

# DIAGNOSTIC IMAGING AND RADIOTHERAPY DEPARTMENT



## DIRECTOR OF DEPARTMENT

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## UNITS

### RADIOLOGY AND DIAGNOSTIC IMAGING 1

Daniele Vergnaghi

### RADIOLOGY AND DIAGNOSTIC IMAGING 2

Alfonso V. Marchianò

### INTRALESIONAL TREATMENT

Francesco Garbagnati

### RADIOLOGY AND DIAGNOSTIC IMAGING 3 AND BREAST IMAGING UNIT

Silvana Bergonzi

### DIAGNOSTIC AND INTERVENTIONAL GASTROENTEROLOGY

Guido Cozzi

### NUCLEAR MEDICINE

Emilio Bombardieri

### CLINICAL PET

Flavio Crippa

### NUCLEAR MEDICINE THERAPY AND ENDOCRINOLOGY

Ettore Seregni

### RADIOTHERAPY 1

Patrizia Olmi (*retired 30 Sept 2010*)

Emilio Bombardieri (*present*)

### RADIOTHERAPY 2

Carlo Fallai

### MEDICAL PHYSICS

Giancarlo Zonca

The Department includes: three Radiology and Diagnostic Imaging Units: RD1 carries out conventional radiologic examinations and magnetic resonance imaging (MRI); RD2 is specialized in mammographic examinations, breast US, diagnostic, interventional radiology, and US for gastroenterology; it is considered the intralesional treatment unit. For diagnostic and interventional activities in 2010, more than 90,000 conventional radiologic examinations, 11,000 MRI scans, and 4,000 interventional procedures were performed. The Nuclear Medicine Unit performs functional imaging by positron emission tomography (PET), nuclear medicine therapy, and has a radioisotope laboratory and endocrinology outpatient clinic. Overall, the clinical activity in 2010 involved more than 3,900 PET examinations, 5,900 diagnostic imaging tests, 84,000 in vitro tests, and 3,200 medical examinations. Two Radiotherapy Units: RT1 performs external radiation therapy, while RT2 carries out inpatient radiation therapy. In 2010, 1,600 outpatients and 367 inpatients were treated. One Medical Physics Unit.

## RADIOLOGY AND DIAGNOSTIC IMAGING 1

### HEAD

Daniele Vergnaghi, MD

### STAFF MEMBERS

Alberto Laffranchi, MD

Antonella Messina, MD

Paolo Potepan, MD

Davide Scaramuzza, MD

Giovanna Trecate, MD

### ADMINISTRATIVES

Angelina Laganà, Sonia Leone, Giulia Melis

### TECHNICIANS

Cinzia Fossaceca, Annunziata Gaetano,

Antonella Laturra, Tina Mastrostefano,

Luca Musumeci, Carmelina Pannone,

Nicola Pulerà, Valeria Tosi, Maurizio

Zattoni

### NURSE

Loredana Palella

Magnetic Resonance Imaging (MRI) continues to play an essential role in diagnosis and staging of primary cancers, monitoring treatment response, and follow-up. Over the past year, two emerging functional techniques, namely DCE-MRI and diffusion weighted imaging (DWI), have established their importance in clinical management. These techniques have been widely used in our investigations to distinguish tumor from non-tumoral tissue, assessing treatment response, and prediction of treatment outcome. Another emerging technology, endorectal magnetic resonance imaging and magnetic resonance spectroscopic imaging (endoMRI/MRSI), has been developed in our Department to improve staging of prostate cancer. Significant efforts have been also directed toward development of breast MRI, for early detection, diagnosis, and treatment planning of breast cancers with particular attention to cases suspect for multifocality (780 breast MRI performed in 2010). Functional imaging increased its role over morphokinetic aspects of breast lesions. The Unit also participates in a multicentric surveillance study of women at high genetic risk for breast cancer aimed at improving the accuracy of MRI in cancer detection, and collaborates with Milan Polytechnic to develop new software for computer-aided diagnosis and follow-up using whole body and head and neck MRI examinations.

Whole-body MRI and whole-body DWI have also been developed as new staging methods, and have been demonstrated to be reliable in detection of skeletal metastases and evaluate the extent of bone diseases. Whole-body MRI also provides additional tumor-related information in lymphomas, especially that related to early response to therapy and surrounding soft tissue and parenchymal status. MRSI and DWI have been utilized for diagnosis and follow up of pediatric brain tumors, an expanding field of clinical commitment and research.

*Keywords: MRI, functional imaging, perfusion, diffusion imaging, total body examination*

### 2010 RELEVANT NOTES

#### Collaborations

Istituto Superiore di Sanità, Rome

Department of Biomedical Engineering of Polytechnic of Milan

Imaging Science and Biomedical Engineering (ISBE) Research Group. Medical School, Faculty of Medical and Human Sciences, University of Manchester

#### Publications

Multicenter Surveillance of Women at High Genetic Breast Cancer Risk Using Mammography, Ultrasonography, and Contrast-Enhanced Magnetic Resonance Imaging (the High Breast Cancer Risk Italian 1 Study): Final Results. *Invest Radiol.* 2011;46:94-105.

#### Contributions

European Guidelines & Protocols for Diagnosis and Follow-up of Pediatric Brain Tumors by MRI (in collaboration with SIOP and Pediatric Oncology Unit)

European Guidelines & Protocols to assess early response on Head & Neck Cancer by DCE-DWI MRI (in collaboration with EORTC)



## RADIOLOGY AND DIAGNOSTIC IMAGING 2

### HEAD

Alfonso V. Marchianò, MD

### STAFF MEMBERS

Enrico M. Civelli, MD

Giuseppe Di Tolla, MD

Laura F. Frigerio, MD

Francesco Garbagnati, MD

Rodolfo Lanocita, MD

Carlo Morosi, MD

Carlo Spreafico, MD

### ADMINISTRATIVES

Giovanni Capone, Giuliana Manzoni,

Ornella Venegoni

### TECHNICIANS

Marilena Barbiero, Pietro Basile, Maria

Ferrarello, Roberto Gallo, Giuseppina

Gentile, Roberto Nioi, Geremia Porcelli,

Salvatore Romaniello, Luciana G.

Tanzini, Vanni Tirella

### NURSES

Pietro Ciccarese, Laura Fagnani, Roberta

S. Populin, Marinella Porceddu

Diagnostic oncology and interventional-oriented radiology represent the core activity of the Unit. Inpatients and outpatients undergo a diagnostic work-up that includes the different steps of patient management: primary cancer diagnosis, staging, follow-up and monitoring after surgery, chemotherapy, and radiotherapy. The lung cancer screening program (MILD) with "low-dose" spiral CT continued in 2010. We performed over 2,000 low-dose spiral CT, and we are currently testing a system of computer-aided detection (CAD) of pulmonary nodules. Interventional radiology activities include long-term venous central catheter placement, embolization, and chemoembolization for regional cancer treatment. Intralesional radiofrequency ablation based-methods, such as the chemo-interventional procedures consisting in local-regional drug delivery for malignancies of the liver, head and neck, pelvis, and limbs, have been successfully performed. An international multicentric study on the treatment of inoperable hepatocellular carcinoma with intra-arterial injection of yttrium-90 radiolabeled microspheres is ongoing in collaboration with Units of Nuclear Medicine and Gastrointestinal and Hepatopancreatobiliary Surgery and Liver Transplantation. The Unit has also developed an original experience of percutaneous cryoblation in selected patients with small renal tumors. During 2010, over 1,000 vascular diagnostic procedures, 500 vascular and non-vascular interventional procedures, over 550 long-term venous central catheters, and 600 percutaneous biopsies in various body districts were performed.

*Keywords: image-guided therapies, ultrasonography, computed tomography, multifunctional fluoroscopy, digital angiography*

## 2010 RELEVANT NOTES

### Publications

Lung function predicts lung cancer risk in smokers: a tool for targeting screening programs. *Eur Respir J.* 2010;35:146-51.

Comparison of the prognostic value of assessing tumor diameter versus tumor volume at diagnosis or in response to initial chemotherapy in rhabdomyosarcoma. *J Clin Oncol.* 2010;28:1322-8.



## INTRALESIONAL TREATMENT

### HEAD

Francesco Garbagnati, MD

Beginning in 1988, a procedure was developed to evaluate the possibility of utilizing a percutaneous mini-invasive approach in non-operable parenchymal tumors using intralesional thermal ablation. Overall, more than 900 patients with non-operable hepatic tumors, and kidney, lung, and bone neoplasms have been treated without major complications. The Intralesional Treatment Unit takes advantage of the experience of interventional radiology staff to organize tumor treatment in collaboration with the clinical and surgical units. The results of intralesional thermal ablation can be optimized with the addition of a radiological intralesional approach, with guidance procedures as ultrasound, CT, MR, and angiography. During 2010, we treated 80 patients with percutaneous intralesional radiofrequency, most of whom had non-operable HCC with a diameter of about 3.5 cm. When the diameter was larger than 3.5 cm, we combined radiofrequency with temporary arterial stop-flow during selective hepatic angiography. The combination of radiofrequency and arterial stop-flow can lead to the destruction of very large liver tumors, with only one insertion of the radiofrequency electrode in mini-invasive approach and only one day of hospitalization. We have also treated kidney neoplasms, primary and secondary lung tumors, soft tissue and suprarenal gland tumors. In some cases, we have employed microwaves and laser intralesional treatment techniques.

*Keywords: thermal ablation, interventional oncological radiology*



### 2010 RELEVANT NOTES

#### Collaborations

Fondazione IRCCS Policlinico San Matteo, Pavia  
Azienda Ospedaliera, Ospedale di Circolo di Melegnano, Milan  
University of Milan  
The Royal Marsden, NHS Foundation Trust, London

#### Publications

Repeated radiofrequency ablation for management of patients with cirrhosis with small hepatocellular carcinomas: a long-term cohort study. *Hepatology*, September 2010

#### Contributions

Our RF stop-flow combination technique for treatment of large HCC was inserted in the Italian National Radiological Society guidelines for Interventional Radiology

In international guidelines for treatment of HCC, a percutaneous approach with RF thermal ablation of HCC up to 3.5 cm diameter was considered as a definitive mini-invasive therapy.

## RADIOLOGY AND DIAGNOSTIC IMAGING 3

### HEAD

Silvana Bergonzi, MD

### STAFF MEMBERS

Guido Cozzi, MD

Claudio Ferranti, MD

Monica Marchesini, MD

Marco Milella, MD

Monica Salvetti, MD

Gianfranco Scaperrotta, MD

Laura Suman, MD

### TECHNICIANS

Cristina Folini (coordinator)

Luisa Colombo, Luciana Dedei, Enrico

Depedri, Luca Lanzilotti, Maria Pia

Mannella, Stefania Sala, Anna Tavola

### NURSES

Mauro Addolorato, Ferruccio Mirella

### ADMINISTRATIVES

Marzia Gaffo, Lucia Nardin,

Giuseppa Pacicca, Francesca Vescera

This Diagnostic Radiology is composed of two Units: the Breast Imaging Unit and the Diagnostic and Interventional Gastroenterology Unit. The two Units share technicians, while staff members have specific duties in each Unit.

### BREAST IMAGING UNIT (Head: Silvana Bergonzi)

The aims of diagnostic work up and breast biopsy are to localize primary or recurrent breast cancer in the preclinical phase and/or validate clinical findings with the intent to reduce unnecessary surgery. The biopsies performed in non-palpable breast lesions are also a basic element of a multidisciplinary approach to provide the histological parameters needed for surgical planning. Breast imaging consists mostly in clinical mammography and breast ultrasound studies on symptomatic or treated patients and on asymptomatic women for screening and prevention, with specific regard to women with known genetic predisposition and/or family history for breast cancer. In 2010, 13,300 mammographic examinations and 9,000 breast ultrasound studies were performed, in addition to 400 second opinion consultations. Moreover, 830 conventional radiodiagnostic procedures on inpatients were performed.

A total of 1,600 interventional procedures (6% increase vs 2009) were carried out in 2010 on patients with suspicious imaging findings in INT or other diagnostic centers (650 preoperative targeting of non-palpable breast lesions and 950 breast biopsies [ultrasound and stereotactic-guided, particularly vacuum-assisted]).

During 2010, a new breast lesion excision system able to provide a single sample with intact architecture was tested that will be compared to other vacuum-assisted devices.

*Keywords: breast, diagnostic imaging, breast biopsy*

### DIAGNOSTIC AND INTERVENTIONAL GASTROENTEROLOGY (Head: Guido Cozzi)

The clinical activity of the Unit deals with diagnostic and interventional radiology of the digestive and biliary tracts, and diagnostic and interventional ultrasound (US), the latter primarily in thyroid and neck pathologies.

Thyroid diseases (6,104 US examinations) still represent a prominent area of interest. In cooperation with the multidisciplinary outpatient service of thyroid diseases, 2,446 neck US examinations for diagnosis and monitoring of thyroid nodules were performed. A total of 654 diagnostic examinations of functional disorders of the digestive tract were performed.



Compared to 2009, a small decrease in diagnostic radiologic examinations was offset by a considerable increase (12%) in interventional procedures (IP) that may allow resolution of surgical complications without reintervention.

IP represent, both in the biliary and gastrointestinal areas, the most clinically relevant activity of the Unit that has become a point of reference for many institutions.

In the biliary field, definitive jaundice palliation with drainages or stents, curative dilatation of cicatricial stenoses, drainage of fistulas, transluminal biopsies, and other less common maneuvers are routinely performed. In the gastrointestinal field, in addition to treatment of complications (transluminal drainage of fluid collections, dilatation of cicatricial stenoses), IP plays a basic role in nutritional support (percutaneous gastrostomy, positioning of feeding tubes, stenting of inoperable stenoses). The majority of these procedures are urgent, which requires significant organizational capacity.

In 2010, the first non-covered, self-expandable, biodegradable stent was positioned with success in a patient with a benign esophageal stricture. This IP is expected to have an important role in the treatment of benign stenoses of the digestive tract (included biliary), since it provides long-term dilation and self-removal.

*Keywords: interventional biliary radiology, interventional gastroenteric radiology, thyroid biopsy*

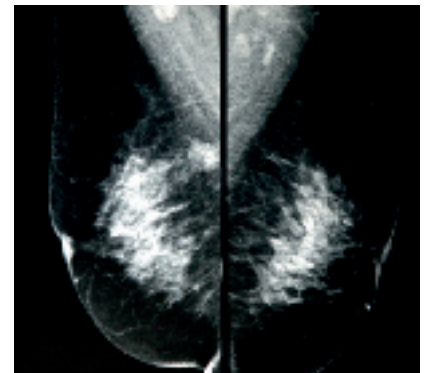
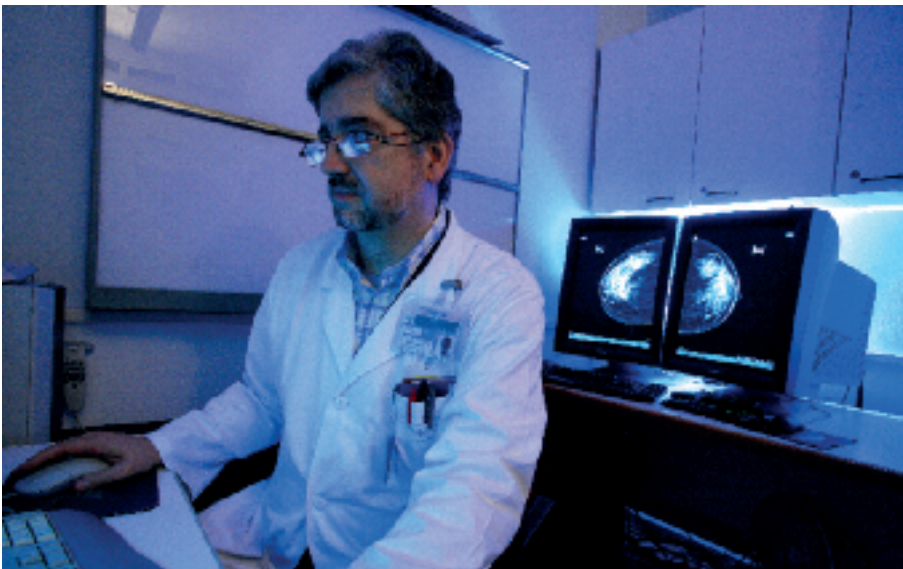
## 2010 RELEVANT NOTES

### Contributions

Guido Cozzi was reviewer for Cardiovascular and Interventional Radiology Journal

### Publications

Is there a specific magnetic resonance phenotype characteristic of hereditary breast cancer? *Tumori*. 2010; 96:363-84



## NUCLEAR MEDICINE

### HEAD

Emilio Bombardieri MD

### STAFF MEMBERS

Alessandra Alessi, MD

Gianluca Aliberti, MD

Anna Bogni, Biol Sci

Maria R. Castellani, MD

Carlo Chiesa, Physicist

Flavio Crippa, MD

Vinicio De Sanctis, Engineer

Marco Maccauro, MD

Eva Orunesu, MD

Claudio Pascali, Radiochemist

Gianluca Serafini, MD

Ettore Seregni, MD

### RESEARCH MEMBERS

Angela Coliva, Chemist

Claudia Cucchi, Chemist

Luca Laera, Chemist

Greta Maiocchi, Chemist

### POST-DOCTORAL FELLOWS

Barbara Padovano, MD

Federica Pallotti, MD

### ADMINISTRATIVES

Annaluisa De Simone Sorrentino  
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Fracchiolla, Rosangela Ghilardi,

Patrizia Gobbi

### TECHNICIANS

Monica Testoni (Coordinator),

Grazia Aprigliano, Danilo Baratella,

Davide Bassani, Sergio Bavusi,

Gianenrico Cucchetti, Maria Di

Francesco, Pietro Di Nuzzi, Martino

Faedui, Rita Filieri, Deborah Mansi,

Giovanni Nido, Rossana Pavesi, Biagio

Perrone, Matteo Regazzoni, Lidia Spano,

Roberto Segreti

### NURSES

Rita Sicari (Coordinator),

Mirella Ferruccio, Gaetano Naso,

Calogero Oliveri, Loredana Palella

This Unit includes different groups and is involved in various clinical and experimental activities. Given the multidisciplinary clinical and research activities, a variety of expertise ranging from nuclear medicine, endocrinology, chemistry, engineering, biology, and physics are present. Major clinical activities include a diagnostic unit for tomographic scintigraphy (SPECT); PET unit; several radiochemistry laboratories for both gamma and beta radiopharmaceuticals; radioisotope laboratory for radioimmunometric tests; protective ward for radiometabolic treatments. The research involves several topics: measurement of biochemical markers of neoplasia and evaluation of bone metabolism parameters in patients with bone metastases; studies on clinical PET and validation of PET applications; development of new radiopharmaceuticals for PET and therapy; new approaches for the radioisotopic therapy of thyroid cancer, neuroblastoma and lymphoma; dosimetry studies to optimize the activity to be administered to increase the efficacy of treatment.

In particular, new radiopharmaceuticals have been synthesized such as <sup>18</sup>F-fluorodeoxythymidine (<sup>18</sup>F-FLT), which is being investigated in experimental and clinical studies in both animal models (with MicroPET) and humans (breast cancer patients). Novel approaches for the treatment of neuroendocrine tumors with tandem radiolabeled somatostatin analogues (<sup>177</sup>Lu/ and <sup>90</sup>Y DOTA-TATE) are being studied. Dosimetric studies on thyroid cancer treatment and HCC therapy with microspheres have been carried out to administer the optimal activity.

*Keywords: molecular imaging, radiopharmaceutical development, radioisotope therapy*

### 2010 RELEVANT NOTES

#### Collaborations

International Agency Atomic Energy (IAEA), Vienna  
Edition of Technical books on PET Application and Development

Associazione Italiana di Medicina Nucleare (AIMN) -  
Multicentric study on dosimetry of radioiodine treatment of advanced thyroid cancer

International Society of Pediatric Neuroblastoma (SIOPEN) Group), Multicentric study on the treatment of advanced neuroblastoma

#### Publications

Imaging of NETs with gamma-emitting radiopharmaceuticals. *Q J Nucl Med Mol Imaging*. 2010;54: 3-15.

<sup>131</sup>I-MIBG treatment of pheochromocytoma: low versus intermediate activity regimens of therapy. *Q J Nucl Med Mol Imaging*. 2010;54:100-13.

#### Contributions

##### GUIDELINES

Bombardieri E, Ambrosini V, Aktolun C, Baum RP, Bishof-Delaloye A, Del Vecchio S, Maffioli L. <sup>111</sup>In-pentetreotide scintigraphy: procedure guidelines for tumour imaging. *Eur J Nucl Med Mol Imaging*. 2010;37:1441-8.

Bombardieri E, Gianmaria F, Aktolun C, Baum RP, Bishof-Delaloye A, Maffioli L. <sup>131</sup>I/<sup>123</sup>I mIBG scintigraphy; procedure guidelines for tumor imaging. *Eur J Nucl Med Mol Imaging*. 2010;37:2436-46.

##### EDITORIAL BOARD

European Journal of Nuclear Medicine and Molecular Imaging - Springer (Heidelberg, Germany)

Quarterly Journal of Nuclear Medicine and Molecular Imaging - Minerva Medica (Turin, Italy)



**CLINICAL PET** (Head: Flavio Crippa)

Clinical activities are focused on PET scans for staging, therapy monitoring, and follow-up of almost all types of human malignancies. The most investigated malignancies were lymphoma, breast cancer, colorectal cancer, lung cancer, melanoma, soft tissue sarcomas, ovarian cancer, head and neck cancers, and gliomas.

Ongoing clinical research programs are based on the use of FDG-PET: in combination with CT for the follow-up of asymptomatic melanoma patients with a high risk of metastases for early detection of tumor progression and potentially curable with surgical treatment; monitoring the efficacy of neoadjuvant chemoradiotherapy in patients with locally advanced rectal cancer and pazopanib monotherapy in patients with relapsed/refractory urothelial cancer (INT70/09, NCT01031875); early evaluation of chemosensitivity in lymphoma patients; providing imaging support to several clinical research programs carried out by the Sarcoma Group of INT with particular reference to GISTs and chordomas. Furthermore, <sup>11</sup>C-methionine PET is under investigation to study brain tumors, and in particular low-grade gliomas, where FDG-PET lacks sensitivity as an imaging modality.

A small animal PET imaging facility (microPET) has been installed, and research has been focused on training a multidisciplinary staff who will perform experiments investigating the biodistribution of PET tracers, such as FDG and <sup>18</sup>F-FLT, in selected cancer animal models.

**Keywords:** PET/CT in tumor staging, metabolic imaging, therapy monitoring, <sup>18</sup>F-FDG, PET radiopharmaceuticals

**2010 RELEVANT NOTES****Collaborations**

Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan  
Azienda Ospedaliero-Universitaria Molinette San Giovanni Battista, Turin

**Publications**

Pretransplantation [<sup>18</sup>F]fluorodeoxyglucose positron emission tomography scan predicts outcome in patients with recurrent Hodgkin lymphoma or aggressive non-Hodgkin lymphoma undergoing reduced-intensity conditioning followed by allogeneic stem cell transplantation. *Cancer* 2010;116: 5001-11.

Treatment with tandem [(<sup>90</sup>Y)DOTA-TATE and [(<sup>177</sup>Lu)DOTA-TATE] of neuroendocrine tumors refractory to conventional therapy: preliminary results. *Q J Nucl Med Mol Imaging*. 2010;54:84-91.

**NUCLEAR MEDICINE THERAPY AND ENDOCRINOLOGY** (Head: Ettore Seregni)

The activities of the Unit cover three main areas involved in routine and experimental procedures: nuclear medicine therapy, radioisotope laboratory, and an endocrinology outpatient clinic. The main therapeutic areas are thyroid cancer, neuroendocrine tumors and endocrine therapy. In 2010, two protocols of experimental therapies were active:

*Efficacy of tandem treatment of neuroendocrine tumors refractory to conventional therapies with the somatostatin analogs <sup>90</sup>Y-DOTA-TATE and <sup>177</sup>Lu-DOTA-TATE.* The protocol prescribes 4 therapeutic cycles alternating [<sup>177</sup>Lu]DOTA-TATE (5.55 GBq) and [<sup>90</sup>Y]DOTA-TATE (2.6 GBq). Dosimetric evaluation after administration of [<sup>177</sup>Lu]DOTA-TATE allows calculation of the absorbed doses in healthy organs. Toxicity was evaluated considering hematological parameters and glomerular filtration rate (GFR), while efficacy was measured with RECIST criteria. In 2010, 10 patients were enrolled and completed all cycles of treatment. In general, treatment was well tolerated and no adverse events were registered. No damage to healthy organs was revealed in accordance with the calculated absorbed doses. Considering the 26 patients treated since the start of accrual, 1 complete response, 9 partial responses, and 12 stabilizations of disease were recorded at 6 months after the last treatment.

*Efficacy of endoarterial treatment with <sup>90</sup>Y-TheraSphere microspheres in hepatocellular carcinoma.* To date, more than 90 patients with unresectable hepatocellular carcinoma have been evaluated after <sup>90</sup>Y radioembolization. Fifty-six patients entered the study and were treated with standard lobar activity of <sup>90</sup>Y TheraSpheres. The therapeutic activity was calculated so that a fixed absorbed dose of 120 Gy to the target lobe was reached. Median follow-up was 10 months, and complete or partial responses were obtained in 27.5-33.3% of patients, depending on the criteria used for evaluation.

**Keywords:** peptide receptor radiotherapy, trans arterialhery radioembolization, pediatric endocrinology



## RADIOTHERAPY 1

### HEAD

Patrizia Olmi, MD (retired 30 Sept 2010)  
Emilio Bombardieri, MD (present)

### STAFF MEMBERS

Nice Bedini, MD  
Anna Di Russo, MD  
Lorenza Gandola, MD  
Laura Lozza, MD  
Ester Orlandi, MD  
Claudia Sangalli, MD  
Fulvia Soncini, MD  
Silvia Tana, MD  
Francesca Valvo, MD  
Sergio Villa, MD

### ADMINISTRATIVES

Donatella Orlandi, Patrizia Riva

### NURSES

Carla Viscardi, Pasquale Brunacci

### HEALTHCARE ASSISTANTS

Grazia Arpaia, Sebastiano Sicilia,  
Cristina Terenghi

### TECHNICIANS

Ciro Pintaudi (Coordinator), Cosimo Attolino, Arianna Bianchini, Claudio Boccadamo, Giuseppina Bonanno, Alberto Buzzetti, Carmelo Campolo, Gabriele Carabelli, Pasquale Contessa, Paolo D'Agnese, Carmelo Di Marco, Lucio Donatone, Rosa Fortunato, Sarah Frasca, Piera Fusar Poli, Franca Gaetano, Emanuela Gatti, Manuela Guerra, Daniela Pierograndi, Antonio Spartano, Francesca Spartano, Carla Valenti, Luca Zappa

The research activity of the Unit is devoted to clinical multidisciplinary trials and projects mainly in the field of pediatric tumors, head and neck cancer, soft tissue sarcomas, and prostate cancer. Clinical activities also involve validation of new technologies (*i.e.* Rapid Arc) in specific clinical settings and quality assurance surveys.

Overall, in 2010, treatment plans were delivered using the following techniques: 926 treatments with 3D conformal radiation therapy, 179 with IMRT, 225 with Rapid Arc, and 573 with 2D conventional radiotherapy, for a total of 1903 treatment plans (>1/patient). Rival plans are often required for optimal assessment of treatment. All treatments were delivered on an outpatient basis. Nearly 80% of patients were treated with curative intent.

*Keywords: radiotherapy, rapid arc technology, quality assurance*

## 2010 RELEVANT NOTES

### Collaborations

Lorenza Gandola: Coordinator of "Radiotherapy Working Group" of the Associazione Italiana Ematologia Oncologia Pediatrica (AIEOP) and Co-Chairman Brain Tumor Group of the International Society of Paediatric Oncology (SIOP)

Ester Orlandi: Co-investigator for the EORTC 24061 study: Randomized phase II feasibility study of Cetuximab combined with 4 cycles of TPF followed by platinum based chemo-radiation strategies and Member of the EORTC Head and Neck Group

Silvia Tana: Member of Italian Germ Cell Cancer Group (IGG), Member of EAU Board for Guidelines on penis carcinoma

Nice Bedini, Sergio Villa: clinicians in charge of Prostate Cancer Research International, active surveillance (PRIAS)

### Publications

Radiobiological basis and clinical results of the simultaneous integrated boost (SIB) in intensity modulated radiotherapy (IMRT) for head and neck cancer: A review. *Crit Rev Oncol Hematol.* 2010;73:111-25.



## RADIOTHERAPY 2

### HEAD

Carlo Fallai, MD

### STAFF MEMBER

Annamaria Cerrotta, MD

### POSTDOCTORAL FELLOWS

Monica Alicia Garcia, MD

### NURSES

Pier Giulio Pezzaglia, Head Nurse  
Rosa Attolino, Marisa De Carli,  
Alessandra Licata, Emanuela Visentin,  
Antonio Micello, Antonella Causio,  
Francesco Tartaglione, Carmen Cuesta  
Garcia, Carmelina Minio, Luigia Cerra,  
Antonio Floresta, Antonio Lucenti

### HEALTHCARE ASSISTANTS

Angela Abatangelo, Brenilda M. Fuentes  
Delgado, Giuseppe Gaglio, Concetta  
Rugolo, Dario Tonelli, Claudia Soave

### ADMINISTRATIVE

Emilia Mausoli

Radiotherapy 2 (RT2) is the inpatient section of the Department of Diagnostic Imaging and Radiotherapy; its facilities include 8 beds in 4 shielded rooms, one operating room, and 1 office for inpatient preparatory procedures and for outpatient follow-up. In 2010, the mean hospital stay for inpatients was 7.7 days.

Its principal aim is care of patients affected with any form of cancer undergoing inpatient radiation therapy. RT2 also cooperates with Radiotherapy 1 (RT1) in the planning and delivery of external beam radiation treatments in outpatients, mainly for gynecologic and head and neck cancers, and in a metastatic/palliative setting.

In addition to external beam radiotherapy, the activities of RT2 consist in administering high dose rate brachytherapy (HDR-BT). BT is generally administered on an outpatient basis: as endocavitary treatment in uterine cancers; as endoluminal treatment in biliary tract cancers; as interstitial treatment in breast cancer.

During 2010, 65 patients were treated with 171 fractions and 167 treatment plans. Prostate cancer HDR-BT, as monotherapy, was activated in December 2010, consisting in 2 treatment sessions of 14 Gy each performed in low risk patients.

RT2 collaborates with the Radiology Diagnostic Units for care of patients undergoing chemo-embolization, intra-arterial chemotherapy, and other oncologically targeted interventional procedures requiring hospitalization. Combination chemoradiotherapy treatments were also performed, mainly in gynecologic, anorectal, and head and neck cancers. A total of 204 cycles of chemotherapy were administered in 2010. Supportive care for acute and, more infrequently, late radiotherapy-related complications is also provided.

*Keywords: head and neck cancer, gynecologic cancer, HDR brachytherapy, geriatric Oncology*



### 2010 RELEVANT NOTES

#### Collaborations

MARCH Collaborative Group, Villejuif Cedex  
Gynecologic Cancer InterGroup (GCG), Kingston, Ontario  
Associazione Italiana Radioterapia Oncologica (AIRO) and Scientific Secretariat of AIRO Annual Congress Regional Group of Lombardy.  
Associazione Italiana di Radiobiologia (AIRB)  
European Society Therapeutic Radiation Oncology (ESTRO)  
American Society Therapeutic Radiation Oncology (ASTRO)  
Società Internazionale Oncologia Geriatrica (SIOG)  
Alleanza Contro il Cancro (ACC) (Project WP4 - Program 1)

#### Publications

Fricke gel-layer dosimetry in high dose-rate brachytherapy. *Appl Radiat Isot.* 2010;68:722-5.  
Hyperfractionated or accelerated radiotherapy for head and neck cancer. *Cochrane Database Syst Rev.* 2010;12:CD002026.

## MEDICAL PHYSICS

### HEAD

Giancarlo Zonca, Physics D

### STAFF MEMBERS

Marta R. Borroni, Physics D

Mauro Carrara, Physics D

Valeria Mongioj, Physics D

Emanuele Pignoli, Physics D

Stefano Tomatis, Physics D

### RESEARCH MEMBERS

Manuela Lualdi, Physics D

### TECHNICIANS

Vito Cosentino, Elena Fraigola, Luca C.

Marrone, Ester Mazzaella, Dario Postè,

Claudio G. Stucchi

### HEALTHCARE ASSISTANT

Giuseppina Esposito

The Unit is engaged in investigating high conformal treatments for the irradiation of different anatomical regions, and to achieve dose distribution optimization. Since many linac parameters can vary during patient irradiation, phantom dosimetric verification of treatment plans are also performed to evaluate the accuracy of the calculated dosimetric distribution on different planes. The accordance obtained between calculated and measured dose distribution in phantom was within the values reported in literature.

Furthermore, in 2010 relevant support to the clinical application of image guided radiotherapy (IGRT) was provided.

In collaboration with Radiotherapy 1 and the Department of Anaesthesiology, the Unit contributed to the adoption and optimization of an innovative facility for high dose rate brachytherapy (HDR-BT) for prostate cancer under real-time ultrasound guidance. Dosimetric calculations were performed for all patients recruited in HDR-BT study.

The application of fluorescence intensity in patients with hereditary colorectal cancer (HCRC) is under investigation in collaboration with the Laboratory Medicine Unit. Promising preliminary data indicate that the intensity of the fluorescence emission peak around 615-635 nm is significantly different between patients with HCRC and control subjects.

*Keywords: dosimetry, radiotherapy, treatment planning*

## 2010 RELEVANT NOTES

### Collaborations

Physics Department of the University of Milan and the National Institute of Nuclear Physics.

### Publications

Feasibility study of a dosimeter for in vivo measurements of the absolute dose delivered in high dose rate brachytherapy. *Il Nuovo Cimento*. 125B(2010),667-73.

