

# Neoadjuvan ve Postoperatif Radyoterapide Hedef Hacim

---

Dr.Duygu Sezen

# Sunum Akışı

- \*Kılavuzlar
- \*İmmobilizasyon/ Simulasyon
- \*Lenfatik Dağılım/ Anatomik Belirteçler
  
- \*Neoadjuvan Radyoterapi
  - Hacimler
  - Doz
- \*Postoperatif Radyoterapi

# Kılavuzlar



CLINICAL I

DEI

FRED

Departments

Purp  
toxic  
targe  
locat  
of th  
Meth  
recu  
the r  
of th  
Resu  
lymp  
the i  
The  
Conc  
recu  
inclu  
the p  
the l  
© 20

Int. J. Radiation Oncology Biol. Phys., Vol. 65, No. 4, pp. 1129–1142, 2006  
Copyright © 2006 Elsevier Inc.  
Printed in the USA. All rights reserved.

Int. J. Radiation Oncology Biol. Phys., Vol. 74, No. 2, pp. 824–830, 2009

Int. J. Radiation Oncology Biol. Phys., Vol. 79, No. 2, pp. 481–489, 2011



## CLINICAL INVESTIGATION

## CLINICAL INVESTIGATION

### ELECTROANORECTAL

ROBERT J.  
ROSS A. ABR  
LEONARDI

\*Department of I  
Maryland Medic  
§Department of R  
Oncology, May  
#Department of R  
Radiation

### PROSPECTIVE RANDOMIZED CONSENSUS ATLAS IMP DELINEATION

CLIFTON D. FULLER  
COEN R. N. RASCH, M.D., PH  
PAUL OKUNIEFF, M.D.,<sup>¶</sup> WILLI  
CARLO G. N. DEMANDANTE  
ALAN W. KATZ, M.D.,<sup>¶</sup>  
DANIEL T. CHANG, M.  
KARYN A. GOODMAN, M.D.,<sup>|||</sup>  
OF THE RADIATION

\*Department of Radiation Oncology at  
Health Science Center at San Antonio,  
Portland, OR; <sup>§</sup>Department of Radiot  
Netherlands; <sup>¶</sup>Department of Radiat  
University of Washington Medical Cent  
Base, San Antonio, TX; <sup>\*\*</sup>Department o  
Oncology, Brooke Army Medical Ce  
Carolina, Charleston, SC; <sup>§§</sup>Departm  
Oncology, University of Kansas, Kan  
Oncology, Memorial Sloan-Kettering Cancer Center, New York, NY; <sup>##</sup>Department o  
Center, and Massachusetts General Hospital Cancer C

Clinical Investigation: Gastroin

### Australasian Gastro Contouring Atlas and Intensity-Modulate

Michael Ng, M.B.B.S. (Hons)  
Trevor Leong, M.B.B.S., M.  
Sarat Chander, M.B.B.S., F.  
Andrew Kneebone, M.B.B.S.  
Susan Carroll, M.B.B.S., F.R  
Samuel Ngan, M.B.B.S., F.R

<sup>\*</sup>Radiation Oncology Victoria, Victoria  
Victoria, Australia; <sup>†</sup>Department of Ra  
NSW, Australia; <sup>‡</sup>Department of Radia  
<sup>¶</sup>Department of Radiation Oncology, I  
<sup>|||</sup>University of Melbourne, Australia; a

Received Jun 19, 2011, and in revised form

Radiotherapy and Oncology 120 (2016) 195–201

Contents lists available at ScienceDirect



ELSEVIER

## Radiotherapy and Oncology

journal homepage: [www.thegreenjournal.com](http://www.thegreenjournal.com)



Rectal cancer guidelines

### International consensus guidelines on Clinical Target Volume delineation in rectal cancer

Vincenzo Valentini<sup>a</sup>, Maria Antonietta Gambacorta<sup>a,\*</sup>, Brunella Barbaro<sup>b</sup>, Giuditta Chiloiro<sup>a</sup>, Claudio Coco<sup>c</sup>,  
Prajnan Das<sup>d</sup>, Francesco Fanfani<sup>e</sup>, Ines Joye<sup>f</sup>, Lisa Kachnic<sup>g</sup>, Philippe Maingon<sup>h</sup>, Corrie Marijnen<sup>i</sup>,  
Samuel Ngan<sup>j</sup>, Karin Haustermans<sup>f</sup>

<sup>a</sup>Università Cattolica del Sacro Cuore, Radiation Oncology Department; <sup>b</sup>Università Cattolica del Sacro Cuore, Department of Radiological Sciences; <sup>c</sup>Università Cattolica del Sacro Cuore, Department of Surgical Science, Rome, Italy; <sup>d</sup>University of Texas MD Anderson Cancer Center, Department of Radiation Oncology, Houston, USA; <sup>e</sup>Università G. D'Annunzio, Gynecologic Oncology Department of Medicine and Aging Sciences, Chieti, Italy; <sup>f</sup>KU Leuven – University of Leuven, Department of Oncology and University Hospitals Leuven, Radiation Oncology, Belgium; <sup>g</sup>Boston Medical Center, Department of Radiation Oncology, USA; <sup>h</sup>Centre Georges-François Leclerc, Department of Radiation Oncology, Dijon, France; <sup>i</sup>Leiden University Medical Center, Department of Radiation Oncology, The Netherlands; <sup>j</sup>Peter MacCallum Cancer Centre, Division of Radiation Oncology and Cancer Imaging, Melbourne, Australia



# Kılavuzlar

overview of different subsites described in the available guidelines.

Name	Subsite	Fuller CD <sup>1</sup>	Valentini V <sup>2</sup>	Roels S <sup>8</sup>	Ng M <sup>6</sup>	Myerson RJ <sup>7</sup>
PS	Presacral space (PS)	X	X	X	X	
M	Mesorectum (M)	X	X	X	X	
LLN	Lateral Lymph Nodes (LLN)			X		
IIN	Internal Iliac Nodes (IIN)	X	X		X	
ON	Obturator Nodes (ON)	X	X		X	
EIN	External Iliac Nodes (EIN)	X	X		X	
IRF/IPS	Ischiorectal Fossa (IRF) Inferior Pelvic Subsite (IPS)		X	X	X	
CTV A	CTV A					X
CTV B	CTV B					X
CTV C	CTV C					X

# İmmobilizasyon ve Simulasyon

Mesane dolu rektum boş simüle edilir.

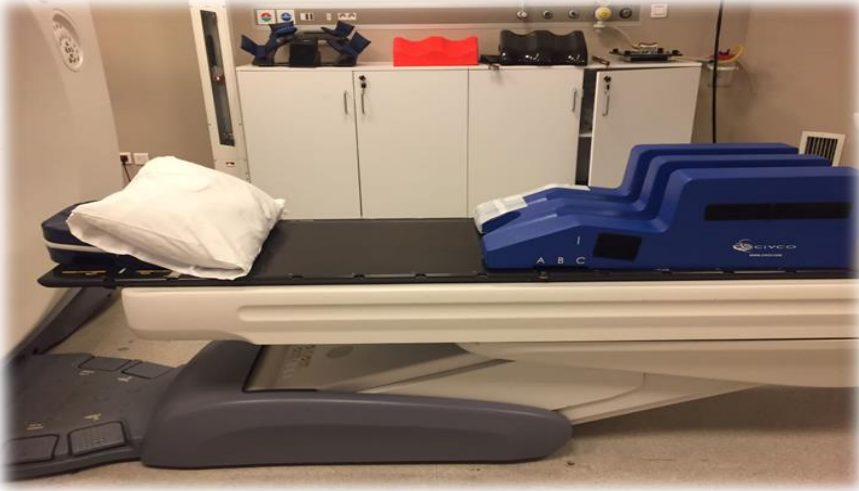
Mesane doluluđu ortalama 200-250 cc olmalıdır (bladderscan)

Supine veya prone simüle edilir.

Prone pozisyonda belly-board kullanımı uygundur.

Anal verge için işaretleyici ve intravenöz/rektal kontrast madde kullanılabilir

# İmmobilizasyon ve Simulasyon



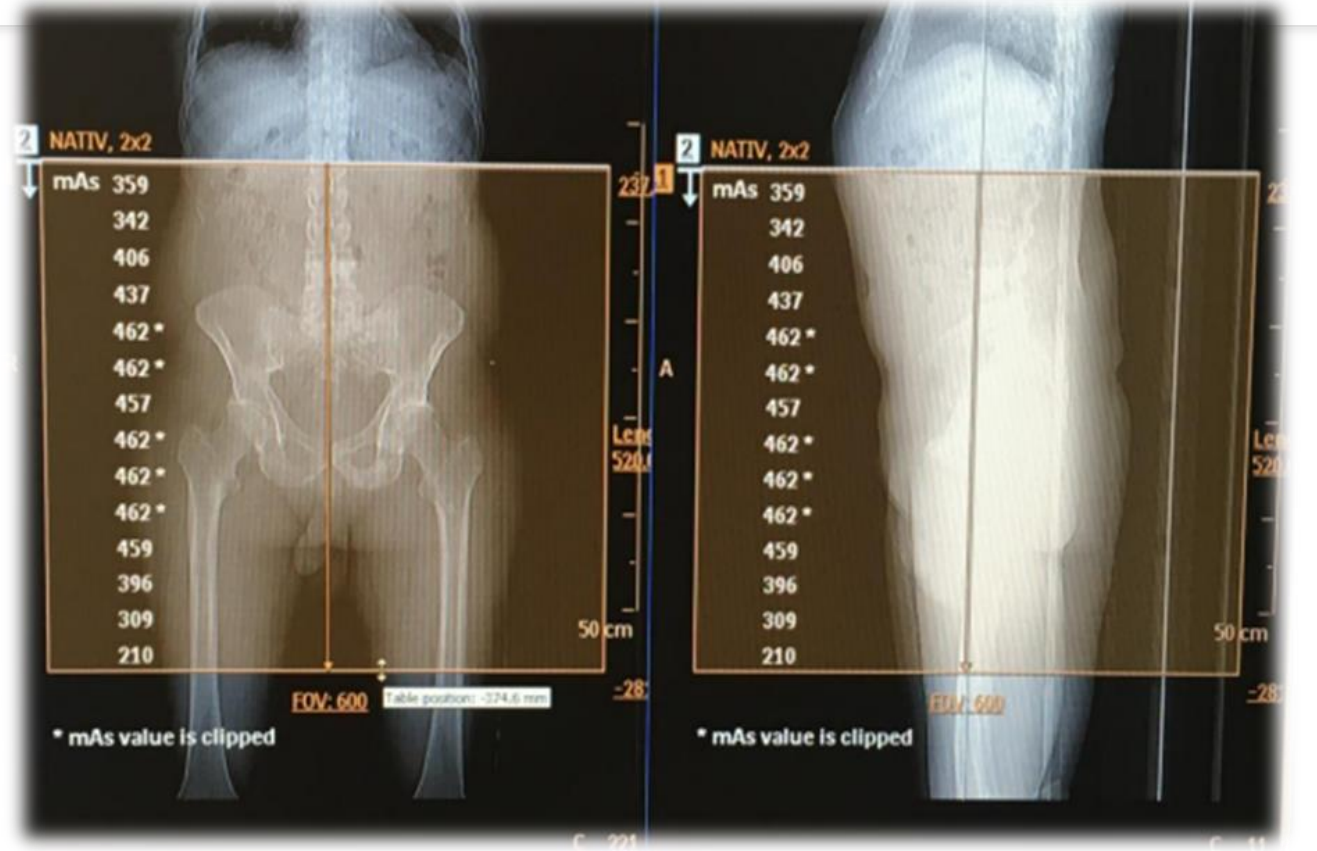
Supine

Prone

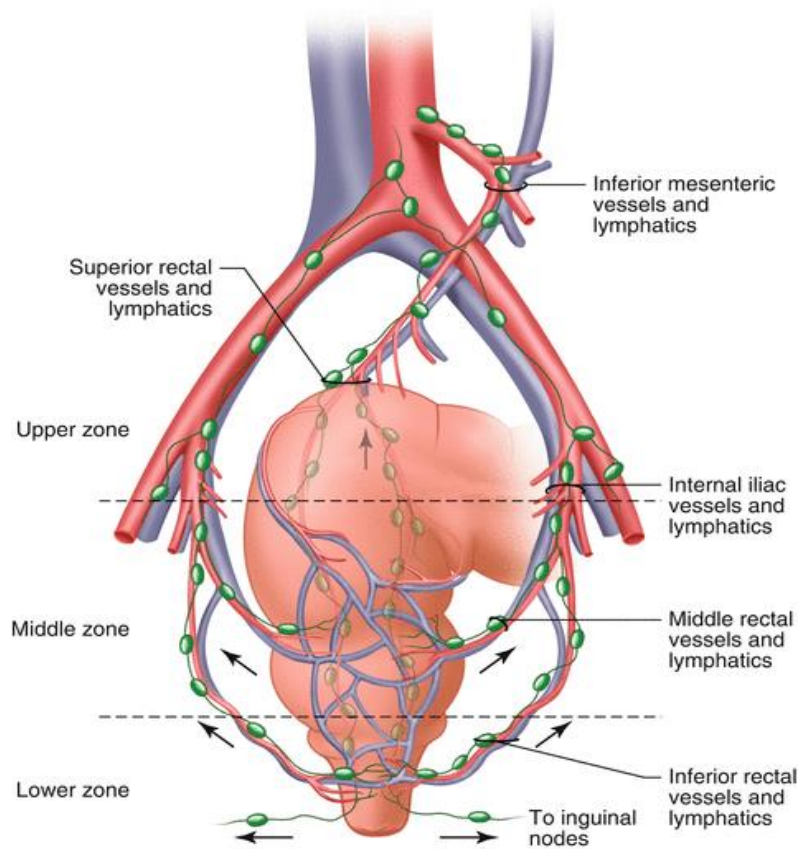


# İmmobilizasyon ve Simulasyon

Tarama L3 seviyesinden femurların ortasına kadar yapılır .  
Gerekli durumlarda bu tarama genişliği arttırılabilir.  
Kesit kalınlığı 2.5-5 mm ile çekilir.

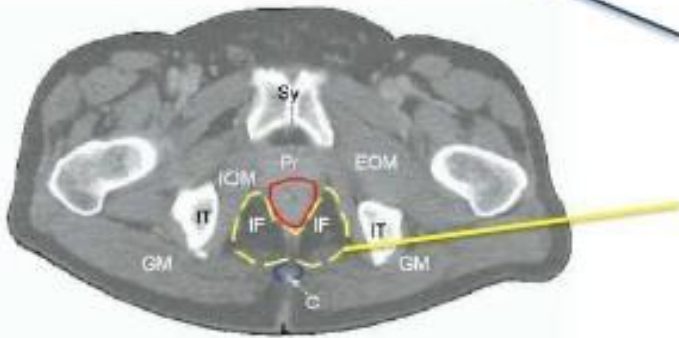
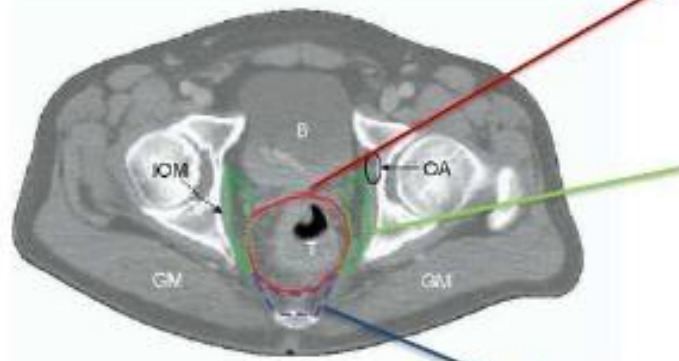


# Lenfatik Dağılım



- **Superior third of rectum** → perirectal, presacral, sigmoidal, and inferior mesenteric nodes
- **Middle third of rectum** → internal iliac nodes
- Tumors extending **below dentate line** → superficial inguinal nodes

# Lenfatik Dağılım



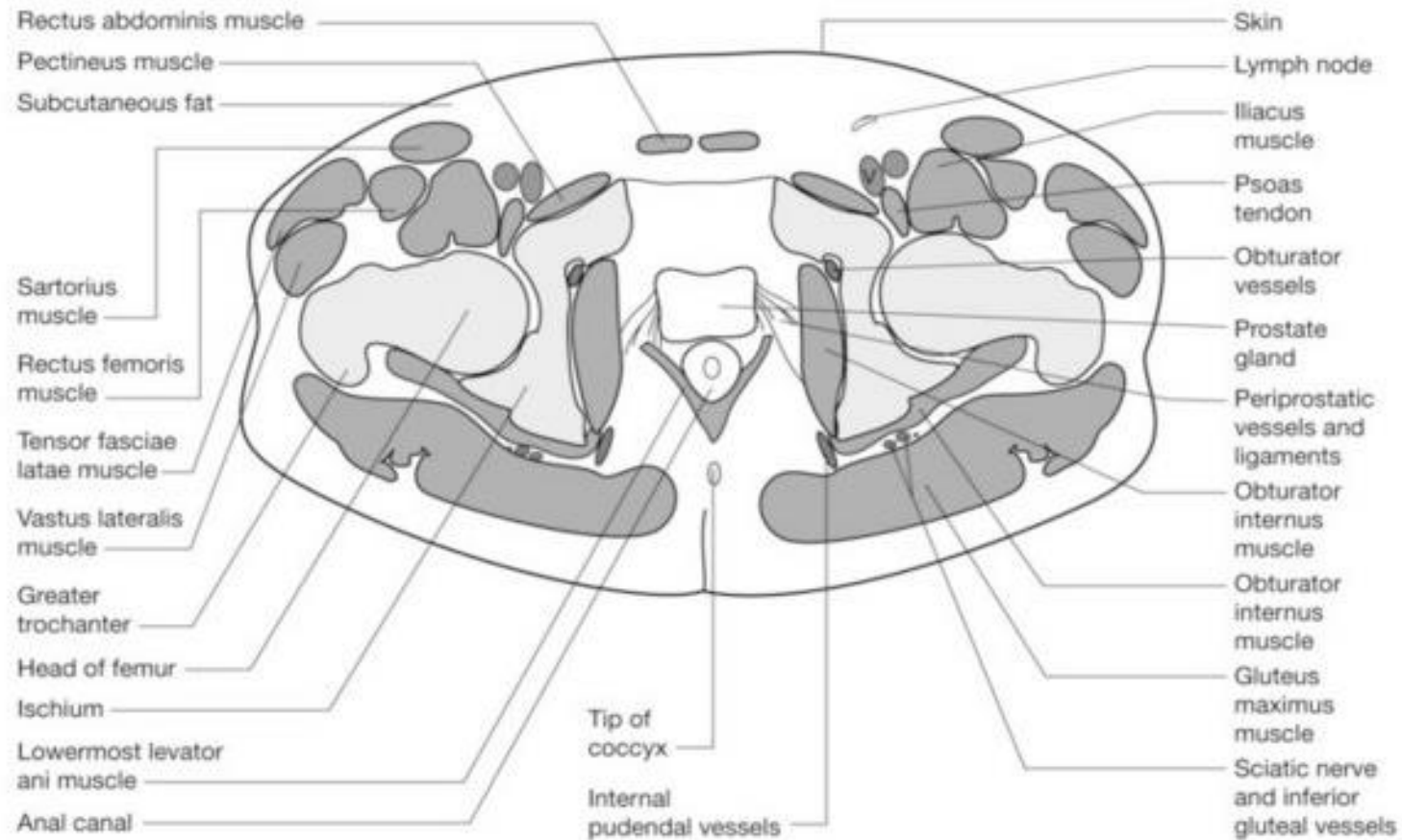
Mesorectal lymph nodes (MLN) :  
46% of all patients  
87% of patients with positive lymph nodes

Risks for Lymph node involvement  
in N+ patients:  
Mesorectal : 87%  
Lateral : 27%  
External iliac : 9%  
Inguinal : 1%

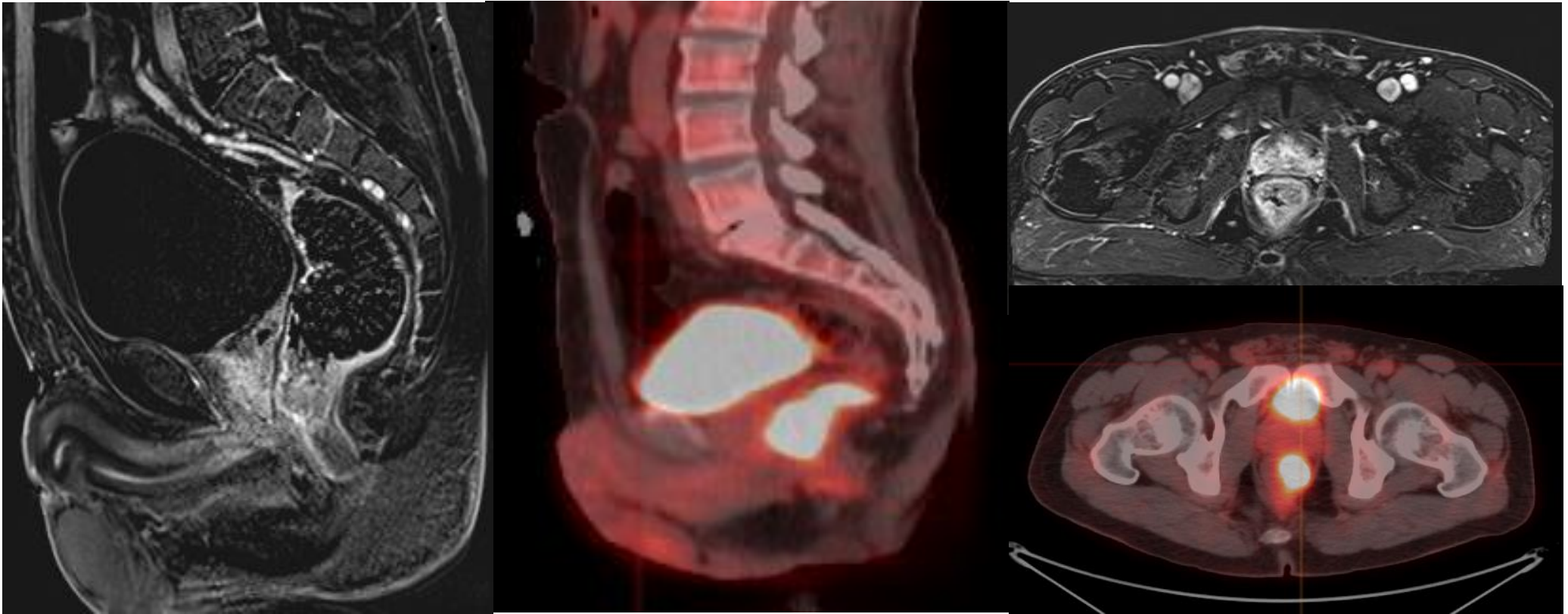
Posterior pelvic subsite (PPS) recurrence :  
22% of all patients

Inferior pelvic subsite (IPS) recurrence:  
4% of all patients  
8% in tumors < 6 cm from anal verge

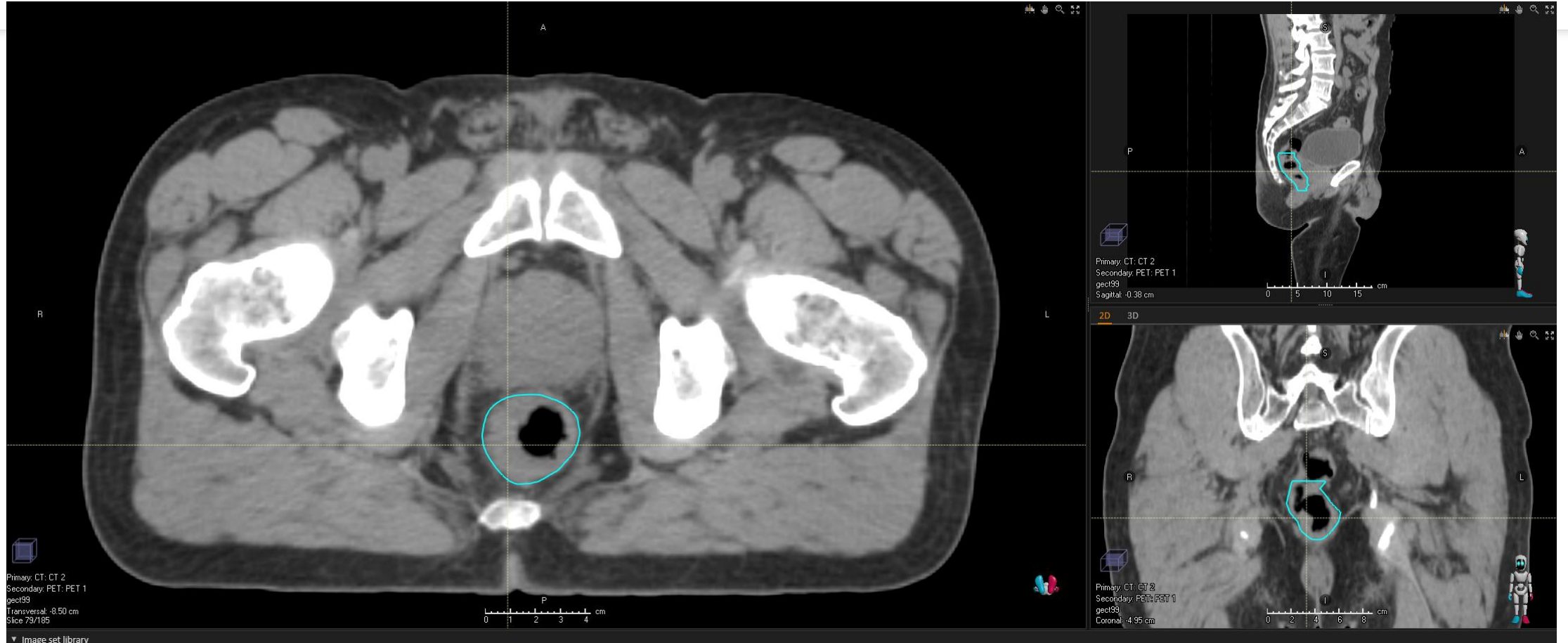
# Anatomik Belirteçler



# Konturlama-Primer Tümör



# Konturlama-Primer Tümör



# Konturlama-Primer Tmr

Tmrn en belirgin grndg yerden bařla

Tanı anı BT, MRG, PET-BT grntleri

Endoskopik bulgular eřlięinde řekillendir

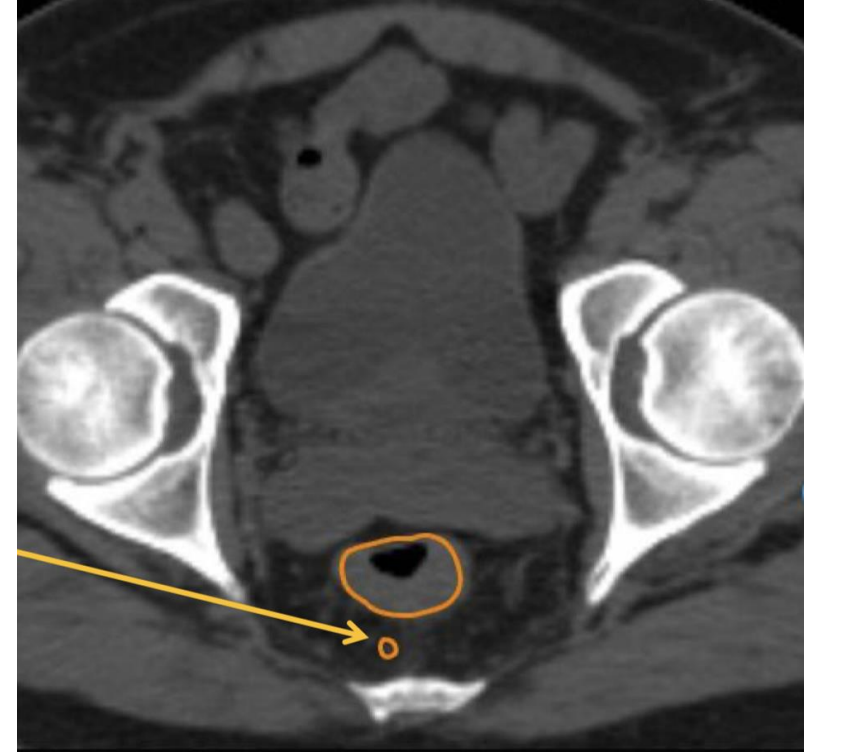
Aksiyel-koronal-sagittal kesitlerde kontrol et

# Konturlama-GTV LN

LAP-Kesitlerde yukarı-aşağı ilerlendiğinde kaybolur  
Vasküler yapı-devamlılık gösterir

Kontrast madde ayrımı kolaylaştırır

MRG görüntülemeleri ile konfirme edilebilir



# Konturlama-CTV

CTVA: Rektum kanserinde mutlaka tedavi edilmesi gereken alanlar  
İnternal iliak, presakral, perirektal

CTVB: Eksternal iliak alan

CTVC: İnguinal nodal alan

\*Olguların büyük kısmında elektif tedavi edilen tek alan → CTVA  
GÜ yapılara uzanım →CTVB  
Perianal uzanım → CTVC

*Recommendation*

*RTOG 2009-2014 Consensus*

# Konturlama-CTVA

	Subsites	Limits	Recommendations
PS	Abdominal	<p><i>Cranial:</i> bifurcation of the aorta in common iliac arteries or 5 mm above the most cranial positive lymph-node</p> <p><i>Caudal:</i> sacral promontory</p> <p><i>Anterior:</i> 1 cm ventral to the lumbar vertebrae</p> <p><i>Posterior:</i> anterior wall of the lumbar vertebrae</p> <p><i>Medial:</i> –</p> <p><i>Lateral:</i> lateral surface of the common iliac vessels</p>	<p>Include it in case of <i>positive lymph nodes</i>.</p>
	Pelvic	<p><i>Cranial:</i> bifurcation of the common iliac arteries into the external and internal iliac artery/sacral promontory</p> <p><i>Caudal:</i> caudal border of the M</p> <p><i>Anterior:</i> 1 cm ventral to the lumbar vertebrae</p> <p><i>Posterior:</i> anterior wall of the lumbar vertebrae</p> <p><i>Medial:</i> –</p> <p><i>Lateral:</i> sacroiliac joints</p>	
M		<p><i>Cranial:</i> bifurcation of the IMA in SA and SRA</p> <p><i>Caudal:</i> insertion of the levator ani muscle into the external sphincter muscles (disappearing of the mesorectal fat around the rectum)</p> <p><i>Anterior</i></p> <p><i>Superior:</i> 7 mm beyond SRA excluding bowel structures</p> <p><i>Mid/inferior:</i> mesorectal fascia, posterior border of the anterior pelvic organs</p> <p><i>Posterior:</i> Anterior surface of the sacrum and coccyx to the level of IRF (including the medial part of the PS)</p> <p><i>Medial:</i> –</p> <p><i>Lateral:</i></p> <p><i>Upper/mid:</i> Mesorectal fascia if visible or medial border of the LLN and EIN</p> <p><i>Lower:</i> medial edge levator ani muscle</p>	<p>Consider anisotropic CTV-PTV margins anteriorly to account for bladder/uterus movement</p>

# Konturlama-CTVA

LLN	Posterior (ex internal iliac nodes)	<p><i>Cranial:</i> Bifurcation of common iliac artery into internal and external iliac arteries</p> <p><i>Caudal:</i> insertion of the levator ani muscle into the external sphincter muscles (pelvic floor)</p> <p><i>Anterior</i></p> <p><i>Upper pelvis:</i> 7 mm around the vessel.</p> <p><i>Mid pelvis:</i> a virtual coronal plane crossing the anterior wall of the ureters when they join the bladder and the posterior aspect of the external iliac vessels cranially</p> <p><i>Inferior pelvis:</i> posterior limit of the obturator fossa</p> <p><i>Posterior:</i> Lateral edge of the sacro-iliac joint</p> <p><i>Medial:</i></p> <p><i>Upper:</i> Above the M add 7 mm around the vessel, excluding normal anatomic structures</p> <p><i>Mid/lower:</i> Mesorectal fascia, pelvic organs</p> <p><i>Lateral</i></p> <p><i>Upper:</i> iliopsoas, pelvic bones</p> <p><i>Mid-lower:</i> medial edge of the pelvic wall muscles (pyriform and internal obturator muscles)</p>
	Anterior (ex obturator nodes)	<p><i>Anterior</i></p> <p><i>Mid pelvis:</i> posterior wall of the EIN</p> <p><i>Low pelvis (when external iliac vessels leave the pelvis):</i> anterior surface of obturator artery</p>

- Cranial limit:*
- (1) In cT3N0, MRF-, the cranial limit may be lowered at the level of the bifurcation of the inferior mesenteric artery in sigmoid artery and superior rectal artery (corresponding to the cranial limit of the M)
  - (2) In all other cases (MRF+ or cT4 or N+) consider the anatomical limit of the bifurcation of the common iliac arteries in to internal iliac and external iliac arteries (corresponding to the cranial limit of the LLN)

- Include in case of:
- (1) positive nodes in the posterior LLN (internal iliac)
  - (2) cT4
  - (3) numerous mesorectal nodes (cN2)

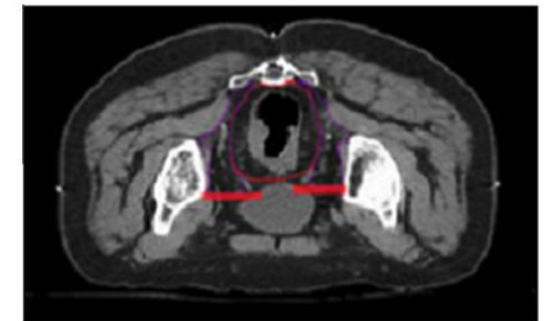
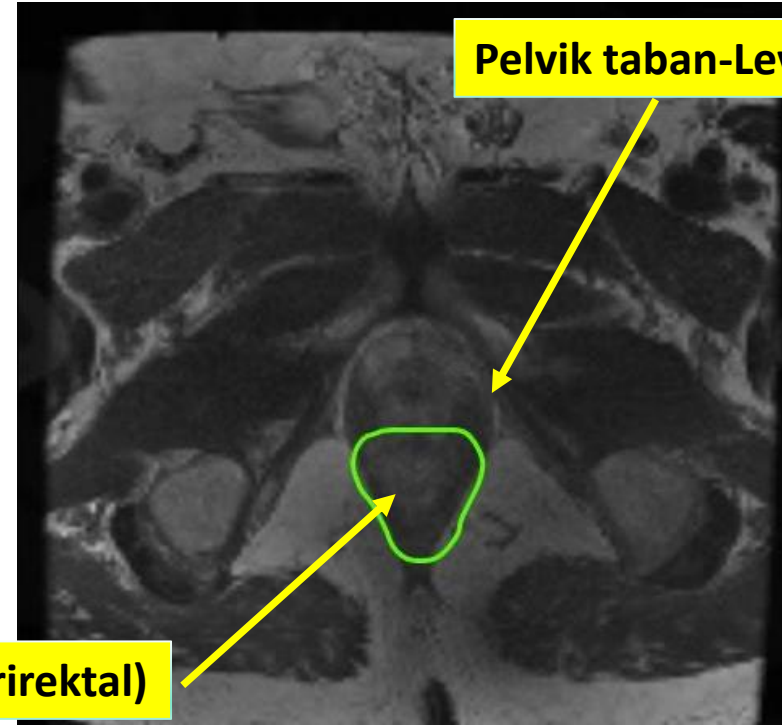
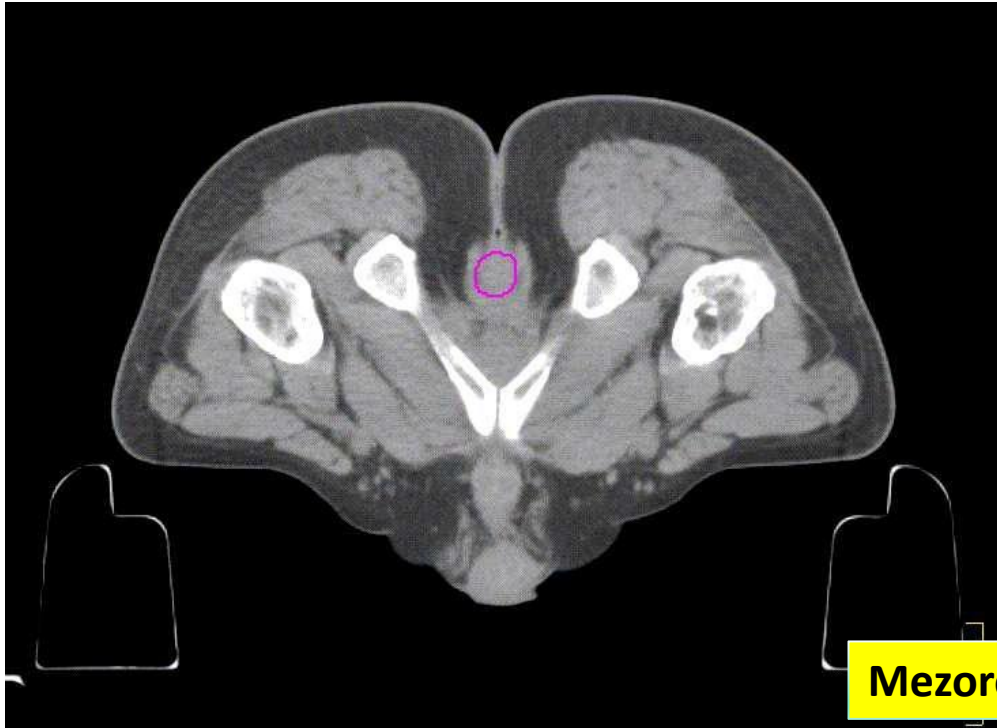


Fig. 1. Anterior border of the posterior lateral node (purple), when the ureters join the bladder (red line).

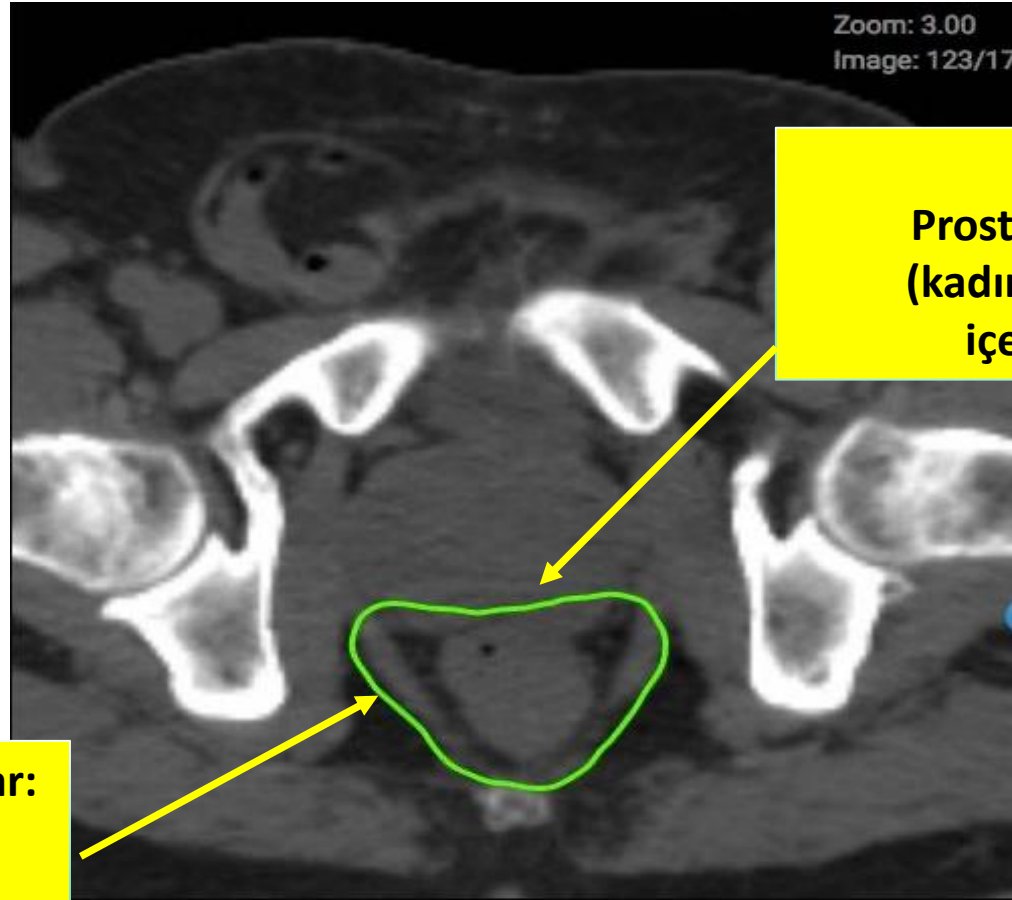
# Konturlama-CTVA

GTV alt sınırından en az 2 cm kaudale inmeli

CTV üst rektum yerleşimli tümörlerde bile en azından pelvik tabana uzanmalı



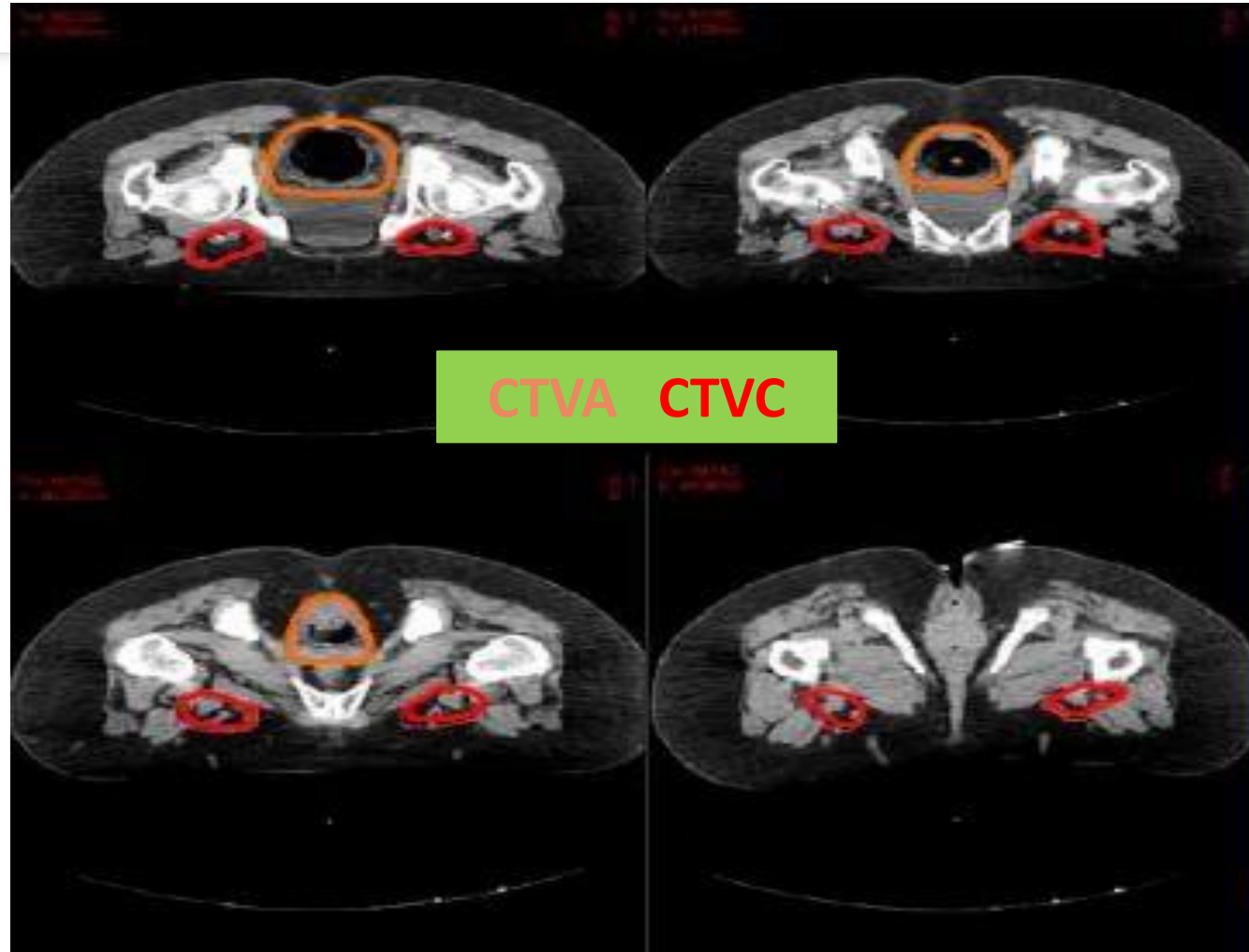
# Konturlama-CTVA



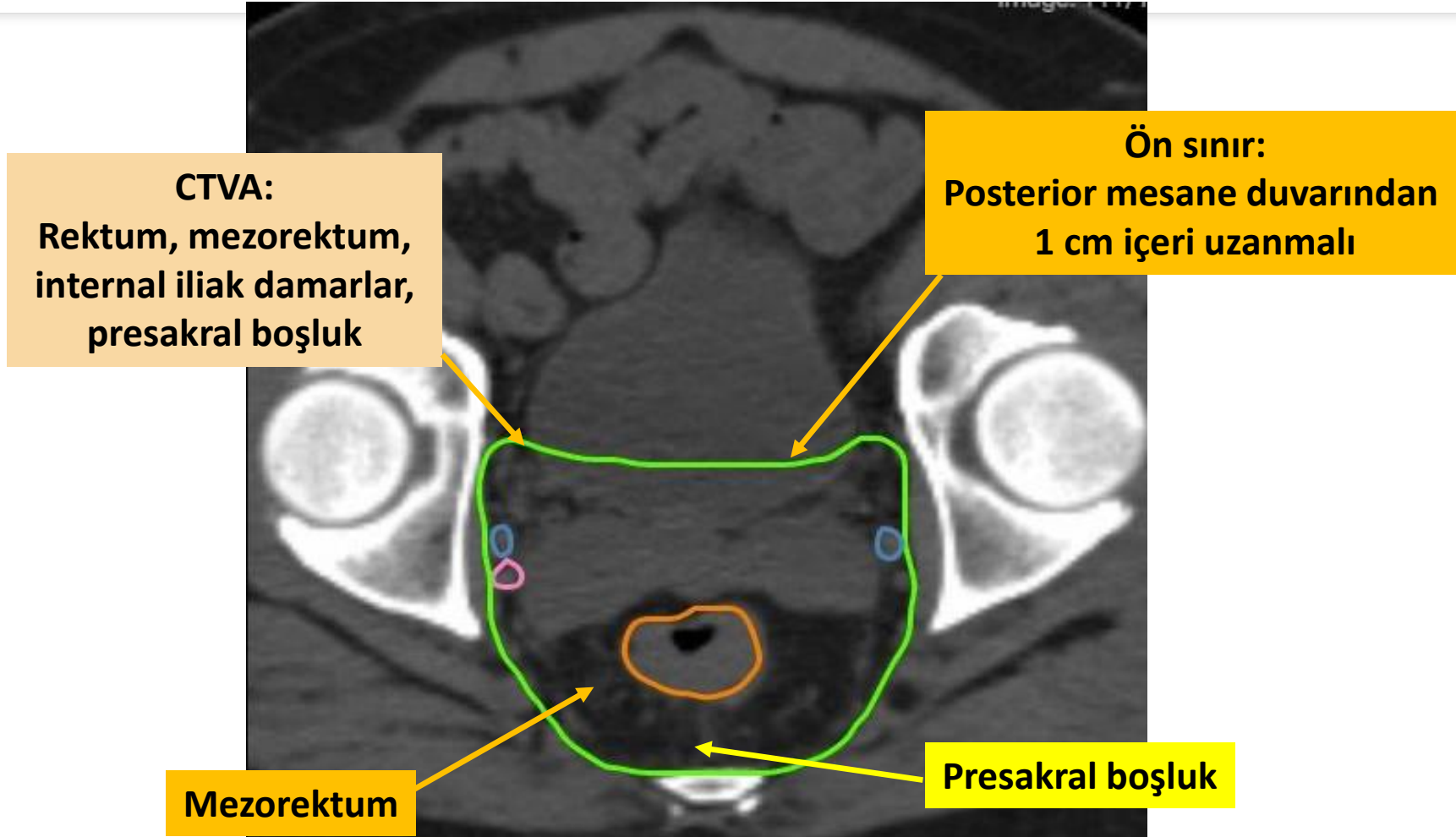
**Ön sınır:**  
Prostat/seminal vezikül  
(kadında vajina/serviks)  
içerisine uzanmalı

**Lateral ve Posterior Sınırlar:**  
Lateral pelvik kaslar  
ya da kemik yapılar

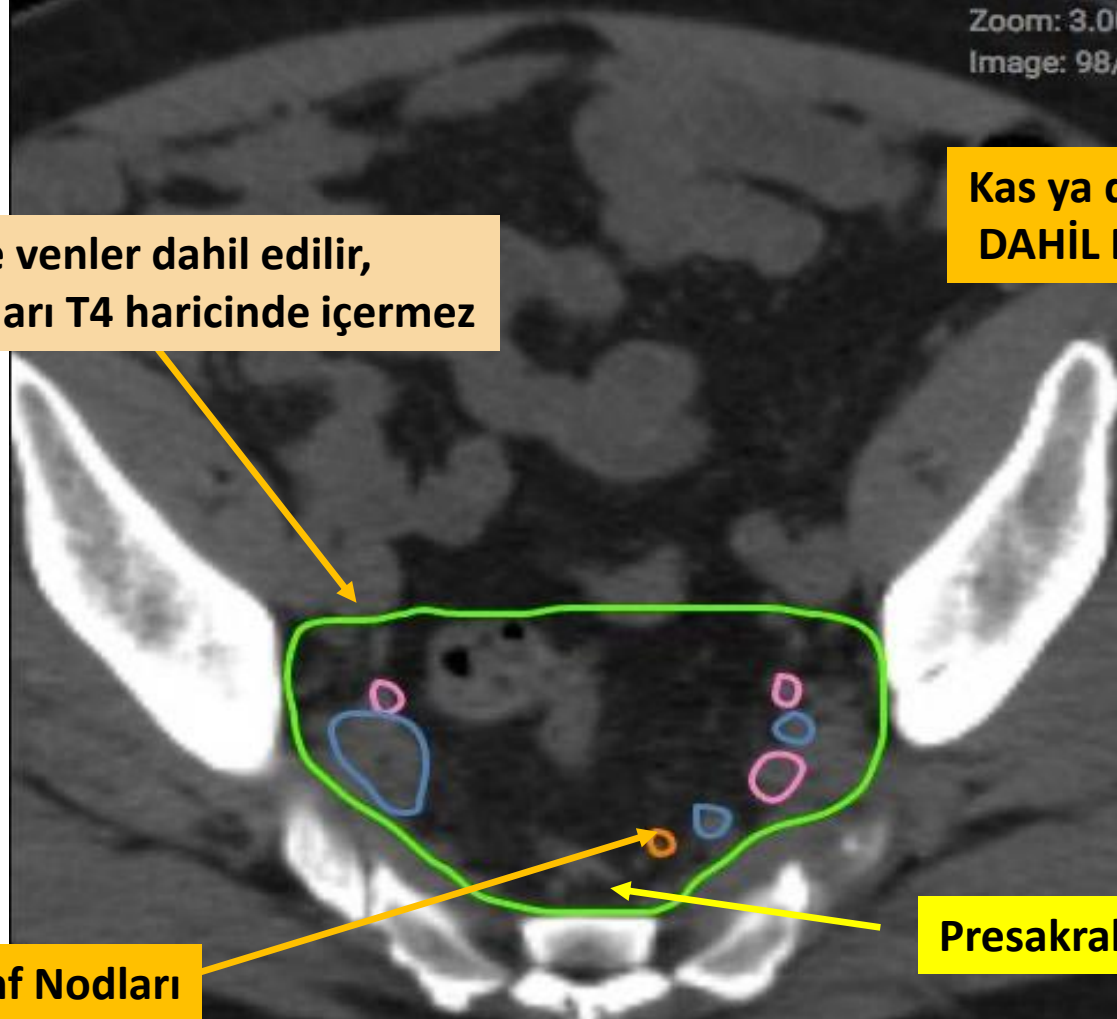
# Konturlama-CTV Alt Pelvis



# Konturlama-CTV Mid-pelvis



# Konturlama-CTV Üst-pelvis



İnternal İliak arter ve venler dahil edilir,  
CTV eksternal iliak damarları T4 haricinde içermez

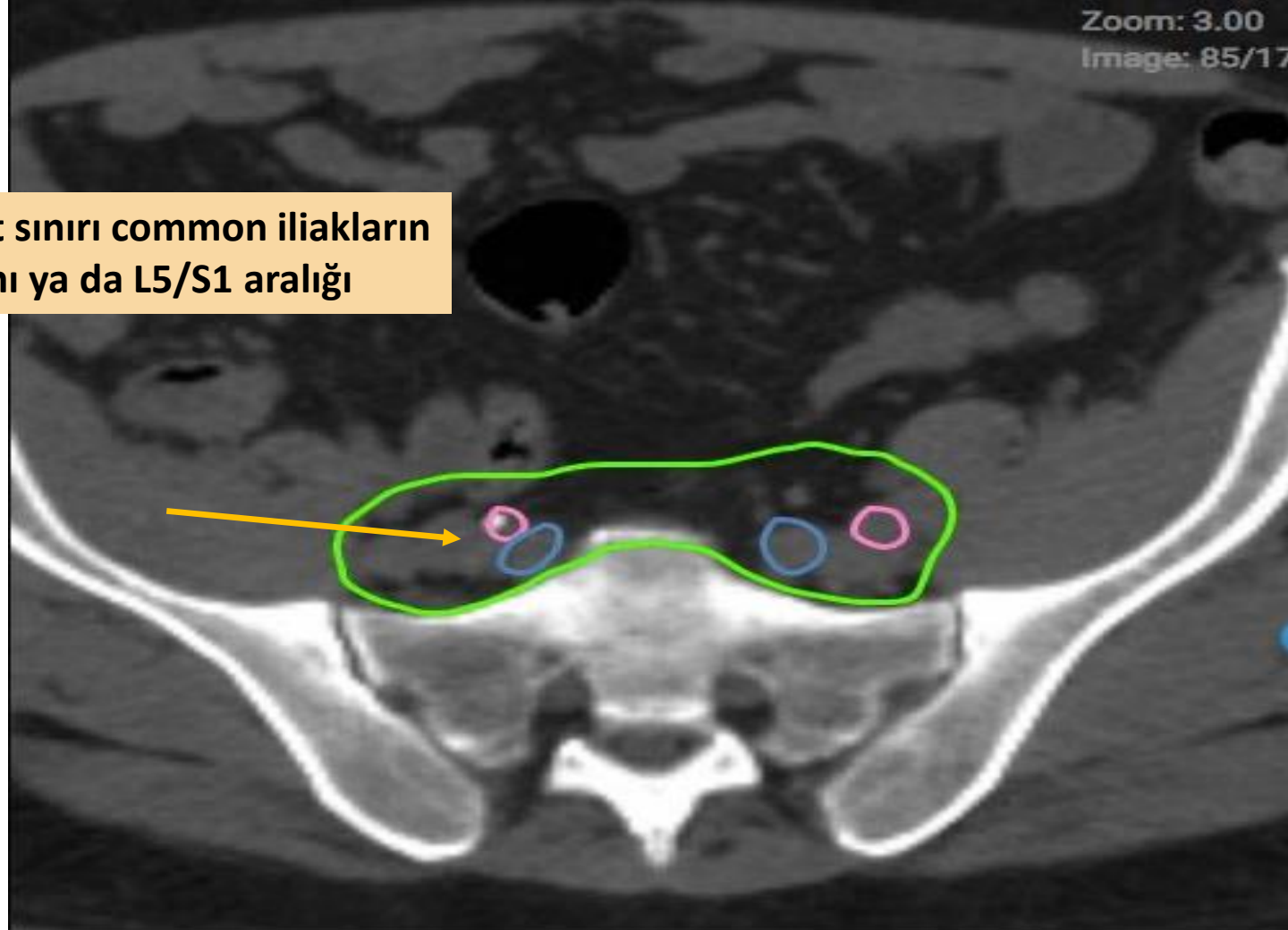
Kas ya da kemik  
DAHİL EDİLMEZ

Lenf Nodları

Presakral boşluk

# Konturlama-CTV Üst Sınır

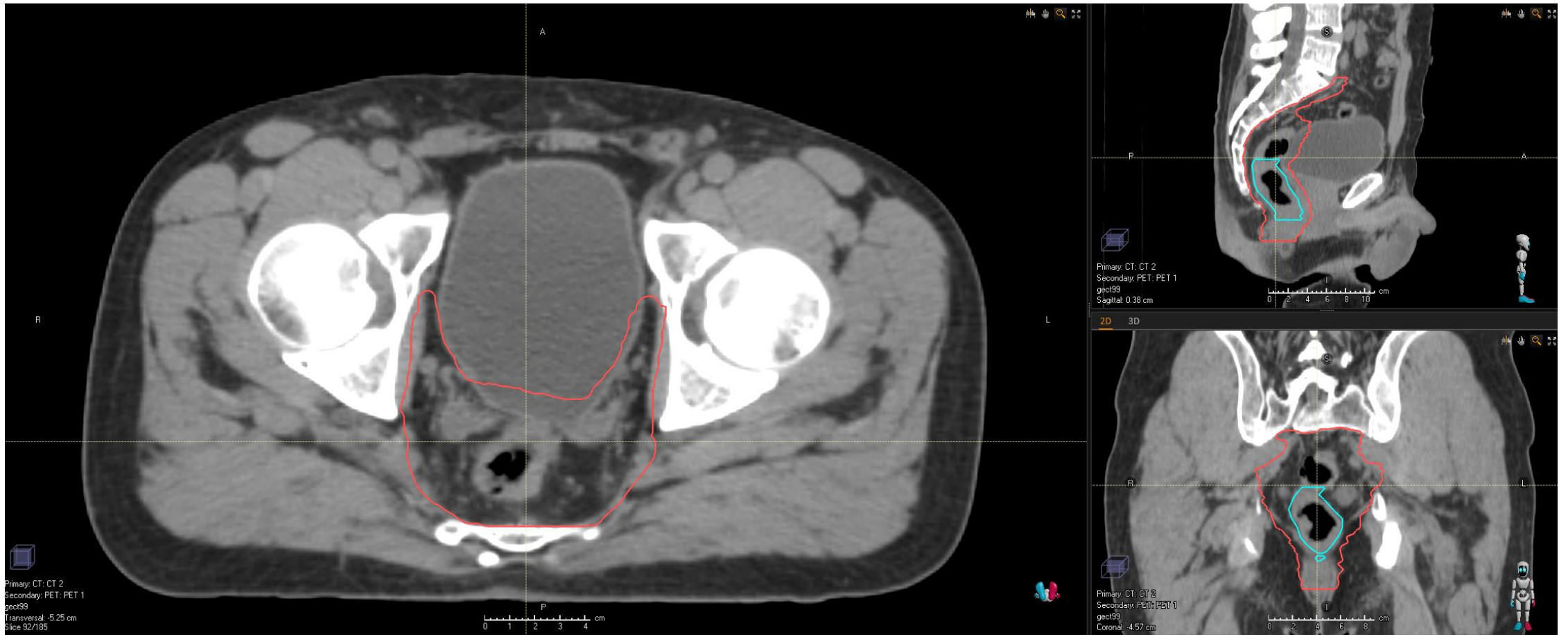
Kontur üst sınırı common iliakların ayrımı ya da L5/S1 aralığı



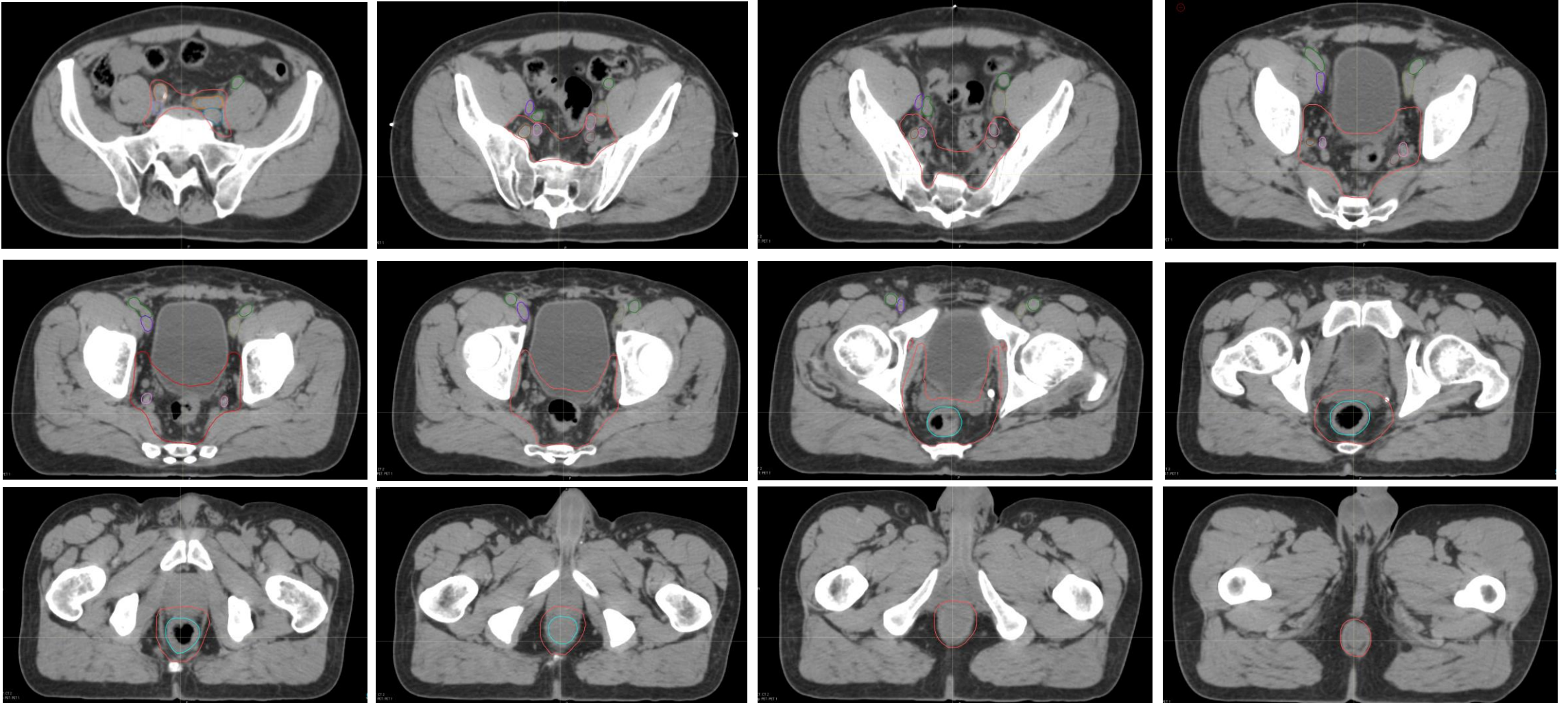
# Konturlama-CTVA



# Konturlama-CTVA



# Konturlama-CTVA



# Konturlama-CTVB

EIN

*Cranial:* bifurcation of common iliac artery into internal and external iliac arteries

*Caudal:* where the deep circumflex vein crosses the external iliac artery. Alternatively (if difficult detection on CT images) between the acetabulum roof and the superior pubic rami

*Anterior:* 0.7 cm anterior to the vessels. 1.5 cm antero-laterally along the iliopsoas muscle to include the antero-lateral nodes

*Posterior:* posterior border of the external iliac vein

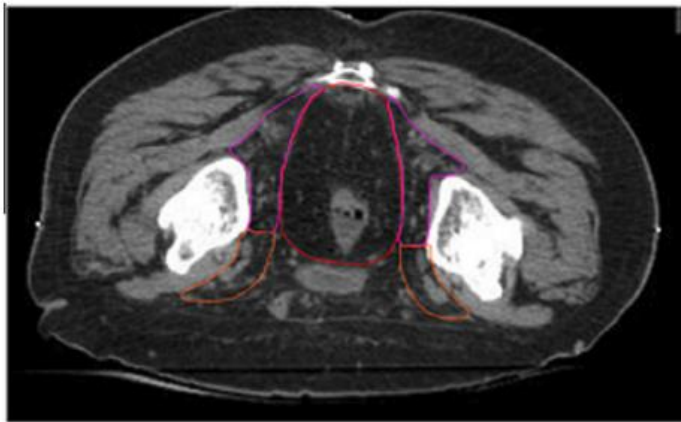
*Medial:* 7 mm medial to the vessel, excluding pelvic organs

*Lateral:* the iliopsoas muscle

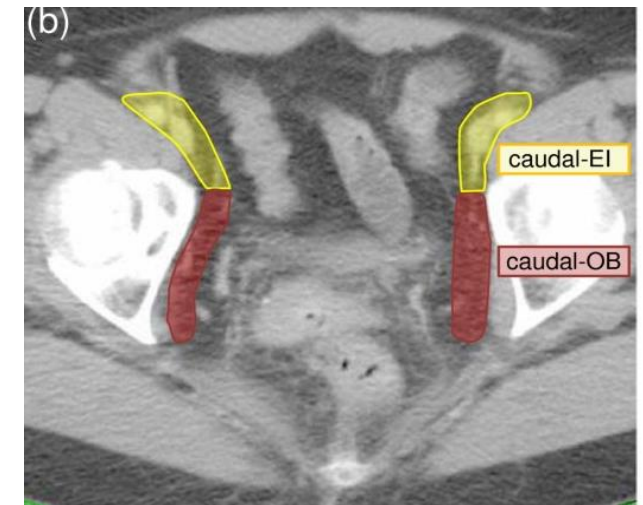
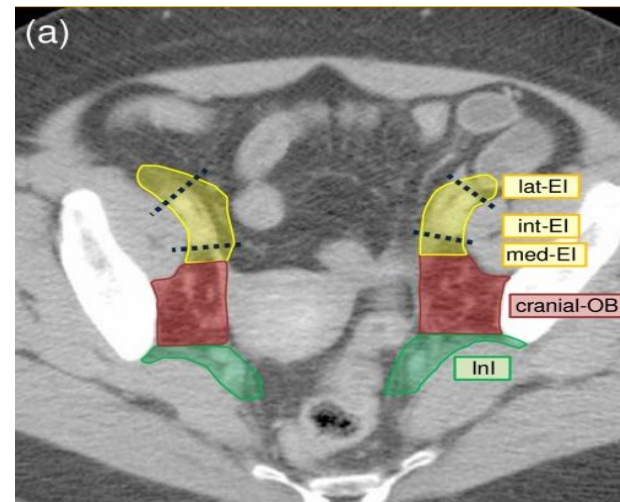
Include in case of:

(1) cT4 tumors

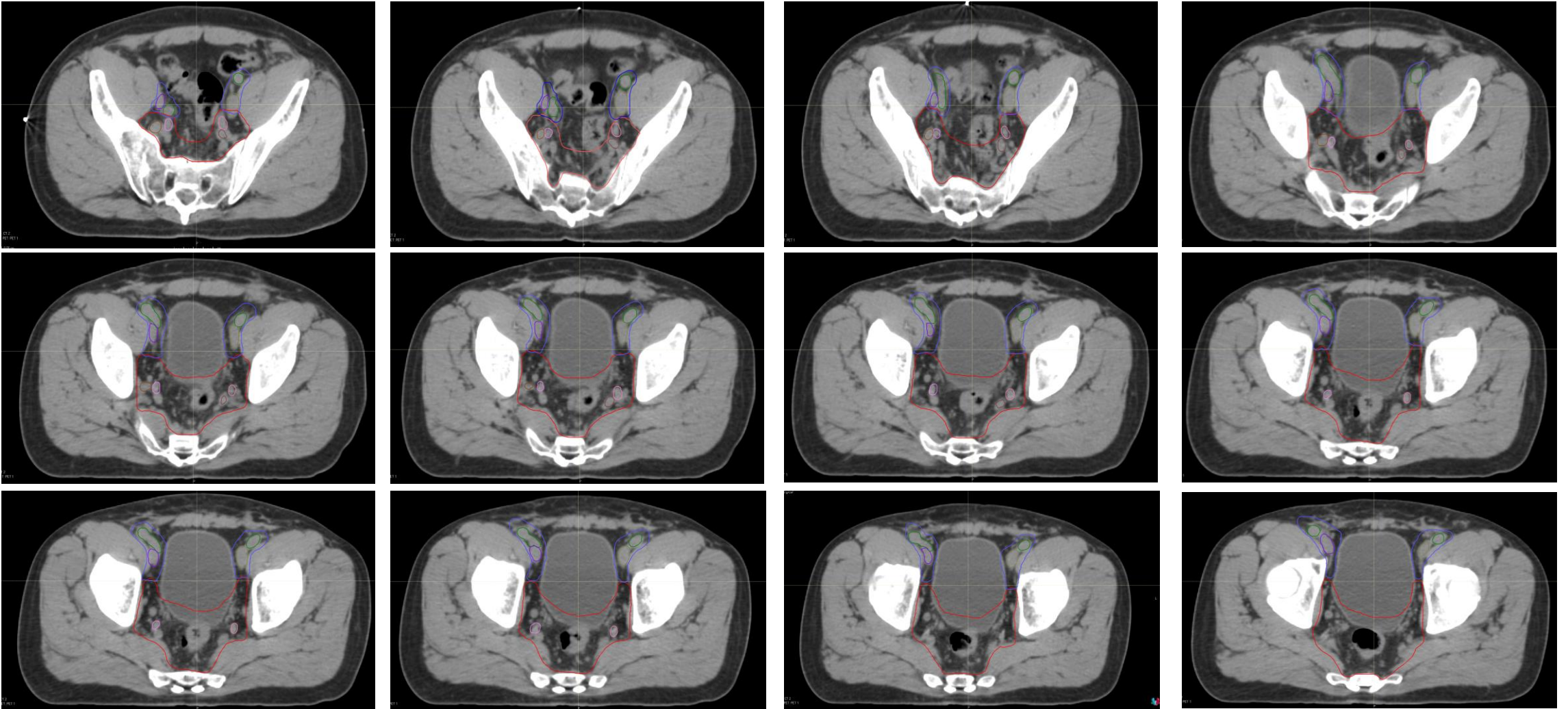
(2) positive anterior LLN (ex obturator)



**Fig. 2.** Caudal border of the external iliac nodes (orange), where the deep circumflex vein crosses the external iliac artery.

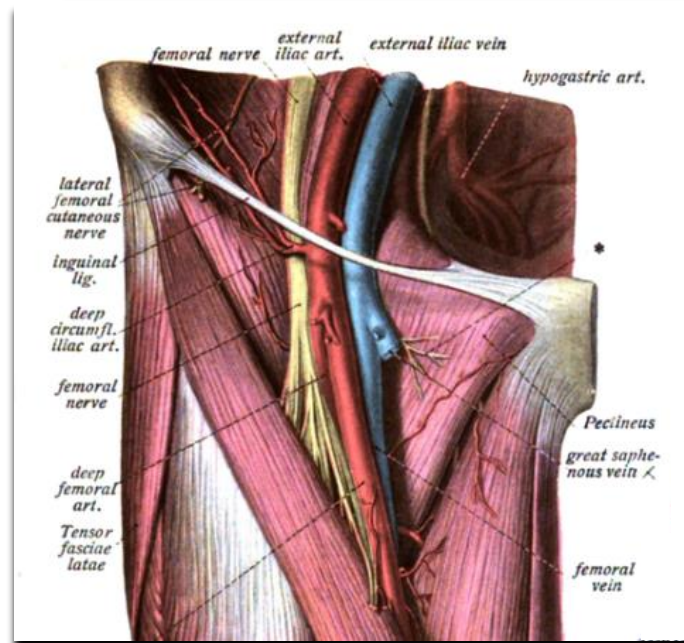


# Konturlama-CTVB



# Konturlama-CTVC

**Caudad extent of elective target volumes:** The group recommended that the caudad extent of the inguinal region (CTVC) should be 2 cm caudad to the saphenous/femoral junction. The transition between inguinal and external iliac regions (CTVC to CTVB) is somewhat arbitrary, but the group recommended the level of the bottom of the internal obturator vessels (approximate boney landmark: upper edge of the superior pubic rami).



# Konturlama-CTVC

IN

*Cranial:* where the deep circumflex vein crosses the external iliac artery. Alternatively (if difficult detection on CT images) between the acetabulum roof and the superior pubic rami

*Caudal:* where the great saphenous vein enters the femoral vein

*Anterior:* at least 20 mm margin around inguinal vessels including any visible lymph nodes or lymphoceles

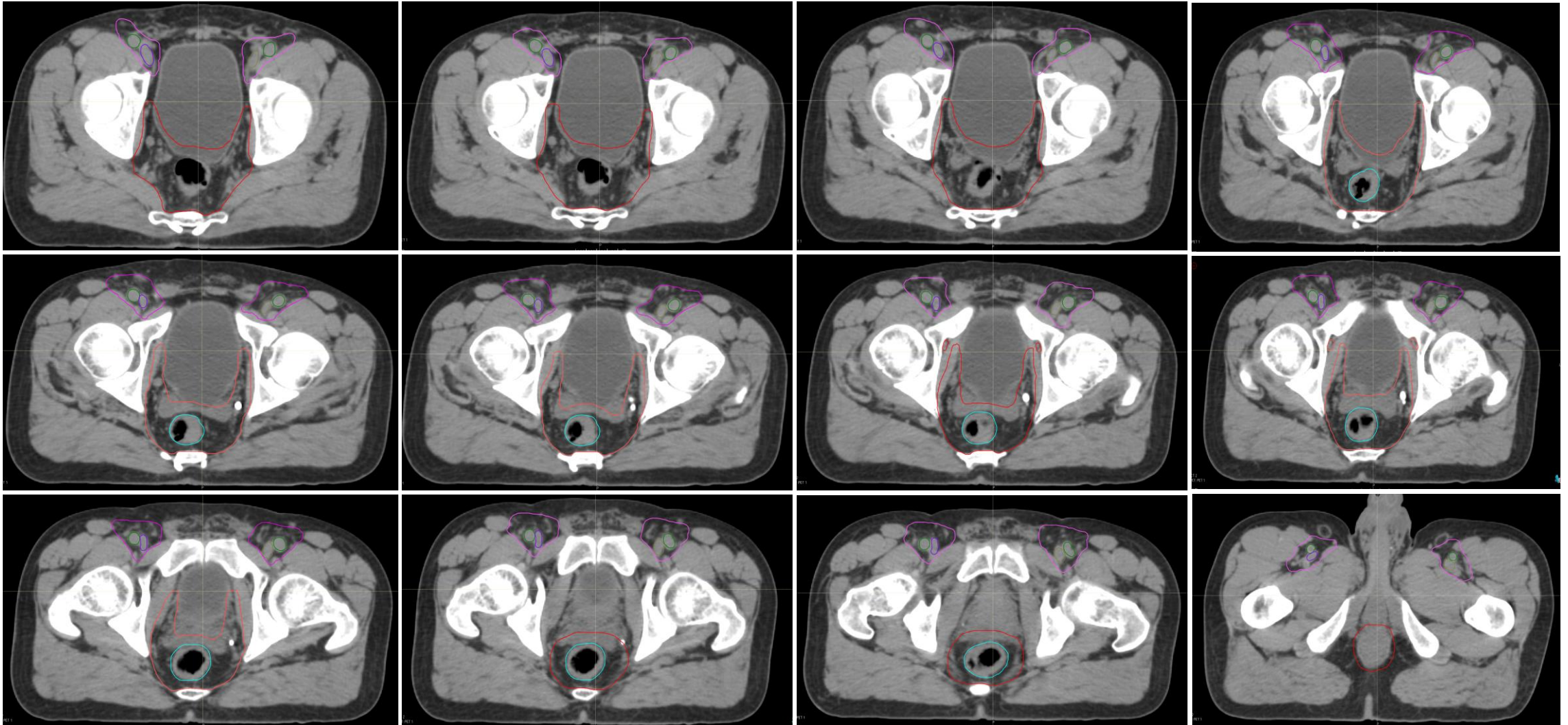
*Posterior:* the femoral triangle formed by iliopsoas, pectineus and abductor longus muscles

*Medial:* 10-20 mm margin around the femoral vessels including any visible lymph nodes or lymphoceles

Include in case of:

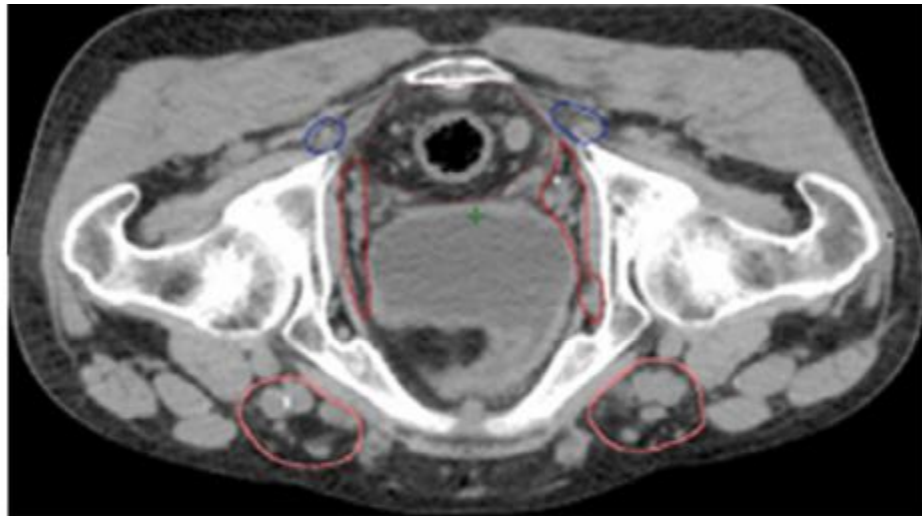
- (1) positive IN
- (2) anal canal/external anal sphincter infiltration
- (3) in cT4 with infiltration of the lower third of the vagina

# Konturlama-CTVC

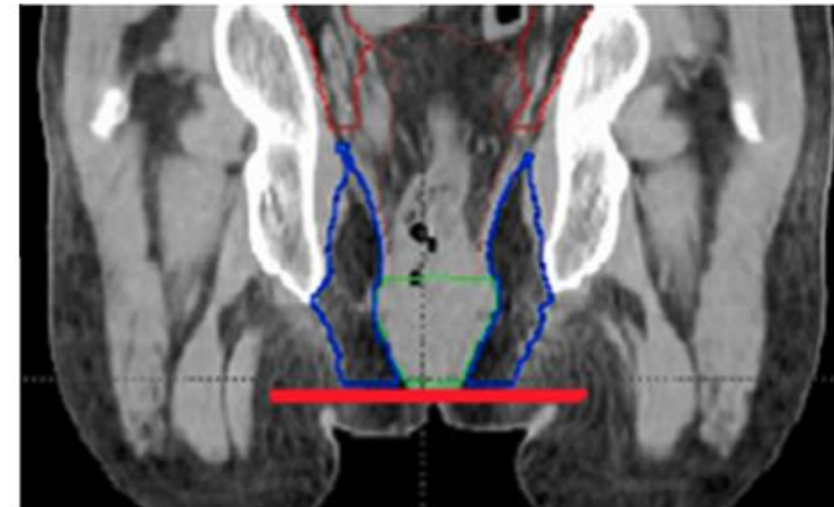


# Konturlama-İskiorektal Fossa

IRF	<i>Cranial:</i> where the inferior pudendal artery leaves the pelvis (ischial tuberosity, internal obturator muscle, gluteus maximus muscle)	Include when there is infiltration of the external anal sphincter or the ischio-rectal fossa
-----	--	--



**Fig. 3.** Cranial border of the ischio-rectal fossa (blue), where the inferior pudendal artery leaves the pelvis going into the Alcock's canal.



**Fig. 4.** Caudal border of the ischio-rectal fossa (blue), at the inferior level of the sphincter complex and the ischial tuberosity.

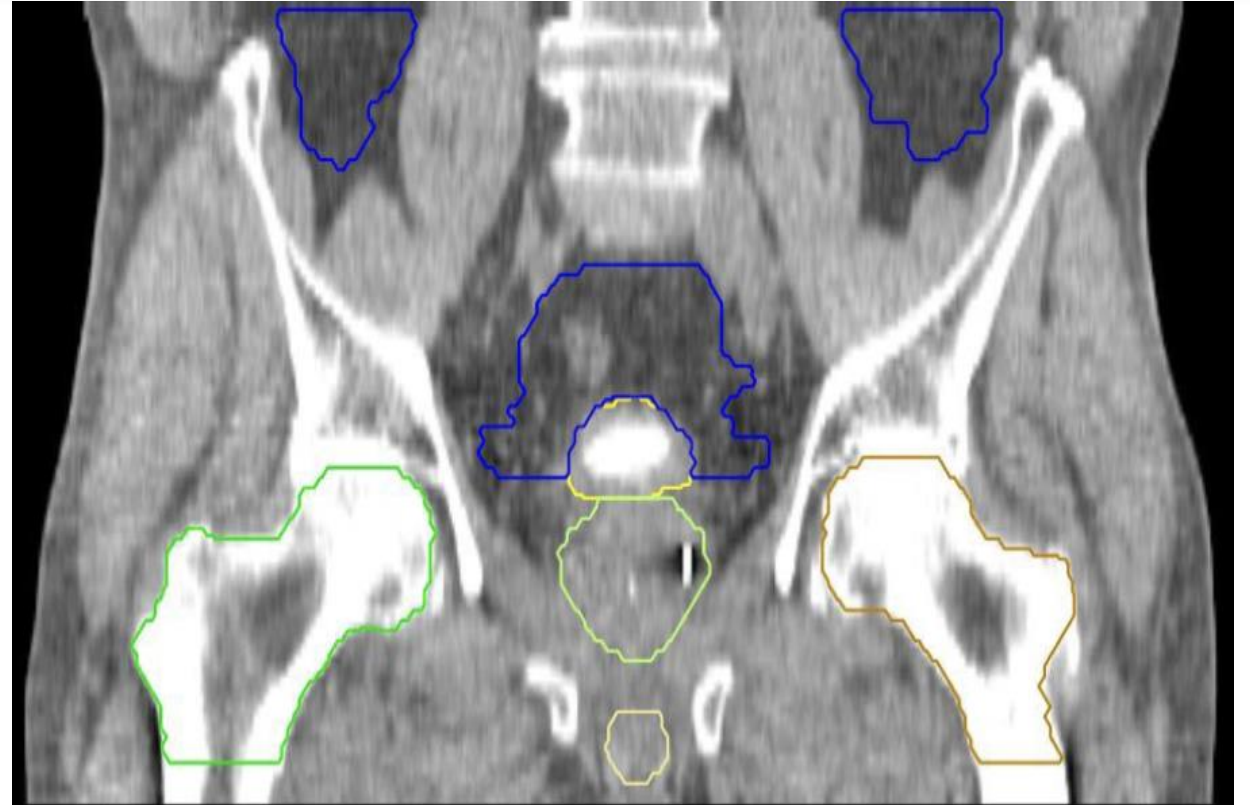
# Konturlama-Boost

## Group Recommendations: Boost Volumes

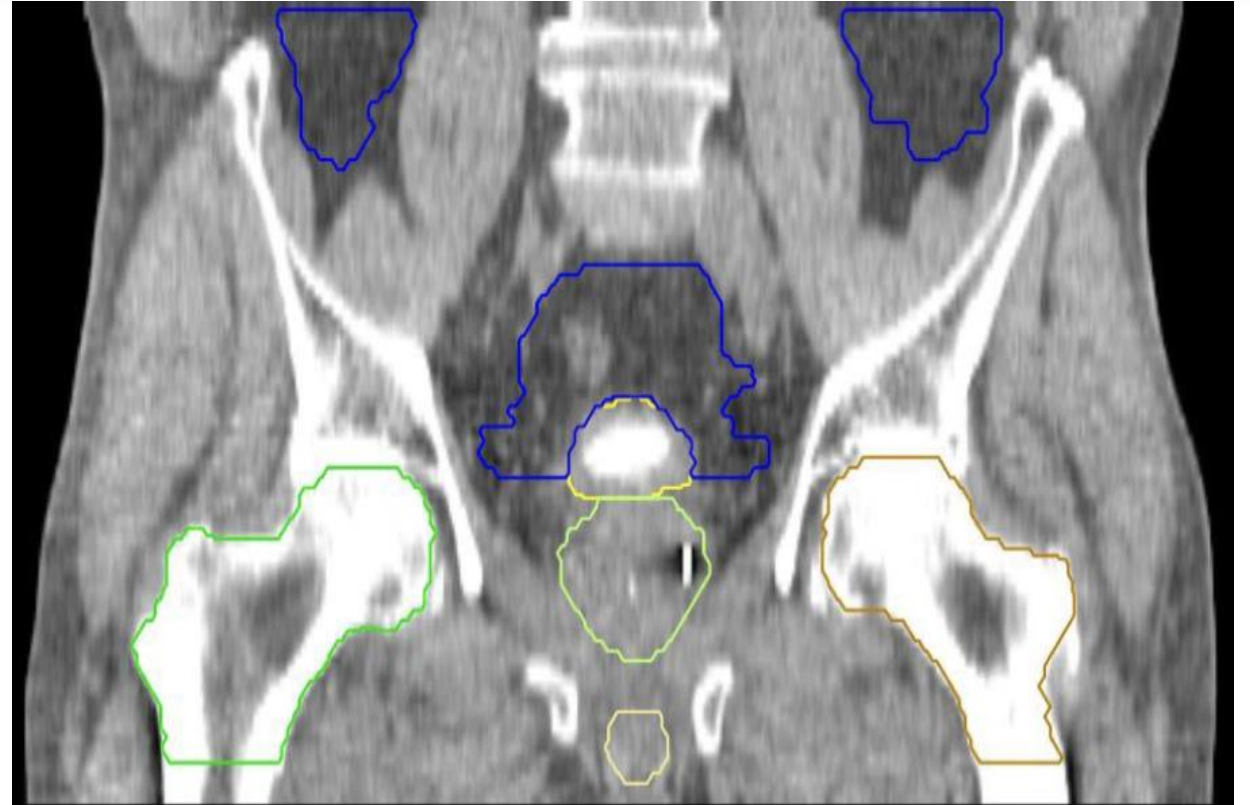
The group opted not to include boost target volumes in this atlas. This was felt to be something that might be defined differently in different protocols, might be affected by evolving imaging capabilities, and vary sharply from one patient to the next. The group did recommend that any boost clinical target volumes extend to entire mesorectum and presacral region at involved levels, including ~2 cm cephalad and caudad in the mesorectum and ~2 cm on gross tumor within the anorectum.



# Konturlama-Normal Dokular



# Konturlama-Normal Dokular



# Konturlama-IMRT/VMAT

www.rcrac.uk



## National rectal cancer intensity-modulated radiotherapy (IMRT) guidance

January 2021

January 2021

### Contents

Foreword	3
1. Introduction	4
2. Pre-radiotherapy investigations	4
3. Indications for radical radiotherapy in rectal cancer	5
Short-course radiotherapy (SRCT)	5
Long-course (chemo)radiotherapy	5
Additional indications	5
4. Therapeutic schema	5
Dose prescription SCRT	5
Dose prescription preoperative LCRT	5
Dose prescription in adjuvant LCRT	5
Concurrent chemoradiotherapy	5
5. Pre-treatment	5
Target volumes	6
Gross tumour volume (GTV)	6
Internal clinical volume (ICTV)	7
Planning target volumes	9
OARs	10
6. Treatment technique and dose calculation	11
7. Dose prescription, target objectives and OAR dose constraints	12
Target objectives	12
Dose constraints for long-course radiotherapy	13
Dose constraints for short-course radiotherapy	14
8. Treatment verification	14
Appendix 1. Suggested rectal filling protocol	16
Appendix 2. Volume definitions	17
Appendix 3. Table detailing ICTV_Elec nodal compartment borders	18
Appendix 4. Step-by-step description of how to create ICTV_Elec	20
Appendix 5. Use of bowel cavity	24
Appendix 6. On-treatment CBCT image troubleshooting	26
Appendix 7. Contributors	31

# Konturlama-IMRT/VMAT

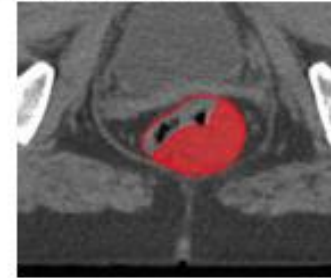
## Gross tumour volume (GTV)

GTVp	Macroscopic primary tumour, areas of adjacent extramural vascular invasion or postoperative macroscopic disease identified on imaging.
GTVn	All nodes involved with tumour.

## Optional GTV volumes

GTVp_Boost	The areas of GTVp the clinician wishes to boost (which may be identical to the GTVp).
GTVn_Boost	All the areas of GTVn the clinician wishes to boost (which may be identical to the GTVn).

- GTVp should include the macroscopic primary tumour, areas of extramural vascular invasion (see Figure 1) or areas of residual macroscopic disease seen on postoperative imaging. If the tumour can be confidently identified, the GTVp can include macroscopic disease only, without the whole lumen. In this situation, lumen, rectal gas or faecal contents should not be included in the volume. However, it is recognised that there will be cases where it is not possible to confidently delineate the tumour alone. In these cases, the whole lumen can be included.



**Figure 1.** Axial CT image showing GTVp (red fill). The red outline of the whole circumference including normal rectum is only used if there is clinical uncertainty of delineating the GTV.

- GTVn is all involved nodes. Involved lymph nodes are defined by the local MDT using all available imaging.
- The GTVp\_Boost is the areas of tumour that would benefit from a boost. The indication and rationale for doing this will vary on an individual patient basis depending on, for example, the extent of disease, planned extent of surgery or whether further treatment will be delivered. As such, this is at the discretion of the treating clinician.
- The GTVn\_Boost is the area of nodes that would benefit from a boost. As above, this will differ in each case and will be at the discretion of the treating clinician.

# Konturlama-IMRT/VMAT

## Internal clinical target volume (ICTV)

ICTV is a CTV that includes a margin for motion according to the American Association of Physicists in Medicine (AAPM) and the International Commission on Radiation Units and Measurements (ICRU).<sup>11,12</sup>

### Required in all cases

ICTVp (primary ICTV)	GTVp + 10 mm in all directions except anteriorly where 15 mm can be considered for tumours that may be more mobile anteriorly (eg, upper rectal tumours above the peritoneal reflection).
ICTVn (any grossly involved nodes)	GTVn + 5 mm in all directions.
ICTV_elec	All elective nodal groups combined.
ICTV_final	ICTVp + ICTVn + ICTVsb (if present) + ICTV_Elec

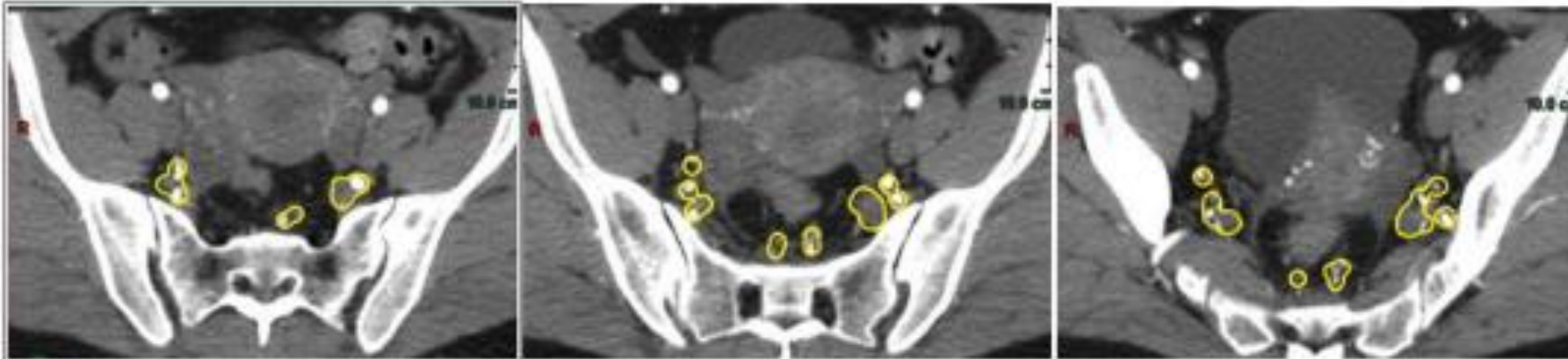
### Required in selected cases

ICTVp_Boost	GTVp_Boost + 10mm in all directions except anteriorly where 15 mm can be considered for tumours that may be more mobile anteriorly (eg, upper rectal tumours).
ICTVn_Boost	GTVn_Boost + 5 mm in all directions.
ICTVsb	Area around surgical bed at risk for microscopic disease (for postoperative radiotherapy only).
ICTV_high	ICTVp_Boost + ICTVn_Boost

# Konturlama-IMRT/VMAT

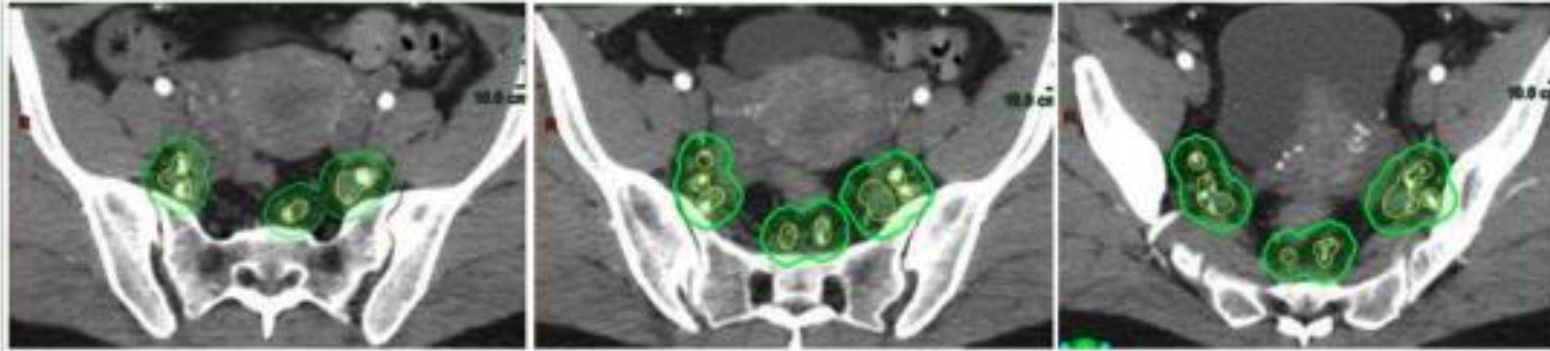
## Internal iliac and presacral nodes

1. Identify the superior most level of ICTVE – this will be either at the junction of S1/S2 or 2 cm above GTV, whichever is most superior.
2. Starting at this level outline the internal iliac vessels (artery and vein combined), the inferior mesenteric artery and the superior rectal vessels. Tracing them inferiorly and posteriorly until reaching the level of the obturator internus muscle.

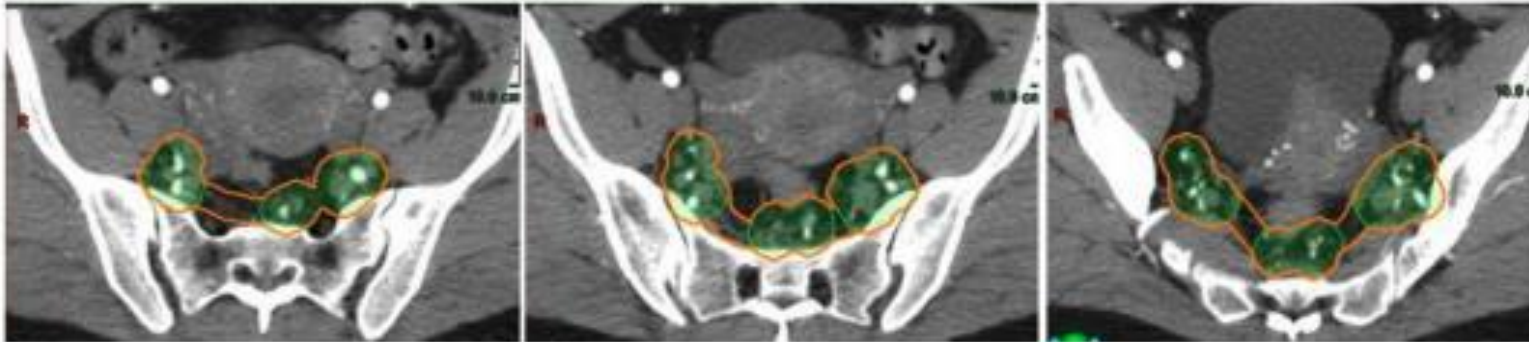


# Konturlama-IMRT/VMAT

3. Add a 7 mm margin around the vessels, in all directions except in the superior-inferior direction.

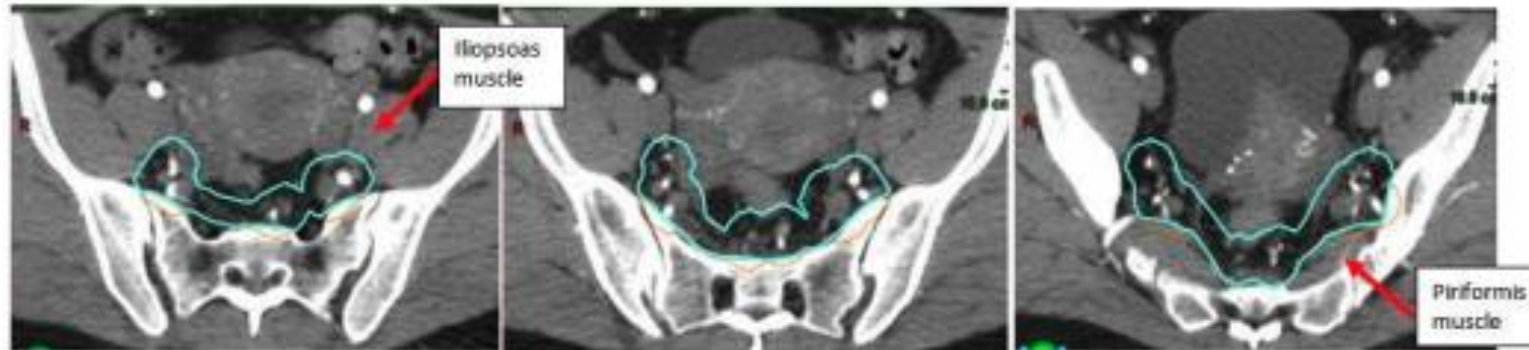


4. Using a 10 mm 'rollerball', join both volumes together along the anterior wall of the vertebra and sacrum to include the remaining pre-sacral nodes.

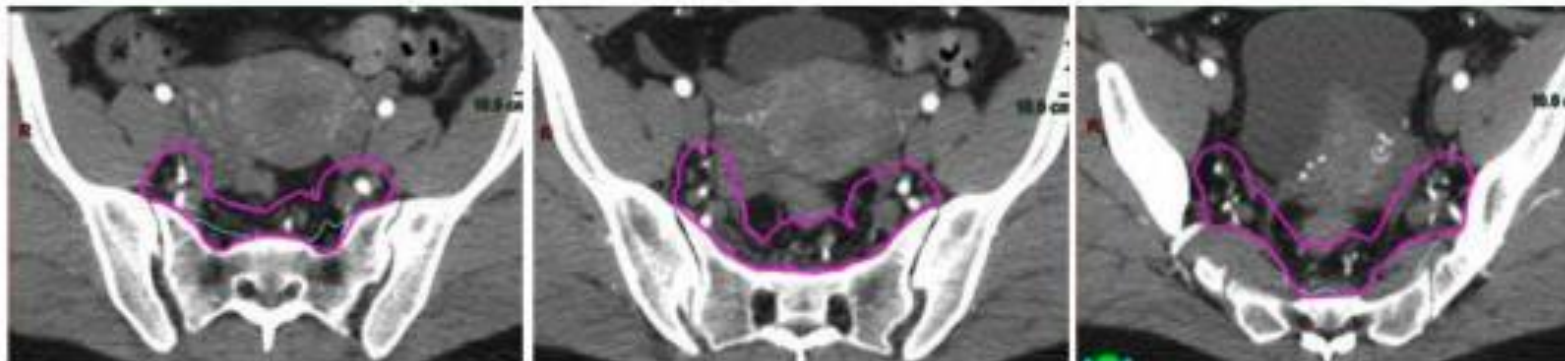


# Konturlama-IMRT/VMAT

5. Manually edit the volume to exclude bone (unless there is infiltration into bone), piriformis muscles (posteriorly) and iliopsoas muscle (anterolaterally).



6. Manually edit volume to include sacral notch.

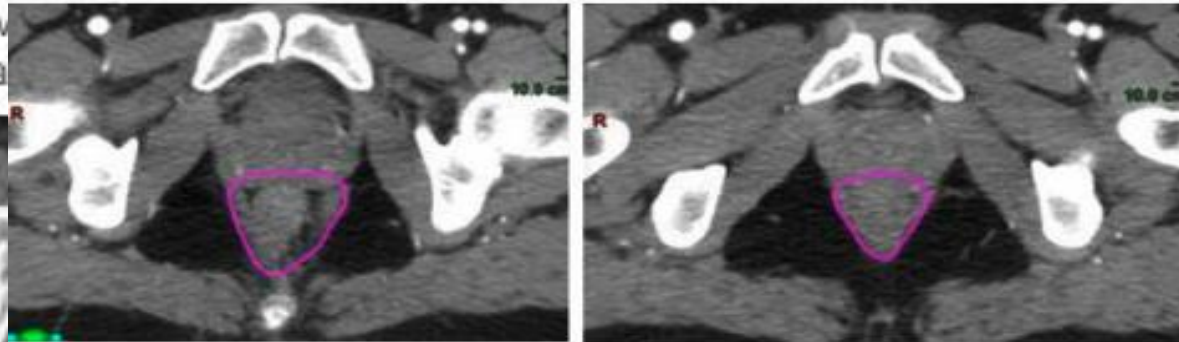
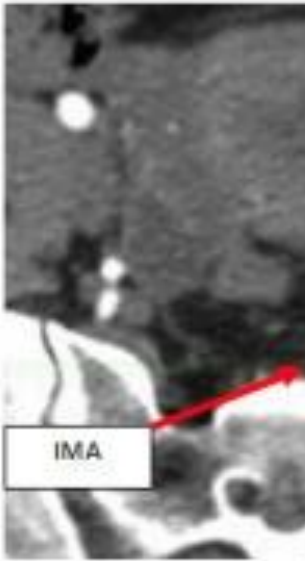


# Konturlama-IMRT/VMAT

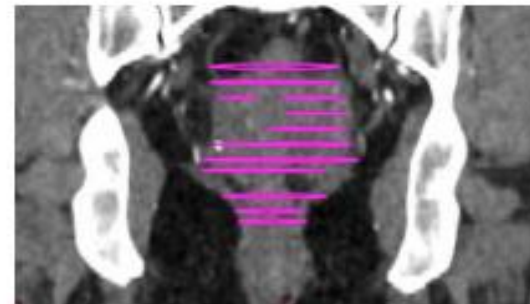
## Mesorectum

7. Identify the top of the mesorectum

8. Delineate the whole mesorectum motion. This will result in over motion. For example, the uterus, prostate



The inferior border can often be visualised more easily on coronal views.

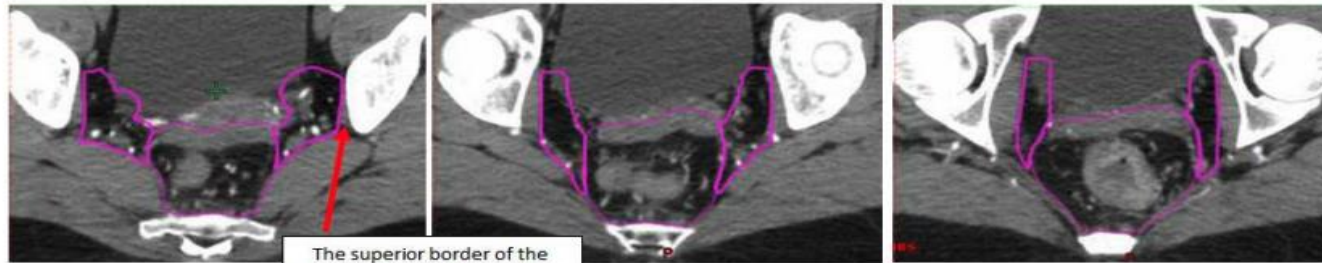


9. The mesorectum continues inferiorly until insertion of the levator ani muscle into the external sphincter muscles (disappearing of the mesorectal fat around the rectum) or 2 cm below the inferior GTVp slice, therefore if appropriate continue the ICTV\_Elec into the anal canal. The levators should be included in the volume with the border being the outer wall of the levators.

# Konturlama-IMRT/VMAT

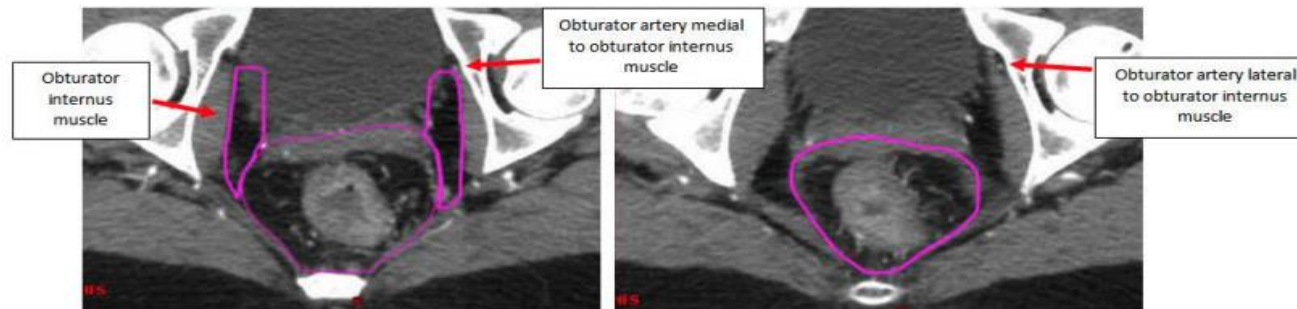
## Obturator nodes

10. Identify the obturator internus muscle. Using a 17 mm 'rollerball' ensure the volume covers the medial aspect of this muscle until the obturator artery moves laterally to the muscle.



The superior border of the obturator compartment is the appearance of the obturator internus muscle

11. Where the obturator artery moves lateral to the obturator internus muscle, there are no more obturator nodes so the posterior border will take a large step from one slice to the other.



Obturator internus muscle

Obturator artery medial to obturator internus muscle

Obturator artery lateral to obturator internus muscle

# Kontrolama-IMRT/VMAT

## With daily online volumetric imaging

PTV (In patients with one dose level only)	ICTV_Final + 5 mm in all directions.
---	--------------------------------------

PTV_High	ICTV_High + 5mm in all directions.
----------	------------------------------------

PTV_Low (Elective dose level for patients treated with SIB)	ICTV_Final + 5 mm in all directions.
---	--------------------------------------

## With offline imaging (verification protocol that does not include daily online imaging)

PTV (In patients with one dose level only)	ICTV_Final + 10 mm in all directions.
---	---------------------------------------

PTV_High	ICTV_High + 10 mm in all directions.
----------	--------------------------------------

PTV_Low (Elective dose level for patients treated with SIB)	ICTV_Final + 10 mm in all directions.
---	---------------------------------------

# ASTRO-Öneriler

**Table 5** Recommendations for appropriate treatment volumes and techniques

KQ4 Recommendations	Strength of Recommendation	Quality of Evidence (Refs)
1. For patients with cT3-4 and/or cN + rectal cancers, inclusion of the rectum, mesorectal nodes, presacral nodes, internal iliac nodes, and obturator nodes in the CTV is recommended.	Strong	High 70,71
2. For patients with rectal tumors invading an anterior organ or structure (eg, prostate, seminal vesicles, cervix, vagina, and/or bladder), inclusion of the external iliac nodes in the CTV is conditionally recommended in addition to the rectum, mesorectal nodes, presacral nodes, internal iliac nodes, and obturator nodes.	Conditional	Low 71
3. For patients with rectal cancer involving the anal canal, inclusion of inguinal and external iliac nodes in the CTV is conditionally recommended in addition to the rectum, mesorectal nodes, presacral nodes, internal iliac nodes, and obturator nodes.	Conditional	Expert opinion
4. For patients with rectal cancer treated with RT, an IMRT/VMAT technique is conditionally recommended. <u>Implementation remark:</u> IMRT/VMAT may be beneficial when the external iliac nodes and/or the inguinal nodes require treatment or when 3-D conformal techniques may confer a higher risk for toxicity.	Conditional	Low 72-77
5. For patients with rectal cancer receiving IMRT/VMAT, daily image guidance to verify localization is conditionally recommended.	Conditional	Expert opinion
6. For patients with rectal cancer in whom the CTV does not include the inguinal nodes, simulation prone with a belly board is conditionally recommended.	Conditional	Low 78-80

*Abbreviations:* 3-D = 3-dimensional; CTV = clinical target volume; IMRT = intensity modulated radiation therapy; KQ = key question; RT = radiation therapy; VMAT = volumetric modulated arc therapy.

# Neoadjuvan Radyoterapi-Doz



National  
Comprehensive  
Cancer  
Network®

## NCCN Guidelines Version 2.2024 Rectal Cancer

[NCCN Guidelines Index](#)  
[Table of Contents](#)  
[Discussion](#)

### Treatment Information

### PRINCIPLES OF RADIATION THERAPY

#### • Target Volumes

- ▶ Target volume definition should be performed per ICRU 50 recommendations.
- ▶ Gross tumor volume (GTV) should include all primary tumor and involved lymph nodes, using information from physical examination, endoscopic findings, diagnostic imaging, and the simulation planning study for delineation. Clinical target volume (CTV) should include the GTV plus areas at risk for microscopic spread from the primary tumor and at-risk nodal areas. A consensus atlas may be helpful to review when defining elective nodal CTVs.<sup>3</sup>
- ▶ At-risk nodal regions include mesorectal, presacral, posterior obturator nodes, and internal iliac nodes. The external iliac nodes should also be included for T4 tumors involving anterior structures. Consider including the inguinal nodes for low-lying tumors involving the anal canal.
- ▶ Fusion of the pelvic MRI is strongly recommended to optimally define gross disease.
- ▶ If using 3D conformal radiation, multiple RT fields should be used (generally a 3- or 4-field technique). Prone positioning, full bladder, and other techniques to minimize the volume of small bowel in the fields are encouraged.
- ▶ For postoperative patients treated by abdominoperineal resection, the perineal wound should be included within the fields.

#### • RT Dosing

- ▶ 45–54 Gy in 25–30 fractions to the pelvis.
  - ◊ For resectable cancers, after 45 Gy a tumor bed boost with a 2-cm margin of 5.4 to 9.0 Gy in 3 to 5 fractions could be considered for preoperative radiation.
  - ◊ Small bowel max point dose should be limited to 50 Gy, V45 Gy should be <195 cc for a bowel bag avoidance, or V15 should be <120 cc for individual small bowel loops.
  - ◊ For unresectable cancers, doses higher than 54 Gy may be required, if technically feasible.
- ▶ Short-course RT (25 Gy in 5 fractions) can also be considered for patients for preoperative radiation.
  - ◊ For high-risk rectal cancer (clinical tumor stage cT4a or cT4b, EMVI, clinical nodal stage cN2, involved MRF, [tumor or lymph node 1 mm or less from the MRF] or enlarged lateral lymph nodes considered to be metastatic), the 5-year follow-up of the RAPIDO trial now indicates a statistically higher locoregional recurrence rate (10%) in the experimental arm of short-course RT → chemotherapy → surgery versus control arm (6%) of chemoRT → surgery → adjuvant chemotherapy.<sup>4</sup>

# Neoadjuvan Radyoterapi-Doz

## Dose prescription SCRT

- 25 Gray (Gy) in 5 fractions, (5 Gy/#) in 5–7 days

## Dose prescription preoperative LCRT

- Dose to elective target volume = 45 Gy in 25 fractions (1.8 Gy/#) in 5 weeks\*
- Optional dose to gross disease for simultaneous integrated boost (SIB) = 50 Gy in 25 fractions (2 Gy/#) in 5 weeks

\*Dose response data correlates with complete response rather than local relapse.<sup>7</sup> As such, an SIB of >50 Gy should only be considered in this setting, for example, organ preservation, postoperative with residual macroscopic disease or disease outside the resection margin. 52 Gy in 25 fractions is an equivalent dose to the 54 Gy in 30 fractions used in the EXPERT trial and reported minimal acute toxicity in a small series.<sup>8,9</sup>

## Dose prescription in adjuvant LCRT

- Elective and postoperative bed = 45 Gy in 25 fractions (1.8 Gy/#) in 5 weeks
- If residual macroscopic disease is present or R1 resection has been performed and the site of R1 can be identified by clips or landmarks, consider SIB.

## Concurrent chemotherapy

In patients receiving LCRT, concurrent chemotherapy should be delivered unless there are contraindications or concerns regarding their ability to tolerate treatment. Dose reductions due to patient co-morbidities, dihydropyrimidine dehydrogenase (DPD) status, performance status and/or age are at the discretion of the treating team.

# Neoadjuvan Radyoterapi-Doz

## Dose constraints for long-course chemoradiotherapy with bowel cavity

Organ at risk	OAR/target	Objective	Mandatory constraint
Bowel cavity <sup>#</sup>	D400cc	<20 Gy	
	D250cc	<30 Gy	
	D200cc	<43 Gy	<47.5 Gy
Femoral heads*	D50%	<30 Gy	<45 Gy
	D35%	<40 Gy	<50 Gy
	D5%	<50 Gy	<52.5 Gy
Bladder*	D50%	<35 Gy	<45 Gy
	D35%	<40 Gy	<50 Gy
	D5%	<50 Gy	<52.5 Gy
Genitalia*	D50%	<20 Gy	<35 Gy
	D35%	<30 Gy	<40 Gy
	D5%	<40 Gy	<52.5 Gy

## Dose constraints for short-course radiotherapy with bowel cavity

Organ at risk	OAR/target	Objective
Bowel cavity <sup>§</sup>	D400cc	<10 Gy
	D250cc	<18 Gy
	D200cc	<23 Gy
Bladder <sup>§</sup>	D45%	<21 Gy

# Neoadjuvan Radyoterapi-Kısa Şema

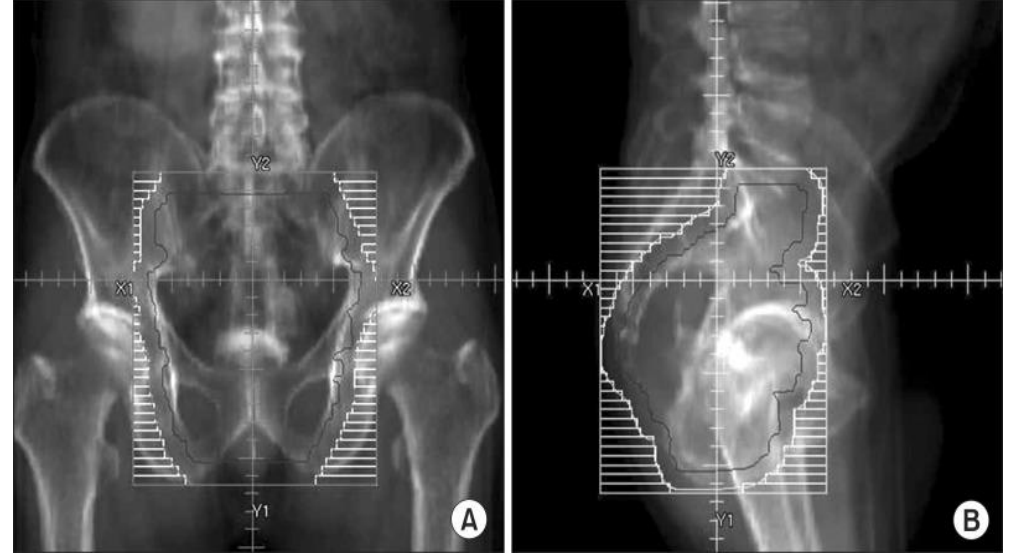
Primer tümör

Mezorektal ve presakral nodlar

İnternail iliak arter çevresindeki LN alanı

L5-S1 vertebra seviyesi

Obturator foramen yerleşimli LN alanları



# Postoperatif Radyoterapi

Günümüzde nadiren uygulanmakta

Yayınlar ve uygulanan teknikler eski

Tümör yatağı, mezorektum, presakral alan

Tümör yerleşimi ve lenf nodu tutulumuna göre belirlenen lenfatik alan

Patolojik risk faktörlerine göre modifikasyon

Alt yerleşimli tümörlerde (APR) → Simulasyonda anal girime tel

Radyasyon dozu, tümör yatağına ve komşu lenf nodu bölgelerine;

45Gy-50.4Gy → 54Gy

# Postoperatif Radyoterapi



Int. J. Radiation Oncology Biol. Phys., Vol. 74, No. 3, pp. 824–830, 2009  
Copyright © 2009 Elsevier Inc.  
Printed in the USA. All rights reserved  
0360-3016/09/\$—see front matter

doi:10.1016/j.ijrobp.2008.08.070

## CLINICAL INVESTIGATION

## Rectum

### ELECTIVE CLINICAL TARGET VOLUMES FOR CONFORMAL THERAPY IN ANORECTAL CANCER: A RADIATION THERAPY ONCOLOGY GROUP CONSENSUS PANEL CONTOURING ATLAS

ROBERT J. MYERSON, M.D., PH.D.,\* MICHAEL C. GAROFALO, M.D.,<sup>†</sup> ISSAM EL NAQA, PH.D.,\*  
ROSS A. ABRAMS, M.D.,<sup>‡</sup> ADITYA APTE, PH.D.,\* WALTER R. BOSCH, PH.D.,\* PRAJNAN DAS, M.D.,<sup>§</sup>  
LEONARD L. GUNDERSON, M.D.,<sup>||</sup> THEODORE S. HONG, M.D.,<sup>¶</sup> J. J. JOHN KIM, M.D.,<sup>#</sup>  
CHRISTOPHER G. WILLETT, M.D.,\*\* AND LISA A. KACHNIC, M.D.<sup>††</sup>

\*Department of Radiation Oncology, Washington University, St. Louis, MO; <sup>†</sup>Department of Radiation Oncology, University of Maryland Medical Center, Baltimore, MD; <sup>‡</sup>Department of Radiation Oncology, Rush University Medical Center, Chicago, IL; <sup>§</sup>Department of Radiation Oncology, University of Texas, MD Anderson Cancer Center, Houston, TX; <sup>||</sup>Department of Radiation Oncology, Mayo Clinic, Scottsdale AZ; <sup>¶</sup>Department of Radiation Oncology, Massachusetts General Hospital, Boston, MA; <sup>#</sup>Department of Radiation Oncology, Princess Margaret Hospital, University of Toronto, Toronto, ON, Canada; \*\*Department of Radiation Oncology, Duke University, Durham, NC; and <sup>††</sup>Department of Radiation Oncology, Boston University Medical Center, Boston, MA

**Purpose:** To develop a Radiation Therapy Oncology Group (RTOG) atlas of the elective clinical target volume (CTV) definitions to be used for planning pelvic intensity-modulated radiotherapy (IMRT) for anal and rectal cancers.  
**Methods and Materials:** The Gastrointestinal Committee of the RTOG established a task group (the nine physician co-authors) to develop this atlas. They responded to a questionnaire concerning three elective CTVs (CTVA: internal iliac, presacral, and perirectal nodal regions for both anal and rectal case planning; CTVB: external iliac nodal region for anal case planning and for selected rectal cases; CTVC: inguinal nodal region for anal case planning and for select rectal cases), and to outline these areas on individual computed tomographic images. The imaging files were shared via the Advanced Technology Consortium. A program developed by one of the co-authors (I.E.N.) used binomial maximum-likelihood estimates to generate a 95% group consensus contour. The computer-estimated consensus contours were then reviewed by the group and modified to provide a final contouring consensus atlas.  
**Results:** The panel achieved consensus CTV definitions to be used as guidelines for the adjuvant therapy of rectal cancer and definitive therapy for anal cancer. The most important difference from similar atlas for gynecologic or genitourinary cancer is mesorectal coverage. Detailed target volume contouring guidelines and images are discussed.  
**Conclusion:** This report serves as a template for the definition of the elective CTVs to be used in IMRT planning for anal and rectal cancers, as part of prospective RTOG trials. © 2009 Elsevier Inc.

## CONCLUSION

This is the first report of the Radiation Therapy Oncology Group anorectal consensus panel. The guidelines and images should serve as a template for the definition of the elective clinical target volumes to be used in conformal planning for anal and rectal cancers. As there is no long-term outcome data demonstrating the efficacy of IMRT in this setting, this atlas will be used as a contouring guideline for two prospective IMRT trials, RTOG 0822, a Phase II evaluation of pre-operative chemoradiotherapy using IMRT in combination with capecitabine and oxaliplatin for patients with locally advanced rectal cancer, and a developing Phase II follow-up study to RTOG 0529, incorporating cetuximab with standard 5FU and mitomycin-C for anal canal cancer. In these studies, particular attention will be warranted to the patterns of recurrence, to ensure that these CTV consensus panel recommendations, as well as the use of IMRT for the management of anorectal cancers, are appropriate.

# Eve Götürülecek Mesajlar

cT3-4 ve/veya N+ hastalarda CTV içerisine rektum, mezorektal nodlar, presakral nodlar, internal iliak nodlar ve obturator lenf nodları dahil edilmelidir.

**Prostat, seminal veziküller, serviks, vajina ve/veya mesaneyi** invaze eden rektal tümörleri olan hastalarda, rektuma ek olarak eksternal iliak nodların, mezorektal nodların, presakral nodların, internal iliak nodların ve obturator nodların hacime dahil edilmesi önerilir.

Anal kanala uzanımı olan rektal kanser olgularında CTV ye **inguinal ve eksternal iliak nodlarından** eklenmesi önerilir.

IMRT ve VMAT ile mesane , kolon ve ince barsaklar üzerinde tedavi ilişkili yan etkilerde azalma sağlanabilir.

*Teşekkürler...*