Swallowing disorders during and after radiochemotherapy for head and neck cancer: a review

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Abstract. Swallowing disorders during and after radiochemotherapy for head and neck cancer: a review. Radiochemotherapy is gaining popularity as organ preservation treatment for patients with advanced head and neck cancer. This article reviews the literature currently available about the side-effects of this treatment regime, and more specifically about swallowing physiology and feeding.

Introduction

Increasing emphasis is being placed on organ preservation techniques in the treatment of head and neck cancer.

Over the last decade, the use of concurrent radiotherapy and chemotherapy has become an acceptable way of increasing tumour control and preserving organ anatomy. Unfortunately, these treatment regimens are often associated with acute and long-term side-effects which have an impact on organ functionality. More specifically, swallowing is known to be highly sensitive to radiotherapy and emerging reports on the effect of radiochemotherapy suggest that it has an even more pronounced negative effect on swallowing and feeding.1-11

Swallowing and feeding are undeniably important aspects of quality of life, and nutritional status is also recognised as a prognostic factor in complications and oncological outcome.12,13 The prevention and rehabilitation of these negative side-effects is therefore of primary importance.9,12,14,15

This article presents a review of the effect of radiochemotherapy on the complex pattern of swallowing. A specific focus is placed on preventive and rehabilitative areas.

Incidence of swallowing problems after RCT

The incidence of swallowing disorders after radiochemotherapy varies depending on the tumour location and size, radiation dose, fraction size, the timing of post-treatment and methods of assessment. Incidences of up to 65% and degrees of severity ranging from moderate to severe have been reported.7,8,16-18 Swallowing problems after radiochemotherapy are very often linked to acute toxicities such as loss of taste, odynophagia, oedema, radiation-induced mucositis and its associated oropharyngeal thick secretions.17,19,20 Late side-effects such as xerostomia and fibrosis are very likely to a effect long-term swallowing.18 It has been stated that vascular, neuropathic and fibrotic changes contribute to the pathophysiology of swallowing after radiochemotherapy.21

Pretreatment swallowing problems

Several studies have demonstrated the presence of radiographic swallowing symptoms even before the start of radiochemotherapy, even though patients at that stage are often taking complete oral feeding by mouth.10,18,22-24 Pretreatment swallowing problems seem to be mainly caused by the presence of the tumour itself or by subsequent pain. Hypopharynx tumours are likely to be associated with swallowing difficulties to a higher degree than those in the oral or laryngeal cavity.23 Different pretreatment videofluoroscopic studies25,26 reported weakness in the posterior motion of the tongue and delayed initiation of the pharyngeal swallow as the most common symptoms. The aspiration rate in this pretreatment stage is rather small and significantly lower than after therapy.10,26
Post-treatment swallowing problems

Objective data

Until a few years ago, objective evaluations were scarce.27 Recently, however, several authors have studied the objective pathophysiology of swallowing after radiochemotherapy, mostly in the acute phase after treatment (i.e., <1 year).2,4,24,26-28 Very often, videofluoroscopy is used as an evaluation instrument. The different evaluation points after treatment, as well as the diversity in tumour locations and treatment doses, make it somewhat difficult to compare outcomes of different studies. However, most papers point in the same direction and report quite similar objective findings. Up to 80% of patients have objective swallowing dysfunctions in the first year after treatment. Typically, these dysfunctions are: reduced tongue base retraction and reduced tongue strength, delay in triggering the pharyngeal swallow, reduced laryngeal elevation and reduced laryngeal closure. In addition, pharyngeal stage dysfunctions have been reported with reduced bolus clearance.30,27 Furthermore, Eisbruch et al.26 noted a reduced inversion of the epiglottis and an uncoordinated or incomplete opening of the upper oesophageal sphincter (UOS) in relation to bolus transport. It has not been demonstrated whether this latter difficulty is caused by the inadequate relaxation of the sphincter itself or is a result of the reduced anterior elevation of the larynx, which is a frequently seen symptom.

All of the factors above obviously exacerbate the risk of aspiration. Aspiration was, however, under-reported until the deliberate use of videofluoroscopy was introduced to the post-treatment evaluation of radiochemotherapy patients.7,29 Aspiration rates between 19% and 81% have been found in this patient population.10,11,18,29-36 Patients with hypopharyngeal and laryngeal tumours are more likely to be aspirators. Eisbruch et al.26 reported aspiration, which was typically silent without eliciting a cough reflex, in 65% of the early post-treatment studies (1-3 months) and 62% in the late post-therapy studies (6-12 months). Subsequent aspiration pneumonias (29%) in their study population, some of which were fatal, were directly related to the therapy-induced aspirations. This high incidence of silent aspiration after radiochemotherapy was recently confirmed in large studies by Langerman et al.31 and Bleier et al.11 and is linked to a reduced laryngeal sensitivity and an ineffective cough reflex.37

Pharyngo-oesophageal strictures, with a subsequent need for dilatation, have been identified in 9% to 12% of patients.7,8,18,31,34,38 Eisbruch et al.26 even reported 35% of patients with oesophageal stenosis. Most of these strictures developed early after post-therapy. Smith et al.31 associated the development of strictures with the use of high dose volumes (74.4 Gy). It has been suggested that the presence of a nasogastric tube might prevent these strictures. However, no randomised trials have been performed.27 Most strictures can be successfully managed with dilatations.

The long-term pathophysiology of swallowing more than one year after treatment is still somewhat vague. Newman et al.39 found that weight and eating changes peaked six months after treatment and that functionality at six months was predictive for long-term swallowing outcome (12 to 18 months) and PEG dependency. They noted no significant deterioration in long-term follow-up. Logemann et al.27 followed a group of patients for at least one year after radiochemotherapy. Their data showed no significant improvement in swallowing in that year. On the contrary, the frequency of several swallowing disorders increased. These findings are in accordance with previous reports in which a worsening of long-term swallowing was noted, suggesting that fibrosis is a major cause of these dysfunctions.11,31,36,40,41

Subjective complaints

There are conflicting data about the match between the videofluoroscopic data described above and the subjective complaints of patients themselves. Subjective complaints in this patient population are mostly assessed with the Performance Status Scale for Head and Neck Cancer (PSS H&N)26 and the M.D. Anderson Dysphagia Inventory (MDADI).5 The value of these patient-assessed symptom scores for predicting equivalent objective changes is, however, very variable. Pauloski et al.41 and Stenson et al.23 found that subjective swallowing complaints correlate well with objective findings. Logemann et al.27 showed that limitations in oral intake and diet after cancer treatment were significantly related to reduced laryngeal elevation, reduced UOS opening and non-functional...
swallows (i.e. with aspiration or pharyngeal residue). Jensen et al. on the other hand found no correlation between subjective complaints and the amount of oral intake, swallowing efficiency and aspiration. A poor correlation was also described between quality of life measurements and diet consistency and objective swallowing dysfunctions.1

Oral intake

In most patients, tube feeding is necessary during the process of radiochemotherapy to prevent dehydration and excessive weight loss. The majority of them recommence with some oral intake a few weeks after the completion of treatment. However, they often need restrictions in consistencies, place and accompanying and have to use PEG (Percutaneous Endoscopic Gastrostomy) as an additional way of feeding. Removal of the PEG tube is most likely one of the most important end points in evaluating the effect of radiochemotherapy on swallowing function. Data about the ability to take food by mouth, during or after radiochemotherapy, are more or less consistent between reports. A median time of 21 weeks is reported before the removal of tube feeding.18,31 Five months after treatment, more than 50% of patients still depend on PEG.10 In our own population of 90 patients treated with chemoradiotherapy, the PEG tube remained in place for a median of 5 months (range, 18-50 days). Of the 54 patients who are currently disease-free, 5 (9.3%) have a PEG tube in place after a median of 9 months (range, 8-11 months) from the end of treatment.46

More than one year after treatment, most patients are generally able to eat orally.7,46 However, between 10 and 40% of patients are reported to have a PEG tube in place for supplemental feeding purposes.31,18,21,39,45 A higher rate of PEG dependency is seen in patients with tongue base lesions.45

There is still some controversy about the prophylactic placement of PEG tubes in patients undergoing radiochemotherapy.40,49,50 Current clinical practice ranges from placing a feeding tube in all patients planned to undergo radiochemotherapy to placing the tube only in case of inadequate oral intake during the treatment regimen. Jensen et al. and Mekhail et al. demonstrated that PEG use during and immediately after radiotherapy had a negative impact on swallowing-related QOL. Long-term tube-fed patients experienced more long-term dysphagia and ‘nil by mouth’ (NPO) intervals were associated with poorer oral intake over a longer period.1 It is suggested that tube-fed patients may experience more muscular dystrophy and fibrosis. Al-Olhaman’s data, on the other hand, indicate that short-term PEG tube placement and long-term PEG tube dependency seem unrelated. They advocate the use of PEG tubes only in patients who are nutritionally compromised. Some other authors also suggest that patients should try to maintain oral intake as long as possible with volumes that are as large as possible and with consistencies other than fluids.18

However, to date, there are insufficient randomised controlled trials addressing the effect of tube feeding on long-term outcome.

Dysphagia-related structures and radiation dose

To date, there is quite a considerable body of evidence about the impact of radiochemotherapy on swallowing physiology. The ultimate goal of research in this area is to identify structures at risk of dysphagia and to build up a model in which doses to these organs can be reduced without compromising the necessary tumour dose. Some preliminary reports have already been published. However, since they all use different doses, different assessment techniques and primary tumour sites, comparison between data is very difficult.

Jensen et al. found significant correlations between both subjective and objective swallowing problems and dose volume parameters. Doses of less than 60 Gy to the supraglottic region, larynx and UOS resulted in a low risk of aspiration. They concluded that ipsilateral treatment reduced subjective swallowing complaints. However, their study was performed retrospectively and only included patients who underwent radiotherapy without chemotherapy.52 Smith et al. confirmed in a prospective study that lowering radiation doses (74.4 Gy to 60 Gy) significantly reduced long-term dysphagia.

Since the pharyngeal constrictors and glottic and supraglottic larynx were found to change anatomically after radiochemotherapy, Feng et al. and Eisbruch et al. studied the correlation between doses to these specific structures and both subjective and objective swallowing problems after therapy. The highest correlations were found with doses to the superior pharyngeal constrictor and larynx and it is suggested that
sparking these structures will result in fewer swallowing disorders. It is hypothesised that both dysfunction and loss of elasticity in the pharyngeal constrictors and larynx may explain many of the abnormalities noted with video-fluoroscopy. Whether a resolution of anatomic abnormalities over time will result in improved swallowing is, however, not known.\textsuperscript{33,54} A recent study by Caglar et al.\textsuperscript{55} confirmed that mean doses $>50$ Gy to the larynx and pharyngeal constrictors and larynx were the most significant predictors for aspiration. In our own patient population, the mean dose to the middle pharyngeal constrictor muscle, as well as the volume of that structure receiving $\geq 50$ Gy, and the mean dose to the supraglottic larynx, were significantly associated with late swallowing problems evaluated by the H\&N35 swallowing symptom score [Dirix P, et al. Personal communication].

Influence of treatment strategies?

Some evidence is emerging that early swallowing interventions, including typical strengthening exercises or facilitation of UOS opening (Mendelsohn Manoeuvre, Shaker exercises, ...), may prevent negative side-effects of radiochemotherapy on swallowing physiology and may even facilitate earlier oral intake.\textsuperscript{2,56,57} Kulbersch et al.\textsuperscript{58} found that the implementation of swallowing manoeuvres before the start of radiochemotherapy is even more successful in improving swallowing measures and related quality of life measures by comparison with post-treatment exercises. However, large multicentre trials are needed for the further study of the effect of specific treatment strategies on swallowing function.

Conclusion

Overall, the radiographic symptoms observed after radiochemotherapy are quite similar in nature to those observed after radiotherapy alone. Deglutition may be affected at several levels. However, the frequency of symptoms seems to be higher in patients receiving a combination of radiotherapy and chemotherapy.\textsuperscript{27} It is suggested that these swallowing symptoms are a result of tissue changes caused by the radiotherapy damage. Chemotherapy only seems to increase their intensity and frequency.\textsuperscript{27} It is also suggested that the incidence and severity of dysphagia is higher after radiochemotherapy than after radiotherapy alone because of the higher proportion of patients with larger tumours and the higher number of oropharyngeal tumours.\textsuperscript{7,54}

Until now, no single organ has been shown to predict overall swallowing outcome, and there is no sufficient evidence to link the tumour site with specific swallowing disorders.

As chemoradiotherapy is gaining popularity as primary treatment, accurate counselling of these patients is of major importance. An issue of concern is the high incidence of silent aspiration in this patient population, which is not always correlated with subjective complaints. Videofluoroscopic follow-up to identify patients at risk of aspiration and subsequent aspiration pneumonia has been advocated in clinical studies. Patients with an established aspiration risk should receive preventive measures and even swallowing therapy.\textsuperscript{26}

References

Swallowing disorders during and after radiotherapy


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