FUTURE AUDIT APPROACHES

David Bernstein
On Behalf of RTTQA IMRT Subgroup
RTTQA IMRT SubGroup

• “To review and improve Quality Assurance of UK IMRT trials”
• 9 Step IMRT credentialing program
• Steps 6-9 = dosimetry audit
Current Audit Procedure

TPS Tests

Clinical Plan Fluence Measurements

Clinical Plan Dose Point Measurements

Dosimetry Audit by RTTQA Physicist
Current Audit Procedure

Each audit visit: 1 day at host centre, including 4.5-5 hours linac time. Additional preparation and analysis time.
Current Audit Procedure

Each audit visit: 1 day at host centre, including 4.5-5 hours linac time. Additional preparation and analysis time.
?
Hierarchy of IMRT complexity or uncertainty?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Least</td>
<td>CHHIP</td>
<td>CHHIP</td>
<td>ARTDECO</td>
<td>PIVOTAL</td>
<td>COSTAR</td>
<td>COSTAR</td>
</tr>
<tr>
<td></td>
<td>COSTAR</td>
<td>COSTAR</td>
<td>COSTAR</td>
<td>ARTDECO</td>
<td>PIVOTAL</td>
<td>CHHIP</td>
</tr>
<tr>
<td></td>
<td>ARTDECO</td>
<td>PIVOTAL</td>
<td>PIVOTAL</td>
<td>COSTAR</td>
<td>CHHIP</td>
<td>PIVOTAL</td>
</tr>
<tr>
<td></td>
<td>PIVOTAL</td>
<td>ARTDECO</td>
<td>PARSPORT</td>
<td>CHHIP</td>
<td>ARTDECO</td>
<td>ARTDECO</td>
</tr>
<tr>
<td></td>
<td>PARSPORT</td>
<td>PARSPORT</td>
<td>CHHIP</td>
<td>PARSPORT</td>
<td>PARSPORT</td>
<td>PARSPORT</td>
</tr>
</tbody>
</table>

**IMRT Fluence Complexity**
Fig. 6. Comparison of point dose measurement and calculation in 9 different treatment sites for a total of 751 cases. The center diamond symbol indicates the mean difference for the treatment site and the error bar is ±1 SD.

Abbreviations: QA = quality assurance; GYN = gynecologic; CNS = central nervous system; GU = genitourinary; H&N = head and neck; THOR = thoracic; PEDI = pediatric; sMLC = step-and-shoot multileaf collimator.
Hierarchy of IMRT complexity or uncertainty?
Reducing Audit Workload and Streamlining

• New approach to assess dosimetry for different trials and centres needed due to increasing workload
• Can not use a hierarchical approach confidently as a basis of reducing workload
• However can streamline the process and identify new approach to audits
New Approach Requirements

- Flexibility for centres
- Reduced linac time
- Independent absolute dose check
- Reflect centre participation in multiple trials with multiple treatment methods
New Approach Requirements

- Flexibility for centres
- Reduced linac time
- Independent absolute dose check

- Reflect centre participation in multiple trials with multiple treatment methods
Postal Audit

Top
Insert
Base

Film Insert
Solid Water Block
Farmer Chamber Insert
Solid Water Block
Postal Audit

- Solid Water phantom developed by RTTQA IMRT Subgroup
- Equipment supplied by RTTQA/NPL
- Results analysed by RTTQA/NPL
- Phantom setup and delivery performed by host centre
- Cornerstone is the NPL Alanine service
- Modular design to allow future modifications, e.g. to include inhomogeneities
- Fiducial markers inserted to facilitate IGRT setup
Postal Audit Process

1. **Output** using local calibrated *Electrometer-Farmer Chamber*
2. **Output** using supplied *Alanine*
3. **Trial plan dose point** using local *Electrometer-Farmer Chamber*
4. **Trial plan dose point** using supplied *Alanine*
5. **Trial plan film** measurement using supplied *Gafchromic film*
6. *Gafchromic Film calibration* irradiation
Audit Streamlining

Established RTTQA guidelines to determine

- When a centre is to receive an audit
- What form the audit will take
Audit Streamlining

1. Previous RTTQA visit?
   - Yes: New TPS/Delivery algorithm
     - Yes: Postal Audit
     - No: Local QA
   - No: Audit Visit

2. < 1 year ago?
   - Yes: New TPS/Delivery algorithm
   - No: Audit Visit

3. < 3 years ago?
   - Yes: Postal Audit
   - No: Audit Visit
New Audit Visit Process
Dosimetry Audit by RTTQA Physicist

Clinical Plan Fluence Measurements

Clinical Plan Dose Point Measurements
Work in Progress

- Pilot Alanine Audits currently taking place (Varian & Elekta)
- Establish which subset of alanine to read out
- Resolve apparent systematic ArcCheck SemiFlex results
- To roll out both audit methods early 2014
References


Acknowledgements

• Emma Wells
• Yat Tsang
• Laura Ciurlionis
• Olivia Niasmith
• Elizabeth Miles
• Catharine Clark
• Nicki Groom

• Karen Venables
• Edwin Aird
• Hayley James
• John Conibear
• Teresa GuerreroUrbano
• Helen Baines
• Antony Carver