

Claire Jeans^{1,2}, Bena Brown^{1,3,4}, Elizabeth C. Ward^{1,3}, Anne E. Vertigan^{5,6,7}, Amanda E. Pigott^{1,3,8}, Jodie L. Nixon^{1,8}, Chris Wratten⁹, May Boggess¹⁰

1. School of Health and Rehabilitation Sciences, The University of Queensland, Queensland, Australia; 2. Speech Pathology Department, Calvary Mater Newcastle, New South Wales, Australia; 3. Centre for Functioning and Health Research, Metro South Health Services District, Queensland Health, Queensland, Australia; 4. Speech Pathology Department, Princess Alexandra Hospital, Queensland, Australia; 5. Speech Pathology Department, John Hunter and Belmont Hospital, New South Wales, Australia; 6. School of Medicine and Public Health, The University of Newcastle, New South Wales, Australia; 7. Centre for Asthma and Respiratory Disease, Hunter Medical Research Institute, New South Wales, Australia; 8. Occupation Therapy Department, Princess Alexandra Hospital, Queensland, Australia; 9. Radiation Oncology Department, Calvary Mater Newcastle, New South Wales, Australia; 10. School of Mathematical and Statistical Sciences, Arizona State University, Arizona, USA

INTRODUCTION AND OBJECTIVES

- >90% of patients with head and neck cancer (HNC) experience some form of head and neck lymphedema (HNL) post treatment.¹
- Studies show that external and internal HNL are associated with instrumental, clinician and patient-reported dysphagia.²⁻⁵
- However, limited data exists on how HNL changes in the 12 months post treatment, and how this relates to presence of dysphagia.



Figure 1: No internal HNL



Figure 2: Severe internal HNL

This project aimed to:

- Examine the trajectory of external and internal HNL in patients with HNC treated with chemoradiotherapy (CRT).
- Explore the relationship between HNL and dysphagia, specifically: penetration-aspiration status, functional diet status, and patient-reported swallowing outcomes.

METHODS

- Design:** Longitudinal cohort study.
- Participants:** Prospectively recruited via the Radiation Oncology Clinic at the Calvary Mater Hospital Newcastle, Australia.
 - Eligibility criteria:** (a) new diagnosis of oral, nasopharyngeal, oropharyngeal, laryngeal or hypopharyngeal cancer; and (b) planned to receive curative CRT.
 - Exclusion criteria:** (a) treated with palliative intent; (b) recurrent disease; (c) pre-existing comorbidity conditions that may result in HNL (e.g., trauma), or impact swallowing function (e.g., neurological injury or insult); or (d) unable to provide informed consent.
- Procedure:** Data was collected at baseline, 3, 6 and 12 months post treatment. External HNL, internal HNL and swallowing were assessed at each time point (Table 1).

Table 1: Assessments and outcomes measures

External HNL (tape measures, MoistureMetreD, toxicity criteria)
• The Assessment of Lymphedema of the Head and Neck (ALPHA)
• MD Anderson Cancer Centre (MDACC) Lymphedema Rating Scale
Internal HNL (transnasal laryngoscopy)
• Patterson's Radiotherapy Oedema Rating Scale
Swallowing (instrumental (FEES), clinical, patient-reported)
• Penetration-Aspiration Scale (scores 1-2 normal, 3-8 dysfunctional ⁶)
• Mann Assessment of Swallowing Ability – Cancer (MASA-C)
• Functional Oral Intake Scale (FOIS)
• Vanderbilt Head and Neck Symptom Survey (VHNSS, v2.0)

- Analysis:** Paired t-test examined changes in continuous variables, and Wilcoxon signed-rank test in categorical variables. Logistic regression models examined the relationships between the HNL variables and the PAS score. Linear regression models examined the relationships between the HNL variables and the MASA-C, FOIS, and VHNSS subscale scores.

RESULTS AND DISCUSSION

- Participants:** 33 patients post CRT were included in the analysis (total 86 observations across the 3, 6 and 12 month time points). Participation in the baseline time point was poor.
- Demographics:** Participants were predominantly male (91%) and a mean of 59.9 years. The majority had early-stage (T1-2, 67%) oropharyngeal tumours (91%), advanced nodal metastases (N2-3, 88%), and HPV-positive disease (76%). Most received conventional radiation treatment (via IMRT or VMAT) of 70Gy in 35# (94%) and 3 cycles of high-dose cisplatin (70%).
- Prevalence of HNL:** all participants had some form of HNL at 3, 6 and 12 months post CRT (Table 2). While external HNL largely resolved, internal HNL remained.

Table 2: Prevalence of external and internal HNL

	3 months	6 months	12 months
	% (n)	% (n)	% (n)
External HNL	71% (17)	58% (18)	10% (3)*
Internal HNL (mod/severe)	96% (23)	83% (26)*	64% (20)*
No. internal sites (mod/severe)	6 of 13 sites	4 of 13 sites*	2 of 13 sites*

*indicates statistical significance between current and previous time point.

Associations between HNL and swallowing:

- Significant relationships were found between external HNL and disordered PAS scores ($p = 0.001$), FOIS scores ($p = 0.036$), MASA-C scores ($p = 0.002$), and the VHNSS swallow solids subscale ($p = 0.004$).
- Significant relationships were found between internal HNL (maximum severity and number of sites affected) and disordered PAS scores ($p < 0.001$ and $p = 0.043$, respectively), FOIS scores ($p = 0.007$ and $p = 0.001$, respectively), and MASA-C scores ($p = 0.002$ and $p = 0.002$, respectively). The number of sites affected was also associated with the VHNSS swallow solids subscale ($p = 0.002$).
- These results indicate that participants were more likely to experience dysphagia, have laryngeal penetration and/or aspiration, and require increased diet modification if they had a higher severity of external and/or internal HNL and more diffuse internal HNL. Participants with higher (or worse) levels of patient-reported symptom burden in relation to swallowing and eating solid foods also had a higher severity of external HNL and more diffuse internal HNL.

CONCLUSIONS

- 2 HNL trajectory patterns exist in the 12 months post CRT:
 - External HNL is most prevalent at 3 months, begins to improve at 6 months, and is largely resolved by 12 months.
 - Internal HNL persists throughout the whole 12 months. There is some reduction in its severity and diffuseness, but it never fully resolves.
- Patients who are 12 months post CRT may be expected to present with internal HNL in the absence of external HNL.
- Patients who have higher severities of external and/or internal HNL or have more diffuse internal HNL post CRT may also experience more severe dysphagia.

REFERENCES

- Ridner, S.H., et al., *A prospective study of the lymphedema and fibrosis continuum in patients with head and neck cancer*. *Lymphat Res Biol*, 2016. 14: p. 198-205.
- Deng, J., et al., *Impact of secondary lymphedema after head and neck cancer treatment on symptoms, functional status, and quality of life*. *Head & Neck*, 2013. 35: p. 1026-35.
- Jackson, L.K., et al., *Internal lymphedema correlates with subjective and objective measures of dysphagia in head and neck cancer patients*. *Journal of Palliative Medicine*, 2016. 19: p. 949-956.
- Queija, D.D.S., et al., *Cervicofacial and Pharyngolaryngeal Lymphedema and Deglutition After Head and Neck Cancer Treatment*. *Dysphagia*, 2019. 35: p. 479-491.
- Jeans, C., et al., *Association between external and internal lymphedema and chronic dysphagia following head and neck cancer treatment*. *Head & Neck*. 2020. 43: p. 255-267.
- Robbins, J., et al., *Differentiation of normal and abnormal airway protection during swallowing using the penetration-aspiration scale*. *Dysphagia*, 1999. 14: p. 228-32.

CONTACT: claire.jeans@uq.net.au