Associazione Italiana Radioterapia e Oncologia clinica

Società Italiana di Radiobiologia

GTV, CTV E OARs NELLA RADIOTERAPIA A FASCI ESTERNI DELLA CERVICE UTERINA

Coordinatore: D. Genovesi

Tutors: A. Augurio, E. Iannacone, B. Pappalardi

Associazione Italiana Radioterapia e Oncologia clinica

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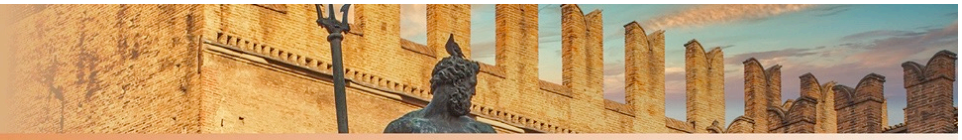


DICHIARAZIONE

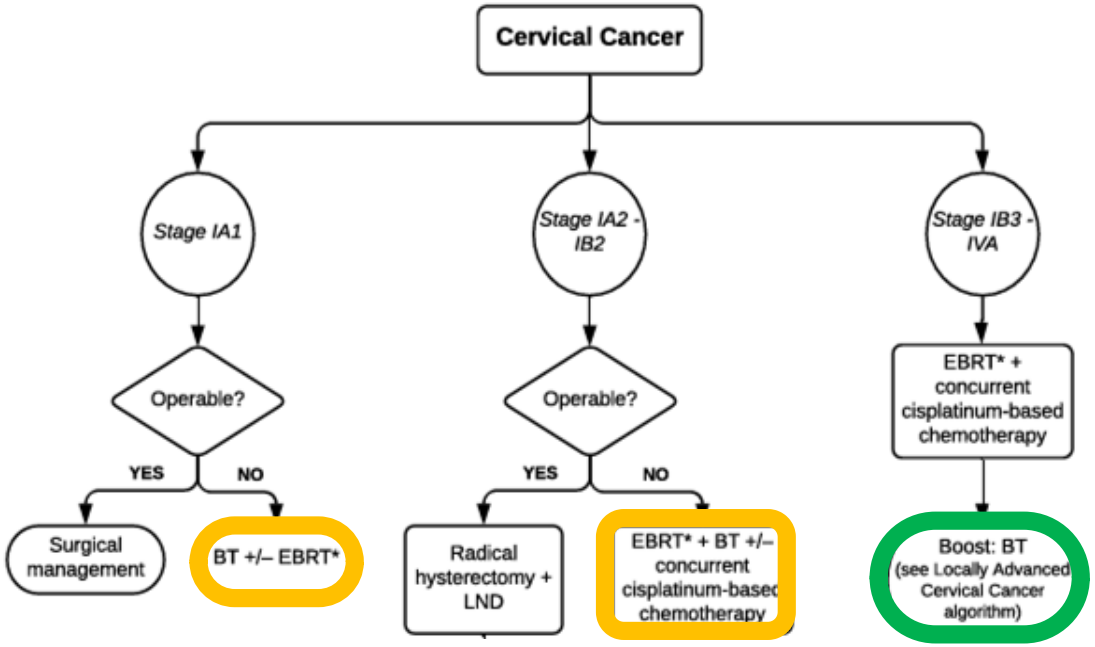
Relatore: **Eva Iannacone**

Istituto Nazionale Tumori IRCCS Fondazione G. Pascale

- Posizione di dipendente in aziende con interessi commerciali in campo sanitario
- Consulenza ad aziende con interessi commerciali in campo sanitario
- Fondi per la ricerca da aziende con interessi commerciali in campo sanitario
- Partecipazione ad Advisory Board
- Titolarità di brevetti in compartecipazione ad aziende con interessi commerciali in campo sanitario
- Partecipazioni azionarie in aziende con interessi commerciali in campo sanitario

NIENTE DA DICHIARARE

PRIMARY RADIOTHERAPY FOR CERVICAL CANCER: EBRT + BT



2018 FIGO STAGING SYSTEM

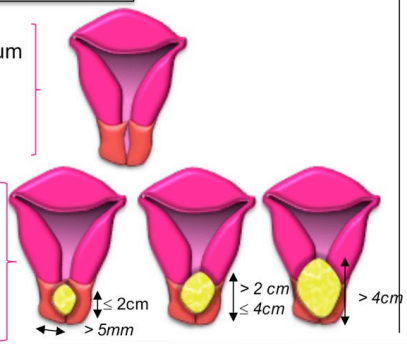
I : Confined to the cervix

IA: Invasive carcinoma with maximum depth of invasion ≤ 5mm

Not visible on MRI

IB: Invasive carcinoma with measured deepest invasion > 5mm

IB1: ≤ 2cm
IB2: > 2 cm and ≤ 4cm
IB3: > 4cm

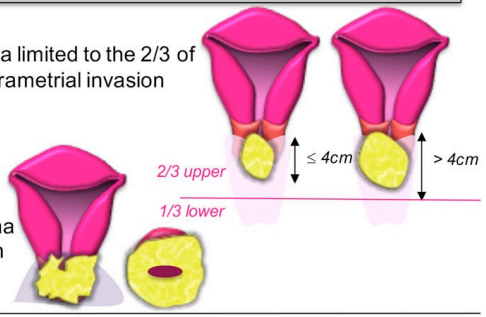


II : Invasion beyond the uterus, but not extended to the lower third of the vagina or pelvic wall

IIA: Invasive carcinoma limited to the 2/3 of the vaginal without parametrial invasion

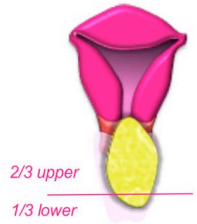
IIA1: ≤ 4 cm
IIA2: > 4 cm

IIB: Invasive carcinoma + parametrial invasion

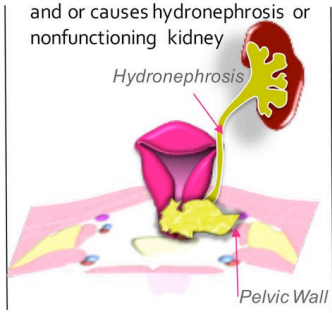


III: Invasion of the lower 1/3 of the vagina/hydronephrosis/ nonfunctioning kidney / pelvic wall / pelvic-paraaortic nodes

IIIA: Lower 1/3 of the vagina, with no extension to the pelvic wall

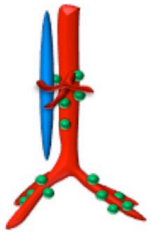


IIIB: Extension to the pelvic wall and or causes hydronephrosis or nonfunctioning kidney



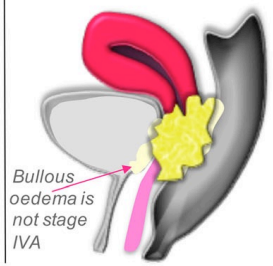
IIIC: Involvement of pelvic and/or para-aortic lymph nodes

IIIC1: Pelvic node metastasis only
IIIC2: Para-aortic nodes metastasis

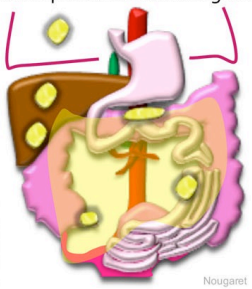


IV: Extension beyond the true pelvis or has involved (biopsy proven) the mucosa of the bladder or rectum.

IVA: Spread to adjacent organs



IVB: Spread to distant organs



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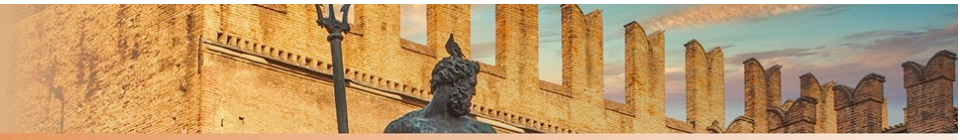

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doi:10.1016/j.ijrobp.2009.10.075

CLINICAL INVESTIGATION **Cervix**

CONSENSUS GUIDELINES FOR DELINEATION OF CLINICAL TARGET VOLUME FOR INTENSITY-MODULATED PELVIC RADIOTHERAPY FOR THE DEFINITIVE TREATMENT OF CERVIX CANCER

KAREN LIM, M.B.B.S.,* WILLIAM SMALL, JR., M.D.,† LORRAINE PORTELANCE, M.D.,‡

BACKGROUND

EMBRACE II study protocol v.1.0

Image guided intensity modulated External beam radiochemotherapy and MRI based adaptive BRAchytherapy in locally advanced CErvical cancer

EMBRACE-II

JJCO Japanese Journal of Clinical Oncology

Jpn J Clin Oncol 2011;41(9)1119–1126
doi:10.1093/jjco/hyr096

A Consensus-based Guideline Defining Clinical Target Volume for Primary Disease in External Beam Radiotherapy for Intact Uterine Cervical Cancer

Takafumi Toita[1,*], Tatsuya Ohno[2], Yuko Kaneyasu[3], Tomoyasu Kato[4], Takashi Uno[5], Kazuo Hatano[6], Yoshiki Norihisa[7], Takahiro Kasamatsu[4], Takeshi Kodaira[8], Ryoichi Yoshimura[9,10], Satoshi Ishikura[11] and

JJCO Japanese Journal of Clinical Oncology

Jpn J Clin Oncol 2010;40(5)456–463
doi:10.1093/jjco/hyp191
Advance Access Publication 4 February 2010

A Consensus-based Guideline Defining the Clinical Target Volume for Pelvic Lymph Nodes in External Beam Radiotherapy for Uterine Cervical Cancer

Takafumi Toita[1,*], Tatsuya Ohno[2], Yuko Kaneyasu[3], Takashi Uno[4], Ryouichi Yoshimura[5], Takeshi Kodaira[6], Kazuhisa Furutani[6], Goro Kasuya[1], Satoshi Ishikura[7], Toshiharu Kamura[8] and Masahiro Hiraoka[9]

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CONSENSUS GUIDELINES FOR THE DELINEATION OF THE CLINICAL TARGET VOLUME FOR INTENSITY MODULATED PELVIC RADIOTHERAPY IN THE POSTOPERATIVE TREATMENT OF ENDOMETRIAL AND CERVICAL CANCER

William Small Jr., MD[1], Loren K. Mell, MD[2], Penny Anderson, MD[3], Carien Creutzberg, MD[4], Jennifer De Los Santos, MD[5], David Gaffney, MD, PhD[6], Anuja Jhingran, MD[7], Lorraine Portelance, MD[8], Tracey Schefter, MD[9], Revathy Iyer, MD[10], Mahesh Varia, MD[11], Kathryn Winter, MS[12], and Arno J. Mundt, MD[13]

Clinical Oncology (2007) **19**: 542–550
doi:10.1016/j.clon.2007.05.002

Original Article

An Atlas of the Pelvic Lymph Node Regions to Aid Radiotherapy Target Volume Definition

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*Department of Radiotherapy, St Bartholomew's Hospital, London, UK; †Department of Radiology, St Bartholomew's Hospital, London, UK

Cancer/Radiothérapie 17 (2013) 486–492

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Mise au point

Délinéation des volumes cibles anatomocliniques pour la radiothérapie des cancers du col utérin

Radiotherapy for cervix carcinomas: Clinical target volume delineation

K. Gnep[a,*], R. Mazeron[b]

International Journal of Radiation Oncology biology • physics
www.redjournal.org

Int J Radiat Oncol Biol Phys, 2021

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Clinical Investigation

NRG Oncology/RTOG Consensus Guidelines for Delineation of Clinical Target Volume for Intensity Modulated Pelvic Radiation Therapy in Postoperative Treatment of Endometrial and Cervical Cancer: An Update

William Small, Jr, MD,* Walter R. Bosch, DSc,†

PHYSICS CONTRIBUTION

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

ALEXANDRA TAYLOR, F.R.C.R.,* ANDREA G. ROCKALL, F.R.C.R.,† RODNEY H. REZNEK, F.R.C.R.,† AND MELANIE E. B. POWELL, M.D., F.R.C.R.*

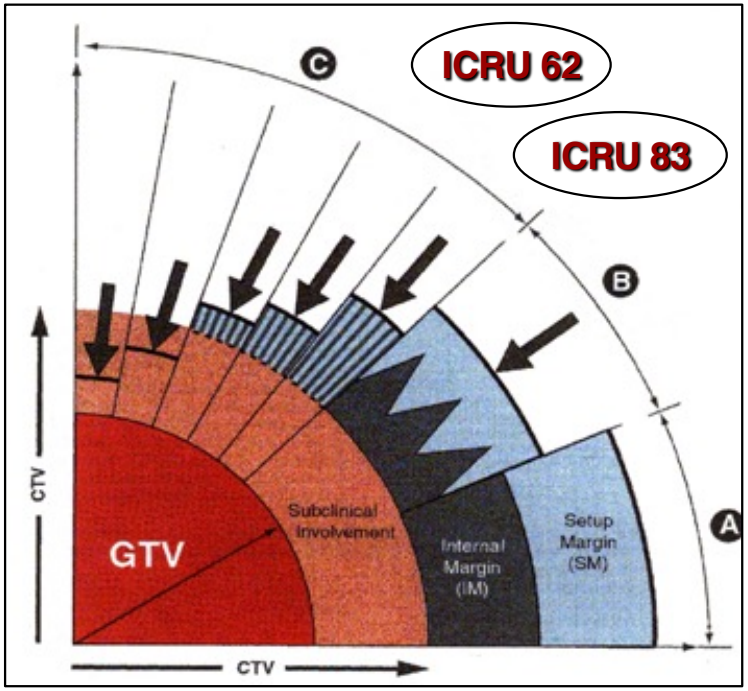
Departments of *Radiotherapy and †Radiology, St. Bartholomew's Hospital, London, United Kingdom

Cervical cancer delineation

An atlas to aid delineation of para-aortic lymph node region in cervical cancer: Design and validation of contouring guidelines

Lorna G. Keenan[a,*], Kathy Rock[a,b], Aini Azmi[a], Osama Salib[a], Charles Gillham[a], Orla McArdle[a]

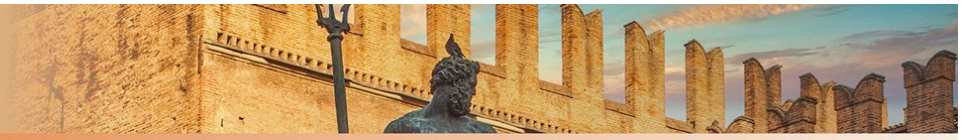
TARGET VOLUMES in 3DCRT / IMRT



- GTVp (GTV primary, GTV-T)
- GTVn (GTV nodal: GTVn1-2…)
- CTVp (CTV-T)
- CTVn (CTV-E; CTV-N1-2….)
- PTVs

CTVp (primary)

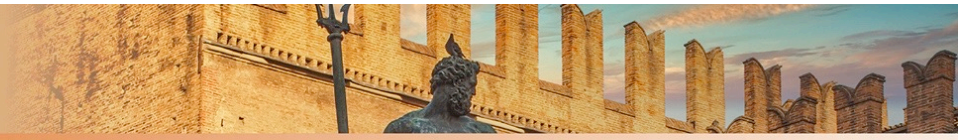
- ❑ GTVp (GTV primary)
- ❑ Uterine cervix
- ❑ Uterine corpus
- ❑ Parametrium
- ❑ Ovary
- ❑ Vagina



CTVp (primary)

Areas of controversy:

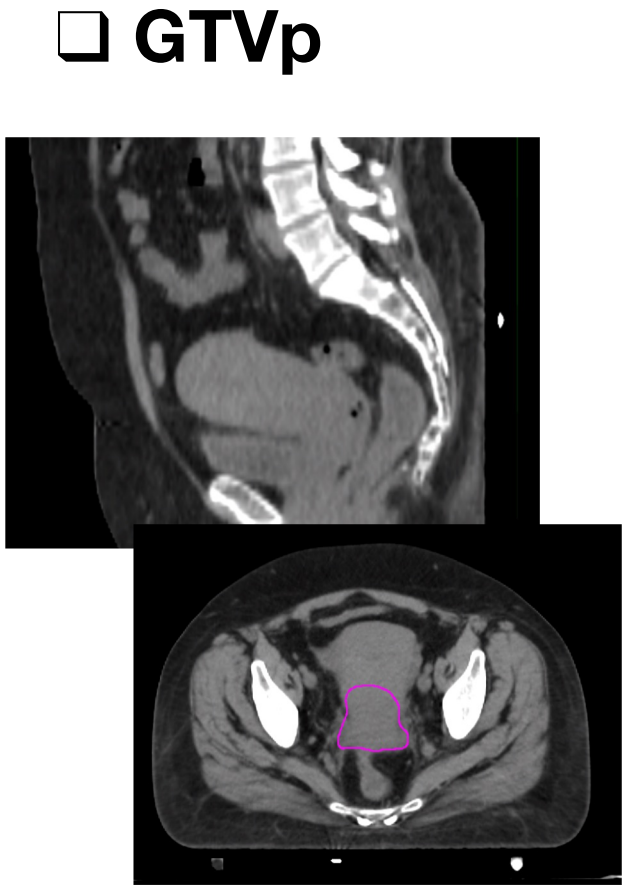
- Anatomical boundaries for the parametrial tissue
- The length of normal vagina to treat
- PTV margin recommendations
- The use of bladder and/or bowel preparation

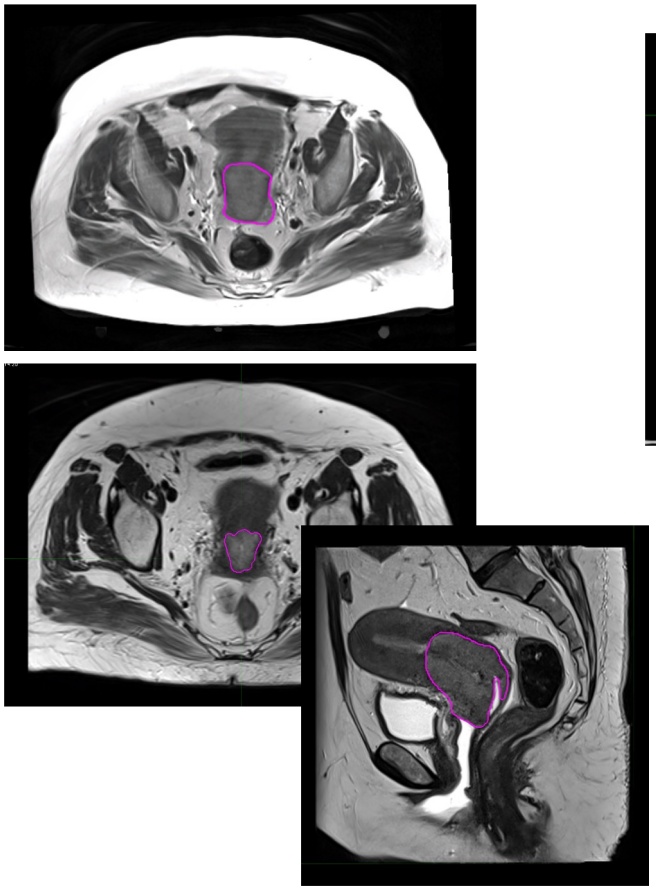


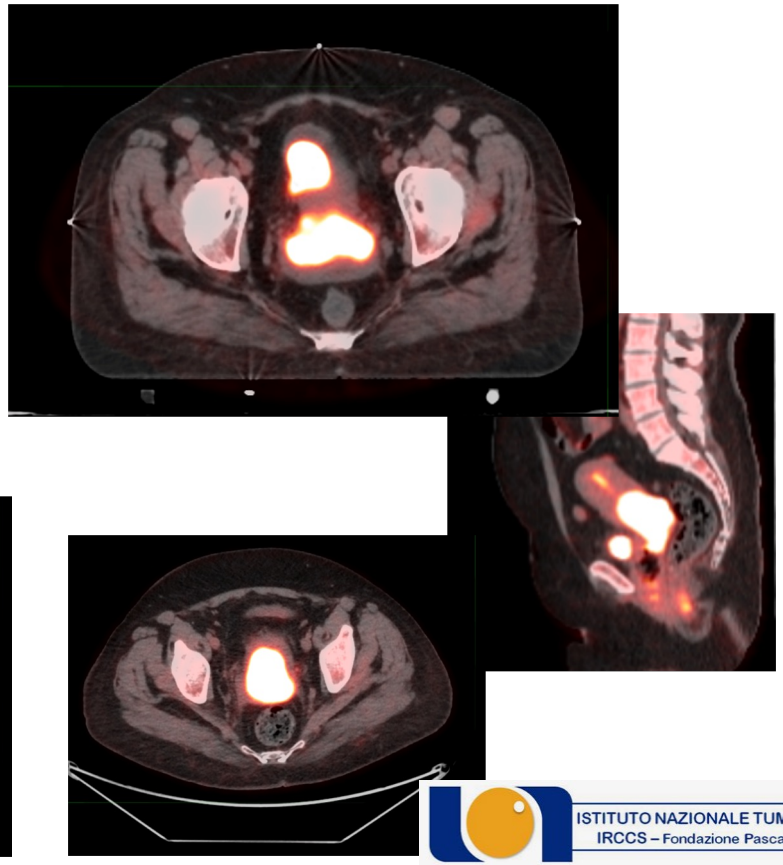
❑ GTVp

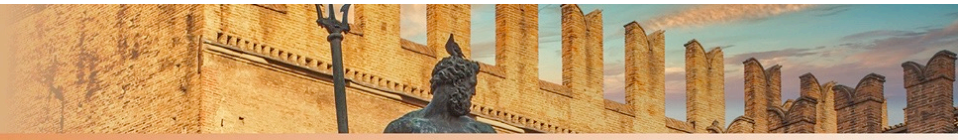
RTOG consensus guidelines, 2011	JCOG consensus guidelines, 2011	K. Gnep, R. Mazeron, 2013	EMBRACE II
• Entire GTV; intermediate/high signal seen on T2-weighted MR images	• Gross disease visible on MRI T2WI • Lesion detected by Clinical examination	• Gross disease visible on MRI and/or PET	• Primary cervix tumour (inside and outside the cervix), defined by T2WI MRI, supported by clinical investigation, FDG PET-CT information

❑ GTVp









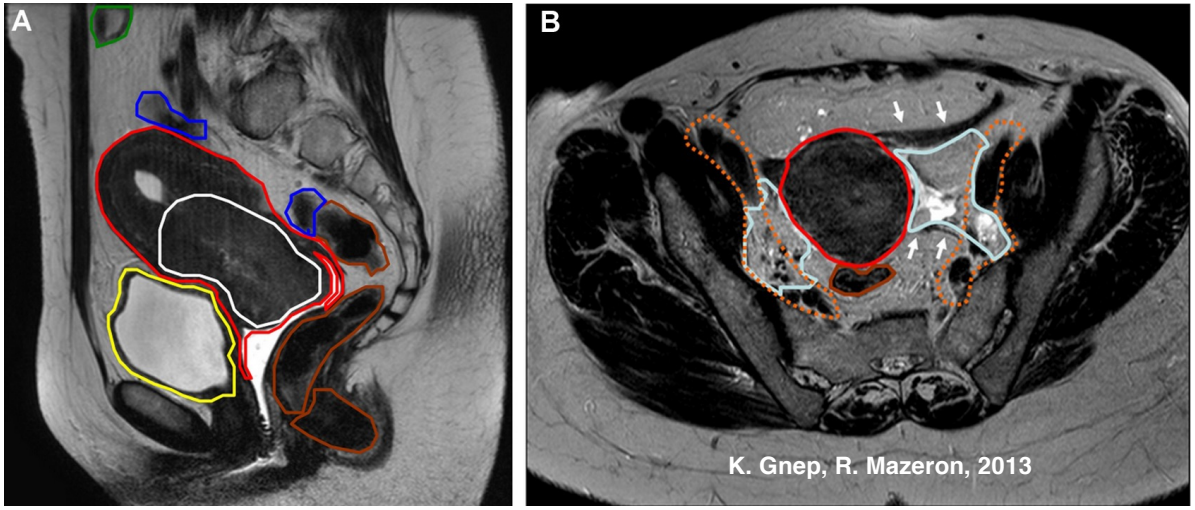
❑ Uterin cervix

RTOG consensus guidelines, 2011	JCOG consensus guidelines, 2011	K. Gnep, R. Mazeron, 2013
• Entire cervix; if not already included within GTV contour	• **Cranial margin:** at level in which uterine arteries enter the uterus (as for parametrium)	• Entire cervix

❑ Uterin corpus

RTOG consensus guidelines, 2011	JCOG consensus guidelines, 2011	K. Gnep, R. Mazeron, 2013
• Entire uterus	• Visualized corpus on CT • No CTV margin (..the majority of the uterine corpus is suspended within the pelvic cavity without surrounding the connective tissue) • The broad ligaments, round ligaments and ovarian ligaments do not need to be included	• Entire uterus

❑ Uterin corpus



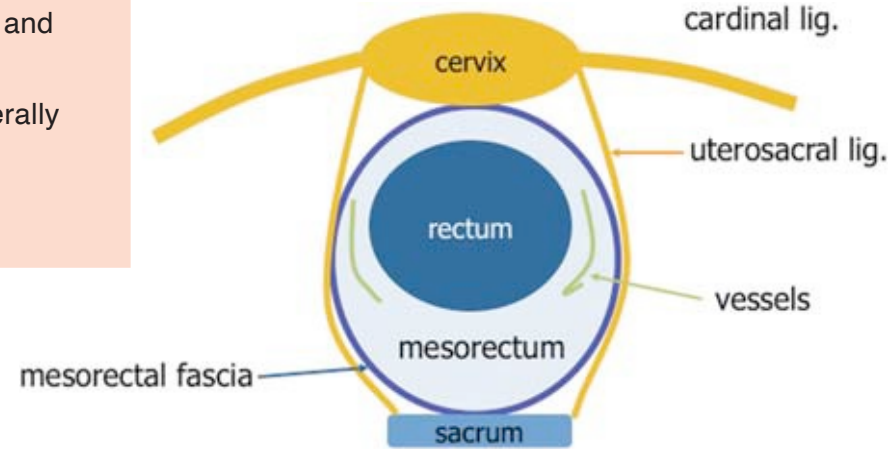
Why the entire uterus?

1. The uterus and cervix are embryologically one unit with interconnected lymphatics and no clear separating fascial plane
2. Determination of myometrial invasion radiologically or clinically can be difficult

Recurrence rates after radical trachelectomy have been substantially higher (up to 10%) for patients with tumor sizes greater than 2 cm (more comparable to a radiotherapy patient cohort) or with the presence of lymph–vascular invasion

❑ Parametrium

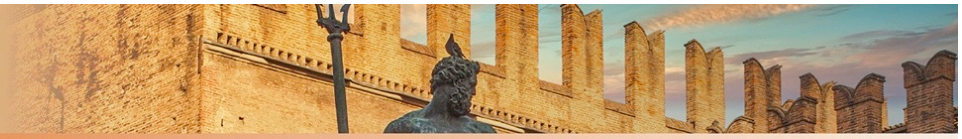
RTOG consensus guidelines, 2011	JCOG consensus guidelines, 2011
• Entire parametrium • Including ovaries • Include entire mesorectum if uterosacral ligament involved	• Adipose tissues between the cervix and pelvic wall • Visible linear structures that run laterally (e.g. vessels, nerves and fibrous structures).



JCOG consensus guidelines, 2011

❑ Ovary

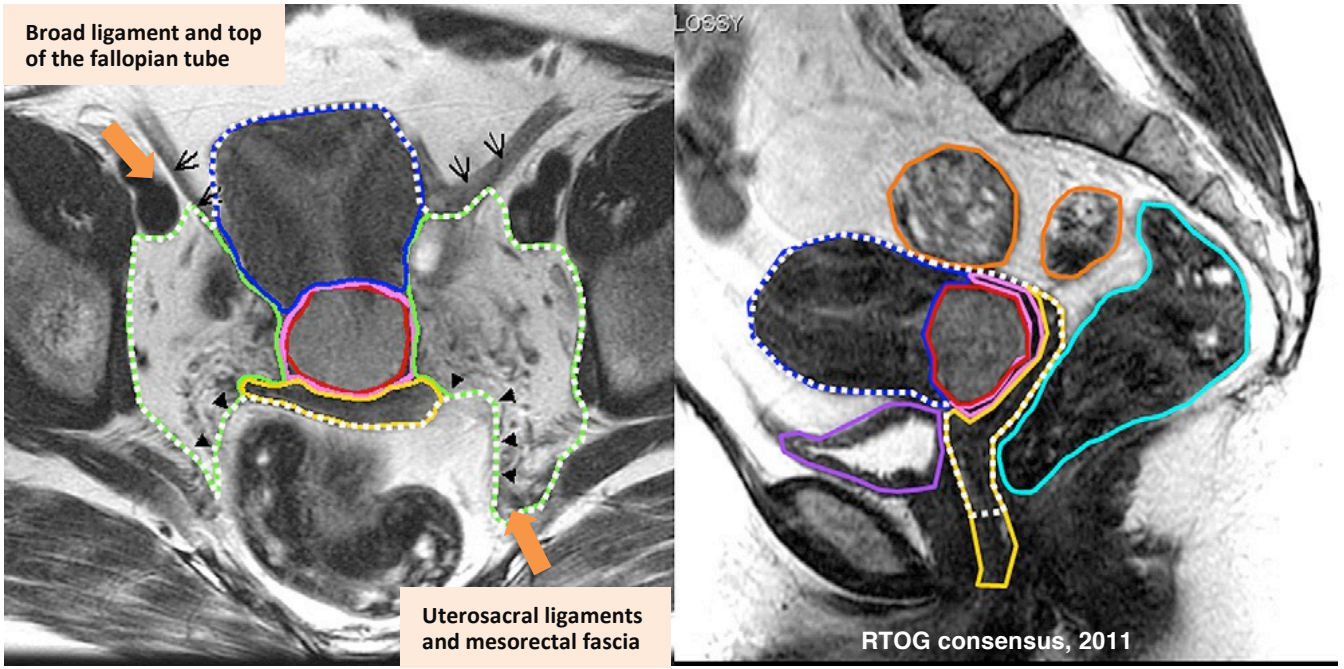
JCOG consensus guidelines, 2011
• Ovaries visible on CT/MRI • No consensus on excluding ovaries on Stage I non bulky or II with SCC



Anatomical boundaries of CTV for parametrium

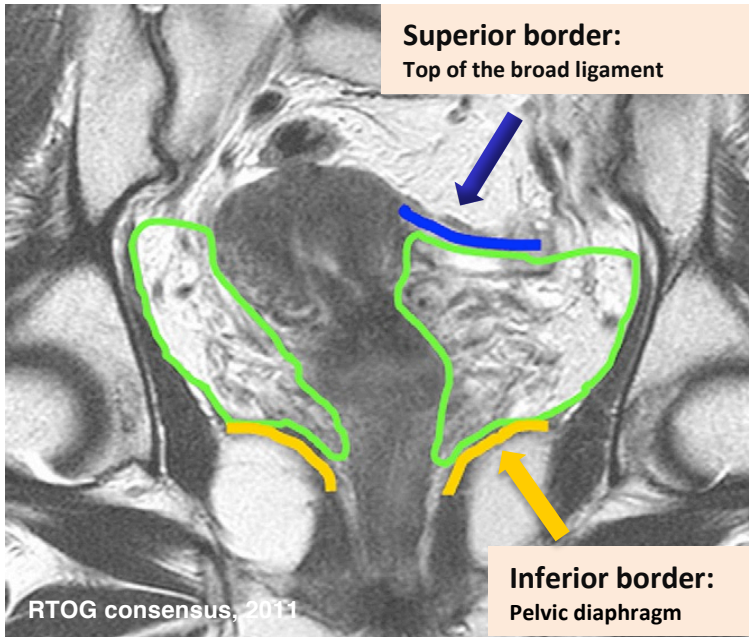
	RTOG, 2011	JCOG, 2011
Cranial	• Top of the fallopian tube/broad ligament. ..contours should stop once loops of bowel are seen next to the uterus as this is clearly above the broad ligament • Depending on degree of uterus flexion, this may also form the anterior boundary of parametrial tissue	• Isthmus of uterus (=level where uterine artery drains into) *Contouring would stop at the level where bowel loops are seen
Caudal	• Urogenital diaphragm: inferior surface of the pelvic diaphragm	• Medial boarder of levator ani (superiore surface of the pelvic diaphragm)
Anterior	• Posterior boarder of bladder or posterior boarder of external iliac vessels	• Posterior boarder of bladder or posterior boarder of external iliac vessels
Posterior	• Mesorectal fascia and Uterosacral ligaments In Stage >IIIB or in extensive nodal involment: entire mesorectal space	• Anterior part (semicircular) of mesorectal fascia *In case with bulky central tumor or significant parametrial invasion, some modification would be considered
Lateral	• Medial edge of internal obturator muscle/ ischial ramus bilaterally • Pelvic side wall (excluding bone and muscles)	• Medial edge of internal obturator muscle, piriformis muscle, coccygeus muscle and ischial ramus
Medial	• GTV, cervix, uterus, vagina	_

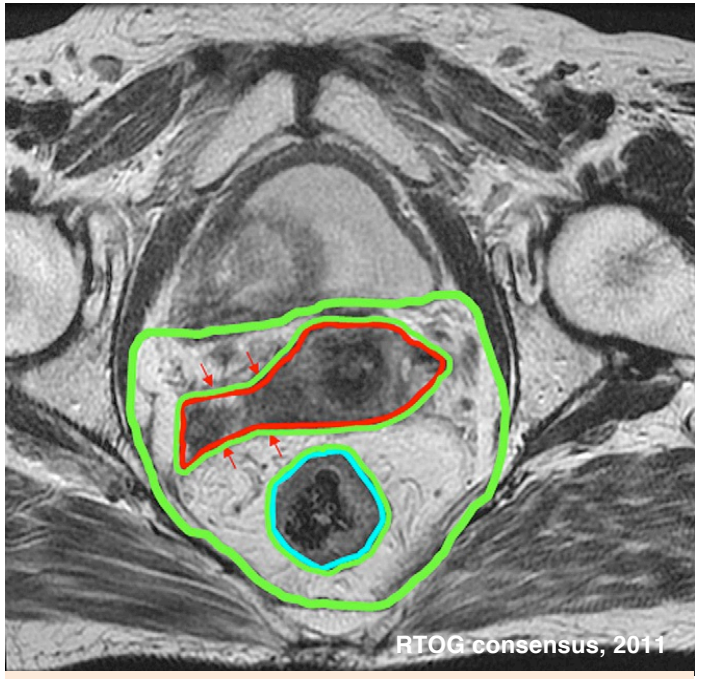
❑ Parametrium



GTV
Cervix
Uterus
Vagina
Parametrium
Bladder
Rectum
Sigmoid
CTV …….

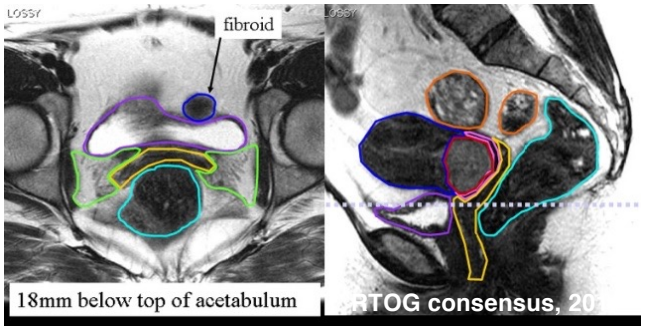
❑ Parametrium

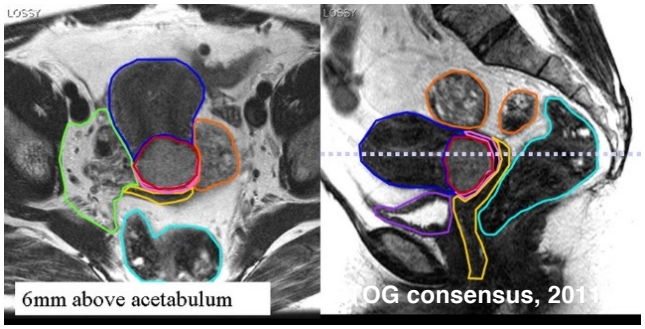


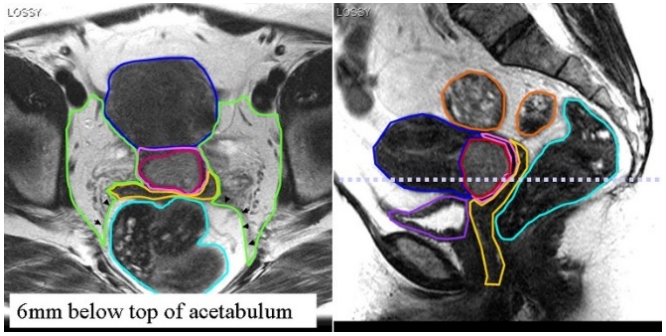


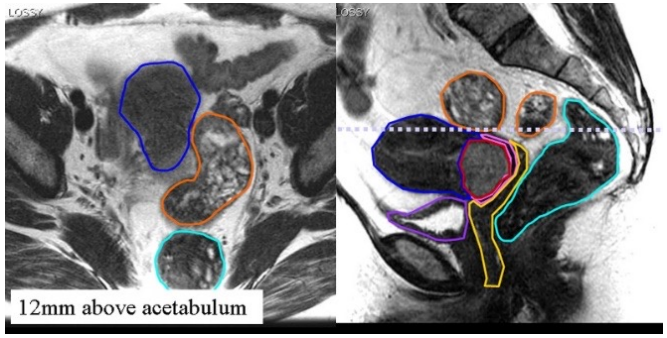
Modified parametrium (green)
Red arrows indicate right proximal uterosacral ligament invasion

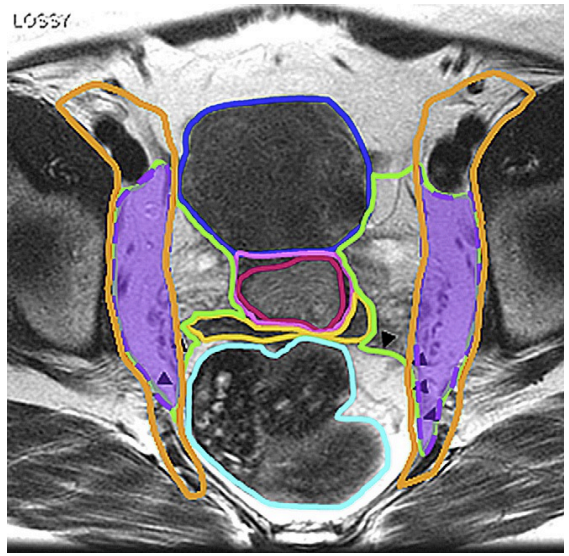
❑ Parametrium









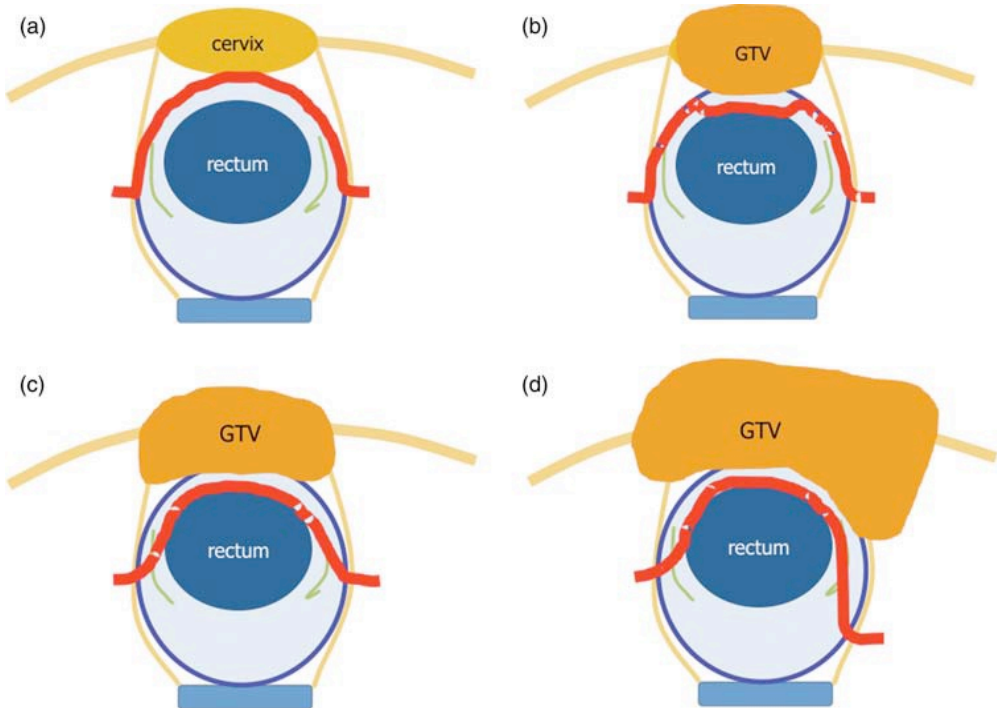


Overlap between nodal CTV (orange contour) **and lateral portion of parametrial volume** (green contour)

❑ Parametrium

Stage specific delineation
for the **posterior border of the parametrium**:

a) Non-bulky early-stage (IB1 or IIA1)
b) Bulky early-stage (IB2 or IIA2)
c) Stage IIB (slight parametrial involvement)
d) Stage IIIB (massive parametrial involvement).

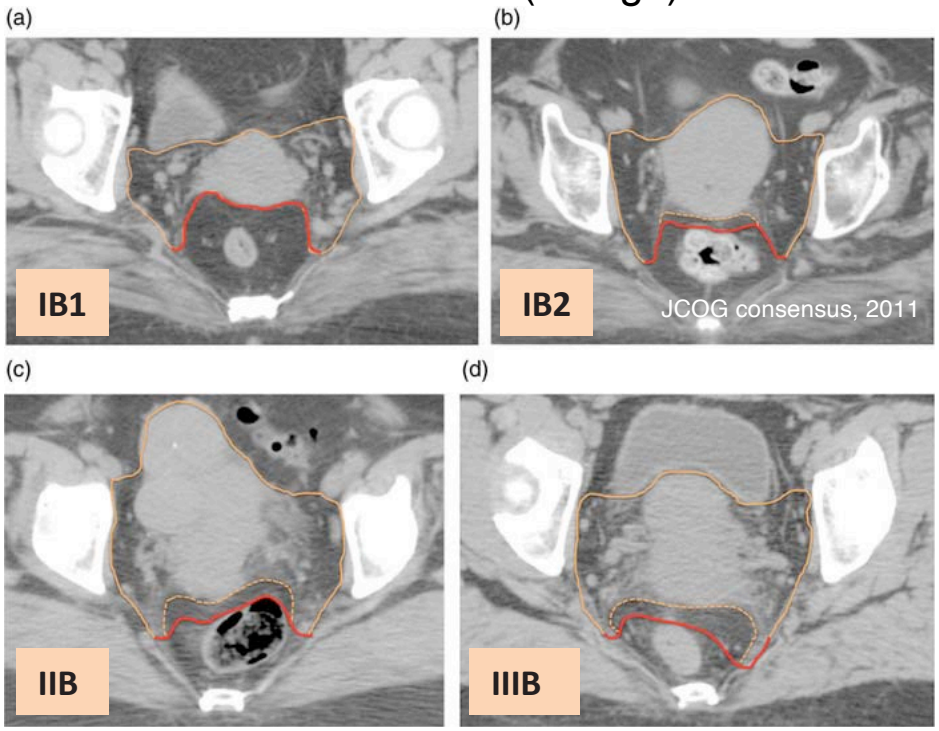


JCOG consensus guidelines, 2011

❑ Parametrium

Caudal border

Anterior border (orange)



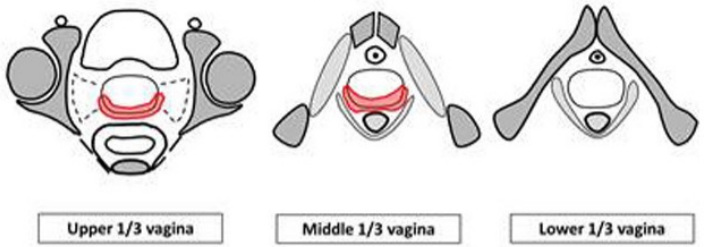
Posterior border (red line) according to T Stage

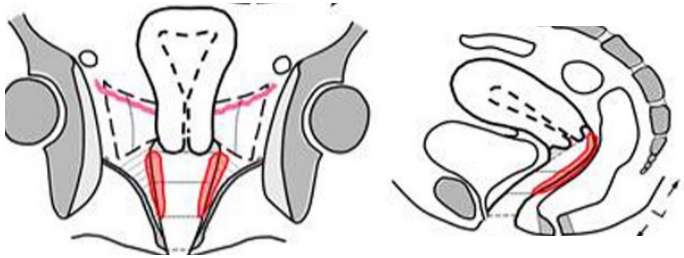
C and d: CTV margin increased into the perirectum and uterosacral ligaments

❑ Vagina

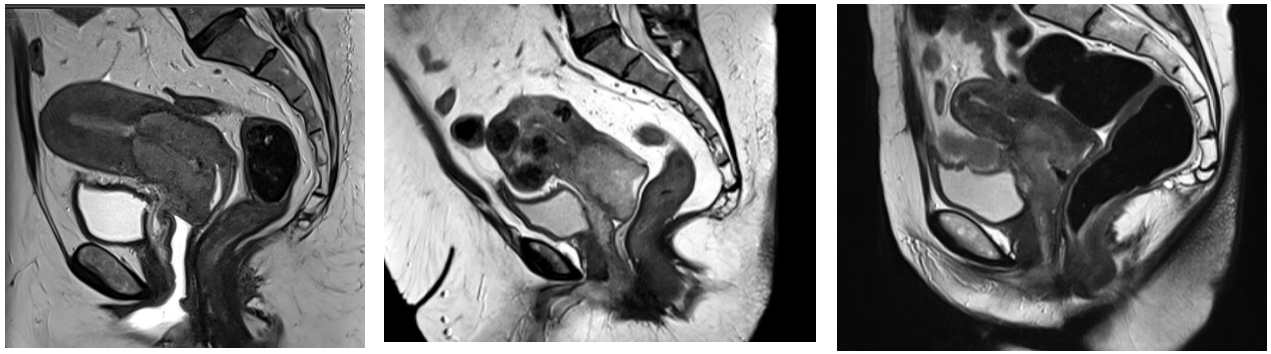
RTOG/JCOG

- Vaginal wall and paravaginal tissue
- **Caudal level according to clinical examination** and findings on MRI
  1. Minimal or no vaginal extension: **upper half of the vagina**
  2. Upper vaginal involvement: **upper two-thirds of the vagina**
  3. Extensive vaginal involvement: **entire vagina**
- Consider an ITV for vaginal CTV





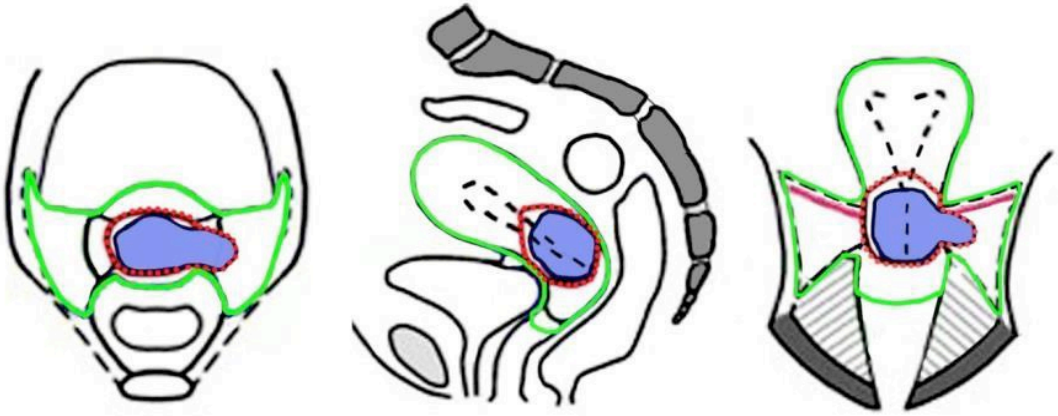
modified from GEC-ESTRO



ISTITUTO NAZIONALE TUMORI
IRCCS – Fondazione Pascale

EMBRACE II: specific nomenclature of volumes of interest

$GTV\text{-}T_{init}$	**Initial Gross Tumour Volume of the primary Tumour**
CTV-T HR_{init}	Initial High Risk Clinical Target Volume of the primary Tumour
CTV-T LR_{init}	Initial Low Risk Clinical Target Volume of the primary Tumour
ITV-T LR_{init}	Initial Internal Target Volume of the primary Tumour



CTV-T HR init: GTV T + cervix

CTV-T LR init:

- CTV-T HR with 5mm margin anterior and posterior towards bladder and rectum (excluding non involved walls)
- Parametria and any pathological lymph nodes in the parametrium
- Uterus
- Uninvolved vagina with a 20 mm margin measured from the most inferior position of the initial HR CTV-T, along the vaginal axis (not starting in the fornix)
- In case of involvement of the pelvic wall, sacro-uterine ligaments, mesorectum or other involved structures a 20 mm margin around the initial HR CTV-Twill be extended into these structures.

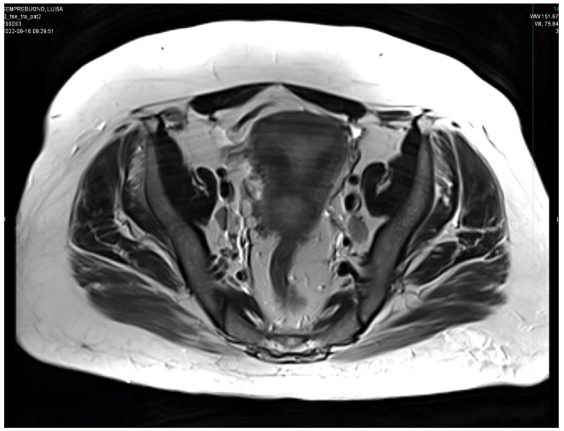
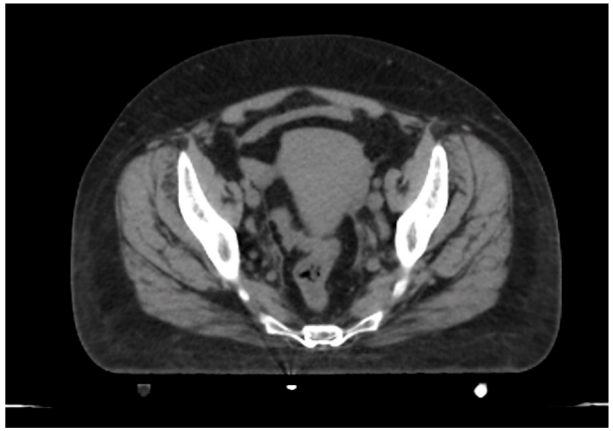
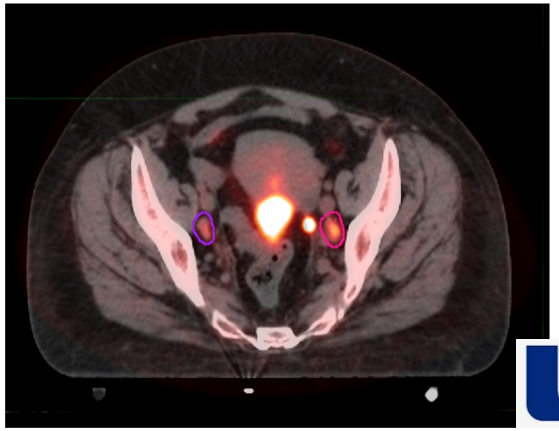
CTV nodal

- **COMMON, INTERNAL, AND EXTERNAL ILIAC LYMPH NODES**
- **OBTURATOR AND PRESACRAL LYMPH NODES**
- Inclusion of **PARA-AORTIC LYMPH NODES** will depend on the extent of disease and results of staging investigations
- Inclusion of **LYMPH INGUINAL NODES** in case of positive inguinal lymph node or involvement of the lower third of the vagina.

Bone and muscles are excluded from CTV, bowel is not routinely excluded (JCOG).

❑ GTVn (1,2,3…)

RTOG consensus guidelines, 2011 JCOG consensus guidelines, 2011 K. Gnep, R. Mazeron, 2013	EMBRACE II
Not detailed	• The outer-contour of the pathological node and visible (macroscopic) extra capsular extension on MRI or CT • PET-CT should primarily be used for overall guidance and not for precise delineation of the pathological nodes • Each GTV-N should be numbered individually

ISTITUTO NAZIONALE TUMORI
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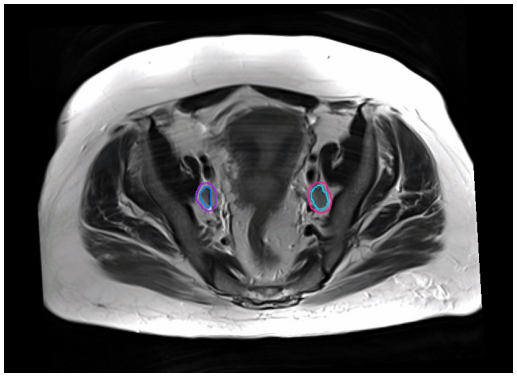
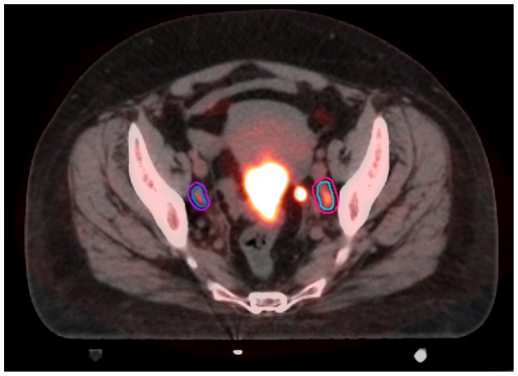
❑ CTVn (1,2,3…)

RTOG consensus guidelines, 2011 JCOG consensus guidelines, 2011 K. Gnep, R. Mazeron, 2013	EMBRACE II
Not detailed	• In principle CTV-N is equal to GTV-N. • An individualized margin may be considered for each pathologic lymph node taking into account extra-capsular extension and possible progression during treatment planning interval, avoiding bones and muscles. • The total CTV-N should encompass the maximum extension as visualized on both CT and MRI. • Typically, the GTV-N to CTV-N margin amounts to 0-3 mm.





ISTITUTO NAZIONALE TUMORI
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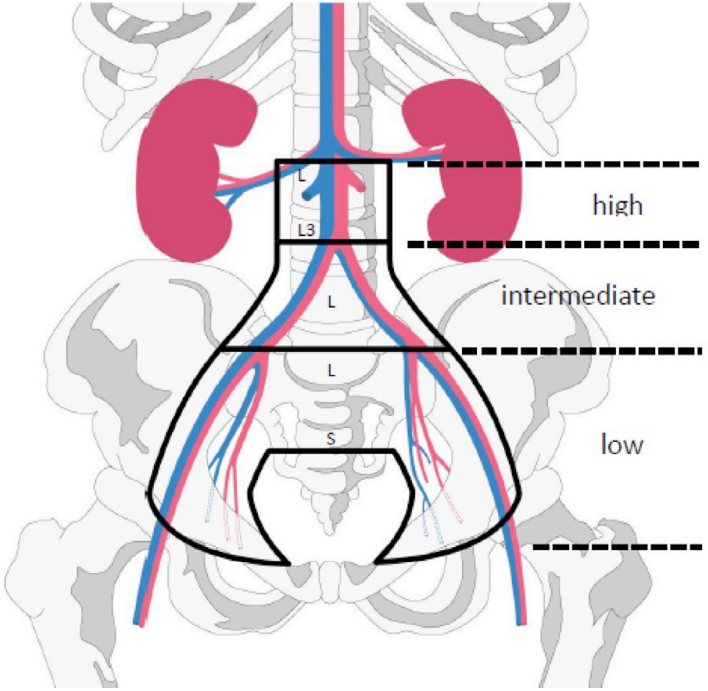
CTV nodal = CTV-E (EMBRACE II)

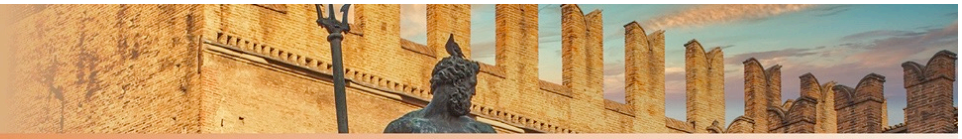


Lymph node risk group	Criteria
Low risk "Small pelvis"	Tumour size ≤ 4cm AND stage IA/IB1/IIA1 AND squamous cell carcinoma AND no uterine invasion
Intermediate risk "Large pelvis"	Not low risk No high risk features
High risk "Large pelvis + para-aortic region"	≥ 1 pathologic lymph node at common iliac or above OR ≥ 3 pathologic lymph nodes

Fig. 1. Risk-adaptive elective lymph node CTV (CTV-E) in the EMBRACE-II protocol

The **CTV-E** (contour in blue) encompasses all individual CTV-N **and** the bilateral lymph node regions for elective nodal irradiation.

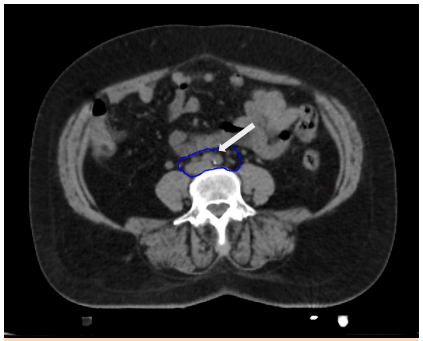
Risk patients	Lymphatic nodal region to contour
Low risk	Internal iliac, external iliac, obturator and presacral regions
Intermediate risk	common iliac, internal iliac, external iliac, obturator, and presacral regions, (groins in case of distal vaginal infiltration)
High risk	para-aortic, common iliac, internal iliac, external iliac, obturator, and presacral regions, (groins in case of distal vaginal infiltration)



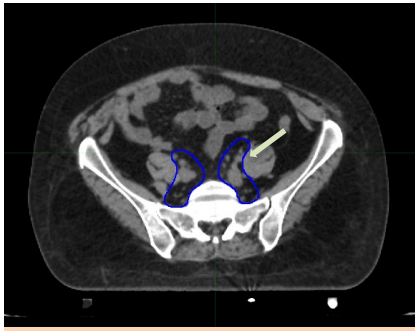
COMMON ILIAC NODAL CTV

Tailor et al. 2005	JCOG, 2011	NRG/RTOG, 2020	EMBRACE II, 2016
• 7mm margin around vessels • Extend posterior and lateral borders to psoas and vertebral body	ANATOMICAL BOUNDARIES: **Cranial:** Aortic Bifurcation or L4-5 interspace **Caudal:** Common iliac at biforcation **Anterior:** 7mm anterior to a/v (artery and vein) **Posterior:** L5-sacrum (adequately involve adipose connective tissue between lateral surface of vertebral body and psoas m.) **Lateral margin:** 7 mm lateral to a/v (expanding to psoas major m.) **Medial:** -	• 7-mm uniform margin surrounding the right and left common iliac a/v excluding bone and muscle (from aortic bifurcation to common iliac a. bifurcation) • CTV margin should increase to 1 cm at the midpoint of the common iliac chain anterior to the vessels while abutting the iliopsoas laterally	ANATOMICAL BOUNDARIES: **Cranial:** One slides below Aortic Bifurcation **Caudal:** One slides below Common iliac a. biforcation **Anterior:** 7mm around vessels excluding bowel loops **Posterior:** Ventro-lateral contours of vertebral bodies until connection with psoas/iliopsoas muscles excluding nerves **Lateral margin:** along outer contour of psoas muscle, up to 7 mm around vessels excluding muscle **Medial:** 7 mm margin around vessels excluding bowel loops

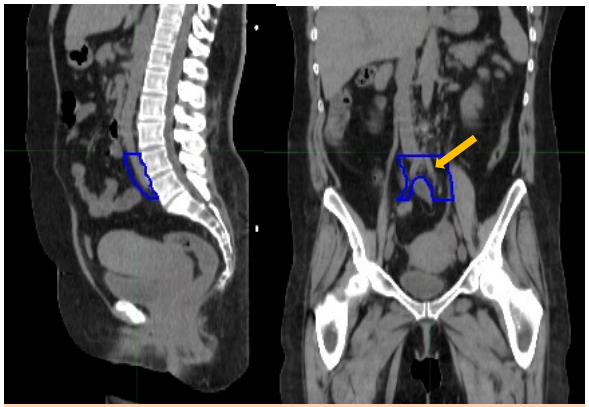
COMMON ILIAC NODAL CTV



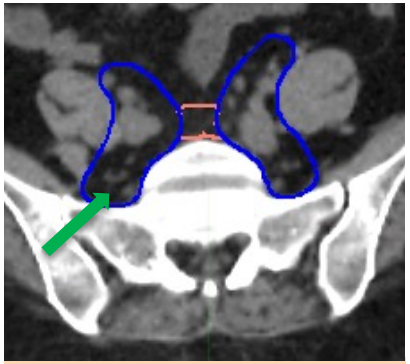
CI superior border:
at the level of the aortic bifurcation



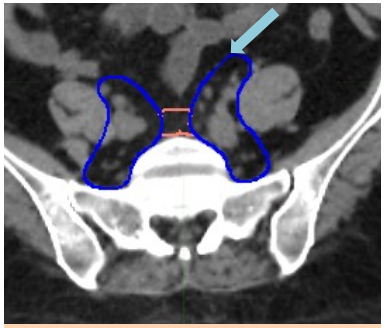
CI inferior border:
at the level of common iliac a. bifurcation



NOTE: aortic bifurcation is not at L4-L5 interspace in this patient

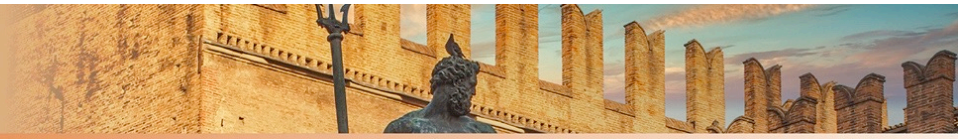


CI posterior border:
L5-sacrum (adequately involve adipose connective tissue between lateral surface of vertebral body and psoas m.)



CI anterior/ lateral border: 7mm
anterior / lateral to a/v

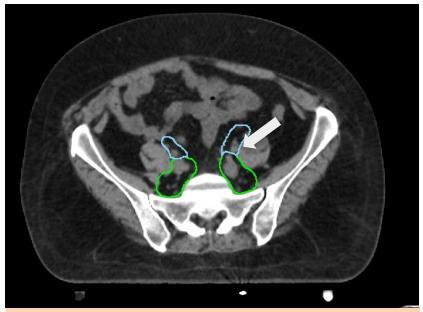
CI CTV at the midpoint:
1 cm anterolateral
to the common iliac artery



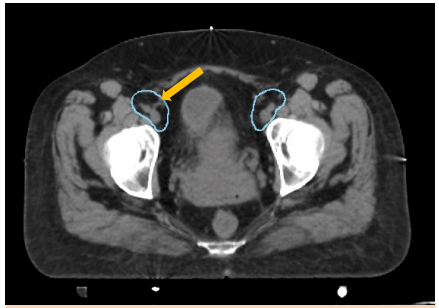
EXTERNAL ILIAC NODAL CTV

Tailor et al. 2005	JCOG, 2011	NRG/RTOG, 2020
• 7 mm margin around vessels • Extend anterior border by a further 10 mm anterolaterally along the iliopsoas muscle to include the lateral external iliac nodes	ANATOMICAL BOUNDARIES: **Cranial:** Common iliac a. bifurcation **Caudal:** Superior aspect of femoral head **Anterior:** 7 mm anterior to a/v **Posterior:** 7mm posterior to a/v (connecting to obturator region) **Lateral margin:** 7 mm lateral to a/v (expanding to psoas major m. or iliacus m.) **Medial:** 7 mm medal to a/v uterus, ovary, bowel, ureter or bladder	• 7-mm uniform margin placed around the vessels not extending into bone or muscle and up to 10 mm anteriorly • **Cranial:** common iliac vessels bifurcation • **Caudal:** The inferior aspect is where the deep circumflex artery branches originates and where the external iliac vessels course laterally as they leave the pelvis to become the inguinofemoral vessels

EXTERNAL ILIAC NODAL CTV

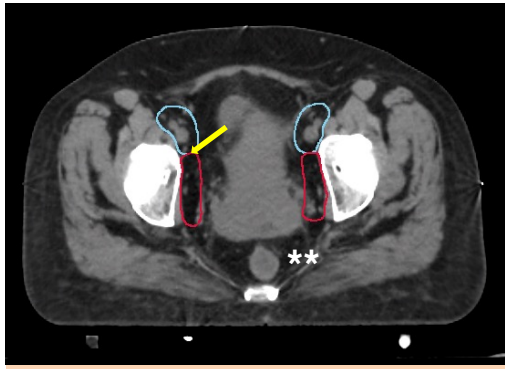


EI superior border:
at the level of common iliac a. bifurcation



EI inferior border:
where the deep circumflex artery branches originates and where the external iliac vessels course laterally as they leave the pelvis to become the inguinofemoral vessels
(Superior aspect of femoral head)

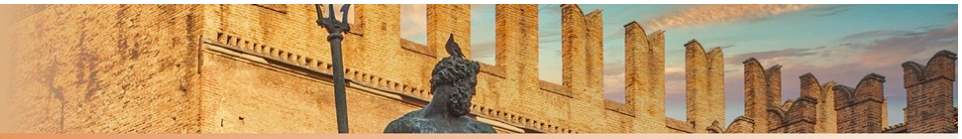
EI anterior border: 7-10mm to a/v up to 10 mm anteriorly



EI posterior border: 7mm posterior to a/v (connecting to obturator region)

EI lateral border: 7mm lateral to a/v (expanding to psoas major m or iliacus m.)

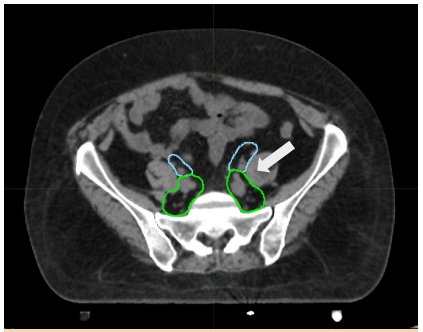
EI medial border: 7 mm medal to a/v uterus, ovary, bowel, ureter or bladder



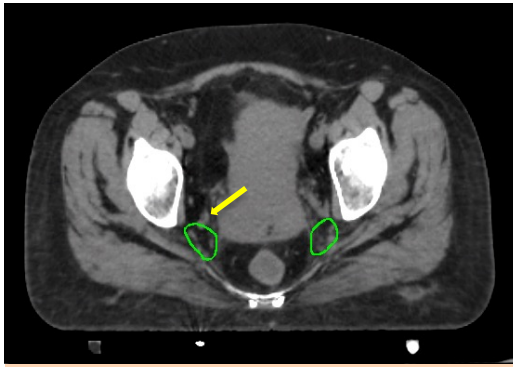
INTERNAL ILIAC NODAL CTV

Tailor et al. 2005	JCOG, 2011	NRG/RTOG, 2020
• 7 mm margin around vessels • Extend lateral borders to pelvic side wall	ANATOMICAL BOUNDARIES: **Cranial:** Common iliac a. Bifurcation **Caudal:** Cranial section of coccygeus m., spine of ischium or uterine a/v (connecting to parametrial region) **Anterior:** 7mm anterior to a/v **Posterior:** -Cranial level: wing of sacrum -Middle-caudal level: anterior edge of piriformis m. or inferior gluteal a/v **Lateral margin:** -Cranial level: psoas m., iliacs m. or lateral edge of sacroiliac joint -Middle level: Iliac bone, psoas m. or medial edge of Iliacus m. -Caudal level: obturator internus m. or piriformis m. **Medial:** 7 mm medial to a/v bowel, uterus or ovary	• 7-mm radial margin placed around the vessels not extending into bone or muscle • **Cranial:** common iliac vessels bifurcation

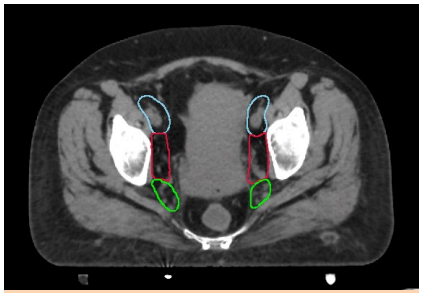
INTERNAL ILIAC NODAL CTV



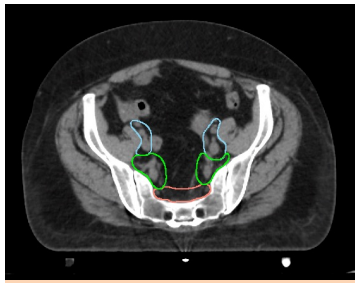
Il superior border:
at the level of common iliac bifurcation



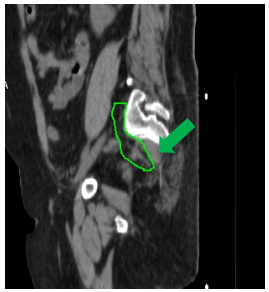
Il inferior border:
Cranial section of coccygeus m, spine of ischium or uterine a/v (connecting to parametrial region)

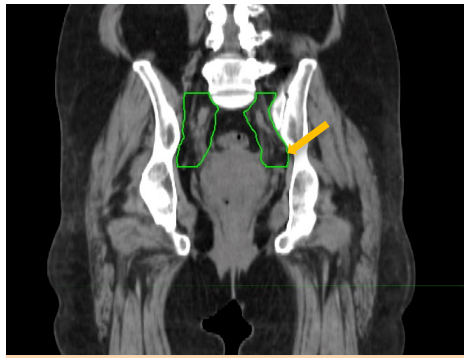


Il anterior border: connetting to external iliac and obturator nodes



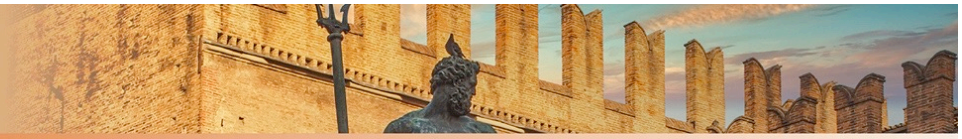
Il posterior border: Cranial level: wing of sacrum/Middle-caudal level: anterior edge of piriformis m. or inferior gluteal a/v





Cl lateral border: 7mm lateral to a/v (expanding to psoas major m. or iliacus m.)

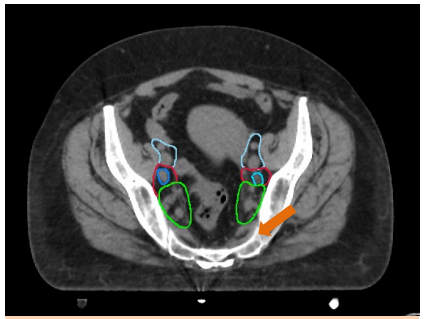
Cl medial border: 7 mm medal to a/v, uterus, ovary, bowel, ureter or bladder



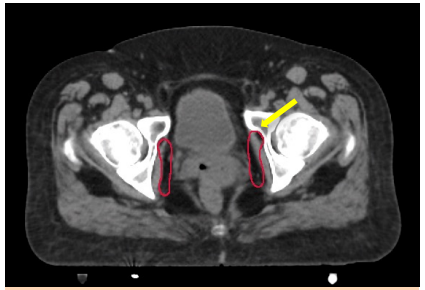
OBTURATOR NODAL CTV

Tailor et al. 2005	JCOG, 2011	NRG/RTOG, 2020
• Join external and internal iliac regions with a 17 mm wide strip along the pelvic side wall	ANATOMICAL BOUNDARIES: **Cranial:** Caudal section of sacroiliac joint (connecting to internal iliac region) **Caudal:** Superior part of obturator foramen **Anterior:** Cranial-middle level: connecting to external iliac region **Posterior:** Cranial-middle level: connecting to internal iliac region **Lateral margin:** Obturator internus m, iliacus m, psoas m or iliac bone **Medial:** Bladder, uterus or bowel	• The space about 15 to 18 mm in diameter between the external and internal iliac nodal CTV contours • **Cranial:** bifurcation of the internal and external iliac vessels, not extending into bone, muscle, or bladder • **Caudal:** where the obturator vessels leave the pelvis through the obturator foramen, which lies lateral to the obturator internus muscle • An obturator nodal ITV should be considered

OBTURATOR NODAL CTV



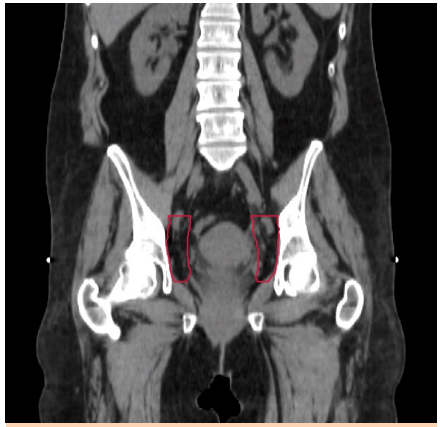
Obt superior border:
Caudal section of sacroiliac joint
(connecting to internal iliac region)



Obt inferior border:
Superior part of obturator foramen

Obt anterior border:
Cranial-middle level: connecting to external iliac region

Oby posterior border:
cranial-middle level: connecting to internal iliac region



Obt lateral border:
Obturator internus m, iliacus m, psoas m or iliac bone

Obt medial border:
Bladder, uterus or bowel

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EXTERNAL/INTERNAL ILIAC AND OBTURATORE NODAL CTV

EMBRACE II, 2016

ANATOMICAL BOUNDARIES:

Cranial: One slice below bifurcation of common iliac artery

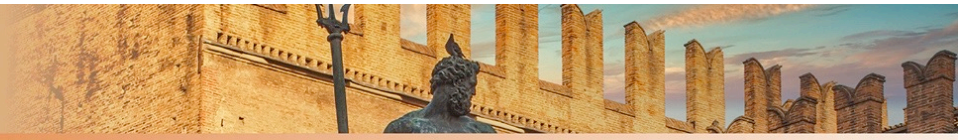
Caudal: at the upper part of the obturator foramen, below the femoral head, where internal iliac vessels leave or enter the true pelvis

Anterior: 7-17 mm ventral to external iliac vessels not extending into the abdominal wall

Posterior: ventro-medial fascia of Piriformis muscle/sacrospinous ligament

Lateral margin: ventro-medial fascia of iliopsoas muscle, bony pelvic sidewall and obturator internus muscle

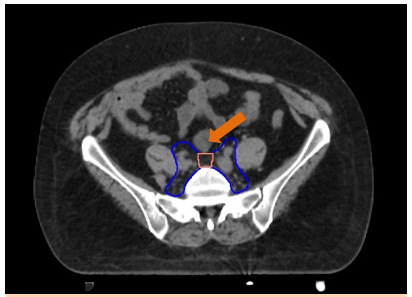
Medial: 7 mm around vessels excluding bowel loops, bladder wall, lateral border of parametrium and mesorectal fascia



PRESACRAL NODAL CTV

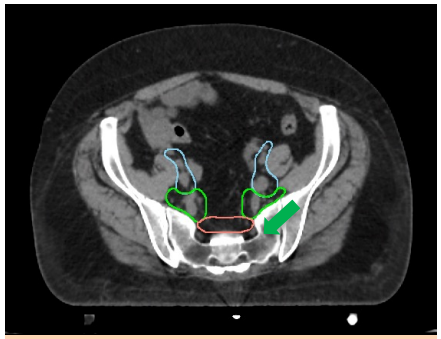
Tailor et al. 2005	JCOG, 2011	NRG/RTOG, 2020	EMBRACE II, 2016
• **Subaortic:** 10 mm strip over anterior sacrum	ANATOMICAL BOUNDARIES: **Cranial:** Common iliac a. bifurcation **Caudal:** Lower level of S2 or cranial section of piriformis m. **Anterior:** 10 mm anterior to sacrum **Posterior:** L5—sacrum **Lateral margin:** Piriformis m. (connecting to external or internal iliac region) **Medial:** _	• The presacral nodes reside anterior to S1/S2 vertebral bodies • Superiorly, they begin between the diverging common iliac vessels • The contour should be 1-1.5cm wide • The inferior extent of the presacral nodal CTV is the first CT image in which the piriformis muscle becomes apparent. If bowel is present in this region, the CTV might extend a few millimeters into the bowel loops that might intermittently move into the presacral nodal CTV space.	**Cranial:** upper border S1 **Caudal:** lower border S2 **Anterior:** 1 cm in front of S1/2 **Posterior:** ventral border S1/2 **Lateral margin:** medial borders of pelvic node compartments **Medial:** _

PRESACRAL NODAL CTV

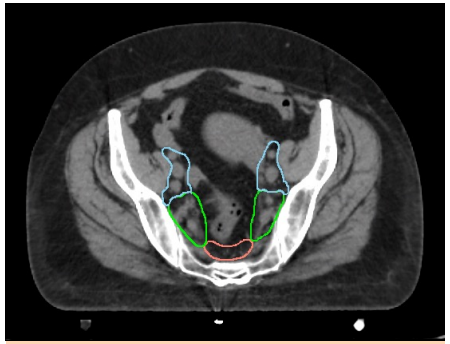


PS superior border:
Common iliac a. bifurcation

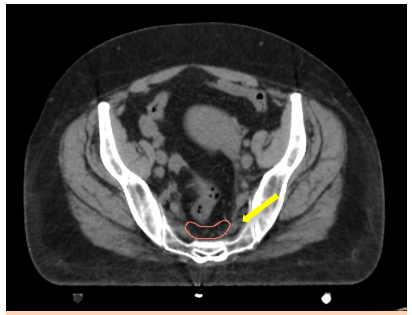
PS anterior border:
10-15 mm anterior to sacrum (S1-S2). it may encompass adjacent bowel if present, to account for motion of the bowel



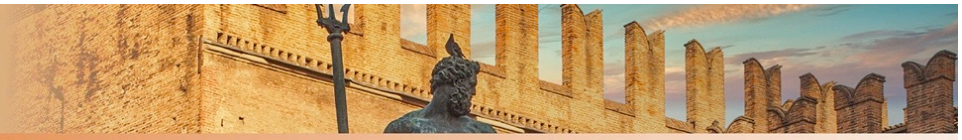
PS posterior border:
L5—sacrum



PS lateral border:
Obturator internus m, iliacus m., psoas m. or iliac bone



PS inferior border:
Lower level of S2 or cranial section of piriformis m.

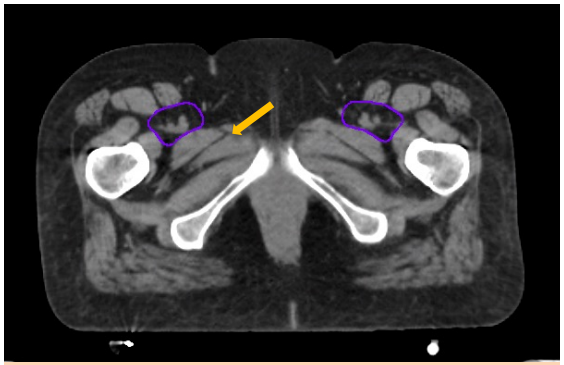


INGUINAL NODAL CTV

Tailor et al, 2005/ JCOG, 2011/ NRG/RTOG, 2020	EMBRACE II, 2016
Not reported	The inguinal/femoral region should be contoured as a compartment with any identified nodes included (especially in the lateral inguinal region) ANATOMICAL BOUNDARIES: **Cranial:** Midfemoral head, external iliac vessels leave bony pelvis as femoral vessels **Caudal:** Lower edge trochanter minor, about 2 cm below junction vena femoralis / vena saphena magna **Anterior:** 7-10 mm margin around vessels **Posterior:** ventral fascia of pectineus muscle **Lateral margin:** medial fascias of ileopsoas /sartorius muscles **Medial:** 7 mm margin around vessels excluding: peritoneal fascia, lateral fascia of rectus abdominis muscle, lateroventral fascias pectineus/adductor longus/brevis muscles

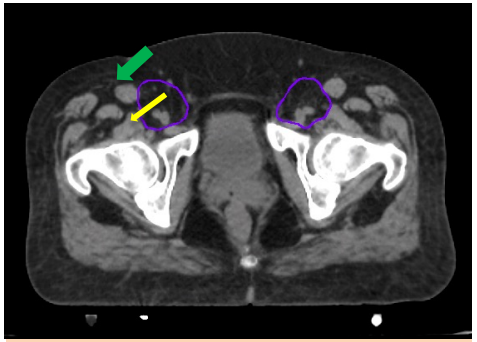
INGUINAL NODAL CTV

ING superior border:
Midfemoral head, external iliac vessels leave bony pelvis as femoral vessels

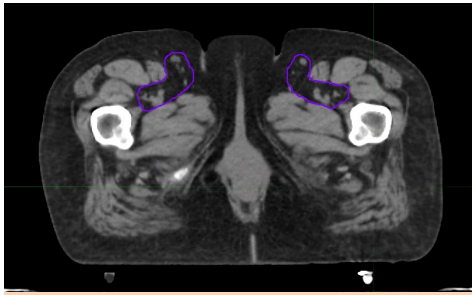


ING anterior border: 7-10 mm margin around vessels

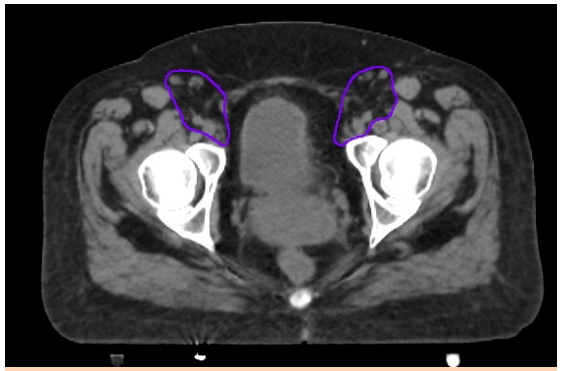
ING posterior border: ventral fascia of pectineus muscle



ING lateral border:
medial fascias of ileopsoas /sartorius muscles

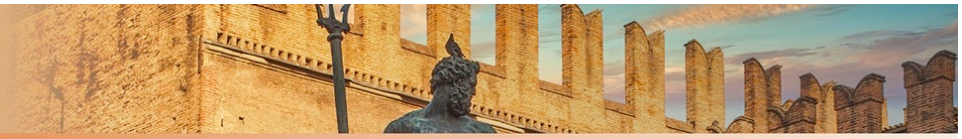


ING inferior border: Lower edge trochanter minor, about 2 cm below junction vena femoralis/ vena saphena



ING medial border: 7 mm margin around vessels excluding: peritoneal fascia, lateral fascia of rectus abdominis muscle, lateroventral fascias pectineus/adductor longus/brevis muscles

ISTITUTO NAZIONALE TUMORI
IRCCS – Fondazione Pascale

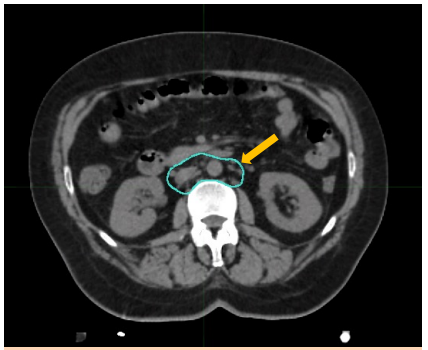


PARAORTIC NODAL CTV

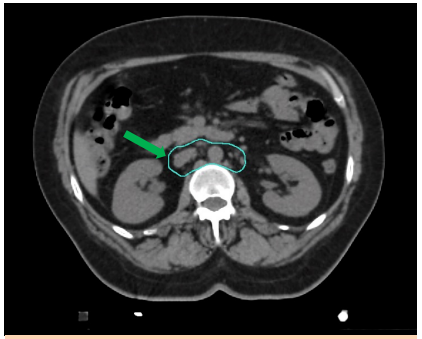
Tailor et al, 2005	JCOG, 2011	NRG/RTOG, 2020	EMBRACE II
Not reported	Not reported	• The para-aortic nodal CTV encompasses the aorta, the inferior vena cava (IVC) and adjacent nodal regions (paracaval, precaval, retrocaval, deep and superficial intercavo-aortic, para-aortic, preaortic, and retroaortic nodes) • **Superior border:** at the level of the left renal vein (consider to raise the superior border if paraortic nodes are positive) • **Inferior border:** at the level of the aortic bifurcation where common iliac nodes become. The PA nodal CTV is **not a uniform expansion** off the vasculature. • **Left lateral border**: 1 to 2 cm lateral to the aorta. From the aorta to the medial border of the left psoas muscle including any visible small nodes in this region • **Right lateral border**: 3 to 5 mm around the IVC. There is minimal evidence of nodal involvement to the right of the IVC and immediately anterior to the aorta and IVC where margins should be tighter The space between the aorta and IVC should be straight (rather than concave), even if there is bowel nearby as the intercavo-aortic nodes are located in this space.	ANATOMICAL BOUNDARIES: • **Anterior:** 7 mm margin around vessels excluding bowel loops or other organs • **Posterior**: ventrolateral contours of vertebral bodies until connection with psoas muscle • **Superior border:** Cranial border of L1 with a minimum of 3 cm superior to the upper border of the last positive lymph node(s) • **Inferior border:** one slice below aortic bifurcation

PARAORTIC NODAL CTV

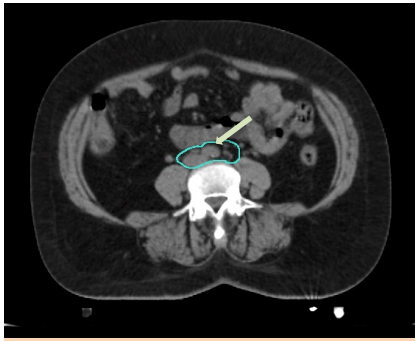
PA superior border:
at the level of the left renal vein



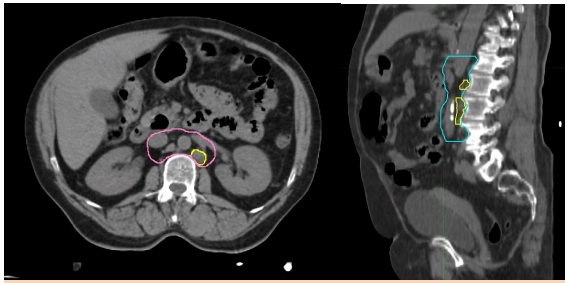
PA left lateral border:
1 to 2 cm lateral to the aorta (to the medial border of the psoas muscle) + any visible small nodes



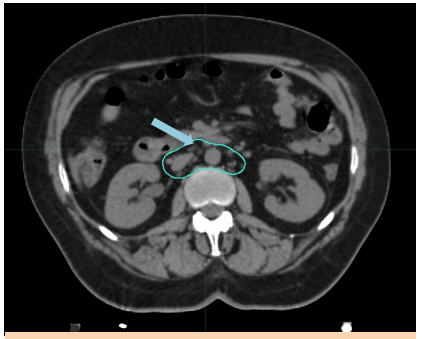
PA right lateral border:
3 to 5 mm around the IVC



PA inferior border:
at the level of the aortic bifurcation



If paraortic nodes are positive
raise the superior border

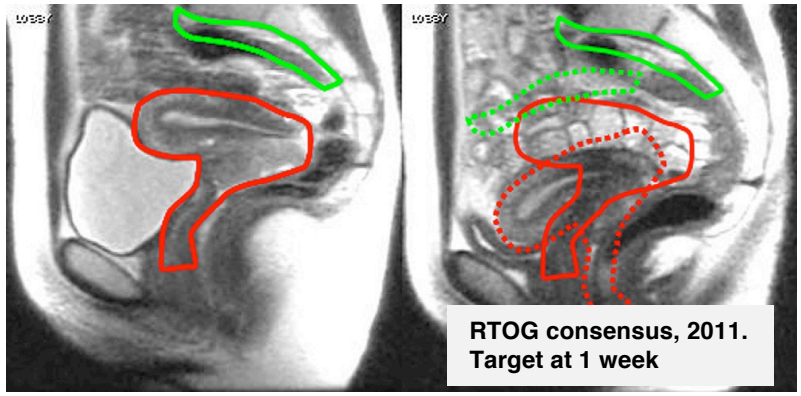


Space between the aorta and IVC should be straight (rather than concave)

ISTITUTO NAZIONALE TUMORI
IRCCS – Fondazione Pascale

PTV

- Ranged from 0,6 to 4cm!
- Depending on metodology to assessing organ motion
- RTOG: 1,5-2 cm around the GTVp and 7mm around the CTV
- As suggested in EMBRACE II, **ITV for CTV-T LR** (especially in the anterior-posterior) should be considered



RTOG consensus, 2011. Target at 1 week