

# Cancer de cervix Braquiterapia 3 D y braquiterapia intratesticial

Cordoba 13/11/2025

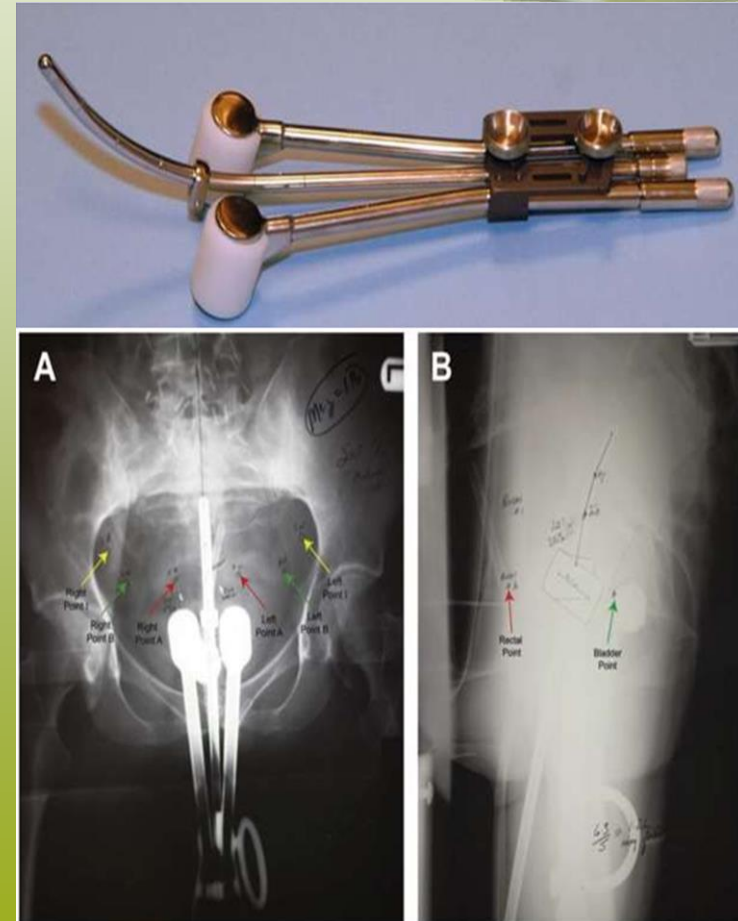


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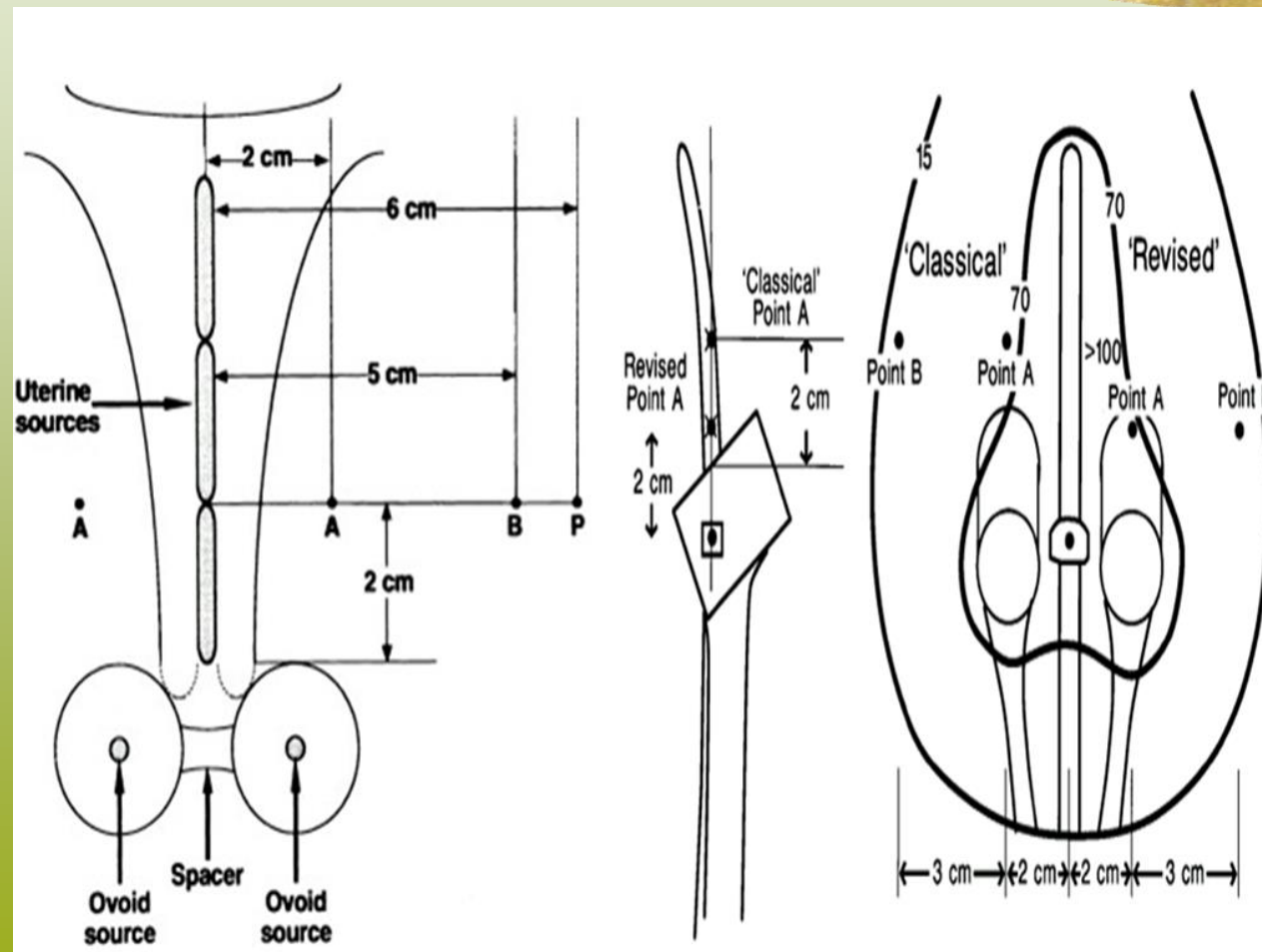
# Braquiterapia Intracavitaria: Tratamiento 2D con LDR o HDR

- Fue el tratamiento estándar
- Tasa de control local del 80%
- Toxicidad 3-4 del 15% (RTOG 9001)

G



# Sistema de Manchester

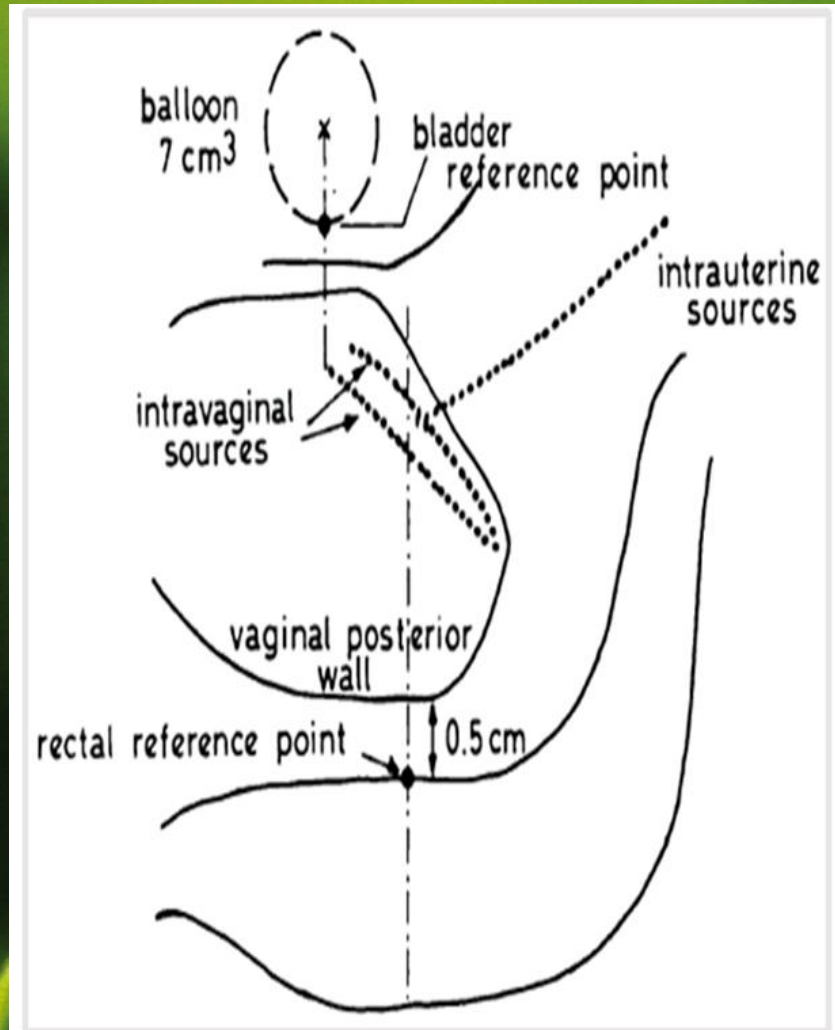




# Órganos a riesgo



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**Vejiga:** ICRU Vejiga <75 Gy  
D2cc<90 Gy

**Recto:** ICRU Recto <70 Gy  
D2cc: 70-75 Gy

**Vagina:** Alto:120-140 Gy  
Bajo: 90 Gy





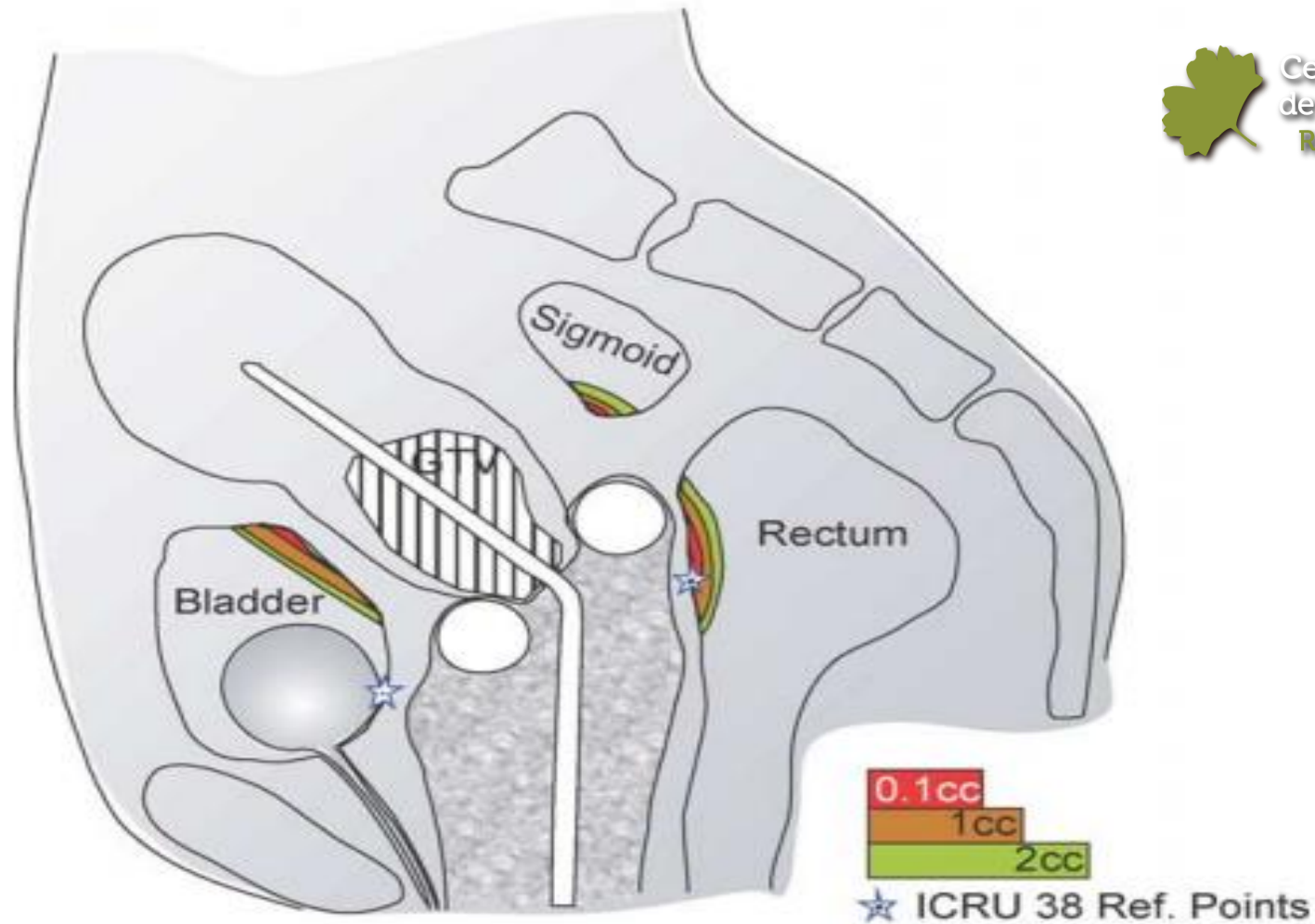
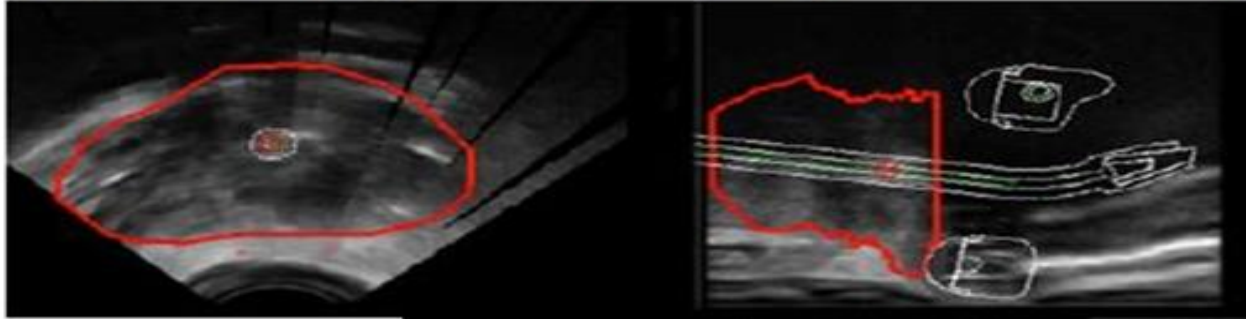
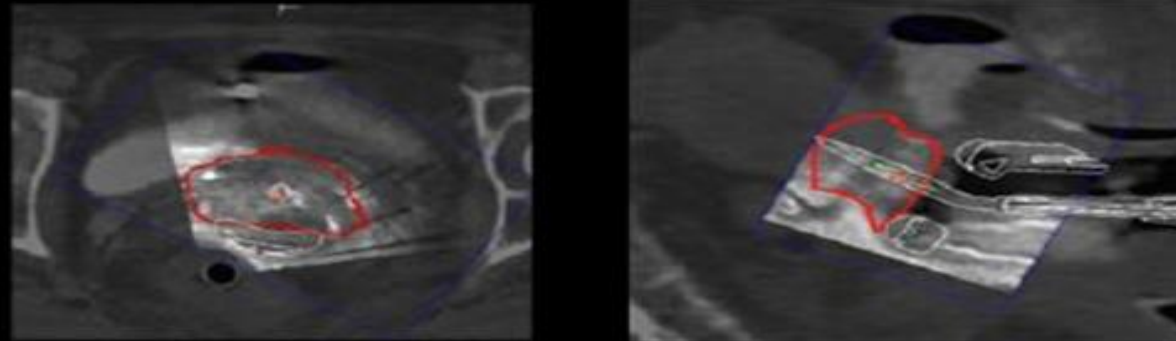


Fig. 6. Schematic anatomical diagram (sagittal view) indicating the most irradiated tissue volumes adjacent to the applicator for rectum, sigmoid and bladder: 0.1, 1, and 2 cm<sup>3</sup> (identical patient as in Figs. 1 and 2, dose volume parameters for this schematic patient example can be taken from Fig. 5).

# Desarrollo de tecnología de imágenes que integra US, CT (y MRI) para el contorno de volúmenes para externa aplicables a la braquiterapia

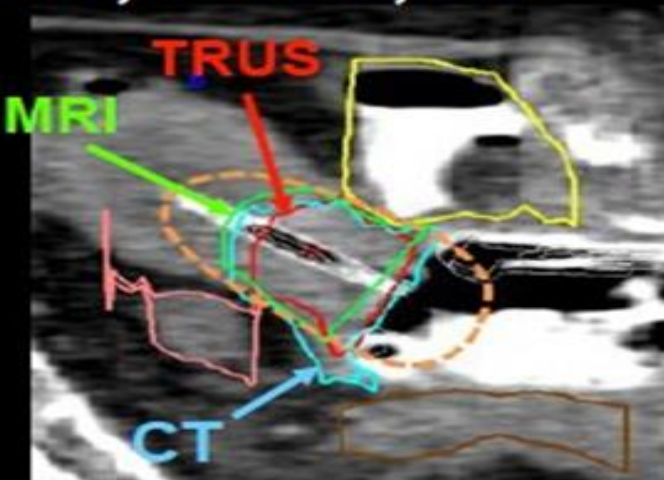


**TRUS:** target delineation,  
applicator reconstruction



**TRUS/CT**  
registration via  
applicator +  
target transfer to CT

comparison of  $CTV_{HR}$  from **MRI, TRUS, CT**



Vienna Group, work in progress:  
N Nesvacil, M Schmid, C Kirisits

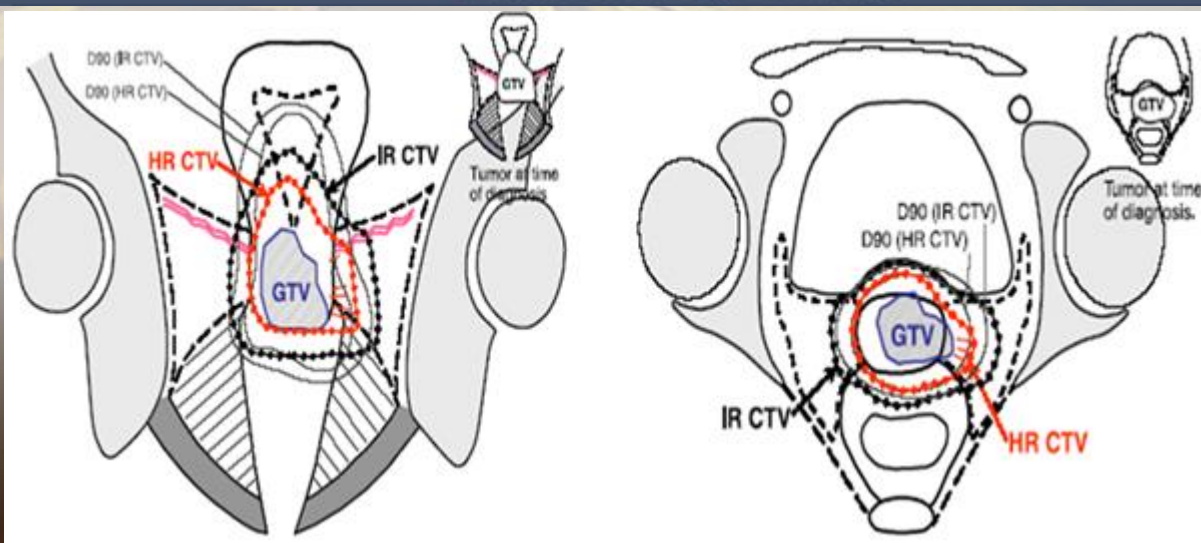
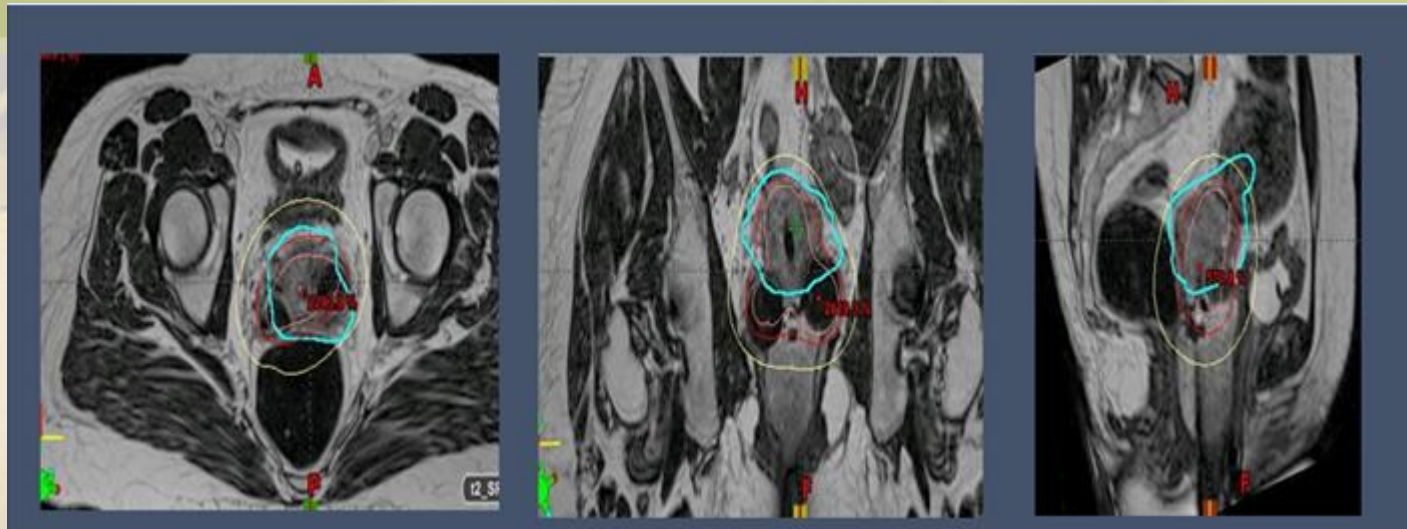




Institution (Years reported)	# Patients	Mode of treatment	Stage	Imaging During BT	Median Follow up (years)	Local control (%)	Disease specific Survival (%)	Overall Survival (%)	Late Grade 3-4 Toxicity %(#)
Vienna (1993-1997)	189	EB/HDR	IA-IVB	CT	2.8	78 <sup>^</sup>	68 <sup>^</sup>	58 <sup>^</sup>	(3GU), (4 GD), (31 V) <sup>^</sup>
Vienna (1998-2003)	145	EB+/-Ch <sup>k</sup> -HDR	IA-IVA	MR	4.3	85 <sup>^</sup>	68 <sup>^</sup>	58 <sup>^</sup>	(3GU), (4GD), (5V) <sup>^</sup>
Vienna (2001-2008)	156	EB+/-Ch <sup>#</sup> -HDR	IA-IVA	MR	3.5	95 <sup>^</sup>	74 <sup>^</sup>	68 <sup>^</sup>	(3GU), (5GD), (2V) <sup>^</sup>
UPMC (2007-2010)	44	ChRT/HDR	IB-IIIB	CT+MR	0.6	88 <sup>+</sup>	85 <sup>+</sup>	86 <sup>+</sup>	0
Addenbrooks (2005-2007)	28	ChRT/HDR	IB1-IIIB	CT	1.9	96 <sup>^</sup>	81 <sup>^</sup>	—	14(3GD) <sup>^</sup>
IGR (2000-2004)	39	Pre-op LDR	IB1-IIB	MR	4.4	91 <sup>±</sup>	86 <sup>±</sup>	94 <sup>±</sup>	0
IGR (2000-2004)	84	ChRT/LDR	IB2-IVB	MR	4.4	89 <sup>±</sup>	52 <sup>±</sup>	57 <sup>±</sup>	(3GU; 1GD) <sup>±</sup>
IGR (2004-2006)	45	ChRT/PDR	IB-IVA	MR	2.2	100 <sup>+</sup>	73 <sup>+</sup>	78 <sup>+</sup>	(1 Fi) <sup>+</sup>
BW/DFCC (2004-2011)	115	ChRT/HDR	IB-IIIB	CT	1.8	93 <sup>+</sup>	83 <sup>+</sup>	78 <sup>+</sup>	—



# Braquiterapia Guiada por RMN



## Definición de Volúmenes:

**GTVd:** Volumen tumoral al DX (por EF+ Imágenes)

**GTVb**(1,2...,n): Volumen tumoral en cada BT

**CTVHR:** Cérvix entero + GTVb + Zonas grises . → **ALTA DOSIS 90EQD2**

-Zona gris: Tejido residual patológico (áreas fibróticas, induraciones) + áreas dudosas

**CTVIR:** CTVHR +5-15mm + GTVd.

→ **DOSIS 60EQD2**

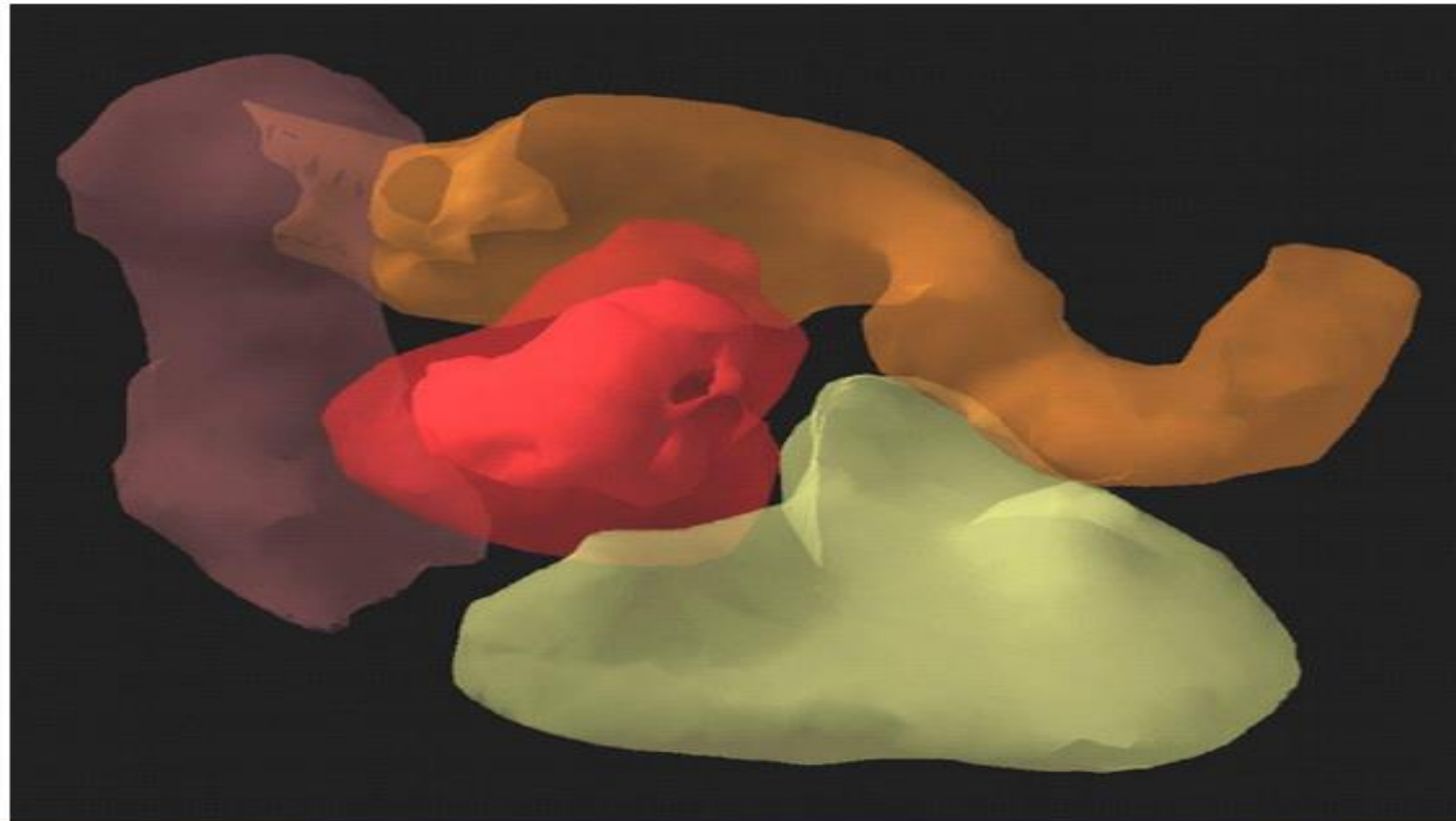
**PTV=CTV**



**A European study on MRI-guided brachytherapy  
in locally advanced cervical cancer**

# **EMBRACE**

**(ENDORSED BY GEC ESTRO)**



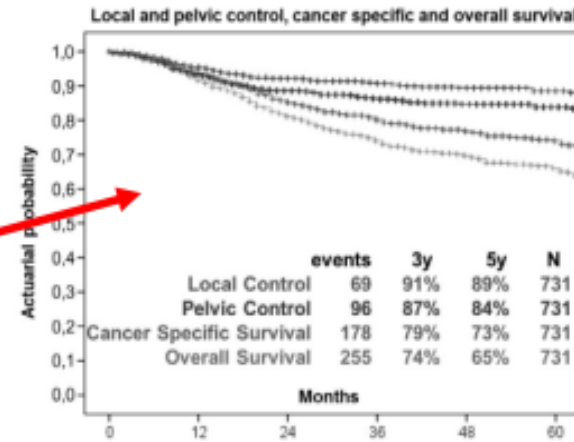


# Brachytherapy - Cervix

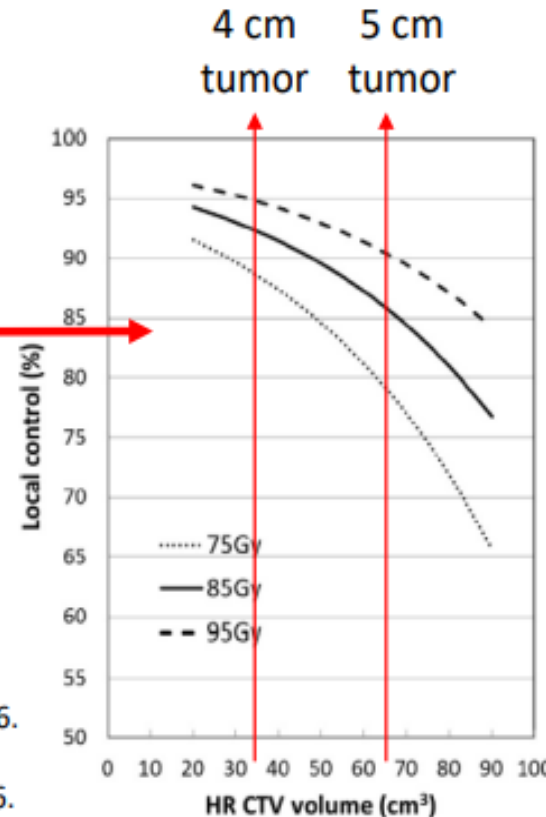
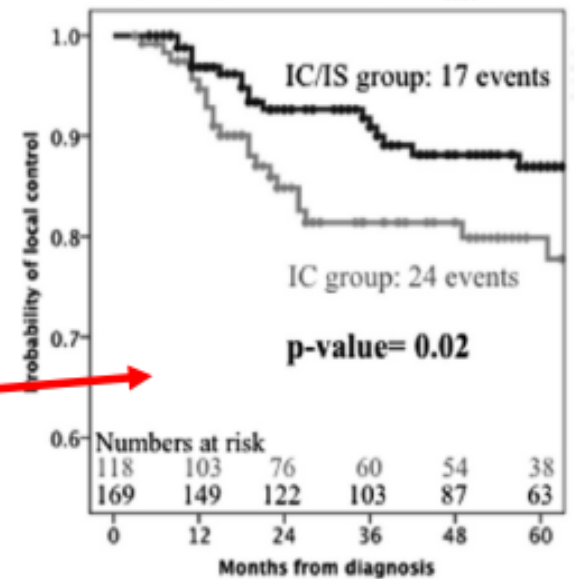
## RetroEMBRACE

- IGABT chemoRT with excellent LC (91%), PC (87%), OS (74%), CSS (79%) and limited severe morbidity.
- Intracavitary/interstitial applicators can dose escalate to the HR-CTV with better LC, no increase in late morbidity, especially for larger tumors
  - Avg dose to HR-CTV is 9 Gy higher with IC/IS vs. IC, with 10% improved LC
- HR-CTV volume and D90, and treatment time predict LC
  - Dose-response curve
  - Extra 5 Gy to HR-CTV needed to overcome increased OTT of 1 wk
- Distant-only is the most common type of failure

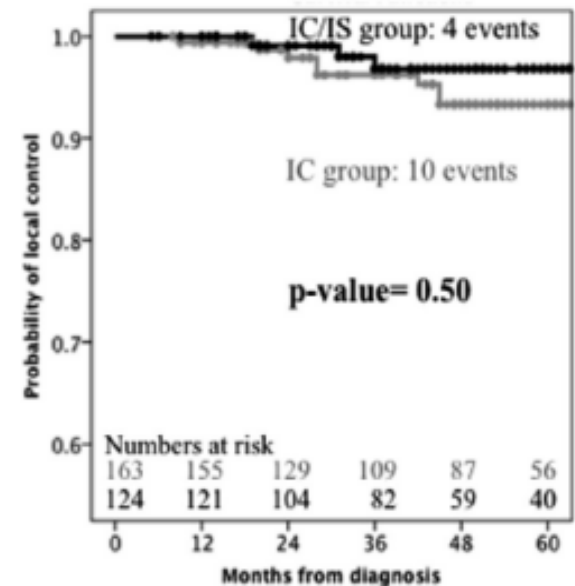
Sturdza A et al. Radiother Oncol. 2016.  
 Fokdal L et al. Radiother Oncol. 2016.  
 Tanderup K et al. Radiother Oncol. 2016.  
 Tan L et al. IJROBP. 2019.



4 cm tumor = 33.5 cm<sup>3</sup>  
 2B. Large target volume (CTV<sub>HR</sub> ≥ 30 cm<sup>3</sup>)



2C. Small target volume (CTV<sub>HR</sub> < 30 cm<sup>3</sup>)



# Resultados

	Embrace	UK series
Control pelviano a 5 años	87%	77%
O. S	65%	55%
C.E.S.	73%	59%
Toxicidad G $\frac{3}{4}$	GU 5% GI 7%	GU 12% GI 15%

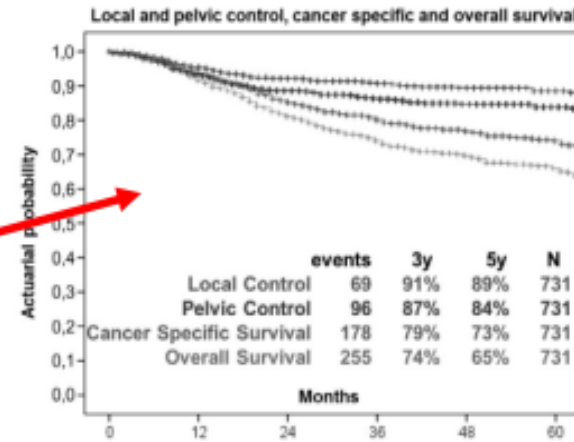


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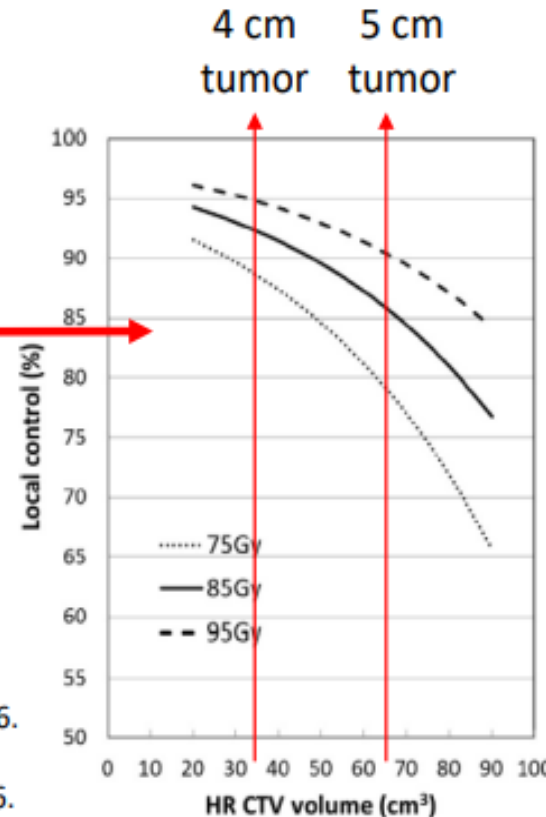
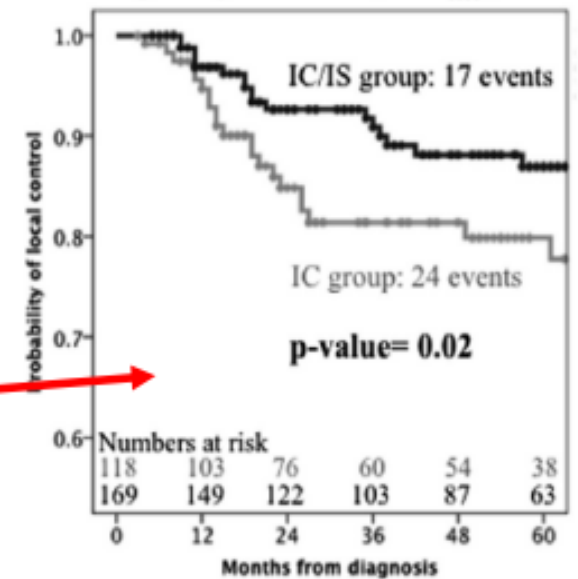
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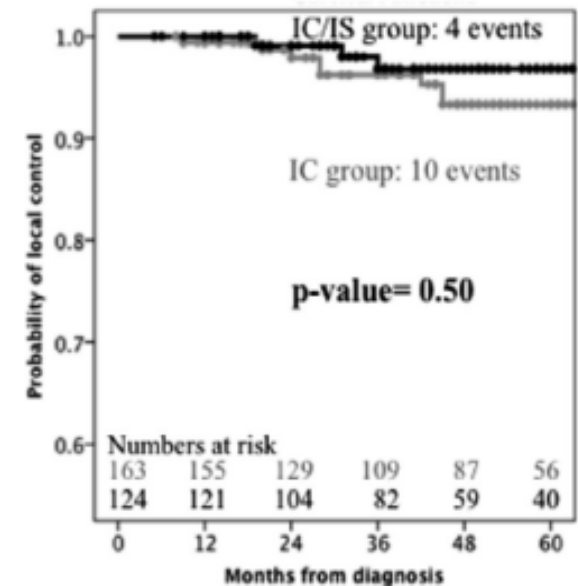
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# Mature EMBRACE Results

Un estudio europeo de MRI-guided brachytherapy en  
cáncer de cérvix local avanzado

■ 1416 pacientes tratadas con IGABT  
43% intersticial      híbrido/intracavitaria

■ Seguimiento medio 51 meses

■ 5 años Control Local 92% (95% CI 90-93%)

■ Toxicidad G3 a 5 años

6,8% GU

8,5% GI

5,7% Vaginal

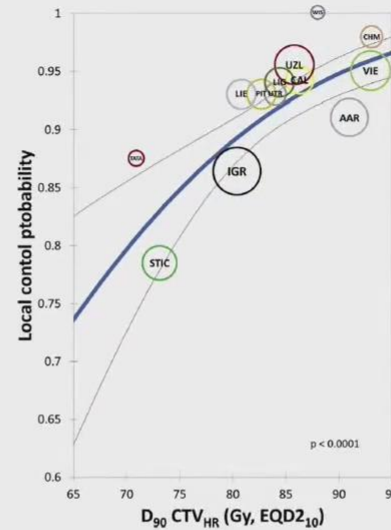
3,2% Fístula



Potter et al. Lancet Oncology 2021;22:538/47

# Dose Escalation to MR-defined Target with Dose Reduction to the OARs

- **EMBRACE II:** escalate dose to the MR-defined HR CTV (<30 cc vs > 30 cc) to ~ 85-95 Gy.
- Requires MR to enable delineation of the target: HR CTV
- Will require interstitial needles (Hybrid applicator) in > **20-50%** of patients.
- **70%** at the close of EMBRACE II
- Opened March 2016
- Closed in 2021

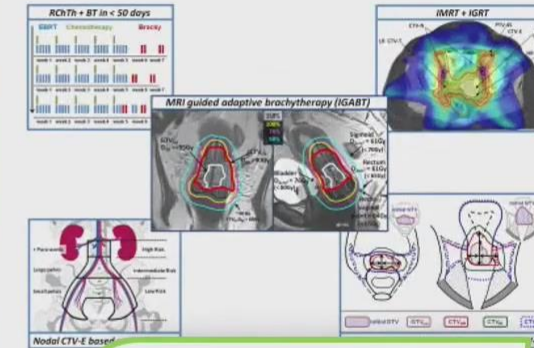


D90 with 95%(92.8-96.3%)probability of local control: **90 Gy**

Mazeron et al Brachytherapy 15(2016)537-542.

Image guided intensity modulated  
External beam radiochemotherapy and  
MRI based adaptive BRachytherapy  
in locally advanced Cervical cancer

## EMBRACE-II



Protocol  
Christian  
Kathrin  
Wolfgang



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# M&M: diseño de estudio y tratamiento

- Estudio de cohorte multicéntrico, intervencionista y prospectivo, de un solo brazo (basado en múltiples hipótesis)
- 49 centros, 1449 pacientes
- Reclutamiento de pacientes desde marzo de 2016 hasta diciembre de 2021





# OBJETIVOS

- Aplicación sistemática de **IMRT/VMAT con IGRT diario**
- Implementar una **prescripción dosis-volumen adaptativa** en el protocolo de IGABT.
- Escalamiento/desescalamiento al CTVHR** de acuerdo al tamaño y caso.
- Uso de Br. Intersticial en casos avanzados** para cumplir los objetivos de planificación.
- Desescalamiento de dosis en vagina** *cuando sea apropiado*
- Disminución de dosis en OAR**, principalmente en CTVHR de bajo volumen.
- Sistematizar el contouring, prescripción y reporte.**
- EBRT adaptada al riesgo** : Boost en adenopatías, irradiación de RTP.
- Disminución del volumen total de tratamiento.**
- Mejorar la administración/compliance de QTP concurrente.**



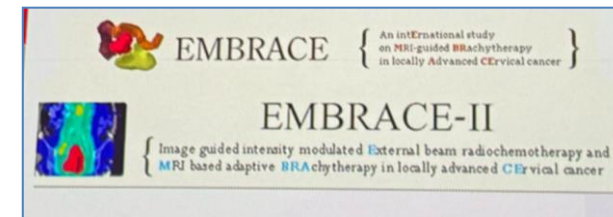
# Resultados:

## Embrace I vs Hipótesis Embrace II vs Embrace II

EMBRACE I      EMBRACE II      (basado en datos de noviembre de 2024)

	Resultados Generales 3 años	Hipótesis general 3 años	Resultados generales 3 años
n Pacientes	1341	-	<b>1376</b>
Control de la enfermedad	51	-	<b>39</b>
Control local	92%	93%	<b>93%</b>
Control pélvico	88%	90%	<b>89%</b>
Control de los ganglios pélvicos	93%	95%	<b>95%</b>
Control de ganglios paraaórticos	92%	-	<b>94%</b>
Control de ganglio pélvico y PAO	88%	90%	<b>91%</b>
Control local, pélvico y paraórtico	83%	-	<b>86%</b>
Control a distancia más allá de PAOortic	86%	86%	<b>88%</b>

- Hipótesis sobre diversos criterios de valoración: confirmadas y superadas.
- Las intervenciones conducen a la mejora esperada del resultado clínico.



# Resultados: Morbilidad tardía G3-5 (urinaria, gastrointestinal, vaginal, n: 1309)

Embrace I* vs Embrace II (n)	Reducción de la morbilidad de
Total G3 (casos)	42%
Diarrea (9), sangrado (GI) (8)	+50%
Cistitis (5), frecuencia de orina (9)	+50%
Estenosis vaginal	20%
Fístula (11)	68%
Total G4 (pacientes)	+80%
Total G5 (pacientes)	+80%

\*Lancet Oncology 2021, Vittrup et al. IJROBP 2023



# Resultados: Morbilidad tardía G3-5 (urinaria, gastrointestinal, vaginal, n: 1309)

	Casos	Pacientes	% (crudo)
Total G3	170	116	1376
G3	159	106	8.1
G4	9	8	-1%
G5	-	2	-0.2%
G3 Urinario	51	37	2.8%
G3 Gastrointestinal	65	49	3.7%
G3 Vagina	43	42	3.2%
Fístula		11 (9 G3, 2 G4)	0.8%

# EMBRACE II: Nuevo estándar de atención para el cáncer de cuello uterino localmente avanzado

## Uso de tecnología avanzada de radioterapia

- **EBRT: IGRT/IMRT 45 Gy** con márgenes PTV limitados (5 mm), selección de objetivo adaptada al riesgo (PAO baja)

Planificación de tratamiento multiparamétrica altamente conformada: IC: +1,05

LN-SIB (57 Gy) con márgenes limitados (5 mm), planificación CovP

- **BT: MR-IGABT** con técnica IC/IS, volúmenes objetivo adaptativos, planificación del tratamiento basada en un protocolo multiparamétrico que equilibra CTV HR D90% + 90 Gy y OAR 2 cm<sup>3</sup> + 65-75 Gy

## Uso concomitante de cisplatino (5-6 ciclos)

Limitación de la duración total del tratamiento (42-45 días)

**Mejor control local regional y a distancia, mejor sobrevida global y  
Disminución de la morbilidad aguda y tardía.**



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	2D	CT	MR	Others
United States (IJROBP 2010)	43%	55%	2%	US for insertion (55%)
Canada (Brachy 2013)	63%	66%	13%	9% (Cone beam CT)
Australia & NZ (JMIRO 2010)	30%	65%	-	20% (US+MR)
UK (Clin. Oncol. 2011)	29%	51%	20%	--
GYNESTRO TC Survey (AVG)				
European Courses	45%	50%	30%	US (10%)
Outside Europe Courses	60%	40%	10%	US (15%)

**Overall : > 50% use CT Imaging for Brachytherapy planning**



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Clinical Trial > [Int J Radiat Oncol Biol Phys.](#) 2018 Dec 1;102(5):1448-1456.

doi: [10.1016/j.ijrobp.2018.05.080](#). Epub 2018 Jun 7.

# A Prospective Comparison of Computed Tomography with Transrectal Ultrasonography Assistance and Magnetic Resonance Imaging-Based Target-Volume Definition During Image Guided Adaptive Brachytherapy for Cervical Cancers

Umesh Mahantshetty <sup>1</sup>, Pushpa Naga Ch <sup>2</sup>, Chira Ranjan Khadanga <sup>2</sup>, Shivakumar Gudi <sup>2</sup>,  
Supriya Chopra <sup>2</sup>, Lavanya Gurram <sup>2</sup>, Swamidas Jamema <sup>2</sup>, Yogesh Ghadi <sup>2</sup>,  
Shyamkishore Shrivastava <sup>3</sup>

Affiliations + expand

PMID: 30146092 DOI: [10.1016/j.ijrobp.2018.05.080](#)

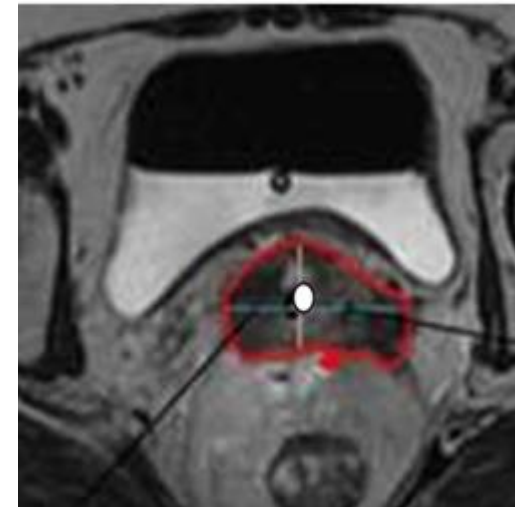
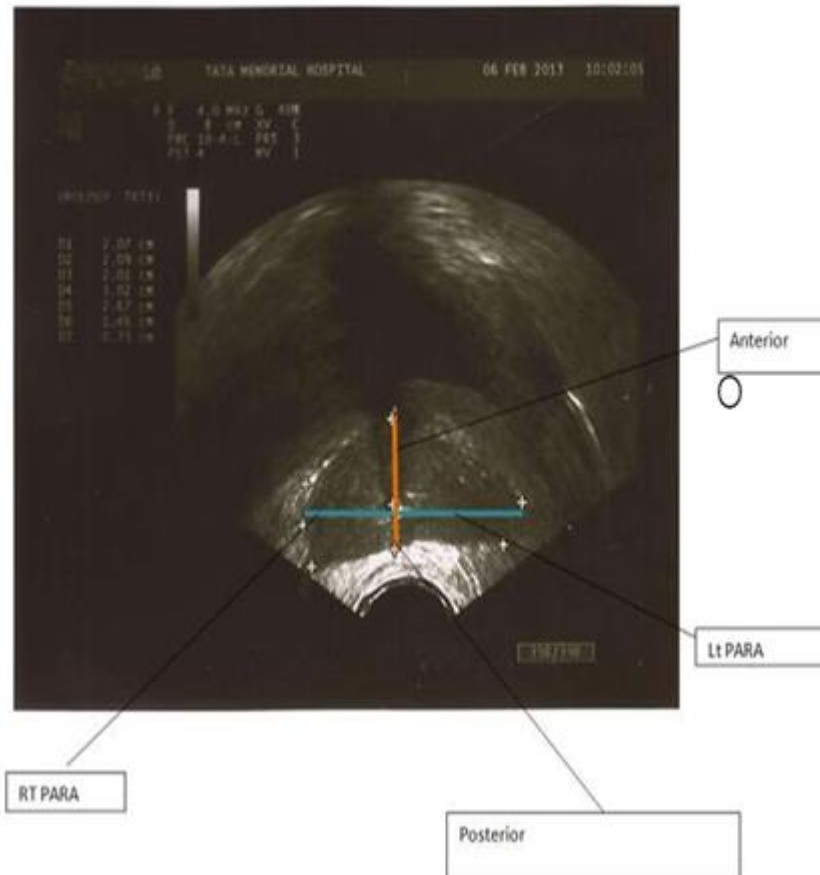


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# TRUS Imaging

## *Learning Curve*

- Real time TRUS Imaging : To define the thickness & width (TRUS NMD's) of HR-CTV on CT better
- Acquire TRUS axial images with tandem in place



TMH STUDY: (N=27 pts)  
MRI- TRUS based CT Target  
Correlation

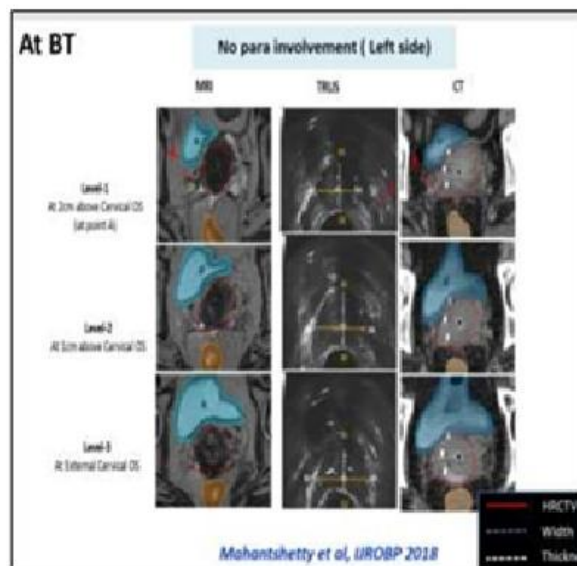
Mahantshetty et al, IJROBP 2018



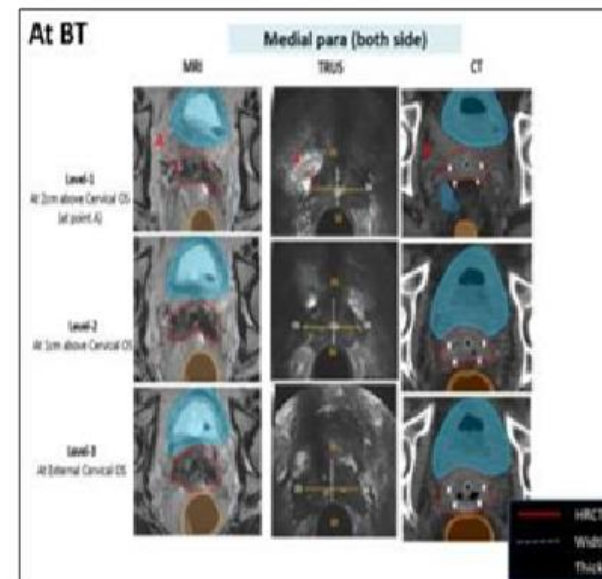
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# TRUS combinado con imágenes de CT

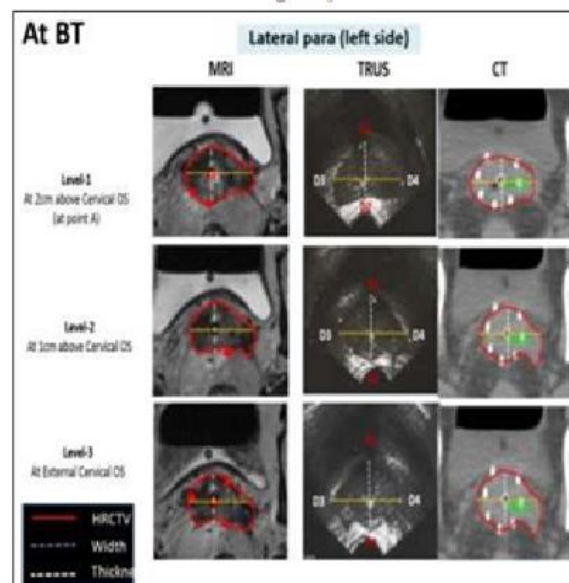
## BT Category I



## BT Category II



## BT Category III



Mahantshetty et al, IJROBP 2018



**Braquiterapia 3D  
intracavitaria**

**Vs.**

**Braquiterapia 3D  
intersticial**



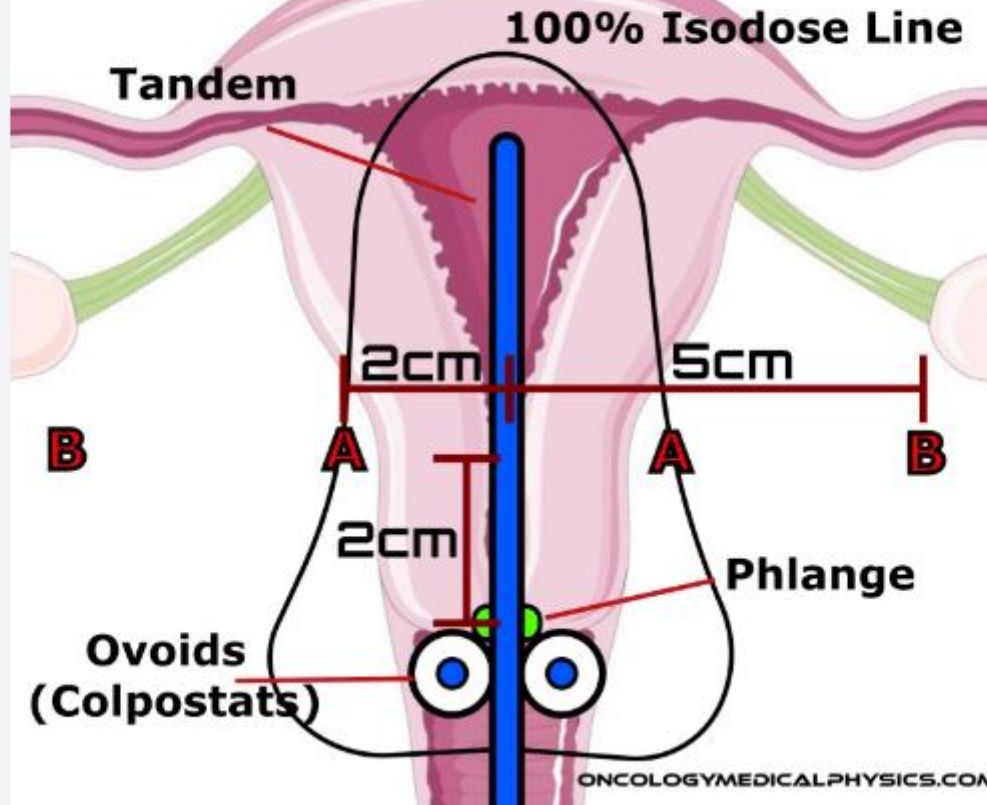
**Tabla 3.** Objetivos de dosis y límites de prescripción para la planificación del tratamiento en EMBRACE II.  
EQD2 incluye 45 Gy/25 fracciones de RTE.

<b>Volúmenes Blanco</b>	<b><math>D_{90\% \text{ CTV}_{HR}}</math> EQD2<sub>10</sub></b>	<b><math>D_{98\% \text{ CTV}_{HR}}</math> EQD2<sub>10</sub></b>	<b><math>D_{98\% \text{ GTV}_{res}}</math> EQD2<sub>10</sub></b>	<b><math>D_{98\% \text{ CTV}_{IR}}</math> EQD2<sub>10</sub></b>	<b>Punto A EQD2<sub>10</sub></b>
Objetivo de Dosis Absorbida	> 90 Gy < 95 Gy	> 75 Gy	> 95 Gy	> 60 Gy	> 65 Gy
Límite de Dosis Absorbida Prescrita	> 85 Gy		> 90 Gy		
<b>Órganos de Riesgo</b>	<b><math>D_{2cm^3 \text{ Vejiga}}</math> EQD2<sub>3</sub></b>	<b><math>D_{2cm^3 \text{ Recto}}</math> EQD2<sub>3</sub></b>	<b>Punto recto- vaginal EQD2<sub>3</sub></b>	<b><math>D_{2cm^3 \text{ Sigma}}</math> EQD2<sub>3</sub></b>	<b><math>D_{2cm^3 \text{ Intestino}}</math> EQD2<sub>3</sub></b>
Objetivo de Dosis Absorbida	< 80 Gy	< 65 Gy	< 65 Gy	< 70 Gy*	< 70 Gy*
Límite de Dosis Absorbida Prescrita	< 90 Gy	< 75 Gy	< 75 Gy	< 75 Gy*	< 75 Gy*

\*Para sigma e intestino, estas restricciones son válidas en el caso de asas intestinales no móviles, lo que da como resultado que el volumen más expuesto se encuentre en una zona similar del órgano.



# HDR Tandem And Ovoid The Manchester System



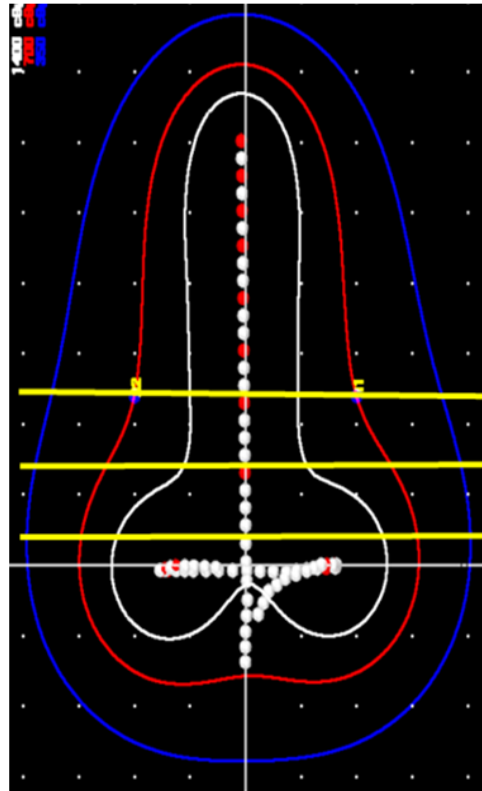
800 × 800





# Planificación estándar de BT Intracavitaria: distribución de isodosos en forma de pera

Dimensiones del tratamiento de la dosis prescrita: diferentes  
niveles para la carga estándar



At the level of Point 'A'

2 cm from UT tandem (4 cm width)

1 cm below the level of Point 'A'

2.5 cm from UT tandem (5 cm width)

2 cm below the level of Point 'A'  
(at the level of vaginal fornices)

3 cm from UT tandem (6 cm width)

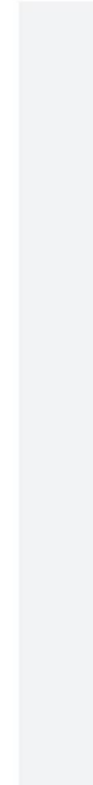
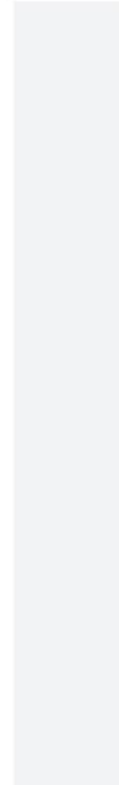
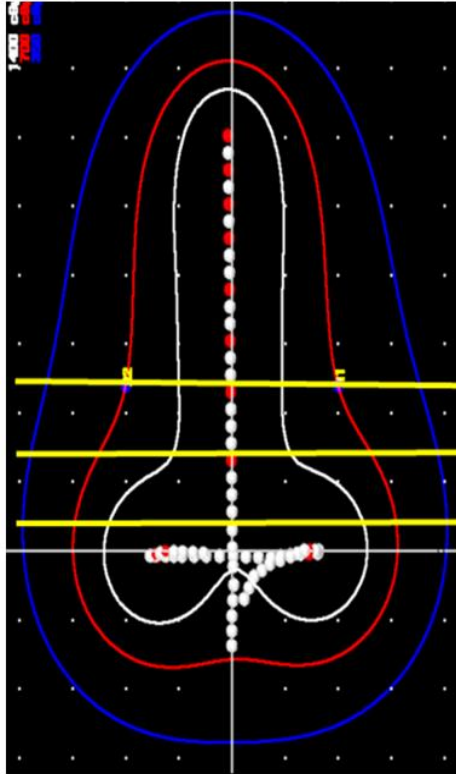


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Ut tandem: 6 cm  
Ovoids+ 2.5 cm / Ring 30 mm)

# Planificación estándar de BT Intracavitaria: distribución de isodosis en forma de pera

Dimensiones del tratamiento de la dosis prescrita: diferentes  
niveles para la carga estándar



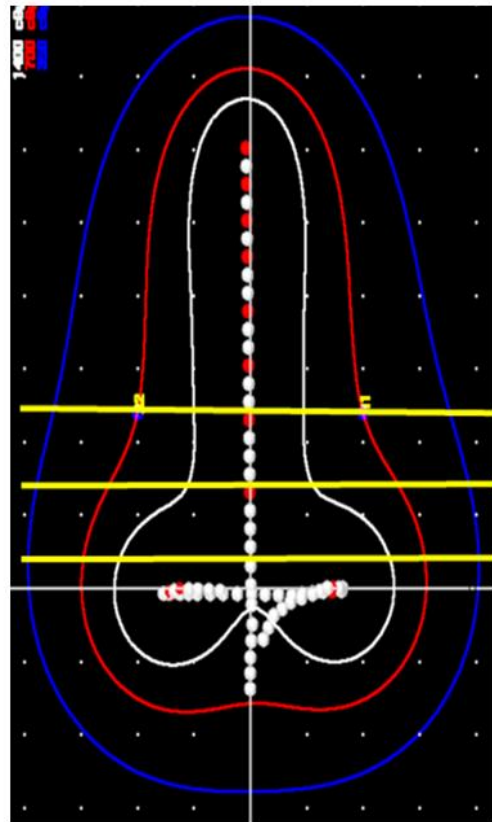
Ut tandem: 6 cm  
Ovoids+ 2.5 cm / Ring 30 mm)



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# Planificación estándar de BT Intracavitaria: distribución de isodosis en forma de pera

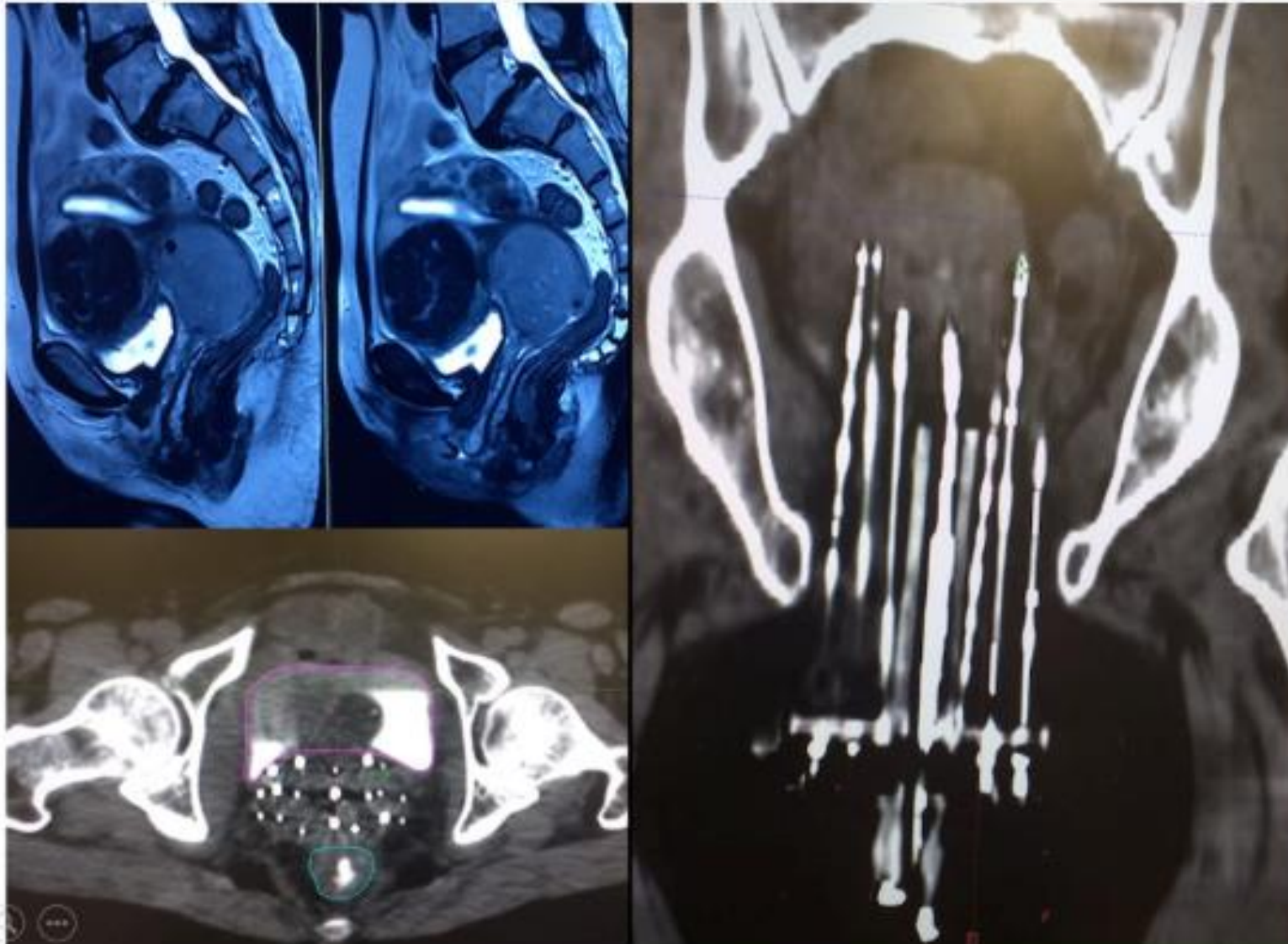
## Dimensiones del tratamiento de la dosis prescrita: diferentes niveles para la carga estándar



Ut tandem: 6 cm  
Ovoids+ 2.5 cm / Ring 30 mm)





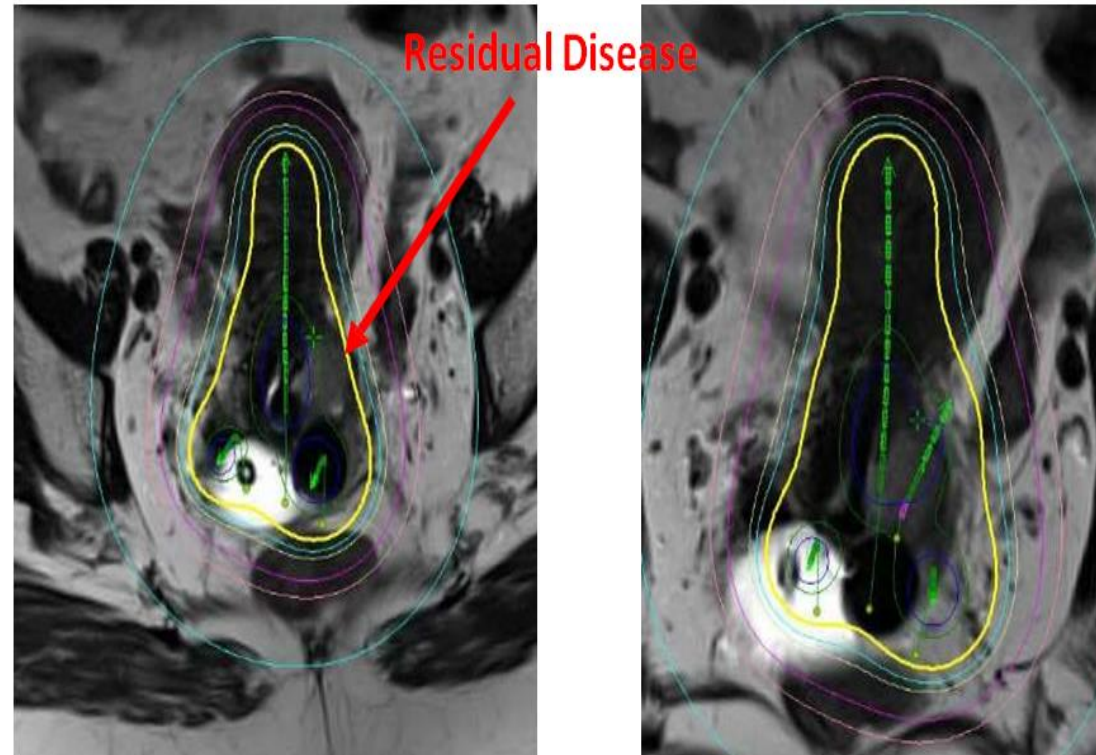


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# Agregar intersticial a T&O/T&R estándar

Un resultado esperable de una mejor obtención de imágenes es que uno comienza a descubrir que una talla no sirve para todos



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# Indicaciones

- ✿ Volumen
- ✿ Tumores asimétricos
- ✿ Anatomía desfavorable
- ✿ Canal cervical no permeable
- ✿ Falsa vía



Multicenter Study

› Radiother Oncol. 2016 Sep;120(3):434-440.

doi: 10.1016/j.radonc.2016.03.020. Epub 2016 Apr 21.

# Image guided adaptive brachytherapy with combined intracavitary and interstitial technique improves the therapeutic ratio in locally advanced cervical cancer: Analysis from the retroEMBRACE study

Lars Fokdal <sup>1</sup>, Alina Sturdza <sup>2</sup>, Renaud Mazon <sup>3</sup>, Christine Haie-Meder <sup>3</sup>, Li Tee Tan <sup>4</sup>, Charles Gillham <sup>5</sup>, Barbara Šegedin <sup>6</sup>, Ina Jürgenliemk-Schultz <sup>7</sup>, Christian Kirisits <sup>2</sup>, Peter Hoskin <sup>8</sup>, Richard Pötter <sup>2</sup>, Jacob C Lindegaard <sup>9</sup>, Kari Tanderup <sup>9</sup>

Affiliations + expand

PMID: 27113795 DOI: 10.1016/j.radonc.2016.03.020



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## Abstract

**Background and purpose:** Image guided adaptive brachytherapy (IGABT) using intracavitary applicators (IC) has led to a significant improvement of local control in locally advanced cervical cancer (LACC). Further improvement has been obtained with combined intracavitary/interstitial (IC/IS) applicators. The aim of this analysis was to evaluate the impact on local control and late morbidity of application of combined IS/IC brachytherapy in a large multicentre population.

**Material/methods:** 610 patients with LACC from the retroEMBRACE study were included. Patients were divided into an IC group (N=310) and an IC/IS group (N=300). The IC/IS group was defined from the time point, when a centre performed IC/IS brachytherapy in more than 20% of cases.

**Results:** With systematic usage of IC/IS the D90 of CTV<sub>HR</sub> increased from  $83 \pm 14$  Gy to  $92 \pm 13$  Gy ( $p < 0.01$ ). No difference in doses to organs at risk was found. The 3-year local control rate in patients having a CTV<sub>HR</sub> volume  $\geq 30 \text{ cm}^3$  was 10% higher ( $p = 0.02$ ) in the IC/IS group. No difference was found for CTV<sub>HR</sub>  $< 30 \text{ cm}^3$  ( $p = 0.50$ ). No significant difference in late morbidity was found between the IC/IS group and IC group.

**Conclusion:** Combined IC/IS brachytherapy improves the therapeutic ratio in LACC by enabling a tumour specific dose escalation resulting in significantly higher local control in large tumours without adding treatment related late morbidity.

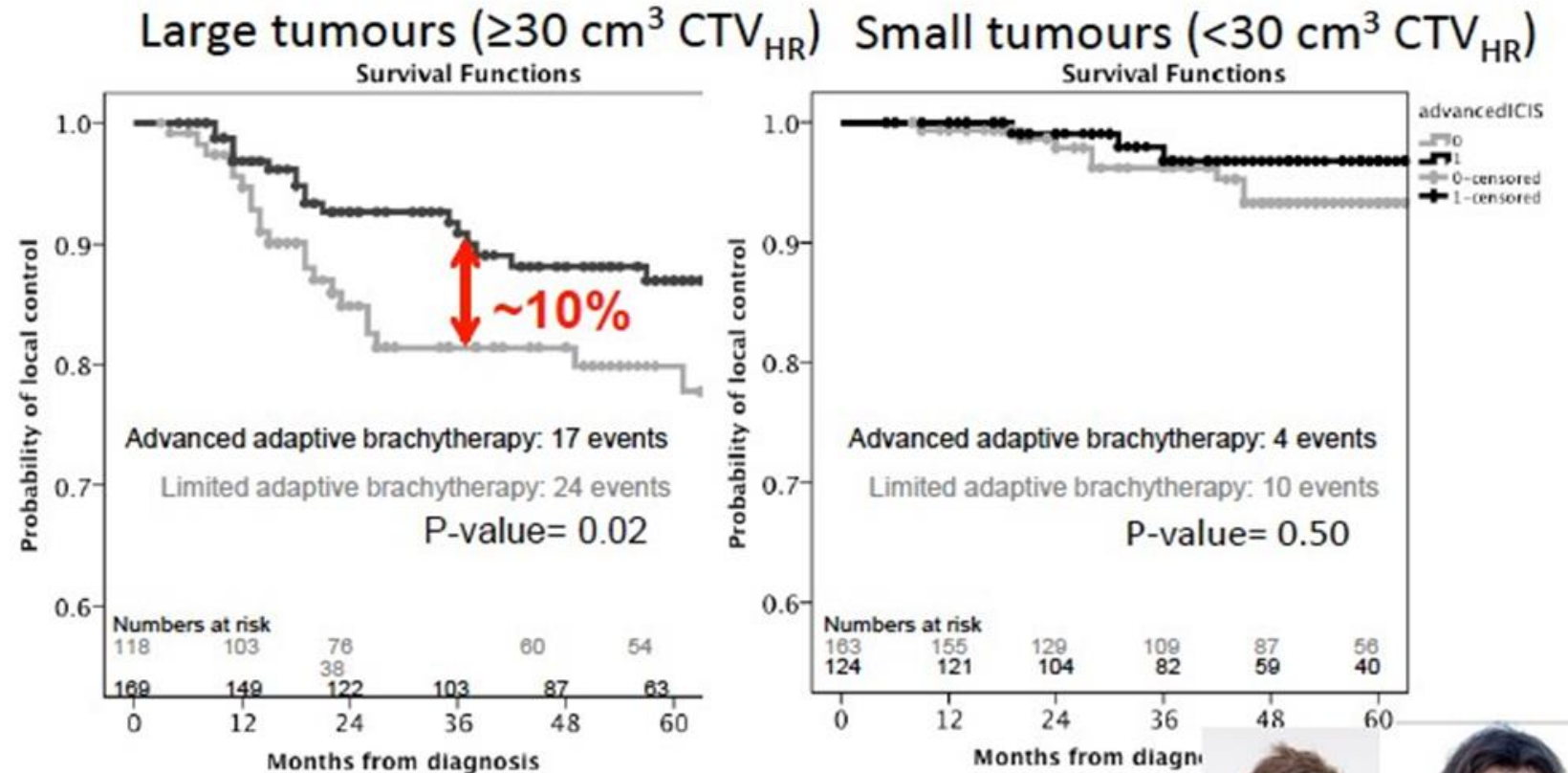
**Keywords:** Cervical cancer; Image guided adaptive radiotherapy; Local control; Morbidity.

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# Control local mejorado con IC/IS en tumores grandes (retroEmbrace)

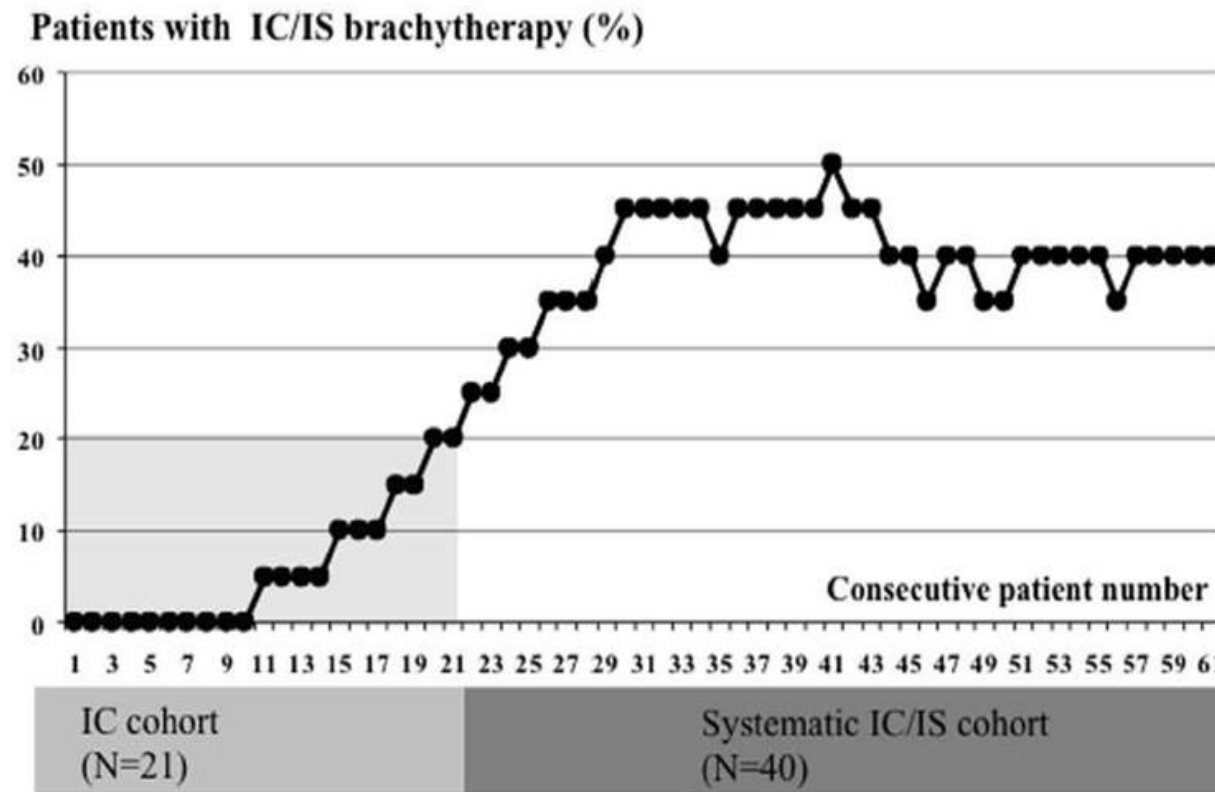


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Fokdal et al RO, in press  
Fortin et al, WCB 2016



## Uso de canales suplementarios intersticiales para alcanzar las metas HRCTV



# **Braquiterapia intersticial**

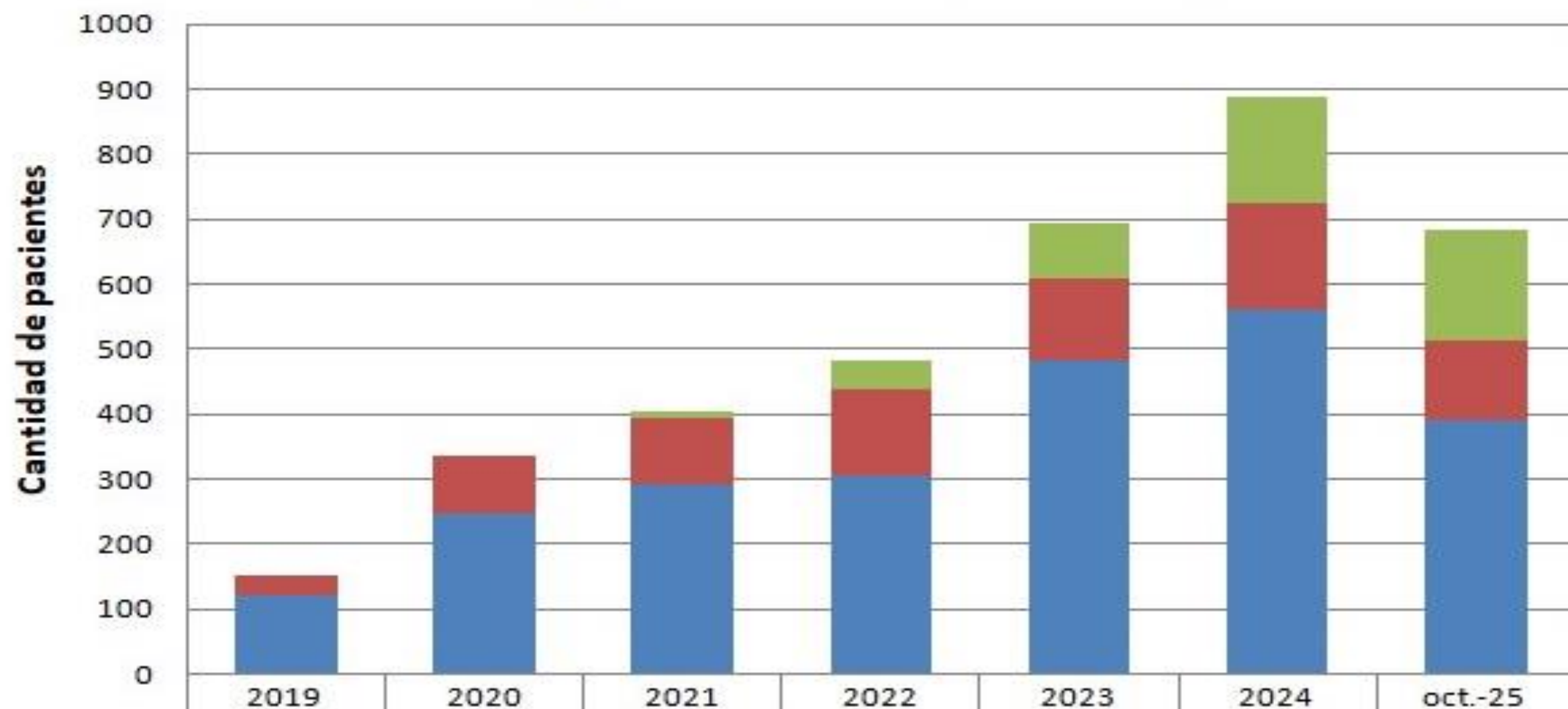
**Retroembrace 22% de los casos.**

**Embrace I en el 43% de los casos**

**Embrace II en el 70% de los casos**



## Distribución temporal de técnicas de BQT-HDR



Intersticial	0	0	13	46	84	164	170
Vaginal	33	90	102	132	126	162	123
Intracavitaria	120	246	290	305	483	562	389



# Complicaciones en Braquiterapia Intersticial



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## Prospective evaluation of acute procedural complications

Intruded organ	Total Insertions	# insertions positive intrusions
Rectum	73	12
Bladder	73	15
Bowel	73	18

## Complications

Total	G3
0	-
4	-
1	1
4	1

## Late Toxicities with Organ Puncture

Table 3. Radiation Therapy Oncology Group late genitourinary toxicity

Late GU toxicity	Patients with bladder puncture (n = 19)	Patients without bladder puncture (n = 17)
Grade 1-2	0 (0)	1* (5.8)
Grade 3-4	2 <sup>†</sup> (10.5)	0 (0)

Table 5. Radiation Therapy Oncology Group late gastrointestinal toxicity

Late GI toxicity	Patients with bowel puncture (n = 26)	Patients without bowel puncture (n = 10)
Grade 1-2	1* (3.8)	1 <sup>†</sup> (10)
Grade 3-4	1 <sup>†</sup> (3.8)	2 <sup>†</sup> (20)

Shah et al, *Int J Radiat Biol*, 2010; 77 (1), 171-179

Mendez et al, *Brachytherapy*, 2019; 18(1), 44-49

## Riesgo de sangrado

**El riesgo de ginecorrágia que requiera una transfusión posterior al retiro del aplicador es bajo**

- 5% range, e.g. Mendez et al: 1/73 procedures
- Sustained packing or pressure
- Risk may be higher in hybrid applicators (oblique needles)
- May consider transfusion for tumor radiosensitivity
  - International Delphi consensus , experts endorse 9 g/dL transfusion target

### **Hematuria post extracción**

- Hematuria post-removal
  - Manual or continuous irrigation

*Manhantshetty U, Radiother Oncol 2019; 141: 123-129*  
*Zayed S et al, JAMA Netw Open 2021; 4 (4):e213531*

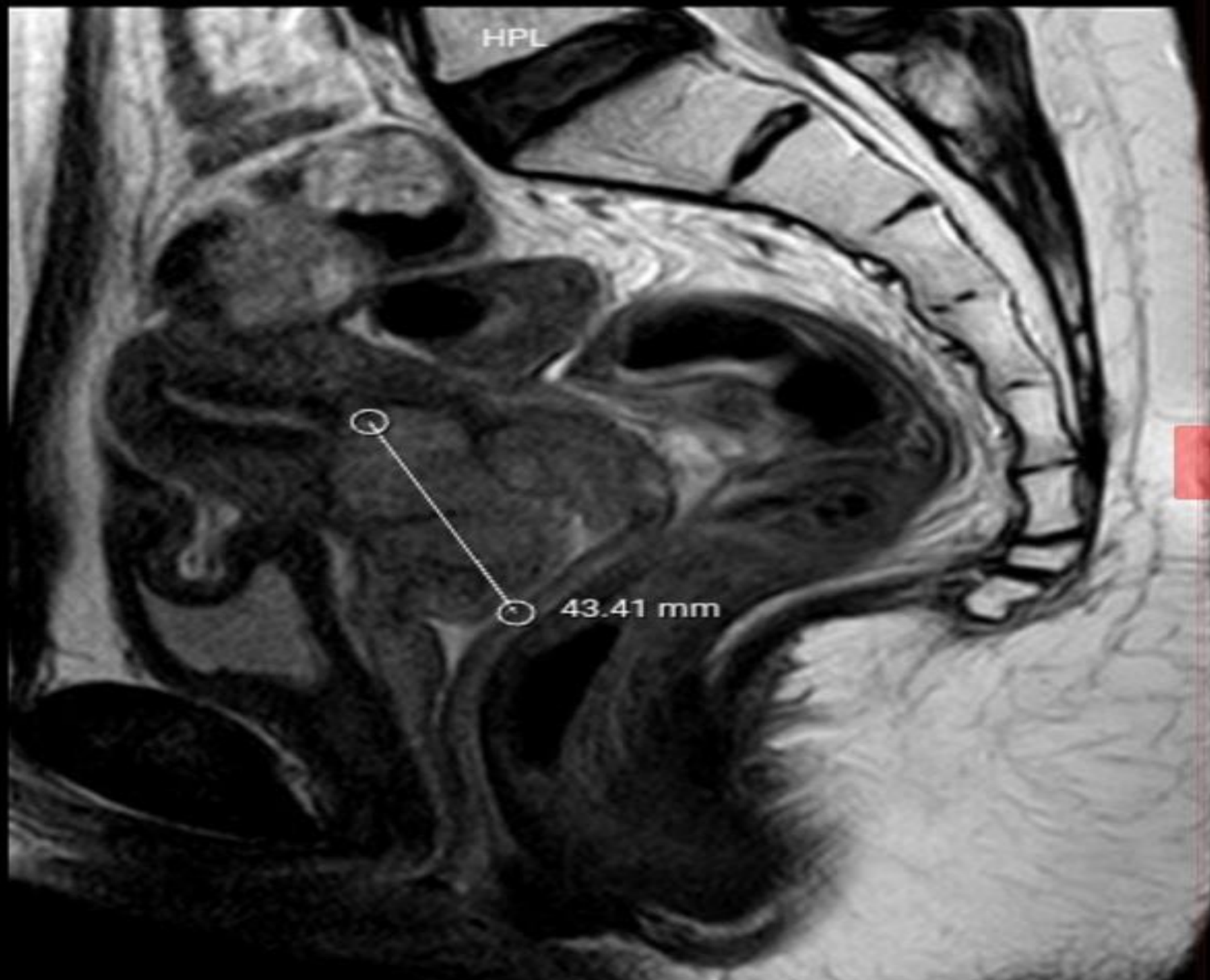
# Caso1: volumen



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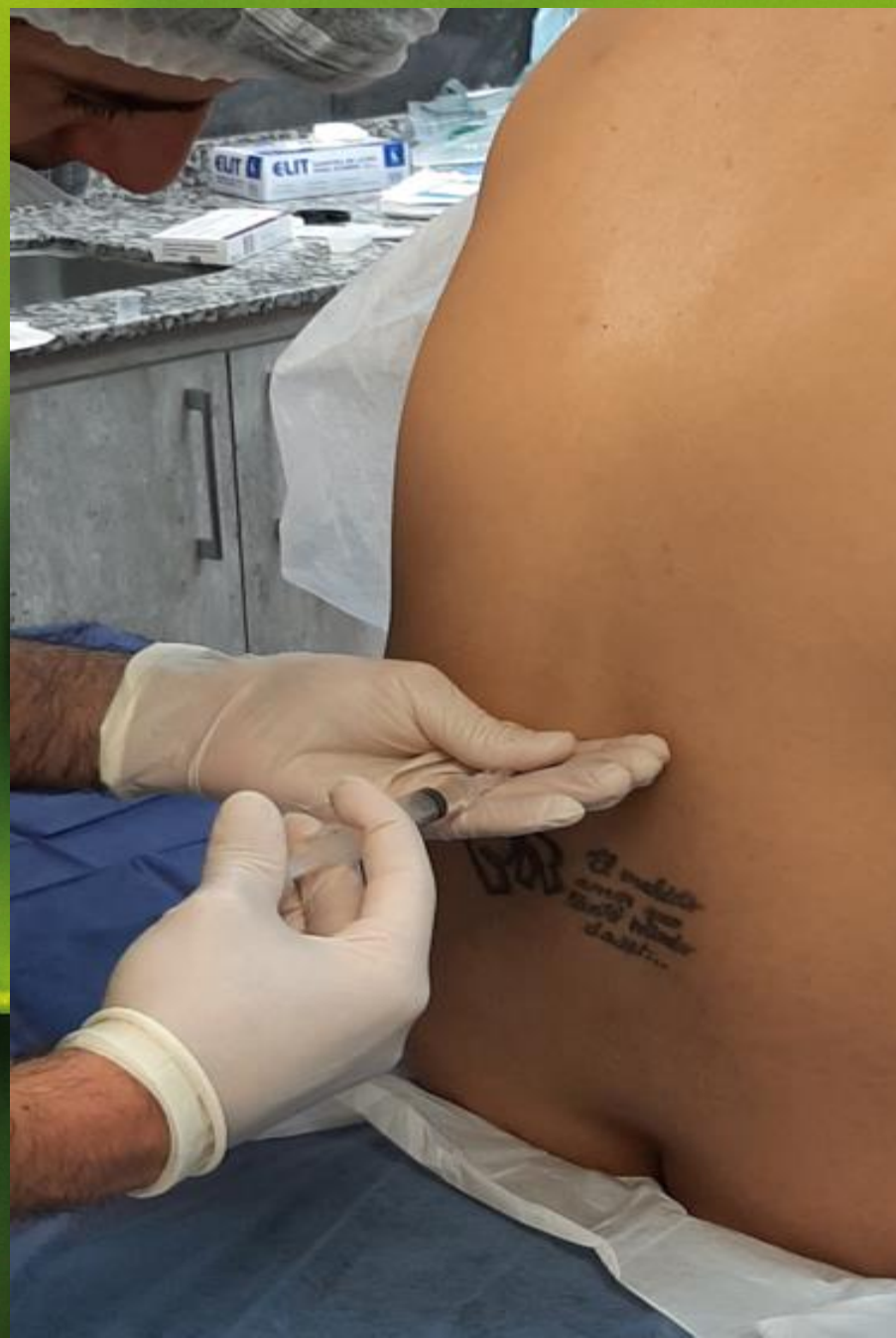








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# Colocación de taden intrauterino

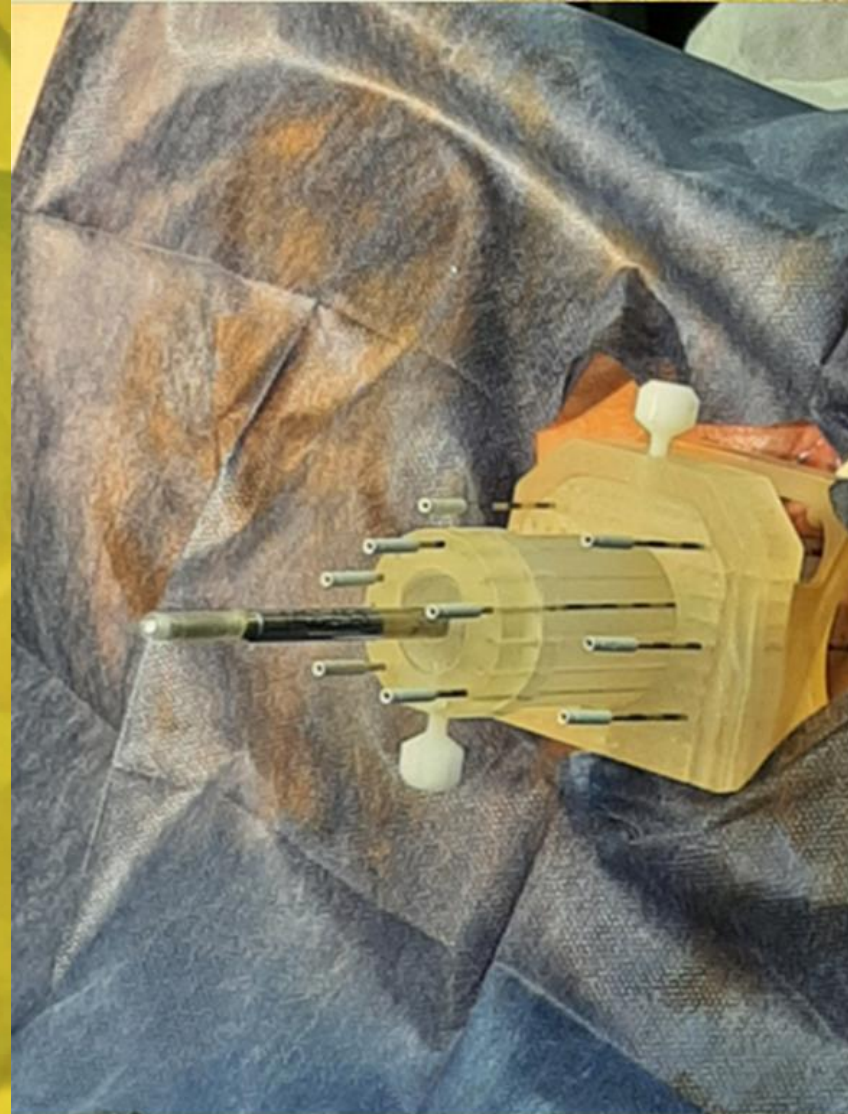




# Guía ecográfica durante el procedimiento



# Procedimiento finalizado





# Tomografía computada

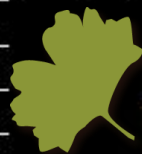




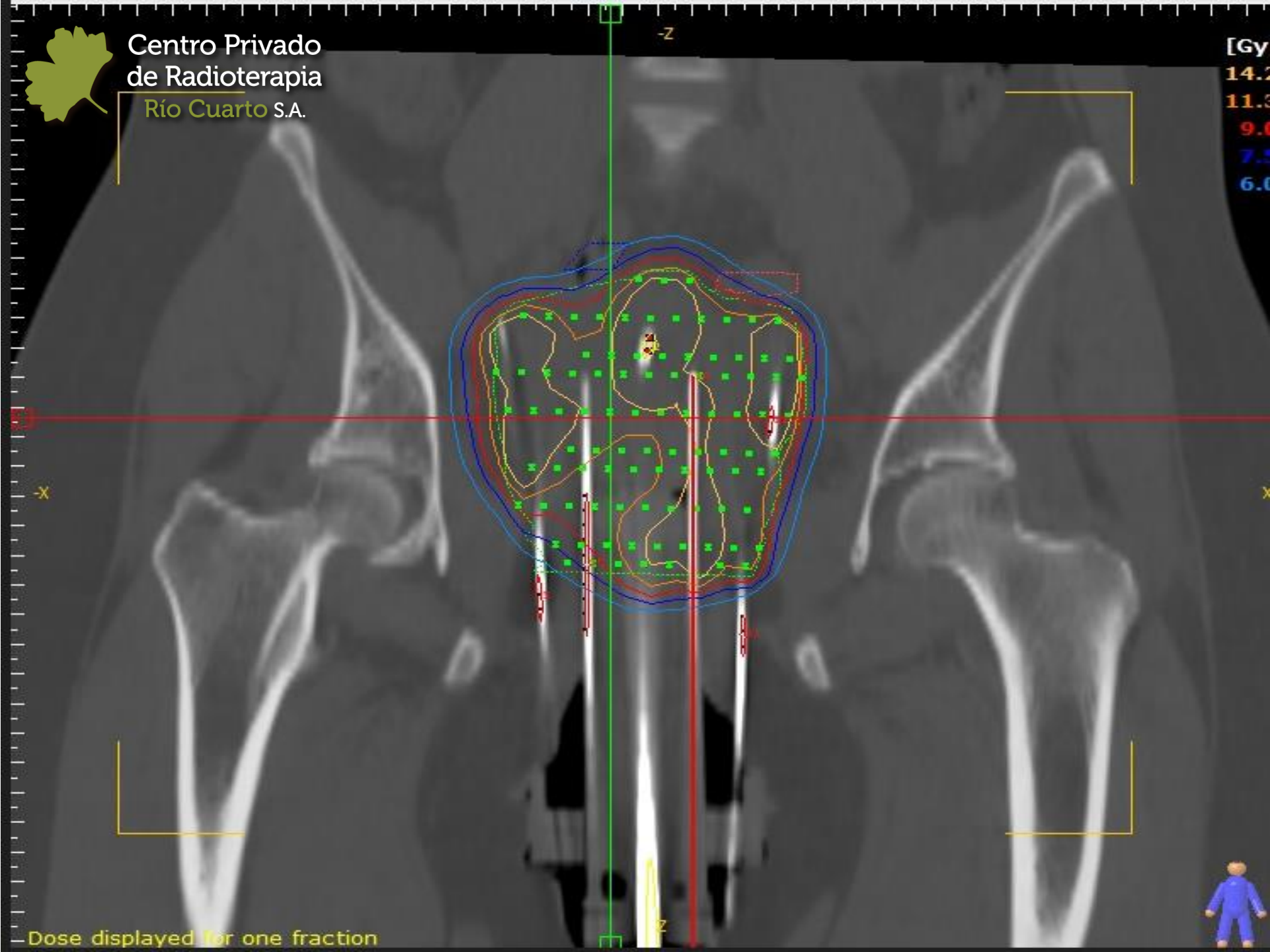
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Dose displayed for one fraction



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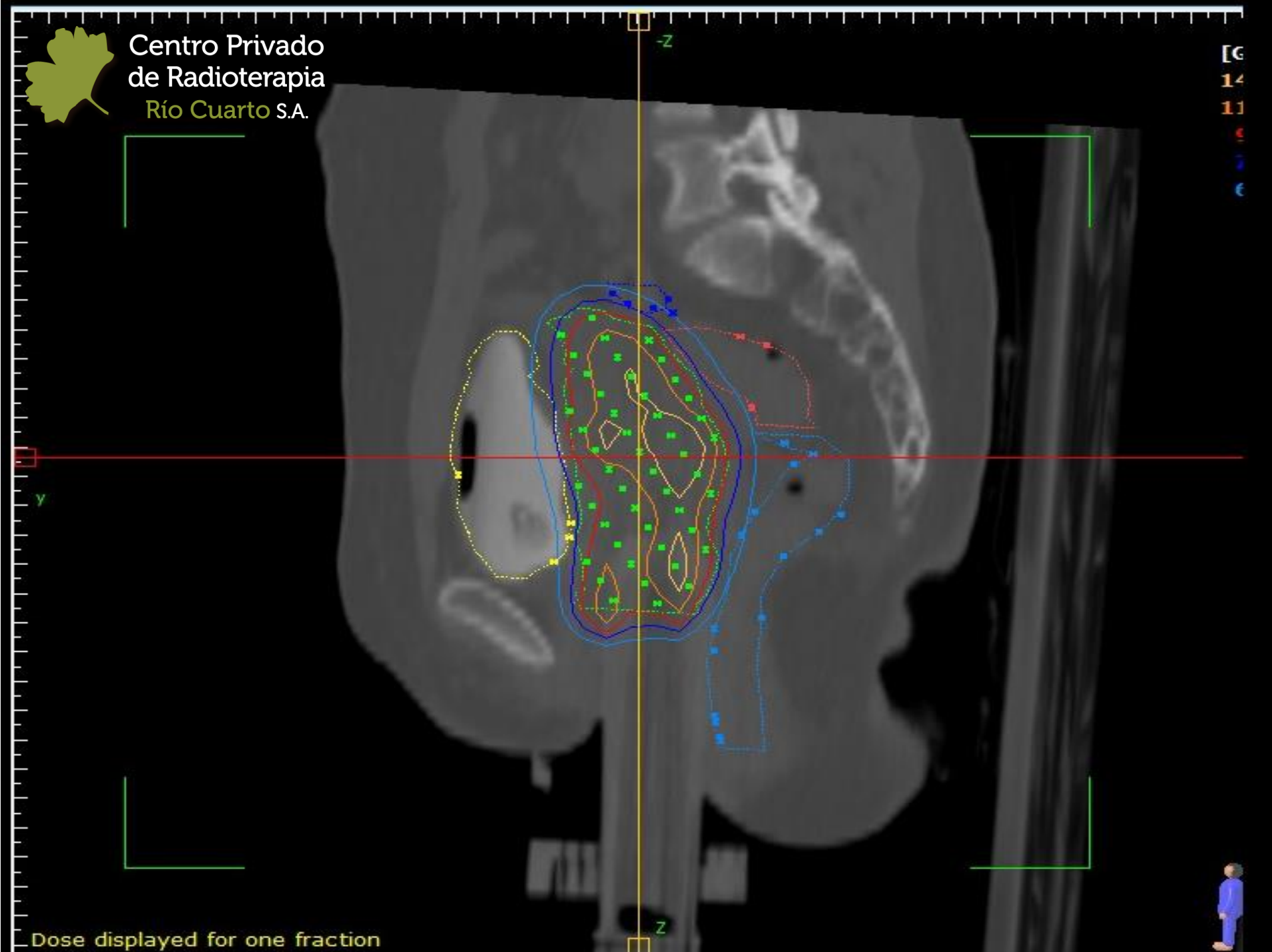






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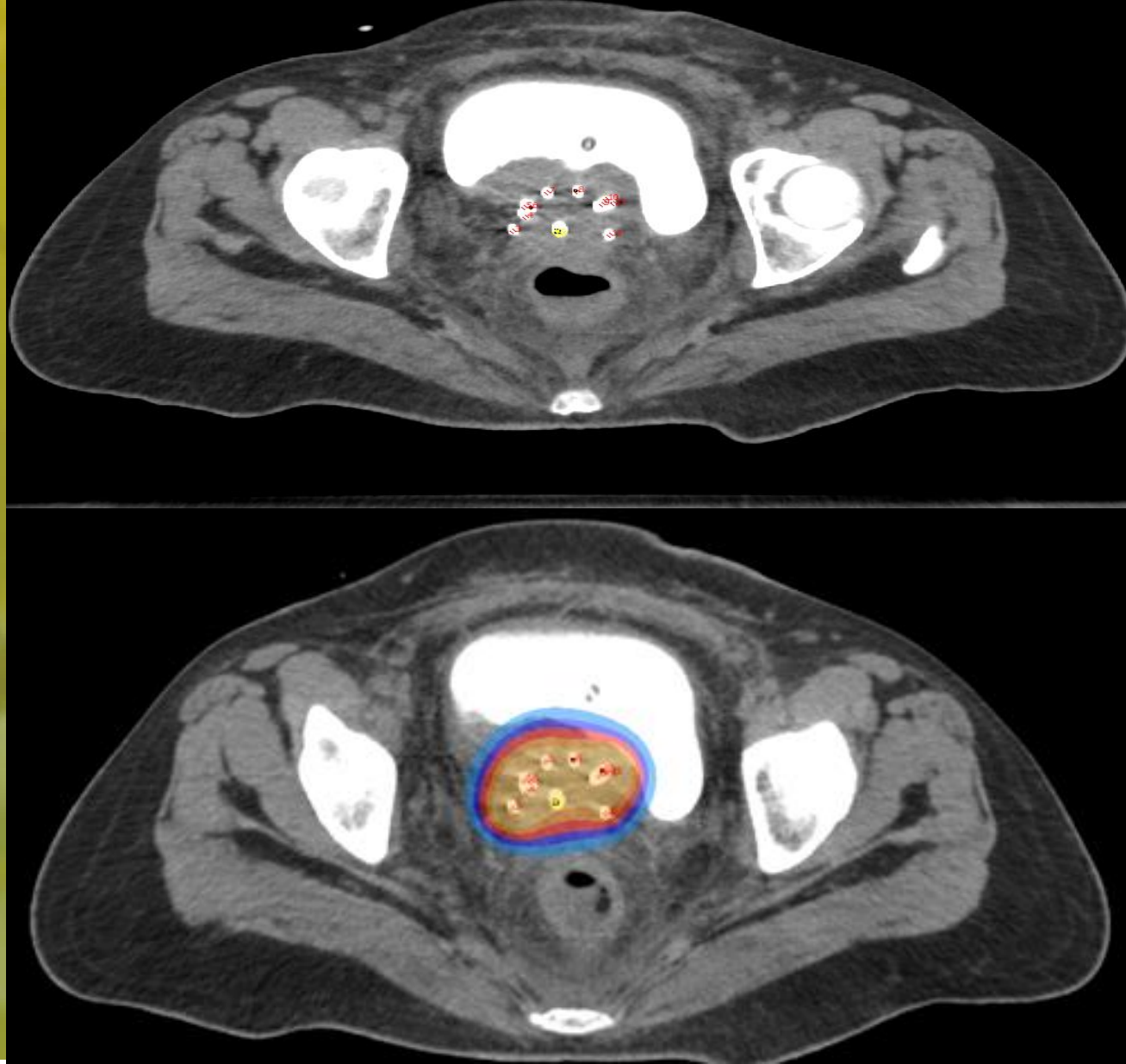
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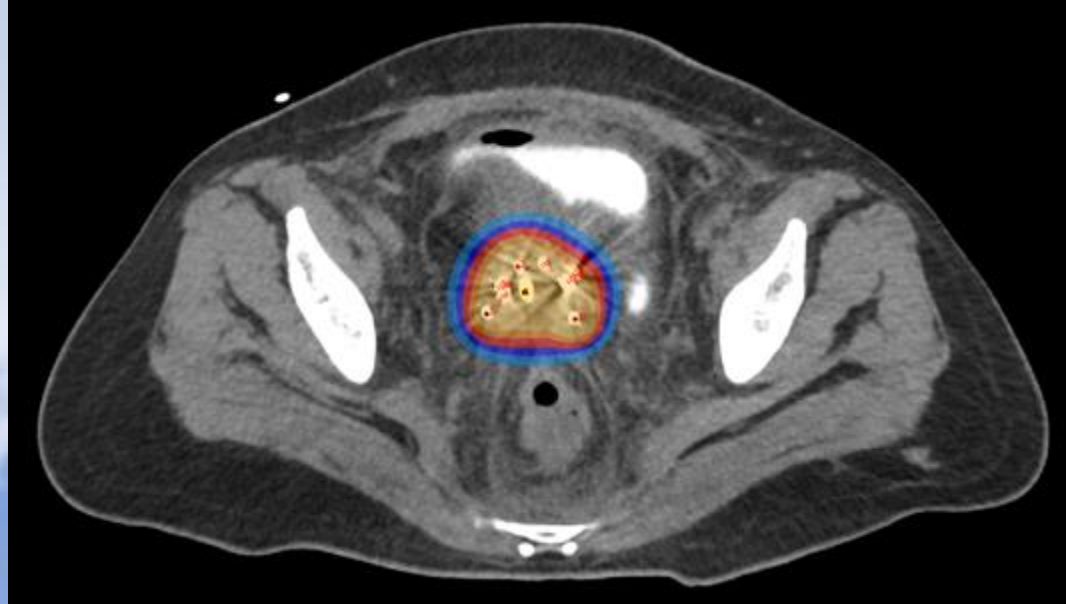


Dose displayed for one fraction



# Caso2: Tumor asimétrico





Guía Ecográfica



Sagital



Axial

MRI



# Caso3: Anatomía desfavorable

Sagiplan 2.0 in Sequential Planning Mode - Centro Privado de Radioterapia Rio Cuarto - Patient: Gabriela Silvina Azcurra - Study: Hdr fx 1

Patient Source Images View Applicator Treatment Setup Show ? English

REC Video Images Calibration Structures Applicators Dwell Times Control Points BED Report

< 1 > Contours

40 mm

26 Xdpi 26 Ydpi

✓ Square Pixels

Fusion Planes

Dose Matrix

Dose displayed for one fraction

Reference

Orthogonal	Projection	Reference	1. Sequence	2. Sequence	3. Sequence	4. Sequence	5. Sequence	6. Sequence	Overview											
87.0mm	30	90.0mm	31	93.0mm	32	96.0mm	33	99.0mm	34 - 102.0mm	35	105.0mm	36	108.0mm	37	111.0mm	38	114.0mm	39	117.0mm	40

Plane: 34 Offset: 0.00 [mm]

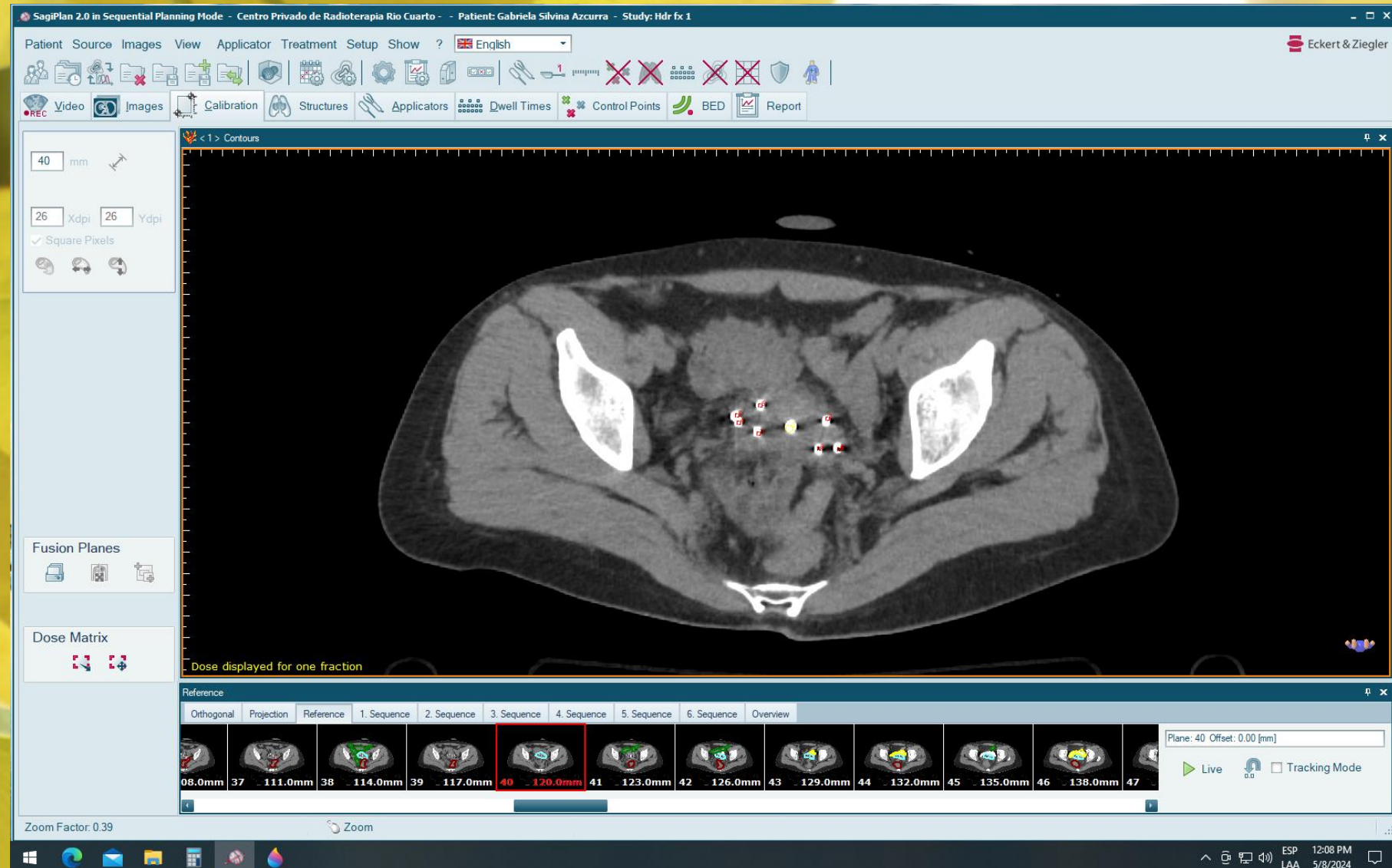
Live Tracking Mode

Zoom Factor: 0.39

ESP 12:09 PM  
LAA 5/8/2024

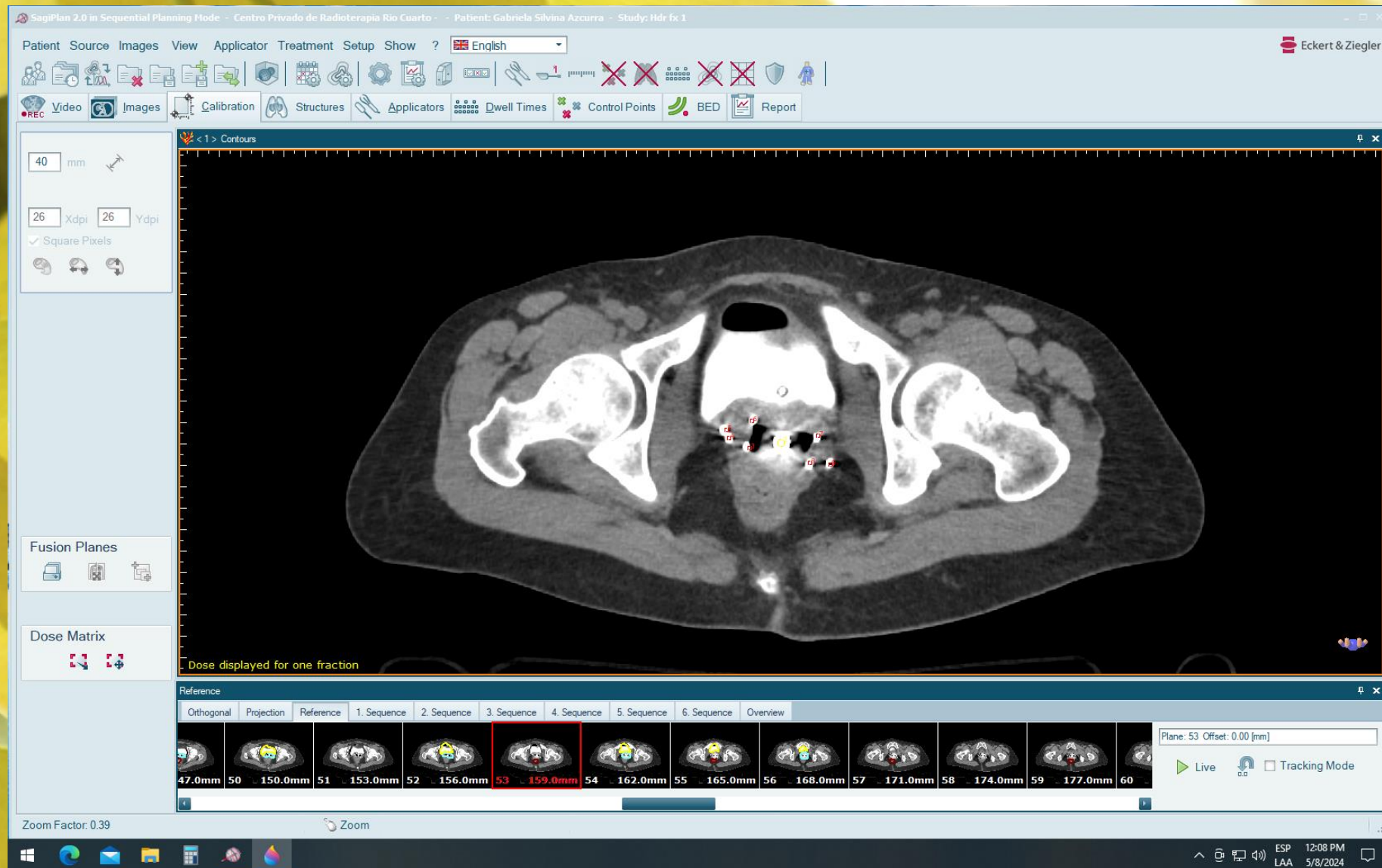


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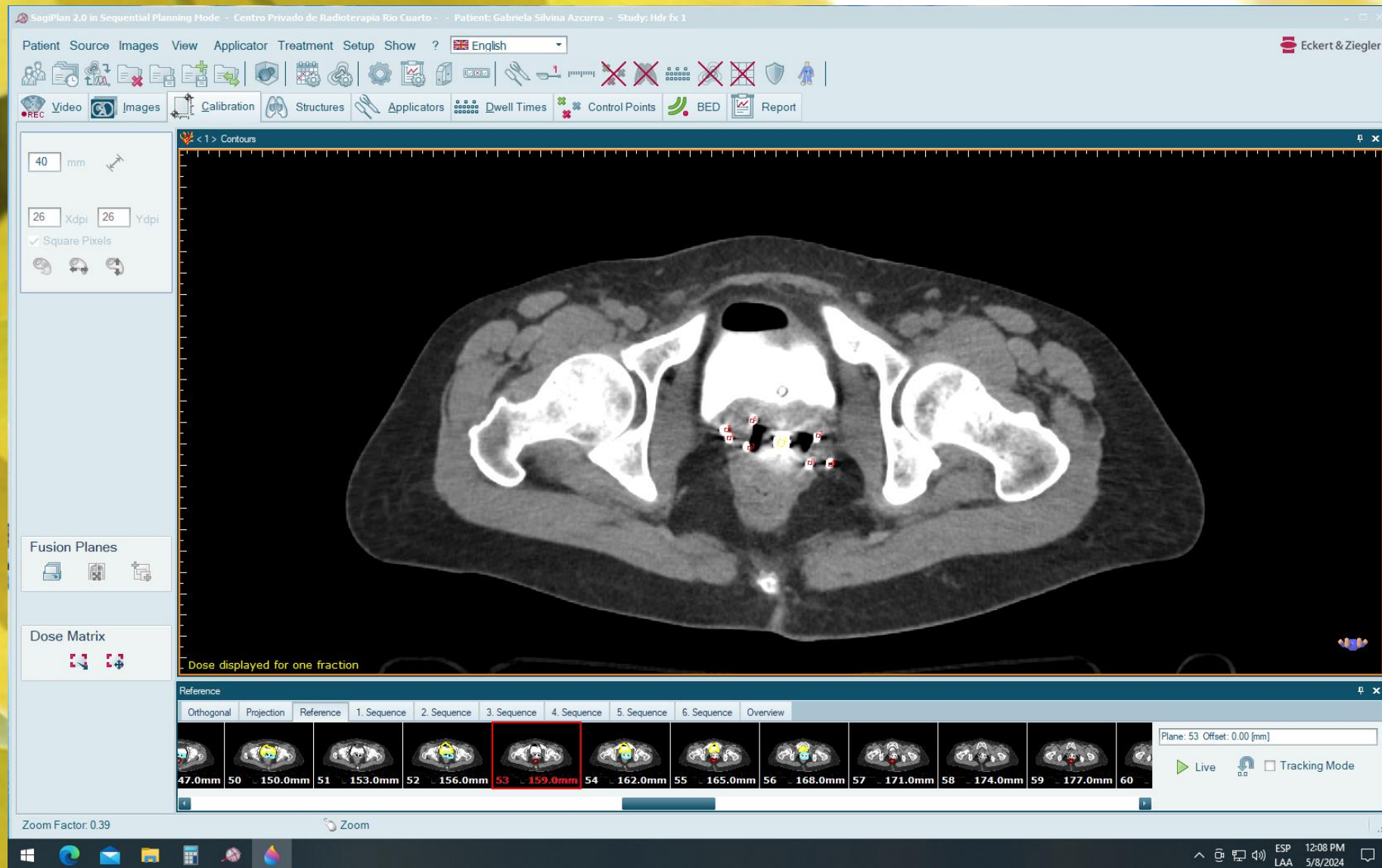




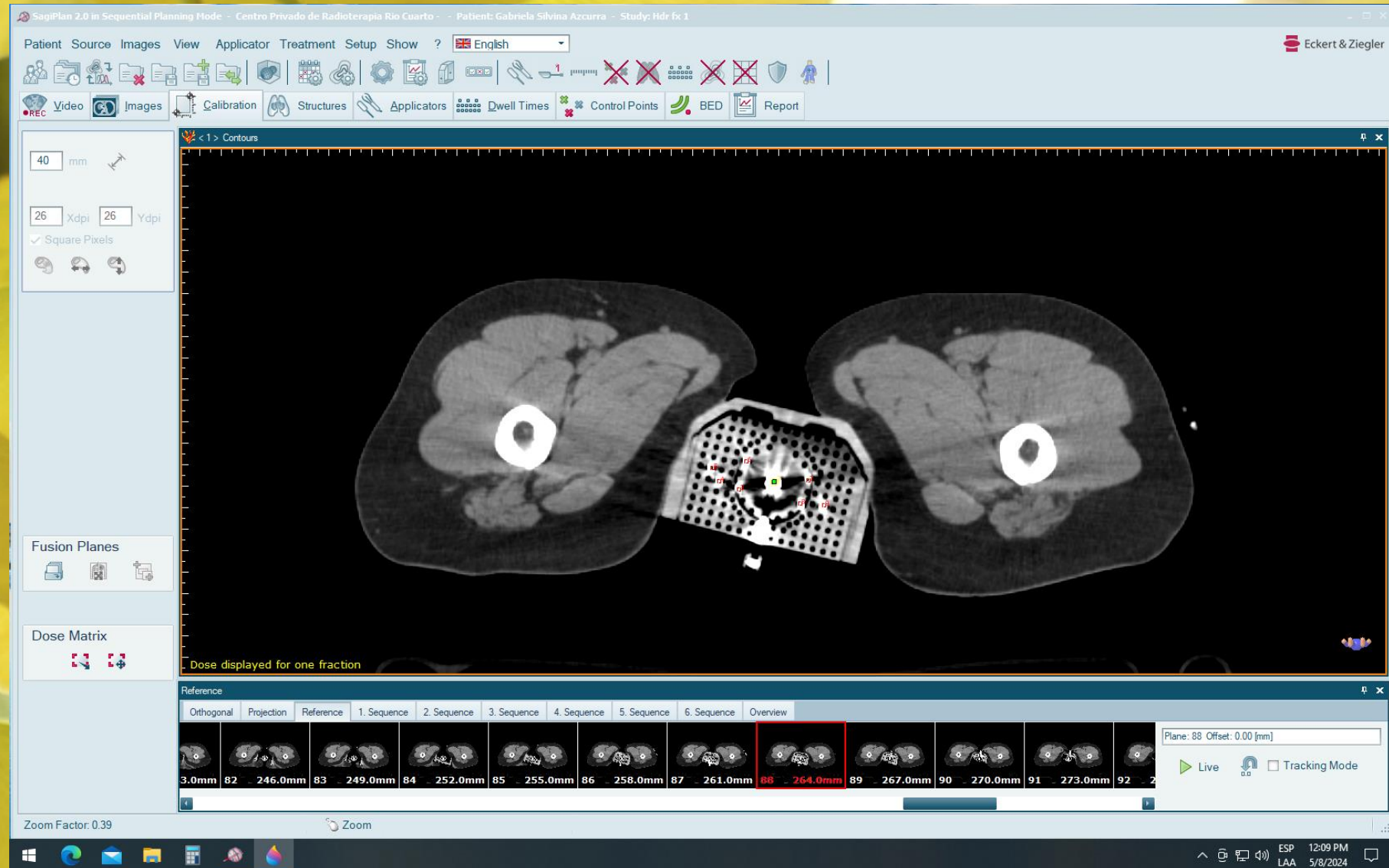
# Caso:3



# Caso:3

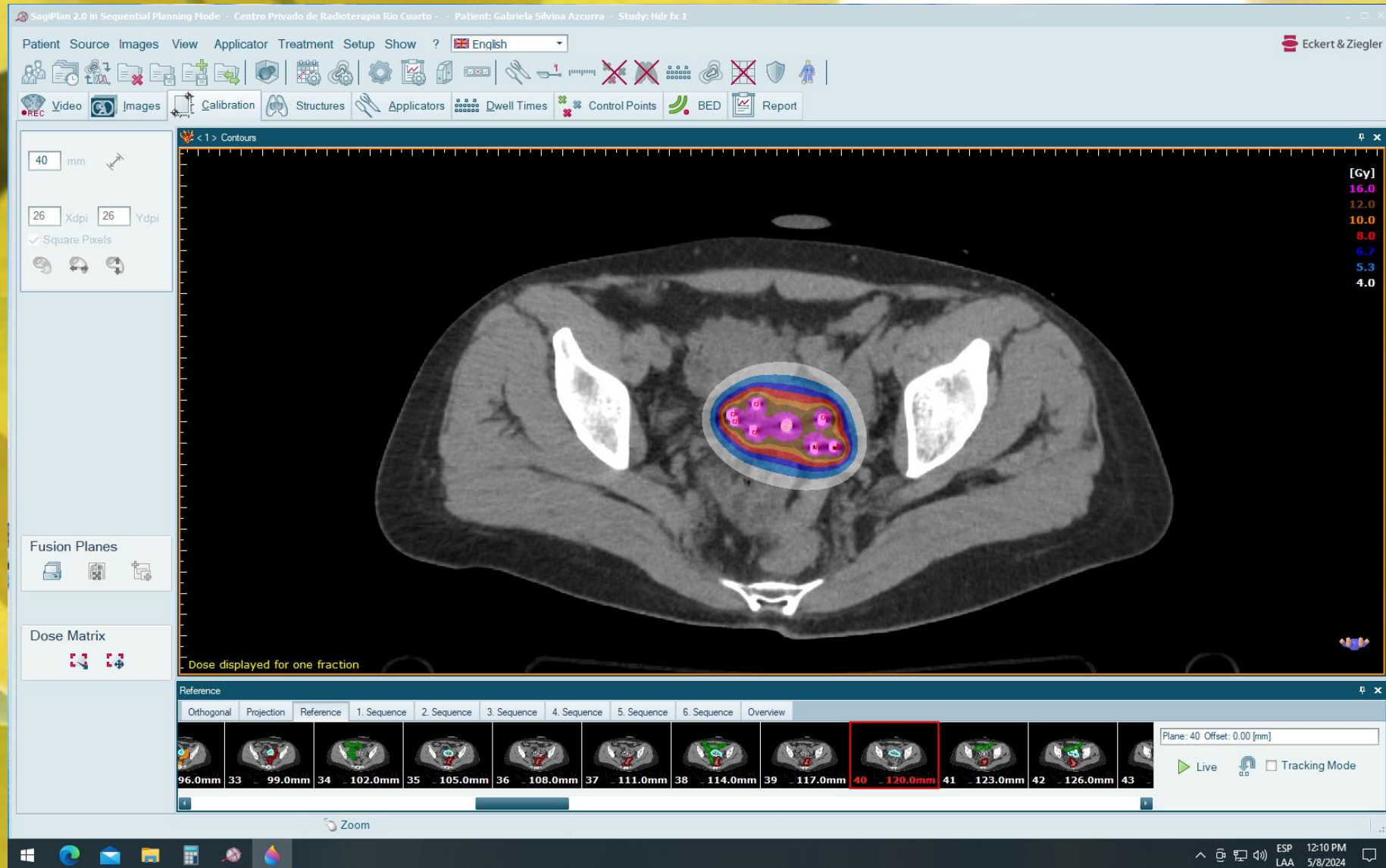


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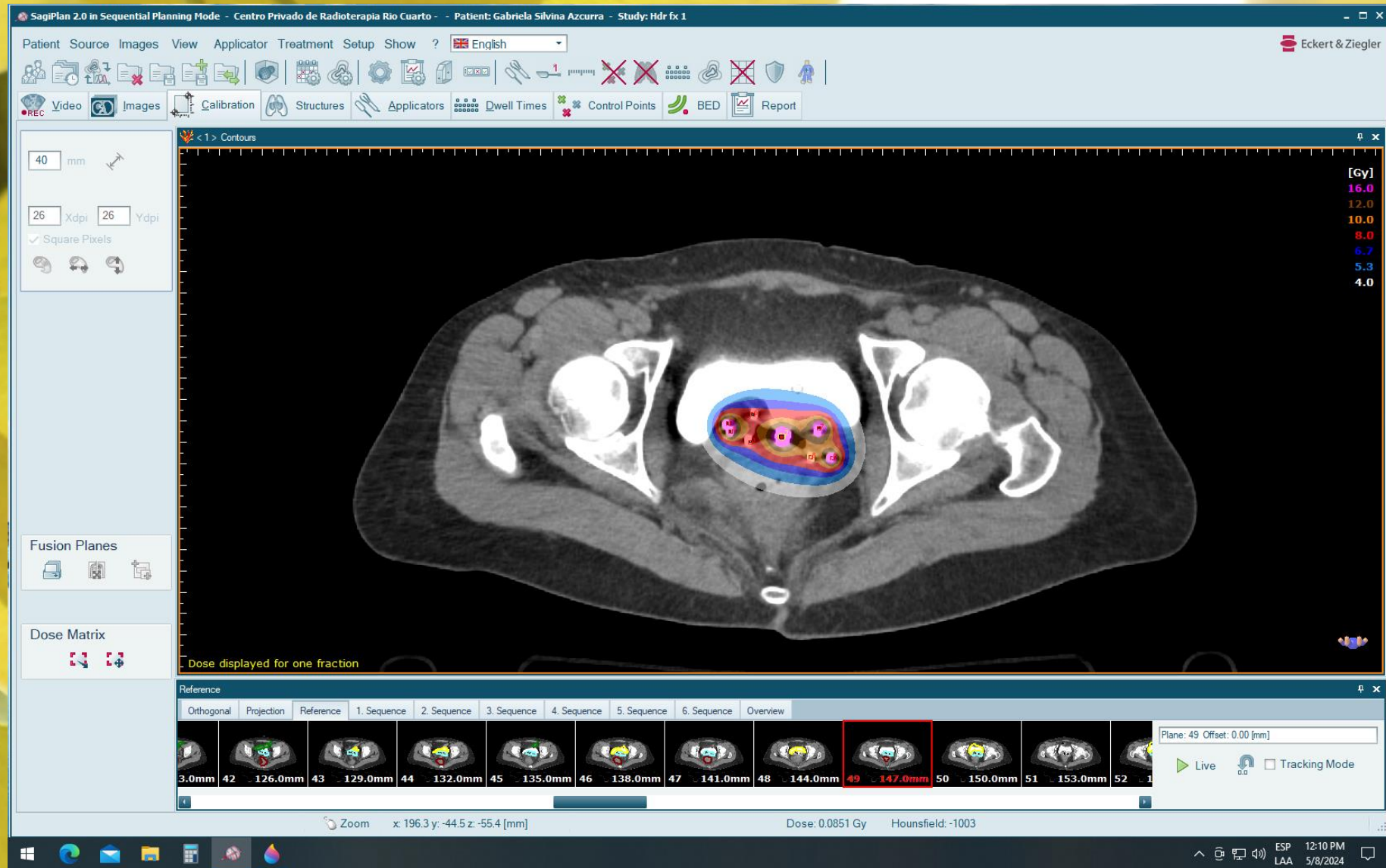


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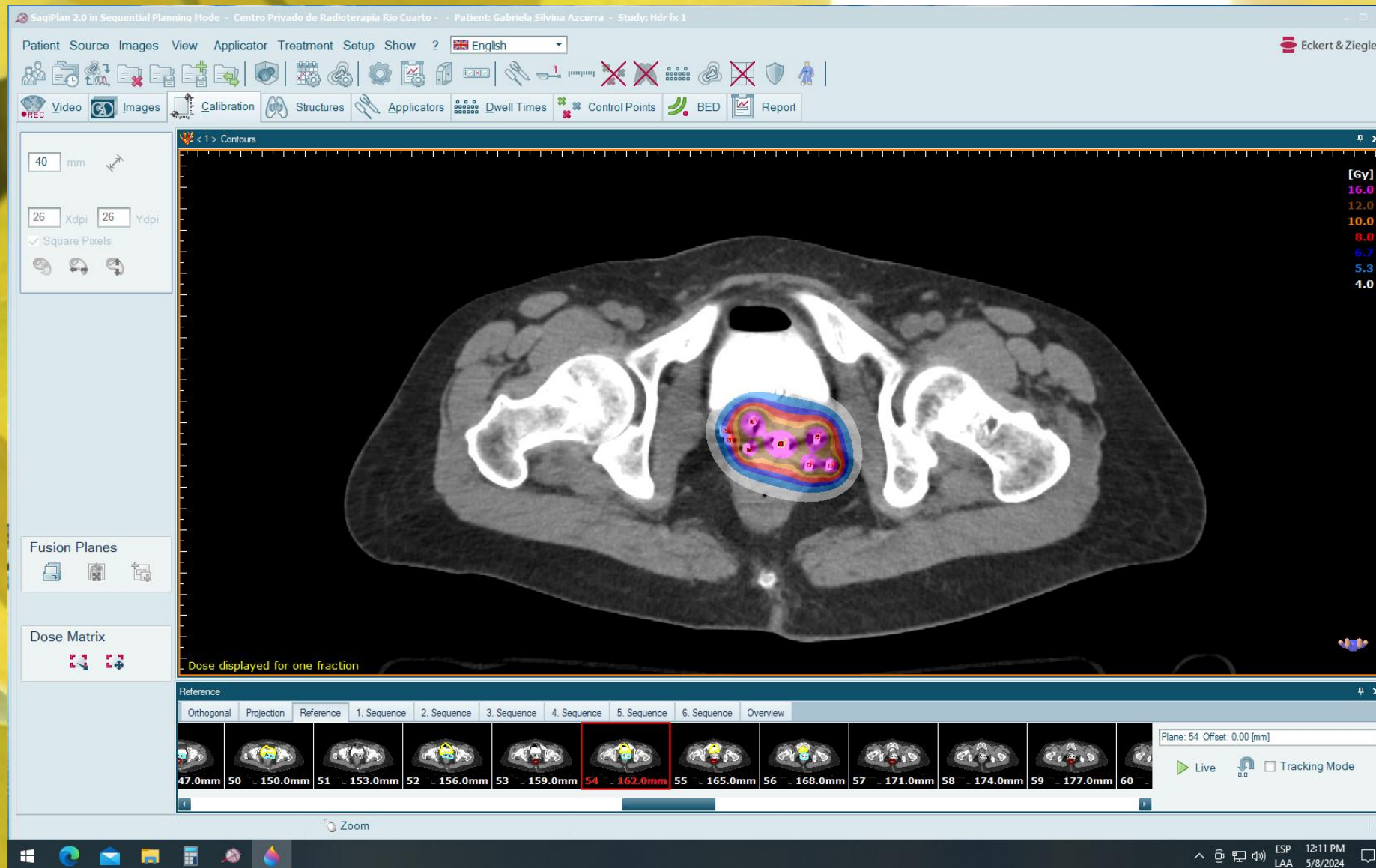




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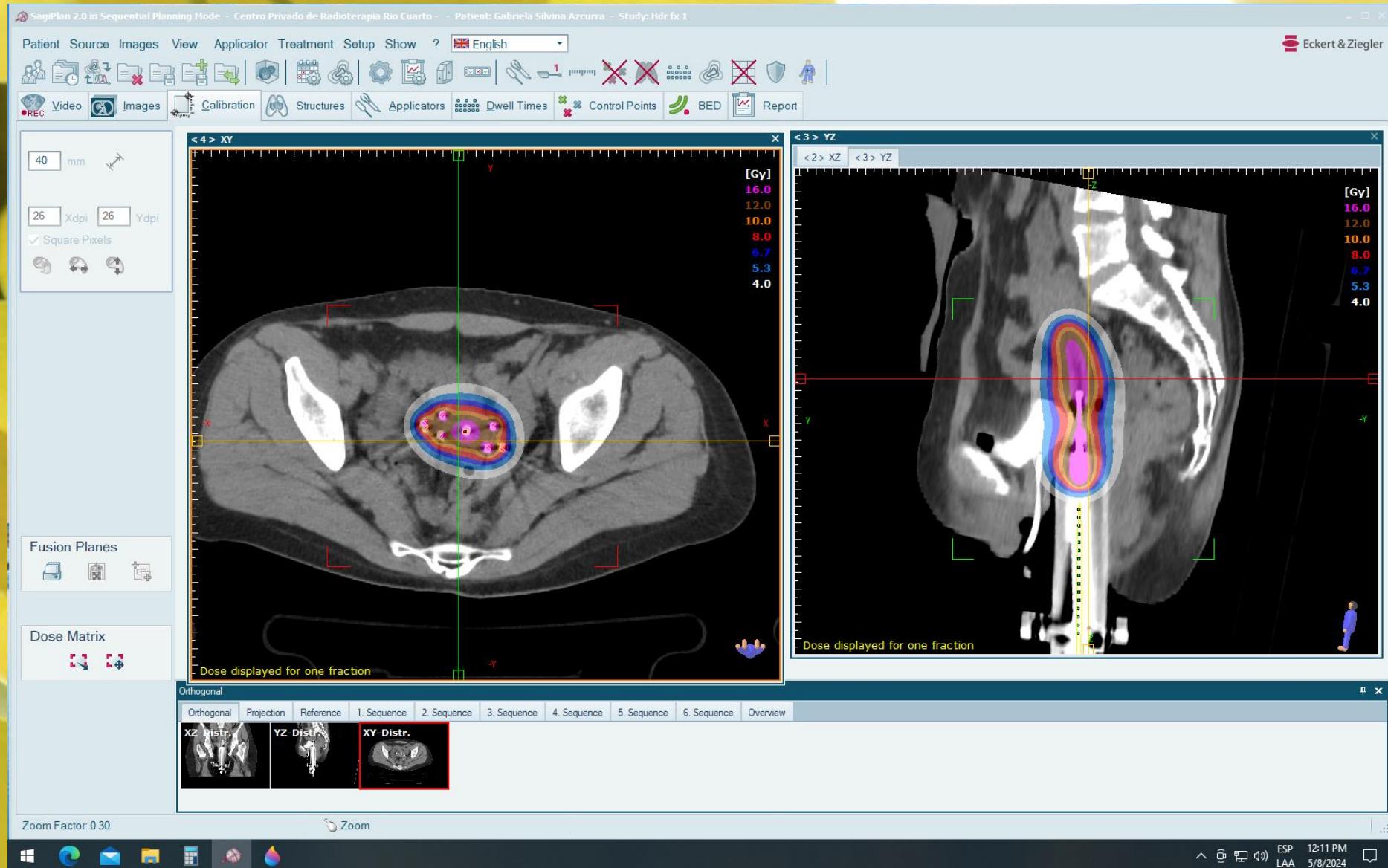


# Caso:3





# Caso:3





# Caso:4

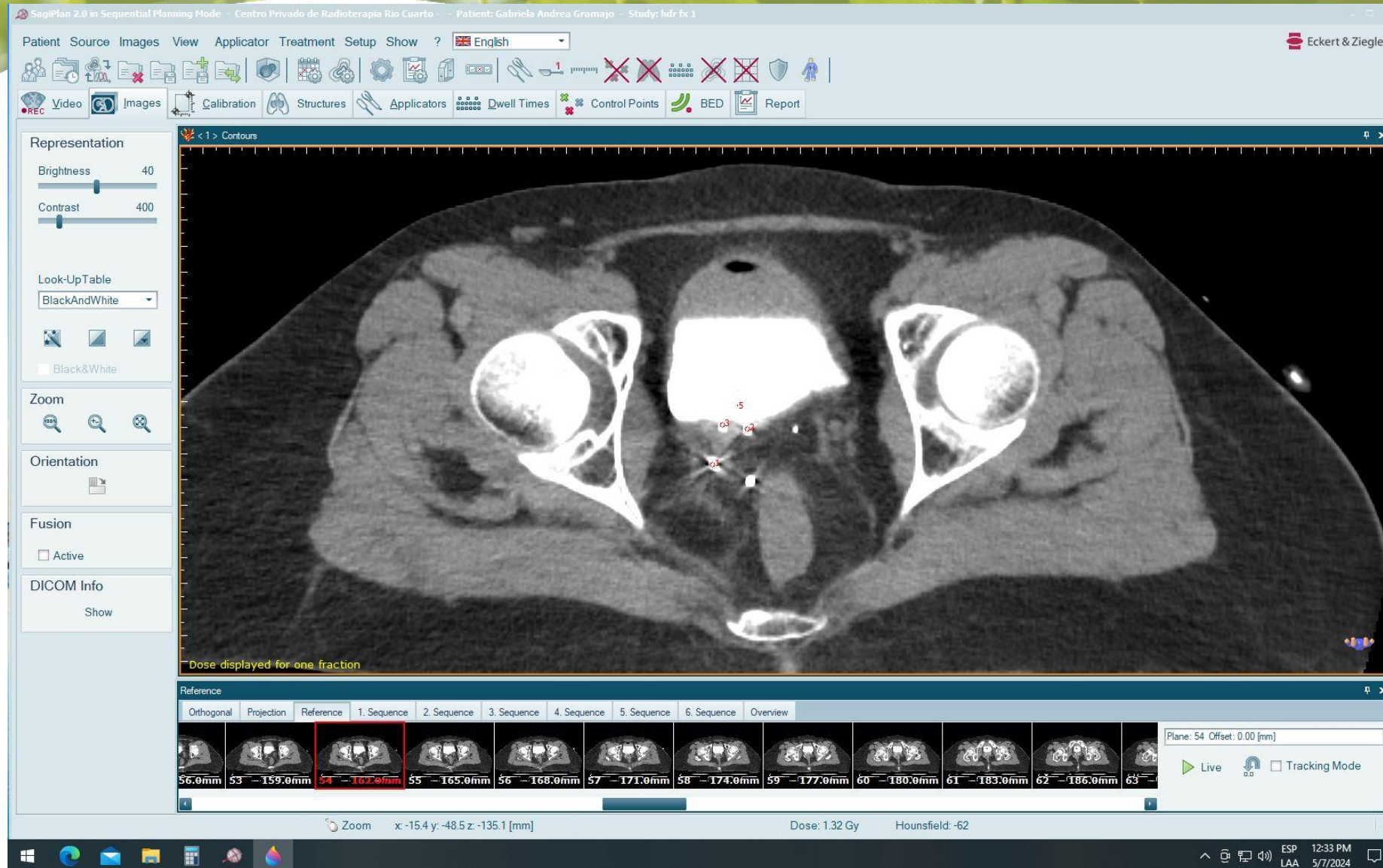


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RASTE 10'

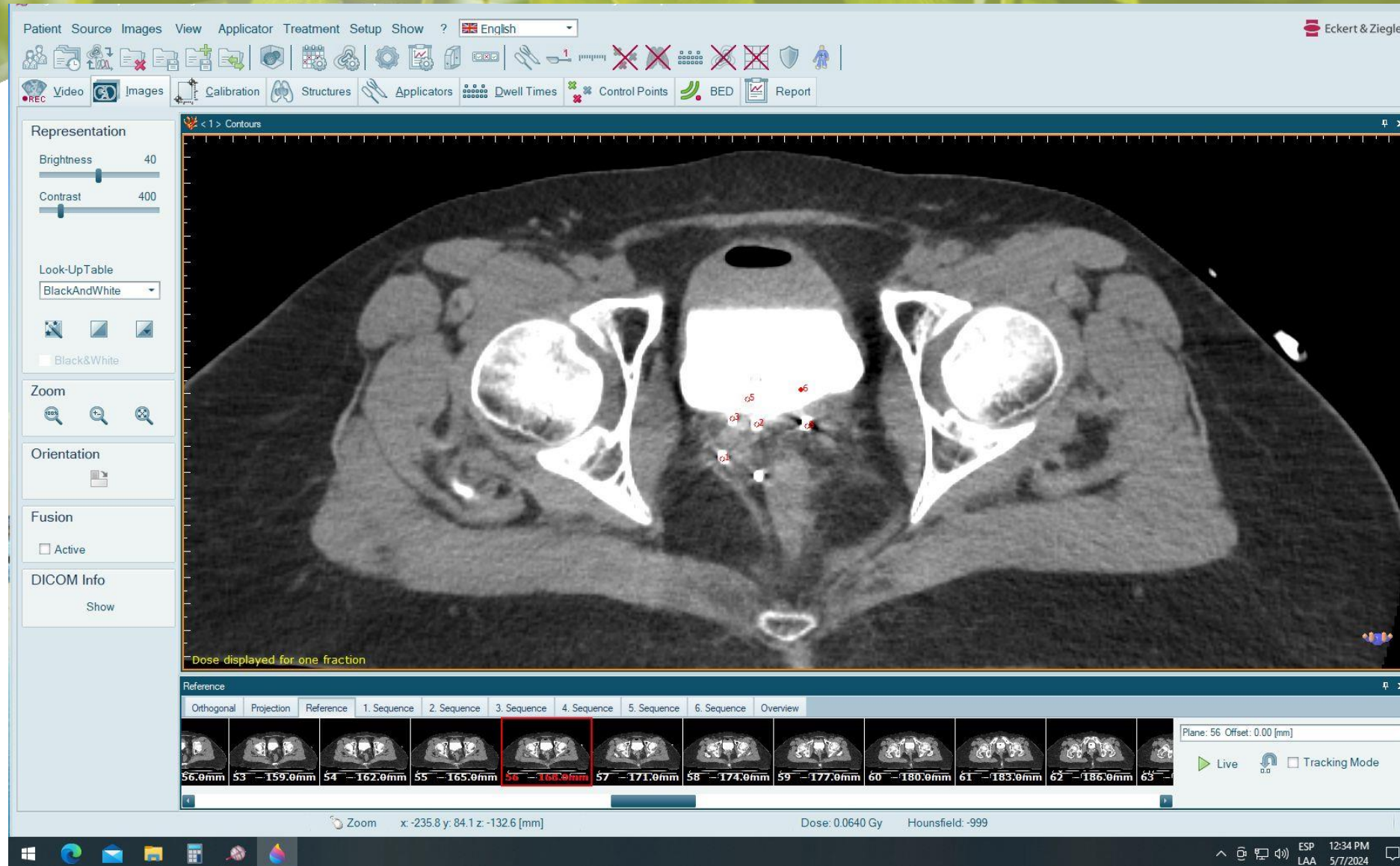


# Caso:4





# Caso:4





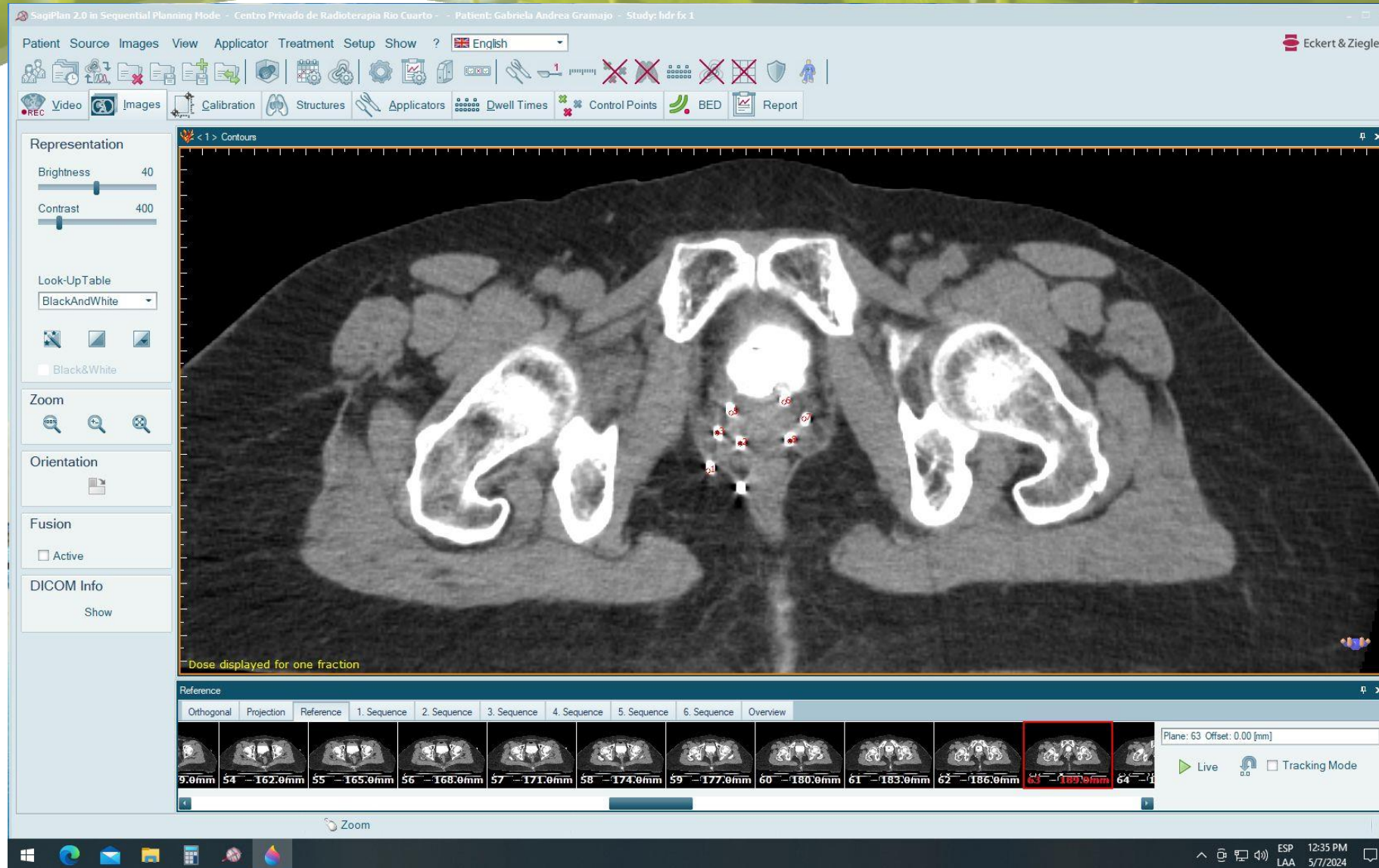
# Caso:4



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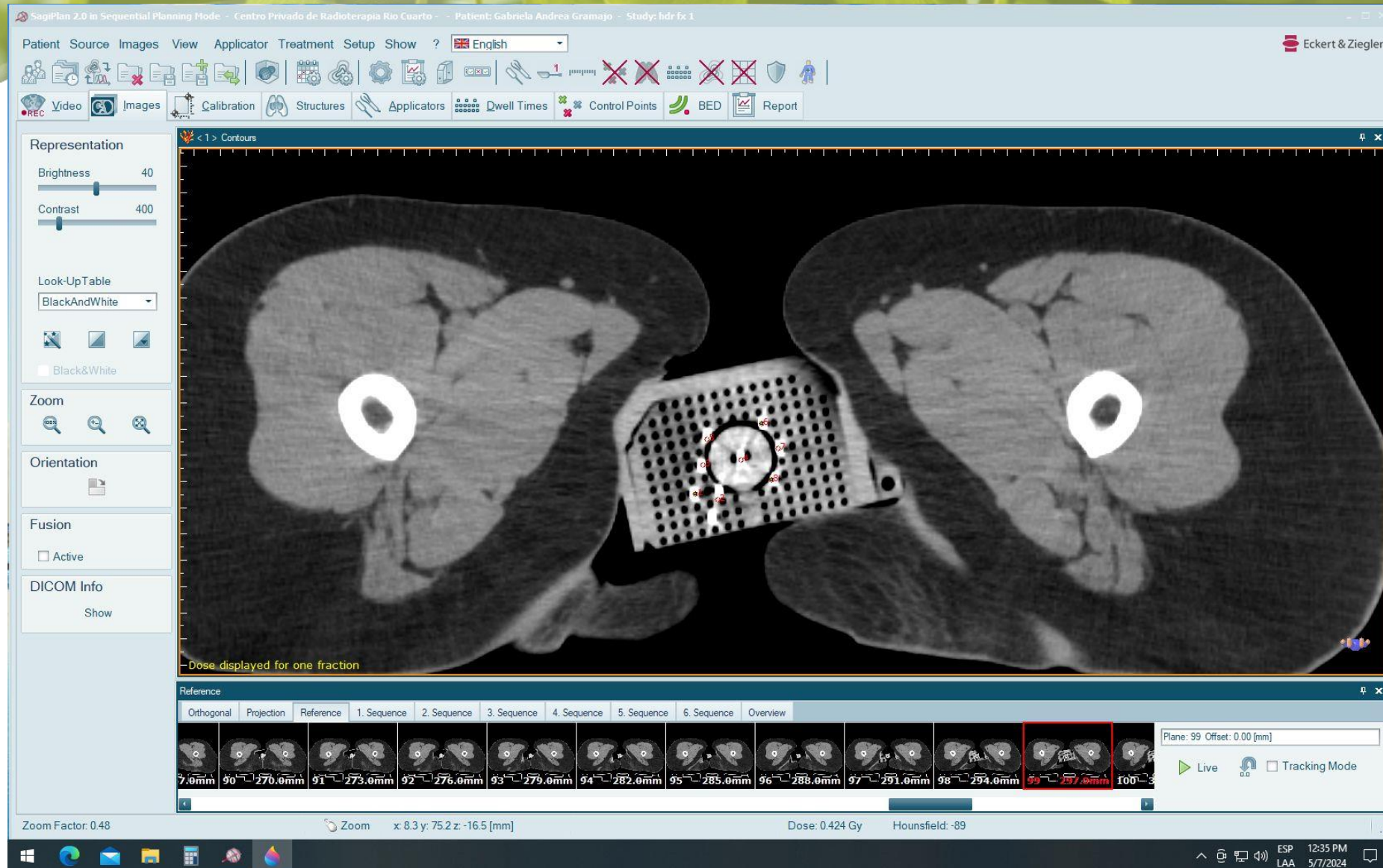


# Caso:4





# Caso:4





# Caso:4

SagiPlan 2.0 in Sequential Planning Mode - Centro Privado de Radioterapia Rio Cuarto - Patient: Gabriela Andrea Gramajo - Study: hdr fx 1

Patient Source Images View Applicator Treatment Setup Show ? English

REC Video Images Calibration Structures Applicators Dwell Times Control Points BED Report

Eckert & Ziegler

Representation

Brightness 40

Contrast 400

Look-UpTable  
BlackAndWhite

Black&White

Zoom

Orientation

Fusion

Active

DICOM Info  
Show

<1> Contours

[Gy]  
12.7  
10.0  
8.0  
6.7  
5.3

Dose displayed for one fraction

Reference

Orthogonal Projection Reference 1. Sequence 2. Sequence 3. Sequence 4. Sequence 5. Sequence 6. Sequence Overview

65.0mm 56 -100.0mm 57 -171.0mm 58 -174.0mm 59 -177.0mm 60 -180.0mm 61 -183.0mm 62 -186.0mm 63 -189.0mm 64 -192.0mm 65 -195.0mm 66 -198.0mm

Plane: 56 Offset: 0.00 [mm]

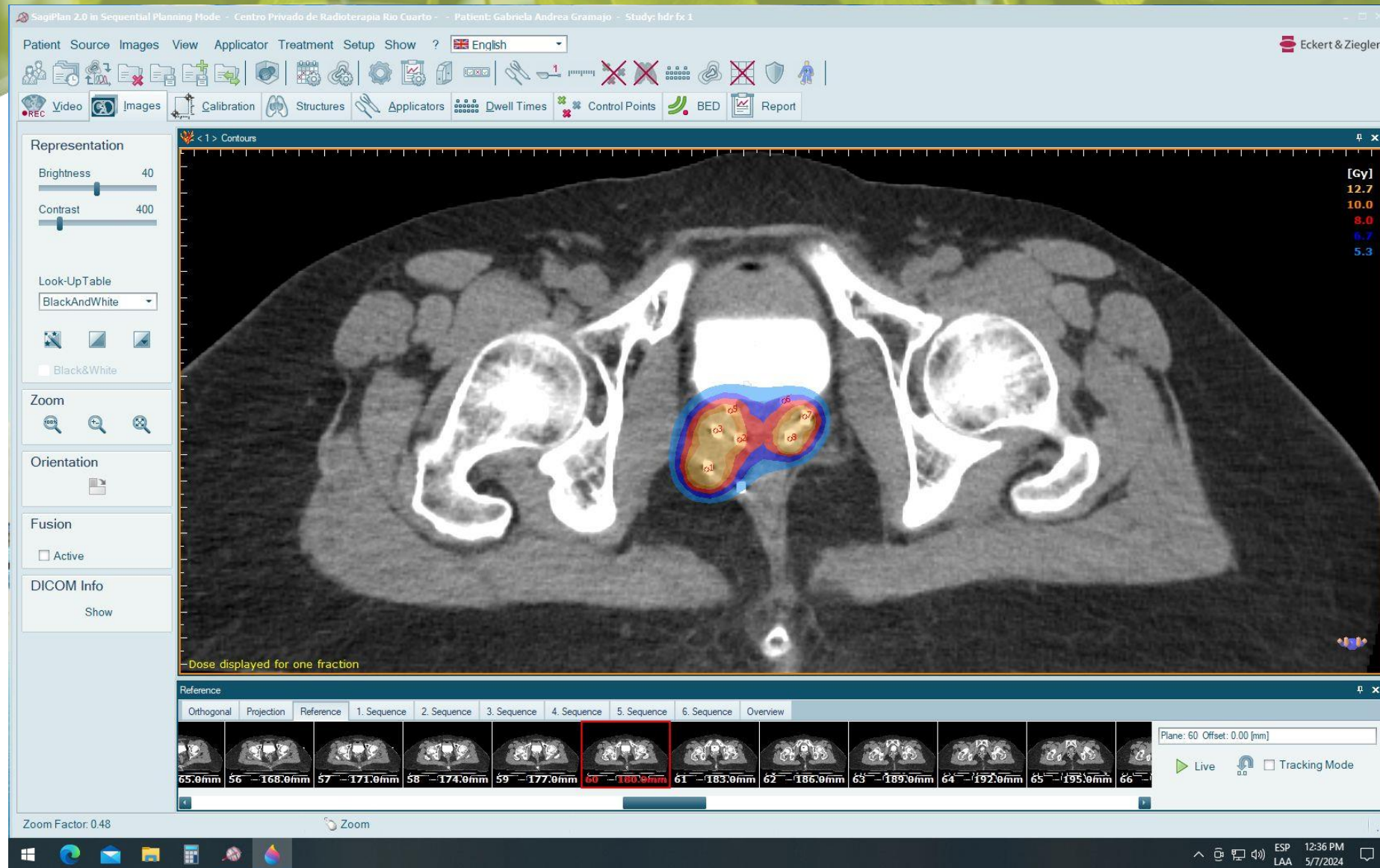
Live Tracking Mode

Zoom Factor: 0.48

Zoom

Windows Taskbar: 12:36 PM 5/7/2024

# Caso:4





# Caso:4

SagPlan 2.0 in Sequential Planning Mode - Centro Privado de Radioterapia Rio Cuarto - Patient: Gabriela Andrea Gramajo - Study: hdr fx 1

Patient Source Images View Applicator Treatment Setup Show ? English

REC Video Images Calibration Structures Applicators Dwell Times Control Points BED Report

Representation

Brightness 40

Contrast 400

Look-UpTable

BlackAndWhite

Black&White

Zoom

Orientation

Fusion

Active

DICOM Info

Show

< 1 > Contours

[Gy]

12.7

10.0

8.0

6.7

5.3

Dose displayed for one fraction

Reference

Orthogonal Projection Reference 1. Sequence 2. Sequence 3. Sequence 4. Sequence 5. Sequence 6. Sequence Overview

5.0mm 56 -168.0mm 57 -171.0mm 58 -174.0mm 59 -177.0mm 60 -180.0mm 61 -183.0mm 62 -186.0mm 63 -189.0mm 64 -192.0mm 65 -195.0mm 66 -198.0mm

Plane: 63 Offset: 0.00 [mm]

Live Tracking Mode

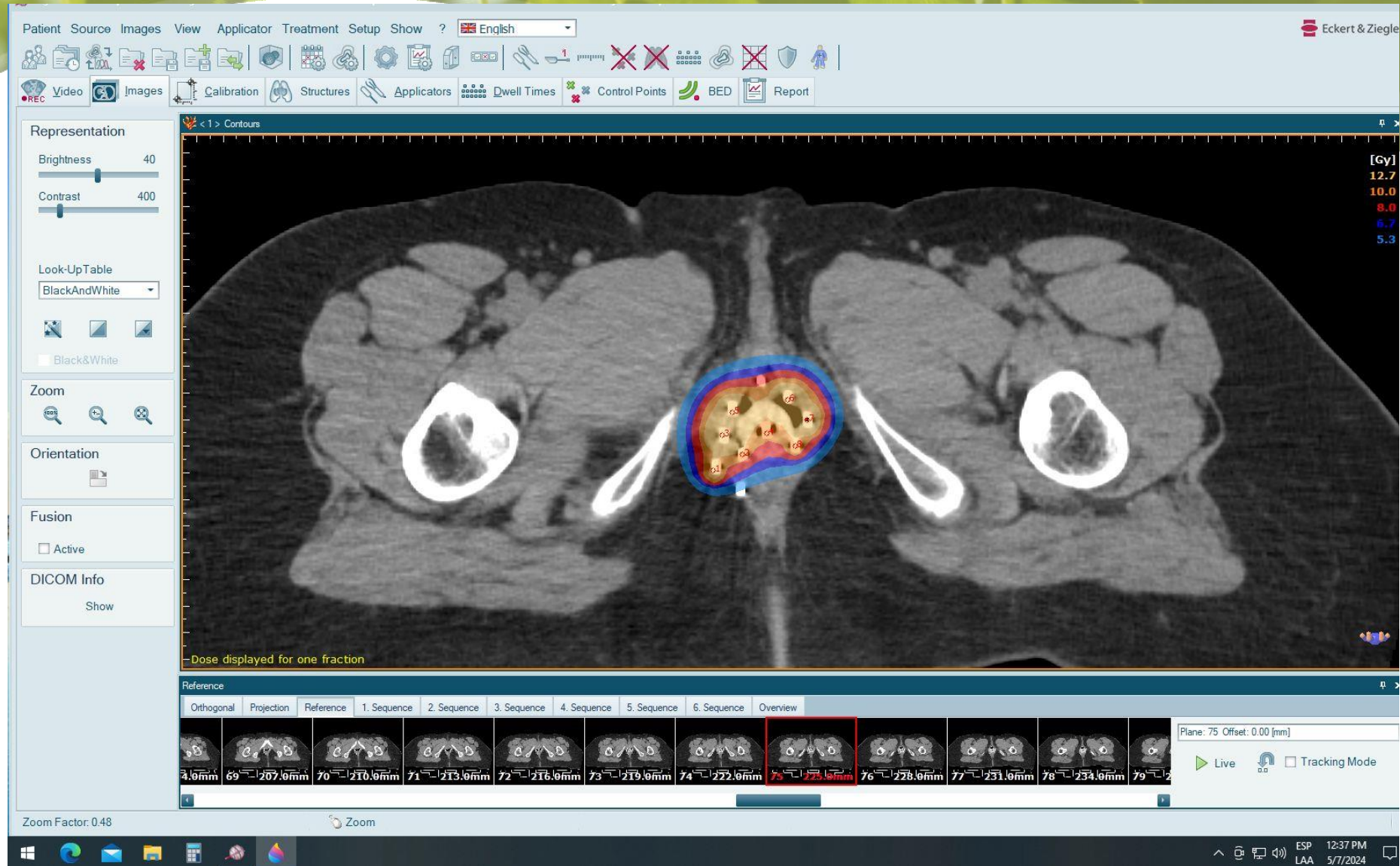
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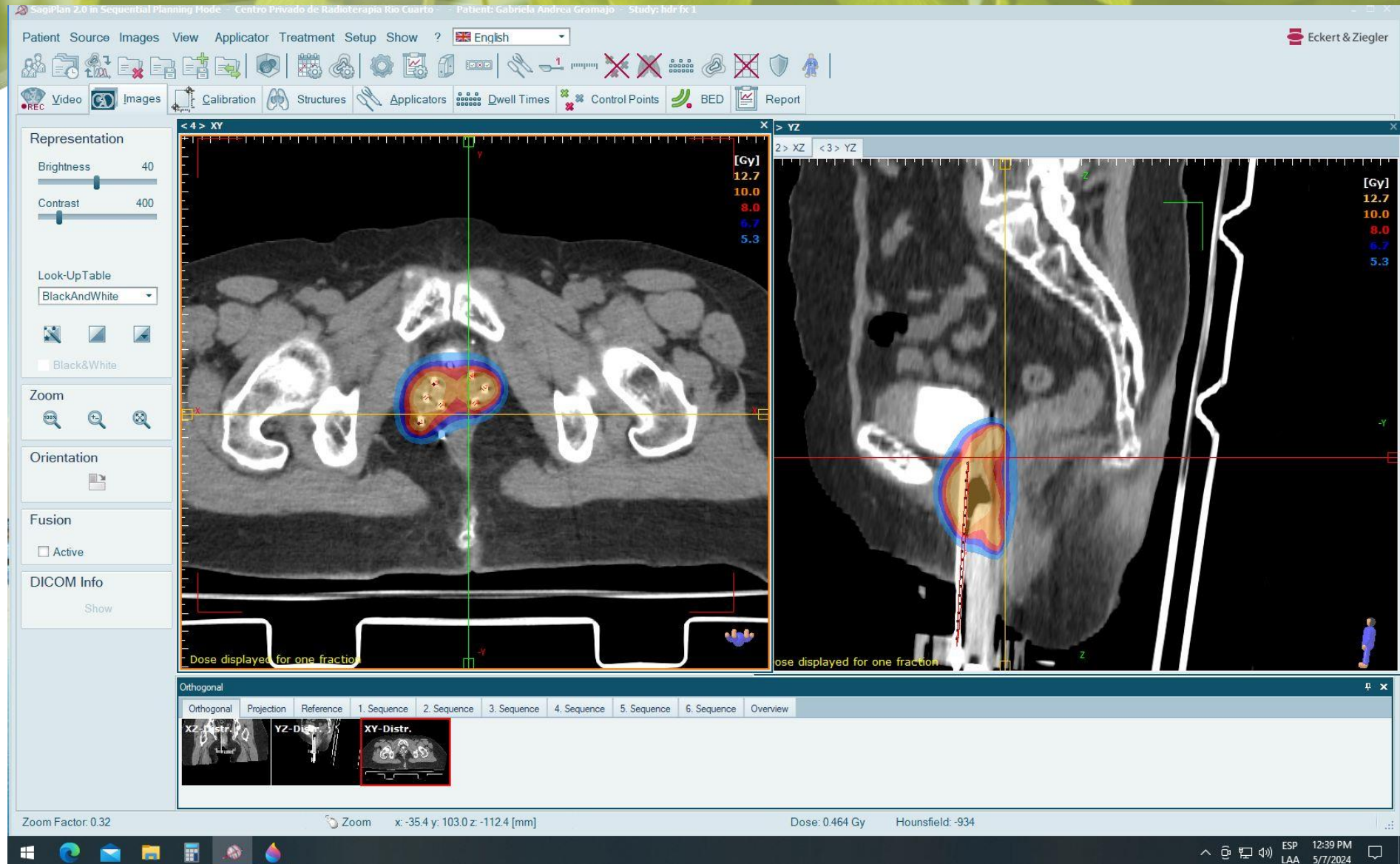
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# Caso:4



# Caso:4



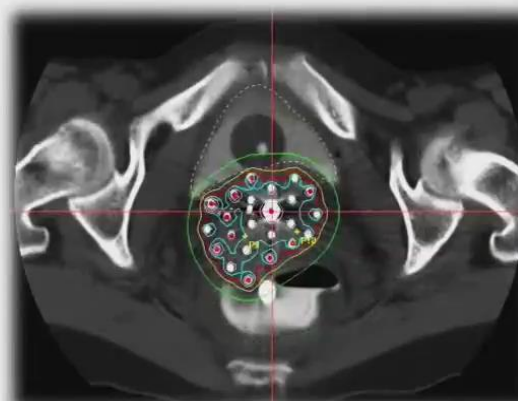
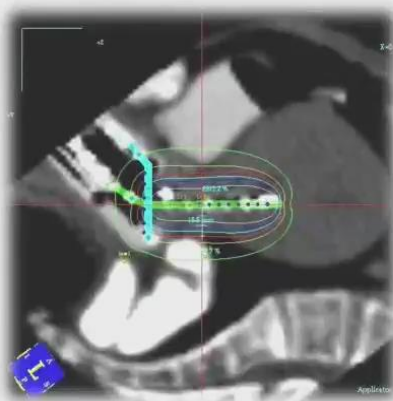


# Residency Training : RRC 2023 Requirements

Each resident must perform at least seven interstitial and 15 intracavitary brachytherapy procedures. (Core)

Of the required intracavitary brachytherapy procedures, a minimum of five must be tandem-based insertions for at least two patients. (Core)

Of the required intracavitary brachytherapy procedures, no more than five should be cylinder insertions. (Core)



BRACHYTHERAPY

Brachytherapy 23 (2024) 290–300

Can an in-person hands-on applicator-based teaching session improve trainee knowledge and comfort with complex gynecologic brachytherapy?

Abigail Groszkiewicz<sup>1</sup>, Emily Foust<sup>2</sup>, Brett Palestra<sup>2</sup>, Michelle C. Ertel<sup>3</sup>, Michelle Boisen<sup>3</sup>,  
Paniti Sukumvanich<sup>3</sup>, Shannon Kroskie Smith<sup>2</sup>, Ryan P. Smith<sup>3</sup>, John A. Vargo<sup>2,\*</sup>

Groszkiewicz et al Brachytherapy 23: 290-300, 2024



ASTRO 66TH ANNUAL MEETING | September 29 – October 2, 2024



#ASTRO24



**Tabla 1.** Principales características de los aplicadores con componente intersticial.

Marca Modelo	Número de agujas	Material	Diámetro	Longitud (mm)	Vaginales o perineales	Dirección de las agujas	Extensión lateral máx. (mm)	Punta: roma o afilada
Bebig								
Ring	8	plástico	1.7 mm	300	vaginales	paralelas a la SIU	20	roma
Mac	36 (a)		Varios (b)	150, 200, 300	ambas	paralelas al obturador vaginal	30	afilada
Elekta								
Viena	9 (c)	titanio	1.9 mm	240	vaginales	paralelas a la SIU	19	ambas
Utrecht	10 (d)	plástico	2 mm	294		paralelas a la SIU (d)	29.2	
Ring	9 (c)					paralelas a la SIU	19	
Venezia	134 (e)			ambas	paralelas a la SIU y divergentes a 20°	45		
Varian								
Fletcher	8	plástico	2 mm	320	vaginales	paralelas a la SIU	30	ambas
3D Ring	19 (f)						39	
Viena style	16	titanio	16G	200, 250, 320			44	
		plástico	2 mm	200, 320				
Kelowna	40	plástico	2 mm	113, 200, 320	perineales	paralelas al obturador vaginal (g)	(h)	ambas
		titanio	16G	113, 200, 250, 320			para 0°: 27	afilada
			17G				para 90°: 40	

(a) 6 en obturador vaginal (o.v.), 11 en plantilla perineal a 2 cm del centro o.v., 19 en plantilla perineal a 3 cm del centro del o.v.

(b) 15.5G, 17G, 18G, 1.65 mm y 2.0 mm.

(c) Los anillos de 30 mm y 34 mm de diámetro. El anillo de 26 mm tiene capacidad para 7 agujas.

(d) 8 agujas con tope cervicouterino.

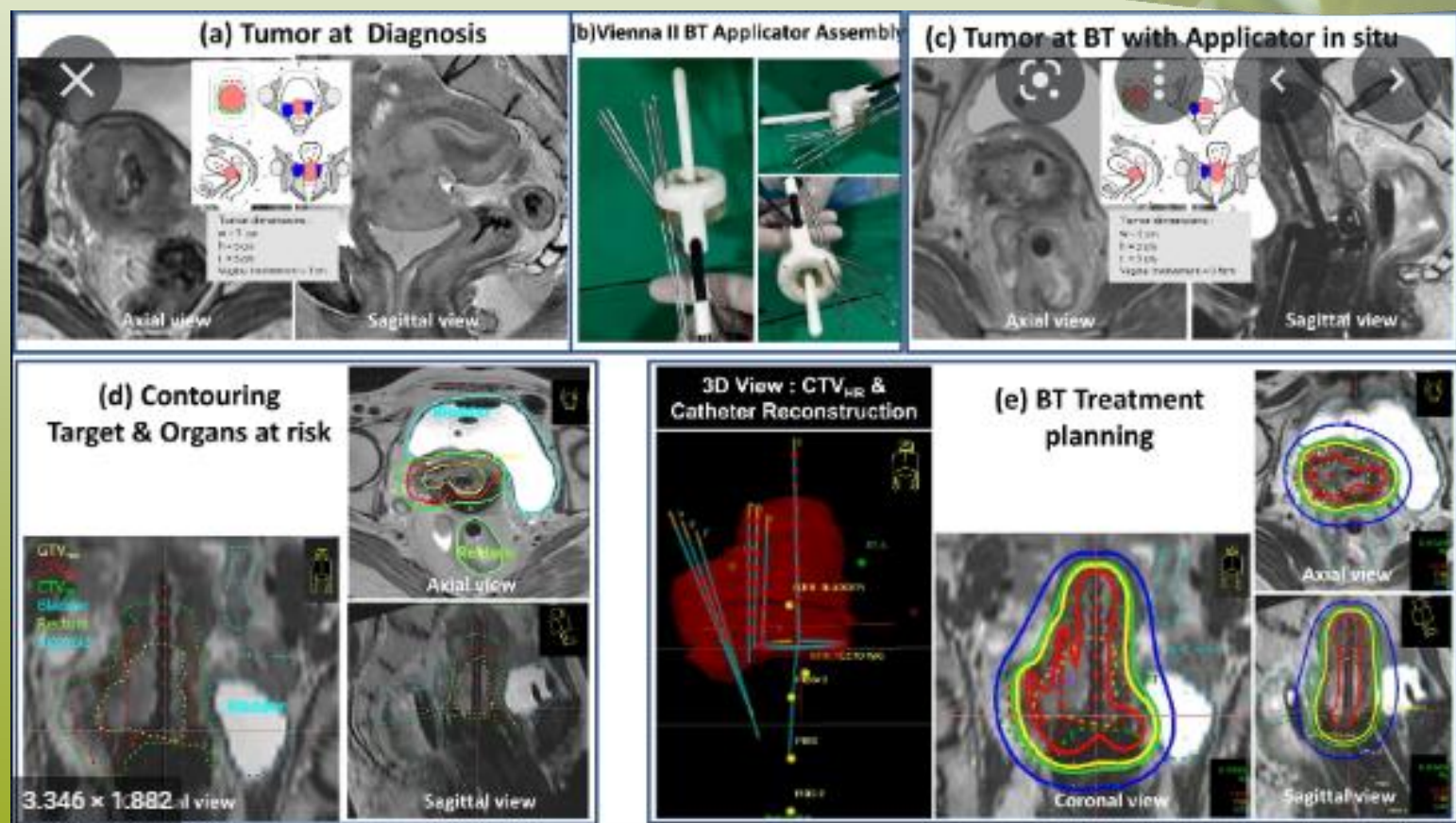
(e) 6 agujas en cada media luna y 122 en la plantilla perineal.

(f) 12 en el anillo y 7 en la SIU.

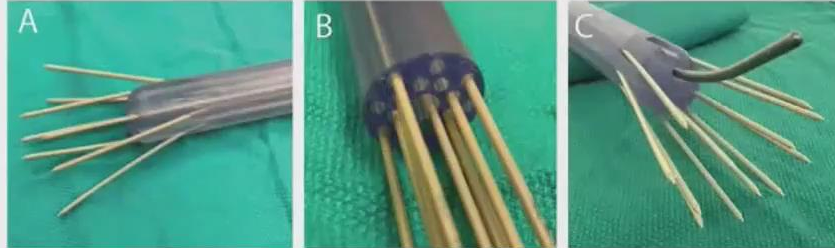
(g) Con opción de desviarlas manualmente.

(h) La plantilla se puede rotar 90° alrededor del eje/obturador. En la tabla se indican los valores en ambas posiciones.

# Aplicadores de Viena



# 3D Printed Applicators



Brachytherapy 23 (2024) 282–289

BRACHYTHERAPY

Original Article

## Design approach and benefits of the 3D-printed vaginal individualized applicator (VIA)

Agnes Ewongwo, Thomas Niedermayr<sup>\*,\*</sup>, Elizabeth A. Kidd<sup>\*,\*</sup>

*Department of Radiation Oncology, Stanford University, Stanford, CA*

Ewongwo et al Brachytherapy 23: 282-289, 2024



Brachytherapy 23 (2024) 149–153

BRACHYTHERAPY

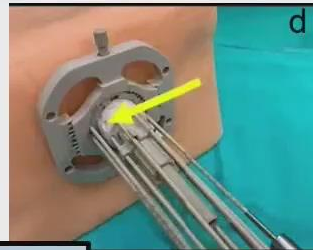
Original Article

Development and clinical implementation of simple needle attachment post placement interstitial template (SNAPP-IT) enabling a shorter, more direct needle path while preserving tumor visualization

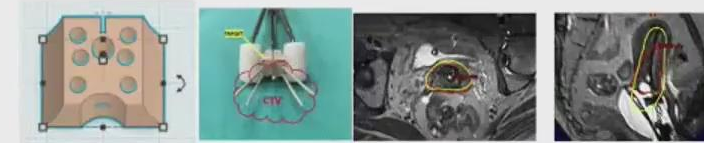
Claire C. Baniel, Caressa Hui, Pete A. Franco, Thomas Niedermayr<sup>\*,</sup>, Elizabeth A. Kidd<sup>\*,\*</sup>

*Department of Radiation Oncology, Stanford University, Palo Alto, CA*

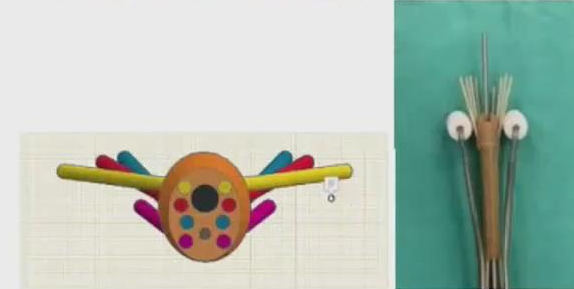
Baniel et al Brachytherapy 23: 149-153, 2024



a) Original TARGIT template depicted (left-to-right) as a design blueprint, assembled with a standard Varian Fletcher tandem-and-ovoid applicator, and visualized on post-procedure imaging for treatment planning



b) TARGIT-FX template depicted (left-to-right) as a design blueprint and fully assembled with a Varian Fletcher tandem-and-ovoid applicator with 2 mm Varian needles applied through all 9 channels. TARGIT-FX dimensions include 2 cm diameter and 10 cm length. Needles exit the TARGIT-FX at the ovoid level and can curve within the TARGIT-FX up to 20 degrees. 6 of the 9 needle channels follow the tandem at distinct lateral distances, while 3 of the 9 needle channels complement the implant posteriorly.



**Developing Next-Generation 3-Dimensional Printing for Cervical Cancer Hybrid Brachytherapy: A Guided Interstitial Technique Enabling Improved Flexibility, Dosimetry, and Efficiency**



Marar et al IJROBP 117(2): 312-320, 2023



ASTRO 66TH ANNUAL MEETING | September 29 – October 2, 2024



#ASTRO24



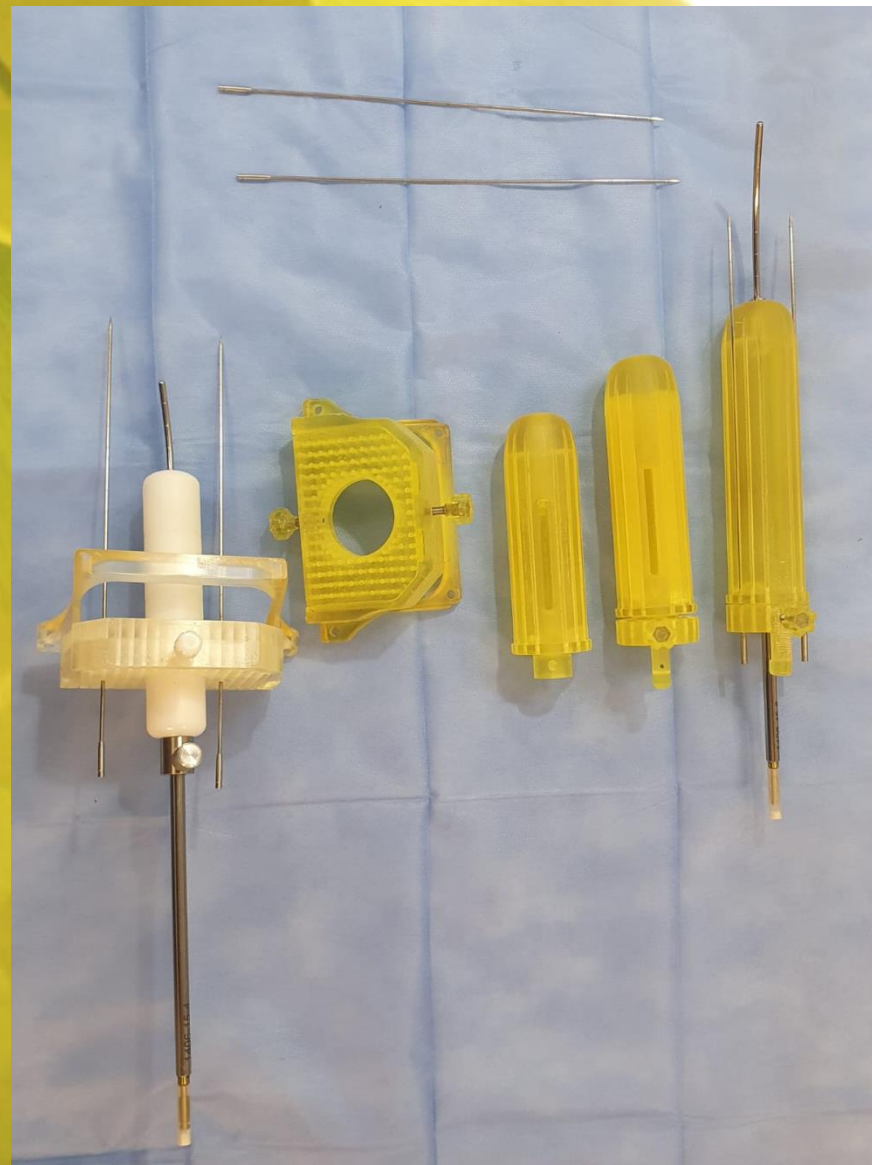


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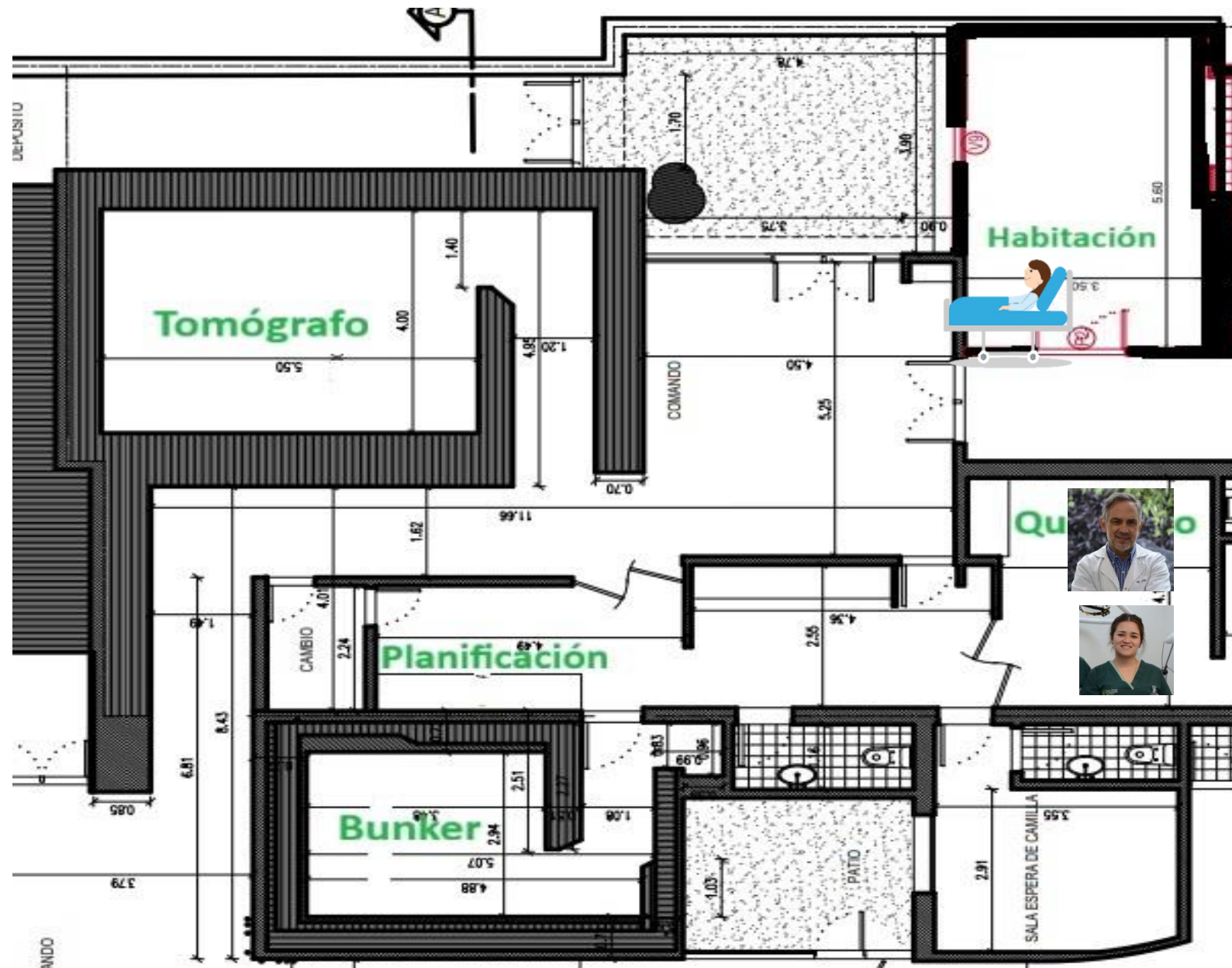




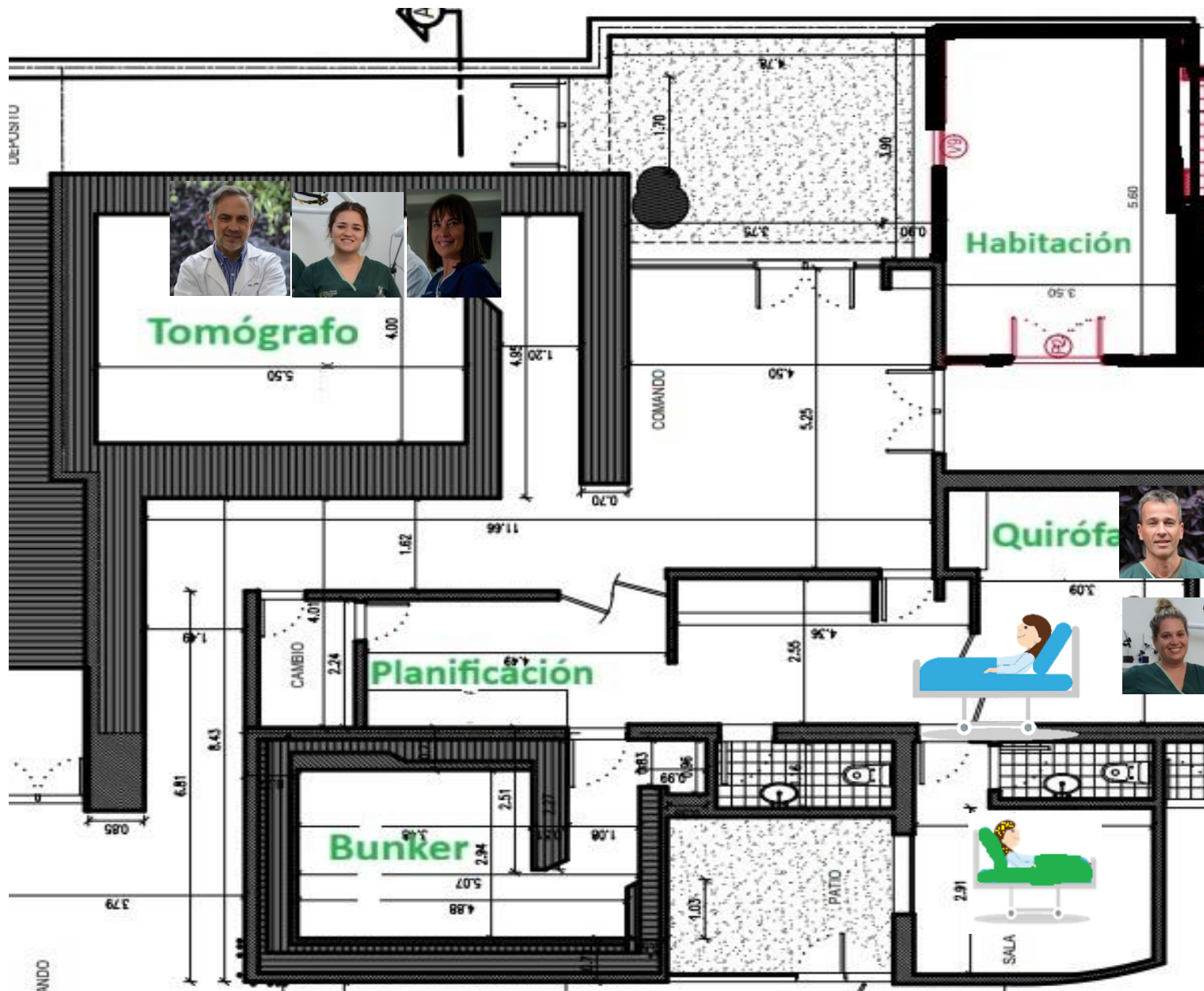
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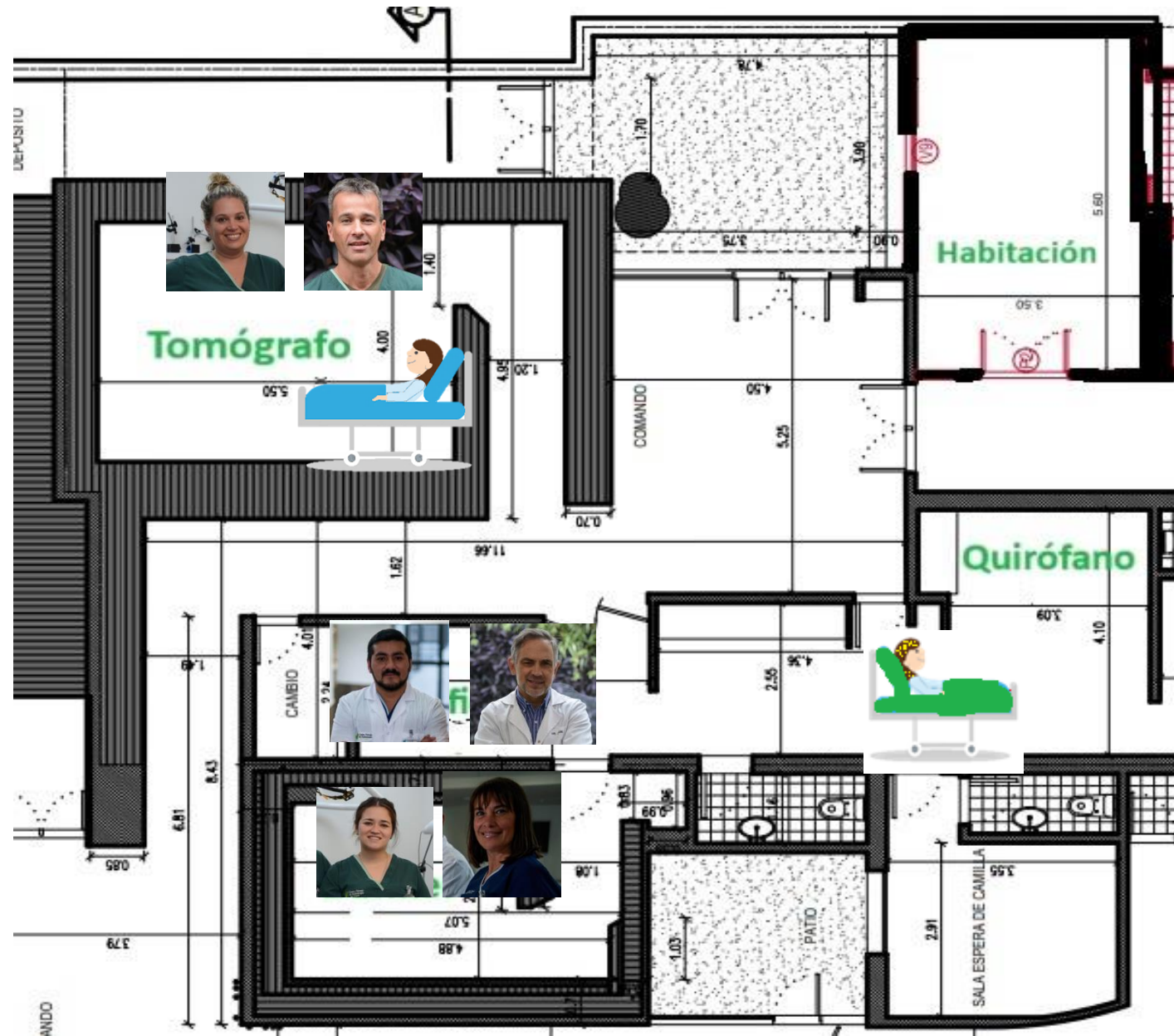


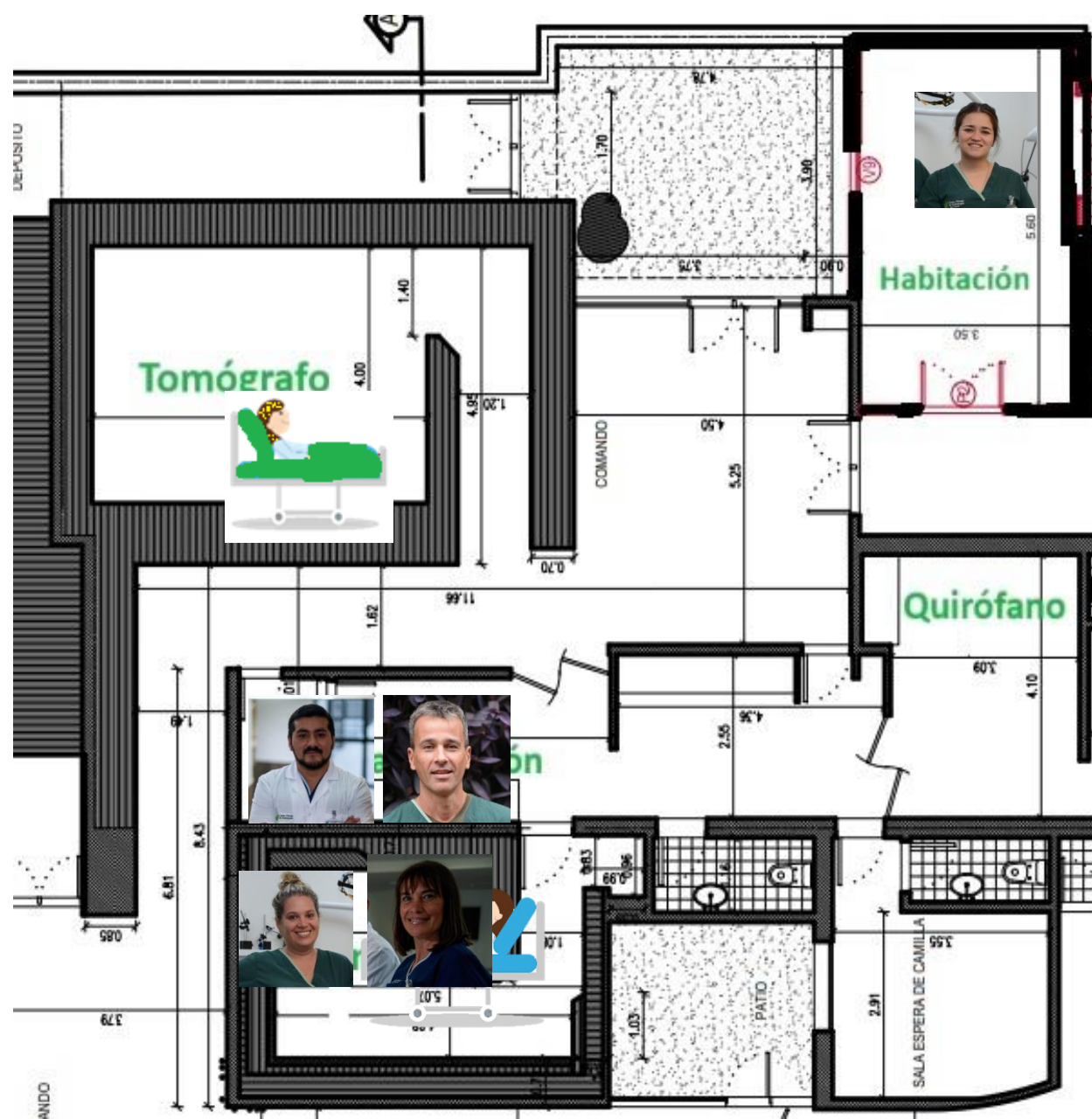






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**Radio oncólogos:**

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Andrés Gil  
Gabriel Heinrich

**Físicos:**

Joseph Simon Primo  
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Maximiliano Gallo

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Marcela Valero  
Javier Schusselin  
Natalia Palacios  
Lourdes Argüello  
Agustina Brugna

**Enfermeras:**

Egle Altamirano  
Lucía Pereyra

**GRACIAS**