

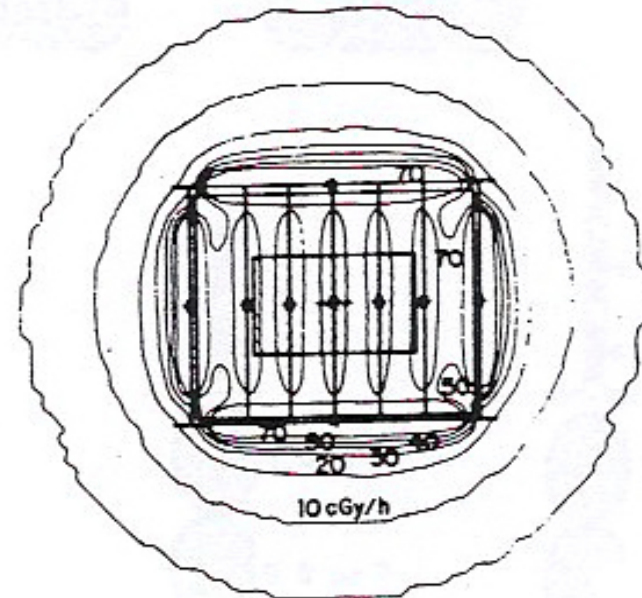
Modalità di IGBT

Luca Tagliaferri

*Università Cattolica del Sacro Cuore
Policlinico "Agostino Gemelli" - Roma
Divisione di Radioterapia Oncologica*



IMAGE GUIDED IN BRACHITERAPIA



- Meredith W.J.: Radium Dosage, The Manchester System, Edinburgh and London, Livingstone, 1958
- Rays, Volume 15 – numero 4 – Ottobre/Dicembre 1990.

MODALITÀ DI IGBT

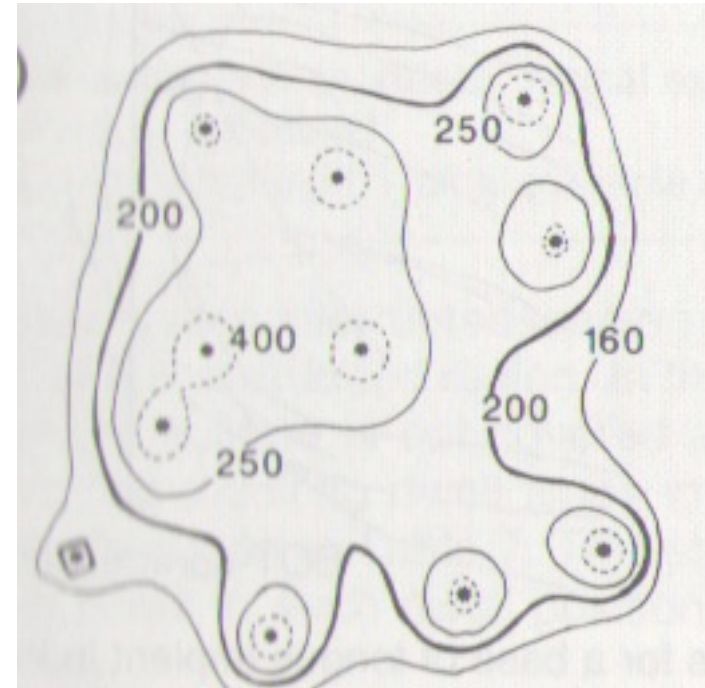
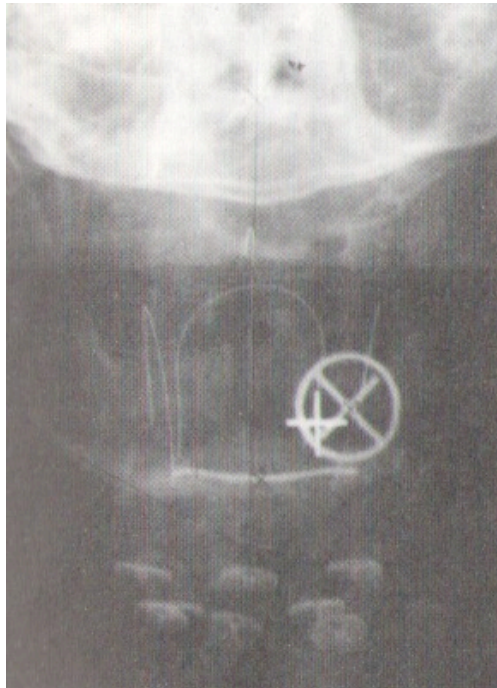
POSIZIONAMENTO CATETERI	DEFINIZIONE TARGET/OAR	DOSIMETRIA
2D	2D	2D



- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

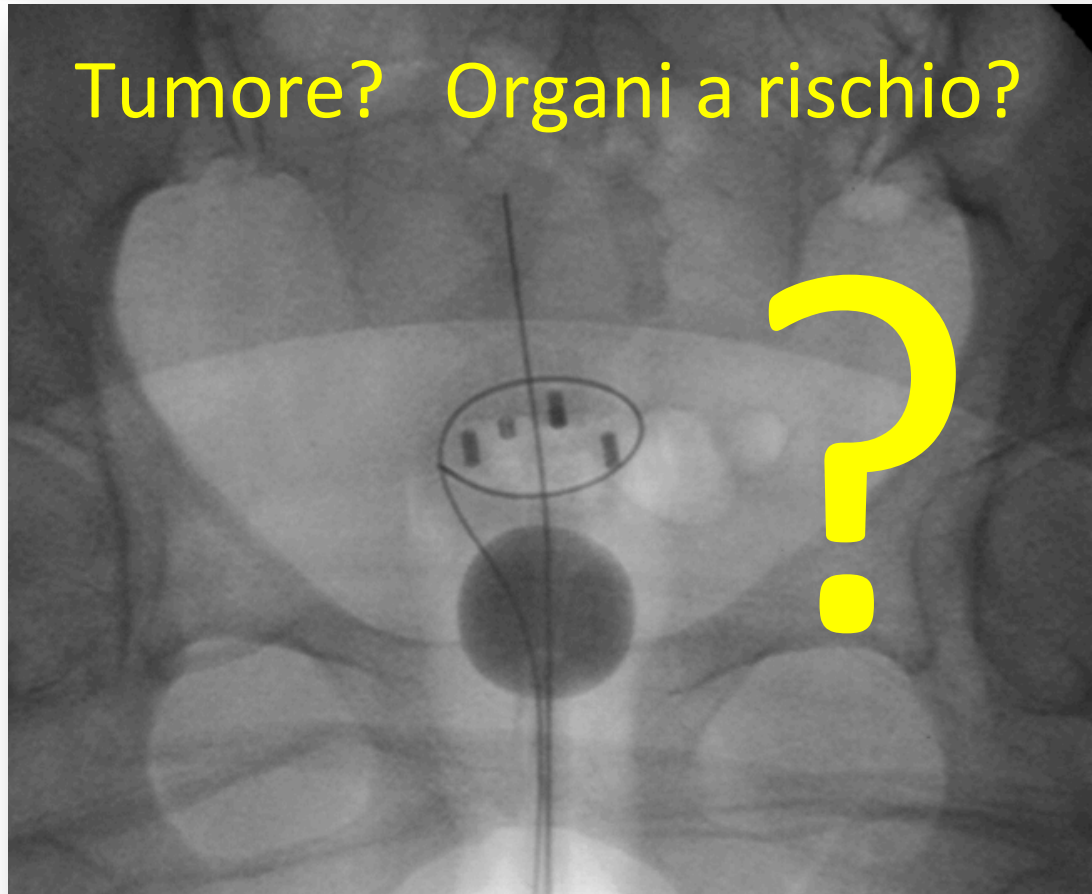
Modalità IGBT: TESTA E COLLO

2D

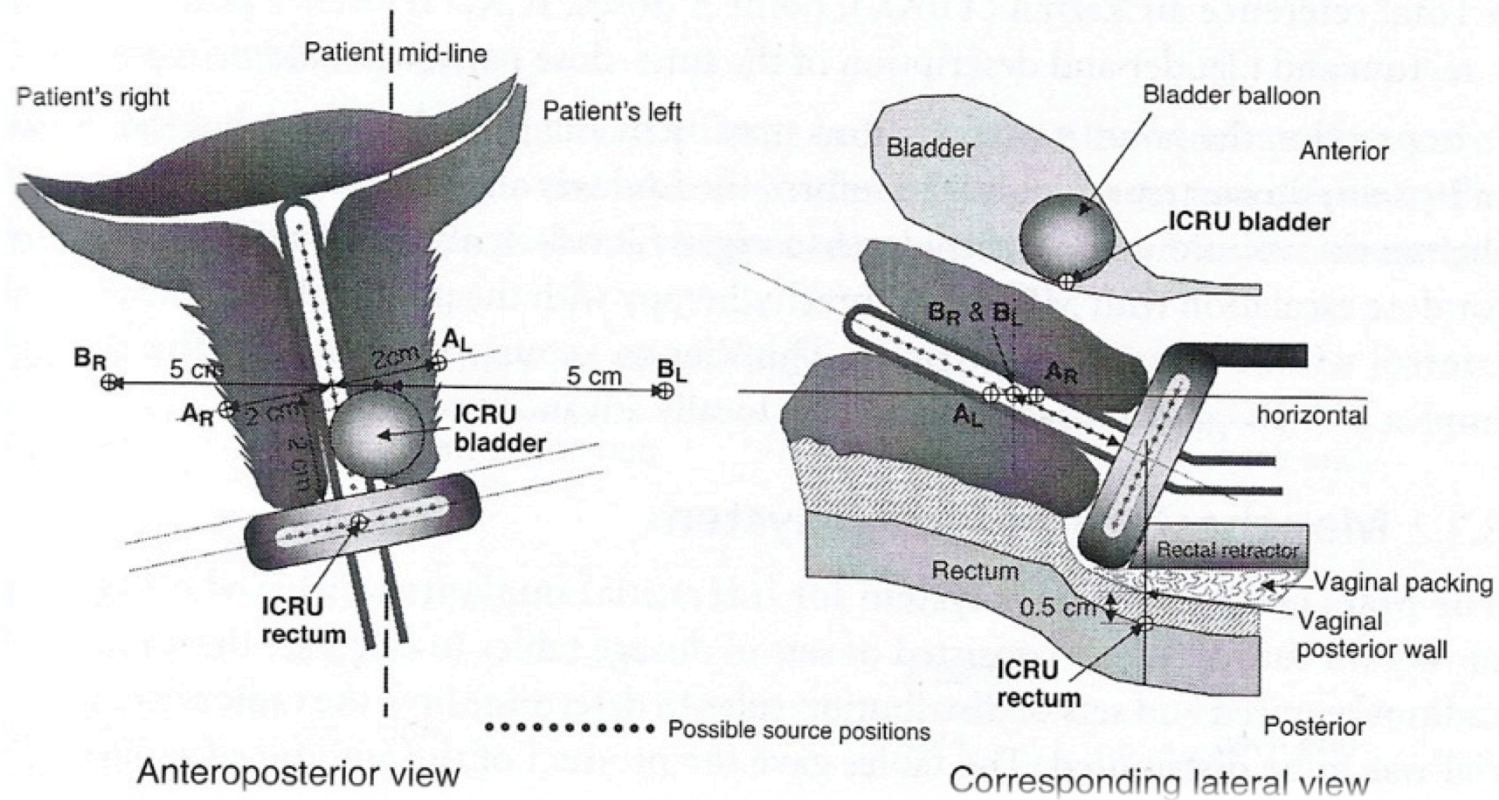


Modalità IGBT: CERVICE 2D

Tumore? Organi a rischio?



Modalità IGBT: CERVICE 2D



- Principles of brachytherapy dosimetry, in Hoskin PJ, Coyle C (eds): Radiotherapy in Practice: Brachytherapy. Coyle C. Oxford University Press, Oxford, 2011

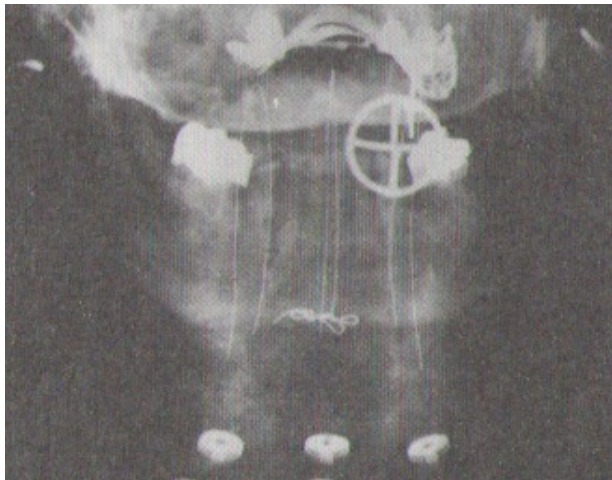
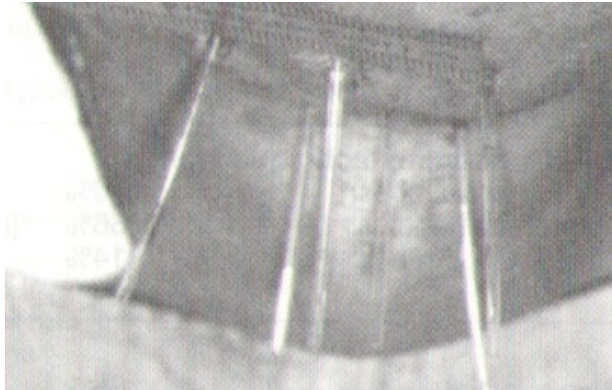
MODALITÀ DI IGBT

POSIZIONAMENTO CATETERI	DEFINIZIONE TARGET/OAR	DOSIMETRIA
2D	2D	2D
2D	2D	3D



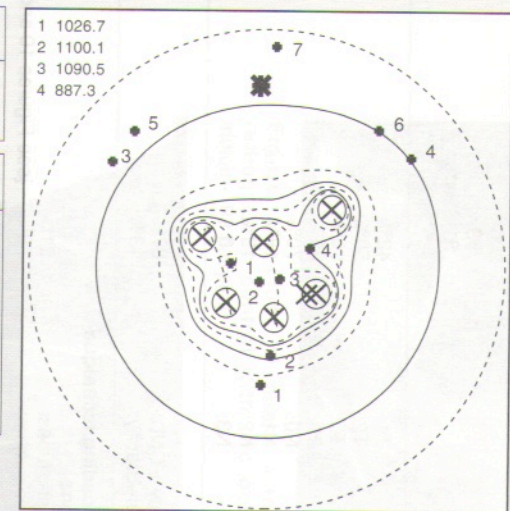
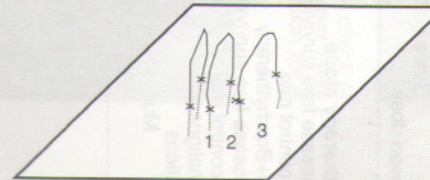
- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

Modalità IGBT: 2D/3D



Sources		L.Activ	T. App		Activite
NO	NAT	CM	J	H	muGyHM/cm
1	IR	12.6	1	0	5.03
2	IR	12.1	1	0	5.03
3	IR	12.3	1	0	5.03

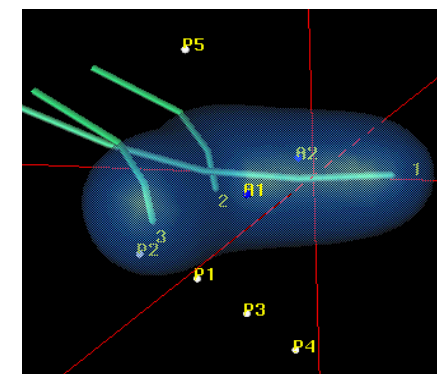
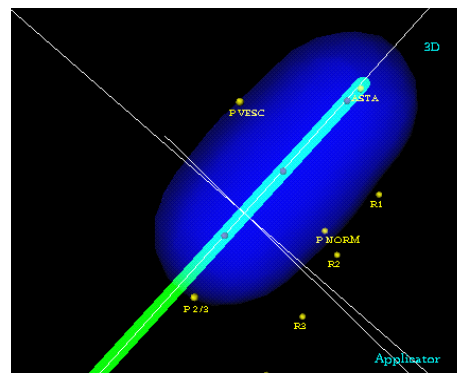
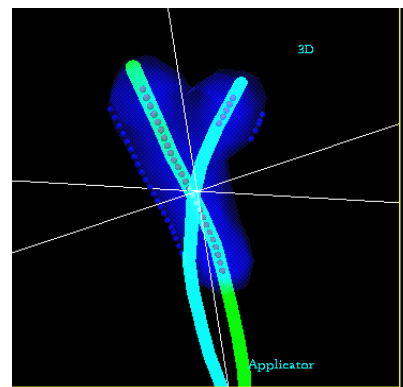
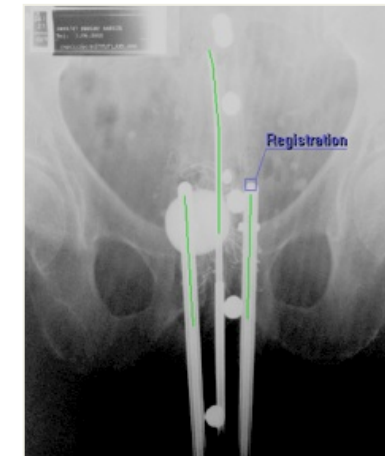
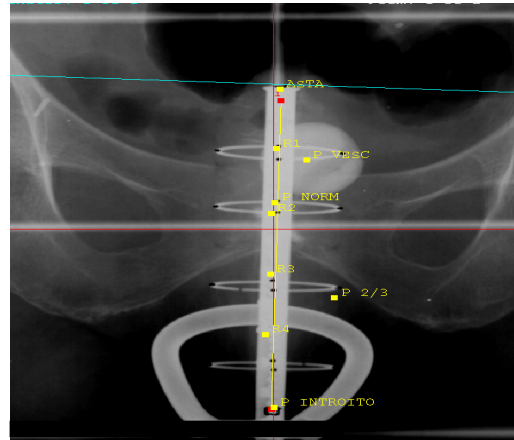
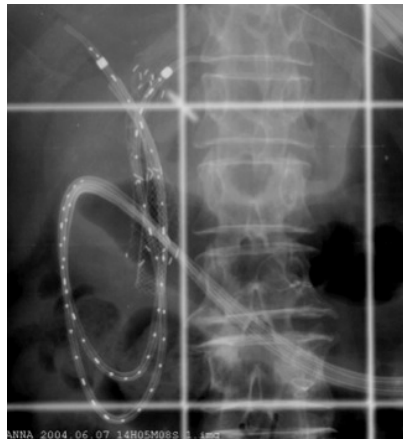
Reperes		
NO	Nom	Dose (cGy)
1	MENTON	225.7
2	SYMPHYSE	325.1
3	MAX D	151.8
4	MAX G	187.4
5	SS DIG D	143.8
6	SS DIG G	187.1
7	MOELLE	103.9
8	A	9549.9
9	B	14304.0
10	C	2853.7



8908466EF 28 09 89
E 28 9 89
PLAN Reperes Oblique POS. Plan = 0.00 AG. = 1.00
ISODOSES — 170 100 70 20 EN % DE DOSE DE REF. —
----- 120 85 50 10 872.2

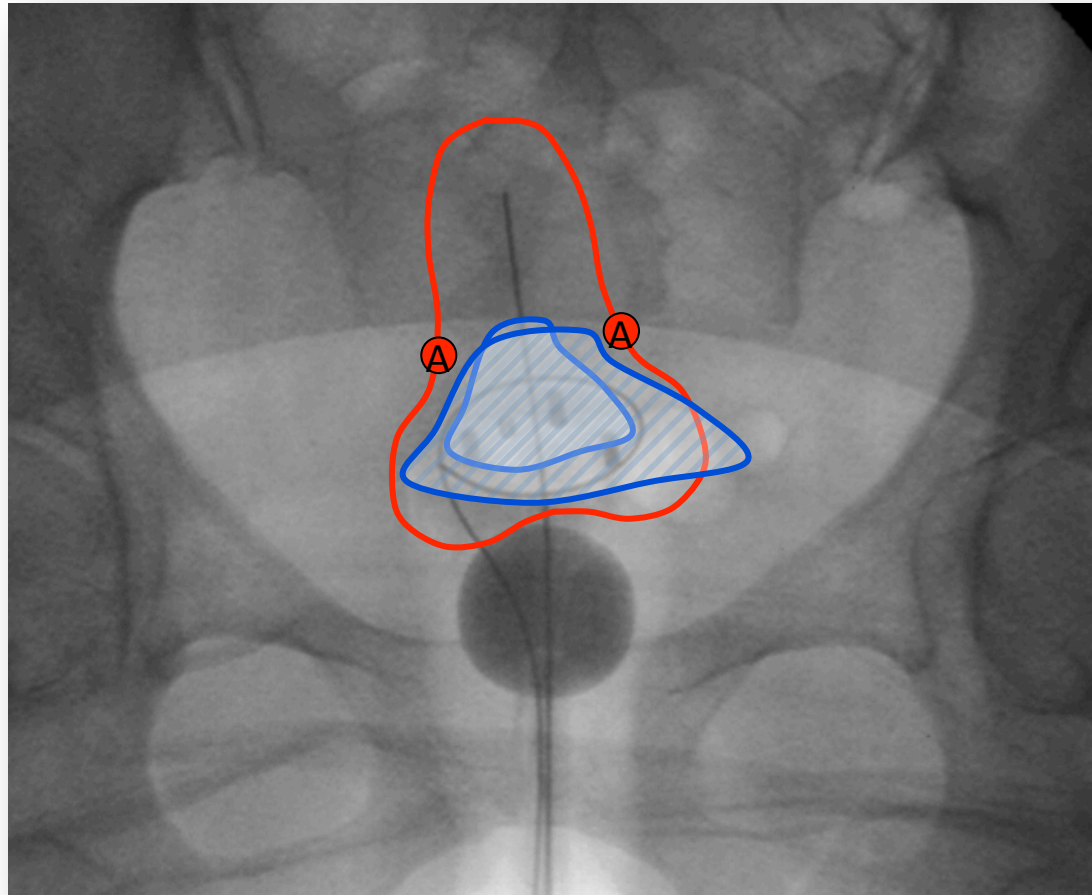


Modalità IGBT: 2D/3D



Modalità IGBT: CERVICE

2D/3D



Courtesy of Primož Petrič

MODALITÀ DI IGBT

POSIZIONAMENTO CATETERI	DEFINIZIONE TARGET/OAR	DOSIMETRIA
2D	2D	2D
2D	2D	3D
2D	3D	3D



- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

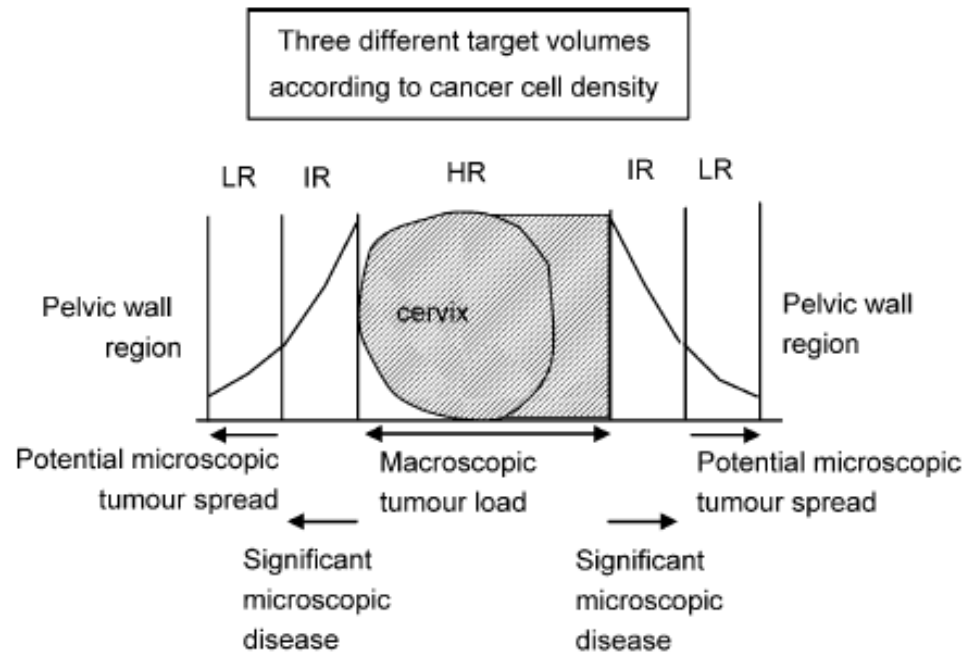
NUOVI APPLICATORI



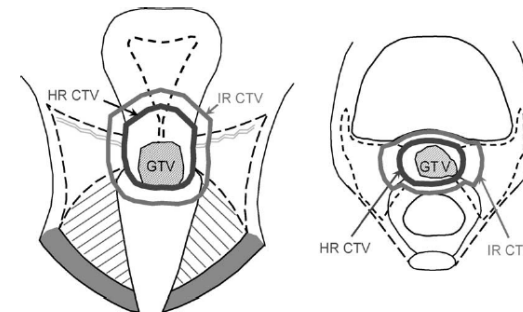
- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

Modalità IGBT: CERVICE

3D



HR: High risk CTV
 IR : Intermediate risk CTV
 LR: Low risk CTV

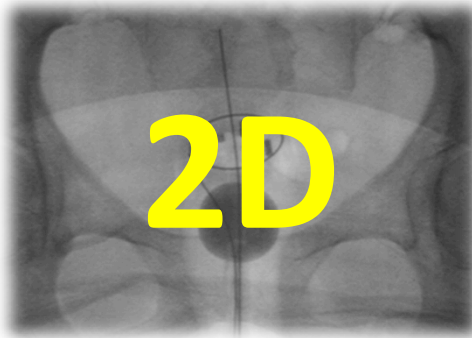


- Recommendations from Gynaecological (GYN) GEC-ESTRO Working Group (I): concepts and terms in 3D image based 3D treatment planning in cervix cancer brachytherapy with emphasis on MRI assessment of GTV and CTV. Haie-Meder C, Pötter R, Van Limbergen E, Briot E, De Brabandere M, Dimopoulos J, Dumas I, Hellebust TP, Kirisits C, Lang S, Muschitz S, Nevinson J, Nulens A, Petrow P, Wachter-Gerstner N; Gynaecological (GYN) GEC-ESTRO Working Group. Radiother Oncol. 2005 Mar;74(3):235-45.

Modalità IGBT: CERVICE

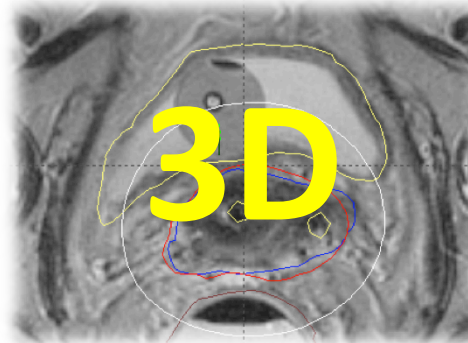
2D vs 3D

Controllo locale in IIb-IIIb



- *Pernot M, et al. Bull Cancer 1995; 82(7):568 – 81.*
- *Gerbaulet A, et al. The GEC ESTRO Handbook of Brachytherapy*
- *Perez CA, et al. Cancer 1984; 54: 235-46.*
- *Fletcher GH, et al. Textbook of radiotherapy. Philadelphia: 1980; 720-89.*
- *Pötter R, et al. Bull Cancer Radiother 2000; 4: 159 – 172.*
- *Horiot JC, et al. Int J Radiat Oncol Biol Phys 1988; 14(4): 605-11.*

40 - 75%



- *Pötter R. Radiother Oncol 2007*
- *Haie-Meder C. Radiother Oncol 2007*
- *Chargari C. IJROBP 2009*
- *Dimopoulos JCA. Radiother Oncol 2009*
- *Dimopoulos IJROBP 2009*
- *Fidarova EF et al. Radiother Oncol 2010*
- *Georg P et al. IJROBP 2009*

80 - 95%
minor tossicità



Modalità IGBT: CERVICE

TC o RM?

Structure	Visualization	
	At diagnosis	At brachytherapy
Applicator	—	100%
GTV _D	98%	—
GTV _{BT} and “grey zones”	—	98%
Cervical rim	37%	81%
Uterine corpus	98%	98%
Bladder wall	100%	98%
Rectal wall	67%	98%
Sigmoid colon wall	96%	98%
Vaginal wall	63%	98%
Pelvic side wall	100%	100%
Perirectal fascia	49%	59%

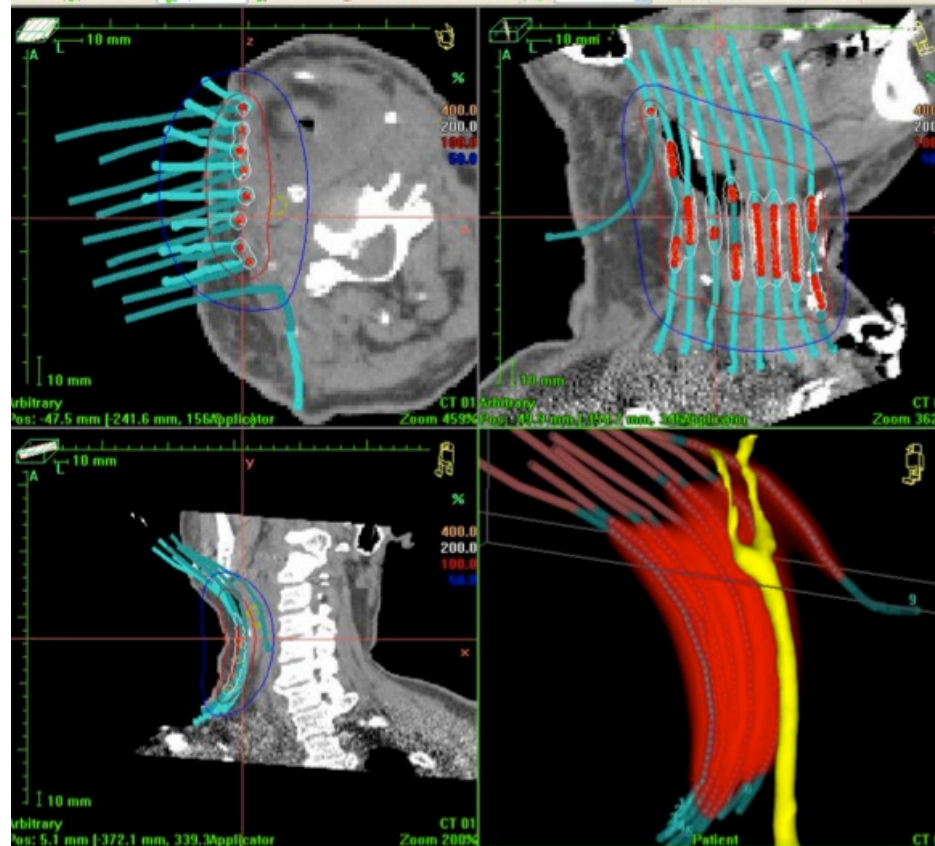
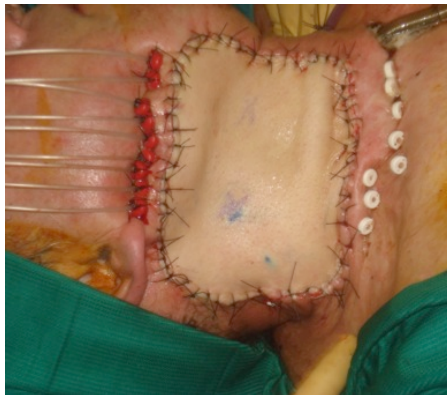
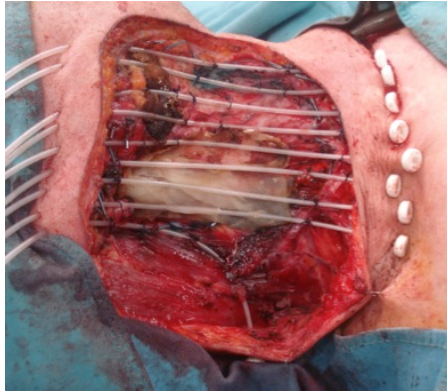
RISONANZA MAGNETICA : GOLD STANDARD



- Systematic evaluation of MRI findings in different stages of treatment of cervical cancer: potential of MRI on delineation of target, pathoanatomic structures, and organs at risk. Dimopoulos JC, Schard G, Berger D, Lang S, Goldner G, Helbich T, Pötter R. Int J Radiat Oncol Biol Phys. 2006 Apr 1;64(5):1380-8.

Modalità IGBT: TESTA E COLLO

3D



- Università Cattolica del Sacro Cuore – Policlinico Agostino Gemelli – Roma

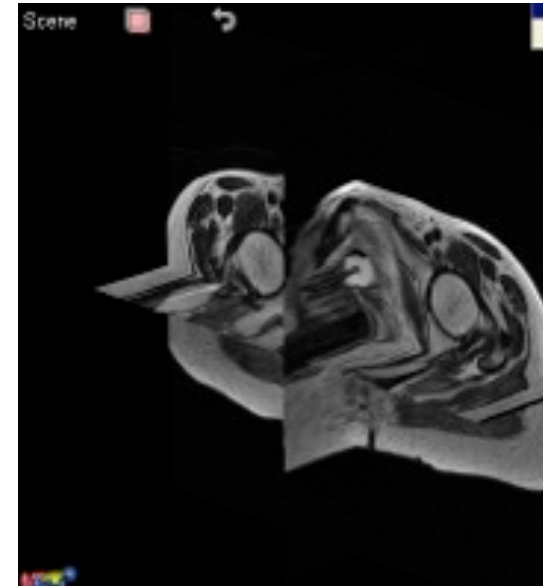
MODALITÀ DI IGBT

POSIZIONAMENTO CATETERI	DEFINIZIONE TARGET/OAR	DOSIMETRIA
2D	2D	2D
2D	2D	3D
2D	3D	3D
3D	3D	3D



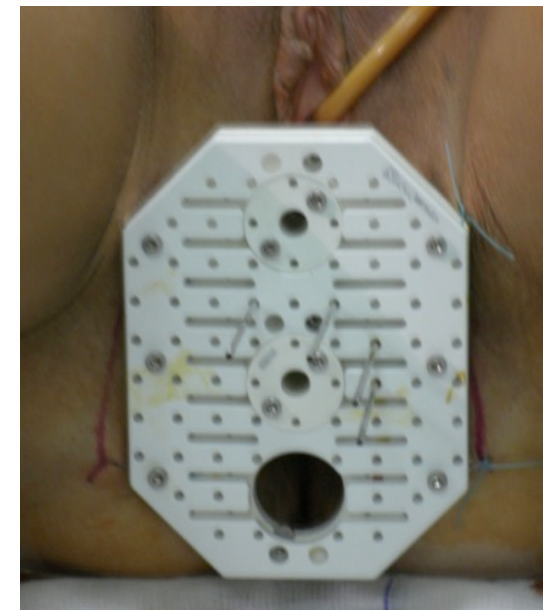
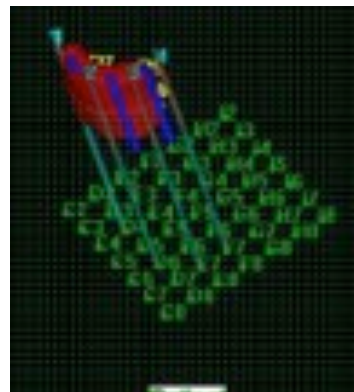
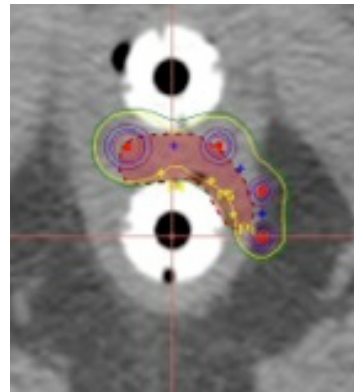
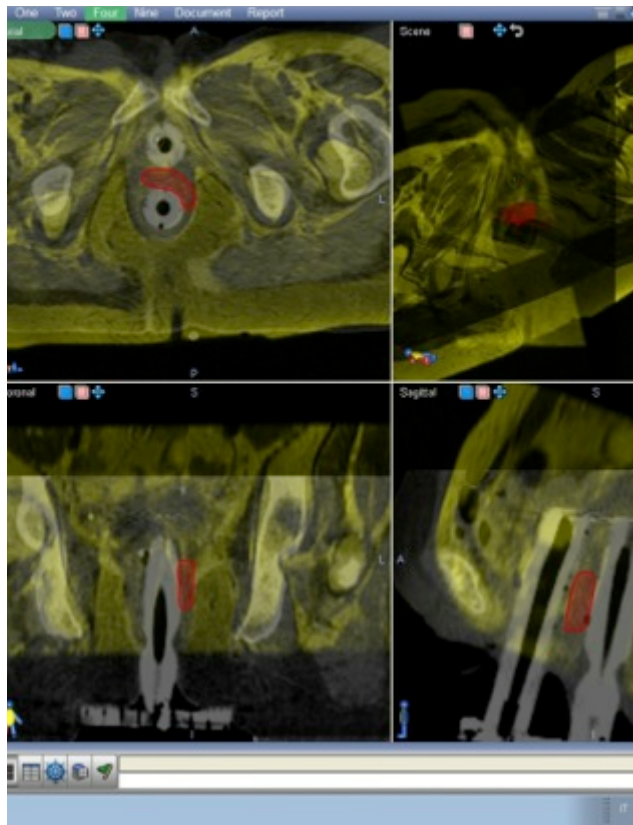
- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

Modalità IGBT: ANO RM-GUIDED BT



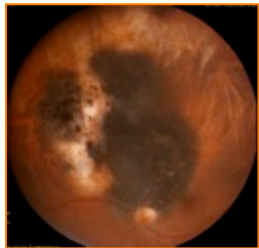
- La brachiterapia RM-guidata (RM-GBT) nel tumore del canale anale: studio preliminare dosimetrico e clinico - L. Tagliaferri, S. Manfrida, G.C. Mattiucci, M.M. Colangione, V. Masiello, S. Luzi, D. Smaniotto, B. Barbaro, A. Larghi, V. Valentini – Università Cattolica S. C. – Roma - Congresso AIRO 2013

Modalità IGBT: ANO RM-GUIDED BT

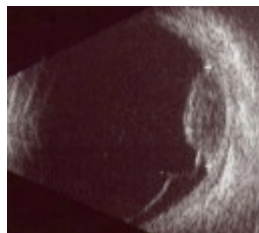


- La brachiterapia RM-guidata (RM-GBT) nel tumore del canale anale: studio preliminare dosimetrico e clinico - L. Tagliaferri, S. Manfrida, G.C. Mattiucci, M.M. Colangione, V. Masiello, S. Luzi, D. Smaniotto, B. Barbaro, A. Larghi, V. Valentini – Università Cattolica S. C. – Roma - Congresso AIRO 2013

Modalità IGBT: OCCHIO 3D



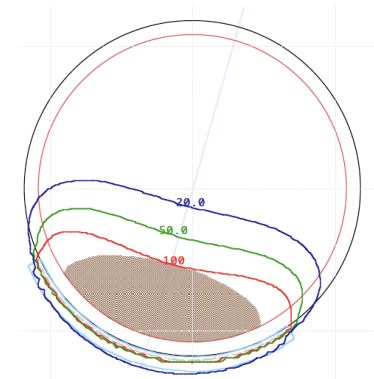
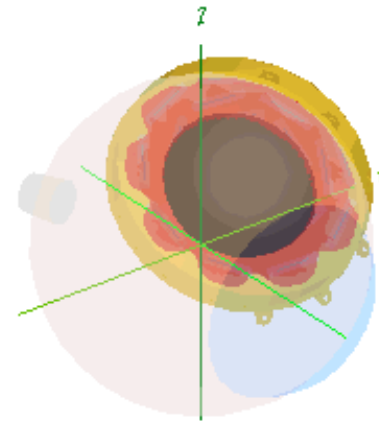
Panoret



Ecografia



MRI



**Piano di trattamento 3D
con controllo del posizionamento
della placca ecografico**



Ruthenium plaque brachytherapy for uveal melanoma. Smaniotto D., Diletto B., Fersino S., Azario L., Sammarco M.G., Pagliara M., Caputo M.C., Scupola A., D'Amico G., Tagliaferri L., Luzi S., Balestrazzi E., Blasi M.A., Cellini - 2011 - Università Cattolica S. C. – Roma - ESTRO Anniversary Congress - London

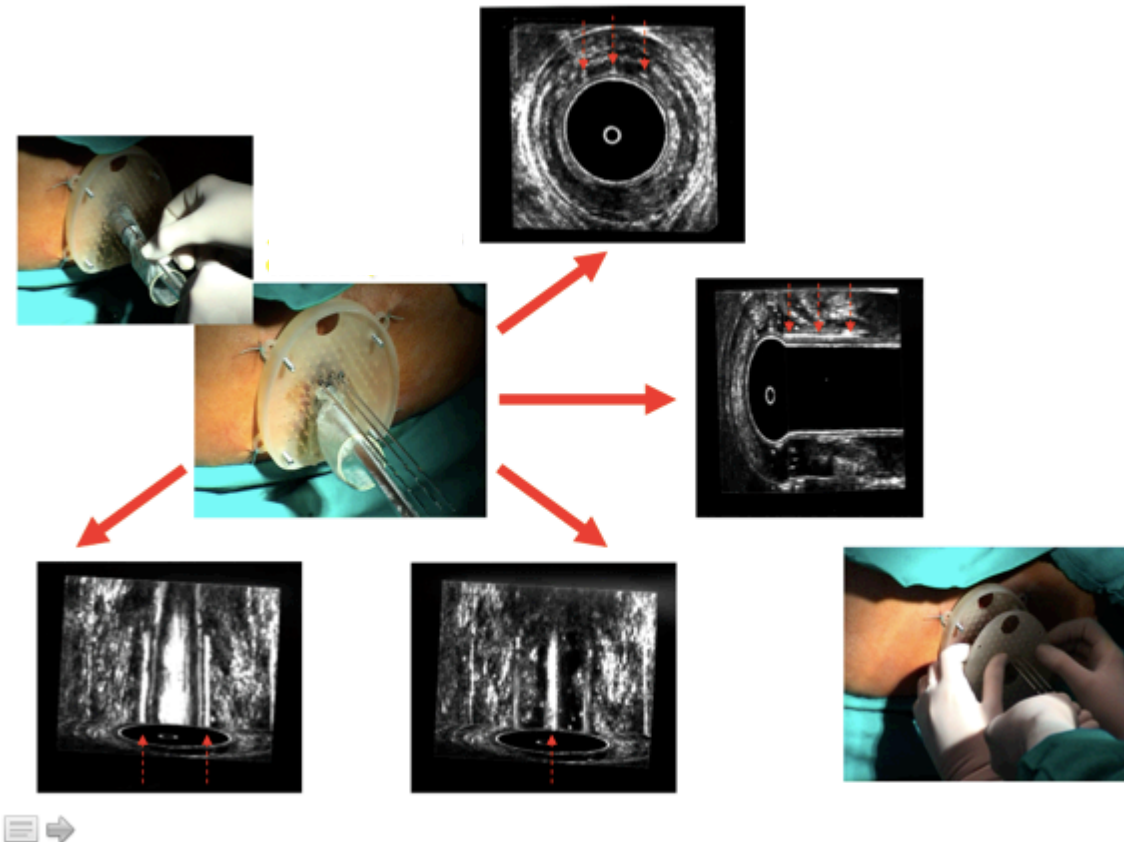
MODALITÀ DI IGBT

POSIZIONAMENTO CATETERI	DEFINIZIONE TARGET/OAR	DOSIMETRIA
2D	2D	2D
2D	2D	3D
2D	3D	3D
3D	3D	3D
4D	3D	3D



- *Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.*

Modalità IGBT: ANO US-GUIDED BT



- Uso di un nuovo applicatore per brachiterapia high dose rate (HDR-BT) ecoguidata nel tumore del canale anale: analisi a lungo termine di 16 pazienti S. Manfrida, L. Tagliaferri, M.M. Colangione, V. Masiello, A. Corbosiero, D. Smaniotto, S. Luzi, G.C. Mattiucci, A. Parello, C. Ratto -Università Cattolica S. C. – Roma - Congresso AIRO 2013

Modalità IGBT: ANO US-GUIDED BT

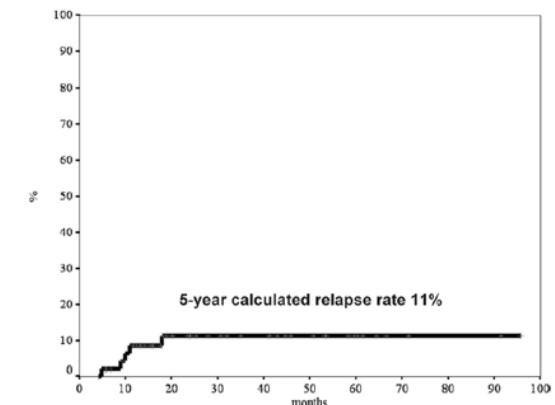
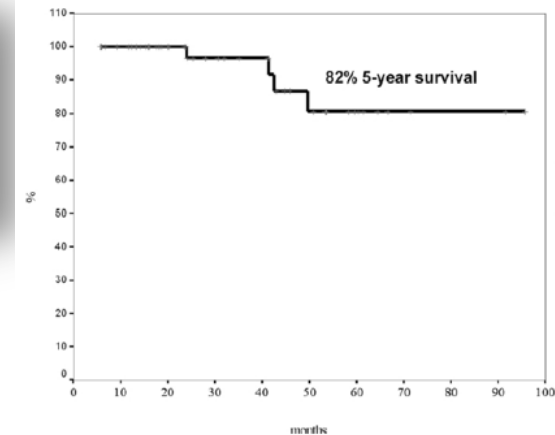
Multimodal therapy of anal cancer added by new endosonographic-guided brachytherapy

J. M. Doniec,^{1*} B. Schniewind,^{1*} G. Kovács,² V. Kahlke,¹ M. Loehnert,³ B. Kremer¹

US-guided brachytherapy

- is safe in terms of side effects
- in comparison to conventional brachytherapy

**IMPROVE LOCAL CONTROL
AND MINIMIZE MORBIDITY**

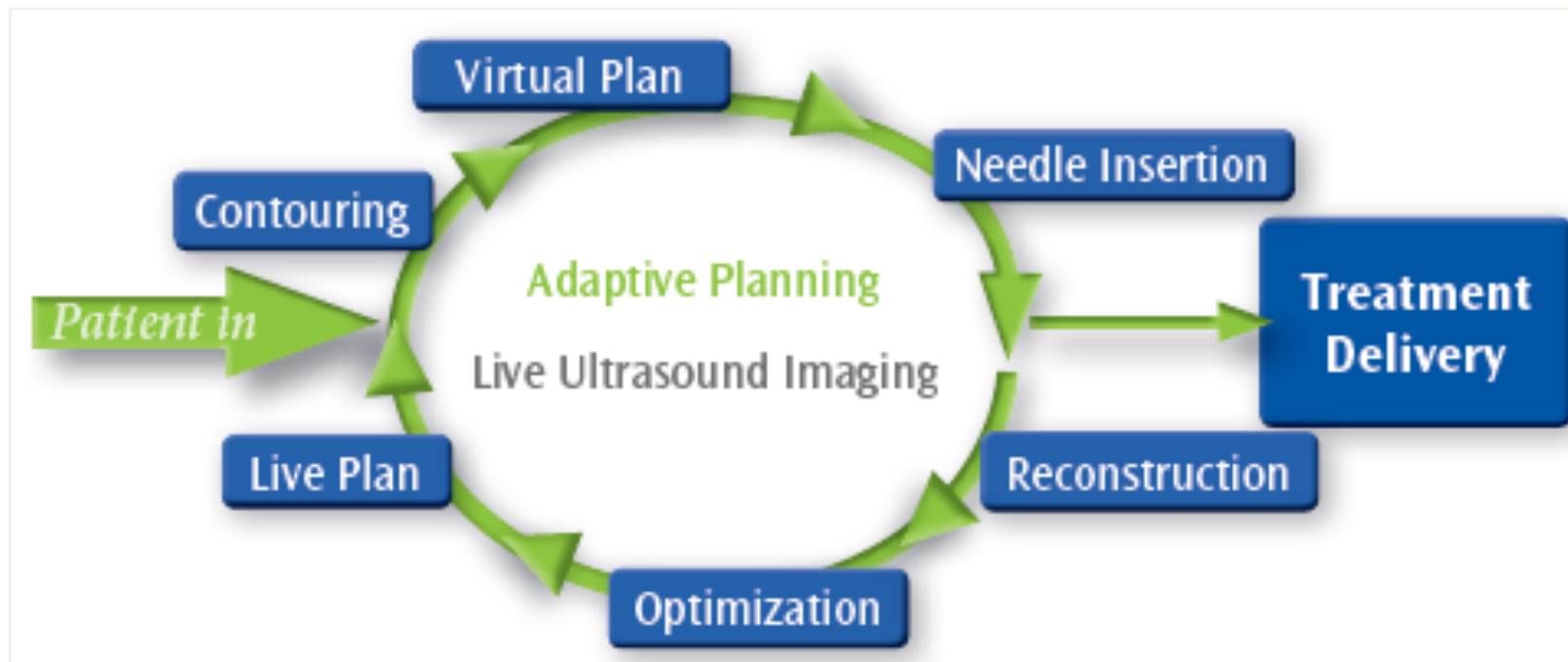


Surg Endosc. 2006 Apr;20(4):673-8. Epub 2006 Jan 21. Multimodal therapy of anal cancer added by new endosonographic-guided brachytherapy. Doniec JM, Schniewind B, Kovács G, Kahlke V, Loehnert M, Kremer B.

Modalità IGBT: PROSTATA

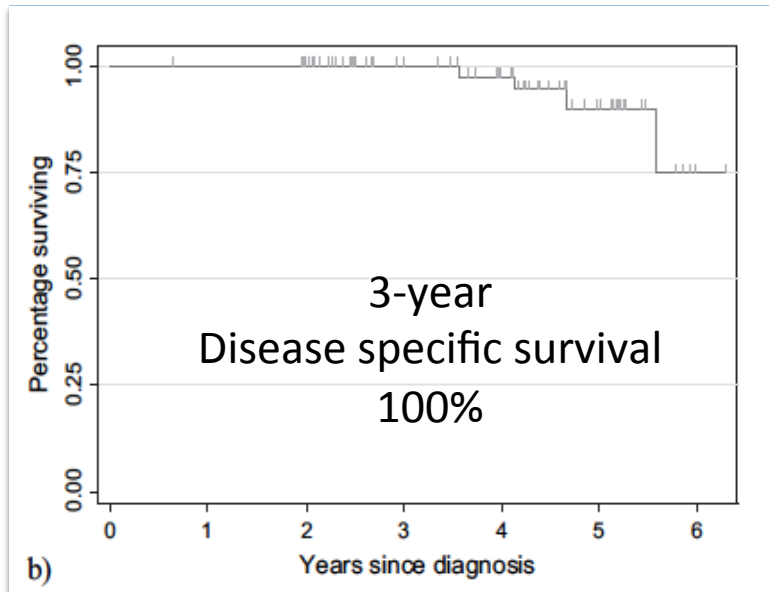
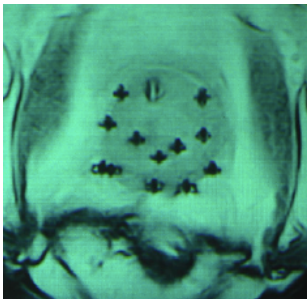
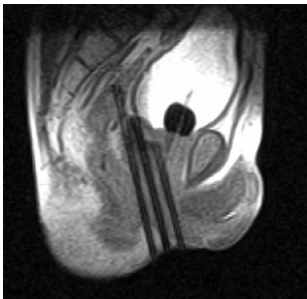
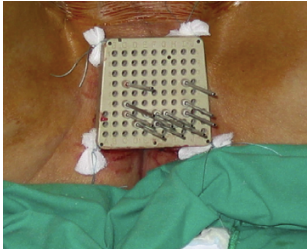
Interactive planning

US-GBT con “online real-time planning”



- Intraoperative planning and evaluation of permanent prostate brachytherapy: Report of the American brachytherapy society. Nag S, Ciezki JP, Cormack R, et al: Int J Radiat Oncol Biol Phys 51:1422-1430, 2001
- The American Brachytherapy Society recommendations for permanent prostate brachytherapy postimplant dosimetric analysis. Nag S, Bice W, DeWyngaert K, et al: Int J Radiat Oncol Biol Phys 46:221-230, 2000

Modalità IGBT: PROSTATA RM-GBT

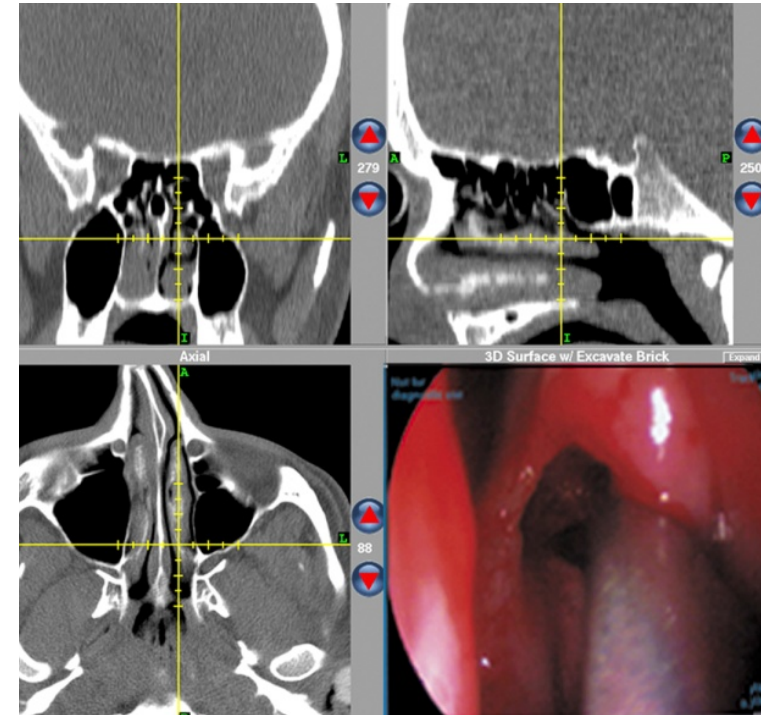
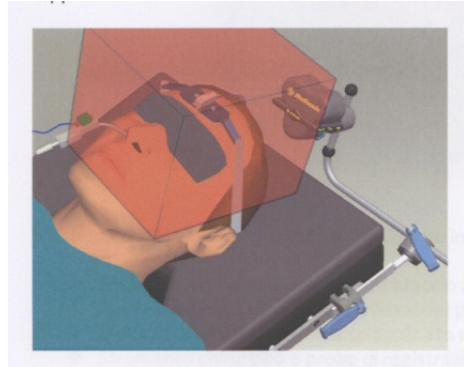
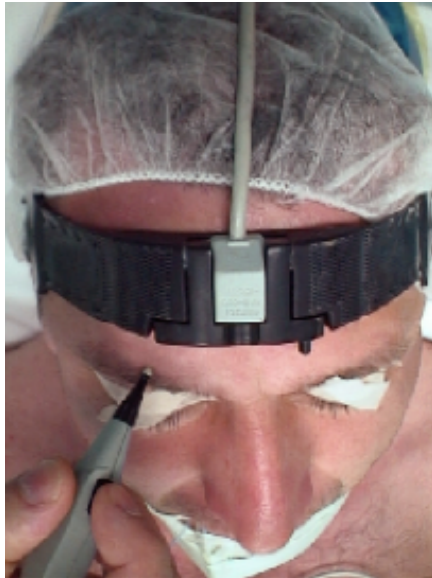


Authors (reference)	n	Grade ≥ 2 urinary toxicity (% risk)	Grade ≥ 2 low-GI toxicity (% risk)
Aström <i>et al.</i> (23)	214	36*	17*
Demanès <i>et al.</i> (24)	209	19 [†]	2 [§]
Duchesne <i>et al.</i> (25)	108	25*	11*
Galalae <i>et al.</i> (26)	144	6.2 [†]	11 [†]
Hoskin <i>et al.</i> (27)	109	40 [§]	20 [§]
Martin <i>et al.</i> (28)	102	12 [†]	7 [†]
Present study	77	8.5 [§]	5.5*



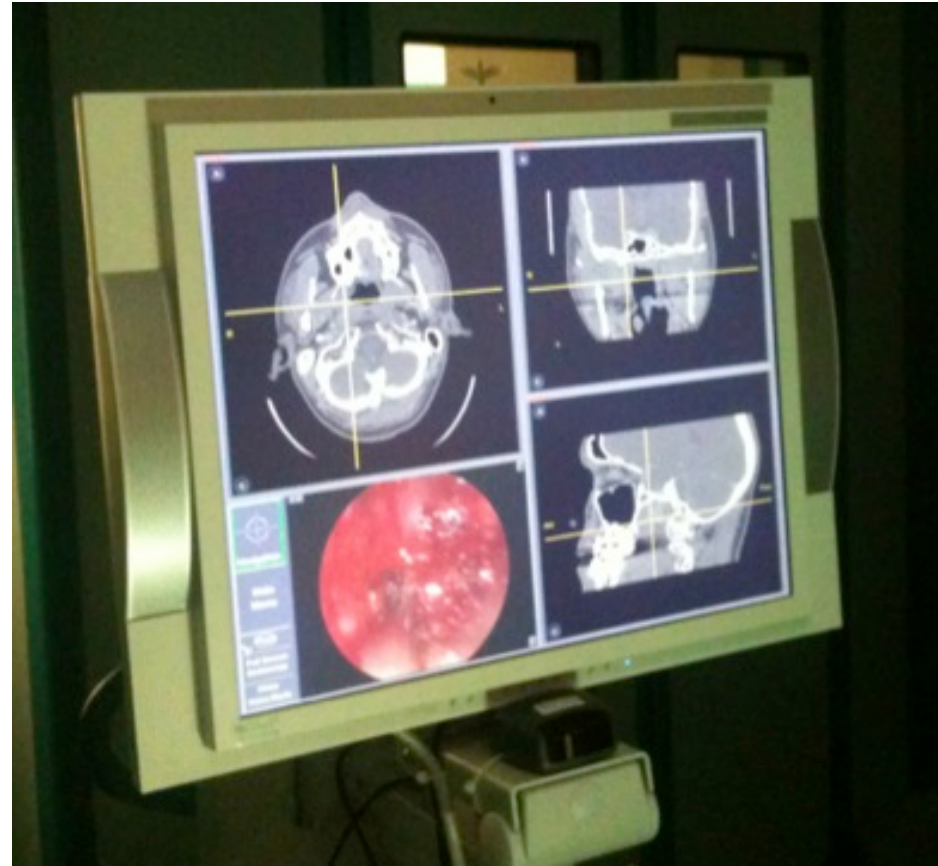
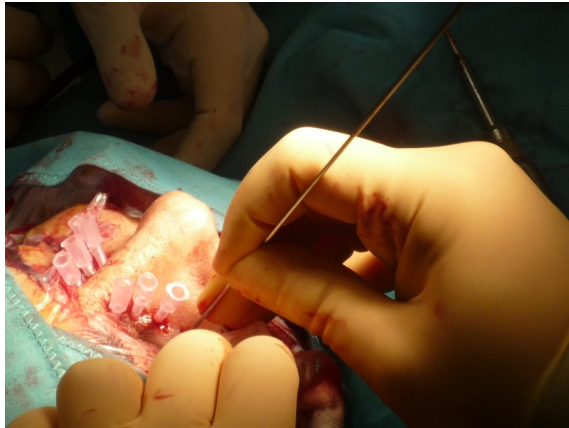
- Hypofractionated boost with high-dose-rate brachytherapy and open magnetic resonance imaging-guided implants for locally aggressive prostate cancer: a sequential dose-escalation pilot study. Ares C, Popowski Y, Pampallona S, Nouet P, Dipasquale G, Bieri S, Ozsoy O, Rouzard M, Khan H, Miralbell R. *Int J Radiat Oncol Biol Phys.* 2009 Nov 1;75(3):656-63. doi: 10.1016/j.ijrobp.2008.11.023. Epub 2009 Feb 26.

Endoscopic Guided Brachytherapy



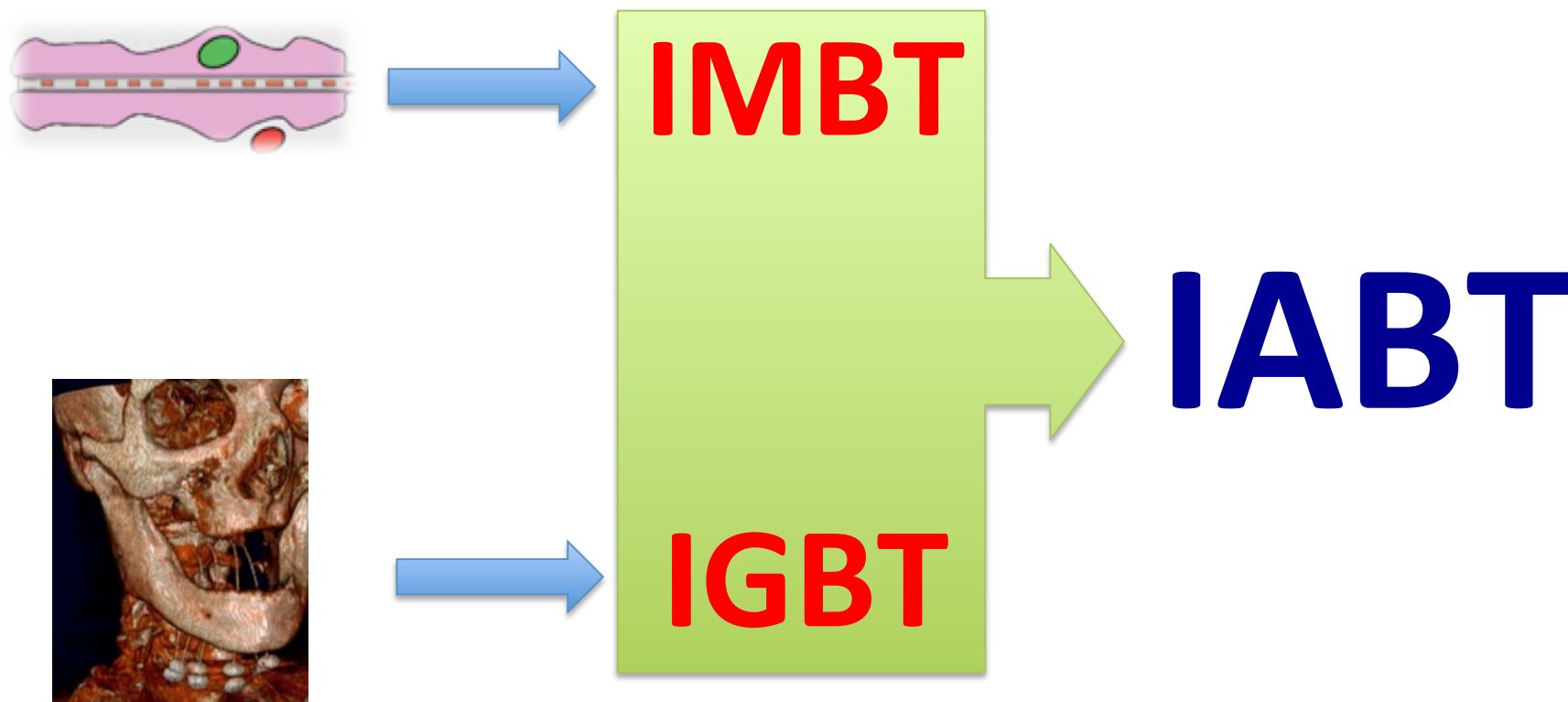
Brachiterapia guidata dall'endoscopia nelle recidive naso sinusali e nasofaringee: R. Autorino, L. Tagliaferri, F. Bussu, M. Rigante, F. Miccichè, N. Dinapoli, M.A. Gambacorta, G.C. Mattiucci, G. Chiloiro, J. Galli, G. Almadori, G. Paludetti, V. Valentini – Università Cattolica S. C. – Roma - Congresso AIRO 2013

Endoscopic Guided Brachytherapy



Brachiterapia guidata dall'endoscopia nelle recidive naso sinusali e nasofaringee: R. Autorino, L. Tagliaferri, F. Bussu, M. Rigante, F. Miccichè, N. Dinapoli, M.A. Gambacorta, G.C. Mattiucci, G. Chiloiro, J. Galli, G. Almadori, G. Paludetti, V. Valentini - Università Cattolica S. C. – Roma - Congresso AIRO 2013

IMAGE-ADAPTED BRACHYTHERAPY

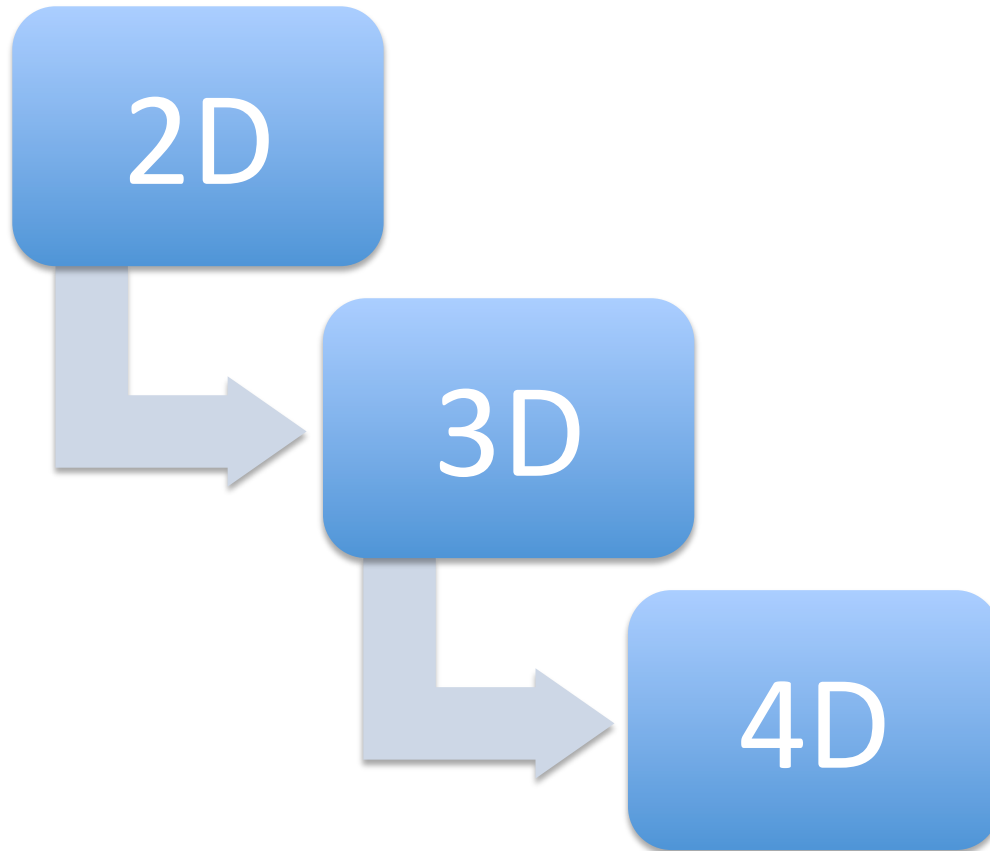


Courtesy of prof. G. Kovacs



- Brachytherapy for the treatment of head and neck cancer. Meyer JE, Brocks C, Maune S, Strnad V, Werner JA, Wollenberg B, Kovács G. HNO. 2010 Sep;58(9):947-58.
- Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. Semin Radiat Oncol. 2006 Oct;16(4):209-17.
- Image guided, adaptive, accelerated, high dose brachytherapy as model for advanced small volume radiotherapy. Haie-Meder C, Siebert FA, Pötter R. Radiother Oncol. 2011 Sep;100(3):333-43.
- High-dose-rate (HDR) or pulsed-dose-rate (PDR) perioperative interstitial intensity-modulated brachytherapy (IMBT) for local recurrences of previously irradiated breast or thoracic wall following breast cancer.

IMAGE-ADAPTED BRACHYTHERAPY

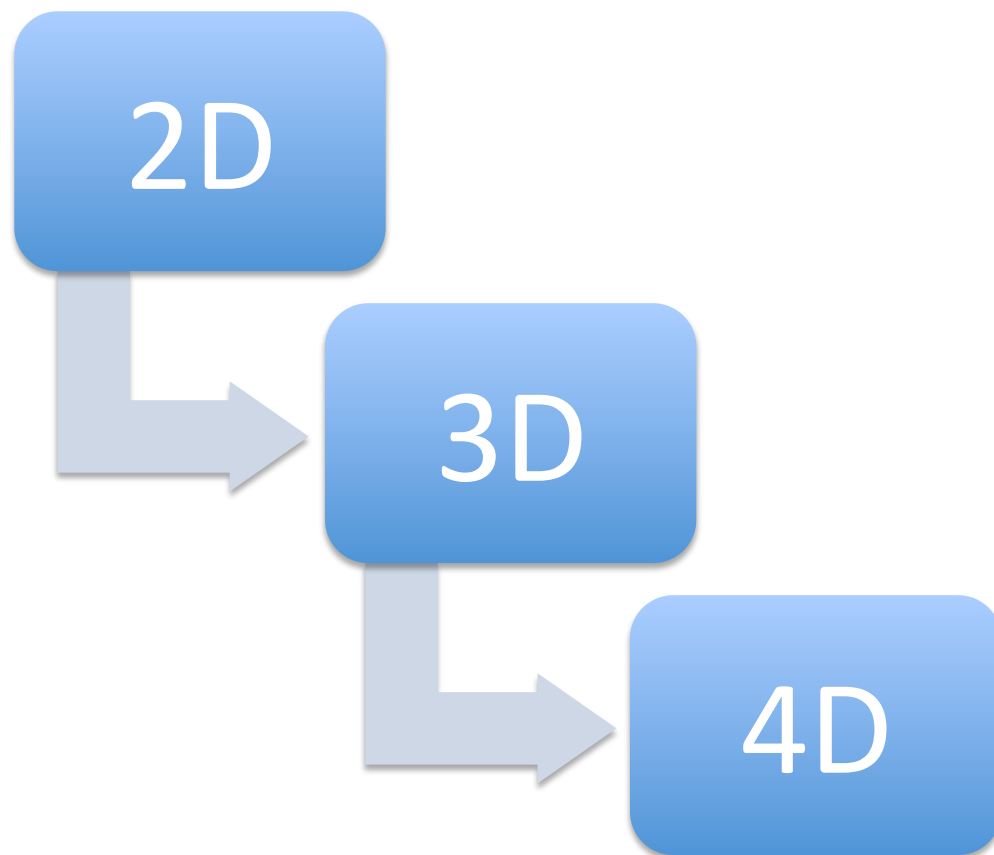


**PROCEDURE
COMPLEXE**



- Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. *Semin Radiat Oncol.* 2006 Oct;16(4):209-17.
- Current brachytherapy quality assurance guidance: does it meet the challenges of emerging image-guided technologies? Williamson JF. *Int J Radiat Oncol Biol Phys.* 2008
- Multimodal therapy of anal cancer added by new endosonographic-guided brachytherapy. Doniec JM, Schniewind B, Kovács G, Kahlke V, Loehnert M, Kremer B. *Surg Endosc.* 2006 Apr;20(4):673-8. Epub 2006 Jan 21.

IMAGE-ADAPTED BRACHYTHERAPY



**NOTEVOLE
MIGLIORAMENTO
OUTCOMES**



- Innovative technologies in radiation therapy: brachytherapy. Hoskin PJ, Bownes P. *Semin Radiat Oncol*. 2006 Oct;16(4):209-17.
- Current brachytherapy quality assurance guidance: does it meet the challenges of emerging image-guided technologies? Williamson JF. *Int J Radiat Oncol Biol Phys*. 2008
- Multimodal therapy of anal cancer added by new endosonographic-guided brachytherapy. Doniec JM, Schniewind B, Kovács G, Kahlke V, Loehnert M, Kremer B. *Surg Endosc*. 2006 Apr;20(4):673-8. Epub 2006 Jan 21.



*Università Cattolica del Sacro Cuore
Policlinico "Agostino Gemelli" - Roma
Divisione di Radioterapia Oncologica*

