Target
in post operative cancer cervix

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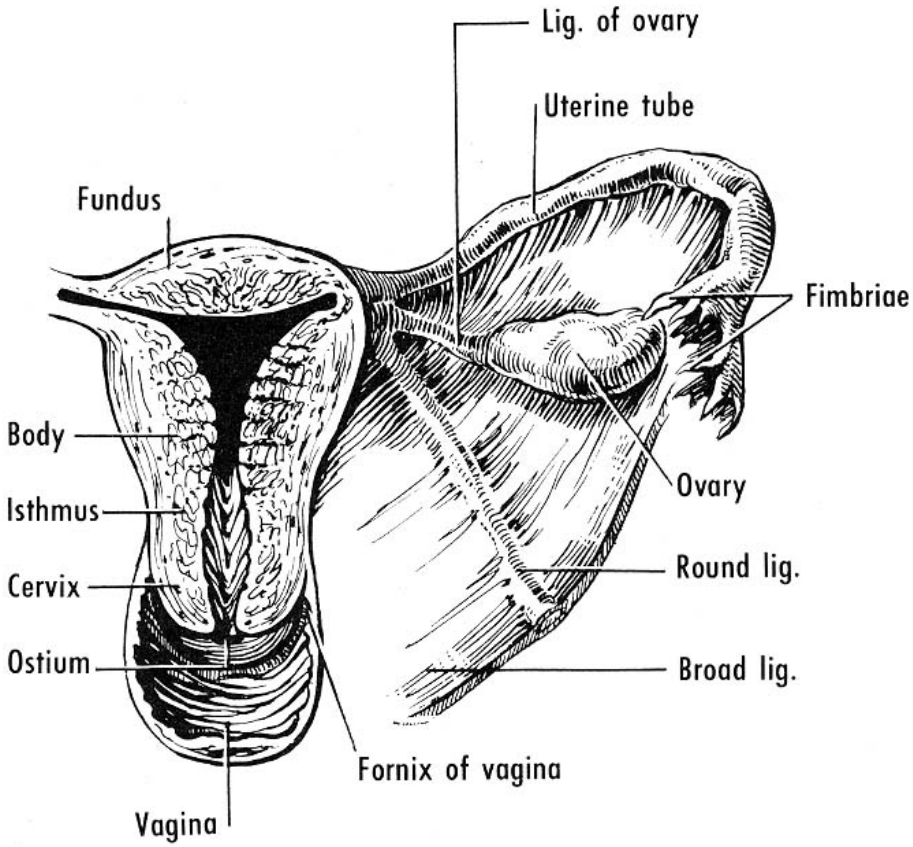
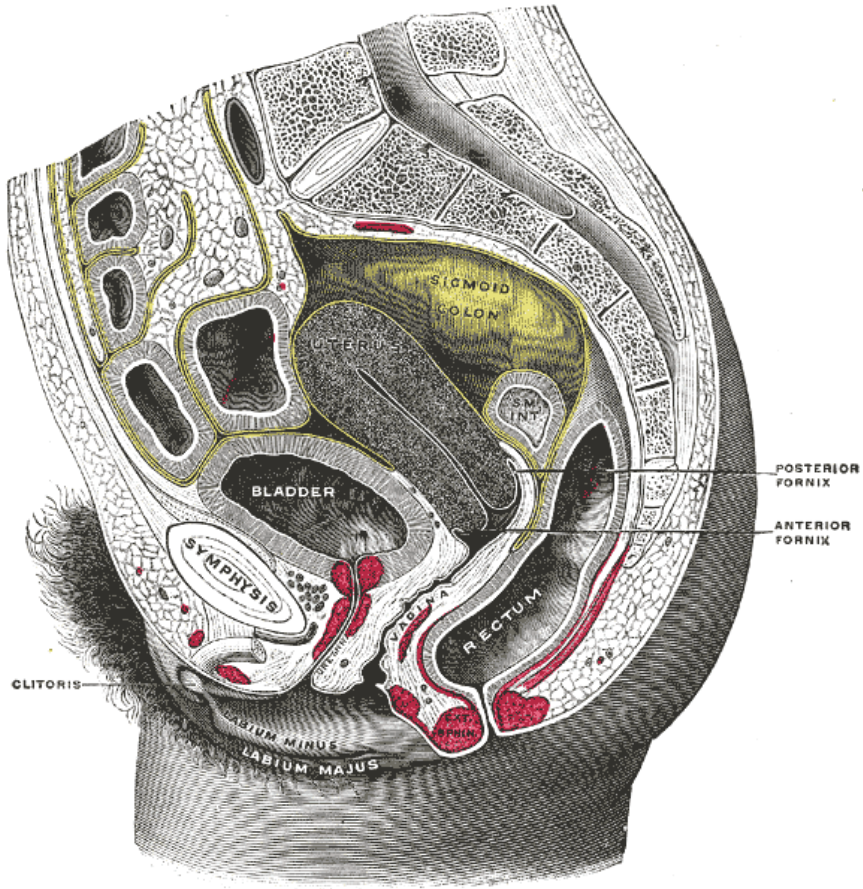
Learning objectives

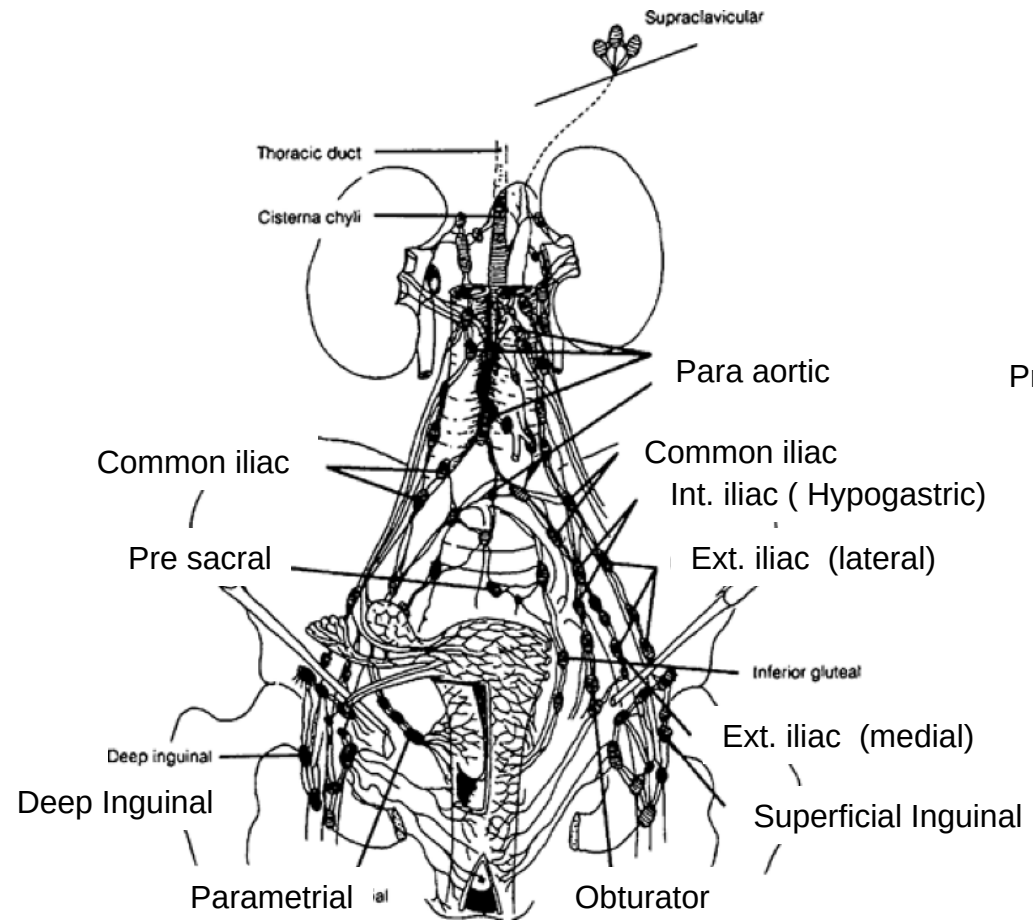
- Knowledge of basic anatomy, lymphatic and pattern of spread in cervical cancer
- To understand the definition of CTV in post operative case of cervical cancer.
- To know the delineation of normal tissue / organ at risk in post operative case of cervical cancer.
- Importance of target definition in radiotherapy planning in post operative case.

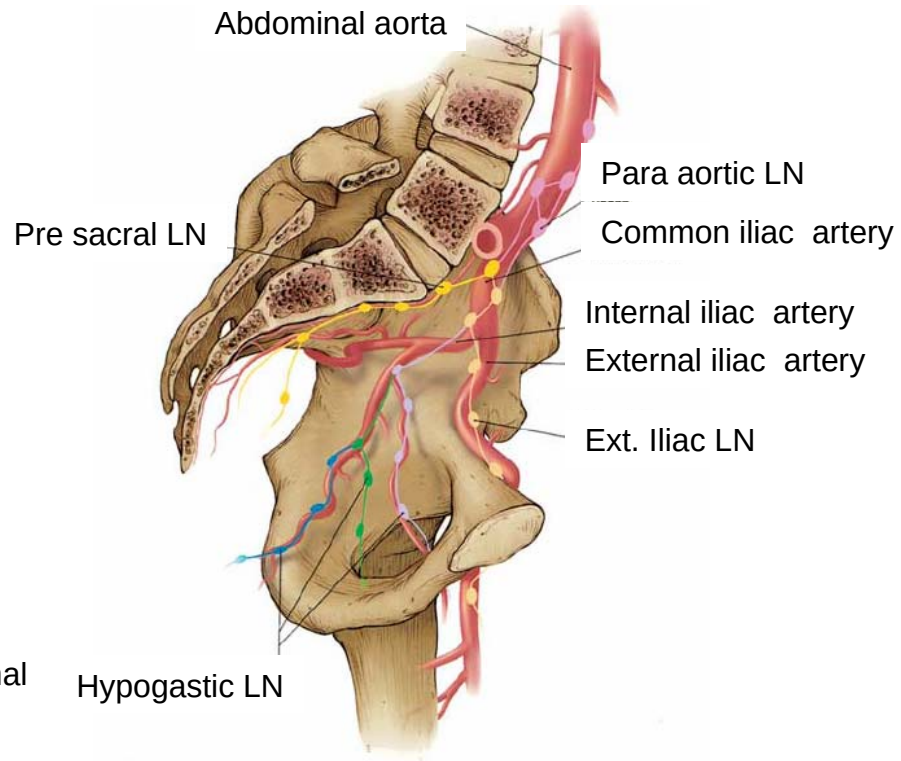
Anatomy : Cervix





Lymphatic spread : Cervical cancer



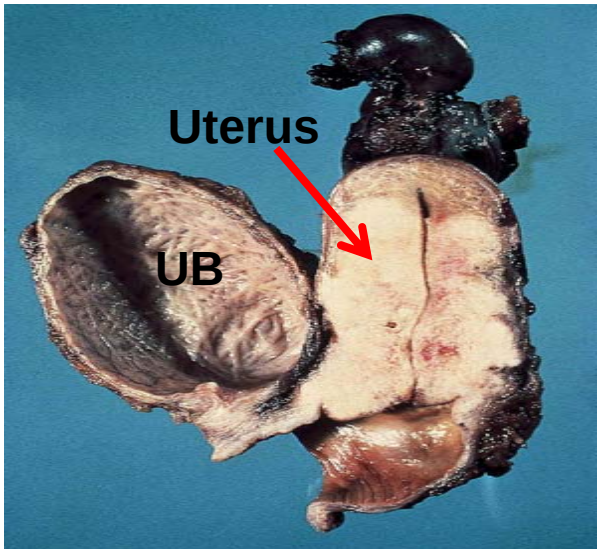


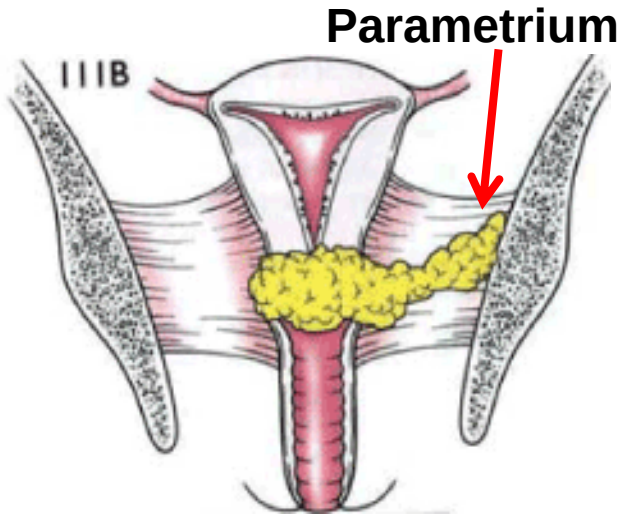
Laterally : Obturator → Int. iliac (Hypogastric LNs) → Ext iliac & Common iliac LNs→ Para aortic

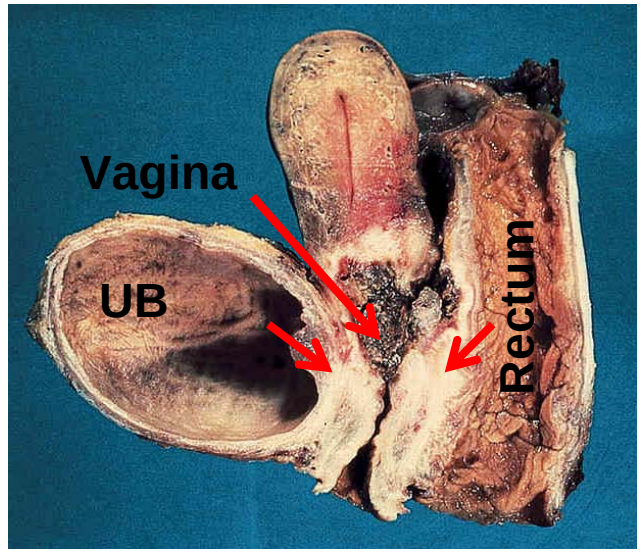
Anteriorly : Ext . iliac LNs

Posteriorly : Sacral → Common iliac & Para aortic LN

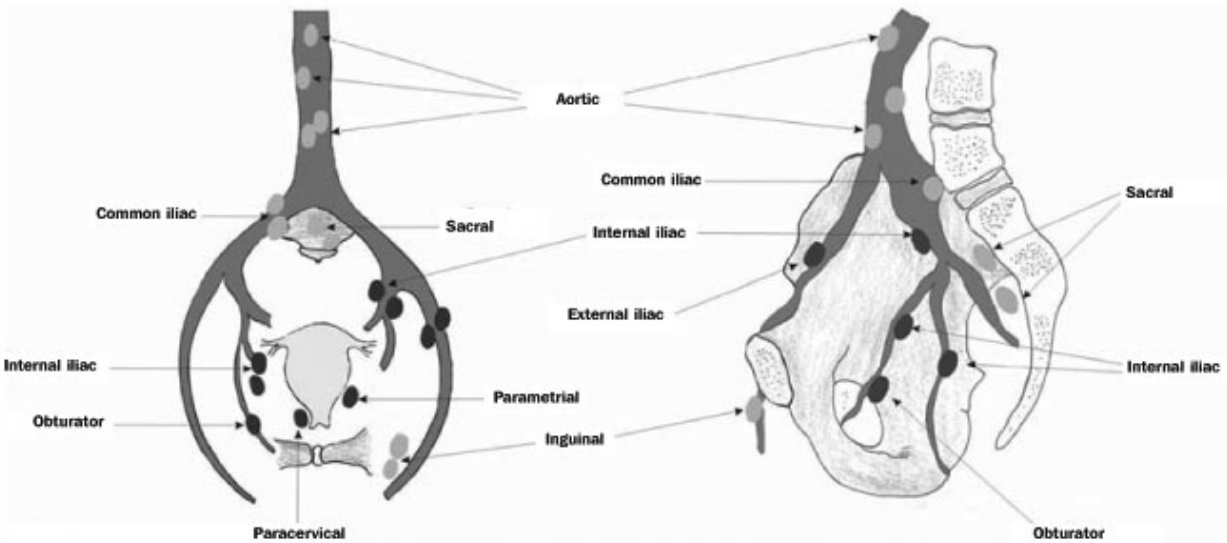
Patterns of spread: Cervical cancer







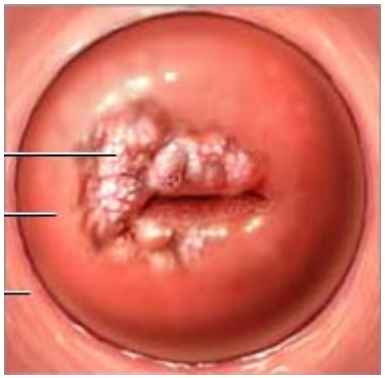
Local Spread: Adjacent structure & organs

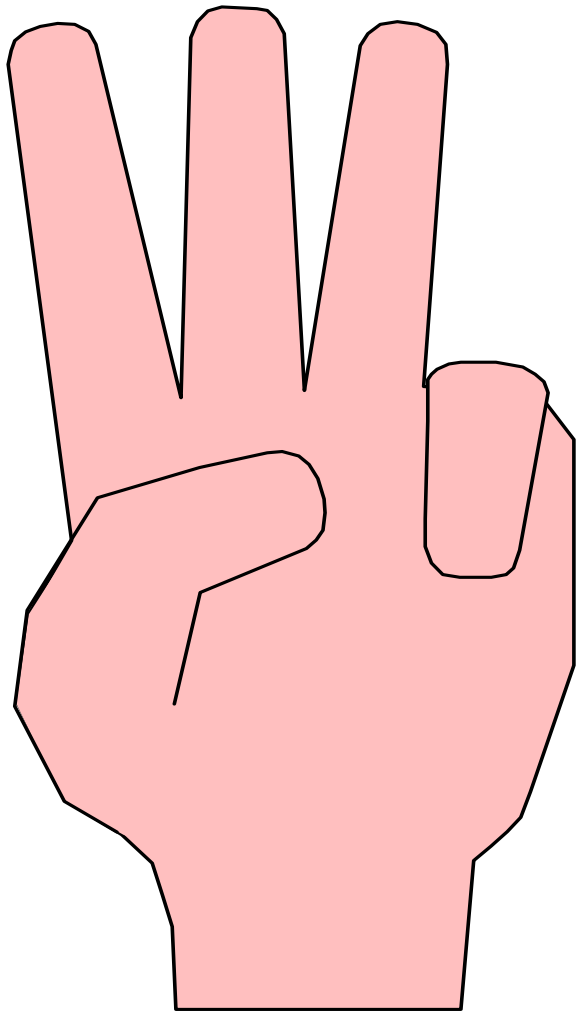


Lymphatic Spread : Pelvic & Para Aortic Nodes

Distant Spread

Treatment options





Surgery

Radiotherapy

Chemotherapy

Incidence of Lymph Nodes mets. after radical hysterectomy

- 208 cervical cancer patients
- Stage IB-IIB

Clinical Stage	Number of patients	Pelvic LN mets. Number (%)	Para aortic LN mets. Number (%)
I B	96	11 (11.5)	2 (2.15)
II A	15	4 (26.7)	0
II B	97	38 (39.2)	7 (7.2)

Sakuragi et al Cancer 1999;85:1547-54

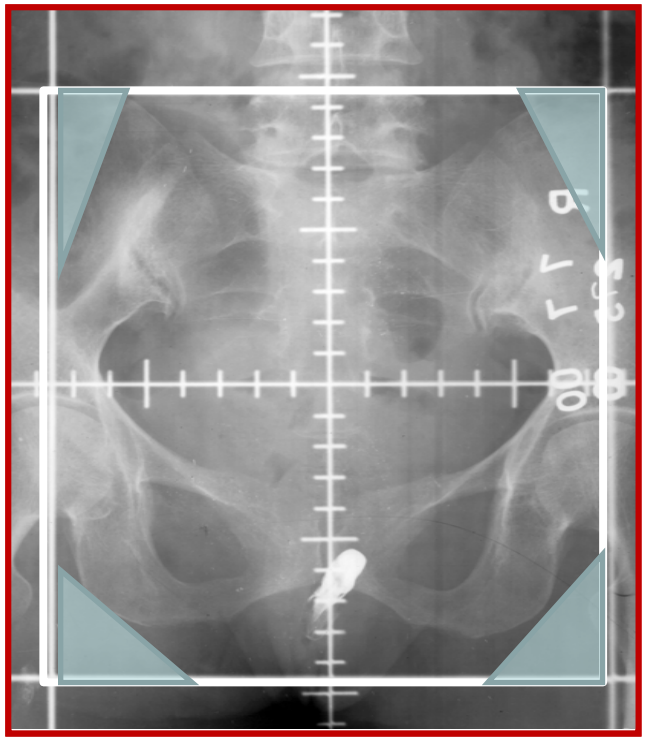
Indications for Pelvic RT post op

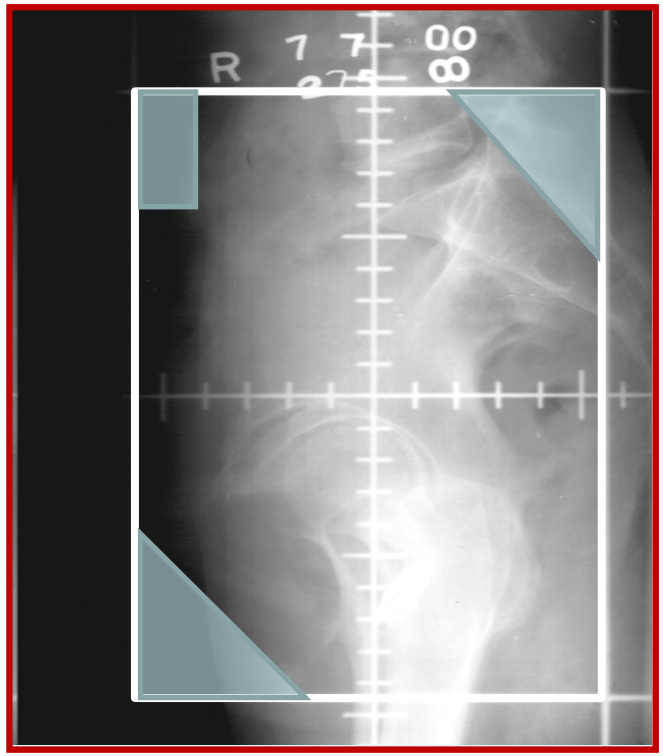
- Most common failure pattern following radical surgery for cervical cancer is pelvic relapse.
- Factors affecting higher failure rate include:
  - Positive lymph nodes
  - Large primary tumor
  - Involved surgical margins
  - Lympho-vascular space invasion
  - Depth of stromal invasion

CTV: Postoperatively

- Parametrial & paravaginal tissues: Vaginal cuff to medial edge of internal obturator muscle/ischial ramus both side
- Vagina: Upper 1/2 =Vaginal cuff and 3cm of vagina inferior to cuff
- Regional Lymph nodes: Pelvic & Presacral LN
- Controversies in upper extent of LN drainage: 72% include Common iliac nodes (*Mell LK et al; ASTRO 2004)*

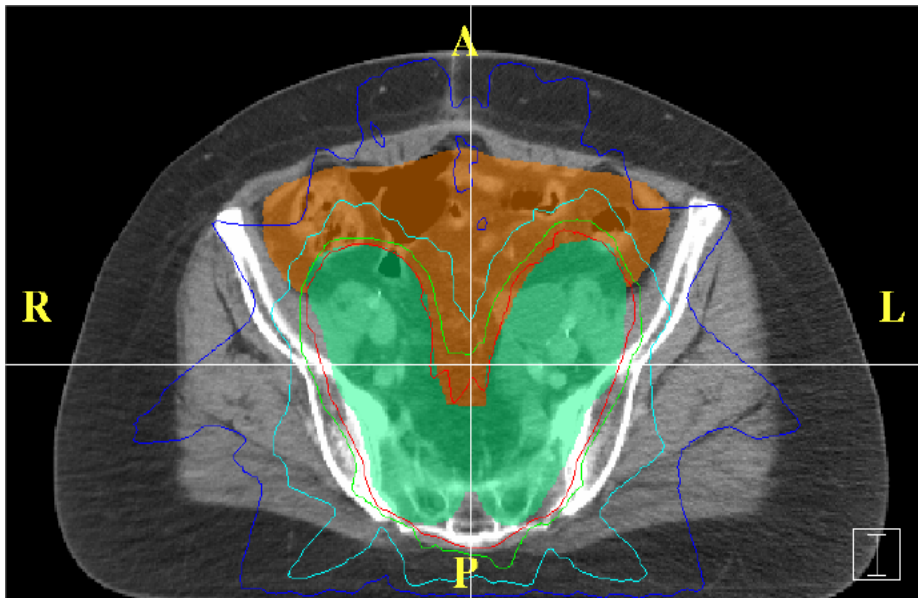
4 Field Box Pelvic RT

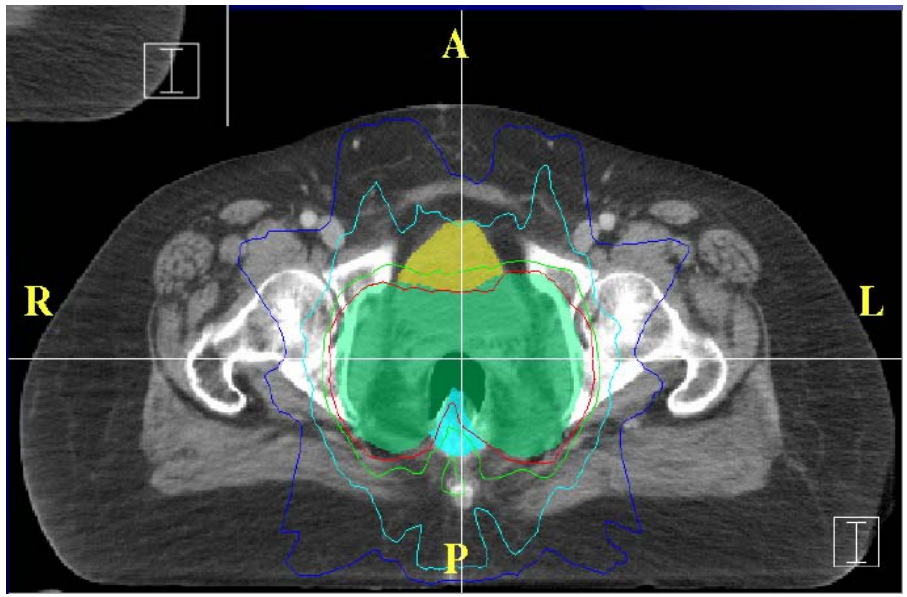




- Conventional RT irradiation of large volumes of normal tissues → multiple acute and chronic toxicities
  - Small bowel : SBO, enteritis, malabsorption
  - Rectum : Proctitis, rectal bleeding
  - Bone Marrow: ↓se WBC, ↓se platelets, anemia
  - Pelvic Bones : Insufficiency fractures, femoral head necrosis

If you know the target……



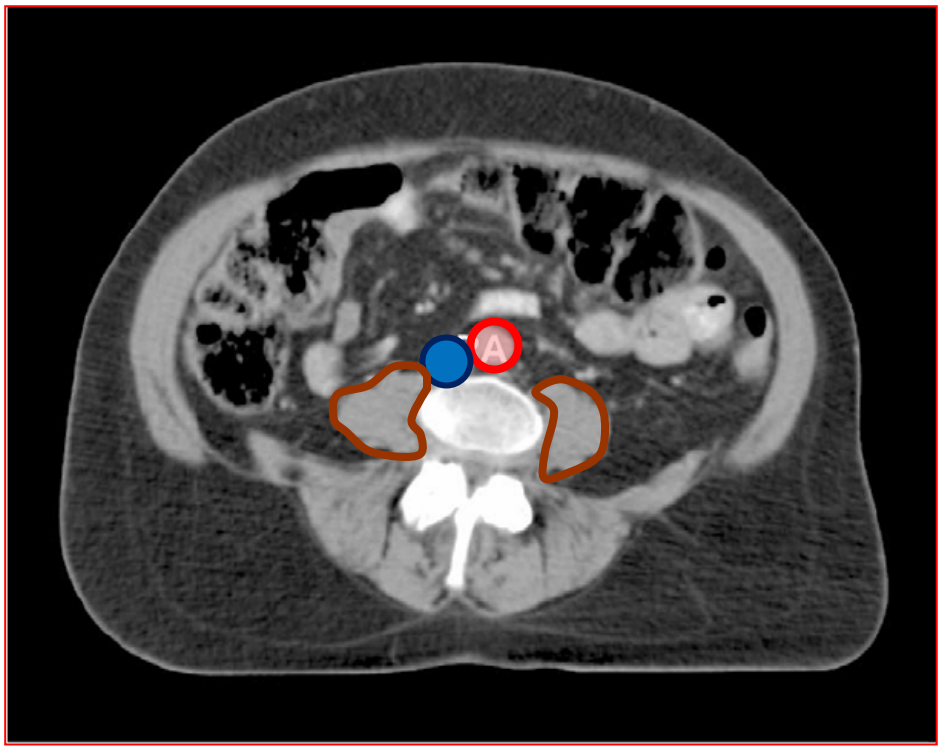


Conformation reduces volume of small bowel in upper pelvic region while bladder and rectum in lower pelvis to receive high doses

RTOG-GOG-ESTRO-NCIC
Consensus Guideline

- RTOG (June 2006), a consensus conference on target design was held.
- Developed guidelines for CTV in postoperative cervix and endometrial cancer patients treated by pelvic IMRT
- Atlas on RTOG website
  http://www.rtog.org/pdf_document/GYN-Atlas.pdf

Lymph nodes Delineation

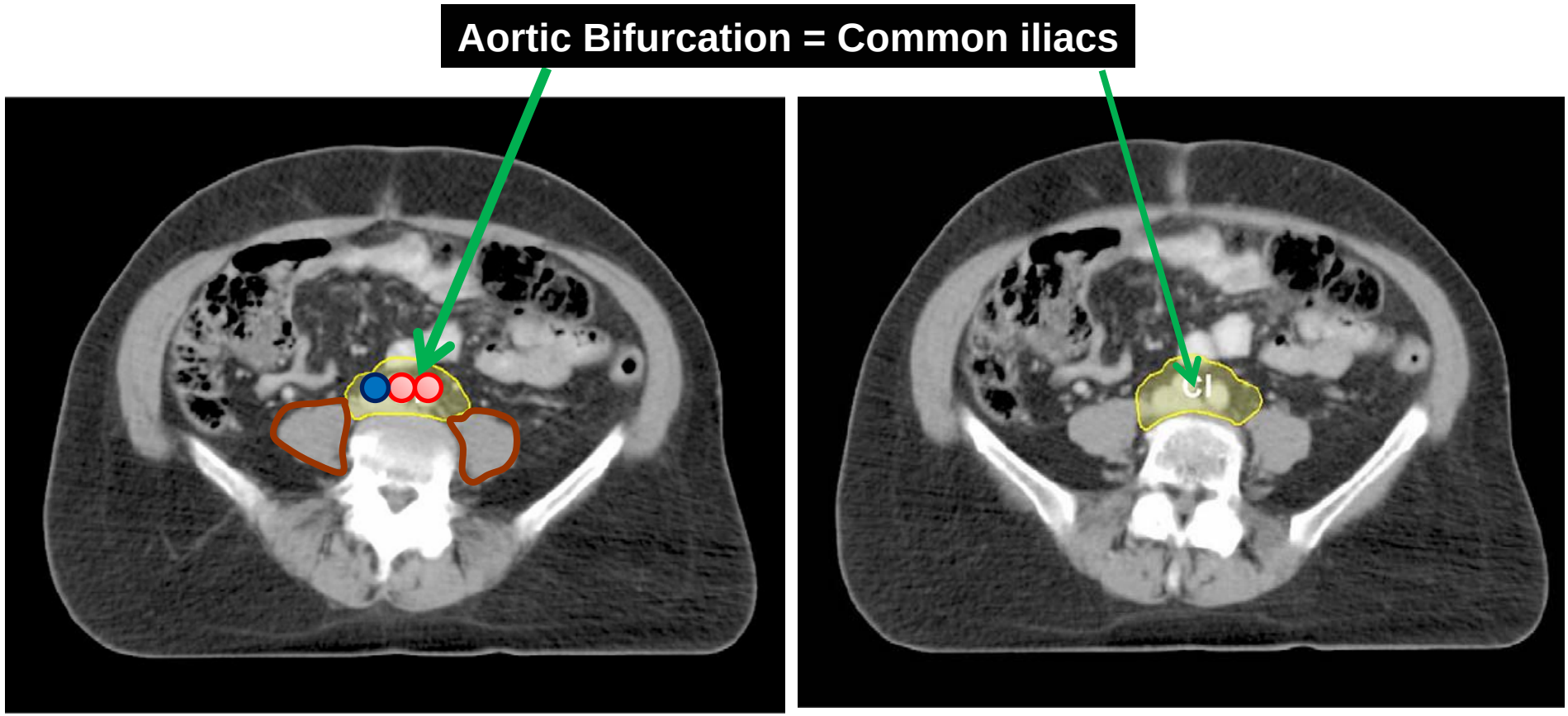


Aorta

Inf. Vena Cava

Psoas Muscle

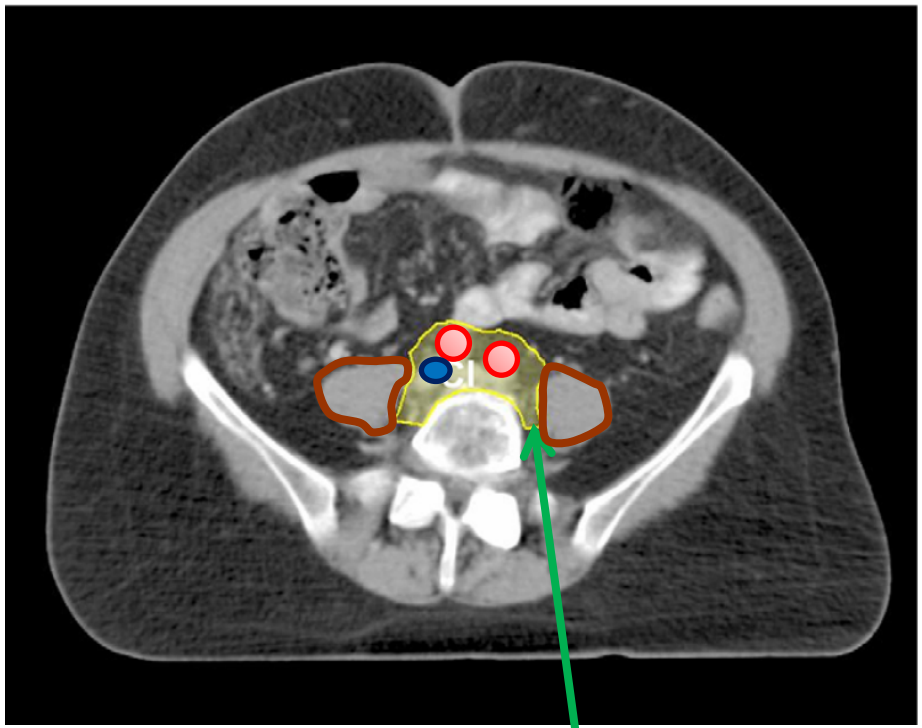
Lymph nodes Delineation

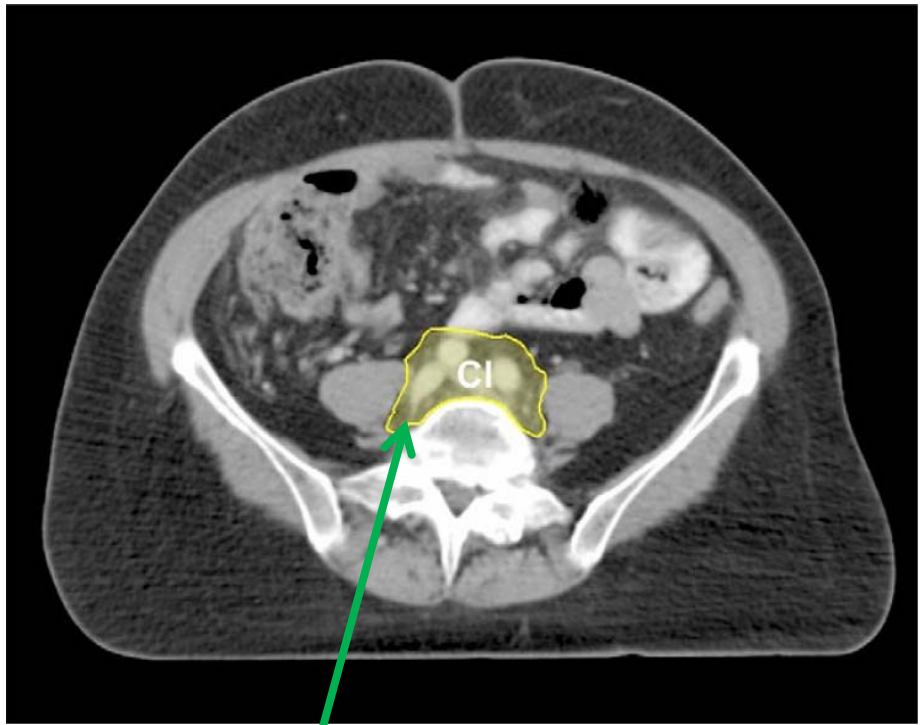


CTV : Add 7-mm margin around the Common iliac vessels
Extend to include any visible or suspicious lymph nodes, lymphoceles and pertinent surgical clips.

CTV should be modified to exclude the vertebral body, psoas muscle and bowel.

Lymph nodes Delineation

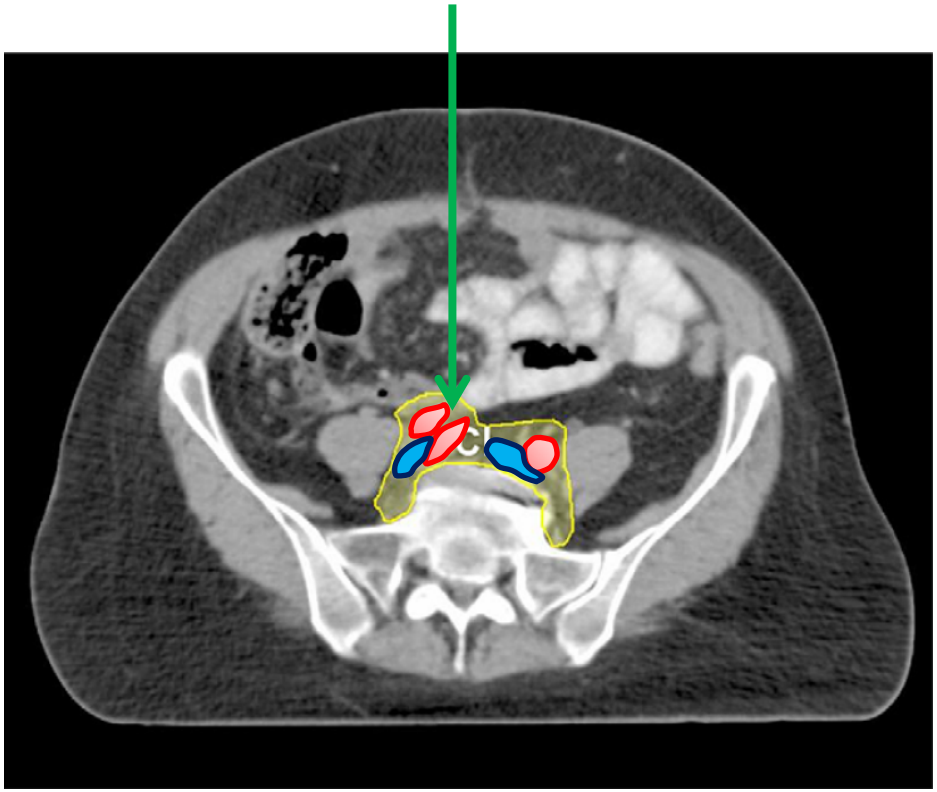


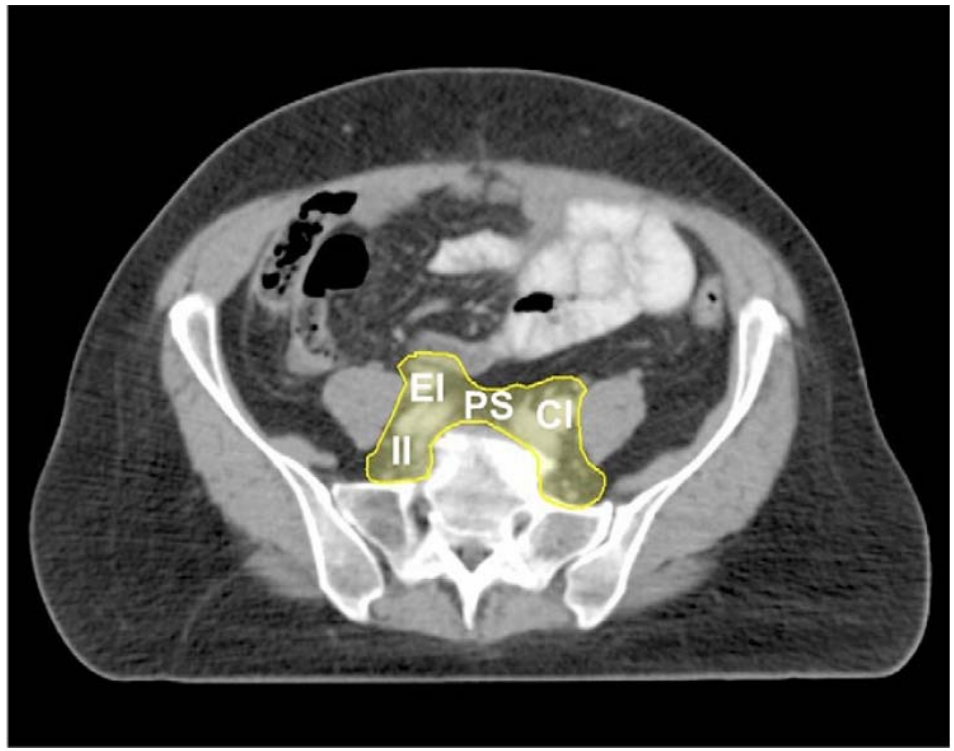


CTV to extend posterior and lateral borders to psoas ms. and vertebra

Pelvic Lymph nodes Delineation

Bifurcation of CI artery to External & Internal iliac artery

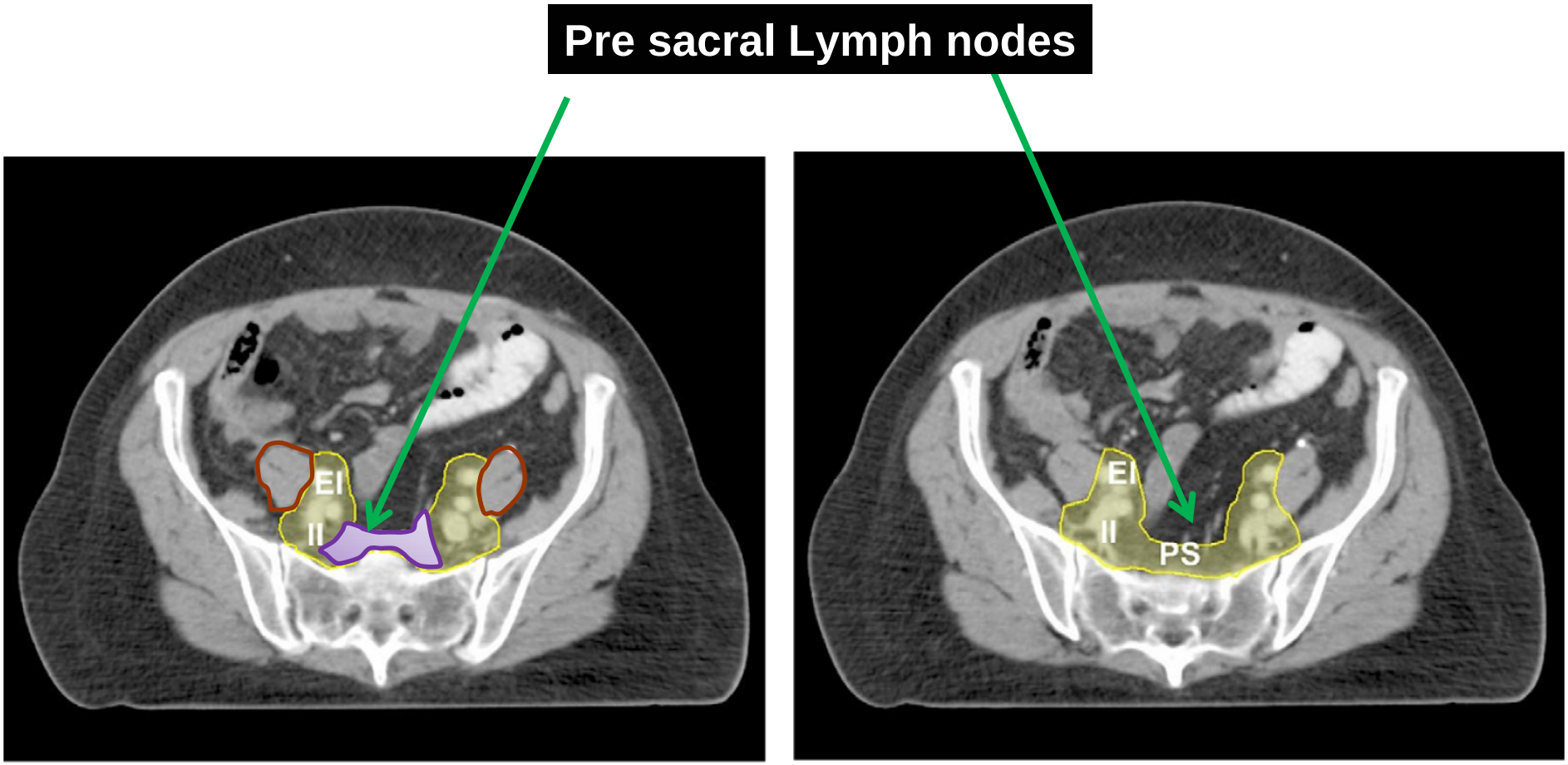




CTV : Add 7-mm margin around the External and Internal iliac vessels

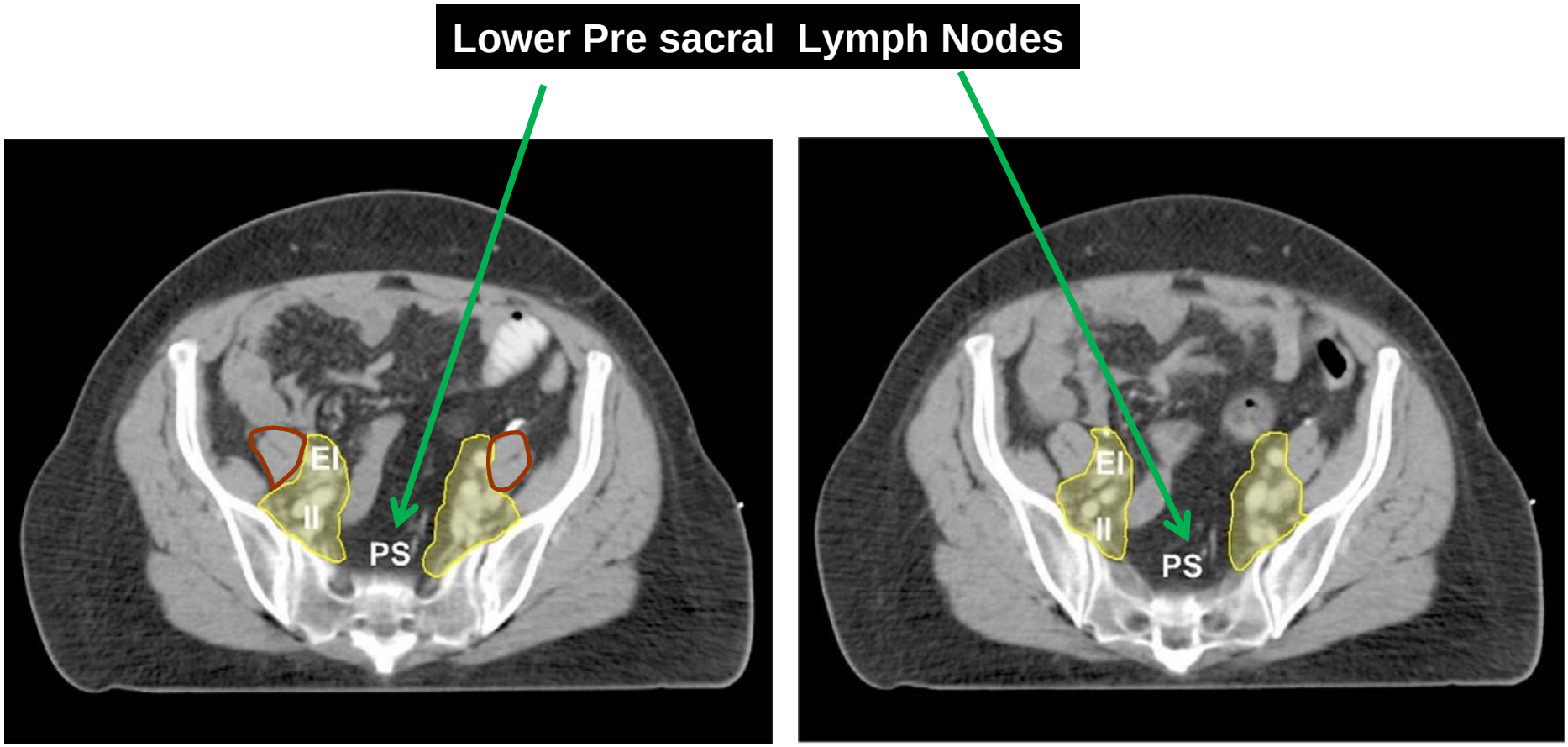
CTV : Bow tie appearance

Pelvic Lymph nodes Delineation



CTV : includes presacral LN In all cervical and endometrium ca. with cervical extend 10-15mm strip drawn anterior to vertebral body at S1 and S2 level. U shaped appearance. Bladder and rectum included when CTV overlap these structures.

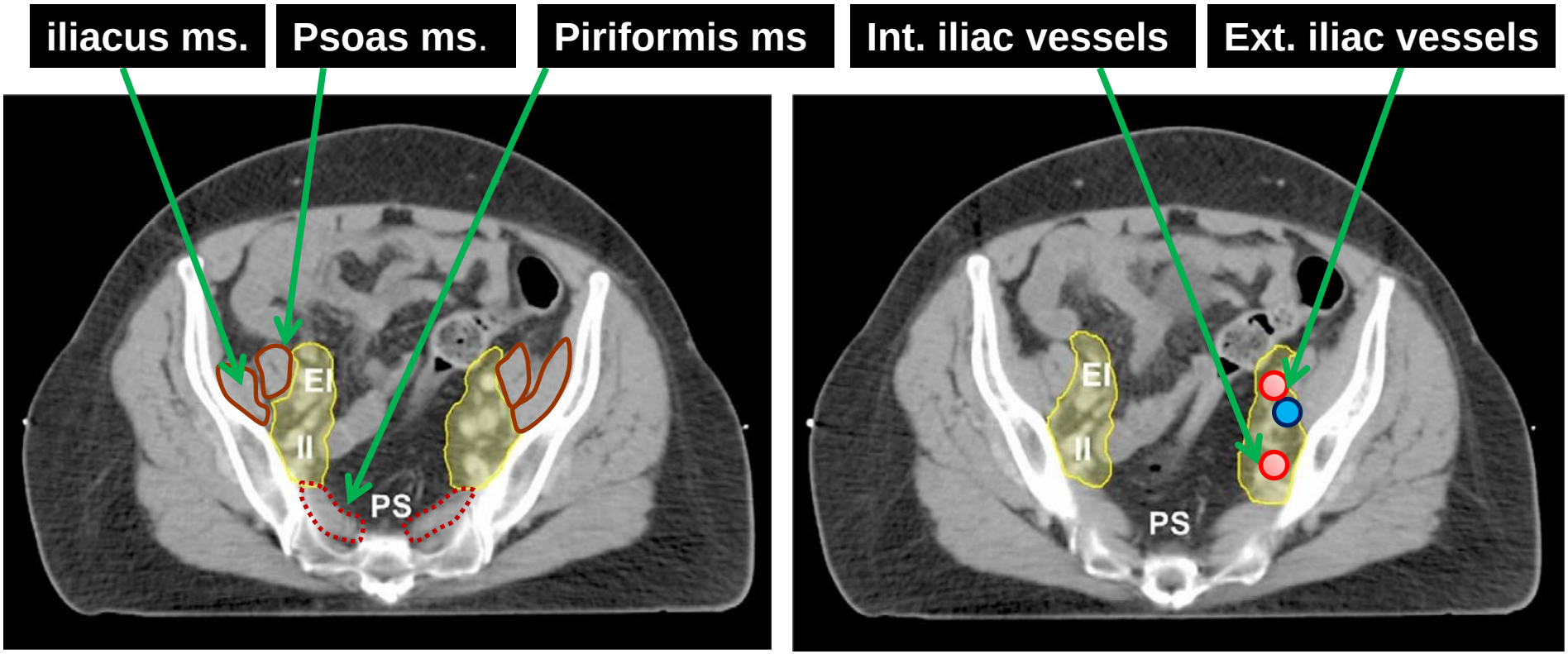
Pelvic Lymph nodes Delineation



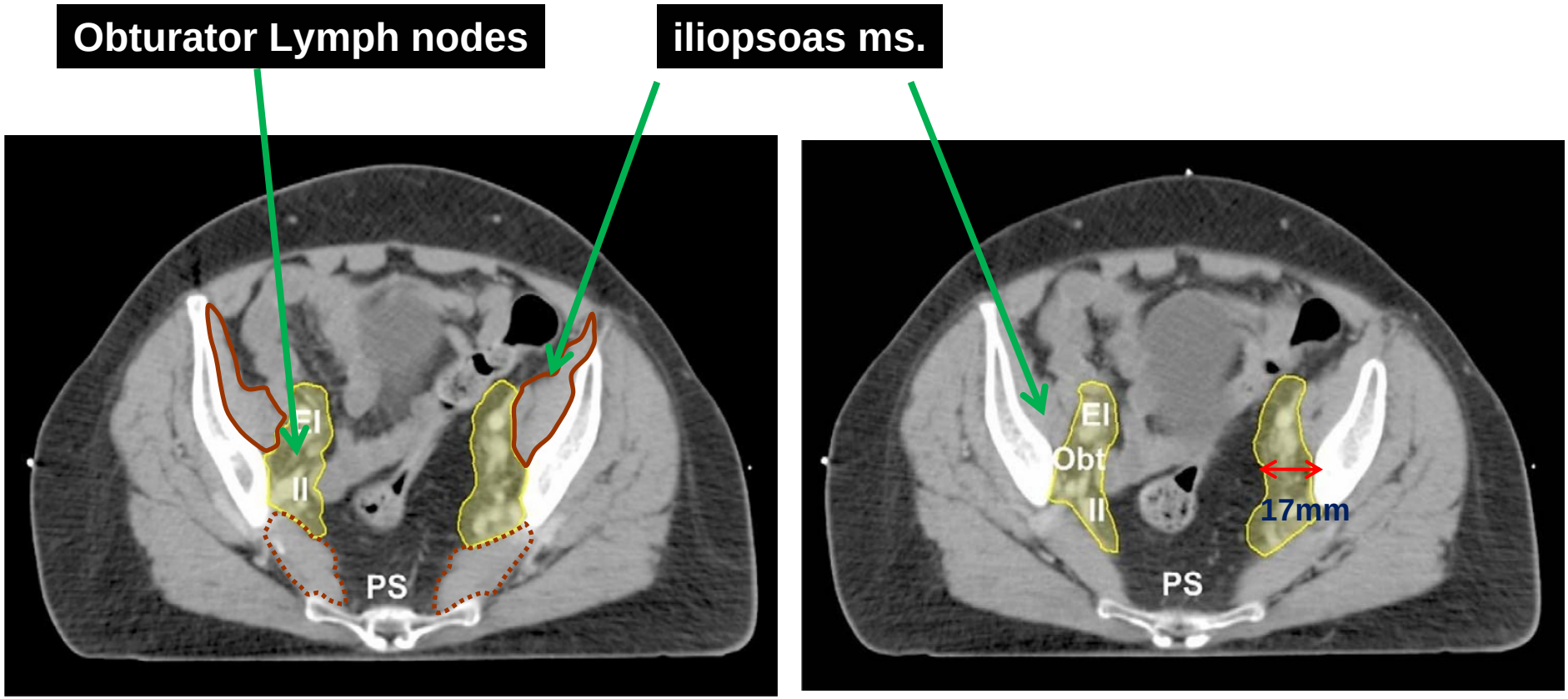
Lower Presacral Nodes included in CTV

if tumor extension into uterosacral ligaments or rectal involvement

Pelvic Lymph nodes Delineation

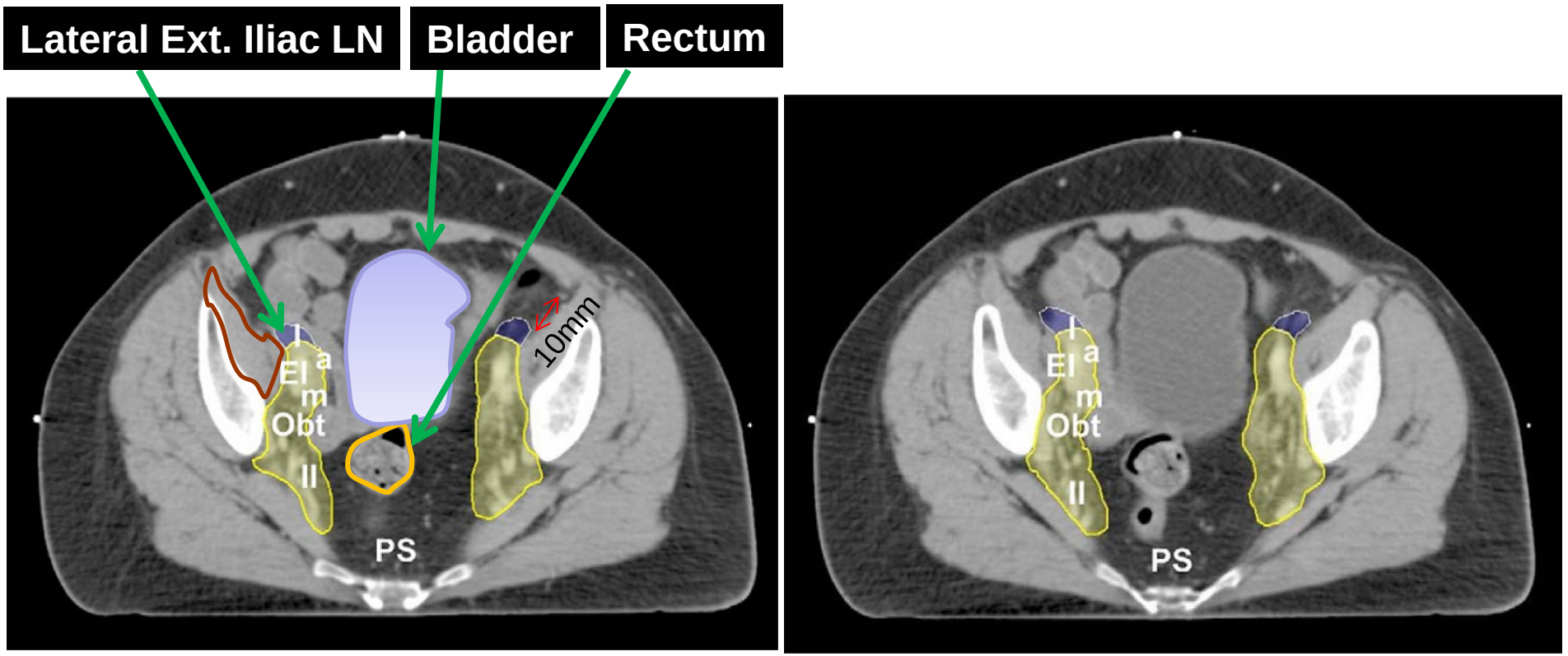


Pelvic Lymph nodes Delineation



At Obturator LN level : CTV expand to 17mm wide strip from pelvic wall

Pelvic Lymph nodes Delineation



Lateral Ext. iliac nodes : 34-45% missed by conventional fields

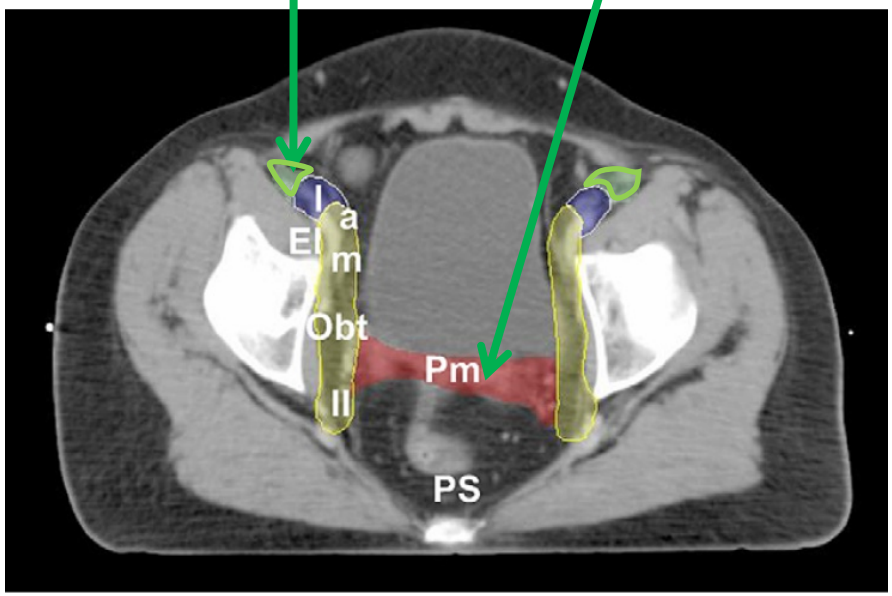
However rare site of recurrence. May not be routinely included in Nodal CTV.

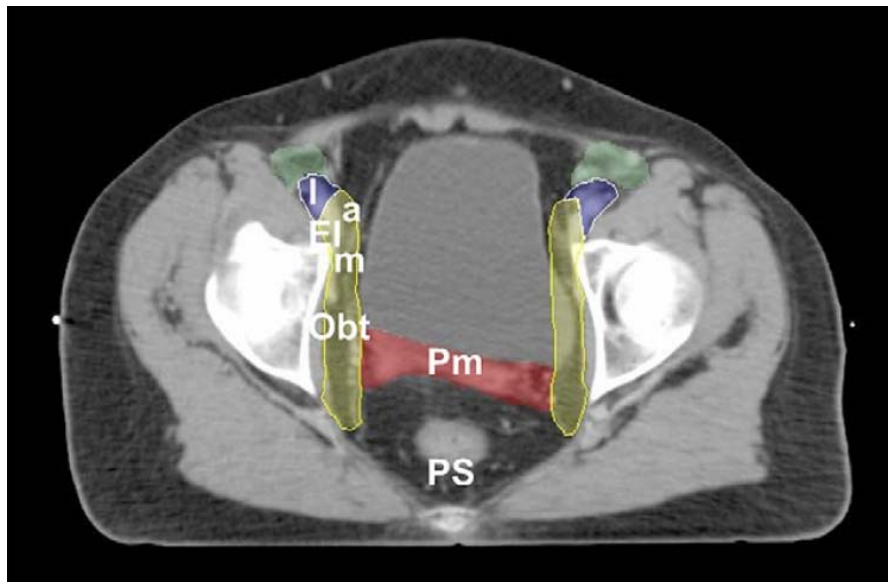
Included only if Ext. iliac Nodes involved or if target includes inguinal region.

Extend anterolaterally10mm along iliopsoas ms.

Pelvic Lymph nodes Delineation

Inguinal Lymph nodes **Parametrial tissue**





Parametrial & paravaginal tissues

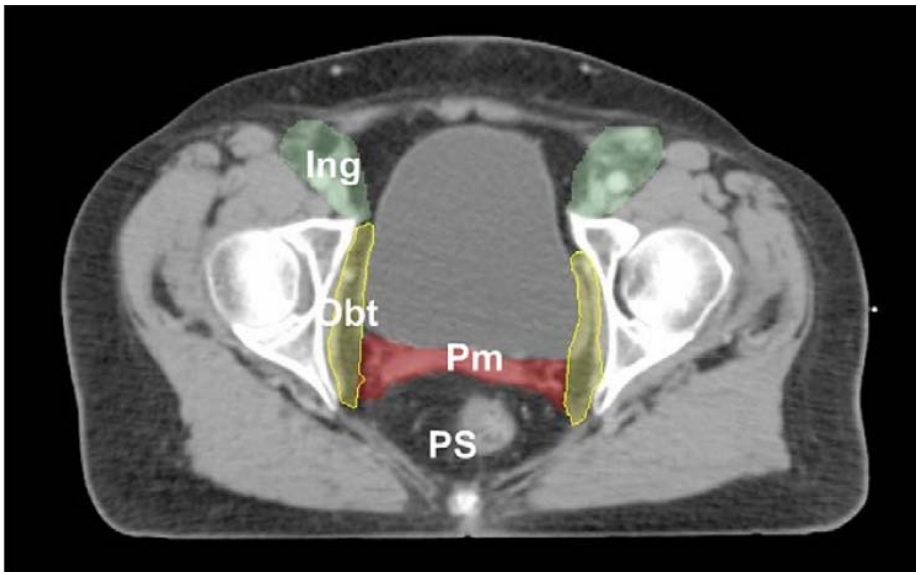
Vaginal cuff to medial edge of internal obturator muscle/ischial ramus both side

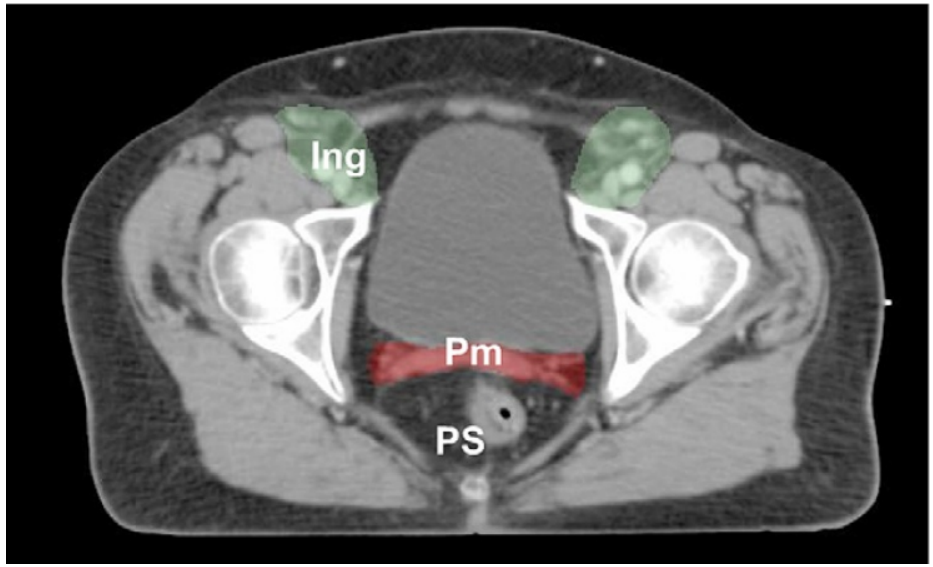
Internal iliac Nodal CTV terminate at

Level of vaginal cuff.

Cranial section of coccygeal ms.

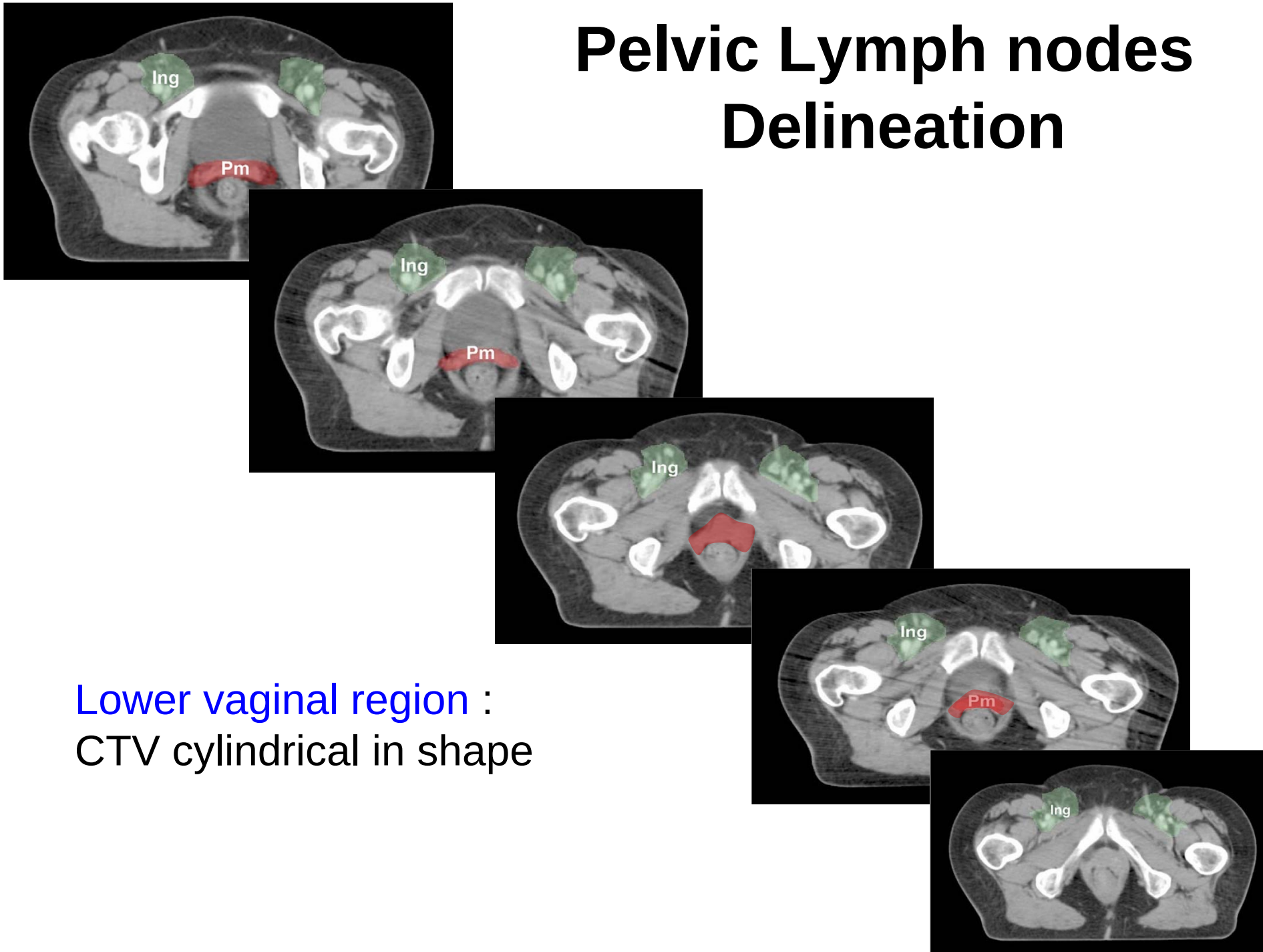
Pelvic Lymph nodes Delineation





Ext iliac Nodal CTV terminate at
-Level of superior aspect of femoral head
-Translation point of Ext iliac vein from post to medial position to femoral A.

Pelvic Lymph nodes Delineation



Lower vaginal region :
CTV cylindrical in shape

Normal tissue contouring (OAR)

- No consensus among experts
- Normal tissue contoured in most patients

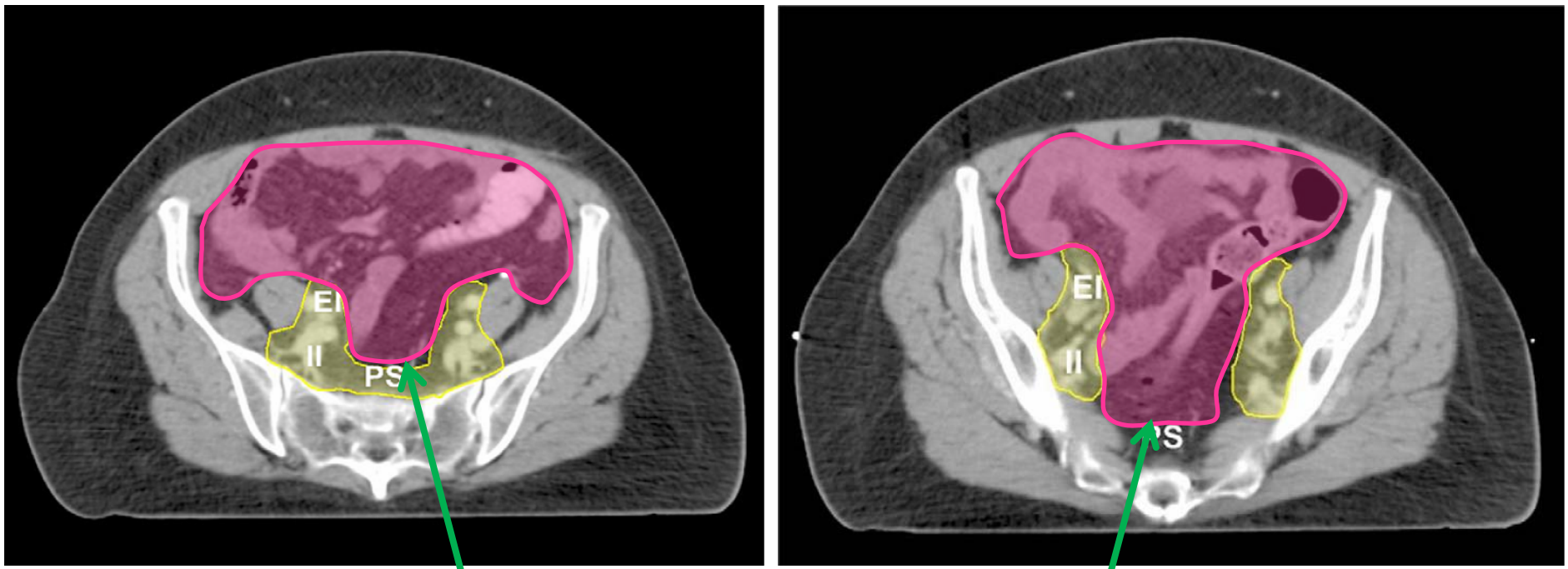
Small bowel, rectum, bladder

- In patients receiving chemotherapy with radiotherapy bone marrow may be included
- Femoral heads esp in pelvic-inguinal RT,
- Kidneys and Liver in more comprehensive field

Normal tissue contouring (contd..)

- Be consistent in delineation: it helps in DVH interpretation
- Bladder: Outer wall
- Rectum: Outer wall: From recto-sigmoid junc. to just above anal verge or upper limit of anal canal
- Small bowel : Outer most loops; colon included in “small bowel” above recto-sigmoid junction
- Bone / Bone Marrow: outer Iliac crest/ Intra-medullary canal of crest ± Lumbo-sacral spine

Normal tissue contouring (contd..)



Dip small bowel contour into concavity of CTV / sacral hollow

PTV definition

- Margins to account for

✓ Uncertainties in patient positioning and alignment at daily treatment

✓ Physiological changes in size, shape and position of Organ at risk as well as tumor during course of treatment

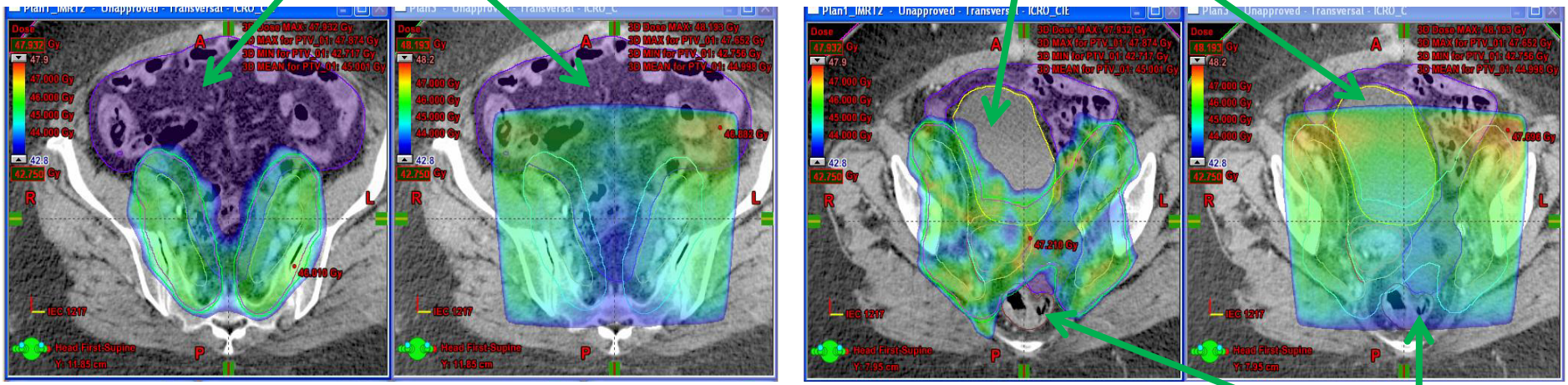
✓ Avoid contouring the PTV directly. CTV-PTV is a 3-D expansion

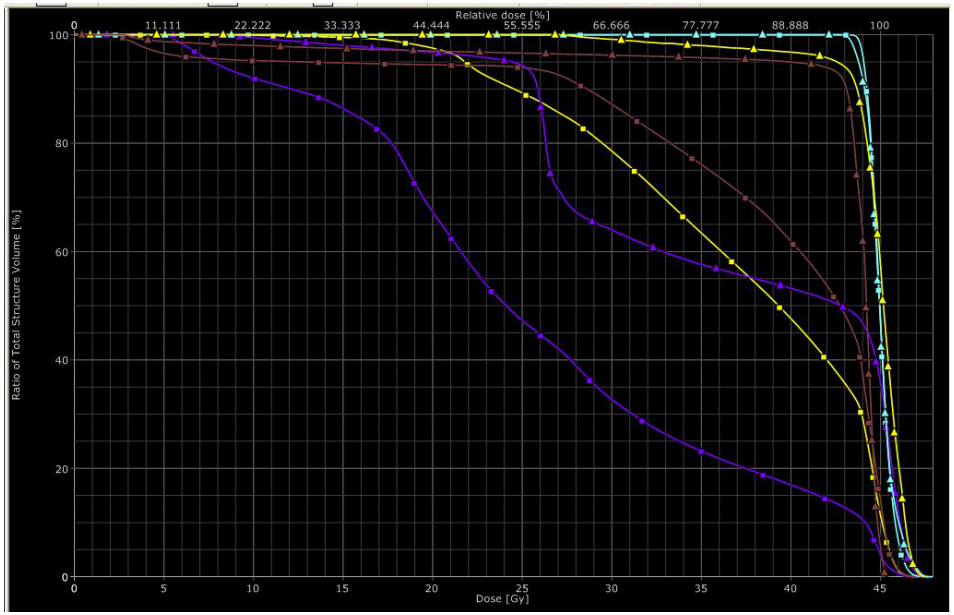
IMRT vs. 4 field box Planning

Dose : 45 Gy @ 1.8Gy/Fraction

Colon

Urinary bladder





Rectum

IMRT: Planning studies

Decrease volume receiving prescription dose

Authors	Bowel	Bladder	Rectum
Roeske	↓50%	↓ 23%	↓ 23%
Ahamad	↓ 40-63%*	NS	NS
Chen	↓ 70%	↓ **	↓ **
Selvaraj	↓ 52%***	↓ 36%***	↓ 66%***

*dependent on PTV expansion used
**data not shown
***reduction in percent volume receiving 30 Gy or higher

Roeske et al. *Int J Radiat Oncol Biol Phys* 2000;48:1613
Ahamad et al. *Int J Radiat Oncol Biol Phys* 2002;54:42
Chen et al. *Int JRadiat Oncol Biol Phys* 2001;51:332

Clinical outcome studies

Post operative Cervix					
Authors	**N**	**Stage**	**Median FU**	**DFS**	**Pelvic Control**
Kochanski	18	I-II (N+)	21m	79% 3yr	94%
Chen	33	I-II (N+)	35m	NS	93%

Significant decrease in both acute and chronic GI, GU related toxicities

Kochanski et al., IJROBP 2005; 63:214
Chen et al., IJROBP 2001; 51: 332

Issues that need to be addressed……

- CTV delineation
- Optimal CTV-PTV margin
- Organ motion issues
- Which normal tissues should be avoided?
- Presently CT used, integration of other novel imaging (MRI, PET, MRS, NanoMRI) for better target and normal tissues delineation

Thank You