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## Chapter

# Hypopharyngeal Cancer

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## Abstract

Hypopharyngeal cancer is one of the most challenging pathologies regarding location, evolution, prognosis and functional implications. Since the hypopharynx is a crossroad in the digestive and respiratory pathways malignant pathology located at this site can cause dysphagia, odynophagia, respiratory distress and dysphonia. Complex anatomy and physiology of the hypopharynx make for pathology with a poor prognosis in late stages. Diagnosis and therapy are mandatory for ensuring high survival rates and as little functional impairment as possible. Therapy of hypopharyngeal cancer is a difficult test for both physician and patient. It requires a good collaboration between the ENT surgeon, pathologist, radiotherapist, chemotherapist, nutrition therapist and psychologist. Our approach to the subject is due to that data concerning this pathology is limited and the results of the overall oncology therapy are discouraging. Nonetheless, the technical steps of surgery make it difficult for ENT cancer surgeons to approach it, therefore the surgeons' experience plays a very important role in decision making and establishing a good doctor-patient relationship, both during initial therapy and follow-up. We will also present an original technique developed in our clinic for restoring the continuity of the pharynx after total circular resection using the synthetic prosthesis.

**Keywords:** Hypopharynx, neoplasm, pharynx reconstruction, pharynx cancer, laryngo-pharyngectomy

## 1. Introduction

Cancer is still a major problem of modern medicine. Research continues trying to understand the tumor biology mechanisms as well as to find new methods of effective treatment [1]. The hypopharynx is a crossroad in the upper part of the digestive and respiratory pathways and malignant appearance at this level leads to the impairment of two vital functions, breathing and feeding. It also affects speech. Therapy of this pathology creates disability for the patient under economic, social, psychological and medical aspects. Therefore, we can advocate that hypopharyngeal cancer is one of the most challenging cancers pathologies regarding location, evolution, prognosis and functional implications. Therapy of hypopharyngeal cancer is a difficult endeavor for both physician and patient and requires a multidisciplinary approach: ENT surgeon, oncologists, radiologists, vocal rehabilitation specialist, psychologist and nutritionist.

The primary purpose of the oncology management of aero-digestive malignant neoplasms is survival. Nevertheless, preserving respiratory, deglutition and speech functions are mandatory if oncology principles are not broken.

The survival rate for hypopharyngeal cancer is low despite advanced surgical techniques, radiotherapy and chemotherapy. Patients go for medical examination in advanced stages of the disease when the tumor already exceeds the mucous layer and causes cervical lymph node metastases, thus being a challenge for the medical oncology team. Hypopharyngeal cancer management requires the presence of experienced surgeons within trained oncology surgery teams due to the radical surgical therapy aimed to locally control this type of cancer. Oncology radicality overcomes the principle of function preservation which is sometimes impossible to achieve.

## **2. Surgical anatomy of the hypopharynx**

The pharynx is a muscular-fibrous organ that belongs to the upper aero-digestive tract. It is located anteriorly to the cervical spines and posteriorly to the nasal fossae, oral cavity and larynx with which it communicates at different levels.

From a topographical perspective the pharynx is divided into 3 segments:

- superior segment – the rhinopharynx (also known as nasopharynx, epipharynx or cavum) communicates anteriorly with the nasal fossae through the two choanae.
- middle segment – the buccopharynx (also known as oropharynx or mesopharynx) communicates anteriorly with the oral cavity.

- inferior segment – the hypopharynx (also known as laryngopharynx) communicates with the larynx, extends from the upper junction with the oropharynx at the level of the hyoid bone, and is continued inferiorly with the cervical esophagus. Hypopharyngeal cancer can occur at the site of the lateral walls, piriform sinuses, posterior wall and the retro-cricoid region. The anterior wall consists of the base of the tongue, supraglottic larynx and the posterior blade of the cricoid cartilage. The lateral walls join with the outer limits of the larynx to create two grooves, the piriform sinuses, through which fluids and food pass towards the mouth of the esophagus. The hypopharynx is shaped as a three-walled pyramid (anterior, lateral, medial) with the base located up at the pharyngoepiglottic fold and the free edge of the aryepiglottic fold, and the tip located below the cricoid cartilage. The upper lateral limit of the piriform sinus is considered an oblique line on the pharyngeal lateral wall in opposition to the aryepiglottic fold. The relations of the piriform sinus with the larynx explain why malignant tumors of the hypopharynx invade the larynx early and require surgical resections by partial or total laryngectomies. The posterior wall of the hypopharynx has a close relationship with the retropharyngeal space, the prevertebral fascia, the longitudinal spinal muscles (the long muscle of the head) and has a width of 4 cm–5 cm and a height of 6 cm–7 cm. The distance between the posterior pharyngeal wall and the vertebral bodies is no greater than 1 centimeter, therefore the submucosal protrusions caused by osteophytes or by the anterior edges of the vertebral bodies can be misinterpreted as submucosal tumors. In addition, tumors of the posterior wall of the hypopharynx can invade these prevertebral soft tissues. Between the prevertebral aponeurosis and the posterior pharyngeal and esophagus wall there is

a loose cellular tissue that allows surgical approach and detachment of the two regions. From a surgical perspective, a tumor located in the retro-cricoid region that invades the upper esophageal sphincter raise special problems. Therefore, the anterior wall of the retro-cricoid region is also called “party wall”. The retro-cricoid region extends from the portion immediately below the arytenoids to the upper esophageal sphincter and forms the posterior wall of the larynx in the lower region. The anatomical relations explain the extension of the tumors of the post-cricoid region to the recurrent nerve, the paratracheal lymph nodes, the thyroid gland, the common carotid artery with its terminal branches and to the vagus nerves.

From inside out, in a cross-section, the pharyngeal wall is made out of four layers: the lining mucosa represented by a multi-layered squamous cell epithelium, a fibrous stroma developed from the pharyngeal aponeurosis, the muscular layer formed by the pharynx constrictor muscles arranged circularly and the lifting muscles arranged longitudinally and the buccopharyngeal fascia located on the outside. The constrictor muscles are superior, middle and inferior. The middle and inferior constrictor muscles surround the lateral and posterior walls of the hypopharynx that continue inferiorly with the walls of the cervical esophagus. Anteriorly, the posterior cricoarytenoid muscle represents the muscular layer. Below the hyoid bone, where the middle and lower constrictor do not cross, there is a weak point of the pharyngeal lateral wall represented by the thyrohyoid membrane, which is passed through by the vessels, nerves and lymph vessels of the hypopharynx.

The pharyngo-esophageal junction, also known as “Killian’s mouth of the esophagus”, makes the transition between the hypopharynx and the cervical esophagus. The difficulty of diagnosing pharyngo-esophageal junction cancer is variable depending on the circumstances of appearance and development of the malignant neoplastic lesion at this site.

The branches of the external carotid artery provide the arterial supply. Venous drainage is achieved through the facial vein and pterygoid plexus to the internal jugular vein. Lymphatic circulation drains lymph from the hypopharynx to the jugular lymph nodes. The submucosal layer of the hypopharynx contains a rich lymphatic network that exits superiorly through the thyro-hyoid membrane to reach the superior and middle jugular lymph nodes and the inferior lymphatics drain into the paratracheal and middle jugular lymph nodes.

The hypopharynx is an essential organ in assuring breathing, swallowing and speech. Tumors located at this level can cause swallowing and breathing impairment, both by the mass effect (large tumors) and/or by edema caused by the lymphatic invasion. Tumor invasion of neural structures can cause pharyngeal muscle contraction impairment or intense pain with negative effects on the swallowing process and the quality of life of the patients [2].

Damage to the arytenoid cartilages or recurrent nerves by malignant neoplasia invasion can cause major respiratory impairment with tracheobronchial aspiration phenomena by paresis of the vocal cords. Peritumoral infections can cause impaired swallowing [3, 4].

### **3. Epidemiology**

The epidemiology of the hypopharyngeal and cervical esophageal cancer deals with the spread of the disease in the human population regarding sex, age, profession, time and space, as well as risk factors that contribute to these phenomena [5, 6].

The main factors involved in the occurrence of this type of cancer are chronic smoking and alcoholism. The risk of cancer occurrence is directly proportional to the ingested dose and alcohol concentration. The average age of onset is between 60 and 65 years, more common in men with a sex ratio of 5:1 men to women. The general tendency of the hypopharyngeal and cervical esophageal cancer is that of increased incidence, due to increased tobacco and alcohol consumption. Increased mortality is also associated with late diagnostic of hypopharyngeal and cervical esophageal cancer. 77.3% of patients are diagnosed with stage 3 or 4 upon admittance to the hospital [7, 8].

Usually, due to the anatomic relation between the site of the hypopharyngeal and cervical esophageal cancer, the two are studied together. Tumor lesions invade both regions at the time of diagnosis, which is usually in the late stages. At the beginning of the 21st century, hypopharyngeal and cervical esophageal cancer is still a major concern worldwide [8].

Piriform sinus location accounts for 85% of cases of hypopharyngeal cancer, 15% affect the posterior wall and the retro-cricoid region. The incidence of hypopharyngeal cancers varies from country to country and sometimes from region to region within the same country. The location of the tumor also differs from country to country and is closely related to the etiology factors involved. Hypopharyngeal and esophageal cancers are more common in countries with low social and economic standards and low education levels [3].

#### **4. Pathology and pathogeny of hypopharyngeal cancer**

The hypopharynx is lined entirely by a malpighian epithelium, so most cancers at this level are differentiated malpighian carcinomas (squamous cell carcinoma). However, hypopharyngeal cancer raises special problems for both pathologists and therapists due to its peculiarities, the way it spreads and the macro-microscopic aspects.

##### **4.1 Morphopathology of hypopharyngeal cancer**

From a macroscopic point of view, the hypopharynx may present two different forms of malignant tumors that are distinguished by their way of extension and prognosis. The ulcero-infiltrative form is most common and is characterized by invasion of the mucosa with more or less deep destruction of adjacent structures. The extension pathways mainly depend on the starting point of the tumor and the greater or lesser resistance of the encountered structures. The diffuse form with extension to the surface has a vegetative aspect being difficult to differentiate from an inflammatory type mucosa. This form develops on the surface without affecting the deep tissues being a carcinoma isolated to the mucosa but with distant spreading, affecting all or only parts of the epithelium of the hypopharynx. It is frequently associated with areas of infiltrative carcinoma and with more or less extensive areas of dysplasia and leucoplakia. There are other forms of cancer at this level with fairly well defined macroscopic and microscopic features: epithelial sarcoma (well-circumscribed tumor, pediculate, with minimal implantation surface, located especially in the membranous part of the piriform sinus and in the retro-cricoid region), wart-like carcinoma or malignant villous keratosis (rare, lymphophilic form, slow evolution, high chemosensitivity), adenoid malpighian carcinoma (muriform appearance, extremely rare, it can be found in the hypopharyngeal adenocarcinomas, non-Hodgkin's malignant lymphomas, melanomas).



## 4.2 Dissemination pathways

Tumor dissemination is achieved through direct local extension, lymphatic or hematogenous pathways. Finding the primary site and the pathway of dissemination is essential for the management of these tumors. Hypopharyngeal cancer is very rarely detected in the initial stage due to lack of symptoms.

Regarding local dissemination, tumors of the piriform sinus are located in its anterior angle from where the extension is made to the external and internal walls towards: 1. the internal wall of the sinus, from where it extends through the larynx (it is difficult to establish the pharyngeal or laryngeal origin of the tumor); 2. the lateral wall of the hypopharynx, from where it extends anteriorly to the anterior angle of the piriform sinus and the pharyngo-epiglottic fold, then to the thyroid cartilage and soft tissues of the anterior and superior cervical region to the lateral wall of the oropharynx.

The most important dissemination route is lymphatic. Lymph node invasion is present in 75% of patients at the time of diagnosis, detectable by palpation or imaging studies. For 10% of patients, lymph node involvement is bilateral from the time of presentation. Malignant tumors of the piriform sinus, lateral wall and posterior wall of hypopharynx usually spread towards the middle internal jugular lymph nodes. Tumors of the retro-cricoid region spread to the paraoesophageal, paratracheal and supraclavicular fossa [3].

## 4.3 Distant site metastasis

Distant site metastases are common. Patients with advanced cervical lesions and lymph node invasion are prone to develop distant site metastases to the lungs, liver, bones and brain.

## 5. Stages and grades

According to the American Joint Committee on Cancer (AJCC), the TNM staging of carcinomas originating in the hypopharynx is as follows (**Table 1**) [9].

## 6. Clinical and paraclinical evaluation of patients with hypopharyngeal cancer

Hypopharyngeal cancer is asymptomatic in the early stages, which is why most patients refer to a doctor in the advanced stages of the disease. The clinical examination corroborated with the paraclinical investigations contribute to positive and differential diagnosis. Histopathological examination is mandatory.

### 6.1 Symptoms

In early-stage tumors, symptoms are non-specific and may mimic laryngopharyngeal reflux or globus sensation. The first manifestation of the disease usually consists of unilateral dysphagia, especially during swallowing saliva. Very often patients go see a specialist due to the appearance of a cervical tumor or due to difficulty in breathing [10]. Dysphagia is progressive, initially for solid food and later for liquids. Severe dysphagia

AJCC Stage	Stage grouping	Stage description 2 cm = about 4/5 inches; 4 cm = 1.5 inches; 6 cm = about 2.3 inches
0	Tis N0 M0	The tumor is located only in the top layer of cells lining the inside of the hypopharynx and has not grown any deeper (Tis). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).
I	T1 N0 M0	The tumor has grown deeper, but it is only in one part of the hypopharynx, and it is no more than 2 centimeters (cm) across (T1). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).
II	T2 N0 M0	The tumor has grown into more than one part of the hypopharynx, OR it has grown into a nearby area, OR it is larger than 2 cm but no larger than 4 cm across and has not affected the vocal cords (T2). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).
III	T3 N0 M0	The tumor is larger than 4 cm across, OR the tumor is affecting the movement of the vocal cords, OR the tumor has grown into the esophagus (T3). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).
	OR	
	T1 to T3 N1 M0	The tumor can be any size and might or might not have grown into structures outside the hypopharynx, and it might or might not have affected a vocal cord (T1 to T3). The cancer has spread to a single lymph node on the same side of the neck as the tumor, which is no larger than 3 cm across (N1). The cancer has not spread to distant parts of the body (M0).
IVA	T4a N0 or N1 M0	The tumor has grown into the thyroid or cricoid cartilage, the hyoid bone, the thyroid gland, or nearby areas of muscle or fat. This is also known as a <b>moderately advanced local disease</b> (T4a). The cancer has not spread to nearby lymph nodes (N0), or it has spread to a single lymph node on the same side of the neck as the tumor, which is no larger than 3 cm across (N1). The cancer has not spread to distant parts of the body (M0).
	OR	
	T1-T4a N2 M0	The tumor can be any size and might or might not have grown into structures outside the hypopharynx (as far as a moderately advanced disease), and it might or might not have affected a vocal cord (T1 to T4a). The cancer is N2: It has spread to a single lymph node on the same side of the neck as the tumor, which is larger than 3 cm but no larger than 6 cm across, OR It has spread to more than one lymph node on the same side of the neck as the tumor, none of which is larger than 6 cm across, OR It has spread to at least one lymph node on the other side of the neck, none of which is larger than 6 cm across. The cancer has not spread to distant parts of the body (M0).

AJCC Stage	Stage grouping	Stage description 2 cm = about 4/5 inches; 4 cm = 1.5 inches; 6 cm = about 2.3 inches
IVB	T4b Any N M0	The tumor is growing into the area in front of the spine in the neck, surrounds a carotid artery, or is growing down into the space between the lungs. This is also known as a <b>very advanced local disease</b> (T4b). The cancer might or might not have spread to nearby lymph nodes (any N). It has not spread to distant parts of the body (M0).
	OR Any T N3 M0	The tumor can be any size and might or might not have grown into structures outside the hypopharynx, and it might or might not have affected a vocal cord (any T). The cancer has spread to at least one lymph node that is larger than 6 cm across, OR it has spread to a lymph node and then grown outside of the lymph node (N3). It has not spread to distant parts of the body (M0).
IVC	Any T Any N M1	The tumor can be any size and might or might not have grown into structures outside the hypopharynx, and it might or might not have affected a vocal cord (any T). The cancer might or might not have spread to nearby lymph nodes (any N). The cancer has spread to distant parts of the body (M1).

**Table 1.**  
 Table 1. Hypopharyngeal cancer TNM staging according to the American Joint Committee on Cancer (AJCC).

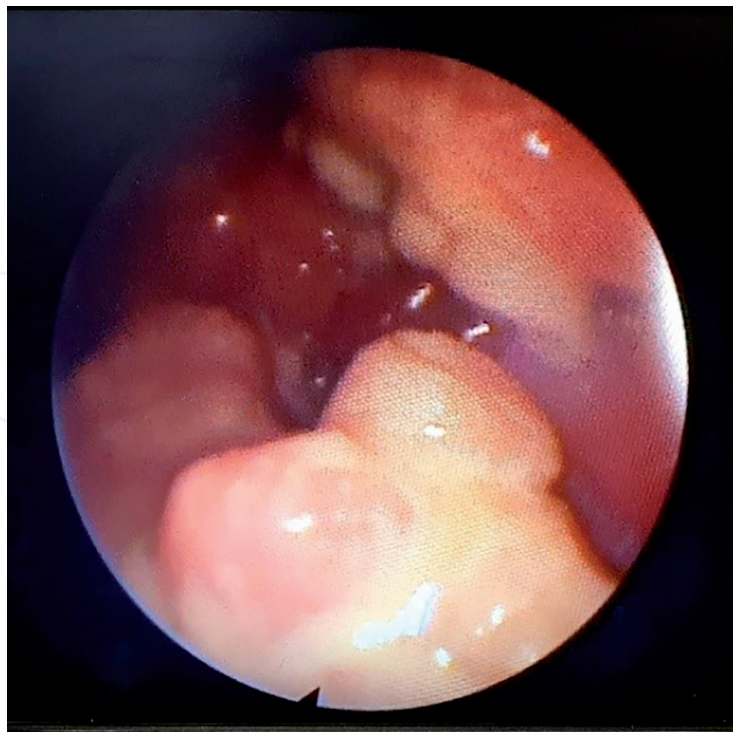
and odynophagia are symptoms that occur in advanced cancers when the entire hypopharynx or cervical esophagus are invaded. Any unilateral dysphagia that persists for more than 2–3 weeks requires an ENT consultation. Weight loss is significant, sometimes leading to cachexia, so the assessment of nutritional status is an important element in establishing therapeutic management. Pharyngeal paresthesia, reflex otalgia, hemoptysis may be present. Dysphonia and dyspnea occur in late stages by the invasion of the pharyngo-laryngeal wall, recurrent paralysis or peritumoral inflammation [7].

## 6.2 Clinical examination

Inspection may suggest the condition by the presence of a cachectic patient, with the presence of a latero-cervical tumor or with anterior prominence of the larynx, hypersialorrhea and putrid breath. Performing bucco-pharyngoscopy we can detect synchronous buccopharyngeal cancers or tumor extension to this level.

The most reliable method of diagnosis in hypopharyngeal cancer is a direct examination of the pharynx and larynx so all structures can be assessed. Examination of the mucosa is mandatory and it can be done by using direct pharyngo-laryngoscopy or fiber optic examination with or without digital image subtraction filters. Indirect pharyngo-laryngoscopy permits an overview of the tumor, its location and size, as well as the mobility of the vocal cords. Retro-cricoid tumors, as well as those located at the apex of the piriform sinus which is very difficult to highlight. Indirect signs like oedema, mucosal erythema, stagnant secretions or salivary stasis require further investigation. (**Figures 1 and 2**).





**Figure 1.**  
*Extensive tumor comprising all walls of the hypopharynx – circular tumor of the hypopharynx.*



**Figure 2.**  
*Infiltrative tumor of the left pyriform sinus with the invasion of the left hemilarynx.*

Palpation of the neck leads to the detection of metastatic lymph nodes. Spread towards cervical tissues through the mobility of the laryngeal skeleton can also be appreciated [11].

### **6.3 Paraclinical evaluation**

To establish the correct and complete diagnosis, as well as to achieve the biological balance of the patient, the clinical examination must be completed with a paraclinical evaluation. Pharyngo-esophageal barium examination might reveal the location of the lower limit of the tumor and degree of extension. The main method of pre-therapeutic evaluation is computerized tomography scan (CT) with contrast which, compared to magnetic resonance imaging (MRI), provides us with important data related to cartilage invasion. Positron emission tomography scan and computed tomography (PET-CT) is to be considered mainly for stages III and IV, for the detection of the primary tumor, regional and distant recurrences, as well as for evaluation of oncology therapy response [3]. MRI helps to assess tumor extension to the submucosa, to the hyo-thyro-epiglottic fossa, paraglottic space, subglottic space and invasion of muscle tissue [12]. Rigid endoscopy performed under general anesthesia provides a clear view of the mucosa, determines the lower extension of the tumor and the relationship with the piriform sinus, upper esophageal sphincter and cervical esophagus and allows sampling biopsies in optimal conditions. Breathing and speech cannot be examined.

Since it is a cost-effective, non-invasive method of evaluating lymph nodes ultrasound examination is yet another imaging modality that has been recommended, but not preferred, for assessing the primary tumor site [13]. Chest CT scans or PET-CT are mandatory for the evaluation of distant site metastases. The therapy management plan is established by a multidisciplinary team. In addition, dental and nutritional evaluation should not be forgotten.

The only method that gives a certainty diagnosis is sampling biopsy during the endoscopic examination, followed by the histopathological examination and/or immunohistochemistry. Oncology therapy management, prognosis and follow-up must be determined by the tumor board [14].

## **7. Treatment of hypopharyngeal cancer**

The treatment of hypopharyngeal cancer is complex, comprising a series of therapeutic methods consisting of surgery, radiotherapy and chemotherapy. These are applied successively or simultaneously, depending on the stage of the malignant neoplasm, but also on the general biology status of the patient [15]. For stage I and II cancers treatment consist of surgery or radiation therapy. Unfortunately, these patients are difficult to diagnose in stages T1N0 and T2N0 because of their lack of symptoms. Standard regimens of therapy for stages III and IV meaning resectable tumor include radical surgery followed by adjuvant radiotherapy and chemotherapy. Stage IV disease with the unresectable tumor benefits from elective treatment of radiotherapy combined with neoadjuvant chemotherapy [16, 17]. Unresectable tumors benefit from palliative surgical techniques (tracheotomy to maintain respiratory flow, gastrostomy for optimal nutrition). Neoadjuvant chemotherapy is used to reduce the volume of tumors and to convert them into operable or radiation-treatable tumors. It is used to treat patients with advanced local lesions to improve loco-regional control or survival [17, 18]. If the tumor has been converted by chemotherapy to a lower stage surgery will be performed according to the initial T! Psychological counseling of patients with hypopharyngeal cancer is mandatory both in the pre-therapeutic stage, during therapy and post-therapy.

## 7.1 Surgical therapy

The aim of the surgical treatment is to achieve a complete tumor resection with the preservation of functions as much as possible, minimizing a possible local or systemic recurrence. In some cases, the surgery is not performed either due to the invasion of the common carotid artery, prevertebral fascia or due to the lack of reconstruction possibilities or given by the functional status of the patient.

There are several types of surgery that can be performed:

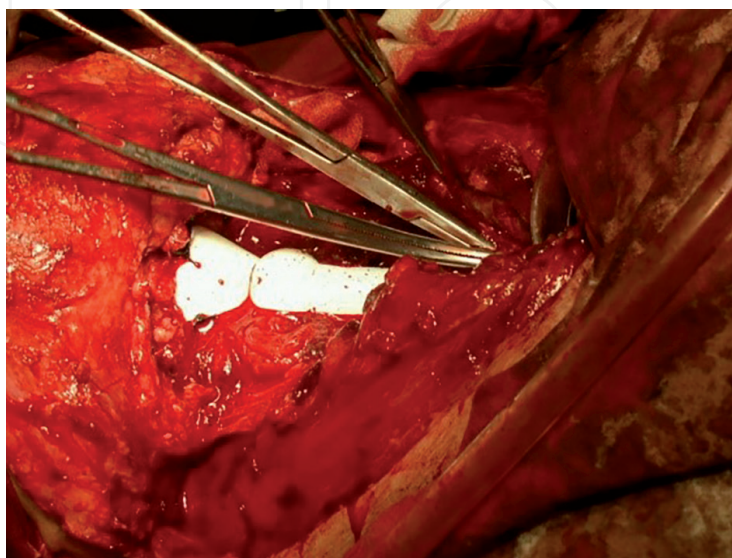
- Suprahyoid pharyngotomy, indicated for tumors limited to the posterior wall of the hypopharynx. The reconstruction is done with a supported skin graft.
- Partial pharyngectomy, only for T1-T2 tumors limited to the posterior or lateral wall of the piriform sinus. It is not performed if the tumor is extended to the prevertebral fascia.
- Partial laryngo-pharyngectomy or extended supraglottic laryngectomy indicated in T1-T2 lesions of the piriform sinuses. It is not performed in patients over 60 years of age.
- Supraglottic hemi-pharyngo-laryngectomy, indicated in T2 cancer, is limited to the upper part of the piriform sinus. Both vocal cords are preserved, half of the ipsilateral wing of the thyroid cartilage is resected. Postoperative swallowing is possible. Removal of the tracheostomy tube is performed a few days after surgery. If chronic pulmonary aspiration occurs, a total laryngectomy will be performed.
- Posterior pharyngectomy is indicated in cancers located superiorly on the posterior wall of the pharynx.
- Endoscopic resection with CO<sub>2</sub> laser does not require tracheotomy and reconstruction. It is performed in the case of T1-T2 tumors, but also the T3-T4 stages, but with a less satisfactory local control because of the narrow line of sight due to the use of a laryngoscope.
- Transoral robotic surgery (TORS) can overcome the limitations of CO<sub>2</sub> laser surgery. It does not require tracheotomy and it is performed in T1-T2 stages, in some selected cases even T3. A Laryngeal Advanced Retractor System (LARS) to open the patients' mouths is required for achieving a proper exposure of the surgical site. Intraoperative extemporaneous histopathological examination is required to assess the invasion of the surgical margins [19].
- Total laryngectomy with partial pharyngectomy is indicated in T3/T4 tumors. It requires definitive tracheotomy and vocal rehabilitation.
- Subtotal laryngectomy, for tumors in stages T2 and T3 that pass through the apex of the piriform sinus and it fixates the ipsilateral hemilarynx. Patient will have permanent tracheostomy.
- Total eso-pharyngo-laryngectomy, indicated for tumors extending to the cervical esophagus. It is a combination of circular pharyngo-laryngectomy and total esophagectomy. Safety resection margins should be at 3 cm from the tumor edges.



- Total circular pharyngo-laryngectomy, indicated in cancer of the pharyngo-esophageal junction comprising the retro-cricoid region, the hypopharyngeal posterior wall and the cervical esophagus, T3-T4 stage tumors. Hypopharynx and larynx are completely resected circularly between the plane of the hyoid bone and that of the first tracheal ring, sometimes requiring inferior extension or extension to the thyroid gland [3, 4]. Reconstruction of the remaining defect is the difficult part of this intervention and requires the collaboration of the ENT specialist with the general surgeon and sometimes with the thoracic surgeon if the lower resection limit decreases in the upper mediastinum. Reconstruction is performed with musculo-cutaneous flap from the pectoralis major muscle, delto-pectoral tubular flap, free radial flap or jejunum-free flap, colonic transposition, revascularized fascio-cutaneous flaps, synthetic pharyngeal-esophageal prostheses.

As a first intraoperative stage after total circular pharyngo-laryngectomy a Montgomery tube can be placed between the pharyngostomy and the esophagostomy. In the ENT Clinic of Colțea Clinical Hospital in Bucharest, Romania, Professor Dr. Cristian Radu Popescu restored the pharyngo-esophageal continuity using a Montgomery esophageal prosthesis **Figure 3** [20].

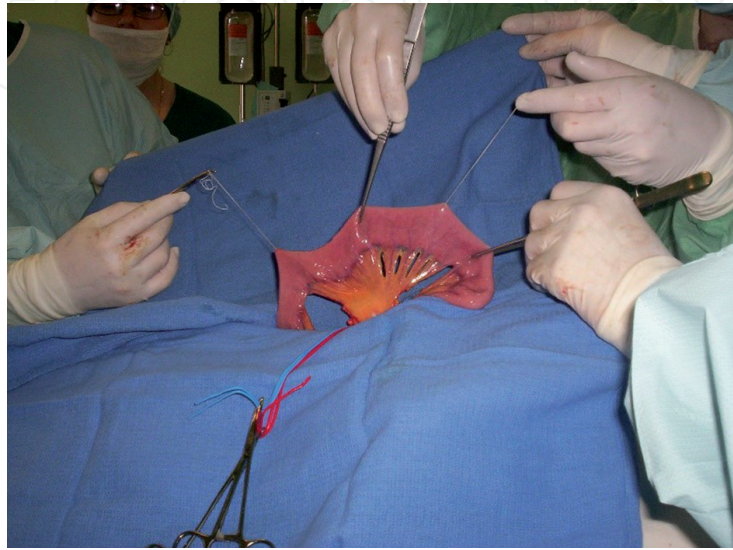
This procedure has been used in patients without metastasis to the seventh lymph node station. The insertion of this synthetic prosthesis is done on the inside. The prosthesis is funnel-shaped at the upper pole and after adjusting the trusses of the esophageal and pharyngeal section to fit the ends of the prosthesis it is sutured at the base of the tongue and oro or hypopharynx with non-resorbable threads. The lower end of the prosthesis is inserted into the remaining esophagus over 5 cm. No suture is required at this level. The prelaryngeal muscles are fixed over the prosthesis. Postoperative feeding of the patient is performed by gastrostomy or by the nazo-gastric feeding tube inserted through the prosthesis at the moment of insertion. Because this method shortens and simplifies reconstructive intervention, without the esthetic defect left after flap reconstruction it has tolerance to radiotherapy comparable to other reconstructive methods, the material is biocompatible and allows the



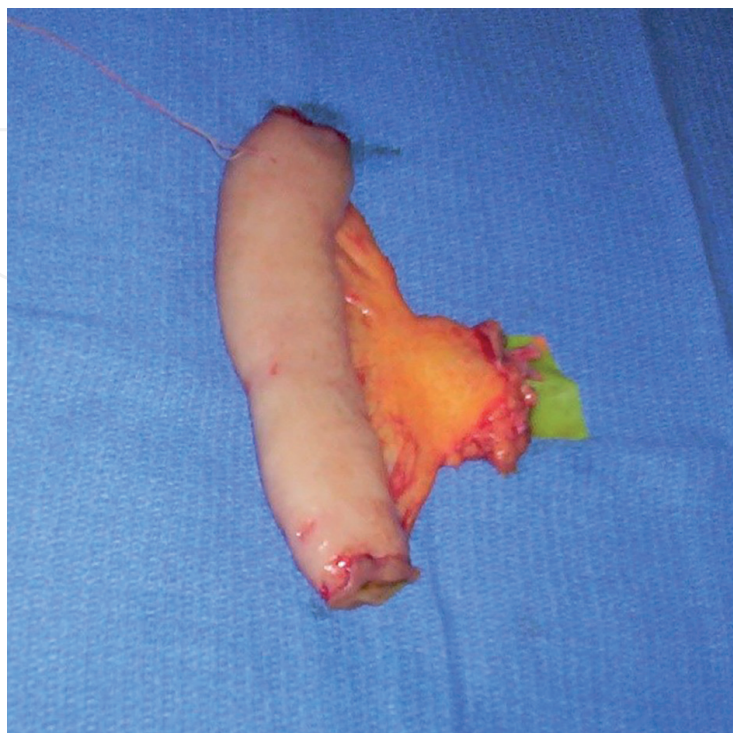
**Figure 3.** Montgomery prosthesis is used for primary reconstruction of the upper digestive tract. The upper funnel-shaped portion of the prosthesis is sutured at the base of the tongue and the lower end is inserted in the esophagus.

resumption of oral nutrition. This method is now used as an alternative to reconstruction with flaps and not as a temporary solution [3].

Reconstruction of the defect can be performed with transposition of the small or large intestine in a mixed surgical team – ENT surgeon – general surgeon – vascular surgeon. This type of reconstruction favors a more natural feeding and deglutition process. However, it has more possible and life-threatening complications than primary reconstruction with Montgomery prosthesis – **Figures 4–7**.



**Figure 4.**  
*Dissection and identification of a portion of the small intestine and vessel pedicle which will be resected and transposed to the neck area to reconstruct the upper digestive tract defect.*

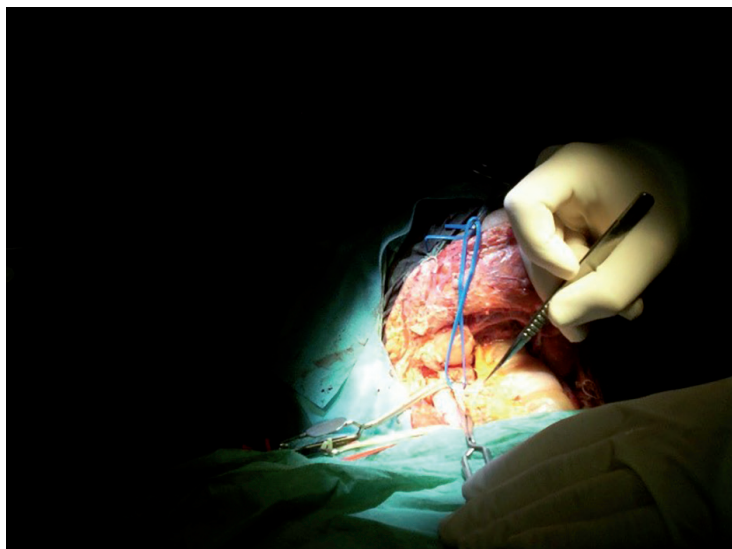


**Figure 5.**  
*Small intestine sample prepared for transposition.*





**Figure 6.**  
*Measuring the graft before suturing it in the neck region for reconstruction.*



**Figure 7.**  
*Attaching vascular pedicle to the external carotid artery and internal jugular vein.*

Oncological excision of the tumor must be accompanied by lymph node dissection, even if macroscopically metastatic lymph nodes. Micrometastases can occur in fatty tissue after complete resection. Neck dissection is done depending on the degree of lymph node invasion, but regardless of the N staging, station IV must be dissected if the pharyngo-esophageal junction is invaded [4].

There are four major types of neck dissection published by the Academy's Committee for Head and Neck Surgery and Oncology:

- Radical neck dissection – all lymphatic and fatty tissue are removed from the clavicle to the mandible, from the posterior edge of the trapezius muscle to the midline of the neck, spinal nerve, sternocleidomastoid muscle and internal jugular vein.
- Modified radical neck dissection – different from the previous one, either the spinal nerve (subtype I), the spinal nerve and internal jugular vein (Subtype II) are preserved, or the spinal nerve, VJI and SCM (subtype III) are preserved.

- Selective neck dissection – supraomohyoid, posterolateral, lateral and anterior.
- Radical neck dissection – in addition to radical neck dissection, other lymphatic structures are removed.

## **7.2 Radiotherapy**

Radiotherapy as a single therapy is useful in T1 tumors, in rare T2 stage cases, in elderly patients, in patients who refuse surgery or as palliative treatment.

Radiotherapy in combined treatment regimens can be used before and after surgery. In our experience, the best treatment regimen is surgery followed by radiotherapy. Before radiotherapy, the patient needs a dental check-up to treat any conditions in this area, the treatment of comorbidities and the improvement of the general nutrition and biological status.

## **7.3 Chemotherapy**

Chemotherapy is the treatment of hypopharyngeal cancer is used only in association with other methods of oncology therapy, not as a single way of treatment. Cytostatic drugs decrease tumor volume, improve clinical status and can prolong life. Adjuvant chemotherapy is instituted after surgical excision of the tumor and is used after or along with radiotherapy to eradicate a possible residual disease or micrometastases. Neoadjuvant chemotherapy is administered preoperatively to reduce tumor volume and primary tumor vascularization. It plays a role in lowering the chance of intraoperative tumor dissemination.

## **7.4 Nutrition**

An important component in the therapeutic management of hypopharyngeal cancer is clinical nutrition. In hypopharyngeal cancer, we find a severe dysphagic syndrome that can lead to altered nutritional status, both by the cachexia-anorexia syndrome specific to the neoplastic disease, and by local causes that lead to weight loss and malnutrition. Tumor resection can cause severe disturbances to the complete cessation of food intake, and radiation therapy alters the taste and affects the surrounding normal tissues, compromising nutritional status.

Clinical nutrition can be achieved by the enteral or parenteral route. Enteral feeding is preferable in the case of a functional gastrointestinal tract and is made through the nasal-intestinal tubes (nasogastric, nasoduodenal or nasojejunal), stents mounted in the upper digestive tract, through the esophagostoma, gastrostoma or jejunostoma. The patient must learn to administer his own enteral nutrition, which can last for several months. If enteral feeding is not possible, the parenteral route of nutritional support is used, so that malnutrition does not compromise the surgery and the patient's life. Postoperatively, patients have a strict contraindication to oral feeding, and even swallowing saliva can adversely affect the prognosis by the appearance of fistulas. The nutritional intake is ensured on the nasogastric tube, gastrostoma, jejunostoma, nasojejunal tube. The nasogastric tube is kept for at least 10 days, depending on the reconstructive procedure used.

The nutrition of these patients includes a complete plan tailored to the condition of the patients and their nutritional status to reduce morbidity and mortality, being considered a method of adjuvant treatment with chemo- and radiotherapy in patients with hypopharyngeal cancer [3].

## **8. Prognosis**

Hypopharyngeal cancer is asymptomatic in early-stage and patients go to a physician in advanced disease stages when metastases are already present and the prognosis is reserved. At the presentation, to the physician 50% of patients show cervical lymph node metastases. The survival rate in hypopharyngeal cancer depends on the tumor stage. Patients in T1-T2 stages have a survival rate at five years of approximately 60%. For patients in stages T3-T4 the survival rate decreases to 17–25%. Cancers in stages I and II, located on the posterior wall of the hypopharynx, have a much better prognosis compared to pyriform sinus cancers, even if it is small, but cause early metastases. Cancers of the retro-cricoid region are diagnosed in advanced stages with extended metastases at paratraheal and mediastinal sites with a severe prognosis. Patients with hypopharyngeal cervical esophagus cancer who have suffered reconstructions, have a two-year survival rate between 9 and 39%. The five-year survival rate in hypopharyngeal cancers is the lowest of cancers with other head and neck localizations [3].

## **9. Conclusions**

Hypopharyngeal cancer mainly affects men around the age of 60. It is mostly located in the pyriform sinus, being a squamous cell carcinoma. Being asymptomatic in the early stages patients at the time of diagnosis are classified in stages III and IV of the disease, presenting cervical lymph node metastases and extensive tumors. Most patients require extensive surgical interventions and only a few can benefit from partial interventions. The type of neck dissection depends on the level of lymph node invasion. More than 50% of patients present local recurrences in the first five years after the surgical intervention, the risk of local recurrences being significantly higher in retro-cricoid and posterior wall tumors than in pyriform sinus tumors. The survival rate of hypopharyngeal cancer patients is influenced by tumor location and tumor stage. Therapy must be individualized, multimodal, with correct evaluation for each case and by involving several specialists like surgeons, radiotherapists, chemotherapists, nutritionists, psychologists. Surgical treatment remains the indication with the best results both as first intent and after radiotherapy failure, although it involves the sacrifice of the larynx. Montgomery pharyngoplasty after circular pharyngo-laryngectomy through the C. R. Popescu technique is a viable reconstructive alternative for oral feeding with small complications, low mortality rates and low hospitalization period. Surgery must be followed by radiotherapy and chemotherapy.

## **Conflict of interest**

The authors declare no conflict of interest.

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