

## Advances in diagnostic and interventional radiology

*Massimo De Filippo<sup>1</sup>, Luca Brunese<sup>2</sup>, Alfonso Reginelli<sup>3</sup>*

<sup>1</sup> Department of Medicine and Surgery, Unit of Radiologic Science, University of Parma, Maggiore Hospital, Parma, Italy;

<sup>2</sup> Department of Medicine and Health Sciences "V. Tiberio", University Of Molise, Campobasso, Italy; <sup>3</sup> Department of Precision Medicine, University of Campania "L. Vanvitelli", Naples, Italy

This Special Issue includes a series of contributions whose central theme are the recent advances in the field of diagnostic and interventional radiology. In recent years, in fact, technological innovations, together with clinical research, have led to the development of new imaging applications in clinical practice (1-8). These innovations have involved the purely diagnostic aspect of imaging, thanks to the implementation of new protocols and advanced sequences, but also have given a significant boost to the ever-increasing use of interventional radiology procedures for the treatment of various diseases in different fields (9-18). The articles published in this volume are intended to give an overview of some of these new applications, focusing on, or reviewing, the state of the art in specific diagnostic and interventional settings (19-27).

The first article entitled "Internal hernias: a difficult diagnostic challenge. Review of CT signs and clinical findings", by Lanzetta et al., is a review article focused on a rather rare but of fundamental clinical and diagnostic importance pathological picture that general, emergency and abdominal radiologists have to confront with. The authors carefully summarize the most important clinical and imaging aspects of this pathology, often of difficult assessment.

Still on the subject of diagnostic radiology, Bruno et al., in the second article "Application of Diffusion Tensor Imaging (DTI) and MR-tractography in the evaluation of peripheral nerve tumours: state of the art and review of the literature", present the role of a particular novel advanced MRI technique in the pre-operative study of peripheral nerves, whose results are very promising, with important clinical implications.

The importance of imaging in clinical management (28-30) is also underlined by Danti et al., the authors of the article "Relationship between diagnostic imaging features and prognostic outcomes in gastrointestinal stromal tumors (GIST)", focused on the CT classification systems in the diagnostic imaging of GIST, and their role in risk stratification (31-35).

Starting from the description of a case (36, 37), Mariniello et al., in their article "Radiation-induced brain cavernomas in elderly: review of the literature and a rare case report", review the literature of radiation-induced cavernomas with their pathological features and imaging findings.

Interventional radiology nowadays gained application for the treatment of degenerative, traumatic, and tumor diseases in several fields (38-46). A very effective procedure used in the musculoskeletal field is the percutaneous lavage of rotator cuff calcifications, described in terms of technique and results by Pagnini et al. in their article "Ultrasound-guided percutaneous irrigation of calcific tendinopathy: technical developments".

Another clinically relevant interventional radiology technique is the execution of biopsies in almost all body districts (47-53). In the article "Percutaneous needle biopsy of retroperitoneal lesions: technical developments" by Bevilacqua et al., the authors describe the difficult but fundamental role of the imaging guidance in the biopsy of retroperitoneal lesions, underlining the primary role of the interventional radiologist in the choice of the imaging modality, the approaches and the techniques to be used.

A multimodal imaging approach is often useful for an accurate diagnosis of certain diseases. In their

article “Magnetic Resonance Enterography (MRE) and Ultrasonography (US) in the study of the small bowel in Crohn’s disease: state of the art and review of the literature”, Manetta et al. describe the state of the art of diagnostic imaging in the study of this condition, comparing the advantages and limitations of the two techniques.

Beyond diagnostic purposes, imaging plays a determinant role in the monitoring of therapeutic regimens in particular settings where novel or advanced therapies are administered. The contribution by Reginelli et al. “Diagnostic value/performance of radiological liver imaging during chemotherapy for gastrointestinal malignancy: a critical review” is a diagnostic focus on the imaging of liver alterations during systemic therapy in cancer patients, with particular reference to the chemotherapeutic agents and the diagnostic challenges that can be encountered in these cases.

The last article by Zappia et al., entitled “Imaging of long head biceps. A multimodality pictorial essay” is an all-round review of the diagnostic imaging modalities in the evaluation of the LHBT of the shoulder.

We are sure that the contributions of this volume can represent an opportunity for updating both for the radiologists and for the clinicians of various specialties, and we thank the authors for the intense commitment and the excellent scientific value of their work.

## References

1. Valeri G, Mazza FA, Maggi S, et al. Open source software in a practical approach for post processing of radiologic images. *Radiol Med* 2015; 120: 309-23.
2. Grassi R, Cavaliere C, Cozzolino S, et al. Small animal imaging facility: New perspectives for the radiologist. *Radiol Med* 2009; 114: 152-67.
3. Di Cesare E, Gennarelli A, Di Sibio A, et al. Image quality and radiation dose of single heartbeat 640-slice coronary CT angiography: A comparison between patients with chronic Atrial Fibrillation and subjects in normal sinus rhythm by propensity analysis. *Eur J Radiol* 2015; 84: 631-36.
4. De Cecco CN, Buffa V, Fedeli S, et al. Preliminary experience with abdominal dual-energy CT (DECT): True versus virtual nonenhanced images of the liver. *Radiol Med* 2010; 115: 1258-66.
5. Buffa V, Solazzo A, D’Auria V, et al. Dual-source dual-energy CT: dose reduction after endovascular abdominal aortic aneurysm repair. *Radiol Med* 2014; 119: 934-41.
6. Iacobellis F, Segreto T, Berritto D, et al. A rat model of acute kidney injury through systemic hypoperfusion evaluated by micro-US, color and PW-Doppler. *Radiol Med* 2018;
7. Cappabianca S, Iaselli F, Reginelli A, et al. Value of diffusion-weighted magnetic resonance imaging in the characterization of complex adnexal masses. *Tumori* 2013; 99: 210-17.
8. Barile A, La Marra A, Arrigoni F, et al. Anaesthetics, steroids and platelet-rich plasma (PRP) in ultrasound-guided musculoskeletal procedures. *Br J Radiol* 2016; 89: 20150355.
9. Masciocchi C, Arrigoni F, Ferrari F, et al. Uterine fibroid therapy using interventional radiology mini-invasive treatments: current perspective. *Med Oncol* 2017; 34: 52.
10. Cappabianca S, Porto A, Petrillo M, et al. Preliminary study on the correlation between grading and histology of solitary pulmonary nodules and contrast enhancement and [18F] fluorodeoxyglucose standardised uptake value after evaluation by dynamic multiphase CT and PET/CT. *J Clin Pathol* 2011; 64: 114-19.
11. Cantisani V, Grazhdani H, Drakonaki E, et al. Strain US Elastography for the Characterization of Thyroid Nodules: Advantages and Limitation. *Int J Endocrinol* 2015; 2015: 908575.
12. Muccio CF, Di Blasi A, Esposito G, Brunese L, D’Arco F, Caranci F. Perfusion and spectroscopy magnetic resonance imaging in a case of lymphocytic vasculitis mimicking brain tumor. *Pol J Radiol* 2013; 78: 66-69.
13. Cirillo M, Caranci F, Tortora F, et al. Structural neuroimaging in dementia. *J Alzheimers Dis* 2012; 29: 16-19.
14. Zappia M, Capasso R, Berritto D, et al. Anterior cruciate ligament reconstruction: MR imaging findings. *Musculoskelet Surg* 2017; 101: 23-35.
15. Barile A, Arrigoni F, Bruno F, et al. Computed Tomography and MR Imaging in Rheumatoid Arthritis. *Radiol Clin North Am* 2017; 55: 997-1007.
16. Valentini V, Buquicchio GL, Galluzzo M, et al. Intussusception in Adults: The Role of MDCT in the Identification of the Site and Cause of Obstruction. *Gastroenterol Res Pract* 2016; 2016: 5623718-18.
17. Di Cesare E, Patriarca L, Panebianco L, et al. Coronary computed tomography angiography in the evaluation of intermediate risk asymptomatic individuals. *Radiol Med* 2018; 123: 686-94.
18. Lo Re G, Cappello M, Tudisca C, et al. CT enterography as a powerful tool for the evaluation of inflammatory activity in Crohn’s disease: Relationship of CT findings with CDAI and acute-phase reactants. *Radiol Med* 2014; 119: 658-66.
19. Barile A, Bruno F, Mariani S, et al. What can be seen after rotator cuff repair: a brief review of diagnostic imaging findings. *Musculoskelet Surg* 2017; 101: 3-14.
20. Splendiani A, Perri M, Marsecano C, et al. Effects of serial macrocyclic-based contrast materials gadoterate meglumine and gadobutrol administrations on gadolinium-related dentate nuclei signal increases in unenhanced T1-weighted brain: a retrospective study in 158 multiple sclerosis (MS) patients. *Radiol Med* 2018; 123: 125-34.
21. Scialpi M, Cappabianca S, Rotondo A, et al. Pulmonary

- congenital cystic disease in adults. Spiral computed tomography findings with pathologic correlation and management. *Radiol Med* 2010; 115: 539-50.
22. Tedeschi E, Caranci F, Giordano F, Angelini V, Cocozza S, Brunetti A. Gadolinium retention in the body: what we know and what we can do. *Radiol Med* 2017; 122: 589-600.
  23. Vivarelli M, Vincenzi P, Montalti R, et al. ALPPS Procedure for Extended Liver Resections: A Single Centre Experience and a Systematic Review. *PLoS One* 2015; 10: e0144019.
  24. Di Cesare E, Cademartiri F, Carbone I, et al. Clinical indications for the use of cardiac MRI. by the SIRM Study Group on Cardiac Imaging. *Radiol Med* 2013; 118: 752-98.
  25. Zappia M, Castagna A, Barile A, Chianca V, Brunese L, Pouliart N. Imaging of the coracoglenoid ligament: a third ligament in the rotator interval of the shoulder. *Skeletal Radiol* 2017; 46: 1101-11.
  26. Di Pietto F, Chianca V, de Ritis R, et al. Postoperative imaging in arthroscopic hip surgery. *Musculoskelet Surg* 2017; 101: 43-49.
  27. Barile A, Bruno F, Arrigoni F, et al. Emergency and Trauma of the Ankle. *Semi Musc Rad* 2017; 21: 282-89.
  28. Salvolini L, Urbinati C, Valeri G, Ferrara C, Giovagnoni A. Contrast-enhanced MR cholangiography (MRCP) with GD-EOB-DTPA in evaluating biliary complications after surgery. *Radiol Med* 2012; 117: 354-68.
  29. Francone M, Di Cesare E, Cademartiri F, et al. Italian registry of cardiac magnetic resonance. *Eur J Radiol* 2014; 83: e15-e22.
  30. Perrotta FM, Astorri D, Zappia M, Reginelli A, Brunese L, Lubrano E. An ultrasonographic study of enthesitis in early psoriatic arthritis patients naive to traditional and biologic DMARDs treatment. *Rheumatol Int* 2016; 36: 1579-83.
  31. Lai Q, Nicolini D, Inostroza M, et al. A novel prognostic index in patients with hepatocellular cancer waiting for liver transplantation Time-Radiological-response-Alpha-feto-protein-INflammation (TRAIN) score. *Ann Surg* 2016; 264: 787-96.
  32. Mocchegiani F, Vincenzi P, Coletta M, et al. Prevalence and clinical outcome of hepatic haemangioma with specific reference to the risk of rupture: A large retrospective cross-sectional study. *Dig Liver Dis* 2016; 48: 309-14.
  33. Cortellini A, Verna L, Porzio G, et al. Predictive value of skeletal muscle mass for immunotherapy with nivolumab in non-small cell lung cancer patients: A "hypothesis-generator" preliminary report. *Thorac Cancer* 2019; 10: 347-51.
  34. Cortellini A, Palumbo P, Porzio G, et al. Single-institution study of correlations between skeletal muscle mass, its density, and clinical outcomes in non-small cell lung cancer patients treated with first-line chemotherapy. *Thorac Cancer* 2018; 9: 1623-30.
  35. Maurizi N, Passantino S, Spaziani G, et al. Long-term Outcomes of Pediatric-Onset Hypertrophic Cardiomyopathy and Age-Specific Risk Factors for Lethal Arrhythmic Events. *JAMA Cardiol* 2018; 3: 520-25.
  36. Caranci F, Napoli M, Cirillo M, Briganti G, Brunese L, Briganti F. Basilar artery hypoplasia. *Neuroradiol J* 2012; 25: 739-43.
  37. Battipaglia G, Avilia S, Morelli E, Caranci F, Perna F, Camera A. Posterior reversible encephalopathy syndrome (PRES) during induction chemotherapy for acute myeloblastic leukemia (AML). *Ann Hematol* 2012; 91: 1327-28.
  38. Arrigoni F, Gregori LM, Zugaro L, Barile A, Masciocchi C. MRgFUS in the treatment of MSK lesions: A review based on the experience of the university of L'Aquila, Italy. *Transl Cancer Res* 2014; 3: 442-48.
  39. Barile A, Arrigoni F, Zugaro L, et al. Minimally invasive treatments of painful bone lesions: state of the art. *Med Oncol* 2017; 34: 53.
  40. Ferrari F, Arrigoni F, Miccoli A, et al. Effectiveness of Magnetic Resonance-guided Focused Ultrasound Surgery (MRgFUS) in the uterine adenomyosis treatment: technical approach and MRI evaluation. *Radiol Med* 2016; 121: 153-61.
  41. Barile A, Arrigoni F, Bruno F, et al. Present role and future perspectives of interventional radiology in the treatment of painful bone lesions. *Future Oncol* 2018; 14: 2945-55.
  42. Arrigoni F, Bruno F, Zugaro L, et al. Developments in the management of bone metastases with interventional radiology. *Acta Biomed* 2018; 89: 166-74.
  43. Briganti F, Leone G, Marseglia M, Cicala D, Caranci F, Maiuri F. P64 Flow Modulation Device in the treatment of intracranial aneurysms: Initial experience and technical aspects. *J Neurointerv Surg* 2016; 8: 173-80.
  44. Arrigoni F, Barile A, Zugaro L, et al. Intra-articular benign bone lesions treated with Magnetic Resonance-guided Focused Ultrasound (MRgFUS): imaging follow-up and clinical results. *Med Oncol* 2017; 34: 55.
  45. Macchi M, Belfiore MP, Floridi C, et al. Radiofrequency versus microwave ablation for treatment of the lung tumours: LUMIRA (lung microwave radiofrequency) randomized trial. *Med Oncol* 2017; 34: 96.
  46. Dialetto G, Reginelli A, Cerrato M, et al. Endovascular stent-graft treatment of thoracic aortic syndromes: A 7-year experience. *Eur J Radiol* 2007; 64: 65-72.
  47. Gatta G, Parlato V, Di Grezia G, et al. Ultrasound-guided aspiration and ethanol sclerotherapy for treating endometrial cysts. *Radiol Med* 2010; 115: 1330-39.
  48. Bertolini L, Vaglio A, Bignardi L, et al (2011). Subclinical interstitial lung abnormalities in stable renal allograft recipients in the era of modern immunosuppression. *Transplantation Proceedings*, vol. 43, p. 2617-2623, ISSN: 0041-1345, doi: 10.1016/j.transproceed.2011.06.033.
  49. Palma BD, Guasco D, Pedrazzoni M, et al. Osteolytic lesions, cytogenetic features and bone marrow levels of cytokines and chemokines in multiple myeloma patients: Role of chemokine (C-C motif) ligand20. *Leukemia*. 2016 Feb;30(2):409-16. doi: 10.1038/leu.2015.259. Epub 2015 Sep 30.
  50. Bozzetti C, Nizzoli R, Tiseo M, et al. ALK and ROS1 rearrangements tested by fluorescence in situ hybridization in cytological smears from advanced non-small cell lung can-

- cer patients. *Diagnostic Cytopathology*, vol. 43, p. 941-946, ISSN: 8755-1039, doi: 10.1002/dc.23318.
51. De Filippo M, Gira F, Corradi D, Sverzellati N, Zompatori M, Rossi C. (2011). Benefits of 3D technique in guiding percutaneous retroperitoneal biopsies. *RAD. MED*, vol. 116(3), p. 407-416, ISSN: 0033-8362, doi: 10.1007/s11547-010-0604-2
52. De Filippo M, Onniboni M, Rusca M, et al. (2008). Advantages of multidetector row CT with multiplanar reformation in guiding percutaneous lung biopsies. *RAD. MED*, vol. 113, p. 945-953, ISSN: 0033-8362, doi: 10.1007/s11547-008-0325-y
53. Carrafello G, Fontana F, Mangini M, et al. Initial experience with percutaneous biopsies of bone lesions using Xper-Guide cone-beam CT (CBCT): Technical note. *Radiol Med* 2012; 117: 1386-97.