Rectal Ultrasound

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• CW is a 66 year old Caucasian female who presented with a four month history of painless rectal bleeding.
Our Patient: Pelvic CT

Multiple axial images of the pelvis with contrast

Rectal Mass

Oral and IV contrast

All images are from BIDMC PACS
Our Patient: Rectal Cancer

Multiple axial images of the pelvis with contrast

CT does not yield information about tissue type, depth of invasion, or cell cytology
Our Patient: Rectal Cancer on Pelvic CT

Multiple axial images of the pelvis with contrast
CT

• While CT is a good means of identifying masses in the pelvis its greater utility is in identifying distant organ involvement. CT yields little information on the depth of invasion locally of rectal cancer unless metastases are seen. (Stage IV)\(^1,7\)
Colonoscopy

- Her colonoscopy showed a pale nodular non-bleeding mass protruding into the lumen of her upper rectum.
- Colonoscopy offers the ability to directly visualize the tumor but lacks the ability to define depth of invasion. Colonoscopy is also used to evaluate the rest of the colon for other possible lesions. Under direct visualization with colonoscopy one can biopsy lesions and send tissue samples for cytology.
Our Patient

Our patient was diagnosed with rectal cancer by CT and colonoscopnic biopsy. She was referred for endorectal ultrasound for further staging.
Endorectal Ultrasound

• Reported to be 72%-97% accurate in determining depth of tumor invasion with 12% overstaged and 9% understaged. Sensitivity is 86% and specificity is 33%.²
• Sensitivity and specificity of determining perirectal lymph node involvement is between 60-90% for both.
• 6-8 weeks after radiation therapy endorectal US measures resulting fibrosis and is hence less useful although many have reported that if residual tumor remains it will be confined to the area of fibrosis.⁶
Preparation

- Patients need only a phosphate enema prior to examination.
- No sedation, bowel preparation, or patient monitoring is necessary.
- Patient placed in the left lateral decubitus position with knees and hips flexed.
- Ultrasound transducer is surrounded by an expandable balloon that must be filled with water after it is placed in the rectum.
- Special care must be take to assure that there is no air in the balloon (shadowing artifact).
- A condom containing transducer jelly is placed over the transducer before insertion in the rectum.
Most clinicians subscribe to a 5 layer model when analyzing the appearance of the rectal wall. The normal rectum appears as hyper- and hypo-echoic bands around a hypoechoic lumen. There is some controversy as to the anatomic correlation of the bands (anatomic layers vs. anatomic interfaces). There is agreement that the outer hypoechoic band represents the muscularis propria. (The muscularis propria is important for staging)
Normal Rectum

- Perirectal Fat
- Muscularis propria
- Submucosa
- Muscularis Mucosa
- Balloon/Mucosa Interface

[Image showing the layers of the rectum with labeled sections: muscularis mucosae, mucosa, submucosa, crypt of Lieberkuhn, muscularis externa.]
Pitfalls

- Anal Verge - If the tumor is at the anal verge it may be hard to pass the transducer
- Transducer angle - Oblique angle of the wall may cause blurring and overestimation
- Balloon Inflation - Over inflation causes stacking of layers and hence overestimation
- Air - In the balloon, ulcer or necrotic tumor will cause distant shadowing.
- Stool - Artifact of mixed echotexture can appear similar to villous tumors.
- Surface Contact - Villous adenomas have air in the villi
Rectal Cancer

- 15% of all cancers in men and women occur in the lower GI tract; 33% of which occur in the rectum\(^1\)
- Survival is inversely proportional to stage
- Transrectal US is most influential in the treatment of lower stage tumors.
Staging

- **T1** – Submucosal involvement only; Treatment: Full thickness local excision. Low likelihood of lymphatic spread (6-11%).
- **T2** – Into but not beyond the muscularis propria. There may be thickening of the muscularis propria with preservation of the hyperechoic perirectal fat layer; Treatment: Local excision (higher rate of recurrence) Lymph node involvement in 10-35%.
- **T3** – Tumor extends beyond the muscularis propria into the perirectal fat area; Treatment: Low anterior or abdominoperineal resection with adjuvant preoperative chemotherapy and/or radiation.
- **T4** – Invasion of adjacent organs or the pelvic wall; Treatment: depends on the extent of and organs involved.
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Perirectal Fat
Muscularis propria
Submucosa
Muscularis Mucosa
Balloon/Mucosa Interface

Loss of clear perirectal fat layer could be artifactual

Our Patient
Our Patient

Submucosa layer appears intact
Perirectal fat layer appears disrupted.
Perirectal fat layer appears disrupted

Patient was staged as T2, but T3 disease could not be ruled out
Our Patient
Our Patient
MR

- Sensitivity is 89% and specificity is 68%.
  US: Sensitivity is 86% and specificity is 33%.\(^4\)
- Although MR is slightly better at staging rectal cancer, it is much more expensive.\(^3,4,5\)
Summary

We discussed:

- **Normal Rectum & Rectal Cancer**
  - Five Layers: Perirectal Fat, Muscularis propria, Submucosa, Muscularis Mucosa, Balloon/Mucosa Interface
  - Four Stages: I, II, III, IV
- **CT**
- **Colonoscopy**
- **Rectal US**
  - Preparation
  - Technique
  - Findings
- **MR**
References

1. Kruskal JB, Kane RA, Sentovich SM, Longmaid HE. Pitfalls and Sources of Error in Staging Rectal Cancer with Endorectal US. 1997 Radiographics 17(3)609-626
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