TARGET VOLUME DELINEATION

RECTAL CANCERS

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OBJECTIVES

Natural history and patterns of spread

- Local
- Nodal
- Systemic

2. Radiological Anatomy

- Anorectum, rectum, mesorectum, pelvic organs
- internal iliac, external iliac, presacral, inguinal/femoral vessels and nodes
- anastomosis, perineal scars and presacral region
CARCINOMA RECTUM

RESECTABLE
T1-2/T3, N0-1
- Local Excision
- Radical Surgery +/- Adj. CT/RT
- Pre-op CT + RT + Sx
- CT+RT (unfit for Sx)

UNRESECTABLE
T3-4,N1-2M0
- Pre-op CT + RT + Sx
- CT+RT (unfit for Sx)
- Palliative CT/RT

METASTATIC
- Neoadjuvant CT + Sx
- CT + RT + Sx
- Palliative CT/RT
* Sx: Local + Metastatic (Liver)

* Highlights the Role of Radiation in Rectal Cancers
Role of RT – Rectal Cancer

“In contrast to colon cancer, there is a significant risk of local-regional failure as the only or first site of recurrence in patients with curative resected rectal cancer.”

- **Stage I** 5% to 10%
- **Stage II** up to 25% to 30%
- **Stage III** up to 50% or higher

- “Combined post op CT+RT improves local control and survival in stage II and III patients and is recommended”

*NIH Consensus Conference on Adjuvant Therapy for Patients with Colon and Rectal Cancer, JAMA, Sept. 19, 1990*
Carcinoma Rectum: Need for Adjuvant RT / CT?

- **Curative Surgery mainstay of treatment.**
- After curative resection the 5 year survival
  - 80% Stage I
  - 40% Stage III
- Local recurrence a major site of failure ranging from 5% in few selected series to about 50% in most reports.
- Distant (hepatic/non-hepatic) metastasis after Sx : 15-40%
- LF associated with devastating symptoms that severely affects the QOL & difficult to salvage.
# PATTERNS OF PELVIC FAILURE

<table>
<thead>
<tr>
<th>Author/ref</th>
<th>Year</th>
<th>N° pts</th>
<th>Pelvic subsite</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syk [17]</td>
<td>2005</td>
<td>880</td>
<td>Anastomosis, presacral pelvic wall, pelvic floor</td>
<td>preoperative RT + surgery (528 pts); surgery alone (352 pts)</td>
</tr>
<tr>
<td>Roeder [18]</td>
<td>2006</td>
<td>243</td>
<td>retrovesical/retroprostatic, anastomosis, promontorium, ileocecal, perineum</td>
<td>Surgery + IOERT to the presacral space</td>
</tr>
<tr>
<td>Kusters [20]</td>
<td>2008</td>
<td>1079</td>
<td>presacral, lateral spaces, anterior, anastomosis, perineum</td>
<td>TME alone (376), preoperative RT + TME (379), Extended lymphnode dissection (ELND) + abdominoperineal excision and resection of anterior organs (324)</td>
</tr>
</tbody>
</table>

Ippolito, et al; Acta Oncologica, 47:7, 1317-1324; 2008

These recurrence sites serve as benchmark for Contouring and Treatment with Newer RT Techniques
Importance of Imaging in Radiation therapy today

1. Imaging for planning
2. Treatment planning
3. Patient set-up for treatment
4. Imaging for verification
5. Treatment
6. Imaging response

Adaptive radiotherapy

Several images for adaptive radiotherapy

Set-up correction
LAR planned: perineum *not* in field

APR planned: perineum in field

Knowledge of Principles and 2 D X-ray based planning : Essential
ADVANCES IN RADIATION THERAPY

- Stereotactic radiotherapy using SBF
- Intensity Modulated Radiation Therapy (IMRT)
- IGRT etc..

“You treat what you mark as target and spare what you mark as OAR”
<table>
<thead>
<tr>
<th>Node chains</th>
<th>Cranial margin</th>
<th>Caudal margin</th>
<th>Anterior margin</th>
<th>Lateral margin</th>
<th>Posterior margin</th>
<th>Medial margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>External iliac nodes</td>
<td>Common iliac bifurcations (about L5–S1)</td>
<td>Femoral ring: disappearance of lateral muscles of abdominal wall and artery gets lateral</td>
<td>Fat of small bowel</td>
<td>Cranially</td>
<td>Cranially</td>
<td>Cranially</td>
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<td></td>
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<td>Deferent duct or round ligament</td>
<td>Iliac muscle</td>
<td>External iliac vein</td>
<td>Ureter</td>
</tr>
<tr>
<td>Internal iliac nodes</td>
<td>Common iliac bifurcations (about L5–S1 space)</td>
<td>Cranial sections of coccygeal muscle</td>
<td>Bladder</td>
<td>Cranially</td>
<td>Cranially</td>
<td>Caudally</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Uterus</td>
<td>Poas muscle</td>
<td>Sacral wing</td>
<td>Bladder</td>
</tr>
<tr>
<td>Obturator nodes</td>
<td>Cranial sections of obturator muscle</td>
<td>Superior margin inferior branch of pubic bone</td>
<td>External Iliac vein</td>
<td>Cranially</td>
<td>Caudally</td>
<td>Mesocolon</td>
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<td>Acetabulum</td>
<td>Internal obturator muscle</td>
<td>Ureter</td>
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<tr>
<td>Pudendal nodes</td>
<td>Cranial sections of coccygeal muscle</td>
<td>Inferior sections of inferior branch of pubic bone</td>
<td>Cranially</td>
<td>Scatic n.</td>
<td>Cranially</td>
<td>Elevator ani</td>
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<td></td>
<td>Posterior portion of internal obturatorius muscle</td>
<td>Gluteus muscle</td>
<td>Elevator ani</td>
<td>mesorectum</td>
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<tr>
<td>Deep inguinal nodes</td>
<td>Femoral ring: disappearance of lateral muscles of abdominal wall and artery gets lateral</td>
<td>Ischiatic tuber</td>
<td>Plane on the anterior face of sartorius muscle</td>
<td>Sartorius and ilipsoas mm.</td>
<td>Pectineus m.</td>
<td>Subcutis and pectineus muscle</td>
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<td></td>
<td>Femoral vein</td>
<td></td>
<td>Spermatic cord or round ligament</td>
</tr>
<tr>
<td>Superficial inguinal nodes</td>
<td>Cranial section of sartorius and adductor muscles crossing</td>
<td>Subcutis and cutis</td>
<td>Lateral edge of sartorius muscle</td>
<td>Pyriform muscle</td>
<td>Subcutis and cutis</td>
<td>Spermatic cord or round ligament</td>
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<td></td>
<td>Transversus abd. m</td>
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<tr>
<td>Ponsacral nodes</td>
<td>Aortic bifurcation</td>
<td>Cranial slices of coccygeal bone</td>
<td>Posterior rectum wall</td>
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<td>Subcutis</td>
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<td></td>
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<td></td>
<td>Rectus abd. m</td>
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<td>Obliquus m.</td>
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<td>Sovrapubic fat</td>
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ELECTIVE CLINICAL TARGET VOLUMES FOR CONFORMAL THERAPY IN ANORECTAL CANCER: AN RADIATION THERAPY ONCOLOGY GROUP CONSENSUS PANEL CONTOURING ATLAS

RTOG CONSENSUS PANEL RECOMMENDATIONS

• Various risk volumes for pelvic failures defined as CTV’s

• Local (mesorectum, anastomosis, presacrum, scar tissue)
  • Nodal (perirectal, internal & external iliac, inguinal)
  • CTV’s combined due to major overlap

• CTVA: Internal iliac, pre-sacral, peri-rectal regions
  • CTVB: external iliac nodal region
  • CTVC: inguinal nodal region
CTV A: Peri-rectal, Pre-sacral, Internal iliac regions

Lower Pelvis:
Caudal extent should be a minimum of 2 cm caudal to gross disease

Mid pelvis:
Posterior and Lateral margins of CTVA should extend to lateral pelvic sidewall musculature or, where absent, the bone

Upper pelvis:
- Superior extent: Recto - sigmoid junction or 2 cm proximal to the superior extent of macroscopic disease in the rectum/peri-rectal nodes
- Landmark: Cephalad aspect of CTVA should be where the common iliac vessels bifurcate into external/internal iliac, (promontory)
AR : CTV A (CTV Rectum + Internal Iliac Nodal Region)
APR : CTV A (CTV Rectum + Internal Iliac Nodal Region)
CTV B (External Iliac Nodal Region)
CTV C (Inguinal Nodal Region)
CTV B (external iliac region) and CTV C (inguinal region)

Indications:

1. CTV B & C : to be treated in squamous carcinoma anal cancers

2. CTV B to be included with CTV A : For rectal carcinomas extending into gynecologic or genitourinary structures.

3. CTV B & C : to be included if rectal cancers extending into anal canal and perianal region (no consensus)
CTVB and CTV C Vessel Regions

- Caudad extent of the inguinal region (CTVC) should be 2 cm caudal to the saphenous / femoral junction.
- Transition between inguinal and external iliac regions (CTVC to CTVB) is somewhat arbitrary, but the group recommended the level of the bottom of the internal obturator vessels (approximate boney landmark: upper edge of the superior pubic rami).

- Margins around blood vessels: 7-8 mm margin in soft tissue around the external iliac vessels excluding the bones / normal muscles,
- But 10+ mm margin antero-laterally—especially if small vessels or nodes are identified in this area.
SUMMARY

• RTOG Consensus Guidelines Available

• Needs Validation : In terms of Control Rates and Toxicities

• Contouring for Pre-op RT : Relatively Easier

• Measures and Methods to define risk Areas on Imaging : Research Area

• Incorporation of Newer Imaging Modalities

• Multidisciplinary-multimodality (radiologist / Nuclear Medicine Physician) Approach

THANK YOU