

Investigating Clarity Ultrasound Transperineal Ultrasound Imaging as a Method of Localising the Prostate, Compared to Cone Beam Computed Tomography with Fiducials

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Abstract : Although fiducial marker insertion is regarded as the 'gold standard' in terms of image guided radiotherapy (IGRT), its application must be considered carefully as the procedure can be invasive, time-consuming, and reliant on consultant expertise. Precision of the fiducials is dependent on these markers remaining in the same location and on the prostate not changing shape during the course treatment. To facilitate the acquirement of non-ionising IGRT and intra-fractional prostate tracking, Clarity TPUS was developed as an alternative imaging system. The main benefits of Clarity TPUS are that it is non-invasive, non-ionising and cost-effective. Other studies have compared fiducials to transabdominal ultrasound, which has since been proven to not be as accurate as trans-perineal imaging, as included in this study. CBCT fiducial translations and Clarity TPUS translations for 120 images as part of the PACE-C prostate SABR trial were retrospectively evaluated by three imaging specialists. Differences were analysed using correlation and Bland-Altman plots. Inter-observer matches agreed within 3mm 88.3 % of the time in left/right direction, 86.7 % of the time in superior/inferior direction, and 91.7% of the time in ant/post direction. They agreed within 5mm more than 98.3 % of the time in all directions. The intra-class correlation co-efficient was calculated for each direction to show agreement between imaging specialist for inter-observer variability. Each was 0.95 or above, with 1 indicating perfect reliability. Agreement between observers was slightly higher for CBCT and fiducials at 98.7% agreement within 5 mm, compared to clarity TPUS where 96.7% agreement was seen within 5mm. Clarity TPUS has the benefit of no additional dose and intra-fractional monitoring, and results show a good correlation between the different modalities. Inter-observer variability is to be considered, and further research with a larger population would be of benefit.

Keywords : oncology, prostate radiotherapy, image guided radiotherapy, IGRT

Conference Title : ICRR 2023 : International Conference on Radiography and Radiotherapy

Conference Location : Tokyo, Japan

Conference Dates : September 04-05, 2023