Rectal MRI - Background

• After prostate and lung cancer, colorectal cancer is the third most common in men and second most common in women after breast.
• 1/3 of colorectal Cancers are rectal cancer.
• 5-Year Relative Survival Rates has been improved for colon and rectal cancers in United States in-between 1975–2005.

Colon 52 to 66%, Rectum 49 to 69%


• Related to the combined effects of better staging, improved preoperative treatment strategies, and total mesorectal excision (TME) surgery.
Rectal MRI - Background

- Optimal treatment of rectal cancer involves a multidisciplinary approach, with collaboration between radiologists, oncologists, surgeons, and pathologists to achieve local control and decrease the rate of recurrence.

- Currently, surgical resection with stage-appropriate neoadjuvant combined therapy is the mainstay of treatment.

- Advances in preoperative therapies require accurate preoperative staging with MR imaging to select those patients who may benefit from more intensive treatment.

- MR imaging is now an essential tool to enable the oncology team to make appropriate treatment decisions.

MRI Protocol

<table>
<thead>
<tr>
<th></th>
<th>Matrix</th>
<th>Slice thickness (mm)</th>
<th>FOV (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronal T2 Abdomen</td>
<td>448 x 340</td>
<td>3</td>
<td>400</td>
</tr>
<tr>
<td>Axial T1</td>
<td>320 x 288</td>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>Sag T2</td>
<td>320 x 320</td>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>Axial T2</td>
<td>256 x 256</td>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>Coronal T2</td>
<td>320 x 320</td>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>Oblique Axial T2</td>
<td>384 x 269</td>
<td>3</td>
<td>160</td>
</tr>
<tr>
<td>Oblique Coronal T2</td>
<td>384 x 269</td>
<td>3</td>
<td>160</td>
</tr>
<tr>
<td>DWI</td>
<td>128 x 103</td>
<td>5</td>
<td>330</td>
</tr>
</tbody>
</table>
Image interpretation

- Morphology.
- Distance from lower edge to anal verge.
- Distance to Anal sphincter complex.
- Tumor relation to Peritoneal reflection.
- T staging.
- CRM.
- EMVI (Extramural vascular invasion).
- Nodal staging.
Morphology

Morphology
Distance from lower edge to anal verge and in low rectal cancers to anal sphincter complex.

Peritoneal Reflection
CRM

Low signal line encircling the mesorectal fat. Plane for TME resection. Should be described for all T3 lesions. MRI accuracy 95%.
CRM
A positive margin is defined as tumor lying within 1 mm of the mesorectal fascia.

- Tumor deposits.
- Main tumor extension.
- EMVI.
- Suspicious lymph nodes.
T-Staging

• MRI accuracy: 59-95%.
  – Brown G, Preoperative staging of rectal cancer:
    • The MERCURY research project. Recent Results Cancer Res 2005;165: 58–74.
  – Beets-Tan RG. MRI in rectal cancer: the T stage and circumferential resection margin.
    • Colorectal Dis 2003;5(5):392–395
    • Radiology 1999; 211(1):215–222

• Most staging failures occur in the differentiation between T2 and borderline T3 lesions.

T-Staging

• Clinically and therapeutically, it is much more important to measure the depth of extramural spread in mm than to give the T stage.

• A T2 tumor has almost the same prognosis as a T3 tumor with less than 1 mm spread proven in different histopathologic studies.

• Cancer-specific 5 year survival rate:
  – T3 tumor with less that 5mm mesorectal invasion: 84%.
  – T3 tumor with more than 5 mm mesorectal invasion: 54%.
T-Staging

• 1mm distinction between T2 and T3 will not potentially govern treatment decisions.
• The depth of extramural spread is a key factor in determining prognosis and stratifying patients for preoperative therapy.
• Now having sub classifications of T3 staging.
• RCAC, Quick Silver Study.

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Low Rectal Cancer

• <5 cm from anal verge.
• Muscolaris Propria = Internal sphincter.
• Intersphincteric plane.
• Puborectalis sling. External sphincter complex.
Low Rectal cancer

TABLE 3: Stages of Low Rectal Cancer as Seen on MRI

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Tumor confined to bowel wall but does not extend through full thickness; intact outer muscle coat</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Tumor replaces muscle coat but does not extend into intersphincteric plane</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Tumor invades intersphincteric plane or lies within 1 mm of levator muscle</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Tumor invades external anal sphincter and is within 1 mm and beyond levators with or without invading adjacent organs</td>
</tr>
</tbody>
</table>

AJR:191, December 2008

Lower Rectum

Stage 1
Low rectal cancer

Stage 2, 3 or 4.

Abdominoperineal resection or extralavator APR.

Surgical approach

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EMVI


Lymph nodes

- Size, >5mm
- Shape, border and signal.
  - Sens 77-85% and Spec 88-97%
- Accuracy of up to 85%.
- Homogenous signal, well defined margins = Benign NPV 96%
- Stage N1 (1-3 perirectal LN) and N2 ( >4 LN).
- Abnormal Ext. Iliac or inguinal LN: Stage M1.
Lymph nodes

M1 LN.
Synoptic reporting

- Accuracy average falls from 85 to 50%.
- T2 signal change and use it for tumor regression grading (TRG1-5).
- Tumor volume measurement. (>70% reduction)
  - Barbaro B, Radiology 2009;250(3):730–739
- DWI sequence.
Summary

• Optimal rectal cancer treatment mandates a multidisciplinary approach.
• Tumor morphology and distance to anal verge and puburectalis.
• T sub-staging.
• CRM and EMVI.
• N and M staging.
• For low rectal cancer: Inter-sphincteric invasion for TME or extended surgery planning.