. Interestingly, two separated operators performed TB and SB with the operator performing SB blinded to the results of the MRI. SB and TB detected cancer in 61 and 56% of cases, respectively. This difference was statistically significant (95% CI -4.5% to -11.8%) suggesting the inferiority of TB for overall PCa detection. The detection rates of clinically significant PCa did not differ between TB and SB (48 and 46%, $p = 0.69$) suggesting that in real-life practice, TB might not improve the detection of significant PCa compared with SB in the first-line biopsy setting. Other groups suggested that using only TB missed 15% of Gleason 3 + 4 or higher PCa reinforcing the role of concomitant SB to achieve a maximally accurate biopsy [22].

In a study of 223 consecutive biopsy-naïve patients, Schouten et al. evaluated the difference of cancer locations between PCa detected by TB or SB [23]. The aim of this article was to understand why and where significant PCa are missed by the combination of MRI and TB. All included patients underwent both transrectal SB and TB in case of

positive MRI ($n = 142$). The findings of this study showed that, in patients with positive TB, SB also detected PCa in 83% of cases and these foci were significant in 68% of cases. Moreover, even in case of negative TB, SB were positive in one-third of cases, and if so, positive for significant cancer in half of the cases. Another relevant result was that if the TB classified the detected PC as low risk, SB upgraded it as clinically significant in 50% of cases. The authors perfectly showed that the cancer location did matter regarding the diagnostic performance of TB and SB. When looking at the different locations of missed cancers according to the biopsy technique, Shouten et al. demonstrated that TB and SB were complementary. Failures of MRI targeting were mainly located in the far lateral peripheral, at the base and the mid zone, and in the peripheral zone of the whole apex (dorsolateral part: 58% of missed lesions; apex: 37%). Conversely, the majority of cancers missed by SB were located in the anterior zone (missed lesions: 79%) where no lesion was missed by targeted cores. Thus, this study showed the significant differences between both biopsy approaches regarding cancer location and highlighted the need for a combination of TB and SB to offer the best sampling of the gland [23].

Comparative trials Several randomized prospective trials have assessed the performance of TB and SB in patients undergoing a first set of biopsies [17, 18]. Main studies are showed in Table 2. Tontilla et al. included 120 patients without prior biopsy, having a PSA < 20 ng/ml who were randomized between SB only and TB with SB after pre-biopsy MRI. When considering the definition of significant PCa as any cancer $>$ Gleason score 6 or with more than 2 positive cores or a maximal cancer core length of 3 mm, they did not find any difference between both biopsy approaches. Same conclusion was achieved in the 175-patient series from Baco et al. comparing TB and SB. Park et al. [24] have reported conflicting finding and a significant improvement of detection rate by adding TB. More recently, Porpiglia et al. also suggested the benefit from adding TB to SB in biopsy-naïve patients [19]. Patients were randomized into a pre-biopsy MRI group ($n = 107$) or SB approach without prostate imaging ($n = 105$). Cancer detection rate findings showed that a diagnostic pathway integrating MRI and TB significantly improved the detection of both PCa and clinically significant PCa as compared with SB alone.

In 2015, Arsov et al. randomly compared in-bore TB and the combination of TB and SB in a prospective series of 210 patients [20]. The overall PCa as well as the detection rates for significant PCa (29 vs 32%; $p = 0.7$) and the highest tumor burden per core were comparable between the arms. Thus, this trial failed to identify meaningful diagnostic yield for the combined SB and TB approach over in-bore TB alone.

Table 2 Main clinical 2-arm studies comparing TB and SB in biopsy-naïve and repeat biopsy setting [17–20, 24, 25, 35, 36]

	Prior biopsy	Arm 1	Arm 2	<i>n</i>	Primary endpoint	Detection rate <i>P</i> value
Park [24]	No	TB + SB	SB	86	Any PCa	29 vs 10% 0.03
Panebianco [35]	No	TB + SB	SB	1140	CS PCa	N/A
Arsov [20]	Yes	In-bore MRI-TB	TB + SB	210	Any PCa	37 vs 39% NS
Tonttila [17]	No	TB + SB	SB	130	Any PCa	64 vs 57% NS
Taverna [36]	Yes	TB + SB	SB	200	Any PCa	26 vs 24% NS
Porpiglia [19]	No	TB + SB	SB	212	CS PCa	44 vs 19% <0.001
					Any PCa	50 vs 29% 0.002
Kasivisvanathan [25]	No	TB	SB	500	CS PCa	26 vs 38% 0.005
Baco [18]	No	TB + SB	SB ^a	175	Any PCa	59 vs 54% NS

^a+TB based on US/DRE

CS PCa clinically significant PCa, N/R not reported, NS not significant, SB systematic biopsies, TB targeted biopsies

The PRECISION trial recently provided the highest level of evidence by comparing a blinded SB strategy and a pure imaging-guided TB strategy in patients undergoing first biopsies [25]. In this multicenter, randomized, noninferiority trial, 500 patients with a clinical suspicion of PCa were assigned to two separate biopsy strategy. In the first arm, SB were performed without pre-biopsy mpMRI. In the second arm, patients underwent mpMRI and TB only if MRI was suggestive for PCa (72% of men from this arm with a PI-RADS 3–5). The primary endpoint was the detection of clinically significant PCa as defined by at least one core with grade 4 (Gleason score 3 + 4 or greater). Overall, 38% of clinically significant PCa were detected in the MRI group as compared with 26% in the SB group ($p = 0.005$) showing that the imaging-guided strategy (without SB) as noninferior to the SB strategy. When considering Gleason score 6 PCa, 22% were detected in the SB group compared with only 9% in the MRI group ($p < 0.001$).

Whole gland pathology as reference test

The ideal reference test for assessing the true diagnostic performance of prostate biopsies remains the final pathology in radical prostatectomy specimens, however, this assessment is only applicable for men who test positive for cancer. This also offers a per-lesion analysis by evaluating all the lesions present in the gland, not only the index lesion. The risk of missing of significant PCa has often been evaluated on a patient basis by only evaluating the detection rate of the visible index lesion. This could be considered as sufficient

if the visible index lesion always drives the prognosis of the disease, and if the presence of secondary cancer foci does not influence the future PCa management. However, this statement remains debatable.

Thus, the performance of MRI and of MRI-TB should also be assessed on a per-lesion basis. In other terms, how many tumors, and significant tumors, in one prostate gland, will not be detected by TB alone?

This has been well assessed by the study of Le and colleagues by analyzing preoperative MRI before radical prostatectomy in a cohort of 122 patients [10]. Cancer detection rate was evaluated on a per-lesion basis, and overall, 283 cancer foci were identified. The authors found that, in case of solitary lesion, MRI performed extremely well, with less than 10% Gleason score 7 cancers missed. However, in case of multifocal lesions (representing 64% of cases), imaging failed to identify 60% of cancer foci including at least 30% of high-grade lesions (Gleason score 7–10). Large cancer foci measuring more than 1 cm were also missed in a not negligible proportion of cases. The MRI sensitivity for cancer detection was 47%, with increased accuracy for larger tumors (72% when > 1 cm), high-grade lesions (72% when Gleason score > 6), and index tumors (80%). Globally, the detection of nonindex lesions, even significant, by imaging was poor.

Another retrospective study has confirmed these findings: Radtke et al. have compared the performances of MRI, TB and SB for the detection of the index lesion and of the secondary significant lesions [8]. The authors have analyzed a cohort of 120 patients who underwent transperineal biopsy

and had subsequent radical prostatectomy [8]. All patients received saturation biopsies in addition to TB. Combined TB and SB detected 97% of all significant PCa lesions as compared with 85% for MRI, 79% for TB alone, and 88% for SB alone ($p < 0.001$). Thus, the biopsy scheme integrating TB plus SB performed better than TB alone for the detection of index lesions and of all significant lesions. This improvement regarding the detection rate was greater when assessing the detection of clinically significant PCa (97 vs 79%, $p < 0.001$). Moreover, whereas significant lesions were detected on MRI in 92% cases, almost 15% of these lesions were finally not detected by TB alone. Thus, the addition of the risks of MRI misreading and of targeting error during TB, resulted in the lack of significant PCa detection by TB alone in 20% of cases.

Prognostic role of SB in case of positive TB

The detection of PCa and the assessment of its aggressiveness by an accurate Gleason score remain the cornerstone for treatment decision-making. Evidence suggests that MRI followed by TB help to improve both detection and grading, and thereby, the PCa management [5]. However, secondary pathological features such as cancer involvement per core, positive biopsy core number, or multifocality have demonstrated to be relevant prognostic tools that influenced treatment decisions. By analyzing only TB, the physician might omit several meaningful factors that could be relevant for patient counseling and accurate staging. Multifocality and the intratumoral heterogeneity of PCa are two important features that could be underestimated by only index lesion targeting biopsies. Multifocality is one of the main characteristics of PCa and, as presented previously, the secondary lesions are often missed by imaging [8, 10]. Recent basic research articles have highlighted the intratumoral heterogeneity of PCa and have suggested that the disease aggressiveness could not always be driven by the index lesion [26]. Detecting not visible lesion by SB could thereby modify our prognostic assessment of the disease and correct the treatment strategy that would have been chosen only based on the TB findings.

Current calculators and nomograms evaluating the risk classification and the prognosis of PCa at diagnosis are based on these secondary pathologic features, provided by SB. Although widely used in daily practice, the integration of biopsy findings from TB into these risk models remains yet elusive [27, 28].

In a series of 215 men undergoing TB and SB, Kamrava et al. [27] showed that 16% of men had a higher Gleason score on TB vs SB and that the incorporation of TB into the risk assessment after biopsies led to an upgrading in risk group classification for 12–18% of patients. Nevertheless, the appropriateness of treatment changing based on

TB findings remains uncertain due to a lack of dedicated literature.

Pitfalls of MRI reading and biopsy targeting

Most high level of evidence studies assessing the impact of TB have been published by expert teams from high-volume academic centers [7, 15]. Thus, the large-scale generalization of these results may be questioned. Thus, the dissemination of their results in routine practice may be questioned. Experience, learning curve, continuous feedback and back and forth between imaging and final pathology are key factors for improving the imaging-guided strategy. A recent study assessing the learning curve of the MRI-TB approach has perfectly shown a continuous improvement in PCa detection with operator and team experience, in both MRI reading and targeting, with no clear plateau reached even after 300 procedures [29]. Thus, until the appropriate quality is assured outside of expert centres, the sequence of mpMRI followed by only TB is not ready for a widespread use in a general population. The report of MRI-targeted cores should be interpreted with caution and related to the reader and operator experience. Moreover, there is an increasing trend in the outpatient urological community to interpret and biopsy the suspect lesions without any consultation of an experienced uro-radiologist mostly associated with a significant loss of quality regarding cancer detection rates.

The technique of biopsy targeting may also matter. The simplest one is the cognitive process that integrates the real-time 2D-TRUS images into a 3D-mental representation of MRI images. Software systems based on TRUS/MRI volumes reconstruction and using rigid or elastic registration systems are also available aiming to improve biopsy precision. Literature reviews suggested that diagnostic performance of software-based TB and cognitive fusion TB seemed almost comparable with a slightly improvement favoring software-based strategies [5]. In-bore MRI-target biopsy and fusion TB appeared to have similar PCa detection rate and superior overall PCa detection compared with cognitive TB [5]. However, head-to-head comparisons between all TB techniques are still lacking. A recent systematic review did not report any significant difference between rigid and elastic registration for fusion TB, but confirmed that both techniques detected more significant PCa than SB [30].

In an ex vivo study on prostate phantoms, Westhoff et al. have compared the precision of different targeting systems (elastic vs rigid fusion, transperineal vs transrectal approach [31]). The overall detection rate was only 79.6% meaning that the target lesion was not sampled in 20% of cases. The best precision was achieved using a transperineal approach with a slight difference. The median error of precision was 2–3 mm, and overall, the elastic fusion was shown to be

the most precise technique independent of prostate volume, target size or location.

Recently, Cornud et al. published the first clinical study assessing the precision of TB techniques in real-life setting [32]. In this prospective, multicentre, comparative series, cognitive TB and software-based elastic fusion TB were compared in terms of precision and of PCa detection rate (any grade and significant PCa). Precision was measured by the distance to the center of the MRI target and by the distance from the core to the surface of the lesion. Regardless of the location of the lesion, software-based elastic TB targeted significantly better than cognitive TB. The mean distance from the core to the center was 3.6 mm in case of software-based elastic TB compared with more than 8 mm in case of cognitive TB. Interestingly, this improved precision was significantly and positively correlated with the overall PCa detection, high-grade PCa detection, and pathologic biopsy features (maximal tumor involvement per core).

In clinical practice, given the costs of the software-based systems, the vast majority of urologists are using cognitive fusion as targeting approach [33].

Biopsy morbidity and biopsy core number

The potential decrease in complications' rate by reducing the number of core sampled remains unproven. A recent systematic review of the literature concluded that to date, serious adverse events after biopsies were rare and comparable whatever the biopsy technique (MRI-targeted biopsies with or without SB) [34]. Previous series have demonstrated that adverse events after biopsies were equal between sextant, extended, and saturation schemes without clear association linking biopsy core number and complication rate increases. No clear correlations have been demonstrated between the biopsy core number and the morbidity after biopsies. In most TB studies, from 2 to 3 cores are used per lesion and two lesions, on average, are detected, meaning that approximately 5 TB are performed. Thus, finally, this scheme is close to the old sextant scheme. And no difference has been demonstrated in the literature between this scheme and more extended protocols including 12 or 18 cores. Recent data from the PRECISION trial prospectively showed that health-related quality of life and immediate postbiopsy discomfort did not differ significantly between the MRI-targeted biopsy group and the standard-biopsy group [25]. Nevertheless, the participant-reported complications at 30 days were less frequent in the MRI-targeted biopsy group than in the standard-biopsy group, in terms of events of blood in the urine and the semen, pain, rectal bleeding, and erectile dysfunction. However, these findings mainly reflected the lower percentage of patients undergoing biopsies in the MRI group (28% patients with negative MRI did not undergo biopsies) rather than a difference between the two biopsy techniques.

Conclusions

Large prospective studies and the recent randomized PRECISION trial have demonstrated that the diagnostic strategy implementing MRI and TB undoubtedly improves the detection and characterization of significant PCa in both initial and repeat biopsy settings. TB have shown the potential to overcome some limitations of SB. This literature review evaluates the risk of missing PCa at approximately 30% for the detection of PCa of any grade, and from 5 to 15% for the detection of clinically significant PCa, by omitting SB, due to limits of MRI performance/reading and of precision during lesion targeting. Thus, to date, given the lack of dedicated high level of evidence trials, SB remain necessary, in addition to the TB, to obtain the most accurate assessment of the entire prostate gland in this sub-group of patients at risk of significant disease.

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Compliance with ethical standards

Conflict of interest The authors declared that they have no conflict of interest.

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