



# A review of unplanned admissions in head and neck cancer patients undergoing oncological treatment

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Received: 16 January 2023 / Accepted: 18 April 2023 / Published online: 8 May 2023  
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## Abstract

**Aim** Non-surgical treatment for head and neck cancer (HNC) often results in severe toxicities, which are detrimental to a patient's health and quality of life. There is limited published UK data on unplanned hospital admissions and reasons associated with admission. We aim to identify frequencies and reasons for unplanned hospital admissions, highlighting those patient groups who are most vulnerable.

**Methods** A retrospective study of unplanned hospital admissions of HNC patients receiving non-surgical treatment was completed. An inpatient admission was defined as  $\geq 1$  night spent in the hospital. To test potential demographic and treatment predictors of inpatient admission, a multiple regression model was constructed using the endpoint measure (unplanned admission), as the dependent variable.

**Results** A cohort of 216 patients was identified over a 7-month period, and 38 of these patients (17%) required an unplanned admission. Treatment type was the only statistically significant predictor of in-patient admission. The majority of admissions were patients receiving chemoradiotherapy (CRT) (58%) with predominant reasons for admission being nausea and vomiting (25.5%) and decreased oral intake/dehydration (30%). Of the patients admitted, 12 had a prophylactic PEG placed pre-treatment, and 18 of 26 admitted without prophylactic PEG required nasogastric tube feeding during their admission.

**Discussion** Almost one-fifth of HNC patients over this time period required hospital admission; the majority of which can be attributed to treatment toxicities when receiving CRT. This is concurrent with other studies which review the impact of radiotherapy versus CRT. Increased support and monitoring, particularly focused on nutrition, are required for patients with HNC who receive CRT.

**Key message** This article describes a retrospective review of a patient undergoing non-surgical treatment for head and neck cancer. These patients frequently require unplanned hospital admission. The results indicate that patients undergoing (chemo)radiotherapy are most vulnerable to deterioration and additional support focused on nutrition for these patients is indicated.

**Keywords** Unplanned admission · Head and neck cancer · Oncology · Chemoradiotherapy

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## Introduction

Chemoradiotherapy is an important and effective treatment for head and neck cancer (HNC) but can often induce acute and chronic toxicities such as significant swallowing difficulties [1] that can be detrimental to patients' health and quality of life. Although treatment schedules and regimes have sought to reduce toxicity and improve overall disease control [2], side effects such as mucositis, dysphagia and nausea and vomiting remain common [3]. As well as the incurred distress to patients and their families, these symptoms can lead to treatment breaks with high healthcare resource utilisation, such as unplanned hospital admission during treatment [4].

Current evidence affirms that treatment breaks are associated with poorer overall survival rates, patients with short (4–8 days) or long breaks (> 8 days) had lower absolute 4-year overall survival by 4 and 12% [5], with preliminary data suggesting that hospitalisation during radiotherapy for HNC may be an early marker for worse survival in this patient cohort [6]. A small number of studies in the USA suggest that hospitalisation during treatment is a relatively common occurrence, affecting up to a third of patients [7–9].

Identified risk factors associated with unplanned hospitalisation include treatment type, premorbid status and social circumstances. Systemic chemotherapy is an independent risk factor for treatment toxicity leading to unplanned admission as well as comorbidities (notably poorly controlled diabetes and chronic pulmonary disease) [7–9]. An individual's social circumstances have also been shown to influence the likelihood of unplanned admission [6] with unmarried status purporting a greater admission risk. There is currently limited corroborative evidence from UK-based treatment cohorts in the literature, and both nutritional and oral intake status are risk factors of particular interest that warrant further impact assessment for admission.

Research in this area is vital to establish pre-emptive management pathways to minimise admission risk, reduce treatment interruptions and ultimately, improve patient outcomes. The aim of this study was to investigate the frequency, reasons and predictors of unplanned hospital admissions in HNC patients during non-surgical treatment modalities, with a specific focus on enteral feeding status and associated issues.

## Methods

The study was registered and approved following institutional review (Clatterbridge Cancer Centre NHS Foundation Trust's Audit Committee).

This was a single-centre cohort study of unplanned hospital admissions of HNC patients receiving non-surgical treatment modalities as part of their treatment package at a large tertiary oncology unit in North West England over a 7-month period. These admissions all occurred at varying time points during their treatment schedule.

All HNC referrals from 1.4.20 to 31.10.20 were screened, and those patients who underwent chemoradiotherapy in either primary, adjuvant or palliative settings were included in the analysis and entered into an anonymised electronic medical record system. This time period coincided with the first wave of the COVID-19 pandemic.

Data on patient demographics—age, gender and disease characteristics including tumour site and staging, TNM7

stage [10] treatment intent (curative or palliative) and the treatment modality (chemotherapy, radiotherapy, chemoradiotherapy)—was captured. Feeding tube status was recorded, including the timepoint of placement, pre or during treatment, and route of insertion—nasogastric or long-term enteral feeding tube (ie. percutaneous endoscopic gastrostomy (PEG), radiologically inserted percutaneous gastrostomy (RIG) or jejunostomy (JEJ)).

Unplanned admissions were categorised according to attendance at the “Clinical Decisions Unit” in the Clatterbridge Cancer Centre—where urgent medical care is provided during normal working hours. Reasons for unplanned admission are recorded by the medical professional who completes the initial assessment, and these reasons were categorised and coded using the terms: nausea and vomiting, nasogastric tube insertion, reduced oral intake/dehydration, infection, dysphagia/aspiration, deranged types of blood, etc. Data on admissions to other acute centres was not available.

Data was anonymised and screened for accuracy and consistency by a second internal reviewer.

## Analysis

Analyses were carried out using SPSS for Windows version 24 (Chicago, Illinois, USA) [11]. Univariable analysis was initially performed to test each potential explanatory variable association with hospital admission, using Pearson's Chi-square test for categorical explanatory variables. A conservative  $p$  value (0.1) for univariate analysis was used to take variables forward to binary logistic regression. A backwards selection procedure was used to determine the final model (criteria for entry  $p < 0.05$  and for removal  $p > 0.1$ ). The overall fit of the model was ascertained using the Hosmer and Lemeshow goodness of fit test.

## Results

### Patient characteristics

There were 216 patients identified as fitting the inclusion criteria during the six-month data collection period. Patient characteristics are summarised in Table 1.

Of this cohort, 38 patients (17%) required an unplanned admission during their treatment, and 9 of these patients had more than one admission with a total admission number of 47. The majority of admissions were patients receiving primary curative-intent chemoradiotherapy (CRT) (58%). For the majority of patients, the treatment intent was curative.

**Table 1** Patient characteristics: age, sex, tumour location and stage and treatment modality

| Characteristics           | Number (%)  | Unplanned admission ( <i>n</i> ) | <i>p</i> value |
|---------------------------|-------------|----------------------------------|----------------|
| <b>Age</b>                |             |                                  |                |
| < 50                      | 19 (0.9%)   | 6                                | <b>0.009</b>   |
| 50–59                     | 64 (29.6%)  | 12                               |                |
| 60–69                     | 70 (32.4%)  | 17                               |                |
| > 70                      | 63 (29%)    | 3                                |                |
| <b>Sex</b>                |             |                                  |                |
| Male                      | 171 (79%)   | 26                               | 0.41           |
| Female                    | 44 (21%)    | 12                               |                |
| <b>Tumour site</b>        |             |                                  |                |
| Oral                      | 41 (19%)    | 9                                | 0.19           |
| Oropharyngeal             | 86 (40%)    | 18                               |                |
| Larynx                    | 39 (18%)    | 2                                |                |
| Hypopharynx               | 13 (6%)     | 4                                |                |
| Nasopharynx               | 12 (5.6%)   | 3                                |                |
| Unknown primary           | 6 (2.7%)    | 1                                |                |
| Other                     | 19 (8.8%)   | 1                                |                |
| <b>Tumour stage</b>       |             |                                  |                |
| 1                         | 39 (18%)    | 5                                | <b>0.06</b>    |
| 2                         | 67 (31%)    | 9                                |                |
| 3                         | 28 (13%)    | 4                                |                |
| 4                         | 63 (29%)    | 16                               |                |
| Unknown/not documented    | 19 (9%)     | 4                                |                |
| <b><i>N</i> stage</b>     |             |                                  |                |
| 0                         | 55 (25.5%)  | 5                                | <b>0.08</b>    |
| 1                         | 31 (14.4%)  | 8                                |                |
| 2                         | 109 (50.5%) | 18                               |                |
| 3                         | 6 (2.8%)    | 3                                |                |
| Unknown                   | 15 (6.9%)   | 4                                |                |
| <b>Treatment</b>          |             |                                  |                |
| Radiotherapy              | 142 (65.7%) | 14                               | <b>0.003</b>   |
| Chemoradiotherapy         | 72 (33.3%)  | 22                               |                |
| Chemotherapy only         | 2 (0.9%)    | 2                                |                |
| Pre-treatment gastrostomy | 45 (21%)    | 12                               | <b>0.07</b>    |

*P* values for each potential explanatory variable for unplanned admission. Those in bold were taken forward to the binary logistic model

In total, 45 (21%) patients had a prophylactic gastrostomy tube (PEG/RIG/ JEJ) placed pre-treatment. Eighteen patients had a reactive nasogastric tube placed during an admission. Oropharynx was the most common tumour site for both PEG (*n* = 26) and NG placement (*n* = 7) followed by oral cavity (PEG (*n* = 7) and NGT (*n* = 5)).

Of the patients admitted (*n* = 38), 12 had a prophylactic gastrostomy placed pre-treatment, and 18 of 26 admitted without prophylactic enteral feeding required reactive nasogastric tube feeding during their admission.

## Predictors of unplanned hospital admission

A binary logistic regression model was tested to see if independent variables ( $p > 0.1$ ) from the univariate analysis (see Table 1) predicted an unplanned admission. The model was statistically significant  $\chi^2 = 18.47$ ,  $p < 0.0001$  (see Table 2). Patients treated with chemoradiation were more likely to be admitted than those receiving radiotherapy. Patients with T3-4 tumours were more likely to be admitted than those with T1-2 (25% vs. 15%). Age was also a significant variable. Just under one-third of patients aged < 50 years were admitted to hospital, compared with five per cent of those aged > 70 years.

The predominant reasons for admission being nausea and vomiting (34%) and decreased oral intake/dehydration (34%) are shown in Table 3.

## Discussion

This study is the first UK-based cohort to our knowledge to report on unplanned hospital admissions for HNC patients receiving non-surgical treatment in a tertiary oncology centre. The frequency of admissions was lower than reported in other studies; 21% compared with 36% [7, 8] despite similar demographics. During the data collection period, the COVID-19 pandemic placed unprecedented pressure upon surgical services [12] with a subsequent increase in non-surgical management of HNC. Services aimed to reduce unplanned hospital admissions and the risk of COVID-19 exposure in this vulnerable group meaning that criteria for admission were likely temporarily elevated. There was advice published suggesting increased caution with the use

**Table 2** Treatment intent

| Treatment intent    | Number (%)  | Number admitted |
|---------------------|-------------|-----------------|
| Curative (primary)  | 116 (53.7%) | 27              |
| Curative (adjuvant) | 72 (33.3%)  | 10              |
| Palliative          | 28 (13%)    | 1               |

**Table 3** Hospital admission during non-surgical treatment

| Variable           | $\beta$ | Std error | Odds ratio | 95% CI    | <i>p</i> value |
|--------------------|---------|-----------|------------|-----------|----------------|
| Treatment category | 0.71    | 0.29      | 2.0        | 1.2–3.6   | 0.01           |
| Tumour stage       | 0.35    | 0.15      | 1.4        | 1.1–1.9   | 0.02           |
| Age                | 0.44    | 0.21      | 0.64       | 0.43–0.97 | 0.03           |

Standardised beta coefficients, 95% CI and *p* value for binary logistic regression model

of chemoradiotherapy with the majority of those patients over 60 years of age receiving radiotherapy alone or palliative RT (with reduced volumes) [13]. This may explain the reduction in unplanned admissions in our study compared to published cohorts. Despite this, almost one-fifth of HNC patients required hospital admission, and one-fifth of these had multiple admissions, similar to findings elsewhere. [7]

In keeping with previous work, patients receiving primary chemoradiotherapy were at greater risk of admission, many of whom had substantial deterioration in their diet and fluid intake [8, 9]. Reasons for chemoradiotherapy-related admissions include nausea and vomiting, dehydration/malnutrition, mucositis-related eating and drinking problems and pneumonia [14]. Although not coded for within our data, it is likely that reduced intake (one of the predominant reasons for admission in our study) was due to mucositis. Prevention and treatment strategies for mucositis should be a core part of clinical care and patient education [15]. A quarter of patients admitted also had nausea and vomiting with decreased oral intake/dehydration. Although implicated as a reason for admission in other cancer groups [16], nausea and vomiting appear more common in HNC patients (25% vs. 13%).

**Table 4** Unplanned hospital admissions ( $n=38$ ) and reasons for admission

| Unplanned admission        | Number (%) |
|----------------------------|------------|
| More than one admission    |            |
| Yes                        | 9 (4%)     |
| No                         | 207 (96%)  |
| Total number of admissions | 47         |
| Admission reason           |            |
| Reduced PO intake          | 14 (30%)   |
| Nausea and vomiting        | 12 (25.5%) |
| Deranged bloods            | 6 (13%)    |
| NGT insertion              | 4 (8.5%)   |
| Dysphagia/aspiration       | 3 (6%)     |
| Infection                  | 2 (4%)     |
| Pain                       | 0          |
| Other                      | 6 (13%)    |

**Table 5** Enteral feeding status

|                                       | Number |
|---------------------------------------|--------|
| Pre-treatment enteral feeding tube?   |        |
| Yes                                   | 45     |
| No                                    | 170    |
| Nasogastric tube placed on admission? |        |
| Yes                                   | 18     |

|    | Number |
|----|--------|
| No | 20     |

Importantly, placing a prophylactic gastrostomy did not seem to prevent hospital admission, as 27% of those with a prophylactic gastrostomy required admission compared with 15% of patients without a tube. Conversely, other centres have reported prophylactic gastrostomy does reduce unplanned admissions [17]. In our cohort, the decision to place a prophylactic gastrostomy was on a personalized case-by-case basis rather than a protocol-driven approach. The placement of prophylactic versus reactive feeding tubes has long been debated within the literature, and there are no nationally agreed selection criteria, with demonstrable variation in clinical practice [18]. Recent work to identify a clinical algorithm suggests performance status, tumour subsite, stage and nodal involvement, and platinum-based chemotherapy are predictors of the need for prophylactic gastrostomy [19, 20].

The tumour stage was also a predictor of an admission. Patients with higher staged tumours are more likely to have multi-modality treatment but may also present at diagnosis with significant weight loss, dysphagia and multiple comorbidities rendering them more vulnerable to hospital admission [21, 22]. The analysis showed that age was an important variable, with those < 50 years having a higher percentage of admissions, although patient numbers in this category were low. Whether other previously identified predictors such as social circumstances influenced these findings is unknown [7].

There are a number of limitations in this study. We did not include co-morbidities, frailty score or social circumstances in our data collection as these were details not uniformly entered into medical records. These may be significant influencing factors [9, 23] and may help to identify vulnerable groups at an earlier stage. For future research, it would also be beneficial to review whether t-stage data and time point of treatment influenced admission in this group.

A better understanding of unplanned hospital admissions is important as such events can lead to a change in treatment plan e.g. reduced chemotherapy cycles, to manage severe side effects, thus negatively impacting overall survival [24]. In summary, whilst our admission rates appear favourable, findings suggest that concurrent chemoradiotherapy results in more severe toxicities and increased unplanned admission rates. Pre-emptive management of treatment side effects, such as mucositis, nausea and dysphagia, should be prioritised, particularly in vulnerable groups. Nutritional prehabilitation delivered before and during treatment may help to prevent deterioration, although evidence to support its effectiveness in HNC is lacking [25]. Regional data is also important in

order to appropriately consent patients when discussing treatment plans. Patient's nutrition and hydration status should be closely monitored throughout treatment. An increased focus on nutritional support may help to reduce the frequency of hospital utilisation in this patient group in the future.

**Author contribution** All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by Emer Fahy. The first draft of the manuscript was written by Emer Fahy, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

## Declarations

**Ethical approval** Not applicable.

**Competing interests** The authors declare no competing interests.

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