CENTRAL3D: A CLINICIAN TOOL FOR ROBUST CHARACTERIZATION OF CENTRALLY LOCATED NON-SMALL CELL LUNG CANCER

Dominique Mathieu MD MSc, Vincent Cousineau Daoust MSc, Laurent Bilodeau MD, Stéphane Bedwani PhD, Édith Filion MD, Alexis Lenglet MD MSc, Houda Bahig MD, Toni Vu MD, David Roberge MD, Marie-Pierre Campeau MD

Département de radio-oncologie, Centre hospitalier de l'Université de Montréal (CHUM), 1560 Sherbrooke Est, Montréal, Québec H2L 4M1, Canada

Introduction: The aim of this study is to evaluate inter observer variability in the proper identification of centrally located lung tumors and to evaluate the clinical applications of an anatomy visualization tool. Central3D is a software which uses available treatment planning contours to allow clinicians to visualize the gross tumor volume (GTV) in an interactive 3D environment and appreciate its relationship to organ at risks (OARs). This algorithm precisely calculates the minimal GTV distance to any structure of interest and displays volume relations through a user-friendly surface projection map. Central3D also displays the planning target volume (PTV) overlap to any desired anatomical structure.

Method: We asked 4 experienced radiation oncologists to blindly classify 20 lung tumors as central versus peripheral as per Radiation Therapy Oncology Group (RTOG) 0813 definition and to identify ultracentral lesions defined as presenting a 5 mm PTV overlap with the heart, proximal bronchial tree (PBT), main vessels or oesophagus. Reliability of agreement between radiation oncologists was reported with a Fleiss' kappa analysis and cases with challenging classification were purposely included. Additionally, clinicians were asked to measure the minimum GTV distance ($D_{min}$) to the PBT. Measures were compared to those obtained with the Central3D software using delineated
GTV and OARs structures. Contours were as per RTOG 1106 lung atlas and rigorously performed by a thoracic radiologist.

**Results:** Fleiss’ Kappa coefficients for central/peripheral classification and identification of ultracentral lesions by clinicians were respectively 0.81 (N = 3 discordant cases) and 0.58 (N = 5). Mean (±SD) absolute difference between clinicians and Central3D $D_{\text{min}}$ was 0.7 ± 0.8 cm (max = 3.9 cm). All cases of disagreement were reviewed using Central3D and prompt consensus was obtained. Evaluation bias were mainly induced by the rigid plane viewing used by clinicians (axial, sagittal, coronal view) which restricts proper 3D distance evaluation as well as discordant identification of complex anatomical structure such as lobar bronchi bifurcation.

**Conclusion:** Classification of centrally located lung tumors is subject to inter observer variability. Central3D can be a useful tool to quantitatively assist radiation oncologists in characterizing central lesions.
**Fig**: Central tumor visualization with Central3D. A: Anterior; $D_{\text{min}}$: Minimal distance; GTV: Gross tumor volume; I: Inferior, L: Left; P: Posterior; PBT: Proximal bronchial tree; PTV: Planning target volume; R: Right; S: Superior.