Evaluation of inter- and intrafractional motion of liver tumors using interstitial markers and implantable electromagnetic radiotransmitters in the context of image-guided radiotherapy (IGRT) - the ESMERALDA trial.

Abstract:

With the development of more conformal and precise radiation techniques such as Intensity-Modulated Radiotherapy (IMRT), Stereotactic Body Radiotherapy (SBRT) and Image-Guided Radiotherapy (IGRT), patients with hepatic tumors could be treated with high local doses by sparing normal liver tissue. However, frequently occurring large HCC tumors are still a dosimetric challenge in spite of modern high sophisticated RT modalities. This interventional clinical study has been set up to evaluate the value of different fiducial markers, and to use the modern imaging methods for further treatment optimization using physical and informatics approaches. Surgically implanted radioopaque or electromagnetic markers are used to detect tumor localization during radiotherapy. The required markers for targeting and observation during RT can be implanted in a previously defined optimal position during the oncologically indicated operation. If there is no indication for a surgical resection or open biopsy, markers may be inserted into the liver or tumor tissue by using ultrasound-guidance. Primary study aim is the detection of the patients’ anatomy at the time of RT by observation of the marker position during the indicated irradiation (IGRT).
Secondary study aims comprise detection and recording of 3D liver and tumor motion during RT. Furthermore, the study will help to develop technical strategies and mechanisms based on the recorded information on organ motion to avoid inaccurate dose application resulting from fast organ motion and deformation. This is an open monocentric non-randomized, prospective study for the evaluation of organ motion using interstitial markers or implantable radiotransmitter. The trial will evaluate the full potential of different fiducial markers to further optimize treatment of moving targets, with a special focus on liver lesions.