Manchester Cancer

Colorectal Pathway Board (Clinical Subgroup):

Imaging Guidelines

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Contents

1. OBJECTIVE

This guideline seeks to provide information in order to optimise imaging technique, standardise reporting information and highlight the appropriate choice of imaging investigation in specific clinical situations.

2. IMAGING TECHNIQUES

a. Staging CT

All colorectal cancer patients should have CT chest, abdomen and pelvis.

Body area: thorax, abdomen, pelvis

IV contrast: thorax – in arterial phase; abdomen and pelvis – in portal venous phase

Oral contrast medium: optional

b. MRI pelvis

Indicated for rectal cancers (tumours within 15cm of the anal margin at rigid sigmoidoscopy).

Sequences:

i. **T2W sagittal from one pelvic side wall to the other.** Aims to localise tumour, assess height above anal verge and relationship with peritoneal reflection.
   - 3 mm thick slices and small field of view (FOV) (16cm).

ii. **Large FOV T2W axial sections of the whole pelvis.** Aims to assess pelvic disease outside mesorectum and assess lymph nodes.
   -3 mm slices

iii. **High resolution T2W axial oblique images.** Aims to assess the depth of extramural spread and involvement of circumferential resection margin (CRM).
   - 3mm thick slices and small FOV (16cm).
   - Must be performed perpendicular to the long axis of the rectum at the level of the tumour.

iv. **High resolution T2W coronal oblique images**. Aim to show the anatomy of levator ani, sphincter complex, inter-sphincteric plane and relationship to the rectal wall.
   - Performed for low rectal cancer as defined by cancer within the lower 1/3 of the rectum.
   - Images acquired parallel to the long axis of the anal canal.

v. **Diffusion weighted images and other additional sequences according to local protocol** – optional.

Intravenous contrast is not indicated.

c. CT colonography

CT colonography is indicated as a diagnostic test for the investigation of bowel symptoms in symptomatic patients or to complete assessment of the colon following incomplete endoscopic examination.
Body area: abdomen and pelvis
Position: 2 position-supine/prone versus supine and lateral decubitus
Colonic distension with CO2
Full bowel clearance and faecal tagging is recommended.

For diagnostic purposes, intravenous contrast may or may not be used according to local practice, however, if the CT colonography identifies a colonic lesion, additional scans would be required with intravenous contrast if not performed at the initial CT colonography. This would require a completion CT in the supine position with intravenous contrast in the portal venous phase of abdomen and pelvis.
Where CT colonography identifies a colonic lesion, completion CT of thorax is required with intravenous contrast in the arterial phase.

Readers should have attended an accredited CT colonography course.

d. MRI liver (refer to Greater Manchester HPB guidelines Section 5.8)

MRI imaging of the liver is indicated for characterization of indeterminate liver lesions and where CT scan suggests metastatic disease. Imaging of the liver with MRI aims to determine:
Number, size, character and location of liver lesions
Define relationship with surrounding major vascular structures

MRI Liver Protocol
Axial T1W In/ Out phase
Axial and Coronal T2W (eg HASTE, FIESTA)
Axial Fat saturated T1W pre contrast (eg VIBE, LAVA)
Coronal Fat saturate T1W pre contrast (eg VIBE, LAVA)
Axial Fat saturated T1W post contrast (eg VIBE, LAVA) - immediate, 30secs, 60 secs, 5mins and hepatocyte specific phase (20-40mins for Primovist and 60-90mins for MultiHance)
Coronal Fat saturated T1W post contrast (eg VIBE, LAVA) – 2 mins and 10 mins
Diffusion Weighted/ ADC sequences

The use of hepatocyte specific agents and DWI images in combination has been proven to increase the diagnostic accuracy and sensitivity of liver metastases and it is suggested should also be included.

e. Endorectal ultrasound (ERUS)

Endorectal ultrasound is sensitive in the assessment of early rectal cancers (T1 and T2 lesions) and useful in surveillance following post trans-anal minimally invasive surgery. This has a complementary role to high resolution MRI and is indicated in staging of early rectal cancers prior to minimally invasive trans-anal surgery.

The standard technique involves a trans-anal probe with 360^0 degree view, enclosed in a water filled balloon introduced in to the rectum, allowing radial visualization of the rectum.

3. STAGING OF COLORECTAL CANCER

The following is provided as background to aid interpretation of radiological images and to highlight the importance of providing an integrated TNM stage into the final radiological report to aid assessment of pre-operative staging and assessment of suitability for clinical trials and neo-adjuvant therapies.
Staging based on TNM 7 classification:

Tumour status

Tumour not visible	Tx
Invades submucosa	T1
Invades muscularis propria	T2
Invades beyond muscularis propria into subserosa or non peritonealised pericolic / perirectal tissues	T3
Tumour perforates visceral peritoneum and or directly invades other structures	T4 T4a penetrates visceral peritoneum - T4b invades other organs or structures

Nodal status

Location of regional nodes:

- Caecum – ileocolic; right colic
- Ascending colon – ileocolic; right & middle colic
- Hepatic flexure – right & middle colic
- Transverse – right, middle & left colic; inferior mesenteric
- Splenic flexure – middle & left colic; inferior mesenteric

- Descending – left colic; inferior mesenteric
- Sigmoid – sigmoid; left colic; superior rectal; inferior mesenteric
- Rectum – superior, middle & inferior rectal; inferior mesenteric; internal iliac; mesorectal; lateral sacral; presacral;

Metastasis in 1-3 regional nodes	N1 N1a Metastasis in 1 regional node N1b Metastasis in 2-3 regional nodes
Metastasis in 4 or more regional nodes	N2 N2a Metastasis in 4-6 regional nodes N2b Metastasis in 7 or more nodes

Metastases

No distant metastasis	M0
Distant metastasis	M1 M1a: Confined to one organ (liver, lung, ovary) or non regional lymph nodes. M1b: To more than one organ or the peritoneum**.**

4. RADIOLOGICAL REPORTING

Radiological reporting of imaging is crucial for planning treatment and highlighting potential difficulties that may be encountered at surgery, allowing proper preoperative preparation. Consideration should be given to the use of synoptic reporting to ensure that all important points are included in a report. The following information lists points that should be included in radiological reports.

a. Staging CT/CT colonography

Primary tumour

- Site of tumour
- Morphology - polypoid, sessile, annular, ulcerating.
- TNM stage (See Section 2)
- Assessment of the colonic wall:

i. Smooth outline – tumour confined to the wall (T1/T2)
ii. Nodular outline – may indicate extramural spread of disease (possible T3)
iii. Involvement of adjacent structures and peritoneal infiltration (T4)

- Presence of extramural vascular invasion.
- Relationship to and involvement of adjacent structures eg.sigmoid lesion comment on relation to pelvic structures (urinary bladder/ uterus and adnexa), right colonic lesion comment on relation to duodenum
- Other significant findings eg. presence of hydronephrosis/ proximity of ureter in pelvic colonic lesions, impending presence of mechanical bowel obstruction.

Metastatic disease

- state specifically when defining M positive disease the location of the disease: non-regional nodes, lung, liver, bone, omental or peritoneal deposits.
- liver lesions: comment on number, location and segments involved and spared including number per segment and percentage liver replacement.
- lung metastasis: comment on number and anatomic distribution (documentation of image number is useful for follow up purposes).

The conclusion to the staging CT scan should state a TNM stage

b. MRI pelvis

Primary tumour

- State: site of tumour – upper, mid or lower third
- Morphology - polypoid, sessile, annular, ulcerating, mucinous.
- TNM stage:

Tumour stage

Tumour not visible	**Tx**
Invades submucosa	**T1**
Invades muscularis propria	**T2**

T3 tumours : Tumour extension beyond muscularis propria.

Invasion <1mm beyond muscularis	**T3a**
>1 and < than 5mm beyond muscularis	**T3b**
5-15mm beyond muscularis	**T3c**
>15mm beyond muscularis	**T3d**

Describe position of extramural margin using clock face.

T4 tumours:

Into adjacent organs	**T4a**
Through visceral peritoneum	**T4b**

Nodal stage.

Mesorectal nodes.

N0: homogenous signal, smooth outline and chemical shift artifact.

N1: 1-3 positive nodes (mixed signal intensity and irregular border)

N2 : 4 or more positive nodes.

Comment on presence or absence of significant pelvic side wall nodes (nodes outside of mesorectum).

Measurements:

i. Length of tumour.
ii. Distance from anal margin/ anorectal junction to caudal border of tumour
iii. Depth of extramural extension.
iv. CRM status (nearest distance from the tumour to the mesorectal fascia).
v. Presence of nodal deposits in mesorectum and distance to the CRM

Presence or absence of extramural vascular invasion

The conclusion to the staging CT scan should state a TNM stage.

Post chemo-radiotherapy assessment of a primary rectal tumour
Similar reporting format.
Comment on downsizing / downstaging.
Option to report using Dworak classification to classify response to treatment.

c. MRI liver

Aims to detect as many liver metastases as possible and accurately characterize benign lesions to avoid unnecessary surgical procedures.
Reporting should include:

- number, size, character and location of liver lesions
- the relationship with surrounding major vascular structures
- liver segments involved and spared including the number of lesions per segment
- where multiple liver metastases are present, the percentage liver replacement by tumour (to predict future liver remanant volume).

5. CHOICE OF INVESTIGATIONS

a. Diagnosis of primary colorectal tumours

Colonoscopy is the investigation of choice for investigation of colonic symptoms (NICE 2014). However, CT colonography provides an alternative for elderly, frail patients, or those in whom endoscopic examination is incomplete. Plain CT may be used in those too frail for any form of bowel preparation.

b. Staging of primary colorectal tumours (NICE 2014)

Staging CT for all primary colorectal tumours

MRI pelvis for rectal tumours – within 15cm of anal verge at rigid sigmoidoscopy
ERUS where MRI pelvis suggests the rectal tumour is T1 to improve accuracy of local staging and assess suitability for local excision or if MRI is contraindicated. Request for this modality follows discussion in MDT.

c. Metastatic disease

MRI liver – for suspected liver metastasis
USS liver – may be required to aid in assessment of indeterminate liver lesions
PET-CT – in the presence of resectable liver lung metastatic disease, to identify further remote sites of disease. Request for this modality follows discussion in MDT.

d. Obstruction

Colonic stent insertion may be considered. CT chest, abdomen and pelvis should be performed prior to procedure for up to date staging, to determine the level of obstruction, to detect metastasis and assess for evidence of complications which would form a contraindication to the procedure.
Contraindications:

i. Mid – low rectal tumour and proximal right colonic tumour.
ii. Bowel perforation.

Stenting should be carried out according to regional colonic stent guidelines and only be personnel appropriately trained in the procedure.

e. Response to treatment

Following long-course radio/chemotherapy for locally advanced rectal tumours, re-staging MRI pelvis and CT chest, abdomen and pelvis is appropriate to assess response to treatment, suitability for surgical resection and determine the presence or absence of metastatic disease.
MR should be performed between 8 - 12 weeks following completion of radiotherapy with surgery thereafter.

f. Follow up and surveillance

Intensive follow up after curative resection is only appropriate in patients who are fit and willing to undergo further treatment. NICE guidance suggests a minimum of 2 CT scans of the chest, abdomen and pelvis in the 3 years following resection (NICE 2014).
Following liver resection for metastatic disease, patients should have 6 monthly CT scans of chest, abdomen and pelvis for 2 years, followed by yearly scans up to a minimum of 5 years following resection.
For patients choosing a ‘watch and wait’ strategy after complete clinical response to neoadjuvant therapy for rectal cancer, surveillance requires

MRI pelvis at 3,6,9,12, 18, 24, 36 months and CT chest, abdomen and pelvis as per FU for colorectal cancer.

g. Recurrent disease

Recurrence will usually be detected on follow up CT either for surveillance or because of symptoms. Recurrent disease should be fully staged with CT of chest, abdomen and pelvis. Depending on the site of recurrence, MRI pelvis may be indicated and PET-CT is likely to be required to detect remote sites of disease.

Patients receiving palliative chemotherapy will require CT follow up before and after treatment and 6 monthly follow up CT as requested by the oncologists.

6. REFERENCES

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