Protocol of Radiotherapy for Cervical Cancer

- **Indication of radiotherapy**
  - Definite RT with or without concurrent chemotherapy:
    1. Resectable, medically inoperable or those who refuse surgery [IA1-IIA2]
    2. Parametrial invasion (IIB以上)

  Adjuvant CCRT:
  1. Surgical margin involvement
  2. LN metastasis
  3. Parametrial involvement

  Adjuvant radiotherapy alone: see Sedlis Criteria for external pelvic radiation after radical hysterectomy in node-negative, margin-negative, parametria-negative cases
  1. Lymphovascular space invasion
  2. Stromal invasion
  3. Tumor size by clinical palpation

<table>
<thead>
<tr>
<th>LVSI</th>
<th>Stromal invasion</th>
<th>Tumor Size (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Deep 1/3</td>
<td>Any</td>
</tr>
<tr>
<td>+</td>
<td>Middle 1/3</td>
<td>≥2</td>
</tr>
<tr>
<td>+</td>
<td>Superficial 1/3</td>
<td>≥5</td>
</tr>
<tr>
<td>-</td>
<td>Middle or Deep 1/3</td>
<td>≥4</td>
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</table>

*Risk factors may not be limited to the Sedlis criteria

RT ± CC for incidental finding of invasive cancer after simple hysterectomy:
  1. Stage IA1 with LVSI
  2. Stage IA2 以上

- **General radiotherapy information**
  - Prior to simulation, charts, pertinent radiographs, procedure notes and pathology reports should be reviewed. This will allow an informed determination of treatment volume and field borders prior to simulation.
  - Radiotherapy course (external beam irradiation plus brachytherapy) should be completed within 9 weeks.

- **Simulation and Treatment Planning**
• Use of CT-based 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. MRI is the best imaging modality for determining soft tissue and parametrial involvement in patients with advanced tumors. In patients who are not surgically staged, PET imaging is useful to help define the nodal volume of coverage.
• Use of an immobilization device (such as vacuum cushion) is strongly recommended for reproducibility of daily set-up.
• All patients should be simulated and treated in the supine position.
• Routine image guidance, such as cone-beam CT (CBCT), may be helpful in defining daily internal soft tissue positioning.
• There are increasing efforts to use and standardize image-based volumetric brachytherapy approaches using MRI, CT, or ultrasound – international validation efforts are underway.

### Radiation Treatment Fields

- **GTV (Gross Target Volume)**
  - gross visible primary tumor and metastatic lymphadenopathy
  - maybe absent in post-operative setting

- **CTV (Clinical Target Volume)**: GTV plus uterus, vagina (at least 3 cm from the gross disease), parametria, and lymph node regions include:
  - internal iliac (hypogastric and obturator)
  - external iliac (stop right at the level of the femoral head)
  - common iliac (stop at L4/L5 interspace)
  - pre-sacral and soft tissue (uterosacral ligaments), down to the level of S3
  - treat para-aortic nodes end at the top of L2 for positive common iliacs
  - treat para-aortic nodes end at the top of T12 for positive para-aortic node
  - please refer to the RTOG Gynecological Atlas for volume specifications
  - if lower third vagina is involved, include inguinal lymph node region in CTV should be considered

- **PTV (Planning Target Volume)**: CTV with 7 to 20 mm margin

### Radiation dose

- Total dose (EBRT plus brachytherapy) is according to the NCCN guideline.
- External beam radiation therapy:
whole pelvic RT: 45 to 50.4 Gy (1.8-2.0 Gy per daily fraction, 5-6 fractions per week)
- persistent or bulky parametrial tumor: up to 60 Gy
- para-aortic region: 45 Gy
- bulky lymphadenopathy: 50-60 Gy

• Brachytherapy: 2~6 fractions, 4~6 Gy per fraction; 2 fractions per week is recommended. Multiple schemes have been used, such as
  - definite: HDR point A dose of 30 Gy in 5 fractions (equivalent to 40 Gy to point A using LDR brachytherapy)
  - adjuvant: 12-18 Gy to the vaginal surface in 2 to 3 applications

■ Constraints of OAR
• Box field:
  - kidney: 2/3 of each kidney should not receive more than 18 Gy (V18 < 33%, each)
  - spinal cord: limited to 45 Gy (< 45 Gy)
• IMRT is useful to reduce unnecessary dose to normal structures including:
  - liver: V30 < 30%, or mean < 20 Gy, or V15 < 75%
  - kidneys: 70% of each kidney to receive ≤ 15 Gy, or 2/3 of each kidney to receive ≤ 18 Gy, or V20 < 25%, or mean dose < 17.5 Gy
  - spinal cord: no more than 50 Gy at any point
  - rectum: V45 < 40%
  - bladder: V45 < 65%
  - bowel: V40 < 70%, or mean < 2.5 Gy, or Dmax(point dose -1c.c.) < 52 Gy.

■ References
2. Phase III randomized study of concurrent chemotherapy and pelvic radiation therapy with or without adjuvant chemotherapy in high-risk patients with early-stage cervical carcinoma following radical hysterectomy. Available at: http://www.rtog.org/ClinicalTrials/ProtocolTable/StudyDetails.aspx?study=0724