



Diagnosis and Management of Carcinoma of the Larynx

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ABSTRACT

Introduction. Laryngeal carcinoma is a major malignancy of the head and neck, with a global incidence of 58.67%. This malignancy commonly affects men over the age of 50 with a significant history of smoking. The diagnosis is frequently delayed until advanced stages, especially in low-resource settings. The study aimed to present a case series of laryngeal carcinoma and evaluate the diagnosis and management. **Method.** A case series and literature review involving patients diagnosed with laryngeal carcinoma who underwent assessment through to definitive treatment. **Results.** We report four male patients aged 51–67 years who presented with longstanding hoarseness and respiratory distress. All underwent tracheotomy followed by micro-laryngoscopic biopsy, which confirmed squamous cell carcinoma. Tumor staging was determined via CT imaging ranging from T2N0M0 to T4aN2M0. Treatment for all patients consisted of total laryngectomy combined with either selective or modified radical neck dissection. Histopathology revealed well to moderately differentiated squamous cell carcinoma in each case. Postoperative outcomes were favourable, with no major early complications. **Conclusion.** The diagnosis and management of laryngeal carcinoma remain challenging, particularly in resource-limited settings. Early detection is crucial for improving treatment outcomes and overall prognosis. Enhancing public awareness, strengthening multidisciplinary approaches, and expanding diagnostic infrastructure are essential to optimize patient care and survival.

1. Introduction

Laryngeal carcinoma is a malignancy of the larynx, encompassing the supraglottis, glottis, and subglottis. Laryngeal carcinoma ranked as the second most common malignancy of the ear, nose, and throat worldwide and a major cause of morbidity and mortality, with an estimated 238,000 new cases and 106,000 deaths annually.¹ The current global incidence is approximately 2.76 cases per 100,000 population, with a prevalence of 14.33 cases and a mortality rate of 1.66 deaths per 100,000. Over the past three decades, the incidence has steadily declined in Europe but has risen in Southeast Asia and the Western Pacific.² The incidence of laryngeal carcinoma in Indonesia is still limited, with an estimated incidence of 2–5% of all cancers.³ Tobacco use and alcohol consumption are well-established risk factors, with a synergistic effect that markedly increases the risk of developing laryngeal cancer.⁴

Squamous cell carcinoma is the most common histological type, representing nearly 95% of primary malignant laryngeal tumors. The remaining tumors are primarily from soft tissue, neuroepithelial tissue, small salivary glands, or the cartilaginous tissue of the larynx.¹ Multiple etiological factors, including chronic

tobacco and alcohol exposure, occupational hazards, environmental carcinogens, poor nutritional status, socioeconomic factors, and genetic predisposition, are correlated with the development of laryngeal squamous cell carcinoma.⁵ Treatment strategies depend on tumor stage and may include combination therapy, chemoradiation, or partial to total laryngectomy.¹

Laryngeal carcinoma has a significant impact on quality of life, yet many patients present at an advanced stage due to the limited availability of optical laryngoscopes in healthcare facilities. In Indonesia, the diagnosis and management of laryngeal cancer are restricted by limited medical infrastructure and reliance on tertiary care-based multimodal diagnostics, reflecting significant deficiencies in early detection capacity within primary healthcare settings. Published case series on laryngeal carcinoma from Indonesia are lacking, leaving a gap in the global ENT oncology literature regarding disease patterns and management in resource-limited contexts. This study addresses this gap by documenting a series of surgically managed cases to contribute locally relevant data to inform early detection strategies and improve clinical

outcomes.

2. Methods

This study was a retrospective case series and literature review. Four patients diagnosed with laryngeal carcinoma were included. Inclusion criteria were: (1) patients with histopathological confirmation of laryngeal squamous cell carcinoma obtained through microlaryngoscopic biopsy; (2) availability of complete clinical records including demographic data, history of presenting illness, risk factors, imaging results, and tumor staging; and (3) patients who underwent definitive surgical management. Patients with incomplete clinical records or without histopathological confirmation were excluded from the study. Data collected included patient demographics, clinical presentation, risk factors, examination findings, diagnostic results, operative details, histopathology, and postoperative outcomes. Diagnostic work-up consisted of physical examination with neck palpation, direct microlaryngoscopy with biopsy for histopathological confirmation, and neck CT for tumor extension and nodal status. Chest radiography or abdominal ultrasonography was performed when distant metastases were suspected. Tumors were staged according to the AJCC TNM classification (8th edition). All patients underwent total laryngectomy with either selective or modified radical neck dissection based on nodal involvement, followed by standard perioperative and postoperative care. Table 1 shows the clinical and demographic data of the four patients included in this case series.

3. Case Presentation

Case 1

A 51-year-old male driver presented with progressive hoarseness for 18 months. The patient experienced a hoarse voice that worsened and began to suffocate for the last 6 months before finally performing tracheotomy surgery. The patient had a 30-year smoking history with one pack of tobacco per day. Physical examination of the neck area revealed palpable bilateral cervical nodules. A laryngeal biopsy was performed using the micro-laryngoscopic biopsy technique, which confirmed keratinizing squamous cell carcinoma. Abdominal ultrasonography was performed, and no evidence of intra-abdominal metastasis was found. Cervical CT imaging revealed a malignant mass originating in the glottic region (4.2 × 5.9 × 4.9 cm), extending into the supraglottis and subglottis, obstructing the partial airway obstruction at C4–C6 with a minimum airway diameter of 1.2 mm. A CT scan also showed a trachea cannula with stoma insertion at cervical vertebra 6 and the distal tip, which was not visualized. Lymphadenopathy was found in the bilateral upper, mid, and lower jugular

and the right supraclavicular. The patient was diagnosed with T4aN2M0 laryngeal carcinoma and planned for a total laryngectomy and bilateral selective nodules dissection.

Case 2

A 67-year-old unemployed male presented with a one-year history of hoarseness. The patient's complaint worsened with progressive dyspnea in the three months preceding admission, then a tracheotomy was performed. The patient had a 40-year history of smoking one pack per day. On examination, a well-functioning tracheostomy cannula was in place, with no enlarged lymph nodes. Microlaryngoscopic biopsy was performed and revealed well-differentiated squamous cell carcinoma, chest X-ray showed no pulmonary metastases. The patient was diagnosed with T3N0M0 laryngeal carcinoma and was planned for total laryngectomy and bilateral selective nodules dissection.

Case 3

A 66-year-old unemployed male presented with progressive hoarseness over six months. The patient had a 10-year history of daily cigarette smoking for ≥1 pack/day. A tracheostomy and a micro-laryngoscopic biopsy were performed one month later due to worsening dyspnea and confirmed moderately differentiated squamous cell carcinoma. The tracheostomy cannula was functioning well, and no cervical lymphadenopathy was observed. The thorax photo examination is within normal limits, with no metastases. The patient was diagnosed with T2N0M0 laryngeal carcinoma, and a total laryngectomy with bilateral selective neck dissection was scheduled.

Case 4

A 57-year-old male farmer presented with a two-year history of hoarseness, along with hemoptysis and progressive dyspnea. A tracheotomy was performed due to the complaints of hoarseness getting worse, and shortness of breath was felt in the last 8 months. The patient had a 30-year smoking history with ≥1 pack/day. The patient then performed a micro-laryngoscopic biopsy, which revealed moderately differentiated squamous cell carcinoma. A CT scan showed an enhancing solid mass in the glottis to the right subglottis, left dominant. The mass infiltrated the vocalis plica and infiltrated the left thyroid cartilage. The CT scan also showed conglomerated lymph nodes in the left mid-jugular, right mid-posterior cervical, left submandibular, right sub-digastric, and right-left lower jugular. The patient was diagnosed with T4N2M0 laryngeal carcinoma and scheduled for total laryngectomy, total thyroidectomy, and modified radical neck dissection.

Table 1. Overview of data per case

	Case 1	Case 2	Case 3	Case 4
Sex	Male	Male	Male	Male
Age	51 yo	67 yo	66 yo	57 yo
Job	Driver	Unemployed	Unemployed	Farmer
Chief complaint	Hoarseness for 1,5 years	Hoarseness for 1 year	Hoarseness for 1,5 years	Hoarseness for 2 years
Additional complaints	Shortness of breath	Shortness of breath	Shortness of breath	Shortness of breath and bloody cough
History of smoking	30 years / one pack per day	40 years / one pack per day	10 years / one pack per day	30 years / one pack per day
Neck nodule	Right: Nodule level 1A, solid mobile, 1x1 cm Left: Nodule level 1A, solid mobile, 1x1 cm	No enlarged lymph nodes	No enlarged lymph nodes	Right: Nodule level III, solid fixed, 1x1 cm Left: Nodule level III, solid fixed, 3x3 cm
Metastatic process	No	No	No	No
Microlaryngoscopic biopsy	keratinizing squamous cell carcinoma	squamous cell carcinoma well-differentiated	squamous cell carcinoma moderately differentiated	squamous cell carcinoma moderately differentiated
Diagnosis	T4aN2M0 laryngeal carcinoma	T3N0M0 laryngeal carcinoma	T2N0M0 laryngeal carcinoma	T4N2M0 laryngeal carcinoma
Therapeutic management	Total laryngectomy and selective nodules dissection in the right and left neck	Total laryngectomy and selective nodules dissection in the right and left neck	Total laryngectomy and selective nodules dissection in the right and left neck	Total laryngectomy and modified radical neck dissection in the right and left neck

4. Discussion

Assessment of Laryngeal Carcinoma

Diagnosing laryngeal carcinoma requires a comprehensive clinical evaluation, including detailed patient history, physical examination, and endoscopic and imaging examinations. Initial assessment typically begins with an indirect laryngoscopy using a laryngeal mirror. Fiberoptic laryngoscopy, with or without stroboscopy, provides a wider field of view, evaluates vocal cord mobility, and allows better assessment of tumor extent. Definitive diagnosis requires direct laryngoscopy under general anesthesia, which provides a tissue biopsy. The radiography imaging, especially CT scan, was essential for staging, particularly in supraglottic and advanced glottic tumors, which may involve the pre-epiglottic space, cartilage, or lymph nodes not easily assessed clinically.⁶

All reported patients in this case were male, reflecting the higher global incidence of laryngeal carcinoma in men compared to women. European studies report an incidence of 2.5–17.1 per 100,000 men, which is higher than in Asian populations.⁶ In Indonesia, laryngeal carcinoma was reported as the third or fourth most common ENT malignancy in Surabaya between 1996 and 2000, comprising 10.2–13.0% of cases.⁷ The disease predominantly affects individuals over 50 years, with the highest incidence in those over 65. Common presenting symptoms include persistent hoarseness, dysphagia, odynophagia, throat discomfort, airway obstruction, hemoptysis, and referred otalgia.⁸

Glottic tumors typically present with early hoarseness, while supraglottic and subglottic tumors often present with cough, with hoarseness appearing only after vocal cord involvement.^{2,4} All patients in

this case series had a shared history of smoking at least one pack of cigarettes per day (approximately 16 cigarettes). Predisposing factors for the occurrence of malignant tumors of the larynx are smoking, alcohol abuse, and genetics.^{3,9,10} Individuals who consume cigarettes and alcohol are more likely to develop malignant tumors of the larynx.⁴ Long-term heavy smoking is estimated to account for 78% of cases, alcohol for 34%, and combined exposure for up to 82%, with mortality rates significantly higher among heavy smokers. Additional contributing factors include gastroesophageal reflux, low intake of fruits and vegetables, prior neck irradiation, family history, and occupational exposures such as wood dust, asbestos, and polycyclic hydrocarbons.¹¹

Access to advanced diagnostic tools, such as fiberoptic laryngoscopy, remains limited in many Indonesian healthcare settings, particularly in East Java. Nonetheless, thorough endoscopic evaluation is critical to confirm tumor extent, assess local invasion, and identify the primary lesion's origin, which informs staging and management.¹²

Staging and Metastasis Evaluation

Evaluation of regional and distant metastases involves thoracic radiographs, abdominal ultrasound, and CT scans. Advanced tumors (T3–T4) carry a 20–25% risk of regional metastases, with the lungs and bones being the most common sites of distant spread.⁶ Metastasis to mediastinal lymph nodes is considered the most distant metastasis.⁷ CT scans were used in all case series to stage laryngeal cancer. The staging of laryngeal malignant tumors was determined by TNM classification, according to the American Joint Committee on Cancer (AJCC) 2010.¹²

Laryngeal structures such as membranes and

cartilage play an essential role in the spread of laryngeal tumors. 1) The conus elasticus inhibits tumor spread to the inferior glottis so that spread to the subglottis occurs at an advanced stage; 2) tumors involving the anterior commissure usually spread to the thyroid cartilage because this area is thinner in the midline while the lateral area is thicker; 3) the paraglottic space containing the vocalis muscle is thinner in the lateral cricothyroid space so that glottic tumors can spread to the neck through this route so that malignant tumors of the glottis can be misdiagnosed because evaluating spread to this area is difficult. The paraglottic space links to the preepiglottic space, allowing glottic tumors to spread to the supraglottis. 4) Epiglottic malignant tumors can spread directly to the pre-epiglottis via the epiglottic cartilage attachment, so this space should be resected entirely during supraglottic laryngectomy.^{5,6}

Malignant tumors of the larynx in the glottic region are usually located in the anterior 2/3, while the supraglottic region is most common in the epiglottis. The supraglottic region has a lot of lymph flow and empties into level II neck lymph nodes, while the glottic region does not have two lymph channels.⁵ The Broyles ligament is a structure that functions as a defense; if this structure is affected, it means that the tumor has invaded the thyroid cartilage, and if it has

invaded the thyroid cartilage, the tumor stage changes to T4.¹² The incidence of regional metastasis in T3 and T4 ranges from 20-25%.^{7,8} Operative action is performed as the main option, Table 2 summarizes the treatment recommendations for laryngeal carcinoma based on stage, according to the NCCN guidelines.¹² In the study of Gourin et al., a study of 451 patients with malignant tumors of the larynx from 1985–2002, found that the 5-year life expectancy in stage I was 85%, stage II was 77%, stage III was 51%, and stage IV was 35%.¹³ The distribution of laryngeal carcinoma stages in this case series according to the AJCC 2017 classification is illustrated in Figure 1.¹³

Histopathology

All patients underwent tracheotomy to secure the airway before definitive diagnosis. Subsequent biopsies confirmed malignancy. Squamous cell carcinoma is the predominant histology (>95%), reflecting the squamous epithelial lining of the larynx and its susceptibility to carcinogenic stimuli. The change of normal epithelium to malignant usually begins with leukoplakia, hyperplasia, non-atypical keratosis, atypical keratosis, carcinoma in situ, and microinvasive carcinoma.^{5,7}

Table 2. Treatment of laryngeal carcinoma by stage, according to NCCN¹³

Stage	Therapy
T1, T2	Initial therapy with the aim of laryngeal preservation, using transoral laser microsurgery (TLM), partial laryngectomy, or radiotherapy (RT)
T3a	Total laryngectomy (TL) surgery may be performed initially, but an organ-saving protocol with concurrent chemoradiotherapy or induction chemotherapy followed by radiotherapy for preservation of the larynx and its function should be added.
T4a	Total laryngectomy with chemoradiotherapy without organ preservation

Table 3. Clinical summary between supraglottis, glottis and subglottis^{5,7}

	Supraglottis	Glottis	Subglottis
Subsite	Suprahoid epiglottis, infrahyoid epiglottis, aryepiglottic folds (laryngeal surface), arytenoids, ventricular bands (false vocal cords)	True vocal cords, anterior and posterior commissure	No subsites
Clinical manifestations	Might be asymptomatic; foreign body sensation; pain while swallowing; throat burns; enlargement of cervical lymph nodes	Hoarseness in the early symptom; respiratory obstruction will happen in late stage	There are no definitive symptoms in the early stage; dyspnea and lymph nodes metastasis in the late symptoms
Clinical classification	Poorly differentiated, early metastasis	Well-differentiated, late metastasis	Poorly differentiated, early metastasis
Lymphatic drainage			
Treatment of early stage	Radical radiotherapy (60-66 Gy) or surgery (T1-T2) N0	Radiotherapy: if radiation therapy is not successful, a hemilaryngectomy should be performed	Patients with early-stage laryngeal carcinoma should be treated using a larynx-preserving approach, with either RT or transoral laser surgery

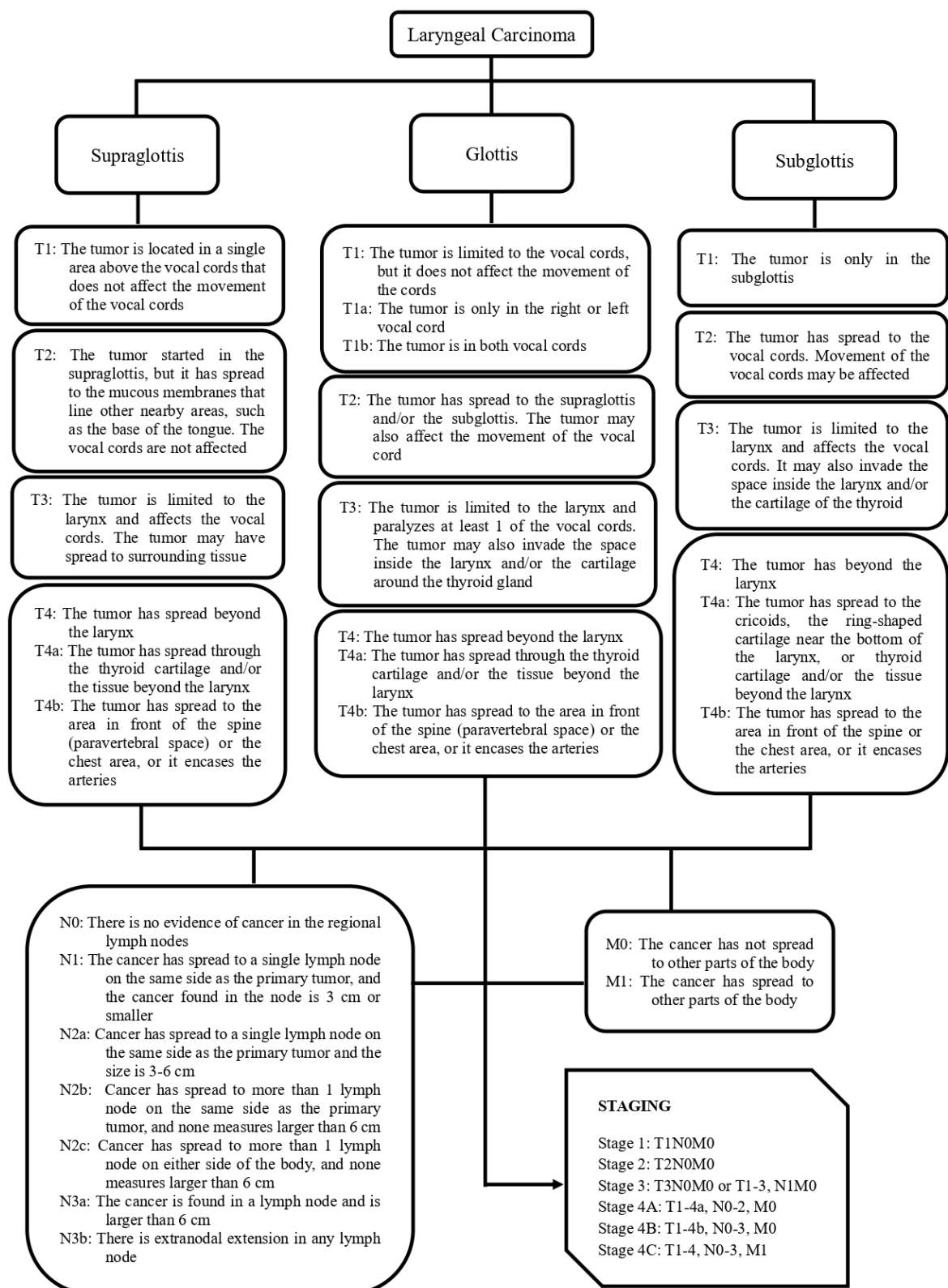


Figure 1. Stage of laryngeal carcinoma based on the AJCC 2017¹³

In addition to squamous cell carcinoma, other histopathologic forms are verrucous carcinoma, pseudosarcoma, and adenocarcinoma. Lymphoma ranks second in laryngeal carcinoma, at less than 1%, and is an important differential diagnosis as it has a good prognosis with chemotherapy. Other rare histologic types include verrucous squamous cell

carcinoma, adenocarcinoma, spindle cell carcinoma, fibrosarcoma, and chondrosarcoma. Carcinoma can develop in all parts of the larynx. Glottic carcinoma is the most common site of laryngeal carcinoma (51%), followed by supraglottic (32%) and subglottic (2%).¹⁴ A more detailed explanation of the clinical summary of the site of laryngeal carcinoma in Table 3.

Postoperative Complications and Rehabilitation

Postoperative management includes NGT feeding for 7–10 days, gradually progressing from liquid to soft diets.¹⁵ The postoperative patient's diet starts with liquid-consistency food for 5–7 days. The complications of total laryngectomy that threaten the outcome of surgery are pharyngocutaneous fistulas, wound infection, necrotizing flaps, and hematomas.¹⁶ Surgical wound care is crucial for healing and preventing complications such as fistulas. Sutures should be checked every 8 hours to ensure proper function and prevent hematoma, seroma, and infection. Signs of infection is redness, swelling, or discharge and should be promptly addressed. Good postoperative oral hygiene helps control infection and reduce bad breath.¹⁷

Pharyngocutaneous fistulas, often appearing within the first week after surgery, are most common in patients undergoing extensive resections, pharyngectomy, or surgery after failed chemoradiation.¹⁸ Swallowing difficulties after laryngectomy are typically caused by reduced pharyngeal muscle pressure, as seen in video-fluoroscopic examinations, due to loss of anterior and superior pharyngeal movement and tongue base retraction.¹⁹ This decrease in pharyngeal function is due to the loss of anterior and superior pharyngeal movement during the process of hyolaryngeal elevation and retraction of the base of the tongue, which is necessary to assist in the opening of the Upper Esophageal Sphincter (UES).²⁰ Postoperative swelling, resection-related muscle impairment, or overly tight closure of hypopharyngeal defects can further hinder swallowing, leading to residue in the pharynx, prolonged transit time, and a sensation of blockage.²⁴ In addition, compensatory strategies, such as head rotation or assisted swallowing exercises, are effective in increasing pharyngeal pressure and helping the bolus pass through the pharynx. Swallowing by pulling the tongue and then holding it during the swallowing process can be done to maximize the patient's swallowing process.¹⁹

After a total laryngectomy, doctors and medical staff play a role in assisting patient-family communication. Using writing aids, pictorial instructions, whiteboards, and even finger signals is instrumental in communication.²¹ Due to the laryngeal removal process, several methods are needed to produce sounds, such as oesophageal speech, an artificial larynx, and transesophageal puncture (TEP). TEP is to create a fistula in the wall that separates the trachea from the oesophagus. In this fistula, a one-way valve prosthesis allows air from the lungs to pass through the esophagus and vibrate the pharyngeal-esophageal segment to produce sound.^{21,22}

Our case series with similar underlying pathology yet differing clinical presentations, airway conditions, and management pathways provides clinically grounded insight into diagnosing and managing

laryngeal carcinoma in a resource-limited setting. All cases had histopathologic confirmation, and careful correlation of endoscopic findings with cross-sectional imaging guided TNM staging and surgical planning. By integrating our observations with a regional and international literature review, we contextualized the shared epidemiologic patterns. The study limitation was a single-center, retrospective series with only four cases, which cannot provide generalizable epidemiologic or survival estimates. Diagnostic work-up was not entirely uniform, as equipment availability varied, and not all patients underwent the same imaging or laryngoscopic techniques. A multi-center prospective study is recommended for a more comprehensive understanding of laryngeal carcinoma presentation and management across diverse healthcare settings. By addressing these gaps, future research could help define context-appropriate, evidence-based strategies that improve survival and functional outcomes for patients with laryngeal carcinoma.

5. Conclusion

Laryngeal carcinoma is frequently diagnosed at an advanced stage, particularly in regions with limited access to specialized diagnostic facilities. In this case series, all patients were male, long-term smokers, and presented with persistent hoarseness accompanied by progressive airway obstruction. Histopathological examination following microlaryngoscopic biopsy confirmed squamous cell carcinoma in all cases, while imaging was indispensable for accurate tumor staging and surgical planning. Consistent with current evidence, total laryngectomy with selective or modified neck dissection constituted the definitive treatment in each patient. The delay in diagnosis due to the lack of readily available medical expertise and specialized equipment leads to poorer prognoses and reduced treatment options. A multidisciplinary approach is fundamental to enhancing prognosis in laryngeal carcinoma, while ongoing research and investment in diagnostic and treatment infrastructure are vital for improving patient outcomes in low-resource settings.

6. Author Contribution

T.H. conceived the conceptualisation, wrote the original draft, and supervised the study. A.N.F. and R.S.R. collected the data, performed the case analysis, and revised the final manuscript. All authors approved the final version of the manuscript.

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