Abstract ECCO Sept 2011

Initial Results of Comparison of Localisation of the Prostate using Calypso® 4D localisation system with Cone Beam CT.

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Background
The Calypso® system uses electromagnetic transponders to localise and track the prostate position during radiotherapy without the use of ionising radiation. A Calypso® system was installed at the Royal Marsden NHS Foundation Trust and Institute of Cancer Research in January 2010. Initial patients were treated as part of a quality assurance and implementation programme assessing the accuracy of Calypso® with respect to cone beam CT (CBCT) used to image the Calypso transponders as markers. Preliminary results for the first 17 patients are reported here.

Methods
Patients referred for radical radiotherapy to the prostate had three Calypso® electromagnetic transponders (8mm x 2mm) implanted in the prostate at the right base, left base and apex using a 14G needle guide. Patients were set-up to skin marks and prostate displacement from the isocentre measured using Calypso® and cone beam CT (CBCT) with the transponders as fiducial markers (FM). Calypso® localisation co-ordinates were recorded simultaneously with CBCT displacements following registration of the FM and CBCT with the reference image. A comparison of set-up displacements from skin marks using Calypso® and CBCT was made in order to establish its accuracy in our department.

Results
Seventeen patients completed treatment between July 2010 and February 2011. All had Calypso® transponders implanted in the prostate with no adverse effects and no loss or migration of transponders. A total of 263 fractions were imaged and 1481 displacements have been analysed. The number of fractions with a displacement in any direction of > 3mm, 5mm and 10mm were 79% 22% and 0.7% respectively. The systematic errors measured with Calypso and FM/ CBCT displacements were similar (see Table 1). The mean difference between Calypso and FM/ CBCT displacements (mm) were RL -0.1 (± 0.6), SI -0.2 (± 0.5), AP 0 (± 0.5) (Right, inferior and posterior are positive).

Table 1. Population Systematic and Random Errors using Calypso and FM/CBCT and skin marks

<table>
<thead>
<tr>
<th></th>
<th>Population Systematic Error (mm) $\Sigma_{set-up}$</th>
<th>Population Random Error (mm) $\sigma_{set-up}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RL</td>
<td>SI</td>
</tr>
<tr>
<td>Calypso</td>
<td>2.2</td>
<td>1.8</td>
</tr>
<tr>
<td>FM / CBCT</td>
<td>1.9</td>
<td>2.5</td>
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Conclusions
The quality assurance and implementation programme is ongoing. Preliminary results confirm Calypso® is an accurate method of localising the prostate with close agreement with the current gold standard of fiducial markers and radiological imaging.