Management of Localized Prostate Cancer

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Disclosure Information

Andrew K. Lee

Dr. Lee has indicated no financial relationships, arrangements or affiliations.

This presentation will not include discussion of investigational or off-label use of a product.
Learning Objectives

• The attendee should understand basic risk stratification schema for localized prostate cancer and the appropriate work up for each.
• The attendee should understand appropriate criteria for selecting a treatment for patients.
• The attendee should understand the role of dose-escalation radiation therapy to improve clinical outcomes for localized prostate cancer.
• The attendee should understand the methods to achieve dose-escalation radiation therapy with acceptable toxicity in prostate cancer patients.
Predicting clinical outcomes

Clinical factors: cT-stage, bx Gleason, PSA

Pathologic factors: Path stage, nodes, path Gleason, margins

Post-op PSA kinetics: PSAF interval, PSADT

Clinical outcomes: LC, DM, DFS, OS
Localized prostate cancer

Localised PCa

- T1-2

Low risk
- T1-2
- Gleason 6
- PSA <10
- Surgery
- BrachyRx
- EBRT
- Active surveillance

Intermediate
- T2b
- Gleason 7
- PSA 10-20
- Surgery
- EBRT +/- HT
- EBRT + Brachy

High
- T2c
- Gleason 8-10
- PSA >20
- EBRT + HT
- EBRT + Brachy +HT
- Surgery (select)
Know which risk stratification is being used

Favorable    T1c-2, PSA ≤10, Gl 3+3
Intermediate  Elevation in 1 factor
Unfavorable  Elevation in 2 or more

Example:
- T1c, PSA 15, Gleason 3+4 (Intermediate vs. Unfavorable)
- T1c, PSA 4.5, Gleason 4+4 (High vs. Intermediate)

NCCN:
- Low        T1c-2a, Gleason sum ≤6, and PSA<10
- Int        T2b-c, or Gl 7, or 10-20
- High       T3a, Gl 8-10, or >20
- Very High  T3b-4 or N1
2009 AJCC Staging/Prognostic GROUPS (7th Edition)

- **Group I** (Low risk)
  - T1a-2a, Gleason 6, PSA <10
  - T1-2a, Gleason X, PSA X

- **Group IIA** (Intermediate)
  - T2b or Gleason 7 or PSA 10-20

- **Group IIB** (High)
  - T2c or Gleason 8-10 or PSA ≥ 20

- **Group III** (Locally-advanced, T3a-b)

- **Group IV** (Mets T4, N1, M1)
Risk of what?

- Risk of biochemical recurrence after “conventional” local therapy
  - Radical prostatectomy
  - External beam radiation therapy (≈70-72Gy)
  - Brachytherapy implant
Refers to risk of biochemical recurrence after “conventional” local therapy (e.g. RP, Brachy, 70 Gy).

Localized prostate cancer

Low Risk

- T1c-2a
- Gleason 2-6
- PSA 0-10
- 5y bNED >80-85%

Intermediate Risk

- T2b or
- Gleason 7 or
- PSA 10.1-20
- 5y bNED 50-75%

High Risk

- T2c or
- Gleason 8-10 or
- PSA >20
- 5y bNED <50%
PSA outcome after radical prostatectomy

Localized prostate cancer

Low Risk  Intermediate Risk  High Risk

% BNEd Survival

Time (Years)

Low  Intermediate  High

459  321  190  122  73  38
263  165  99  64  34  23
232  138  87  39  19  10
PSA control after conventional dose RT ~70Gy

Int J Rad Onc Biol Phys 2001;49
MSKCC- 81Gy: Nadir + 2 ng/ml

Why risk stratify?

• Match a given state of disease with the appropriate level of therapy
Workup for prostate patient

- All: History and physical exam (DRE), PSA, testosterone, AUA-SI, IIEF, EPIC, prostate volume, TURP, hip prosthesis, electronic medical devices, health factors (cardiac, smoking, DM, HTN, recent colonoscopy), meds & supplements (e.g. anti-coag, finasteride, MTX, fish oil)

- Staging w/u
  - Low risk: None
  - Int risk: None (I may stage select pts...especially ER-MRI)
  - High risk: Bone scan & pelvic imaging (CT, MRI)
Treatment options for low-risk patients

• Radical prostatectomy
• External beam radiation therapy (>74Gy @ 1.8-2Gy)
• Brachytherapy implant
• Active surveillance

• Similar PSA control regardless of therapy (~85-90% at 5 years)
Active surveillance (AS)

- In general, for low risk patients with *life expectancy* <10 years or pts who want to defer Rx for a few years

- **Observation vs. AS** “with opportunity for delayed intervention”
  - Approximately 40% will come off AS w/in 5 years (Klotz. JCO 2010)
  - Consider repeat TRUS-Bx (10-12 core including anterior horns and central zone) prior to AS
  - Repeat PSA @ 3-6 month intervals
  - Repeat TRUS Bx @ 1y (compare w/ entrance bx)
  - If no significant difference continue to monitor PSA and repeat TRUS Bx @ 2-3 y

- Consider Rx for “significant” PSA increase, Gleason score change, DRE findings

- Benefits vs. Risks (e.g. repeat bx, missed opportunity for cure, more aggressive Rx, limit Rx options, development of comorbidities may impact definitive Rx)
Patient selection for brachytherapy

- cT1c-2a
- Gleason < 7
- PSA ≤ 10

These criteria are beginning to expand to include some int risk features

- Prostate volume < 50-60 cc (pubic arch interference)
- AUA score < 15 (post-implant obstruction)
- No prior TURP (Urethral necrosis, post-implant incontinence, dosimetry)
- Hypertrophic median lobe (post-implant obstruction, dosimetry)
Brachytherapy

- Check for pubic arch interference (CT or US)
- TRUS volume study (dorsal lithotomy, stirrups, 5mm sections base-apex, define prostate on each slice)
- CTV= prostate (SV only w/ stranded seeds)
- PTV=5mm except 3mm ant, 0mm post
- Modified-peripheral loading w/ $^{125}\text{I}$ ($T_{1/2}$ 60d, avg 0.028MeV) to 145 Gy or modified-uniform loading w/ $^{103}\text{Pd}$ ($T_{1/2}$ 17d, avg 0.021 MeV) to 125 Gy
- For $\geq$ Int risk: EBRT (45Gy) + BrachyRx ($^{125}\text{I}$ 108-110 Gy, $^{103}\text{Pd}$ 90-100 Gy)
- **Planning** parameters/goals:
  - PTV: V100, 150, 200 = >95%, <60%, <20%
    (For $^{103}\text{Pd}$ >95%, <70%, <40%)
  - Urethra: V125, 150, 200*= <50%, <15%, 0%*
  - Rectum: V100 < 1cc
Post-Brachytherapy parameters

- CT Day 0, CT Day 30
- CT Day 0 for “enhancements”
- CT Day 30 for post-implant dosimetry evaluation
- D90 >140 Gy is main objective
- These you should report but probably not going to change
- Target V100, 150, 200
- Urethral V125, 150. UD30, UD5
- Rectal R\geq100 in cc’s
- alpha- blockers, steroids, catheterization
Intermediate risk treatment options

- Radical prostatectomy
  - Decreased bilateral nerve-sparing in some pts

- EBRT
  - Dose-escalation (>75Gy)
  - RT + Hormone therapy

- EBRT+Implant (+/- HT)

- Implant alone (select patients)
Role of HT + RT for intermediate risk

- RCT’s showing overall survival benefit to HT in intermediate risk: DFCI (D’Amico) and RTOG 9408 (NEJM 365, 2011)

- Short-term HT (4-6 months) improves local control (potential systemic benefit to 6 months)
- Long-term HT for local and systemic benefit

- HT should be given before RT begins
- HT should be ≥ 4 months
Any other factors (beyond T-stage, PSA, Gleason) that may provide additional information?

- **Localized prostate cancer**
  - **Low Risk**
    - T1c-2a
    - Gleason 2-6
    - PSA 0-10
  - **Intermediate Risk**
    - T2b or
    - Gleason 7 or
    - PSA 10.1-20
  - **High Risk**
    - T2c or
    - Gleason 8-10 or
    - PSA >20

- Lower risk
- Int risk
- Higher risk
PSA control after conventional dose RT (~70Gy)

IJROBP 2001;49
Intermediate Risk: Clinical Predictors of PSA Outcome

• What other pre-operative, clinical-based factors further stratify this group’s risk for PSA failure?

• **Consider adding hormone therapy (\& maybe staging w/u) for these men:**
  – Multiple intermediate risk factors (e.g. T2b, Gleason 4+3, PSA 17)
  – Percent positive biopsies >50%
  – Gleason 4+3
  – Endo-rectal MRI T3 (technique and reader dependent)
  – PSA kinetics prior to diagnosis (>2ng/ml per year)
  – Tertiary Gleason grade 5 (e.g. Gleason 4+3 w/ tertiary grade 5)*

(*Core biopsy path should **NOT** really report tertiary grade 5 or Gleason grade 1-2)
D’Amico randomized RT vs. RT+HT for localized (T1-2) intermediate and high risk

- Randomized study 206 mostly intermediate and some high risk prostate cancer patients
- T1-2b, Gleason ≥7, PSA 10.1–40, MRI T3

- RT (70.35 Gy) vs. RT + HT (TAB 6 mo)
- Median FU 7.6 years

- Significant benefit to HT
  - 5-y salvage-free survival 82 vs 57%
  - 8-y overall survival 74 vs 61%
  - Benefit primarily in men w/ few comorbidities

- D’Amico et al. JAMA 292, 2004
- JAMA 299, 2008
D’Amico RCT comments

- Mixture of intermediate-high risk patients
  - Included PSA <40, Gleason 8-10
- Relatively low dose (70Gy)

- Preferential benefit in healthier patients
- HT may be detrimental in less healthy
- Systemic benefit to 6 months?
Don’t just use age to determine HT use...
Mortality in healthier men over 72 yo

Nguyen et al. IJROBP 2009.
What is the role of HT w/ dose-escalation RT in Intermediate risk?

- Single institution reports suggest good outcomes w/ high dose RT alone
- Failure rate may still be >15%
- RTOG 0815 will hopefully answer this
  - RCT: Dose-escalated RT (EBRT +/- LDR,HDR) +/- TAB
  - Primary endpoint is overall survival
MDACC retrospective analysis for int risk

- 636 men w/ int risk who had >75Gy (1995-2009)
- RT alone 45% vs. RT + HT 55% (median 6mo)
- Recursive partitioning analysis defined “favorable” vs. “unfavorable” int risk
- Gleason 4+3 and/or ≥ 50% positive cores

Bian et al. Annals of Oncology 2012, epub
Preferential benefit in 5y-FFS for “unfavorable” intermediate risk who received HT
Practical considerations of HT + RT

• **Begin HT at least 2 mos prior to RT**
  – Leuprolide (LHRH agonist) or goserelin (GnRH agonist)
  – Bicalutamide (androgen receptor blocker)
  – If high AUA-SI, then start bicalutamide >2 weeks prior & consider adding alpha blocker (e.g. Flomax, Uroxatral, Rapaflo)

• **Consider total androgen blockade prior to RT**
  – Prostate volume may reduce >30% in first 2-3 months
  – Total androgen blockade results in faster volume reduction than LHRH agonist monotherapy
  – Want stable target volume through radiation course, decrease dose to rectum

• **Consider pre-HT planning target volume for patients with locally-advanced (T3) disease**
  – Prostate volume reduction may be concentric but tumor regression may not be (neoadjuvant HT studies prior to RP)
Neoadjuvant hormone therapy in locally-advanced cancer

30-50% PROSTATE VOLUME REDUCTION AFTER HT
Evolution of RT + HT

- RTOG 85-31
- RTOG 86-10
- EORTC 22863
- RTOG 92-02
- RTOG 9408/ DFCI

- Role of adjuvant HT
- Neo-adjuvant HT
- Concurrent long-term
- Long-term > short-term
- HT for intermediate risk
MDACC external beam recommendations

- **Low risk**
  - 78 Gy (2 Gy) PTV
  - (>80 Gy CTV)

- **Intermediate risk**
  - Prostate & “Proximal” SV
  - 6 mo HT for select pts
  - (2 mos TAB then leuprolide alone)

- **High risk & T3**
  - Prostate & most of SV
  - 2 years HT
Randomized studies showing benefit to higher dose

- MDACC randomized study of 70 vs. 78 Gy (prescribed to isocenter)
  - Benefit for 78 Gy including low risk
  - No difference in distant mets or overall survival
    [JCO 18, 2000...Updated IJROBP 2008]

- Proton randomized study LLUMC & MGH
  - 70.2 Gy vs. 79.2 Gy (1.8Gy fxn)
  - First proton boost 19.8 vs. 28.8 CGE followed by photon 50.4 Gy
  - PSA control benefit in all patients including low risk
    [JAMA 294:1233-39, 2005...updated JCO 2010]
Randomized studies showing benefit continued...

- **Dutch** multicenter trial 68 vs 78 Gy (isocenter)
  - 664 men (Low 18%, Int 27%, High 55%)
  - 3D-CRT various techniques
  - 22% HT (11% short-, 11% long-term)

- **5-y FFF 64 vs 54%** (Median FU 51 months)
  - Benefit primarily in intermediate and high risk
  - No difference in clinical failure, survival
  - No significant difference in toxicity
    - (3D-CRT, rectal DVH constraints)

[Peeters et al. J Clin Oncol 2006;24]
MDACC Dose-escalation Study Update

• Median FU 8.7 y (9.5y for alive)

• For entire group 8y FFF 59 vs. 78%
• For PSA >10 8y FFF 39 vs. 78%

• Improved “clinical failure rates” for higher dose
• No difference is overall survival
• Side effect essentially stable from prior reports

[IJROBP 2008]
Conventional RT – AP and LAT
Computer Planned Isodose Distribution

- 45 Gy
- 65 Gy
- 70 Gy
- 76 Gy
- 78 Gy
- 25 Gy
MDACC 78 vs 70 Gy: Freedom from failure

![Graph showing freedom from clinical and/or biochemical failure over years after end of RT with two lines, one for 70 Gy and one for 78 Gy, and a p-value of 0.004.]
PSA >10 ng/ml

78 Gy

70 Gy

\[ p = 0.012 \]

Months after radiotherapy
Int risk 8-y failure rate: 94 vs. 65%
Pretreatment PSA >10 and T1/T2
PROG 95-09
Proton-photon randomized trial

T1-2b, PSA<15
N=393

70.2 GyE
Protons 19.8 GyE
4F X-rays 50.4 Gy

79.2 GyE
Protons 28.8 GyE
4F X-rays 50.4 Gy

JAMA 294, 2005
FIG. 1. Sagittal CT reconstruction shows perineal proton boost technique and how beam high dose region incorporates prostate, prostatic urethra and bladder neck.

Difference in bNED survival between arms persists with median follow-up of 9 years

No difference in Gr≥3 GI/GU morbidity between arms using data from validated patient questionnaire

Fewer patients in high dose arm required salvage hormones
Proton-photon trial: PSA-Failure free survival
CORRECTED calculation (JAMA 299, 2008)

92% PSA-FFS

Proportion Free From
Biochemical Failure

Time From Randomization, y

Gray test P<.001

Spring 2012 Refresher Course
April 13-15, 2012 | Westin Chicago River North | Chicago
ASTRO
Corrected
PSA control benefit for low-intermediate risk
PROG update: Low risk PSA control ~95% w/ median FU 9 years
(J Clin Oncol March 2010)
Randomized studies showing benefit continued... [Peeters et al. J Clin Oncol 2006;24]

- Dutch multicenter trial
  - 68 vs 78 Gy
  - 664 men
  - 3D-CRT/IMRT
  - 22% hormone therapy
  - Median FU 51 mos

- **5-y FFF 64 vs 54%**

- Grade 2+ GI toxicity **32% vs. 27%!**
Dose-escalation is not free

- Rectal toxicity
- Urinary
- Erectile
More Grade $\geq 2$ rectal complications in 78 Gy arm

$[IJROBP~53,~2002]$
More Grade 2+ rectal toxicity if >25% of rectum received ≥70Gy
Late side effects: grade 2-3 rectal

<table>
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<tr>
<th></th>
<th>MDACC</th>
<th>Proton-photon</th>
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<td>70 Gy 13%</td>
<td>70.2 CGE 9%</td>
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<tr>
<td></td>
<td>78 Gy 26%</td>
<td>79.2 CGE 18%</td>
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</table>

Late GU side effects ~15-20% for all arms
Dose-escalation w/ less toxicity

• Delivery techniques
  – IMRT
  – Protons

• Reduce PTV
  – Target localization (e.g. ultrasound, fiducials)
  – Target immobilization (e.g. rectal balloon)
  – Reduce CTV

• Selective dose-escalation
At simulation

- If using fiducials: ≥3 fiducials ≥5 days prior to sim
- Comfortably semi-full bladder (do NOT overfill)
- Not overly distended rectum (+/- enema)
- Supine
- Leg immobilization
- Make sure patient is relaxed
- Scan from L5 through lesser trochanters
- 2-3 mm slices
Defining Structures

- Rectum (anal verge to anterior flexion of sigmoid)
- Bladder (whole bladder)
- Femoral heads (down to lesser trochanter)
- CTV
  - Low risk = prostate only
  - Int risk = prostate + prox SV
  - High risk = prostate + SV (+/- nodes)

- Use zoom
- Use window and level (e.g. “neck”)
- Use other planes of view (especially sagittal for apex)
Don’t forget to window-level
Rectum and Bladder

• Want to contour the rectum-not the peri-rectal muscles.

• If you using ultrasound-based guidance, pay special attention to bladder-prostate interface.
  – Also need to contour non-CTV portion of SV as reference structure
BAT Alignment (sagittal)
IGRT PTV: Expand CTV 5-7 mm except posterior 4-5mm.

**Review** PTV prior to planning. **Validate** PTV margin for your clinic.

Current MDACC technique is 78Gy (2Gy) prescribed to PTV
MDACC DVH Plan Evaluation: Clinical Constraints
(Clinical constraints ≠ Planning parameters)

PTV: \( >96\% \text{V} @ 78\text{Gy} \)

Prostate: \( 100\% \text{V} @ 78\text{Gy} \)

SV: \( >96\% \text{V} @ 78\text{Gy} \)

Rectum: \( <20\% \text{V} @ 70\text{Gy} \)
\( <35\% \text{V} @ 60\text{Gy} \)
\( <50\% \text{V} @ 45\text{Gy} \)

Bladder: \( <25\% \text{V}@70\text{Gy} \)
\( <35\% \text{V}@60\text{Gy} \)

Femoral Heads: \( <5\% \text{V}@50\text{Gy} \)
8 angles for virtually any anatomy

Use <15 MV when possible

Beam Arrangement
30
65
100
135
225
260
295
330
MDACC current IMRT planning method

• Use series of avoidance “rings” in addition to individual organs
• Conformal plans with “compact” dose distributions
• Fewer trials are needed
• 8 beam angles
• Minimize total monitor units
  – Fewer beam segments
OAR and Objectives

- **Max Dose 3800 cGy**
- **Max Dose 5500 cGy**
- **Max Dose 8100 cGy**
- **Max DVH 7500 2%**
- **Uniform Dose 7800 cGy**

- External
- Ring 2
- Ring 1
- Prostate + SV
## ROI Objectives (IMRT)

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<th>Type</th>
<th>Target cGy</th>
<th>% Volume</th>
<th>Weight</th>
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DVH Plan Evaluation: Clinical Constraints
(Clinical constraints ≠ Planning parameters)

Prostate:
>100% V@78Gy
SV:
>96% V@78Gy

Rectum:
<20% V@70Gy
<30% V@60Gy

Bladder:
<25% V@70Gy
<35% V@60Gy

Femoral Heads:
<5% V@50Gy
Axial dose distribution (qualitative evaluation)
Sagittal dose distribution
Minimum dose vs. Mean dose

- >96% PTV receives $\geq 78$ Gy
- 100% CTV receives $\geq 78$ Gy
- Mean dose to prostate $\approx 80-81$ Gy
- Need to have threshold for heterogeneity

Typically prescribe to $>96\%$ of mean dose
MSKCC: Rectal toxicity (CRT vs. IMRT)
J Urol 166:876-881, 2001
Sharp dose-fall off with IMRT requires accurate DAILY target localization
Reducing PTV through IGRT (Image Guided Radiation Therapy)

• Requires daily imaging of the target

• Decrease “systematic” setup error
  – From simulation to treatment

• Correct for INTER-fractional movement
  – Pelvis
  – Rectal and bladder filling

• May not account for INTRA-fractional movement
IGRT

• Portal imaging

• Ultrasound

• Fiducial markers (intraprostatic)

• Volumetric on-board imaging
  – In-room CT
  – Cone-beam CT
Ultrasound is *reasonably* accurate.

- PTV margins must still be employed!
  - 5mm may be enough
- Careful contouring of bladder/prostate interface
- Thinner patients easier
- Therapists training and feedback important
- Patient training and cooperation are important (e.g. bladder filling)
Ultrasound-based alignment

**Pros**
- Non-invasive
- Reasonably good alignment
- Visualize SV/bladder
- Visualize prostate surface contour

**Cons**
- User-subjectivity
- Patient anatomy may affect image quality
- Impact of probe pressure on prostate position
- Different imaging modality
Fiducial markers
Fiducial markers should form a triangle in each dimension around the isocenter if possible.

Fiducial markers should be >2mm away from prostate capsule, urethra, SV.

Coronal

Sagittal-2 options

Left

Right
Fiducials: MV vs. KV imaging

- Most systems use MV imaging to calculate center of mass shift
  - Increased dose to patient
  - Need to incorporate daily MV dose

- KV imaging less dose
- 2D-2D matching
  - Easy
  - Allows use of 2 fiducial markers
  - Error 1-2mm

- Can use smaller fiducials or non-metallic
  - Decrease CT artifacts at simulation
EPID based fiducial alignment
AP and Rt Lateral
Sample AP kV radiograph (large pt)

Thanks to R. Kudchadker

DRR

Fiducials

kV
Problem with gold
Fiducial-based alignment

**Pros:**
- Less subjectivity
- Good alignment
- Allows target tracking
- Better for large patients
- Image fusion (e.g. MRI-CT)
- Visualize rectal gas
- MDACC study comparing fiducials vs. CT-on-rails:
  1=BAT, 2 (base-apex)=90%, 3=best
  (IJROBP 2009, 74)

**Cons:**
- Invasive
- Requires daily ports
  - (unless KV imaging onboard)
- Fiducials may migrate
- No image of SV, rectum/bladder
- No image of prostate surface contour
- Shifts may not be representative of volume
• Better dose delivery => Better bullet
• Better targeting => Better aim

• This all leads to smaller treatment margins
  – Lower toxicity for a given dose
  – Minimize toxicity at higher doses
Still need adequate PTV with fiducials

- 70-78 Gy
- 25 treated w/ fiducials

- 5-y FFBF: 58% w/ fiducials vs. 91% w/out (p=0.02)!
  - Multivariable analysis: Worse for fiducials p=0.047
  - 4mm PTV expansion may have been too tight

Engels. IJROBP 2009
Think smarter...not harder
PSA control by mean rectal
Cross Sectional Area at simulation
• Impact of rectal distention may be more significant than risk group
Take home message

Do not miss posterior aspect of prostate!

>2/3 cancers arise in peripheral zone

Simulate with empty rectum (e.g. use enema)

Decrease chances of missing posteriorly regardless of PTV
Decreasing “systematic” setup error from simulation to treatment is over half the battle

• At simulation: Goal is **reproducible** anatomy
  – Comfortable position (a relaxed patient is a stable patient)
  – Empty rectum (allows use of tighter posterior margin)
  – Do not overfill bladder
  – Consider possible CT “table sag”

• During treatment: Be proactive
  – Educate patients about bladder and rectal filling (give feedback)
  – IGRT primarily for **translational** rather than **rotational** shifts
  – Examine large variations
CT table sag on geometrical accuracy during virtual simulation

CT sag by site and scanner
Intra-fraction variation due to gas

IJROBP 2007
Gas may migrate superiorly!

Note change in rectum, bladder, and prostate (translation, rotation)

IJROBP 2007
Fiducials vs. MRI

Max prostate deformations after translational matching of fiducials: 6mm x-direction, 13mm in y, 7mm in z

[Nichol et al. IJROBP 67, 2007]
Prostate alignment does not guarantee SV alignment

[Frank et al. IJROBP 71, 2008]
Larger margin needed to cover SV’s

5mm margin will miss SV almost 30% of the time
May need to re-define “adequate” PTV coverage
(Don’t pump in more monitor units than you need)
Localized prostate cancer

Localized PCa
  T1-2

Low risk
  T1-2
  Gleason 6
  PSA <10
  Surgery
  BrachyRx
  EBRT
  Active surveillance

Intermediate
  T2b
  Gleason 7
  PSA 10-20
  Surgery
  EBRT +/- HT
  EBRT + Brachy
  Brachy alone (select)

High
  T2c
  Gleason 8-10
  PSA >20
  EBRT + HT
  EBRT + Brachy + HT
  Surgery (select)
MDACC external beam recommendations

- **Low risk**
  - 78 Gy (2 Gy) PTV
  - (>80 Gy CTV)

- **Intermediate risk**
  - Prostate & “Proximal” SV
  - 6 mo HT for select pts
  - (≥ 2 mos TAB then leuprolide alone)

- **High risk & T3**
  - Prostate & most of SV
  - 2 years HT

A relaxed patient is a stable patient (reproducibility)
Even with IGRT use appropriate PTV margins
Investigate (e.g. re-CT) large shifts during treatment
Start HT ≥ 2 months prior to RT
Thank you