RECTAL CARCINOMA: A “DISTANCE APPROACH”

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Despite the major improvements that have been made due to total mesorectal excision (TME) management of rectal cancer still remains a challenge. Optimal treatment of rectal cancer involves a multidisciplinary approach with collaboration between radiologists, oncologists, surgeons and pathologists to achieve local control and decrease recurrence. As we enter the era of personalized medicine with therapies stratified according to the risk of local or distant recurrence, imaging has become an essential tool in the preoperative decision making, to avoid both under- and overtreatment. This requires a full understanding of the disease, as well as a full understanding of what impact false- positive or false-negative findings can have on treatment choices and outcome. MRI assessment of tumor extramural spread, Circumferential Resection Margin or nodal status is critical for rectal cancer staging. Using a standardised reporting enables a systematic approach to the interpretation of the magnetic resonance images, thereby enabling all the clinically relevant features to be adequately assessed.

The presentation will be focused on an easy mnemonic: " DISTANCE " to help radiologists use a systematic approach to the interpretation of rectal MRI.

Using the mnemonic we will highlight all the pearls and pitfalls of rectal imaging especially in response assessment after neoadjuvant therapy.

Summary of "DISTANCE"

DIS: "**D**istance from the **I**nferior part of the tumor to the transitional **S**kin

-Low third (<5cm),
-Middle third (5-10cm)
-Upper third (>15cm)

T: "**T** staging", Extramural spread must be recorded as well as peritoneal reflection involvement

-**T1**: Tumor invades submucosa
-**T2**: Tumor invades but does not penetrate muscularis propria
-**T3**: Tumor invades subserosa through muscularis propria
T3a: Tumor extends <1mm beyond muscularis propria
T3b: Tumor extends ≥1-5mm beyond muscularis propria
T3c: Tumor extends >5-15mm beyond muscularis propria
T3d: Tumor extends >15mm beyond muscularis propria
-**T4**: Tumor peritoneal reflexion (T4a) or others organs (T4b)

A: "**A**NAL COMPLEX" for Low Lying tumor with specific classification

-**Stage 1**: tumor invading partial thickness of muscularis propria
-**Stage 2**: tumor invading full thickness of muscularis propria
-**Stage 3**: tumor invading the intersphincteric plane
-**Stage 4**: tumor less than 1mm or beyond the puborectal muscle

N: "**N** staging" assessed on border definition and signal criteria

-**N0**: No metastasitc lymph nodes
-**N1**: Metastasis in 1-3 perirectal nodes
-**N2**: Metastasis in 4 or more perirectal nodes
-Pelvic side wall lymph nodes must be recorded for radiotherapy field and surgery adjustment

C: "**C**RM": Circumferential Resection Margin; a positive margin is defined as: tumor, lymph nodes, EMVI or tumoral deposits lying within 1mm (<1mm) of the mesorectal fascia

E: "**E**xtramural vascular invasion"

MAIN DIAGNOSIS TIPS AND TAKE HOME MESSAGES

Clues at the Workstation for T staging:

-T stage must be assessed on planes strictly perpendicular to the tumor. Incorrect prescription of the acquisition plane leads to blurring of the muscularis propria and may lead to overstaging.

-In differentiating between stage T2 and T3 tumors, the crucial criterion is involvement of the perirectal fat. In stage T3, the muscularis propria is completely disrupted and cannot be clearly distinguished from the perirectal fat: The tumor spreads beyond the muscularis propria into the perirectal fat with a broad-based bulge or nodular appearance.

-Outer longitudinal layer of the muscularis propria can be focally disrupted by small vessels penetrating the wall; this does not necessarily indicate tumor invasion.

-Peritoneal reflection must be assessed in upper rectal tumors. It may be identified on sagittal T2W images as a low-signal linear structure that can be seen extending from the posterior aspect of the dome of the bladder to the ventral aspect of the rectum. On axial, the point of attachment has a V-shaped configuration

Clues at the Workstation for staging low lying tumors:

-High-spatial-resolution T2W FSE coronal imaging must be added to optimally depict the tumor relationship with the levator and puborectal muscles, sphincter complex, and intersphincteric plane.

-On coronal T2W images, the commencement of the puborectalis sling marks the start of the narrowest part of the mesorectum; below lies the anal canal. The

first question to answer in low lying tumors is where the lower edge of the tumor is located in relation to the puborectalis sling: if the tumor is located above the puborectalis sling, sphincter involvement can be easily excluded.

-When the tumor extends below the puborectalis sling: 3 areas have to be evaluated and reported on:

→Muscularis propria: Does the tumor invade partially or the full thickness of the muscularis propria (Stage T1 versus T2)?

→Is there an extension into the intersphincteric plane (Stage T3)?

→Is there an extension into the external sphincter (Stage T4)?

-Levator, puborectalis muscles or external sphincter involvement are considered as Stage T4.

<u>Clues at the Workstation for Nodal staging:</u>

-Uniform nodes with homogeneous signal intensity are not suspicious.

-Nodes with irregular borders, mixed signal intensity, or both are considered to be suspicious.

-One to three suspicious nodes is stage N1 and four or more is stage N2.

-Any lymph node lying within 1 mm of the circumferential resection margin must be reported because it is highly suspicious of CRM involvement.

-Recording the location and size of any suspicious pelvic sidewall lymph nodes is critical. This will inform the radiotherapy team to change and adjust the radiotherapy field. Secondly, the surgeon will need to perform an extended lymph node resection with additional removal of the internal iliac nodes. This lymph node group is not removed when a regular TME is performed.

Clues at the workstation for a Positive CRM:

-The mesorectal fascia represents the potential CRM in patients undergoing total mesorectal excision surgery.

-A positive margin is defined as tumor lying within 1mm of the mesorectal fascia.

-Positive margins can be due to tumor deposits, main tumor extension, extramural vascular invasion, or suspicious lymph nodes

-Anteriorly the mesorectal fat can be thin, and the rectum can be close to the CRM. In cases where the rectum abuts the mesorectal fascia anteriorly; the tumor must be at least a Stage T3 before discussing CRM involvement.

Clues at the workstation for EVMI:

-By definition, EMVI must be associated with tumors that are at least category T3.

-Signs suggestive for EMVI:

→Presence of tumor signal intensity within a vascular structure.

→Expanded vessels.

→Tumoral expansion through and beyond the vessel wall, disrupting the vessel border.

-Finally, If extramural venous invasion is present, considerations of whether the involved veins threaten the mesorectal fascia (i.e., whether they are within 1 mm of the fascia) have to be made.