

CASE STUDY

Benefits of Multiparametric Magnetic Resonance imaging of the Prostate (mpMR)



Dr. Tufik Bauab Jr., PhD

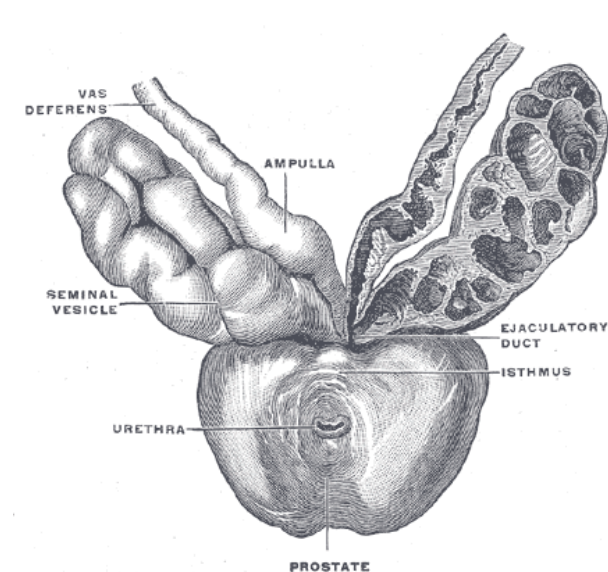
Director of Mama Imagem Clinic - São José do Rio Preto- SP- BR
 Professor at São José do Rio Preto School of Medicine;
 Coordinator of Rio Preto Institute of Radio Diagnosis;
 Research Fellow in Urological Radiology at University of Alabama at Birmingham;
 PhD in Medicine from FMUSP

Introduction

The prostate is the biggest accessory gland from male system reproductive and it is proportionally higher in newborn than adult, because the pelvis is relatively small when baby is born¹. Growing very slowly in the first years of life, then increasing at puberty, showing higher

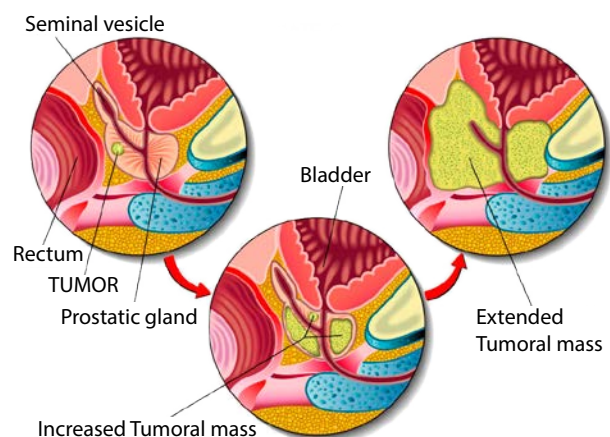
growth rate in adolescence, when it shows an increasing around of 1,6 g per year, being considered adult when it reaches 20 g of weight, which occurs between the 18-20 years of age². This growth in prostate size occurs because the gland is androgen dependent, and the conversion from testosterone to di-hydrotestosterone stimulates its growth³.

Prostate Anatomy image



Henry Vandyke Carter, Public domain, via Wikimedia Commons⁴

Prostate Cancer



The prostate cancer (PCa) is the second neoplasia more diagnosed, and the fifth main cause of dead by cancer on men. 85% of all cases are diagnosed on men with more than 65 years of age. The World Health Organization (WHO) predicts an incidence of 2.293.818 new cases prostate cancer in 2040 (+79%). There has been a significant increase in rates of prostate cancer diagnosed since men's screening became popular in the 1990s with prostate-specific antigen test (PSA) and the digital rectal exam. The biopsy is an outpatient procedure that is most often performed as a transrectal biopsy by needle under oriented via TRUS (trans-rectal ultrasound).

The Prostate Magnetic Resonance imaging began less promising in 1990's⁵, when it was limited to the use of endorectal coil, alone, generating low spatial resolution images and of contrast. With the improved hardware, as utilization of pelvic coils of high number of channels (isolated or together with endorectal coil), associated to the incorporation of functional techniques together with traditional morphological analysis, the paper of MRI at the approach of patients with prostate cancer has changed considerable⁶.

In 2012, the European Society of Uroradiology (ESUR) has published recommendations for the use of MRI at the approach of prostate cancer⁷. Besides to propose differentiated protocols, according to with the indication of the exam, this panel from experts has recommended at least, the utilization of two functional techniques together with the morphological sequences (pondered in T2 of high resolution), to know: diffusion and dynamic contrast. This combined approach receives the name of multiparametric MRI (mpMR) of prostate. Is important to highlight that together with the recommendations related to the technique⁸, the ESUR has proposed a standardization scheme of interpretation and report from diagnoses found at the mpRM, known by the acronyms PI-RADS® (Prostate Imaging Reporting and Data System).

The Canon Medical Systems do Brazil through the partnership with great names from radiology, follow the European Society of Uroradiology (ESUR) orientations and in this document shows in four clinical cases the efficiency in diagnoses in our equipment: **Vantage Elan 1.5T**.

Clinical Cases of Multiparametric Prostate Resonance (mpRM):

Case 1: PI-RADS 2

The measure prostate is 6.1 × 5.0 × 5.4 cm, with nearly volume of 85 cm³.

The diffuse increase in the transition zone is noticed. The ZT standard is cystic-stromal with nodules formation, which measures until 2.8 cm, with surgical capsules well defined.

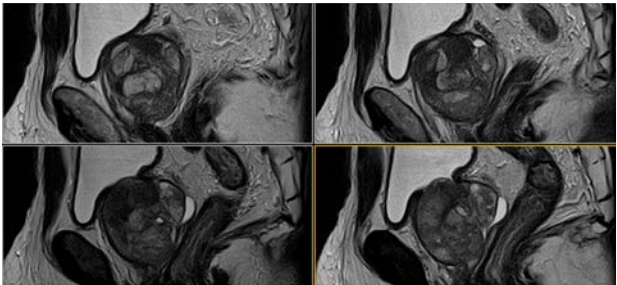


Figure 1 Pondered sagittal in T2 high resolution.

There is elevation of the vesical floor. Posterior deviation of the trigone.

Discrete posterior deviation of the prostatic urethra is noticed.

Peripheral zone shows diffusive atrophy with heterogeneous signal, but without forming typical area of the hypo-signal on T2 images or ADC map. (Figures 2 and 3) No hyper-capture area detected at the dynamic phase or hyper-signal of diffusion. (Figures 3 and 4)

The capsule is intact. The rectal-prostatic angles are free. There are no lymphadenomegaly images.

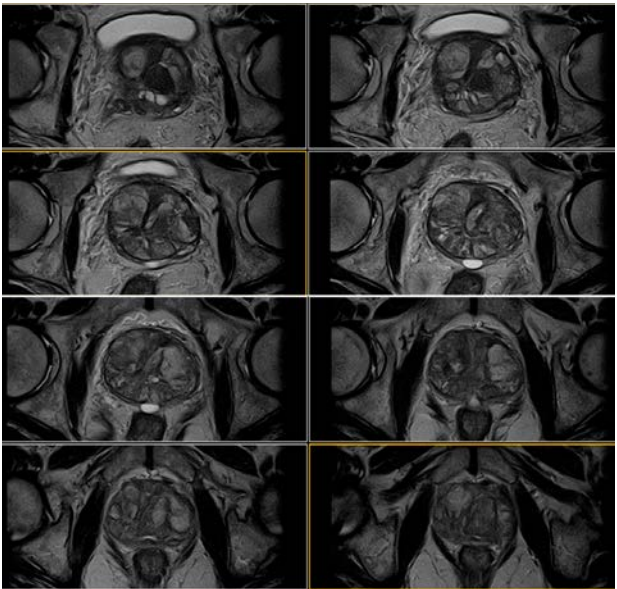


Figure 2 Pondered Axial in T2 high resolution (mpRM protocol)

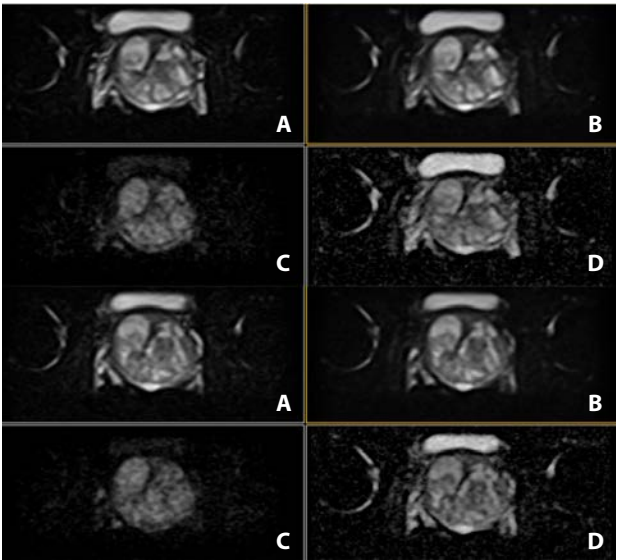


Figure 3 Axial DWI – A=b0, B=Iso b800, C=Iso b1000 e, D=Iso ADC (mpRM protocol)

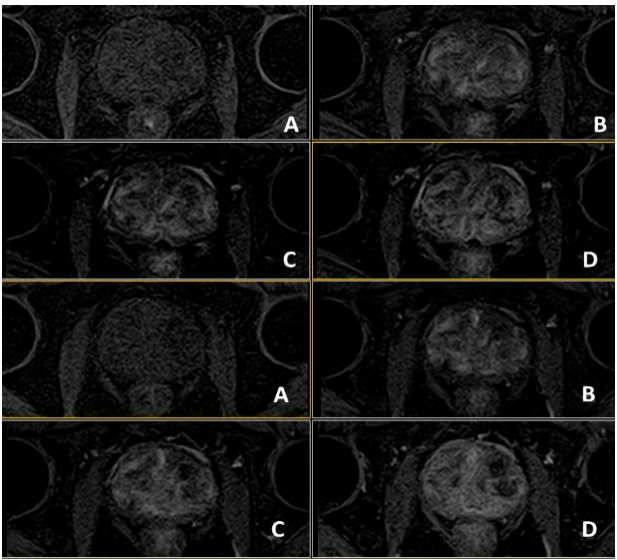


Figure 4 Dynamic Axial (12 phases): A=1ª phase pre, B=3ª phase pos, C=6ª phase pos, D=12ª phase (mpRM protocol)

Case 2: PI-RADS 2

The measure prostate is 5.2 × 4.7 × 6.6 cm, with nearly volume of 83 cm³. Diffuse increase of volume from transition zone, with posterior periurethral glands predominance, with corresponding elevation of bladder floor and trigone deviation. (Figure 5)

Discrete posterior deviation of the prostatic urethra is noticed. Membranous urethra measuring 1.5 cm.

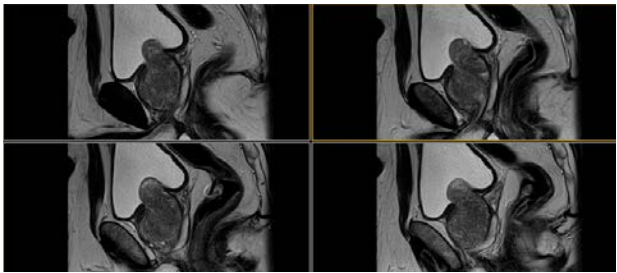


Figure 5 Pondered Sagittal in T2 high resolution.

The peripheral zone has normal thickness, with homogeneous signal, without forming hypo-signal typical area in T2 images and ADC map. (Figures 6 and 7). Was not detected hyper-capture area at dynamic phase or hypersignal in diffusion images. (Figures 7 and 8)

The capsule is full. The rectum prostatic angles are free. There is no lymphadenomegaly image.

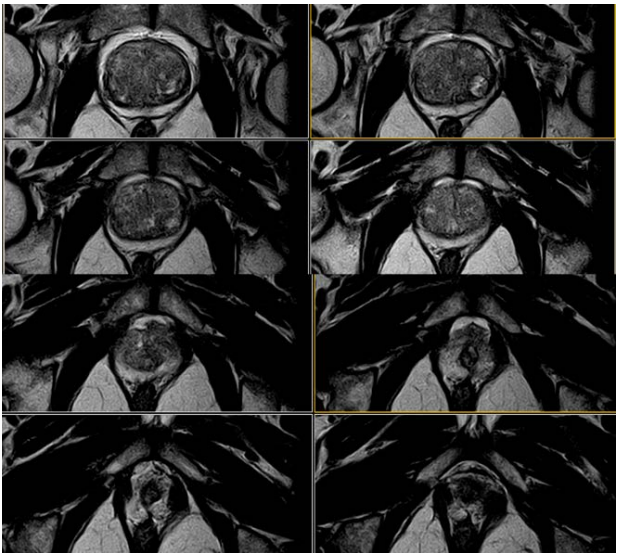


Figure 6 Pondered Axial in T2 high resolution (mpRM protocol)

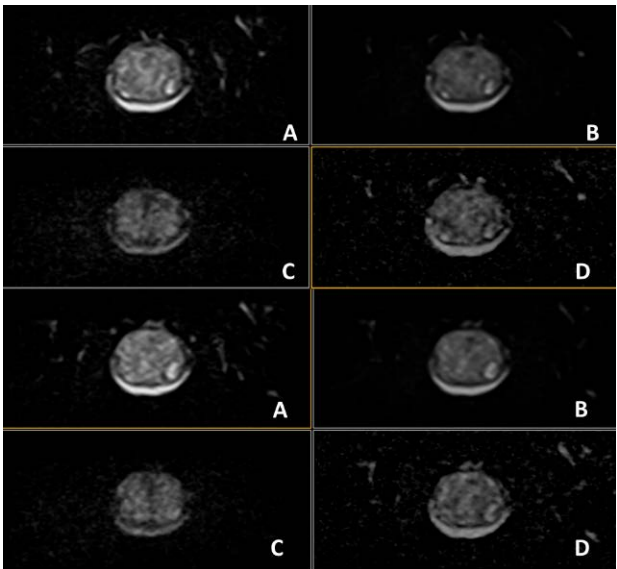


Figure 7 Axial DWI – A=b0, B=Iso b800, C=Iso b1000 e, D=Iso ADC (mpRM protocol)

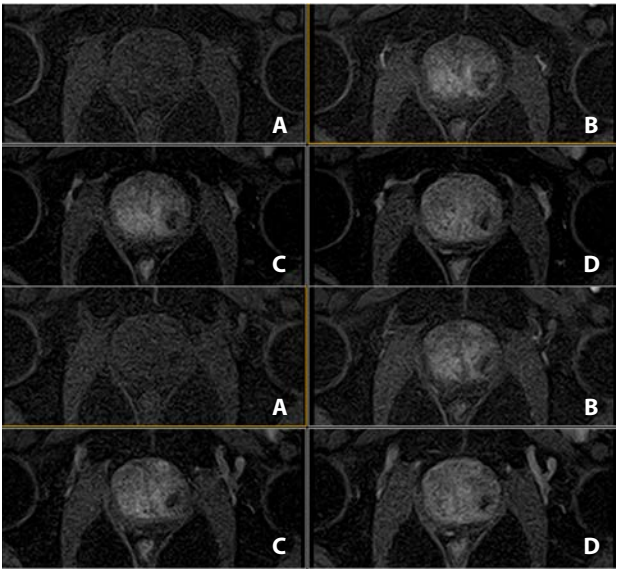


Figure 8 Dynamic Axial (12 phases): A=1° phase pre, B=3° phase pos, C=6° phase pos, D=12° phase (mpRM protocol)

Case 3: PI-RADS 4

The measure prostate is 5.3 × 3.5 × 3.4 cm, with nearly volume of 33 cm³. The ZT standard is predominantly stromal without surgical capsule formation bad defined.

The peripheral zone has normal thickness, with heterogenous signal, hypo-signal is noticed at T2 and the

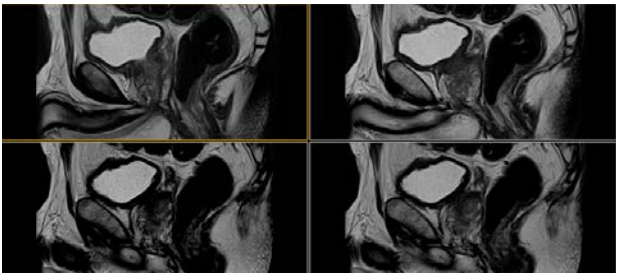


Figure 9 Pondered Sagittal in T2 high resolution.

ADC map, (Figures 10 and 11) localized posterior the left at medium prostate. Was not detected hyper-capture area at dynamic phase or hypersignal in diffusion images. (Figures 11 and 12)

The capsule is full. The rectum prostatic angles are free. There is no lymphadenomegaly image.

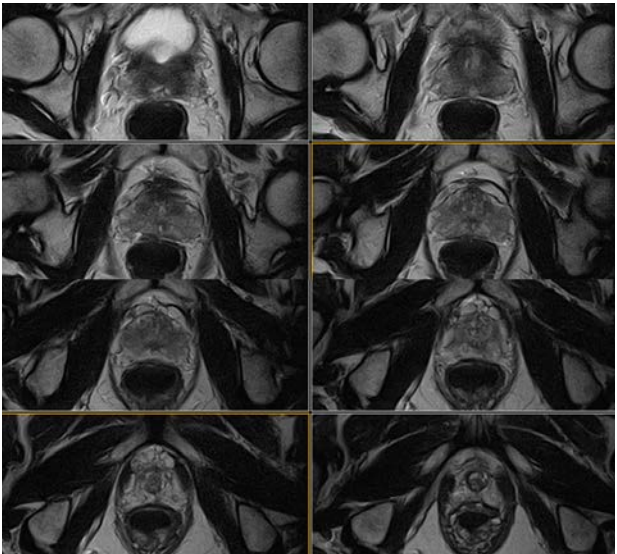


Figure 10 Pondered Axial in T2 high resolution (mpRM protocol)

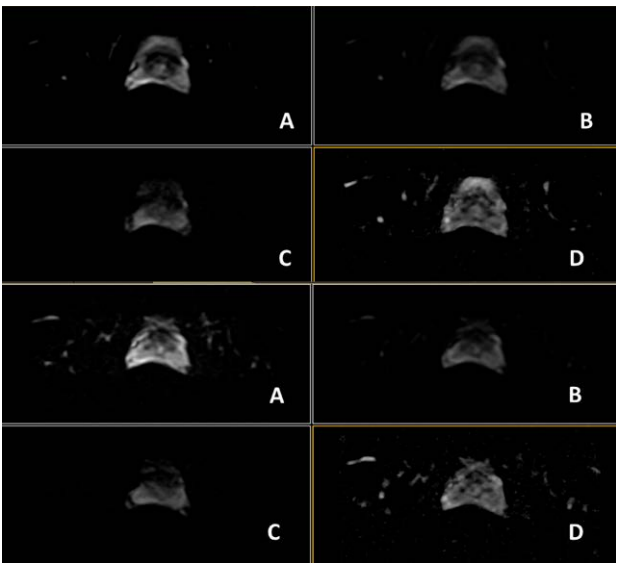


Figure 11 Axial DWI – A=b0, B=Iso b800, C=Iso b1000 e, D=Iso ADC (mpRM protocol)

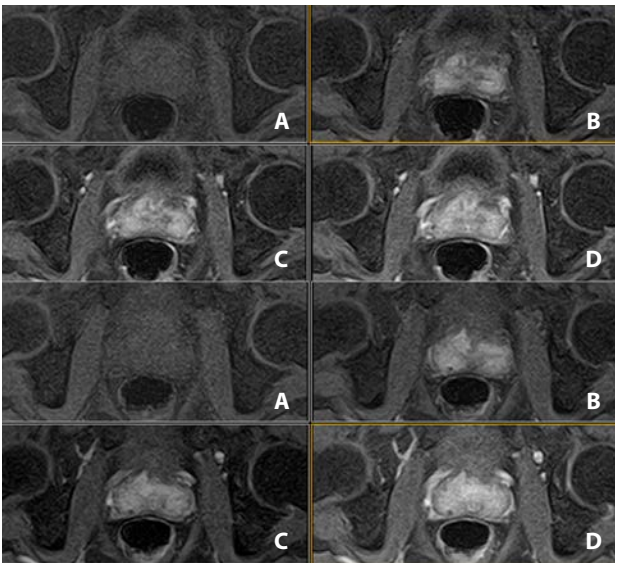


Figure 12 Dynamic Axial (12 phases): A=1° phase pre, B=3° phase pos, C=6° phase pos, D=12° phase (mpRM protocol)

Caso 4: PI-RADS 3

The measure prostate is 5.1 × 3.6 × 3.8 cm, with nearly volume of 36 cm³. The standard increase ZT is cystic-stromal, without macro-nodules formation, with surgical capsule well defined.

There is discrete elevation at the vesical floor. There is no trigone deviation.

Discrete posterior deviation of the prostatic urethra is noticed.

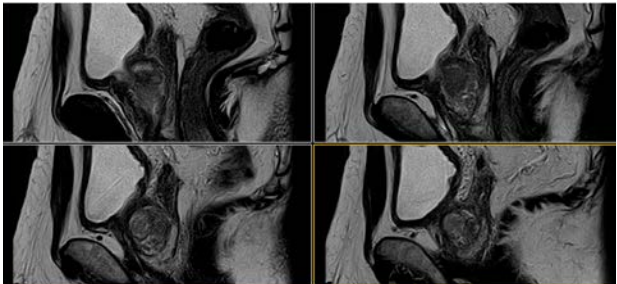


Figure 13 Pondered Sagittal in T2 high resolution.

The peripheral zone has normal thickness, with heterogenous signal, noting hypo-signal area at T2 images and the ADC map. (Figures 14 and 15) measuring 1.0, localized at the left apical zone. Was not detected hyper-capture area at dynamic phase or hypersignal in diffusion images. (Figures 15 and 16)

The capsule is full. The rectum prostatic angles are free. There is no lymphadenomegaly image.

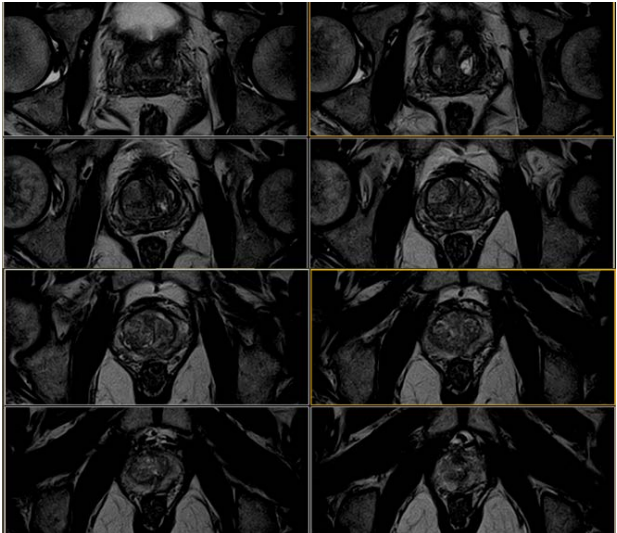


Figure 14 Pondered Axial in T2 high resolution (mpRM protocol)

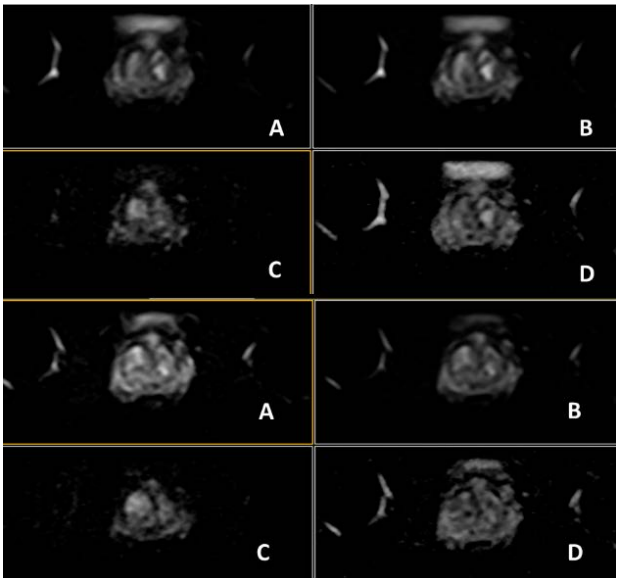


Figure 15 Axial DWI – A=b0, B=Iso b800, C=Iso b1000 e, D=Iso ADC (mpRM protocol)

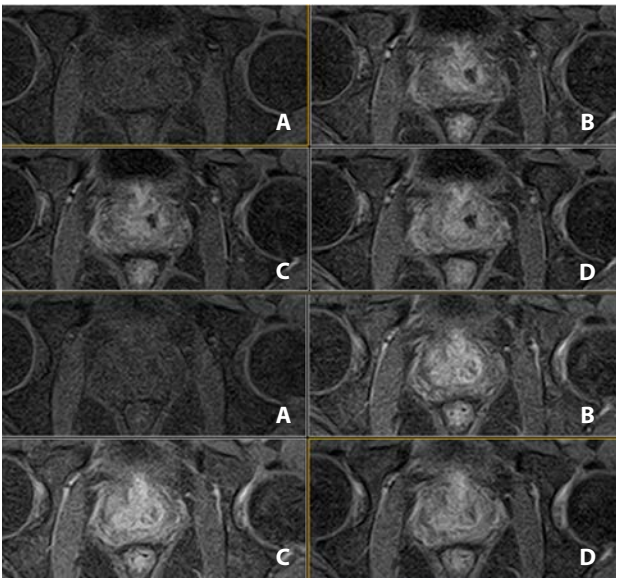


Figure 16 Dynamic Axial (12 phases): A=1ª phase pre, B=3ª phase pos, C=6ª phase pos, D=12ª phase (mpRM protocol)

Conclusion:

The Multiparametric Magnetic Resonance of Prostate (mpRM), show great advantages, because by optimizing the protocol, results in technical parameters (slice thickness, resolution and ponder) standardizing the image quality for utilizing precisely the PI-RADS interpretation , and it confirms as determinant at the clinical reality from patients, with incisive research data, and techniques whose association increase its elucidative spectrum and consequently, represents a precise help at the therapeutic handling definition.

References

1. CRELIM, 1988;
2. MOORE, 1984; LEE et al., 2001;
3. SHAPIRO et al., 1997; PARTIN e COFFEY, 1998; KERR, 2000;
4. Henry Vandyke Carter, Public domain, via Wikimedia Commons, <https://commons.wikimedia.org/wiki/File:Gray1160.png>
5. Rifkin MD, Zerhouni EA, Gatsonis CA, et al. Comparison of magnetic resonance imaging and ultrasonography in staging early prostate cancer. Results of a multi institutional cooperative trial. *N Engl J Med.* 1990;323:621-6.
6. Murphy G, Haider M, Ghai S, et al. The expanding role of MRI in prostate cancer. *AJR Am J Roentgenol.* 2013;201:1229-38.
7. Barentsz JO, Richenberg J, Clements R, et al. ESUR prostate MR guidelines 2012. *Eur Radiol.* 2012;22:746-5.
8. Westphalen AC, Rosenkrantz AB. Prostate imaging reporting and data system (PIRADS): reflections on early experience with a standardized interpretation scheme for multiparametric prostate MRI. *AJR Am J Roentgenol.* 2014;202:121-3
9. The Importance of Multiparametric Magnetic Resonance in Prostate Cancer Screening- DOI/ 10.29184/1980-7813.rcfmc.205. vol.13.n2.2018

Acknowledgement

Paulo César Aissa, BSc
Clínica Mama Imagem, São José do Rio Preto, SP, BR

Angela dos Santos Marin, BSc
Strategic Manager of Clinical Application - Magnetic Resonance Imaging
Departamento Comercial, Canon Medical Systems do Brasil

Disclaimer: The clinical results, performance and views described in this document are the experience of the health care providers. Results may vary due to clinical setting, patient presentation and other factors. Many factors could cause the actual results and performance of Canon's product to be materially different from any of the aforementioned.

CANON MEDICAL SYSTEMS CORPORATION

<https://global.medical.canon>

©Canon Medical Systems Corporation 2021. All rights reserved.
Design and specifications are subject to change without notice.
MCSMR0012EA 2021-03 CMSC/Produced in Japan

Canon Medical Systems Corporation meets internationally recognized standards for Quality Management System ISO 9001, ISO 13485. Canon Medical Systems Corporation meets the Environmental Management System standard ISO 14001.

Vantage Elan and Made for Life are trademarks of Canon Medical Systems Corporation.
PI-RADS is registered trademark of the American College of Radiology.

Made For life