Potential Benefits of Endo-Rectal Balloons During IMRT for Localized Prostate Cancer  

John Sylvester MD.
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Potential Benefits of Endo-Rectal Balloons (ERB’s)

• Limit prostate intra-fraction motion during IMRT
• Decrease volume of rectum and anus receiving high dose radiation
• Decrease rectal and anal wall late toxicity
• Visualize target better in bilateral THR patients
• Allow “normal” diet during IMRT course
How about limiting prostate motion?
• Intra-fraction prostate motion during IMRT
• Prostate moved during IMRT /3dCrt in 34/35 patients in initial Calypso studies
Endorectal Balloon - MDAH

Robert Jan Smeenk et al; Radiotherapy and Oncology 95 (2010) 277–282
The Influence of an endorectal Balloon on intrafraction prostate motion

30 patients analyzed with the calypso system: threshold for correction 3mm

- In No-ERB-group 207 corrections were made vs. 88 in the ERB-group ($p = 0.02$).
- During the first 150 s, in both groups only small deviations were observed.
- After 150 s, ERB significantly reduced intrafraction deviations.
- The largest reductions were observed in the AP direction.
- The Balloon does reduce prostate motion during the daily treatment session.

Smeenk, ASTRO 2010, MD Anderson
Rectal balloon limits prostate motion

Wachter et al. IJROBP 2002
• Investigate intrafraction prostate motion with Calypso and daily endorectal balloon (ERB)

• 24 patients in 787 treatment sessions was evaluated

• The overall mean time with prostate excursions >3 mm was 5%.

• Conclusions:
  - Daily endorectal balloon consistently stabilizes the prostate,
  - prevents clinically significant displacement (>5 mm)
  - 3-mm margin may sufficiently account for 95% of intrafraction prostate movement for up to 6 minutes of treatment time.
Motion Summary:

ERB Limits Intra-Fraction Motion
ERB does not Prevent Inter-fraction Motion
ERB Decreases Volume of Rectum and Anus receiving High Doses Radiation
Air-filled (ERB) reduces Rectal wall and Anal wall doses

van Lin, IJROBP 2005; Smeenk, Rad Onc 2009
Curved 100 cc air-filled ERB reduces Rwall and Awall dose exposure in IMRT

Dose: 78 Gy
Endorectal balloon for Postoperative or Salvage RT

PTV = CTV + 9 mm Dose 70 Gy
3 beams: AP + 2 lat
Endorectal balloons in post prostatectomy: Do gains in stability lead to more predictable dosimetry?

M. Jameson\(^1,2\), J. De Leon\(^1\), A. Windsor\(^1,3\), K. Cloak\(^1\), J. Dowling\(^4\), S. Chandra\(^4\), P. Vial\(^1,5\), M. Sidhom\(^1\), L. Holloway\(^1,2,5\), P. Metcalfe\(^2\)

Holloway et al Med Dosim 2012

- To perform a comparative study assessing potential benefits of endorectal balloons (ERB) in post-prostatectomy patients
  - Geometrically & Dosimetrically
Results - Geometric

Superior Rectum

- No Balloon
- Balloon

p < 0.0001

Inferior Rectum

- No Balloon
- Balloon

p < 0.0001
Reduce Ano-Rectal Toxicity
Anal Wall sparing with ERB in 3D-CRT and IMRT

Peeters, *IJO* 2006

Anal wall mean dose: ptv 78 Gy

-ERB  
- 3D-CRT 41 Gy  
- IMRT 27 Gy

+ERB  
+ 3D-CRT 29 Gy  
+ IMRT 20 Gy

Smeenk, Radiother Oncol. 2009
Endorectal Balloon reduces late toxicity and mucosal damage

- 48 patients, with and without balloon: Follow-up 30 months.
- Acute toxicity equal.
- Late Toxicity is reduced with endorectal balloon

Van Lin, IJROBP 2007
Endorectal Balloon reduces severe rectal damage

Rectal Wall dose surface maps

T2-3 = 70-80% probability of late rectal bleeding

T2 - T3 score

Van Lin, IJROBP 2007
RECTAL WALL SPARING BY DOSIMETRIC EFFECT OF RECTAL BALLOON USED DURING INTENSITY-MODULATED RADIATION THERAPY (IMRT) FOR PROSTATE CANCER

Medical Dosimetry, Vol. 30, No. 1, pp. 25-30, 2005  BIN S. TEH, M.D., et al; Baylor College of Medicine, The Methodist Hospital, Houston, TX
The use of rectal balloon during the delivery of intensity modulated radiotherapy (IMRT) for prostate cancer: more than just a prostate gland immobilization device?

Rectal wall sparing by dosimetric effect of rectal balloon used during intensity-modulated radiation therapy (IMRT) for prostate cancer.

- Using multiple-beam IMRT, a 15% dose reduction at the air-tissue interface was observed.
- At distance from the cavity the dose built up rapidly, with 8% and 5% lower doses at 1 and 2 mm, respectively.
- The posterior part of the prostate, located 6 mm from the air-tissue interface, received the same dose, compared to the phantom without air cavity.
- These results suggest that ERBs have an anterior Rectal wall sparing effect without under-dosing the prostate.
Rectal toxicity = ano-rectal toxicity = bleeding

35% of patients ≥ Grade 2 rectal toxicity in the 78 Gy arm of the Dutch dose-escalation study, after 7 years follow-up. Al-Mamgani, IJROBP 2008

Size and spatial distribution of Rwall exposed to high and low doses predicts for late toxicity
Tucker, IJROBP 2006; Gulliford, IJROBP 2010

Severe fecal complaints (incontinence pads needed) is correlated to Mean Awall dose
Peeters, IJROBP 2006

Ano-rectal toxicity (rectal bleeding, loose stools, proctitis) correlated to spatial dose distribution over the Rwall (dose surface map, dose surface histogram)
Buettner, PMB 2009
Is a balloon a daily burden for patient and therapist? No

1. Patients tolerate it very well

Acute Anal toxicity/irritation  n= 146
Grade 0  73%
Grade 1 irritation  23%
Grade 2 irritation + local medication  3%
Grade 3 stop balloon  0%

2. After training/education all are applying
-- 150 pts a year (Emile van Lin since 2008)
-- 300 pts a year (Sylvester since 2012)
Practical Stuff

- “Visualize” Target better in bilateral THR patients
- Symmetrical round balloon
- Contour Target Volumes faster by erasing target volume from rectum with round cursor that is a few mm larger than balloon
Summary of Advantages:

• Distends rectum so lower % of rectum treated
• Reduces objective rectal mucosal telangectasias
• Reduces anal and rectal late toxicity
• Limits prostate movement while “beam on”
• Increases ease of visualization in daily set-up in bilateral THR patients
• Allows patients to follow less restrictive diet