Examining Credentialing Criteria and Poor Performance Indicators for IROC Houston’s Anthropomorphic Head and Neck Phantom

Mallory Carson       Andrea Molineu
Paige Taylor       David Followill       Stephen Kry

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Outline

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• New Results
• Summary

IMRT H&N Phantom
Background

• IMRT H&N phantom used in credentialing for NCI-sponsored clinical trials since 2001

• Pass rate climbed from initial 66% in 2001 to 88.5% in 2012*

• Phantom failures still occur (even with current 7% criteria)

• We were interested in delineating the types of errors experienced and determining the feasibility of tightening criteria

Methods

• 156 phantom irradiations (Nov. 2014 – Oct. 2015) were evaluated using the following criteria:
  • 7% TLD and 7%/4 mm (Current)
  • 5% TLD and 5%/4 mm
  • 5% TLD and 5%/3 mm
  • 4% TLD and 4%/4 mm
  • 3% TLD and 3%/3 mm

• Phantom failures were categorized qualitatively as:
  • Systematic errors
  • Setup errors
  • Global (nonsystematic) errors
  • Local (single-point) errors.
Failing phantom categorizations

Systematic under-dose

Setup error
Failing phantom categorizations

Global error

Local error

8/3/2016
## Results

### Table 1: Institutional percentage pass rates for overall and individual criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Overall pass</th>
<th>TLD pass</th>
<th>Gamma pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>7% TLD, 7%/4 mm</td>
<td>90</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>5% TLD, 5%/4 mm</td>
<td>77</td>
<td>80</td>
<td>86</td>
</tr>
<tr>
<td>5% TLD, 5%/3 mm</td>
<td>70</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>4% TLD, 4%/4 mm</td>
<td>63</td>
<td>67</td>
<td>79</td>
</tr>
<tr>
<td>3% TLD, 3%/3 mm</td>
<td>37</td>
<td>49</td>
<td>48</td>
</tr>
</tbody>
</table>
Results – Causes of Failure

7%/4mm Criteria
- Systematic Low: 56%
- Global: 19%
- Setup: 13%
- Syst. High: 12%
N = 16

5%/4mm Criteria
- Systematic Low: 47%
- Global: 8%
- Local: 22%
- Setup: 11%
- Syst. High: 11%
N = 36
Summary

- Most detectable errors are systematic and dosimetric (~60%)
  - Systematically low (~50% of all phantom failures)
- 5%/4 mm criteria are theoretically and practically achievable (77%)
  - 0.5% chance of failure caused by TLD uncertainty at 5% threshold
- Further work is warranted to better determine the cause of continuing errors in phantom credentialing
Thank you!

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Mallory Carson
mecarson@mdanderson.org