Herlev Hospital

REGION

MRI in Radiotherapy

Implementation and Workflow

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Install medio 2009

Fig. 1

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Criteria

An open Philips HFO Panorama 1 Tesla MRI scanner with RT options was installed at the RT department at Herlev Hospital, Denmark next to the department's 2 CT scanners.

The RTTs already working with the CT scanners, import of images, and palliative treatment planning were to handle this new modality.

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Plan

A nine month cooperation agreement was made with the MRI centre at the hospital.

One from a group of five MRI qualified radiographer each day helped and trained a RTT. The scanner was used ½ day for diagnostic purposes and ½ day for RT purposes.

An MRI radiologist and an MRI physicist were available whenever needed e.g. for supporting the RTTs and the oncologist in choosing the optimal sequences

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Timeline

Aug. 09	Start up: 3 RTT, c. cerebri, c. prostatae and c. cervicis uteri pre external RT
Sep.	Sarcoma
Oct.	C. cervicis uteri pre brachytherapy
Nov.	
Dec.	C. ani, c. nasi and c. rhinopharyngis
Jan. 10	
	C. corporis uteri
Feb.	C. oropharyngis
Mar.	C. oris
Apr.	C. nasi and c. oris scanned after 3 wks. of RT (to evaluate whether plan must be adapted)
May	Start up: 2 RTT end of MRI centre cooperation
Jun.	C. cutis
Jul.	C. recti
Aug.	C. vesica Start up: 1 RTT

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Not ”Plug and Play”

The RT departments’ technical workshop assisted throughout the whole implementation making adjustments to the existing fixation equipment in order to make it MRI-compatible.


Fig. 2

Setup

- All patient groups in which MRI is beneficiary for target volume delineation are both MRI and CT scanned. The CT and MRI images are fused prior to delineation. This is possible as the patients are both CT and MRI scanned in the treatment position. All protocols are optimized to use as few sequences as possible while enabling proper target delineation.

Wrap up - implementation

- Due to the cooperation with the MRI centre, a larger number of patients were MRI scanned each day. This ensured that the RTTs learned fast how to handle the MRI scanner.
- A key feature in our successfully implementation of the MRI scanner was the cooperation with the MRI centre, and the easy accessibility to the department's technical workshop.
- Further, it was important that the MRI scanner is placed in the vicinity of the CT scanners, as it is the same personnel that operate both the MRI scanner and the CT scanner including import and fusion of the images.

Physics

- Did not post-trained a RT physicist heavily in MRI
- Focused more on cooporation with existing MRI physicist (from diagnostic) and RT physicists to make the best of the two worlds
- MRI is not ”plug and play” and you need clever experience. Do not expect to quick learn RT physicist the bits and pieces of MR imaging.
- Now – years later – we have a few RT physicist (mostly research) who have gained a lot of experience in MRI. Most of it based on work together with th MRI physicist.

Who is MR scanned

- All
  - Except – breast and lung

Daily workflow anno 2013

- Patients are normally first in the CT
- Second - directly moved on to the MRI
- Difficult booking since we have two CT's
  - Many restrictions on slots
- Normally booked 1 hour
- Seems to be many un-used slots
  - Try to use these for resaerch activities
- Same group of RTT who does the scanning also fuse the images
- Radiologist and Oncologist together use all the combined image sets (CT, PET and MRI) to define relevant structures. Radiologist availiable every day

Prostate – use of only image sequence

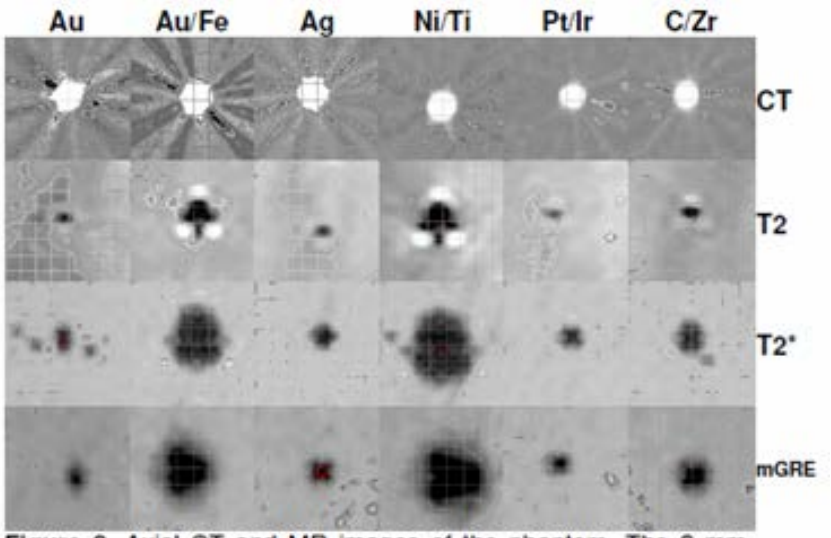

Figure 2. Axial CT and MR images of the phantom. The 2 mm grid size and the red area in the MRI indicates the size and the shift between the markers on MRI compared to CT.

We then use Ni/Ti (Nitinol)

Example: Even thoug the images are denoted T2 and T2* they heavily Adjusted to fit our criteria. This work was done in colaboration with RT and MRI physicist and very much the RTT's