

Aggiornamenti in Urologia: Specialisti e MMG a confronto

Teatro Auditorium Poggio Rusco (MN)
17 Marzo 2018

Il tumore prostatico: Ruolo della Risonanza Magnetica



Dott. Simone Sala
Specialista in Radiologia

Sezione di Risonanza Magnetica
X Ray One Poggio Rusco, MN

Il tumore Prostatico

Ruolo della Risonanza Magnetica

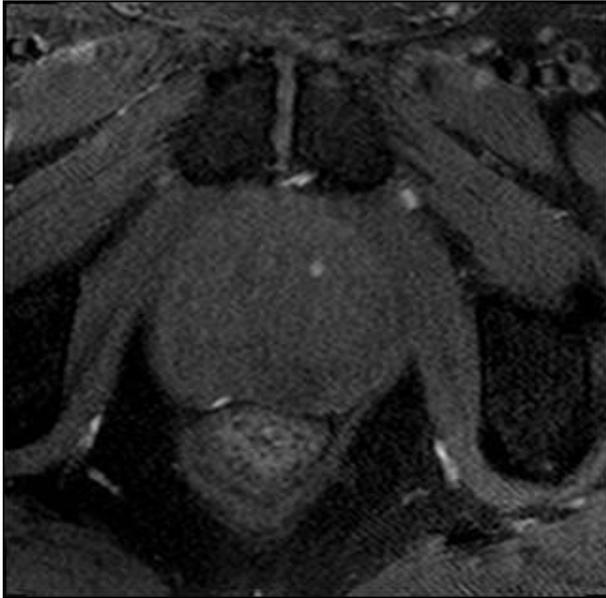
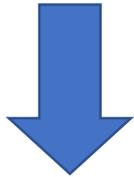


Stadiazione locoregionale

Valutazione Morfologica di Base – Immagini T1 e T2 pesate

Valutazione Morfologica di Base

Immagini T1



Parenchima Omogeneo

Immagini T2



Dettaglio anatomico

Il tumore Prostatico

Ruolo della Risonanza Magnetica

IMAGING MULTIPARAMETRICO



Diagnosi

Guida alla Biopsia

Stadiazione

Sorveglianza attiva

Recidiva biochimica

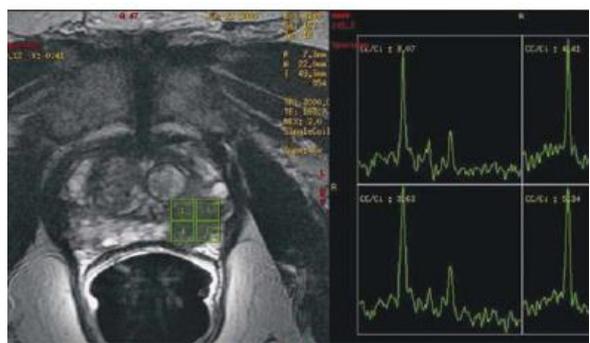
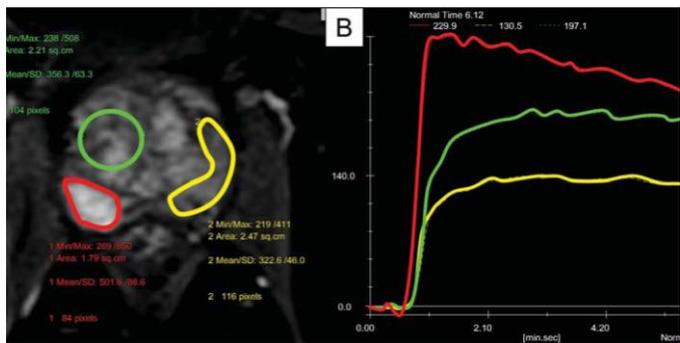
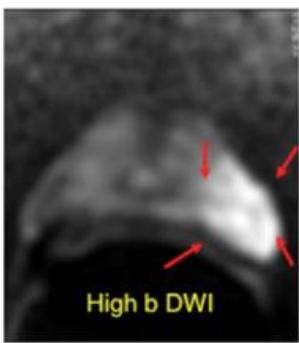
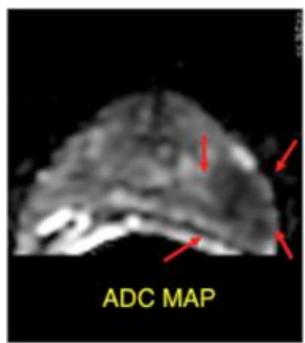
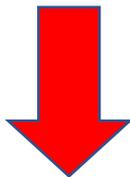
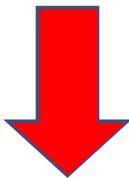
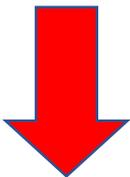
Avanzamenti Tecnologici Nuove sequenze di acquisizione



Imaging in Diffusione

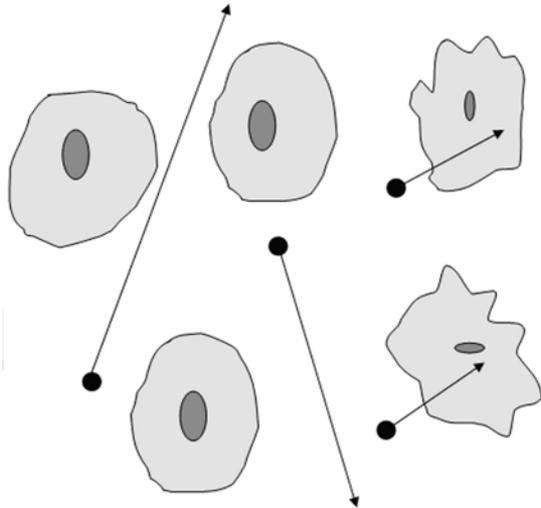
MDC dinamico

Spettroscopia

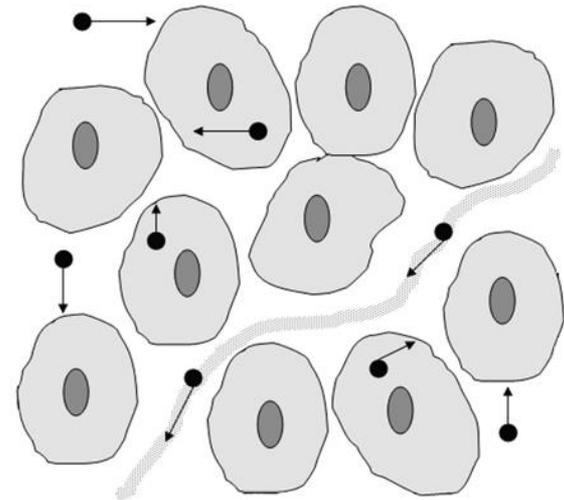


IMAGING MULTIPARAMETRICO

Imaging di Diffusione (DWI)

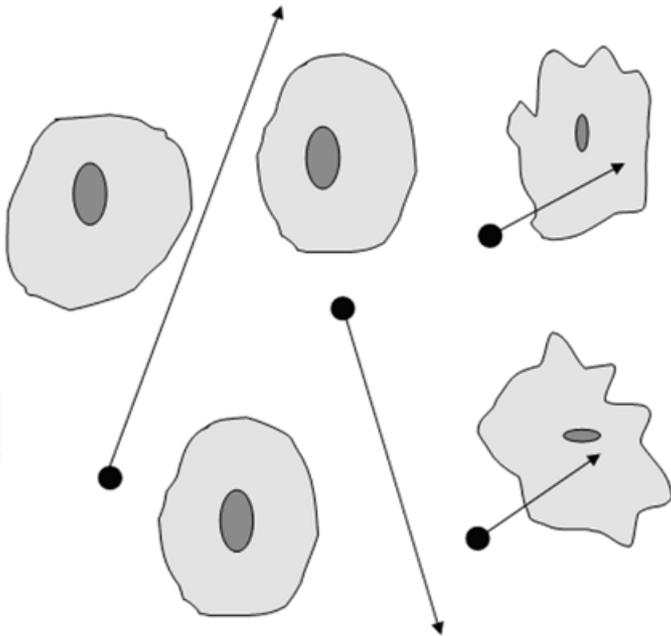


Diffusione
LIBERA delle
molecole
d'acqua.



Diffusione
RISTRETTA
delle molecole
d'acqua.

Imaging di Diffusione (DWI)



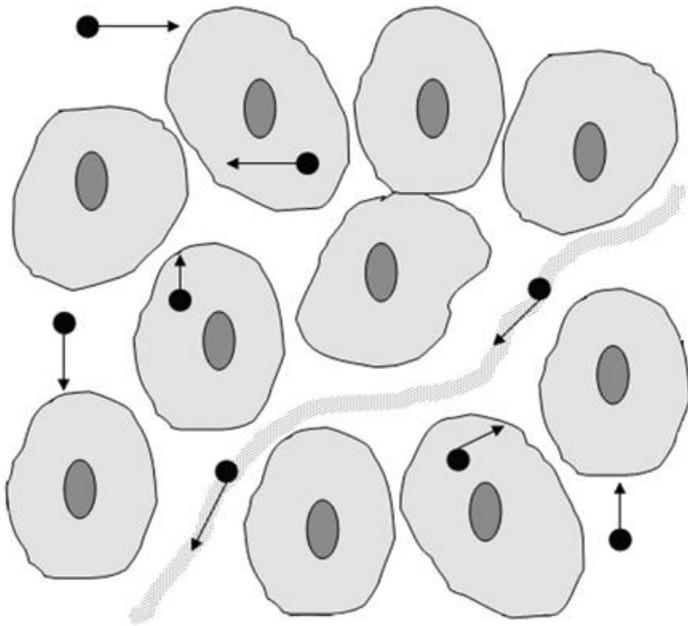
Sequenza DWI

Diffusione **LIBERA** delle
molecole d'acqua.

Diffusione LIBERA ➔ **Segnale basso**

Imaging di Diffusione (DWI)

TUMORE



Diffusione **RISTRETTA**
delle molecole d'acqua.



Sequenza DWI

Diffusione RISTRETTA ➡ Segnale alto

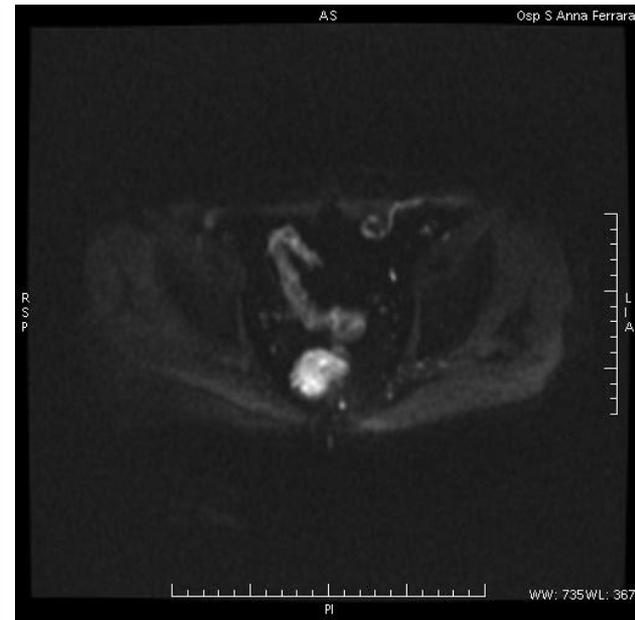
Imaging di Diffusione (DWI)



T1



T2

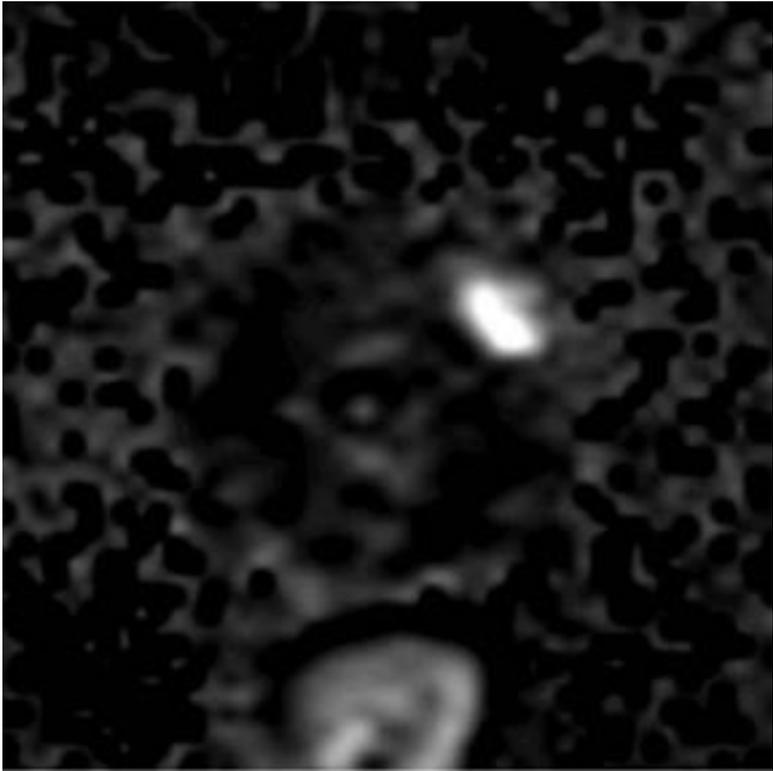


DWI

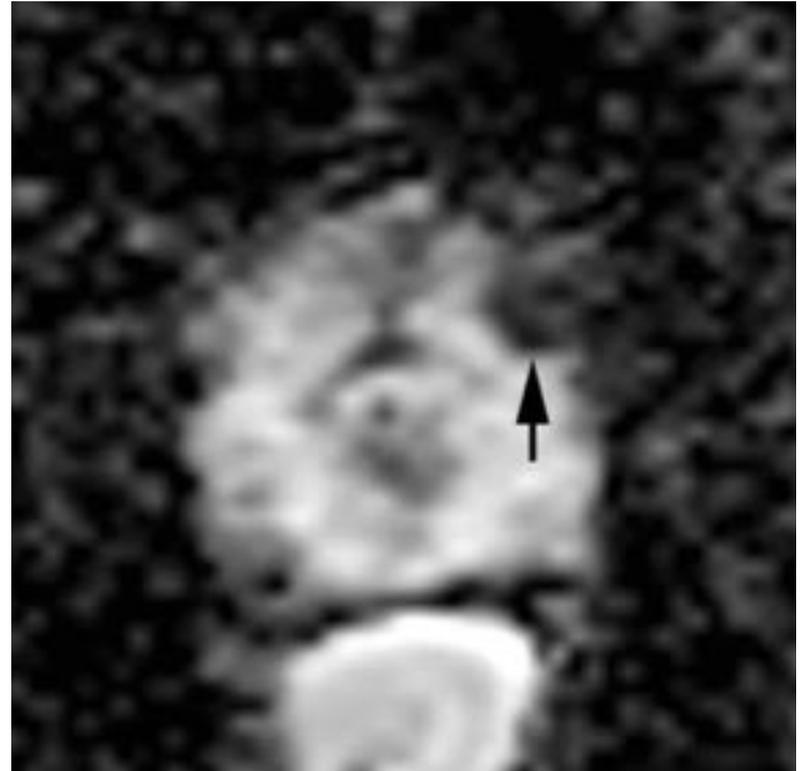
Imaging di Diffusione (DWI e ADC MAP)

- Un parametro quantitativo della Diffusione è il **Coefficiente di Diffusione Apparente (ADC)**
- Si possono costruire delle Mappe in base a questo parametro definite **Mappe ADC**

Imaging di Diffusione

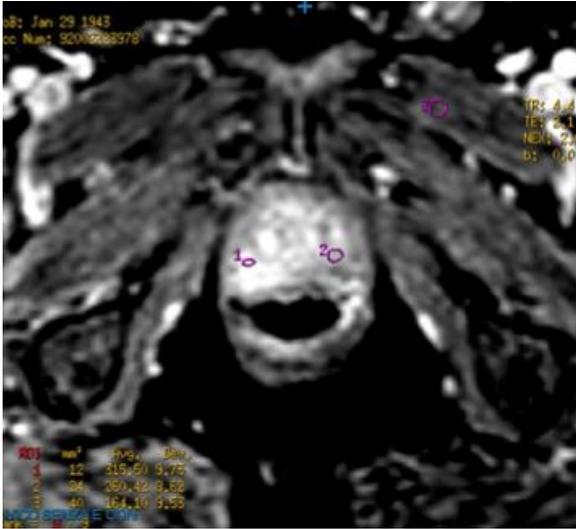


DWI

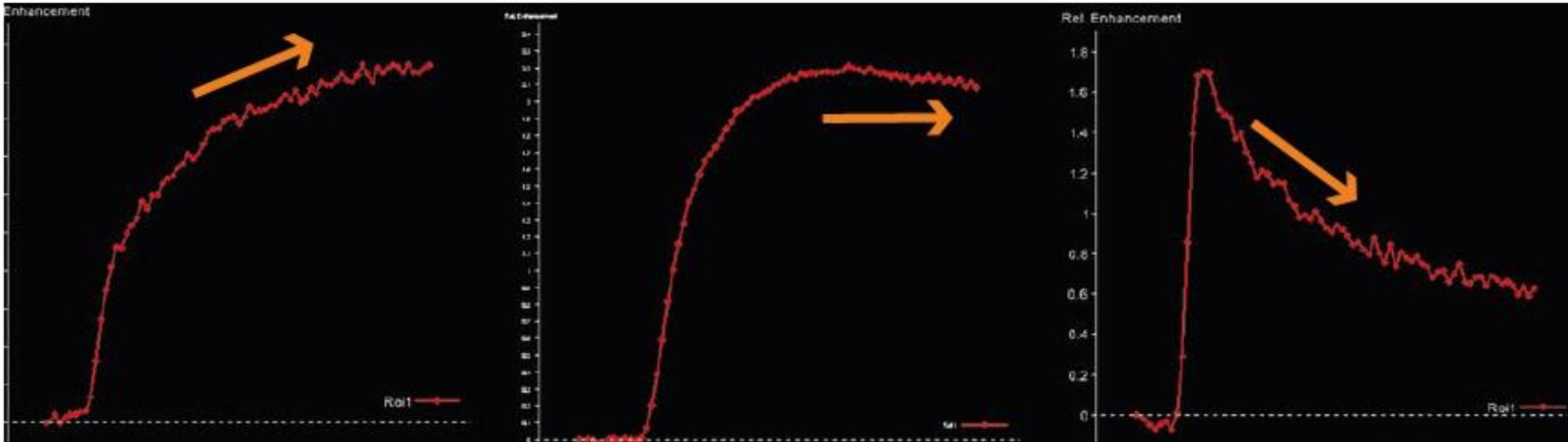


Mappa ADC

Imaging dinamico con mezzo di contrasto (DCE)



- Tipo 1: tipica del tessuto sano
- Tipo 2: aspecifica
- Tipo 3: tipica del tumore



Tipo 1

Tipo 2

Tipo 3

Spettroscopia

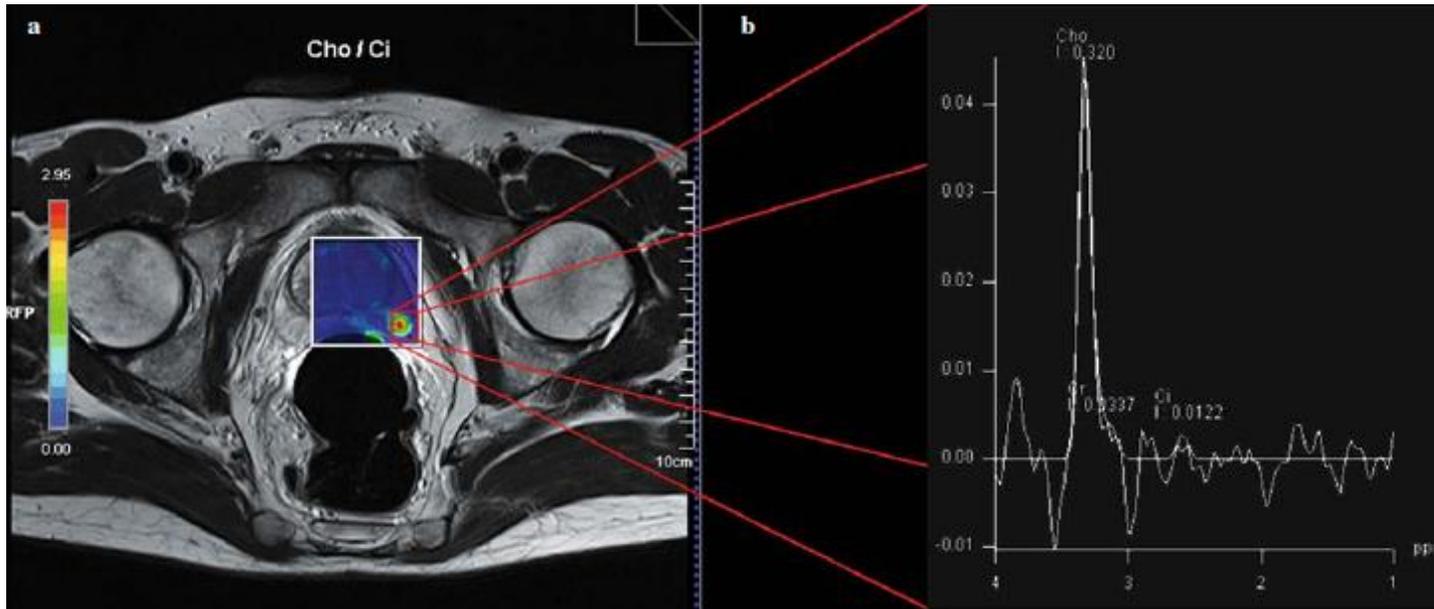
Rileva la concentrazione di metaboliti all'interno di volumi di interesse

Rapporto Colina+Creatina/Citrato

< 0,8 Tessuto Normale

> 0,8 Tessuto neoplastico

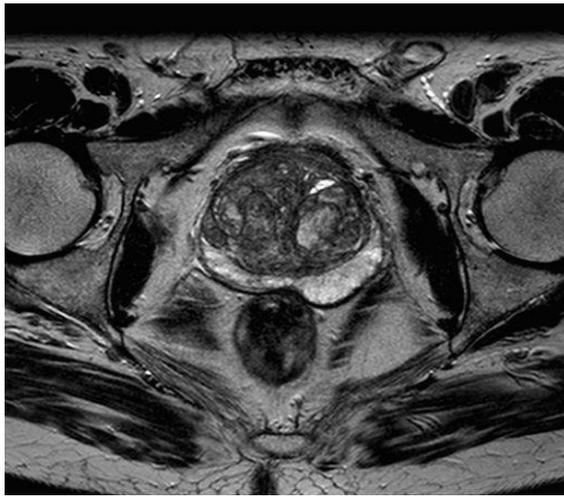
Role of magnetic resonance spectroscopic imaging ($[^1\text{H}]$ MRSI) and dynamic contrast-enhanced MRI (DCE-MRI) in identifying prostate cancer foci in patients with negative biopsy and high levels of prostate-specific antigen (PSA)



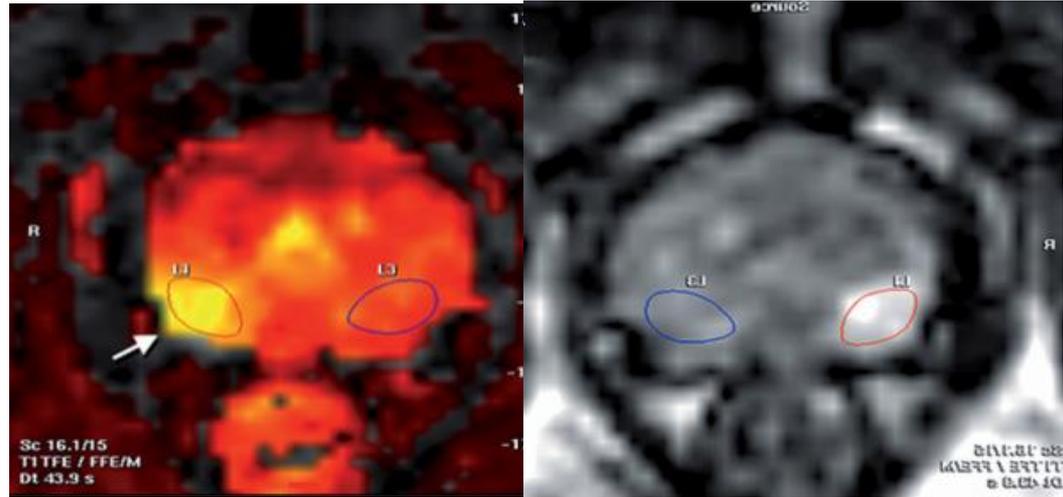
Risonanza Magnetica Prostatica MULTIPARAMETRICA

IMPORTANT

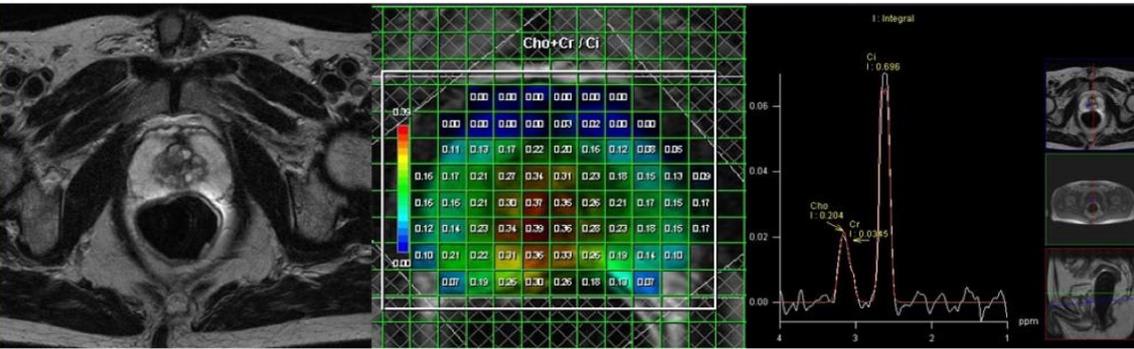
Studio Morfologico



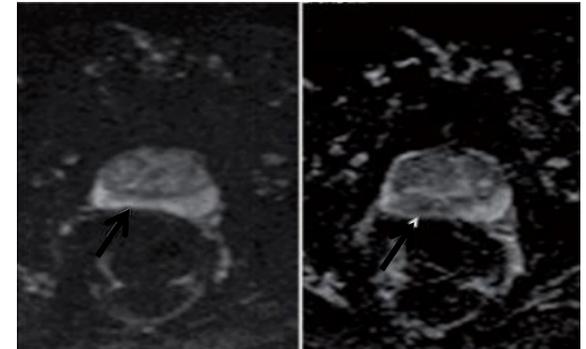
Studio Dinamico Perfusionale MDC



Studio Metabolico Spettroscopico

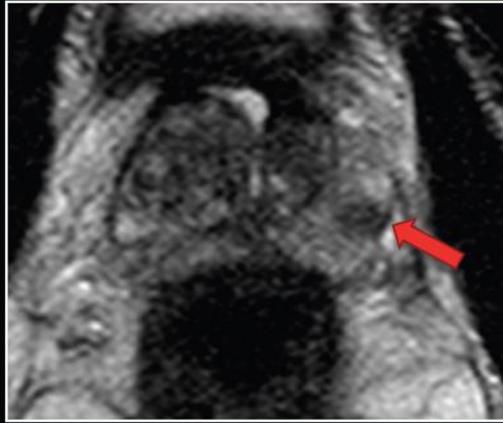


Studio di Diffusione

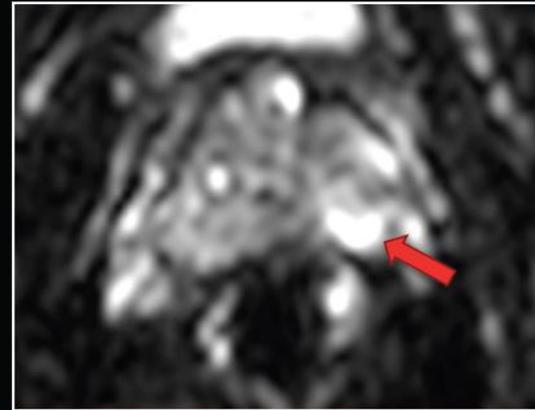


Analisi delle lesioni: Il carcinoma prostatico

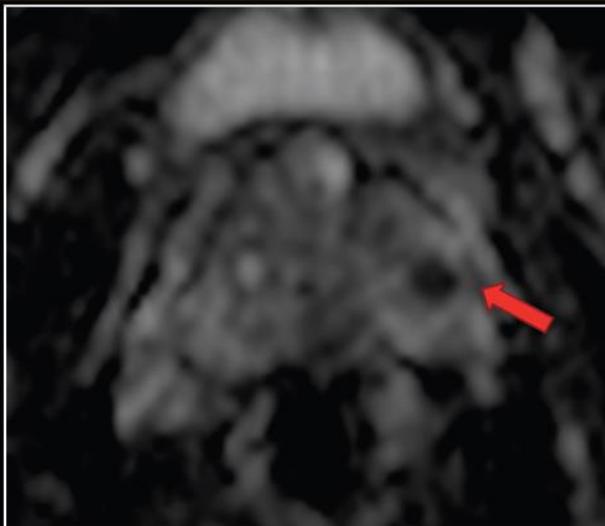
Ipointenso nelle sequenze TSE pesate in T2



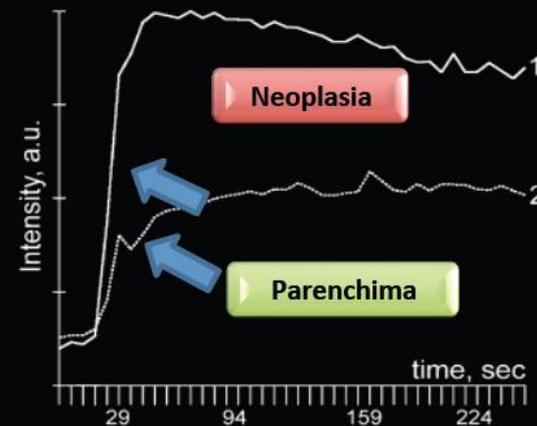
Iperintenso nelle sequenze EPI pesate in DWI



Ipointenso nelle mappe ADC



Ha una curva perfusionale (DCE) caratterizzata da un rapido wash-in e un progressivo wash-out



Il tumore Prostatico

Ruolo della Risonanza Magnetica



Diagnosi

Guida alla Biopsia

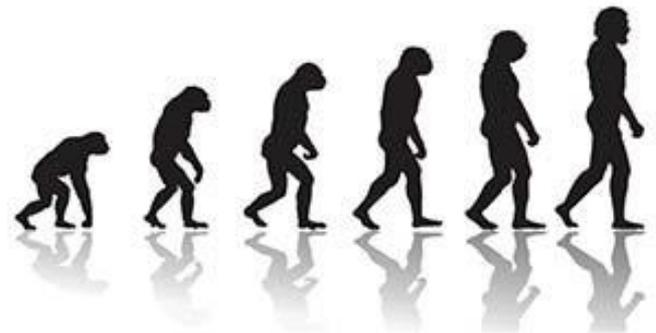
Stadiazione

Sorveglianza attiva

Recidiva biochimica



- Evoluzione Tecnologica..
- Evoluzione nella Interpretazione/Refertazione...



Evoluzione nella interpretazione/refertazione

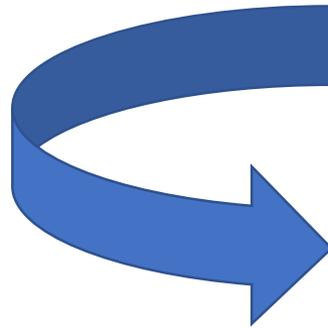


STANDARD COMUNI

2012



European Society of Urogenital Radiology



PI-RADS v1

2015



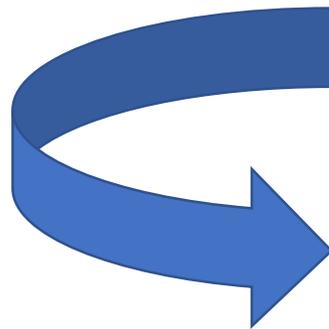
European Society of Urogenital Radiology



American College of Radiology



AdMeTech Foundation



PI-RADS v2

PI-RADS v2

Prostate Imaging and Report and Data System: Version 2

INTRODUCTION

SECTION I Clinical Considerations and Technical Specifications

SECTION II Normal Anatomy and Benign Findings

SECTION III Assessment and Reporting

SECTION IV Multiparametric MRI (mpMRI)

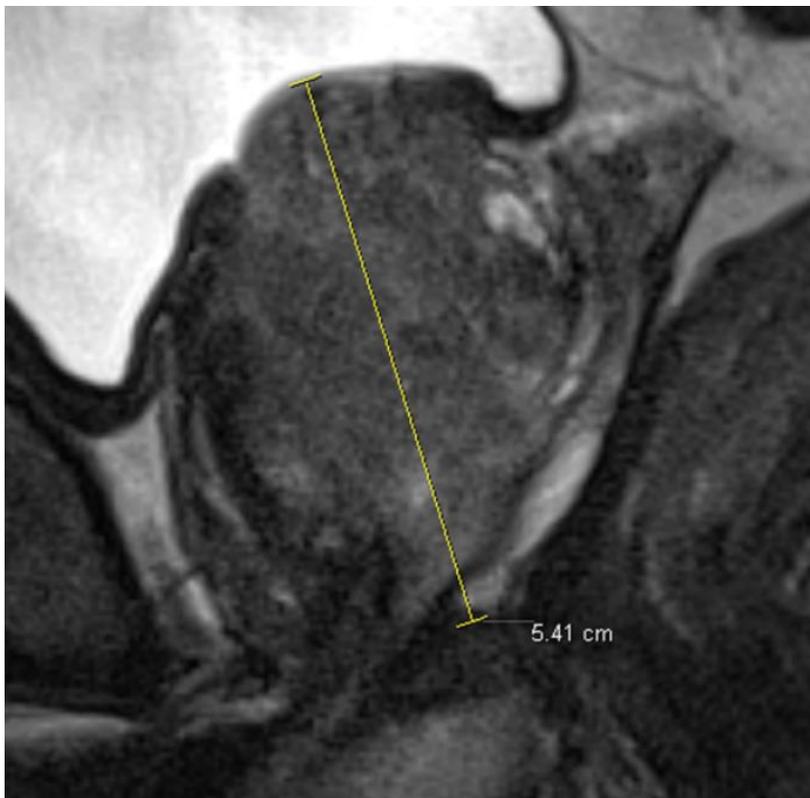
SECTION V Staging

PI-RADS v2

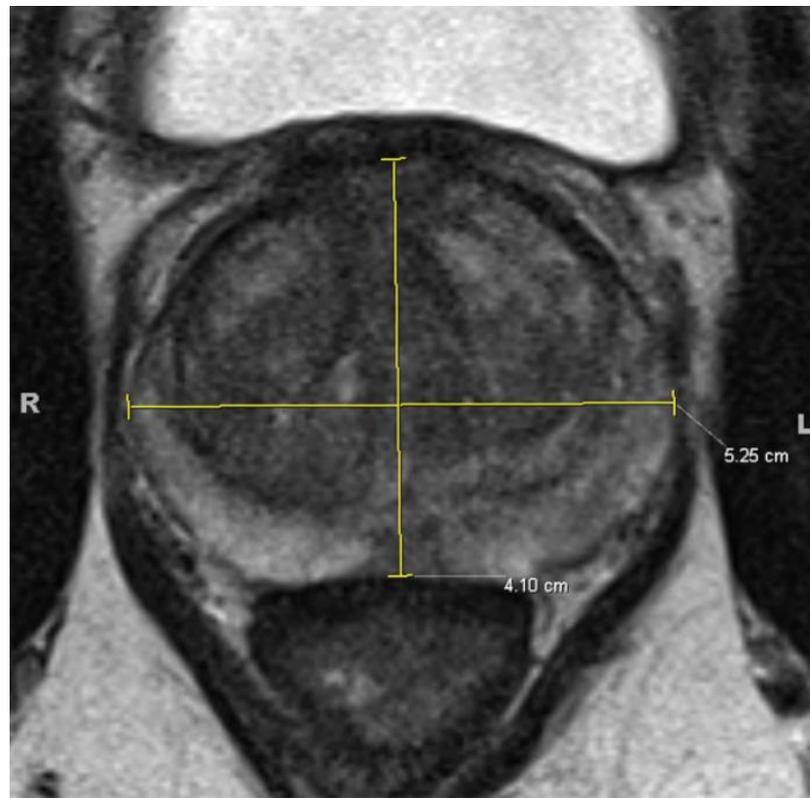
Obiettivi

- Stabilire i **requisiti tecnici** essenziali
- Semplificare e **standardizzare** la refertazione
- Facilitare l'uso della RM nelle **biopsie TARGET**
- Stabilire **i livelli di rischio** delle lesioni individuate
- Favorire la **raccolta dati** e le valutazioni di outcome
- **Ridurre la variabilità** individuale tra Radiologi
- Favorire la **comunicazione** interdisciplinare

Accurata misurazione dimensioni ghiandolari



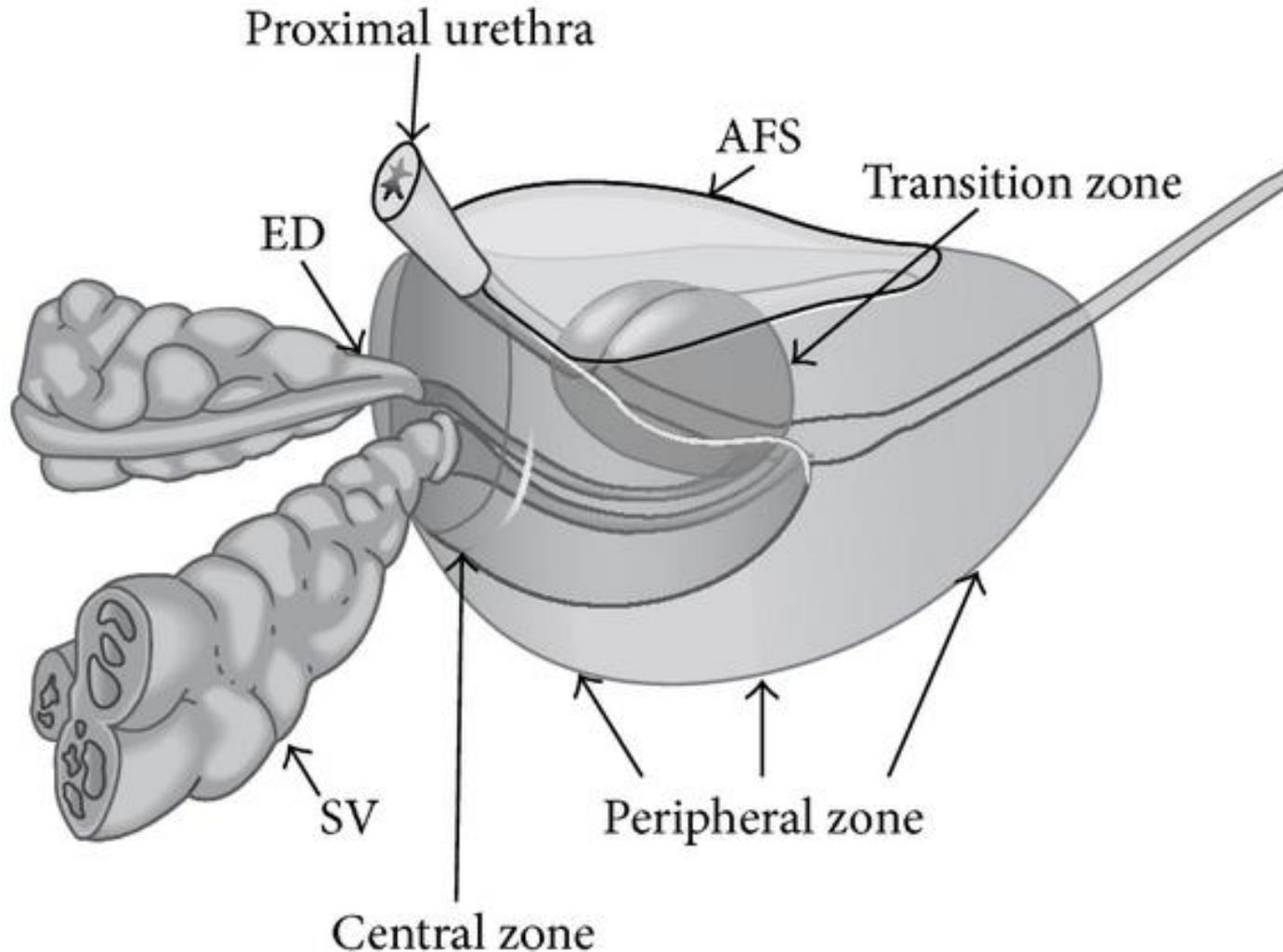
Sagittale



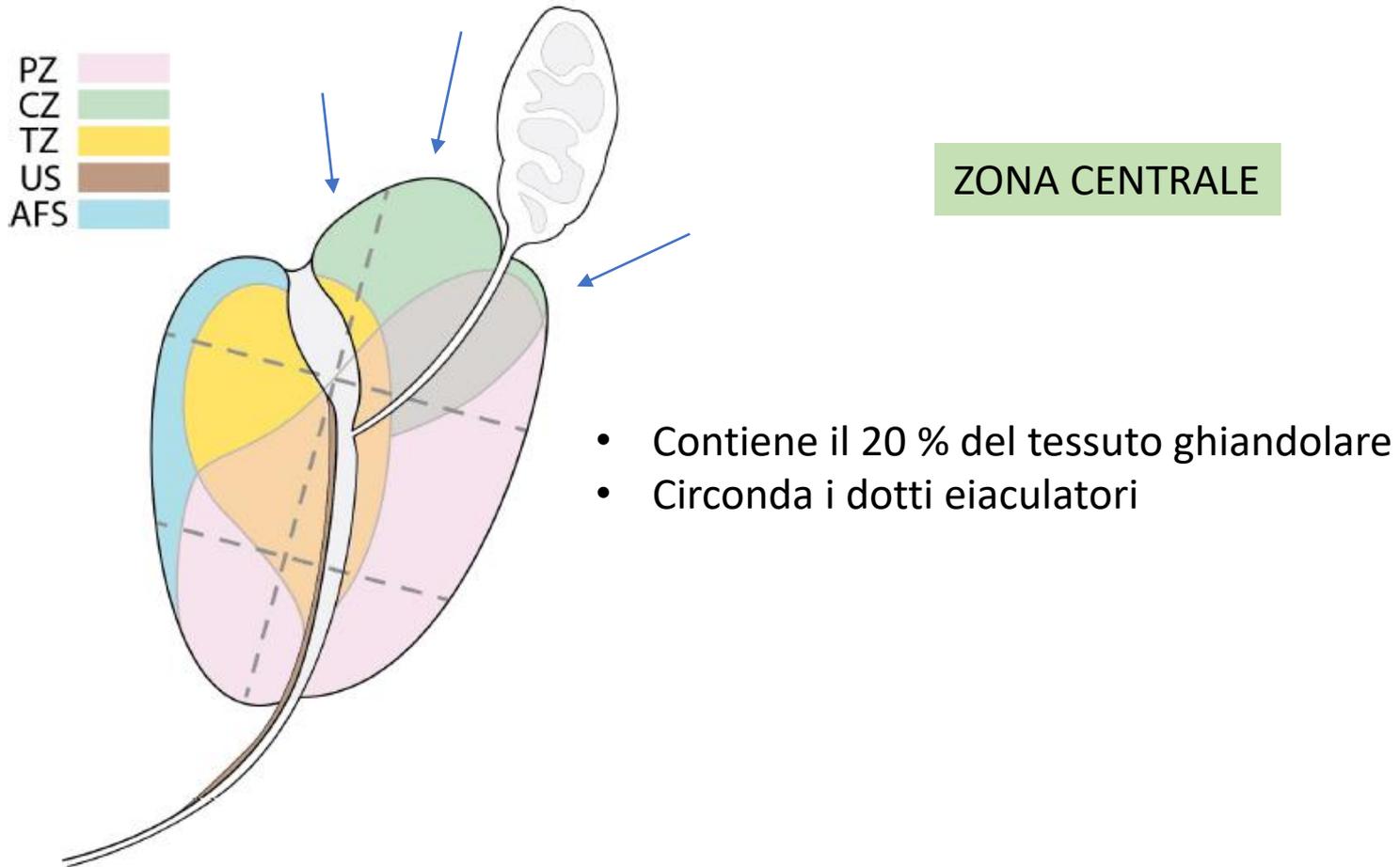
Assiale

PI-RADS v2

Punto di partenza: Anatomia zonale prostatica

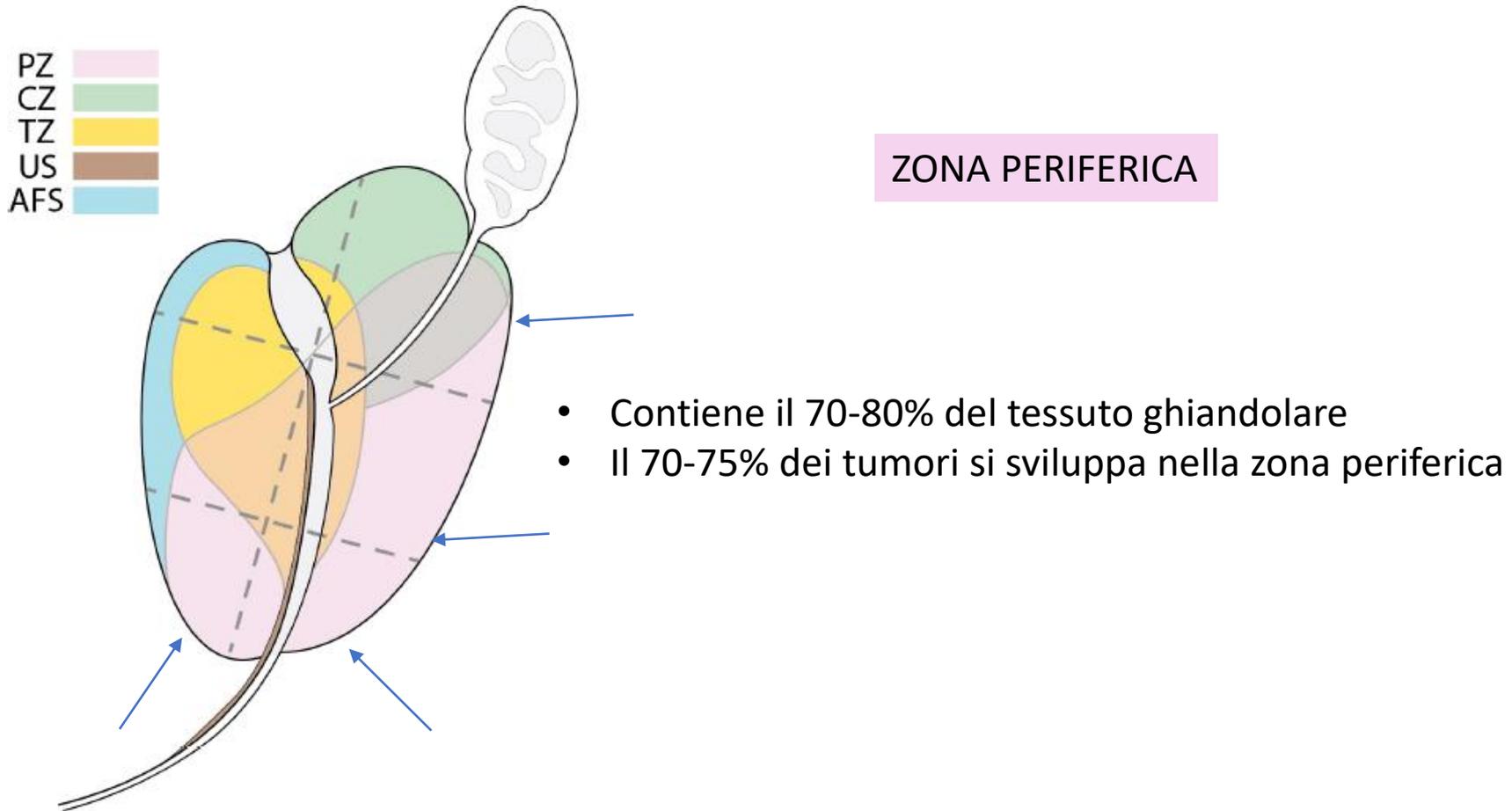


PI-RADS v2



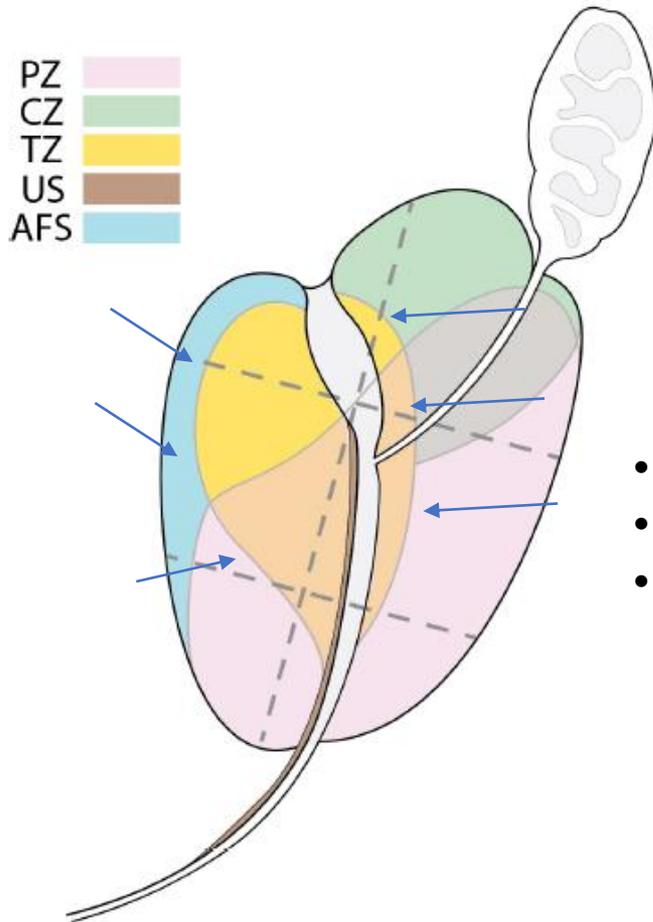
Punto di partenza: Anatomia zonale prostatica

PI-RADS v2



Punto di partenza: Anatomia zonale prostatica

PI-RADS v2

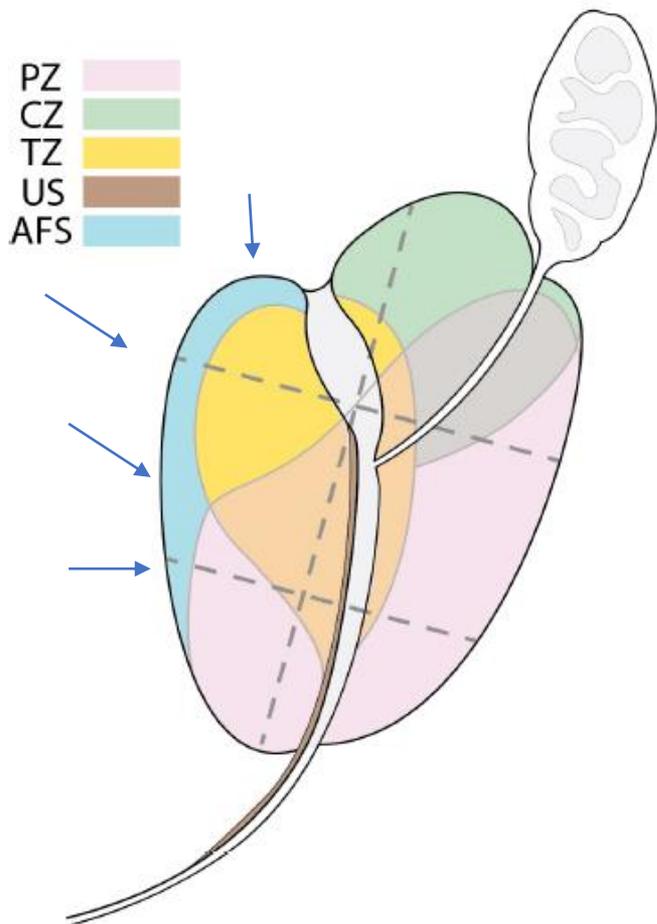


ZONA di TRANSIZIONE

- Contiene il 5% del tessuto ghiandolare
- Circonda l'uretra prossimale sino al veru montanum
- Il 20-30% dei tumori origina dalla zona di transizione

Punto di partenza: Anatomia zonale prostatica

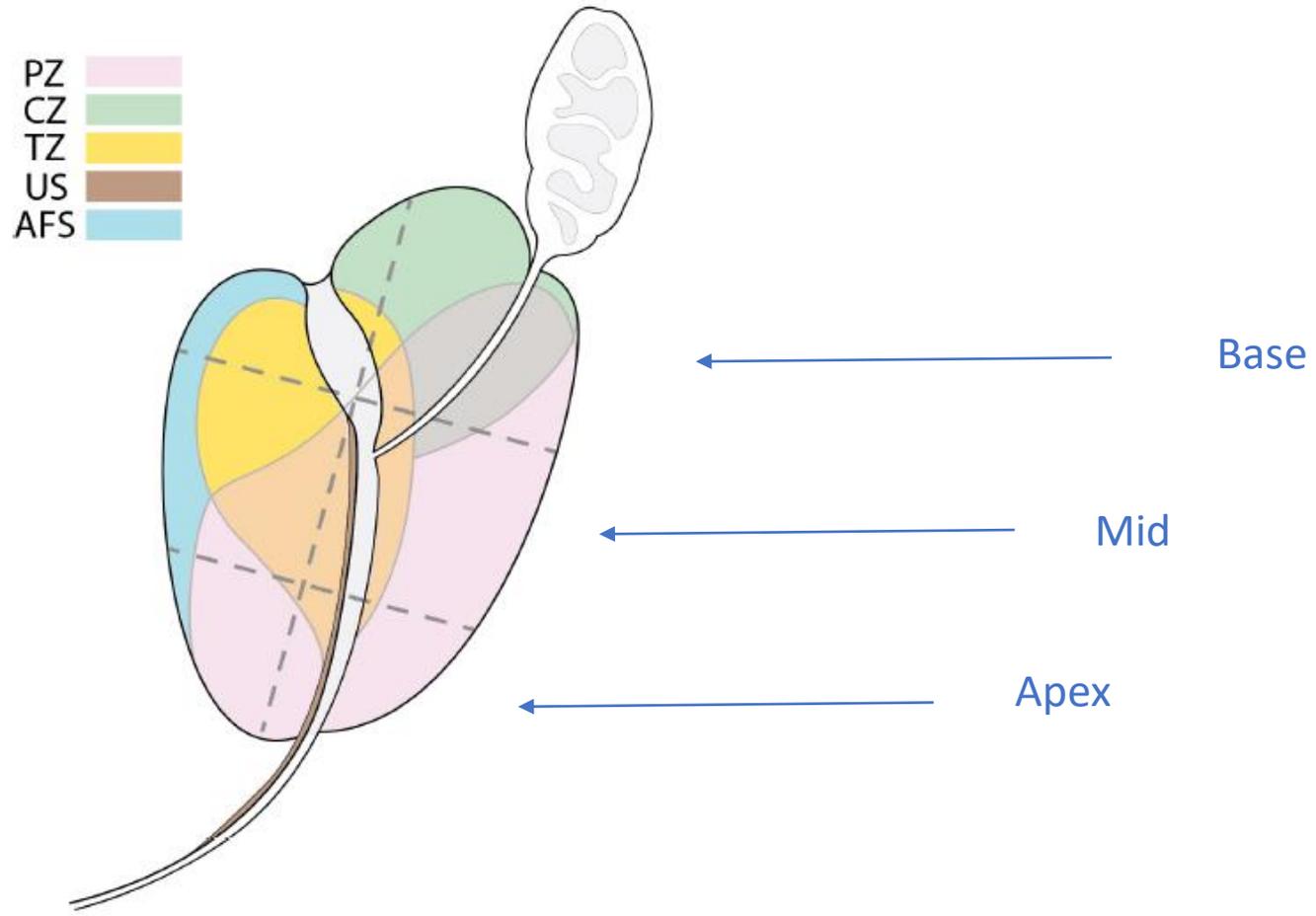
PI-RADS v2



STROMA FIBROMUSCOLARE ANTERIORE

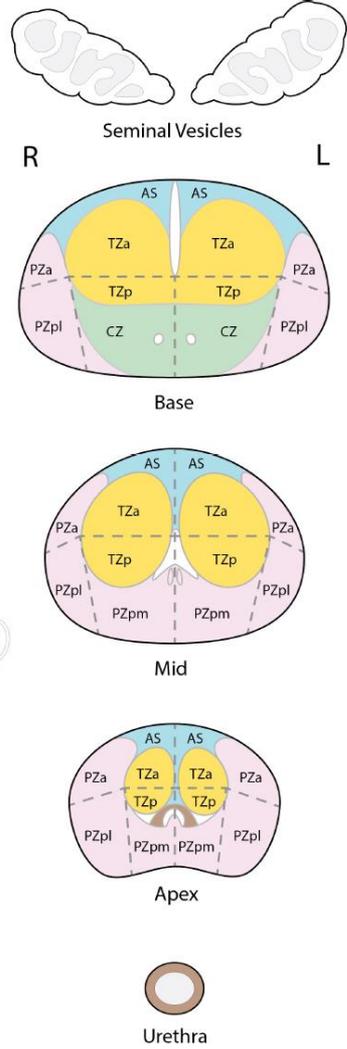
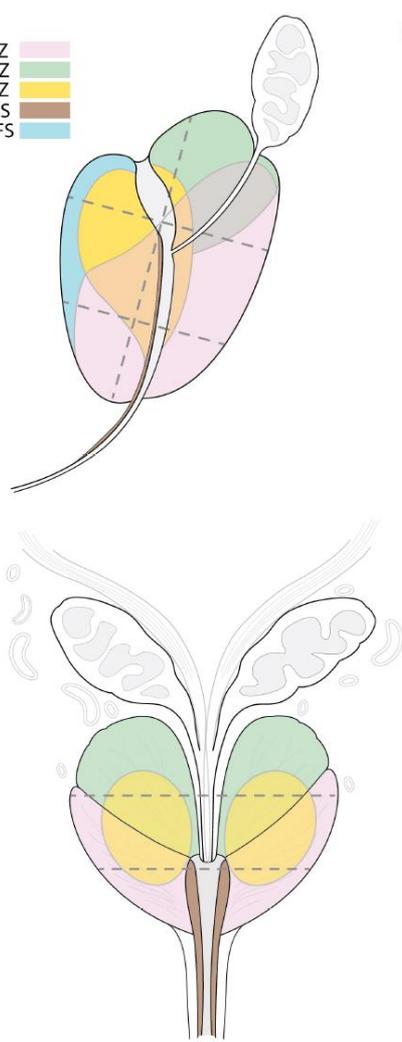
Punto di partenza: Anatomia zonale prostatica

PI-RADS v2



TRE diversi livelli anatomici

PZ
CZ
TZ
US
AFS



Base

Mid

Apex

Il modello di segmentazione PI-RADS v2 definisce **39** regioni:

- 36 regioni prostatiche
- 2 vescicole seminali
- 1 sfintere uretrale esterno

PI-RADS v2

Analisi delle lesioni

Zona Periferica o Zona di Transizione?

PZ



TZ

PI-RADS v2

Analisi delle lesioni

Zona Periferica o Zona di Transizione



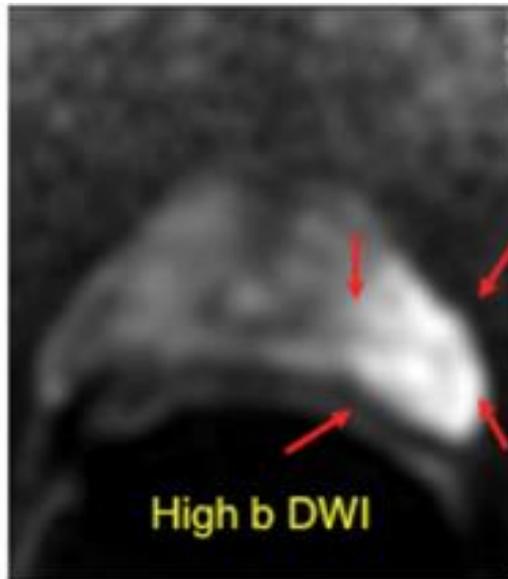
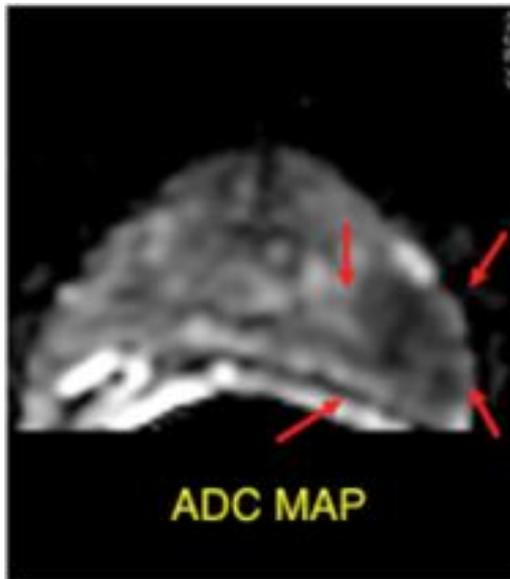
PZ

TZ



Analisi delle lesioni Zona Periferica

SI PARTE DA
Imaging di Diffusione (DWI e Mappe ADC)





Analisi delle lesioni

Zona Periferica

**In base ai rilievi
dell'Imaging di Diffusione (DWI e Mappe ADC)**

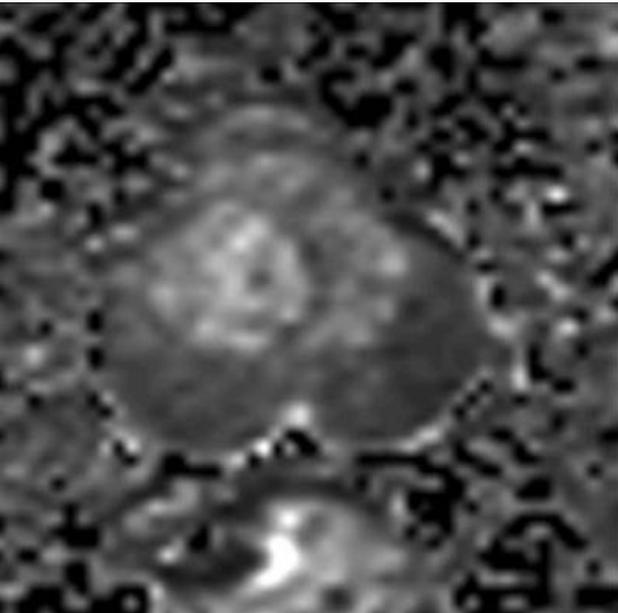
**Attribuiamo un punteggio
(Score)**



Analisi delle lesioni

Zona Periferica

Punteggio DWI = 1



DWI



Mappa ADC

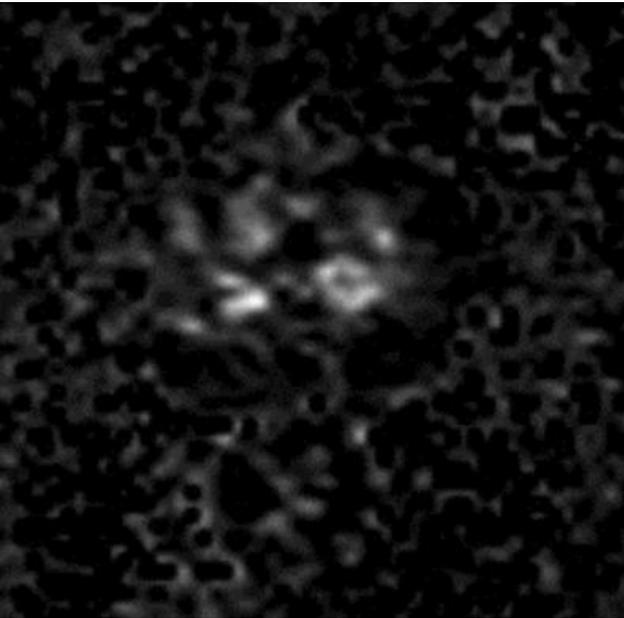
No abnormality
(i.e. normal) on
ADC and high b-
value DWI.



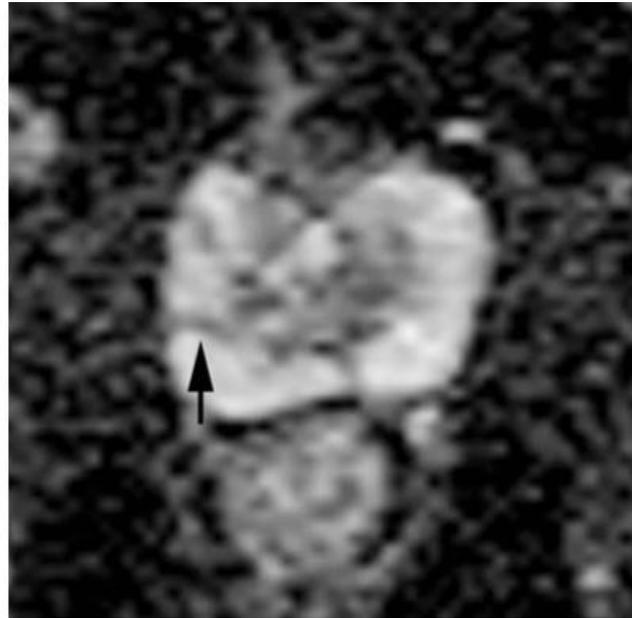
Analisi delle lesioni

Zona Periferica

Punteggio DWI = 2



DWI

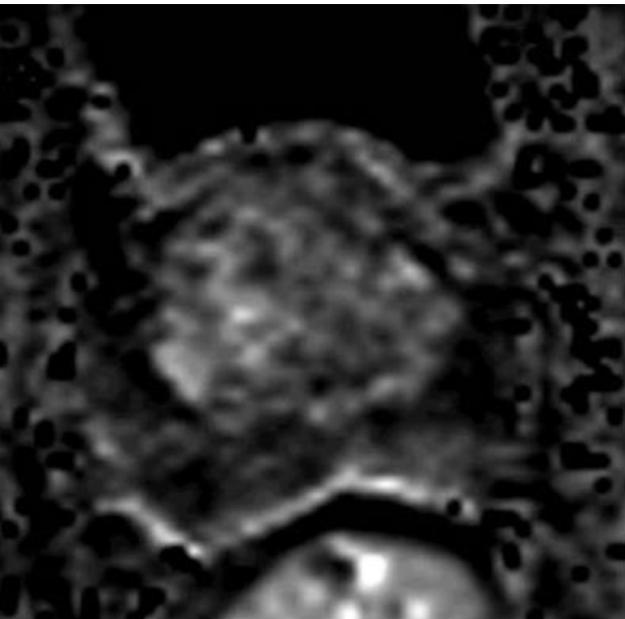


Mappa ADC

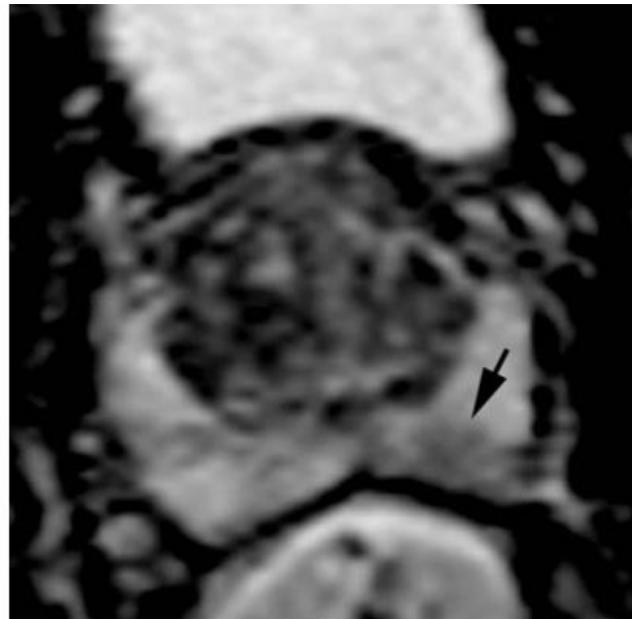
Indistinct hypointense on ADC (arrow).



Analisi delle lesioni Zona Periferica Punteggio DWI = 3



DWI



Mappa ADC

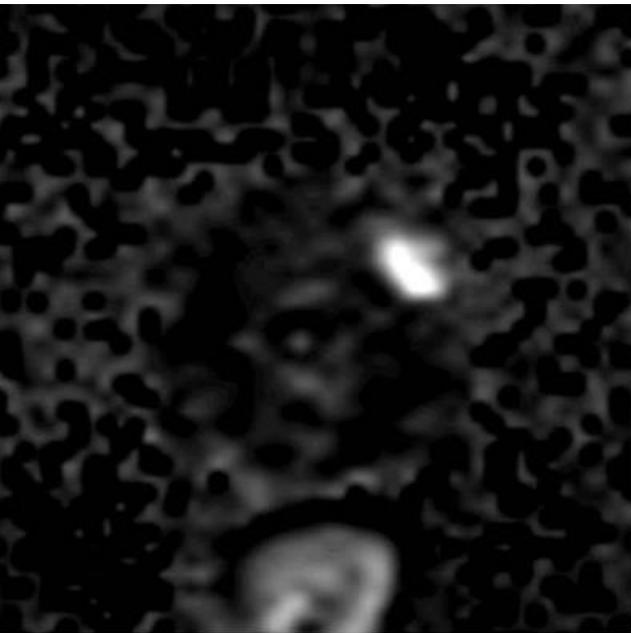
Focal mildly/moderately hypointense on ADC (arrow) and isointense/mildly hyperintense on high b-value DWI.



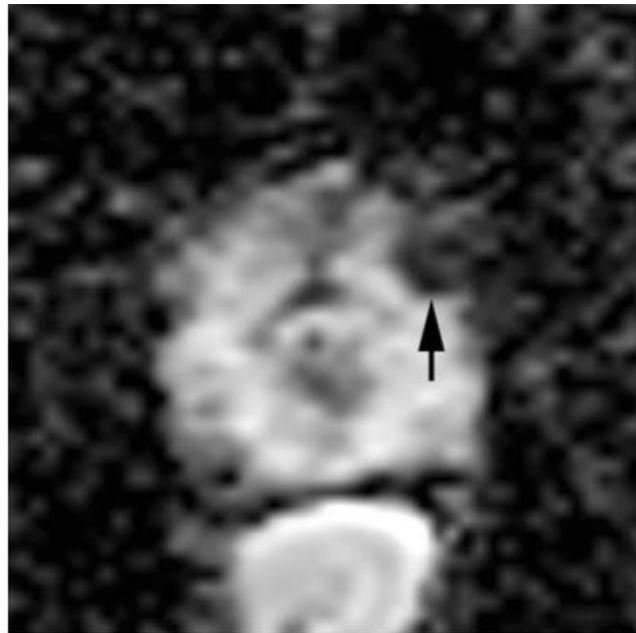
Analisi delle lesioni

Zona Periferica

Punteggio DWI = 4



DWI

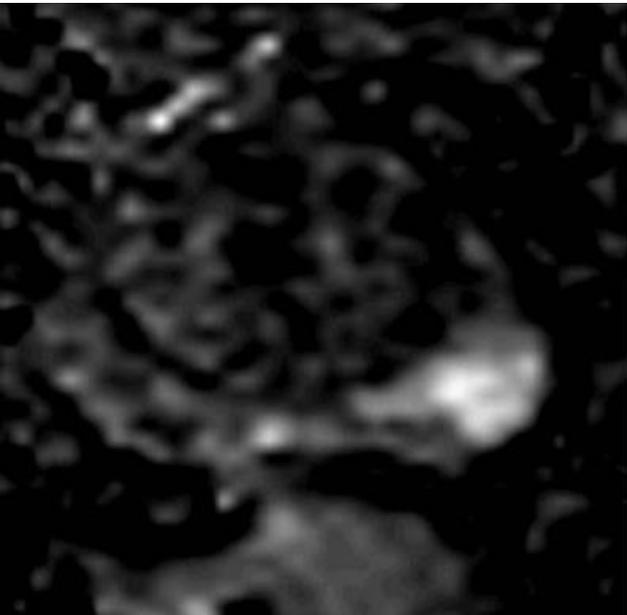


Mappa ADC

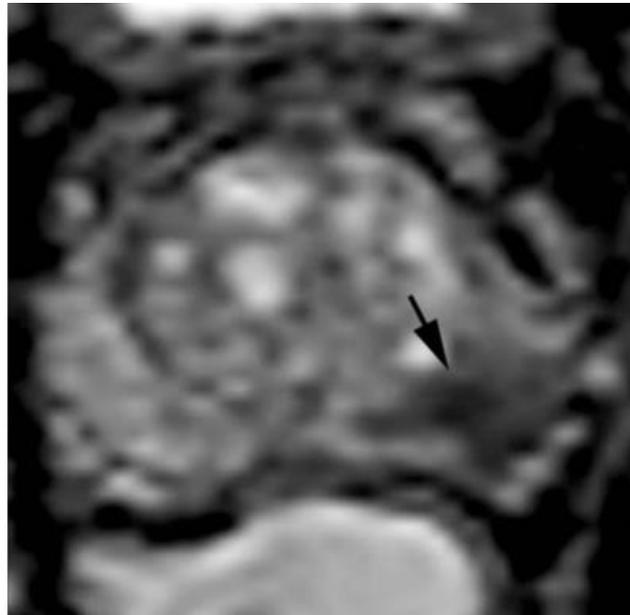
Focal markedly hypointense on ADC (arrow) and markedly hyperintense on high b-value DWI; < 1.5cm on axial images.



Analisi delle lesioni Zona Periferica Punteggio DWI = 5



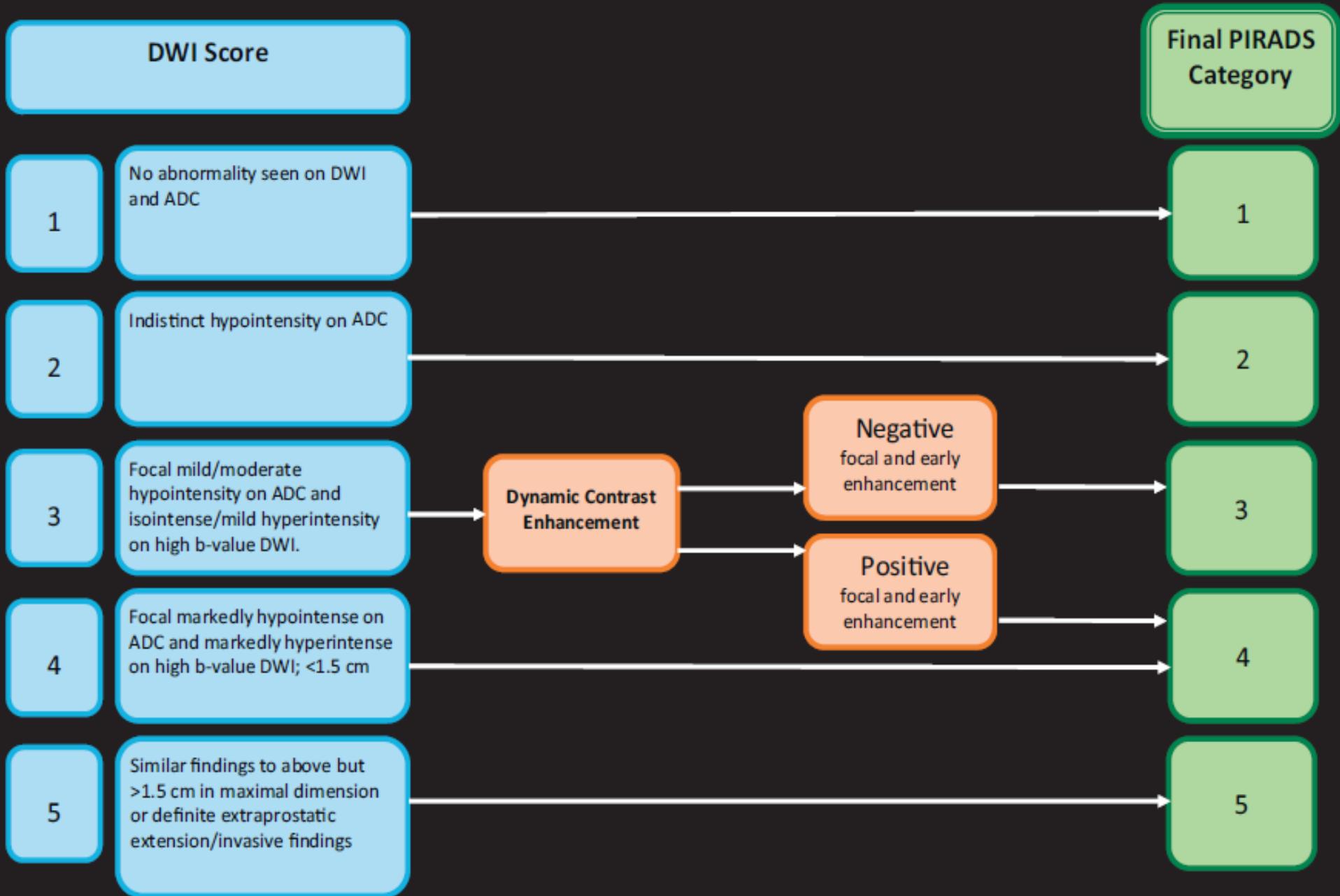
DWI



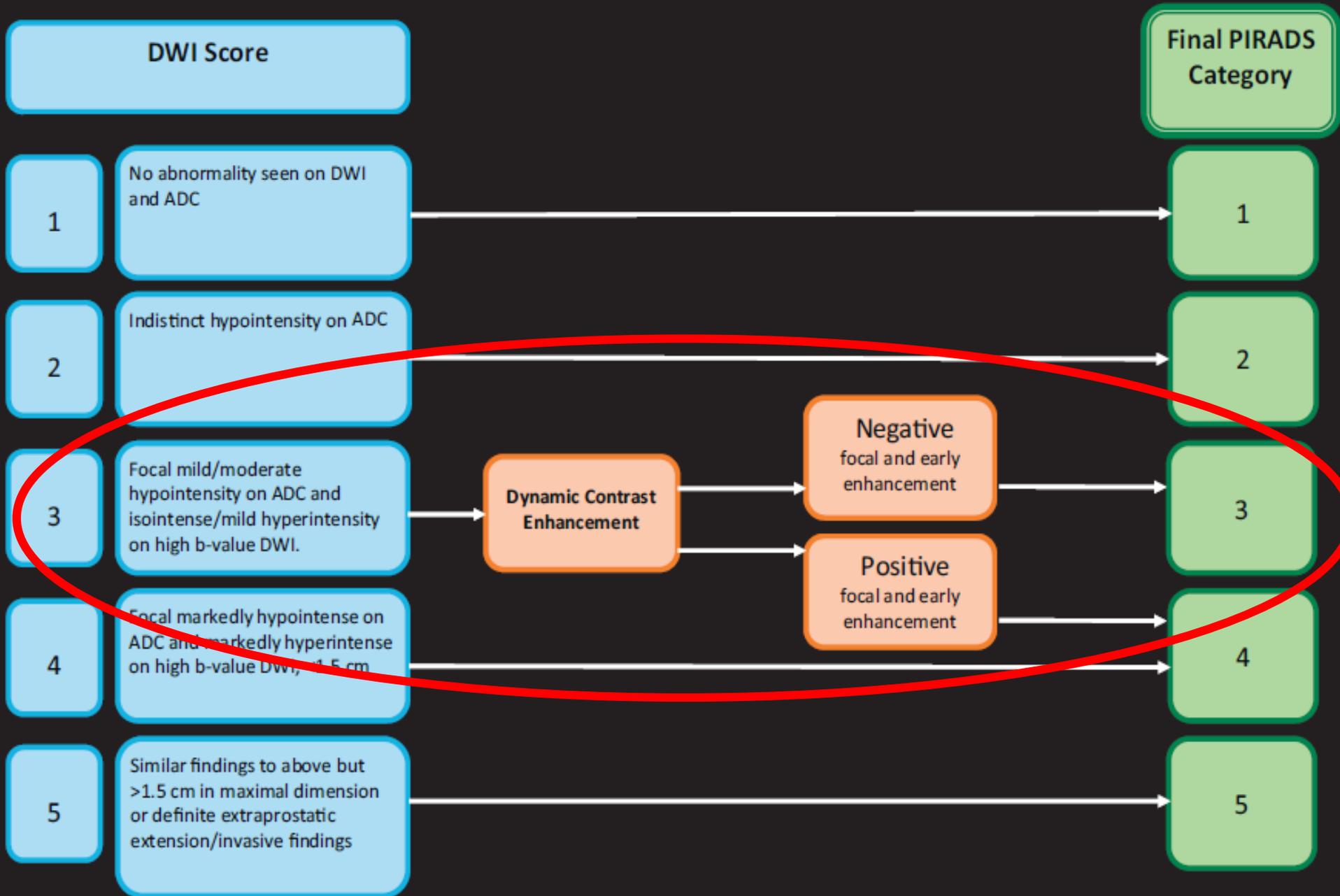
Mappa ADC

Same as 4 but \geq 1.5cm in greatest dimension (arrow) or definite extraprostatic extension / invasive behavior.

Peripheral Zone Lesion



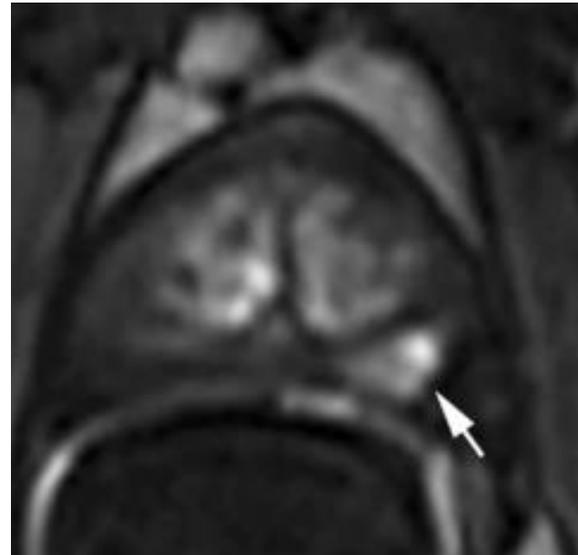
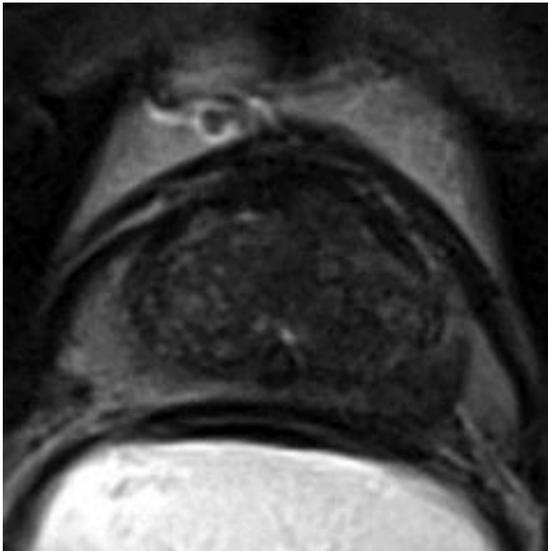
Peripheral Zone Lesion





Analisi delle lesioni Zona Periferica

Punteggio DWI = 3
Ruolo dirimente del mdc



DWI 3 con MdC negativo -> resta PI-RADS 3
DWI 3 con MdC positivo -> diventa PI-RADS 4

PI-RADS v2

Analisi delle lesioni

Zona periferica o Zona di Transizione?

PZ



TZ

PI-RADS v2

Analisi delle lesioni

Zona periferica o **Zona di Transizione**

PZ

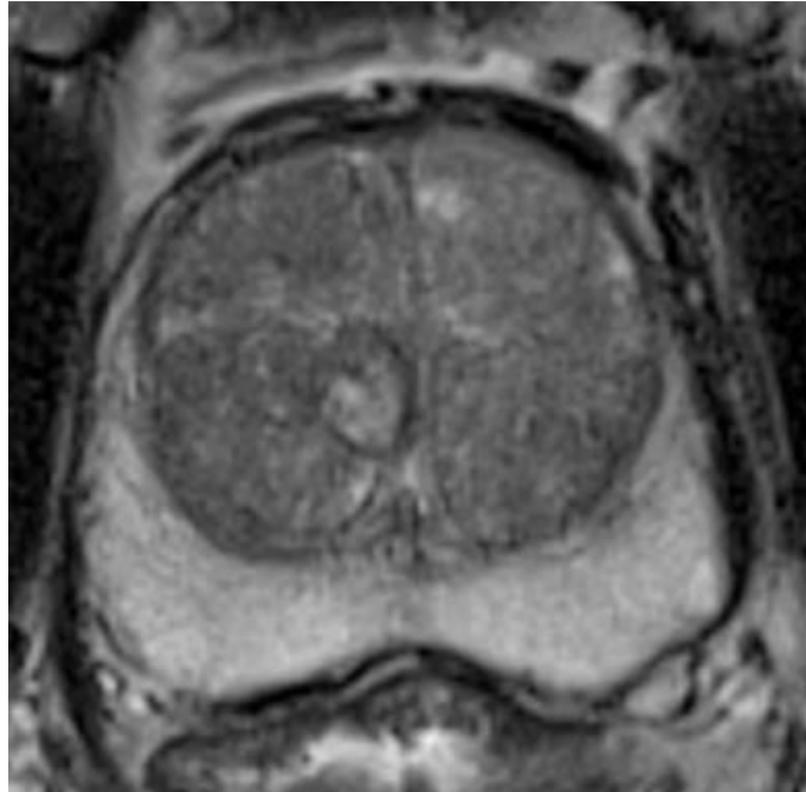


TZ

Analisi delle lesioni Zona di Transizione



SI PARTE DA
Imaging Morfologico T2



Analisi delle lesioni

Zona di Transizione



In base ai rilievi dell'Imaging Morfologico T2

Attribuiamo un punteggio
(Score)

Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 1



Homogeneous intermediate signal intensity (normal).

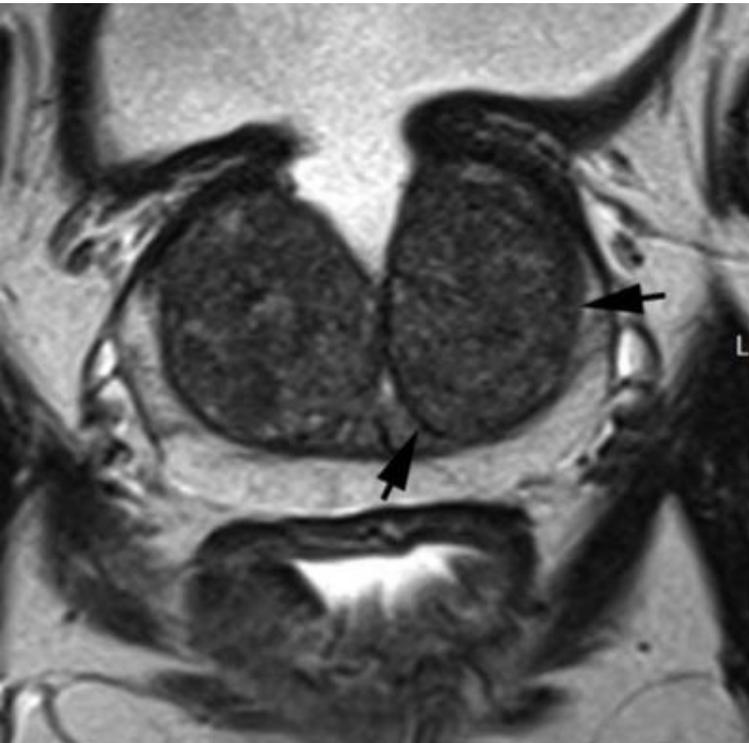
T2

Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 2



Circumscribed (arrows)
hypointense or heterogeneous
encapsulated nodule(s) (BPH).

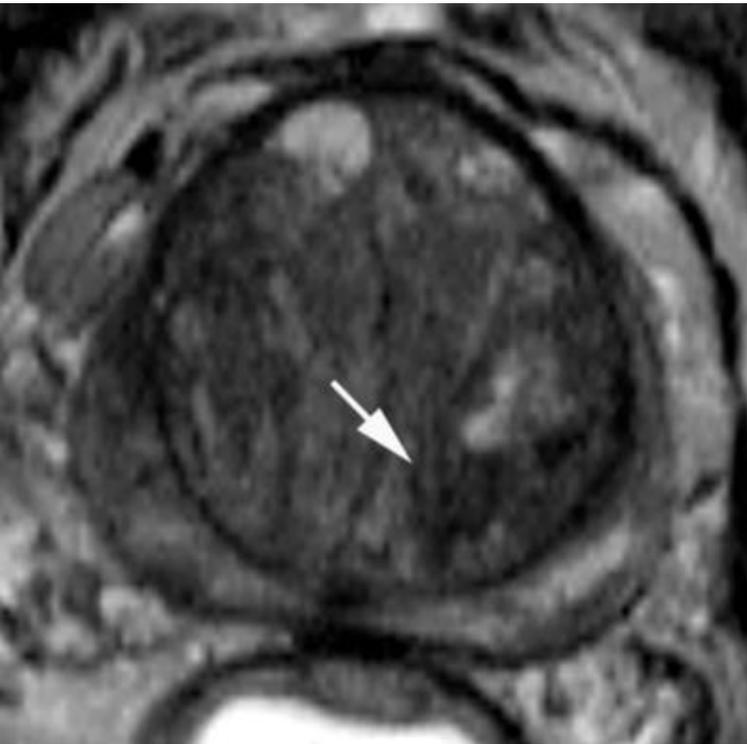
T2

Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 3



Heterogeneous signal intensity with obscured margins (arrow). Includes others that do not qualify as 2, 4, or 5.

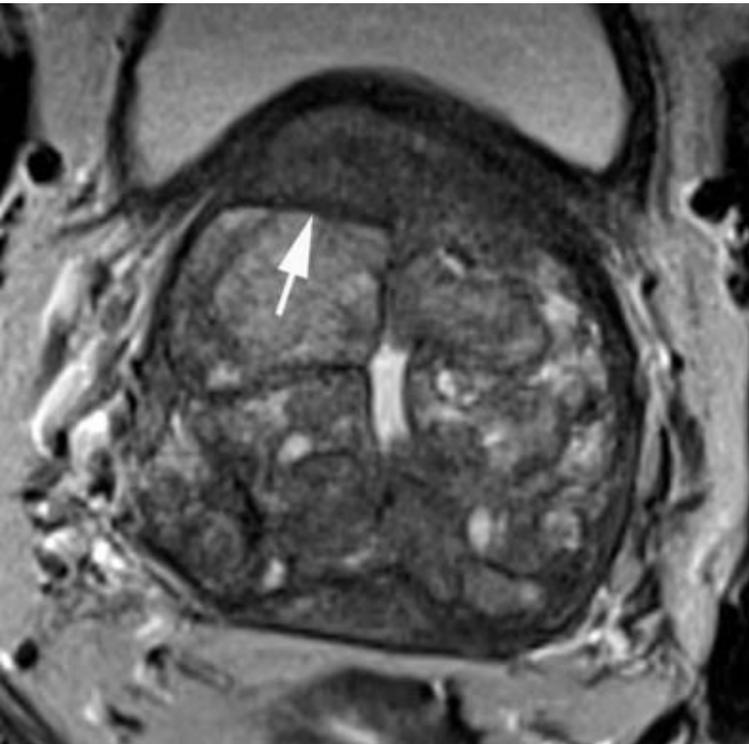
T2

Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 4



Lenticular (arrow) or non-circumscribed, homogeneous, moderately hypointense, and <1.5 cm in greatest dimension.

Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 5



Same as 4, but $\geq 1.5\text{cm}$ in greatest dimension (arrows) or definite extraprostatic extension/invasive behavior.

T2

Transition Zone Lesion

T2W Score

Final PIRADS Category

1

Homogenous intermediate signal intensity (normal)

1

2

Circumscribed hypointense or heterogenous encapsulated nodules (BPH)

2

3

Heterogeneous signal intensity with obscured margins
Include those not 2, 4, or 5

DWI Score

≤4

3

5

4

Lenticular or noncircumscribed, homogenous, moderately hypointense, and <1.5 cm

4

5

Similar findings to above but ≥1.5 cm in maximal dimension or definite extraprostatic extension/invasive findings

5

Transition Zone Lesion

T2W Score

Final PIRADS Category

1

Homogenous intermediate signal intensity (normal)

1

2

Circumscribed hypointense or heterogenous encapsulated nodules (BPH)

2

3

Heterogeneous signal intensity with obscured margins
Include those not 2, 4, or 5

DWI Score

≤4

3

5

4

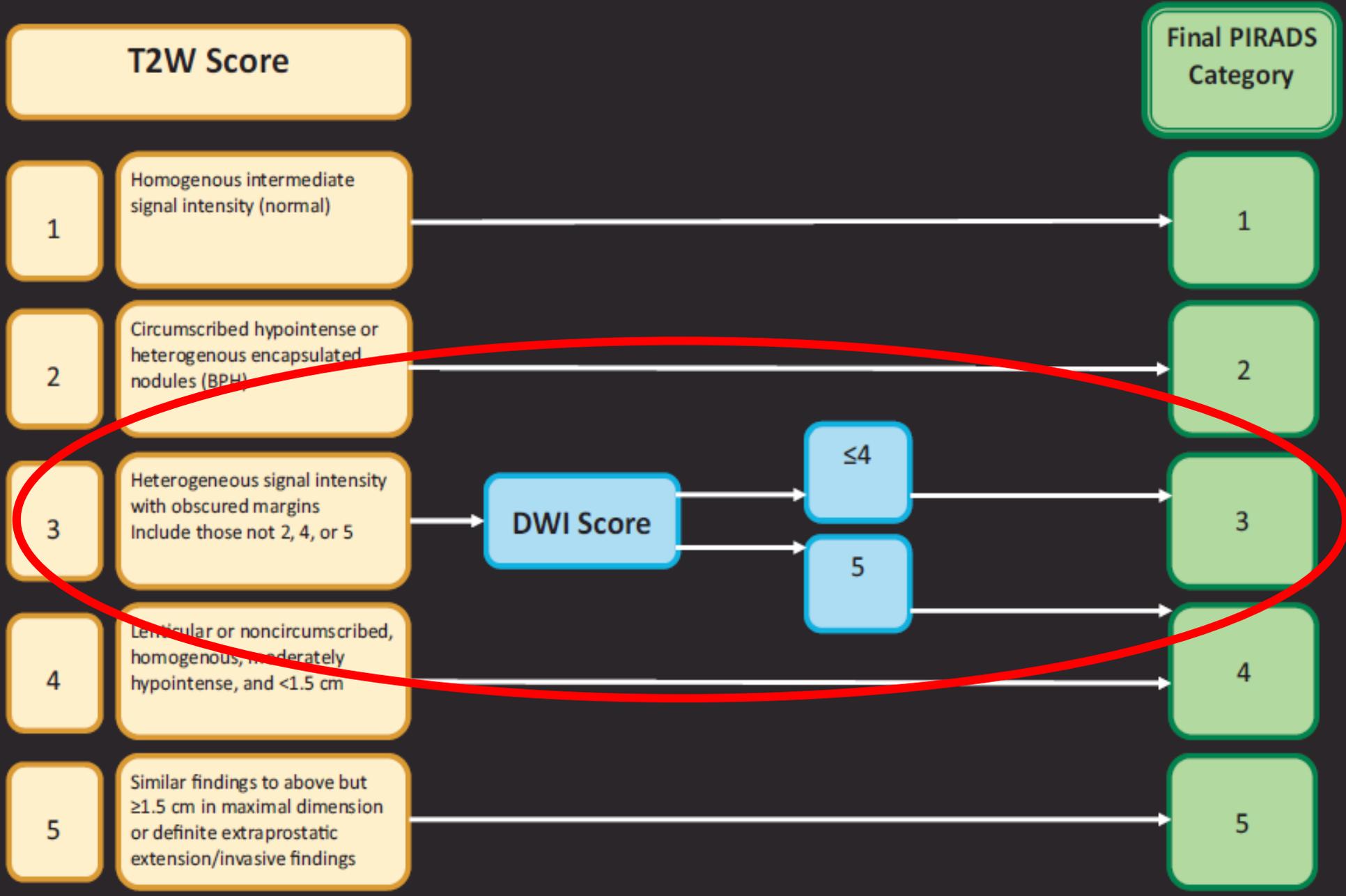
Lenticular or noncircumscribed, homogenous, moderately hypointense, and <1.5 cm

4

5

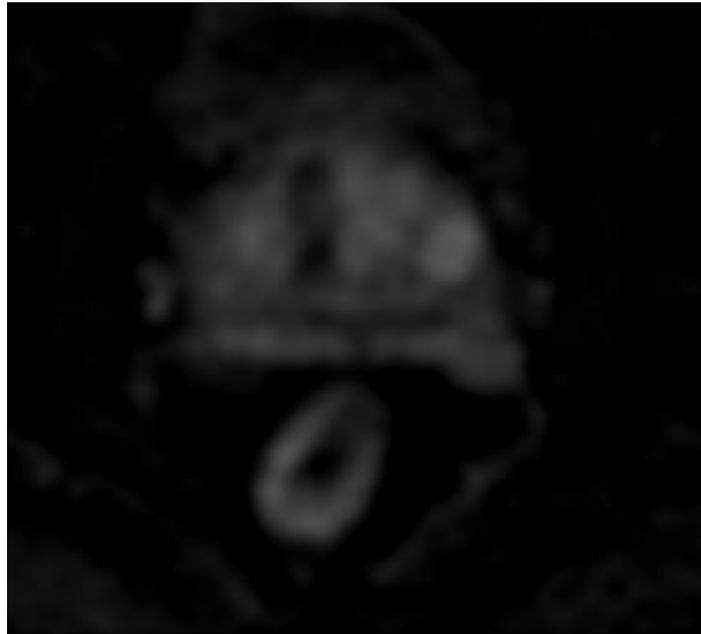
Similar findings to above but ≥1.5 cm in maximal dimension or definite extraprostatic extension/invasive findings

5



Analisi delle lesioni

Zona di Transizione



Punteggio T2 = 3 con DWI negativa -> resta PI-RADS 3

Punteggio T2 = 3 con DWI positiva -> diventa PI-RADS 4

Se punteggio T2 = 3
Ruolo dirimente della Diffusione (DWI)

PI-RADS v2

Riassumendo...



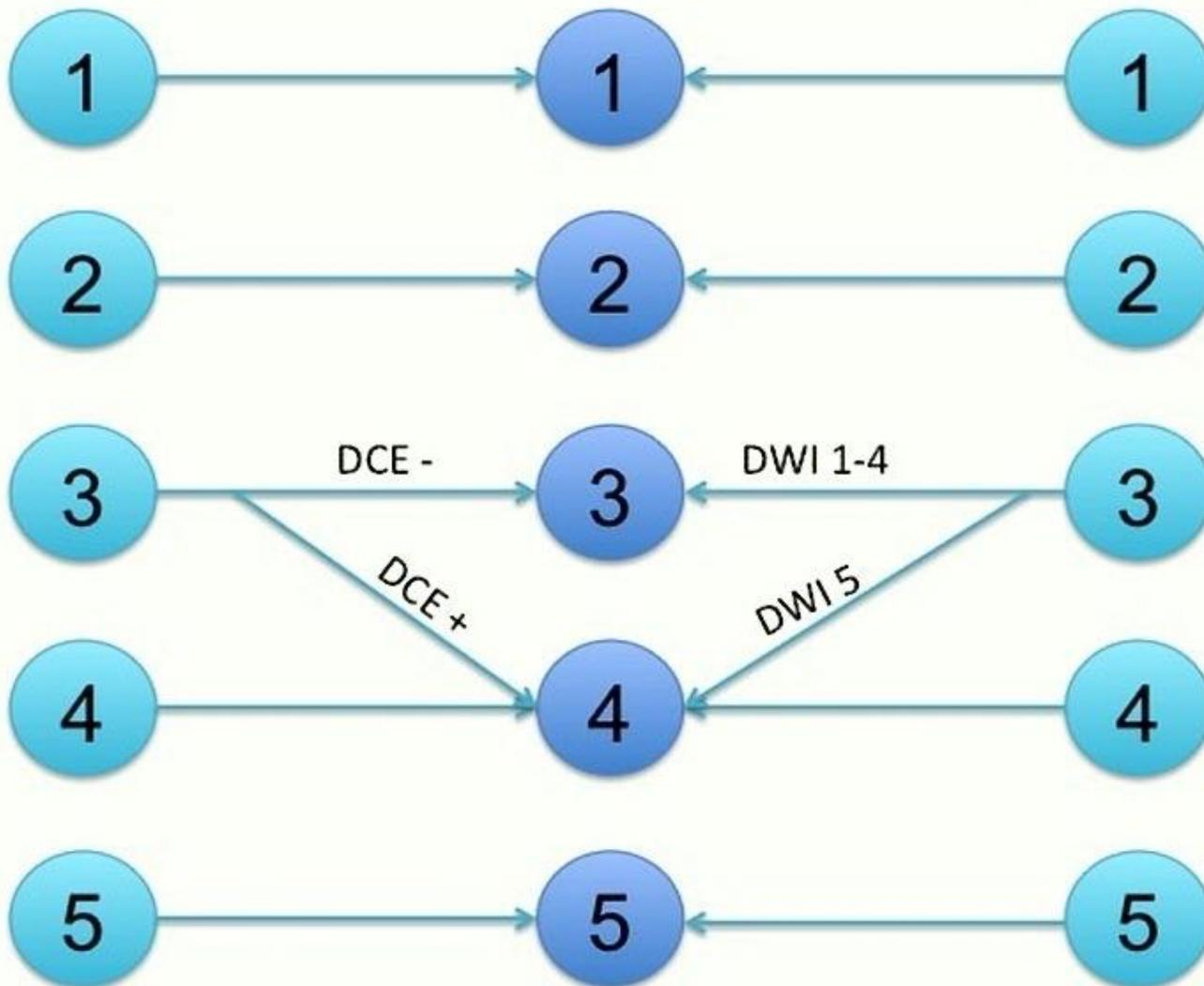
PZ

PIRADS

TZ

DWI SCORE

T2WI SCORE



PI-RADS v2

Il punteggio finale definisce i livelli di rischio

PI-RADS I	PI-RADS II	PI-RADS III	PI-RADS IV	PI-RADS V
Most probably benign	Probably benign	Intermediate	Probably malignant	Most probably malignant



1



5



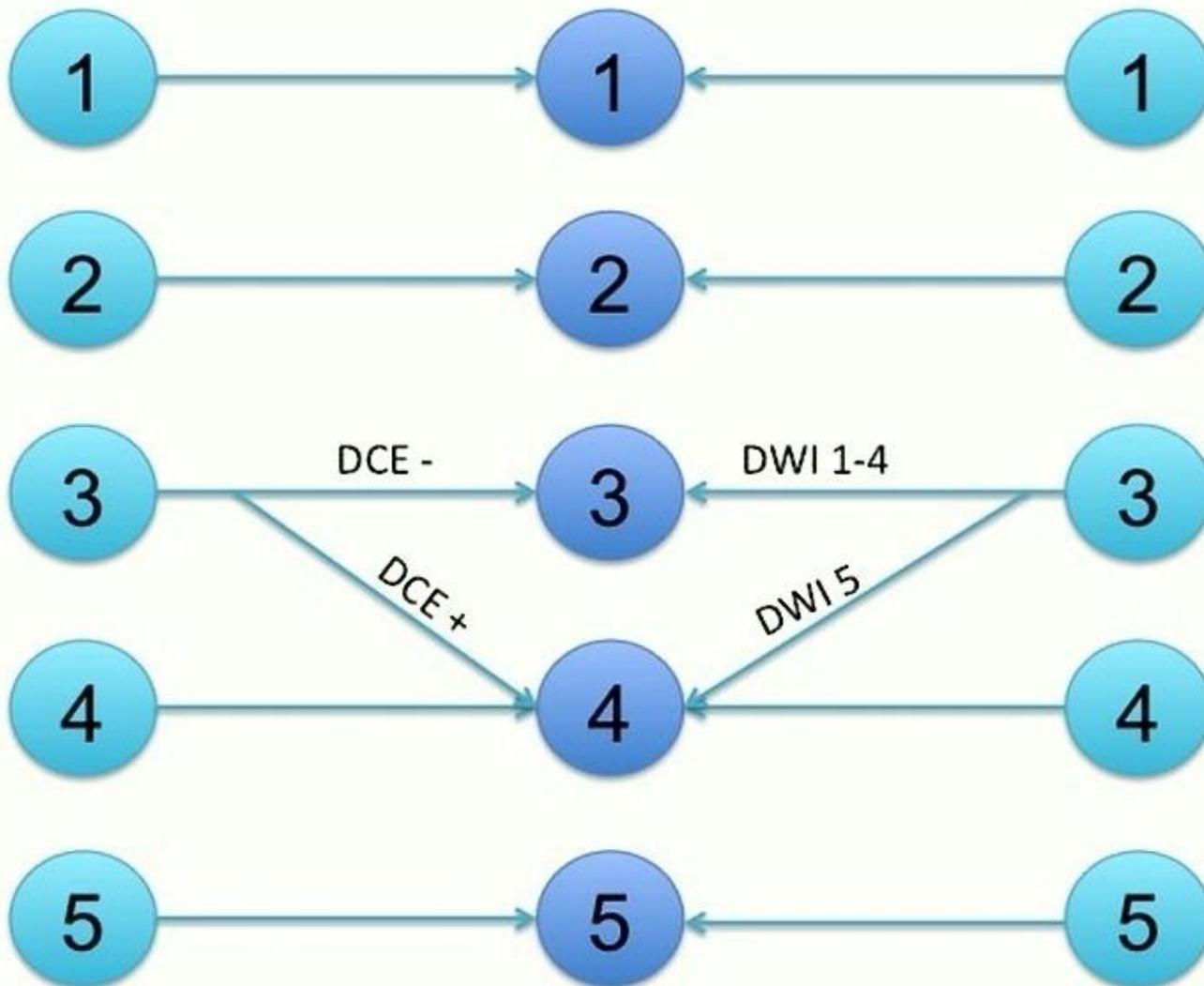
PZ

PIRADS

TZ

DWI SCORE

T2WI SCORE



PZ

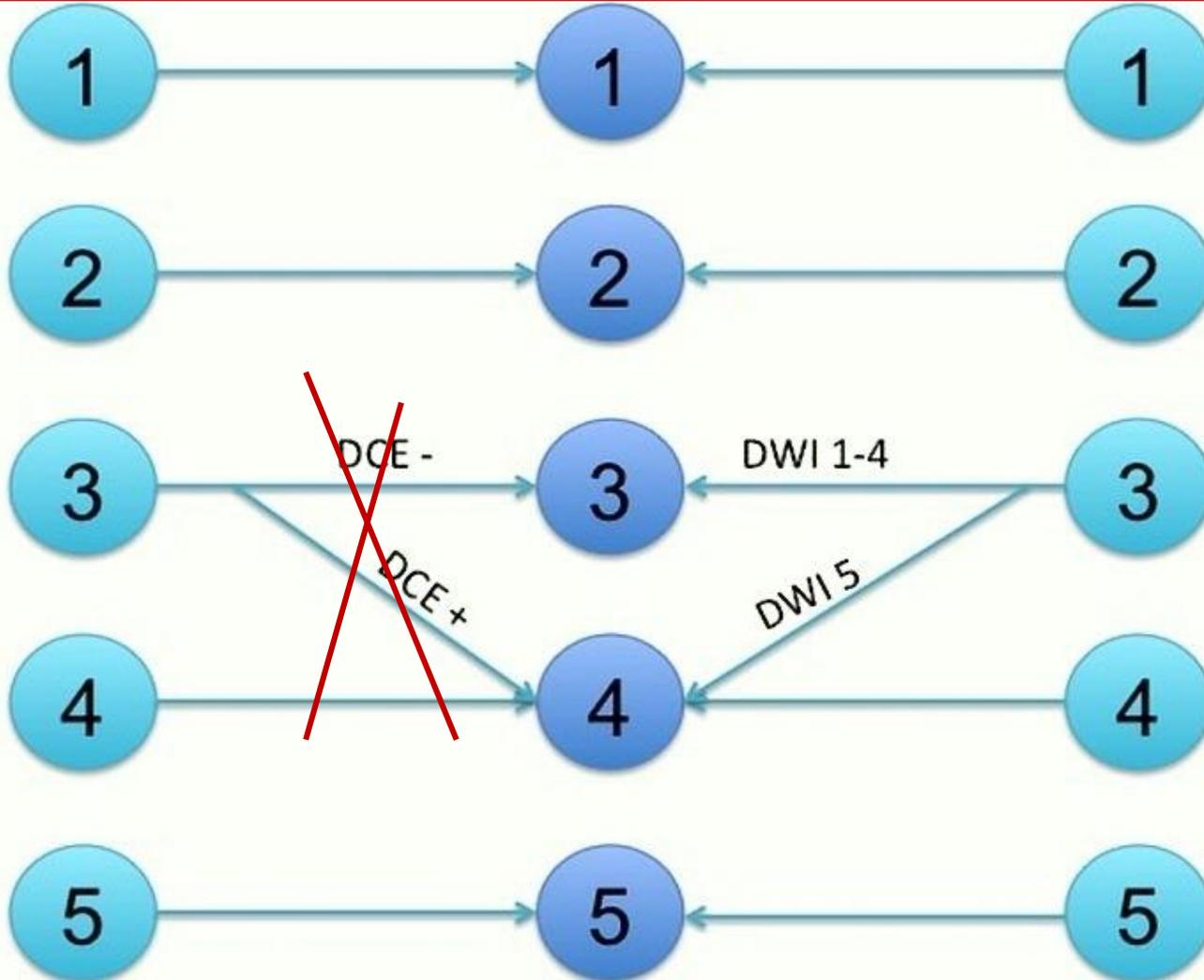
PIRADS

TZ

DWI SCORE

BIPARAMETRICA ?

T2WI SCORE



Il tumore Prostatico

Ruolo della Risonanza Magnetica

A large, 3D red arrow that starts from the bottom left and curves upwards and to the right, pointing towards the text on the right side of the slide.

Guida alla Biopsia

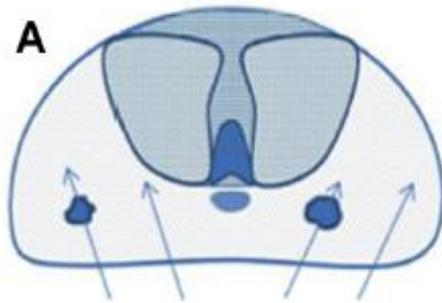
Stadiazione

Sorveglianza attiva

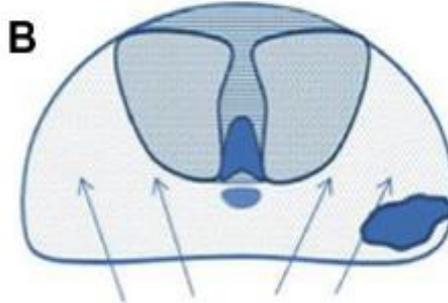
Recidiva biochimica

2018

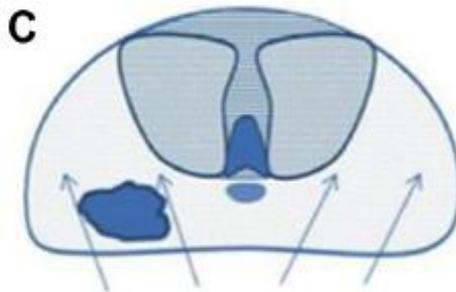
Limiti della biopsia Random



A. Oversampling

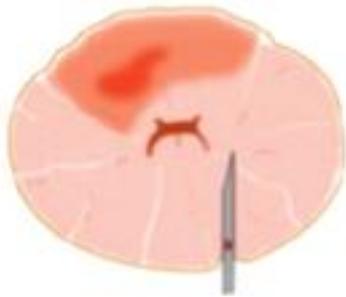


B. Undersampling

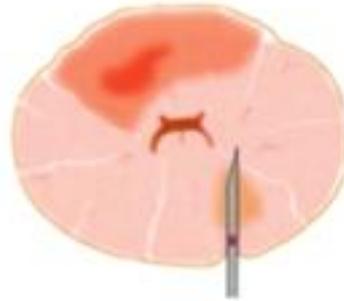


C: Undersampling-missing

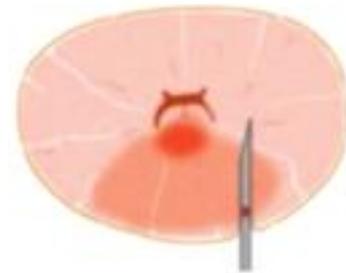
I Limitations of PSA-TRUS biopsy for cancer diagnosis



The needle missed the area of cancer



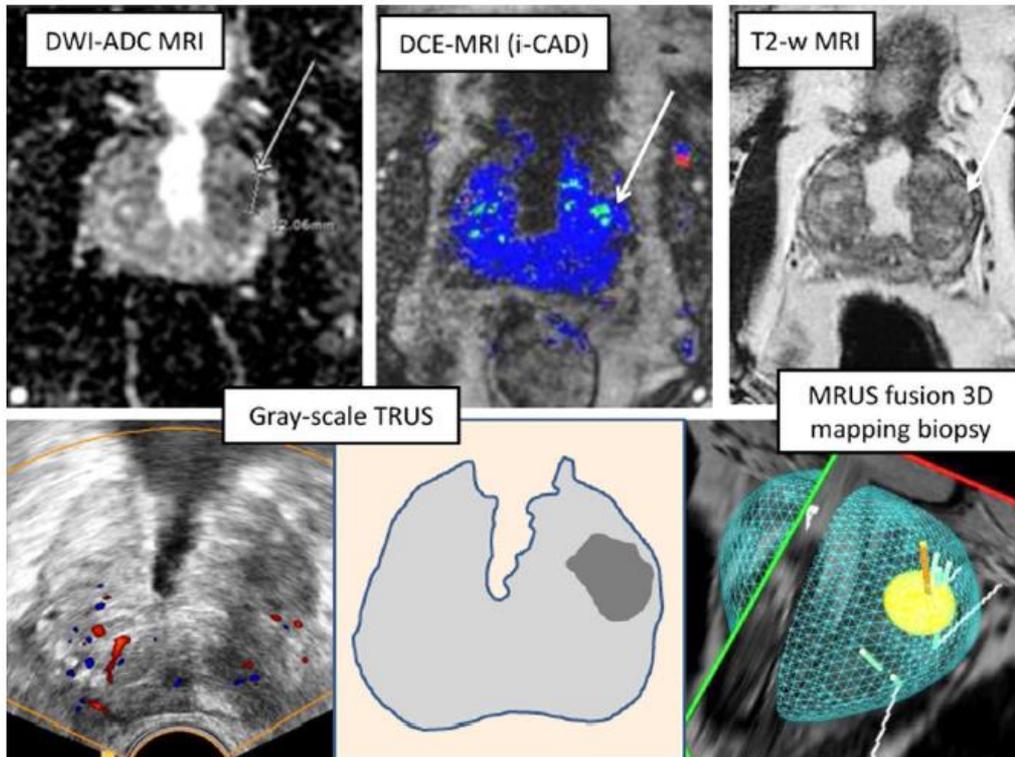
Needle detected insignificant cancer



Needle missed the more aggressive area of the cancer

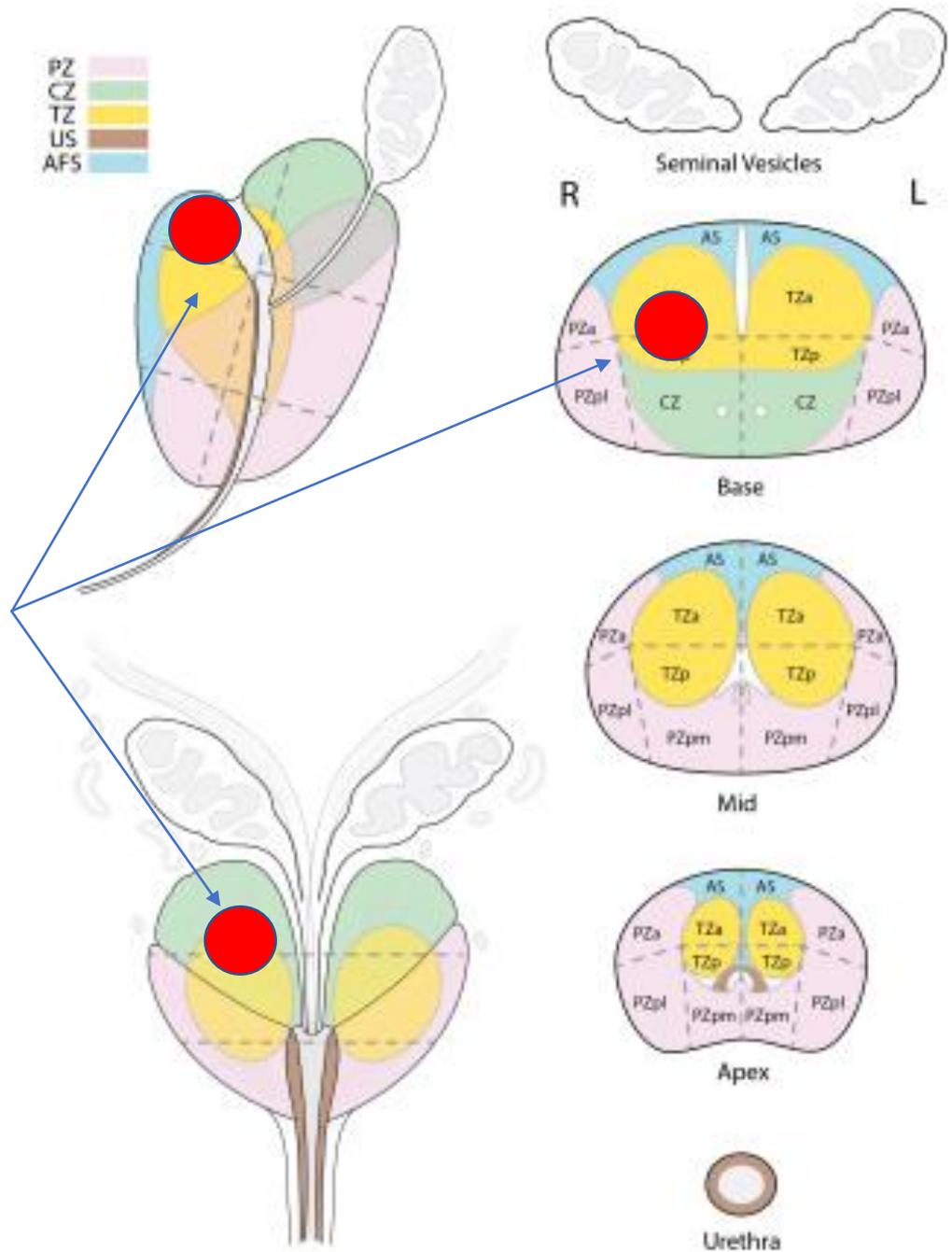
Biopsia & Risonanza Magnetica

- Direttamente MR Guidata (in-bore biopsy)
- Fusione Immagini MR–Ecografia (software dedicati)
- Biopsia cognitiva



Biopsia cognitiva

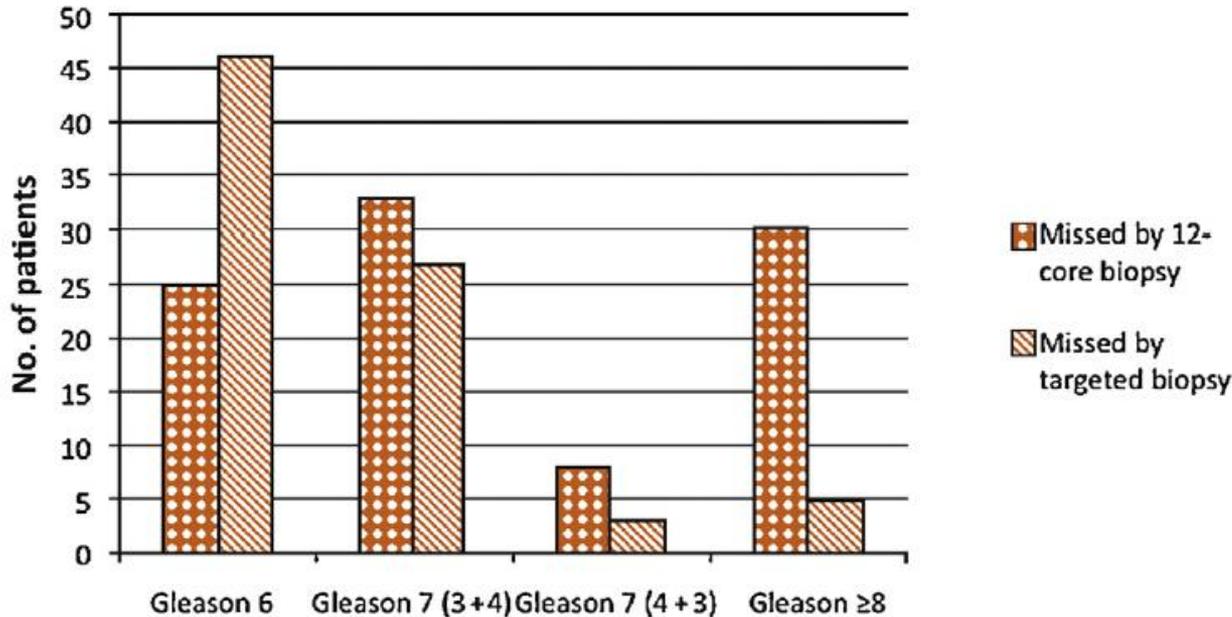
Prelievi aggiuntivi allo schema standard nella zona "target" individuata dalla RM



Biopsia Fusion

Magnetic Resonance Imaging/Ultrasound–Fusion Biopsy Significantly Upgrades Prostate Cancer Versus Systematic 12-core Transrectal Ultrasound Biopsy

M. Minhaj Siddiqui^a, Soroush Rais-Bahrami^a, Hong Truong^a, Lambros Stamatakis^a, Srinivas Vourganti^a, Jeffrey Nix^a, Anthony N. Hoang^a, Annerleim Walton-Diaz^a, Brian Shuch^a, Michael Weintraub^a, Jochen Kruecker^d, Hayet Amalou^c, Baris Turkbey^b, Maria J. Merino^e, Peter L. Choyke^b, Bradford J. Wood^c, Peter A. Pinto^{a,c,*}



Conclusions: MRI/US-fusion-guided biopsy upgrades and detects PCa of higher Gleason score in 32% of patients compared with traditional 12-core biopsy alone. Targeted biopsy technique preferentially detects higher-grade PCa while missing lower-grade tumors.

Mp-RM Targeted-Biopsy

Review – Prostate Cancer

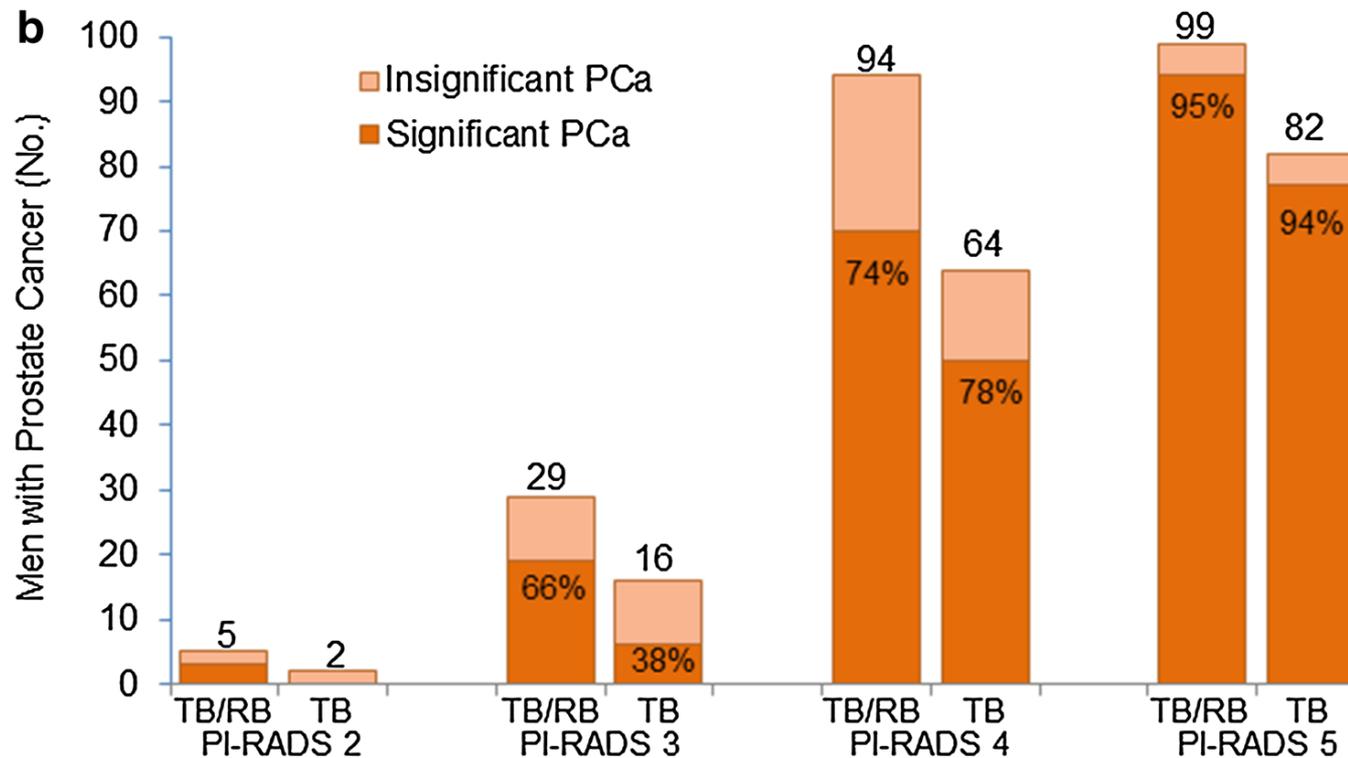
Magnetic Resonance Imaging–targeted Biopsy May Enhance the Diagnostic Accuracy of Significant Prostate Cancer Detection Compared to Standard Transrectal Ultrasound-guided Biopsy: A Systematic Review and Meta-analysis

Ivo G. Schoots^{a,*}, Monique J. Roobol^b, Daan Nieboer^c, Chris H. Bangma^b,
Ewout W. Steyerberg^c, M.G. Myriam Hunink^{a,d,e}

- ***MRI-TBx compared to TRUS-Bx***
 - ***did not differ in overall cancer detection***
 - ***a higher rate of detection of significant Pca.***
 - ***A lower rate of detection of insignificant Pca***

The detection of significant prostate cancer is correlated with the Prostate Imaging Reporting and Data System (PI-RADS) in MRI/transrectal ultrasound fusion biopsy

Hannes Cash¹ · Andreas Maxeiner¹ · Carsten Stephan¹ · Thomas Fischer² · Tahir Durmus² · Josephine Holzmann¹ · Patrick Asbach² · Matthias Haas² · Stefan Hinz¹ · Jörg Neymeyer¹ · Kurt Miller¹ · Karsten Günzel¹ · Carsten Kempkensteffen¹



Linee Guida 2016

European Association of Urology (EAU)

European Society for Radiotherapy & Oncology (ESTRO)

International Society of Geriatric Oncology (SIOG)

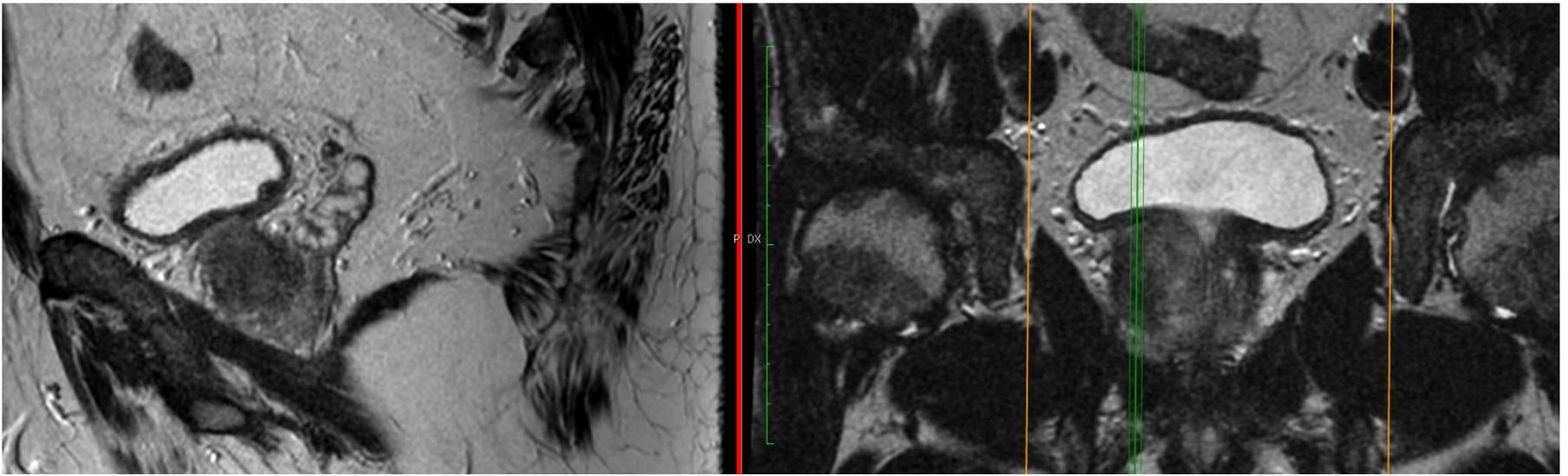
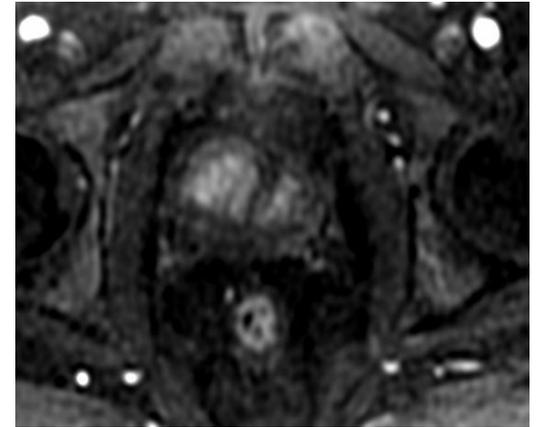
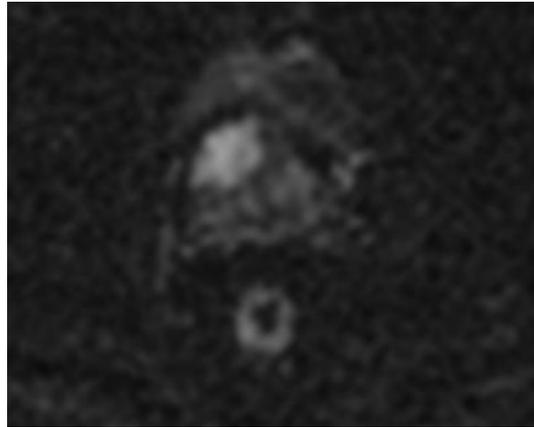
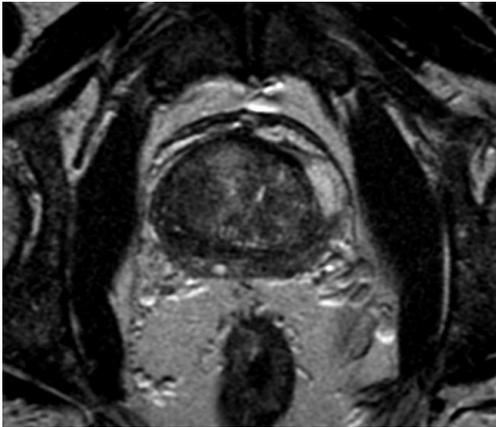
Prostate Cancer Detection rates (%) by mpMRI for tumour volume and Gleason Score

Gleason score	Tumour volume (mL)		
	< 0.5	0.5-2	> 2
GS6	21-29%	43-54%	67-75%
GS7	63%	82-88%	97%
GS >7	80%	93%	100%

RM accurata per i Ca superiori ai 5 mm e con Gleason ≥ 7

Paziente di 67 aa

PSA >20 in progressivo aumento
12 prelievi bioptici negativi



Il tumore Prostatico

Ruolo della Risonanza Magnetica

A large, 3D red arrow that starts as a flat base on the left and curves upwards and to the right, ending in a sharp arrowhead. It is positioned behind the '2018' text and the list of topics.

Stadiazione

Sorveglianza attiva

Recidiva biochimica

2018

Stadiazione Parametro T

Attualmente parametri clinici

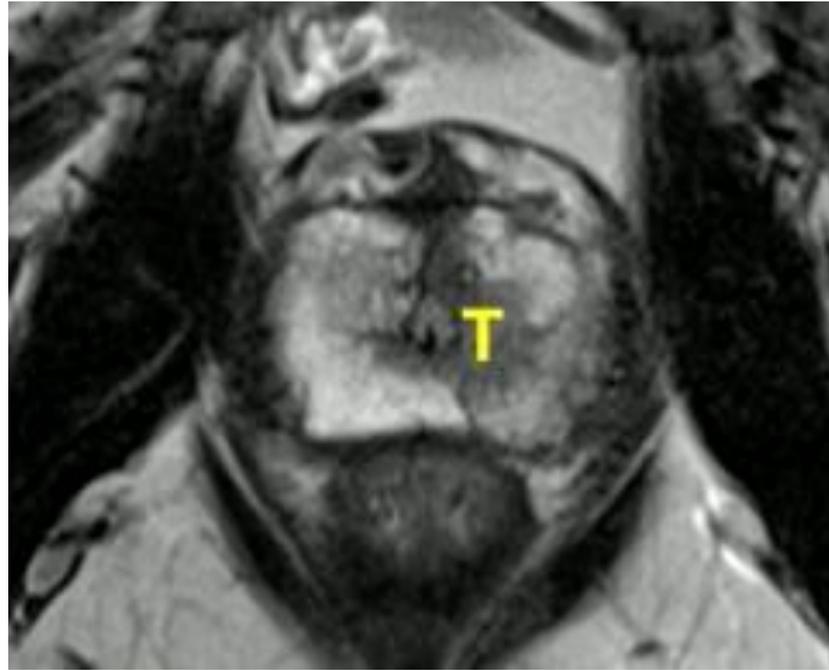
- Stadio clinico (DRE)
- Gleason Score
- PSA
- Biopsia
 - % prelievi positivi > 15 %
 - % Tumore nei campioni biotici
 - Presnza di invasione perineurale

Stadiazione Parametro T

Perché non usare la RM?

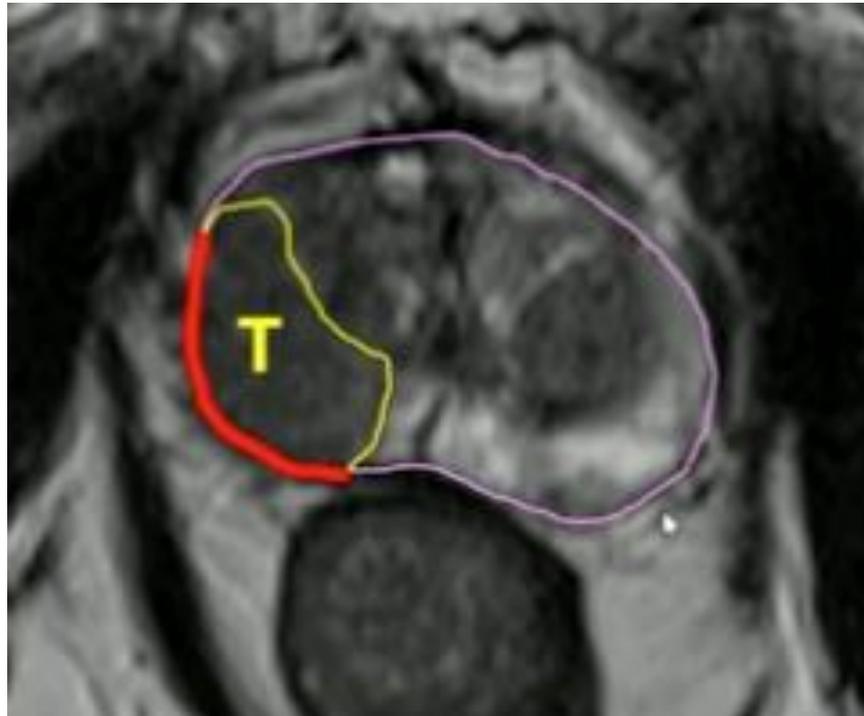
- Identifica l'estensione extracapsulare
- Identifica l'invasione delle vescicole seminali
- Aiuta nella scelta del trattamento

Stadiazione Parametro T



Tumore confinato nella prostata

Stadiazione Parametro T



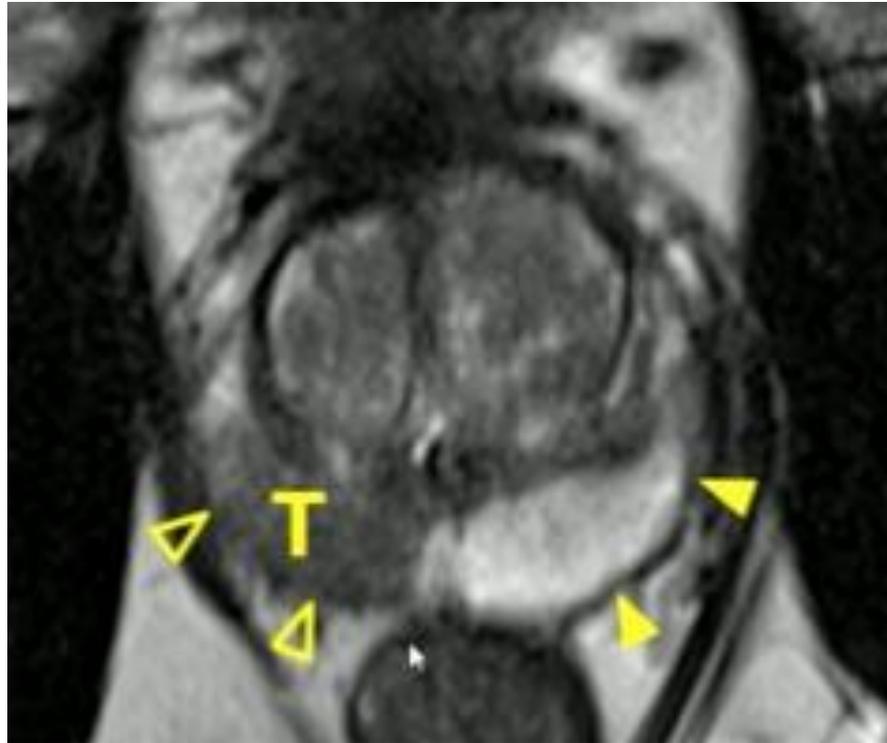
Ampio contatto con la capsula

Stadiazione Parametro T



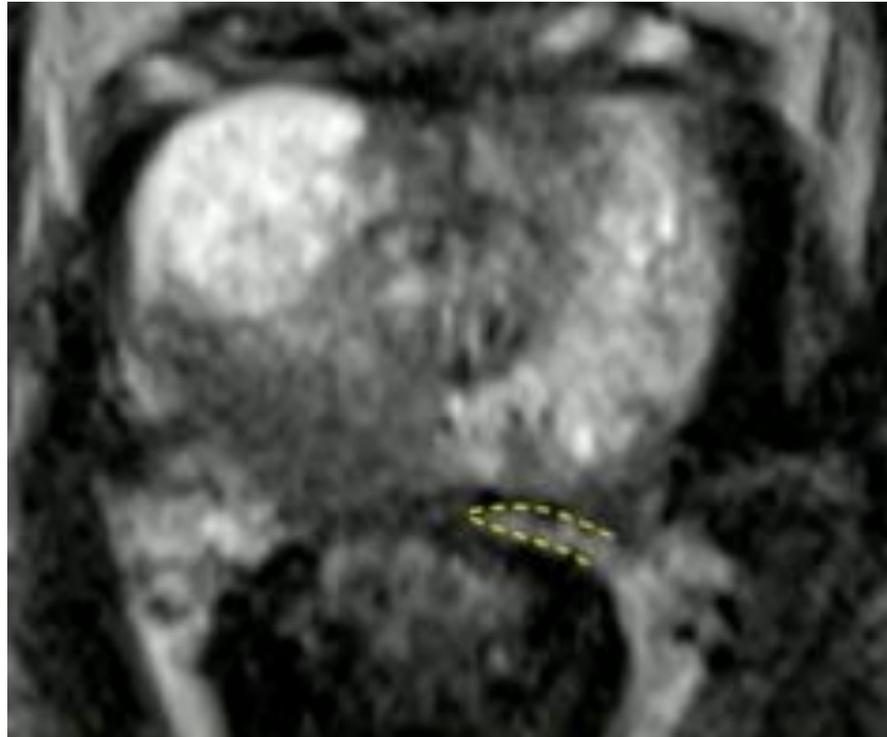
Bulging capsulare

Stadiazione Parametro T



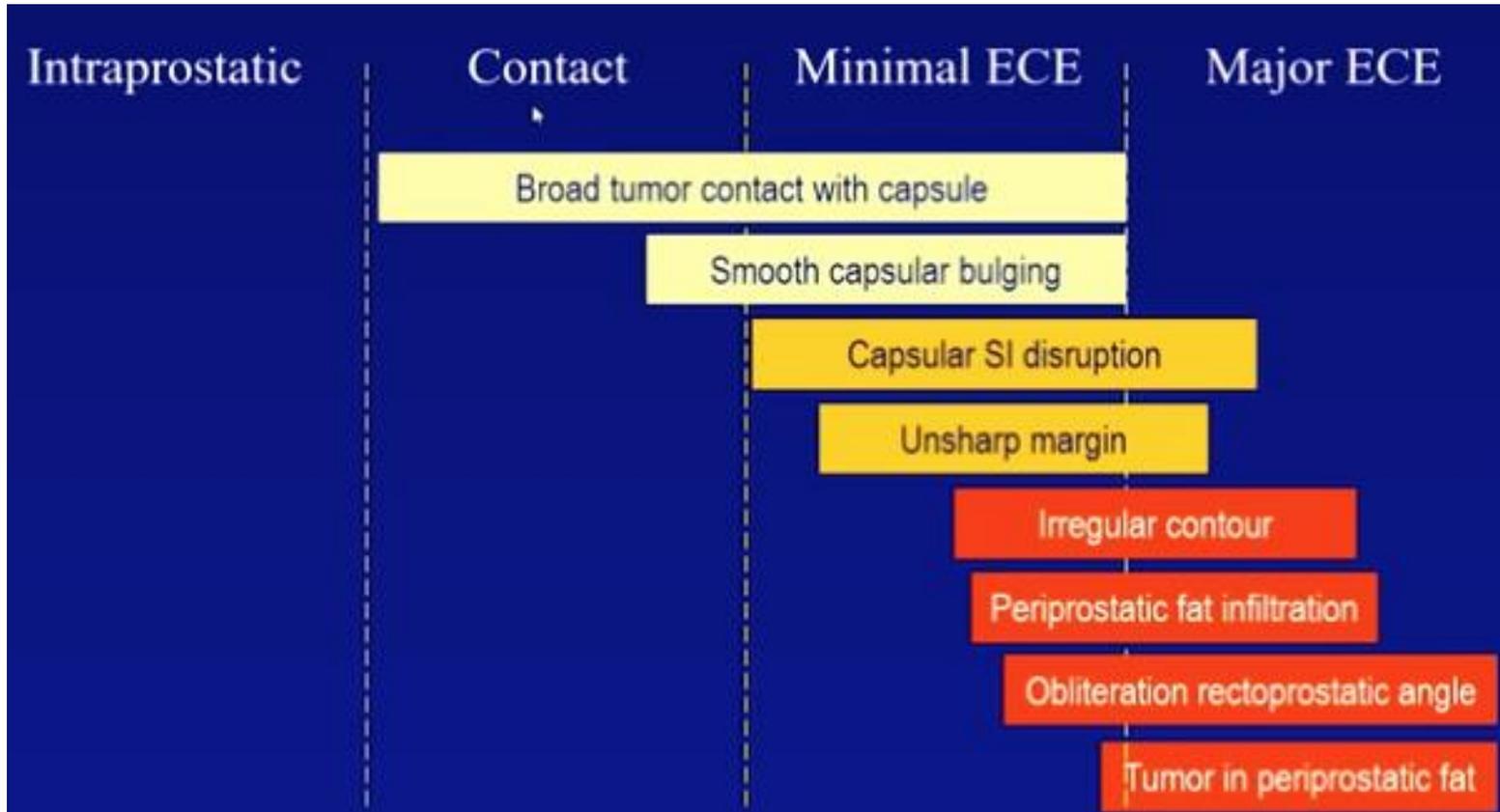
Infiltrazione capsulare

Stadiazione Parametro T

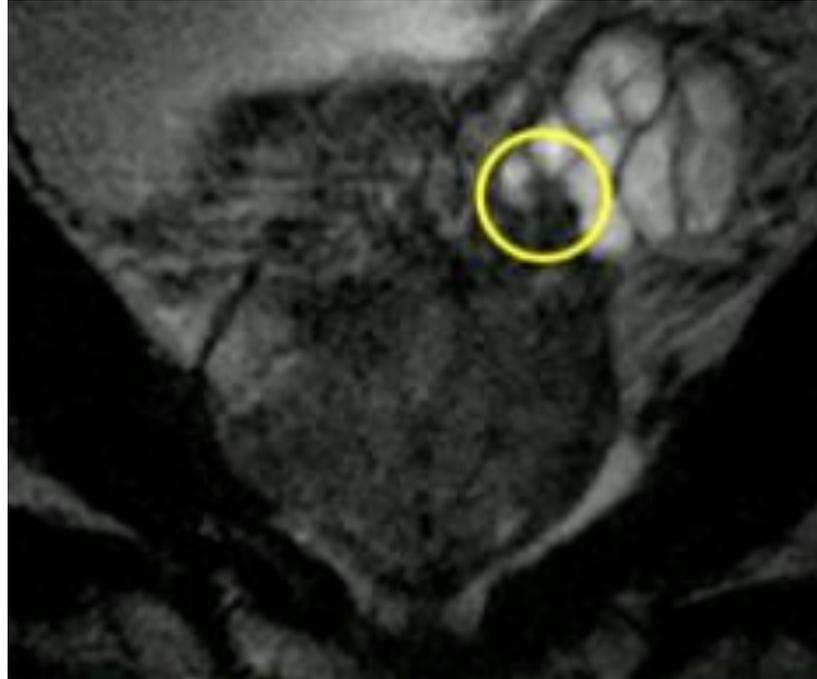


Obliterazione angolo retroprostatico

Stadiazione Parametro T



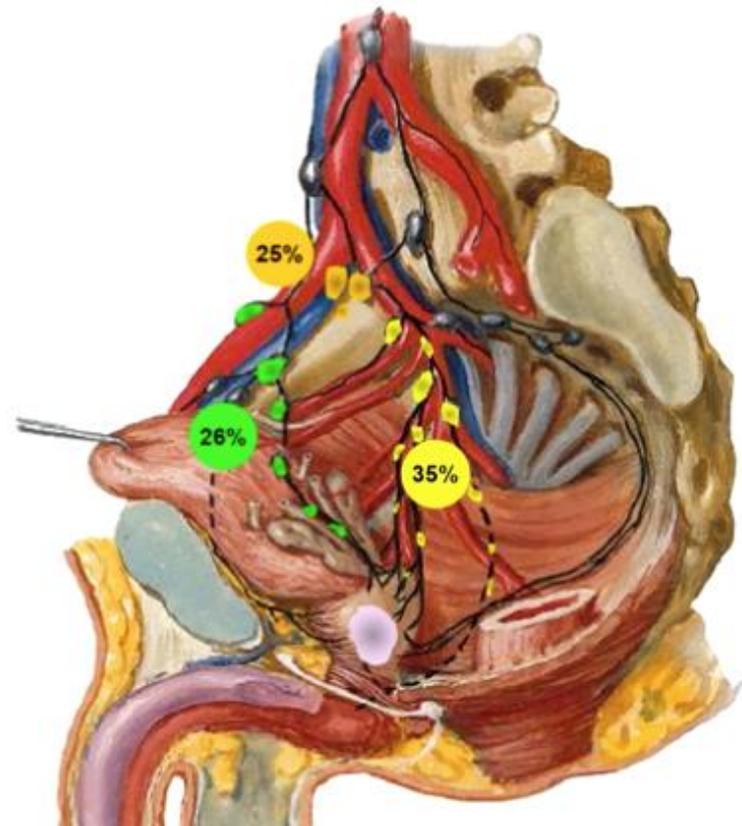
Stadiazione Parametro T



Infiltrazione vescicole seminali

Stadiazione Parametro N

Linfonodi dove?



Stadiazione Parametro N

Quando cercare i linfonodi?

Linee Guida EAU

- NON nei pazienti a basso rischio
 - PSA < 10
 - Gleason <6
 - cT2 o inferiore

Stadiazione Parametro N

Dimensioni del linfonodo:

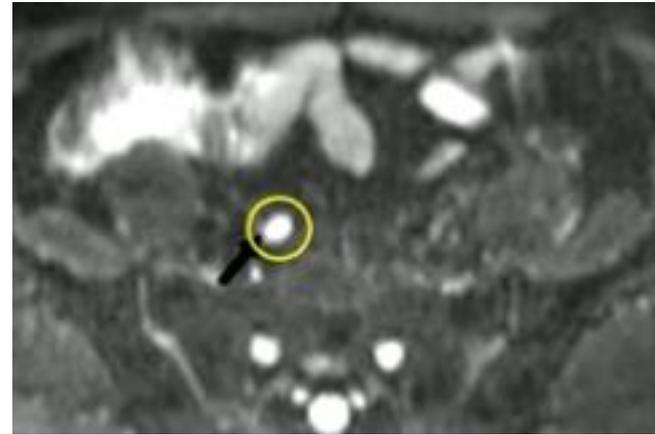


Linfonodo patologico se:

- Ovale > 10 mm
- Rotondo > 8 mm

Stadiazione Parametro N

DWI:



Stadiazione Parametro M

Di solito metastasi ossee

- 80 % osteoblastiche
- 5 % osteolitiche
- 15 % Miste

Metastasi viscerali sono molto rare

Stadiazione Parametro M

Metastasi ossee:

Vanno ricercate se:

- PSA > 20ng/ml
- Gleason > 8
- cT3-cT4

Stadiazione Parametro M

Gold Standard

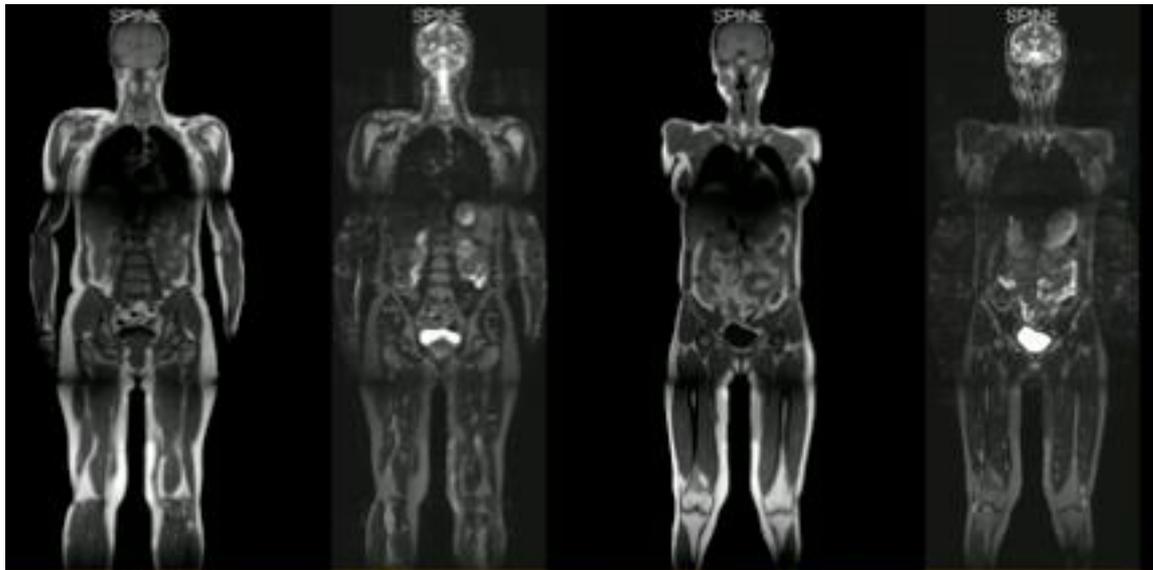
Bone Scan + Targeted Imaging



La Risonanza ha un ruolo ?

Stadiazione Parametro M

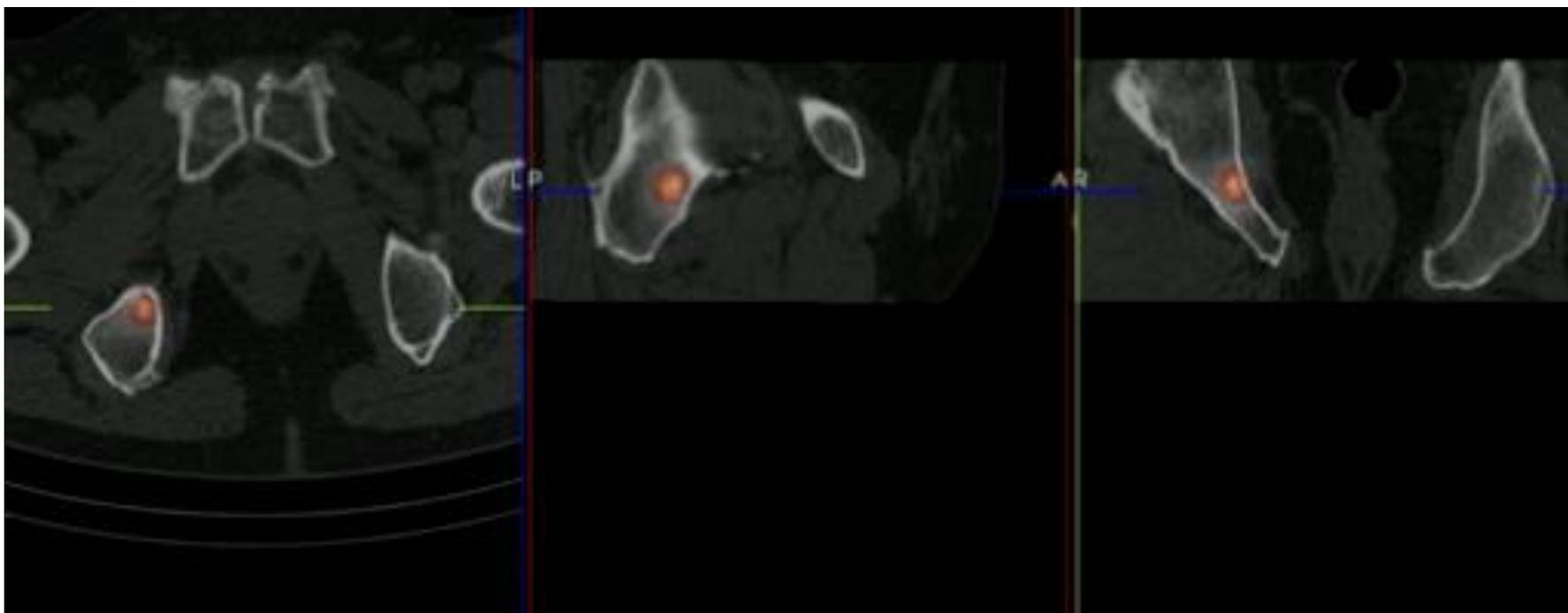
MRI



100 high-risk patient	Sensitivity	Specificity
BS + RX/CT/MRI	86	98
MRI	98-100	98-100

Stadiazione Parametro M

PET-CT



Il tumore Prostatico

Ruolo della Risonanza Magnetica

A large, 3D red arrow that starts as a flat line on the left and curves upwards and to the right, ending in a sharp arrowhead. It is positioned behind the '2018' text and the 'Sorveglianza attiva' text.

Sorveglianza attiva

Recidiva biochimica

2018

Sorveglianza attiva

Ruolo della Risonanza Magnetica



- ***EAU non la prevede al momento***
 - ***ESUR prevede il suo utilizzo***
- in letteratura molte review spronano il suo utilizzo***

[Curr Urol Rep. 2015 Jun;16\(6\):42. doi: 10.1007/s11934-015-0507-9.](#)

The role of MRI in active surveillance for prostate cancer.

Fascelli M¹, George AK, Frye T, Turkbey B, Choyke PL, Pinto PA.

[Urol Oncol. 2014 Jan;32\(1\):39.e1-10. doi: 10.1016/j.urolonc.2013.04.002. Epub 2013 Jun 17.](#)

Performance of multiparametric magnetic resonance imaging in the evaluation and management of clinically low-risk prostate cancer.

[Dianat SS¹, Carter HB², Macura KJ³.](#)

The Emerging Role of MRI in Prostate Cancer Active Surveillance and Ongoing Challenges

Tristan Barrett¹ and Masoom A. Haider²

☑ Share

+ Affiliations:

Citation: American Journal of Roentgenology. 2017;208: 131-139. 10.2214/AJR.16.16355

- La stabilità del quadro RM riduce la necessità di biopsie ripetute
- Una variazione del quadro RM può consigliare nuove biopsie e un trattamento più aggressivo

Il tumore Prostatico

Ruolo della Risonanza Magnetica

A large, 3D red arrow that starts from the bottom left and curves upwards and to the right, pointing towards the text 'Recidiva biochimica'.

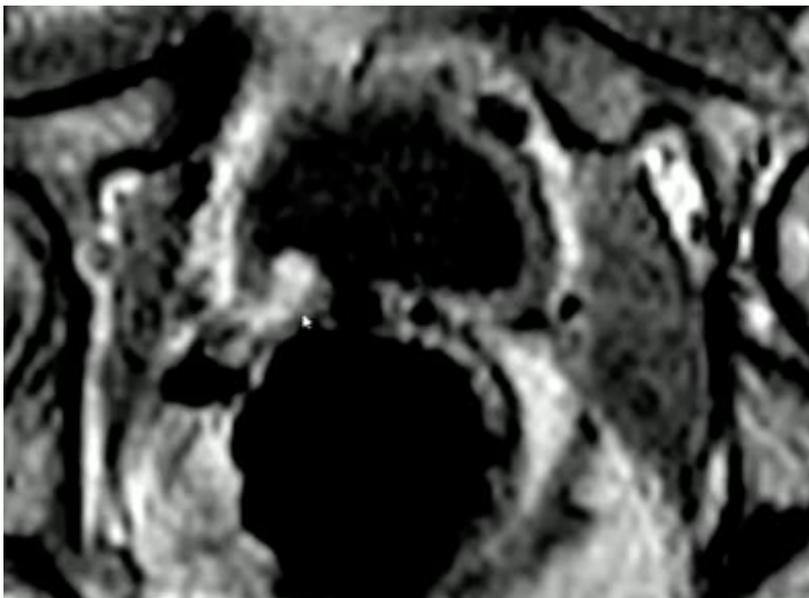
Recidiva biochimica

2018

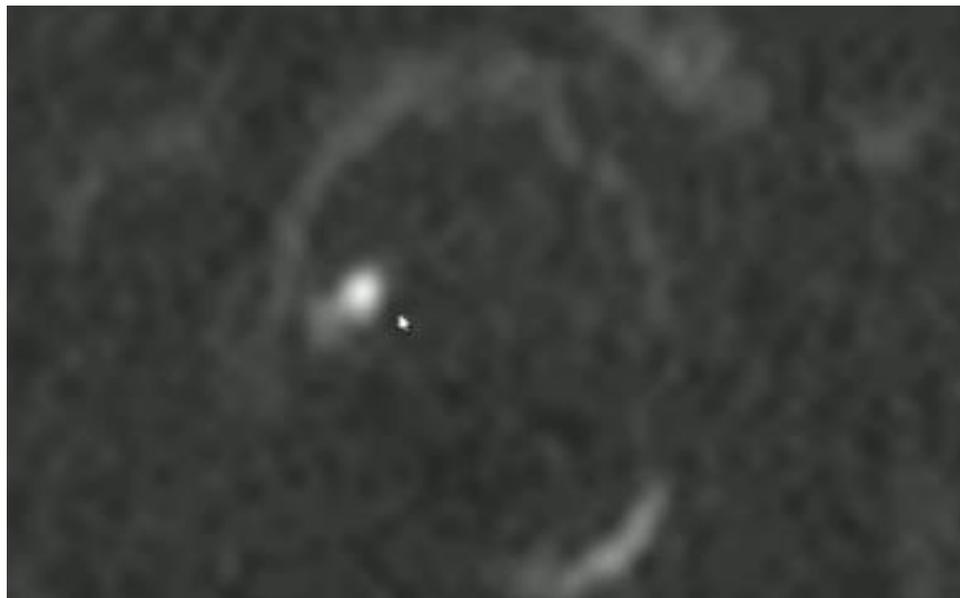
Recidiva biochimica

- Il 40% dei pazienti con CA prostatico sviluppa una recidiva biochimica dopo prostatectomia o RT
- La diagnosi precoce della recidiva consente una RT curativa se i livelli di PSA sono bassi
- La mpRM consente la diagnosi precoce (early detection)
- I risultati migliori si hanno con la PET

Recidiva biochimica



T1 mdc



DWI

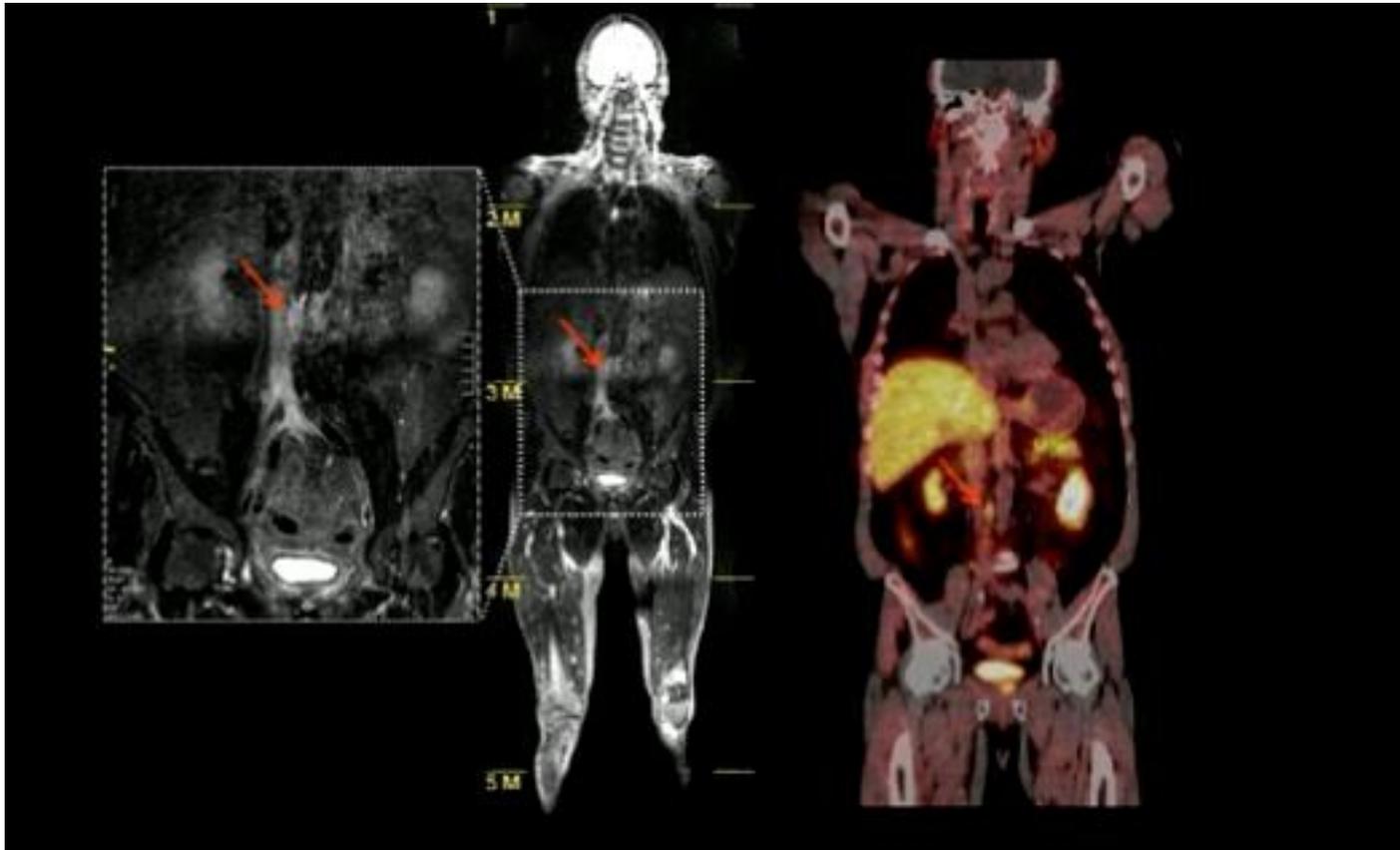
Recidiva biochimica

Whole-Body MRI Vs C-Choline PET/CT



Recidiva biochimica

Whole-Body MRI Vs C-Choline PET/CT



Grazie per l'attenzione



Special Thanks to:

Giovanni Saiaci

Massimo Tilli

Donato Stefanelli

Dott.sala@gmail.com