

AI-assisted Biparametric vs Multiparametric MRI for Clinically Significant Prostate Cancer

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Background

Multiparametric MRI (mpMRI) remains the pre-biopsy reference standard for detecting clinically significant prostate cancer (csPCa, ISUP Grade ≥ 2). Biparametric MRI (bpMRI) provides a faster, lower-cost alternative that may reduce barriers to pre-biopsy imaging. Artificial intelligence (AI) may improve diagnostic performance in both modalities. We systematically reviewed AI models for csPCa detection using bpMRI and mpMRI.

Methods

A systematic review (PROSPERO ID: CRD420251037432) searched MEDLINE, PMC, EMBASE, SCOPUS and COCHRANE. Of 6,389 records, 202 underwent full-text review; with six meeting inclusion criteria. Studies were evaluated using TRIPOD-SRMA and TRIPOD-AI.

Results

Six studies compared AI-assisted csPCa diagnosis using bpMRI (PMID: 40259798, 36222324, 38876123) and mpMRI (PMID: 40016318, 37345961, 33671533). Considerable methodological heterogeneity was observed, particularly in data preparation, sample size estimation, fairness assessment, and external validation.

Table 1. Comparative diagnostic performance of AI-assisted bpMRI and mpMRI for csPCa

Performance Metric	AI-assisted mpMRI (pooled)	AI-assisted bpMRI (pooled)	Human-only mpMRI (PROMIS trial)	AI-assisted bpMRI (PI-CAI benchmark)
Sensitivity	0.88 (0.75-0.98)	0.65 (0.39, 0.84)	0.93 (0.88, 0.96)	0.97 (0.95, 0.98)
Specificity	0.68 (0.51-0.80)	0.93 (0.69, 0.99)	0.41 (0.36, 0.46)	0.50 (0.42, 0.58)
AUC	0.84 (0.69-0.95)	0.88 (0.80, 0.93)	Not Reported	0.92 (0.89, 0.94)

AI-assisted bpMRI demonstrated higher specificity than mpMRI, although with lower sensitivity. This indicates a potential trade-off between detecting all cases of clinically significant prostate cancer and minimising false-positive findings, which may be influenced by differences in model training approaches and the simplified imaging protocol used in bpMRI.

Conclusion

AI-augmented MRI is emerging as a radiologist-assistive tool with potential to reshape pre-biopsy prostate cancer imaging. AI-assisted bpMRI may offer comparable diagnostic accuracy to mpMRI while reducing acquisition time and cost, supporting implementation in high-throughput or resource-limited settings. Conversely, AI-assisted mpMRI may improve precision in diagnostic imaging at tertiary centres. Future work should prioritise external validation, multi-centre calibration, and assessment of real-world clinical utility to ensure safe, equitable integration of AI into prostate cancer diagnostic workflows.

