Protocol of Radiotherapy for Rectal Cancer

- **Indication of radiotherapy**
  Indication of neoadjuvant CCRT:
  (1) cStage II, III
  (2) Lower rectum cStage I disease for organ preservation. (RT +/- C/T) (optional)

  Indication of adjuvant CCRT:
  (1) pStage II, III
  (2) After local excision, pT1Nx with high risk factors (close/positive margin, LVI, PNI, and poorly differentiated, or sm3 invasion), pT2Nx

- **Simulation and Treatment Planning**
  - Use of CT simulation and 3D/IMRT/VMAT treatment planning is required to ensure adequate target volume coverage and avoid normal tissue irradiation.
  - When clinically appropriate, use of IV and/or oral contrast for CT simulation may be used to aid in target localization.
  - Use of an immobilization device (such as vacuum cushion or ankle holder) is strongly recommended for reproducibility of daily set-up.
  - Patients could be simulated and treated either in the supine or prone position. Positioning and other techniques to minimize the volume of small bowel in the field should be encouraged.
  - Full bladder filling is not compulsorily necessary (Drzymala et al., 2009).

- **Radiation Treatment Fields (CTV)**
  - Radiation therapy fields should include the tumor or tumor bed and mesorectum with an adequate margin, the pre-sacral nodes, and the internal iliac nodes.
  - The external iliac nodes should also be included for T4 tumors involving anterior structures.
  - The inguinal nodes should also be included for lower tumors involving the anal canal or the anal margin or advanced disease with lower third vaginal involvement.
  - Pelvic nodal CTV contours: 7mm around vessels, carving out bowel, bladder and bone. (based by RTOG consensus)
  - The ischial fossa should be included RT field if tumor invasion to this area.
  - For postoperative patients treated by abdominoperineal resection, the perineal wound should be included within the fields.
  - Different CTV to create PTV margin should be considered for motion target (rectum) and motionless target (pelvis nodal) (5~20 mm), but if IGRT used, the
margin could be reduced.

■ **Radiation dose**

- Once daily, 5-6 fractions per week.
- For resectable cancers, after 45 Gy to pelvis, a tumor bed boost with an adequate margin of 5.4 Gy in 3 fractions could be considered for preoperative radiation (for T4 disease, total dose 54 Gy may be considered) and 5.4-9.0 Gy in 3-5 fractions for postoperative radiation.
- For patients with very close or positive margins after resection, especially for patients with T4 or recurrent cancers, as an additional boost, 10-20 Gy external beam radiation (IMRT) to a limited volume could be considered soon after surgery, prior to adjuvant chemotherapy.
- For unresectable cancers, doses higher than 54 Gy may be required, if technically feasible.

■ **Constraints of OAR**

**References:** RTOG 0822 (IMRT Planning Constraints)

- Small bowel:
  - No more than 180 cc above 35 Gy
  - No more than 100 cc above 40 Gy
  - No more than 65 cc above 45 Gy
  - No small bowel volume should receive 50 Gy

- Femoral heads:
  - No more than 40% volume above 40 Gy
  - No more than 25% volume above 45 Gy
  - No femoral head volume should receive 50 Gy

- Bladder:
  - No more than 40% volume above 40 Gy
  - No more than 15% volume above 45 Gy
  - No bladder volume should receive 50 Gy

- Unspecified Tissue:
  - No specific constraints, however a DVH will be generated for “unspecified tissue” which consists of any tissue within the skin but not contoured as a part of any of the normal structures above and/or the PTV.
References

12. Garofalo M, Moughan J, Hong T, Bendell J, Berger A, Lerma F, et al. RTOG 0822: A Phase II Study of Preoperative (PREOP) Chemoradiotherapy (CRT) Utilizing IMRT in Combination with Capecitabine (C) and Oxaliplatin (O) for Patients with