ABSTRACT: Determination of tumor regression/progression assessments during radiation therapy (RT) provides the possibility to control radiation dose, which influence adaptive-RT decisions. Quantitative analysis of daily-CT (computed tomography) indicates that the mean Hounsfield Units (HU) in lung tumor was reduced during RT-delivery. This reduction was noted in the early-phase of RT and is patient specific and correlated to the delivered dose. Higher HU reduction in gross-tumor-volume (GTV) is correlated significantly with higher patient survival. The change of daily-CT features, such as mean HU, kurtosis, skewness, and entropy on GTV may be used for early assessment of radiation responses during RT-delivery for lung cancer. Ultrafast cone-beam CT (UCBCT) is relatively new imaging modality and this device is used to real-time monitor many oncological, cardiovascular, and neuro procedures. Post-processed perfusion-blood-volume (PBV) images used color-coded images to increase detection and produce good tumor differentiation. Post-processed UCBCT-MR fusion accurately identified tumors, feeding vessels, located contrast injection sites and catheter-tips without additional image-data acquisition and produced excellent tumor sensitivity, detectability and diagnostic ability. This method is considered to be classical for the detection of tumors and remarkably improved sensitivity during tumor detection especially for small-unenhanced tumor lesions. Image fusion in dual-energy CT (DECT) shows different fusion factors causes significant differences in HU-value, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) and image quality. Best results obtained using weighting factor 0.6 for all anatomical structures. Image analysis showed similar results for standard (SSCT), high-pitch (HPCT), and DECT-0.6W datasets regarding image quality. HPCT yielded lower patient dose compared to other groups. HPCT and DECT can be used with similar image quality and lower dose compared to SSCT for the scans and can be utilized to various clinical advantages. Estimates of effective dose (ED) based on DLP work equally well for SSCT, HPCT and DECT examinations. ED estimations by ICRP-103 and -60 for both single-energy and dual-energy exams differ no more than 0.04 mSv. Medical imaging continues to play major role in cancer diagnosis, tumor staging, treatment decisions, and monitoring treatment effects.

Biography: Dr. Paul graduated from the Frankfurt University, Germany, with a PhD in Medical Physics in 2011. He has worked as a research scientist in the Department of Radiology at the University Hospital Frankfurt since 2009. Upon graduation he took a Post-doctoral fellowship in Medical Physics at the Frankfurt University Hospital, Germany, where he conducted a number research projects in collaboration with Siemens Healthcare. He moved to the Department of Radiation Oncology, Medical College of Wisconsin, in 2015 and worked with numerous research projects. While working at the MCW he completed a CAMPEP-accredited certificate in Medical Physics program. He earned his MSc in Medical Physics from the Manipal University (India) in 2007, and MPhil in Physics from the Vinayaka Missions University (Salem, India) in 2009. He worked two years as a staff Medical Physicist at the Department of Radiation Oncology, Indo-American Cancer Hospital, beginning immediately after the completion of Radiation Safety Officer certification in 2007. He has published more than 25 research articles with various high-ranking journals; moreover, he is a member of multiple Medical Physics, Oncology and Radiological international societies.