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A Comprehensive Review of Throat Cancer: Clinical Aspects and Herbal Management Approaches

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Abstract: Throat cancer refers to a group of cancers that develop in the pharynx (throat) or larynx (voice box), and includes several subtypes such as nasopharyngeal, oropharyngeal, hypopharyngeal, and laryngeal cancer. While it remains less common than other forms of cancer, its impact on speech, swallowing, and breathing makes it particularly life-altering. The leading causes of throat cancer include long-term tobacco use, excessive alcohol consumption, and infection with human papillomavirus (HPV), especially in younger, non-smoking individuals. Environmental exposure to certain chemicals and a diet low in fruits and vegetables may also contribute to risk. Treatment options vary depending on the cancer's type, location, and stage, but often involve a combination of surgery, radiation therapy, and chemotherapy. In recent years, advancements such as targeted therapy and immunotherapy have shown promise, particularly for recurrent or advanced cases. Early detection plays a critical role in improving survival rates and preserving quality of life, yet many patients are diagnosed at a late stage. There are few herbal management such as green tea, turmeric etc. This review explores the major types of throat cancer, their known risk factors, and the current landscape of treatment strategies, aiming to provide a comprehensive understanding of this challenging but increasingly treatable disease.

Keywords: Throat cancer, tonsil cancer, Pharyngeal cancer, Laryngeal cancer

I. INTRODUCTION

Throat cancer or tonsil cancer is often called as Oropharyngeal squamous cell carcinoma a malignancy that affects the central region of the pharynx. This includes structures ranging from the soft palate down to just above the hyoid bone, such as the posterior third of the tongue, the tonsils, the soft palate, and the back and side walls of the throat.[1] or simply throat cancer is defined as abnormal growth of cells in throat region.[2] In humans, the throat (pharynx) serves dual roles—forming part of both the digestive system and the respiratory conducting zone, which also comprises the nose, larynx, trachea, bronchi, and bronchioles; together, these structures warm, moisten, filter, and guide air into the lungs. [3] The main contributors to throat cancer risk are smoking or chewing tobacco, heavy drinking, and infection with the human papillomavirus (HPV), which is increasingly associated with cancers of the oropharynx. Additionally, factors like inadequate diet, contact with specific industrial or environmental chemicals, and chronic acid reflux (GERD) could also play roles in the disease's onset.[4] The World Health Organisation predicts that cases of throat cancer (cancer of the larynx, nasopharynx, oropharynx, and hypopharynx) will rise by 15% by 2040[5] Symptoms like a sore throat that won't go away, trouble swallowing, persistent hoarseness, or unexplained weight loss may serve as warning signs—but because they often mimic more benign ailments, they can be easily overlooked.[4] various treatment method are available for curing of throat cancer such as surgery, radiation therapy, and chemotherapy etc. Researchers are actively investigating HPV's influence on throat cancer progression and developing targeted therapies—including reduced-intensity radiation, immunotherapies, and therapeutic vaccines—to boost survival rates and lessen long-term treatment side effects.[4]

II. THROAT CANCER

Throat is muscular tube which connect the mouth and nose to the oesophagus (food pipe) and larynx (voice box). It is part of both the digestive and respiratory systems. Throat cancer is define as abnormal growth of cells in throat region such as larynx or voice box [2] throat cancer are also known as laryngeal cancer, pharyngeal cancer according to their position of malignant tumors development Throat cancer is frequently identified at a late stage, making early diagnosis and prompt treatment essential for better patient outcomes. Common symptomssuch as a long-lasting sore throat, difficulty swallowing, hoarseness, or unexplained weight loss can often be confused with less serious health issues.

Treatment strategies usually involve a combination of surgery, radiation, and chemotherapy, tailored to the cancer's stage and specific location. Although medical advances have improved care, throat cancer still poses major challenges due to its effects on speaking, swallowing, and overall quality of life. Current research is focused on targeted therapies and the influence of HPV on cancer development, with the goal of increasing survival rates and minimizing long-term side effects.[4]

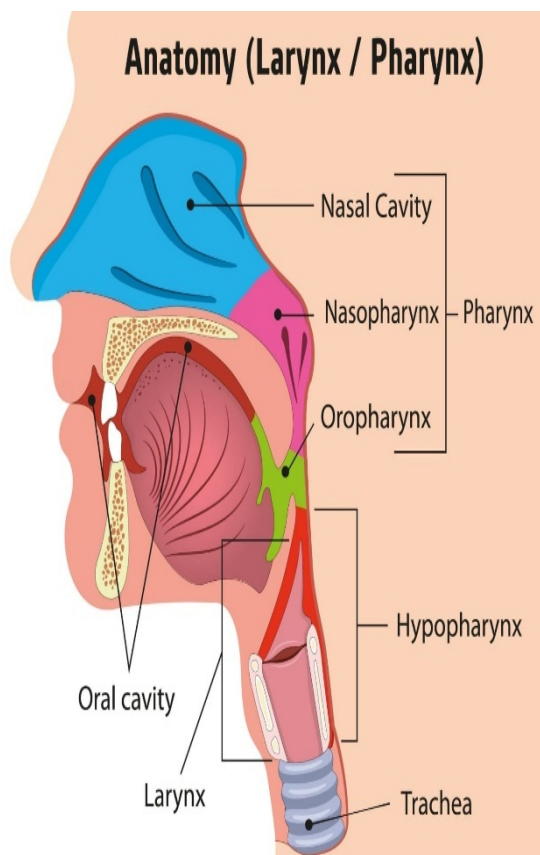
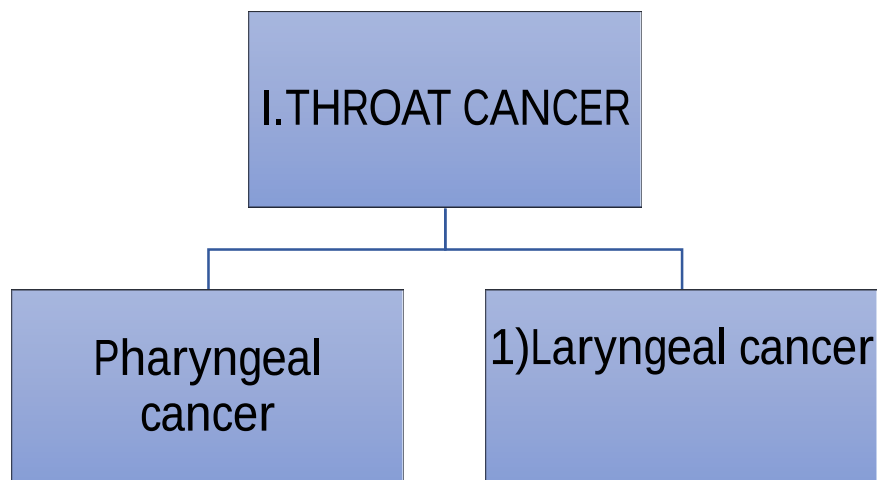


Fig 1 . Anatomy of throat

III. TYPES OF THROAT CANCER

Types of throat cancer can be explained by following chart:-



1) *Pharyngeal cancer*

- *Nasopharynx:*

The nasopharynx is the uppermost portion of the pharynx, situated behind the nasal cavity and above the back of the mouth, serving as a passageway that connects the nasal passages to the throat. When abnormal cells begin to grow uncontrollably in this region, the resulting disease is referred to as nasopharyngeal cancer, a condition that can affect breathing, swallowing, and other functions of the upper respiratory tract.[6]

- *Oropharynx:*

The oral cavity and oropharynx are the topmost parts of the digestive tract, containing a wide variety of tissues in a small area. Understanding their anatomy is essential to identify where a tumor originates, how it spreads, and how it behaves.

Treatment—including surgery, chemotherapy, or radiotherapy depends on the tumor's stage, making accurate staging crucial for effective therapy and to avoid unnecessary complications.[7]

- *Hypopharynx*

Hypopharyngeal cancers, usually squamous cell carcinomas, have the poorest prognosis among head and neck cancers, often presenting at advanced stages with nodal metastasis. Imaging (CT, MRI, FDG-PET) is crucial for staging and detecting recurrence. Poor survival is due to distant metastasis and second primary tumors.[8]

2) *Laryngeal cancer*

- **Glottic:** This type of throat cancer develops in the vocal cords, which play a key role in producing sound and speech.[4] It is one of the most frequently diagnosed forms, representing a major proportion of all laryngeal malignancies. Studies indicate that it can constitute as much as 60% of total cases.[9] Glottic cancers usually arise in the anterior part of the vocal cord's upper free margin and may cause cord fixation from tumor bulk, spread to intrinsic muscles or ligaments, or rarely, recurrent laryngeal nerve involvement. [10]
- **Supraglottic:** This type affects the upper part of the larynx, including the epiglottis, which helps protect the airway during swallowing [4] It may extend superiorly to the epilarynx, vallecula, tongue base, or pyriform fossa. Supraglottic laryngectomy, often with bilateral neck dissection, is the preferred treatment. [11]
- **Subglottic:** This form occurs in the lower part of the larynx, located beneath the vocal cords, and may spread toward the windpipe.[4] Primary subglottic squamous cell carcinoma (SCC) is rare, accounting for only 1–3% of laryngeal cancers. It should be distinguished from glottic carcinoma extending into the subglottis. Reports in the literature vary regarding its definition, frequency, diagnosis, and treatment outcomes. Most clinicians consider the upper margin of the conus elasticus as the boundary separating primary vocal cord tumors from true subglottic tumors.[12]

IV. CAUSES OF THROAT CANCER[4]

- 1) **Alcohol Use:** Regular alcohol intake raises the risk, particularly when combined with smoking.
- 2) **Human Papillomavirus (HPV):** Infection with certain HPV strains is linked to an increased likelihood of throat cancer.
- 3) **Chemical Exposure:** Contact with substances such as asbestos, formaldehyde, and other industrial chemicals can heighten the risk.
- 4) **Genetic Predisposition:** A family history of throat or related cancers may contribute to higher susceptibility.
- 5) **Inadequate nutrition**
- 6) **Gastroesophageal reflux disease (GERD)**
- 7) **HPV (human papillomavirus)**
- 8) **Family history of head and neck cancer**
- 9) **Long or intense exposure to certain workplace materials, including:[13]**
 - Asbestos
 - Wood dust
 - Paint fumes

Cigarettes contain toxic substances such as nitrosamines and polycyclic aromatic hydrocarbons, both of which can damage DNA and increase disease susceptibility.

For individuals who avoid alcohol, tobacco remains the leading cause of oral cancer, while in non-smokers, alcohol consumption is the predominant risk factor.

The risk of cancer also rises depending on the strength and type of alcohol consumed—for example, spirits pose a greater risk than beer or wine, even when the overall intake is the same.

Alcohol also acts as a solvent, making it easier for carcinogens to penetrate the mucosal tissues and be absorbed by cells. Moreover, acetaldehyde, a key metabolite of alcohol, can attach to DNA and disrupt its repair and replication processes.

Diet plays a crucial role in cancer prevention as well. Research indicates that consuming plenty of fruits, non-starchy vegetables, and carotenoid-rich foods can significantly reduce the likelihood of developing head and neck squamous cell carcinoma (HNSCC).[14]

V. SYMPTOMES[15]

- 1) Cough – A cough that doesn't go away could be a sign of throat cancer.
- 2) Voice changes – Your voice may sound hoarse or unclear if cancer affects the voice box.
- 3) Difficulty swallowing – Cancer can make swallowing painful or feel like something is stuck.
- 4) 4.Ear pain – Throat cancer can sometimes cause pain that spreads to the ear.
- 5) Lump or sore – A lump or sore in the throat or neck that doesn't heal may be a warning sign.
- 6) 6.Sore throat – A sore throat that lasts for a long time and doesn't get better could mean cancer.
- 7) 7.Weight loss – Losing weight without trying may happen if cancer makes eating difficult
- 8) 8. Persistent sore throat – Continuous throat discomfort that does not improve over time.
- 9) 9. Neck lump – Noticeable swelling or mass present in the neck area.
- 10) 10. Unusual patches – White areas or large wounds visible inside the throat.
- 11) 11. Early warning lesions – Raised or reddish patches that could progress into cancer.[16]

VI. DIAGNOSIS OF THROAT CANCER

It is very important to diagnosis cancer in early stages to reduce the complication of treatment and for throat cancer it is very to protect the ability of speaking and swallowing food so the following are the method to diagnosis the throat cancer.

A. Tumor, Node, Metastasis (TNM) Staging System

The TNM staging system is commonly used to classify oral squamous cell carcinoma (OSCC) by looking at the size of the tumor (T), whether it has spread to nearby lymph nodes (N), and if it has reached other parts of the body (M). The latest edition of the system also considers how deeply the tumor has invaded and whether cancer has spread beyond the lymph nodes. However, 20–40% of OSCC patients may not show signs of lymph node spread on scans, but microscopic examination still finds cancer there. This means TNM staging alone may not fully predict patient outcomes. To improve diagnosis and treatment planning, doctors also look at how aggressive the tumor is and how it invades surrounding tissues.[17]

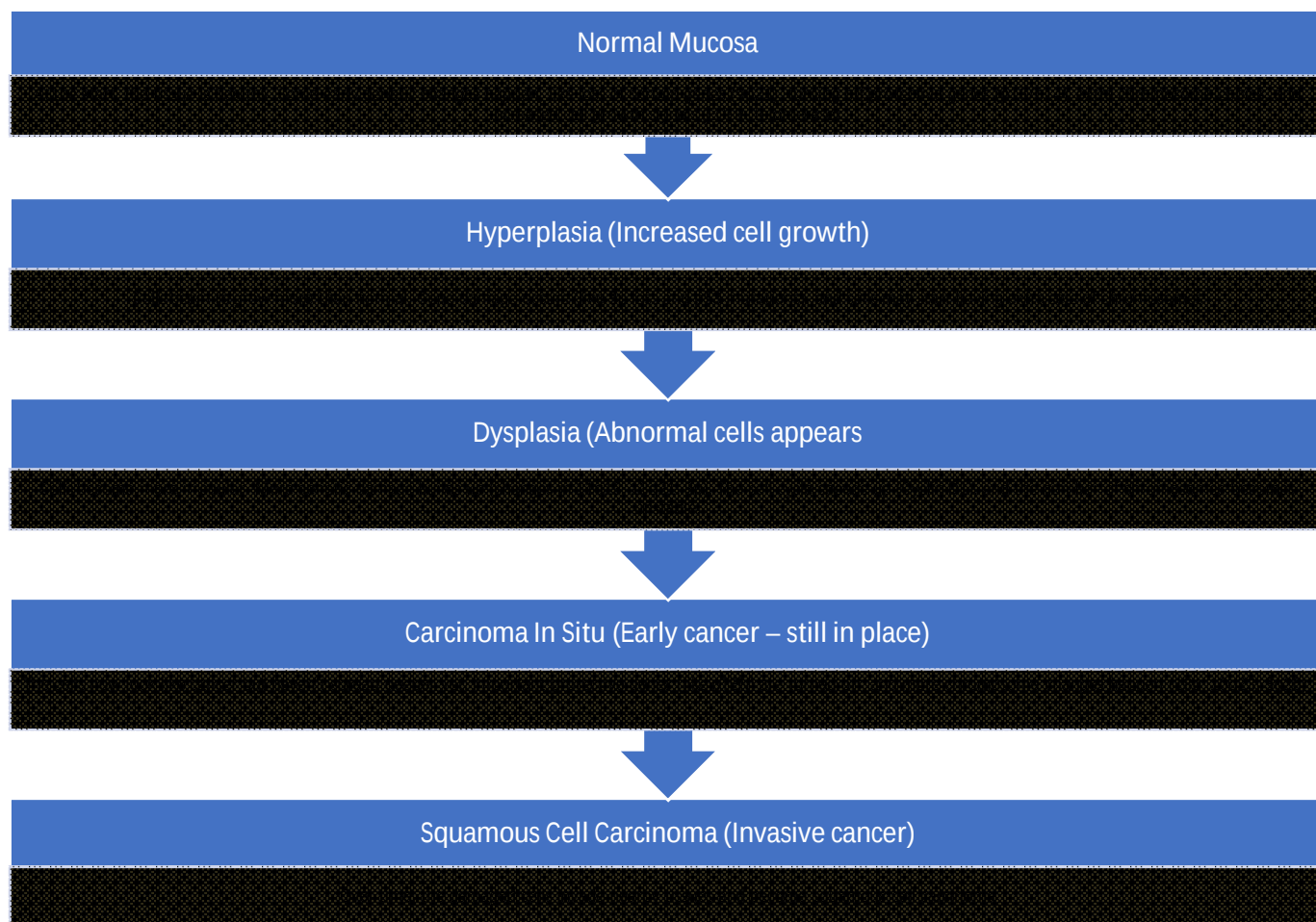
B. Imaging Evaluation

Medical imaging plays a key role in detecting and assessing early-stage oral squamous cell carcinoma (OSCC). CT scans are useful for showing details like bone involvement and tissue density. MRI provides better soft tissue contrast, helping to detect tumor spread into nearby tissues, bone marrow, or nerves. PET scans reveal early metabolic changes in cells—often before visible changes appear—but they lack precise location details. That's why PET is often combined with CT or MRI (as PET-CT or PET-MRI) for a more accurate diagnosis.[17]

C. Biopsy

While imaging helps identify tumors, a biopsy is still the most reliable way to confirm a diagnosis. One simple method is exfoliative cytology, where surface cells are gently scraped and checked under a microscope for signs of cancer. More commonly, doctors perform incisional biopsies (removing a small tissue sample) or excisional biopsies (removing the whole tumor and some nearby tissue). Fine needle aspiration uses a thin needle to collect small tissue or fluid samples from the tumor. Liquid biopsy is a newer, noninvasive option that tests body fluids like blood or saliva for cancer-related changes.[17]

VII. PATHOPHYSIOLOGY OF THROAT CANCER



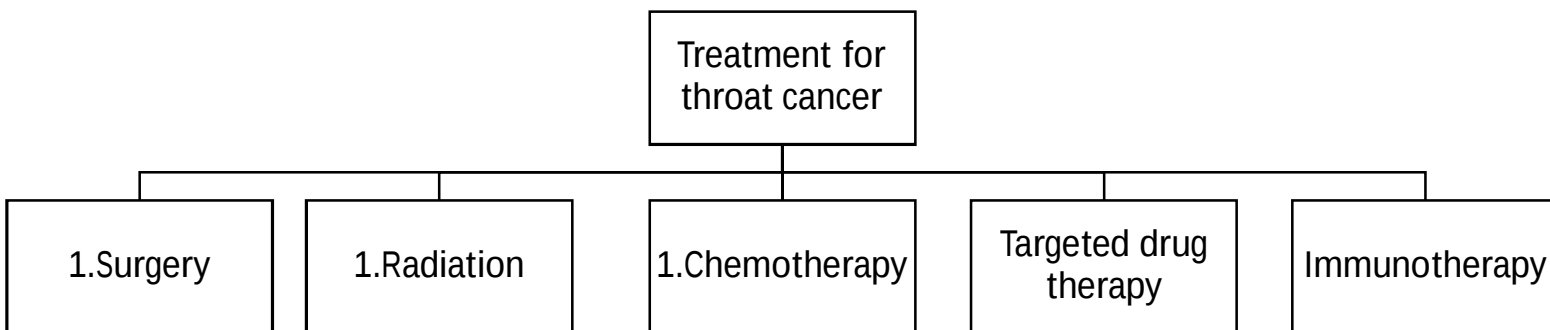
Pathophysiology of throat cancer can be understood with the help of following flow chart :-[18]

VIII. TREATMENT OF THROAT CANCER

Throat cancers detected at an early stage—categorized as stage I, stage II, and select cases of stage III—are typically small and localized, and they respond very well to treatment using surgery, radiation, chemotherapy or a combination of three, with a high probability of a cure. [16] The treatment approach is determined by a variety of variables, including where the throat cancer is located and how advanced it is, the specific cell type, whether there is evidence of HPV involvement, the patient's general health status, and your individual treatment goals.[19] Throat and voice box cancers are commonly treated with surgery or radiotherapy, and in some cases, chemotherapy may be added. The goal of surgical intervention is to eliminate the cancerous tissue. When the disease is caught early, only a small area may require removal.[2]

Effectively treating throat cancer requires not only eliminating the disease but also maintaining speech and swallowing capabilities. With HPV-positive oropharyngeal cancers—known for their heightened sensitivity to chemoradiotherapy—becoming more common, evaluating HPV status via p16 immunohistochemical staining is valuable for gauging treatment success and prognosis. Moreover, enhanced surgical techniques for tumor removal and reconstruction have significantly improved postoperative functional outcomes, even in advanced cases.[20]

Treatment options for throat cancer are as follows:



1) Surgery

The procedure may entail excising the tumor, removing a portion of the voice box, or performing a complete removal of the larynx.[4]The primary objective of surgery is to eliminate as much of the cancer as possible while maintaining essential functions such as breathing, speaking, and swallowing. In some cases, small tumors might be removed during the vivisection process. For more largetumors, open surgery may be required, which could involve removing part or all of the voice box (a procedure called laryngectomy) or portions of the throat.Also if cancer has spread to the lymph bumps, a neck analysis may be needed to remove the affected nodes.[21]Early stageof throat cancer can now be treated with Transoral Robotic Surgery (TORS).Transoral Robotic Surgery (TORS) is a procedure involves inserting robotic instruments through the mouth to access and remove tumors. It is especially usefull for cancers located in the throat and oral cavity, such as those on the tonsils or tongue. TORS is advantageous not only due to its minimally invasive nature but also because it may reduce the need for further treatments. numerous cases who choose TORS frequently bear lower radiation, and in some cases, may avoid radiation and chemotherapy entirely.[16]

2) Radiation

Radiation therapy involves the use of high-energy beams, like X-rays or protons, to target and destroy cancer cells. This treatment can be administered externally using a machine that directs the radiation at the tumor (external beam radiation), or internally by placing small radioactive sources, such as seeds or wires, close to or inside the body near the cancer (brachytherapy).[4]For small tumors that haven't spread, radiation therapy might be the only treatment required. However, in some cases, it may be used in combination with other treatments such as surgery or chemotherapy. [21]

Types of radiation therapy[22]

- Intensity Modulated Radiation Therapy (IMRT) delivers targeted radiation by directing multiple beams of varying intensities at the tumor to maximize the dose. A specific form of IMRT, known as Volumetric Modulated Arc Therapy (VMAT), involves a rotating machine that administers radiation from several angles.
- Proton therapy is a form of radiation treatment that uses protons instead of traditional X-rays, potentially enabling lower radiation doses to surrounding healthy tissues while effectively targeting the tumor.
- MR LINAC radiotherapy utilizes advanced equipment that allows for daily treatment adaptations, helping to minimize side effects and accurately target tumors as they change over time
- Stereotactic Body Radiation Therapy (SBRT), also referred to as stereotactic ablative radiotherapy or stereotactic ablative body radiation, delivers highly focused, high-dose radiation to tumors using multiple beams from various directions to ensure precision.

3) Chemotherapy

Chemotherapy involves the use of drugs that target and destroy fast-growing cells, including cancer cells. However, since some healthy cells in areas like the skin and digestive system also divide quickly, they can be affected as well, leading to side effects.[23] Chemotherapy treatment choices depend on several factors, including the cancer's location and stage, the specific cell type, the presence of HPV, your general health, and your individual preferences.[4] Docetaxel-based chemotherapy has demonstrated strong effectiveness in treating locally advanced head and neck cancers. It is the only taxane approved by the FDA for this condition, used alongside cisplatin and fluorouracil as part of induction therapy for cases that cannot be treated surgically.[24] Chemotherapy can be given to reduce the size of a throat tumor before surgery or to eliminate any remaining cancer cells after surgery or radiation.

In some cases, it is combined with radiation therapy as the main treatment, especially for patients with larger tumors or those who are not suitable candidates for surgery.

4) Targeted drug therapy

Targeted therapy drugs are designed to stop or slow the growth or spread of cancer. This happens on a cellular level.[22] These treatment aim to disrupt specific pathways involved in tumor growth.[25] Targeted therapy involves the use of drugs or other agents, like monoclonal antibodies, to specifically identify and destroy cancer cells while minimizing damage to healthy cells. In head and neck cancers, commonly used targeted therapies include cetuximab, bevacizumab, and erlotinib.[24] Cetuximab (Erbix) is an example of a targeted therapy approved for use in specific cases of throat cancer. It works by blocking a protein that exists in normal cells but is found in higher amounts in some throat cancer cells.[19] Targeted drug therapy can also be used in combination with radiation therapy or chemotherapy.[26]

5) Immunotherapy

Immunotherapy is a type of treatment that activates the immune system to fight cancer. [24] Cancer cells can evade detection by the immune system by producing proteins that mask them from immune cells. Immunotherapy helps disrupt this process, allowing the immune system to recognize and attack the cancer.[19] In 2016, the FDA gave accelerated approval to pembrolizumab for patients with recurrent or metastatic head and neck cancer that had progressed after treatment with platinum-based chemotherapy. That same year, nivolumab also received FDA approval for similar cases. In 2019, pembrolizumab was additionally approved as a first-line treatment for metastatic or inoperable recurrent throat cancer.[24] Immunotherapy is typically used for individuals with advanced throat cancer that has not responded to conventional treatment options.[19]

IX. HERBAL THERAPIES IN THE MANAGEMENT OF THROAT CANCER

Following are the herbs are used for the treatment of throat cancer

Sr no	Herbs	Phytochemical present
1	Green tea	Flavonoids
2	Turmeric (<i>Curcuma longa</i>)	Xanthophyll carotenoid
3	Garlic	S-allylcysteine
4	mulberries	Resveratrol

1) Green tea

Green tea contains several beneficial antioxidants, mainly flavonoids and polyphenols like EGCG, ECG, and EGC, which are known for their strong anti-cancer properties. Among these, EGCG is the most powerful compound—it helps restrict the growth and spread of cancer cells, particularly in oral and throat cancers. It does so by promoting cell death, pausing the cell cycle, and regulating key transcription factors such as NF- κ B and AP-1. Research evidence shows that consuming green tea regularly can lower the chances of developing cancers in the mouth and digestive tract. Laboratory and animal studies have demonstrated that its natural compounds help reduce oxidative stress, inhibit harmful enzymes, and support the body's detoxification system. Clinical findings also reveal that green tea extracts may shrink early cancerous oral lesions and decrease cancer-linked markers like VEGF and cyclin D1. Frequent consumption—especially above 10 cups per day—has been associated with delayed cancer development and a reduced overall risk. Additionally, green tea extract helps limit DNA damage in the oral cells of smokers..[17]



Fig no 2 .Image of tea leave

2) Turmeric (*Curcuma longa*)

Curcumin, the main active compound in turmeric (*Curcuma longa*), is known for its anticancer properties across various cancers, including oral cancer. It suppresses cell invasion and epithelial–mesenchymal transition (EMT) by downregulating MMP-2 and MMP-9 and modulating the p53-E-cadherin pathway. In oral cancer cell lines, curcumin also inhibits proliferation by enhancing miR-9 expression and blocking the Wnt/ β -catenin pathway. Additionally, it activates the p38 pathway, promoting IGFBP-5 expression through C/EBP α activation. In animal models, curcumin reduces tumor incidence and size, and in clinical settings, topical application has shown symptom relief in some patients with external cancerous lesions. It is well-tolerated, even at high doses (up to 8 g/day), with studies confirming its safety.[17]



Fig 3. Image of turmeric

3) Garlic

Several studies have shown that increased consumption of allium vegetables, such as garlic and onion, may lower the risk of cancer . S-allylcysteine (SAC), a bioactive compound in garlic, has been reported to effectively suppress cell proliferation and epithelial–mesenchymal transition (EMT) in human oral squamous cancer CAL-27 cells as well as in a mouse xenograft model . In addition, SAC administration significantly inhibited DMBA-induced hamster buccal pouch (HBP) carcinogenesis by reducing lipid peroxidation and enhancing antioxidant activity. A combined treatment with tomato and garlic also demonstrated strong inhibitory effects on DMBA-induced HBP carcinogenesis through activation of the apoptotic pathway .[27]Although clinical evidence regarding the effective doses of garlic for oral cancer prevention and treatment is still limited, no reports of garlic toxicity have been documented. Clinical trials indicated that a daily intake of about 20 g of garlic reduced the risk of gastric and colorectal cancers. Similarly, onion extract markedly delayed tumor development in DMBA-induced HBP carcinogenesis. Quercetin, a major flavonoid present in onions, has shown cytotoxic activity while reducing migration and invasion in SAS cells . In clinical evaluation, quercetin doses ranging from 250 to 5000 mg/day were safely administered to 30 untreated patients with chronic hepatitis C virus infection, with no adverse effects or signs of toxicity reported. In fact, quercetin is commercially available as a dietary supplement in some countries, with a recommended daily dose of 200–1200 mg.[27]



Fig 4 . Image of garlic

4) Mulberry

Mulberry (*Morus* spp.), belonging to the Moraceae family, is considered a remarkable plant because of its wide distribution across continents, adaptability to diverse cultivation systems, and versatile applications. Its foliage is highly valued, while the plant as a whole plays a significant role in environmental conservation through land restoration, pollution control, water preservation, soil erosion prevention, and carbon sequestration.

Beyond its ecological importance, mulberry also serves as a medicinal resource, with bioactive compounds in its leaves, stems, and roots contributing to human health and well-being. The plant has further attracted industrial interest, being utilized in pharmaceuticals, nutraceuticals, food, cosmetics, and health-care products. Owing to its multifaceted benefits—ranging from sericulture and industry to ecological restoration—it stands out as an ideal candidate for sustainable development. This review brings together the key attributes of mulberry to highlight its potential in shaping a sustainable future.[28]



Fig 5. Image of mulberry

X. CONCLUSION

Throat cancer is a serious disease that affects the voice box and the upper part of the throat, which are important for speaking, swallowing, and breathing. Detecting the cancer early is very important because it allows treatment to work more effectively, increases the chances of recovery, and can prevent the cancer from spreading to other parts of the body. People who smoke, drink alcohol heavily, or have certain viral infections are at higher risk of developing throat cancer. Simple steps can help reduce the risk, such as avoiding tobacco, limiting alcohol use, eating healthy foods, and visiting a doctor regularly for check-ups. Being aware of symptoms like persistent sore throat, difficulty swallowing, or changes in voice can also help in finding the disease early. By following these precautions and seeking medication.

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