

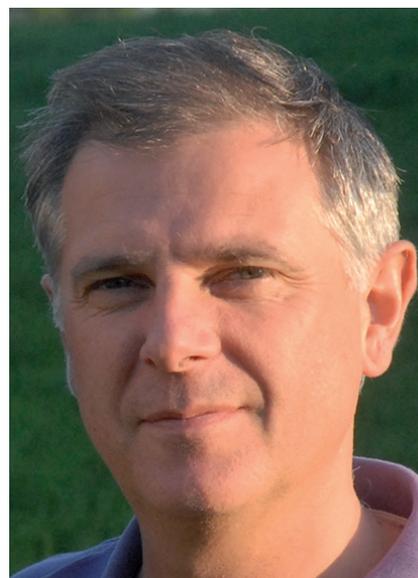
## LUNG CANCER IMAGING IN 2012: UPDATES AND INNOVATIONS\*

### EDITORIAL<sup>1</sup>

The idea of editing a special issue of the Belgian Journal of Radiology arose rapidly during the successful meeting in Tervuren on the 10<sup>th</sup> of November 2012. This meeting "Lung Cancer Imaging in 2012: updates and innovations" was held in the magnificent venue of the Palace of the Colonies built in 1897 by the King of Belgium Leopold the second. During this one-day symposium, Belgian and internationally-renowned experts presented the most significant and recent advances in lung cancer imaging.

Lung cancer is one of the most common malignancies worldwide and remains a leading cause of mortality. Hopefully research is evolving rapidly in this area with many recent and important innovations in the fields of pathology, imaging and treatment. Consequently, radiologists have to adapt their interpretation of chest CT/MR/PET-CT to the recent refinements of the technology and guidelines. The earlier the diagnosis the better the survival. Radiologists have therefore a prominent role to play to detect lung cancer as early as possible, and thus decrease the mortality related to this life-threatening disease. Indeed surgery is the treatment of choice for stage I and II NSCLC, with survival of 75 and 50%, respectively. Recurrence rate is lower in case of lobectomy / pneumonectomy than in sub-lobar resection. For stage IIIa, survival after a classic multidisciplinary treatment does not exceed 10-15%. Stage IIIb is not surgical and combined radio-chemotherapy results in a survival of less than 5%. Chemotherapy alone is used in stage IV with a median survival of 8 months (1, 2).

A new International Association for the Study of Lung Cancer/American Thoracic Society/European Respiratory Society classification of lung adenocarcinoma has been recently proposed (3). Various recent studies have presented correlations between histologic findings of lung adenocarcinoma and the



pattern of ground-glass and non-solid pulmonary nodules on CT. Moreover, serial CT imaging has demonstrated stepwise progression of these nodules in a subset of patients, characterized by increase in size and density of ground glass nodules and development of a solid component (4).

The seventh edition of the lung cancer TNM staging has provided major refinements over the previous version (5, 6). This new edition provides more accurate TNM descriptors (most changes concern the T and the M) and stage groups resulting in better patient grouping in terms of survival and prognosis. Moreover, use of new staging techniques often lead to better accuracy and stage migration, PET-CT often upstaging disease. Important advances in nodal staging have also resulted from minimally invasive guided sampling under endobronchial and endoesophageal ultrasound (7, 8). Besides increasing the accuracy in N and M staging over CT, FDG PET may further refine prognosis of the patient by providing metabolic information from the primary tumor (9, 10). MRI is emerging as the only ionizing radiation-free technique that enables non-invasive whole-body assessment. Besides providing high soft tissue contrast with high spatial resolution (i.e. for superior sulcus

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tumor), MR further improves lung cancer work-up thanks to functional exploration using MR spectroscopy, perfusion and diffusion-weighted images (DWI) (11, 12). The future will let us know if PET-CT and MR are complementary or competitive techniques for whole-body imaging in lung cancer.

Refinements in lung cancer therapy have also evolved rapidly. While new systemic drug therapy based on genetic analysis provide encouraging early results, non-resectable tumors may benefit from advances of radiation therapy and the more recent advent of percutaneous ablative therapy. New high precision radiotherapy modalities, such as intensity modulated radiation therapy, image-guided radiotherapy and stereotactic body radiation therapy, may offer better local control of the tumor together with lower toxicities to the sensitive intra-thoracic organs (13, 14). By the turn of the millennium, percutaneous ablation of primary or secondary malignant disease in the thorax has been increasingly performed using various types of energies. Early results of percutaneous ablation treatment of stage I and II lung cancer appear to be comparable to those of surgery. The post-ablation survival data are not yet mature as the technique is still too recent. The position of percutaneous ablation in the therapeutic armamentarium for lung cancer remains to be defined (15). It is interesting to note that, rather than competing, ablation and radiotherapy may have synergistic effects and prove to be complementary (16).

CT radiation dose has to be carefully selected and recent data reinforce the ALARA (As Low As Reasonable Achievable) principle to be applied on any CT technique, and in particular for screening, diagnosis and follow-up examinations (17, 18). Indeed, the dose has to be on the one hand minimal in screening examination, which is applied by definition on a healthy population, and on the other hand high enough to enable high-quality images in a diagnosis CT examination. During follow-up, the delivered radiation dose can be decreased because such examination will be interpreted by comparison with the reference high-quality diagnosis examination.

With the development of low-dose CT techniques, there has been a resurgent interest in screening for lung cancer. The most recent studies published in this field support the fact that lung-cancer screening may be used as an efficient tool in a high-risk population of smokers to detect early lung cancer (19, 20). A recent paper published in the *New England Journal of Medicine* has demon-

strated a 20% decrease in lung-cancer related mortality in the cohort of subjects screened by low-dose CT compared to the arm-control group screened by chest radiograph (19). However, we need to be very cautious before spreading screening in the public policy recommendations. We need to rigorously analyse the cost-effectiveness of low-dose CT screening and the consequences of additional radiation and of the many false positive results encountered during the screening and follow-up process. Logistic and financial data will probably be the major limitations of this method of screening and need to be taken into account.

Response to therapy is routinely evaluated on CT by two-dimensional measurements as recommended by the RECIST group (21). This method suffers from many limitations mainly due to the inter- and intra-observer variability. Furthermore, in the vast majority of cases morphologic criteria are unable to document early changes in patients responding to therapy. For those reasons, some researchers have proposed to evaluate lung tumors with volumetric segmentation combined with functional data provided by FDG-PET and density measurements of the tumor. Some studies have suggested that perfusion CT might have potential utility in the assessment of patients undergoing chemotherapy and radiation therapy (22). Some parameters like blood flow, blood volume, and permeability values are different in responding and non-responding patients. Some discrepancies between perfusion measurements and RECIST evaluation are observed. Further studies are needed to clearly define the potential role of perfusion CT in the work-up of lung tumors.

Professor Pierre Bodart, Professor of Radiology and founder of the current Medical Imaging Unit at the Cliniques Universitaires St-Luc in Brussels, died on June 27<sup>th</sup> 2012. He was an extraordinary man with a great sense of humanity and respect of patients. His field of expertise was the gastrointestinal imaging but he was involved in many facets of radiology. He was the mentor of many Belgian radiologists. During this symposium, we took the opportunity to pay tribute to this exceptional man.

Finally, we would like to address our grateful thanks to Professor Jacques Pringot, Editor-in-chief of the *Belgian Journal of Radiology*, to have given the opportunity to edit this special issue summarizing the key points of our symposium on "Lung Cancer Imaging in 2012: updates and innovations".

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