above the carina from both the inspiration and expiration scans. The tracheal shape (TS), encoded by the length of rays cast from the center of the trachea, and emphysema score (ES) at -950 HU on the inspiration scan, were used as features for classification. A nearest-mean statistical classifier was trained to assign subjects to GOLD stage based on three sets of features: ES, TS, and ES + TS.
Results: Accuracy of GOLD stage classification was 42%, 41%, and 51% for ES, TS, and ES + TS, respectively. For distinguishing non-COPD subjects (GOLD 0) versus COPD patients (GOLD 1-4), accuracies were 67%, 72% and 80%.
Conclusions: Tracheal shape can be extracted automatically from CT scans and is related to pulmonary function. Including tracheal shape features together with density mask scores improves CT-based detection and quantification of COPD.

P102: Evaluation of an Automated Image Quantification System of Interstitial Lung Disease in CT

Alexandra Kazantzi*, Panayiotis Korfiatis*,w, NIKOLAOS PAPAPANAGIOTOU*, Spiros Skiadopoulos*,w, Dimitrios Daousis‡, Theodoros Petsas*, Lena Costaridou*,w, and Christina Kalogeropoulou*. *Department of Radiology, University Hospital of Patras, Rion, Patras, Greece, wLaboratory of Medical Physics, School of Medicine, University of Patras, Rion, Patras, Greece; and ‡Division of Rheumatology, University Hospital of Patras, Rion, Patras, Greece.
Purpose: To evaluate the performance of an automated 3D system in quantification of interstitial lung disease extent in CT compared to radiologists' semi-quantitative assessment and pulmonary function tests (PFTs) indexes.
Methods: System output of total disease, ground glass and reticular pattern extents are evaluated in volumetric chest CT scans of 37 patients with ILD. Two experienced radiologists reviewed the above CTs and provided their visual score in consensus, for total disease extent and for the substitute patterns of reticular and ground glass. All patients had PFTs measurements within 60 days.
Results: Almost perfect agreement is demonstrated between system and radiologists for total disease extent (ICC = 0.809, CI = [0.599, 0.894]) and reticular pattern (ICC = 0.806, CI = [0.714, 0.865]), while moderate agreement for ground glass pattern (ICC = 0.543, CI = [0.405, 0.652]). Comparison of volumetric system output with PFTs yields moderate negative correlations with DLCO and FEV1 for total disease extent ($R = -0.567$, $P = < 0.0001$, $R = -0.545$, $P < 0.0001$). For the constituent patterns, comparison depicts moderate negative correlation of reticular extent for all PFTs indexes ($-0.529 < R < -0.615$), while no statistical significant correlation was observed for ground glass extent and PFTs. A weak correlation was observed between radiologists' scoring and PFTs in terms of total disease extent, significant only for DLCO (R-0.398, P = 0.015). Scoring for reticular extent demonstrated weak negative correlation with all PFTs indexes ($-0.326 < R < -0.485$), though no statistical significant correlation was found with ground glass extent.
Conclusion: Computer-derived disease extent agrees highly to radiologists' semi-quantitative assessment. It also proved superior to radiologists' scoring in terms of correlation with PFTs indexes.

P103: Interstitial Lung Disease Progression in CT: Registration Algorithm Evaluation

Georgios Vlachopoulos*, Panayiotis Korfiatis*, Christina Kalogeropoulou*,w, NIKOLAOS PAPAPANAGIOTOU*,w, and Lena Costaridou*. *Laboratory of Medical Physics, School of Medicine, University of Patras, Rion, Patras, Greece; and wDepartment of Radiology, University Hospital of Patras, Rion, Patras, Greece.
Objectives: The follow up of disease progression, of patients who suffer from Interstitial Lung Disease (ILD) is one of the most challenging problems for image based quantification systems in CT. It is important to be sure that any measured volume change between follow up scans is caused by ILD pattern change and not by patient's breathing or positioning. Thus, evaluation of image registration techniques is critical for accurate disease progression estimation.
Materials and Methods: Four volumetric ILD affected lung scans, considered as ground truth were registered to the corresponding artificially warped data. Affine registration techniques were evaluated for this purpose while grid search was performed for optimal parameter selection. Evaluation was performed based on Dice Similarity Coefficient (DSC), as well as mean value and percentage of negative values of the Jacobean matrix.
Results: A multi-resolution registration approach, with affine transform for the first three levels and third order B Spline for the last level provided optimal results. The selected metric was mutual information, and the standard gradient decent was used as optimizer. The selected interpolator was first order B Spline for the first three levels and third order B spline for the last. The selected image sampler was the random coordinate, with 3000 spatial samples. For the above set of parameters the DSC was 92.21%, while Jacobian Matrix mean value was 0.9997 with 0% of negative values.
Conclusions: Multi-resolution registration techniques demonstrated promising performance and can be exploited in the framework of tools aimed at reproducible ILD disease progression estimation.

P104: Bone Metastasis: Detection by 18 F-Fluorodeoxyglucose (FDG) Positron Emission Tomography (PET)/Computed Tomography (CT) in Lung Cancer Patients

ANNALORI PANUNZIO, Roberta Polverosi, Fabio Pomerri, Pier Carlo Muzzio, and Laura Evangelista Istituto Oncologico Veneto, Padua, Italy.
Objectives: We aimed to evaluate the impact of FDG PET/CT in detecting different types of bone metastasis in patients with lung cancer.
Materials and Methods: We retrospectively selected 57 patients (45 male and 12 female; median age: 70 y) with lung cancer (24 adenocarcinoma, 6 SCLC, 12 NSCLC and 15 not disposable) who underwent FDG PET/CT for initial staging (n = 16, 28%), restaging (n = 32, 56%) and follow-up (n = 9, 16%). All images were re-evaluated by a nuclear medicine physician and a radiologist. All site of metastases were registered and confirmed by follow-up imaging or by histological staining. The distribution of bone metastases was determined and described.
Results: All patients had a positive FDG PET/CT, in particular 23 had bone metastases and were confirmed in 21 of them by followed CT or magnetic resonance imaging (MRI). Two patients were falsely positive at PET/CT (one for arthritis and one for fractures), three patients had bone marrow involvement (one patient at left 5th rib, one at lumbar spine and one at pelvis). In these latter patients the lesion SUVmax was 3.01, 9.82 and 6.9, respectively. Pathological FDG-uptake was reported in two patients with both osteolytic and osteoblastic lesions, in 12 patients with osteolytic ones and in 4 with osteoblastic metastases.
Conclusions: FDG PET/CT is able to detect bone metastases in patients with lung cancer in any phase of disease. The support of CT can address to the anatomical characteristic of bone lesion, being useful for the assessment of treatment.

P105: Neuroendocrine Tumors of the Lung Revisited

CECÍLIA LEAL, Rosana Santos, Romeu Mesquita, Pedro Ananias, Hugo Marques, Nuno Costa, Otília Fernandes, Eugénia Pinto, and Luísa Figueiredo. Hospital de Santa Marta - Centro Hospitalar de Lisboa Central, Lisboa, Portugal.
Our aim is to make a revision of the spectrum of neuroendocrine tumors of the lung, illustrating their radiological appearances, based on our casuistic.
Neuroendocrine tumors of the lung arise from Kulchitzky cells that are normally present in the bronchial mucosa. They can be classified clinically, radiologically and pathologically into four subtypes: typical carcinoid, atypical carcinoid, large-cell neuroendocrine carcinoma and small-cell lung cancer.
The carcinoids are relatively indolent and well-differentiated tumors, whereas large-cell neuroendocrine carcinoma and small-