

Target Volumes and Contouring Guidelines: Anal Canal Malignancies

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Introduction

- APR historically standard of care
- Colostomy free survival-0%
- 5Yr OS: 40-70%
- Initial study of CTRT by Nigro et al, Wayne Univ (Dis Colon Rectum)
- Initial 3 patients had pCR
- EBRT-30 Gy + 2cycles of cont. inf 5FU + 1 cycle of MMC
- Updated result 1985 (Leichman et al, Am J Med)
- **5Yr OS 66%, Colostomy free survival-59%**
- Subsequent multiple RCT
- Radiation dose 30-60 Gy, 5FU, MMC
- 5yr OS: 72-89%, CFS 70-85%
- Local failure rate 14-37%

Malignancies of Anal Canal

- WHO (2010)
 - Intraepithelial and invasive neoplasms
 - Invasive
 - Squamous cell carcinoma (85-90%)
 - Squamous
 - Large-cell keratinizing and nonkeratinizing
 - Basaloid
 - Cloacogenic
 - Transitional
 - Adenocarcinoma (10-15%)
 - Rectal-type mucosa-primary rectal cancers
 - Rare variants: Squamous with mucous microcysts, small cell, undifferentiated cancers
 - Epidermoid no more used

Stage

8th Ed AJCC Staging

- Tis - high-grade squamous intraepithelial lesion
- T1 - 2 cm or less
- T2 - >2 - 5 cm
- T3 - >5 cm
- T4 - Adjacent organ involvement, e.g. vagina, urethra, bladder

Invasion of the rectal wall, perirectal skin, sphincter muscle, subcutaneous tissue: not included T4

Regional Nodes:

- **N0 - No regional lymph node metastases**
- **N1a - Inguinal, mesorectal, or internal iliac lymph nodes**
- **N1b - External iliac nodes**
- **N1c - External iliac nodes + N1a**

7th Ed AJCC Staging

- Tis - high-grade squamous intraepithelial lesion
- T1 - 2 cm or less
- T2 - >2 - 5 cm
- T3 - >5 cm
- T4 - Adjacent organ involvement, e.g. vagina, urethra, bladder

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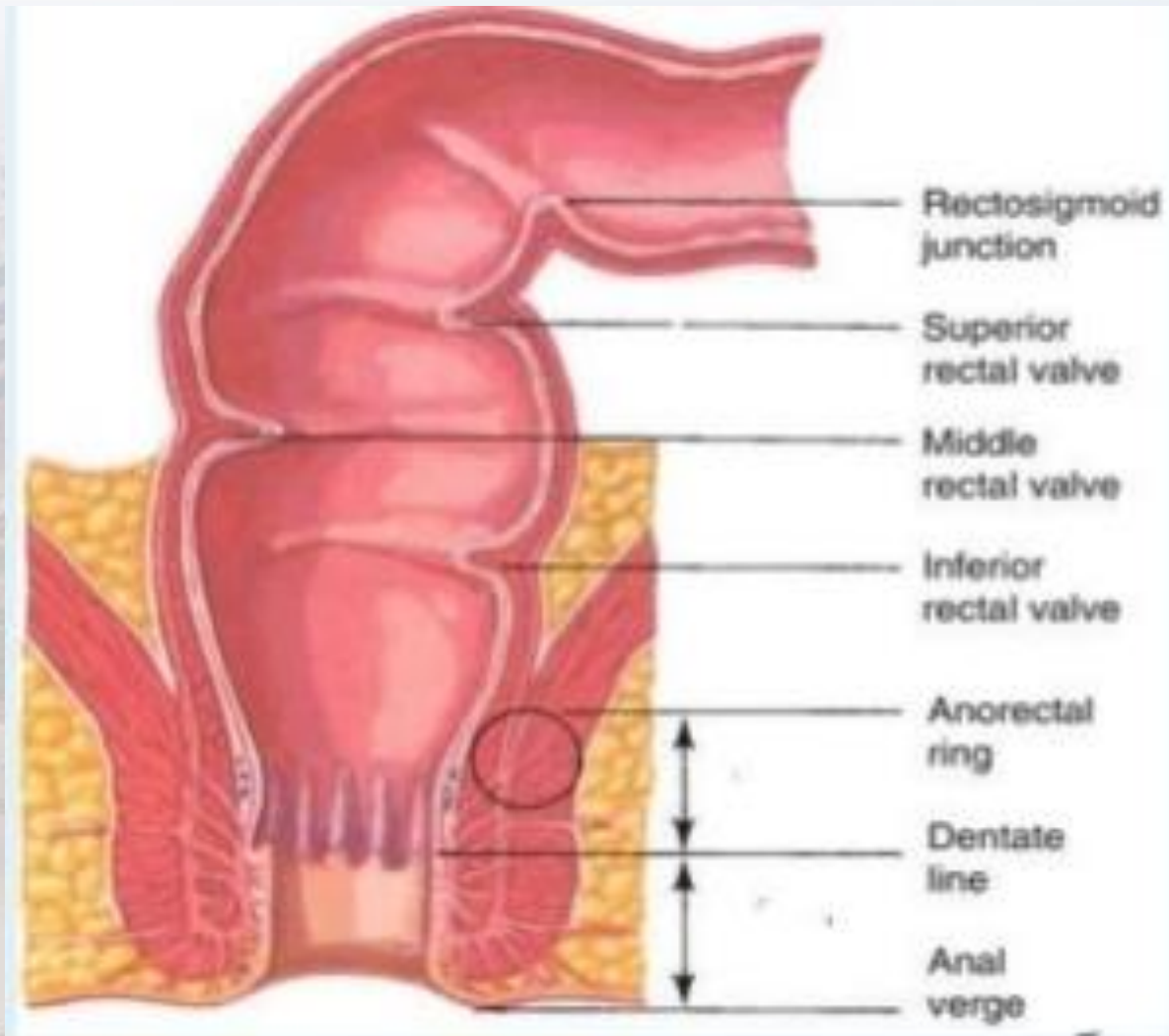
Regional Nodes:

- **N0 - No lymph nodes**
- **N1 - Perirectal lymph nodes**
- **N2 - Unilateral internal iliac or (unilateral) inguinal lymph nodes or both**
- **N3 - Perirectal AND inguinal lymph nodes; and/or bilateral internal iliac; and/or (bilateral) inguinal lymph nodes**

Anatomy

Anal canal:

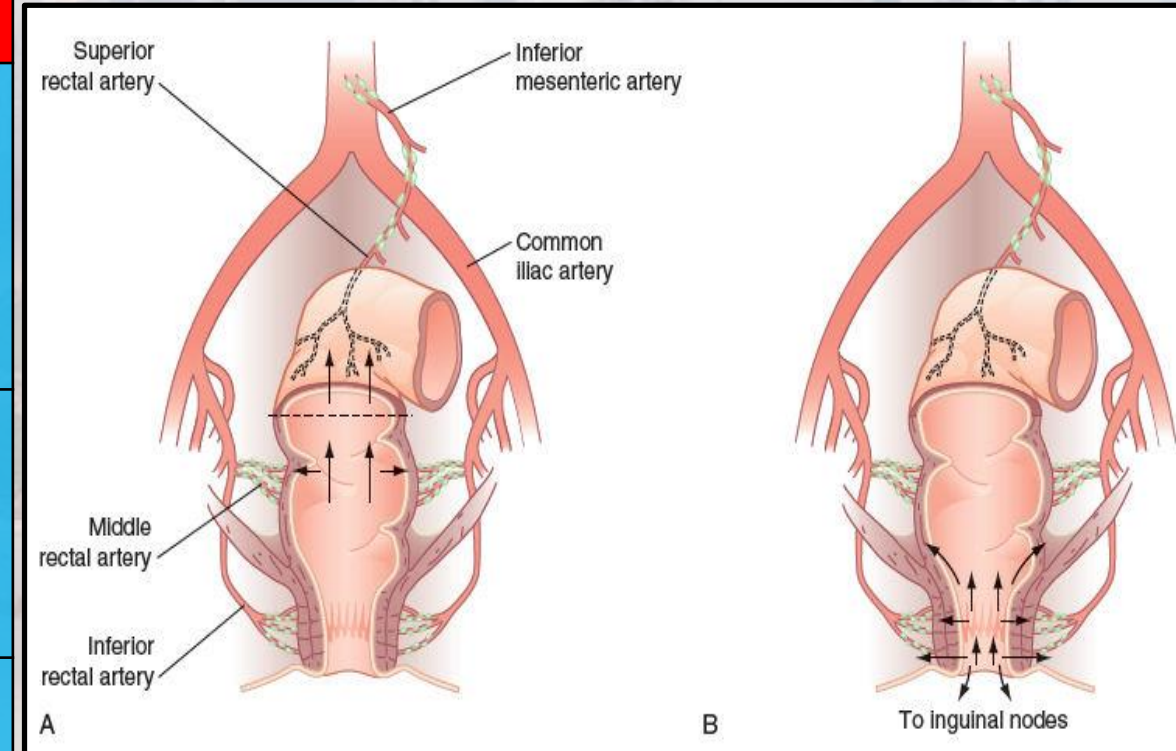
- Anorectal ring (where rectum enters puborectalis sling) to anal verge
- Anorectal ring to dentate line: Colorectal mucosa (~1-2 cm)
- Dentate line to anal verge: Modified squamous epithelium (~2 cm)
- **Anal verge:** Transitional area at distal end of the anal canal
- **Anal margin:** Perianal skin ~5cm radius from anal verge



**Second, third, and fourth sacral nerves
are important for CONTINENCE**

Anatomy cont..

Part	Lymph Node
<ul style="list-style-type: none"> ➤ Perianal skin ➤ Anal verge ➤ Canal distal to dentate line 	<ul style="list-style-type: none"> ➤ Superficial inguinal nodes ➤ Femoral nodes (external iliac systems)
<ul style="list-style-type: none"> ➤ Around and above dentate line 	<ul style="list-style-type: none"> ➤ Internal iliac nodes ➤ Obturator (Internal Iliac)
Proximal canal	Perirectal

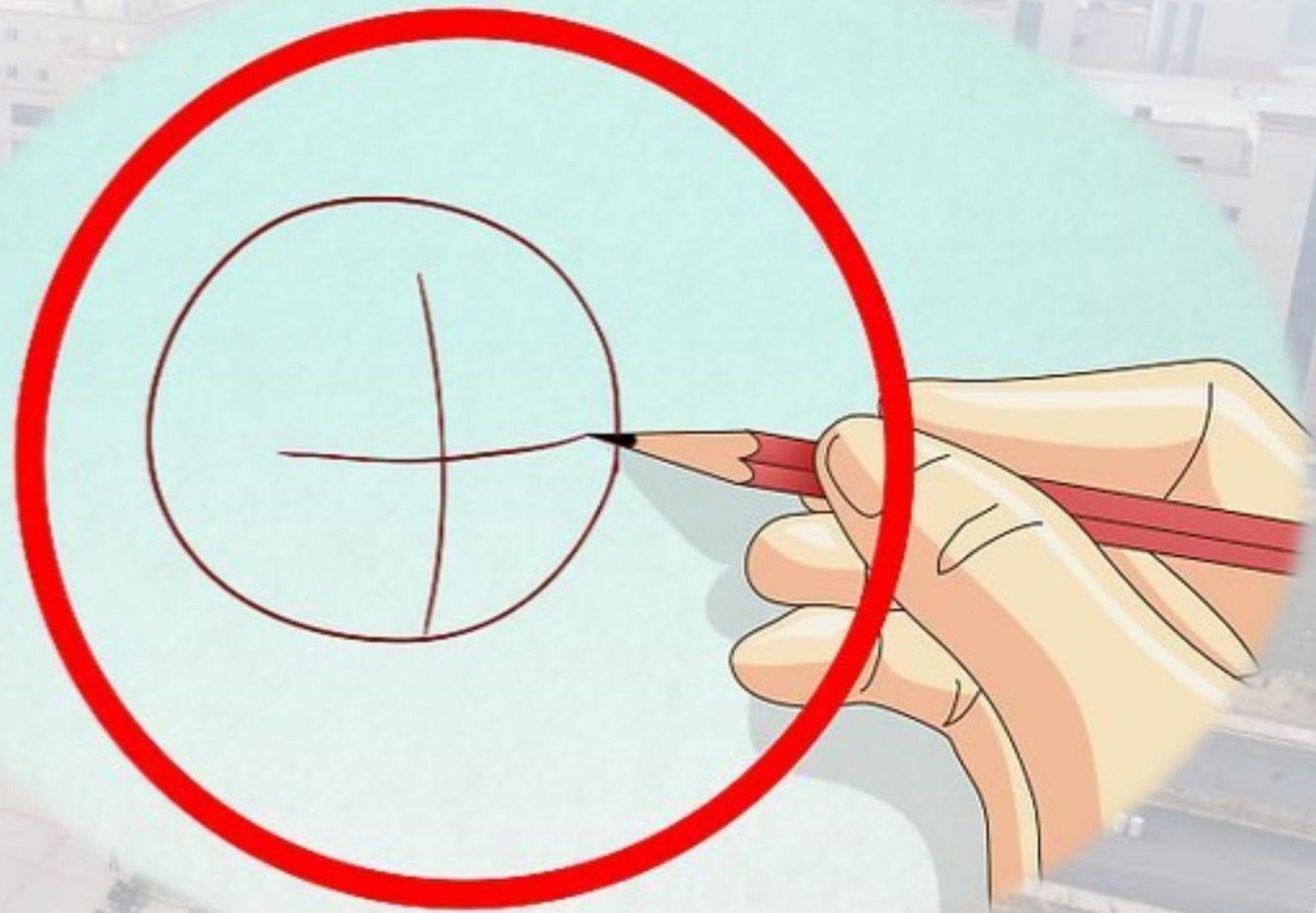


Pattern of spread and survival

- Primary route **local and LN**
- At presentation:
 - Overall LN involvement ~25%
 - Pelvic LN+ 30%
 - Inguinal LN+ 15-30%
 - 10-15% occult positive
- Extrapelvic visceral mets 5-10%

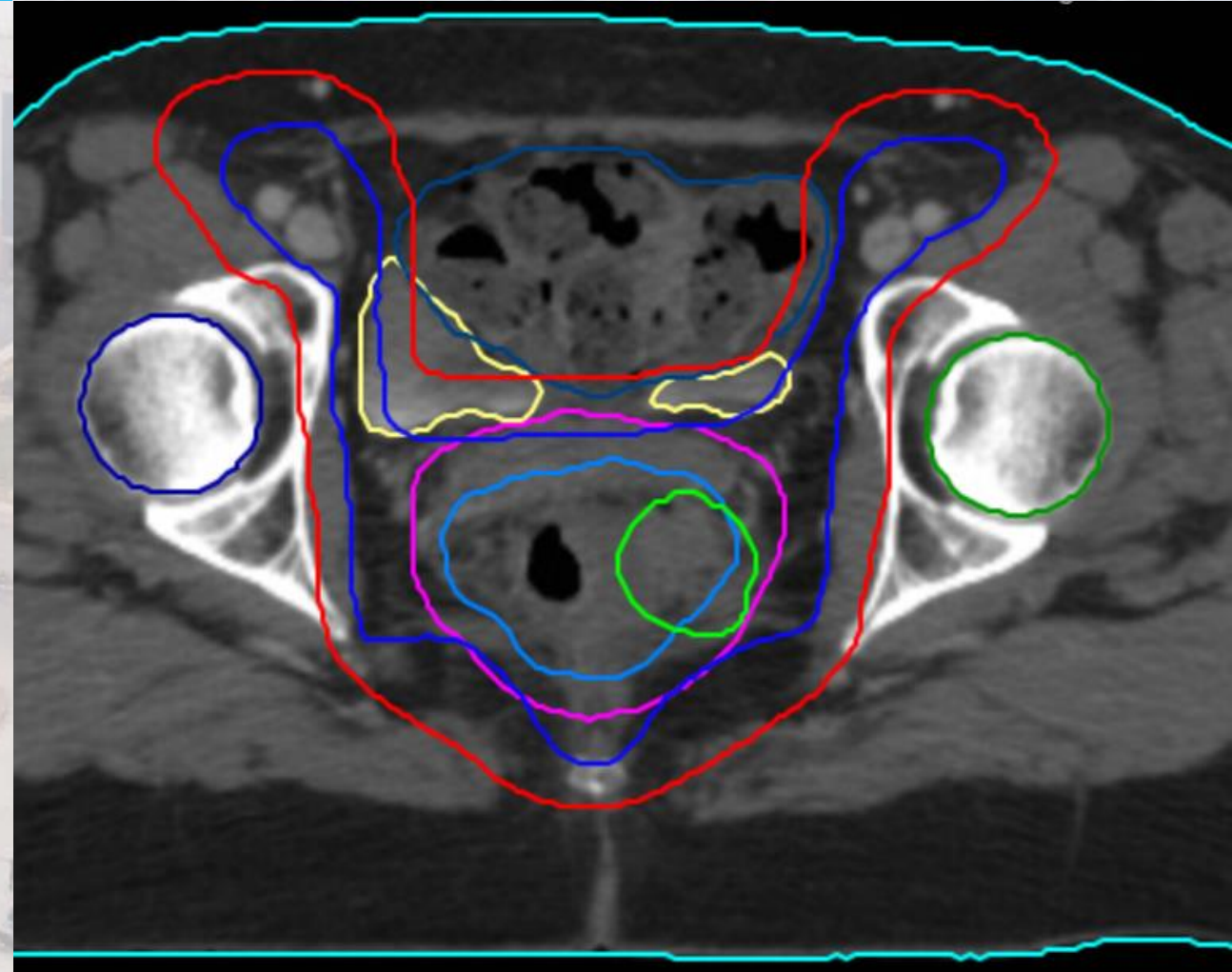
Stage	OS (%)	Local Control (%)	Sphincter fn (%)
T1	80	90-100	-
T2	70	65-75	-
T3-T4	50	40-55	-
Overall	65-75	60	70

What to contour?



1. Organ At Risk (OAR)

2. Target Volumes



Suggested reading for contouring guidelines

1. OAR: RTOG contouring atlas for normal OARs (Male and female pelvis)

<https://www.rtog.org/LinkClick.aspx?fileticket=054g99vNGps%3d&tabid=354>

<https://www.rtog.org/LinkClick.aspx?fileticket=P5eAjYB90Ow%3d&tabid=355>

2. Mapping pelvic lymph nodes. Int J Radiat Oncol Biol Phys. 2005 Dec 1;63(5):1604-12

3. RTOG 0529 Protocol

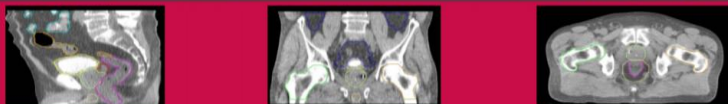
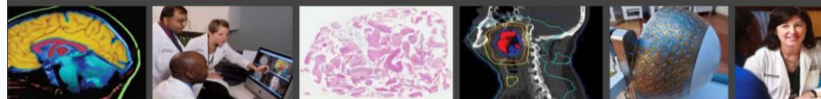
<https://www.rtog.org/ClinicalTrials/ProtocolTable/StudyDetails.aspx?action=openFile&FileID=4641>

4. RTOG consensus panel contouring atlas (Int J Radiat Oncol Biol Phys. 2009 Jul 1;74(3):824-30. doi: 10.1016/j.ijrobp.2008.08.070)

5. AGITG contouring atlas and planning guidelines for IMRT in anal canal [Int J Radiat Oncol Biol Phys. 2012 Aug 1;83(5):1455-62. doi: 10.1016/j.ijrobp.2011.12.058]

Suggested reading for contouring guidelines

6. RTOG 0529 initial result (Int J Radiat Oncol Biol Phys. 2013 May 1;86(1):27-33. doi: 10.1016/j.ijrobp.2012.09.023)
7. Contouring inguinal and femoral nodes; how much margin is needed around the vessels? (Pract Radiat Oncol. 2012 Oct-Dec;2(4):274-278. doi: 10.1016/j.prro.2011.12.005)
8. Contouring the Lumbosacral Plexus (Int J Radiat Oncol Biol Phys. 2012 Oct 1;84(2):376-82. doi: 10.1016/j.ijrobp.2011.11.074)
9. Target volume delineation of anal cancer based on magnetic resonance imaging or positron emission tomography (Radiat Oncol. 2017 Sep 6;12(1):147. doi: 10.1186/s13014-017-0883-z)



MALE PELVIS Normal Tissue RTOG Consensus Contouring Guidelines

Hiram A. Gay, M.D., H. Joseph Barthold, M.D., Elizabeth O'Meara, C.M.D., Walter R. Bosch, Ph.D., Issam El Naqa, Ph.D., Rawan Al-Lozi, Seth A. Rosenthal, M.D., Colleen Lawton, M.D., F.A.C.R., W. Robert Lee, M.D., Howard Sandler, M.D., Anthony Zietman, M.D., Robert Myerson, M.D., Ph.D., Laura A. Dawson, M.D., Christopher Willett, M.D., Lisa A. Kachnic, M.D., Anuja Jhingran, M.D., Lorraine Portelance, M.D., Janice Ryu, M.D., William Small, Jr., M.D., David Gaffney, M.D., Ph.D., Akila N. Viswanathan, M.D., M.P.H., and Jeff M. Michalski, M.D.

Supported by grants from the National Cancer Institute, CA21661, CA32115, and CA37422



RADIATION THERAPY ONCOLOGY GROUP

RTOG 0529

A Phase II Evaluation of Dose-Painted IMRT in Combination with 5-Fluorouracil and Mitomycin-C for Reduction of Acute Morbidity in Carcinoma of the Anal Canal

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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.,[†] ISSAM EL NAQA, Ph.D.,* ROSS A. ABRAMS, M.D.,[‡] ADITYA APTE, Ph.D.,* WALTER R. BOSCH, Ph.D.,* PRAJAN DAS, M.D.,[§] LEONARD L. GUNDERSON, M.D.,^{||} THEODORE S. HONG, M.D.,[¶] J. J. JOHN KIM, M.D.,[#] CHRISTOPHER G. WILLETT, M.D.,** AND LISA A. KACHNIC, M.D.,^{††}

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CLINICAL INVESTIGATION

MAPPING PELVIC LYMPH NODES: GUIDELINES FOR DELINEATION IN INTENSITY-MODULATED RADIOTHERAPY

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Purpose: To establish guidelines for delineating the clinical target volume for pelvic nodal irradiation by mapping the location of lymph nodes in relation to the pelvic anatomy.

Clinical Investigation: Gastrointestinal Cancer

Australasian Gastrointestinal Trials Group (AGITG) Contouring Atlas and Planning Guidelines for Intensity-Modulated Radiotherapy in Anal Cancer

Michael Ng, M.B.B.S. (Hons), F.R.A.N.Z.C.R.,* Trevor Leong, M.B.B.S., M.D., F.R.A.N.Z.C.R.,^{†,||} Sarat Chander, M.B.B.S., F.R.A.N.Z.C.R.,[‡] Julie Chu, M.B.B.S., F.R.A.N.Z.C.R.,[†] Andrew Kneebone, M.B.B.S., F.R.A.N.Z.C.R.,^{†,***} Susan Carroll, M.B.B.S., F.R.A.N.Z.C.R.,^{||,***} Kirsty Wiltshire, M.B.B.S., F.R.A.N.Z.C.R.,[†] Samuel Ngan, M.B.B.S., F.R.C.S.Ed., F.R.A.N.Z.C.R.,^{†,||} and Lisa Kachnic, M.D.,^{††}

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Clinical Investigation

RTOG 0529: A Phase 2 Evaluation of Dose-Painted Intensity Modulated Radiation Therapy in Combination With 5-Fluorouracil and Mitomycin-C for the Reduction of Acute Morbidity in Carcinoma of the Anal Canal

Lisa A. Kachnic, MD,* Kathryn Winter, MS,[†] Robert J. Myerson, MD,[‡] Michael D. Goodyear, MD,[§] John Willins, PhD,* Jacqueline Esthappen, PhD,[‡] Michael G. Haddock, MD,^{||} Marvin Rotman, MD,* Parag J. Parikh, MD,[‡] Howard Safran, MD,[#] and Christopher G. Willett, MD**

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BJR

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Received:
9 January 2015

Revised:
10 April 2015

Accepted:
6 May 2015

doi: 10.1259/bjr.20150032

Cite this article as:
Brooks C, Hansen VN, Riddell A, Harris VA, Tait DM. Proposed genitalia contouring guidelines in anal cancer intensity-modulated radiotherapy. Br J Radiol 2015;88:20150032.

SHORT COMMUNICATION

Proposed genitalia contouring guidelines in anal cancer intensity-modulated radiotherapy

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Clinical Investigation: Gastrointestinal Cancer

Development of a Standardized Method for Contouring the Lumbosacral Plexus: A Preliminary Dosimetric Analysis of this Organ at Risk Among 15 Patients Treated With Intensity-Modulated Radiotherapy for Lower Gastrointestinal Cancers and the Incidence of Radiation-Induced Lumbosacral Plexopathy

Sun K. Yi, M.D.,* Walter Mak, M.D.,[†] Claus C. Yang, Ph.D.,[‡] Tianxiao Liu, Ph.D.,[‡] Jing Cui, Ph.D.,* Allen M. Chen, M.D.,* James A. Purdy, Ph.D.,* Arta M. Monjazebe, M.D., Ph.D.,* and Ly Do, M.D.[§]

28th April 2019 AROI-ICRO FARIDKOT

Original Report

Contouring inguinal and femoral nodes; how much margin is needed around the vessels?

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Received 18 November 2011; accepted 19 December 2011

Rusten et al. Radiation Oncology (2017) 12:147
DOI 10.1186/s13014-017-0883-z

Radiation Oncology

RESEARCH

Open Access



Target volume delineation of anal cancer based on magnetic resonance imaging or positron emission tomography

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Abstract

Purpose: To compare target volume delineation of anal cancer using positron emission tomography (PET) and magnetic resonance imaging (MRI) with respect to inter-observer and inter-modality variability.

Methods: Nineteen patients with anal cancer undergoing chemoradiotherapy were prospectively included. Planning computed tomography (CT) images were co-registered with 18F-fluorodeoxyglucose (FDG) PET/CT images and T2- and diffusion-weighted (DW) MR images. Three oncologists delineated the Gross Tumor Volume

Dr Dodul Mondal

How to improve contouring

1. Read the guidelines
2. Reach the department before others grab the system
3. Practice keeping the guidelines in front of you
4. Compare with contouring by the consultant
5. Go back to guidelines and re-check

Use proper window and contrast for proper identification of structure

Contour skin meticulously

WHERE YOU EXPECT CTV/ PTV TO EXTEND BEYOND BODY

Most important practical tip



5/3/2019



Dr Dodul Mondal FHNO2018 Kolkata

Basic Principles of Target Delineation

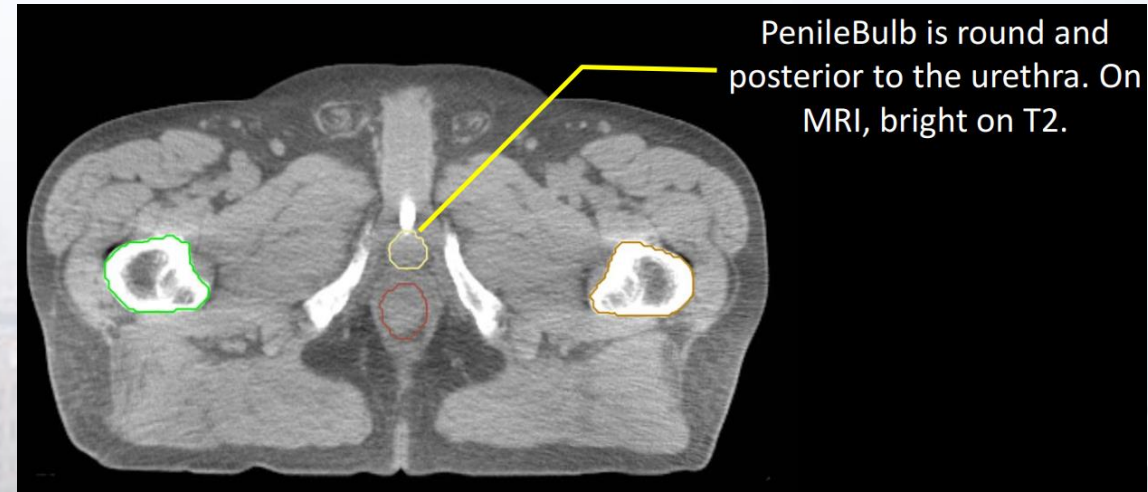
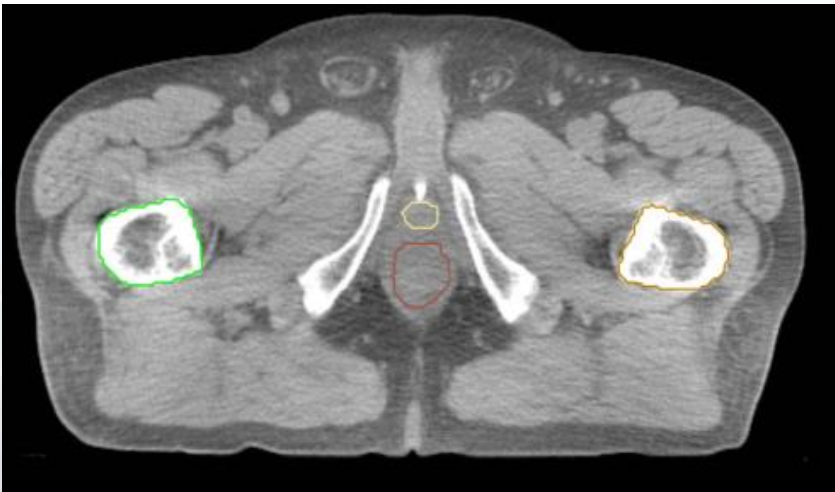
1. Do a very good clinical examination
2. Have proper understanding of local and nodal spreading pattern and direction
3. Have a sound knowledge of radiological anatomy
4. Maximum information from all diagnostic images: co-registration
5. Use combined view to see axial, sagittal and coronal planes simultaneously
6. Use information from endoscopy or other ancillary tests
7. Understanding of tumor and OAR radio sensitivity
8. Know the target and OAR motion for understanding positional uncertainty
9. Use consensus guidelines for target and OAR delineation
10. Never follow guidelines blindly, use clinical knowledge as well

Organ at Risk (OAR)

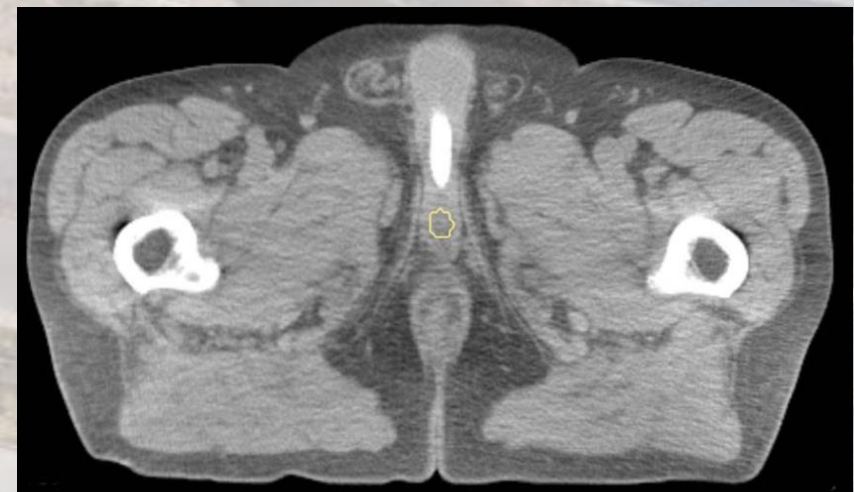
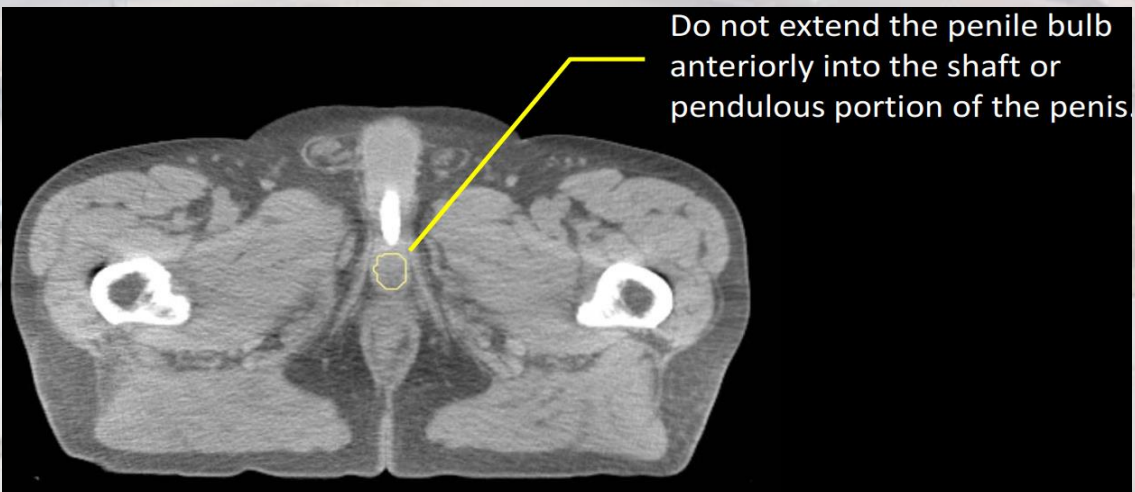
1. Body
2. Urinary bladder
3. Small bowel loops (individual loops or as part of entire peritoneal bag)
4. Large bowel loops (individual loops or as part of entire peritoneal bag)
5. Sigmoid colon
6. Proximal femur (Left and Right, individually)
7. Sacral plexus
8. Penile bulb in male
9. Testes and scrotum in male
10. Prostate and seminal vesicle in male
11. Ovaries in female
12. Uterus and cervix in females
13. External genitalia in both male and female
14. Bone marrow

OAR	Description
Body	<ul style="list-style-type: none"> ➤ Autosegmentation ➤ Manual verification
Urinary Bladder	<ul style="list-style-type: none"> ➤ Cranial-Dome ➤ Caudal- base of bladder ➤ Contour outer wall including urine
Small Bowel Loops	<ul style="list-style-type: none"> ➤ Use oral contrast ➤ 30-40 minutes prior to scanning, small sips ➤ Small bowel loops contain contrast
Large Bowel Loops	<ul style="list-style-type: none"> ➤ Ascending colon ➤ Transverse colon ➤ Descending colon ➤ Sigmoid colon ➤ Caudal-Continues with upper border of sigmoid

OAR	Description (cont..)
Bowel Bag	<ul style="list-style-type: none"> ➤ Entire abdominal contents excluding muscle and bones ➤ Caudal- Most inferior small or large bowel loop, or above the Rectum or AnoRectum, whichever is most inferior ➤ If Rectum or AnoRectum is present, it should be included
Sigmoid colon	<ul style="list-style-type: none"> ➤ Continuous with AnoRectum ➤ Stops prior connecting to the ascending colon laterally
Proximal femur	<ul style="list-style-type: none"> ➤ Inferiorly lowest level of ischial tuberosities ➤ Superiorly top of the ball of the femur ➤ Include trochanters ➤ Use bone window
Penile Bulb	<ul style="list-style-type: none"> ➤ Portion of bulbous spongiosum of penis ➤ Immediately inferior to GU diaphragm ➤ Does not extend into shaft or pendulous portion penis

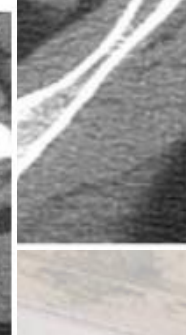
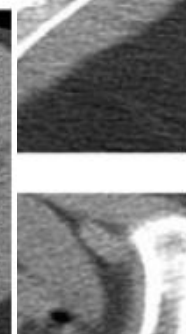
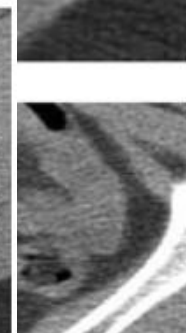
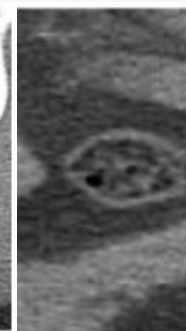
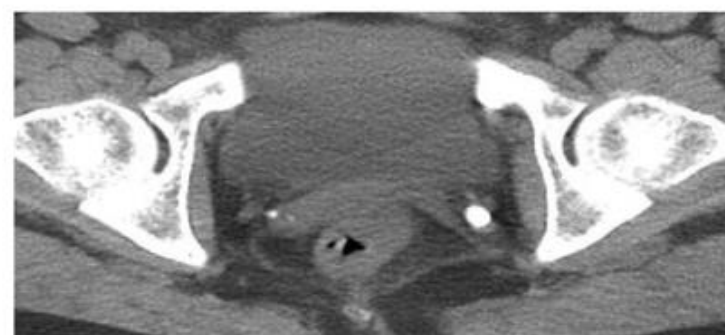
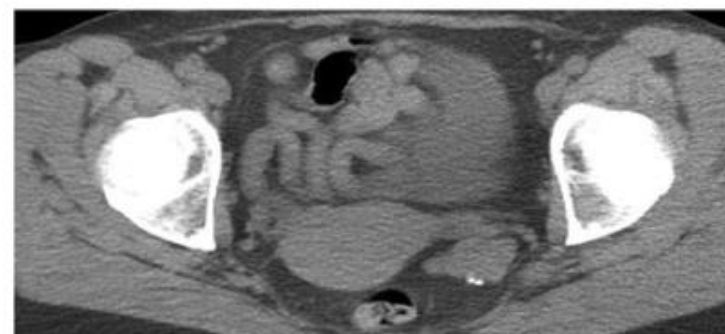
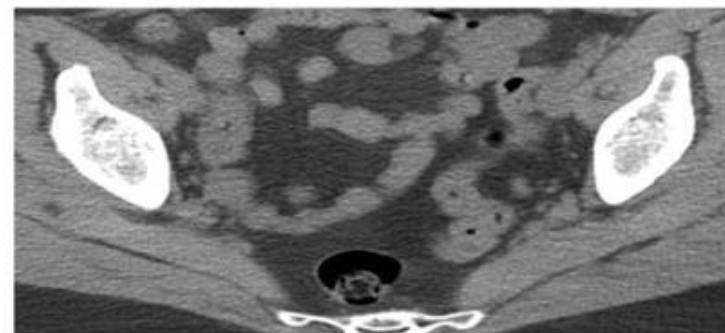
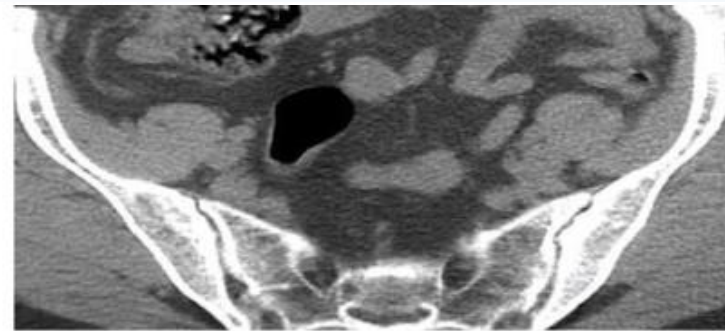
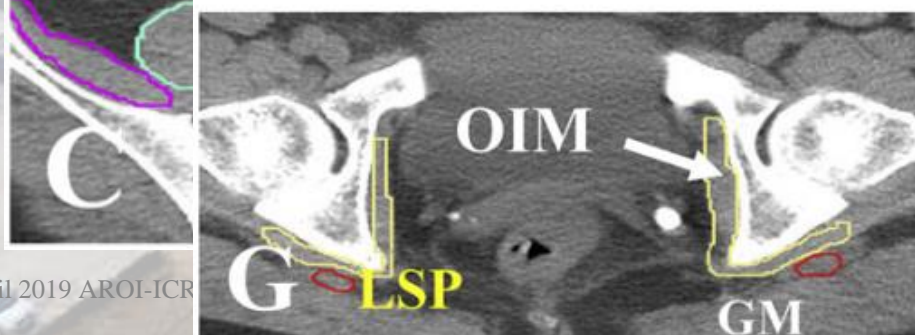
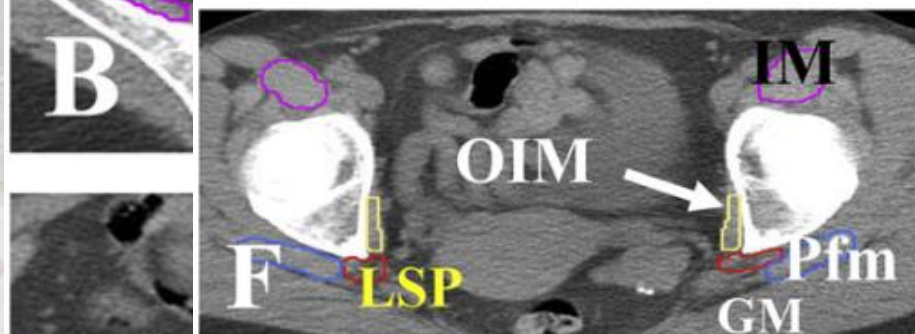
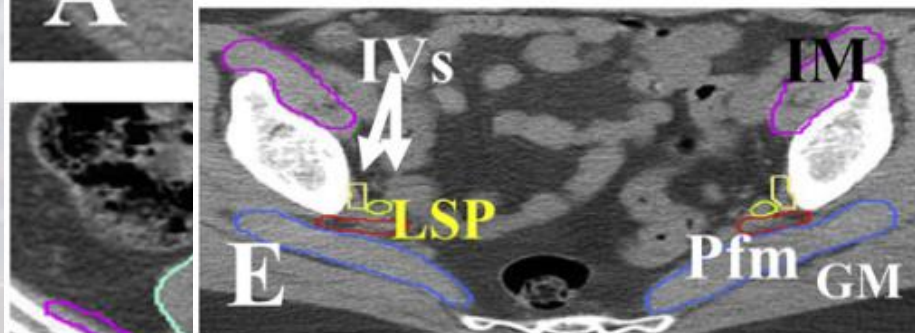
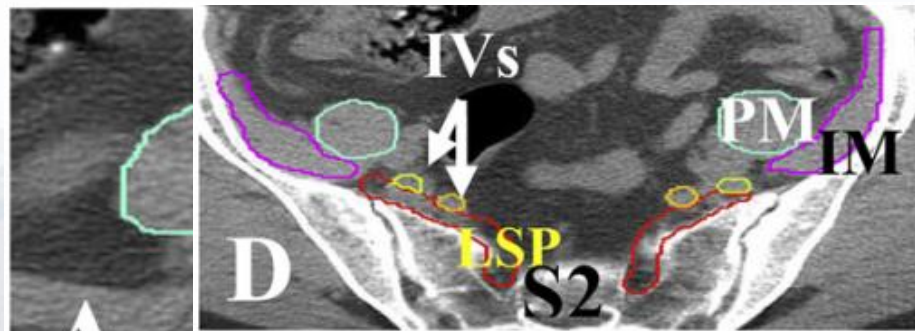


Penile Bulb

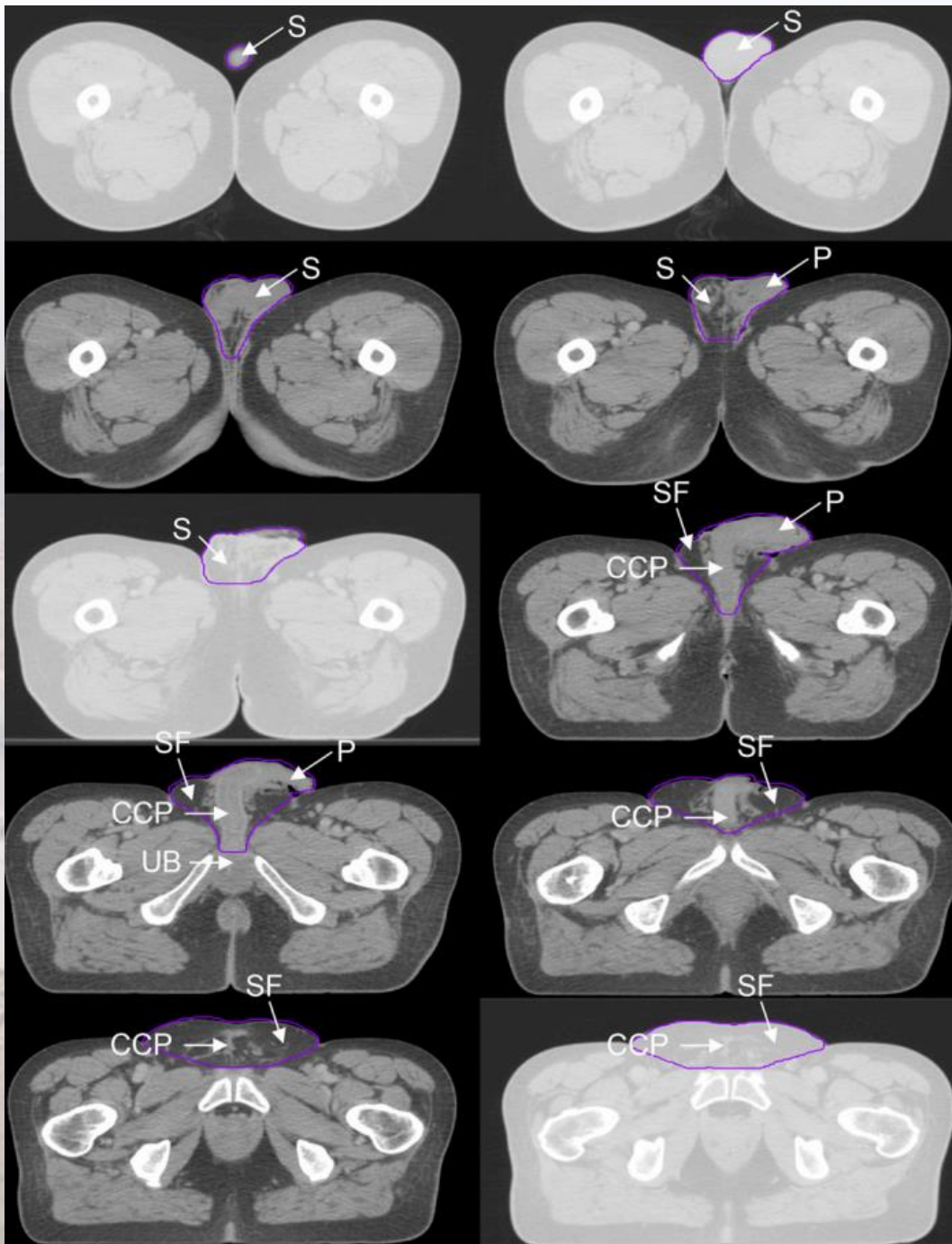


OAR	Description (cont..)
Lumbosacral Plexus	<ul style="list-style-type: none"> ➤ At L4 and L5 level: Entire respective foramina ➤ L4 root: Space between psoas major anterior and laterally, facet joint/posterior vertebral body posteriorly ➤ L5 root: Common iliac vein and psoas anteriorly, iliacus laterally, vertebral body and sacrum posteriorly. ➤ Below L5 foramen: SI joint laterally ➤ At the level of S1 foramen, lumbosacral plexus (L4/L5) and S1 lie in the area bounded by iliac vessel anteriorly, iliacus muscle and SI joint laterally, sacral ala posteriorly, and medial margin of S1 foramen medially. ➤ Beginning at the level of origin of the piriformis muscle (PFM), the lumbosacral plexus should be contoured in the space bounded by iliac vessels anteriorly, iliacus muscle and iliac wing wing laterally, and piriformis muscle posteriorly

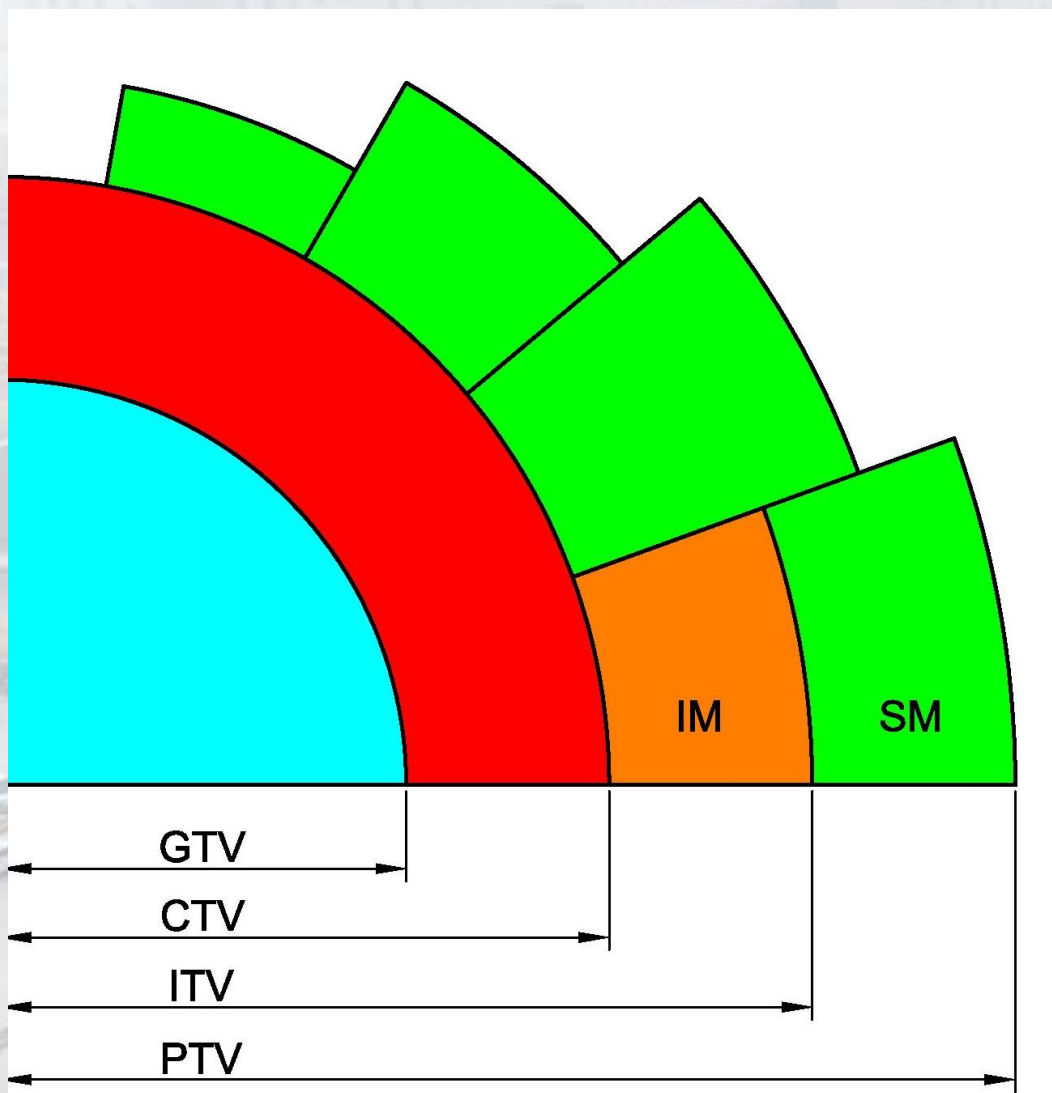
OAR	Description (cont..)
Lumbosacral Plexus (cont.)	<ul style="list-style-type: none"> ➤ At the lower margin of the greater sciatic foramen, contour the space bounded by the obturator internus muscle (OIM)/ischial spine anteriorly, PFM, and gluteus maximus (GM) posteriorly. The medial portion of the OIM should serve as the medial extent. ➤ Below PFM, contour the space between the OIM anteriorly and the GM posteriorly. The medial and lateral extent should be 1 to 2 cm in length. ➤ Contour to the level of the superior most portion of the femoral neck.



OAR	Description (cont..)
Prostate	<ul style="list-style-type: none"> ➤ Inferiorly from apex and superiorly to base ➤ Muscles and soft tissues abutting the capsule are excluded
Seminal Vesicle	<ul style="list-style-type: none"> ➤ Entire seminal vesicles
Ovaries and fallopian tube	<ul style="list-style-type: none"> ➤ Both right and left ovary and fallopian tube ➤ Normal fallopian tubes difficult to see
Uterus	<ul style="list-style-type: none"> ➤ The uterus and cervix as one structure. ➤ Tip: Fuse with MRI to help identify it.
Genitalia	<ul style="list-style-type: none"> ➤ Scrotum, perineal body, corpus cavernosum of penis ➤ Clitoris, labia majora and minora for females ➤ Surrounding fat, soft tissue anterior to symphysis pubis ➤ Exclude muscle and bone



Target volumes



GTV: Clinical examination + Endoscopy + Imaging
CTV: GTV+ Pattern of recurrence + Clinical judgement
ITV: Respiratory movement + Tumor movement + OAR movement + Filling effects
PTV: Setup error (Departmental margin)

An aerial photograph of a large medical facility, likely a cancer center, featuring several multi-story buildings with modern architectural designs. The facility is surrounded by extensive parking areas with numerous cars parked. The image is slightly hazy, suggesting a clear but bright day. A prominent blue rectangular banner is overlaid in the center of the image, containing white text.

Based on RTOG 0529 protocol

RTOG 0529-Planning details

- CT-based planning
- CT thickness 5mm or less
- Upper lumbar spine to the mid femur
- Oral and IV contrast
- Radio-opaque marker anal verge
- Wire to outline caudal extent
- Supine, “arms-up,” frog-legged position
- Prone position with bowel displacement
- Custom immobilization / Belly board

RTOG 0529-Planning details

GTV A: Primary tumor

GTV N54: Nodes >3 cm

GTV N50: Nodes <3 cm

CTV = GTV plus areas of potential microscopic disease

2.5-cm and 1-cm expansion around primary and nodal GTV

Elective nodal CTV:

Mesorectum

Presacral space

Bilateral internal and external iliac

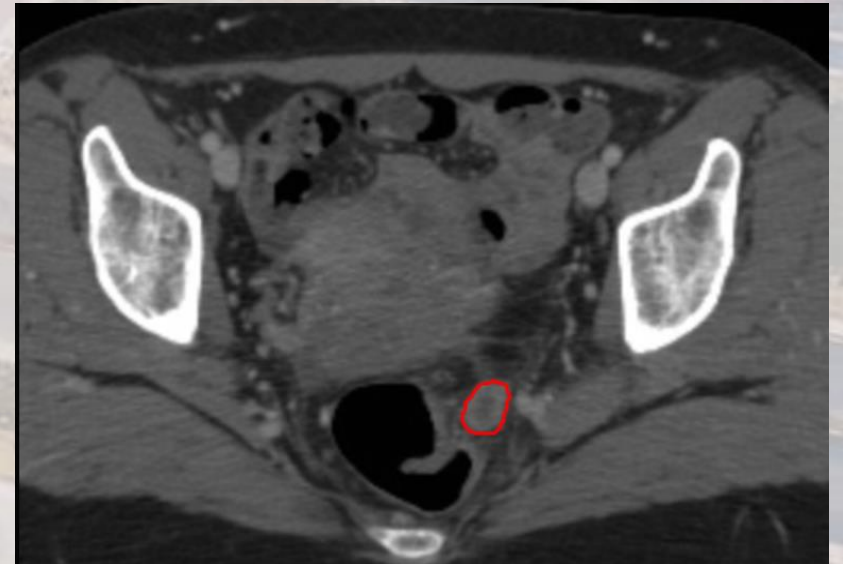
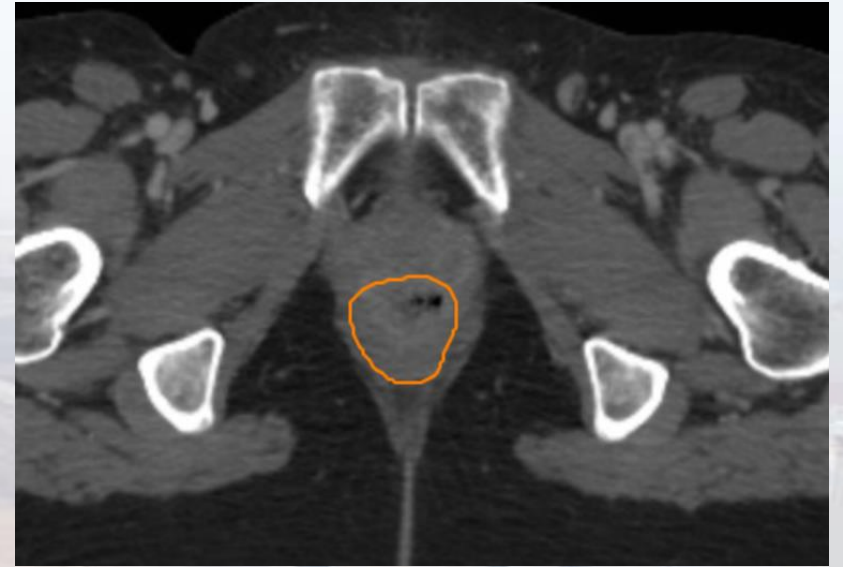
Bilateral inguinal

1 cm expansion to CTV = PTV

PTV not edited except skin

GTV

- GTV-P: All gross disease on physical examination including DRE, endoscopy and imaging (CT, MRI, PET)
- GTV-N:
 - All nodes ≥ 1.5 cm
 - PET positive
 - Biopsy proven
 - In absence of biopsy, any clinically or radiographically suspicious lymph nodes should be included in the GTV-N



GTV-N

- ❑ **GTV-N54:** Macroscopic nodal disease > 3 cm in greatest dimension (Biopsy or Imaging)
- ❑ **GTVN50.4:** Macroscopic nodal disease < 3 cm in greatest dimension (Biopsy or Imaging)

Nodal regions include:

- Mesorectal (including perirectal and presacral)
- Right and left inguinal
- Right and left external iliac
- Right and left internal iliac

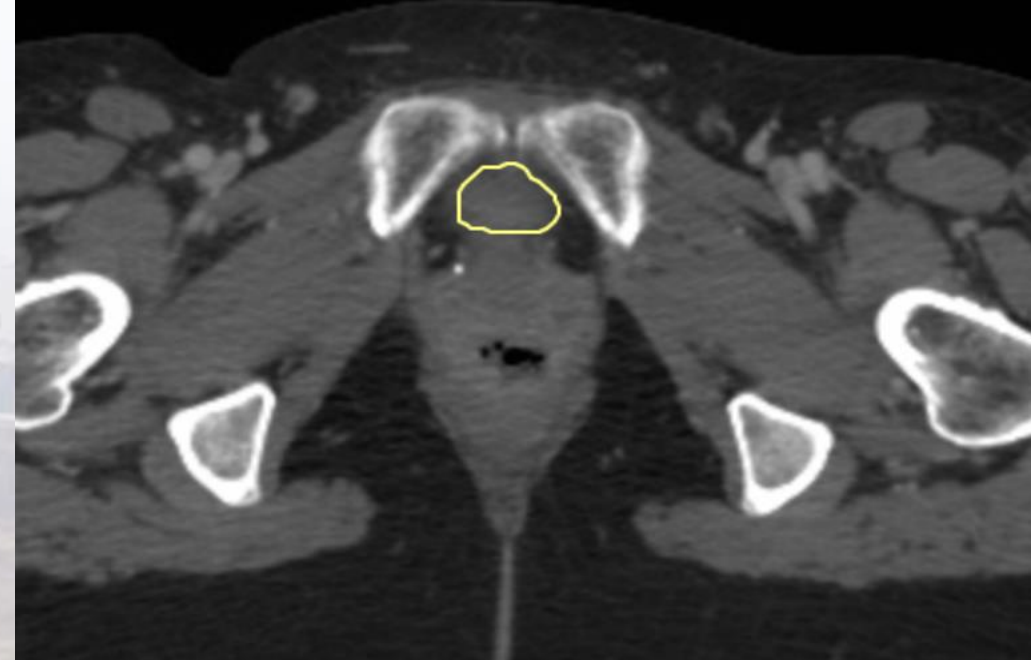
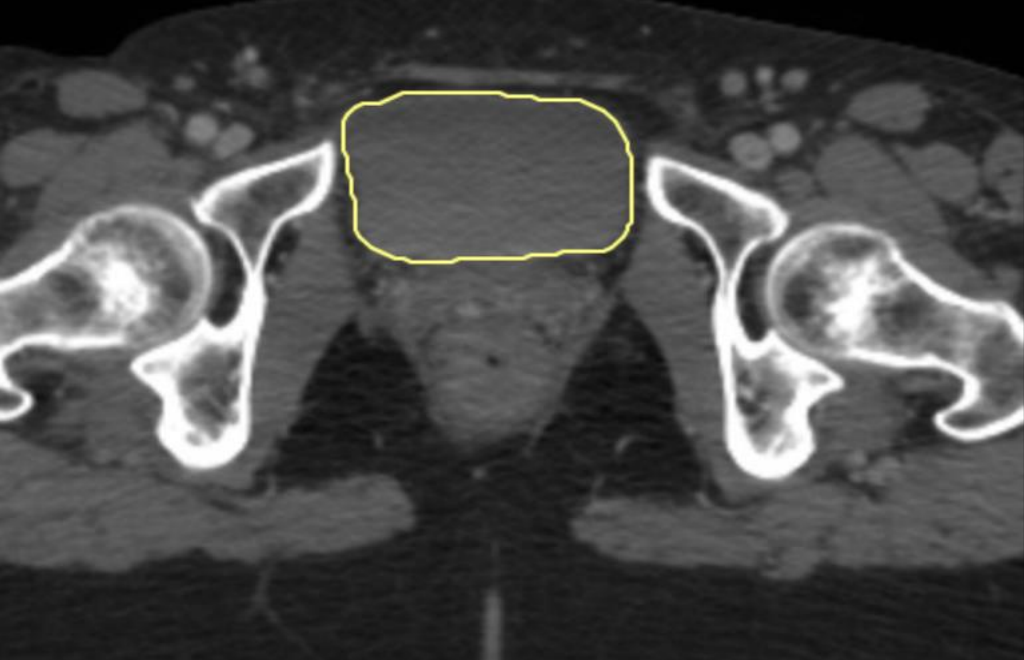
CTV

- CTV: GTV plus areas considered to contain potential microscopic disease
 - CTV-P: GTV plus area containing microscopic disease
 - Primary anal canal GTV + remaining anal canal + 2.5 cm margin
 - Exclude bone, muscle, air
- CTV-N54: GTV node ($> 3\text{cm}$ in greatest dimension) plus 1cm expansion plus nodal regions containing macroscopic disease
- CTV-N50: GTV node ($< 3\text{cm}$ in greatest dimension) plus 1cm expansion plus nodal regions containing macroscopic disease
- CTV45: Elective nodal regions will receive 45 Gy for T3, T4, N0 disease
- CTV-N42: Elective nodal regions will receive 42 Gy for T2N0 cases

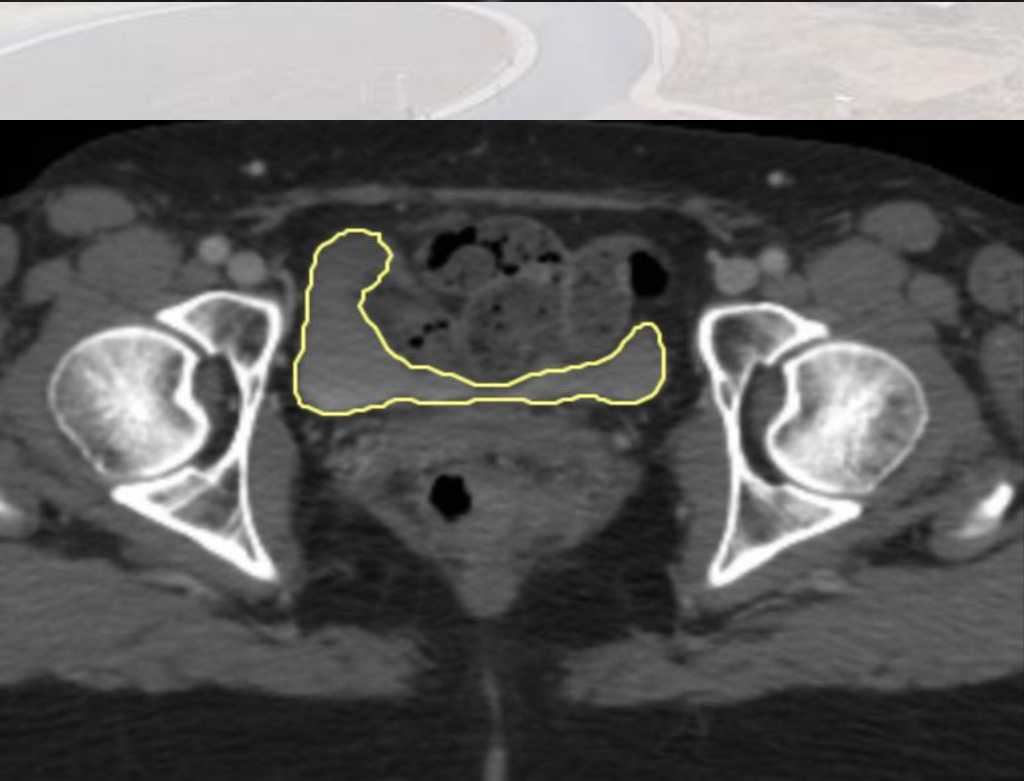


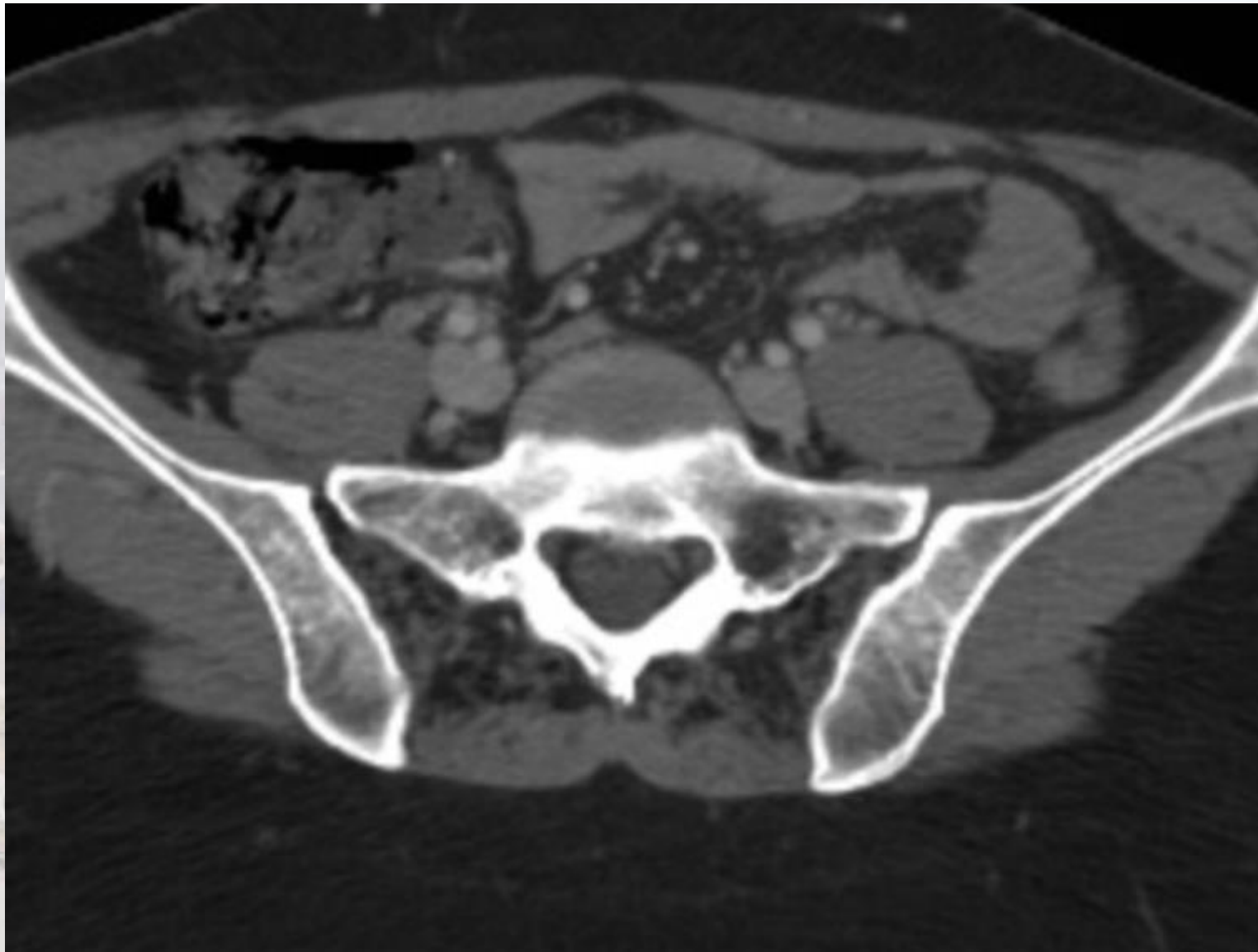
Clinical Example

Ca Anal Canal, Radical CTRT cT2cN1M0, SCC



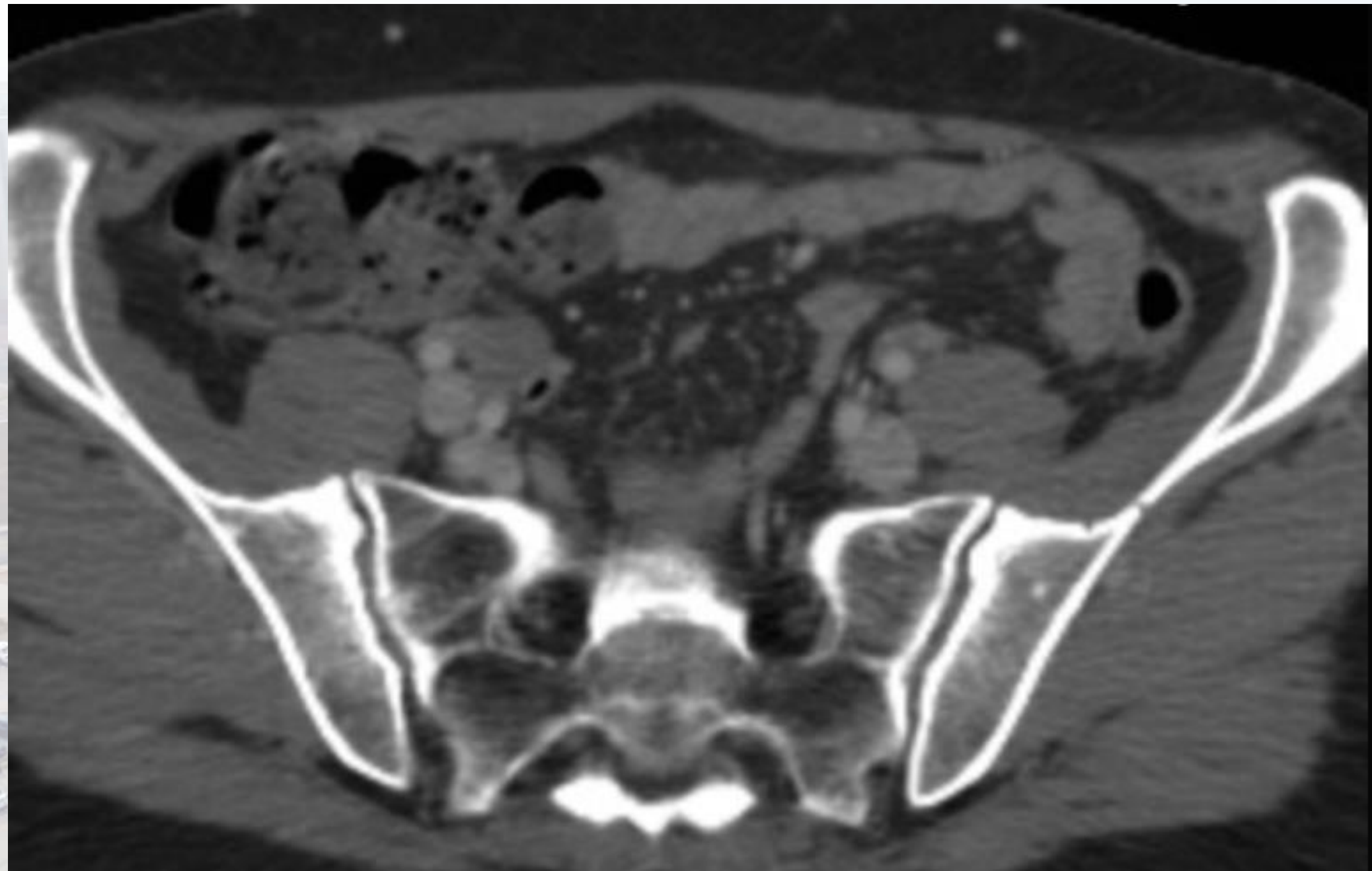
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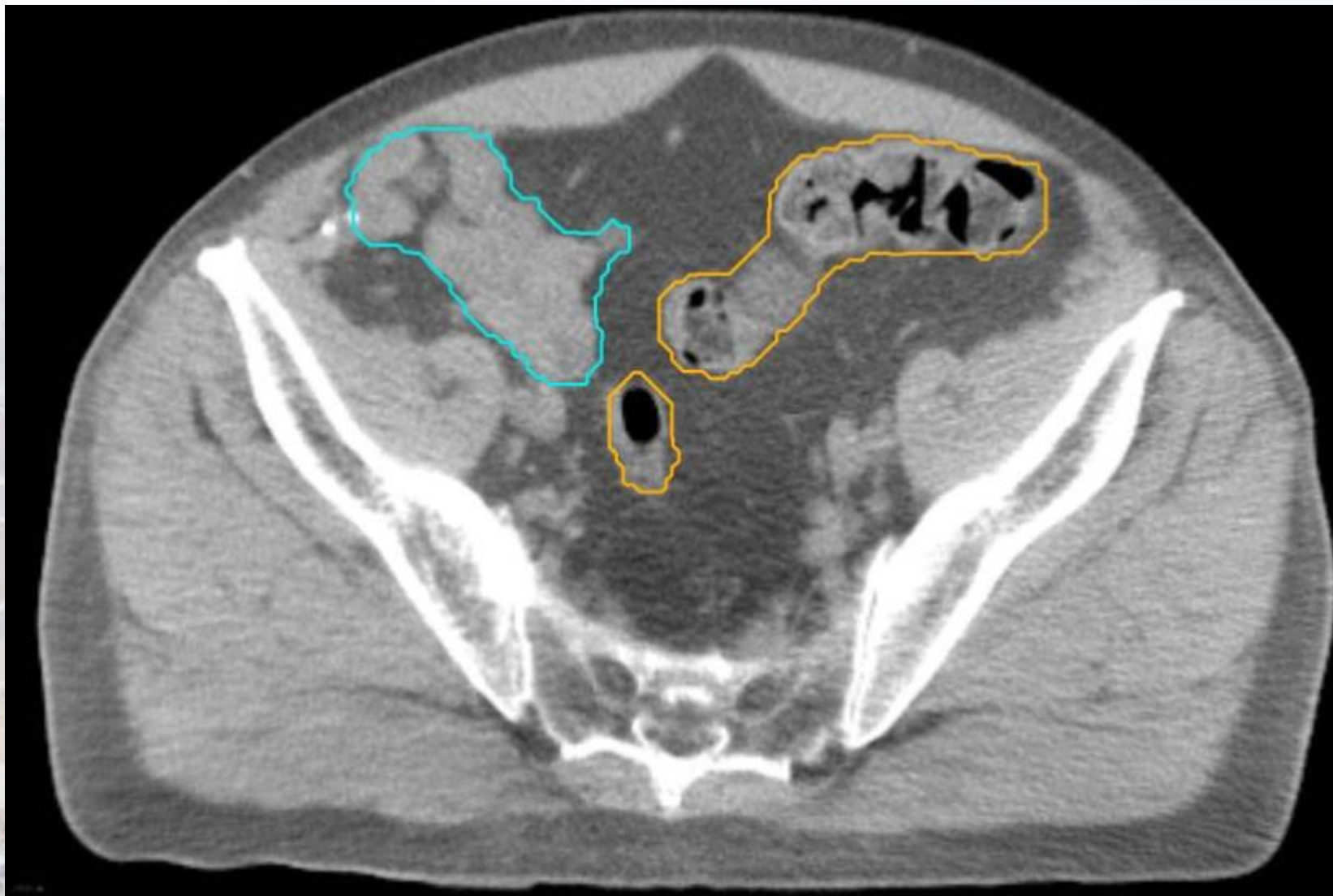
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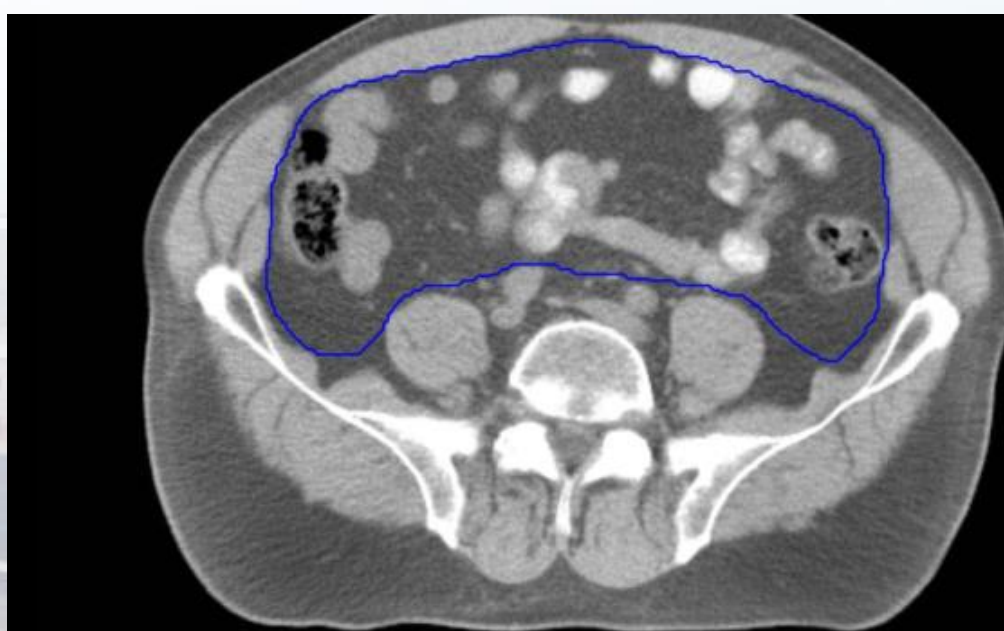
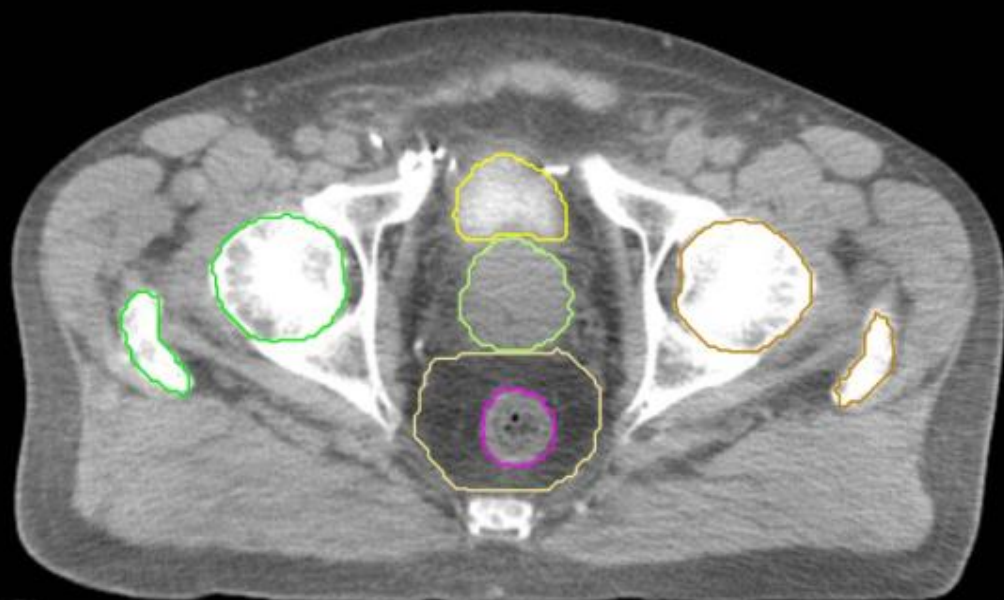
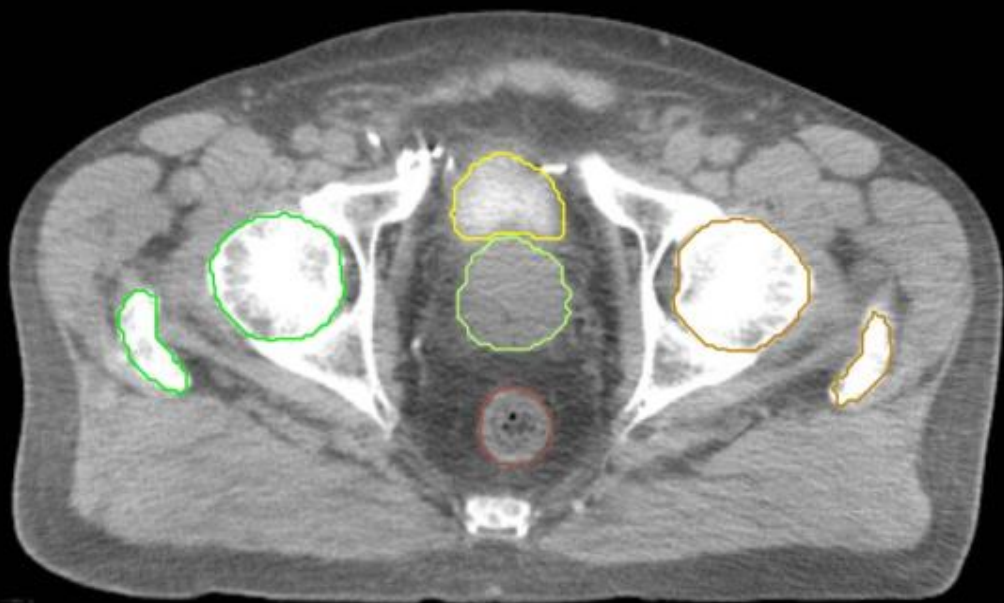


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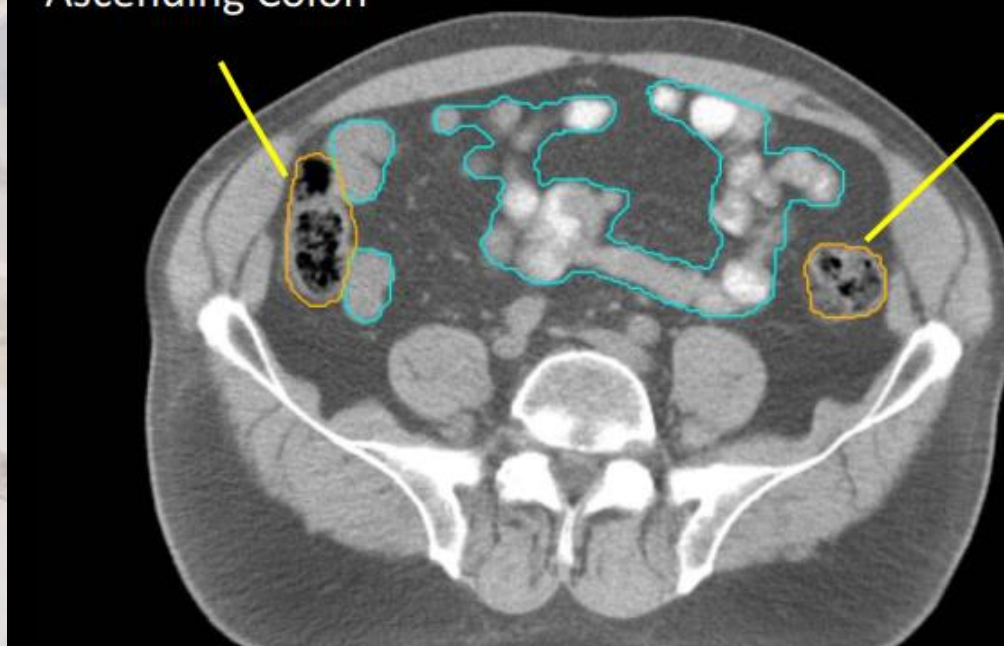
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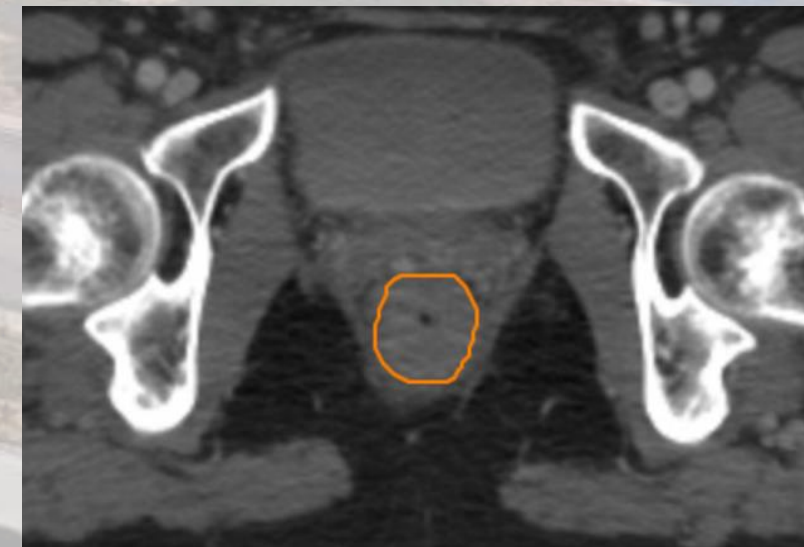
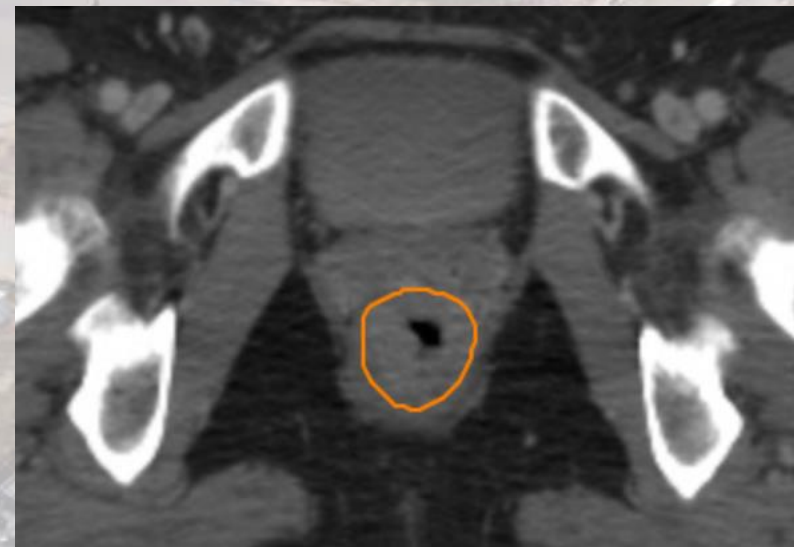
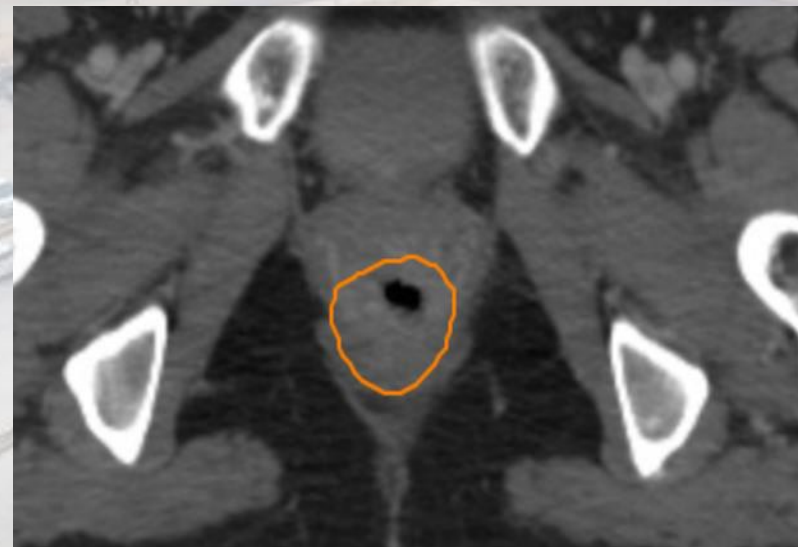
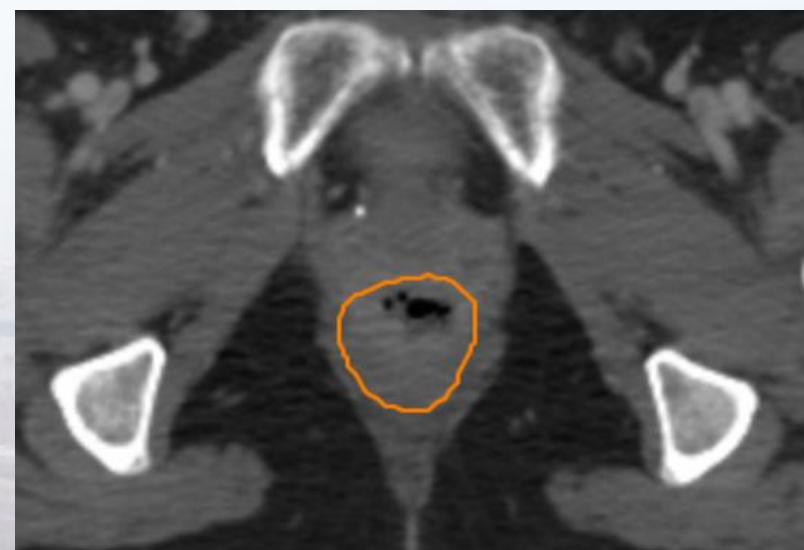
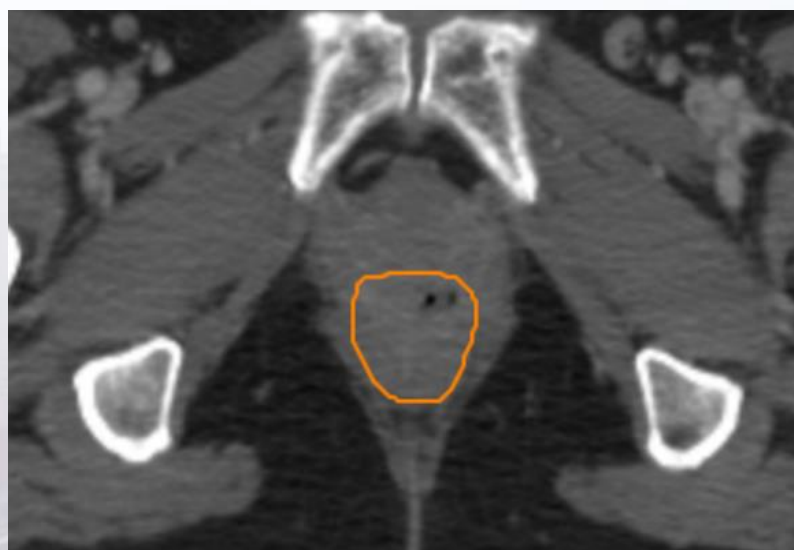
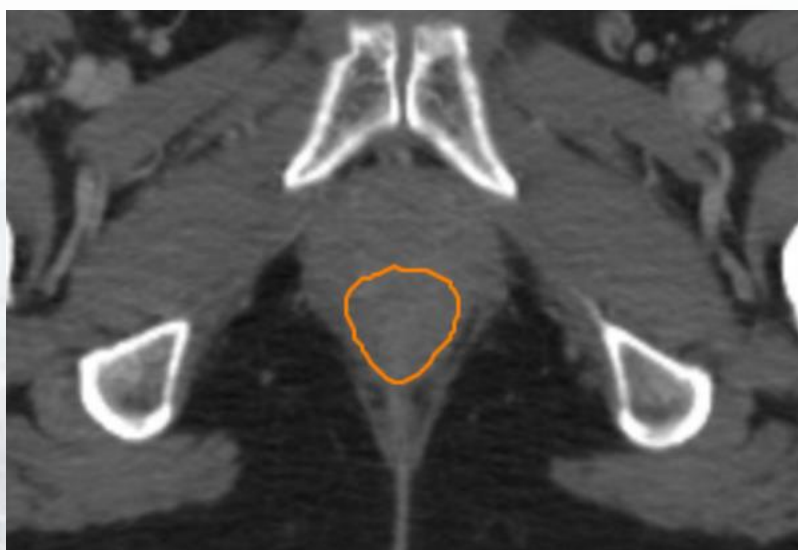
SMALL AND LARGE BOWEL LOOPS

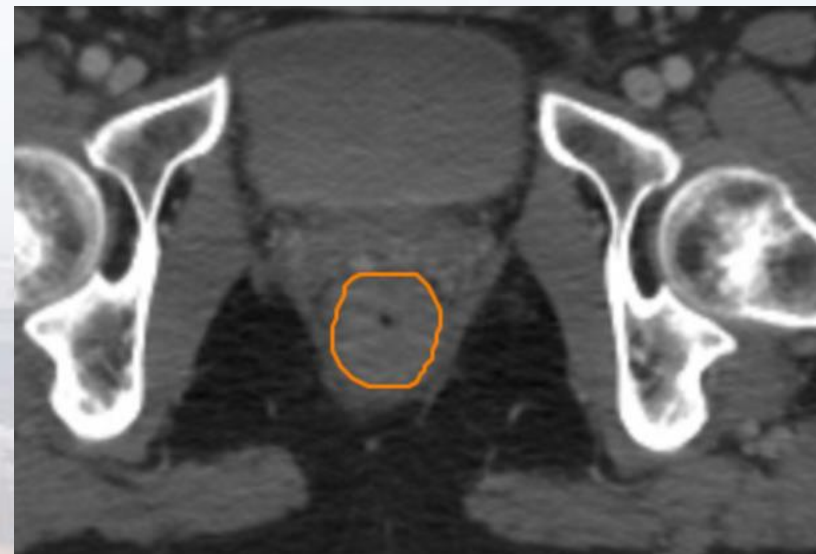
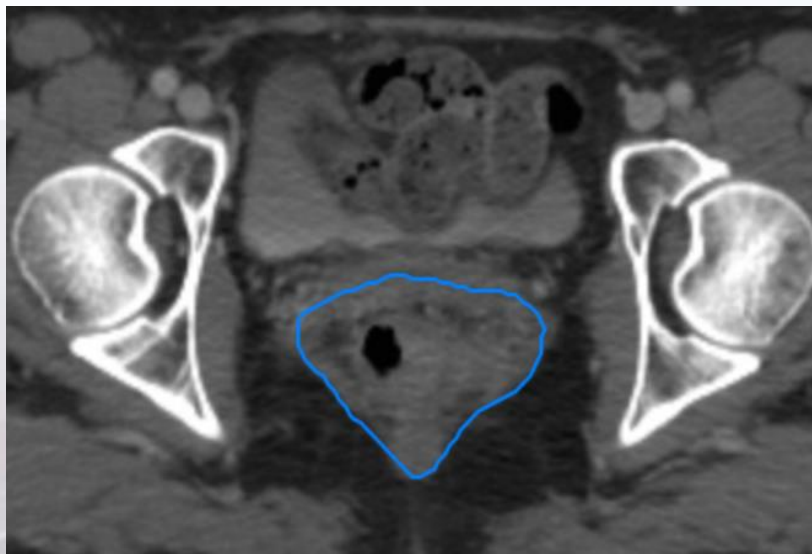
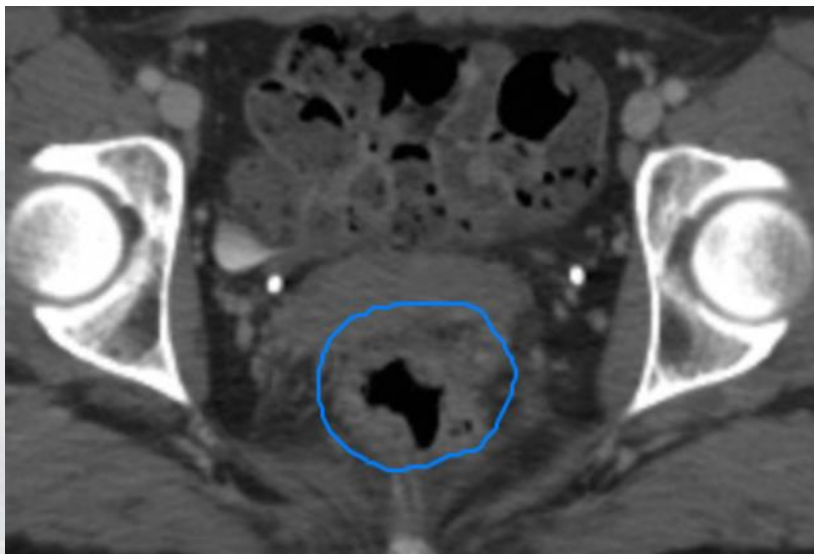


Ascending Colon

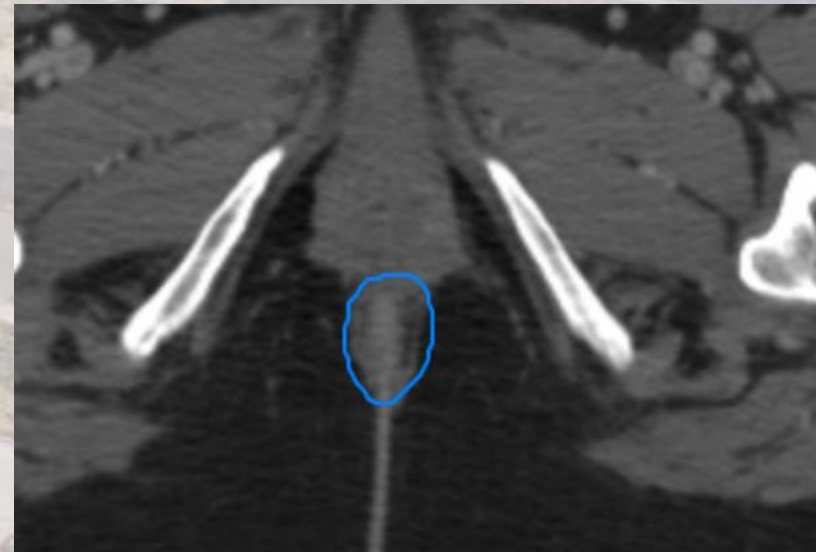
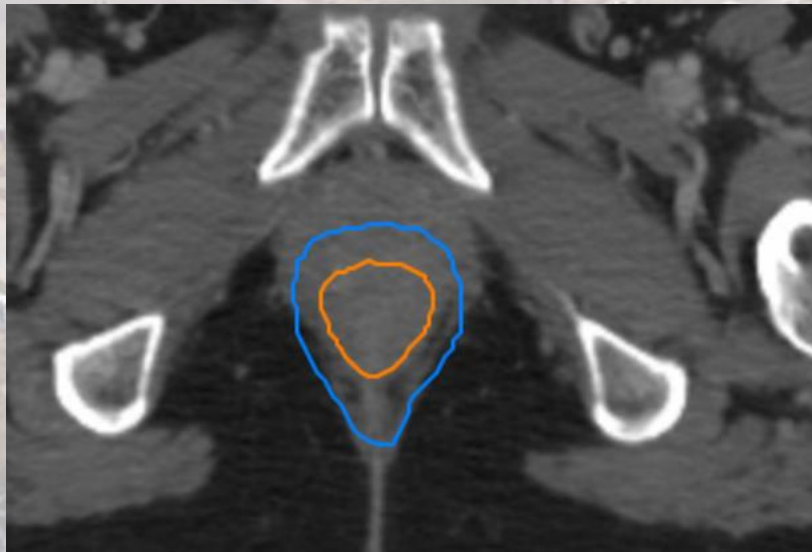
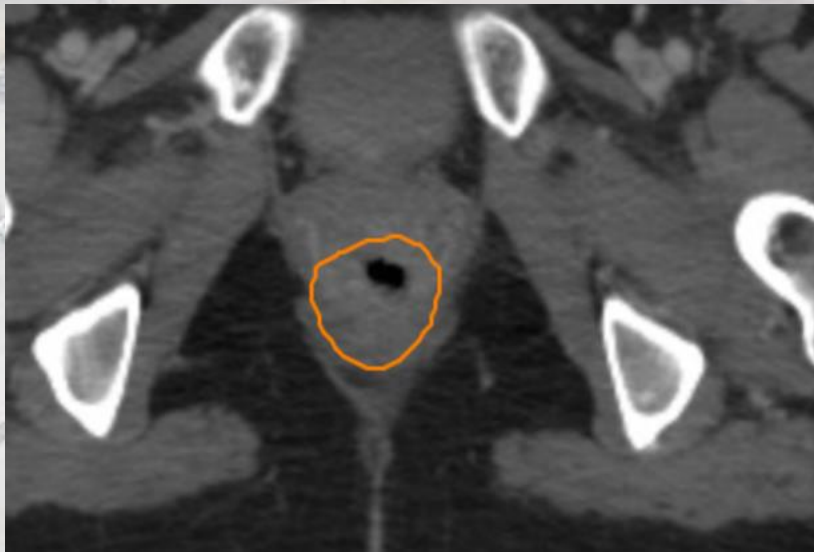


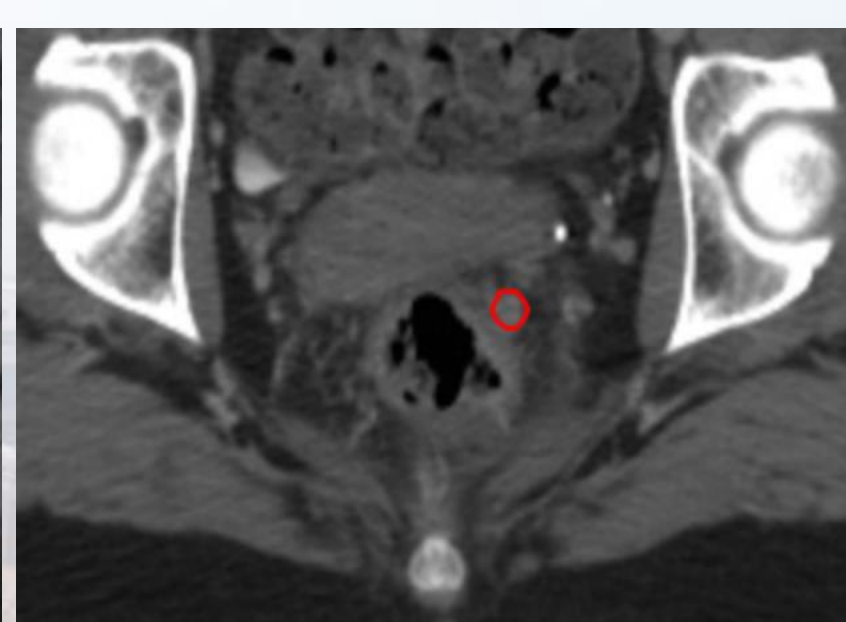
Descending Colon



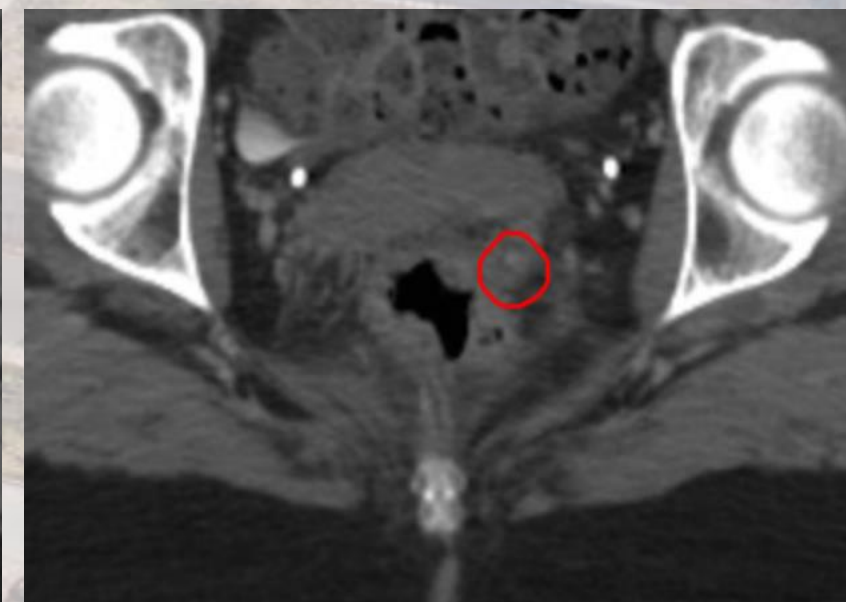
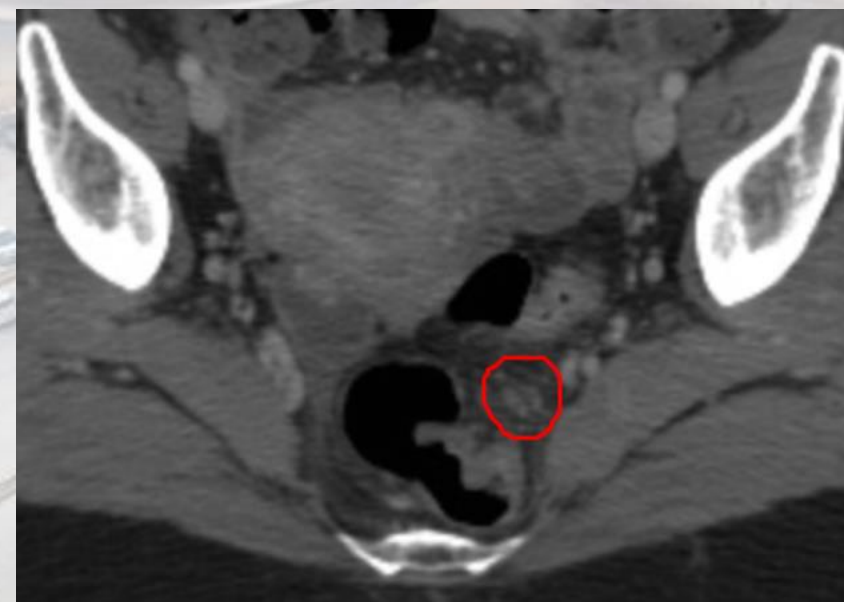


CTV 54 PRIMARY

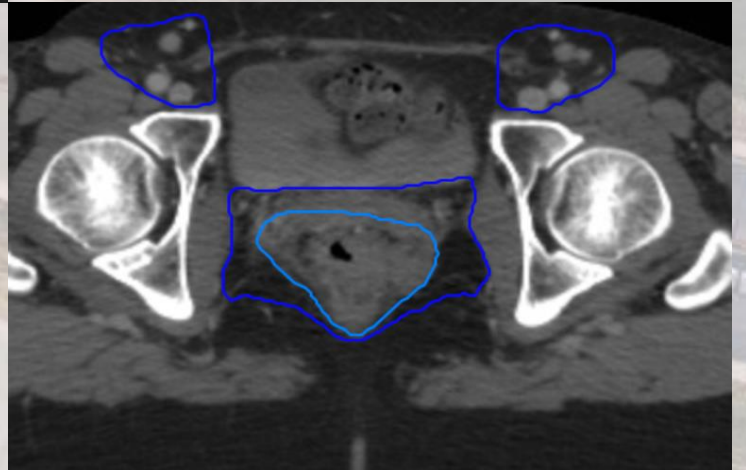
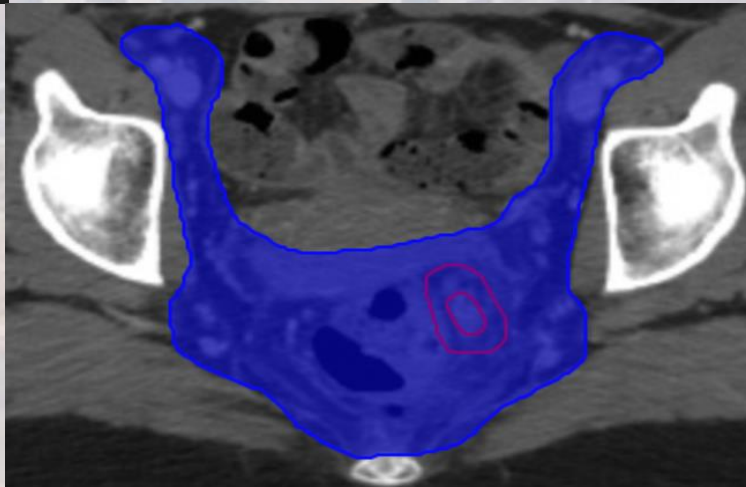
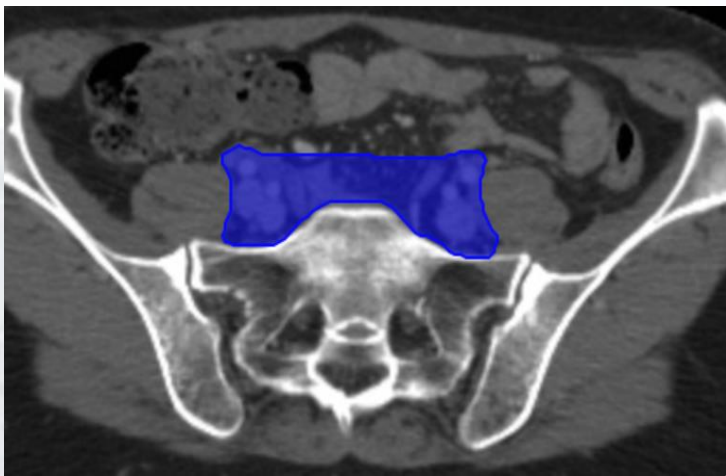




GTV AND CTV 50.4



CTV 45





Based on Australasian Gastrointestinal Trials Group (AGITG)

GTV-P: Based on all available clinical and imaging information
GTV-N: All involved node(s)

CTV-P:

1. GTV-P
2. Entire anal canal from the ano-rectal junction to the anal verge
3. Internal and external anal sphincters
4. (1 + 2 + 3) + 20 mm isotropic margin
5. Respect anatomical boundaries
6. Ensure coverage of perianal skin
7. 20-mm radial and caudal margin around perianal and skin lesion

CTV-N:

1. Involved node(s) or nodal region(s) with a 10- to 20- mm margin
2. Respect anatomical boundaries

Description of the borders used in defining the elective nodal regions

	Mesorectum	Presacral space	Internal iliac nodes	Ischiorectal fossa	Obturator nodes	External iliac nodes	Inguinal nodes
Cranial	Rectosigmoid junction	Sacral promontory (L5/S1) interspace	Bifurcation of common iliac artery (L5/S1)	Apex formed by levator ani, g. maximus, obturator internus	3–5 mm cranial to obturator canal	Bifurcation of common iliac artery	Level where ext. iliac a. leaves bony pelvis to become femoral artery
Caudal	Anorectal junction (levators fuse with external sphincter)	Inferior edge of coccyx	Level of obturator canal or level where there is no space between obturator internus and midline organs	Anal verge	Obturator canal, where obturator artery has exited the pelvis	Between roof of acetabulum and superior pubic rami	Lower edge of ischial tuberosities
Posterior	Presacral space	Position at anterior border of sacral bone; should include sacral hollow	N/A	Transverse plane joining anterior edge of medial walls of the gluteus maximus muscle	Internal iliac nodes	Internal iliac nodes	Muscle boundaries
Anterior	Males: penile bulb and prostate in the lower pelvis, SV, and bladder Females: bladder Internal margin of 10 mm added to anterior mesorectal border on slices containing bladder	10 mm anterior to the sacral border encompassing any lymph nodes	Obturator internus mm or bone in the lower pelvis; in upper pelvis, 7 mm margin around the internal iliac vessels	Level where obturator internus, levator ani, and sphincter muscle fuse; inferiorly, at least 10–20 mm anterior to sphincter muscles	Anterior extent of obturator internus	7 mm margin anterior to the external iliac vessels	Minimum 2 cm margin on the inguinal vessels
Lateral	Lower pelvis = medial edge of levator ani; upper pelvis = internal iliac nodes	Sacroiliac joints	Medial edge of muscle or bone	Ischial tuberosity, muscles	Obturator internus	Iliopsoas muscle	Medial edge of sartorius or iliopsoas
Medial	N/A	N/A	Mesorectum and presacral space in the lower pelvis; 7 mm margin around vessel in the upper pelvis	N/A	Bladder	Bladder or 7 mm margin around vessel	10–20 mm margin around the femoral vessels

Dose and fractionation

- SIB preferred
- Gross disease: 54 Gy over 30 fx with conc chemotherapy
- T1 and non-bulky T2 tumors: 50.4 Gy in 28 fx
- Involved nodes/regions: 50.4 to 54 Gy, depending on size
- For total doses of 54 Gy- elective dose 45 Gy
- For total dose 50.4 Gy- elective dose 42 Gy
- Sequential technique: Initial elective dose 30 to 36 Gy, followed by a boost to macroscopic disease to 50.4 to 60 Gy

An aerial photograph of a large medical facility, likely a cancer center, featuring several multi-story buildings with modern architectural designs. The facility is surrounded by parking lots with numerous cars and some green spaces. A prominent blue rectangular box is overlaid on the center of the image, containing the title text.

RTOG Anorectal contouring atlas

Clinical target volume	Key highlights
CTV-A (perirectal, presacral, internal iliac regions)	<p>Lower pelvis: The inferior border should be 2 cm below gross disease. Should include the entire mesorectum. Does not need to extend more than a few millimeters beyond the levator muscles</p> <p>Mid-pelvis: Includes the internal iliac region. Posterior and lateral margins should extend to pelvic sidewall muscle or bone. Recommends at least 1 cm anteriorly into the bladder</p> <p>Upper pelvis: The most superior extent should be at the bifurcation of the common iliac vessels (approximate bony landmark: the sacral promontory). At midline, CTVA should extend at least 1 cm anterior to the sacrum</p> <p>Recommend 7–8 mm margin in soft tissue around the iliac vessels, but at least 1 cm anteriorly, especially if vessels or small nodes are seen in this area. CTV should be trimmed off uninvolved muscle and bone</p>
CTV-B (external iliac region)	<p>The border between the inguinal and external iliac region is somewhat arbitrary. The consensus was that the border should be set at the level of the inferior extent of the internal obturator vessels (bony landmark: the upper edge of the superior pubic rami)</p> <p>Recommend 7–8 mm margin in soft tissue around the iliac vessels, but at least 1 cm anteriorly, especially if vessels or small nodes are seen in this area. CTV should be trimmed off uninvolved muscle and bone</p>
CTV-C (inguinal region)	The most inferior extent should be 2 cm below the saphenous/femoral junction

Myerson et al. 2009

- RTOG 0529 protocol is based on this consensus target volume concept
- Combined guideline for anorectal tumor

Dose to target volume and OAR

CTV-P	T1N0: Not included T2N0: 50.4 Gy at 1.8 Gy/fx N + or T3-T4: 54 Gy at 1.8 Gy/fx
CTV-N	50.4 Gy at 1.68 Gy/fx if node ≤ 3 cm 54 Gy at 1.8 Gy/fx if node > 3 cm
CTV-HR	T2N0: 42 Gy at 1.5 Gy/fx T2N + or T3-T4: 45 Gy at 1.5 Gy/fx

OAR dose constraints

OAR	RTOG 0529	QUANTEC
Small bowel	$V_{30Gy} < 200 \text{ cc}$ $V_{35Gy} < 150 \text{ cc}$ $V_{45Gy} < 20 \text{ cc}$ $D_{max} < 50Gy$	$V_{15Gy} < 120 \text{ cc}$ (individual loops) $V_{45Gy} < 195 \text{ cc}$ (entire potential space within peritoneal cavity)
Large bowel	$V_{30Gy} < 200 \text{ cc}$ $V_{35Gy} < 150 \text{ cc}$ $V_{45Gy} < 20 \text{ cc}$	
Femoral heads	$V_{30Gy} < 50 \%$ $V_{40Gy} < 35 \%$ $V_{44Gy} < 5 \%$	
Iliac crests	$V_{30Gy} < 50 \%$ $V_{40Gy} < 35 \%$ $V_{50Gy} < 5 \%$	

OAR dose constraints

OAR	RTOG 0529	QUANTEC
External genitalia	V20Gy < 50 % V30Gy < 35 % V40Gy < 5 %	
Bladder	V35Gy <50% V40Gy <35% V50Gy <5%	Dmax < 65 Gy V65Gy < 50 %
Large bowel	V30Gy <200 cc V35Gy <150 cc V45Gy <20 cc	

Conclusion

- Target and organ delineation is central to success
- Clinical examination is as important as imaging and endoscopy
- Understanding recurrence pattern, lymphatic drainage is vital
- Co-register all imaging
- Radiological anatomy is necessary component of successful treatment
- Follow guidelines judiciously with appropriate modifications
- Contouring precision should be akin to surgical precision

An aerial photograph of a large, modern hospital complex. The complex consists of several multi-story buildings with light-colored facades and blue accents. A large, circular paved area is visible on the left side of the image. In the foreground, there are parking lots with several cars and motorcycles parked. The sky is overcast and hazy.

THANK YOU