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ORIGINAL ARTICLE

Functional Endoscopic Evaluation of Swallowing in Patients Treated by Total Laryngectomy and Adjuvant Treatment for Advanced Laryngeal and Hypopharyngeal Malignancies

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Abstract Treatment of locally advanced laryngeal and hypopharyngeal cancers often requires total laryngectomy with partial pharyngectomy and adjuvant radiotherapy. Dysphagia is common after such aggressive treatment which is often under reported, but adversely affects the quality of life in these patients. The cause for this dysphagia is loss of pharyngeal mucosa, fibrosis, disruption of constrictors and loss of skeletal support to soft tissues. In this study 32 patients treated by laryngectomy with partial pharyngectomy and adjuvant radiotherapy underwent fibreoptic endoscopic evaluation of swallowing at 6 and 12 weeks after completion of treatment. Majority of them had delayed transit of bolus, dryness and edema and 6 of them had pharyngeal stenosis, 2 had fibrotic band and 2 had adynamic pharyngeal segments. These findings were the cause of dysphagia. The frequency of occurrence of the above findings and their association with extent of resection of pharyngeal mucosa and adjuvant treatment have been documented. Bilateral neck dissection, post operative chemotherapy with radiotherapy and use of myocutaneous flap for the reconstruction of neopharynx were found to cause severe dysphagia in our series. Some of these patients benefitted by swallowing therapy, diet modifications and nasogastric feeding. Therefore early identification of cause of dysphagia in these patients and timely intervention to facilitate rehabilitation can improve the quality of life and reduce the long term morbidity in these patients.

Keywords Functional endoscopic evaluation of swallowing · Total laryngectomy · Partial pharyngectomy · Dysphagia · Pharyngeal stenosis · Delayed transit of bolus

Introduction

Head and neck malignancies account for 30% of all malignancies in India. Among head and neck malignancies 11% are hypopharyngeal and 14% laryngeal cancer [1]. Treatment protocols and prognosis vary widely and are based on the stage of the disease at the time of diagnosis. Many patients presenting with locally advanced disease require aggressive, multimodality treatments like total laryngectomy with or without partial pharyngectomy and adjuvant treatment in the form of radiotherapy or chemoradiation. Neoadjuvant chemotherapy followed by surgery and adjuvant radiotherapy or chemotherapy and radiation is also an accepted modality of treatment. This results in significant morbidity due to loss of structure and alteration in function [2, 3]. In addition to loss of speech, majority of laryngectomized patients experience dysphagia which is often underestimated by clinicians. Neck dissection and post operative radiotherapy can further aggravate the dysphagia. This can result in weight loss, poor quality of life, depression and sometimes cachexia. In literature various reasons have been documented to explain the dysphagia after laryngectomy. These include loss of positive pressure in the airway at the level of cricopharynx, loss of elevation of the trachea during swallowing due to resection of hyoid which results in delay in the opening of cricopharyngeal sphincter and subsequent delayed peristalysis in upper oesophagus. In hypopharyngeal and supraglottic tumors, part of the pharyngeal wall is resected

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together with the primary tumor. Thus, the pharyngeal lumen (neopharynx) is smaller [4].

Surgery may also result in fibrosis, stenosis, alteration in pharyngeal constrictors, adynamic segments and stiffness of soft tissues of neck contributing to dysphagia [4, 5].

Swallowing problems are common after total laryngectomy, with an incidence of 70–75%. Severe distress due to dysphagia has been reported in up to 40% of patients after total laryngectomy [4, 6]. Therefore early and objective identification of the site and cause for dysphagia by objective fibreoptic endoscopic evaluation will help to provide supportive care, swallowing therapy or diet modification or surgical intervention or alternative feeding methods like nasogastric tube or jejunostomy thereby facilitating in better recovery of patient [5, 6].

Other methods to evaluate the site and function of the compromised segment of the aerodigestive tract and exact problem include Videofluoroscopy, direct pharyngolaryngooesophagoscopy, barium swallow and dynamic MRI. There are different questionnaires and scales to assess the severity of dysphagia incorporating all events during deglutition. Fibreoptic endoscopic evaluation of swallowing (FEES) is an affordable, useful tool available in most hospitals, easy to use and convenient for patient and helps in office examination to objectively identify and diagnose the severity of dysphagia and the site of adynamic or insensitive segment. It avoids radiation exposure and provides illumination and magnification. It helps to evaluate swallowing by patient in terms of complete swallowing, bolus transit time and residual food in pharynx [5, 6]. FEES is now considered the investigation of choice in cases of dysphagia in Europe.

This observational study was performed at a rural tertiary care hospital on 32 patients treated with total laryngectomy with partial pharyngectomy with neck dissection and adjuvant radiation or chemoradiation for hypopharyngeal cancer and laryngeal cancer patients staged T3 and T4a between January 2018 to July 2019. All patients underwent fibreoptic endoscopic evaluation of swallowing.

Objectives

To perform endoscopic evaluation of swallowing using a fibreoptic laryngoscope in all patients treated for advanced laryngeal and hypopharyngeal malignancies by total laryngectomy with partial pharyngectomy with neck dissection and followed by adjuvant radiation or chemoradiation and to document the site of structural and functional deficit and severity of dysphagia and factors contributing to it.

Materials and Methods

This is a Descriptive Observational study conducted at a tertiary rural hospital from January 2018 to July 2019 on patients with advanced laryngeal and hypopharyngeal malignancies undergoing total laryngectomy with partial pharyngectomy and neck dissection followed by radiation or chemoradiation at a rural tertiary care hospital. The Institutional Ethical committee clearance was obtained. Informed written consent was obtained from all patients.

The study included 32 patients with advanced laryngeal and hypopharyngeal malignancies treated by surgery followed by radiotherapy or chemoradiation between the ages of 40–70 years and staged T3 (11 patients) and T4a (21 patients). There were 27 male patients and 5 female patients. Majority of the patients were in the age group of 55–65 years. Majority of the patients in this study were addicted to tobacco quid chewing, smoking, and alcohol.

Patients with recurrent tumour, history of previous neck dissection, neck contracture, patients with kyphoscoliosis, hypothyroidism or goitre were excluded from this study.

In this study, 53% were supraglottic malignancies, 15% were glottic and 31% were hypopharyngeal malignancies. 11 patients were staged T3 (34.37%) and 21 patients were staged T4a (65.6%). All patients underwent total laryngectomy and partial pharyngectomy with neck dissection (8 bilateral and 24 unilateral). Among them 6 patients (18.7%) received neoadjuvant chemotherapy using weekly cisplatin 40 mg per square metre body surface area. 2 patients required reconstruction with pectoralis major myocutaneous flap. 8 patients were treated with post operative adjuvant chemoradiation (25%) using weekly cisplatin 40 mg per square metre body surface area and 66 Gy radiation. Among them 3 patients had close margins of resection (< 5 mm after formalin fixation) and 5 patients had extranodal spread from lymph nodes. All patients underwent cricopharyngeal myotomy or denervation of cricopharyngeus during surgery. No patient in our series had pharyngocutaneous fistula. After minimum follow up of 4 months post treatment, no patients had recurrence.

All these patients underwent fibreoptic endoscopic evaluation of swallowing using 3.5 mm PENTAX FB-10V fibreoptic laryngopharyngoscope 6 weeks and 12 weeks after the completion of treatment. After anesthetizing nasal cavity with 4% xylocaine with vasoconstrictor agent, a 3.5 mm PENTAX FB-10 V fibreoptic laryngopharyngoscope was passed through the nasal cavity and advanced behind the soft palate. Mucositis, severity of edema or stenosis was documented. Solid, semisolid and liquid food in form of small bolus was given while performing the above endoscopy trans-nasally and the pharyngeal phase of swallowing was assessed. The dryness of mucosa or

dysfunction in deglutition in the form of delayed transit of bolus, requirement of repeated swallow, residue of food in pharynx after swallow, pockets of residual food, adynamic segments of neopharynx and fibrotic bands if any were documented and compared at 6 weeks and 12 weeks after completion of treatment.

22 patients were subjected to swallowing therapy as they had significant dysphagia and residual food in pharynx, among them 10 patients improved with mendelsohn maneuver and 12 patients with shaker exercises over a period of 2–4 weeks. All these patients had diet modification in the form of high protein non sticky semisolid diet for 3 weeks followed by soft diet. Among them 8 patients had severe dysphagia and were continued on nasogastric feed for 6 weeks. However they were also encouraged to take thin semisolid diet orally along with nasogastric feeds.

Results

In our study, 32 patients underwent total laryngectomy and partial pharyngectomy with neck dissection. Adjuvant radiotherapy was administered in 24 patients and adjuvant chemoradiation in 8 patients. Among them 13 patients (40%) had frequent stasis of food after repeated deglutition post treatment and 4 patients (12.5%) had severe dysphagia.

Functional endoscopic evaluation of swallowing done at 6 weeks post treatment showed that, 16 patients (50%) required repeated second and third swallow to clear the bolus, and among them 6 patients had received neoadjuvant chemotherapy and 2 patients had received adjuvant chemoradiation after surgery. A repeat assessment at 12 weeks showed only 5 patients (15.6%) had persistent repeated swallow. 9 patients (28%) had severe edema and ulceration, among them 7 patients had received adjuvant chemoradiation after surgery. They were started on anti edema medications and 4 patients (12.5%) had persistent edema in a repeat assessment at 12 weeks. 7 patients (21.8%) had dryness of mucosa at 6 weeks post treatment. But 11 patients (34.37%) had dry mucosa in the repeat assessment done at 12 weeks. 16 patients (50%) had delayed transit of bolus at 6 weeks and 6 patients (18.75%) persisted with the problem at 12 weeks (Fig. 1). Among them 4 patients had received adjuvant chemoradiation following surgery. 6 patients (18.7%) had pharyngeal stenosis and 3 patients who had severe stenosis underwent serial dilatations (Fig. 2). Among them 2 patients had received neoadjuvant chemotherapy and 4 patients received adjuvant chemoradiation following surgery. However 2 patients continued to have pharyngeal stenosis even after serial dilatations. They had undergone extensive resection of pharyngeal mucosa and PMMC flap

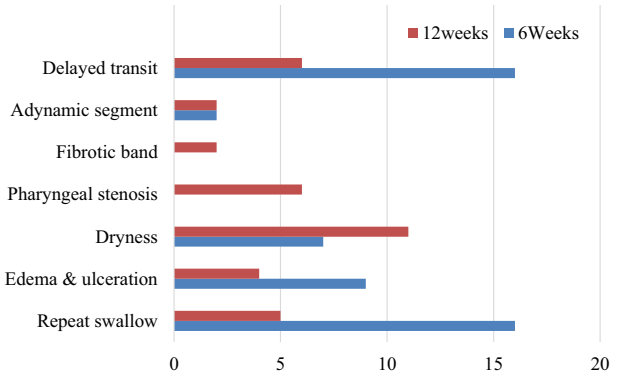

Fig. 1 Comparison of factors causing dysphagia in 6 weeks and 12 weeks after completion of treatment

reconstruction (Fig. 3). At the time of last follow up, 1 patient had persistent dryness and delayed transit of food in neopharynx 4 months after completion of treatment.

The 2 patients who underwent PMMC flap reconstruction of the neopharynx had large adynamic segment in the form of flap and the adjoining mucosa and this adynamic segment did not improve at the end of 12 weeks. 2 patients who had received adjuvant chemoradiation after surgery had fibrotic band in the cricopharynx at 12 weeks after treatment. 6 patients had pockets of residual food in neopharynx above the level of cricopharynx. 22 patients were subjected to swallowing therapy as they had significant dysphagia and residual food in pharynx, among them 10 patients improved with Mendelsohn maneuver and 12 patients with shaker exercises over a period of 2–4 weeks. All these patients had diet modification in the form of high protein non sticky semisolid diet for 3 weeks followed by soft diet. Among them 8 patients had severe dysphagia and weight loss, they were continued on nasogastric feed for 6 weeks. However they were also encouraged to take thin semisolid diet orally along with nasogastric feeds (Table 1). 4 patients had stiff neck and pain during deglutition who underwent bilateral neck dissection and post operative adjuvant chemoradiation (Table 2).

Discussion

In our study, majority of patients were between 40 and 70 years of age [6]. This was similar to other studies which have shown that majority of patients in India present at an advanced stage, resulting in a greater challenge for the treatment. According to studies done in USA, laryngeal and hypopharyngeal cancer is 2–3 times more common among men compared to women. In our study, 84.3% were males. The consumption rate of tobacco among adults in

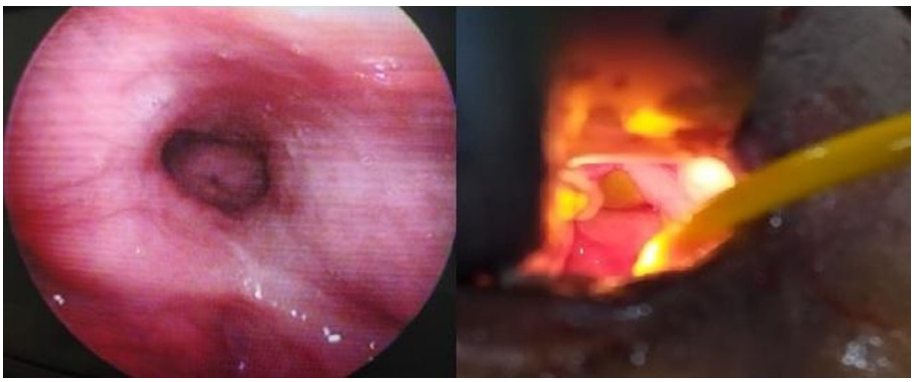

Fig. 2 Endoscopic view of cricopharyngeal stenosis after total laryngectomy with partial pharyngectomy and endoscopic balloon dilatation in progress

Fig. 3 PMMC flap reconstruction of neopharynx and neck after total laryngectomy and partial pharyngectomy with resultant neck stiffness

India is 34.6%. It is higher in males (47.9%) compared to females (20.7%). It is more prevalent in the rural areas (38.4%) where two-thirds of the nation's population resides. Inability to seek timely medical attention and socioeconomic factors are main factors contributing to approximately 60% of cases presenting in an advanced stage (Stage III, IV) [2, 3].

According to literature, supraglottic cancer is more common than glottic cancer in India. Hypopharyngeal cancer has higher prevalence in India compared to western countries (11%). In our study supraglottic cancer was more common. This is due to use of chewable carcinogens, spicy diet and alcohol abuse.

The primary treatment modalities for locally advanced laryngeal and hypopharyngeal Cancer include surgery followed by radiotherapy, concurrent chemotherapy and radiation, neoadjuvant chemotherapy followed by surgery or concurrent chemotherapy and radiation. Targeted therapy with radiation is also an option for patients not suitable for surgery or aggressive chemotherapy. All treatment modalities may result in acute and long-term swallowing dysfunction [6, 7].

In our study, all patients underwent total laryngectomy and partial pharyngectomy followed by adjuvant radiotherapy in 24 patients and adjuvant chemoradiation in 8 patients. Adjuvant chemoradiation was adminstered for

Table 1 Swallowing outcome in laryngectomized patients

Swallowing outcome	Frequency	Percent
Improvement in dysphagia 2–4 weeks	24	75
Improvement in dysphagia after serial dilation of stenosis	1	3
Prolonged nasogastric feeds after 12 weeks	4	12.5

Table 2 Distribution of subjects according to Outcome of swallowing at last follow up

Status at last follow up	No. of patients
Able to swallow solids	24
Delayed transit of bolus	1
Dry mucosa	1
Fibrotic band at cricopharynx	2
Persistent pharyngeal stenosis (after dilatation)	2
Adynamic segment	2

close margins or extranodal spread. Among them 13 patients (40%) had stasis of food post treatment and 4 patients (12.5%) had severe dysphagia. Other studies have reported dysphagia to be between 50 and 80% after total laryngectomy [6, 7].

Dysphagia is a debilitating, depressing, and potentially life-threatening complication in cancer patients that is under-reported. Surgical interventions result in anatomic or neurologic insults with site-specific patterns of dysphagia. Transection of muscles and nerves, loss of sensation, and scar tissue, dry mucosa, adynamic segments may all affect functioning of tissues vital for swallowing. The swallowing deficits that occur after surgical resections vary with the site of the tumor, the size of the tumor, the extent of surgical resection, and type of reconstruction. Larger resections will lead to more swallowing impairment [8]. Total laryngectomy which includes resection of hyoid eliminates elevation of trachea and midline soft tissues during deglutition. It disrupts the cricopharyngeal constriction resulting in delayed bolus transit time, as well as pharyngeal residue. Neck dissection and post operative radiotherapy further results in fibrosis and stiffness in the neck [9, 10].

Functional endoscopic evaluation of swallowing done at 6 weeks post treatment showed that, 16 patients (50%) required repeated second and third swallow to clear the bolus, and among them 6 patients had received neoadjuvant chemotherapy and 2 patients had received adjuvant chemoradiation after surgery. A repeat assessment at 12 weeks showed only 5 patients (15.6%) had persistent repeated swallow. Similar to our findings, a study done in London showed that there was food residue in neopharynx in 13% of laryngectomized patients [11]. 2 patients who underwent PMMC flap reconstruction were found to have adynamic segment and persistent severe dysphagia which did not show improvement. Other studies have also reported persistent dysphagia in up to 40% in extensive resection [12].

Patients had severe difficulty in swallowing for dry and sticky solid foods especially in the first 3 months post treatnment period. Diet modifications were made specific to each patients and they were initially started on liquids and later to soft and semisolids. This was also observed in similar studies who reported at the end of 6 months, 76.5% patients were able to eat semisolid food [5].

Various other studies also reported delayed bolus transit in laryngectomy patients. This may be due to pharyngeal constrictor contraction significantly altered by surgical closure of the pharynx post surgery, loss of mucosa and muscle tissue thereby narrowing pharyngeal lumen, fibrosis and denervation resulting in delayed bolus transit. However in western countries, lesser prevalence of dysphagia was reported among laryngectomized patients. This could be due to the fact that glottic cancer is more prevalent in western countries and patients present with early disease and are better nourished. In our study adjuvant radiotherapy or chemoradiation with resultant fibrosis may have further reduced propulsion of bolus resulting in food residue in neopharynx [10].

9 patients (28%) had severe edema and ulceration. Among them 7 patients had received adjuvant chemoradiation after surgery. They were started on anti edema medications and 4 patient (12.5%) had persistent edema in a repeat assessment at 12 weeks. 7 patients (21.8%) had dryness of mucosa which was found in 11 patients (34.37%) in the repeat assessment done at 12 weeks. 16 patients (50%) had delayed transit of food and 6 patients (18.75%) persisted with the problem at 12 weeks later. Among them 4 patients had received adjuvant chemoradiation following surgery. Similarly other studies also reported an increase in pharyngeal transit time due to inadequate tongue movement, the loss of mucosa and adynamic segments in the upper and lower hypopharynx and stasis in the anterior and posterior walls of the neopharynx [4].

6 patients (18.7%) had pharyngeal stenosis and 3 patients who had severe stenosis underwent serial dilatations. Among them 2 patients had received neoadjuvant chemotherapy and 4 patients received adjuvant chemoradiation following surgery. However 2 patients continued to have pharyngeal stenosis even after serial dilatations. They had undergone extensive resection and PMMC flap reconstruction. Similarly other studies also reported 44% incidence of pharyngeal stenosis confirmed by videofluoroscopy and most common intervention was balloon dilatation. In literature, factors contributing for pharyngeal stenosis were pharyngocutaneous fistula, post operative chemoradiation, extensive pharyngeal resection and bilateral neck dissection. They also reported 7% incidence of pharyngocutaneous fistulae and 62% of the patients required additional interventions to manage problems with swallowing after Total laryngectomy. No patient in our series had pharyngocutaneous fistula [6].

A study done in Australia reported extended nasogastric tube feeding in 11% of laryngectomy patients and 60% of pharyngolaryngectomy [11].

At the time of last follow up, 1 patient had persistent dryness and delayed transit of food in neopharynx. Similarly other studies also showed that patients achieved at least partial oral feeding at time of hospital discharge and 76.5% achieved exclusive oral feeding within 6 months postoperatively [5].

After total laryngectomy, therapeutic and rehabilitation strategies should be considered in the form of swallowing therapy, maneuvers and diet modifications to improve functional results and increase quality of life after treatment of advanced laryngeal cancer [6].

22 patients were subjected to swallowing therapy as they had significant dysphagia and residual food in pharynx. Among them 10 patients improved with Mendelsohn maneuver and 12 patients with Shaker exercises over a period of 2–4 weeks. All these patients had diet modification in the form of high protein non sticky semisolid diet for 3 weeks followed by soft diet. Among them 8 patients had severe dysphagia and weight loss. They were continued on nasogastric feed for 6 weeks. However they were also encouraged to take thin semisolid diet orally along with nasogastric feeds. 4 patients had stiff neck and pain during deglutition. They underwent bilateral neck dissection and post operative adjuvant chemoradiation. Similarly other studies also reported severe dysphagia in 50% of the patients, who were subjected to diet modifications and continued on nasogastric tube feedings. They reported persistent dysphagia in 20% of patients who required interventions like gastrostomy [11].

Conclusion

There is a high prevalence of supraglottic and hypopharyngeal malignancy in rural India. Majority of the patients present late and require laryngopharyngectomy with neck dissection and adjuvant treatment. Dysphagia is a common sequelae following this treatment and is often ignored thereby affecting quality of life. Larger resections of pharyngeal mucosa, post operative chemoradiation and pharyngocutaneous fistula predispose to stenosis of neopharynx, extensive dryness and edema, disruption of pharyngeal musculature resulting in severe dysphagia. Fibreoptic endoscopic evaluation of swallowing helps in early identification of cause and assessment of severity of dysphagia. Swallowing therapy, diet modification and alternate feeding methods help in rehabilitation and better recovery.

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Compliance with Ethical Standards

Conflict of interest There is no conflicts of interest among the authors.

Human and Animal Rights No Animals or human experiments are done during the study.

Ethical Approval Institutional ethical approval and consent for publication: DMC/KLR/IEC/279/2019-20.

Informed Consent Informed consent was taken from all the patients at the time of treatment and their attendants to include their clinical and histopathological findings in the study not revealing their identity.

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