Purpose:
To verify against CT the effect of different MR imaging sequences and acquisition parameters on the determination of treatment dwell positions in a titanium tandem applicator for 3D-image-based high dose rate cervix brachytherapy.

Methods:
A titanium tandem and ovoid applicator, fixed rigidly within a plastic phantom containing copper sulfate solution, was imaged on a multi-slice CT scanner to obtain a reference image dataset and subsequently on a 1.5T MR scanner to obtain nine test image datasets acquired using different MR sequences (T2-weighted, T1-weighted, and proton-density-weighted with turbo-spin-echo technique), slice thicknesses (0.5 cm and 0.25 cm in the parasagittal plane), and fold-over directions. All images were imported into a brachytherapy treatment planning system, fused, and planned for delivery of an HDR treatment with a 0.5 cm Ir-192 source using our standard treatment protocols. The treatment programming, i.e., number and arrangement of dwells, as well as the 3D coordinates of dwells activated along the tandem on the reference CT were compared against those on the registered MR datasets in terms of differences in right-left (RL), foot-head (FH), and anterior-posterior (AP) directions.

Results:
Distortions along the tandem on MR were non-uniform. Despite this, mean differences in RL, FH, and AP coordinates of activated dwells were approximately 0.1 cm or less, 0.2 cm, and 0.1 cm, respectively. The number and arrangement of dwells activated along the tandem on the MR datasets were identical to those on CT.

Conclusions:
The slice thicknesses, sequences, and fold-over directions used in this study had clinically insignificant effects on treatment dwells defined on MR images versus those on CT. It is recommended that other centers do a similar evaluation before making the transition from CT to MR to better understand how identification of the tandem and determination of HDR treatment dwell positions compares between MR and CT.