Francesco De Cobelli

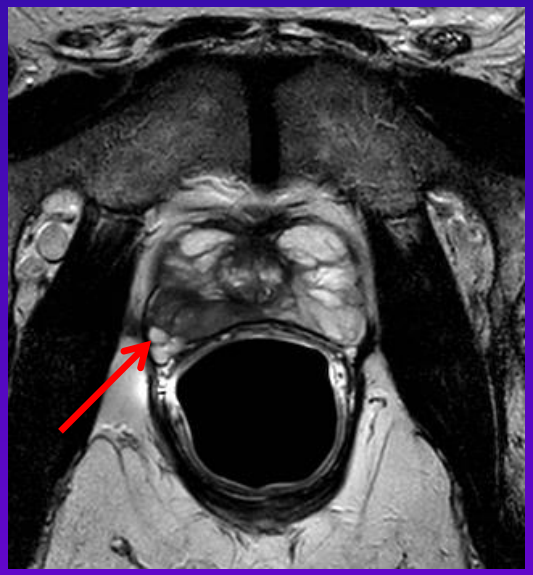
Dipartimento di Radiologia
Centro di Imaging Sperimentale
UNIVERSITA' VITA-SALUTE
IRCCS OSPEDALE SAN RAFFAELE
MILANO

Semeiotica multiparametrica, strutturazione del referto e pittfals

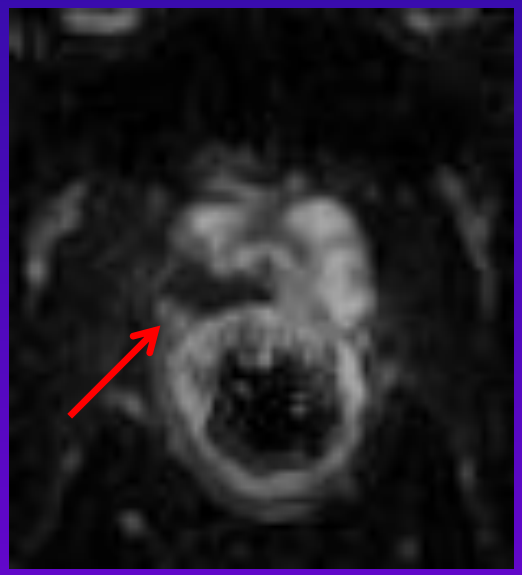
LA RISONANZA MAGNETICA (RM) DELLA PROSTATA

Esame multiparametrico:

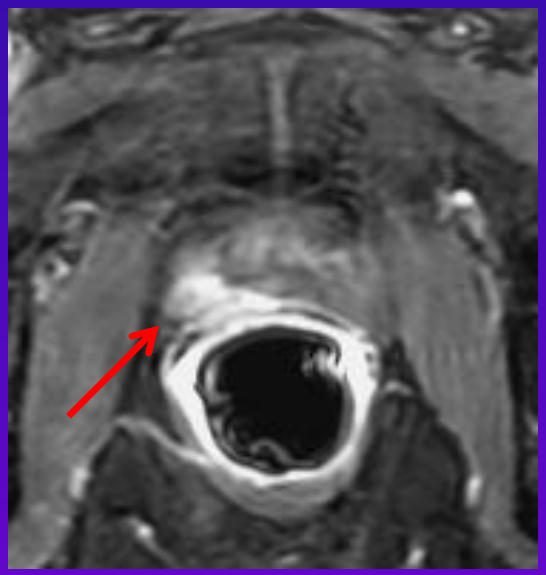
-Studio morfologico T2
-Studio di diffusione (DWI): cellularità
-Studio di perfusione: vascolarizzazione



T2 W



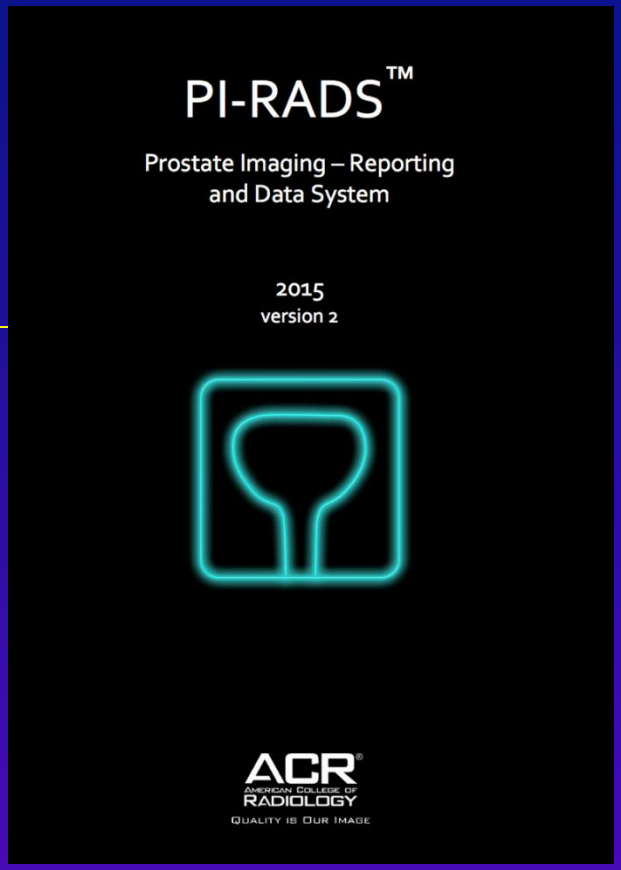
DWI: ADC



DCE

1. Weinreb JC, Barentsz JO et al. PI-RADS Prostate Imaging - Reporting and Data System: 2015, Version 2. Eur Urol. 2016 Jan;69(1):16-40.

mpMRI
PI-RADS v 2.0 - 2015



Prostate Imaging Reporting And Data System

- Division of the prostate in (at least) 16 regions
- Scores from T2WI, DWI e DCE-MRI
- Score assignation to each region:
  - Score 1 = Clinically significant disease is highly unlikely to be present;
  - Score 2 = Clinically significant cancer is unlikely to be present;
  - Score 3 = Clinically significant cancer is equivocal;
  - Score 4 = Clinically significant cancer is likely to be present
  - Score 5 = Clinically significant cancer is highly likely to be present.

mpMRI

PI-RADS - T2WI

Figure 3 – PI-RADS assessment for peripheral zone on T2-weighted imaging.

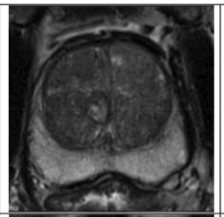
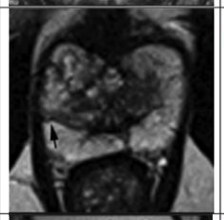
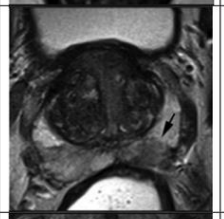
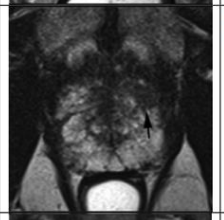
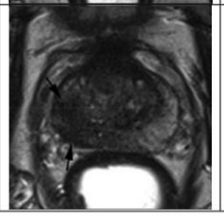
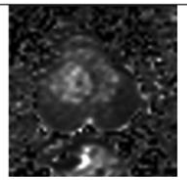
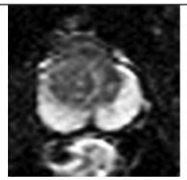
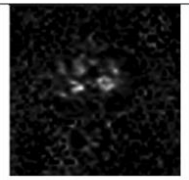
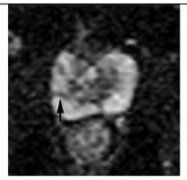
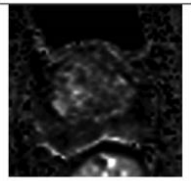
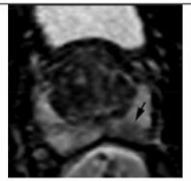
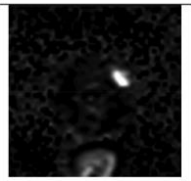
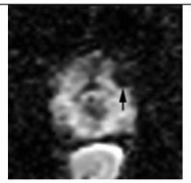
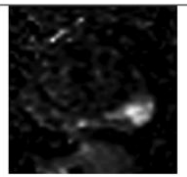
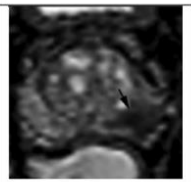
1		Uniform hyperintense signal intensity (normal).
2		Linear *(arrow)*, wedge-shaped, or diffuse mild hypointensity, usually indistinct margin.
3		Heterogeneous signal intensity or non-circumscribed, rounded, moderate hypointensity (*arrow*).
4		Circumscribed, homogenous moderate hypointense focus/mass confined to prostate and <1.5 cm in greatest dimension (*arrow*).
5		Same as 4 but ≥1.5cm in greatest dimension (*arrows*) or definite extraprostatic extension/invasive behavior.

Figure 5 – PI-RADS assessment for peripheral zone on diffusion weighted imaging.

1			No abnormality (i.e. normal) on ADC and high b- value DWI.
2			Indistinct hypointense on ADC (*arrow*).
3			Focal mildly/moderately hypointense on ADC (*arrow*) and isointense/mildly hyperintense on high b-value DWI.
4			Focal markedly hypointense on ADC (*arrow*) and markedly hyperintense on high b-value DWI; <1.5cm on axial images.
5			Same as 4 but ≥1.5cm in greatest dimension (*arrow*) or definite extraprostatic extension / invasive behavior.
	High b-value DWI	ADC map	

mpMRI
PI-RADS - DWI

Figure 4 – PI-RADS assessment for transition zone on T2-weighted imaging.

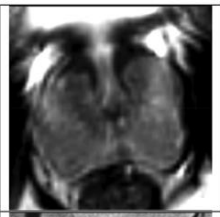
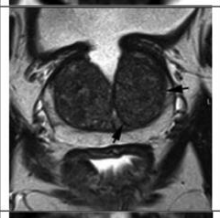
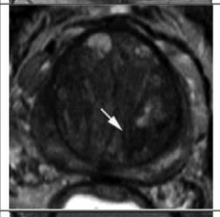
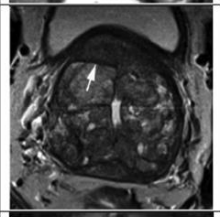
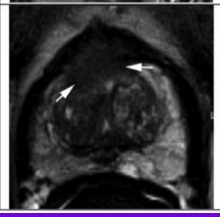
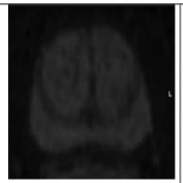
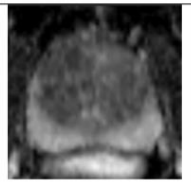
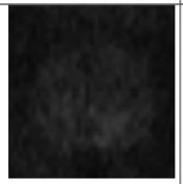
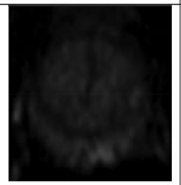
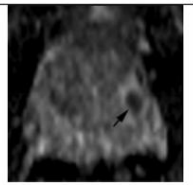
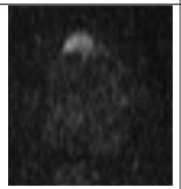
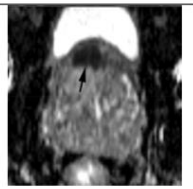
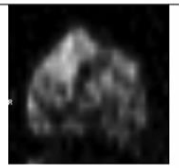
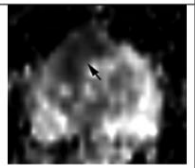
1		Homogeneous intermediate signal intensity (normal).
2		Circumscribed (*arrows*) hypointense or heterogeneous encapsulated nodule(s) (BPH).
3		Heterogeneous signal intensity with obscured margins (*arrow*). Includes others that do not qualify as 2, 4, or 5.
4		Lenticular (*arrow*) or non- circumscribed, homogeneous, moderately hypointense, and <1.5 cm in greatest dimension.
5		Same as 4, but ≥1.5cm in greatest dimension (*arrows*) or definite extraprostatic extension/invasive behavior.

Figure 6 – PI-RADS assessment for transition zone on diffusion weighted imaging.

1			No abnormality (i.e. normal) on ADC and high b-value DWI.
2			Indistinct hypointense on ADC.
3			Focal mildly/moderately hypointense on ADC (*arrow*) and isointense/mildly hyperintense on high b-value DWI.
4			Focal markedly hypointense on ADC (*arrow*) and markedly hyperintense on high b-value DWI; <1.5cm on axial images.
5			Same as 4 but ≥1.5cm in greatest dimension (*arrow*) or definite extraprostatic extension / invasive behavior.
	High b-value DWI	ADC map	

mpMRI PI-RADS – versione 2

PI-RADS™

Prostate Imaging – Reporting and Data System

2015
version 2

ACR
American College of Radiology
Quality is Our Image

PI-RADS™ v2

PI-RADS Assessment

Peripheral Zone (PZ)

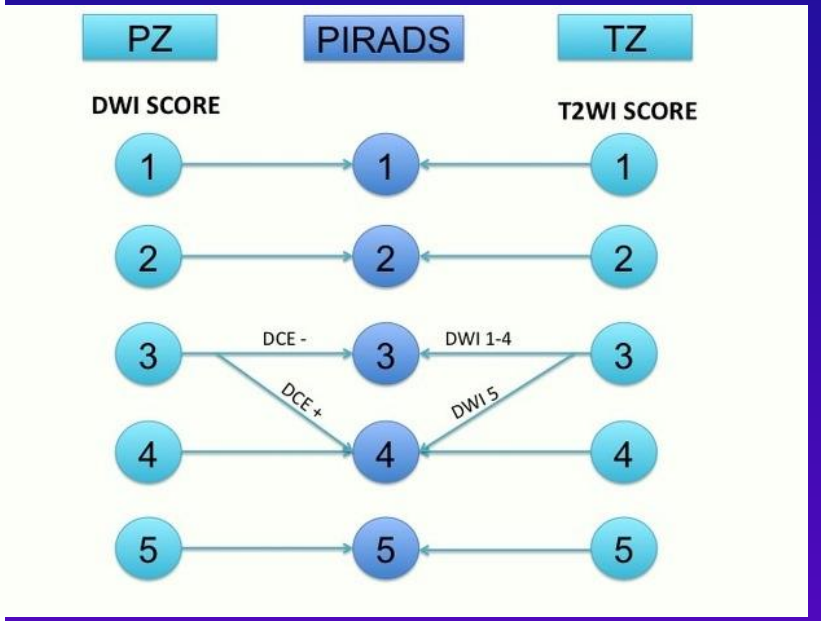
DWI	T2W	DCE	PI-RADS
1	Any*	Any	1
2	Any	Any	2
3	Any	–	3
		+	4
4	Any	Any	4
5	Any	Any	5

* "Any" indicates 1-5

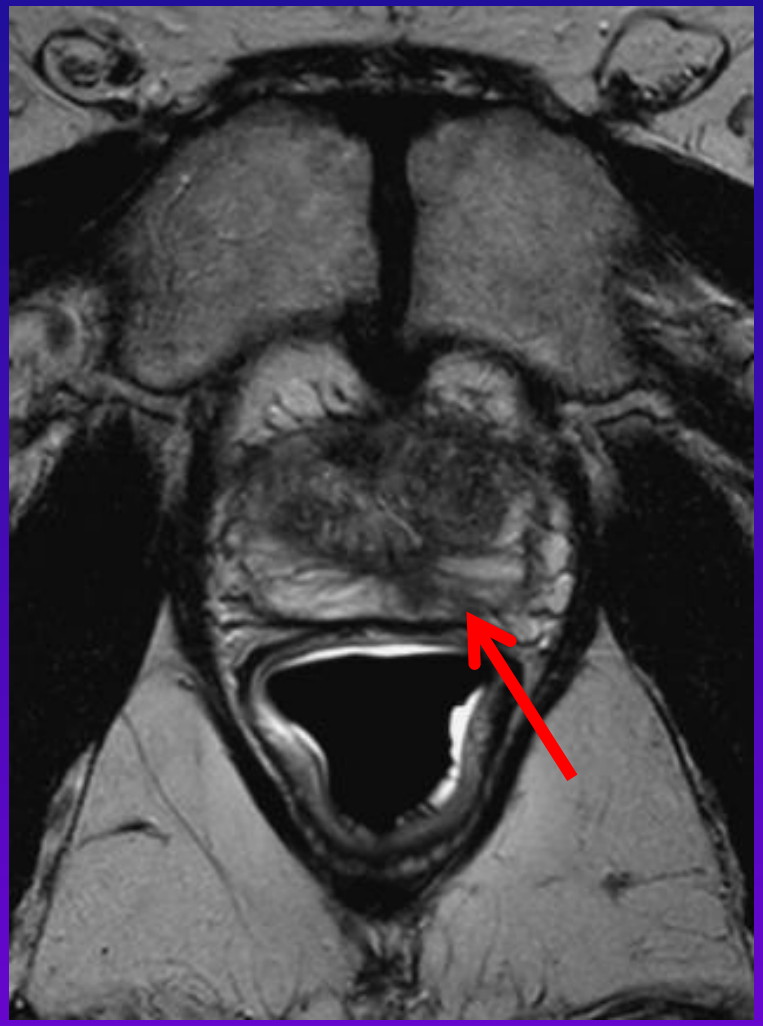
Transition Zone (TZ)

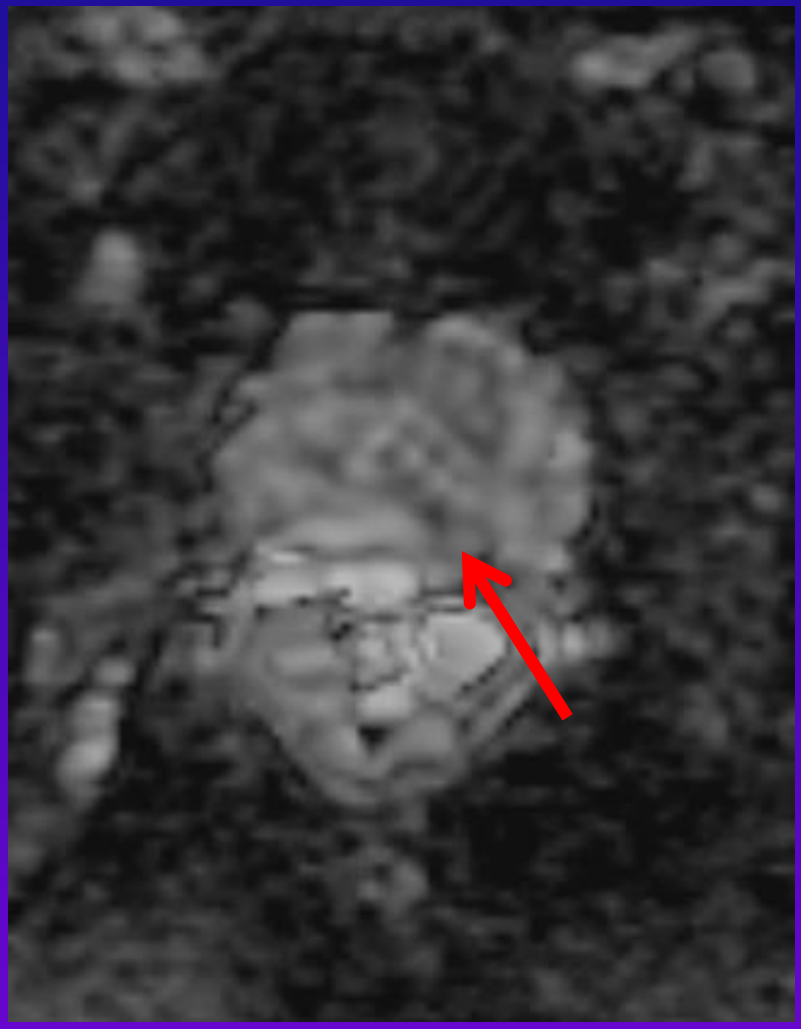
T2W	DWI	DCE	PI-RADS
1	Any*	Any	1
2	Any	Any	2
3	≤4	Any	3
	5	Any	4
4	Any	Any	4
5	Any	Any	5

* "Any" indicates 1-5

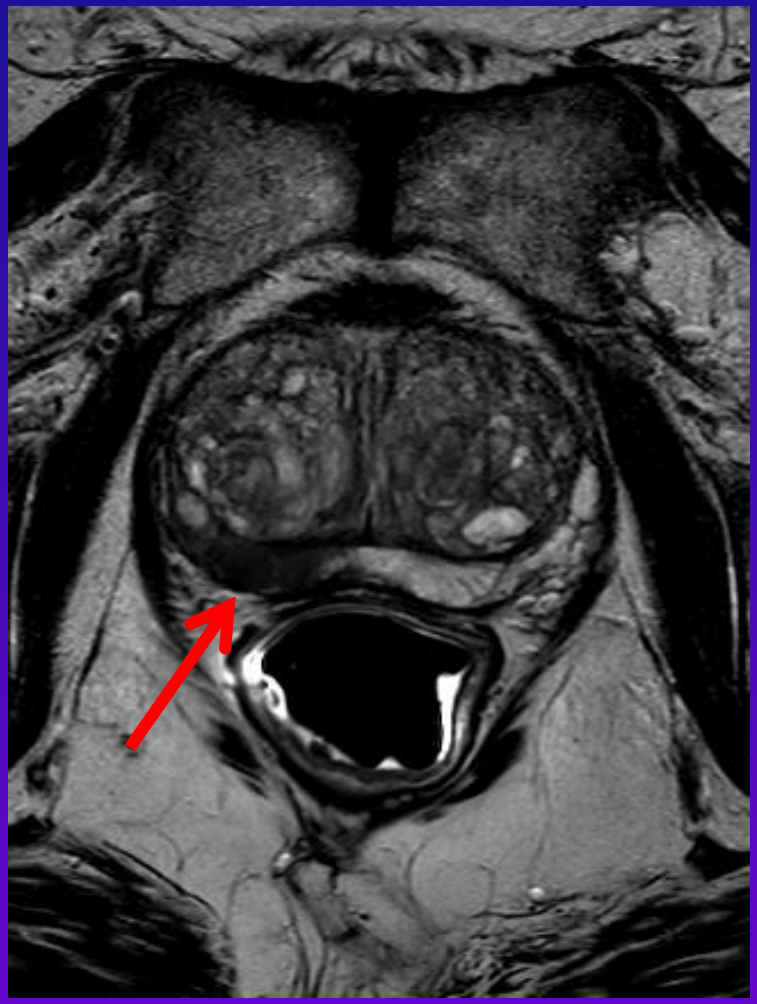


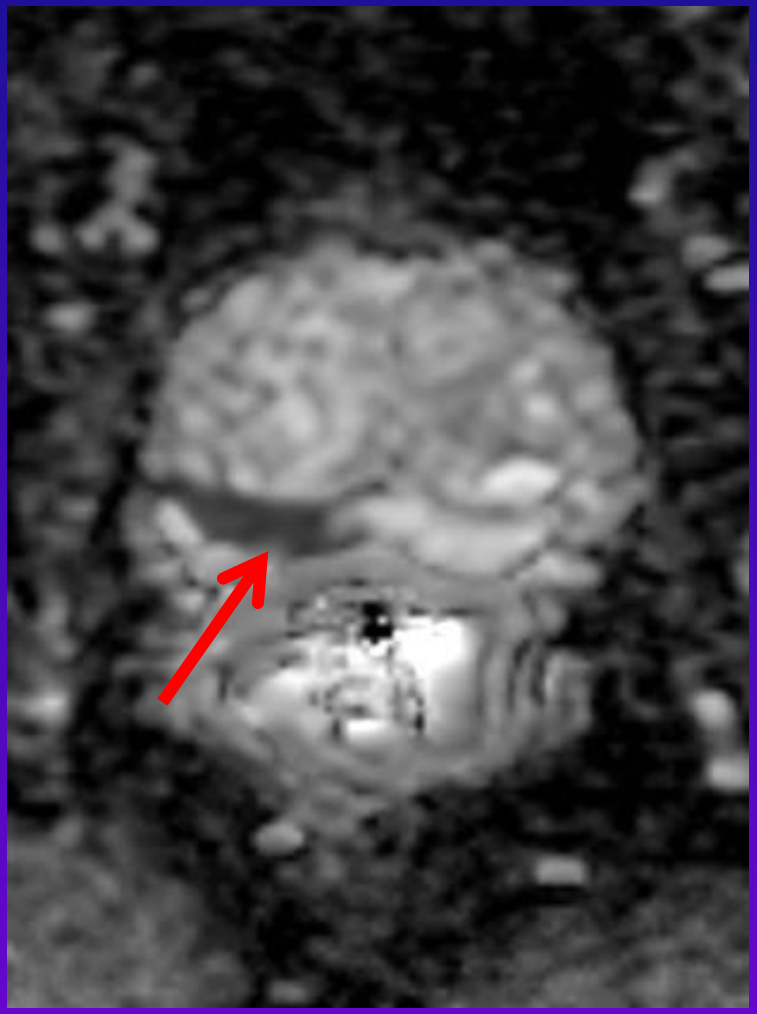
PIRADS 3



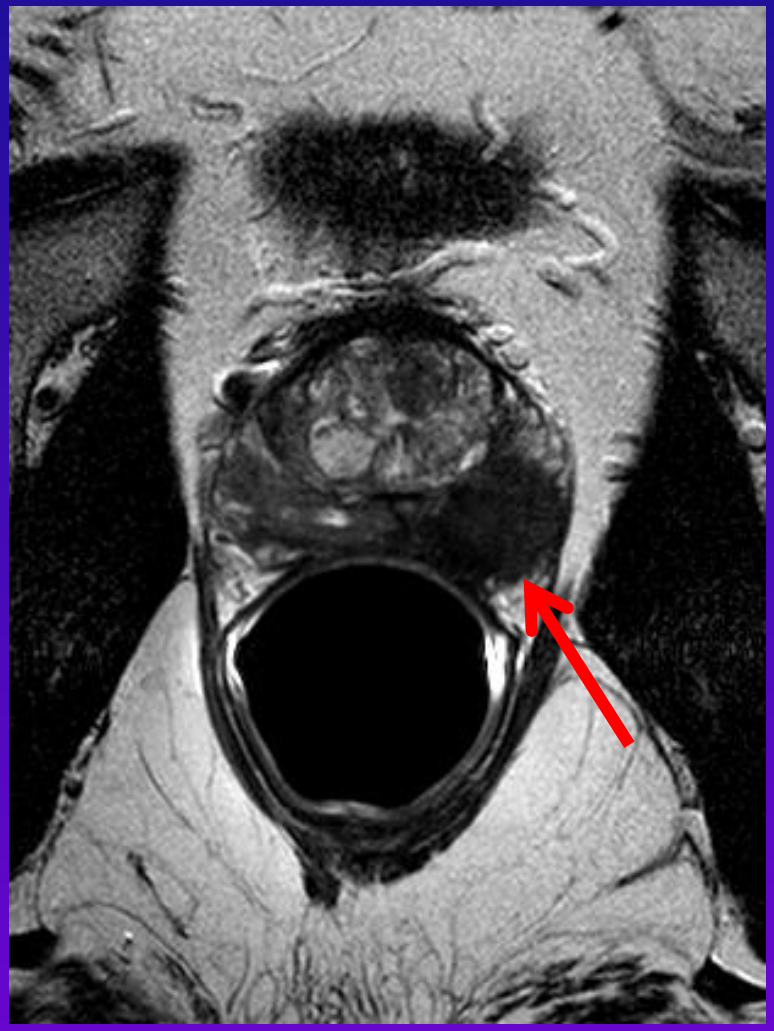


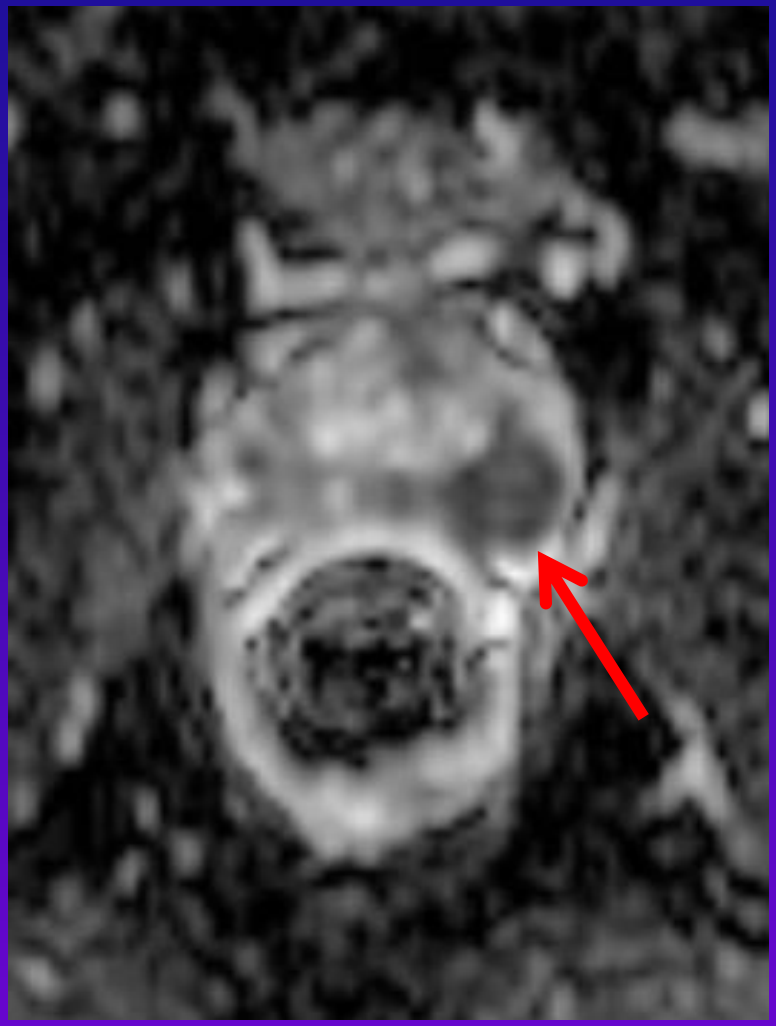
PIRADS 4

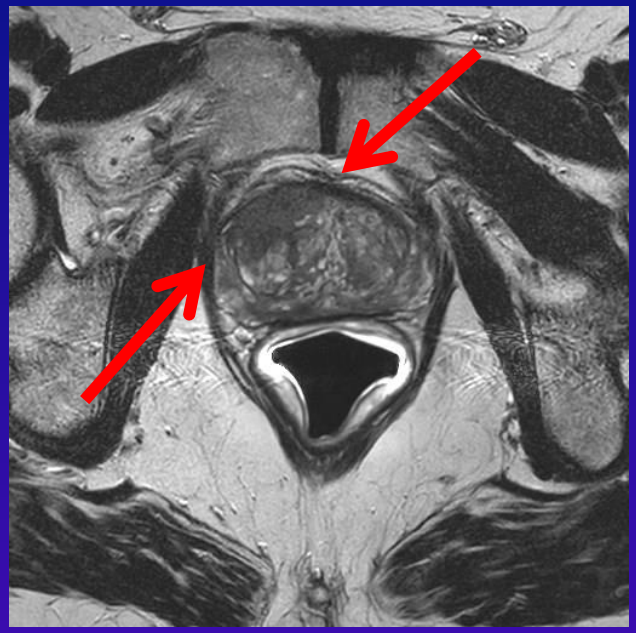


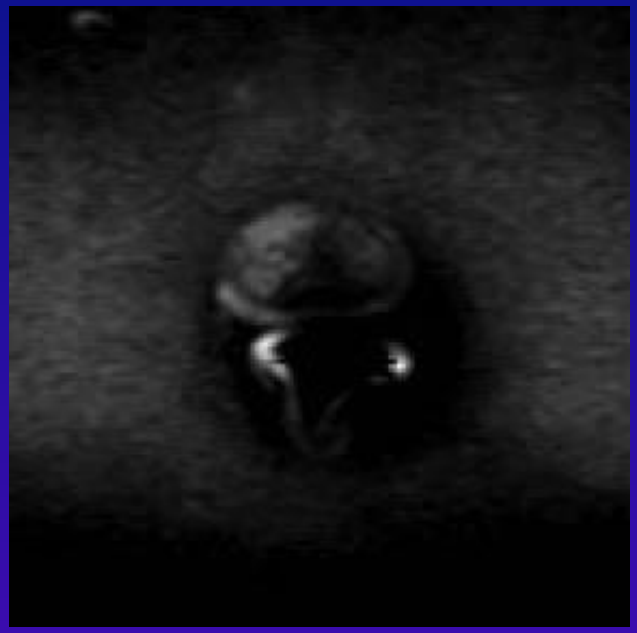


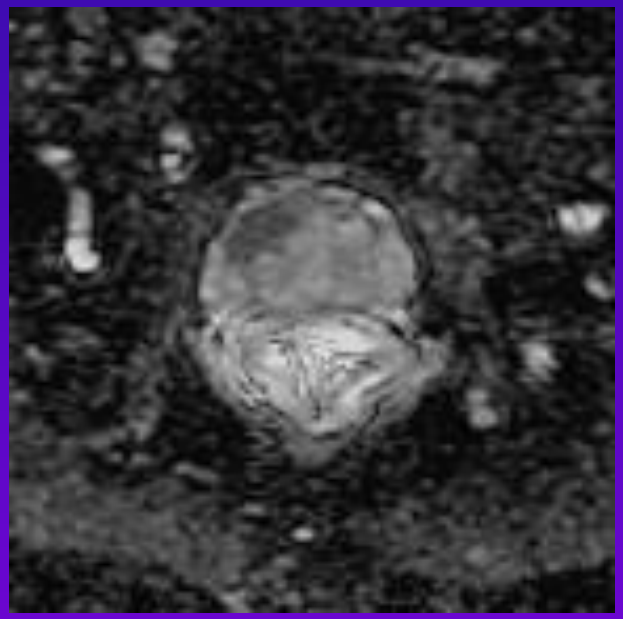
PIRADS 5

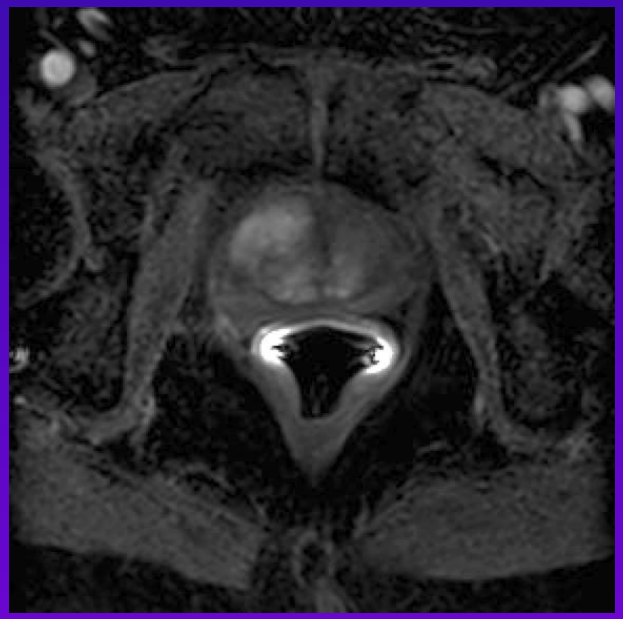




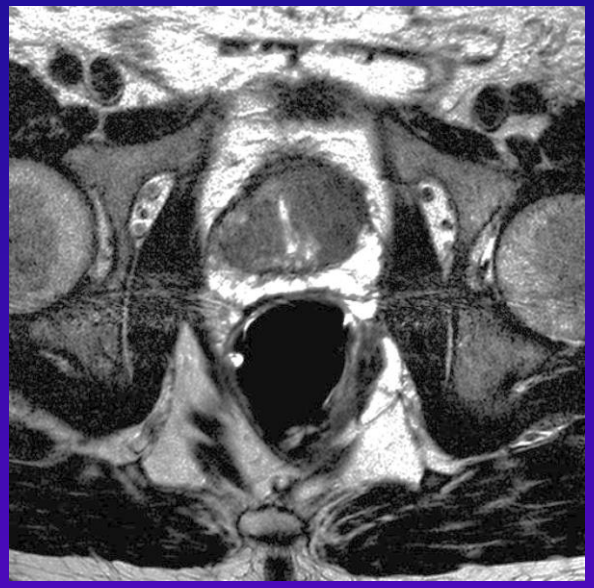


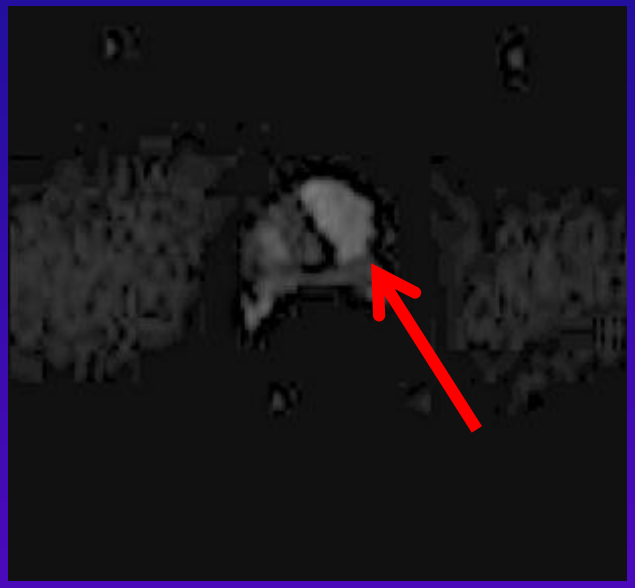


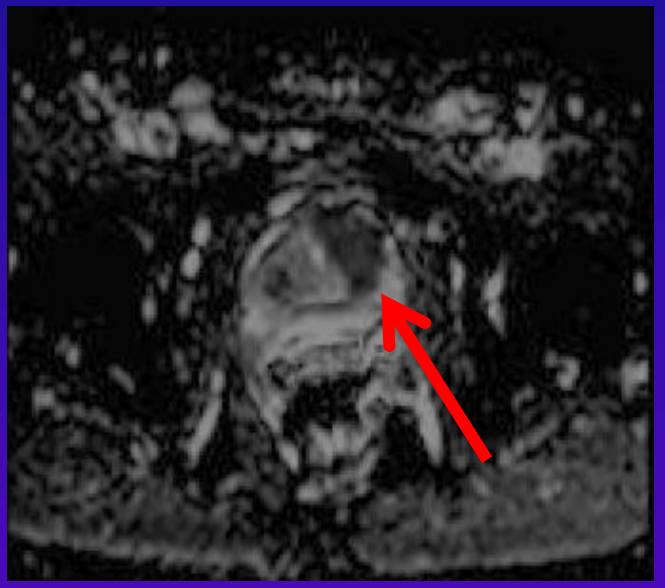


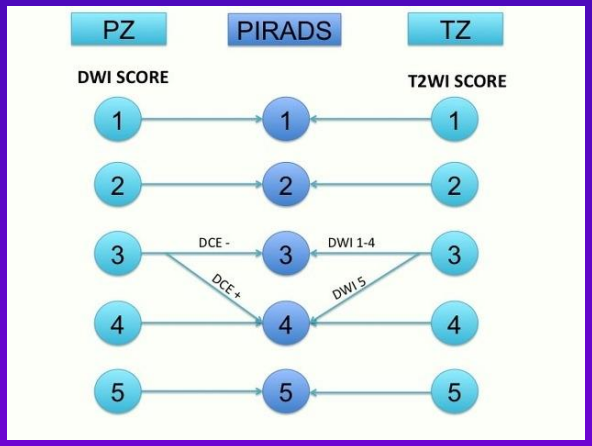


T2 PIRADS 3? T2 PIRADS 4? + DWI PIRADS 5









Transition Zone (TZ)

T2W	DWI	DCE	PI-RADS
1	Any*	Any	1
2	Any	Any	2
3	≤4	Any	3
	5	Any	4
4	Any	Any	4
5	Any	Any	5

* "Any" indicates 1-5

PIRADS 4

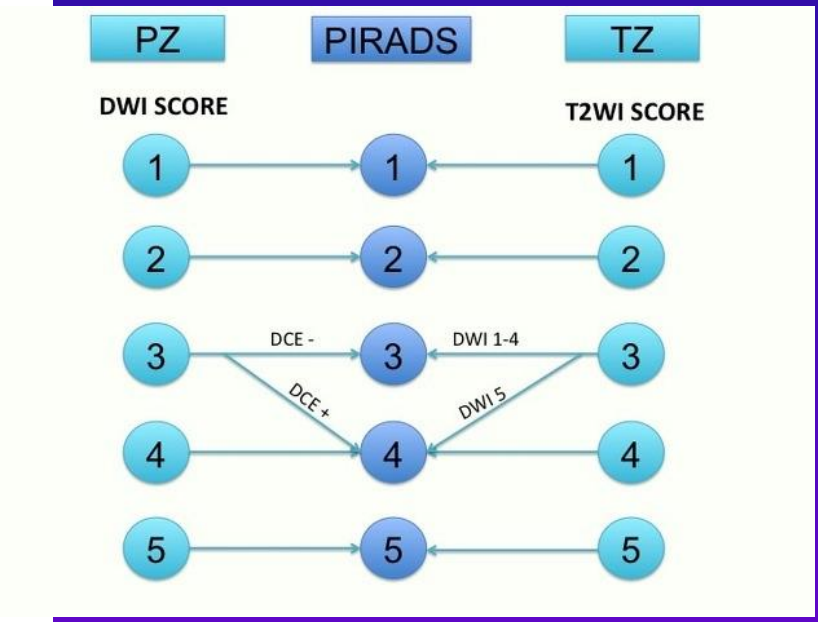
mpMRI PI-RADS - DCE-MRI

PI-RADS v2

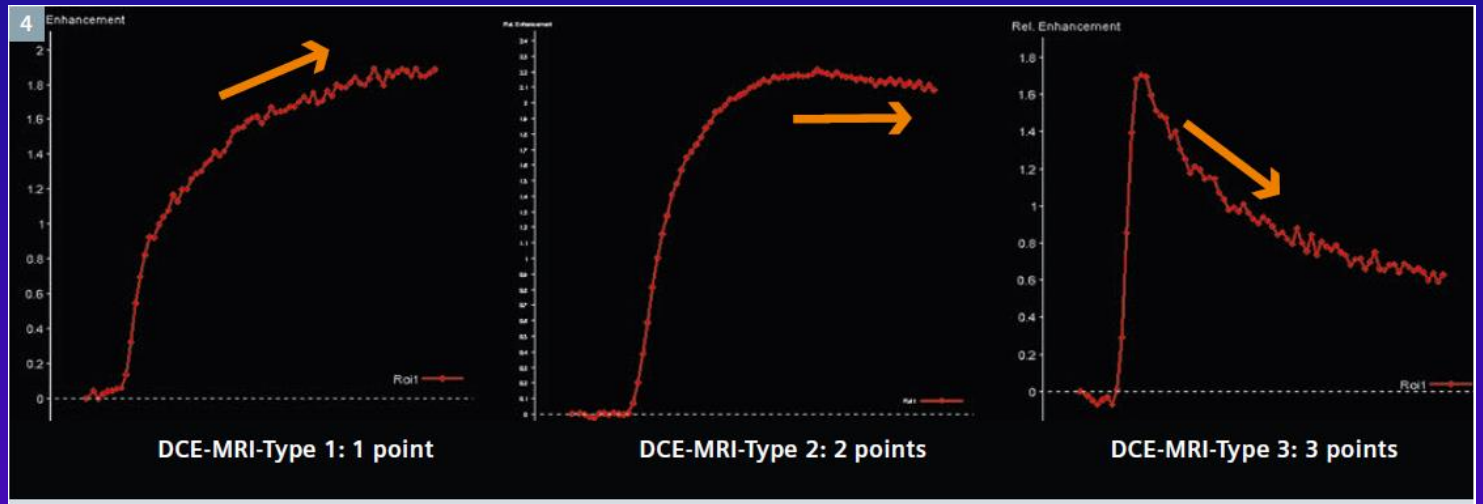
Prostate Imaging and Reporting and Data System: Version 2

Considerable effort has gone into "curve typing" (i.e. plotting the kinetics of a lesion as a function of signal vs. time). However, there is great heterogeneity in enhancement characteristics of prostate cancers, and at present there is little evidence in the literature to support the use of specific curve types. Another approach is the use of compartmental pharmacokinetic modeling, which incorporates contrast media concentration rather than raw signal intensity and an arterial input function to calculate time constants for the rate of contrast agent wash-in (K^{trans}) and wash-out (k_{ep}). Commercial software programs are available that produce "maps" of K^{trans} and k_{ep} and may improve lesion conspicuity. Although pharmacodynamic (PD) analysis may provide valuable insights into tumor behavior and biomarker measurements for drug development, the PI-RADS Steering Committee believes there is currently insufficient peer reviewed published data or expert consensus to support routine adoption of this method of analysis for clinical use.

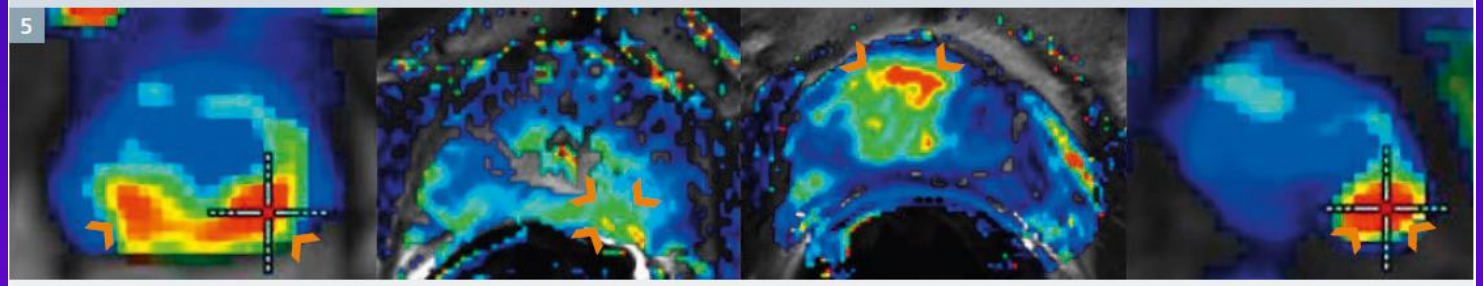
Thus, for PI-RADS v2, a "positive" DCE MRI lesion is one where the enhancement is foca earlier or contemporaneous with enhancement of adjacent normal prostatic tissues, and corresponds to a finding on T2W and/or DWI. In the TZ, BPH nodules frequently enhance early, but they usually exhibit a characteristic benign morphology (round shape, well circumscribed). A "negative" DCE MRI lesion is one that either does not enhance early compared to surrounding prostate or enhances diffusely so that the margins of the enhancing area do not correspond to a finding on T2W and/or DWI.



mpMRI
PI-RADS - DCE-MRI



4 PI-RADS classification of DCE-MRI, part 1: Curve types.



DCE-MRI – symmetric, non-focal: + 0 points

DCE-MRI – asymmetric, non-focal: + 1 point

DCE-MRI – asymmetric, unusual location: + 2 points

DCE-MRI – asymmetric, focal location: + 2 points

5 PI-RADS classification of DCE-MRI, part 2: Additional points for distribution patterns with curve types II + III.

mpMRI
PI-RADS – Final score

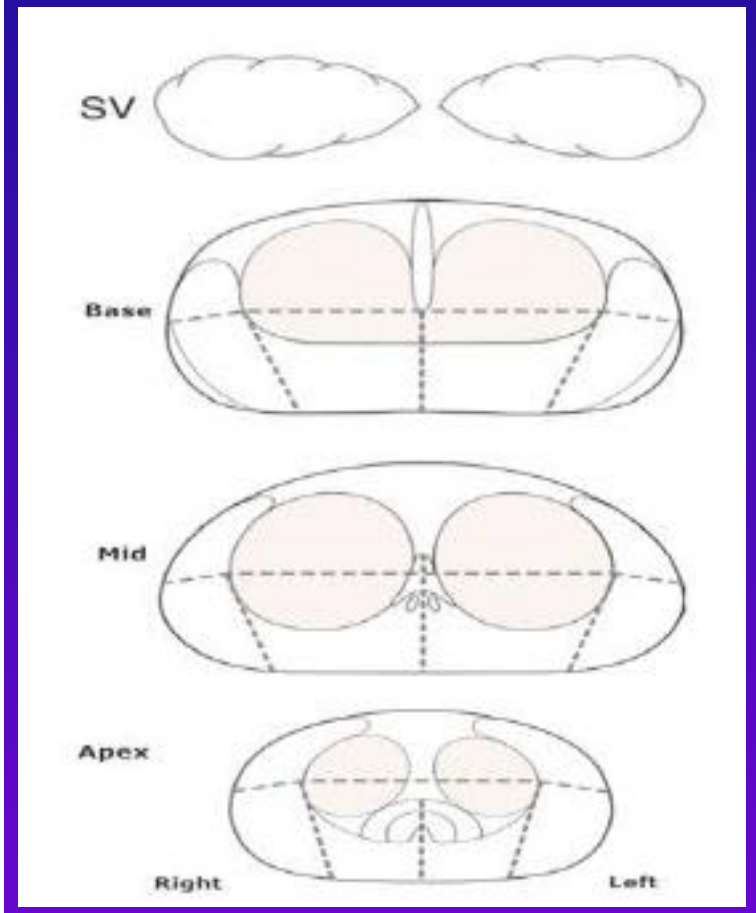
OSPEDALE SAN RAFFAELE
RISONANZA MAGNETICA PROSTATICA TRANSRETTALE
COGNOME E NOME PAZIENTE

	laterale dx	mediana dx	transizionale dx	transizionale sn	mediana sn	laterale sn
vescicole	1					1
base	4	1	1	1	1	2
media	2	2	1	1	2	2
apice		2	1	1	1	
sfintere			1	1		

Scala:
1 = Neoplasia significativa altamente improbabile
2 = Neoplasia significativa improbabile
3 = Neoplasia significativa dubbia
4 = Neoplasia significativa probabile
5 = Neoplasia significativa altamente probabile

NEOPLASIA SIGNIFICATIVA Lesioni di volume > 0,5cc o Gleason Score 3+4 o superiore.

Synopsis of the PI-RADS v2 Guidelines for Multiparametric Prostate Magnetic Resonance Imaging and Recommendations for Use. European Urology 2016



mpMRI
PI-RADS – Report

Motivo della richiesta: rialzo del PSA.

TECNICA DI STUDIO
Esame eseguito con tecnica multiparametrica con acquisizioni multiplanari T1 e T2 pesate, con sequenze pesate in diffusione e con studio dinamico perfusionale durante infusione e.v. di m.d.c. paramagnetico (Gadovist).

REFERTO RADIOLOGICO
DIMENSIONI
Prostata di dimensioni marcatamente aumentate (diametro longitudinale 77 mm, trasverso 69 mm, antero-posteriore 61 mm), per un volume complessivo di circa 170 cc, con voluminoso adenoma che impronta e solleva il pavimento vescicale del volume di circa 110 cc.
ASPETTI MORFOLOGICI
Zona periferica assottigliata, ad intensità di segnale disomogenea per la presenza di strie ipointense di aspetto flogistico cronico.
Noduli di iperplasia stromale, ghiandolare, calcificazioni e cisti da ritenzione a carico della zona transizionale.
LESIONI
Non sono evidenti lesioni con caratteristiche RM di neoplasia significativa a carico della regione periferica o transizionale (PIRADS score 1/5)
CAPSULA
Conservato il profilo capsulare.
VESCICOLE SEMINALI
Vescicole seminali normodistese, nei limiti per morfologia ed intensità di segnale.
VIE URINARIE
Vescica discretamente distesa, senza evidenti ispessimenti patologici.
LINFONODI PELVICI
Non linfonodi aumentati di dimensioni.
STRUTTURE SCHELETRICHE PELVICHE
Non lesioni a carico delle ossa del bacino.

CONCLUSIONI: non alterazioni focali sospette per neoplasia prostatica significativa secondo i criteri PI-RADS v.2.

mpMRI– PIRADS 2.0

EURURO-7872; No. of Pages 12

ARTICLE IN PRESS

EUROPEAN UROLOGY XXX (2018) XXX–XXX

available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Prostate Cancer

Editorial by XXX on pp. x–y of this issue

Prostate Imaging-Reporting and Data System Steering Committee: PI-RADS v2 Status Update and Future Directions

Anwar R. Padhani[a], Jeffrey Weinreb[b], Andrew B. Rosenkrantz[c], Geert Villeirs[d], Baris Turkbey[e], Jelle Barentsz[f,]*

mpMRI– PIRADS 2.0

PIRADS 2.0 - LIMITI

- Variabilità interosservatore moderata anche tra esperti
  i. Particolarmente nella regione transizionale
- PIRADS non chiaro nella differenziazione fra scores DWI 3 e 4-5
- PIRADS non è chiaro positività della DCE nella ZT
- PIRADS non aiuta nell'identificazione dei tumori anteriori-suoperiori che originano dalla zona centrale

mp-MRI SEMEIOTICA

PITFALLS

Radiologist, Be Aware: Ten Pitfalls That Confound the Interpretation of Multiparametric Prostate MRI

Andrew B. Rosenkrantz[1]
Samir S. Taneja[2]

OBJECTIVE. In this article, we describe 10 diagnostic challenges that may confound the interpretation of multiparametric prostate MRI for tumor, grouped into three categories on the basis of our experience: normal anatomic structures that may be misinterpreted as suspicious lesions if their normal appearance is not recognized, benign processes that may mimic tumor, and technical issues relating to acquisition and interpretation of diffusion-weighted imaging that may decrease sensitivity for tumor. Strategies for addressing these challenges are suggested.

CONCLUSION. It is important that the radiologist involved in the interpretation of prostate MRI be aware of these pitfalls that will be encountered during routine clinical practice. This awareness can contribute to improved diagnostic performance in MRI interpretation.

GENITOURINARY IMAGING

162

Benign Conditions That Mimic Prostate Carcinoma: MR Imaging Features with Histopathologic Correlation[1]

Yu Xuan Kitzing, MBBS
Adilson Prando, MD
CeliVarol, MBBS
Gregory S. Karczmar, PhD
Fiona Maclean, MBBS
Aytekin Oto, MD

Multiparametric magnetic resonance (MR) imaging combines a
tomic and functional imaging techniques for evaluating the prost
and is increasingly being used in diagnosis and management of p
tate cancer. A wide spectrum of anatomic and pathologic proces
in the prostate may masquerade as prostate cancer, complicating
imaging interpretation. The histopathologic and imaging finding

Insights Imaging (2015) 6:449–463
DOI 10.1007/s13244-015-0411-3

REVIEW

False positive and false negative diagnoses of prostate cancer at multi-parametric prostate MRI in active surveillance

Jeffrey S. Quon[1] · Bardia Moosavi[1] · Maneesh Khanna[2] · Trevor A. Flood[3] · Christopher S. Lim[1] · Nicola Schieda[1]

ELSEVIER

Seminars in
ROENTGENOLOGY

Common Technical and Anatomical Pitfalls in the Evaluation of Multiparametric Prostate Magnetic Resonance Imaging

CrossMark

Xiaozhou Liu, BS,[*,†] and Sadhna Verma, MD[‡]

BJR

© 2014 The Authors. Published by the British Institute of Radiology

Received: 16 October 2013 | Revised: 6 March 2014 | Accepted: 17 March 2014

doi: 10.1259/bjr.20130659

Cite this article as:
Yu J, Fulcher AS, Turner MA, Cockrell CH, Cote EP, Wallace TJ. Prostate cancer and its mimics at multiparametric prostate MRI. Br J Radiol 2014;87:20130659.

PICTORIAL REVIEW

Prostate cancer and its mimics at multiparametric prostate MRI

[1]J YU, MD, [1]A S FULCHER, MD, [1]M A TURNER, MD, [1]C H COCKRELL, MD, [2]E P COTE, MD and [3]T J WALLACE, MD

mp-MRI
SEMEIOTICA

PITFALLS

Radiologist, Be Aware: Ten Pitfalls That Confound the Interpretation of Multiparametric Prostate MRI

Andrew B. Rosenkrantz[1]
Samir S. Taneja[2]

OBJECTIVE. In this article, we describe 10 diagnostic challenges that may confound the interpretation of multiparametric prostate MRI for tumor, grouped into three categories on

TABLE 1: Pitfalls That Confound the Interpretation of Multiparametric Prostate MRI as Organized in This Article

Category	Pitfall
Normal anatomic structures that may be mistaken for tumor	I. Central zone (Fig. 1)
	II. Thickening of surgical capsule (Fig.2)
	IIIA. Periprostatic venous plexus (Fig. 3)
	IIIB. Neurovascular bundle (Fig. 4)
Noncancerous abnormalities that can mimic tumor	IV. Postbiopsy hemorrhage (Fig. 5)
	V. Stromal BPH nodule (Fig. 6)
	VI. Acute and chronic prostatitis and postinflammatory scars and atrophy (Fig. 7)
	VII. Granulomatous prostatitis (Fig. 8)
Technical challenges related to diffusion-weighted imaging	VIII. Anatomic distortion of high-b-value diffusion-weighted images (Fig. 9)
	IX. Lack of suppression of benign prostate tissue on standard high-b-value diffusion-weighted images (Fig. 10)
	X. Suboptimal windowing of the ADC map (Fig. 11)

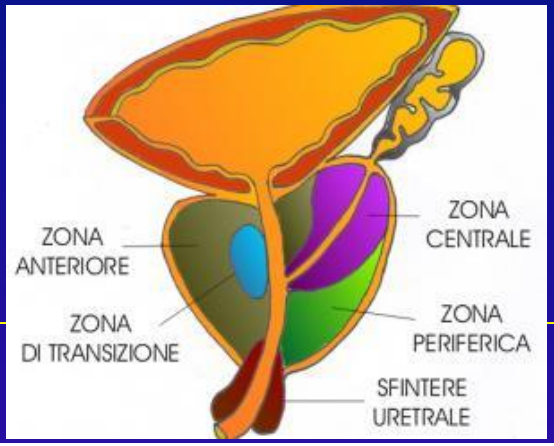
Note—BPH = benign prostatic hyperplasia, ADC = apparent diffusion coefficient.

mp-MRI
SEMEIOTICA

PITFALLS (*ovvero falsi positivi)*

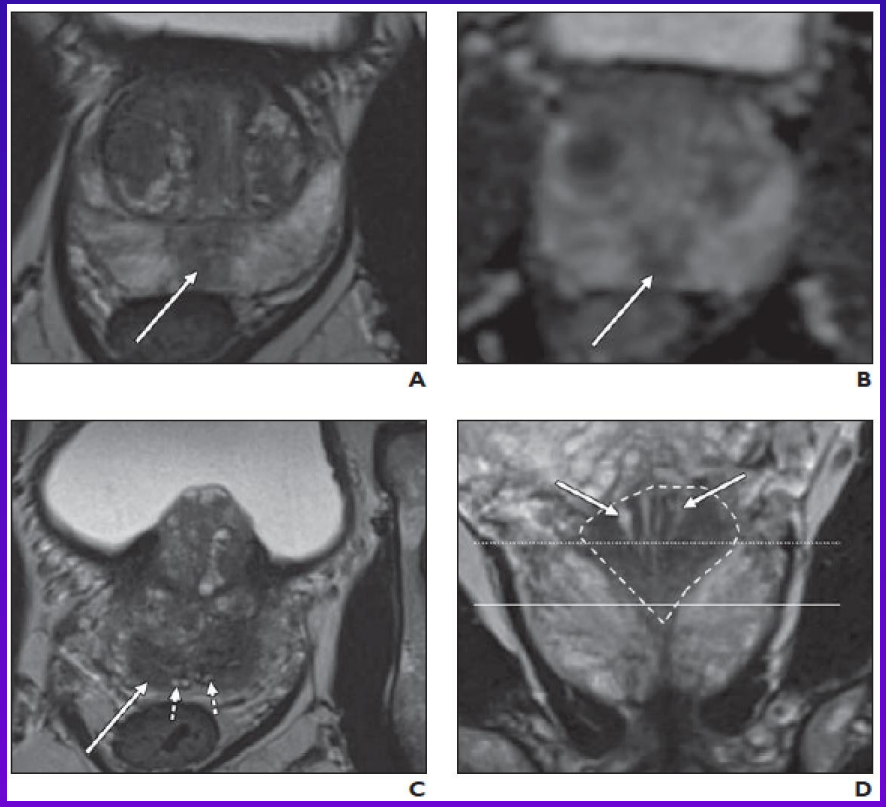
- Anatomic pitfalls
  - Zona centrale
  - Ispessimento focale capsula chirurgica
- Emorragia e prostatite post-biopsia
  - Almeno 4-6 settimane dopo la biopsia
  - Semeiotica seuqneze T1! (sangue = ipersegnale)
- Noduli di prostatite acuta
- Prostatite granulomatosa
- Pseudonodulazione centrale
- Noduli stromali

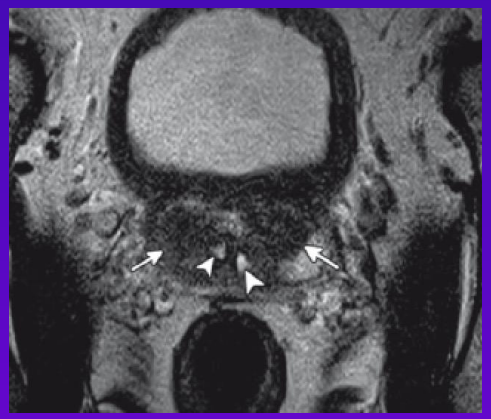
mp-MRI
Zona centrale

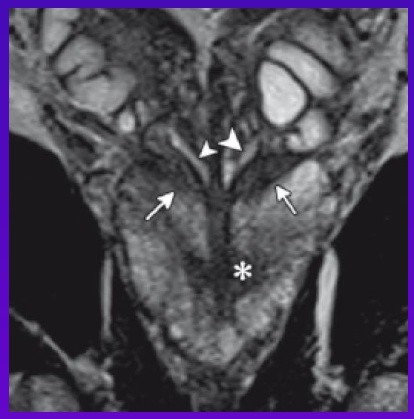


- Regione simmetrica con segnale ipo in T2 alla base della prostata adiacente ai dotti eiaculatori.

the central gland [25, 26]. The central gland in most adult males consists of hypertrophied TZ that compresses the CZ against the surgical capsule [25]. Currently, it is acknowledged that the CZ can be identified separately from the TZ in up to 4/5 of males and the CZ appears as a symmetric band of homogeneously low signal intensity (SI) on T2W MRI and apparent diffusion coefficient (ADC) maps best seen at the prostate base [25], (Fig. 1).





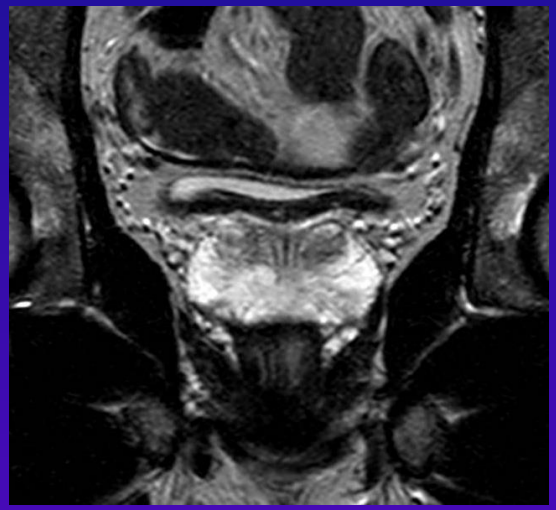


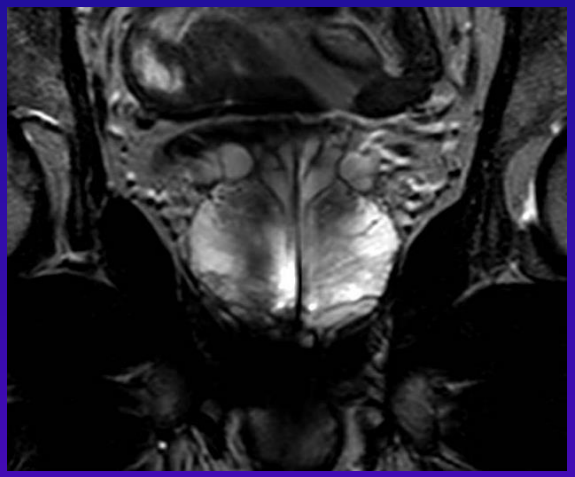
Rosenkrantz AB et al. AJR 2014

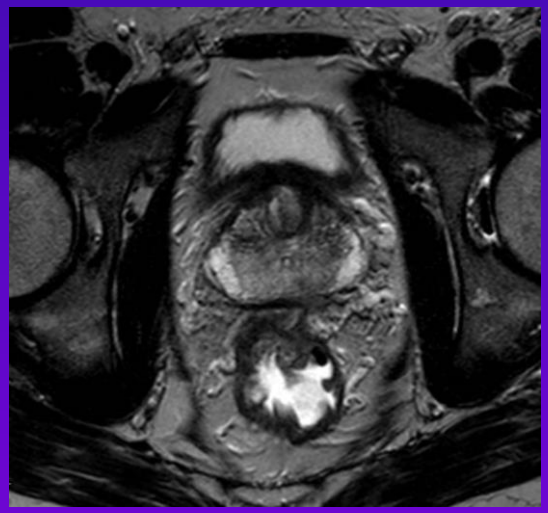
Quon JS et al. Insights Imaging 2015

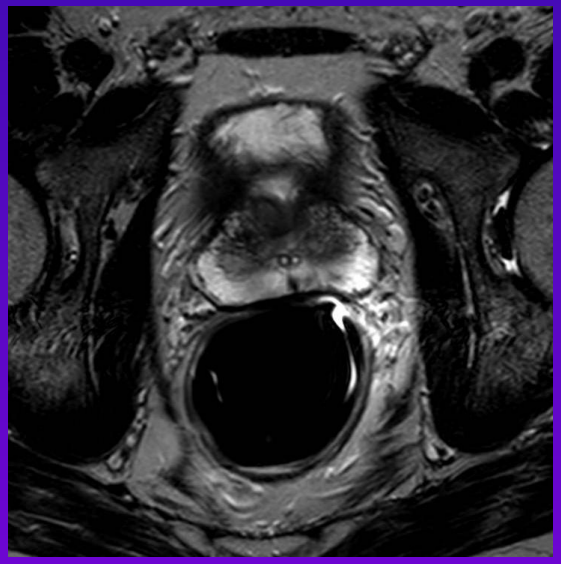
Kitzing YX et al. Radiographics 2016

mp-MRI
Zona centrale



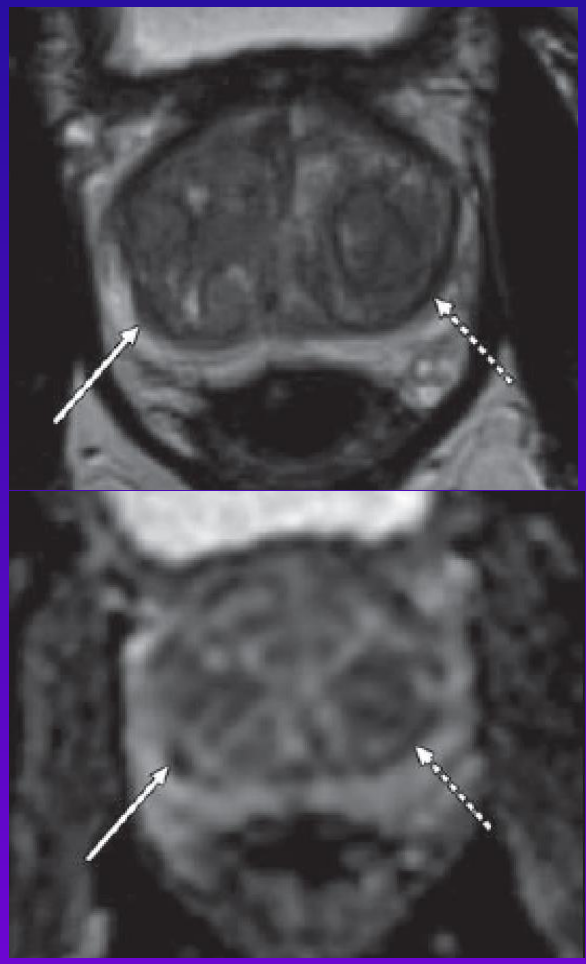


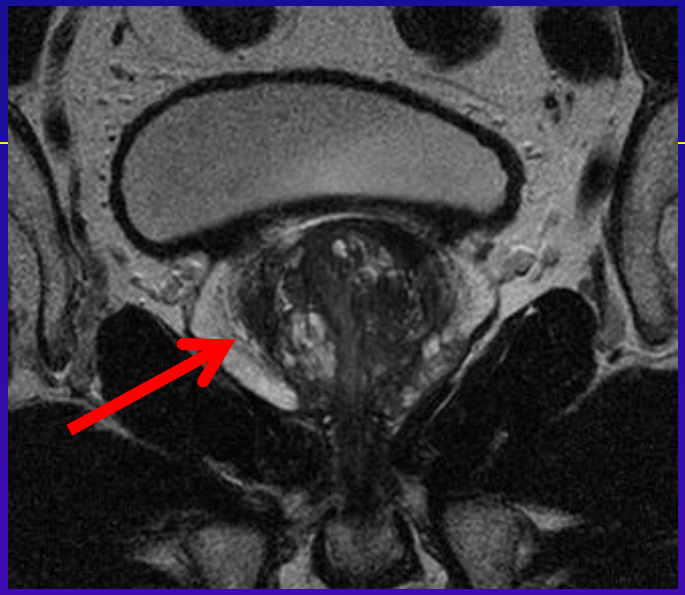


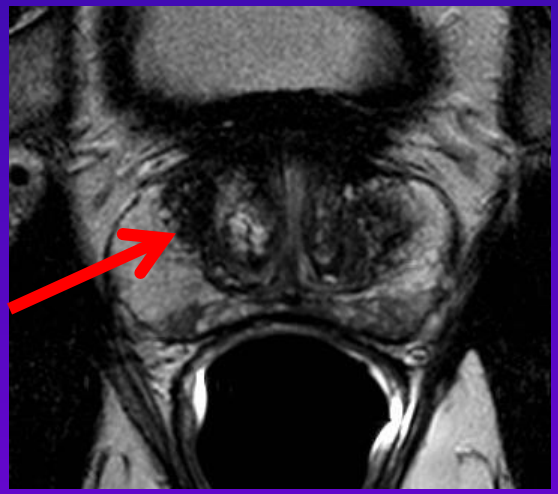


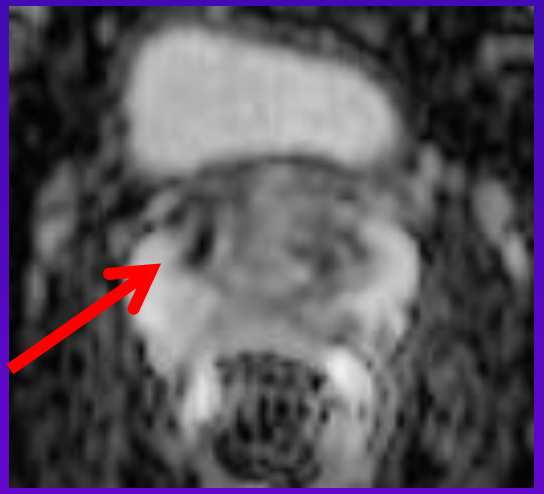
mp-MRI
Capsula chirurgica

- Ispessimento focale capsula chirurgica.





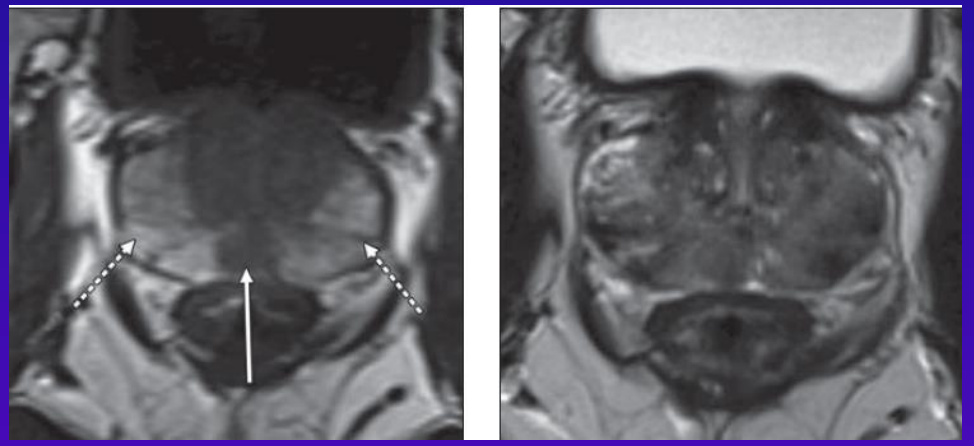




Rosenkrantz AB et al. AJR 2014
Quon JS et al. Insights Imaging 2015
Kitzing YX et al. Radiographics 2016

mp-MRI
Correct Timing

- At least 4-6 weeks after biopsies to avoid biopsy-related haemorrhage artefacts.



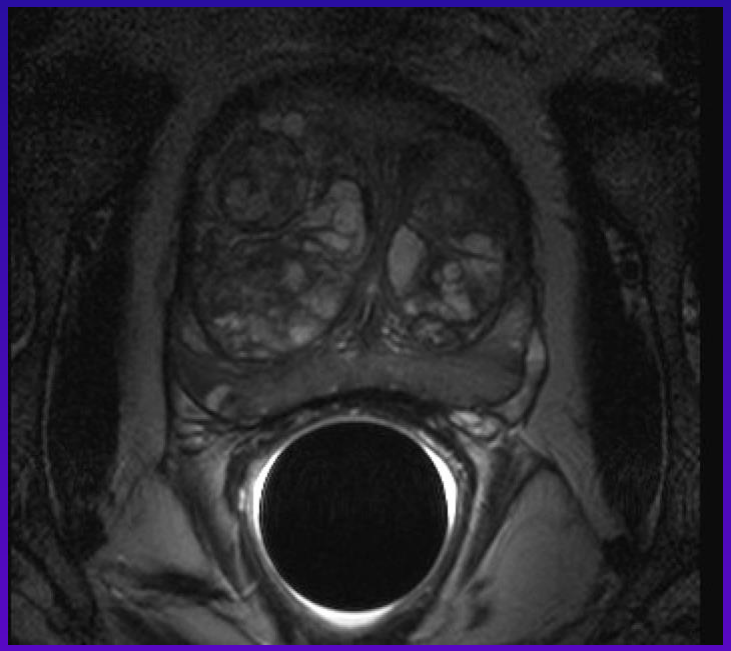
Eur Radiol (2012) 22:746–757
DOI 10.1007/s00330-011-2377-y

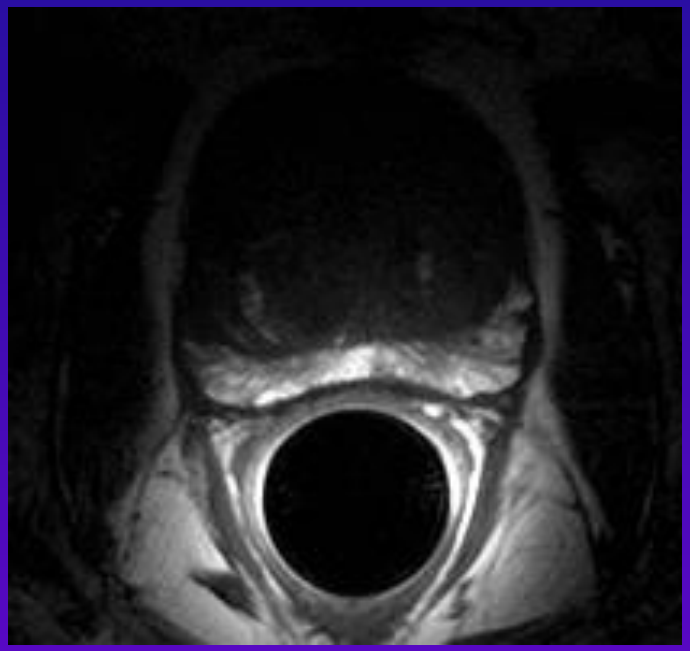
UROGENITAL

ESUR prostate MR guidelines 2012

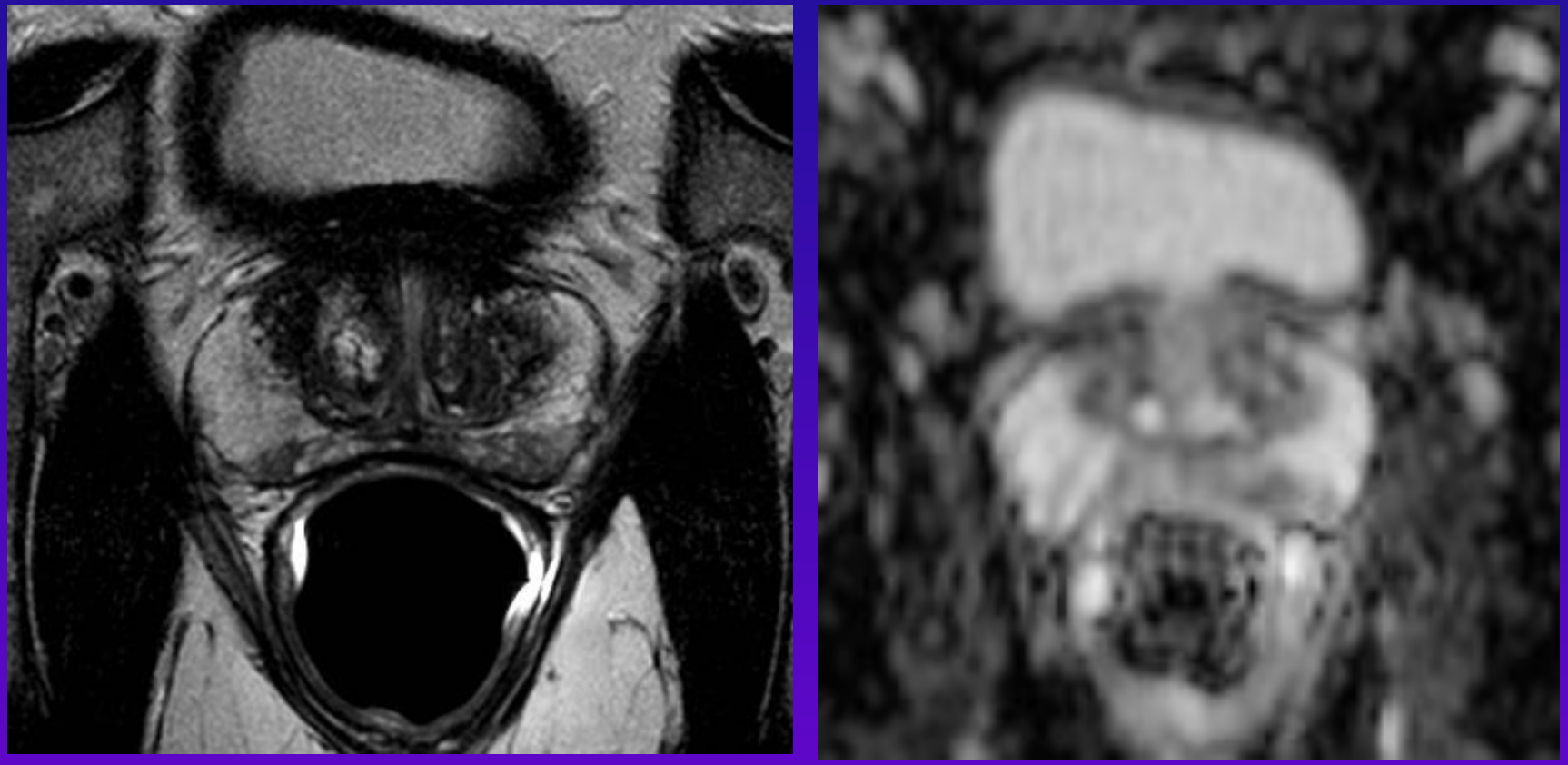
Jelle O. Barentsz · Jonathan Richenberg · Richard Clements · Peter Choyke · Sadhna Verma · Geert Villeirs · Olivier Rouviere · Vibeke Logager · Jurgen J. Fütterer

mp-MRI
componente ematica post-bx



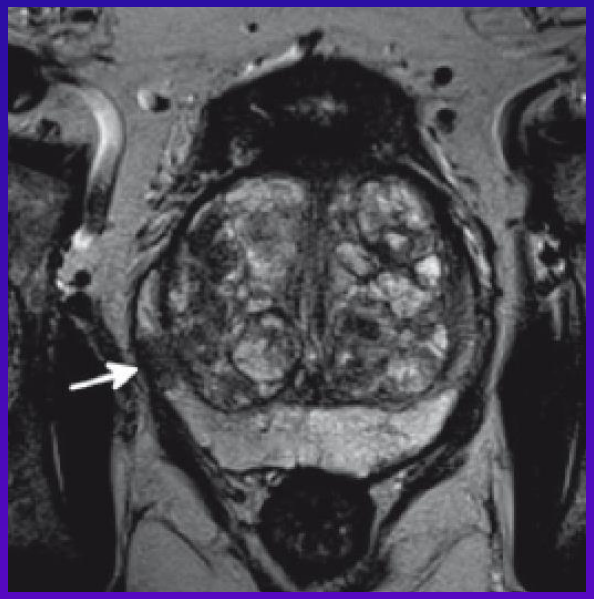


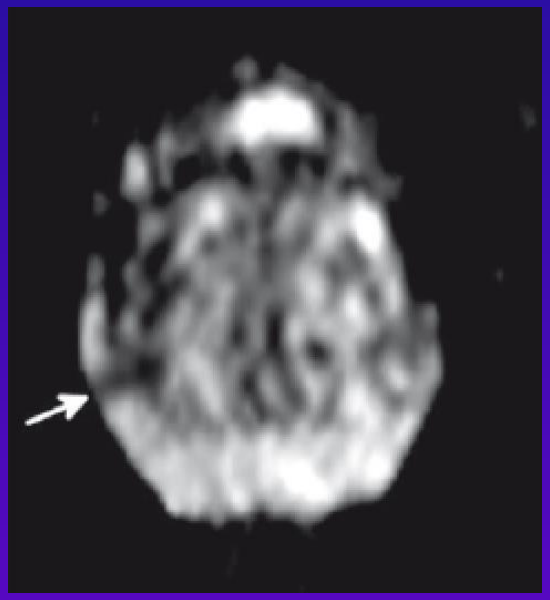
mp-MRI
Prostatite

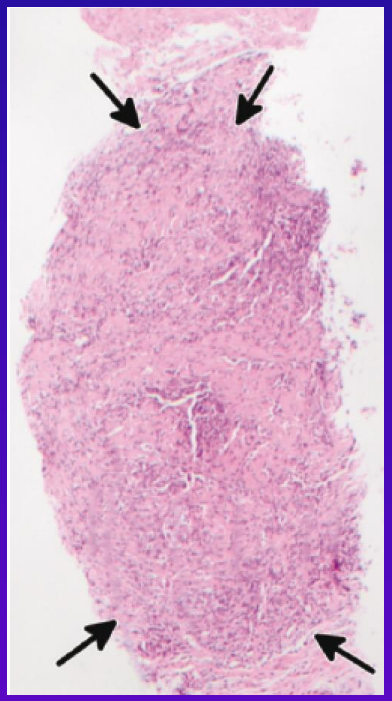


PROSTATITE FOCALE

mp-MRI
Prostatite



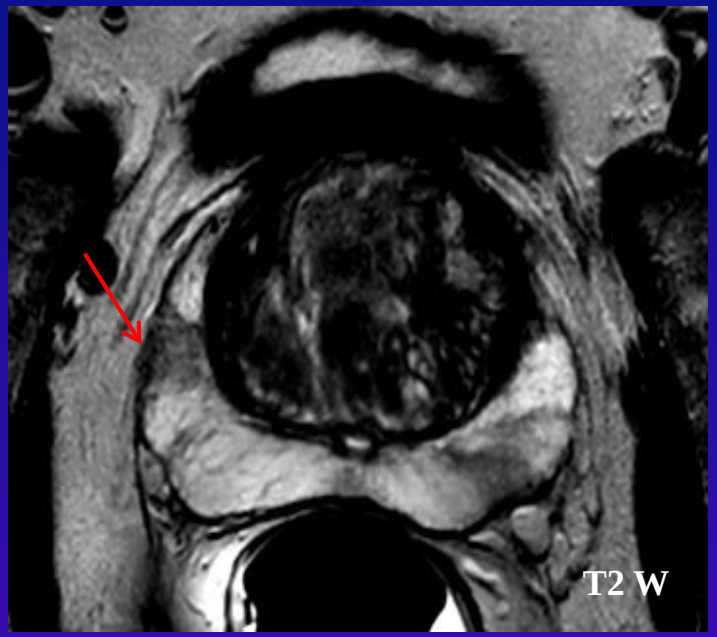




PROSTATITE FOCALE

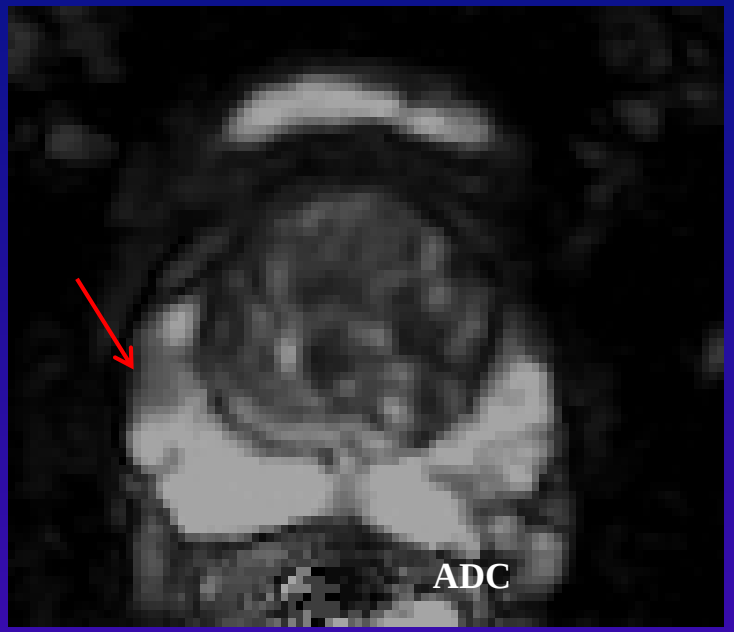
Kitzing YX et al. Radiographics 2016

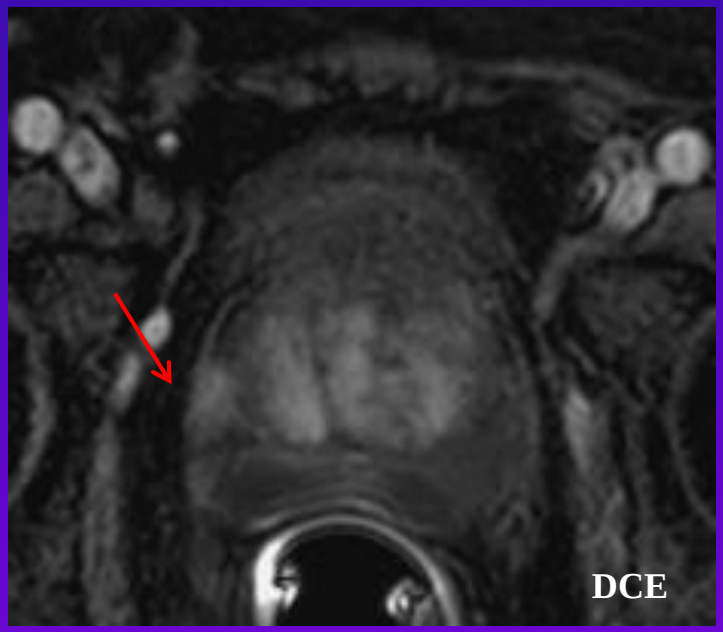
Clinical case 1

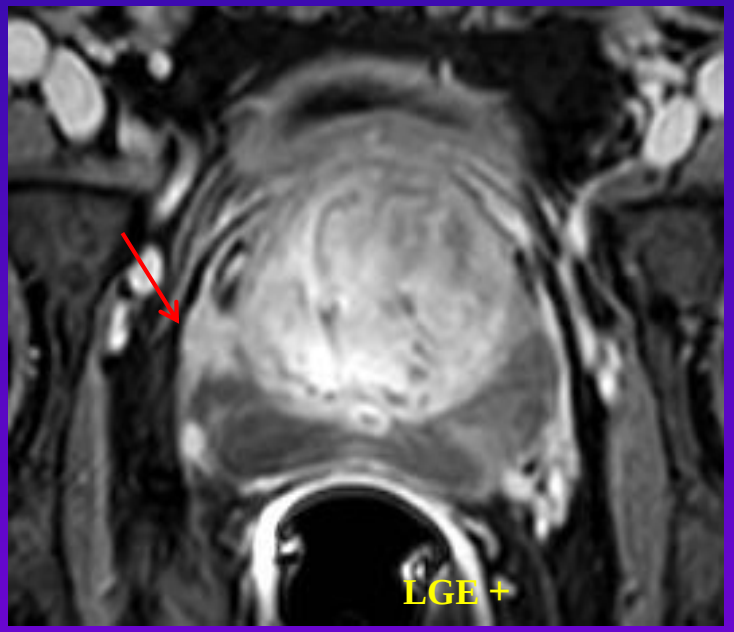


F.V., 60 yo,
rising PSA (7 ng/ml),
previously negative
biopsies

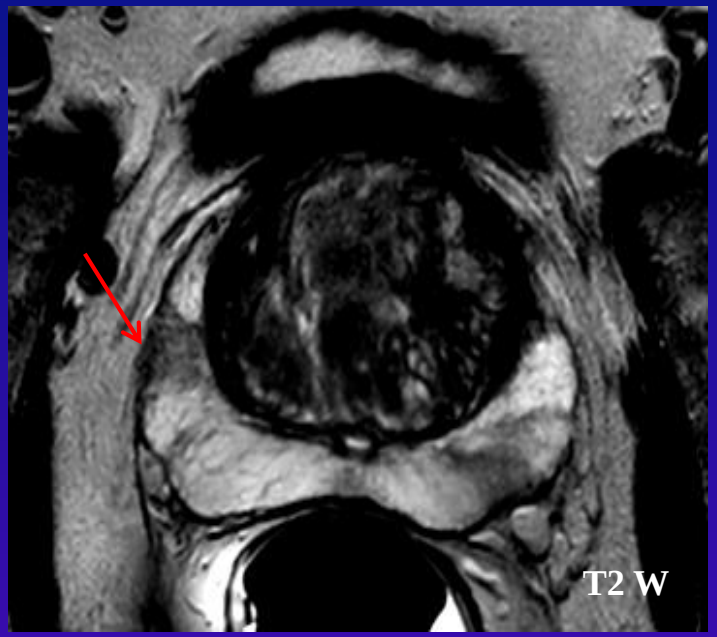
PI-RADS 3







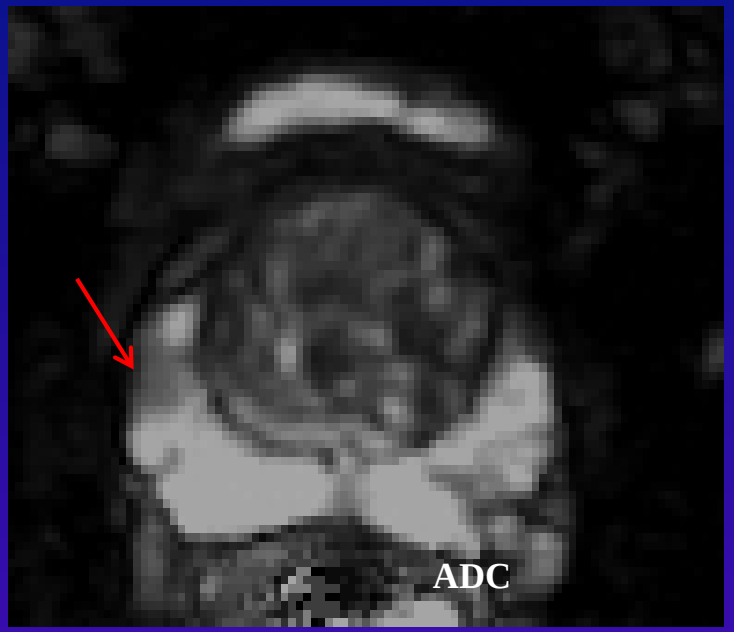
Clinical case 1

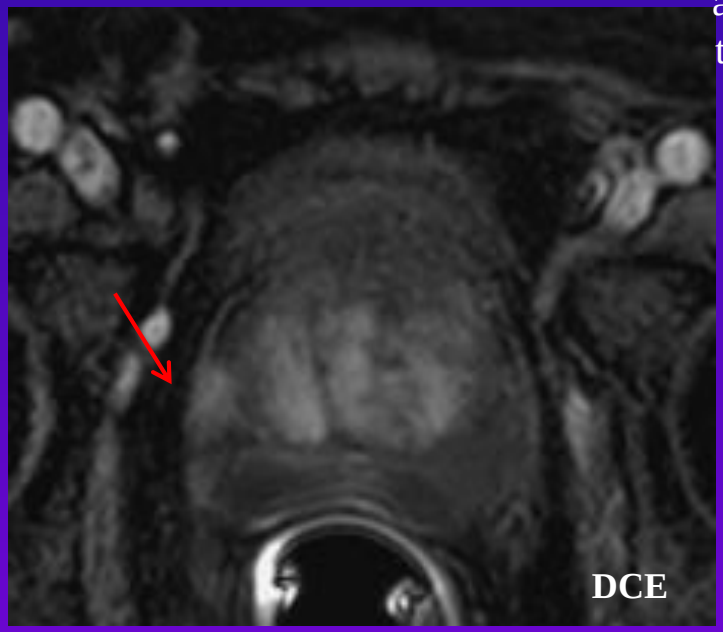


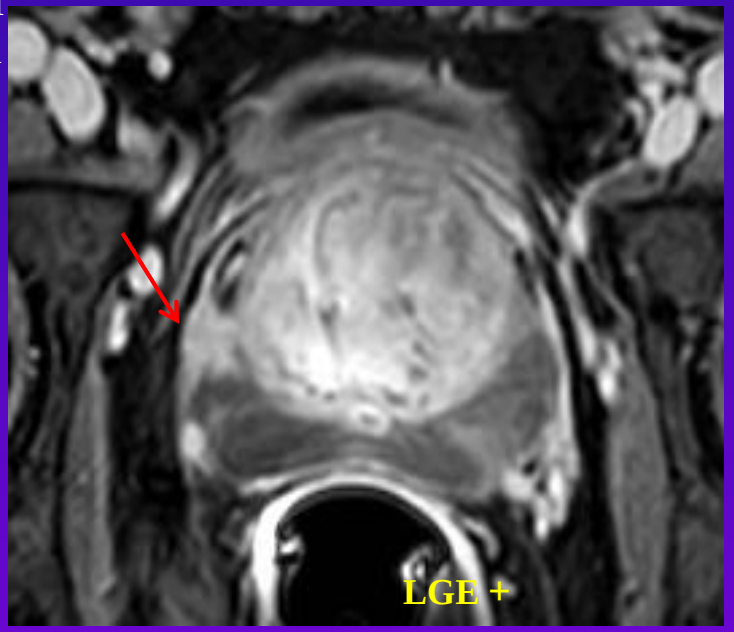
F.V., 60 yo,
rising PSA (7 ng/ml),
previously negative
biopsies

PI-RADS 3 → 4

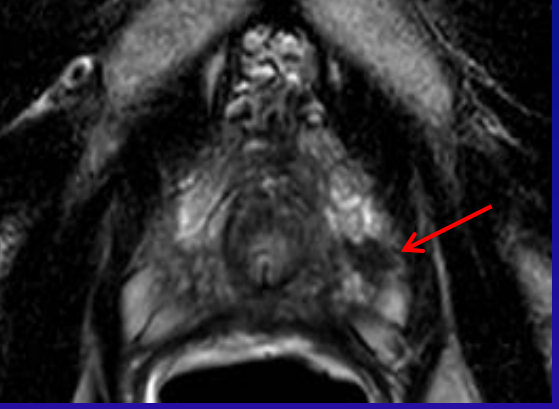
Targeted biopsy:
absence of pathological
tissue with atrophy and
fibrosis



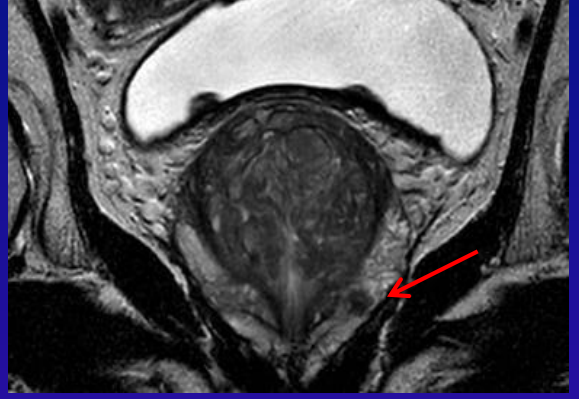




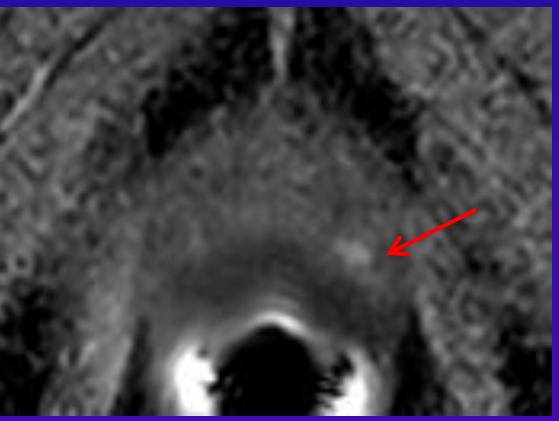
M.V., 60 yo,
rising PSA (6 ng/ml)
previously negative
biopsies



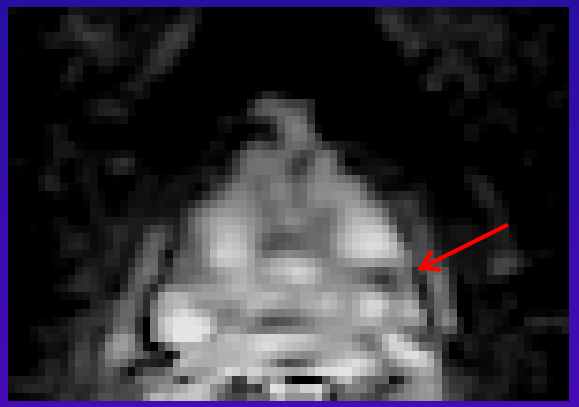
T2 ax



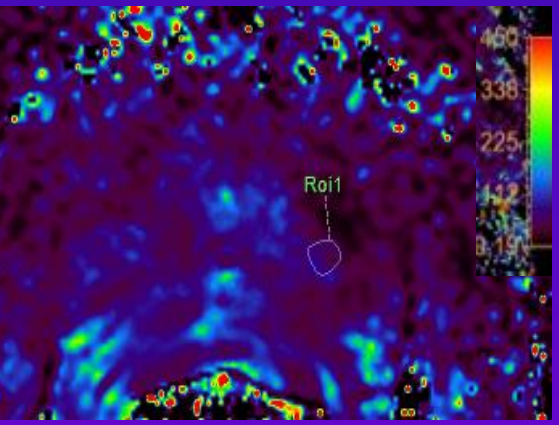
T2 cor



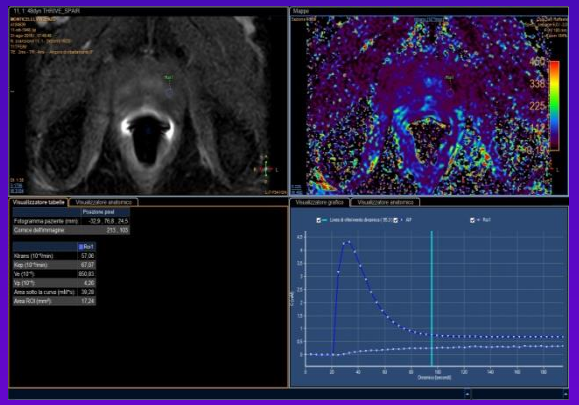
DCE



ADC

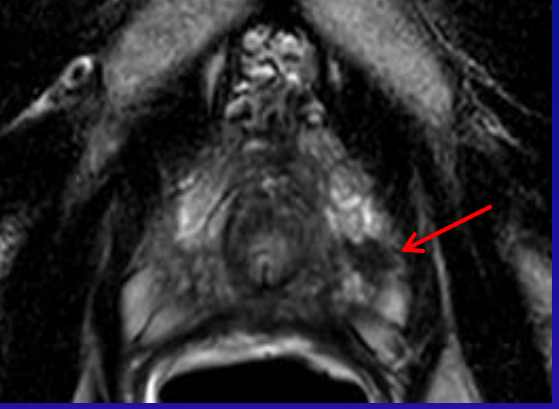


K ^{TRANS}= 57x10^{-3}/min

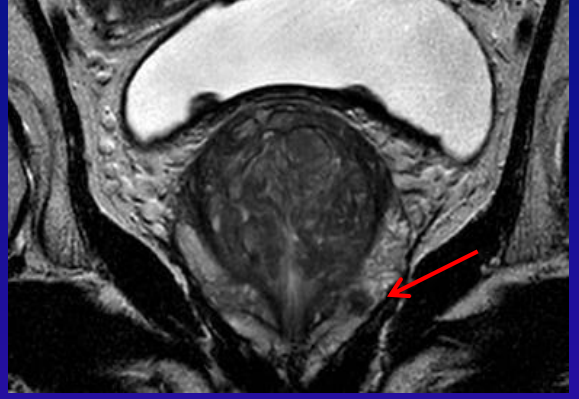


PI-RADS 4

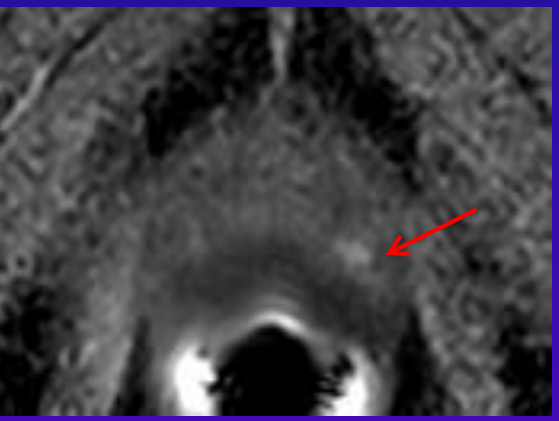
M.V., 60 yo,
rising PSA (6 ng/ml)
previously negative
biopsies



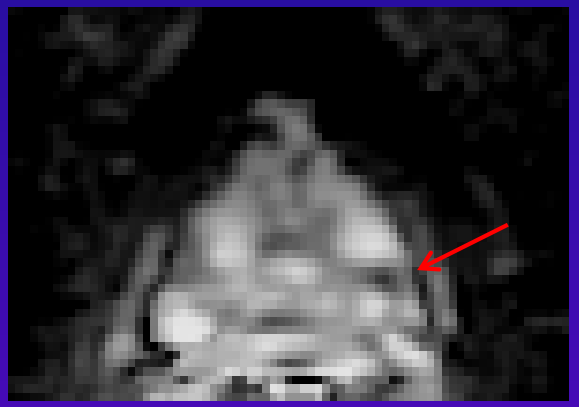
T2 ax



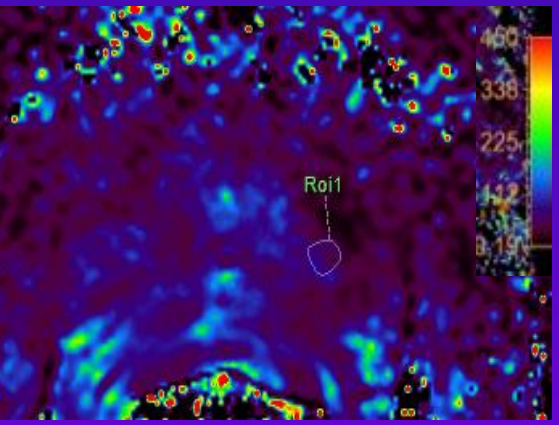
T2 cor



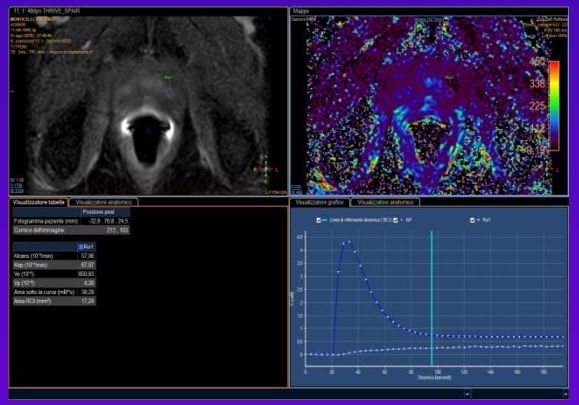
DCE



ADC

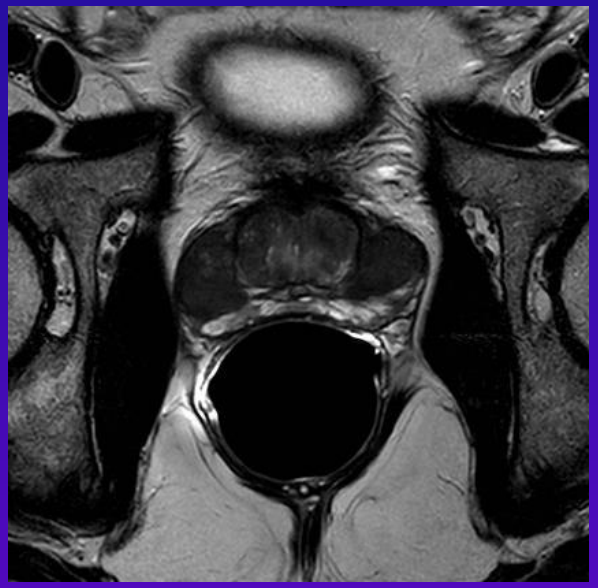
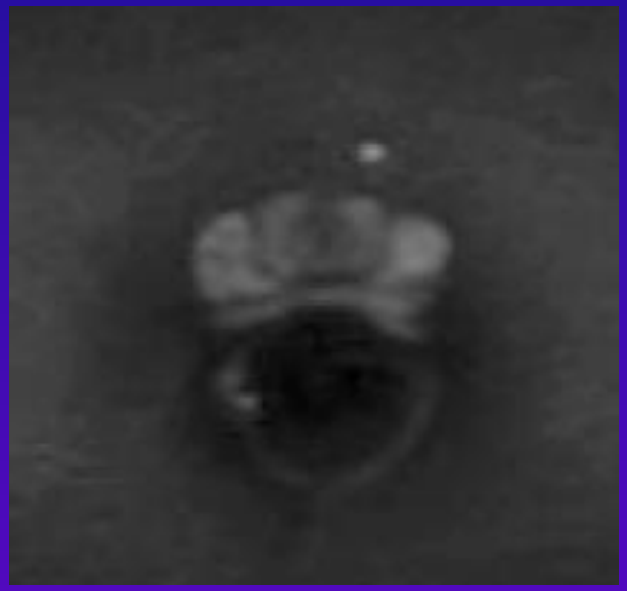
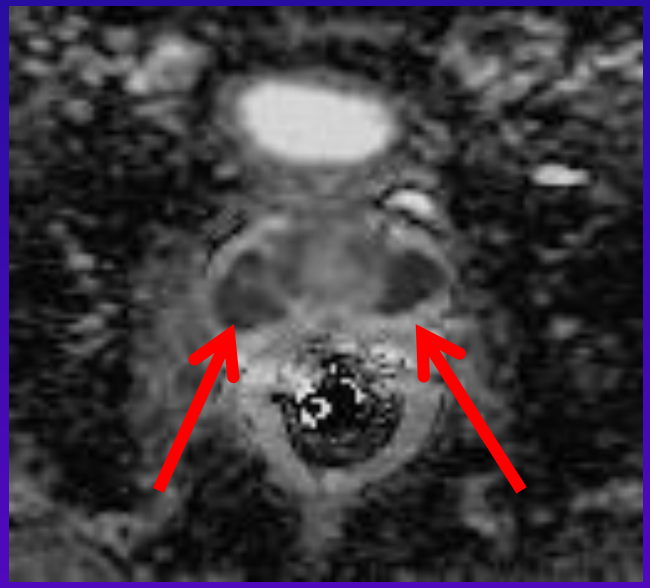


K ^{TRANS}= 57x10^{-3}/min



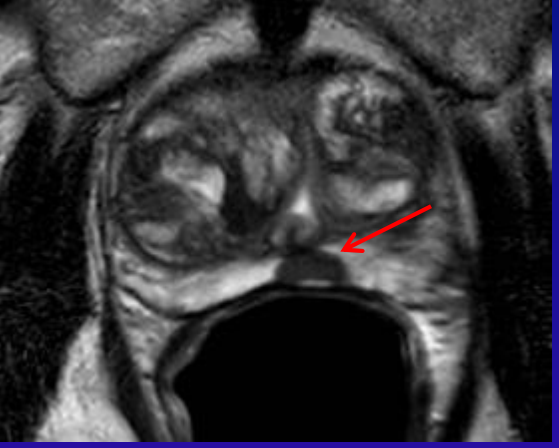
Targeted biopsy: absence of pathological tissue

mp-MRI
Prostatite

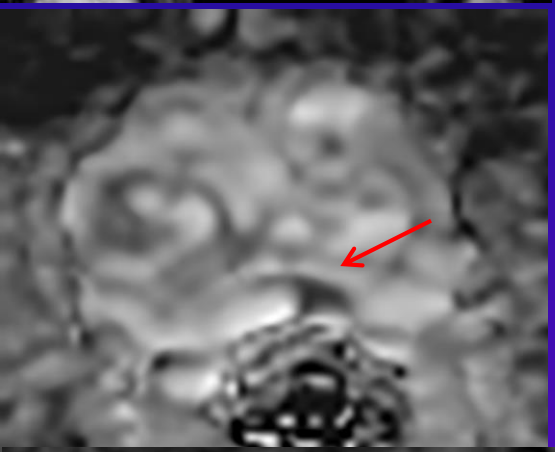




PIRADS 5 (FP)

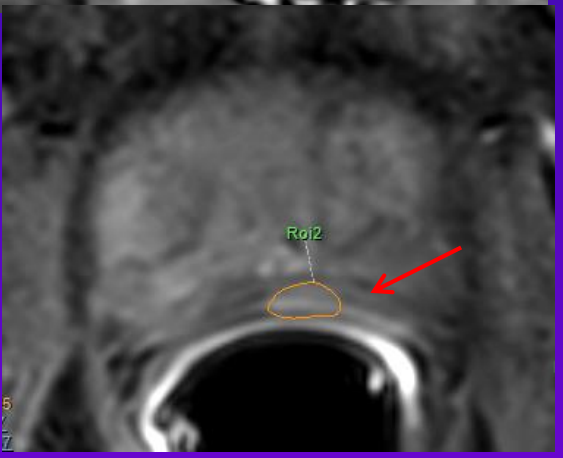
PROSTATITE
GRANULOMATOSA



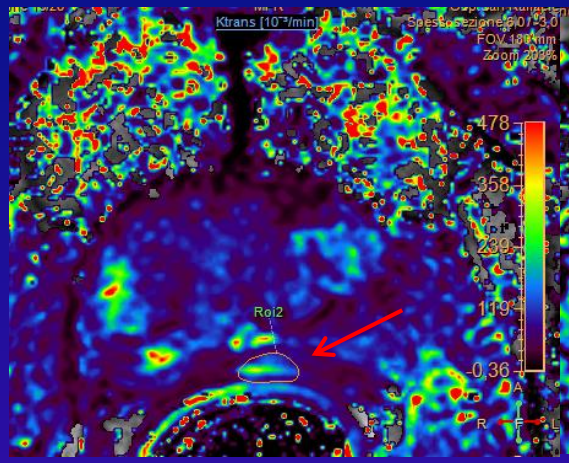
T2 W



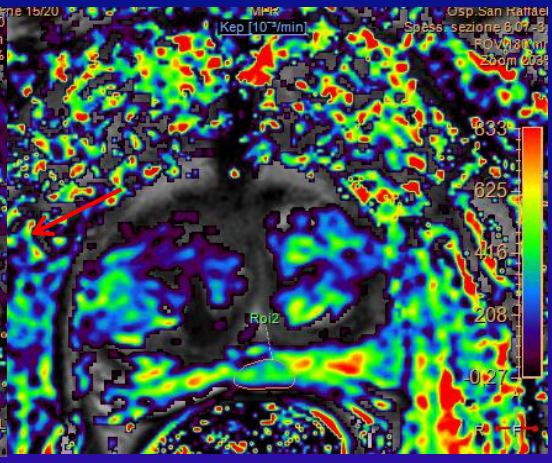
ADC



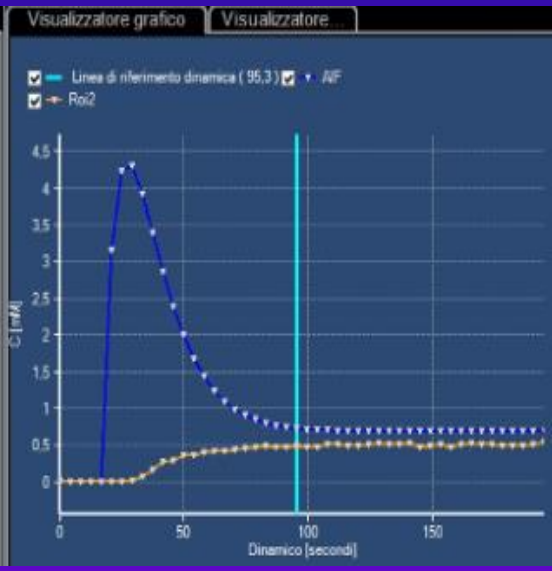
DCE



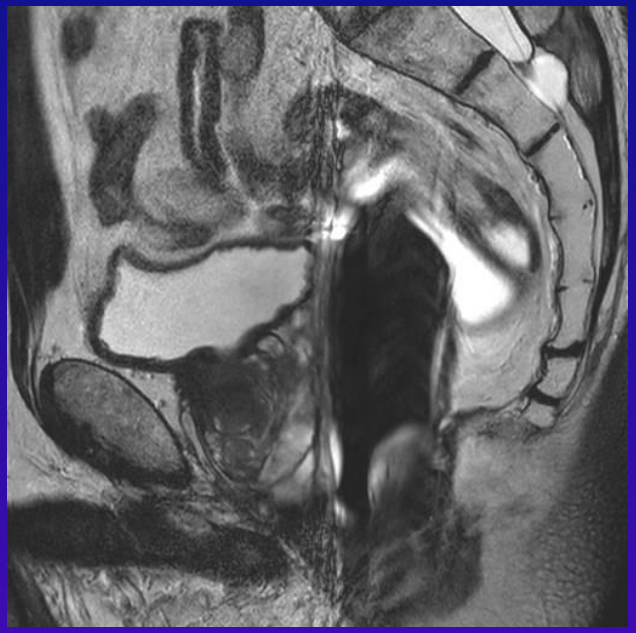
K TRANS

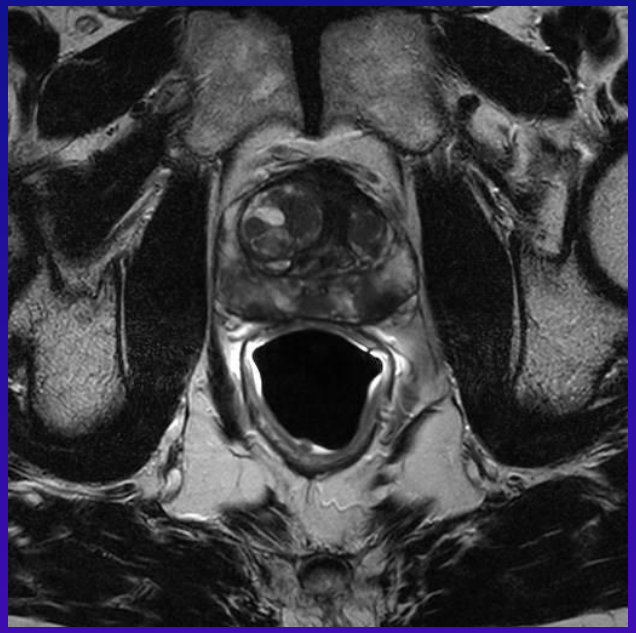


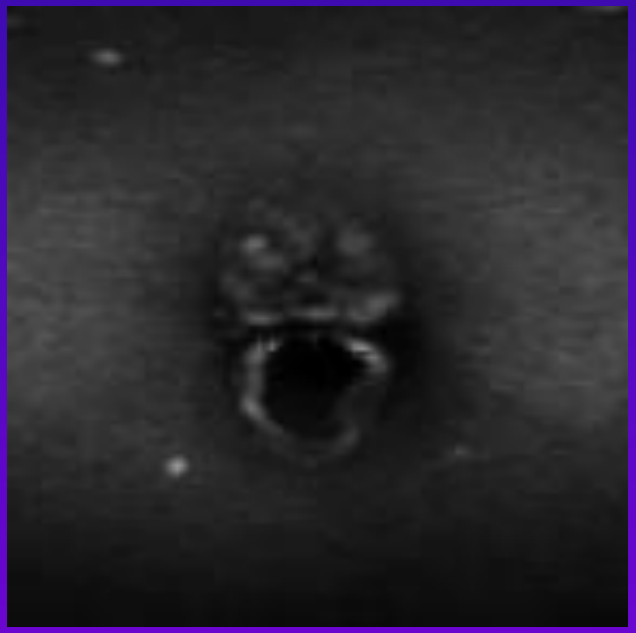
K EP

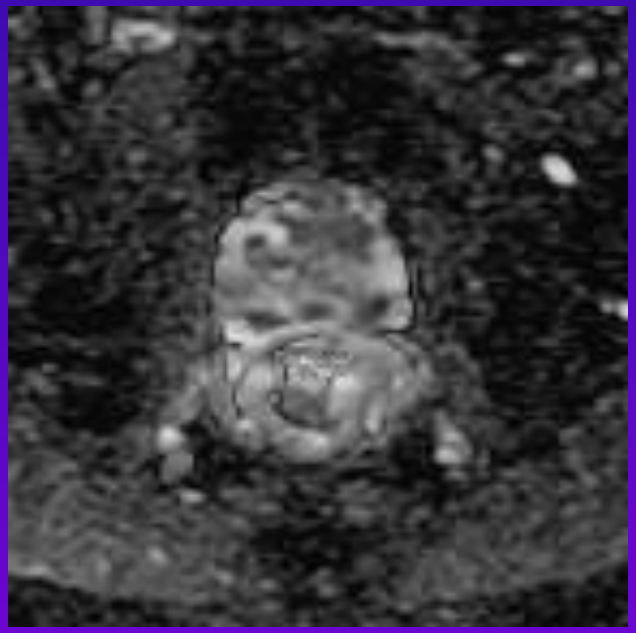


Pseudonodulazione centrale Istologico: negativo

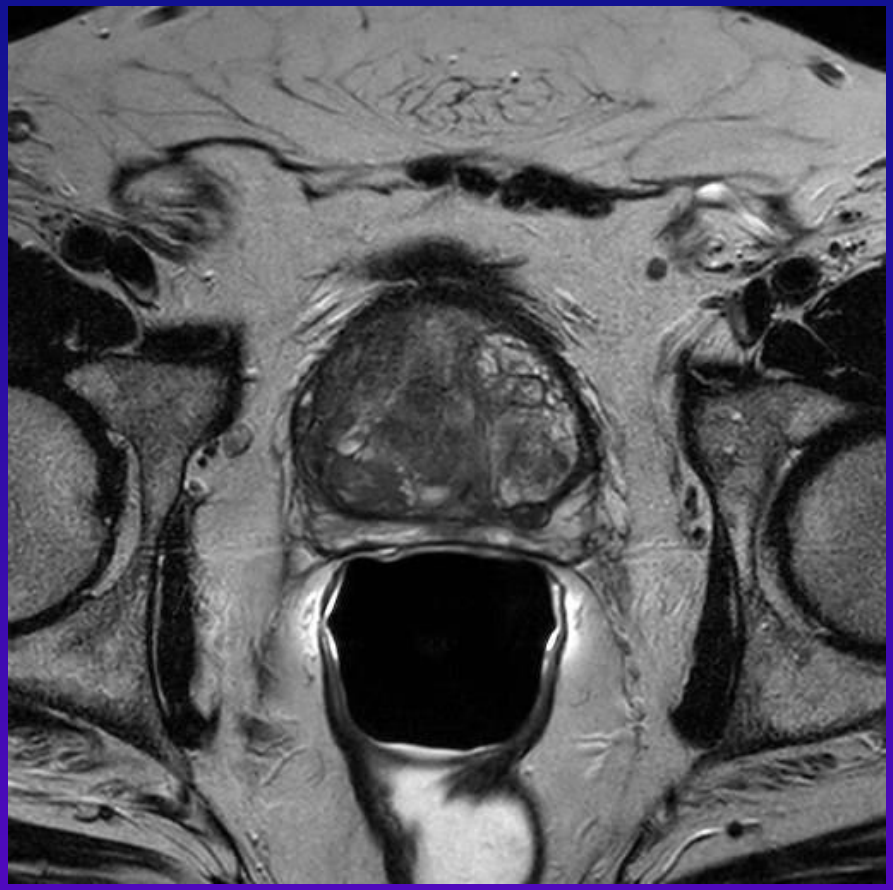


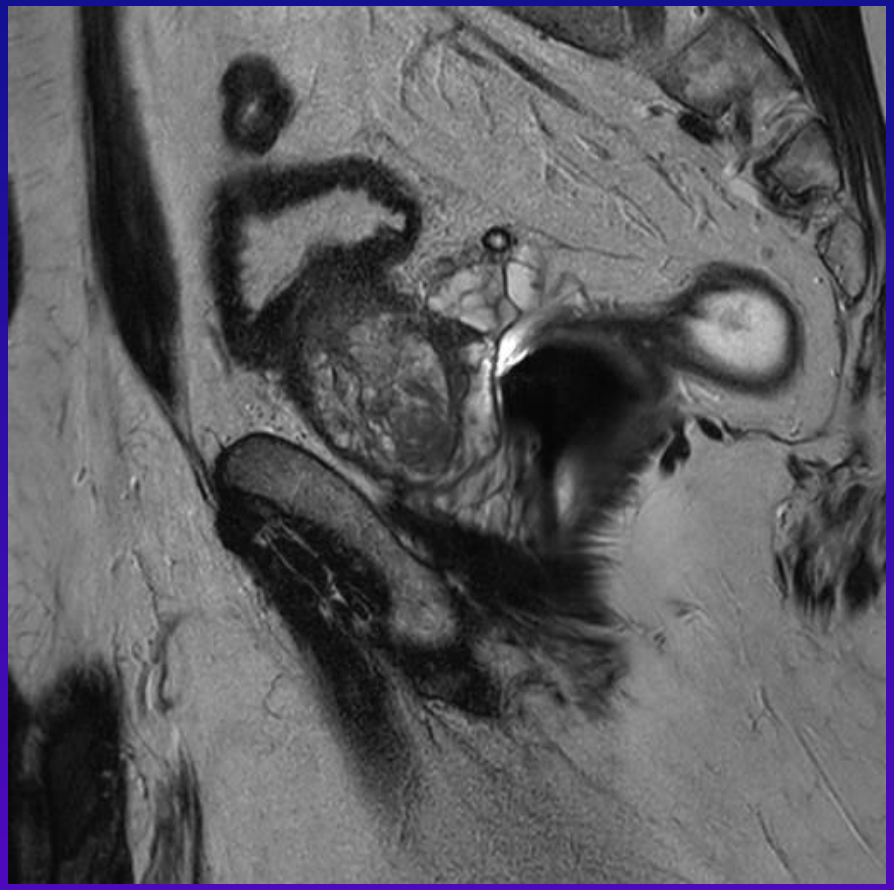






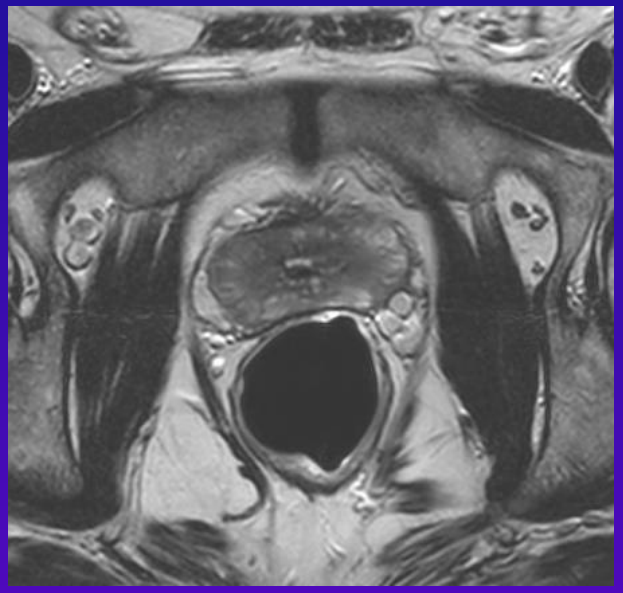
Noduli stromali

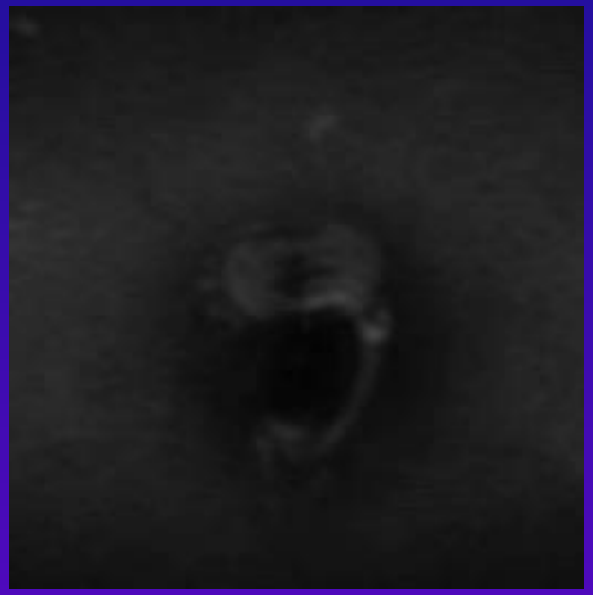


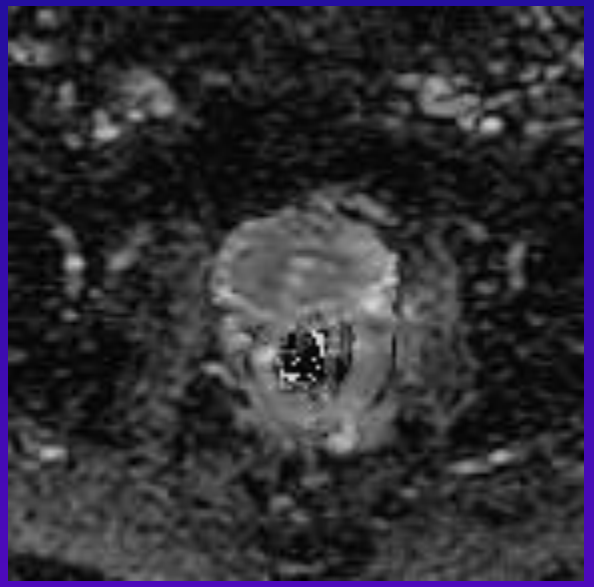


Nodulo stromale che si estroflette nella regione periferica

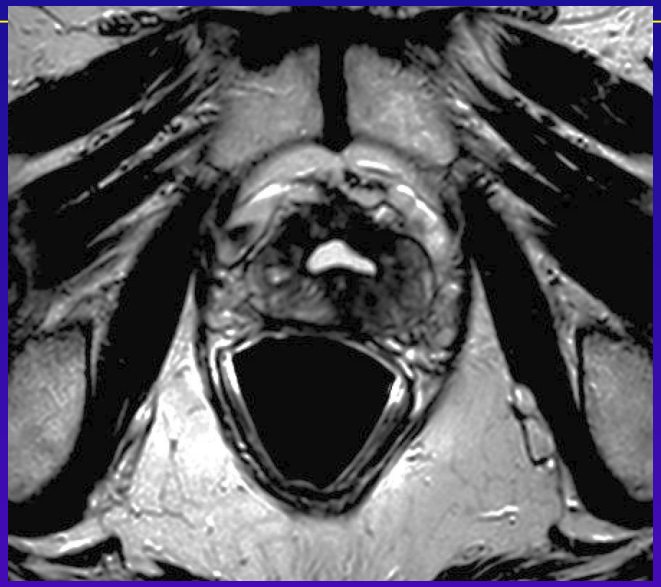
MpMRI after TRUS or Holep

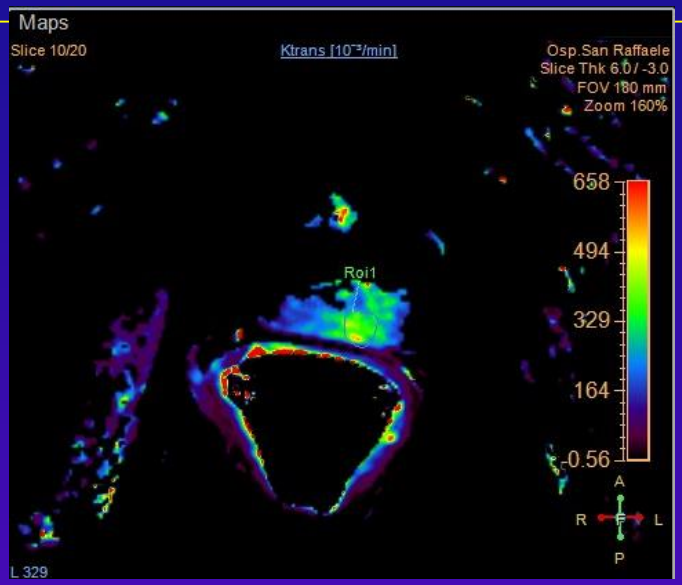


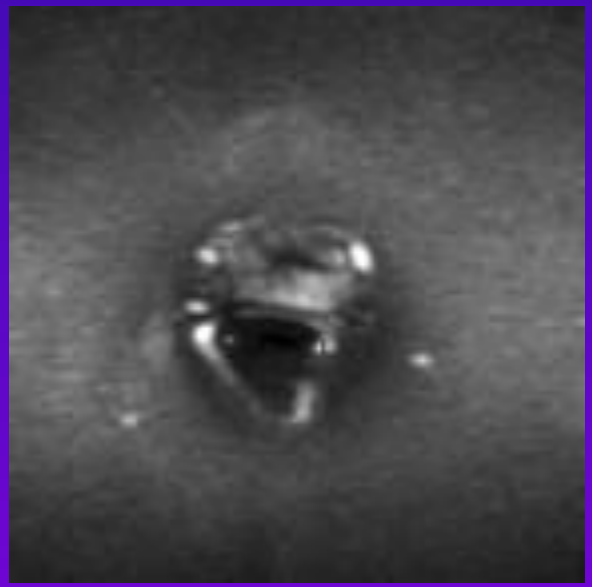


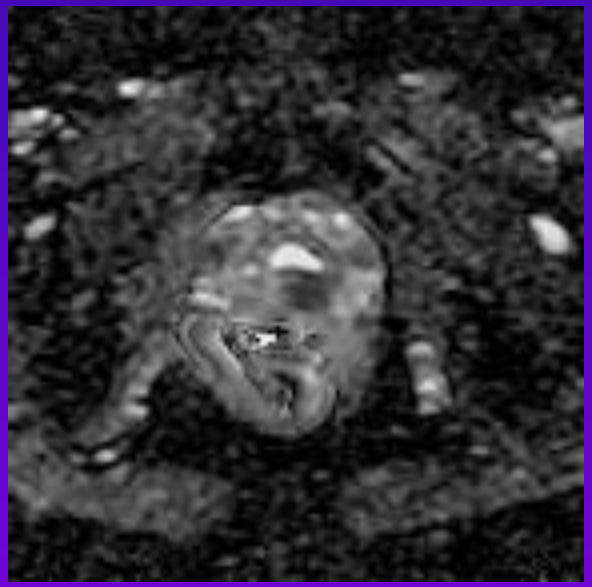


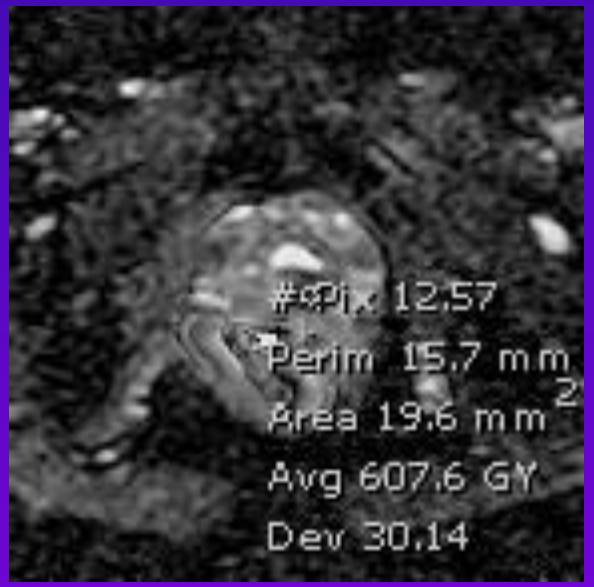
MpMRI after TRUS or Holep











mpMRI PI-RADS – falsi negativi!

Impact of Gleason Subtype on Prostate Cancer Detection Using Multiparametric Magnetic Resonance Imaging: Correlation with Final Histopathology

Matthew Truong, Gary Hollenberg, Eric Weinberg, Edward M. Messing, Hiroshi Miyamoto and Thomas P. Frye*

From the Department of Urology (MT, EMM, HM, TPF), and Department of Pathology and Laboratory Medicine (EMM, HM), University of Rochester Medical Center, and Department of Radiology and Imaging Sciences, University of Rochester School of Medicine and Dentistry (GH, EW), Rochester, New York

Abbreviations and Acronyms

ADC = apparent diffusion coefficient
DWI = diffusion weighted imaging
GS = Gleason score
mp = multiparametric
MR = magnetic resonance
MRI = magnetic resonance imaging
PI-RADS™ = Prostate Imaging Reporting and Data System
ROI = region of interest
RP = radical prostatectomy
SB = systematic biopsy
TB = targeted biopsy
US = ultrasound
WI = weighted imaging

Accepted for publication January 31, 2017.
No direct or indirect commercial incentive associated with publishing this article.
The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review

Purpose: We determined whether Gleason pattern 4 architecture impacts tumor visibility on multiparametric magnetic resonance imaging and correlates with final histopathology.

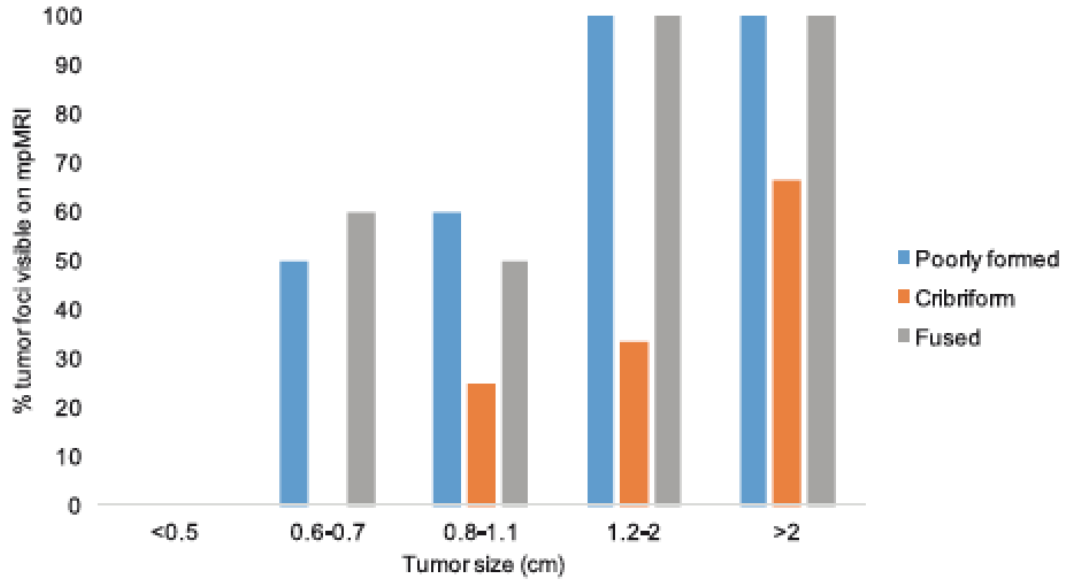
Materials and Methods: A total of 83 tumor foci were identified in 22 radical prostatectomy specimens from patients with a prior negative biopsy who underwent magnetic resonance/ultrasound fusion biopsy followed by radical prostatectomy from January 2015 to July 2016. A genitourinary pathologist rereviewed tumor foci for Gleason architectural subtype. Each prostate imaging reporting and data system category 3 to 5 lesion on multiparametric magnetic resonance imaging was paired with its corresponding pathological tumor focus. Univariable and multivariable analyses were performed to determine predictors of tumor visibility.

Results: Of the 83 tumor foci identified 26 (31%) were visible on multiparametric magnetic resonance imaging, 33 (40%) were Gleason score 3+3 and 50 (60%) were Gleason score 3+4 or greater. Among tumor foci containing Gleason pattern 4, increasing tumor size and noncribriform predominant architecture were the only independent predictors of tumor detection on multivariable analysis ($p = 0.002$ and $p = 0.011$, respectively). For tumor foci containing Gleason pattern 4, 0.5 cm or greater, multiparametric magnetic resonance imaging detected 10 of 13 (77%), 5 of 14 (36%) and 9 of 10 (90%) for poorly formed, cribriform and fused architecture, respectively ($p = 0.01$). The size threshold for the detection of cribriform tumors was higher than that of other architectural patterns. Furthermore, cribriform pattern was identified more frequently on systematic biopsy than on targeted biopsy.

Conclusions: Reduced visibility of cribriform pattern on multiparametric magnetic resonance imaging has significant ramifications for prostate cancer detection, surveillance and focal therapy.

J Urol 2017

mpMRI PI-RADS – falsi negativi!



	Tumor size (cm)	<0.5	0.6-0.7	0.8-1.1	1.2-2	>2
Poorly formed	Visible	0	1	3	1	5
	Total	1	2	5	1	5
Cribriform	Visible	0	0	1	2	2
	Total	4	1	4	6	3
Fused	Visible	0	3	1	5	2
	Total	4	5	2	5	2

Figure 2. MpMRI visibility of Gleason pattern 4 subtype stratified by tumor size. MpMRI did not detect Gleason pattern 4 tumors less than 0.5 cm. Visibility of cribriform tumors was lower than that of other architectural patterns across all tumor sizes.

mpMRI PI-RADS – falsi negativi!

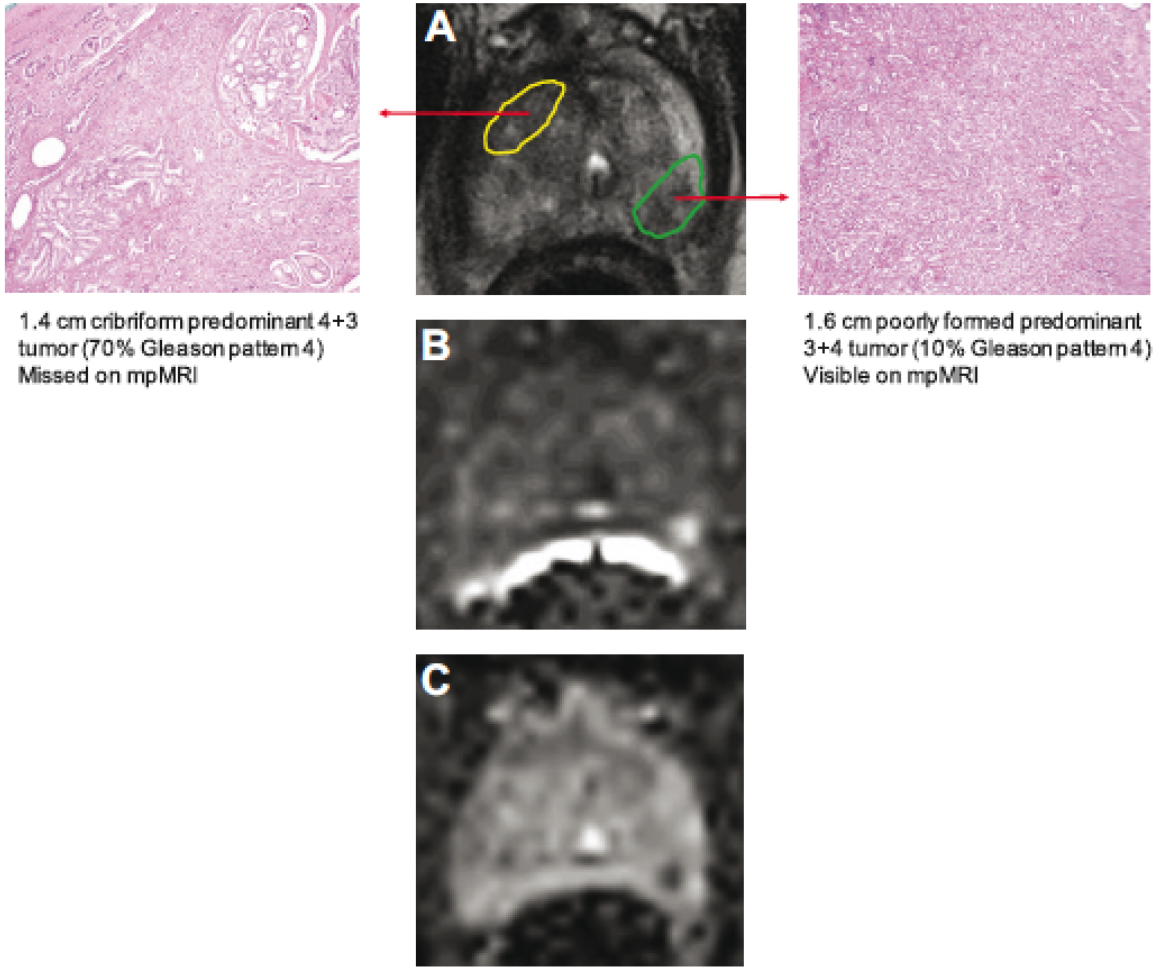
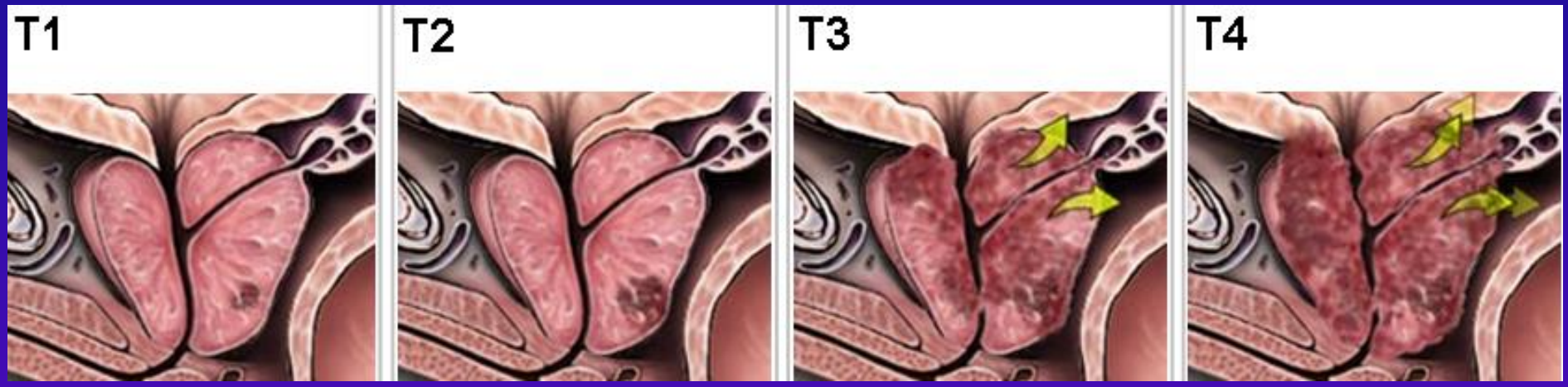
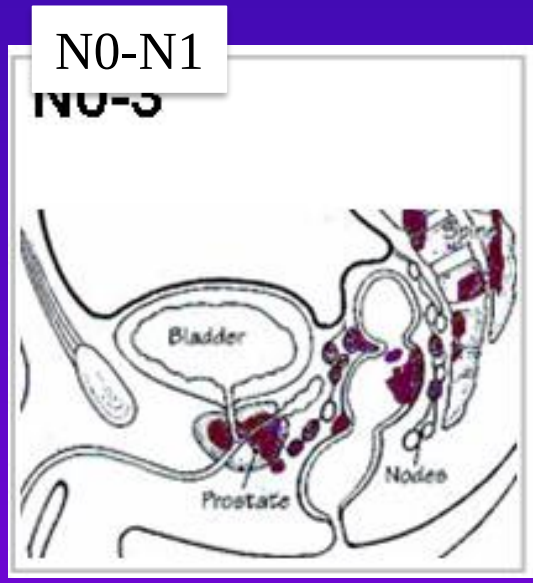


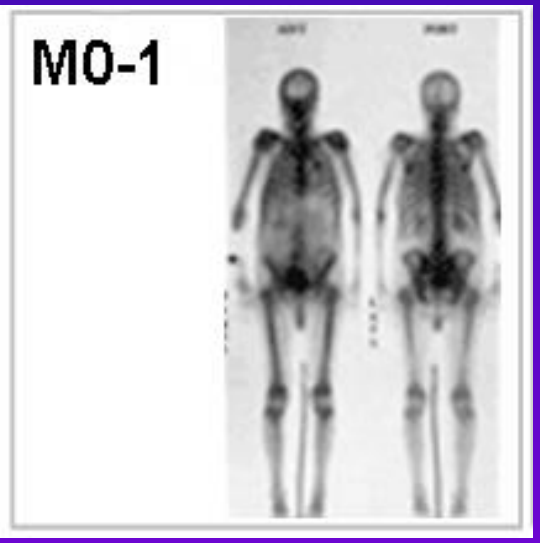
Figure 3. Representative case of invisible cribriform tumor. *A*, fast spin echo T2-weighted image. *B*, high B value DWI. *C*, ADC map. Representative case of 71-year-old male with prostate specific antigen 8.8 ng/ml who underwent RP for GS 3+4 prostate cancer identified on MR/US fusion biopsy. Green circle indicating 1.6 cm lesion demonstrates low T2 signal and restricted diffusion as shown by high signal on DWI and corresponding low signal on ADC map. Yellow circle shows 1.4 cm lesion that was not visible on mpMRI. Reduced from ×40.

Clinical Indication
Staging



N0-N1





Clinical Indication Staging

Organ confined

Non confined

TABLE 1: 2010 TNM staging system of prostate cancer

Localized disease	
Tx	Primary tumor cannot be assessed
T0	No evidence of primary tumor
T1	Clinically inapparent tumor neither palpable nor visible by imaging
T1a	Tumor incidental histologic finding in ≤ 5% of resected tissue
T1b	Tumor incidental histologic finding in > 5% of resected tissue
T1c	Tumor identified by needle biopsy (eg, because of elevated PSA level)
T2	Tumor confined within prostate
T2a	Tumor involves one-half of one lobe or less
T2b	Tumor involves more than one-half of one lobe but not both lobes
T2c	Tumor involves both lobes
Local extension	
T3a	Extracapsular extension (unilateral or bilateral)
T3b	Tumor invades seminal vesicle(s)
T4	Bladder invasion, fixed to pelvic side wall, or invasion of adjacent structures
Metastatic disease	
N1	Positive regional lymph nodes
M1	Distant metastasis

Edge SB, Byrd DR, Compton CC, et al. eds. AJCC cancer staging manual. 7th ed. New York: Springer-Verlag, 2010.

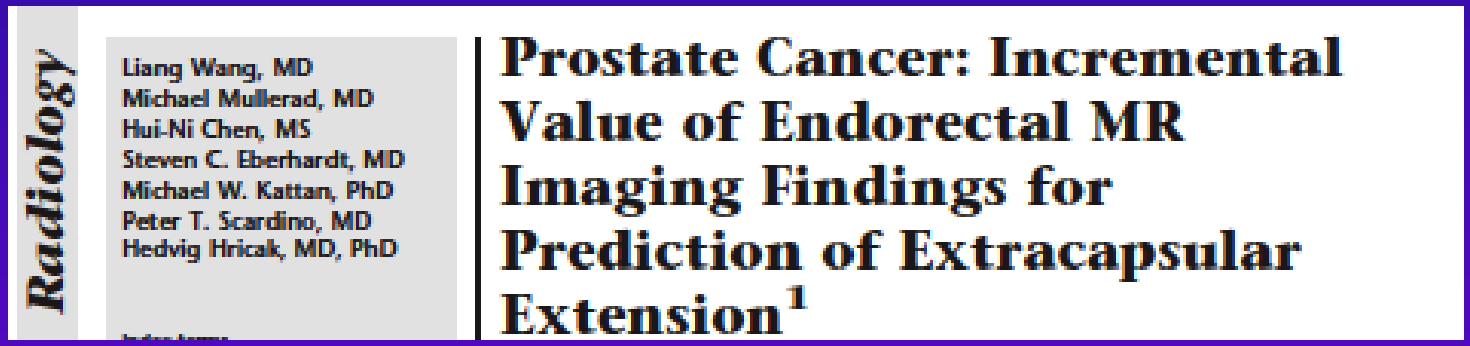
Clinical Indication
Staging

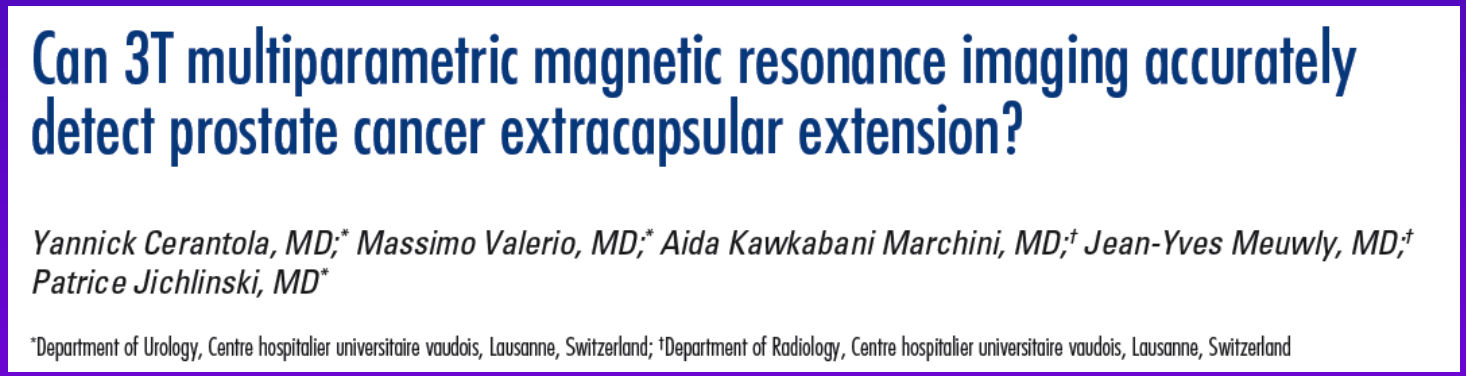
- Different treatment between organ-condined and non-organ-confined prostate cancer
- **EXTRACAPSULAR EXTENSION** is associated with increased risk of a positive surgical margin, which influences post-operative biochemical recurrence after radical prostatectomy
- **SEMINAL VESICLE INVASION** is considered an important marker of tumor progression and connected with increased risk of lymphnode invasion and local tumor recurrence

Clinical Indication
Staging

MRI is considered the most accurate way to detect and stage

extracapsular extension





Clinical Indication
Staging

MR CRITERIA FOR DETECTING ECE

On T2-w, at least one of the following:

- Irregular capsular bulge or edge retraction

- Disruption of the prostatic capsule

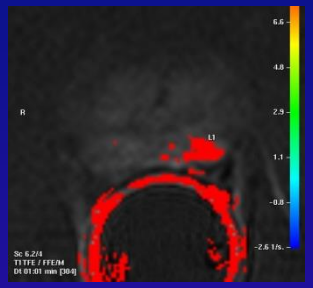
- Extension into the periprostatic fat

- Broad contact with the capsule (< 12 mm)

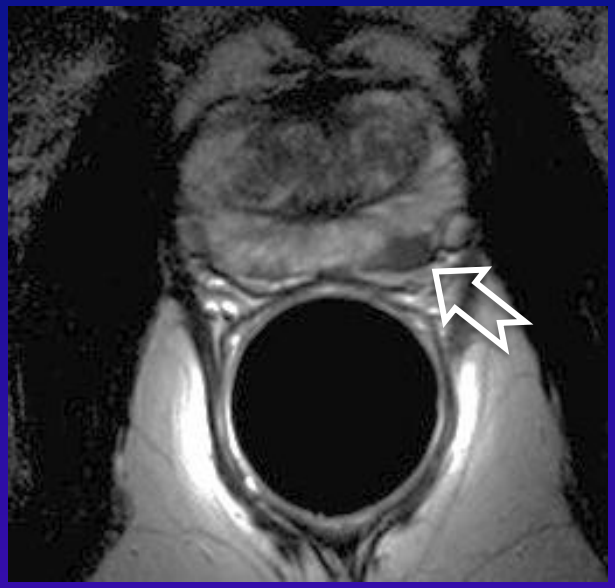
- Obliteration of the retroprostactic angle

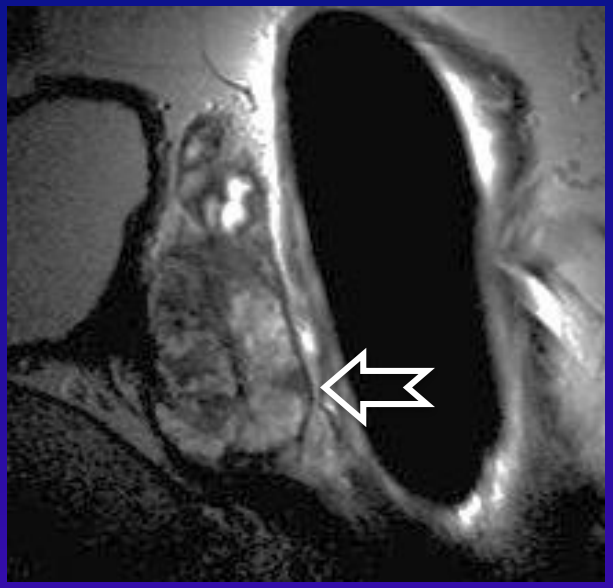
- Asymmetry of the neurovascular bundles

Wang L, Mullerad M, Chen HN, et al. Prostate cancer: incremental value of endorectal MR imaging findings for prediction of extracapsular extension. Radiology 2004;232:133-9.

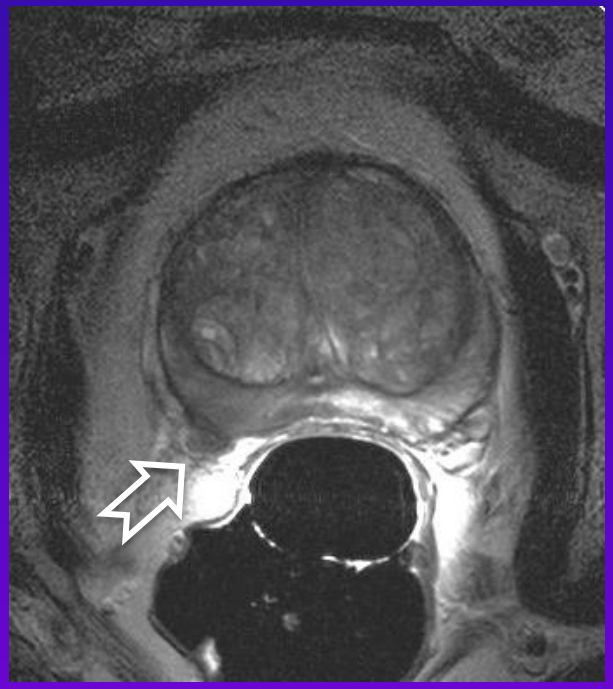


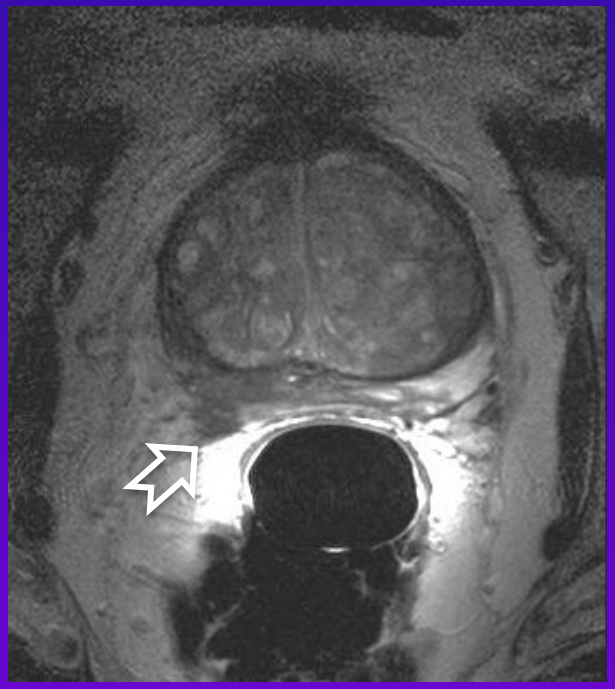
No SVI - No ECE – T2



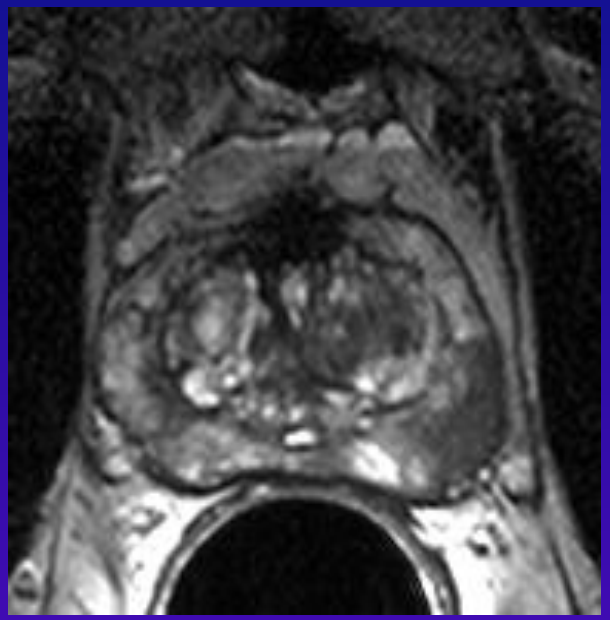


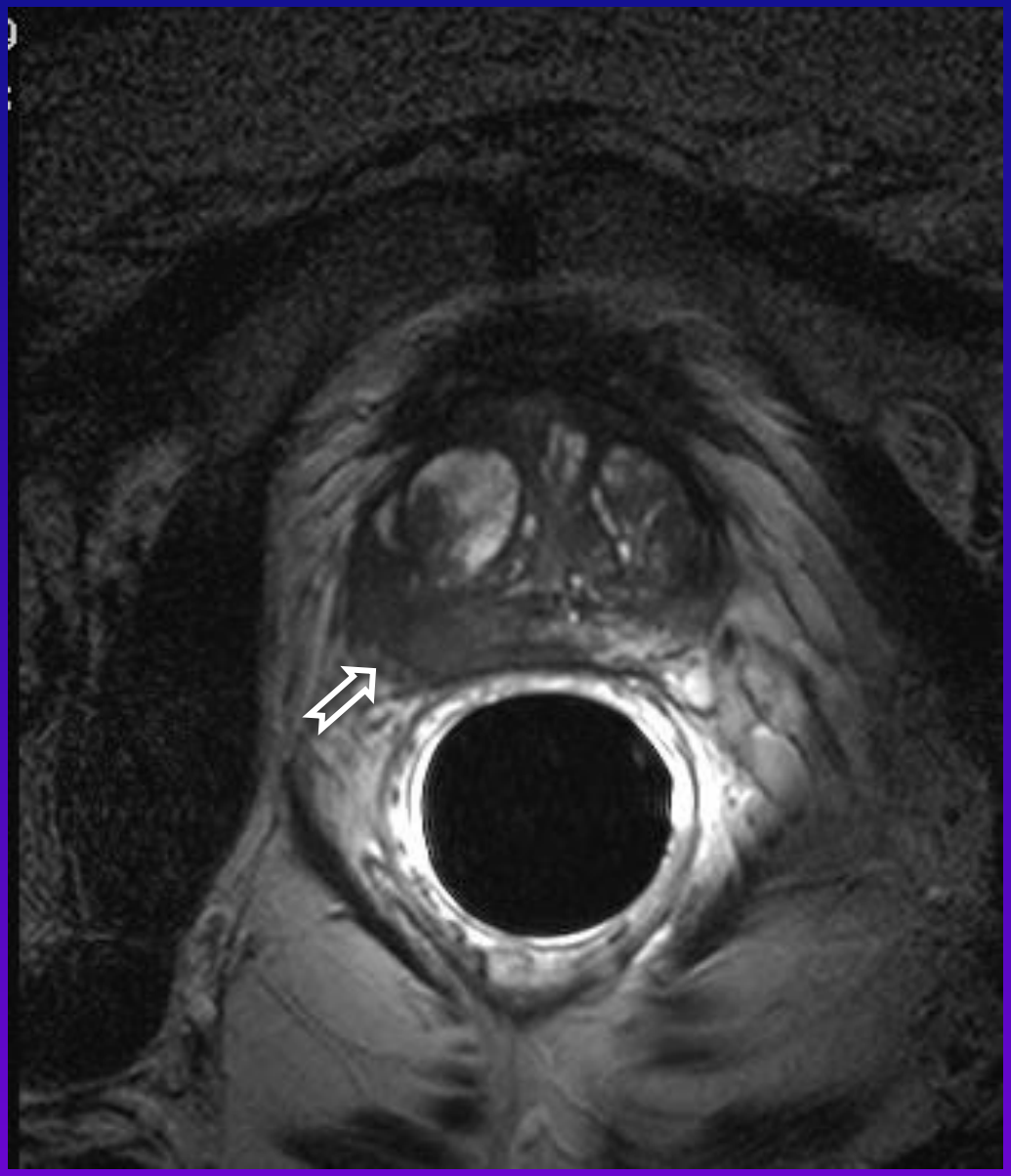
No SVI - ECE – T3a





MR CRITERIA FOR DETECTING ECE





Clinical Indication
Staging

Extracapsular extension

- **1.5 T** [1]
  - endorectal coil MRI in detecting ECE have shown a wide range of sensitivity (13 - 95 %) and specificity (49 - 97 %)

- **3T** [2]:
  - Specificity: 90%
  - Sensitivity: 35%
  - NPV: 57 %
  - PPV: 79%
  - Accuracy: 62%

1. Brajtbord JS, Lavery HJ, Nabizada-Pace F, et al. Endorectal magnetic resonance imaging has limited clinical ability to preoperatively predict pT3 prostate cancer. BJU Int 2011;107:1419-24. http://dx.doi. org/10.1111/j.1464-410X.2010.09599.x
2. Cerantola Y, Valerio M, Kawkabani Marchini A, Meuwly JY, Jichlinski Can 3T multiparametric magnetic resonance imaging accurately detect prostate cancer extracapsular extension? P.Can Urol Assoc J. 2013 Nov-Dec;7 (11-12):E699-703. doi: 10.5489/cuaj.245

Clinical Indication
Staging

Extracapsular extension

European Journal of Ra

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Endorectal 3D T2-weighted 1 mm-slice thickness MRI for prostate cancer staging at 1.5 Tesla: Should we reconsider the indirects signs of extracapsular extension according to the D'Amico tumor risk criteria?

F. Cornud [a,d,*], M. Rouanne [b], F. Beuvon [c], D. Eiss [d], T. Flam [b], M. Liberatore [d], M. Zerbib [b], N.B. Delongchamps [b]

[a] Department of Radiology, Hôpital Cochin, Université Paris Descartes, France
[b] Department of Urology, Hôpital Cochin, Université Paris Descartes, France
[c] Department of Pathology, Hôpital Cochin, Université Paris Descartes, France
[d] IRM Paris 16, 46-48 rue Chardon-Lagache, 75116 Paris, France

ARTICLE INFO

Article history:
Received 12 March 2011
Received in revised form 28 June 2011
Accepted 29 June 2011

Keywords:
Prostate cancer
Staging
3D MRI

ABSTRACT

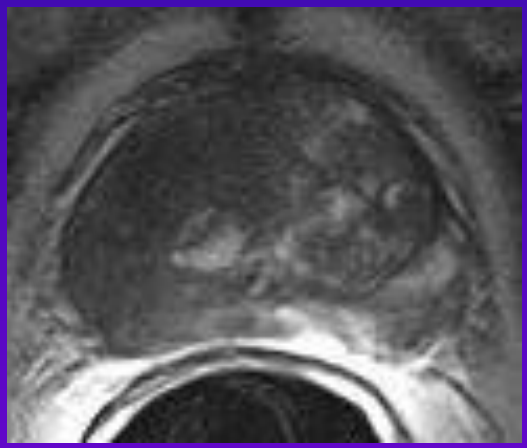
Purpose: To evaluate the accuracy of a 3D-endorectal 1 mm-thick slices MRI acquisition for local staging of low, intermediate and high D'Amico risk prostate cancer (PCa).
Materials and methods: 178 consecutive patients underwent a multiparametric MRI protocol prior to radical prostatectomy (RP). T2W images were acquired with the 3D sampling perfection with application optimized contrasts using different flip angle evolutions (SPACE) sequence (5 mn acquisition time). Direct and indirect MRI signs of extracapsular extension (ECE) were evaluated to predict the pT stage. The likelihood of SVI (seminal vesicle invasion) was also assessed.
Results: Histology showed ECE and SVI in 38 (21%) and 12 (7%) cases, respectively. MRI sensitivity and specificity to detect ECE were 55 and 96% if direct signs of ECE were used and 84 and 89% ($p < 0.05$), if both direct and indirect signs were combined. D'Amico criteria did not influence MRI performance. Sensitivity and specificity for SVI detection were 83% and 99%.
Conclusions: 3D data sets acquired with the SPACE sequence provides a high accuracy for local staging of prostate cancer. The use of indirect signs of ECE may be recommended in low D'Amico risk tumors to optimise patient selection for active surveillance or focal therapy.

- conservative reporting:

- 55% sensitivity
- 96% specificity

- aggressive reporting:

- 84% sensitivity
- 89% specificity



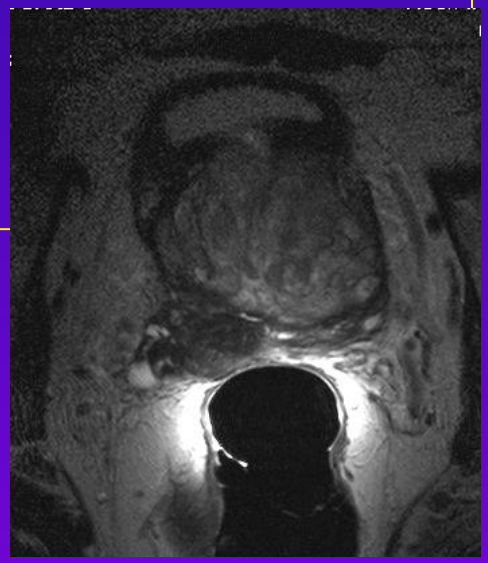
Slight capsular irregularity
Slight capsular undulation

MR CRITERIA FOR DETECTING SV

Seminal vesicle (SV) invasion is an important marker of progression

On T2w images:

- Contiguous low-signal intensity tumour extension from base to SV
- Focal low-signal intensity within the SV disruption
- Loss of the normal structure of SV
- Non visualisation or enlargement of the ejaculatory ducts
- Obliteration of seminal vesicle angle
- Decreased conspicuity of SV

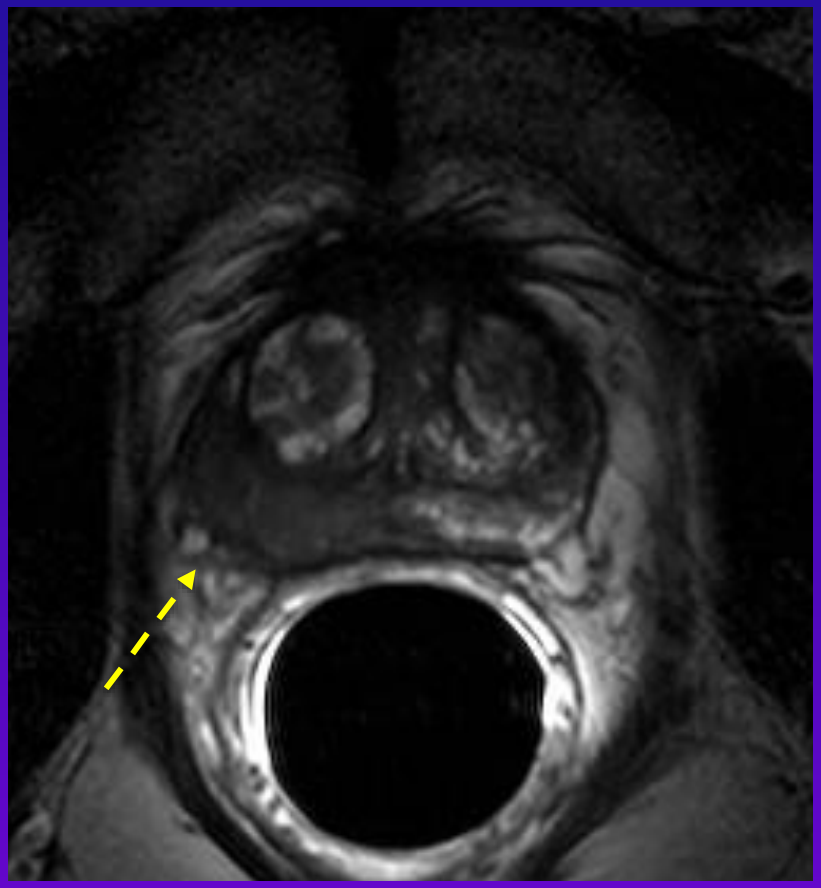


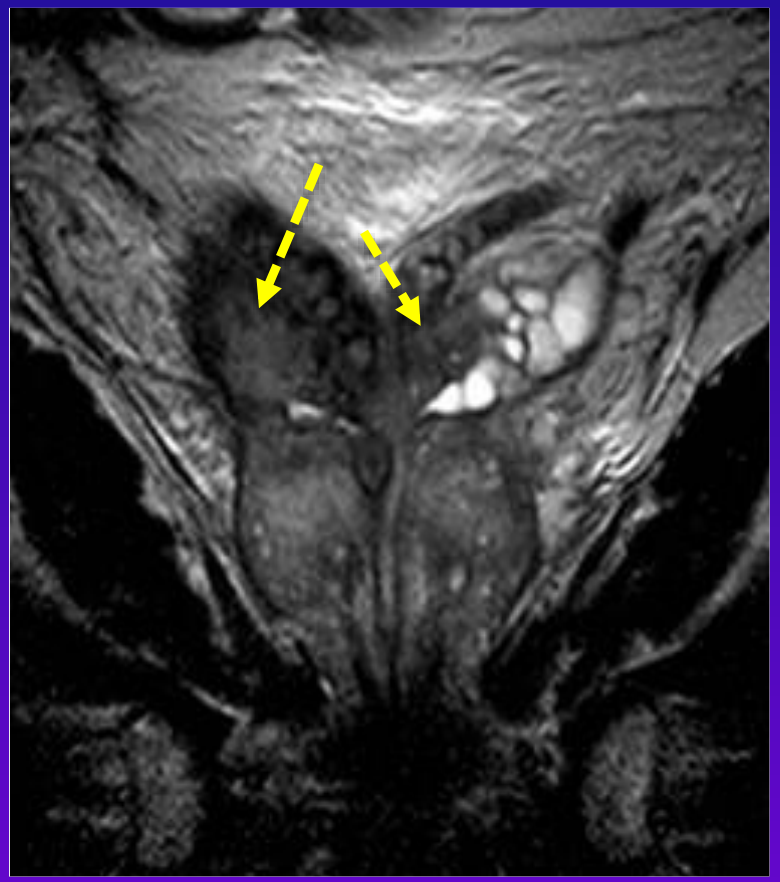
Wang L, Mullerad M, Chen HN, et al. Prostate cancer: incremental value of endorectal MR imaging findings for prediction of extracapsular extension. Radiology 2004;232:133-9.

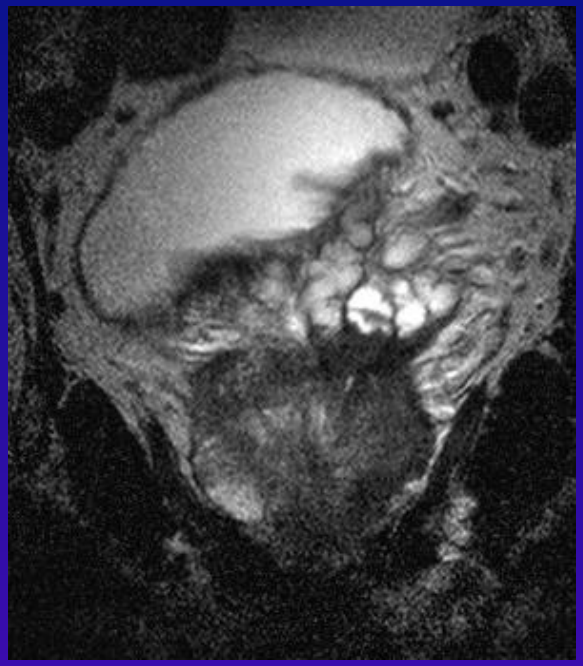
MR SV DETECTION:

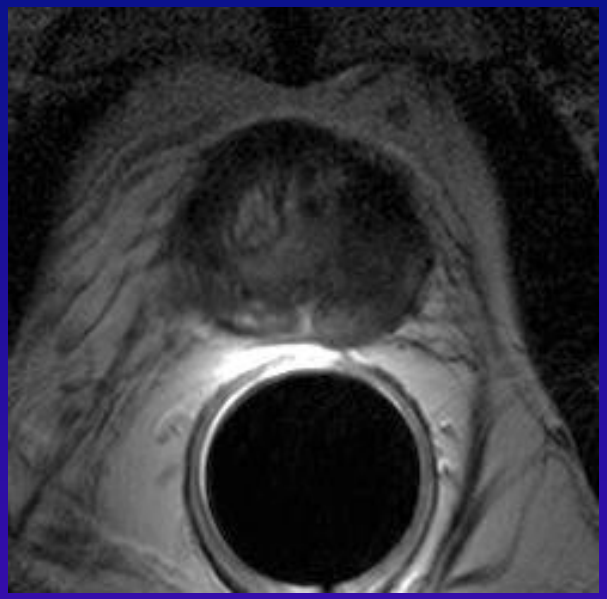
- 83% sensitivity
- 99% specificity

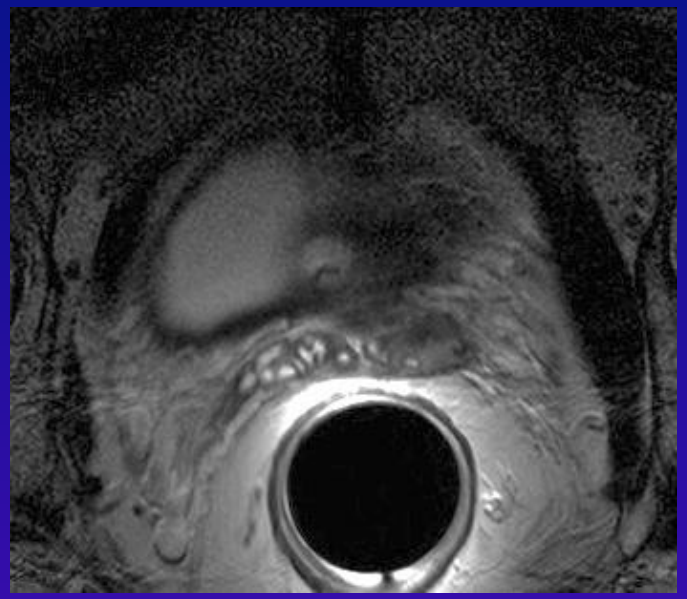
Cornud F , et al. Eur J Radiol 2012;232:133-9.



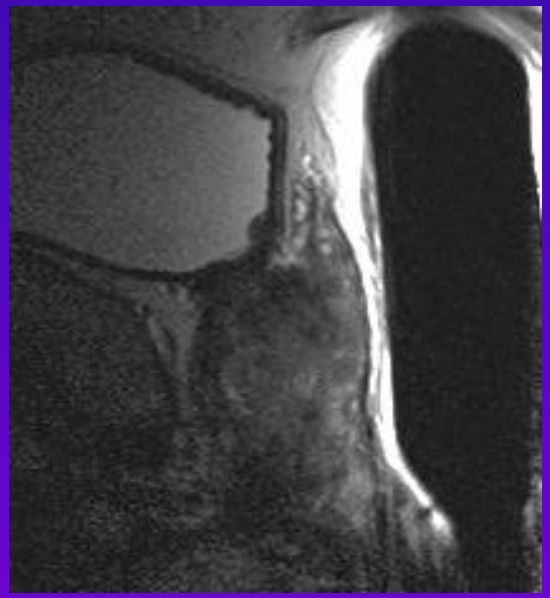


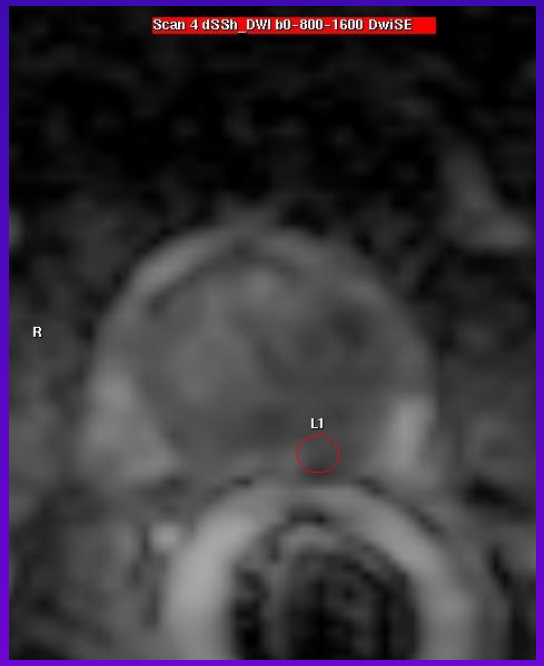


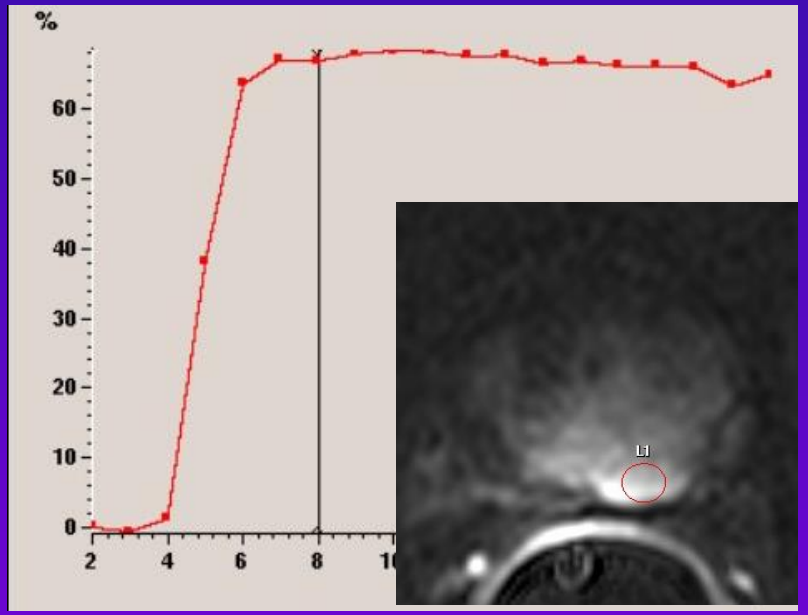




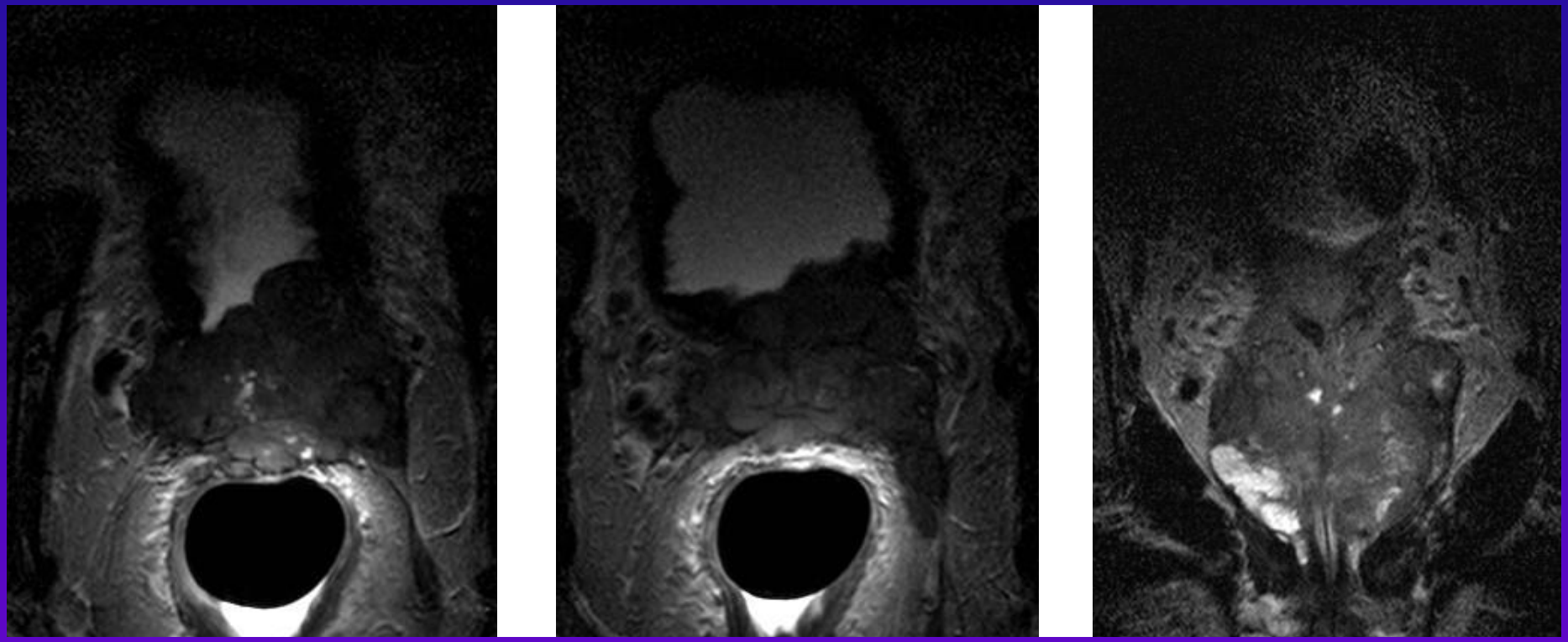
SVI PRESENT
ECE PRESENT







Bladder and rectal invasion (stage T4),



Clinical Indication Staging

ELSEVIER

CrossMark

Urologic Oncology: Seminars and Original Investigations 34 (2016) 291.e9–291.e17

UROLOGIC ONCOLOGY

Original article

Apparent diffusion coefficient in the evaluation of side-specific extracapsular extension in prostate cancer: Development and external validation of a nomogram of clinical use

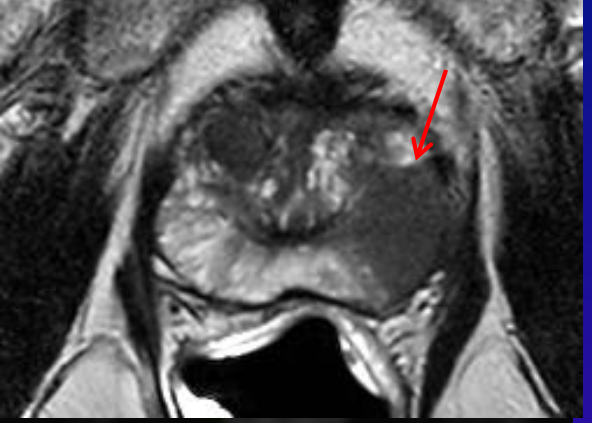
Francesco Giganti, M.D.[a,b,*,1], Andrea Coppola, M.D.[a,1], Alessandro Ambrosi, Ph.D.[b], Silvia Ravelli, M.D.[a], Antonio Esposito, M.D.[a,b], Massimo Freschi, M.D.[c], Alberto Briganti, M.D.[b,d], Vincenzo Scattoni, M.D.[b,d], Andrea Salonia, M.D.[b,d], Andrea Gallina, M.D.[d], Federico Dehò, M.D.[d], Gianpiero Cardone, M.D.[e], Giuseppe Balconi, M.D.[e], Franco Gaboardi, M.D.[f], Francesco Montorsi, M.D.[b,d], Alessandro Del Maschio, M.D.[a,b], Francesco De Cobelli, M.D.[a,b]

Objectives: The aim of this study is to develop a nomogram of clinical utility based on apparent diffusion coefficient (ADC) from diffusion-weighted imaging to predict extracapsular extension (ECE), and to validate externally its clinical utility.

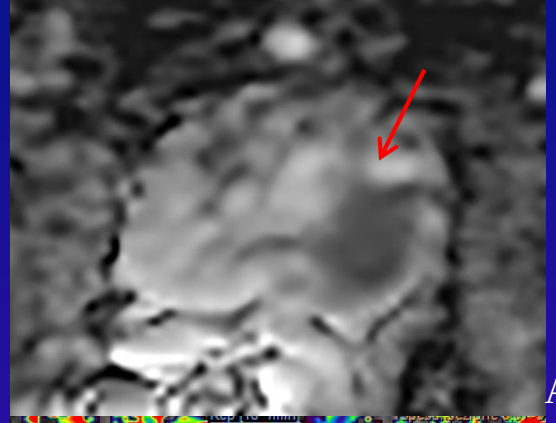
Materials and methods: A total of 101 men (70 for the creation and 31 for external validation of the nomogram) underwent 1.5T multiparametric magnetic resonance imaging followed by radical prostatectomy at 2 different institutions. ADC values were assessed for normal and pathological tissue. Clinical and pathological variables were investigated by univariate and multivariate logistic regression analyses on 70 patients and logistic regression coefficients were used to develop our nomogram. Receiver operating characteristic curve analysis was performed to determine the optimal ADC cut off for ECE. The nomogram was then externally validated on 31 patients at another institution.

Results: At univariate analysis, the following variables were associated with ECE: pathological ADC and Gleason at biopsy ($P < 0.001$) along with tumor volume and ECE at imaging ($P = 0.003$). At multivariate analysis, pathological ADC ($P = 0.027$), tumor volume ($P = 0.011$), and biopsy Gleason ($P = 0.040$) maintained their independent predictor status and were included in our nomogram together with normal ADC and ECE at imaging. Our nomogram showed a significant higher sensitivity (88%) than T2-weighted imaging (54%; $P = 0.010$). External validation resulted in an overall accuracy of 81%.

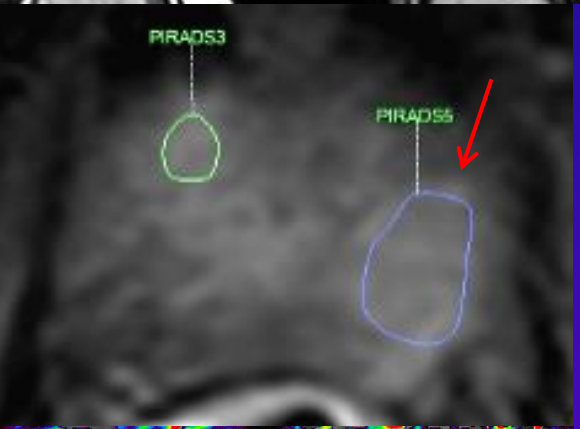
Conclusions: ADC represents a potential imaging biomarker to predict side-specific ECE in patients with prostate cancer. Our nomogram could improve the current diagnostic pathway and possibly the therapeutic approach for this disease.



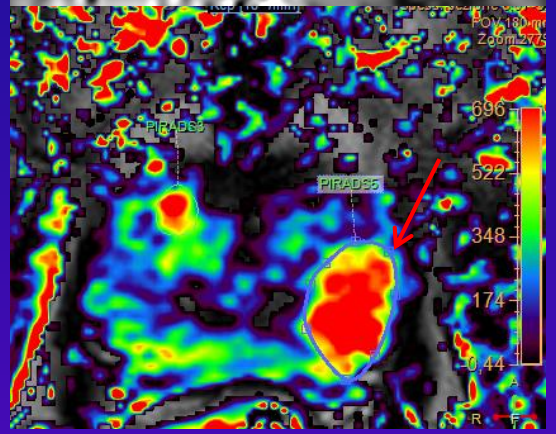
T2 W



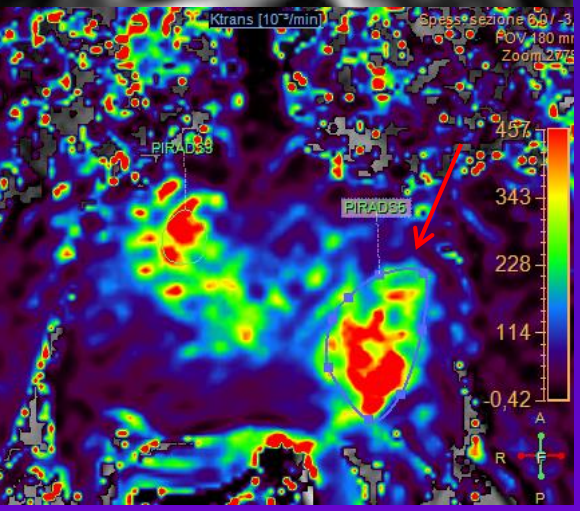
ADC: 0,6



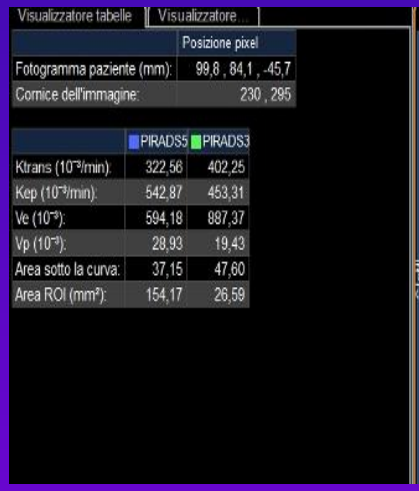
DCE



K EP

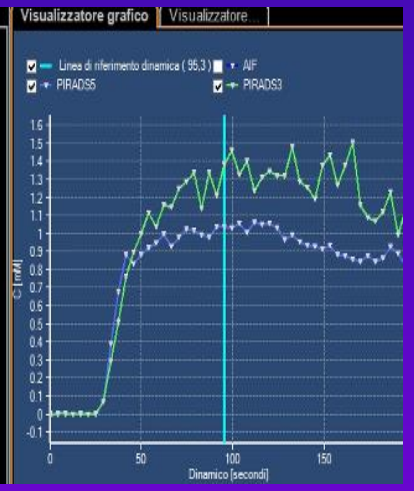


K TRANS



	Posizione pixel
Fotogramma paziente (mm):	99,8 , 84,1 , -45,7
Cornice dell'immagine:	230 , 295

	PIRADS5	PIRADS3
Ktrans (10⁻³/min):	322,56	402,25
Kep (10⁻³/min):	542,87	453,31
Ve (10⁻³):	594,18	887,37
Vp (10⁻³):	28,93	19,43
Area sotto la curva:	37,15	47,60
Area ROI (mm²):	154,17	26,59



PI-RADS 5

mpMRI– PIRADS 2.0

EURURO-7872; No. of Pages 12

ARTICLE IN PRESS

EUROPEAN UROLOGY XXX (2018) XXX–XXX

available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Prostate Cancer

Editorial by XXX on pp. x–y of this issue

Prostate Imaging-Reporting and Data System Steering Committee: PI-RADS v2 Status Update and Future Directions

Anwar R. Padhani[a], Jeffrey Weinreb[b], Andrew B. Rosenkrantz[c], Geert Villeirs[d], Baris Turkbey[e], Jelle Barentsz[f,]*

mpMRI– PIRADS 2.0

Table 1 – Management priorities and proposed MRDB strategies according to mpMRI findings from PI-RADS–compliant protocols

Clinical group	Management priority	MRDB strategy	PI-RADS assessment category		
			PI-RADS 1–2	PI-RADS 3	PI-RADS 4–5
Biopsy-naïve	Minimize overdiagnosis and detect csPCa equally	Recommend [e]	TRUS biopsy if high risk [a]	TRUS biopsy ± MRDB	MRDB target + penumbra
		Option	Lower risk clinically, no immediate biopsy; primary care FU	No biopsy if not high risk [a,d]; urologic FU	MRDB target + TRUS
Prior negative TRUS/low-volume GS 3 + 3 (AS)	Do not miss csPCa	Recommend	No biopsy for lower risk; urologic FU [b]	TRUS biopsy ± MRDB	MRDB target + TRUS [c]
		Option	SBx or TPMB if high risk [a,b,c]	SBx/TPMB	MRDB target + penumbra MRDB target + SBx/TPMB [f]
Negative prior MRDB; no TRUS but at high risk [a]	Do not miss csPCa	Recommend	TRUS/SBx/TPMB according to local rules	TRUS biopsy ± MRDB	MRDB target + penumbra MRDB target + penumbra + TRUS MRDB target + penumbra + SBx
		Option	No biopsy; urologic FU	SBx/TPMB	

MRDB = magnetic resonance–directed biopsy; mpMRI = multiparametric magnetic resonance imaging; PI-RADS = Prostate Imaging-Data and Reporting System; AS = active surveillance; csPCa = clinically significant prostate cancer (various definitions); TRUS = transrectal ultrasound systematic 10–12-core biopsy according to international standards; site specific MR-directed biopsy using US/MRI fusion technique or in-bore technique; SBx = saturation biopsy using transrectal or transperineal sampling (eg, Ginsburg approach); TPMB = transperineal mapping biopsy using 5-mm sampling; FU = follow-up.

[a] High risk according to clinical suspicion, family history, prior biopsy result (if applicable), 4K/PHI/PCA3/FH/PSAD risk calculator scores alone or in combination.

[b] National Institute for Health and Care Excellence (NICE) guideline 2014 [86].

[c] European Association of Urology/American Urological Association/Society of Abdominal Radiation 2017 guidelines [87,88].

[d] NHS England guideline, 2018 [99].

[e] Lack of specific clinical guidance.

[f] Depending on size and likely next step in management if csPCa is found.