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CASE STUDY

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Case series: Using laryngeal mask airway to enhance the radiological evaluation and staging of cancers involving the larynx: A novel technique

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Abstract

The diagnosis and staging of head and neck tumors requires proper clinical, endoscopic, and radiological evaluation. Currently, imaging techniques such as Magnetic Resonance Imagining (MRI) and Computed Tomography (CT) are used for head and neck tumors but are limited in showing involvement of different hypopharyngeal sub-compartments. Several maneuvers have been developed to improve visualization of the head and neck area; however, they demonstrated minimal benefit. In this case series, patients with tumors involving the hypopharynx are studied. A laryngeal mask airway was used to stent the hypopharynx to assess the extent of the disease by creating real space between mucosal surfaces. This case series aims to describe the impact of using laryngeal mask airway on the evaluation of cancers involving the hypopharynx.

KEYWORDS
head and neck imaging, head and neck tumors, laryngeal mask airway

INTRODUCTION

Head and neck tumors are life-threatening tumors that reduce patients' quality of life and are associated with a significant rate of mortality and morbidity. Tumors involving the larynx and hypopharynx are some of the most common head and neck malignancies.[1] The hypopharynx is commonly involved by a primary tumor or by extension from nearby structures.[2] Accurate tumor staging is crucial because it has a significant impact on treatment options and disease prognosis. One of the most challenging aspects is identifying mucosal and submucosal spread.[3] There are many pitfalls that can occur and lead to either under-staging or over-staging which ultimately results in unnecessary laryngectomy or failure in creating safe margins during surgery.[3] These pitfalls can occur due to the complex anatomy of the larynx and hypopharynx. In the neutral position, the hypopharyngeal space is collapsed and difficult to differentiate on imaging.[3] Several techniques have been studied to improve the radiological evaluation of hypopharyngeal space tumors by forcefully separating the mucosal surfaces, using the Valsalva maneuver, reverse Valsalva maneuver, and blowing the cheek techniques,[4–6] however, these techniques have limitations and are frequently shown to be nonpractical.[4,5,7] In this case series, we used a laryngeal mask airway to improve the visualization of the larynx and the surrounding structures for a clearer radiological evaluation, accurate staging, surgical planning, and management.

CASE PRESENTATION

Case 1

A 70-year-old male, diagnosed with locally advanced Trans-glottic Squamous cell carcinoma, was referred to the head and neck surgery clinic for evaluation and assessment. In the clinic, a fiberoptic laryngoscope was introduced and showed a left glottic mass. Pyriform sinus was not visualized due to crowding of the hypopharyngeal structures. However, supraglottic and pharyngeal mucosa looked smooth and within normal limits. Previous computed tomography (CT) scan showed a trans-glottic infiltrative mass involving the left vocal cord, aryepiglottic, pharyngoepiglottic fold with para-glottic extension, and complete airway obstruction. The patient underwent emergency tracheostomy and debulking of the laryngeal mass due to impending airway obstruction. The mass was 6.1 cm × 5.1 cm in size with thyroid cartilage destruction and extra-laryngeal extension. There were bilateral, prominent cervical lymph nodes with the largest on the left supraclavicular region measuring 1.7 cm. Magnetic resonance imaging (MRI) of the neck with contrast in combination with a laryngeal mask airway (LMA) was used to determine the extent of the laryngeal mass and whether the posterior pharyngeal wall and pyriform sinus had been invaded. Using the LMA and MRI, the posterior pharyngeal wall and the pyriform sinuses were visualized. The posterior pharyngeal wall and the right pyriform sinus were intact (Figure 1), however, a bulge in the left pyriform sinus was seen. The final staging was T4aN2cM0 using the TNM staging system.

Case 2

A 54-year-old female, diagnosed with papillary thyroid cancer, presented to the clinic complaining of severe hoarseness of the voice, noisy breath, and shortness of breath which was preceded by a frequent episode of breathing discomfort that worsened over a few days. She has no significant family history of cancer or any other significant risk factor. On examination, there was a right thyroid mass that was hard and fixed, with no palpable cervical lymph nodes. A fiberoptic laryngoscope was used and showed the right vocal cord

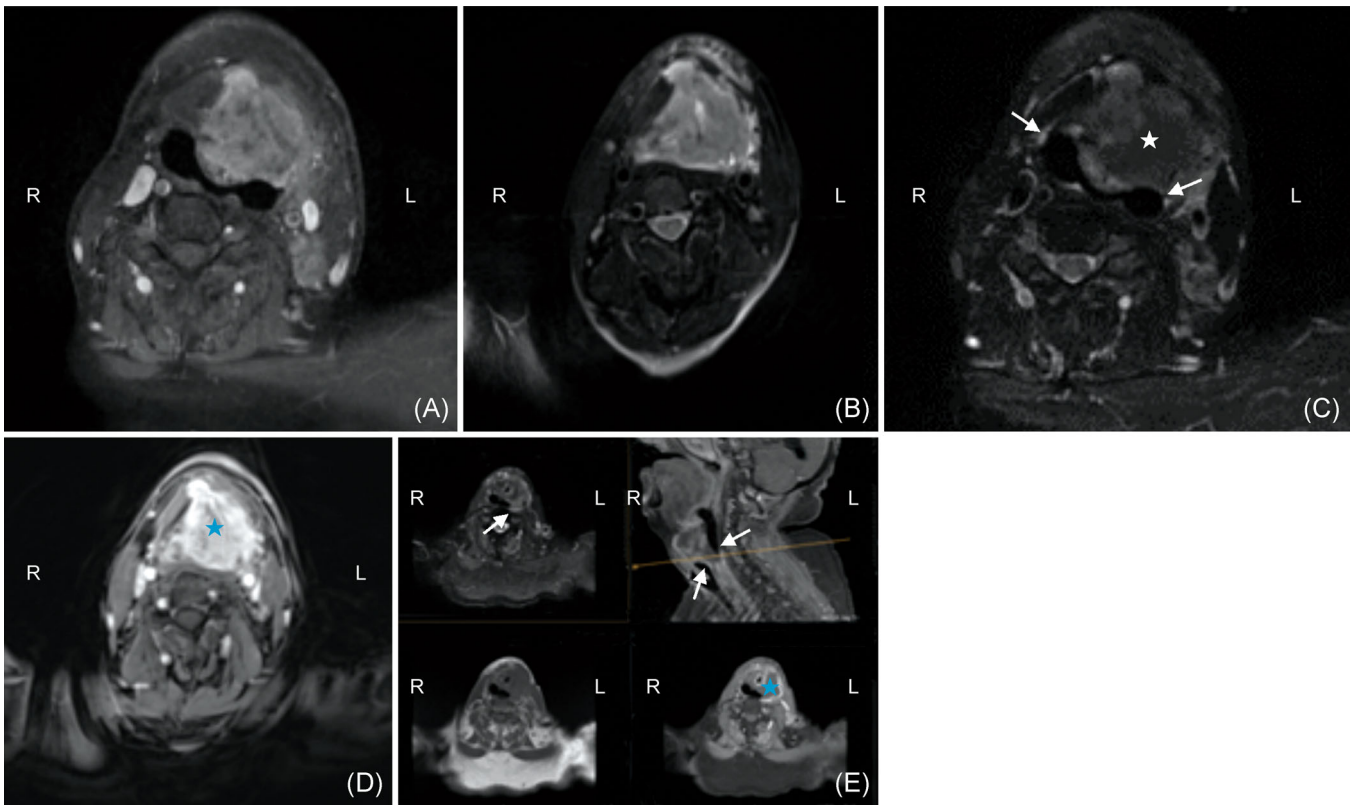

FIGURE 1 Magnetic resonance imaging (MRI) of the posterior pharyngeal wall and the right pyriform sinus. (A) T2 fat-sat axial image, T2 hyperintense mass lesion that totally obliterating laryngeal airway and predominantly located on the left side, extending to anterior–posterior commissures and right side, infiltration of tumoral process on carti; (B) precontrast T1 TSE and postcontrast T1 fat-sat axial images, predominantly solid appearance of tumor, with mildly inhomogeneous but prominent contrast enhancement; (C) after laryngeal mask, well delineation of prevertebral fascial plans after mask application, there is no infiltration on pervertebal area, infiltration on near all cartilage structures, extension of tumor to infra/supraglottic, glottic levels and ext; (D) postcontrast T1 fat-sat axial images; (E) follow up MRI study postchemoradiation, with mask, from same level (yellow line at sagittal image) with previous study.

was paralyzed, as well as the right arytenoid was collapsing into the airway. The patient underwent an urgent tracheostomy due to a nonstable airway. CT scan showed a 3.2 cm × 4.7 cm × 7.5 cm mass surrounding the airway at the level of the subglottic and proximal trachea. However, the planes between the mass and the right side of the esophageal wall and prevertebral plans couldn't be visualized clearly. In addition, there was a narrowing of the airway space and shifting of the trachea to the left side. To assess and visualize whether the esophageal wall and prevertebral planes were involved, MRI with contrast in addition to inserting a LMA was conducted and showed that the mass was abutting the esophageal and anterior prevertebral planes but not invading them (Figure 2). The final diagnosis was papillary thyroid cancer, pT4bN1a M1 using the TNM staging system.

Case 3

A 76-year-old male patient diagnosed with laryngeal squamous cell carcinoma T3N2bMx invading the epiglottis, aryepiglottic folds, arytenoid tips, and base of tongue presented to the clinic for dysphagia and change of voice. Endoscopic examination showed a friable supraglottic mass and bilateral mobile vocal cords. The patient underwent biopsy and imaging studies for further workup to confirm the diagnosis, and tracheostomy to secure the airway. The patient's CT scan showed suspicion of posterior wall infiltration and prevertebral plans. Therefore, the patient underwent MRI with LMA to assess for posterior wall infiltration. The MRI with LMA when compared to the CT before LMA clearly helped to confirm posterior wall infiltration (Figure 3), however, the prevertebral plans were spared.

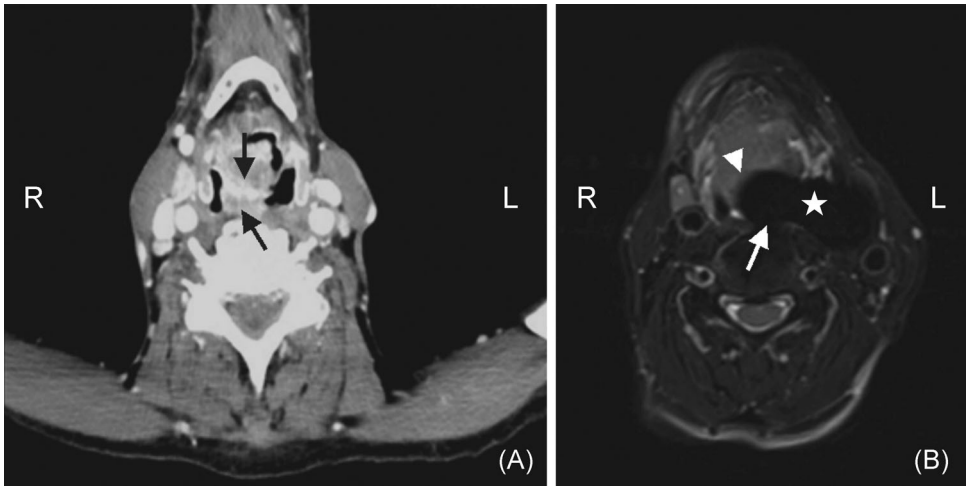

FIGURE 2 An axial T2 magnetic resonance imaging neck. (A) Magnetic resonance imaging of laryngeal mass with no proper appreciation of the posterior pharyngeal wall and determining the tumor margin is difficult; (B) a better visualization of the posterior pharyngeal and prevertebral planes when using a laryngeal mask airway.

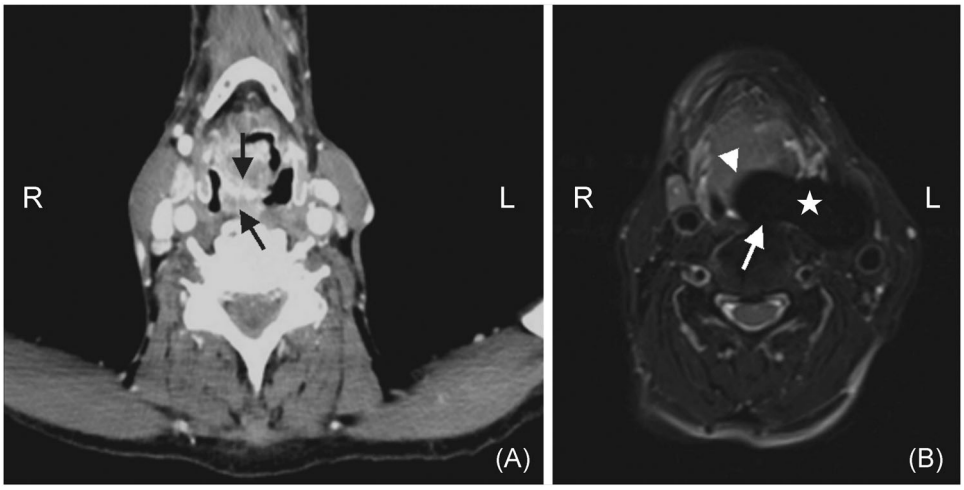

FIGURE 3 Computed tomography (CT) and magnetic resonance imaging (MRI). (A) CT study, heterogeneously contrast-enhancing tumoral lesion seen that infiltrating right aryepiglottic fold and suspicious appearance for posterior wall infiltration on the right side (upper, thin black arrow) and suspicious appearance; (B) MRI study, at T2 fat sat axial image, after laryngeal mask application (mask airway seen at white star level), Well seen of posterior wall infiltration (thick white arrow) but, there is no prevertebral fascial plan infiltration (thin white arrow).

DISCUSSION

Estimating the extent of the invasion and staging of head and neck tumors may be difficult at times.[7–9] The hypopharynx is a potential space anatomically,[8] which is bounded posteriorly by the pharyngeal wall and anteriorly by the postcricoid mucosa. The walls of the hypopharynx are in touch with each other in the neutral resting position, which keeps the potential space of the hypopharynx closed. The Pyriform fossa is another space that is partially obliterated during resting position.[6]

Several techniques have been proposed in the context of improving radiological examination, including the Valsalva maneuver, reversal of the Valsalva maneuver, and blowing the cheek.[4–6] However, these techniques have little effect on the radiological evaluation of head and neck tumors and have their drawbacks.[8] For example, the Valsalva maneuver is difficult to perform and may result in motion artifacts when the patient holds their breath.[4,5,7]

Endoscopy remains the gold standard in the assessment of hypopharyngeal, laryngeal, and oral cavity tumors, which is typically done under general anesthesia.[5,8,10] On the other hand, submucosal spread is more challenging to define endoscopically.[6,8]

In this case series, we proposed a technique to improve visualization of the hypopharyngeal potential space by separating the mucosal surfaces and opening these potential spaces using a LMA as a stent to assess the extent of submucosal spread.

The LMA is advanced to the hypopharynx until resistance is felt; at this point, the sides of the LMA are in the pyriform fossa and the top border is inferior to the base of the tongue.[10] When the LMA is inflated, the hypopharyngeal spaces will separate and become patent.[10]

All patients involved in this case series had tracheostomy due to airway obstruction, which has facilitated the use of LMA. Patients underwent general anesthesia to obtain the images for the study which indeed proposes risk of anesthesia in such patients.

In the first case, the patient has a T4 laryngeal tumor with an MRI image that hadn't clearly shown if there is tumor extension to the lateral border of the pyriform fossa, and posterior pharyngeal wall. As such, LMA was placed to stent the hypopharynx for better evaluation of the extension of the tumor and whether the posterior pharyngeal wall is involved.

In the second case, the CT scan was not able to visualize the planes between the mass and the right side of the esophageal wall and prevertebral fascia. For that reason, an MRI with LMA was done and it showed that the mass was abutting the esophageal wall and prevertebral planes but not infiltrating them. Therefore, the proposed technique can be used as an adjunct to endoscopic evaluation of the hypopharyngeal spaces and tumor involvement. The technique still has some limitations.

Limitations of the study include: (1) The study is a case series. Therefore, the need for a larger scale study multicentric is needed for better evaluation of this imaging technique and potential benefits. (2) The risk of anesthesia for the population in the study and potential comorbidities. (3) The need for tracheostomy tubes.

In conclusion, head and neck tumors occur in an anatomically challenging location, due to the functional anatomy of the region there are no defined planes in neutral resting position, which poses a substantial dilemma in preoperative and oncological planning.

Using an LMA to improve and optimize the radiological evaluation and outcomes of tumors involving the larynx and hypopharynx is a novel technique that may help surgeons and oncologists in preoperative staging and surgical planning. This case series proposes a new imaging technique that has great potential for assessment and evaluation of the hypopharynx in head and neck tumors.

However, due to the limited population where this technique was applied, it is clear that there is a need for further research and fine-tuning of the technique to be applied as a standard in management of head and neck surgery.

AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization, writing, and editing of the case report.

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The authors have nothing to report.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data used in this study are available upon reasonable request from the corresponding author.

ETHICS STATEMENT

Ethical Approval has been waived by the IRB. Publication Approval was granted by the Scientific Research & Development Directorate at King Hamad University Hospital.

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REFERENCES

1. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin*. 2022;72:7-33.
2. Cmelak A, Arneson K, Chau N, Gilbert R, Haddad R. Locally advanced head and neck cancer. *Am Soc Clin Oncol Educ Book*. 2013; 33:237-244.
3. Baugnon KL, Beitler JJ. Pitfalls in the staging of cancer of the laryngeal squamous cell carcinoma. *Neuroimaging Clin N Am*. 2013;23:81-105.
4. Henrot P, Blum A, Toussaint B, Troufleau P, Stines J, Roland J. Dynamic maneuvers in local staging of head and neck malignancies with current imaging techniques: principles and clinical applications. *Radiographics*. 2003;23:1201-1213.
5. Kininy WE. Prospective comparison of CT scan, MRI and PET/CT in the diagnosis of oral cancer and nodal metastasis. *Int J Surg Res Pract*. 2017;4(1):1-7.
6. Becker M, Burkhardt K, Dulguerov P, Allal A. Imaging of the larynx and hypopharynx. *Eur J Radiol*. 2008;66:460-479.
7. Vogl TJ. Different imaging techniques in the head and neck: assets and drawbacks. *World J Radiol*. 2010;2(6):224-229.
8. Çelebi I, Öz A, Sasani M, et al. Using dynamic maneuvers in the computed tomography/magnetic resonance assessment of

lesions of the head and neck. *Can Assoc Radiol J*. 2013;64:351-357.
9. Imre A, Pinar E, Erdoğan N, et al. Prevertebral space invasion in head and neck cancer: negative predictive value of imaging techniques. *Ann Otol, Rhinol, Laryngol*. 2015;124:378-383.
10. Jannu A, Shekar A, Balakrishna R, Sudarshan H, Veena GC, Bhuvaneshwari S. Advantages, disadvantages, indications, contra-indications and surgical technique of laryngeal airway mask. *Arch Craniofac Surg*. 2017;18:223-229.

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