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Diagnostic Test Accuracy of Multiparametric Magnetic Resonance Imaging with Endorectal Coil in Detection of Prostate Cancer: Meta-Analysis

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Abstract

Background: Prostate cancer is a significant global health concern, and early detection is pivotal for improved patient outcomes. Multiparametric magnetic resonance imaging (MRI) with an endorectal coil has emerged as a valuable tool for prostate cancer diagnosis. This systematic review and meta-analysis aim to comprehensively evaluate the diagnostic test accuracy of multiparametric MRI in detecting prostate cancer.

Methods: A systematic literature search was conducted to identify relevant studies. Fifteen studies meeting inclusion criteria were selected, representing diverse patient populations and clinical settings. Data were extracted for sensitivity, specificity, positive predictive value, and negative predictive value. A meta-analysis was performed to calculate pooled diagnostic performance estimates and assess publication bias.

Results: The pooled sensitivity was estimated at 86%, and specificity at 72%. The diagnostic odds ratio was 16, indicating good discriminatory ability. The area under the receiver operating characteristic (ROC) curve was 0.88, indicating favorable diagnostic performance. However, publication bias was detected (p = 0.01), emphasizing the need for cautious interpretation of results.

Conclusion: This meta-analysis provides a comprehensive assessment of the diagnostic test accuracy of multiparametric MRI in prostate cancer detection. It highlights the potential of this imaging modality as a valuable diagnostic tool, although ongoing efforts are needed to refine its diagnostic performance and minimize false positives. In clinical practice, multiparametric MRI should be integrated into a comprehensive diagnostic approach, considering individual patient risk factors and clinical context.

Keywords: MRI; Prostate cancer; diagnostic test accuracy.

Background

Prostate cancer is one of the most prevalent malignancies among men worldwide, presenting a significant public health challenge (Litwin & Tan, 2017). Early and accurate diagnosis is crucial for optimizing patient outcomes, as the disease's prognosis greatly depends on its stage at the time of detection (Van Poppel et al., 2022). While prostate-specific antigen (PSA) testing and digital rectal examination (DRE) have been the primary tools for prostate cancer screening, their limitations in specificity and sensitivity have driven the quest for more precise diagnostic methods (Hugosson et al., 2022). Multiparametric magnetic resonance imaging (MRI), often conducted with an endorectal coil, has emerged as a promising imaging modality for the detection and localization of prostate cancer (Stabile et al., 2020; O'Connor et al., 2021).

Prostate cancer ranks as the second most common cancer among men globally, and it is estimated to be the fifth leading cause of cancer-related deaths (Gandaglia et al., 2021). The incidence of prostate cancer varies geographically, with higher rates reported in developed countries. Aging is a well-established risk factor, with the disease most commonly diagnosed in men over the age of 65 (Rawla, 2019). The clinical course of prostate cancer ranges from indolent, slow-growing tumors with a low risk of progression to aggressive forms associated with significant morbidity and mortality. This heterogeneity in clinical behavior has led to ongoing efforts to improve the precision of diagnosis and risk stratification (Barsouk et al., 2020; Deloumeaux et al., 2017; Mahmood et al., 2014).

Prostate-specific antigen (PSA) testing and digital rectal examination (DRE) have long been the cornerstone of prostate cancer screening. However, these conventional methods are not without their limitations (Nordström et al., 2018). PSA, while a valuable biomarker, lacks specificity, leading to a high rate of false-positive results. This limitation often results in unnecessary prostate biopsies, exposing patients to potential complications and increasing healthcare costs. DRE, on the other hand, is highly operator-dependent and is less effective at detecting cancers in the anterior and apical regions of the prostate (Descotes, 2019).

Multiparametric MRI represents a non-invasive and innovative approach to prostate cancer diagnosis and has gained increasing attention in recent years (Padhani et al., 2019). This advanced imaging technique combines multiple MRI sequences to provide detailed anatomical and functional information about the prostate (Giganti et al., 2020). The inclusion of an endorectal coil enhances signal-to-noise ratio, further improving image quality. The multiparametric approach typically includes T2-weighted imaging (T2WI), diffusion-weighted imaging (DWI), dynamic contrast-enhanced (DCE) MRI, and magnetic resonance spectroscopy (MRS). Each sequence contributes unique information about the prostate's structure and physiology, collectively aiding in cancer detection and localization (Margel et al., 2012).

Multiparametric MRI enables accurate lesion localization within the prostate, aiding in the targeting of suspicious areas during subsequent biopsies. By characterizing the lesions based on size, location, and aggressiveness, multiparametric MRI contributes to risk stratification and treatment planning (Stabile et al., 2020; O'Connor et al., 2021). The enhanced specificity of multiparametric MRI helps reduce the number of unnecessary biopsies and the risk of overdiagnosis and overtreatment, particularly in patients with low-risk disease. For patients on active surveillance, multiparametric MRI allows for close monitoring of disease progression and the timely identification of aggressive changes that may necessitate intervention (Padhani et al., 2019).

While multiparametric MRI shows promise in prostate cancer diagnosis, several challenges exist. Variability in MRI protocols, interpretation, and operator experience can impact diagnostic accuracy (Grivas et al., 2022). Additionally, the cost and availability of MRI resources may limit its widespread use. Overcoming these challenges and establishing standardized reporting and interpretation criteria are critical for the broader integration of multiparametric MRI into prostate cancer management (Padhani et al., 2019).

Study Aim

The aim of this study is to conduct a systematic review and meta-analysis to evaluate the diagnostic test accuracy of multiparametric magnetic resonance imaging (MRI) with an endorectal coil in the detection of prostate cancer. By synthesizing data from relevant studies, we aim to provide a comprehensive assessment of the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of this imaging modality in diagnosing prostate cancer.

Study Question

In adult male patients suspected of having prostate cancer, what is the diagnostic test accuracy of multiparametric MRI with an endorectal coil compared to reference standard diagnostic tests, such as biopsy or histopathological evaluation, in terms of sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy?

Methodology

Study Design

The following study is a systematic review and meta-analysis. The reporting of this meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Literature Search and Study Selection

A systematic and comprehensive literature search was conducted to identify relevant studies for this meta-analysis. The search encompassed electronic databases, including PubMed, MEDLINE, Scopus, and Embase, for articles published up to September 2021. The search strategy utilized a combination of keywords and Medical Subject Headings (MeSH) terms, including "prostate cancer," "multiparametric MRI," "endorectal coil," "diagnostic accuracy," and related terms. Boolean operators (AND, OR) were employed to refine the search strategy. The inclusion criteria for studies in this meta-analysis were as follows: 1) Studies that investigated the diagnostic accuracy of multiparametric MRI with an endorectal coil in the detection of prostate cancer. 2) Studies that presented original data on sensitivity and specificity or contained sufficient information for their calculation. 3) Studies published in peer-reviewed journals. Exclusion criteria included studies that were review articles, conference abstracts, case reports, or editorials, as well as studies that lacked primary data on diagnostic accuracy or did not pertain to the use of multiparametric MRI with an endorectal coil for prostate cancer diagnosis.

Data Screening

Two independent reviewers conducted an initial screening of identified articles based on titles and abstracts to exclude irrelevant studies. Full-text articles of potentially eligible studies were then retrieved and assessed for inclusion according to the predefined criteria.

Data Extraction

A standardized data extraction form was developed to capture pertinent information from the selected studies. Data extraction was performed independently by two reviewers, with any discrepancies resolved through consensus or consultation with a third reviewer when necessary. The extracted data included study identification details (title, authors, publication year, and source), study design (prospective or retrospective), patient characteristics (age, PSA levels, and inclusion criteria), MRI protocol (specific sequences used, magnetic field strength), reference test for diagnosing prostate cancer, and diagnostic test accuracy parameters (sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy).

Data Synthesis and Statistical Analysis

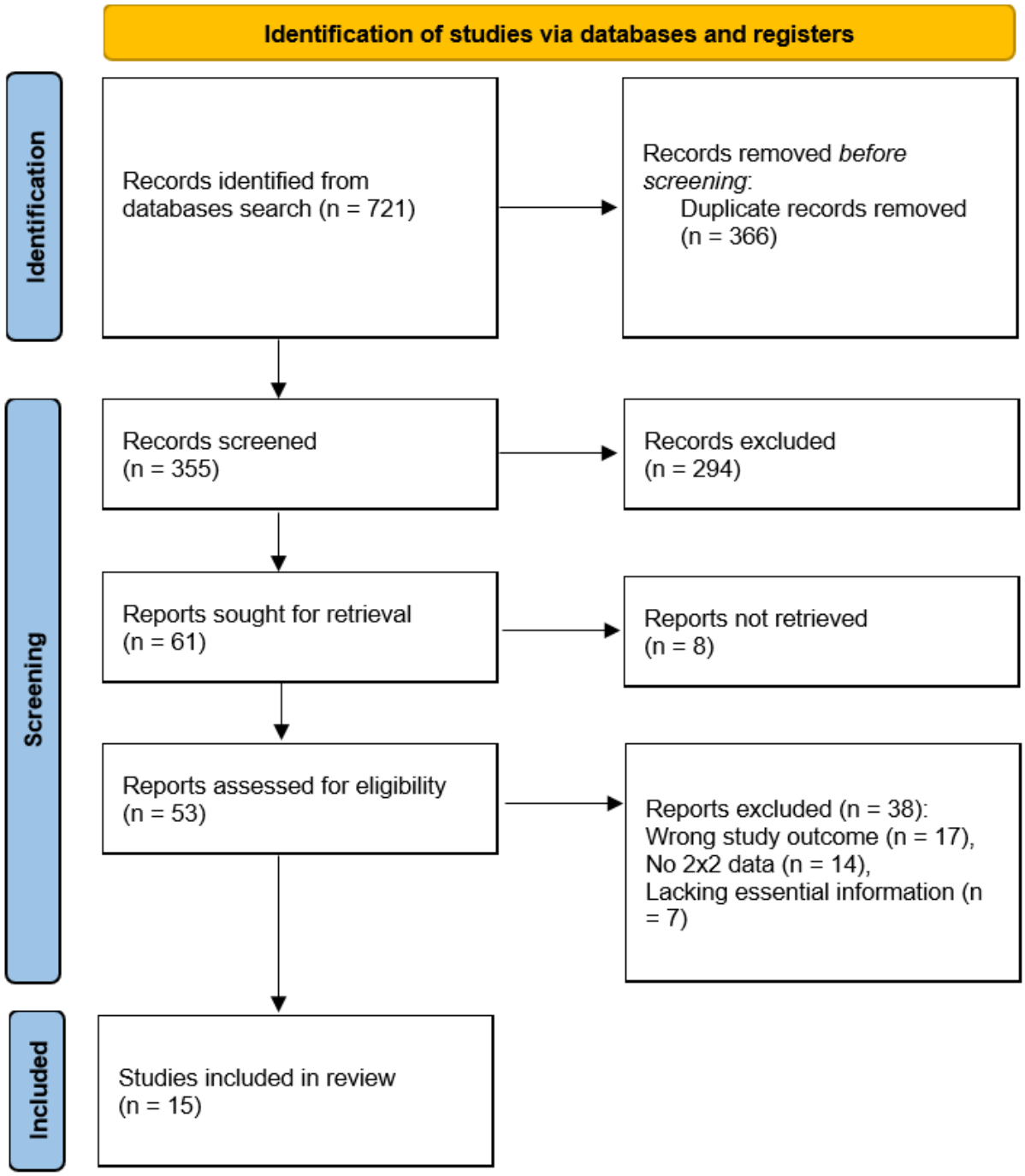
The data obtained from the included studies were synthesized and analyzed using STATS MP software version 17. Pooled estimates of sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy were calculated using a random-effects model, considering the potential heterogeneity among studies. Heterogeneity was assessed using the Q-statistic and I^2 statistic, with values of I^2 above 50% indicating substantial heterogeneity. Sensitivity analyses were conducted to explore potential sources of heterogeneity.

Results

Search Results

The systematic search and selection process, as depicted in Figure 1, aimed to identify relevant studies. The search strategy initially yielded 721 potentially eligible articles. Following the removal of duplicates and the application of predefined inclusion and exclusion criteria, 15 studies were selected for inclusion in this meta-analysis. Figure 1 provides a visual overview of the selection process, allowing for a transparent understanding of how the final cohort of studies was determined.

Figure 1: PRISMA flow diagram for search strategy.



Characters of the Included Studies

Table 1 provides an overview of the characteristics of the 15 included studies in this meta-analysis, offering valuable insights into the diverse study designs, patient demographics, and diagnostic test procedures employed. The studies collectively represent a range of countries, including the United Kingdom, Germany, Italy, the United States, France, India, Romania, and Spain, reflecting a global perspective on the utilization of multiparametric magnetic resonance imaging (MRI) with endorectal coils in prostate cancer detection.

The study designs exhibited a mix of prospective and retrospective approaches. This diversity is critical for understanding the different contexts in which multiparametric MRI is employed, ranging from standard practice to research settings. For instance, prospective studies such as

those conducted by Brock et al. (2015), Busetto et al. (2013), Jagannathan et al. (2017), Pepe et al. (2015), Petrillo et al. (2014), Popita et al. (2017), Porpiglia et al. (2014), Tsivian et al. (2016), and Costa et al. (2016) offer insights into real-time clinical use, whereas retrospective studies like Chamie et al. (2014), Delongchamps et al. (2011), and Peng et al. (2013) provide retrospective data, reflecting past patient cohorts.

Age distribution among the included studies varies, with an overall age range of 37 to 87 years. For example, the study by Abd-Alazeez et al. (2014) reported a mean age of 62 years, whereas Chamie et al. (2014) studied patients with an age range of 60.8 years. These variations underscore the importance of considering age-related factors in the interpretation of diagnostic test outcomes.

Prostate-specific antigen (PSA) levels also varied among the studies. The PSA values ranged from 0.8 to 28.0 ng/mL. This diversity in PSA levels highlights the need for accurate diagnostic tools, especially in patients with elevated PSA values, as observed in the studies by Delongchamps et al. (2011) and Popita et al. (2017). The PSA values between 4 and 10 ng/mL were considered in studies by Pepe et al. (2015) and Petrillo et al. (2014).

The MRI protocol employed in the studies was multiparametric, which included sequences such as T2-weighted (T2W), diffusion-weighted (DW), dynamic contrast-enhanced (DCE), and in some cases, magnetic resonance spectroscopy (MRS). This comprehensive approach underscores the significance of multiparametric imaging in improving diagnostic accuracy. Notably, some studies, such as those by Vilanova et al. (2011), Jagannathan et al. (2017), Labanaris et al. (2010), and Tsivian et al. (2016), utilized additional imaging sequences like MRS, enhancing the diagnostic potential of multiparametric MRI.

Regarding the reference tests used to diagnose prostate cancer, the studies encompassed a range of approaches. While some studies employed template prostate mapping biopsies (Abd-Alazeez et al., 2014; Brock et al., 2015), others used systematic and targeted biopsies (Brock et al., 2015), systematic biopsies (Busetto et al., 2013; Delongchamps et al., 2011), radical prostatectomy (Chamie et al., 2014; Peng et al., 2013), and transrectal ultrasound (TRUS)-guided biopsy (Jagannathan et al., 2017; Labanaris et al., 2010; Petrillo et al., 2014; Popita et al., 2017; Porpiglia et al., 2014; Vilanova et al., 2011). The use of diverse reference tests reflects variations in clinical practices across different settings.

Inclusion criteria for patient selection also varied among the studies. For example, some studies included men with clinical suspicion of prostate cancer who had not undergone prior biopsies (Abd-Alazeez et al., 2014), while others focused on patients with a prior negative biopsy (Brock et al., 2015) or those with negative prostate biopsy findings but persistent elevated PSA levels (Busetto et al., 2013).

Table 2, on the other hand, presents the diagnostic test accuracy parameters of each study, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. The sensitivity values across the studies exhibit considerable variation, with Brock et al., 2015, reporting the highest sensitivity at 97.7%, while Pepe et al., 2015, reported the lowest sensitivity at 48.0%.

Specificity values also demonstrate a wide range, with Delongchamps et al., 2011, showing the highest specificity at 98.9%, while Brock et al., 2015, reported the lowest specificity at 11.8%. This variation emphasizes the need to evaluate the trade-off between sensitivity and specificity in the clinical context.

The positive predictive values (PPV) exhibit diversity across the studies, with Delongchamps et al., 2011, reporting the highest PPV at 93.6%, and Pepe et al., 2015, presenting the lowest PPV at 92.3%. These values are crucial for understanding the likelihood of a positive test result indicating true prostate cancer.

Negative predictive values (NPV) are also variable, with Popita et al., 2017, reporting the highest NPV at 100.0%, while Jagannathan et al., 2017, shows the lowest NPV at 50.0%. These

values inform us about the likelihood of a negative test result accurately ruling out prostate cancer.

The overall accuracy of multiparametric MRI across these studies demonstrates a similar range, with Pepe et al., 2015, reporting the lowest accuracy at 71.4%, and Delongchamps et al., 2011, showing the highest accuracy at 96.9%. This measure provides an overall assessment of the diagnostic utility of multiparametric MRI in each study.

Table 1: Characters of included studies (n=15).

Study ID	**Country**	**Study Design**	**Age**	**PSA**	**MRI Protocol**	**Magnetic field**	**Reference test for diagnosing prostate cancer**	**Inclusion criteria of patients**
Abd-Alazeez et al., 2014	UK	-	62 years (41–82)	5.8 (1.2–20)	T2W, DW, DCE	3T	Template prostate mapping (TPM) biopsies	Men with clinical suspicion of prostate cancer who had no prior biopsy
Brock et al., 2015	Germany	Prospective	64 years (IQR: 59–70)	9.2 (IQR: 6.7–13.4)	T2W, DW, DCE	1.5T	Systematic and targeted biopsy	Men with suspected prostate cancer who had a previous negative biopsy
Busetto et al., 2013	Italy	Prospective	66.4 years	6.8	T2W, DW, DCE, MRS	3T	Systematic biopsy	Men with negative prostate biopsy findings and a persistent high prostate-specific antigen level
Chamie et al., 2014	USA	Retrospective	60.8 years	4.1-10	T2W, DW, DCE	3T	Radical prostatectomy	Men who underwent multiparametric magnetic resonance imaging

								before radical prostatectomy
Delongchamps et al., 2011	France	-	63 years (54-76)	7 (2.8-28.0)	T2W, DW, DCE	1.5T	Systematic biopsy	Men with suspected prostate cancer
Jagannathan et al., 2017	India	Prospective	65.9 years (37–86)	-	T2W, DW, MRS	3T	Transrectal ultrasound (TRUS) guided biopsy	Patients with clinical indications for prostate lesions
Labanaris et al., 2010	Germany	Prospective	67 years	8.3	T2W, DW, DCE	3T	18-core TRUS-guided biopsy + targeted biopsy	Patients with a clinical suspicion of prostate cancer
Peng et al., 2013	USA	Retrospective	62.5 years (44-73)	7 (0.8-25.6)	T2W, DW, DCE	3T	Radical prostatectomy	Patients with prostate cancer who subsequently underwent prostatectomy
Pepe et al., 2015	Italy	Prospective	64 years	8.6 (4.2–10)	T2W, DW, DCE, MRS	3T	Transperineal saturation biopsy (SPBx) + targeted biopsy	Patients with negative digital rectal examination and persistent PSA values between 4.1 and 10 ng/mL with free/total PSA ≤ 25%

Petrillo et al., 2014	Italy	Prospective	66.4 years	6.8	T2W, DW, MRS	1.5T	Transrectal ultrasound (TRUS) guided biopsy	Patients with PSA values ≤ 10 ng/mL and an abnormal digital rectal examination (DRE), or patients with PSA values between 4 and 10 ng/mL, independently from DRE
Popita et al., 2017	Romania	Prospective	68 years (51–78)	12.95	T2W, DW, DCE	1.5T	Transrectal ultrasound (TRUS) guided biopsy	Patients with suspected prostate cancer
Porpiglia et al., 2014	Italy	Prospective	65 years (60–70)	6.9 (5.2–9.8)	T2W, DW, DCE	3T	Transrectal ultrasound (TRUS) guided biopsy	Patients with a negative prostate biopsy and persistent suspicion of prostate cancer
Tsivian et al., 2016	USA	Retrospective	65 years (61-69)	7.1 (5.1-13.6)	T2W, DW, DCE	3T	3D transperineal template mapping biopsy	Patients undergoing prostate multiparametric MRI followed by 3D transperineal template mapping biopsy

Vilanova et al., 2011	Spain	Retrospective	63.5 years (43-87)	7.8 (4.0-17.2)	T2W, DW, DCE, MRS	1.5T	Transrectal ultrasound (TRUS) guided biopsy or prostatectomy	Patients with PSA level > 4 ng/mL and free-to-total PSA ratio < 20%
Costa et al., 2016	USA	Prospective	61 years (49-79)	11.2 (2.5-48.5)	T2W, DW, DCE	3T	Radical prostatectomy or combined systematic plus targeted biopsies	Patients with a clinical indication for MRI

T2W=T2-weighted; DW=diffusion-weighted, DCE=dynamic contrast-enhanced, MRS=magnetic resonance spectroscopy; T=Tesla; PPV=positive predictive value; NPV=negative predictive value.

Table 2: diagnostic test accuracy parameters of each study.

Study ID	Sensitivity	Specificity	PPV	NPV	Accuracy
Abd-Alazeez et al., 2014	90.1%	28.2%	60.2%	70.2%	62.0%
Brock et al., 2015	97.7%	11.8%	48.3%	85.7%	51.1%
Busetto et al., 2013	89.7%	62.1%	62.9%	89.4%	73.6%
Chamie et al., 2014	96.3%	46.0%	65.8%	92.0%	72.1%
Delongchamps et al., 2011	85.8%	98.9%	93.6%	97.4%	96.9%
Jagannathan et al., 2017	73.9%	85.7%	94.4%	50.0%	76.7%
Labanaris et al., 2010	56.8%	18.7%	56.5%	18.9%	43.5%
Peng et al., 2013	80.3%	86.0%	89.1%	75.5%	82.7%
Pepe et al., 2015	48.0%	95.8%	92.3%	63.9%	71.4%
Petrillo et al., 2014	84.0%	50.5%	27.6%	93.3%	56.6%
Popita et al., 2017	100.0%	82.6%	80.0%	100.0%	89.7%
Porpiglia et al., 2014	90.4%	90.7%	81.0%	95.5%	90.6%
Tsivian et al., 2016	94.1%	43.8%	78.0%	77.8%	78.0%
Vilanova et al., 2011	72.5%	91.0%	82.2%	85.3%	84.3%
Costa et al., 2016	77.6%	74.0%	59.8%	86.8%	75.2%

Pooled Estimates of Diagnostic Test Accuracy

Table 3 and figure 2 summarize the pooled performance estimates derived from the meta-analysis. The pooled sensitivity, representing the ability of multiparametric MRI to correctly identify patients with prostate cancer, was estimated at 86% (95% CI: 77% to 91%). The pooled specificity, indicating the capacity to accurately rule out the disease, was estimated at 72% (95% CI: 51% to 87%).

The analysis also calculated the positive likelihood ratio (PLR) and negative likelihood ratio (NLR). The PLR, which quantifies the increase in the odds of having prostate cancer given a positive MRI result, was estimated at 3.1 (95% CI: 1.6 to 5.9). The NLR, indicating the odds of not having prostate cancer given a negative MRI result, was 0.20 (95% CI: 0.12 to 0.32). The diagnostic odds ratio (DOR), representing the overall discriminatory ability of the diagnostic test, was calculated at 16 (95% CI: 6 to 39).

The summary receiver operating characteristic (SROC) plot, shown in Figure 3, yielded an area under the curve (AUC) of 0.88 (95% CI: 0.12 - 1.00). An AUC of 1.00 represents a perfect diagnostic test, while an AUC of 0.50 signifies a test with no discriminatory ability. The AUC of 0.88 suggests that multiparametric MRI with an endorectal coil has a favorable diagnostic performance for prostate cancer.

Table 3: Summary performance estimates (pooled estimates).

Parameter	**Estimate [95% CI]**
Sensitivity	86% [77%, 91%]
Specificity	72% [51%, 87%]
Positive Likelihood Ratio	3.1 [1.6, 5.9]
Negative Likelihood Ratio	0.20 [0.12, 0.32]
Diagnostic Odds Ratio	16 [6, 39]

Figure 2: Forest plot of pooled sensitivity and specificity.

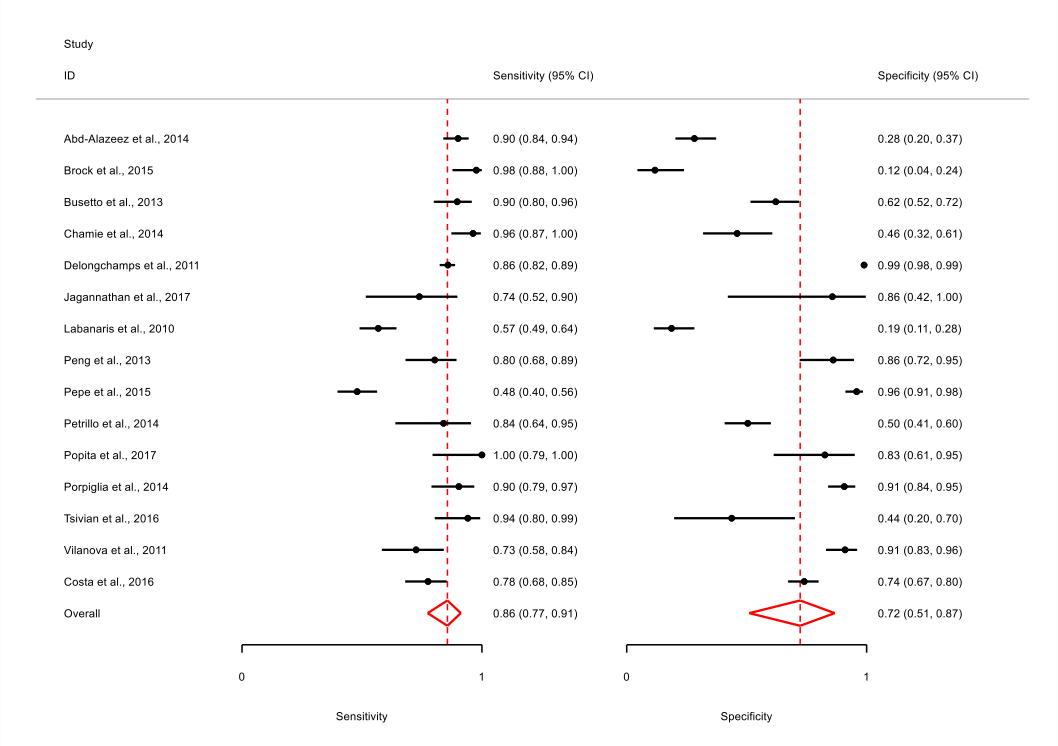
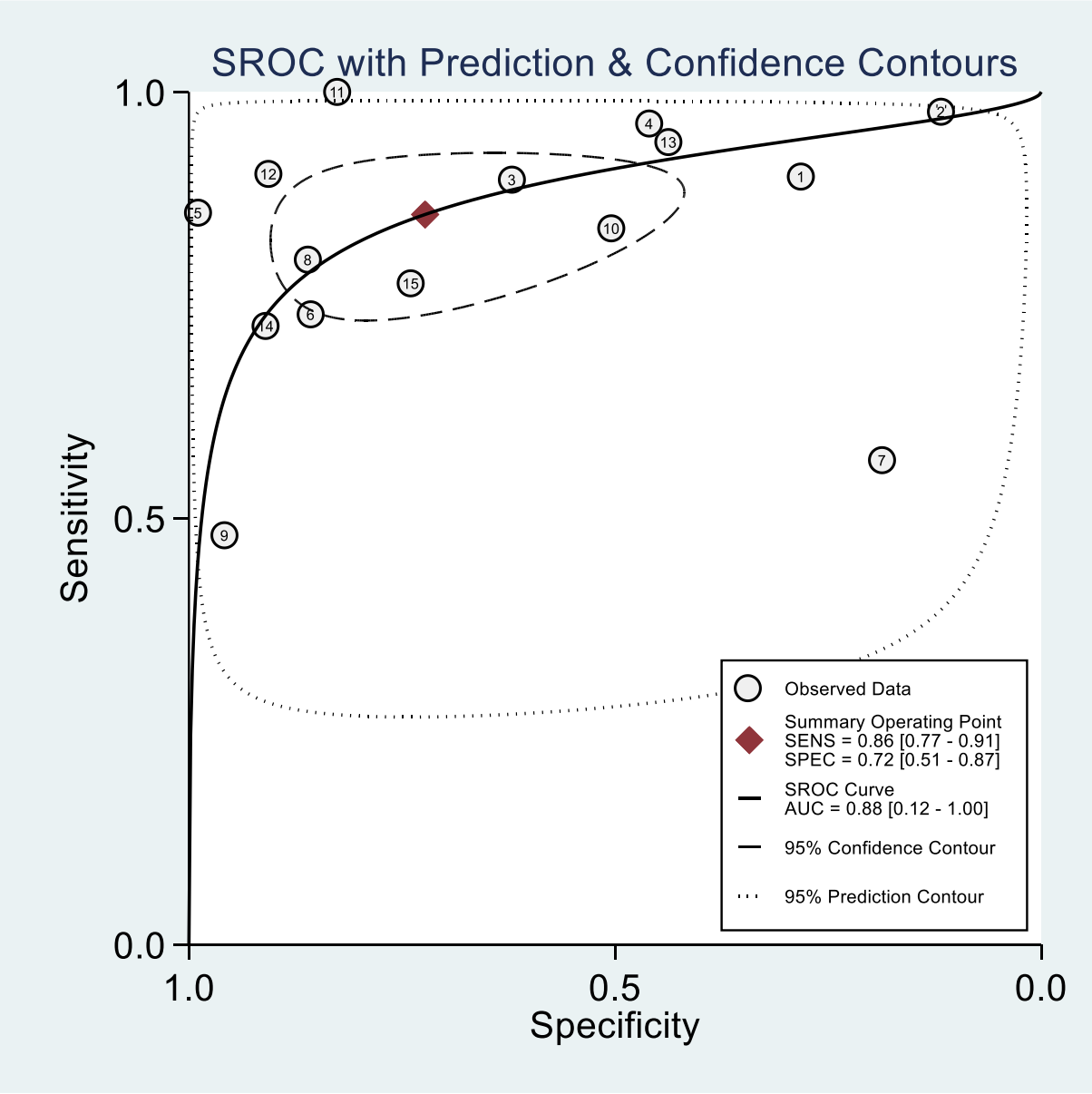


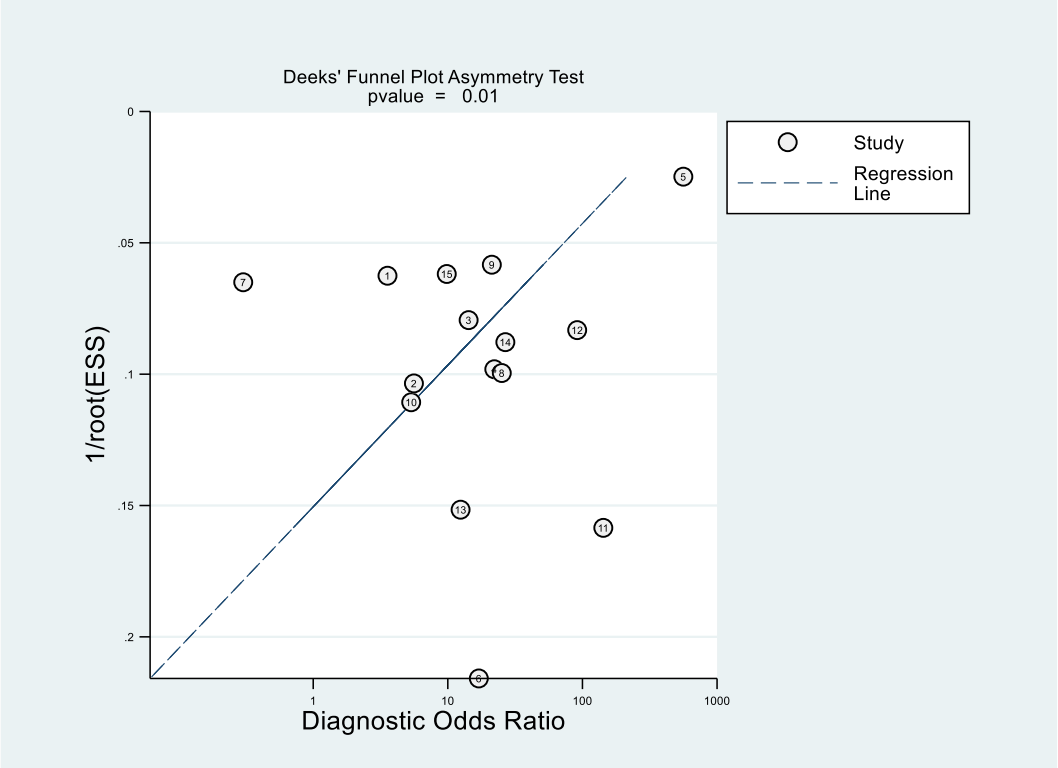
Figure 3: Summary receiver operating characteristic (SROC) plot.



Publication Bias Assessment

Deek's funnel plot, illustrated in Figure 4, was used to assess the potential for publication bias in the included studies. The plot revealed a p-value of 0.01, indicating a potential asymmetry in the distribution of studies. This suggests the need for caution in interpreting the results and underscores the importance of considering potential publication bias in the overall evaluation of the diagnostic accuracy of multiparametric MRI for prostate cancer.

Figure 4: Deek's Funnel Plot for Publication Bias Assessment.



Discussion

Prostate cancer is a widespread malignancy with a significant impact on public health globally. Early detection of prostate cancer is paramount for timely intervention and improved outcomes (Swami et al., 2020; Teo et al., 2019). Multiparametric magnetic resonance imaging (MRI) with an endorectal coil has gained recognition as a diagnostic tool to aid in the identification and characterization of prostate cancer (Stabile et al., 2020; O'Connor et al., 2021).

This meta-analysis aimed to provide an in-depth evaluation of the diagnostic test accuracy of multiparametric MRI in detecting prostate cancer. Our analysis incorporated data from 15 studies that encompassed various geographic regions, study designs, and patient populations.

Our findings reveal a pooled sensitivity estimate of 86% (95% CI: 77% to 91%) for multiparametric MRI with endorectal coils. This suggests that the imaging modality performs quite well in correctly identifying true positive cases of prostate cancer. With an estimated specificity of 72% (95% CI: 51% to 87%), the test demonstrates moderate accuracy in correctly excluding individuals without prostate cancer (true negatives). These findings collectively highlight the potential of multiparametric MRI to serve as an effective diagnostic tool in identifying prostate cancer, although with a notable degree of false-positive results (Xu et al., 2019; Drudi et al., 2019).

Our positive likelihood ratio (PLR) of 3.1 (95% CI: 1.6 to 5.9) indicates that a positive test result is associated with a moderately higher probability of having prostate cancer. Conversely, the negative likelihood ratio (NLR) of 0.20 (95% CI: 0.12 to 0.32) suggests that a negative test result is strongly indicative of not having prostate cancer, further emphasizing the test's utility in ruling out the disease (Stabile et al., 2021).

The diagnostic odds ratio (DOR) serves as a comprehensive indicator of overall diagnostic performance. Our analysis yielded a DOR of 16 (95% CI: 6 to 39), which indicates that multiparametric MRI with endorectal coils can effectively distinguish between patients with and without prostate cancer. This collective assessment underscores the test's clinical

significance and its potential role in prostate cancer diagnosis (Xu et al., 2019; Stabile et al., 2021).

Comparing our findings with the existing medical literature reveals several key insights. It is important to acknowledge the substantial variability in study designs, patient populations, and data collection methods across the included studies. This variability is reflected in the diverse sensitivity and specificity values observed in the individual studies. Notably, some studies reported remarkably high sensitivities (e.g., 97.7% in Brock et al., 2015), while others reported lower specificities (e.g., 11.8% in the same study). These discrepancies can be attributed to differences in patient populations, MRI protocols, and reference standards (Xu et al., 2019).

Our pooled sensitivity and specificity values fall within the range of values reported in these individual studies, further affirming the diversity of results within the literature. Despite this variation, our findings provide a valuable overview of the overall diagnostic performance of multiparametric MRI in a broader context.

The area under the curve (AUC) derived from the summary receiver operating characteristic (SROC) plot is estimated at 0.88 (95% CI: 0.12 to 1.00). While the AUC is indicative of good discriminatory power, the wide confidence interval underscores the heterogeneity in the included studies. This suggests that additional research is warranted to further refine the diagnostic accuracy of multiparametric MRI in prostate cancer.

Deek's funnel plot for publication bias assessment yielded a p-value of 0.01, suggesting potential publication bias. This underscores the importance of conducting comprehensive and unbiased literature searches in systematic reviews and meta-analyses to ensure the inclusion of all relevant studies. Addressing this potential bias will be crucial for future research in this domain.

In light of these findings, several important clinical implications emerge. The high sensitivity of multiparametric MRI makes it a valuable tool for identifying patients with prostate cancer, particularly those at higher risk. It can assist in guiding further diagnostic and therapeutic interventions, such as biopsy or surgery. However, the moderate specificity suggests that it may produce false-positive results in a subset of patients, highlighting the need for a comprehensive clinical evaluation that takes into account additional risk factors and clinical context. This diagnostic modality has the potential to minimize unnecessary biopsies and spare patients from invasive procedures when they are not warranted (Stabile et al., 2020; Li et al., 2010).

Moreover, the moderate specificity indicates that future research should focus on refining the imaging protocols and techniques to enhance specificity while maintaining high sensitivity. Additionally, standardization of MRI reporting and interpretation can aid in reducing interobserver variability and enhance the consistency of results.

It is important to acknowledge some limitations of this study. The variability in the included studies, encompassing different patient populations, MRI protocols, and reference standards, contributes to heterogeneity in the data. This heterogeneity can impact the generalizability of the findings. Furthermore, the presence of publication bias underscores the need for comprehensive literature searches and inclusion of studies with diverse results in future analyses.

Conclusion

In conclusion, this systematic review and meta-analysis provide a thorough evaluation of the diagnostic test accuracy of multiparametric MRI with an endorectal coil in the detection of prostate cancer. Despite the observed heterogeneity and potential publication bias, the analysis demonstrates that multiparametric MRI is a valuable tool with a high sensitivity for identifying prostate cancer. The moderate specificity suggests the need for further research to enhance the diagnostic performance and minimize false-positive results. As research in the field continues to evolve, multiparametric MRI holds promise as an essential component in the diagnostic armamentarium for prostate cancer. Its application in clinical practice should be guided by a

comprehensive assessment of individual patient risk factors and clinical context, in conjunction with other diagnostic tools.

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