



XXXII CONGRESSO NAZIONALE AIRO  
XXXIII CONGRESSO NAZIONALE AIRB  
XII CONGRESSO NAZIONALE AIRO GIOVANI

# AIRO2022

Radioterapia di precisione per un'oncologia innovativa e sostenibile

BOLOGNA, 25-27 NOVEMBRE  
PALAZZO DEI CONGRESSI

## **OARs NELLA RADIOTERAPIA A FASCI ESTERNI DELLA CERVICE UTERINA**

**D.ssa A. Augurio**

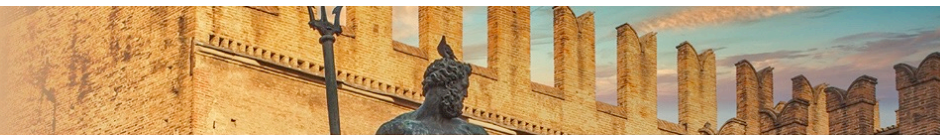
***U.O Radioterapia***

***Ospedale clinicizzato - Chieti***

# AIRO2022

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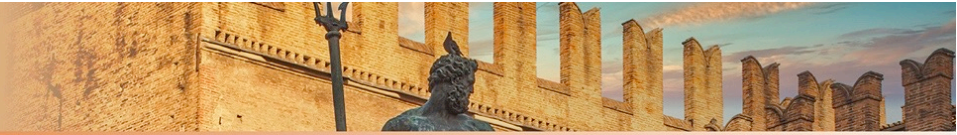


## DICHIARAZIONE

Relatore: ANTONIETTA AUGURIO

Come da nuova regolamentazione della Commissione Nazionale per la Formazione Continua del Ministero della Salute, è richiesta la trasparenza delle fonti di finanziamento e dei rapporti con soggetti portatori di interessi commerciali in campo sanitario.

**(NIENTE DA DICHIARARE)**



- LACC: standard di cura: EBRT(Radioterapia Esterna) con CT concomitante e IGABT (Image Guided Adaptive Brachiterapy): dosi elevate agli OARs
- gli OARs maggiormente interessati nel trattamento radiante (ERT+BRT) del LACC sono:
  - Ano-retto
  - Sigma
  - Colon
  - vescica
  - Vagina (se non interessata dalla neoplasia)
  - Reni, midollo spinale, duodeno (se irradiazione linfondi lomboaortici)
  - Ovaie (se trasposte)
- La RM è il gold standard x la contornazione del target e degli OAR nei tumori della cervice uterina, ma La TC alternativa di maggiore diffusione nel pianificazione del trattamento radiante sia EBRT che BRT: pubblicazione recente di raccomandazioni per individuazione CTV e OARs sulle immagini TC (*Wiswanatan AN: IJROBP 2014; Ohno T: JRR 2017; Umesh M (IBS-GEC ESTRO-ABS) Rad Onc 2021*)



The outer contour of the following organs should be delineated separately:

<b>Bladder</b>	Whole organ including the bladder neck
<b>Rectum</b>	From the ano-rectal sphincter to the recto-sigmoid junction
<b>Sigmoid</b>	From the recto-sigmoid junction to the left iliac fossa
<b>Bowel</b>	Outer contour of bowel loops including the mesenterium
<b>Femoral heads</b>	Both femoral head and neck to the level of the trochanter minor

Reference points:

**Vagina** Lower and mid-vagina doses (PIBS, PIBS ± 2 cm)

For para-aortic irradiation in addition:

<b>Kidneys</b>	Outer contour excluding renal pelvis
<b>Spinal cord</b>	Outer contour

Optional (if para-aortic RT above L1 is applied):

**Duodenum** Whole organ

In case of ovarian transposition

**Ovary** Outer contour

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**

Dose constraints for EBRT for N0 and N1 patients. This table is an update of table 9.4 of the EMBRACE II study protocol version 1.0.

	No lymph node involvement		Involved lymph nodes	
	Hard dose constraints	Soft dose constraints	Hard dose constraints	Soft dose constraints
PTV45	V42.75 Gy > 95% Dmax < 107%	V42.75 Gy = 95%	V42.75 Gy > 95%	V42.75 Gy = 95% Dmax < 107% for helper structure: PTV45 - (PTV-N(#)) + 1 cm)
ITV45	Dmin > 95%		Dmin > 95%	
CTV-HR + 10 mm		Dmax < 103%		Dmax < 103% for helper structure: CTV-HR + 10 mm - (PTV-N(#)) + 1 cm)
PTV-N(#)			D98% > 90% of prescribed LN dose Dmax < 107% of prescribed LN dose	D98% = 90% of prescribed LN dose
CTV-N(#)			D98% > 100% of prescribed LN dose	D50% > 102% of prescribed LN dose
Bowel	Dmax < 105%	V40Gy < 250 cm <sup>3</sup> V30Gy < 500 cm <sup>3</sup>	Dmax < 105% in regions outside 10-15 mm from PTV-N	When no para-aortic irradiation: V40Gy < 250 cm <sup>3</sup> V30Gy < 500 cm <sup>3</sup> For para-aortic irradiation: V40Gy < 300 cm <sup>3</sup> V30Gy < 650 cm <sup>3</sup>
Sigmoid	Dmax < 105%		Dmax < 105% in regions outside 10-15 mm from PTV-N	
Bladder	Dmax < 105%	V40Gy < 60% V30Gy < 80%	Dmax < 105% in regions outside 10-15 mm from PTV-N	V40Gy < 60% V30Gy < 80%
Rectum	Dmax < 105%	V40Gy < 75% V30Gy < 95%	Dmax < 105% in regions outside 10-15 mm from PTV-N	V40Gy < 75% V30Gy < 95%
Spinal cord	Dmax < 48 Gy		Dmax < 48 Gy	
Femoral heads	Dmax < 50 Gy		Dmax < 50 Gy	
Kidney	Dmean < 15 Gy	Dmean < 10 Gy	Dmean < 15 Gy	Dmean < 10 Gy
Body	Dmax < 107%		Dmax < 107% in regions outside 10-15 mm from PTV-N	
Vagina (if not involved)		D <sub>PIBS-2cm</sub> < 5 Gy		D <sub>PIBS-2cm</sub> < 5 Gy
Conformality		1.10 (V43/Volume of PTV) 1.55 (V36Gy/Volume of PTV)		1.10 (V43/Volume of PTV) 1.55 (V36Gy/Volume of PTV)
Transposed ovaries	Dmean < 8 Gy	Dmean < 5 Gy	Dmean < 8 Gy	Dmean < 5 Gy
Duodenum	V55 < 15 cm <sup>3</sup>		V55 < 15 cm <sup>3</sup>	

Percentages of 45 Gy unless stated otherwise for nodes.

Dmax and Dmin for MC plans based on D99.9% and D0.1%.

<sup>†</sup> Soft constraints which can be used in the treatment plan optimisation. Values are based on DVH parameters of EMBRACE II patients entered in the study before June 2017. The constraints are not supposed to be fulfilled in all patients, but by ~70-80% of the patients.



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*Int J Radiat Oncol Biol Phys.* 2012 July 1; 83(3): e353–e362. doi:10.1016/j.ijrobp.2012.01.023.

## Pelvic Normal Tissue Contouring Guidelines for Radiation Therapy: A Radiation Therapy Oncology Group Consensus Panel Atlas

Hiram A. Gay, M.D.<sup>\*</sup>, H. Joseph Barthold, M.D.<sup>†,‡</sup>, Elizabeth O'Meara, C.M.D.<sup>§</sup>, Walter R.

*Pract Radiat Oncol.* 2014 ; 4(2): 82–89. doi:10.1016/j.pro.2013.06.004.

## Upper abdominal normal organ contouring guidelines and atlas: A Radiation Therapy Oncology Group consensus

Salma K. Jabbour, MD<sup>a,\*</sup>, Sameh A. Hashem, MD<sup>b,c</sup>, Walter Bosch, DSc<sup>d</sup>, Tae Kyoung Kim,

EMBRACE II study protocol v.1.0

**Image guided intensity modulated  
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# EMBRACE-II



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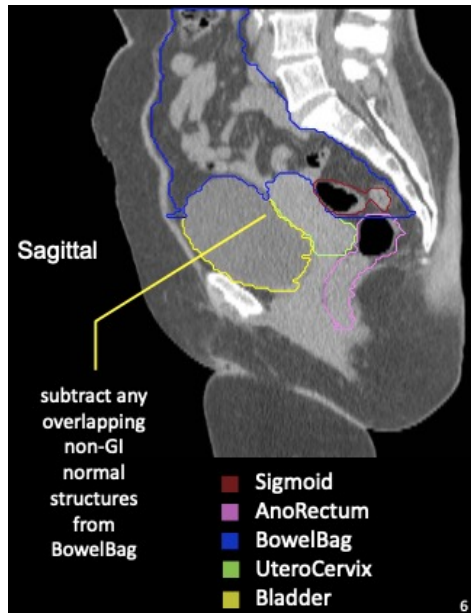
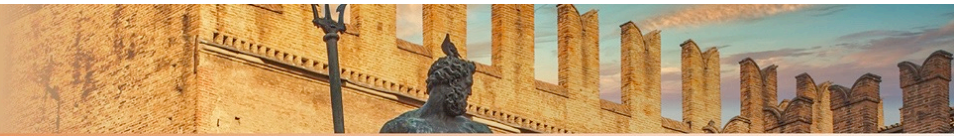
Hiram A. Gay, M.D.<sup>\*</sup>, H. Joseph Barthold, M.D.<sup>†,‡</sup>, Elizabeth O'Meara, C.M.D.<sup>§</sup>, Walter R.

### GYN

Organ	Standardized TPS Name	Tumor Category	Consensus Definition
anus + rectum	AnoRectum	GYN	Inferiorly from the anal verge as marked with a radiopaque marker at the time of simulation. Contouring ends superiorly before the rectum loses its round shape in the axial plane and connects anteriorly with the sigmoid. The AnoRectum is used with the Sigmoid and BowelBag.
sigmoid	Sigmoid	GYN	Bowel continuing where the AnoRectum contour ended. Stops prior to connecting to the ascending colon laterally. Contoured when a brachytherapy applicator rests in the uterus. Any sigmoid adjacent or above the uterus or a brachytherapy applicator should be contoured.
bowel bag	BowelBag	GYN	* Inferiorly from the most inferior small or large bowel loop, or above the Rectum (GU) or AnoRectum (GYN), whichever is most inferior. If when following the bowel loop rule the Rectum or AnoRectum is present in that axial slice, it should be included as part of the bag; otherwise it should be excluded. Tips: Contour the abdominal contents excluding muscle and bones. Contour every other slice when the contour is not changing rapidly, and interpolate and edit as necessary. Finally, subtract any overlapping non-GI normal structures. If the TPS does not allow subtraction leave as is.

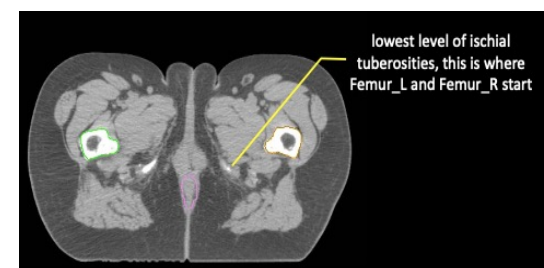
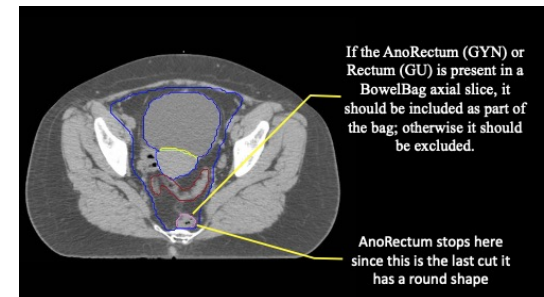
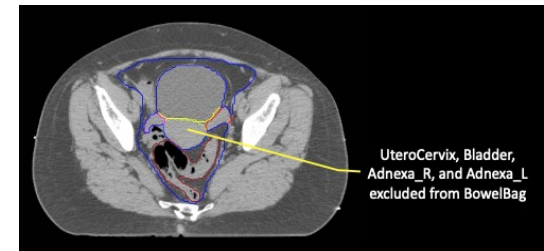
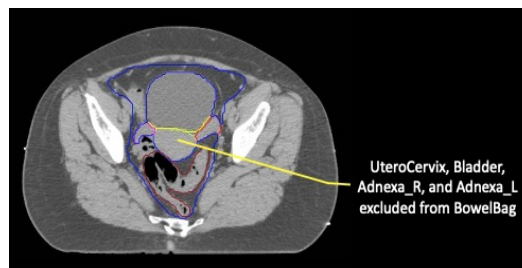
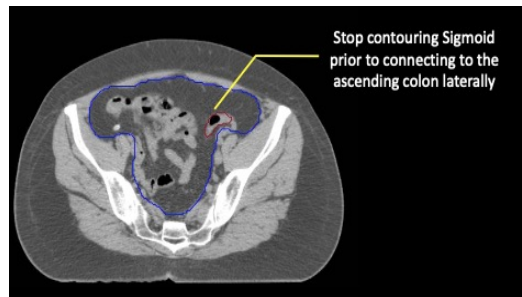
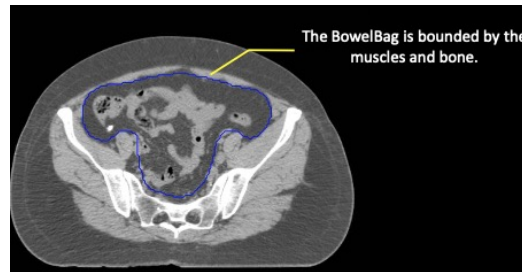
\*Stop contouring the BowelBag, SmallBowel, and Colon 1 cm above PTV for most coplanar beam plans, but the choice will depend on the treatment technique. Stop these PTVs at distances much greater than 1 cm for non-coplanar beam plans depending on the beam angle and path. Tomotherapy plans will require stopping from 1 to 5 cm above the PTV, depending on the selected field size, which is often 2.5 cm.

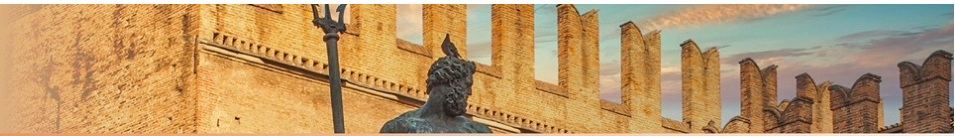
Abbreviations: TPS = treatment planning software



GYN:

- Sigmoid
- AnoRectum
- BowelBag





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<b>Kidneys</b>	Outer contour excluding renal pelvis
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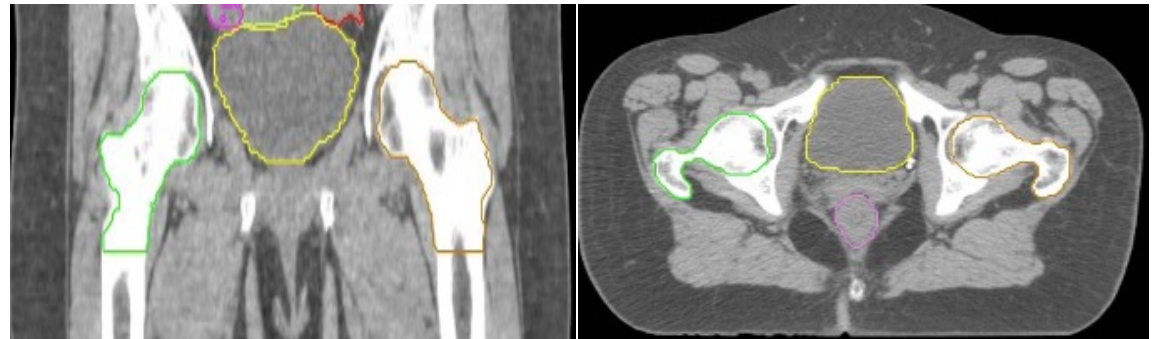
Optional (if para-aortic RT above L1 is applied):

**Duodenum** Whole organ

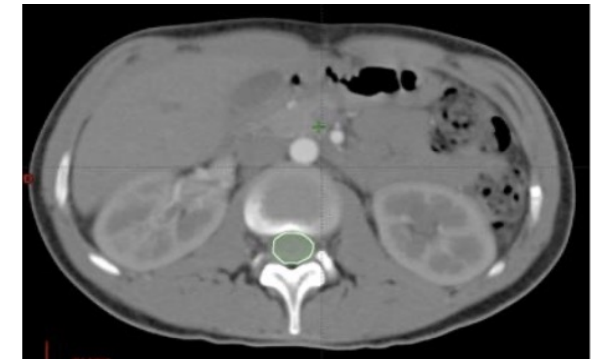
In case of ovarian transposition

**Ovary** Outer contour

proximal femurs Femur\_R GYN, GI The proximal femur inferiorly from the lowest level of the ischial tuberosities (right or left) and superiorly to the top of the ball of the femur, including the trochanters.  
 Femur\_L



Ad escludere la pelvi renale



Intero contorno fino ad L2





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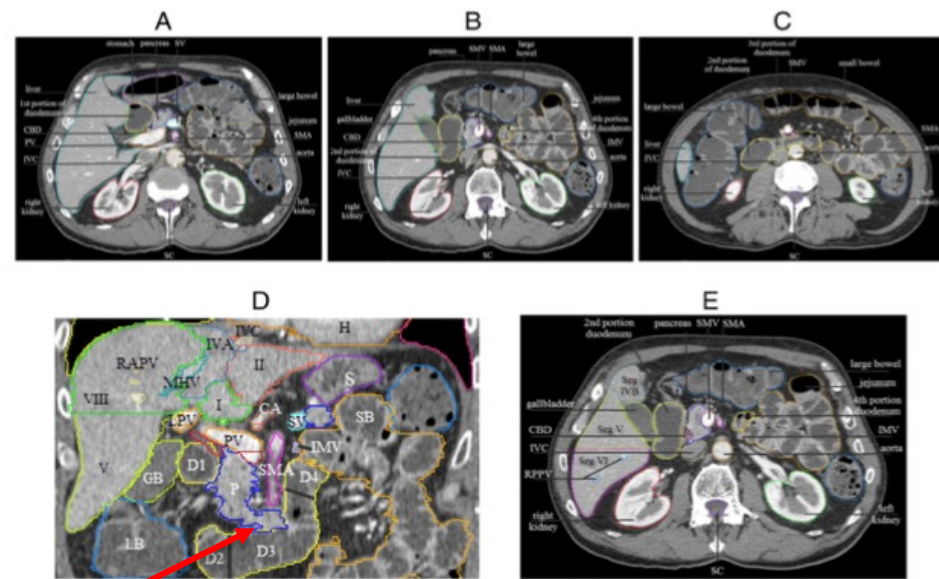
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**Upper abdominal normal organ contouring guidelines and atlas:  
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- 1° parte: retroperitoneale
- 2° parte: adesa alla testa del pancreas, localizzata alla destra dei corpi vertebrali L1-L3
- 3° parte: si porta medialmente ad L3 e poi a sx anteriormente all'aorta e ala Vena cava inferiore e posteriormente alla arteria e alla vena mesenterica superiore, definendo la fine della C duodenale
- 4° parte:( ascendente) si porta superiormente, a sx di L3, fino alla porzione inferiore del corpo pancreatico.

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Reference points:

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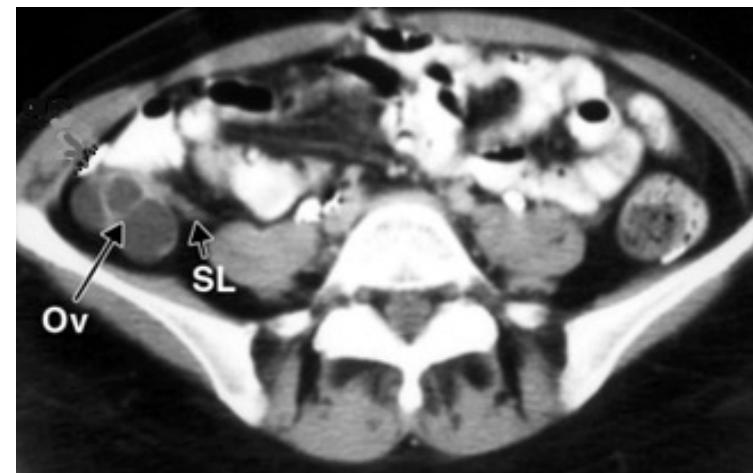
Optional (if para-aortic RT above L1 is applied):

<b>Duodenum</b>	Whole organ
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In case of ovarian transposition

<b>Ovary</b>	Outer contour
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- **OVAIE: CTV-LR**
- **OARs:** se trasposte (mobilizzazione i blocco dell'ovaio e del legamento sospensorio contenete i vasi ovarici
- **Sedi preferenziali di trasposizione:** docce paracoliche poco al di sopra delle creste iliache o spazio intraperitoneale posteriore lateralmente o anterolateralmente al muscolo psoas. Identificazione agevole tramite clip chirurgiche.



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**EMBRACE-II**

Bladder: Outline the whole organ including the bladder wall and the bladder neck (figure 17).

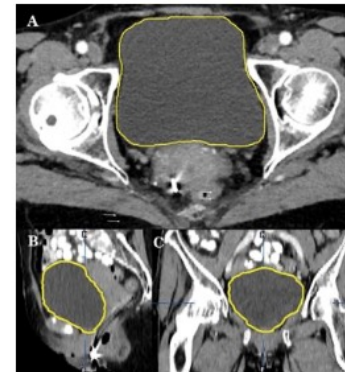
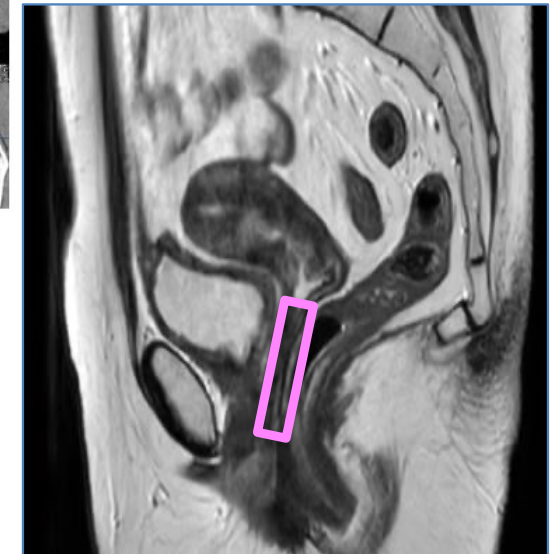
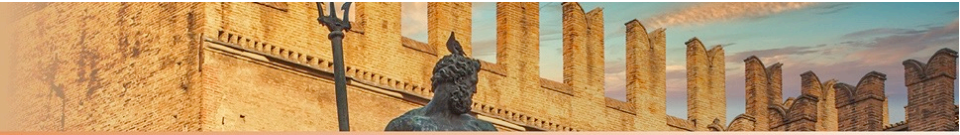


Figure 22.5.17 CT, Bladder contour (yellow) A :axial view, B : Sagittal view, C : Coronal view

OARs associati alla tox  
 tardiva nella ERT +IGAB  
 dei LACC

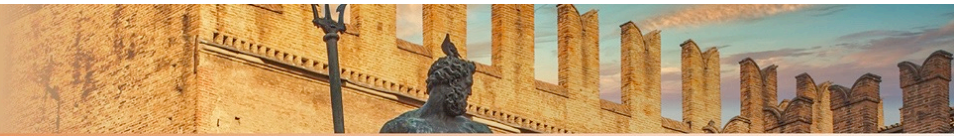




# LA VESCICA

Tossicità urinaria **TARDIVA** associata a radioterapia :

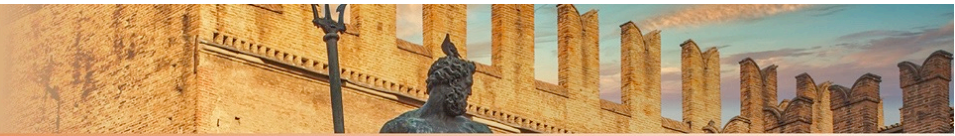
- fenomeno complesso attribuibile a danno focale o globale della vescica
- effetti avversi quali riduzione compliance vescica, cistite e fistole sono secondari a fibrosi della mucosa e della sottomucosa della parete vescicale
- Studi sul tumore della prostata trattato con EBRT e LDR BT hanno mostrato che la dose alla BASE della vescica (AREA TRIGONO E URETRA), è associata a, OSTRUZIONE URINARIA, URGENZA, FREQUENZA, DISURIA e INCONTINENZA



**Table 1**  
 Main urinary sub-structures, their role in the micturition cycle and possible associated late urinary morbidities.

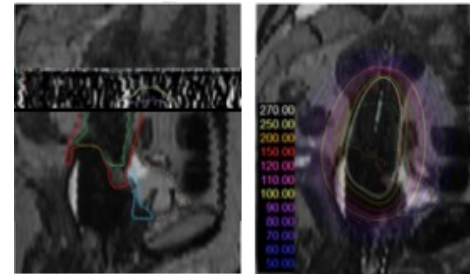
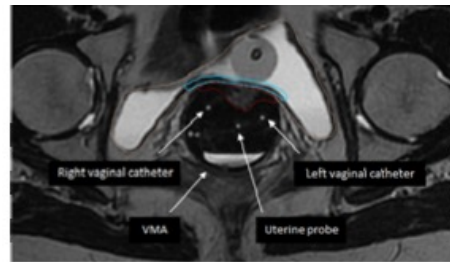
Sub-structure	Role	Endpoint
Bladder smooth muscle (destrusor)	Smooth and elastic muscle, gradually expands to allow an increased volume of urine without a rise in intravesical pressure. During filling/storage it remains relaxed, while it contracts when the voiding reflex is activated.	Dose hotspots can induce fistula and bleeding. Radiation induced inflammation can lead to cystitis. Radiation-induced fibrosis can compromise bladder contractibility, elasticity and compliance.
Trigone	Triangular structure bounded by the two ureteral orifices and the internal urethral opening. Highly innervated, it contracts during filling to keep the ureteral orifices open and the bladder neck shut.	Potential role in urgency, frequency and incontinence.
Bladder neck	Area of the bladder where the urethral lumen merges the musculature of the bladder base. It contains stretch-sensitive receptors which are different from those in the bladder dome.	Potential role in urgency, frequency and incontinence.
Urethra	Cylindrical structure composed by smooth and striated muscle that connects the bladder to the urinary meatus. It contracts during filling to avoid urine leakage until the (voluntary) voiding reflex is activated.	Neurological or mechanical damages could potentially lead to incontinence.

- Strutture interessate in un normale ciclo minzionale: muscolo detrursore, sistema nervoso involontario, sistema nervoso volontario, uretra
- ***Porzione più posteriore della parte più bassa della vescica: riccamente innervata e piena di recettori sensibili allo stiramento che non sono presenti nella cupola.***
- ***Danno meccanico agli sfinteri uretrali potrebbe comportare una perdita di urina***
- Già ICRU 89 auspicava studi che potessero correlare l'insorgenza di disturbi urinari tardivi con specifiche sub strutture del tratto urinario



**Risk of late urinary complications following image-guided adaptive brachytherapy for locally advanced cervical cancer: refining bladder dose/volume parameters**

Elena Manea, MD<sup>1,2\*</sup>, Alexandre Escande, MD,MS<sup>1,2,3\*</sup>, Sophie Bockel, MD<sup>1,2</sup>, Mohamed Khettab MD<sup>3</sup>, Isabelle Dumas, PhD<sup>1,2</sup>, Ioana Lazarescu MD<sup>1,2</sup>, Ingrid Fumagalli, MD,<sup>1,2</sup> Philippe Morice, MD, PhD<sup>4</sup>, Eric Deutsch, MD, PhD<sup>1,2</sup>, Christine Haie-Meder, MD<sup>1,2</sup>, Cyrus Chargari, MD, PhD<sup>1,2,5,6</sup>



-300 pz LACC  
-HOT SPOT TRIGONO →  
SINTOMI URINARI TARDIVI

ELSEVIER

Brachytherapy ■ (2017) ■

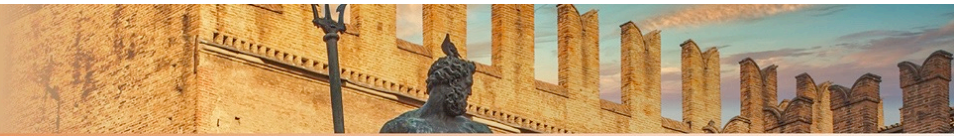
**BRACHYTHERAPY**

Association of bladder dose with late urinary side effects in cervical cancer high-dose-rate brachytherapy

Roja Zakariaee<sup>1,2,\*</sup>, Ghassan Hamarneh<sup>3</sup>, Colin J. Brown<sup>3</sup>, Marc Gaudet<sup>4</sup>, Christina Aquino-Parsons<sup>2</sup>, Ingrid Spadinger<sup>2</sup>

-60 pz LACC  
-HOT SPOT collo  
vescica → INCONTINENZA URINARIA

1. Bladder neck location (blue cross) shown in three (noncardinal) orthogonal views. The location of the bladder neck is determined using the Foley balloon and catheter and the bladder wall contour. Note that since the orthogonal views are rotated from the original cardinal (sagittal, coronal, and axial) views, the bladder wall contour looks slightly jagged. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)



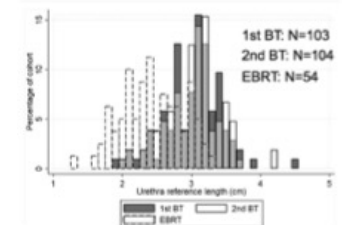
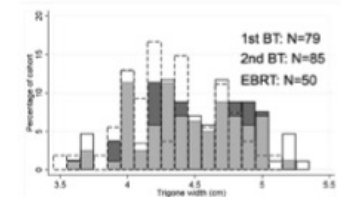
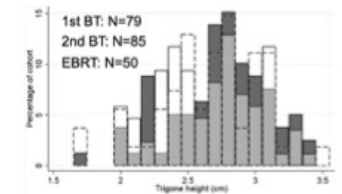
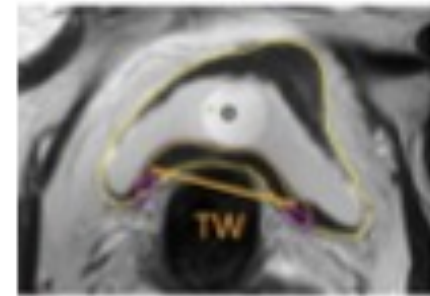
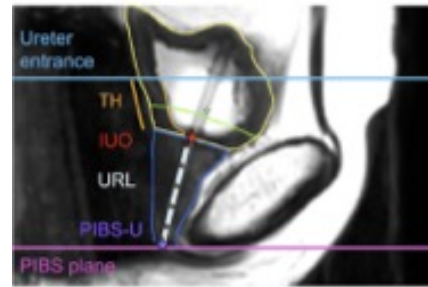
-146 pz -LACC- RT-CT + IGABT(EMBEACE 2008-2015)

-contornazione delle substrutture del tratto urinario inferiore: trigono (base), collo vescica, uretra in RM

- Individuati *Reference*

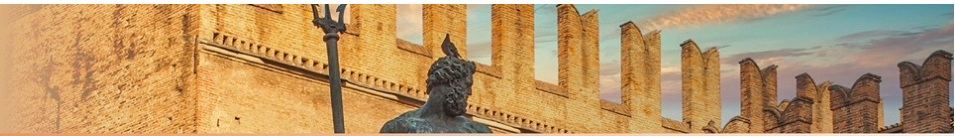
- a) trigono: TH e TW (dimensioni)
- b) uretra: PIBS-U e IUO (punti)

**RISULTATI:** variazioni minime tra i volumi e le «distanze» tra una frazione e l'altra di IGABT e in EBRT, anche indipendentemente dal riempimento vescicale, per cui gli autori concludono che la **contornazione delle substrutture può essere standardizzata e utilizzata per studi futuri che correlino la dose a queste strutture e la tossicità urinaria tardiva.**



g. 4. a) Distribution of TH values for the 1<sup>st</sup> (grey bars) and the 2<sup>nd</sup> (white bars) ABT fractions and EBRT (transparent dashed solid bars). b) Distribution of TW does for the 1<sup>st</sup> (grey bars) and the 2<sup>nd</sup> (white bars) IGABT fractions and EBRT (transparent dashed solid bars). c) Distribution of URL values for the 1<sup>st</sup> (grey bars) of the 2<sup>nd</sup> (white bars) IGABT fractions and EBRT (transparent dashed solid bars). number of patients in the 1<sup>st</sup> and 2<sup>nd</sup> IGABT fraction and EBRT groups are also reported.





IL TRATTO URINARIO INFERIORE:

**1) LA VESCICA:**

-parte superiore, la cupola che è più elastica e contrattile

-parte inferiore, cui individuiamo:

a) **La base** che si trova indietro e in basso e sulla cui parete interna è presente il **trigono** di forma triangolare compresa tra gli orifizi ureterali in vescica e l'orifizio uretrale interno

b) **Il Collo:** cioè la porzione della vescica in cui la muscolatura contribuisce alla funzione dello sfintere uretrale interno. In questa sede, lo strato muscolare longitudinale interno della parete vescicale si fonde con lo strato longitudinale interno dell'uretra.

**2) L'URETRA** è una struttura tubulare di 4 cm che origina dal collo della vescica e termina nel vestibolo della vagina. Lo sfintere uretrale striato esterno è **nei 2/3 prossimali dell'uretra ed è fissato contro la parete vaginale anteriore**. Almeno i 2/3 dell'uretra prossimale è localizzata sopra l'elevatore dell'ano. Il terzo distale dell'uretra è rivestito da epitelio transizionale.

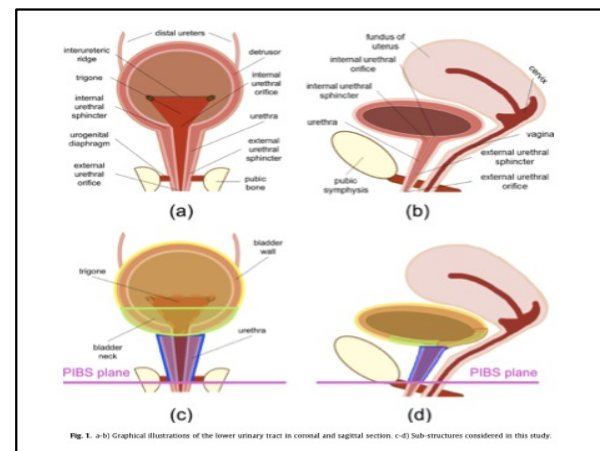
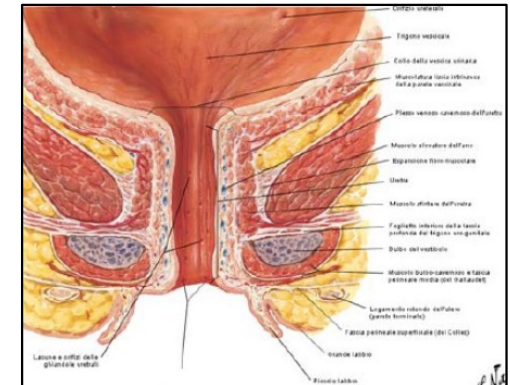


Fig. 1. a-b) Graphical illustrations of the lower urinary tract in coronal and sagittal section. c-d) Sub-structures considered in this study.



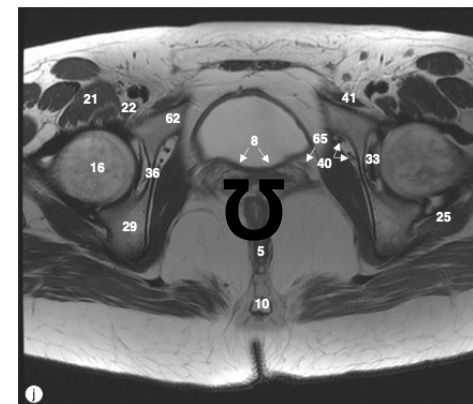


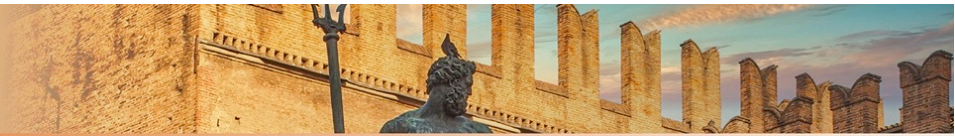
## La BASE

-Area della vescica dove il ***detrusore si continua posteriormente e in basso e prosegue poi nel collo.***

-Sulle ***immagini assiali della RM***, in particolare nelle ***T2w*** può nella porzione iniziale ***apparire a forma di omega rovesciata  $\Omega$***

-***Internamente corrisponde al trigono*** al quale è possibile assimilarlo nella contornazione come unico volume





## TRIGONO

-Struttura di **forma triangolare** tra gli orifizi ureterali cranialmente e l'orifizio uretrale interno caudalmente; molto innervata

-**non** direttamente **identificabile** nelle immagini **assiali** T2w della RM perché *gli orifizi ureterali interni non sono visibili*, ma la sua **posizione** può essere dedotta dall'**entrata degli ureteri nella parete della vescica**

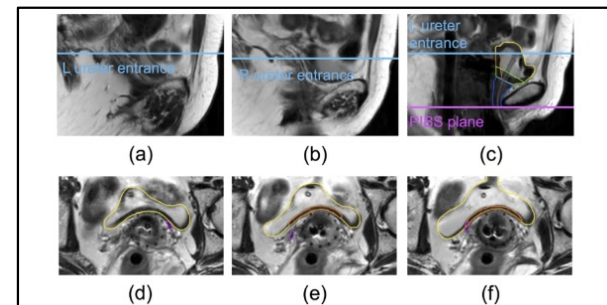
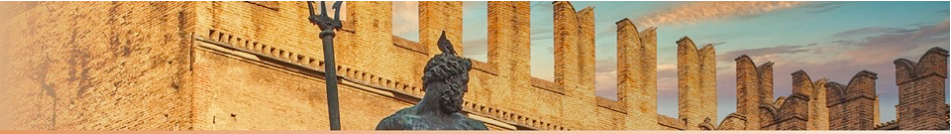
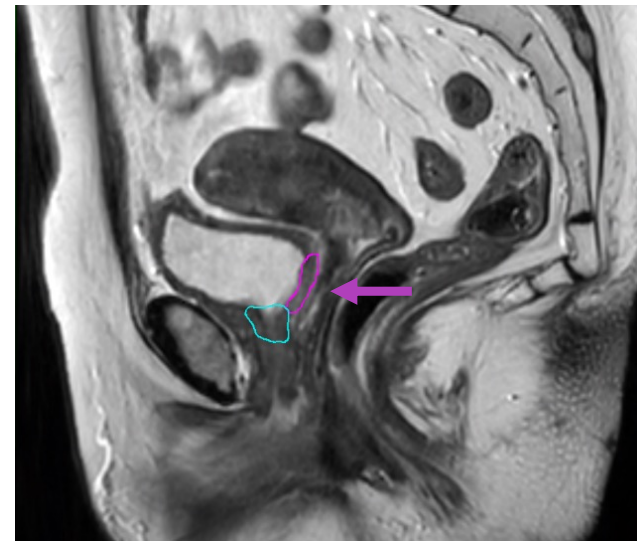
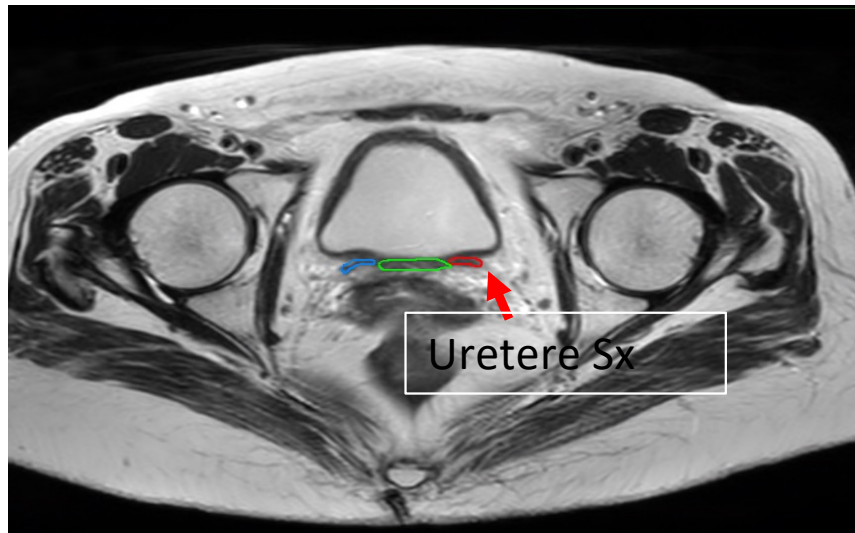


Fig. 3. Example of contouring of the trigone for asymmetric ureters. a-b) Different entrance planes for asymmetric ureters. c-f) Definition of the structures considering the more cranial ureter.



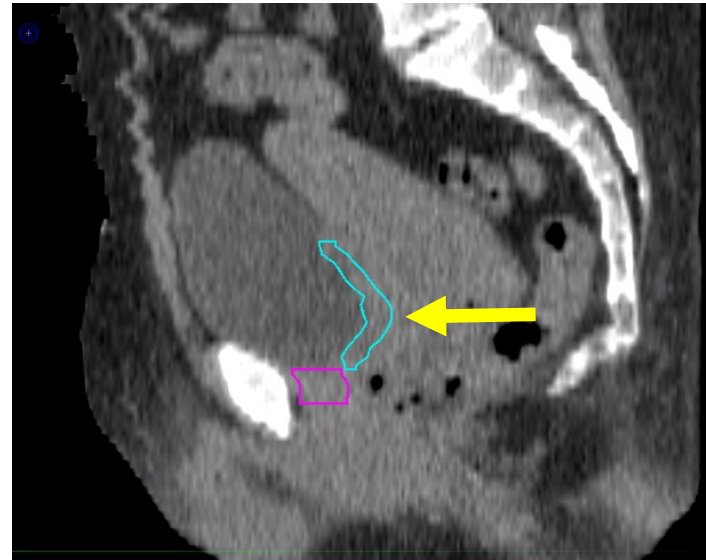
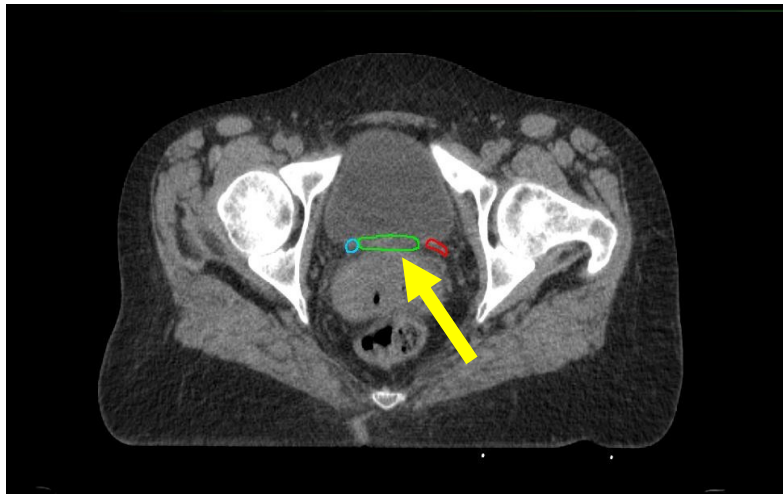
## BASE - TRIGONO

- Porzione** della parete postero-inferiore della vescica **ipointensa sulle immagini assiali T2w tra l'imbocco dei due ureteri in vescica**
- porzione postero-inferiore della parete vescicale al davanti del collo dell'utero fino al collo della vescica** (nelle immagini sagittali e coronali )





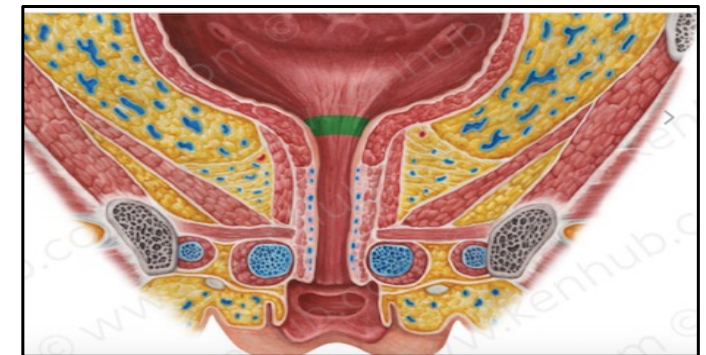
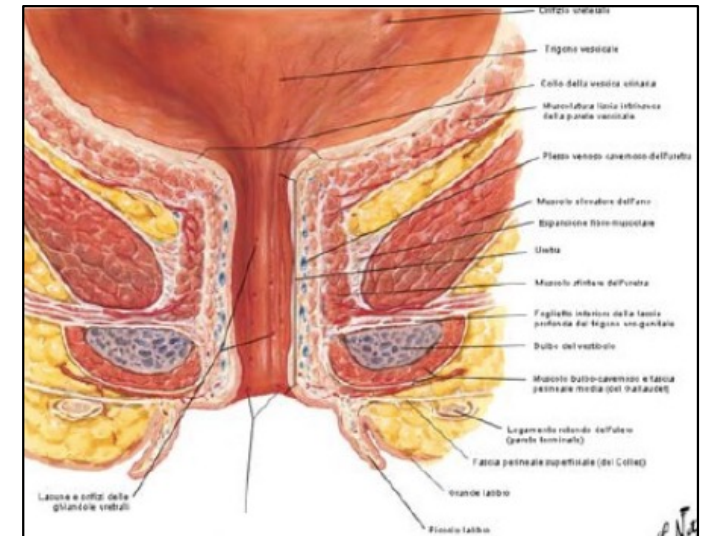
## BASE-TRIGONO: TC





## II COLLO

- Zona di congiunzione tra vescica e uretra
- l'area in cui la **vescica si restringe e la parete vescicale aumenta di spessore**
- Ha **forma circolare** ed è localizzato appena **sopra il pavimento pelvico, collegato alla fascia endopelvica** con i legamenti pubovesicali e con i fasci muscolari più mediali **dell'elevatore dell'ano.**
- E' composto da un complesso di **fibre longitudinali lisce**, che si estendono dalla muscolatura della parete vescicale (detrusore) e da un **anello indipendente di fibre muscolari circolari lisce**





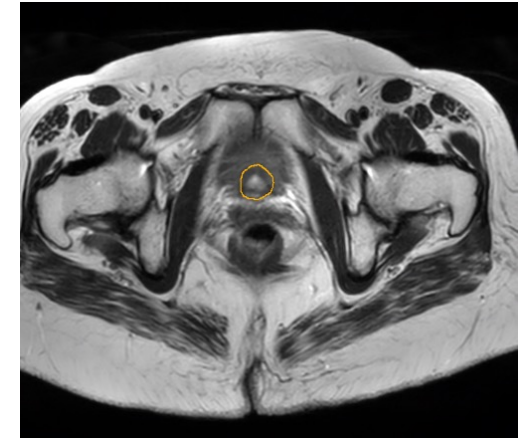
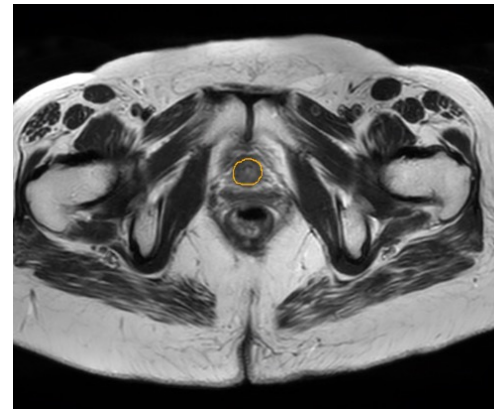
## COLLO VESCICA

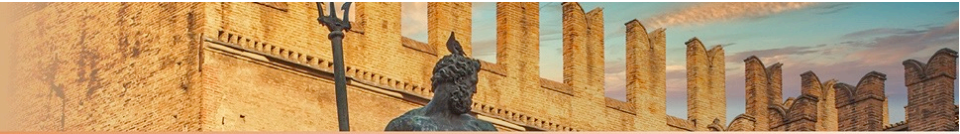
- Il limite superiore non è chiaramente definito da punti di riferimento anatomici, ma può definirsi a partire dalla zona in cui la vescica si restringe e la parete diventa più spessa
- Sulla RM (T2w) è meglio visibile sul **piano sagittale**, a forma di **imbuto ipointenso** con estensione **cranio-caudale dalla zona più ispessita della vescica all'uretra, anteriormente alla vagina e posteriormente alla sinfisi pubica**



## COLLO VESCICA

- Sulle immagini assiali è meno evidente
- Si può comunque individuare nelle sequenze T2w, a partire dal restringimento vescicale e inferiormente quando presente, fin dove è ancora visibile l'urina





## COLLO VESCICA

- Nelle immagini sagittali e coronali in TC: restringimento ad imbuto con ispessimento della parete vescicale
- Nelle assiali difficilmente evidenziabile



*La contornazione degli organi a rischio emergenti  
 della pelvi femminile per la pratica clinica quotidiana*





## VAGINA: OAR e TARGET

Clinical Investigation

### Impact of Vaginal Symptoms and Hormonal Replacement Therapy on Sexual Outcomes After Definitive Chemoradiotherapy in Patients With Locally Advanced Cervical Cancer: Results from the EMBRACE-I Study

Kathrin Kirchheiner, MSc, PhD,\* Stephanie Smet, MD,<sup>1,2</sup>

International Journal of  
Radiation Oncology  
biology • physics

Nov 2021

Table 3 Frequency of vaginal functioning problems and sexual enjoyment in 531 patients who reported sexual activity in at least 3 follow-ups

	Vaginal dryness	Vaginal atrophy	Vaginal tightening	Pain during intercourse	Sexual enjoyment
Never (0% of sexual activities)	308 (58.2%)	311 (58.6%)	330 (62.1%)	338 (63.7%)	144 (27.1%)
Occasionally (<50% of sexual activities)	100 (18.8%)	95 (17.7%)	94 (17.7%)	96 (18.1%)	83 (15.6%)
Frequently (≥50% of sexual activities)	72 (13.4%)	69 (12.8%)	49 (9.2%)	47 (8.8%)	130 (24.5%)
Always (100% of sexual activities)	41 (7.6%)	43 (8.1%)	46 (8.7%)	38 (7.2%)	159 (30.0%)
Total	521	518	519	519	518
Missing	10	13	12	12	13

**Conclusions:** Vaginal functioning problems are associated with pain and compromised sexual enjoyment. Further effort is required for the primary prevention of vaginal morbidity with dose optimization and adaptation. Secondary prevention strategies, including HRT for vaginal and sexual health after radiation therapy in locally advanced cervical cancer, should be considered and sexual rehabilitation programs should be developed further. © 2021 Elsevier Inc. All rights reserved.

International Journal of  
Radiation Oncology  
biology • physics  
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Clinical Investigation: Gynecologic Tumor

### Manifestation Pattern of Early-Late Vaginal Morbidity After Definitive Radiation (Chemo)Therapy and Image-Guided Adaptive Brachytherapy for Locally Advanced Cervical Cancer: An Analysis From the EMBRACE Study

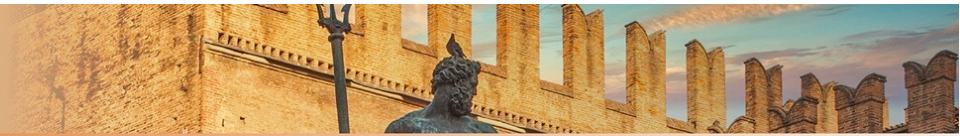
Kathrin Kirchheiner, MSc,\*<sup>1,2</sup> Remi A. Nout, MD, PhD,<sup>3</sup> Kari Tanderup, PhD,<sup>4</sup> Jacob C. Lindegaard, MD, DMSc,<sup>5</sup> Henrike Westerveld, MD, PhD,<sup>6</sup> Christine Haie-Meder, MD,<sup>7</sup> Primož Petric, MD, PhD,<sup>8,9,10</sup> Umesh Mahantshetty, DMRT, MD, DNB,<sup>11</sup> Wolfgang Dörr, DVM, PhD,\*<sup>12</sup> and Richard Pötter, MD, PhD\*<sup>13</sup>

Table 3 Crude incidences of treatment-related individual vaginal symptoms and overall vaginal morbidity in 588 patients with a median follow-up time of 15 months

Grade	Vaginal stenosis	Vaginal dryness	Vaginal mucositis	Vaginal bleeding	Vaginal fistula	Other vaginal symptoms	Overall vaginal morbidity
G0	241 (41%)	312 (53%)	415 (71%)	407 (69%)	582 (99%)	523 (89%)	155 (26%)
G1	256 (43%)	244 (42%)	146 (25%)	175 (30%)	2	47 (8%)	309 (53%)
G2	86 (15%)	32 (5%)	23 (4%)	5 (1%)	0	14 (2%)	111 (19%)
G3	5 (1%)	N.A.	3	1	4 (1%)	4 (1%)	12 (2%)
G4	N.A.	N.A.	1	0	0	0	1
G5	N.A.	N.A.	0	0	0	0	0

Abbreviation: N.A. = not applicable.

Severe grade 3/4 vaginal morbidity after definitive radiation (chemo)therapy including IGABT for locally advanced cervical cancer within 2 years is limited and significantly less than in previous studies with radiographic treatment planning. Thus, the new adaptive target concept including the use of intracavitary/interstitial techniques seems to be a safe treatment with regard to major morbidity in the vagina being an OAR. However, mild to moderate morbidity occurs in the majority of patients within the first 2 years after the end of treatment and is still a substantial problem, which deserves further attention. Mild vaginal symptoms are not always persistent but can heal and fluctuate over time. Vaginal stenosis (shortening and/or tightening) and dryness are most frequent and tend to be more persistent over time.



## VAGINA: relazione dose effetto

Radiotherapy and Oncology 118 (2016) 160–166



Contents lists available at [ScienceDirect](#)

### Radiotherapy and Oncology

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



Brachytherapy

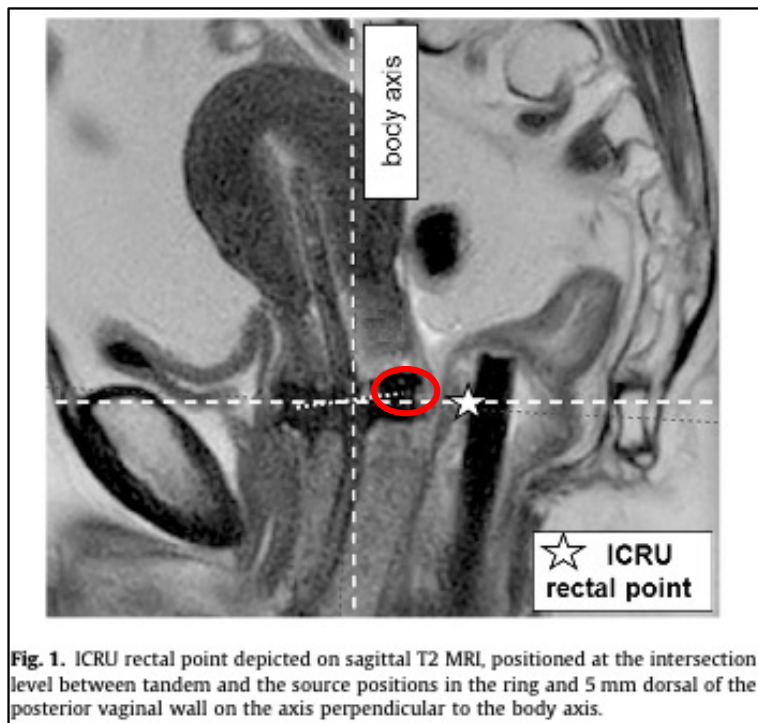
### Dose–effect relationship and risk factors for vaginal stenosis after definitive radio(chemo)therapy with image-guided brachytherapy for locally advanced cervical cancer in the EMBRACE study



Kathrin Kirchheiner <sup>a,\*</sup>, Remi A. Nout <sup>b</sup>, Jacob C. Lindegaard <sup>c</sup>, Christine Haie-Meder <sup>d</sup>,  
Umesh Mahantshetty <sup>e</sup>, Barbara Segedin <sup>f</sup>, Ina M. Jürgenliemk-Schulz <sup>g</sup>, Peter J. Hoskin <sup>h</sup>, Bhavana Rai <sup>i</sup>,  
Wolfgang Dörr <sup>a,j</sup>, Christian Kirisits <sup>a</sup>, Søren M. Bentzen <sup>k</sup>, Richard Pötter <sup>a,j</sup>, Kari Tanderup <sup>c</sup>, the EMBRACE  
Collaborative Group<sup>1</sup>

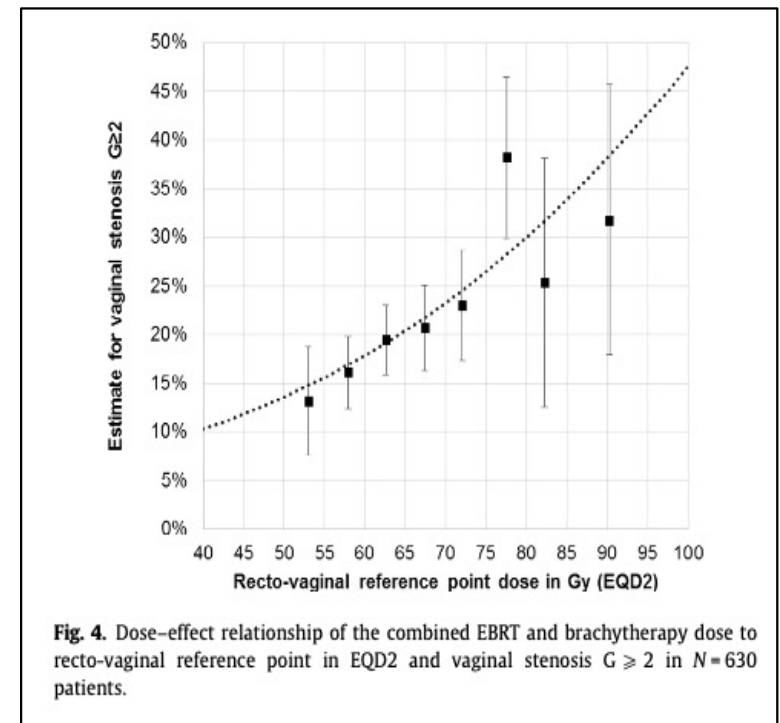


## VAGINA: relazione dose effetto



la probabilità di sviluppare stenosi vaginale > G2 è:

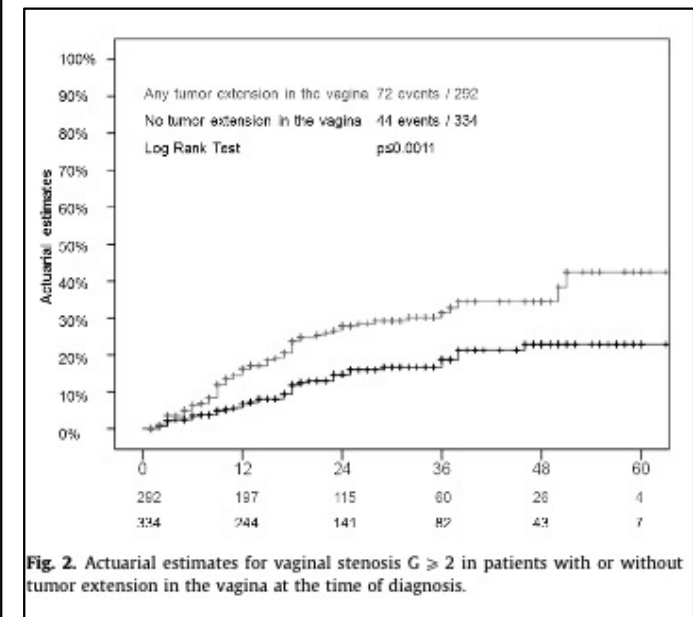
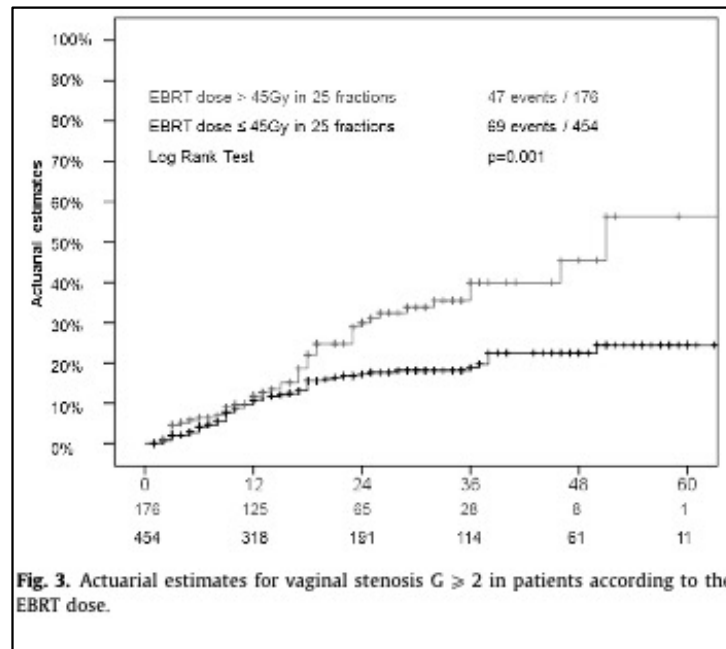
- 16%: EQD2 55Gy,
- 20%: EQD2 65Gy,
- 27 %: EQD2 75Gy,
- 34% con 85 Gy
- 43% con 85Gy





## VAGINA: relazione dose effetto

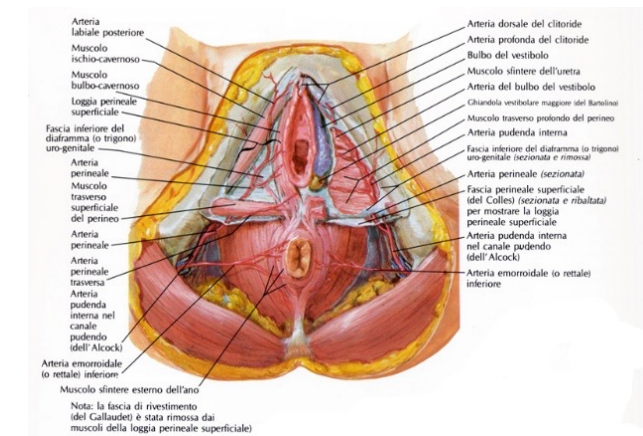
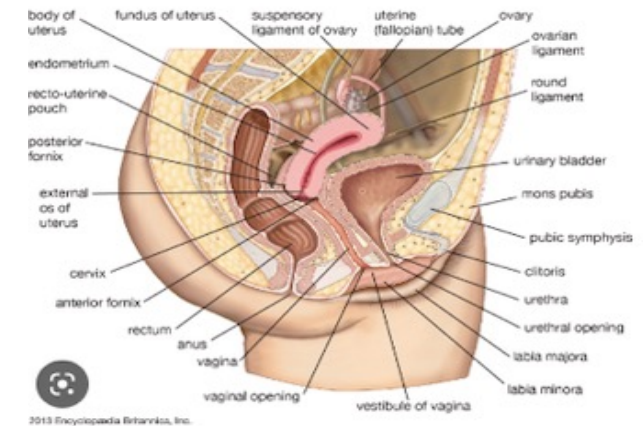
- Stenosi vaginale correlata anche :
- Estensione di malattia in vagina
  - Dose EBRT
  - Per cui consigliamo di mantenere la dose a 45 sulla pelvi e una dose sul punto retto vaginale inferiore ai 65 Gy perché questa sembra correlare con un'incidenza di stenosi vaginale G2 del 21% che è significativamente più bassa di quelle che avevamo con le cosiddette serie storiche.





## VAGINA

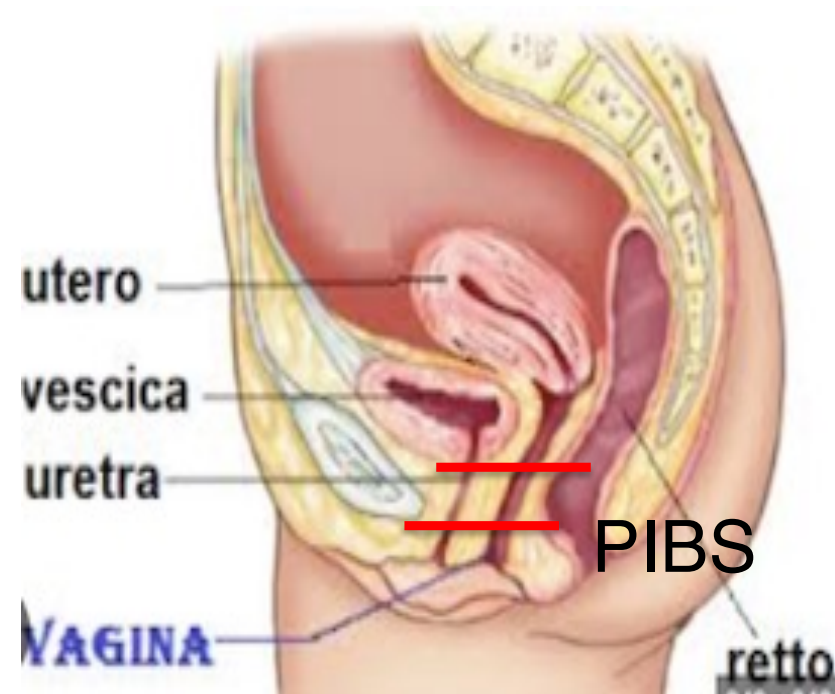
- Canale fibromuscolare di 6-8 cm, che in assiale assume tipica *forma ad H*
- Cranialmente si inserisce sul collo dell'utero creando un *angolo di 90°* e questa disposizione porta alla formazione di tasche a fondo cieco detti *fornici* (*anteriore, posteriore e laterale*)
- *E' sostenuta da varie strutture: muscolo elevatore dell'ano legamento cervicale trasverso, legamento pubo-vescicale, legamento utero sacrale, membrana perineale e corpo perineale*
- *E' in contatto anteriormente con cervice, vescica e uretra; posteriormente con tasca di Douglas, fascia di denonviller e retto, lateralmente elevatore dell'ano, fascia pelvica, uretere*





## VAGINA

- Può essere suddivisa in **3 parti**:  
3° **superiore** (tra cervice e giunzione uretrovescicale); 3° **medio** (tra giunzione uretrovescicale e Bordo Postero-Inferiore sinfisi pubica (PIBS)); 3° **inferiore** (tra PIBS e introito vaginale)
- PIBS: piano tangente al bordo postero-inferiore della sinfisi pubica che corrisponde al passaggio tra terzo medio e terzo inferiore della vagina;
- Vagina media: PIBS+ 2cm;
- Vagina inferiore: PIBS - 2 cm;
- Vagina superiore: dalla vagina media alla cervice uterina

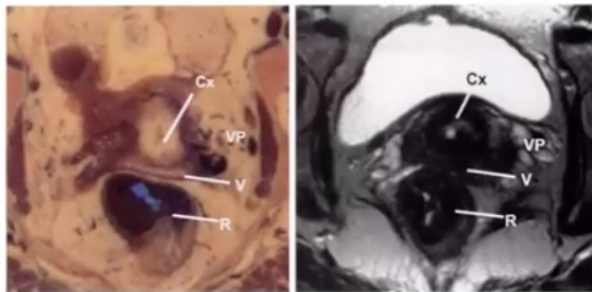




## VAGINA

- Visibile nelle **immagini RM T2w assiali e sagittali**
- Difficilmente visibile in TC soprattutto nelle immagini assiali; di aiuto le immagini sagittali.

Anatomia a livello dei fornici vaginali

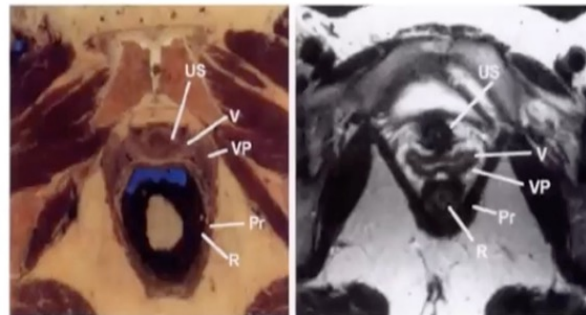


Anatomia

Immagine T2 fast SE assiale

La vagina (V) si estende posteriormente alla cervice (Cx).  
 R =retto, VP = plesso venoso vaginale.

Anatomia a livello della vagina "media"



2a.

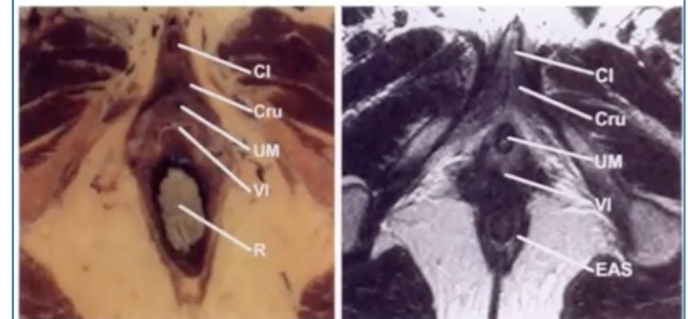
Anatomia

2b.

Immagine T2 fast SE assiale

Sfintere ureterale(US), muscularis della vagina (V), muscularis del retto(R),  
 plesso venoso vaginale (VP), Pr = muscolo puborettale.

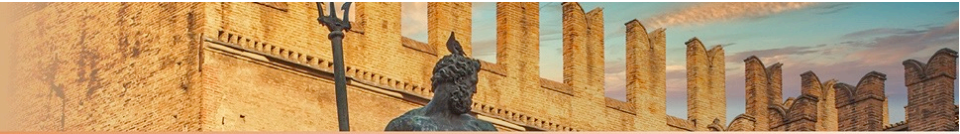
Anatomia a livello dell'introito vaginale



Anatomia

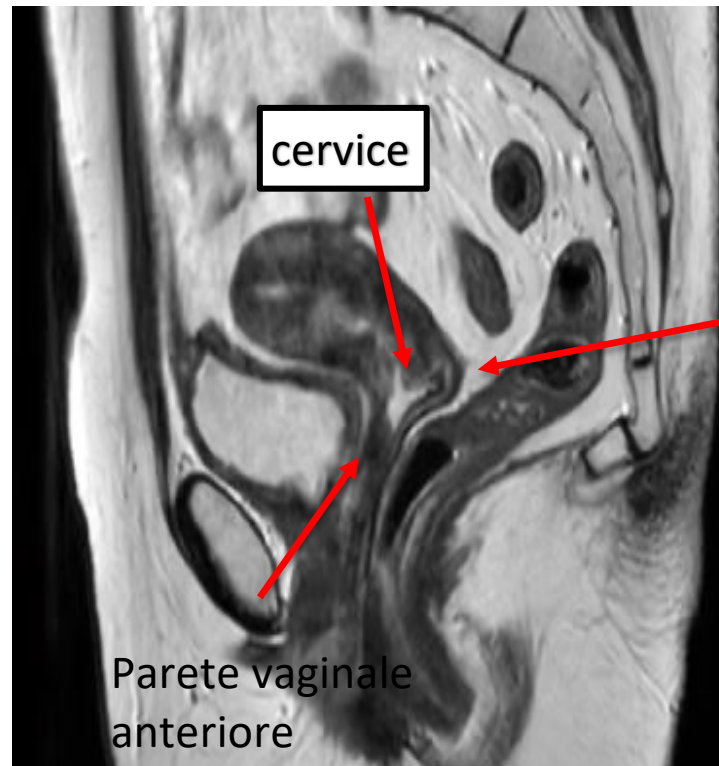
Immagine T2 fast SE assiale

clitoride (Cl), meato uretrale (UM), introito vaginale (VI).  
 Cru = crus del clitoride, EAS = sfintere anale esterno, R = Retto



## VAGINA

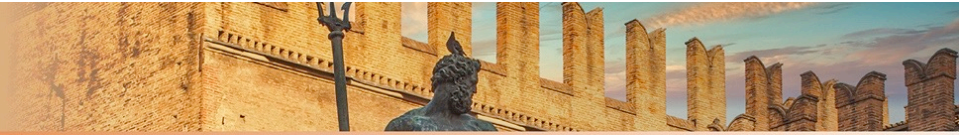
Nelle immagini sagittali si vede che la parte craniale della parete vaginale anteriore termina alla cervice, mentre la parete vaginale posteriore si estende al di sopra dell'ostio vaginale, quindi in assiale possiamo vedere il fornice anteriore ma non quello posteriore



Parete vaginale posteriore

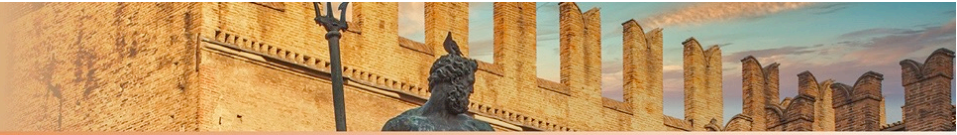
Parete vaginale anteriore





## VAGINA: come contornare

- Imaging di scelta: RM
- CT= RM (*ICRU 89, EMBRACE (Potter 2005), Ohno 2017, GEC-ESTRO (2021)*)
- Intera vagina: solo contorno esterno (*ICRU 89, Berger 2007, Fidarova 2010*)



## VAGINA: come contornare

- *Soprattutto nel caso della BRT è indicato contornare le 3 porzioni: superiore, media e inferiore*
- *Per contornare: si traccia il PIBS (zona transizionale tra 3° medio e 3° inferiore; poi 2 cm sotto il PIBS c'è la vagina inferiore; 2 cm sopra il PIBS c'è la vagina media e dalla vagina media alla cervice c'è la vagina superiore (va contornata seguendo il profilo degli applicatori fino a quando la vagina non incontra la cervice o il CTV ad alto rischio)*

# AIRO2022

XXXII CONGRESSO NAZIONALE AIRO  
XXXIII CONGRESSO NAZIONALE AIRB  
XII CONGRESSO NAZIONALE AIRO GIOVANI

Radioterapia di precisione per un'oncologia innovativa e sostenibile

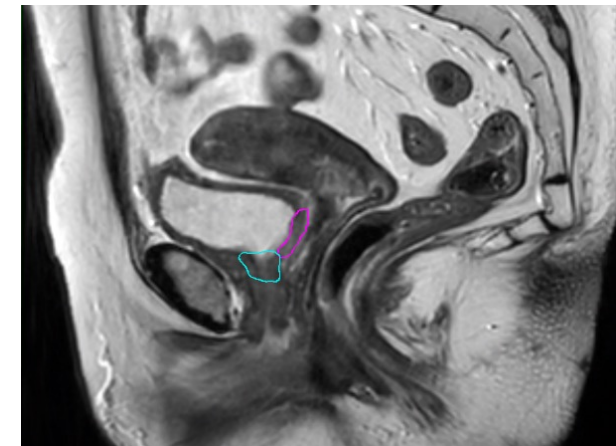
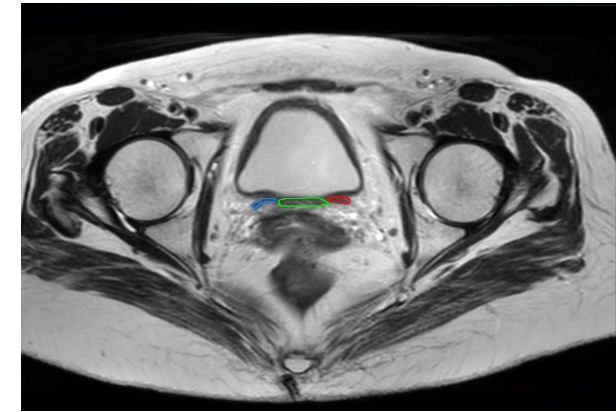
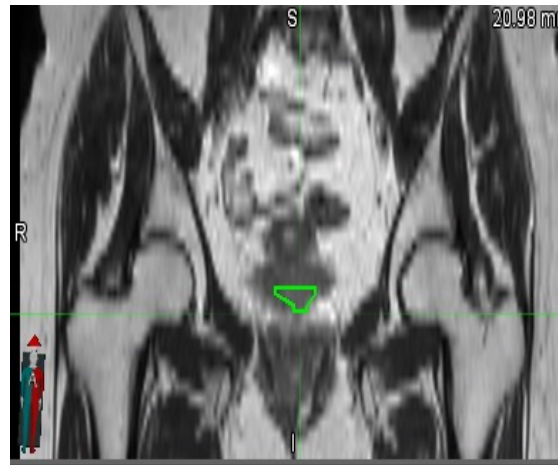


## RICAPITOLANDO...



## BASE-TRIGONO

- RM: Sequenze T2w
- immagini assiali: ispessimento parete postero-inferiore
- imbocco ureteri in vescica
- immagini assiali RM T2w
- Immagini sagittali e coronali di aiuto

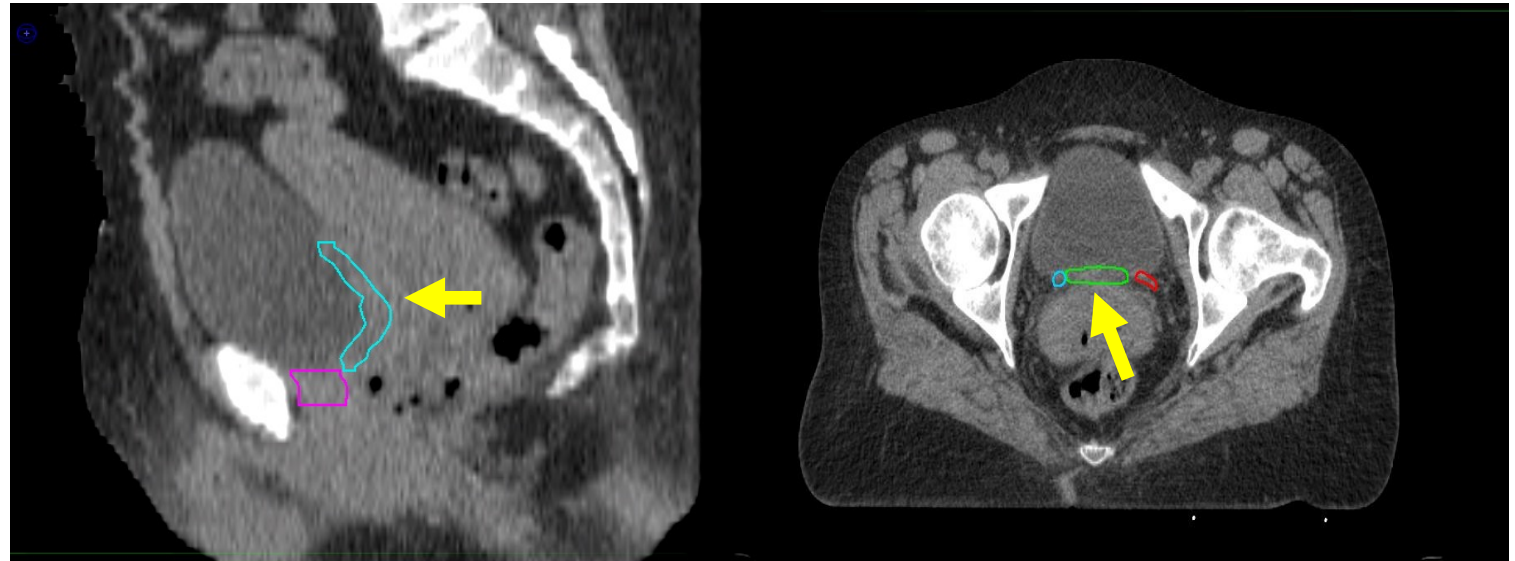


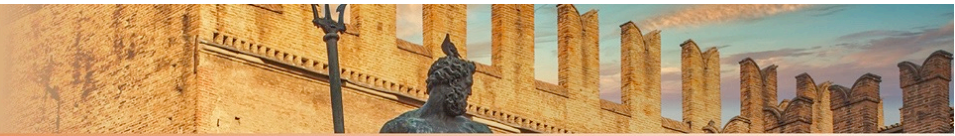


## BASE-TRIGONO

### IMMAGINI TC

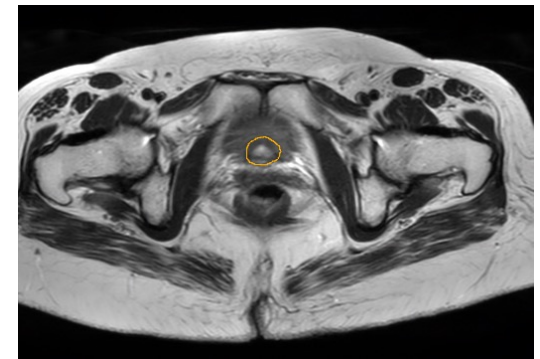
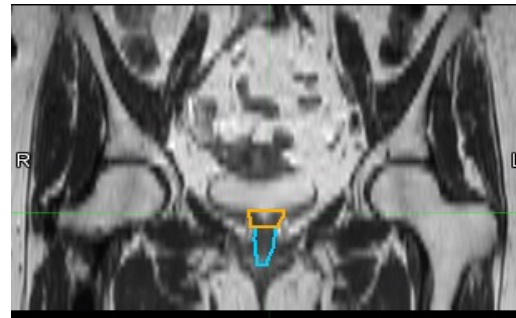
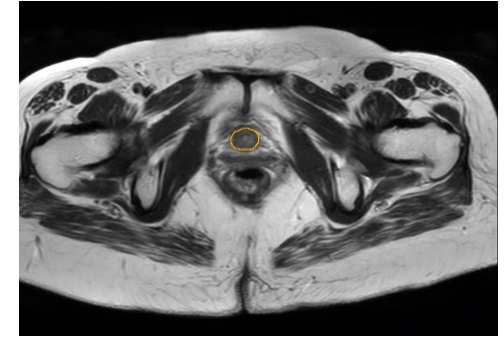
- imbocco ureteri in vescica immagini
- Immagini sagittali e coronali di aiuto





## COLLO VESCICA

- Sulla RM (T2w) è meglio visibile sul **piano sagittale**, a forma di **imbuto ipointenso** con estensione **cranio-caudale dalla zona più ispessita della vescica all'uretra, anteriormente alla vagina e posteriormente alla sinfisi pubica; di aiuto immagine coronale**
- immagini assiali meno nettamente evidenziabili i limiti
- Anteriormente alla vagina e posteriormente alla sinfisi



*La contornazione degli organi a rischio emergenti  
della pelvi femminile per la pratica clinica*

**BOLZANO**, 25-27 NOVEMBRE  
PALAZZO DEI CONGRESSI



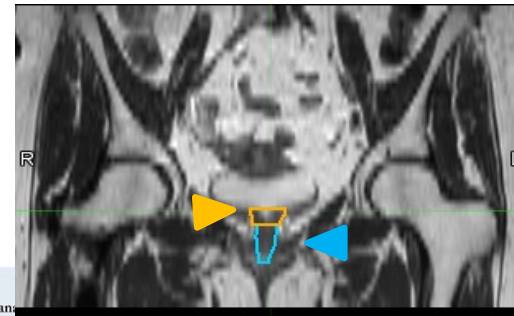
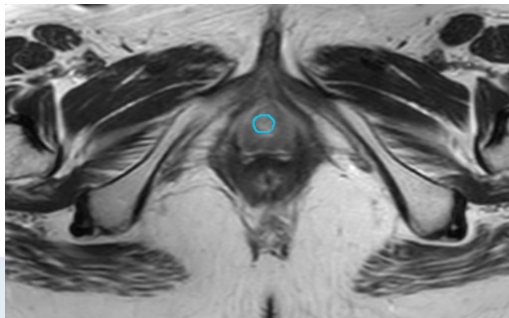
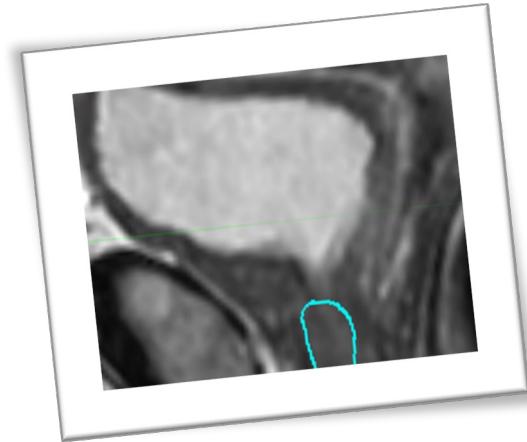
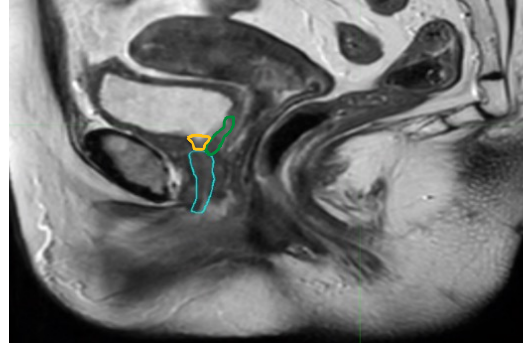
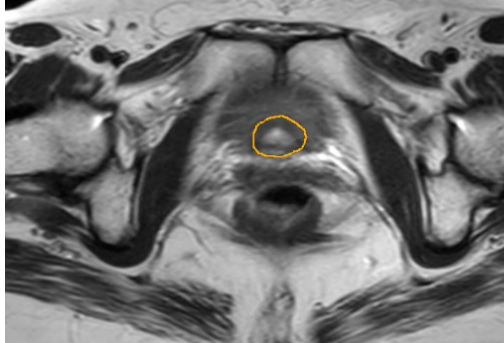
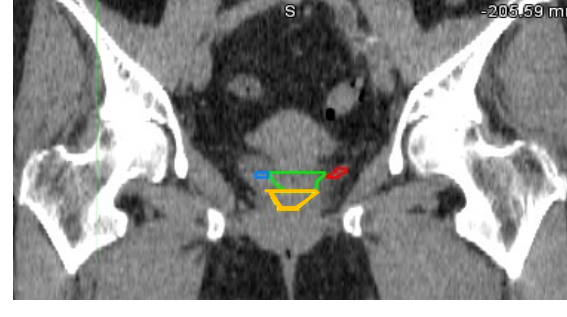
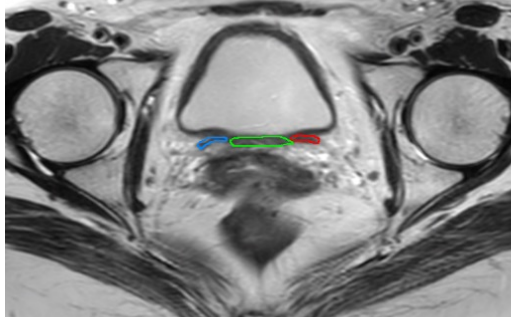
## COLLO VESCICA

### IMMAGINI TC

- Restringimento vescica in sagittale e coronale
- Ispessimento pareti
- Limiti: sinfisi e vagina
- Meno evidenzibile in assiale



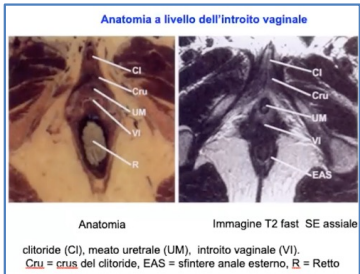
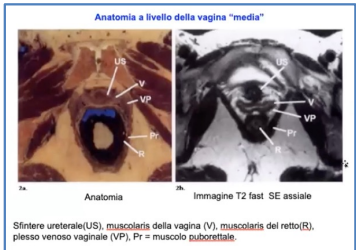
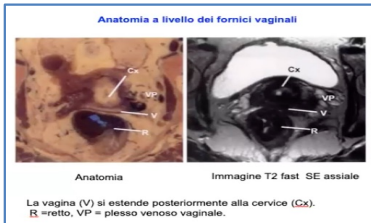
## COLLO ● E BASE/TRIGONO ● VESCICALE, URETRA ●







## VAGINA



**LIMITI:**

**Laterale:** Tessuto adiposo, Muscolo pubo-rettale (PR).

**Posteriore:** Mesoretto/Retto(R)/Canale anale (A)

**Anteriore:** Vescica (V) , Uretra (U)

**Craniale:** Cervice (C)

**Caudale:** Orifizio vaginale (OV)

