


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

 Associazione Italiana  
Radioterapia e Oncologia clinica

 Società Italiana di Radiobiologia

 Associazione  
Italiana  
Radioterapia  
e Oncologia  
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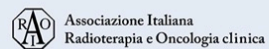
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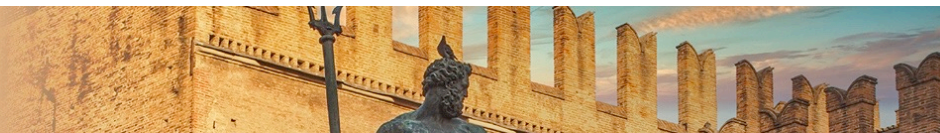
## LE SFIDE FUTURE DELLA RADIOTERAPIA TRA INNOVAZIONE, CLINICA E SOSTENIBILITÀ: RADIOTERAPIA INTERVENTISTICA



Lisa Vicenzi

Azienda Ospedaliera Universitaria delle Marche





## DICHIARAZIONE

Relatore: LISA VICENZI

- Posizione di dipendente in aziende con interessi commerciali in campo sanitario
- Consulenza ad aziende con interessi commerciali in campo sanitario
- Fondi per la ricerca da aziende con interessi commerciali in campo sanitario
- Partecipazione ad Advisory Boards di aziende con interessi commerciali in campo sanitario
- Titolarità di brevetti o licenze di brevetto ad aziende con interessi commerciali in campo sanitario
- Partecipazione in società con interessi commerciali in campo sanitario
- Altro

**NOTHING TO DECLARE**

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ESTRO2022

14:15

Introduction

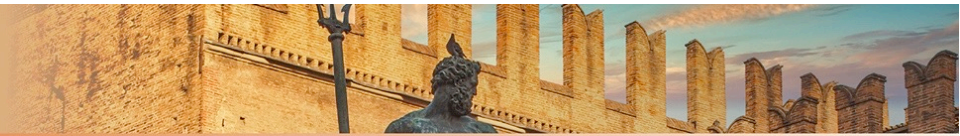
## Pitch Session

Vote via the congress app and online platform

*This house believes that brachytherapy is a dying art*



06 May 2022 - 10 May 2022  
Copenhagen, Denmark



## IRT DECLINE

The cause of this decline is multifactorial:

- Logistical challenges
- Advanced high-tech EBRT techniques
- Lower reimbursement
- Insufficient training of radiation oncology residents



### The Cost-Effectiveness and Value Proposition of Brachytherapy

Charles C. Vu, MD, Maha S. Jawad, MD, and Daniel J. Krauss, MD

Semin Radiat Oncol. 2020 Jan;30(1):87-93.



### Curiethérapie : quand les indications dépassent l'offre de soins

Sophie Espenel<sup>1,2</sup>, Elaine Limkin<sup>2</sup>, Max-Adrien Garcia<sup>3</sup>, Julien Langrand-Escure<sup>1</sup>, Alexis Vallard<sup>1</sup>, Cyrus Chargari<sup>2</sup>, Nicolas Magné<sup>1</sup>

Bull Cancer 2019; 106: 584–589

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## AIRO – IRT WORKING GROUP



Journal of Contemporary  
**BRACHYTHERAPY**



Official Journal of Polish Brachytherapy Society /// [www.brachyterapia.com](http://www.brachyterapia.com) and Indian Brachytherapy Society /// [www.indianbrachytherapy.org](http://www.indianbrachytherapy.org)

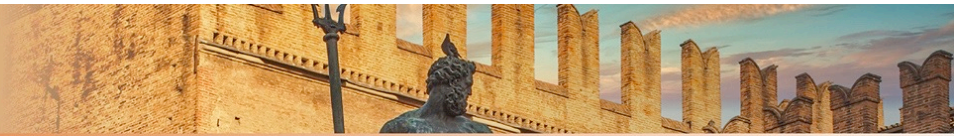
Review Papers

Review paper

### A national survey of AIRO (Italian Association of Radiation Oncology) brachytherapy (Interventional Radiotherapy) study group

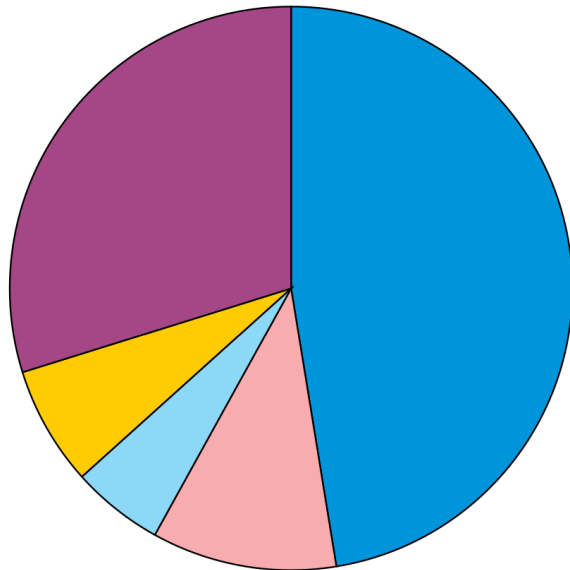
Rosa Autorino, MD, PhD<sup>1</sup>, Lisa Vicenzi, MD<sup>2</sup>, Luca Tagliaferri, MD, PhD<sup>1</sup>, Carlo Soatti, MD<sup>3</sup>, Prof. György Kovacs, MD, PhD<sup>4</sup>, Cynthia Aristei, MD<sup>5</sup>

J Contemp Brachytherapy 2018; 10, 3: 254–259



## AIRO – IRT WORKING GROUP

### Clinical survey among all the Italian centers



- Lack of personnel (47%)
- Lack of expertise (11%)
- The need to update equipment (5%)
- TIME consuming (7%)
- Not specified (30%)

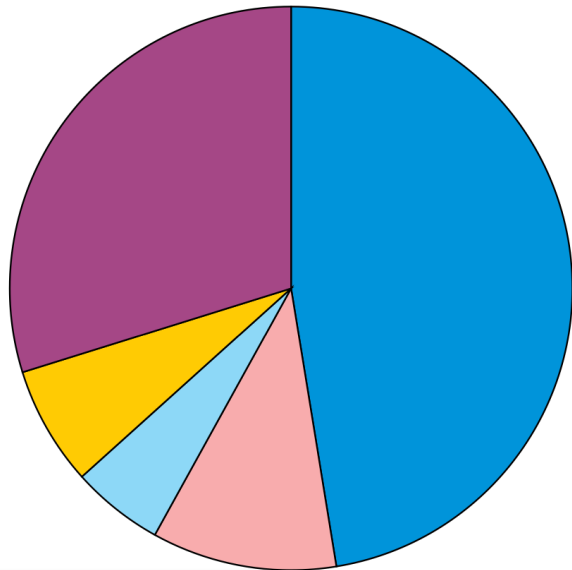
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						2D	3D	Radical	Palliative	
Vagina	31	1089	1041	48	0	3	28	1071	18	CT = 28 RX = 3 MRI = 0 US = 0
Utero-vaginal	26	879	821	58	0	0	26	863	16	CT = 25 RX = 0 MRI = 1 US = 0
Prostate	11	268	59	0	209	1	10	268	0	CT = 0 RX = 0 MRI = 0 US = 11
Breast	6	84	84	0	0	0	6	84	0	CT = 6 RX = 0 MRI = 0 US = 0
Anus	10	38	36	2	0	0	10	82	2	CT = 8 RX = 1 MRI = 1 US = 0
Rectum	4	4	4	0	0	0	4	3	1	CT = 4 RX = 0 MRI = 0 US = 0
Head and neck	6	36	36	0	0	0	6	30	6	CT = 6 RX = 0 MRI = 0 US = 0
Bile ducts	4	7	7	0	0	1	3	4	3	CT = 3 RX = 1 MRI = 0 US = 0
Esophagus	9	35	35	0	0	3	6	23	12	CT = 6 RX = 3 MRI = 0 US = 0
Skin	16	206	206	0	0	6	10	203	3	CT = 10 RX = 3 MRI = 0 US = 3
Choroidal Melanoma	5	115	0	0	115	3	2	115	0	CT = 0 RX = 0 MRI = 0 US = 5
BRONCHUS	9	36	36	0	0	4	5	21	15	CT = 5 RX = 4 MRI = 0 US = 0

Autorino et al. J Contemp Brachytherapy 2018; 10, 3: 254–259



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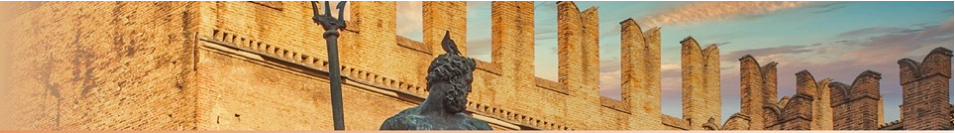


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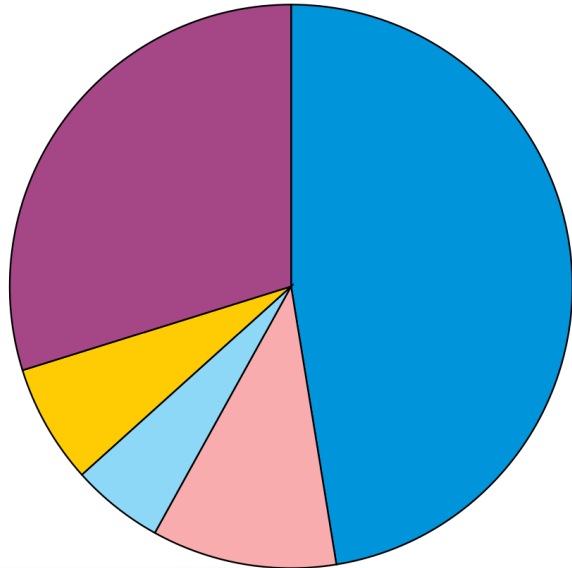
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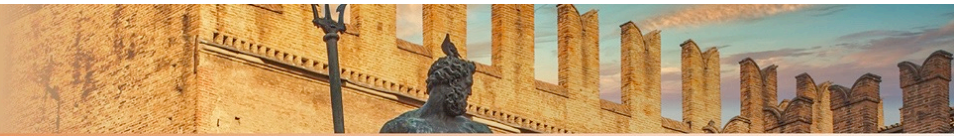
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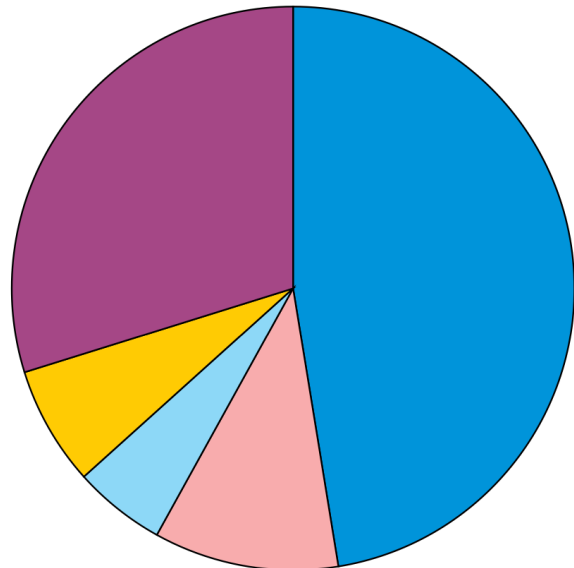
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Journal of Contemporary  
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Educational Article

Original paper

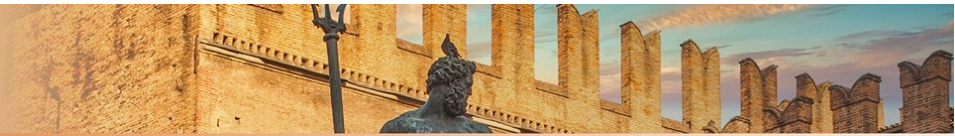
### Can brachytherapy be properly considered in the clinical practice? Trilogy project: The vision of the AIRO (Italian Association of Radiotherapy and Clinical Oncology) Interventional Radiotherapy study group

Luca Tagliaferri, MD, PhD<sup>1</sup>, Andrea Vavassori, MD<sup>2</sup>, Valentina Lancellotta, MD<sup>1</sup>, Vitaliana De Sanctis, MD<sup>3</sup>,  
Fernando Barbera, MD<sup>4</sup>, Vincenzo Fusco, MD<sup>5</sup>, Cristiana Vidali, MD<sup>6</sup>, Bruno Fionda, MD<sup>1</sup>, Giuseppe Colloca, MD<sup>1</sup>,  
Maria Antonietta Gambacorta, MD, PhD<sup>1,7</sup>, Cynthia Aristei, MD<sup>8</sup>, Renzo Corvò, MD<sup>9</sup>, Stefano Maria Magrini, MD<sup>4</sup>

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Fernando Barbato, MD<sup>4</sup>, Vincenzo Fusco, MD<sup>5</sup>, Cristiano Vesik, MD<sup>6</sup>, Bruno Fiorino, MD<sup>7</sup>, Giuseppe Colloco, MD,  
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### MISSION

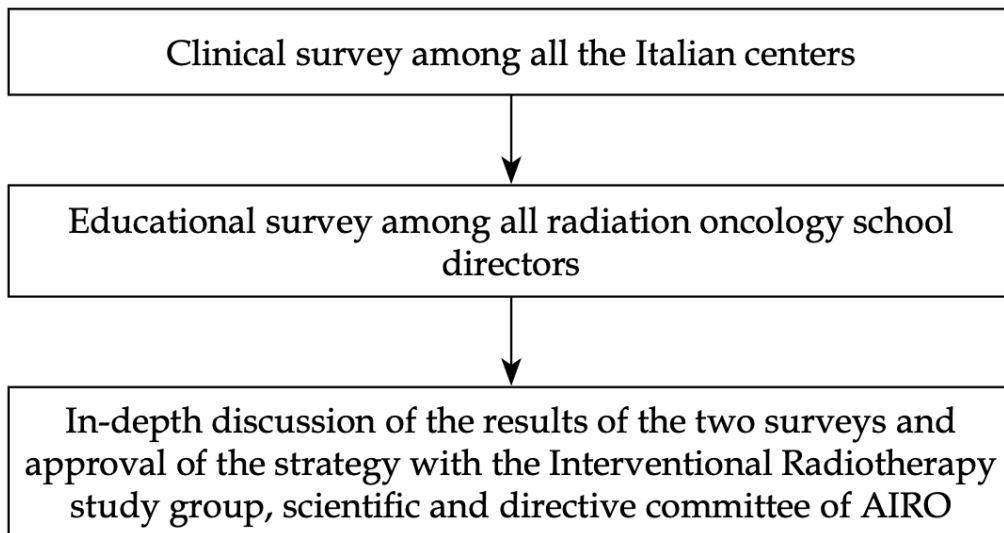
to promote **projects and activities** in the field of  
**Interventional Radiation Therapy (BT and IORT)** addressing  
**clinical issues and technological innovation** in a  
**multidisciplinary and multiprofessional perspective**

Tagliaferri et al. J Contemp Brachytherapy 2020; 12, 1: 84–89



## AIRO – IRT WORKING GROUP TRILOGY PROJECT

### VISION



Review Papers

Review paper

**A national survey of AIRO (Italian Association of Radiation Oncology) brachytherapy (Interventional Radiotherapy) study group**

Rosa Autorino, MD, PhD<sup>1</sup>, Lisa Vicenzi, MD<sup>2</sup>, Luca Taglioferrì, MD, PhD<sup>1</sup>, Carlo Soatti, MD<sup>3</sup>, Prof. György Kovacs, MD, PhD<sup>4</sup>, Cynthia Aristei, MD<sup>5</sup>

Review Papers

Review paper

**Current state of interventional radiotherapy (brachytherapy) education in Italy: results of the INTERACTS survey**

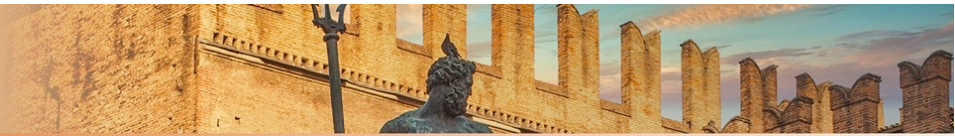
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Educational Article

Original paper

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Luca Taglioferrì, MD, PhD<sup>1</sup>, Andrea Vassoski, MD<sup>2</sup>, Valentina Lanzetta, MD<sup>1</sup>, Vitaliana De Santis, MD<sup>3</sup>, Fernando Barbera, MD<sup>4</sup>, Vincenzo Fusco, MD<sup>5</sup>, Cristiano Vicoli, MD<sup>6</sup>, Bruno Fiorino, MD<sup>7</sup>, Giuseppe Caloca, MD<sup>8</sup>, Maria Antonietta Gambaccorta, MD, PhD<sup>9</sup>, Cynthia Aristei, MD<sup>10</sup>, Renzo Corvò, MD<sup>11</sup>, Stefano Maria Magrini, MD<sup>12</sup>



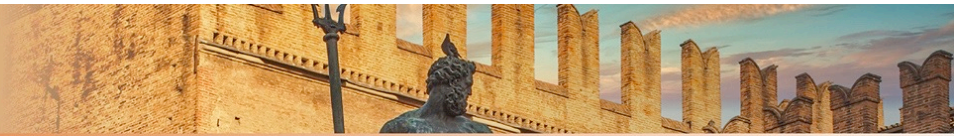
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**Table 2.** Domains, issues, and relative solutions (accomplished or in progress) proposed according to the defined strategy

Domain	Issues	AIRO defined strategy
Clinical practice	Inadequate evidence about the role of BT in national clinical guidelines	Inclusion of representatives of IRT study group within the committees for the discussion of national guidelines Inclusion of IRT study group members in the AGENAS working group for national PDTA Series of systematic reviews and scientific papers Promoting synergies with other scientific societies
Education	Need for an adequate training (especially in residency programs)	Consensus conference promotion Training meeting promotion University Master promotion
Research	Difficulties in creating a network to gather strong evidence	Support to the COBRA project born in the framework of the GEC-ESTRO for a wide international research database
Communication	Difficulties in communication with other specialists, patients, and also institutional representatives	Development of specific printed or web-based booklets for patients The term “interventional radiotherapy” was introduced in the name of the study group and in routine clinical practice

*AIRO – Italian Association of Radiotherapy and Clinical Oncology, AGENAS – National Agency for Regional Sanitary Services, PDTA – Pathway Diagnostic Therapeutic Assistential, COBRA – Consortium for BRachytherapy data Analysis*

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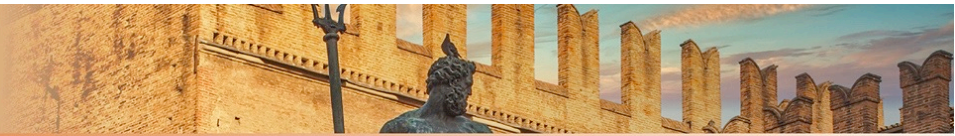
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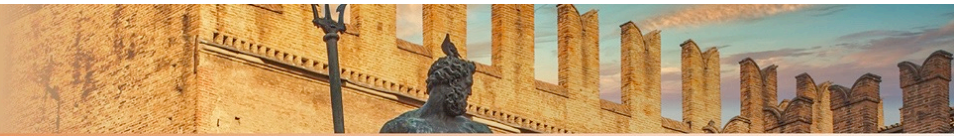
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## TRILOGY PROJECT CLINICAL PRACTICE

Domain	Issues	AIRO defined strategy
Clinical practice	Inadequate evidence about the role of BT in national clinical guidelines	Inclusion of representatives of IRT study group within the committees for the discussion of <u>national guidelines</u> Inclusion of IRT study group members in the AGENAS working group for national PDTA Series of <u>systematic reviews and scientific papers</u> Promoting <u>synergies</u> with other scientific societies



**IORT**

Review paper

### The role of vaginal brachytherapy in stage I endometrial serous cancer: a systematic review

Valentina Lancellotta, MD<sup>1</sup>, Francesca De Felice, MD, PhD<sup>2</sup>, Lisa Vicenzi, MD, PhD<sup>3</sup>, Alfredo Antonacci, MD<sup>4</sup>,  
Valentina Carbonechi, MD<sup>5</sup>, Sara Costantini, MD<sup>6</sup>, Daniela di Cristina, MD<sup>7</sup>, Luca Tagliaferrì, MD, PhD,  
Annamaria Cerrotto, MD<sup>8</sup>, Andrea Vavassori, MD<sup>9</sup>, Sergio Girbaudo, MD<sup>9</sup>, Alessandro Colombo, MD<sup>10</sup>,  
Francesco Lucà, MD<sup>11</sup>, Raffaele Barbara, MD<sup>12</sup>, Monica Mangani, MD, PhD<sup>13</sup>, Francesco Maranzan, MD, PhD<sup>14</sup>,  
Daniela IM, Mattia Falk

### Adjuvant vaginal interventional radiotherapy in early-stage non-endometrioid carcinoma of corpus uteri: a systematic review

Francesca De Felice, MD, PhD, Valentina Lancellotta, MD<sup>2</sup>, Lisa Vicenzi, MD, PhD<sup>3</sup>, Sara Costantini, MD<sup>4</sup>,  
Alfredo Antonacci, MD<sup>5</sup>, Valentina Carbonechi, MD<sup>6</sup>, Daniela di Cristina, MD<sup>7</sup>, Luca Tagliaferrì, MD, PhD<sup>8</sup>,  
Annamaria Cerrotto, MD<sup>9</sup>, Andrea Vavassori, MD<sup>10</sup>, Sergio Girbaudo, MD<sup>11</sup>, Alessandro Colombo, MD<sup>12</sup>,  
Francesco Lucà, MD<sup>13</sup>, Raffaele Barbara, MD<sup>14</sup>, Monica Mangani, MD, PhD<sup>15</sup>, Francesco Maranzan, MD, PhD,  
Daniela Musà, MD<sup>16</sup>, Filippo Ballati, MD, PhD<sup>17</sup>, Ilary Busato, MD<sup>18</sup>, Francesco Iorio, MD<sup>19</sup>, Vincenzo Tombolini, MD,  
Matteo Falchetti, MD<sup>20</sup>, Vitaliana De Sanctis, MD<sup>21</sup>

Review Papers

European Review for Medical and Pharmacological Sciences | 2020; 24: 7589-7597

### The role of interventional radiotherapy (brachytherapy) in stage I esophageal cancer: an AIRO (Italian Association of Radiotherapy and Clinical Oncology) systematic review

V. LANCELOTTA<sup>1</sup>, F. CELI<sup>2</sup>,  
F. FUSCO<sup>3</sup>, F. FRASSINE<sup>4</sup>,  
D. FRANCO<sup>5</sup>, D. GENOVE

**BT**

### INTERACTS (INTERventional Radiotherapy Teaching School) consensus conference on interventional radiotherapy (brachytherapy) endorsed by AIRO (Italian Association of Radiotherapy and Clinical Oncology)

Luca Tagliaferrì, MD, PhD<sup>1</sup>, Andrea Vavassori, MD<sup>2</sup>, Valentina Lancellotta, MD<sup>3</sup>, Vita ana De Sanctis, MD<sup>4</sup>,  
Cristiano Vicoli, MD<sup>5</sup>, Calogero Casa, MD<sup>6</sup>, Cynthia Arias, MD<sup>7</sup>, Domenico Genovesi, MD<sup>8</sup>,  
Barbara Alkai Jorjacob Fossa, MD<sup>9</sup>, Alessio Giuseppe Maranzan, MD<sup>10</sup>, Glauco Kovacs, MD, PhD<sup>11</sup>

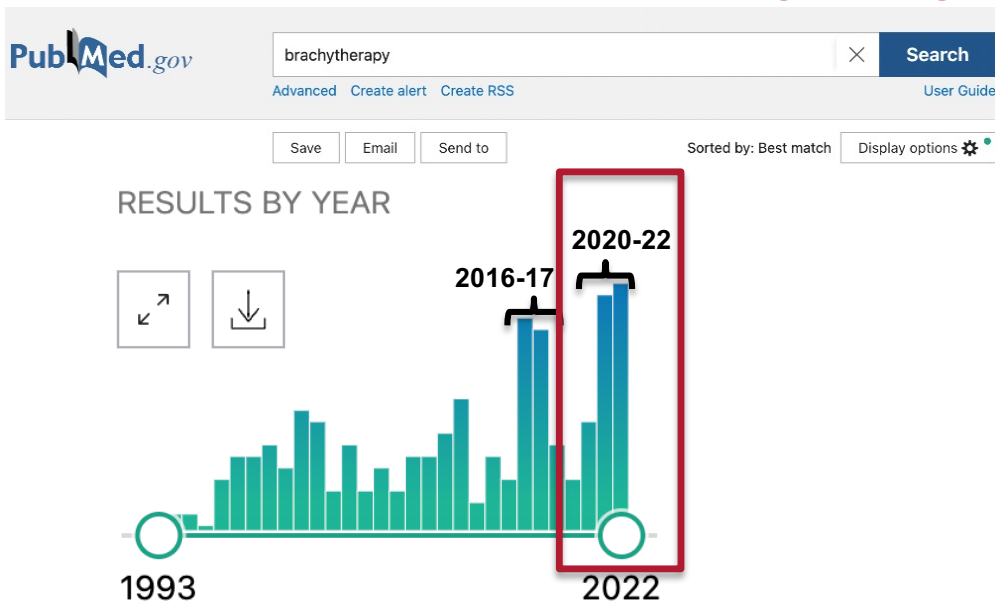


COVID-19 Rapid Letter

Practical indications for management of patients candidate to  
Interventional and Intraoperative Radiotherapy (Brachytherapy, IORT)  
during COVID-19 pandemic – A document endorsed by AIRO (Italian  
Association of Radiotherapy and Clinical Oncology) Interventional  
Radiotherapy Working Group<sup>1</sup>

Andrea Vavassori<sup>1</sup>, Luca Tagliaferrì<sup>1,2,3,4</sup>, Lisa Vicenzi<sup>5</sup>, Andrea D'Aviero<sup>6</sup>, Antonella Ciabattini<sup>7</sup>,  
Sergio Girbaudo<sup>8</sup>, Loredana Lapadula<sup>9</sup>, Gian Carlo Mattiucci<sup>10</sup>, Lorenzo Vianini<sup>11</sup>, Vitaliana De Sanctis<sup>12</sup>,  
Cristiana Vidali<sup>13</sup>, Rita Murri<sup>14</sup>, Maria Antonietta Gambacorta<sup>15</sup>, Marcello Mignogna<sup>16</sup>,  
Barbara A. Jereczek-Fossa<sup>17,18</sup>, Vittorio Donato<sup>19</sup>

## TRILOGY PROJECT CLINICAL PRACTICE



Picco nel 2016-2017 e in aumento nel 2020 e 2022

<https://pubmed.ncbi.nlm.nih.gov/?term=brachytherapy&size=50&filter=pubt.guideline>

Radiotherapy and Oncology 173 (2022) 188–196

Contents lists available at ScienceDirect  
**Radiotherapy and Oncology**  
 journal homepage: www.thegreenjournal.com

Original Article  
**ESTRO-ACROP guideline on surface guided radiation therapy**  
 P. Freislederer<sup>a,1,\*</sup>, V. Batista<sup>b,c</sup>, M. Öllers<sup>d</sup>, M. Buschmann<sup>e</sup>, E. Steiner<sup>f</sup>, M. Kügelé<sup>g</sup>, F. Fracchiolla<sup>h,i</sup>, S. Corradini<sup>j</sup>, M. de Smet<sup>k</sup>, F. Moura<sup>l</sup>, S. Perryck<sup>m</sup>, F. Dionisi<sup>n</sup>, D. Nguyen<sup>o</sup>, C. Bert<sup>1</sup>, J. Lehmann<sup>h,i,p</sup>

Journal of Radiation Research, 2022, pp. 1–10  
<https://doi.org/10.1093/jrr/rtac011>

Review Article  
**H&N and Skin (HNS) GEC-ESTRO Working Group critical review of recommendations regarding prescription depth, bolus thickness and maximum dose in skin superficial brachytherapy with flaps and customized moulds**  
 Victor Gonzalez-Perez<sup>q,r</sup>, Agata Rembielak<sup>h,s</sup>, Jose Luis Guinot<sup>d</sup>, Ramin Jaberi<sup>u</sup>, Valentin Renate Walter<sup>v</sup>, Anysja Zuchora<sup>w</sup>, Ashwini Budrukkar<sup>x</sup>, György Kovács<sup>y</sup>, Ina Jürgeniemi<sup>z</sup>, Frank-André Siebert<sup>1</sup>, Luca Tagliaferri<sup>1</sup>

Journal of Radiation Research, 2022, pp. 1–10  
<https://doi.org/10.1093/jrr/rtac011>

Original Article  
**Japanese Society for Radiation Oncology Consensus Guidelines of combined intracavitary and interstitial brachytherapy for gynecological cancers**  
 Naoya Murakami<sup>1</sup>, Tatsuya Ohno<sup>2,3,4</sup>, Takafumi Toita<sup>5</sup>, Ken Ando<sup>2</sup>, Noriko Ii<sup>5</sup>, Hiroyuki Okamoto<sup>6</sup>, Toru Kojima<sup>7</sup>, Kayoko Tsujino<sup>8</sup>, Koji Masui<sup>9</sup>, Ken Yoshida<sup>10</sup> and Hitoshi Ikushima<sup>11</sup>

Radiotherapy and Oncology  
 journal homepage: www.thegreenjournal.com

Original Article  
**GEC-ESTRO ACROP prostate brachytherapy guidelines**  
 Ann Henry<sup>a</sup>, Bradley R. Pieters<sup>b</sup>, Frank André Siebert<sup>c</sup>, Peter Hoskin<sup>d,e,f,g</sup>, on behalf of the UROGEC group of GEC ESTRO with endorsement by the European Association of Urology<sup>1</sup>

<sup>a</sup> St James University Hospital, Leeds, UK; <sup>b</sup> Amsterdam University Medical Centers, University of Amsterdam, Amsterdam, The Netherlands; <sup>c</sup> University of Kiel/University Hospital Schleswig-Holstein Campus Kiel, Germany; <sup>d</sup> Mount Vernon Cancer Centre, Northwood; and <sup>e</sup> University of Manchester, Manchester, UK

Clinical and Translational Radiation Oncology  
 journal homepage: www.sciencedirect.com/journal/clinical-and-translational-radiation-oncology

Original Article  
**GEC ESTRO ACROP consensus recommendations for contact brachytherapy for rectal cancer**



# TRILOGY PROJECT CLINICAL PRACTICE

## Brachytherapy: An Overview for Clinicians

Cyrus Chargari, MD, PhD <sup>1,2</sup>; Eric Deutsch, MD, PhD<sup>1,3,4</sup>; Pierre Blanchard, MD, PhD<sup>1</sup>; Sebastien Gouy, MD, PhD<sup>5</sup>;  
 H el ene Martelli, MD, PhD<sup>6</sup>; Florent Gu erin, MD, PhD<sup>6</sup>; Isabelle Dumas, PhD<sup>1</sup>; Alberto Bossi, MD<sup>1</sup>; Philippe Morice, MD, PhD<sup>5,7</sup>;  
 Akila N. Viswanathan, MD, MPH<sup>8</sup>; Christine Haie-Meder, MD<sup>1</sup>

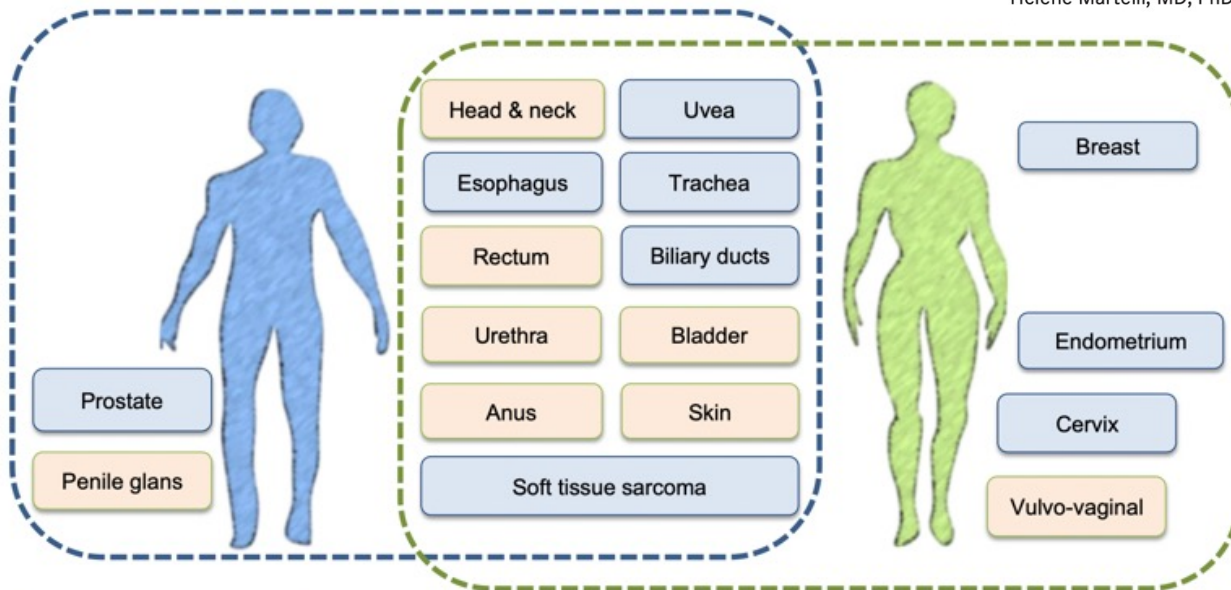


FIGURE 4. Potential Indications of Brachytherapy, With Focus on Level of Evidence.

Chargari et al. CA CANCER J CLIN 2019;69:386-401

AIRO2022

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

Radioterapia di precisione per un'oncologia innovativa e sostenibile



# TRILOGY PROJECT

## CLINICAL PRACTICE

INNOVAZIONE Tecnologica

- Imaging
- Applicatori
- Planning & delivery workflow

CLINICA

- Integrazione con nuove terapie sistemiche



## TRILOGY PROJECT CLINICAL PRACTICE

INNOVAZIONE Tecnologica

- **Imaging**
- Applicatori
- Planning & delivery workflow

CLINICA

- Integrazione con nuove terapie sistemiche

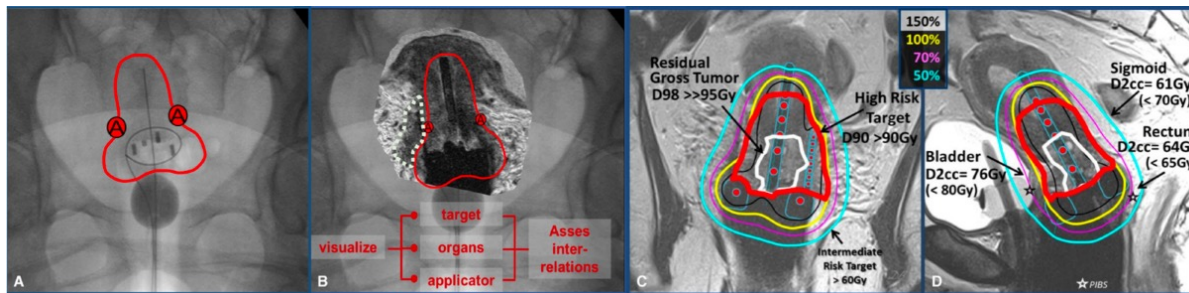


## IMAGING

«The implementation of computed tomography or magnetic resonance imaging (MRI) for 3-dimensional treatment planning has enabled one to accurately tailor treatments to patients and their specific tumors»

Chargari et al. CA CANCER J CLIN  
 2019;69:386-401

### CERVIX

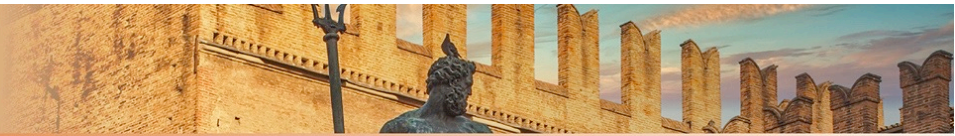


### MRI:

- Increased use of interstitial catheters
- Improvement in needle positioning
- Improvement resulting treatment plans

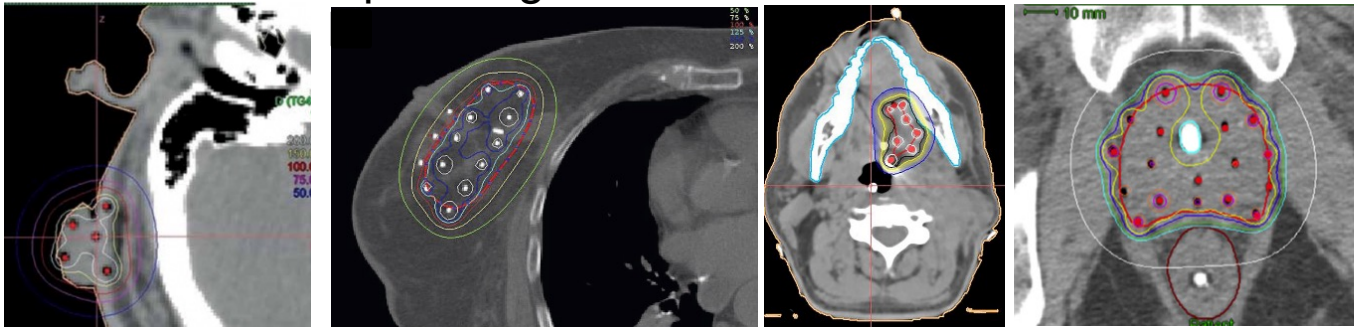
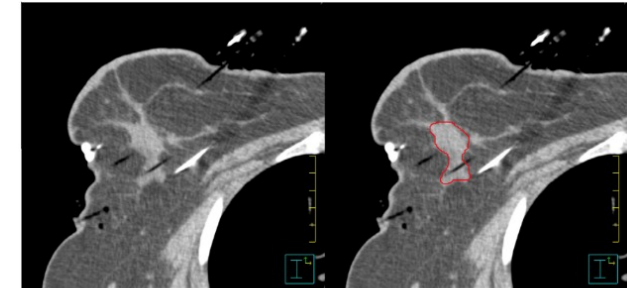
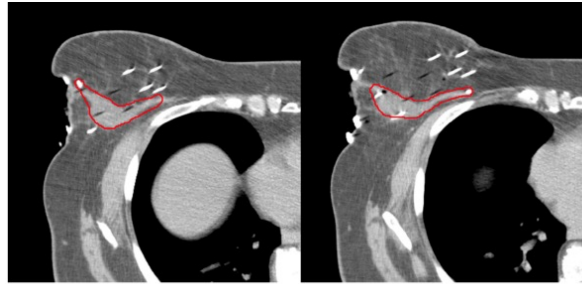
Pötter 2007 Radiother Oncol. 2007 May;83(2):148-55.  
 Charra-Brunaud 2012 Radiother Oncol. 2012 Jun;103(3):305-13.  
 Pötter 2018 Clin Transl Radiat Oncol. 2018 Jan 11;9:48-60  
 Sturdza 2022 Int J Gynecol Cancer. 2022 Mar;32(3):273-280.  
 Fields 2020 Semin Radiat Oncol. 2020 Jan;30(1):16-28.





## IMAGING: TC

- Gold Standard for optimal geometrical precision in reconstruction of needle positions.
- Target identification
- Treatment planning



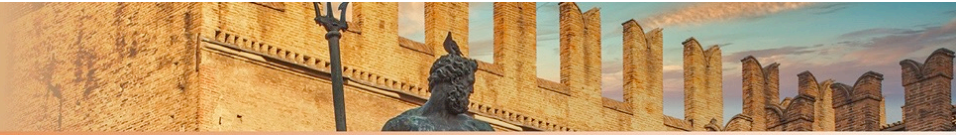
Cancer/Radiothérapie 22 (2018) 326–333

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**ScienceDirect**  
[www.sciencedirect.com](http://www.sciencedirect.com)

Elsevier Masson France  
**EM|consulte**  
[www.em-consulte.com](http://www.em-consulte.com)

ELSEVIER

Review article  
**Place of modern imaging in brachytherapy planning**  
*Place de l'imagerie moderne dans la planification de la curiethérapie*  
 T.P. Hellebust<sup>a,b,\*</sup>

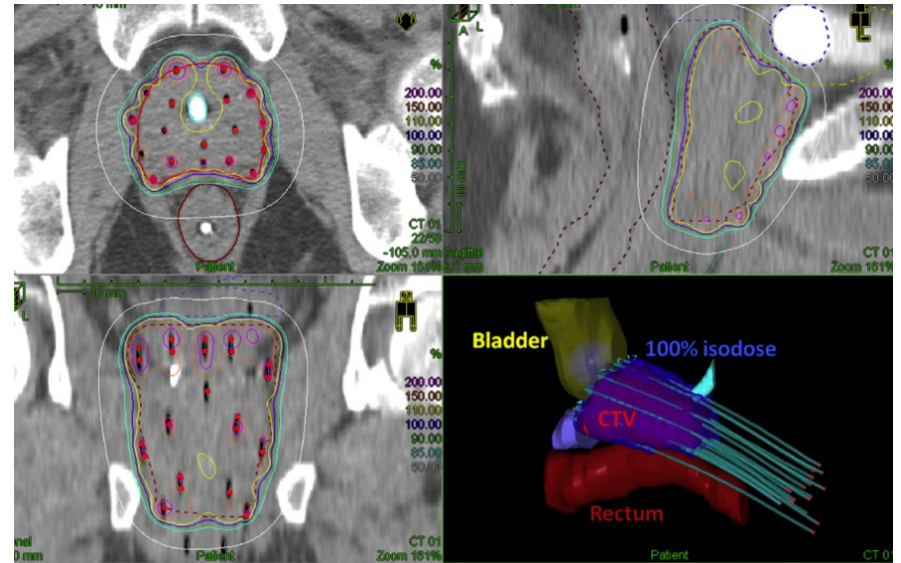
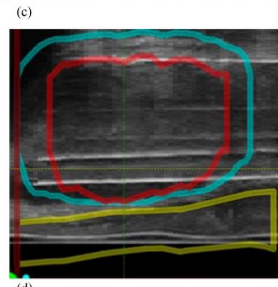
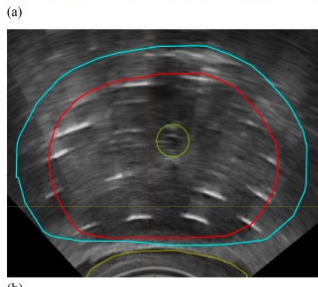
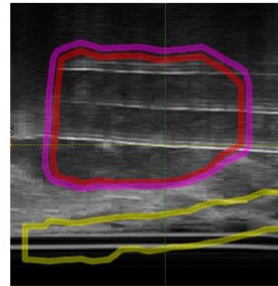
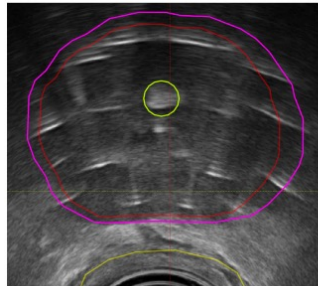


## IMAGING: US

**TRUS**

→for guidance

→treatment planning

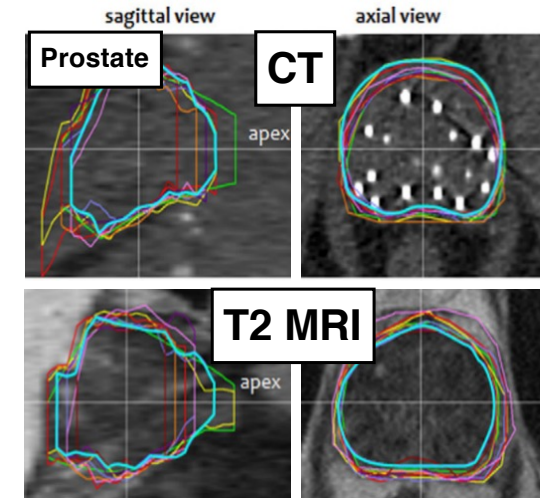
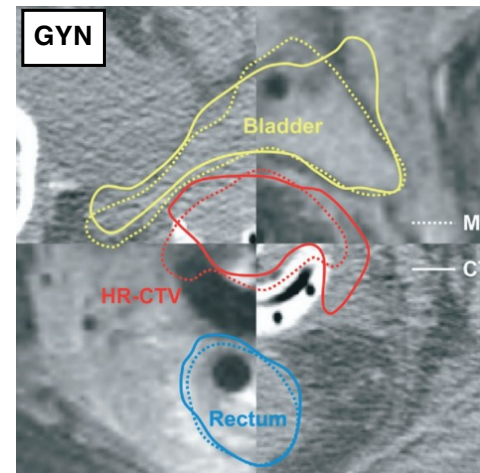


Hellebust 2018 Cancer/Radiothérapie 22 (2018) 326–333



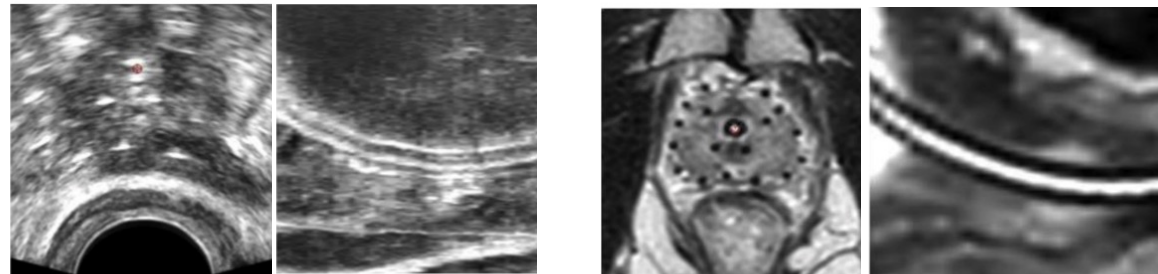
## IMAGING: MRI

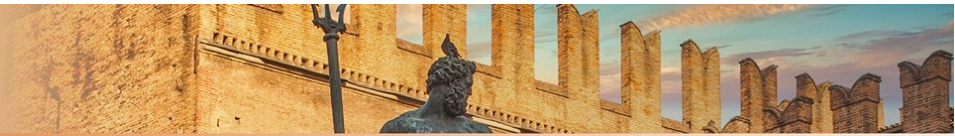
- superior to CT for defining the target volume for many brachytherapy sites
- BUT applicator and source localization is more challenging
- Availability in RT DEPT



### MRI

- Pretreatment imaging
- to guide needle placement
- treatment planning





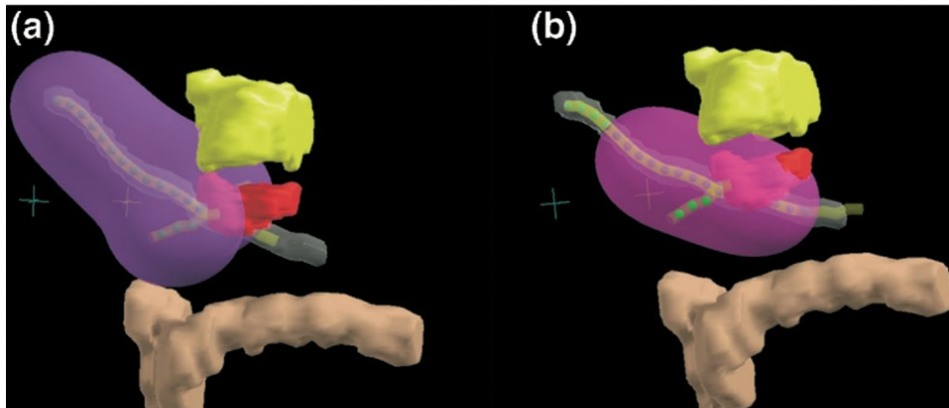
## IMAGING: PET

### CLINICAL INVESTIGATION

### Cervix

#### ADAPTIVE BRACHYTHERAPY TREATMENT PLANNING FOR CERVICAL CANCER USING FDG-PET

LILIE L. LIN, M.D.,\* SASA MUTIC, B.S.,\* DANIEL A. LOW, PH.D.,\* RICHARD LAFORST, PH.D.,†  
 MILOS VICIC, PH.D.,\* IMRAN ZOBERI, M.D.,\*§ TOM R. MILLER, M.D., PH.D.,\*§  
 AND PERRY W. GRIGSBY, M.D.\*‡§



Implant without (a) and with (b) optimization to the PET-defined tumor volume. Bladder, yellow; PET tumor volume, red; rectum, brown.

IJROBP, Vol. 67, No. 1, pp. 91–96, 2007

«PET scan cannot be used to define target volume in BT plan as the only source of information and it could be necessary an integration preferably with MRI for much more individualized brachytherapy treatment»

Meregalli et al., J Nucl Med Radiat Ther 2013, S6



## IMAGING: THE FUTURE



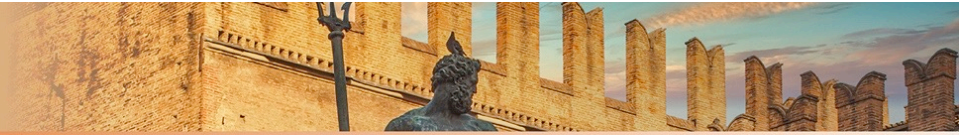
**PET/MR**



### PET/MR scan advantages

- primary tumor evaluation, therapy monitoring, and assessment of potential tumor relapse.
- Reduction time to diagnosis
- Radiation dose savings.
- Expansion to new applications, such as ***RADIATION PLANNING***

Panda et al. Magn Reson Imaging Clin N Am. 2020 Aug;28(3):369-380.  
 Ohliger et al. Magn Reson Imaging Clin N Am. 2017 Aug;25(3):667-684.



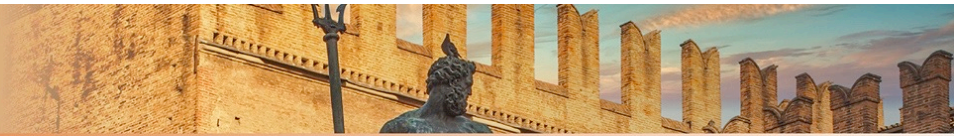
## TRILOGY PROJECT CLINICAL PRACTICE

INNOVAZIONE Tecnologica

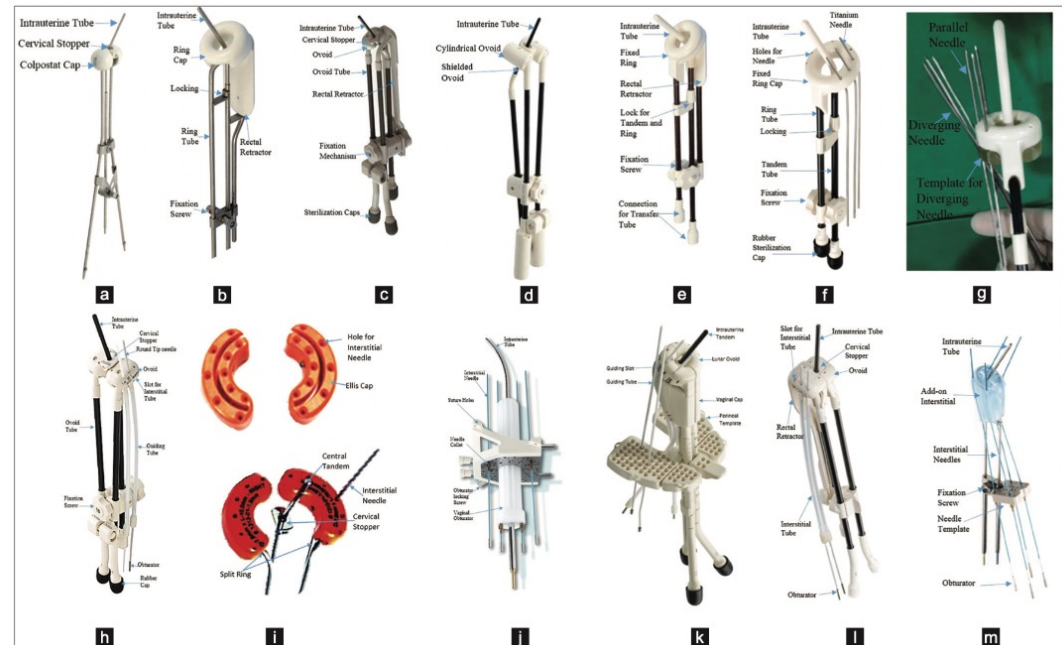
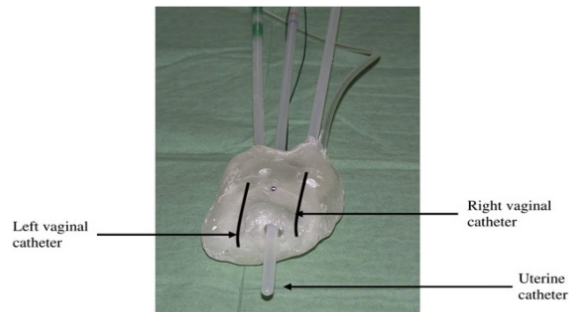
- Imaging
- **Applicatori**
- Planning & delivery workflow

CLINICA

- Integrazione con nuove terapie sistemiche



## APPLICATORI: EVOLUZIONE



**Ovoids/colpostat**

Preloaded 1950

Schematic diagram of Ovoids

Afterloading 1960

Afterloading Mini 1970

a) FSD mini-ovoid

b) FSD Ovoid

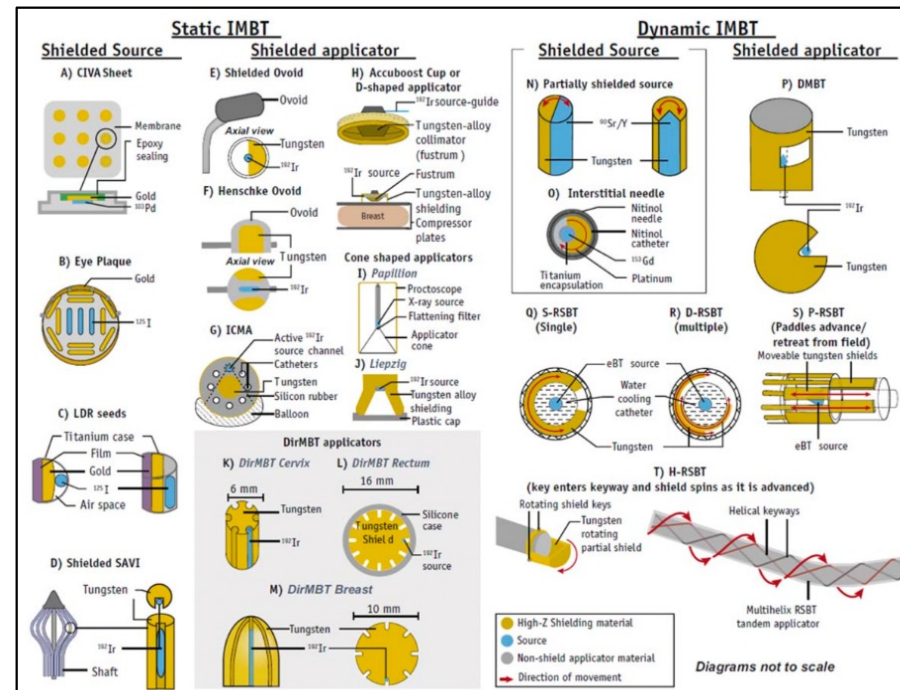


## APPLICATORI: IMBT

### SELF-SHIELDED APPLICATORS

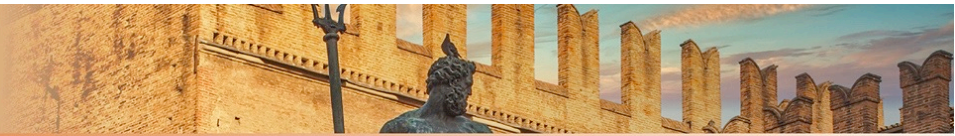


### Intensity modulated brachytherapy (IMBT) ANISOTROPIC DOSE DISTRIBUTION



Song et al. Phys Med Biol. 2021 Nov 22;66(23).  
 Cunha et al. Semin Radiat Oncol. 2020 Jan;30(1):94-106.





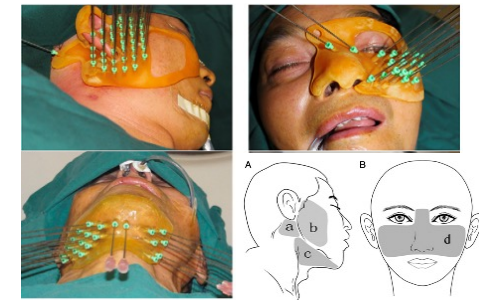
## APPLICATORI: 3D PRINTING



**SKIN**

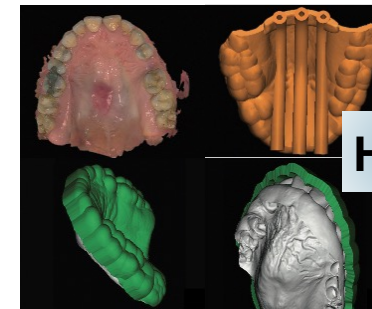


Arenas et al.  
 JCB 2017  
 Jun;9(3):270-276.

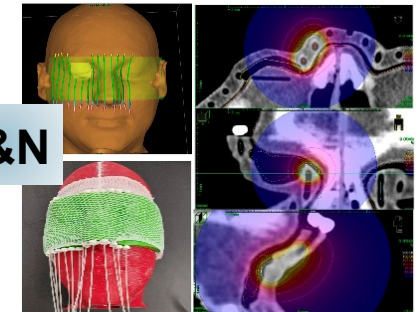


Lancellotta et al. J Prosthet Dent. 2019 Apr;121(4):690-693.

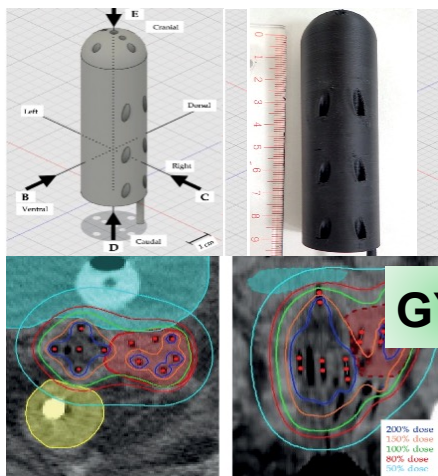
Huang et al. Journal of Rad Res, 2016, pp. 1-6



**H&N**

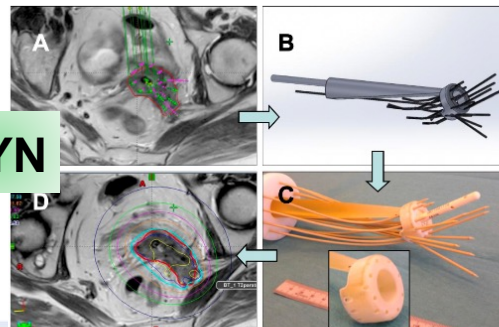


Zwierzchowski et al. J. Pers. Med. 2022,12,1432.



**GYN**

Lindegard et al. Radiother Oncol. 2016 Jan;118(1):173-5.



Sekii et al. J Contemp Brachyther. 2018; 10, 5: 470-477



## TRILOGY PROJECT CLINICAL PRACTICE

INNOVAZIONE Tecnologica

- Imaging
- Applicatori
- **Planning & delivery workflow**

CLINICA

- Integrazione con nuove terapie sistemiche



## PLANNING AND DELIVERY WORKFLOW

### Electromagnetic Tracking:

1. increase precision
2. Minimize the likelihood of error
3. Efficacy in automating catheter reconstruction for interstitial IRT
4. To validate the trasfert tube connections
5. To detect any catheter shift between implantation and treatment



**LIMITATIONS:**  
 Perturbation to the EM field

### IMBT: Intensity modulated brachytherapy



Seminars in  
**RADIATION  
 ONCOLOGY**

#### Brachytherapy Future Directions

J. Adam Martin Cunha, PhD,\* Ryan Flynn, PhD,<sup>†</sup> Cédric Bélanger, MS,<sup>‡,§</sup>  
 Cameron Callaghan, MD, MPH,<sup>†</sup> Yusung Kim, PhD,<sup>†</sup> Xun Jia, PhD,<sup>||</sup> Zhe Chen, PhD,<sup>¶</sup> and  
 Luc Beaulieu, PhD<sup>‡,§</sup>

Semin Radiat Oncol. 2020 Jan;30(1):94-106.



## TRILOGY PROJECT CLINICAL PRACTICE

INNOVAZIONE Tecnologica

- Imaging
- Applicatori
- Planning & delivery workflow

CLINICA

- Integrazione con nuove terapie sistemiche



## IMMUNOTHERAPY

Review paper

### Radioimmunotherapy: future prospects from the perspective of brachytherapy

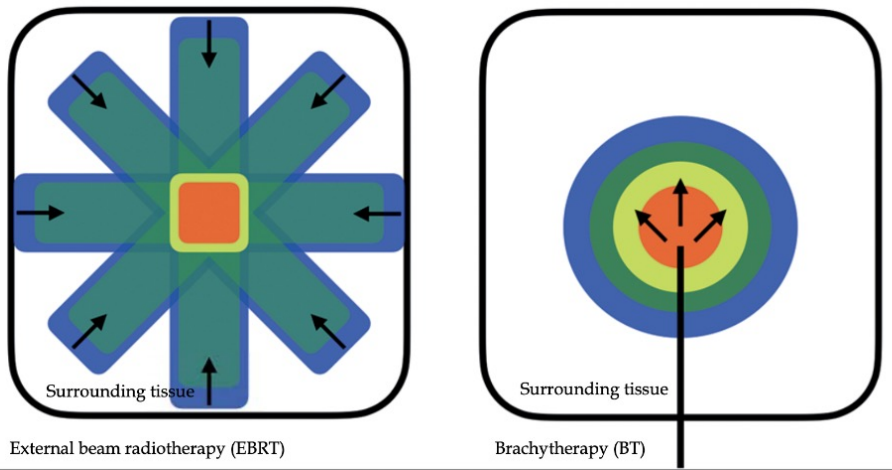
Maximilian Fleischmann, MD<sup>1</sup>, Markus Glatzer, MD<sup>2</sup>, Prof. Claus Rödel, MD<sup>3,4</sup>, Nikolaos Tselis, MD, PhD<sup>1</sup>  
<sup>1</sup>Department of Radiation Oncology, University Hospital Johann Wolfgang Goethe University, Frankfurt, Germany, <sup>2</sup>Department of Radiation Oncology, Kantonsspital St. Gallen, St. Gallen, Switzerland, <sup>3</sup>German Cancer Research Center (DKFZ), Heidelberg, German Cancer Consortium (DKTK), Partner Site Frankfurt am Main, Frankfurt, Germany, <sup>4</sup>Frankfurt Cancer Institute, Frankfurt, Germany

J Contemp Brachytherapy 2021; 13, 4: 458–467



Radiation-induced immune response influenced by:

- Timing
- Dose (higher doses)
- Target volume
- Fractionation

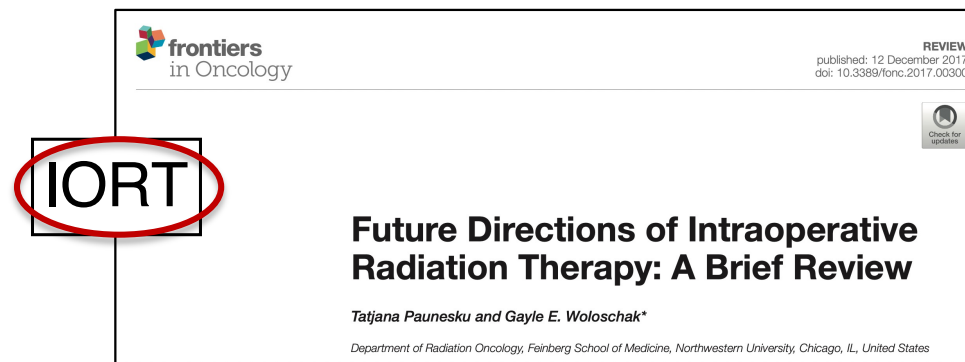


- **Low-dose region (< 2 Gy):** temporary depletion of immune cell lines, such as tumor-infiltration lymphocytes (TILs).
- **Moderate-dose region (2-5 Gy):** cytokine release is leading to enhanced immune cell infiltration to tumor micro-environment.
- **Intermediate-dose region (5-8 Gy):** phenotypic changes in immune marker expression and release of cytoplasmic dsDNA.
- **High-dose region (> 8 Gy):** tumor cell death and release of tumor-specific antigens.

Fig. 1. Comparative, schematic illustration of dose distribution in external beam radiotherapy (EBRT) vs. brachytherapy (BT). Brachytherapy allows for highly conformal dose distribution and optimal sparing of organs at risk (OARs), including blood vessels, lymphatic tissue, and bone marrow

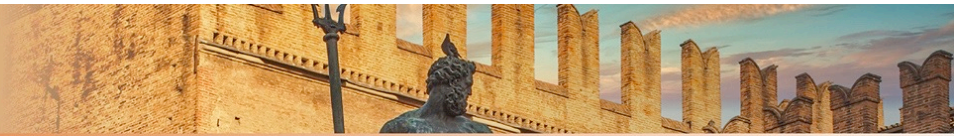


## IMMUNOTHERAPY



- Potential combined use of IORT and IMMUNOTHERAPY Herskind et al. *Front Oncol* (2017) 7:147
- IORT and RADIOSENSITIZING nanoparticle materials Paunesku et al. *Cancer Treat Res* (2015) 166:151–71

Tatjana Paunesku and Gayle E. Woloschak. *Front Oncol*. 2017 Dec 12;7:300



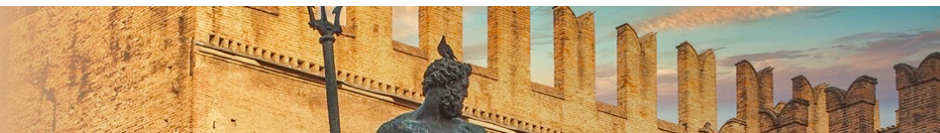
## AIRO – IRT WORKING GROUP TRILOGY PROJECT

**Table 2.** Domains, issues, and relative solutions (accomplished or in progress) proposed according to the defined strategy

Domain	Issues	AIRO defined strategy
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AIRO – Italian Association of Radiotherapy and Clinical Oncology, AGENAS – National Agency for Regional Sanitary Services, PDTA – Pathway Diagnostic Therapeutic Assistential, COBRA – Consortium for BRachytherapy data Analysis

Tagliaferri et al. *J Contemp Brachytherapy* 2020; 12, 1: 84–89



## TRILOGY PROJECT EDUCATION

Review paper

Review Papers

### Current state of interventional radiotherapy (brachytherapy) education in Italy: results of the INTERACTS survey

Luca Tagliaferri, MD, PhD<sup>1</sup>, György Kovács, MD, PhD<sup>2</sup>, Cynthia Aristei, MD<sup>3</sup>, Vitaliana De Sanctis, MD<sup>4</sup>,  
Fernando Barbera, MD<sup>5</sup>, Alessio Giuseppe Morganti, MD<sup>6</sup>, Calogero Casò, MD<sup>7</sup>, Bradley Rumwell Pieters, MD, PhD<sup>8</sup>,  
Elvio Russi, MD<sup>9</sup>, Lorenzo Livi, MD<sup>10</sup>, Renzo Corvò, MD<sup>11</sup>, Andrea Giovagnoni, MD<sup>12</sup>, Umberto Ricardi, MD<sup>13</sup>,  
Vincenzo Valentini, MD<sup>14,15</sup>, Stefano Maria Magrini, MD<sup>16</sup> and the Directors of the Italian Radiation Oncology Schools\*\*

Risultati survey:

Ampia eterogenità nella formazione:

- Conoscenza teorica trasmessa in modo omogeneo ed adeguato
- Significativa variabilità nell'attività pratica tra le varie scuole



# AIRO2022

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

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## TRILOGY PROJECT EDUCATION

Education

Need for an adequate training (especially in residency programs)

Consensus conference promotion  
Training meeting promotion  
University Master promotion

anno accademico 2021/22  
**Master universitario di secondo livello in ONCOLOGIA INTERVENTISTICA**  
ISTITUTO DI RADIOLOGIA in collaborazione con  
Gemelli IIOC  
AIRO INTERACTS

Interventional Radiotherapy  
**INTERACTS**  
Active Teaching School  
**12° Rome Inter-Meeting**  
(Rome Interventional oncology Meeting)  
21-22 April 2022

AGGIORNAMENTI IORT  
TUMORE DELLA MAMMELLA E DEL RETTO  
22/04/2022  
Ore 14.30-16.30  
A cura di:  
Gruppo di Studio AIRO  
Brachiterapia-Radioterapia Interventistica-IORT  
Coordinatore del Gruppo:  
**AIRO WEBINAR**  
LA GESTIONE DEI TUMORI CUTANEI: STATO DELL'ARTE E MULTIDISCIPLINARIETA'  
I VENERDI DI AIRO  
6 Luglio 2022, ore 11:30-17:40  
PAD SINCRONA AIRO (Piazzale PCM 4/5)  
Conse riservate ai Soci AIRO 2022

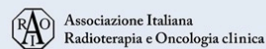
25-26 Settembre 2021  
**AITRO 25 ANNI di STORIA & PROFESSIONE**

**ESTRO COURSES**



**SAPIENZA**  
UNIVERSITÀ DI ROMA

**Master Gynaecological BT**



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



## TRILOGY PROJECT EDUCATION

Original paper

Clinical Investigations

### The role of radiation therapy technologist in interventional radiotherapy (brachytherapy) in Italy: Italian Association of Radiotherapy and Clinical Oncology (AIRO) and Italian Association of Radiation Therapy and Medical Physics Technologists (AITRO) joint project

Patrizia Cornacchione, MSc<sup>1</sup>, Luca Tagliaferri, MD, PhD<sup>1</sup>, Andrea D'Aviero, MD<sup>1</sup>, Antonella Ciabattini, MD<sup>2</sup>, Carmela Galdieri, MSc<sup>3</sup>, Vitaliana De Sanctis, MD<sup>4</sup>, Francesco Fellin, MSc<sup>5</sup>, Sergio Gribaudo, MD<sup>6</sup>, Daniele Lambertini, MSc<sup>7</sup>, Prof. Maria Antonietta Gambacorta, MD<sup>8</sup>, Prof. Barbara Alicja Jereczek-Fossa, MD, PhD<sup>9,10</sup>, Prof. Vittorio Donato, MD<sup>1</sup>, Andrea Vavassori, MD<sup>10</sup>

Do you perform interventional radiotherapy treatments (brachytherapy) in your radiotherapy department?



Fig. 1. Question No. 3 results

If "no", do you consider the three-year training of a radiographer/radiation technologist course sufficient to perform activities in IRT units?

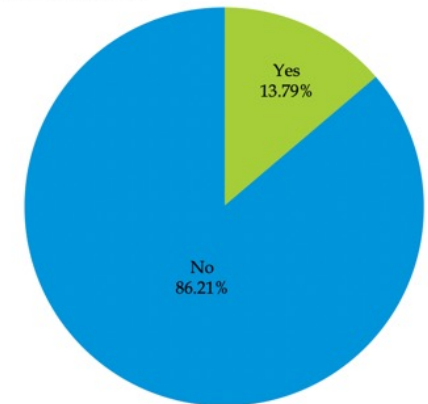


Fig. 4. Question No. 9 results



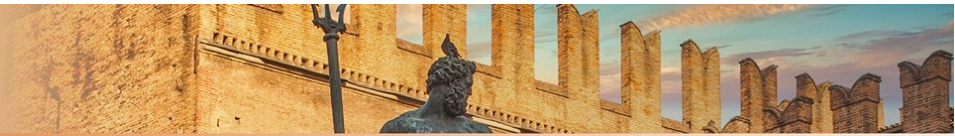
## AIRO – IRT WORKING GROUP TRILOGY PROJECT

**Table 2.** Domains, issues, and relative solutions (accomplished or in progress) proposed according to the defined strategy

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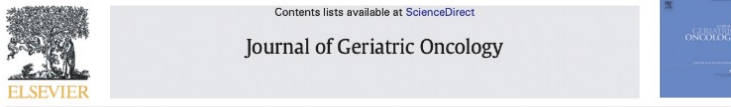
AIRO – Italian Association of Radiotherapy and Clinical Oncology, AGENAS – National Agency for Regional Sanitary Services, PDTA – Pathway Diagnostic Therapeutic Assistential, COBRA – Consortium for BRachytherapy data Analysis

Tagliaferri et al. *J Contemp Brachytherapy* 2020; 12, 1: 84–89



## TRILOGY PROJECT RESEARCH

J Geriatr Oncol. 2019 May;10(3):514-517.



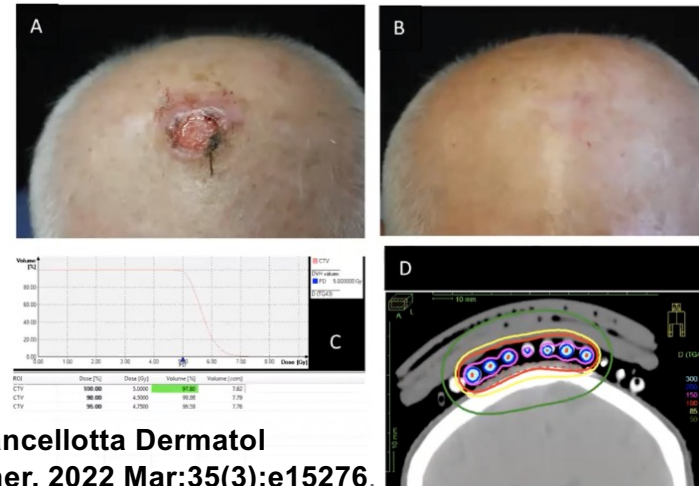
Letter to the Editor

The role of personalized Interventional Radiotherapy (brachytherapy) in the management of older patients with non-melanoma skin cancer

Lancellotta Valentina <sup>a,\*</sup>, Kovács Gyoergy <sup>b</sup>, Tagliaferri Luca <sup>c</sup>, Perrucci Elisabetta <sup>d</sup>, Rembielak Agata <sup>e</sup>, Stingeni Luca <sup>f</sup>, Tramontana Marta <sup>g</sup>, Hansel Katharina <sup>h</sup>, Colloca Giuseppe <sup>g</sup>, Saldi Simonetta <sup>h</sup>, Valentini Vincenzo <sup>i</sup>, Aristei Cvnthia <sup>a</sup>



*«HDR BT emerges as potentially noninferior treatment method providing very good reported cosmetic outcomes».*  
**Krzysztofciak 2022**



**Lancellotta Dermatol  
 Ther. 2022 Mar;35(3):e15276.**



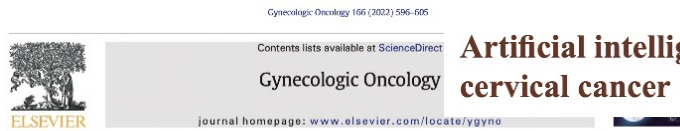
## TRILOGY PROJECT RESEARCH

Review Article

J Cancer Res Ther. 2022

BJR

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### Artificial intelligence in brachytherapy for cervical cancer

A systematic review on the use of artificial intelligence in gynecologic imaging – Background, state of the art, and future directions

Pallabi Shrestha<sup>a</sup>, Bhavya Poudyal<sup>a</sup>, Sepideh Yadollahi<sup>a</sup>, Darryl E. Wright<sup>a</sup>, Adriana V. Grejshova<sup>a</sup>, Joshua D. Warner<sup>a</sup>, Panagiotis Korfiatis<sup>a</sup>, Isabel C. Green<sup>c</sup>, Sarah L. Rassier<sup>c</sup>, Andrea Maria Bohyun Kim<sup>a</sup>, Shannon K. Laughlin-Tommaso<sup>c</sup>, Timothy L. Kline<sup>a,b,\*</sup>



### Artificial Intelligence and Deep Learning for Brachytherapy



JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS

J Appl Clin Med Phys. 2022

Received: 12 February 2021 | Accepted: 12 March 2021  
DOI: 10.1002/acm2.13504

PARALLEL OPPOSED EDITORIAL

### Artificial intelligence can overcome challenges in brachytherapy treatment planning

Xun Jia<sup>1</sup> | J. Adam M. Cunha<sup>2</sup> | Yi Rong<sup>3</sup>

Xiufang Tian<sup>1,2</sup>,  
Cuihua Li<sup>1,2\*</sup>,  
Yong Hou<sup>1</sup>,  
Jian Xie<sup>1</sup>,  
Meijuan Song<sup>1</sup>,  
Kun Liu<sup>1</sup>,  
Jing Zhou

REVIEW ARTICLE

### Artificial intelligence in brachytherapy: a summary of recent developments

Br J Radiol. 2021

<sup>1</sup>SUSOVAN BANERJEE, MD, <sup>2</sup>SHIKHA GOYAL, MD, DNB, <sup>3</sup>SAUMYARANJAN MISHRA, MD, <sup>4</sup>DEEPAK GUPTA, MD, <sup>5</sup>SHYAM SINGH BISHT, MD, <sup>6</sup>VENKETESAN K, MSc, <sup>7</sup>KUSHAL NARANG, MD and <sup>8</sup>TEJINDER KATARIA, MD, DNB



Semin Radiat Oncol. 2022



anta- The Medicity, Gurgaon, Haryana, India  
Graduate Institute of Medical Education and Research, Chandigarh, India

Review Papers

J Contemp Brachytherapy. 2020

### Artificial intelligence (AI) and interventional radiotherapy (brachytherapy): state of art and future perspectives

Bruno Fiondo, MD<sup>1</sup>, Luca Boldrini, MD<sup>2</sup>, Andrea D'Aviero, MD<sup>2</sup>, Valentina Lancellotta, MD<sup>1</sup>, Maria Antonietta Gambacorta, MD, PhD<sup>2</sup>, György Kovács, MD, PhD<sup>3</sup>, Stefano Patamello, Physicist<sup>1</sup>, Vincenzo Valentini, MD<sup>2</sup>, Luca Tagliaferrì, MD, PhD<sup>1</sup>



## ARTIFICIAL INTELLIGENCE



Providing clinical decision support



Mining –omics, analysing data



Facilitating repetitive tasks, optimising time



Modeling behaviors, in heterogeneous contexts



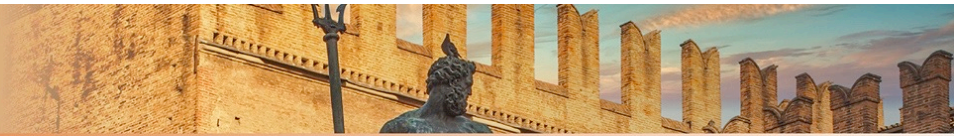
Review Papers

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Bruno Fionda, MD, Luca Baldrini, MD<sup>2</sup>, Andrea D'Aviero, MD<sup>2</sup>, Valentina Lancellotta, MD<sup>1</sup>, Maria Antonietta Gambacorta, MD, PhD<sup>2</sup>, György Kovács, MD, PhD<sup>3</sup>, Stefano Patamello, Physicist<sup>1</sup>, Vincenzo Valentini, MD<sup>2</sup>, Luca Tagliaferri, MD, PhD<sup>1</sup>

Courtesy of Luca Tagliaferri

Fionda et al. J Contemp Brachytherapy 2020; 12, 5: 497–500



# TRILOGY PROJECT RESEARCH

Research Difficulties in creating a network to gather strong evidence Support to the COBRA project born in the framework of the GEC-ESTRO for a wide international research database

Review Articles

Review paper

## ENT COBRA (Consortium for Brachytherapy Data Analysis): interdisciplinary standardized data collection system for head and neck patients treated with interventional radiotherapy (brachytherapy)

Luca Tagliaferri, MD, PhD<sup>1</sup>, György Kovács, MD, Ph  
Jose Luis Guinat, MD<sup>4</sup>, Guido Hildebrand, MD<sup>5</sup>, E  
Jens E. Meyer, MD<sup>6</sup>, Peter Niehoff, MD<sup>7</sup>, Angeles I  
Vito Lanzotti<sup>12</sup>, Andrea Damiani<sup>13</sup>, Tamer Sorar<sup>2</sup>, Vi

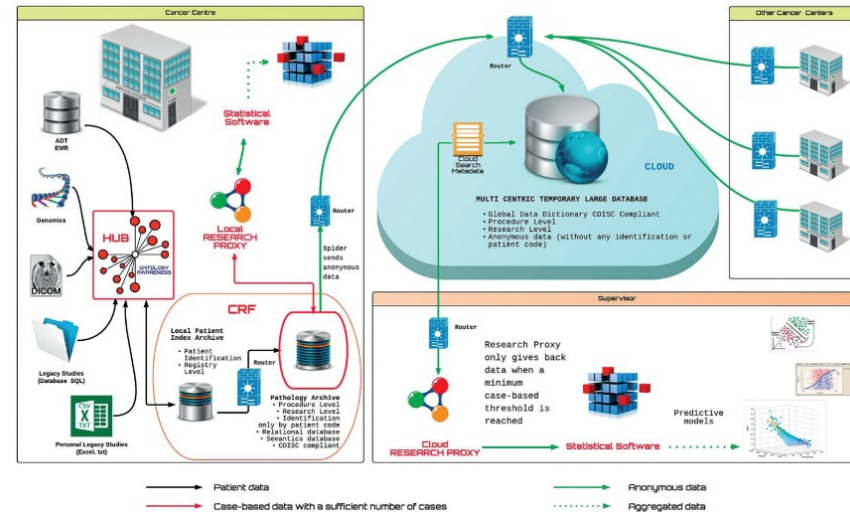
Original paper

## SKIN-COBRA (Consortium for Brachytherapy data Analysis) ontology: The first step towards interdisciplinary standardized data collection for personalized oncology in skin cancer

Valentina Lancellotta, MD<sup>1</sup>, José Luis Guinat, MD<sup>2</sup>, Bruno Fiorida, MD<sup>1</sup>, Agata Rembielak, MD, PhD<sup>3,4</sup>  
Alessandro Di Stefani, MD<sup>5,6</sup>, Stefano Gentileschi, MD<sup>7,8</sup>, Francesco Federica, MD<sup>9,8</sup>, Ernesto Rossi, MD<sup>9</sup>  
Benjamin Quik, MD<sup>10</sup>, Artur Jan Chyrek, MD<sup>11</sup>, Arenas Meritxell, MD, PhD<sup>12,13</sup>, Silvia Rodriguez Villalba, MD<sup>14</sup>  
Giuseppe Ferdinando Colloca, MD<sup>1</sup>, Nicola Dinapoli, MD, PhD<sup>1</sup>, Carlotta Masciocchi, PhD<sup>1</sup>, Jacopo Lenkowitz, PhD<sup>1</sup>  
Nicola Dino Capocchiano, PhD<sup>1</sup>, Andrea Damiani, PhD<sup>1</sup>, Vincenzo Valentini, MD<sup>15</sup>, György Kovács, MD, PhD<sup>16</sup>  
Luca Tagliaferri, MD, PhD<sup>1</sup>

<sup>1</sup>Fondazione Radiologia Università "A. Gemelli" IRCCS, I OC Radioterapia, Coordinatore, Dipartimento di Radioterapia per Impianti

Clinical Investigations





## AIRO – IRT WORKING GROUP TRILOGY PROJECT

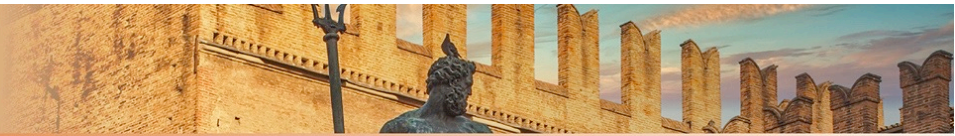
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*AIRO – Italian Association of Radiotherapy and Clinical Oncology, AGENAS – National Agency for Regional Sanitary Services, PDTA – Pathway Diagnostic Therapeutic Assistential, COBRA – Consortium for BRachytherapy data Analysis*

Tagliaferri et al. *J Contemp Brachytherapy* 2020; 12, 1: 84–89





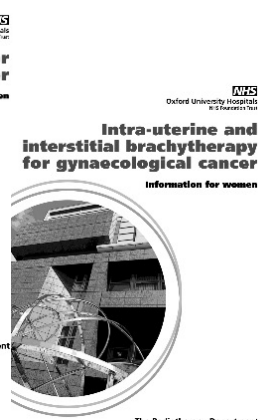
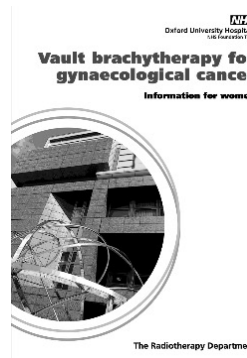
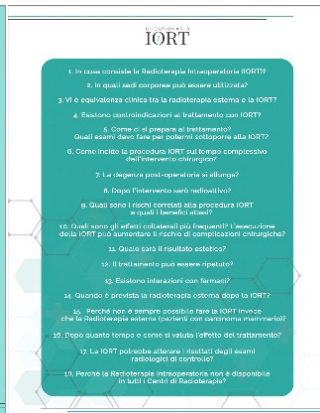
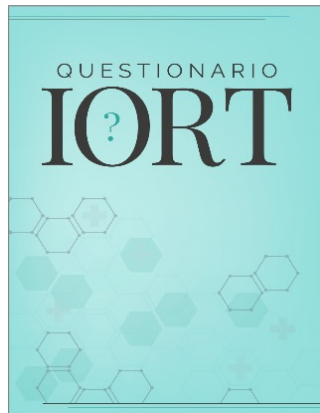
## TRILOGY PROJECT COMMUNICATION

Communication

Difficulties in communication with other specialists, patients, and also institutional representatives

Development of specific printed or web-based booklets for patients

The term "interventional radiotherapy" was introduced in the name of the study group and in routine clinical practice

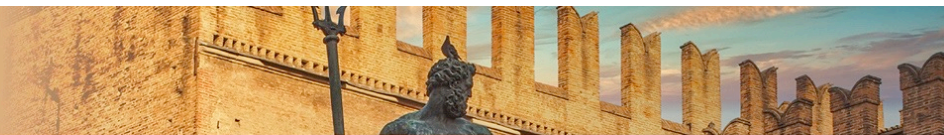


- Website
- Video

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## COMMUNICATION

Editorial

# THE LANCET

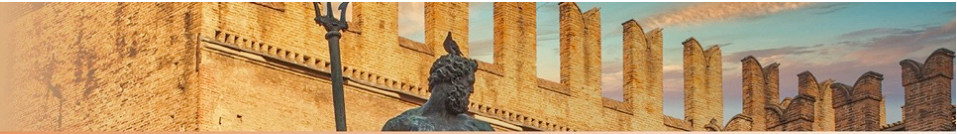
Volume 400 - Number 10364 - Pages 1655-1740 - November 12-18, 2022 [www.thelancet.com](http://www.thelancet.com)

Nov 12, 2022

"Science is important. But education is the vector that transmits to every new generation curiosity, passion, and commitment to reimagine the future, extend the limits of human possibility, and achieve a more just social world."

See Comment page 1666

Volume 400 Number 10364p1655-1740, e12



# CONCLUSIONI

## *IRT*

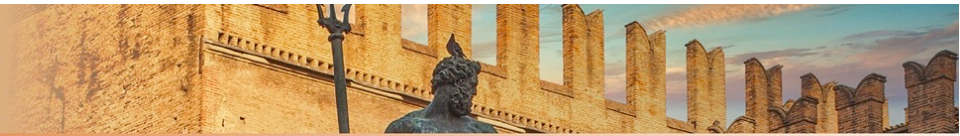
- Perfettamente integrata nel contesto dell'innovazione tecnologica, clinica e sostenibilità
- Integrazione promettente con le terapie sistemiche più innovative
- Sforzi futuri concentrati verso la diffusione della pratica clinica, della formazione e della comunicazione
- Necessario un adeguamento del riconoscimento economico nei nuovi tariffari

*«the future of IRT is even brighter»*

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## Thank you for your attention