MRI guided biopsy

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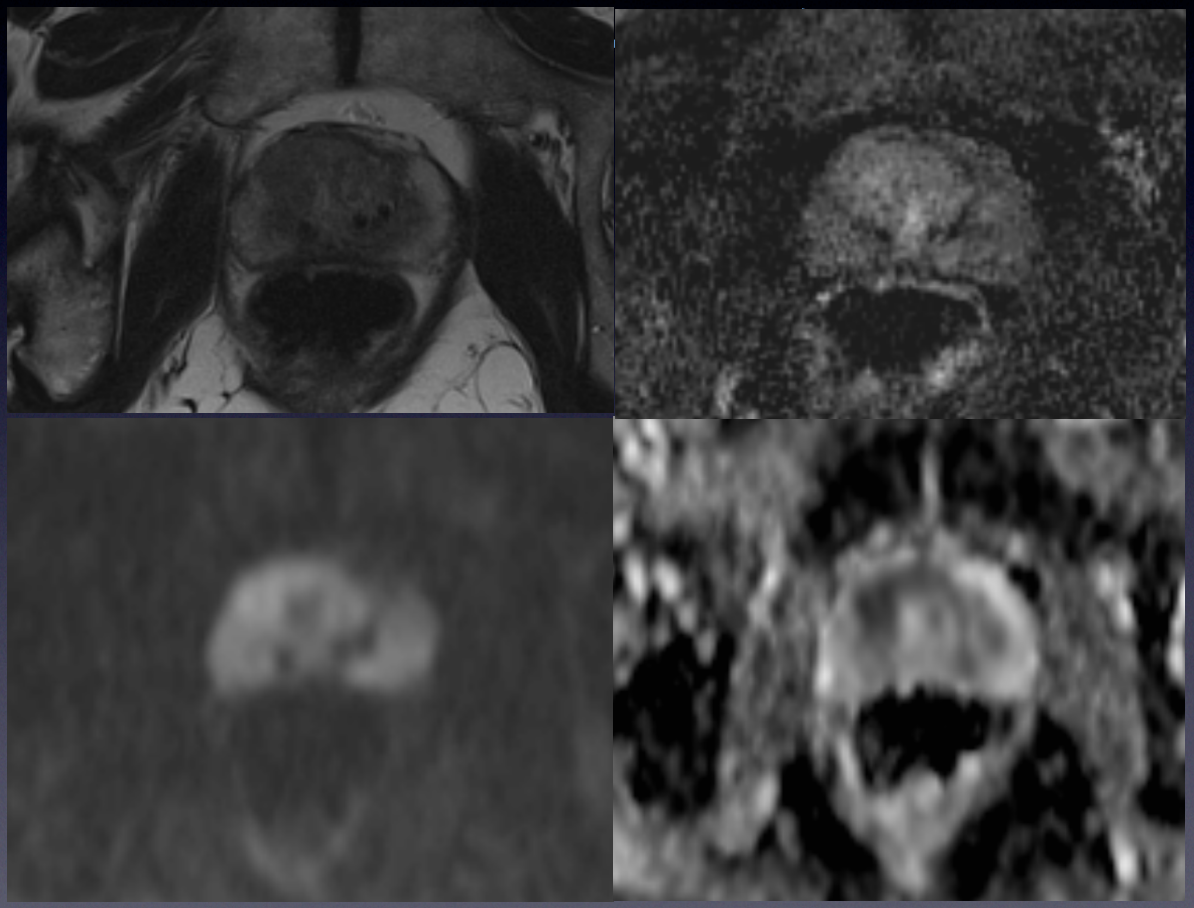
Multiple negative biopsies and raising PSA

1) 07/2005 → PSA 9.9 → Bx negative (8 cores)
2) 01/2006 → PSA 12.3→ Bx negative (18 cores)
3) 12/2007 → PSA 14.2→ Bx negative (8 cores)
4) 06/2008 → PSA 16.6→ Bx negative (25 cores)
5) 01/2010 → PSA 19.8→ Bx negative (14 cores)
6) 03/2011 → PSA 28.6→ Bx HGPIN (20 cores)
7) 03/2012 → PSA 37.5→ Bx HGPIN (24 cores)

We performed a mpMRI



A “targeted” biopsy was performed

- 8) 07/2012 → PSA 41.1 → GS 3+4 (14 cores)

7 years, 131 needles

Problem in PCa management

- Biopsy
  - systematic but non-targeted (blind)
    - Misses at least 20-30% of cancers

Problem in PCa management

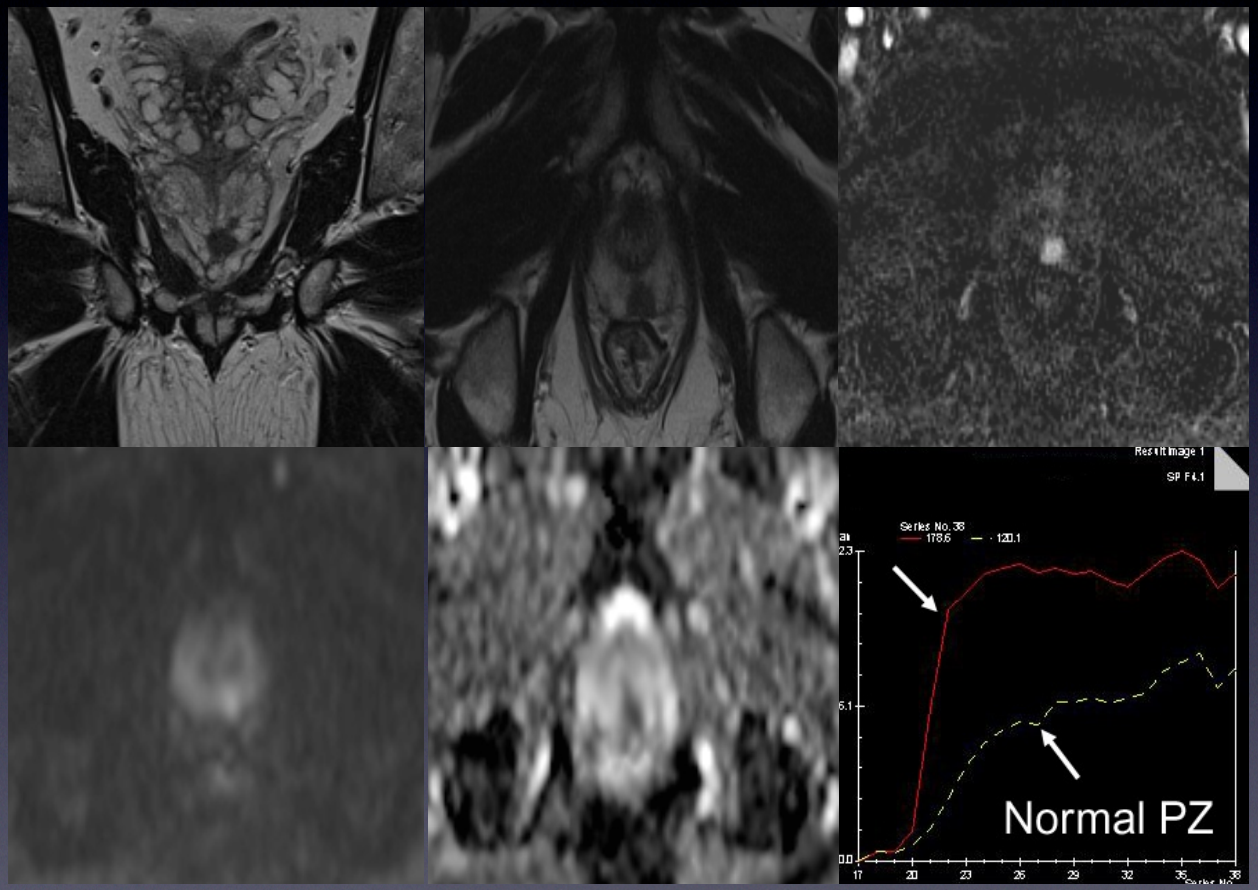
- Biopsy
  - systematic but non-targeted (blind)
    - Underestimates cancer aggressiveness in a substantial proportion

TRUS vs prostatectomy grade: Upgrading/downgrading*

		TRUS biopsy grade							
		GS ≤6		GS 3+4		GS 4+3		GS 8-10	
		no.	%	no.	%	no.	%	no.	%
Other down-grading studies (n>100)			-		4.3-12*[1]		23.5[1]		17.4-56*[1]
Total down-graded			-		24.4*		41.2*		45.0*
Prostatectomy grade	≤6	3797	74.9	386	24.4	55	9.0	11	2.9
	3+4	1016	20.1	856	64.4	198	32.2	57	15.0
	4+3	199	3.9	285	18.0	279	45.4	103	27.1
	8-10	59	1.1	48	3.1	88	13.6	209	55
Total upgraded			25.1*		21.1*		13.6*		-
Other upgrading studies (n>100)			35 (14-53.3)*,[1]		31.8-38.3 [1,2]		41.2[1]		-

*Epstein JI, Eur Urol. 2012; [1]D'Elia C, Mol Clin Oncol. 2014; [2]Saridi H, Can Urol Assoc J 2014

Solution → multiparametric MRI



Communication

- Each prostatic lesion
  - Location & size
  - Extraprostatic disease (ECE or SVI)
  - PI-RADS (v1 = v2) assessment categories[1]
    1. Very low (clinically significant cancer - highly unlikely)
    2. Low (clinically significant cancer – unlikely)
    3. Intermediate (clinically significant cancer - equivocal)
    4. High (clinically significant cancer - likely)
    5. Very high (clinically significant cancer – highly likely)

[1]http://www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/Resources/PIRADS/

WORDS → *Significant cancer*

- significant risk to the health of an individual

- Definition often used*
  - Index lesion vol > 0.5 ml[1,2] and/or
  - Gleason pattern 4 or 5 and/or
  - Extra-capsular disease (ECE/SVI)

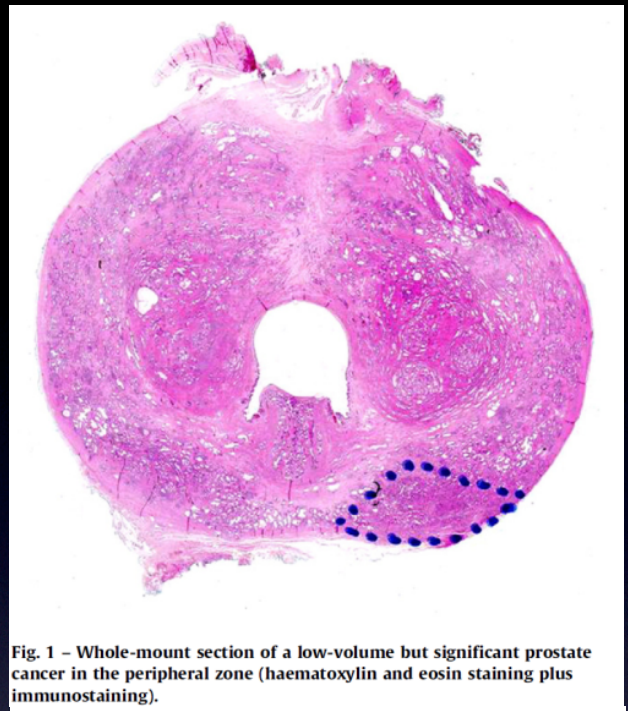


Fig. 1 – Whole-mount section of a low-volume but significant prostate cancer in the peripheral zone (haematoxylin and eosin staining plus immunostaining).

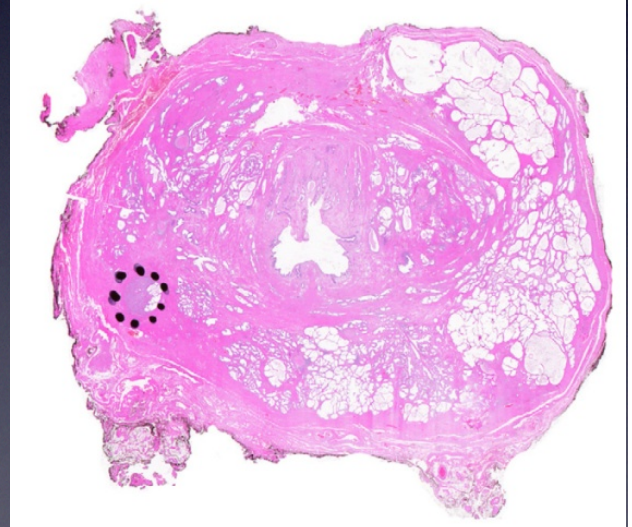


Fig. 2 – Whole-mount section of an insignificant prostate cancer (haematoxylin and eosin staining plus immunostaining).

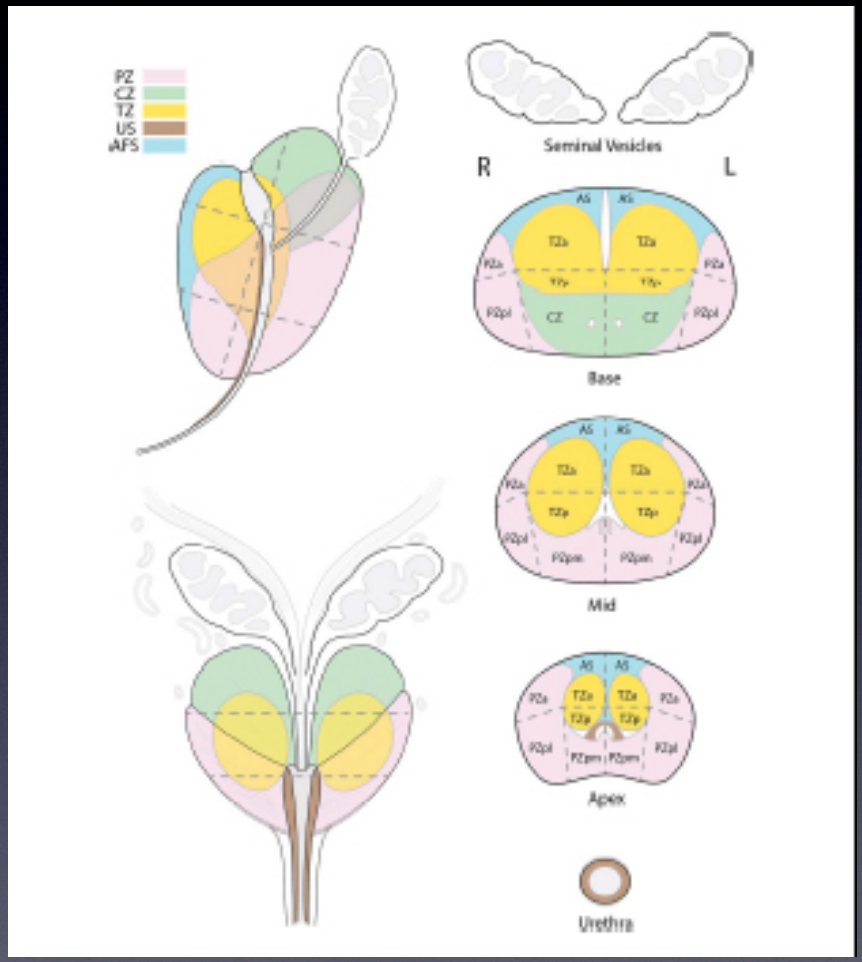
*Bott SR, et al. BJU Int 2010; 106: 1607-1611

[1]Stamey TA et al. Cancer 1993; 71 (suppl.): 933

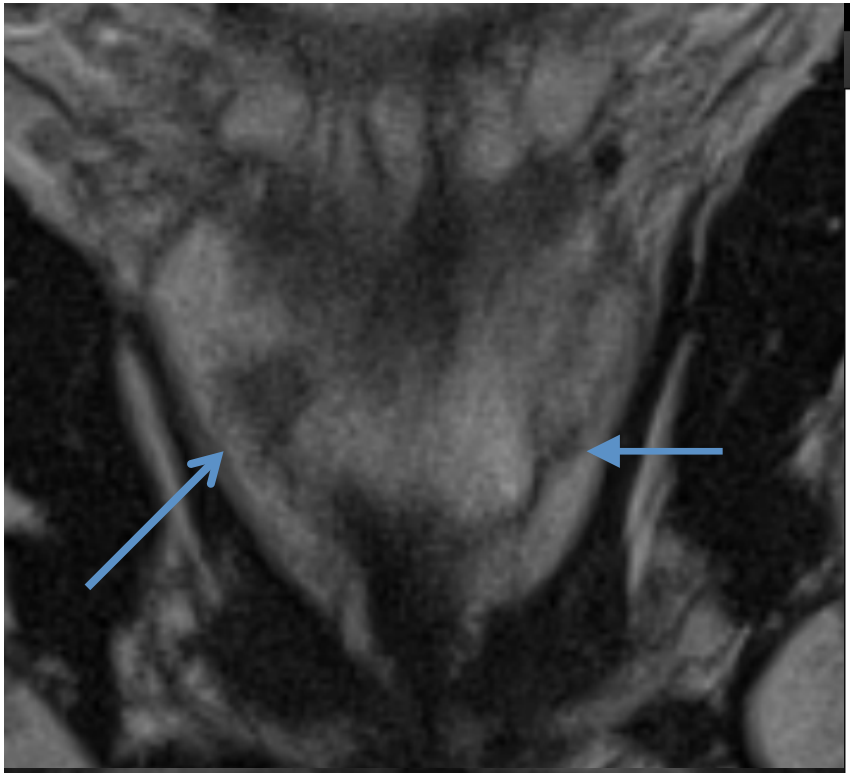
[2]This volume may not be applicable for GI 3+3 disease where 1.3ml for the index lesion maybe more appropriate (Wolters T, J Urol 2011; 185: 121–125)

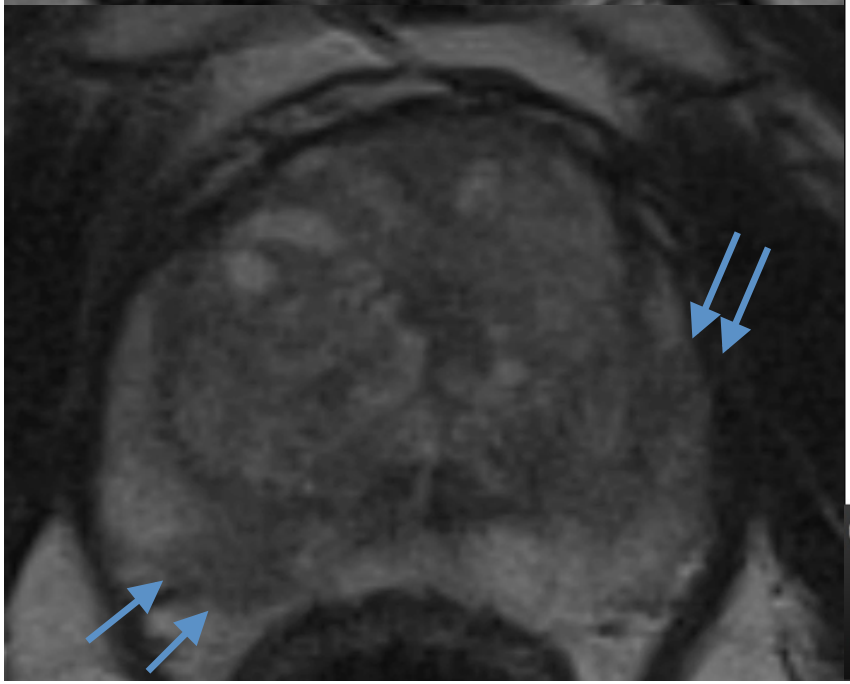
Communication

- Sector Map
  - 39 sectors
    - Direct biopsy
    - Guide surgery



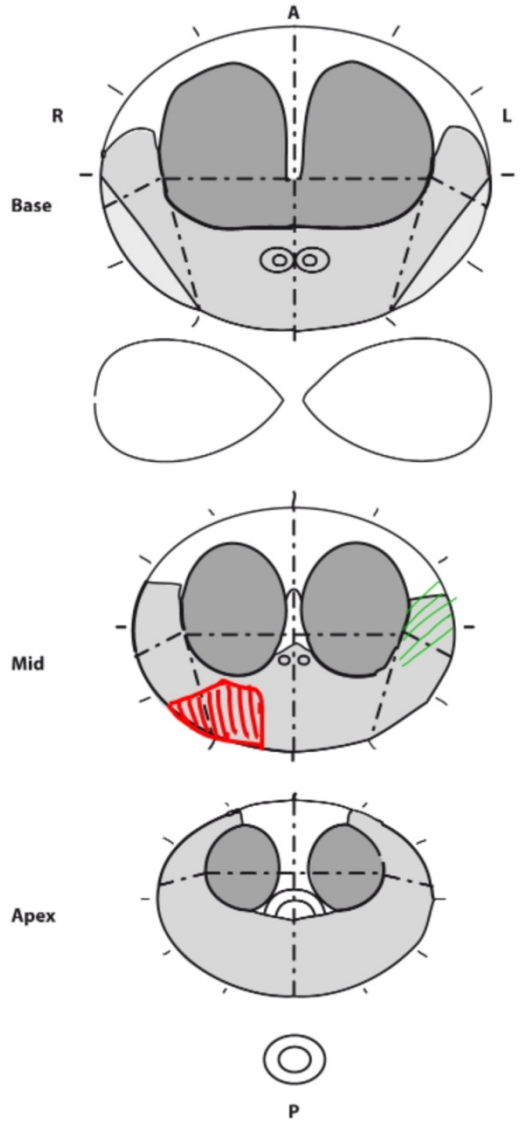
[1]http://www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/Resources/PIRADS/

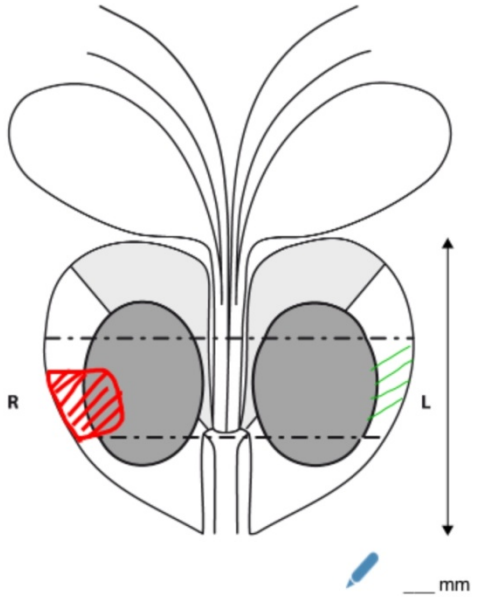




●●●●○ TIM E 13:59 80%

Patient Data





___ mm

	Size	Site	Distance to apex	T2WI	DWI	DCE	Contact with capsule	PI-RADS
1	10	PZ	11	4	4	4	Yes	4

mpMRI: when?

After a negative TRUS biopsy?

Before TRUS biopsy?

What do UK guidelines say about pre-biopsy mpMRI in suspected cancer?

- BUPA-UK (May 2014)
  - "Consider mpMRI for all men destined for prostate biopsy for suspect cancer and appropriate biopsy strategy depending on mpMRI findings"
- London Cancer Alliance best practise prostate pathway (Dec 2013):
  - "there are 4 situation when mpMRI is required before 1st biopsy"
    1. If there is a palpable abnormality on DRE
    2. If the PSA is >10ng/mL
    3. If there is high clinical suspicion of prostate cancer and the patient is potentially fit for radical treatment
    4. To guide biopsy strategy where uncertainty exists, e.g. large gland with BPH where MRI might avoid biopsy
- UK NICE (Jan 2014)
  - "Consider mpMRI for men with negative 10-12 core TRUS biopsy to determine whether another biopsy is needed"
  - "Do not offer another biopsy if the mpMRI is negative, unless other risk factors are present" [HGPIN, ASAP, abnormal DRE]

Courtesy of prof Padhani

Ability of NEGATIVE prebiopsy mpMRI for excluding (ruling out) patients with *clinically significant disease*

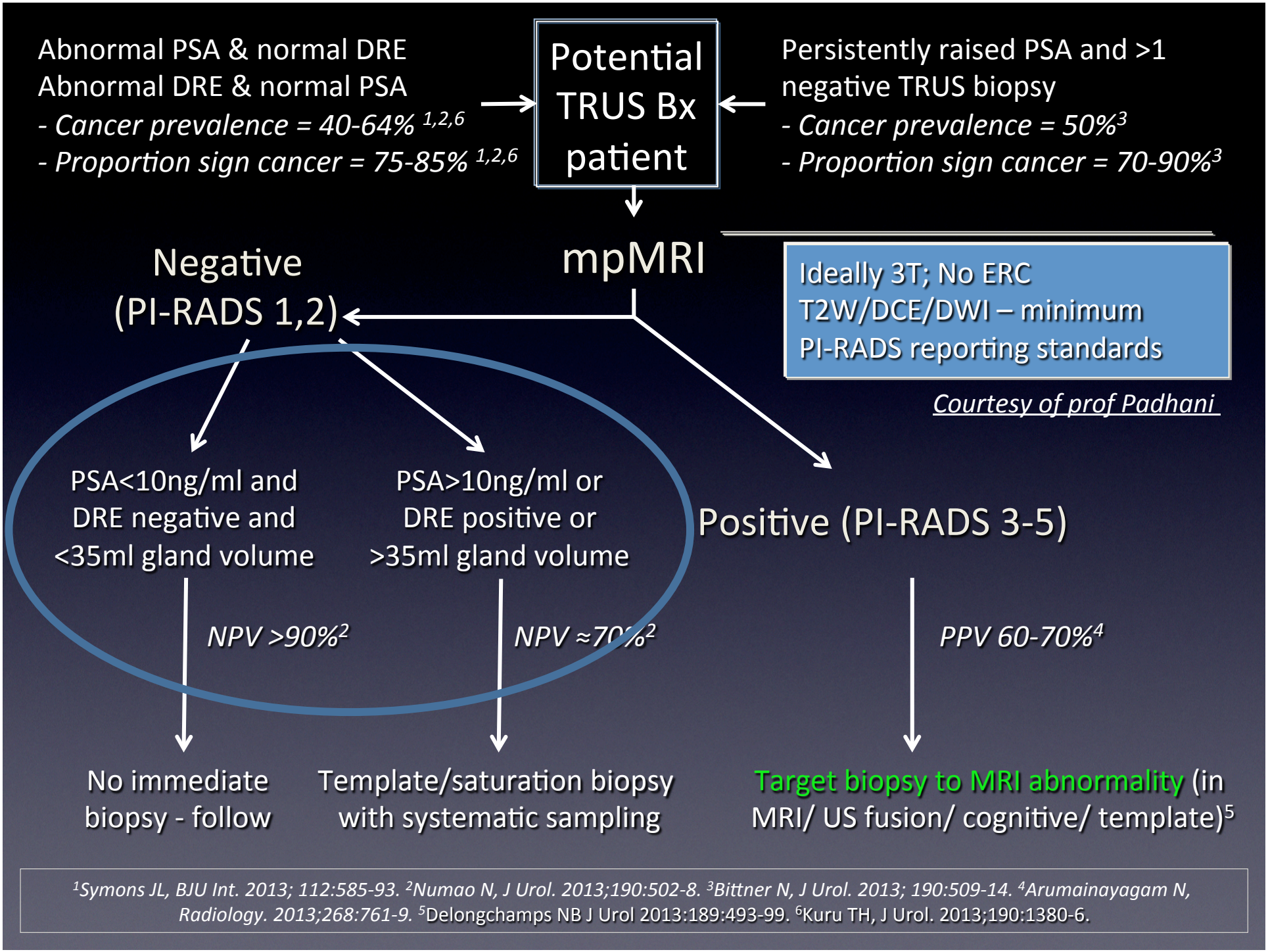
- 352 men with raised PSA (2.4-20 ng/ml) and/or abnormal DRE
- mpMRI before biopsy (no MRSI); 14-29 biopsies including template anterior gland sampling
- Cancer prevalence: all cancer 45%; clinically significant cancer 33-37%
- In subjects with PSA <10 ng/ml and normal DRE, prebiopsy mpMRI has high NPV when prostate volumes are <33ml (NPV 95-97%)

→ Potential to reduce initial prostate biopsy rate

mpMRI performance with low risk characteristics (PSA <10 ng/ml & normal DRE)				
Predicting clinically significant disease in n=245	Sensitivity	Specificity	PPV	NPV
mpMRI alone	71-74%	70-74%	43-50%	87-91%
mpMRI + prostate volume <33 ml	93-96%	41-43%	32-38%	95-97%

Numao N, et al. Usefulness of prebiopsy multiparametric MRI and clinical variables to reduce initial prostate biopsy in men with suspected clinically localized prostate cancer. J Urol. 2013 Mar 6. [Epub ahead of print]

Courtesy of prof Padhani



[1]Symons JL, BJU Int. 2013; 112:585-93. [2]Numao N, J Urol. 2013;190:502-8. [3]Bittner N, J Urol. 2013; 190:509-14. [4]Arumainayagam N, Radiology. 2013;268:761-9. [5]Delongchamps NB J Urol 2013:189:493-99. [6]Kuru TH, J Urol. 2013;190:1380-6.

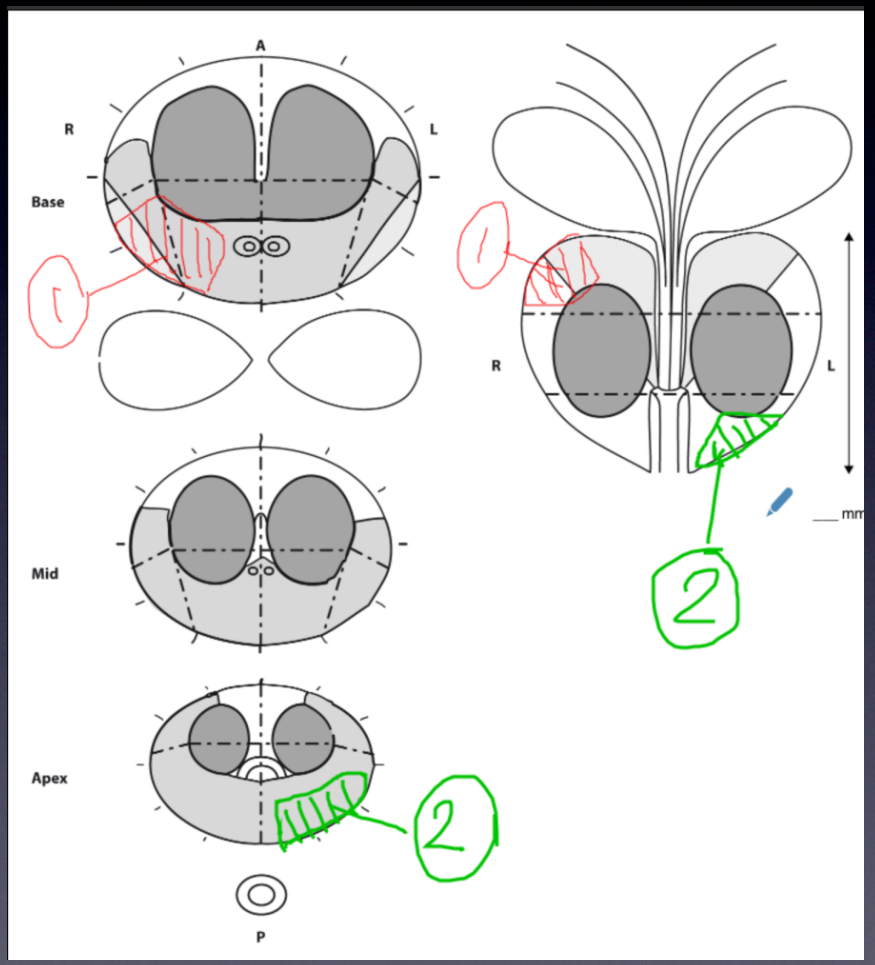
After positive mpMRI: MRI-TBx or standard TRUS biopsy?

- 16 studies with 1926 men with +ve mpMRI[1]
  - 1° biopsy: MRI-TBx → +10% detection rate of significant cancer
    - *Cost & effort may not be justified*
  - Previous negative biopsy : MRI-TBx → +54% of significant cancer
    - *Changes in diagnostic approach justified*
  - MRI-TBx had lower rate (-17 & 49%) of detecting insignificant cancers → added motivaton for changing diagnostic pathway

1. Schoots IG, et al. Eur Urol. 2014 Dec 2.

mpMRI targeted biopsy

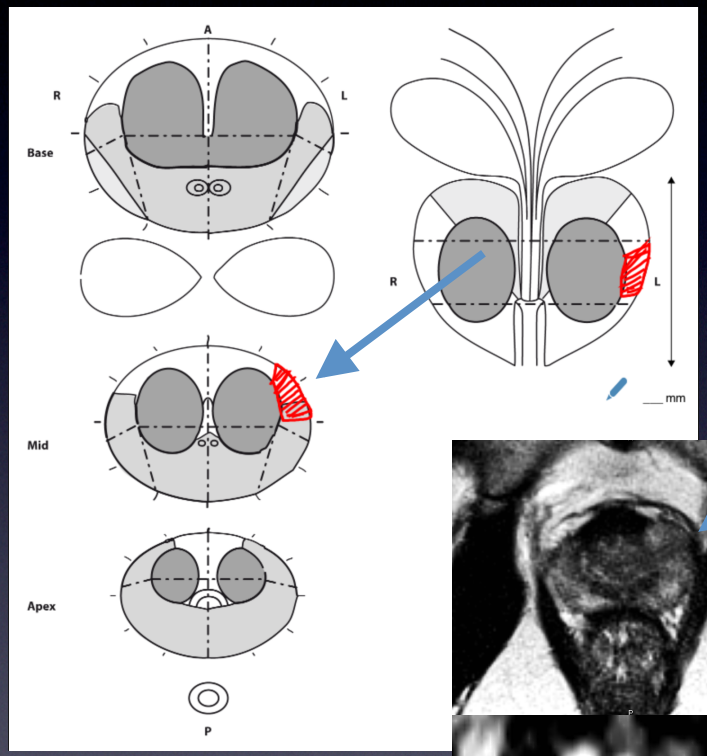
- Cognitive Fusion[1,2]
  - Template
    - RADCOMMUNICATOR
    - iTunes Apple
  - Operator dependent

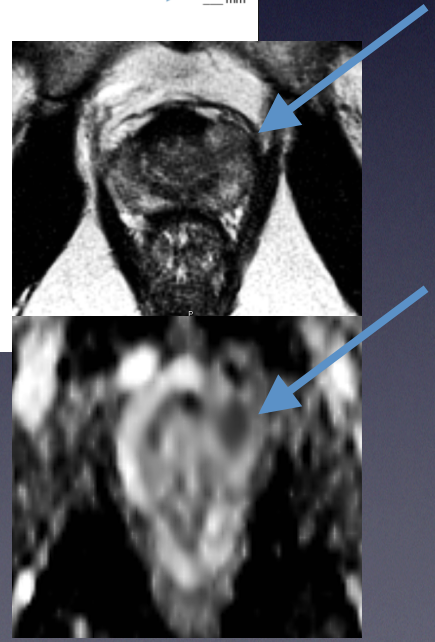


[1] Puech P et al, Radiology. 2013 Aug;268(2):461-9.
[2] Robertson NL, Emberton M, eta l. Nat Rev Urol. 2013 Oct;10(10):589-97

Cognitive fusion (B.G.)

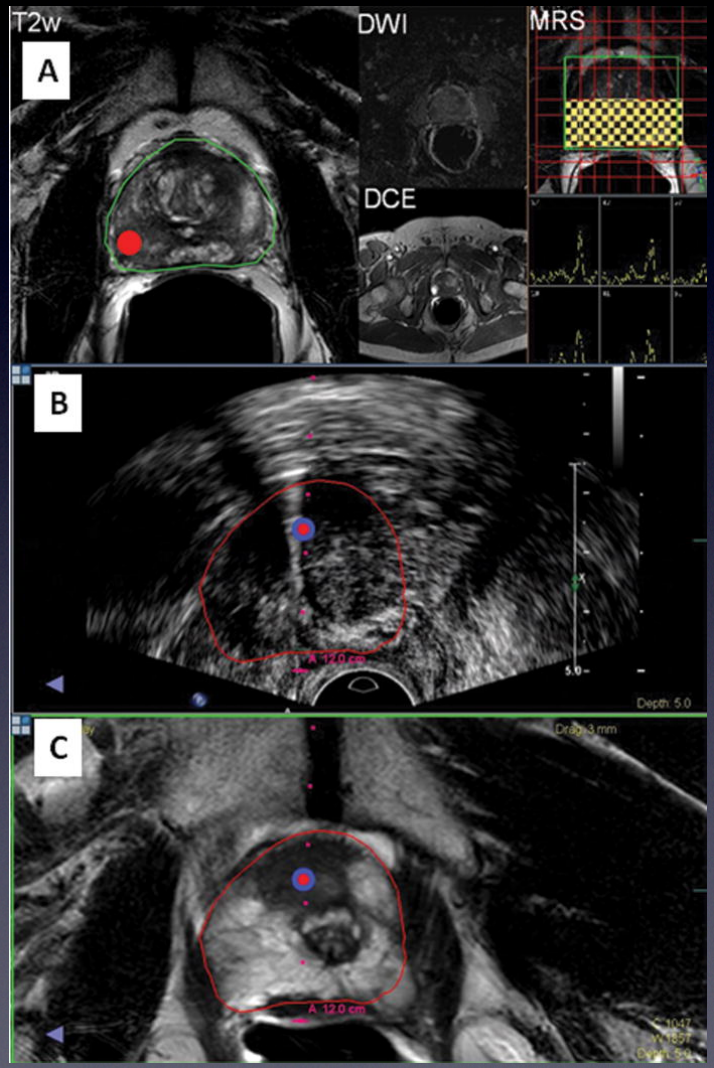
- 56 year-old
  - PSA = 13.46 ng/ml
  - DRE = neg
  - TRUS Bx = neg. x 2
- mpMRI
  - PI-RADS 4, 7mm (PZ left)
- TBX + systematic
  - 1/14 GS 3+3 (40%)





mpMRI targeted biopsy

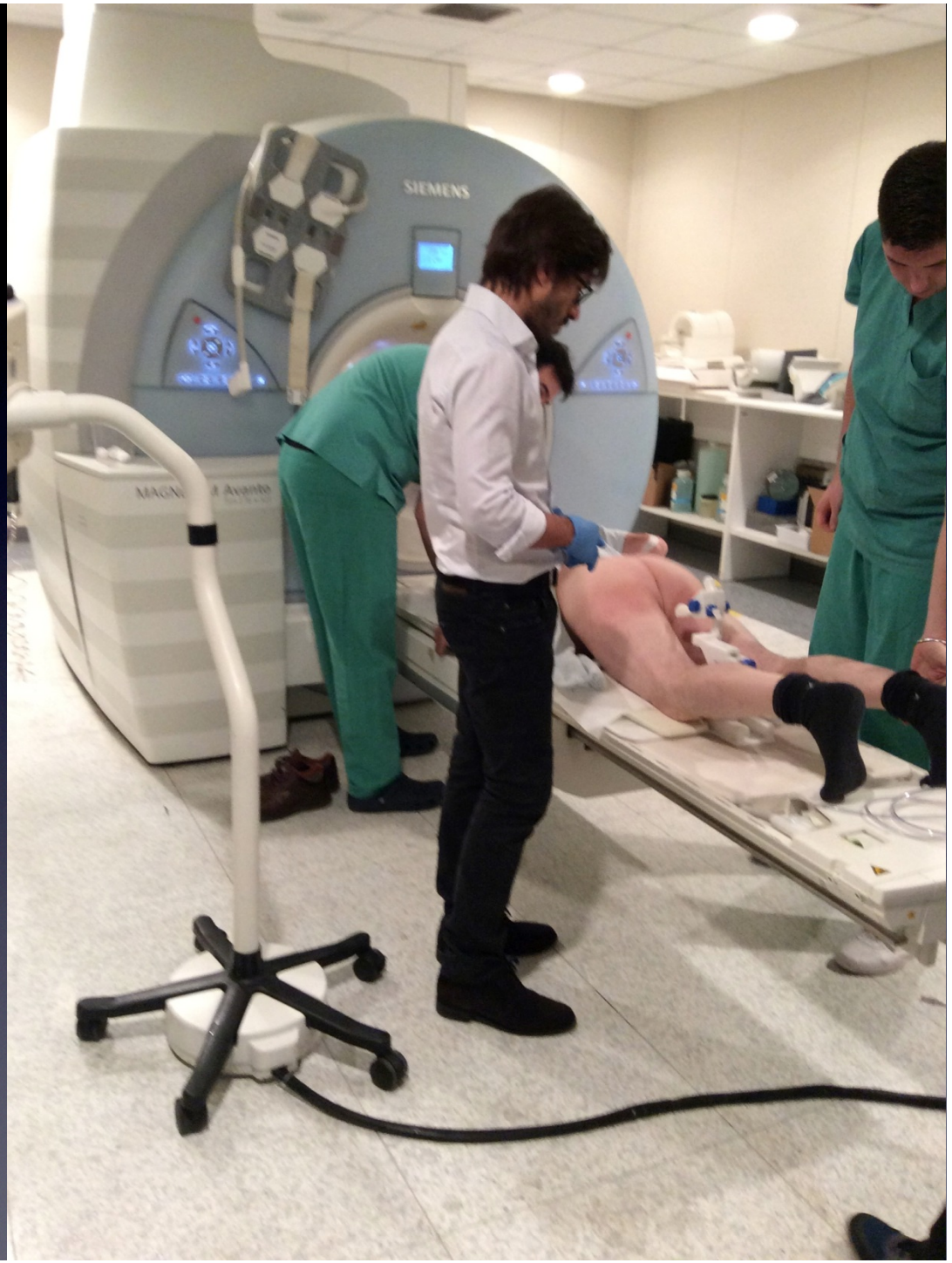
- mpMRI/US Fusion
  - Rigid (4-5mm)
  - Elastic (2mm)
  - Conflicting results[1]
  - Operator dependent



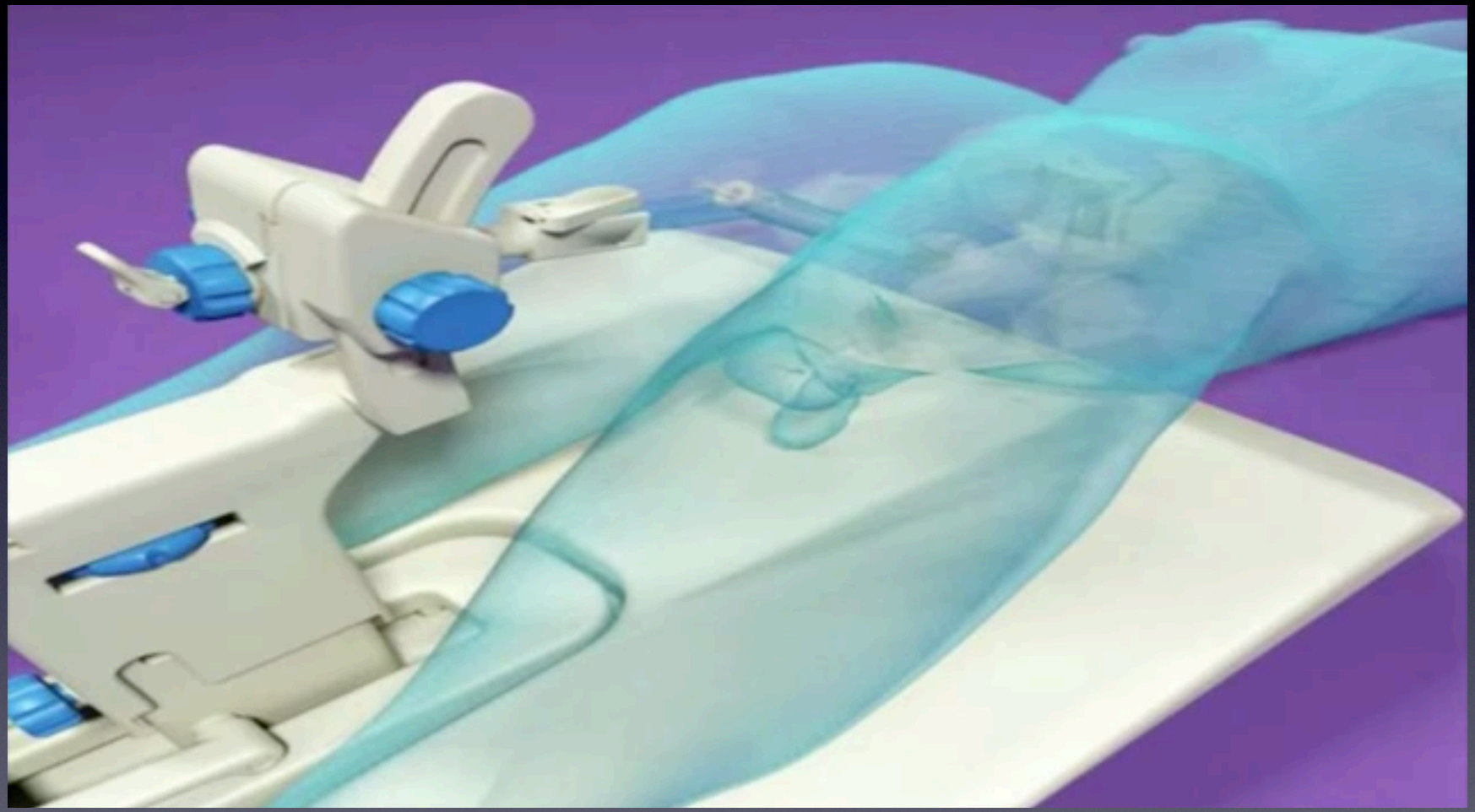
[1] Logan JK et al, BJU Int. 2013 Dec 3.

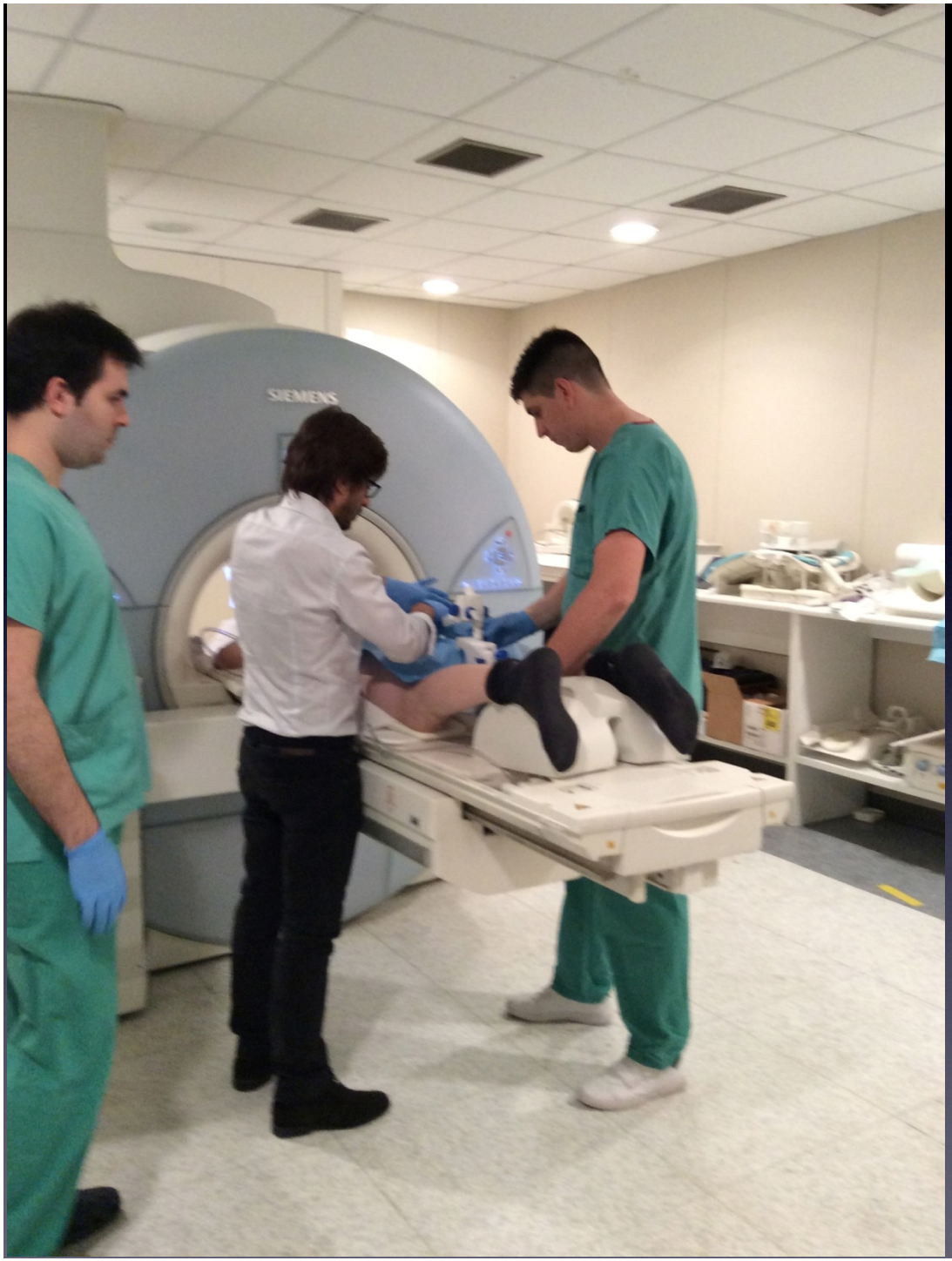
mpMRI targeted biopsy

- Direct “In-bore” MRI target biopsy


SIEMENS

Accurate 3D planning

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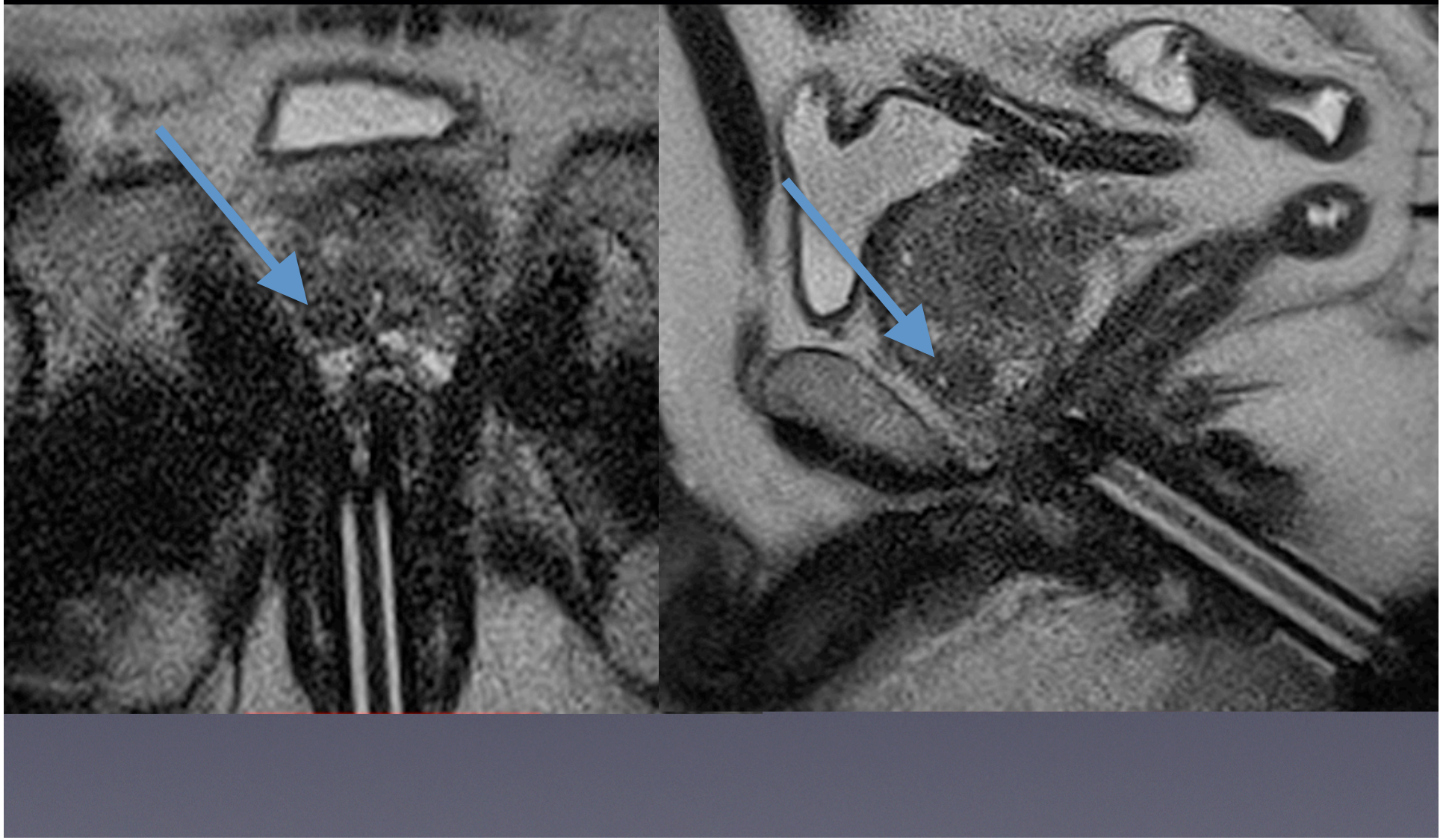
Coronal and sagittal to confirm

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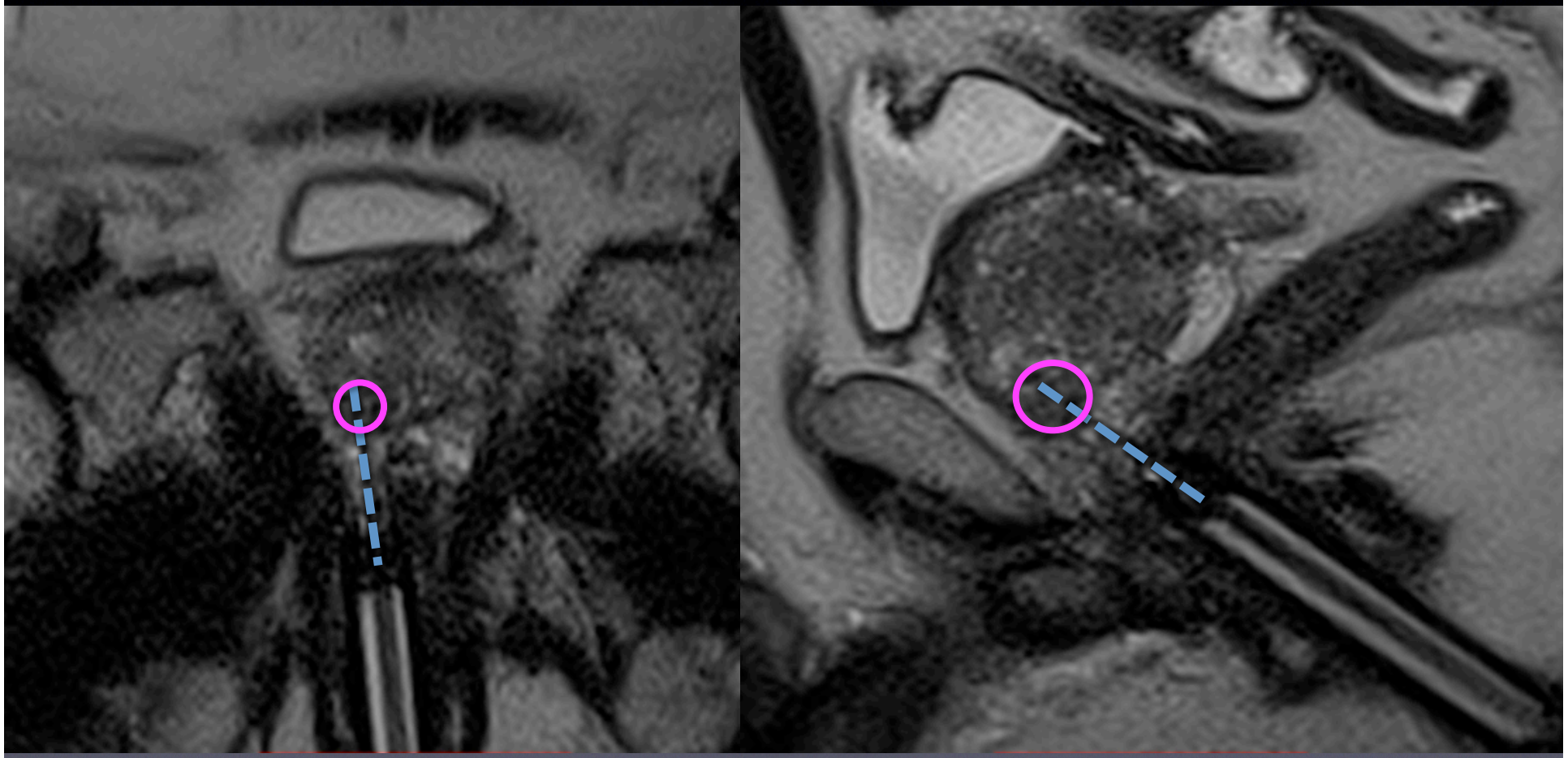
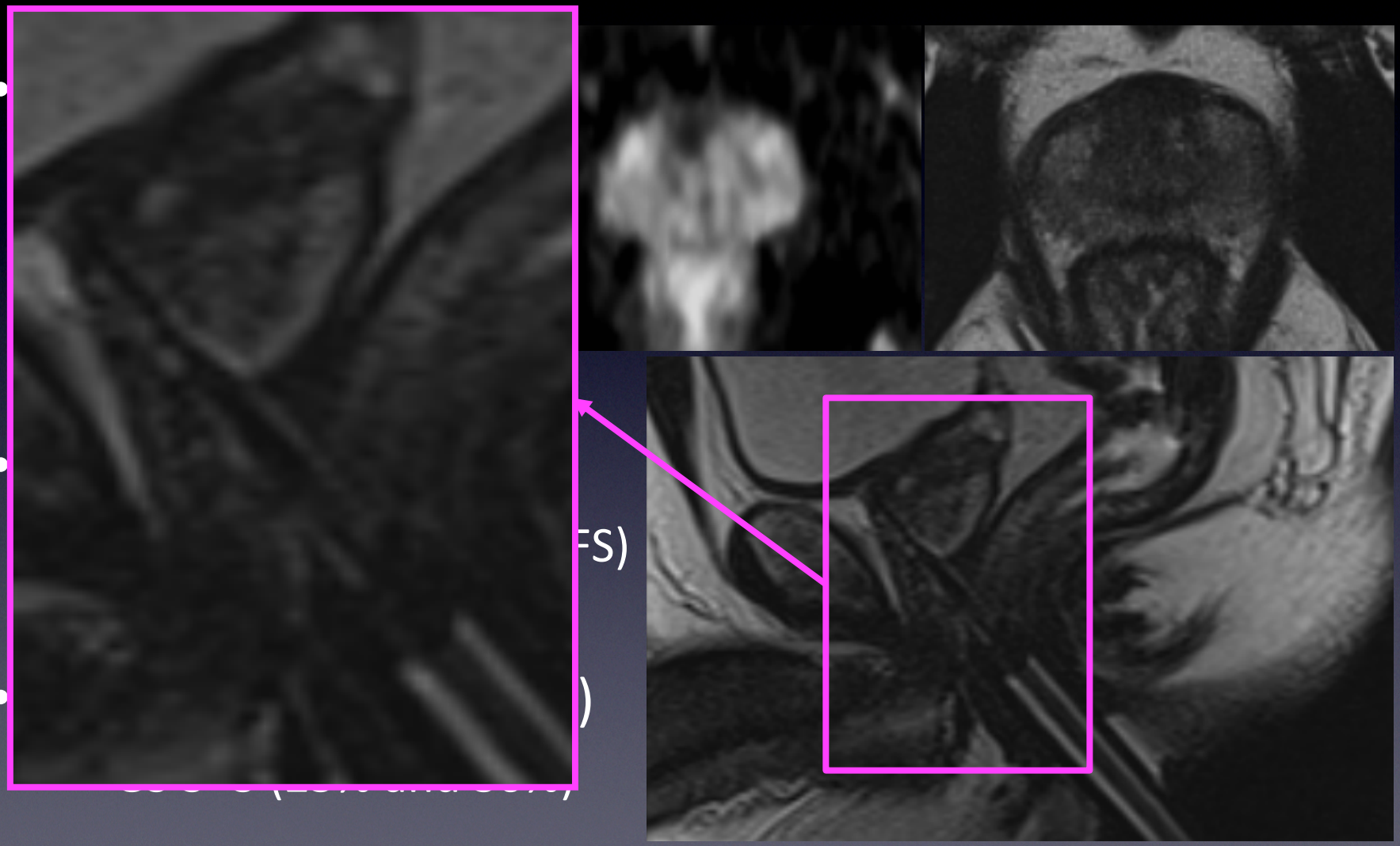
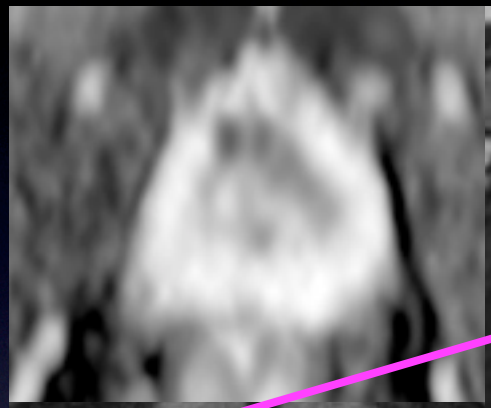
18G needle is in the lesion

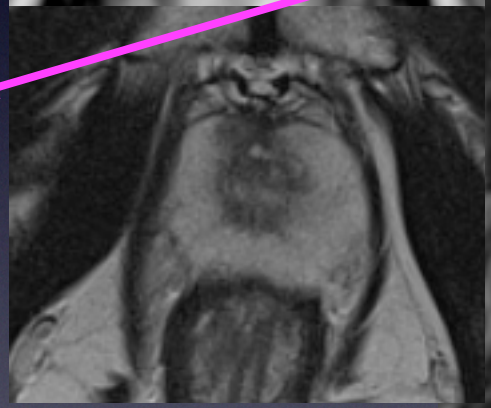


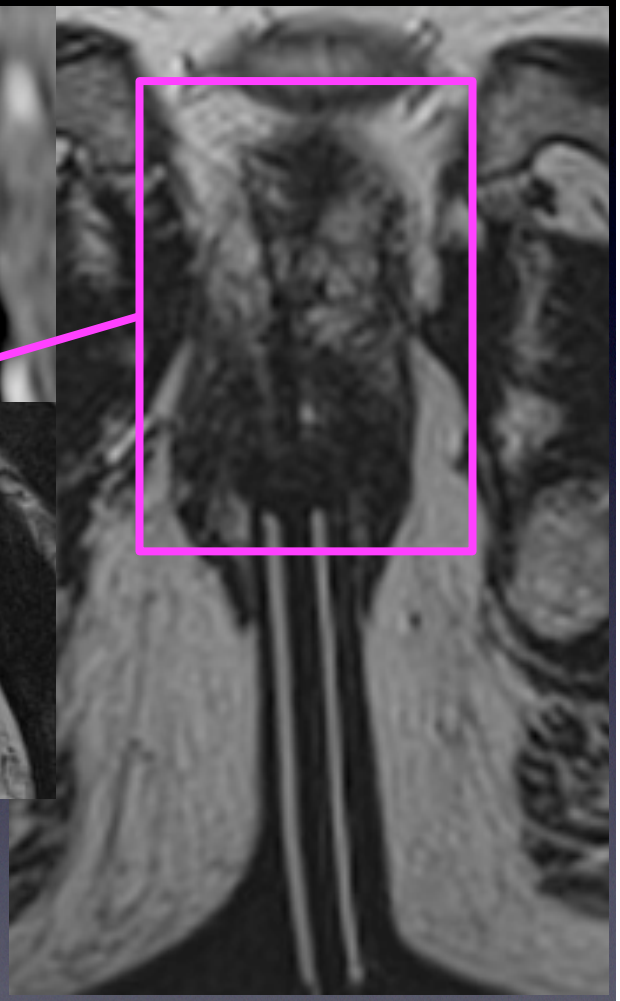
mpMRI targeted biopsy (G.E.)



mpMRI targeted biopsy (G.C.)





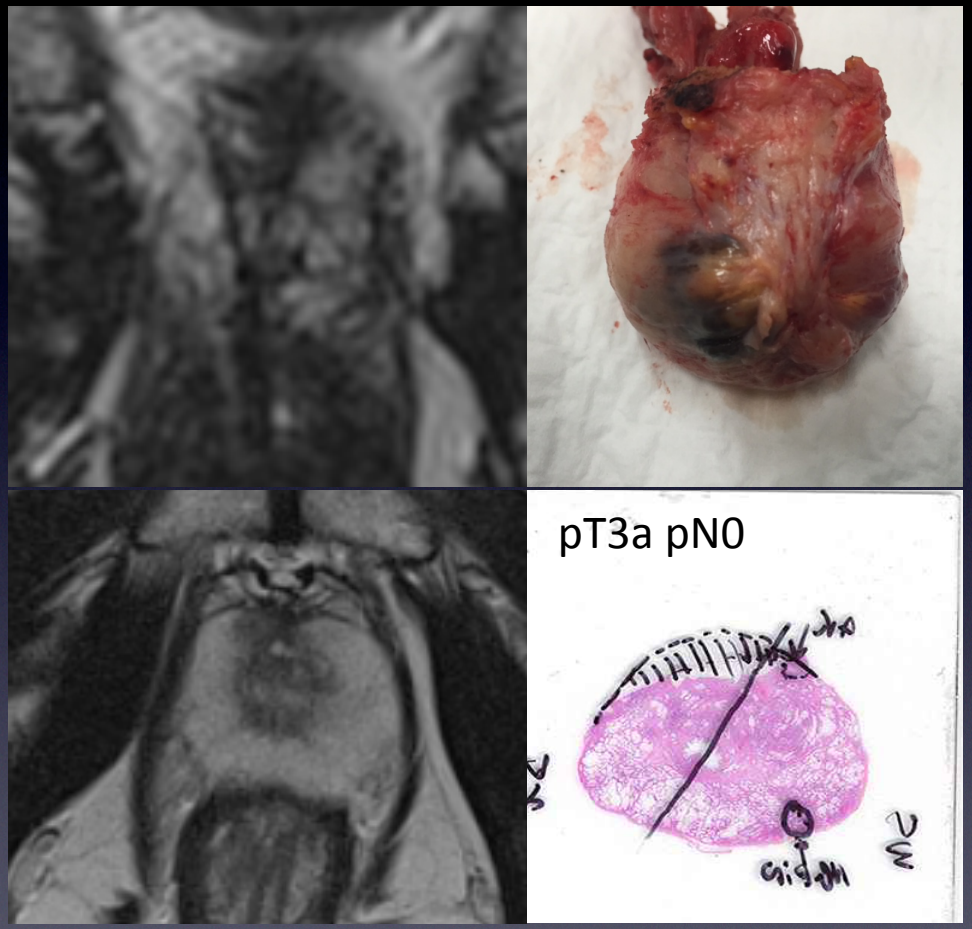


)

%)

mpMRI targeted biopsy (G.C.)

- 65 year-old
  - PSA = 3.2 ng/ml
    - PSA = 1.5 ng/ml (2009)
  - DRE = negative
- mpMRI
  - PI-RADS 4, 6mm (PZ)
- Target biopsy (3 cores)
  - GS 4+3 (50%, 40%, 15%)



Is MRI target biopsy *clinically effective*?

mpMRI targeted biopsy

- 68 pts, PSA>4, ≥ 2 neg TRUS biopsies[1]
  - MRI guided biopsy (avg 4 cores)
    - Cancer in 40 out of 68 pts
    - Significant cancer in 37 out of 40 pts (93%)

[1] de Rooij M, et al Eur Urol. 2013 Dec 21. pii: S0302-2838(13)01333-X.

1) GPS for biopsy

2) Mainly aggressive tumours (93%)

- Low risk → reduce overdiagnosis (-treatment)
- Int-high risk → appropriate treatment

3) Reduces cores (3-4 vs 12-18)

- Smart vs carpet “bombing”

MRI-TBx alone?

- MRI-TBx vs standard TRUS (12 cores) [175 naive pts][1]
  - Detection rates for sign. Pca did not differ btw two groups
    - " …12-core random biopsy may be replaced by two-core MRI/ TRUS targeted biopsy for detection of clinically significant PCa."
- MRI-TBx vs Saturation biopsy (24 cores) [294 pts][2]
    - 186 men first biopsy
      - Trend of being superior to Sat BX for GS7 or greater
    - 108 men with previous negative TRUS-Bx
      - No GS 7 or greater missed by MRI-TBx alone
  - MRI-TBx avoided over diagnosis of 43.8% low-risk

1. Baco E, et al. Eur Urol. 2015 Apr 7
2. Radtke JP, et al. Urol. 2015 Jan;193(1):87-94.

Is MRI target biopsy *cost-effective*?

10,000 simulations

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

European Association of Urology

Platinum Priority – Prostate Cancer

Editorial by Mark Emberton on pp. 437–438 of this issue

Cost-effectiveness of Magnetic Resonance (MR) Imaging and MR-guided Targeted Biopsy Versus Systematic Transrectal Ultrasound–Guided Biopsy in Diagnosing Prostate Cancer: A Modelling Study from a Health Care Perspective

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10,000 simulations

- Two arms
  - Traditional
    - Elevated PSA → TRUS biopsy → if negative, follow-up and re-biopsy → 2392 euro
  - Experimental
    - Elevated PSA → mpMRI → if negative, follow-up, if positive, MRI-guided biopsy → 2423 euro

Comparable costs

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- Prostate Board (IEO)
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- Prostate MRI Team (IEO)
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- MVCC, London (UK)
  - Prof Padhani

Thank you

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Diagnostic pathways incorporating mpMRI and biopsy strategies