

Prostate MRI for local staging and surgical planning in prostate cancer

15th Annual Floyd A. Fried Advances in
Urology Symposium

June 23, 2017

Ray Tan, MD, MSHPM

Assistant Professor



UNC
LINEBERGER

Disclosures

- None

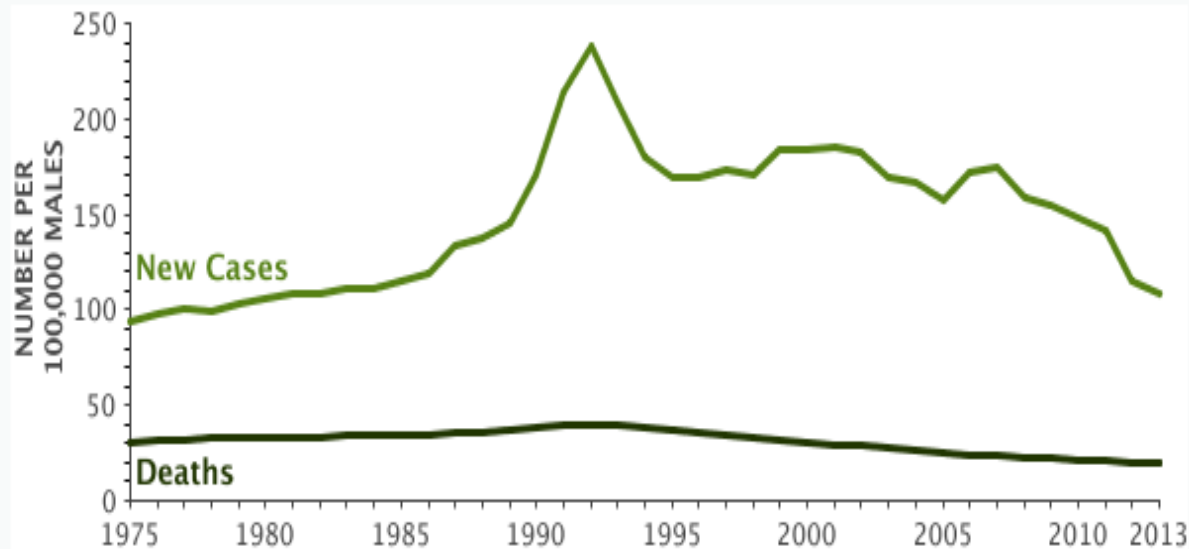
Objectives

- Epidemiologic trends in prostate cancer
- Role of stage in risk and treatment
- Accuracy of multiparametric MRI in defining stage
- Use of MRI in surgical planning

Prostate Cancer Epidemiology

New Cases, Deaths and 5-Year Relative Survival

[View Data Table](#)

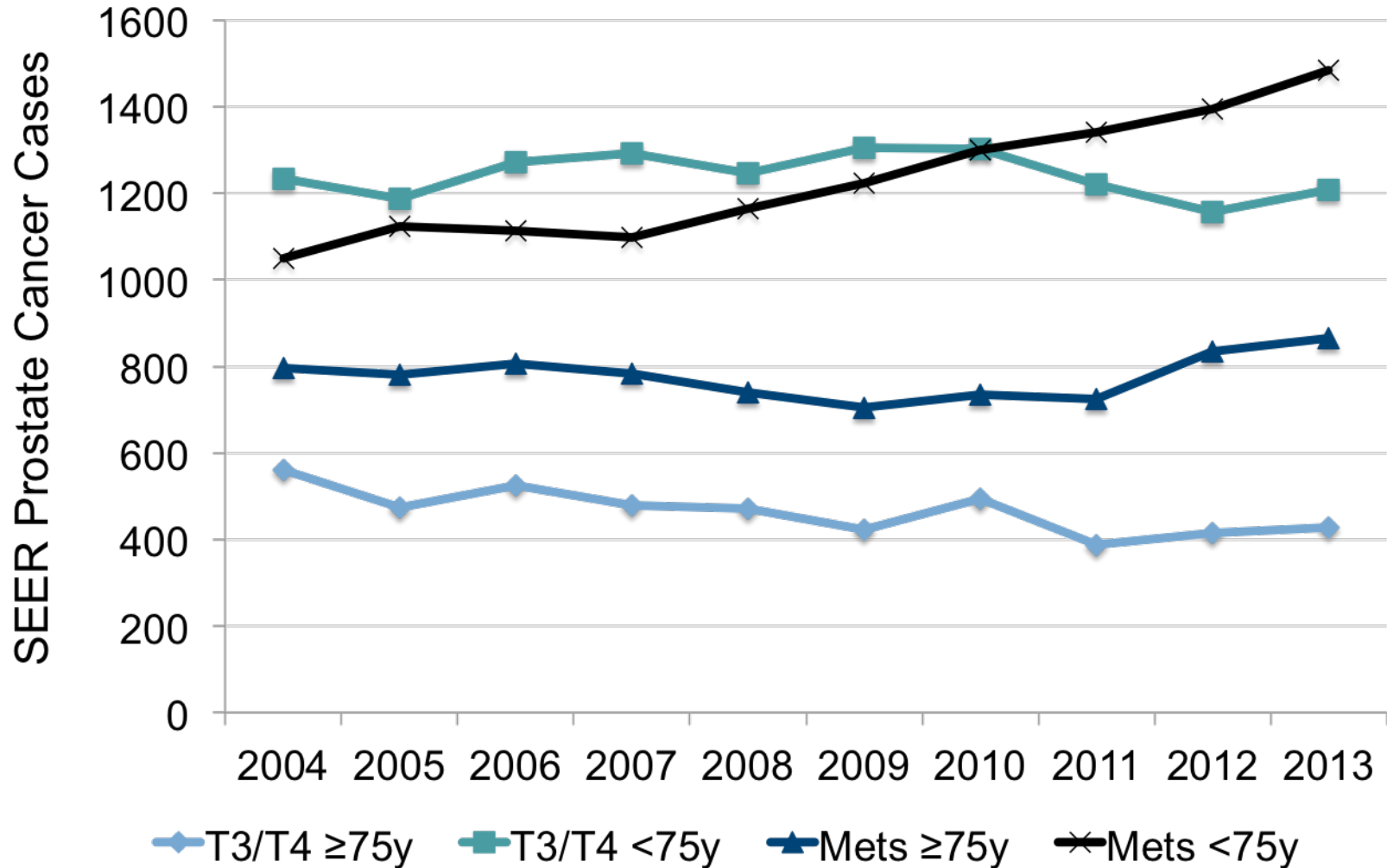


Year	1975	1980	1985	1990	1995	2000	2004	2008
5-Year Relative Survival	66.0%	70.2%	75.0%	88.5%	95.7%	98.8%	99.7%	99.1%

SEER 9 Incidence & U.S. Mortality 1975–2013, All Races, Males. Rates are Age-Adjusted.

Mortality decreasing 3.5%/y since 1995 [SEER]

Prostate Cancer Stage Migration



Prostate Cancer Stage and Risk

TABLE 2: TNM staging system of prostate cancer, 2010 updates^a

Anatomic Stage/Prognostic Groups

GROUP	T	N	M	PSA	Gleason
Stage I	T1a–c	NO	M0	PSA < 10	Gleason ≤ 6
	T2a	NO	M0	PSA < 10	Gleason ≤ 6
	T1–2a	NO	M0	PSA X	Gleason X
Stage IIA	T1a–c	NO	M0	PSA < 20	Gleason 7
	T1a–c	NO	M0	PSA ≥ 10 < 20	Gleason ≤ 6
	T2a	NO	M0	PSA < 20	Gleason ≤ 7
	T2b	NO	M0	PSA < 20	Gleason ≤ 7
	T2b	NO	M0	PSA X	Gleason X
Stage IIB	T2c	NO	M0	Any PSA	Any Gleason
	T1–2	NO	M0	PSA ≥ 20	Any Gleason
	T1–2	NO	M0	Any PSA	Gleason ≥ 8
Stage III	T3a–b	NO	M0	Any PSA	Any Gleason
Stage IV	T4	NO	M0	Any PSA	Any Gleason
	Any T	N1	M0	Any PSA	Any Gleason
	Any T	Any N	M1	Any PSA	Any Gleason

From Edge SB, Byrd DR, Compton CC, et al (eds): AJCC Cancer Staging Manual, 7th ed. New York, Springer, 2010.
^aWhen either PSA or Gleason is not available, grouping should be determined by T stage and/or either PSA or Gleason as available.

D'Amico Risk

Low

PSA <10,
Gleason 6,
≤T2a

Intermediate

PSA 10-20,
Gleason 7, T2b

High

PSA ≥20,
Gleason ≥8,
≥T2c

Prostate Cancer Stage and Risk

<p>CAPRA Score</p>	<p>Scoring system based on age, PSA, primary pattern 4 or 5, clinical stage, % involvement of biopsy core</p> <p>Low: Score 0-2</p> <p>Intermediate: Score 3-5</p> <p>High: Score 6-10</p>
<p>Nomograms (e.g., MSKCC)</p>	<p>Calculates probability of adverse pathology, disease progression, and/or cancer specific survival based on age, PSA, clinical stage, Gleason score, %core positive</p>
<p>NCCN Classification, 2016</p>	<p>Very Low Risk: T1c, Gleason ≤ 6, PSA < 10, < 3 cores with $\leq 50\%$ cancer in each, and PSA density < 0.15 ng/ml/prostate volume</p> <p>Low Risk: T1-T2a, Gleason ≤ 6, and PSA < 10</p> <p>Intermediate Risk: T2b-T2c, Gleason 7, or PSA 10–20</p> <p>High Risk: T3a, Gleason 8–10, or PSA > 20</p> <p>Very High Risk: T3b-T4, primary Gleason pattern 5, or > 4 cores with Gleason 8-10</p>

Potential Decision Point?

Guideline Panel	Recommendation
AUA/ASTRO	Adjuvant XRT should be discussed/offered for men with positive margin, extraprostatic extension, or seminal vesicle invasion after radical prostatectomy
EUA	For men with pT3, particularly with positive margins, can be offered: <ul style="list-style-type: none">• Adjuvant radiation therapy• Careful biochemical monitoring with early salvage before PSA exceeds 0.5 ng/ml
NCCN	For men with pT3 or positive margins: <ul style="list-style-type: none">• Radiation therapy• Observation

Also implications on duration of ADT with XRT

Local Staging with DRE/US



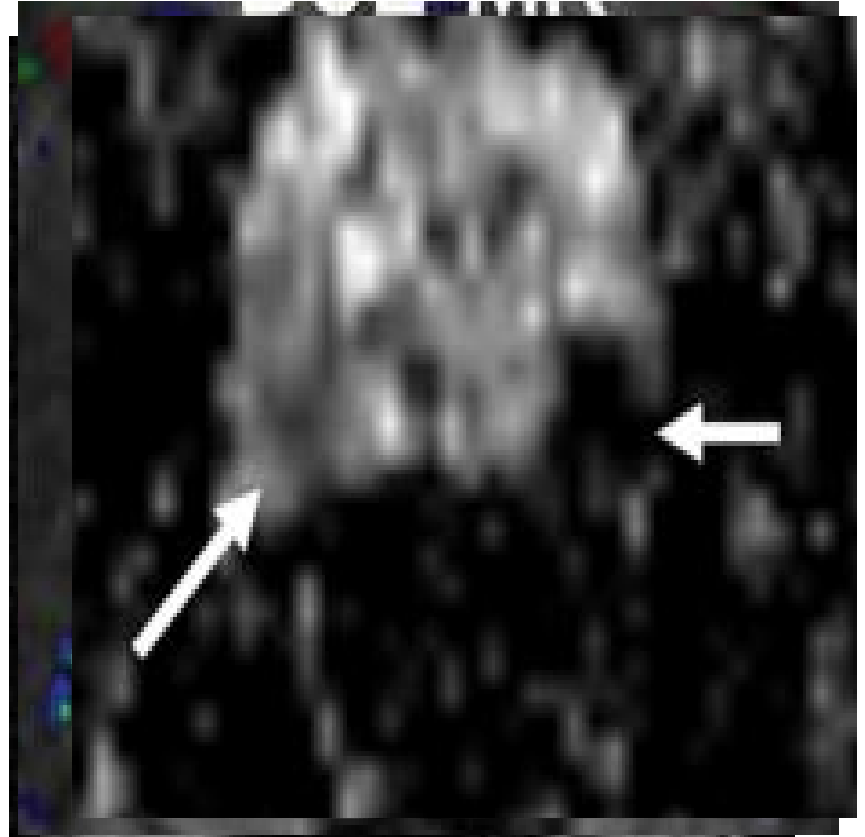
Multiparametric Prostate MRI

AUA Standard Operating Procedures, 2017

- 3.0T vs. 1.5T
- +/- Endorectal Coil
- T1/T2 weighted imaging plus Diffusion weighted and Dynamic contrast enhanced MRI sequences
- PI-RADS version 2

MRI Grading: PI-RADS v2

- **T2-weighted imaging**
 - Low signal intensity = dark
 - High signal intensity = bright
- **Diffusion-weighted imaging**
 - **Apparent diffusion coefficient (ADC) map**
 - High b-value images (i.e., $> 1400 \text{ sec/mm}^2$)
- **Dynamic contrast enhancement**
 - Early enhancement in a lesion not consistent w/ BPH on T2WI



MRI Grading: PI-RADS v2

Peripheral Zone (PZ)

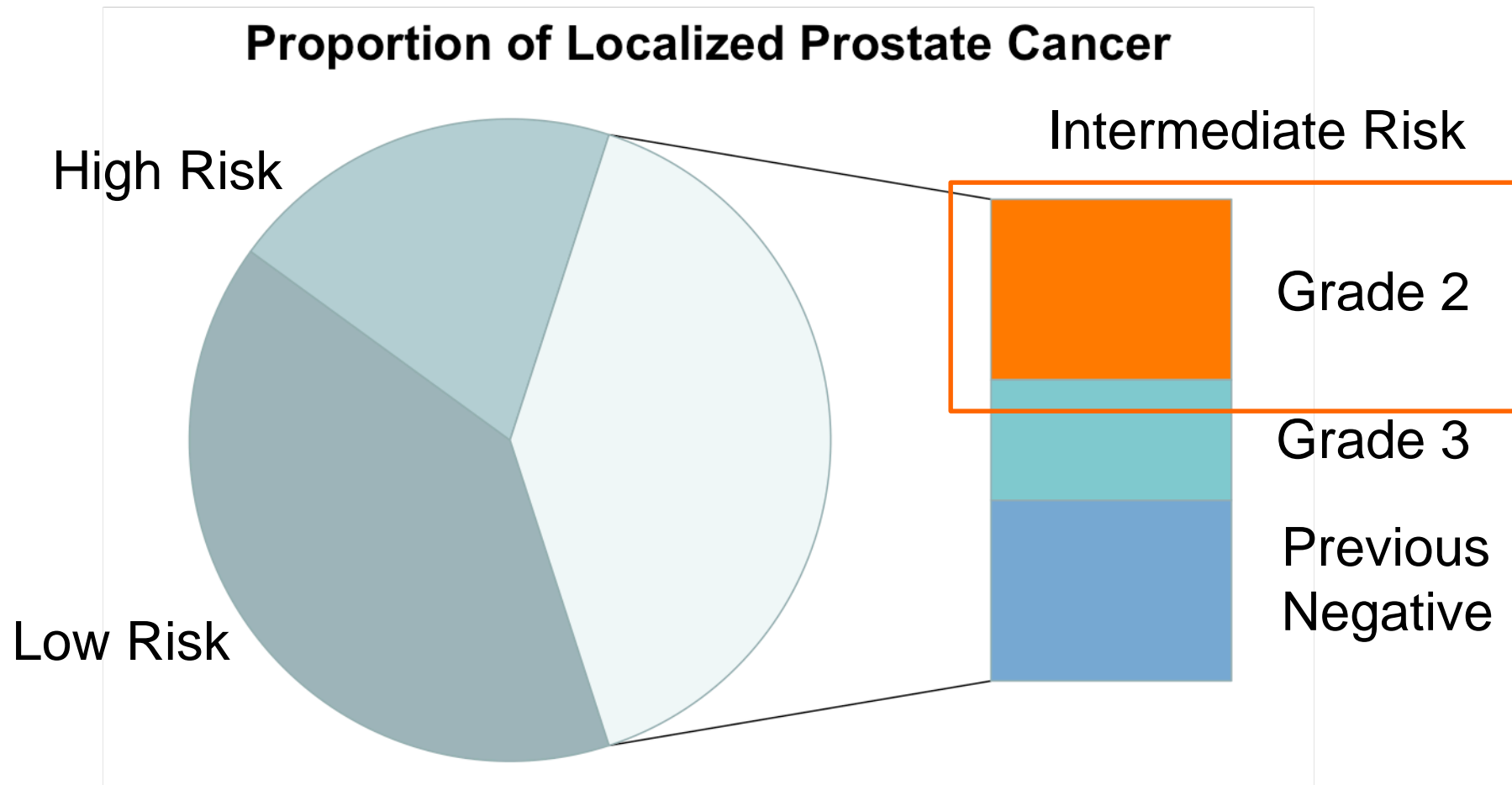
DWI	T2W	DCE	PI-RADS
1	Any*	Any	1
2	Any	Any	2
3	Any	-	3
		+	4
4	Any	Any	4
5	Any	Any	5

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

MRI Biopsy Trends

MRI Indicated for Most Men



CAN WE USE MULTIPARAMETRIC MRI FOR LOCAL STAGING & SURGICAL PLANNING?

MRI for Local Staging

Gupta et al, 2014: 60 men with MRI and RP

- 28.6% of men with <50% T1-T2 had OC while 67.9% of men with >50% T1-T2 had OC
- 83.3% agreement between MRI and RP $\leq T2$ vs. $\geq T3$
- AUC 0.62 for Partin table vs. 0.82 for MRI

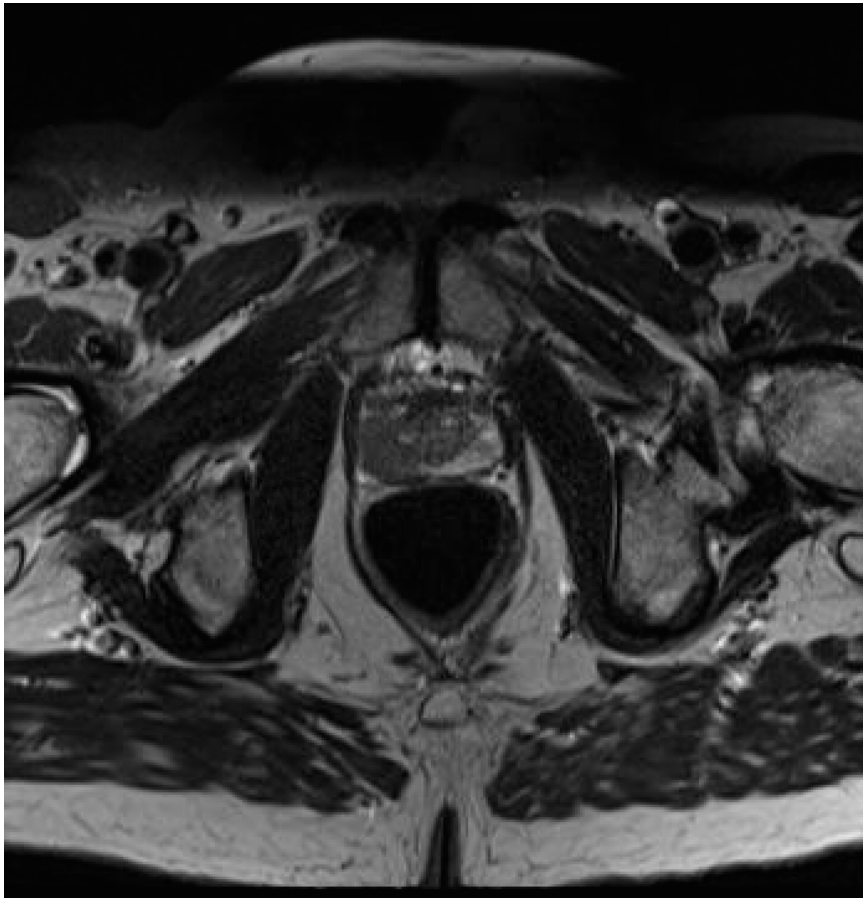
MRI Staging

T1	No suspicious lesions
T2a-b	Unilateral lesion highly suspicious
T2c	Bilateral lesions highly suspicious
T3a	High degree of suspicion for ECE
T3b	High degree of suspicion for SVI
T4	Invades adjacent structures

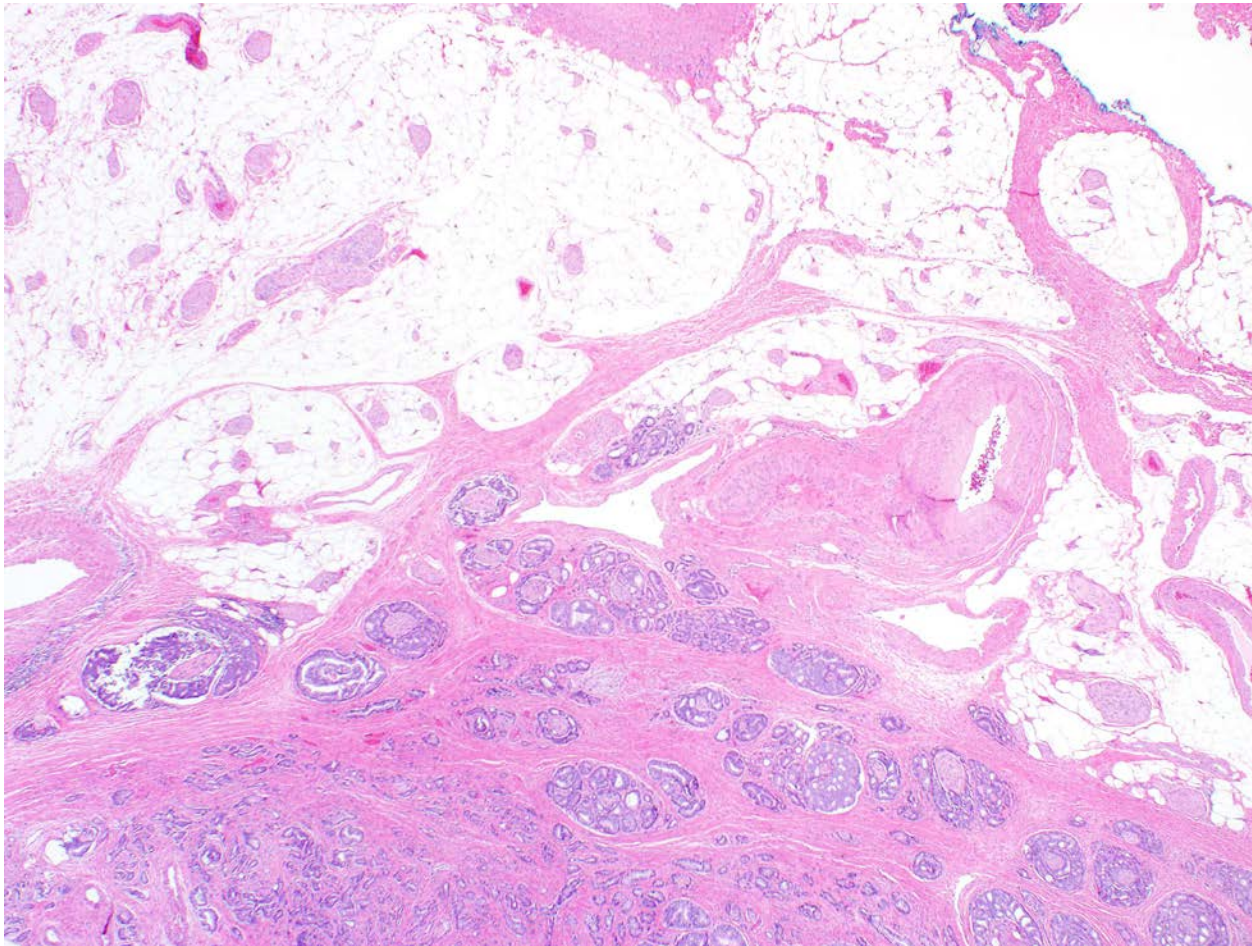
MRI for Local Staging

Study	MRI	Outcome	Sens	Spec	PPV	NPV	Notes
Gupta, 2014	3T (no coil)	T2	81.6	86.4	91.2	73.1	MRI staging system by 1 MD
Gupta, 2014	3T (no coil)	EPE	77.8	83.4	66.7	89.7	
Raskolnikov, 2015	3T with coil	EPE	48.7	73.9	35.9	82.8	2 MD; May be improved with target bx results
Boesen, 2015	3T (no coil)	EPE	74	88	77	86	2 MD/different experience
Feng, 2015	3T (no coil)	EPE	70.7	90.6	57.1	95.1	1 MD; better for non-focal and non-apex
Soylu,	1.5T with coil	SVI	78	96.3	82	95.4	2 MD/different experience; DWI improves

MRI/Pathology Correlates



MRI/Pathology Correlates

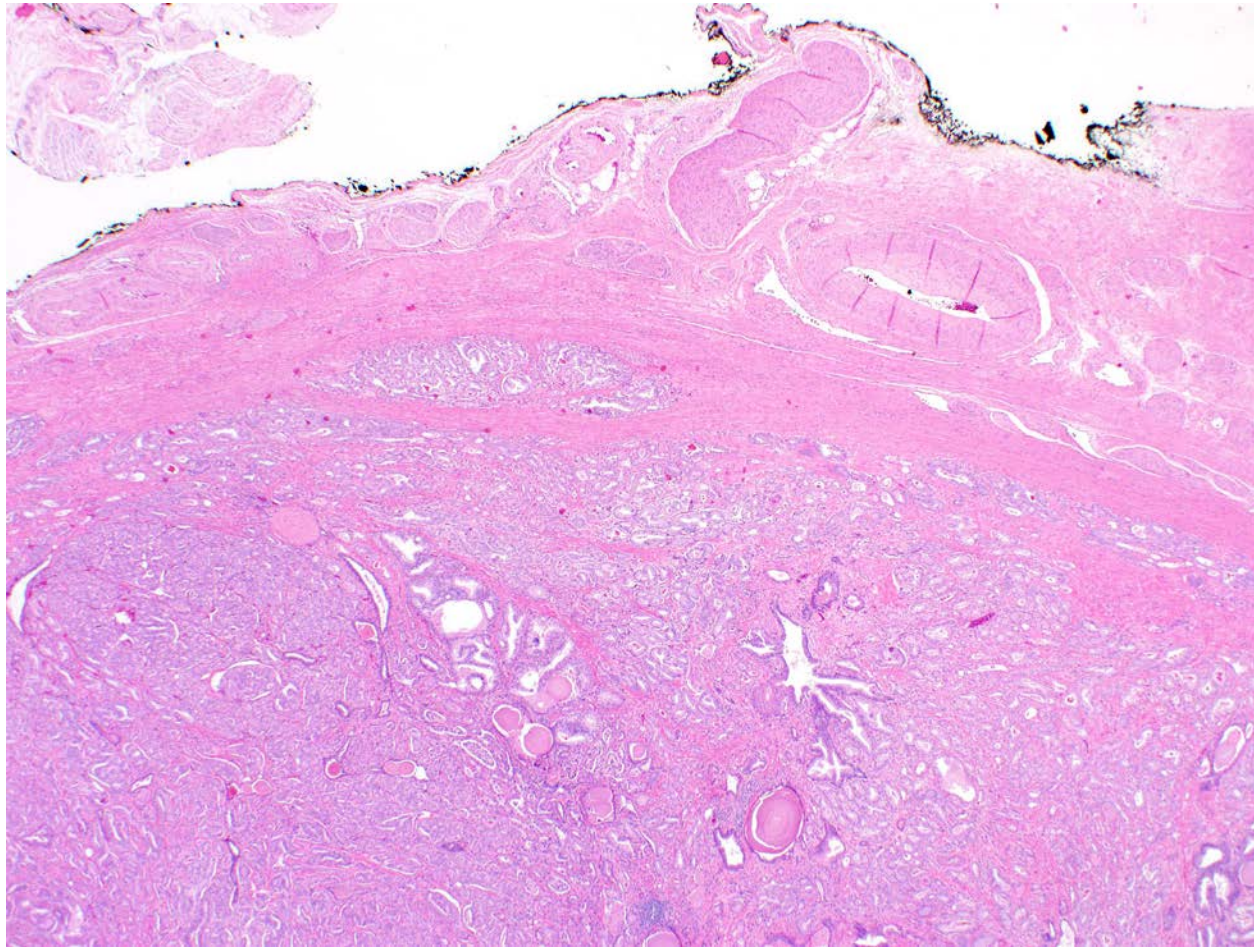


Extraprostatic Extension, Non-nerve sparing

MRI/Pathology Correlates

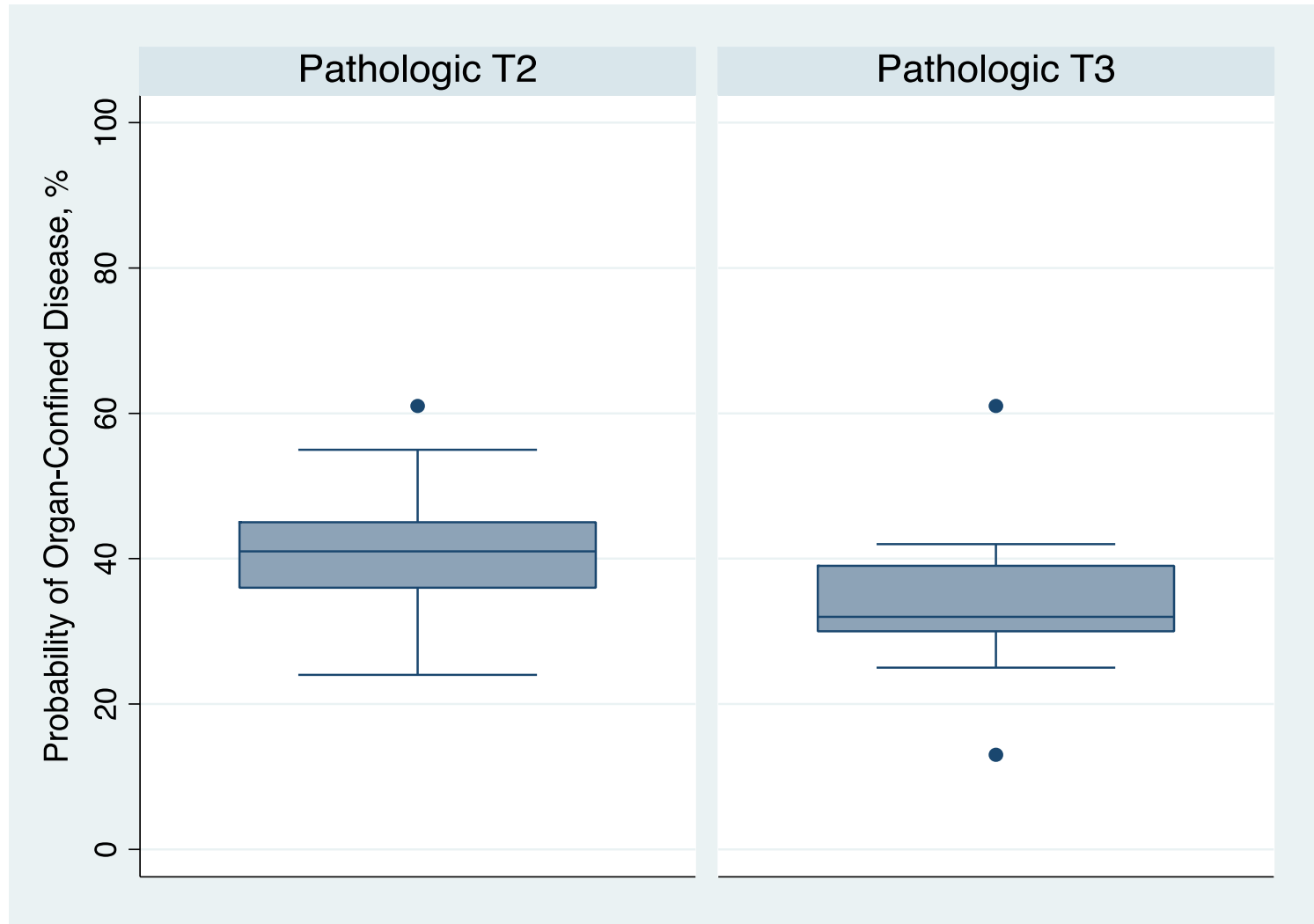


MRI/Pathology Correlates

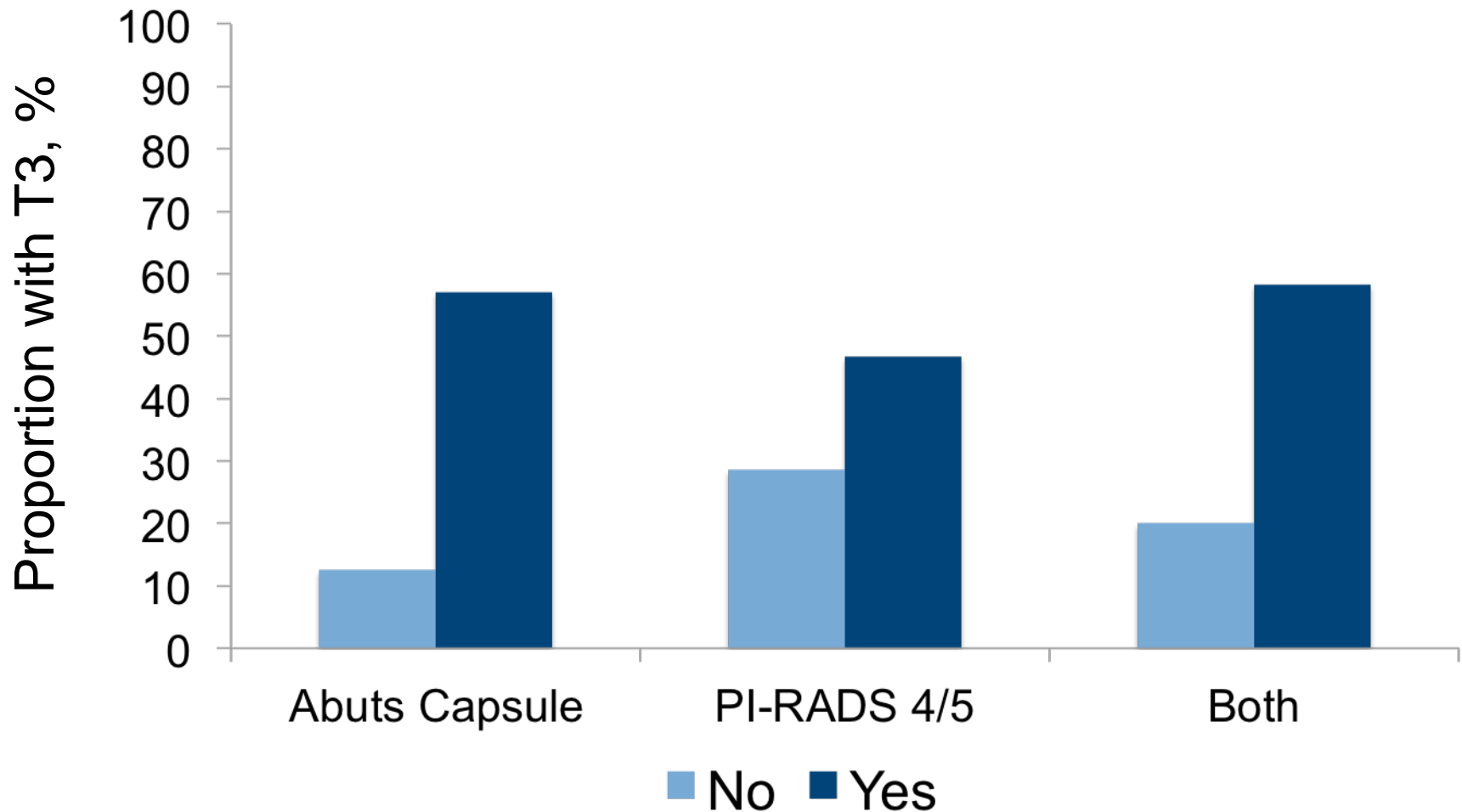


Partial nerve-sparing, Organ-Confined Disease

Predicting T3 with Nomogram



Predicting T3 disease with MRI



MRI for Surgical Planning

UCLA study of 105 men

- 105 men treated with RALP
- MR with 1.5T and endorectal coil
- 50% sensitivity, 97% specificity for T3
- Surgical plan changed 27% of time
 - 61% changed to nerve-sparing, 39% to non-nerve-sparing
 - No positive margins on changed cases

Take Home Points

- Diagnosing T2 vs T3 may be increasingly vital given epidemiology and treatments
- Multiparametric MRI appears to offer moderate accuracy and may outperform existing clinical tools
- Impact on clinical outcomes warrants further study

Special Thanks

- Sara Wobker, MD
- Chris Koller, MS4
- Eric Wallen, MD

QUESTIONS/COMMENTS?