Improving Quality of Life After Head & Neck Radiotherapy

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Introduction

- Radiotherapy (RT) is critical in the management of H&N malignancies
- Multiple tumour groups
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- Multiple tumour groups
- Radiation induced toxicities generated via normal tissue complication
- Acute & Late effects of radiation
Cancer Survival - All Cancers

Figure 1: Survival by year

Relative survival (%)

Years after diagnosis

- 1986-1990
- 1991-1995
- 1996-2000
- 2001-2005
- 2006-2010

CCV, 2010
Cancer Survival - Pharynx

Figure 1: Survival by year

- 1986-1990
- 1991-1995
- 1996-2000
- 2001-2005
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CCV, 2010
Cancer Survival- Oral Cavity

Figure 1: Survival by year

Relative survival (%)

Years after diagnosis

- 1986-1990
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- 1996-2000
- 2001-2005
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CCV, 2010
Developing PhD Topic & Projects

- Our patients are living longer post treatment
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- Obliged to provide a better quality of life (QoL) post RT
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- Particular focus on dysphagia/swallowing outcomes
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## Developing PhD Topic & Projects

### Improved Normal Tissue Sparing in Head and Neck Radiotherapy Using Biological Cost Function Based-IMRT

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Intensity-modulated radiotherapy (IMRT) has reduced the impact of acute and late toxicities associated with head and neck radiotherapy. Treatment planning systems (TPS) are currently used to plan IMRT for head and neck cancers. However, these systems are optimized for tumor control probability (TCP). The biological cost function (BCF) approach has gained recent interest in the evaluation of IMRT. The BCF takes into account the normal tissue complication probability (NTCP) as a function of the mean dose to the normal tissue. The BCF approach has been traditionally limited by the need for extensive data to build patient-specific NTCP models. This paper reports on a novel BCF-based optimization procedure implemented in the Eclipse TPS, which is used in the Department of Radiotherapy at The Alfred Hospital. The BCF approach was tested on a patient with advanced laryngeal cancer, and the results showed significant sparing of normal tissues compared to the standard Eclipse planning.

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**MONASH University**
Medicine, Nursing and Health Sciences

**Austin Health**
Olivia Newton-John Cancer & Wellness Centre

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PhD Thesis Aims

The aims of thesis are:

- To validate current dose guidance recommendations for late dysphagia in the acute setting
- To investigate predictors for enteral feeding (pre-treatment factors & dosimetry)
- To investigate automated methods for delineation of swallowing anatomy
Research Questions

Study 1: Dose Volume Response in Acute Dysphagia Toxicity: Validating QUANTEC Recommendations into Clinical Practice for Head and Neck Radiotherapy.

Aim: To determine the validity of QUANTEC recommendations (for late dysphagia) in predicting acute dysphagia using intensity modulated head and neck radiotherapy.
Study 1 Methodology

- 76 patients (Locally advanced SCC H&N) retrospectively analysed:
  i) Dosimetrically (Larynx/ SG Larynx Dmean, Dmax, V50Gy)
  ii) Acute Dysphagia Toxicity (CTCAEv3- Weeks 1-7**)
Study 1 Methodology

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- Categorized via QUANTEC Recommended Dose Goals
  (Dmean<44Gy, Dmean<50Gy, Dmax<66Gy, V50Gy<27%) [42]
Study 1 Methodology

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- QUANTEC defined categories analysed for grade 3 acute dysphagia incidence
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QUANTEC defined categories analysed for grade 3 acute dysphagia incidence

Is dysphagia in acute setting predictor for late swallowing complications?
Conclusions

- QUANTEC late toxicity recommendations useful in predicting acute dysphagia
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- Precision radiotherapy demands optimisation of planned patient geometry
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- Precision radiotherapy demands optimisation of planned patient geometry

- Reliant on optimal treatment tolerance

- Greater understanding → Greater preventative interventions → Greater adherence to treatment intent
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Dose-volume response in acute dysphagia toxicity: Validating QUANTEC recommendations into clinical practice for head and neck radiotherapy

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Research Questions

Study 2: Dosimetric Predictors of Short and Long Term Percutaneous Endogastric (PEG) Tube Requirement in Head and Neck Radiotherapy

Aim: to establish dose/volume/outcome data on complex swallowing anatomy to predict for acute and late PEG feeding nutritional intervention.
Study 2 Methodology

- 117 (N=117) patients retrospectively identified with definitive head & neck IMRT in a prophylactic centre
- EF duration and intensity derived from prospective nutritional database
- Patients categorized:
  i) Heavy Feeders- FT use for >75% of dietary needs
  ii) Remaining patients (non-heavy feeders)
- Dose to swallowing anatomy analysed in Heavy Feeders v Others
Swallowing Anatomy

Oral Cavity (OC)

Base of Tongue (BOT)
Swallowing Anatomy

Superior PCM
Middle PCM
Inferior PCM
Swallowing Anatomy

Supraglottic Larynx

Glottic Larynx
Swallowing Anatomy

- Cricopharyngeus
- Oesophageal Inlet
- Cervical Oesophagus
Progress...

- Currently undergoing statistical analysis
Research Questions

Study 3: Reactive nutritional interventions: What pre-treatment factors predict for a reactive protocol in a prophylactic institution?

Aim: to determine which pre-treatment factors in head and neck radiotherapy are suggestive of a reactive approach to nutritional maintenance, in a cohort that may otherwise receive a prophylactic PEG as standard practice.
Study 3 Methodology

- 146 (N=146) patients retrospectively identified with definitive head & neck IMRT in a prophylactic centre
- EF duration and intensity derived from prospective nutritional database
- Patients categorized:
  i) Low Feeders- FT use for 25-75% of dietary needs for <4 weeks
  ii) Heavy Feeders- FT use for >75% of dietary needs for >6 weeks (**Analysis in different paper**)
- Differences in frequency distributions of demographics, use of chemotherapy, disease site, stage, and volume were analyzed
### Independent Variables (Potential Predictors)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
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<tbody>
<tr>
<td>Sex</td>
<td>Gross Tumour Volume (cc)</td>
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<tr>
<td>Age</td>
<td>Primary Tumour Volume (cc)</td>
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<tr>
<td>Metro/Rural</td>
<td>Nodal Tumour Volume (cc)</td>
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<tr>
<td>Primary Diagnosis</td>
<td>Planning Target Volume Length</td>
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<tr>
<td>T- Stage</td>
<td>Involved Neck Nodal Levels</td>
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<tr>
<td>N- Stage</td>
<td>Base of Tongue (BOT)</td>
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<tr>
<td>Chemotherapy</td>
<td>Cervical Oesophagus (CO)</td>
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<tr>
<td>Morbidity Score</td>
<td>Cricopharyngeus Muscle (CPM)</td>
</tr>
<tr>
<td>Performance Status</td>
<td>Oesophageal Inlet (OI)</td>
</tr>
<tr>
<td>BMI</td>
<td>Glottic Larynx (GL)</td>
</tr>
<tr>
<td>Pre-treatment Nutrition</td>
<td>Supraglottic Larynx (SGL)</td>
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<td>Pre-existing Dysphagia/Odynophagia</td>
<td>Inferior Pharyngeal Constrictor Muscle (IPCM)</td>
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<td>Alcohol Consumption</td>
<td>Middle Pharyngeal Constrictor Muscle (MPCM)</td>
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<tr>
<td>Current Smoker</td>
<td>Superior Pharyngeal Constrictor Muscle (SPCM)</td>
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<tr>
<td>Smoking Pack Years</td>
<td>Oral Cavity (OC)</td>
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</table>
Results (Preliminary)

No Chemotherapy

Small Primary Tumour

Limited Nodal Involvement

OralCancer.org
Study 4: Investigating the use of atlas based auto-segmentation software in the delineation of complex swallowing anatomy.
Study 4 Methodology

To be determined...
References


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Questions???