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6th MR in RT Symposium 2018

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PRESENTATION TITLE

Indication of accurate gold fiducial marker identification in a prostate MRI only radiotherapy workflow using C-Arm X-ray imaging

AUTHOR(S)

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ABSTRACT

Please type in your abstract up to a MAXIMUM of 500 words. Figures may be included.

Purpose:
Prostate cancer radiotherapy workflows solely based on magnetic resonance imaging (MRI), are now being clinically used. Intra-prostatic gold fiducial markers (GFM), appear as signal voids in MRI-images while calcifications and bleedings show similar signal behavior. Achieving accurate identification of GFM in an MRI-based workflow thereby constitute a major challenge. Several identification methods have been presented but none has reached an accuracy of 100%. C-arm X-ray images (CkV-images), acquired at GFM implantation, could provide GFM position information and be used to indicate correct identification. This would require negligible GFM migration. The aim of this study was to: 1) study the GFM migration 2) show the feasibility of using CkV-images as an indicator of accurate GFM identification.
Materials & Methods:
Frontal digitally reconstructed radiographs (DRR)- and CkV-images were acquired two weeks apart for 31 patients in a CT-based radiotherapy workflow and for 16 patients in an MRI-based radiotherapy workflow. A common image geometry was defined between the DRR- and CkV-image for each patient. For each image, a point cloud was defined from the GFM center of mass coordinates. A rigid registration between the point clouds was performed and the distance between each of the GFM in the DRR- and registered CkV-image was calculated. The distance calculated in the CT-based patient

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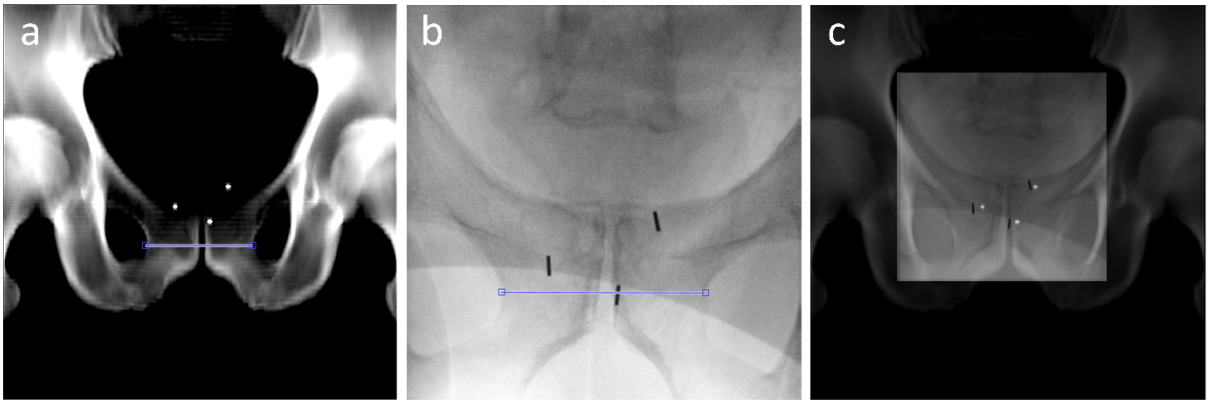
cohort was considered a measure of GFM migration. A statistical test was performed to assess any difference between the cohorts.



Frontal DRR-image generated from sCT with burned in synthetic markers (a), frontal CkV-image acquired in connection to GFM implantation (b). A common image geometry between the CkV-image and DRR-image was defined using the horizontal distance from left to right over the pubic symphysis (line in a and b). The CkV-image and DRR-image was rigidly co-registered and the distance between each of the GFM was calculated (c).

Results:
The mean GFM migration assessed in the CT-based patient cohort was 1.2±0.7 mm. The mean absolute distance difference for the GFM center of mass in the MRI-based cohort was 1.7±1.4 mm. No significant difference between the measured total distances of the two patient cohorts could be detected (p-value = 0.37).

Conclusions:
A C-Arm X-ray image acquired from the GFM implantation procedure could be used as an indicator of accurate GFM identification. GFM migration was present but did not constitute a problem for the proposed method.