Comparison of the MRI sequences in ideal fiducial maker-based radiotherapy for prostate cancer

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Conflict of interest: none

Introduction

- Contouring the prostate using CT alone is difficult.

- To overcome the uncertainty, MRI is used in registration of CT and MRI using fiducial markers.

- However, visualization of the marker itself can be difficult in MRI.

Purpose

- The aim of this study was to determine the optimal MRI pulse sequence to define the marker, as well as the prostate gland, by comparing five MRI sequences.

Methods and materials

Patients n=21

Two gold fiducial markers were placed before a CT/MRI examination.

IMRT was delivered to the low risk group, intermediate risk group and high risk group at 74 Gy, 76 Gy and 78 Gy respectively.

Comparison of MRI sequences

A qualitative image analysis of the sequence was also performed by three observers.

One radiation Oncologist

Two Radiation Technologists

Scoring of MRI quality imaging

scored all images according to the following five evaluation items:

definition the prostate outline;
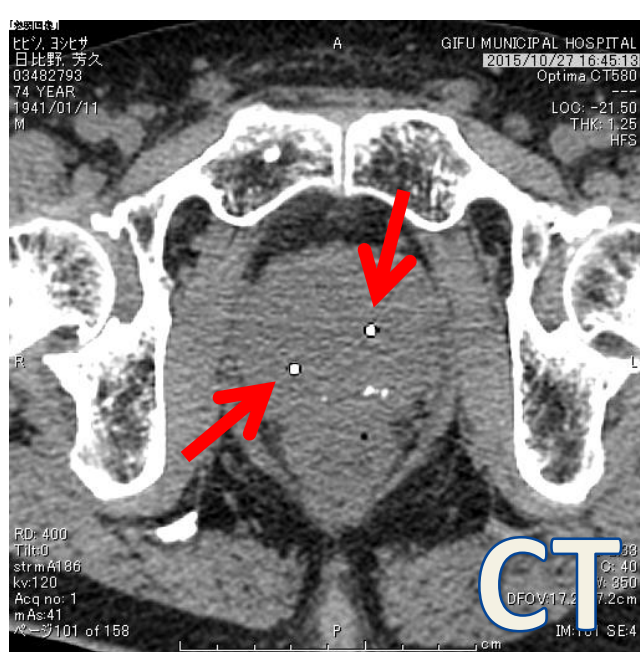
apex vs. soft tissue;

base vs. bladder;

base vs. seminal vesicle
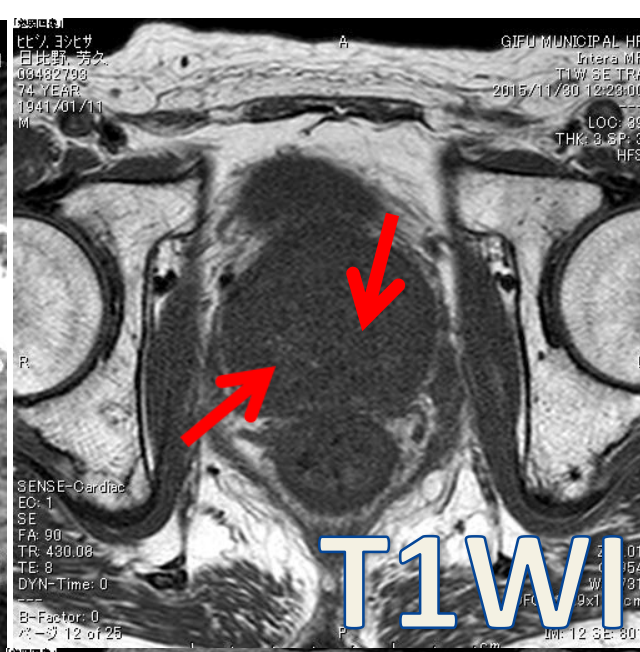
gold fiducial marker detection.

Scoring of MRI quality imaging

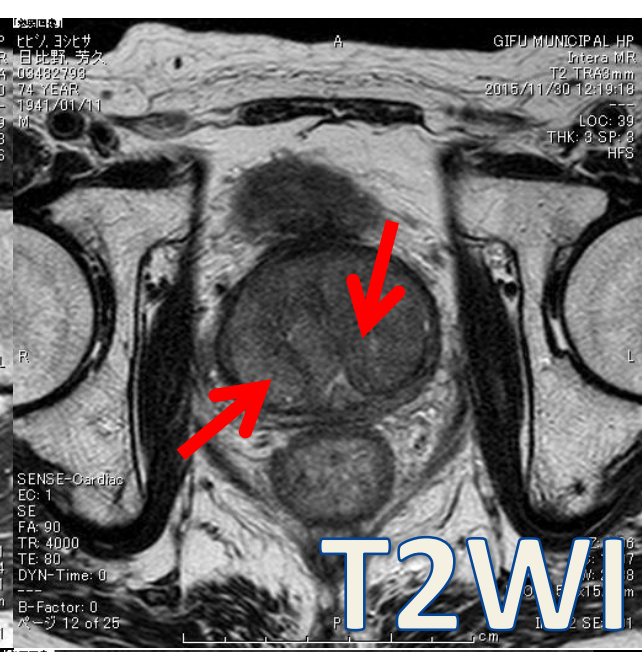A score from 1 to 3 (1= poor, 2= moderate, 3= good) was assigned to all items.

A higher score was regarded to indicate better visualization. We then compared the mean scores for each item.
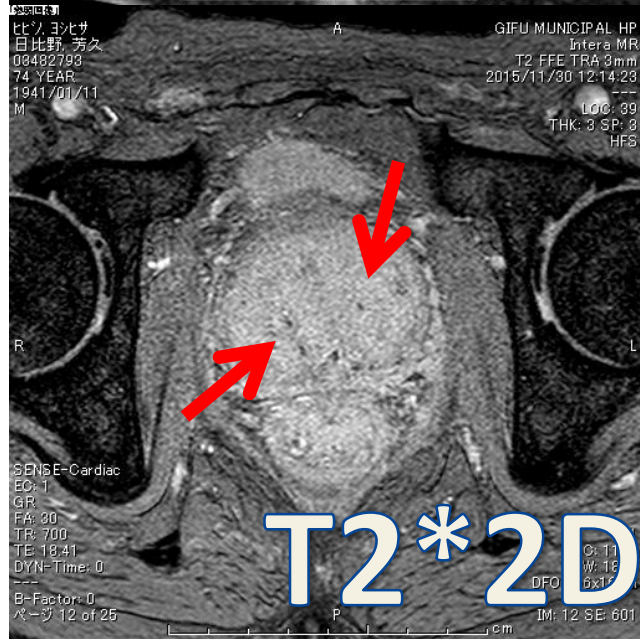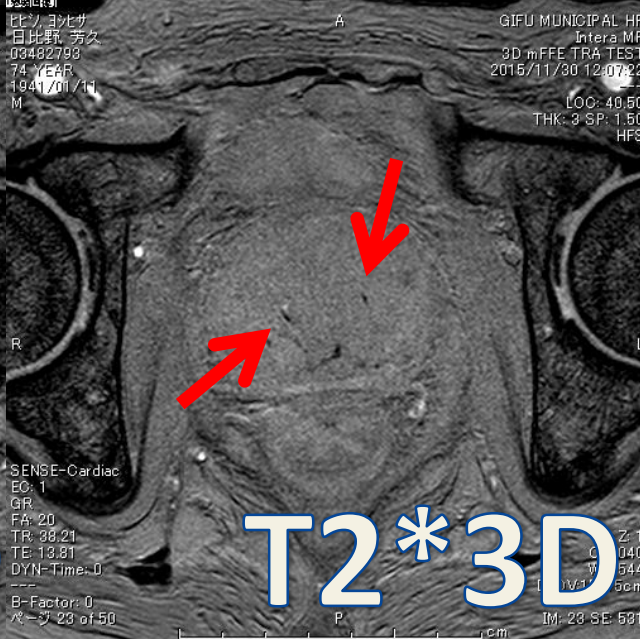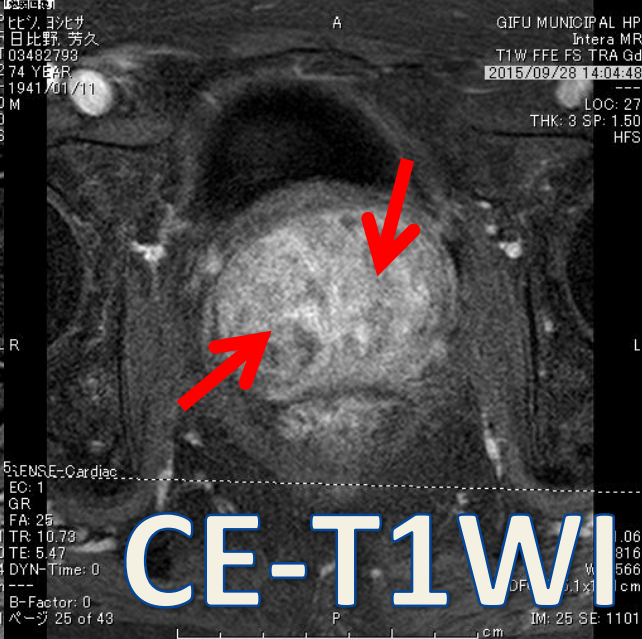
Red arrows ; gold fiducial markers.
The markers were visualized only in the T2*2D and T2*3D sequences.

Results of quality of MR images

	Outline of prostate	Apex vs. soft tissue	Base vs. Bladder	Base vs. SV	Fiducial marker definition
Observer 1					
T1WI	1.6	1.1	1.3	1.2	1.2
T2WI	2.0	1.8	1.5	2.0†	1.2
T2*2D	2.0	2.2	2.4‡	1.0	2.4‡
T2*3D	2.5	1.2	2.4‡	1.1	2.6‡
CE-T1WI	2.4	2.0	1.6	1.1	1.6
Observer 2					
T1WI	2.6	1.0	1	2.4	1.0
T2WI	3.0	2.7†	2.4	3.0	1.1
T2*2D	2.8	1.1	1.3	1.2	2.2‡
T2*3D	2.6	1.3	1.1	1.4	2.4‡
CE-T1WI	2.9	1.7	1.9	2.6	1.0
Observer 3					
T1WI	1.7	1.1	1.6	1.3	1.0
T2WI	2.7	2.4†	2.4†	2.3†	1.1
T2*2D	1.8	1.1	1.1	1.1	2.4‡
T2*3D	1.9	1.2	1.1	1.2	2.7‡
CE-T1WI	2.4	1.9	1.3	1.3	1.0

Conclusion

T2*2D and T2*3D were superior to the other sequences in contouring the prostate and identifying the markers.

The gold markers and **misleading black dots** were more frequently observed in T2*2D than in T2*3D.

Therefore, we recommend that imaging be initially performed with T2*3D, firstly.