

MRI use prior to prostate biopsy after guideline recommendation in Canada: Results from northern Alberta

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ABSTRACT

Introduction: Implementation of magnetic resonance imaging (MRI) prior to a prostate biopsy has improved detection of clinically significant prostate cancer, while reducing overdiagnosis of low-risk disease. Accordingly, the Canadian Urological Association (CUA) updated its prostate screening guidelines to recommend MRI prior to prostate biopsy in biopsy-naïve men in 2022. This study aims to assess real-world implementation of pre-biopsy MRI by urologists in accordance with CUA guidelines.

Methods: We conducted a retrospective, observational cohort study of all men undergoing prostate biopsy from April 2022 to April 2024 in Edmonton, AB, Canada. Data was extracted from a province-wide electronic medical record. Inclusion criteria were biopsy-naïve men with a prostate-specific antigen (PSA) ≤ 20 ng/ml. Statistical analysis completed using Chi-squared and two-proportioned z-tests.

KEY MESSAGES

- Urologists obtain MRI prior to biopsy in ~70% of men since introduction of a CUA guideline in 2022.
- Median wait times to receive a pre-biopsy MRI are approximately 3 months.
- MRI prior to biopsy was associated with increased detection of grade group ≥ 2 prostate cancer and a lower proportion of grade group 1 or benign pathology.

Results: A total of 2626 men underwent prostate biopsy during the study period and 1491 participants met the inclusion criteria; 1054 (71%) received MRI prior to biopsy, with a median wait time to MRI of 101 days (interquartile range [IQR] 30–164). Inclusion of MRI in the diagnostic pathway was significantly associated with a longer interval from initial urology consultation to prostate biopsy (208 vs. 52 days, $p < 0.0001$). Use of MRI resulted in fewer benign pathology results (12% vs. 23%, $p < 0.00001$) and increased detection of grade group ≥ 2 (73% vs. 59%, $p < 0.00001$) compared to those who did not receive MRI.

Conclusions: Approximately seven of every 10 men undergo pre-biopsy MRI, which is markedly higher than the rate that has previously been identified in North America. Furthermore, MRI introduces a delayed time to biopsy but may reduce unnecessary prostate biopsies.

INTRODUCTION

Over the past decade, multiparametric magnetic resonance imaging (mpMRI) has dramatically changed prostate cancer diagnostics. Landmark clinical trial studies demonstrated that MRI prior to biopsy can mitigate the risks involved in overdiagnosis of insignificant prostate cancer and avoid unnecessary biopsies.^{1, 2, 3, 4} Additionally, MRI improves the detection of clinically significant prostate cancer compared to a systematic transrectal ultrasound (TRUS) biopsy.^{1, 2, 3, 4}

These and other clinical trials laid the foundation for the Canadian Urological Association (CUA) to update its guidelines for prostate cancer screening for Canadian men in 2022. The amendment recommends that biopsy-naïve men, who are at risk of prostate cancer, should have MRI prior to prostate biopsy.⁵ In the USA (in 2022), 35.5% of patients received MRI prior to prostate biopsy, with reduced uptake in rural areas.⁶ However, limited research is available on the implementation in a public healthcare setting. In Australia, one publicly funded tertiary institution reported an increase in pre-biopsy MRI use from 36.3% to 77.5% after prostate cancer MRI rebates were introduced.⁷ However, implementation in Canada may be limited by system-specific constraints. Canada's four times lower MRI rate per million people compared to the USA, combined with an approximate three-month nationwide median wait time for an MRI and other limitations of the public healthcare system, can restrict the ability to implement these guidelines in Canada.^{8, 9} Therefore, our primary objective is to assess whether urologists in a Canadian province have implemented pre-prostate biopsy MRI as part of their patient care for prostate cancer diagnosis.

METHODS

This is a retrospective observational cohort study conducted on patients undergoing prostate biopsies from April 2022 to April 2024 in Edmonton, Alberta, Canada. Ethical approval was obtained (HREBA.CC-24-0119). Men were selected for the study following an inclusion criterion: Men ≥ 18 , had no prior prostate biopsy, and had a prostate specific antigen (PSA) level

≤ 20 ng/ml. Men who had imaging showing metastatic prostate cancer or were part of a prostate clinical trial were excluded from the study.

Baseline characteristics were manually collected through electronic medical records and included age, primary urologist, date of initial urological consultation for suspected prostate cancer, and digital rectal examination (DRE) findings. MRI-related variables, when applicable, included date ordered, date performed, PI-RADS score, PSA level, prostate volume, and PSA density. Biopsy-related variables included date of decision to proceed with biopsy, date ordered, date performed, PSA level, prostate volume, PSA density, and pathology report including Gleason Grade Group.

For primary outcome analyses, patients divided into two groups: those who have had an MRI prior to their prostate biopsy, and those who have not. Detection rate of Grade Group ≥ 2 , Grade Group 1 prostate cancer, and benign pathology results are compared between study groups. Secondary outcome analyses included time from follow-up appointment to biopsy date, time from decision to proceed with biopsy to date of biopsy, time from MRI order date and performance date.

Continuous variables were reported as means $\pm$ standard deviation (SD) or median (interquartile range, IQR), as appropriate. Categorical variables were presented as counts and percentages. Comparative analyses were conducted utilizing chi-squared tests and two-proportioned z-tests for primary outcomes and the Mann-Whitney U-test for secondary outcomes. Statistical analyses were performed using GraphPad Prism (version 10.5.0). A p-value < 0.05 was considered statistically significant.

RESULTS

2,626 men underwent prostate biopsy during the study period. A total of 1,491 men were biopsy-naive with PSA ≤ 20 ng/mL, of which 1,054 (70.7%) received a prostate MRI prior to biopsy (Figure 1, Table 3). Among participants who did not receive an MRI prior to biopsy ($n=437$), 26 individuals were identified as having contraindications (Figure 2), while the reason for not performing an MRI was not explicitly stated in the remaining 411. Therefore, 1,080 participants (72.4%) were correctly assessed according to the CUA guidelines.

Of the 411 participants who did not receive an MRI prior to biopsy with no contraindication noted, 220 participants (50.3%) did not receive one for unknown reasons (Figure 1). Inferred rationale for proceeding directly to a biopsy (based on chart review) includes physician preference for modality, a long wait time for MRI, an abnormal prostate on DRE, and a rapidly elevating PSA level.

Participants who received an MRI prior to prostate biopsy waited a median of 101 days (IQR 30-164) before receiving their MRI once ordered (Table 2). There was a significant difference in the days from the initial urology consultation regarding prostate cancer to the prostate biopsy between participants who received MRI vs no MRI (208 vs. 52, $p<0.0001$) (Table 2). However, there was no significant difference between groups in the days to undergo biopsy once a decision to biopsy was made (35 vs. 35 days, $p=0.76$).

Benign prostate biopsies occurred at a lower frequency in those participants who received MRI vs no MRI prior to biopsy (12% vs 23%) (Table 1). Biopsies showing Grade Group ≥ 2 occurred at a higher frequency in those participants who received MRI vs no MRI prior to biopsy (72.6% vs 59.1%). Those receiving an MRI had fewer abnormal DRE results (24.2% vs 63.2%) and PSA density >0.15 on biopsy (59.4% vs 64.5%) compared to those receiving no MRI (Table 3). In participants who received an MRI with biopsies Grade Group 4 or 5 had lower median wait times (50 vs 104 days, $p=0.015$), higher PSA (10.3 vs 8.5, $p<0.0001$), and greater abnormal DRE results (53% vs 25%) compared to those who received an MRI with biopsies Grade Group 2 or 3 (Supplementary Table 1).

DISCUSSION

This study presents a comprehensive assessment of pre-biopsy MRI utilization in a large cohort of biopsy-naïve men undergoing evaluation for clinically significant prostate cancer. In this study, we found that over 70% of patients had biopsies that were preceded by an MRI. Compared with a publicly funded institution in Australia in 2020, MRI utilization was 77%.⁷ In contrast to a private healthcare system, during a similar time period in the United States, only 36% of prostate biopsies were performed with an MRI prior to biopsy, with Minnesota representing the highest rate among states at 44%.⁶ This likely showcases that the cost is a limiting factor in the USA. Although a lower MRI availability per million people reported in Canada compared to the USA, our findings underscore substantial real-world adoption of pre-biopsy MRI, reflecting high uptake within public healthcare systems.⁸

The wait times to receive an MRI in this study from 2022 to 2024 were on par with the Canadian national median of 3 months in 2023.⁹ While we did also find that receiving an MRI prolonged the median wait time to get a biopsy by 155 days, it is unclear if this poses an oncological risk to patients.¹⁰ However it is clear that there are diagnostic benefits for patients to undergo MRI before proceeding to prostate biopsy.^{1, 2, 3, 4, 5, 10}

Among these benefits, our study affirmed the current guidelines that MRI prior to biopsy is critical to determining the likelihood of clinically significant prostate cancer, especially for preventing unnecessary biopsies. The current study demonstrated that in participants who received an MRI prior to biopsy, the rate of benign biopsies was significantly lower, demonstrating the lower false positive rate when an MRI occurs before biopsy. Conversely, clinically significant prostate cancer was detected at a higher frequency in participants who received an MRI prior to the biopsy, demonstrating how MRI can appropriately triage patients and provide biopsies to those who require them. The use of MRI prior to biopsy is critical in restricting unnecessary biopsies and overdiagnosis, promoting patient wellness with reduced rates of post-biopsy sepsis, preventing unnecessary burden on the healthcare system, and creating a more cost-effective diagnostic pathway.^{11, 12, 13}

Despite these known benefits of having an MRI prior to biopsy, 411 men did not receive an MRI with no apparent contraindications. Furthermore, 311 of those patients had an unknown reason, physician preference of modality, or too long an MRI wait time. With Northern Alberta

having a large rural population, the distance to an MRI can be a significant factor in why urologists may go straight to biopsy, despite the fact that rural Albertans have worse prostate outcomes compared to urban men.¹⁴

Recently, the OPTIMUM trial showed non-inferiority of micro-ultrasound to MRI in diagnosing clinically significant prostate cancer in biopsy naïve men.^{15, 16} A clinical trial (MUSIC-Screen, NCT6626022) is currently underway to assess utility of micro-ultrasound for biopsy decision making. If shown to be non-inferior to MRI then micro-ultrasound may provide a more efficient pathway to image and biopsy rural men in one visit rather than two separate visits with MRI and biopsy. This will encourage more imaging prior to biopsy, leading to better patient outcomes for rural patients in Northern Alberta and closing the gap of no MRI pre-biopsy.

Limitations

There are several limitations in the present study. This was a retrospective study and several patients had data elements stored on a separate electronic health record system, which was inaccessible. Furthermore, reasons why several individuals did not receive pre-biopsy MRI were inferred based on chart review or remained unknown. To adequately compare Canada's overall utilization of MRI with the rest of the United States, additional studies will need to be conducted across all provinces. Finally, a number of individuals who received a micro-ultrasound guided biopsy experienced longer intervals awaiting their procedure, attributed to the biopsy suite being incomplete and not fully operational yet. This was the case for those who had their initial consultations between November 2020 to September 2021.

CONCLUSIONS

Since the CUA guideline changes in 2022, Northern Alberta urologists have successfully implemented MRI prior to biopsy in 7 out of 10 patients. Our findings also highlight the importance of having an MRI to reduce overdiagnosis and underdiagnosis of clinically significant prostate cancer, with wait times on par with national medians in 2023. However, 3/10 men in Northern Alberta still do not receive an MRI before biopsy; more research is needed to address this gap to better understand where to put provincial resources to further increase pre-biopsy imaging and improve prostate cancer care.

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FIGURES AND TABLES

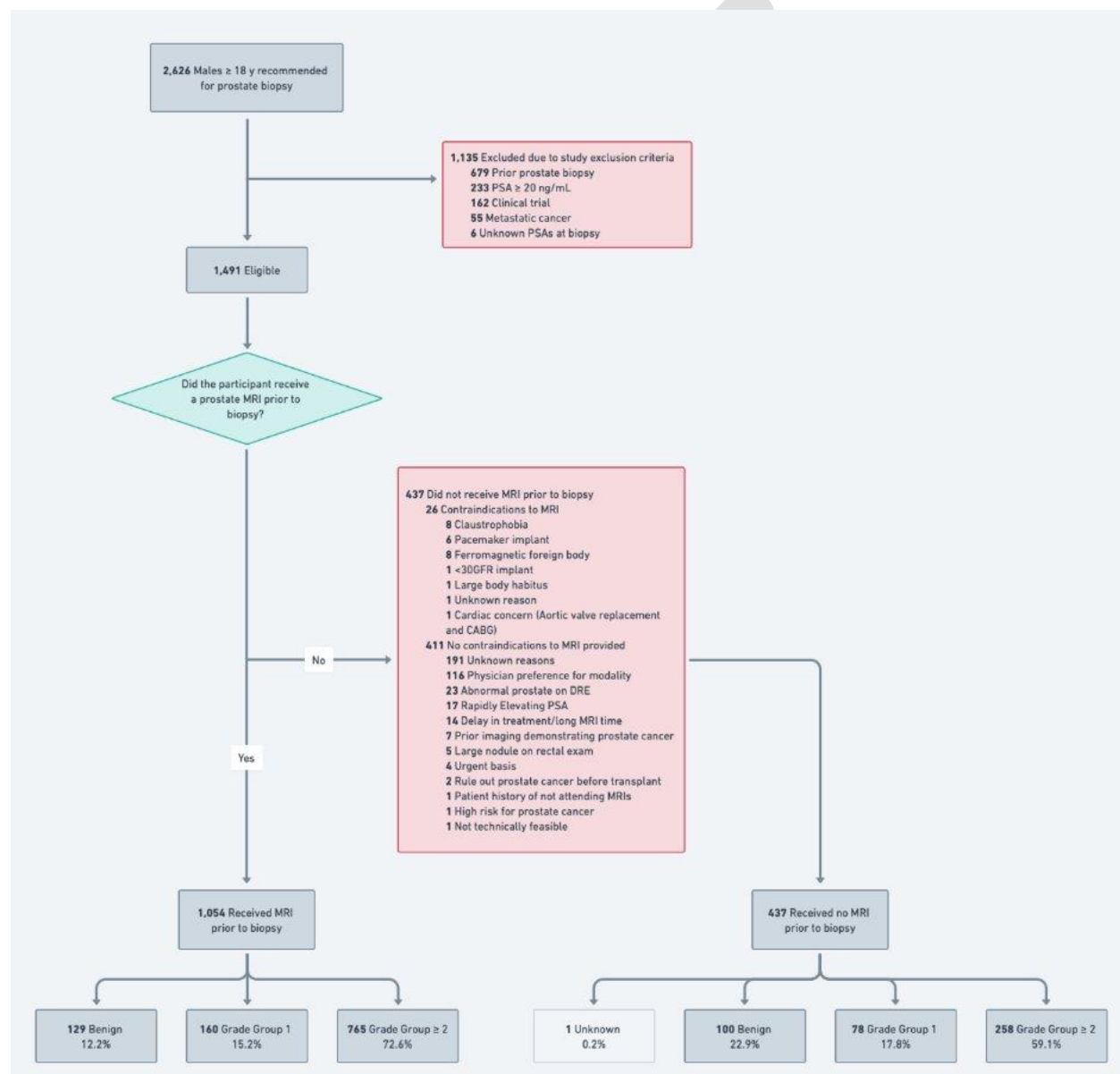
Figure 1. Flow of participants eligible for the study, receiving MRI, reasons for not receiving MRI, and grade group of biopsy. MRI: magnetic resonance imaging.

Table 1. Diagnosis of MRI vs. no MRI prior to biopsy			
	MRI prior to biopsy (n=1054)	No MRI prior to biopsy (n=437)	p
Grade group diagnosis (%)			<0.00001
benign	129 (12.2%)	100 (22.9%)	
Grade group 1	160 (15.2%)	78 (17.8%)	
Grade group 2	516 (49.0%)	159 (36.4%)	
Grade group 3	155 (14.7%)	64 (14.6%)	
Grade group 4	45 (4.3%)	11 (2.5%)	
Grade group 5	49 (4.6%)	24 (5.5%)	
Unknown	–	1 (0.2%)	
csPCa (%)	765 (72.6%)	258 (59.1%)	<0.00001

Note: csPCa is equivalent to grade group ≥ 2 . csPCa: clinically significant prostate cancer; GG: grade group; MRI: magnetic resonance imaging.

Table 2. Wait time (days) and follow-up duration			
	MRI (n=988)	No MRI (n=305)	p
Time from first urology visit to biopsy, median (IQR), days	208 (98-311)	52 (34-98)	<0.0001
Time from decision to biopsy to biopsy, median (IQR), Days	35 (27-49)	35 (27-50)	0.7615
Wait time for MRI, median (IQR), days	101 (30-164)	–	–

IQR: interquartile range; MRI: magnetic resonance imaging.

Table 3. Baseline patient biopsy characteristics			
	MRI (n=1054)	No MRI (n=437)	p
Age at the time of first urology visit, mean ($\pm$ SD)	64.3 ($\pm$ 7.0)	65.1 ($\pm$ 7.5)	0.1309
DRE results, n (% of known)			
Abnormal	153 (24.2%)	191 (63.2%)	<0.0001
Normal	479 (75.8%)	111 (36.8%)	
Unknown	422	135	
PSA at MRI (ng/mL), mean (SD)	8.1 ($\pm$ 3.5)	–	
Prostate volume at MRI (cc), mean (SD)	52.6 ($\pm$ 27.4)	–	
PSA density at MRI (ng/mL/cc), mean (SD)	0.186 ($\pm$ 0.116)	–	
<0.15, n (% of known)	485 (46.5%)		
>0.15, n (% of known)	558 (53.5%)		
Unknown, n	11		
PSA at biopsy (ng/mL), mean (SD)	8.3 ($\pm$ 3.6)	9.0 ($\pm$ 4.3)	<0.0001
Prostate volume (cc), mean (SD)	49.8 ($\pm$ 28.6)	50.1 ($\pm$ 28.1)	0.8488
PSA density at biopsy (ng/mL/cc), mean (SD)	0.203 ($\pm$ 0.132)	0.223 ($\pm$ 0.166)	0.0172 0.0668
<0.15, n (% of known)	419 (40.6%)	154 (35.5%)	
>0.15, n (% of known)	613 (59.4%)	280 (64.5%)	
Unknown, n	22	3	

Note: Age was first time visiting a urologist regarding investigation of prostate cancer. Unknown DRE was that they did not perform it, or it was not reported. DRE: digital rectal exam; MRI: magnetic resonance imaging; PSA: prostate-specific antigen; SD: standard deviation.