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ORIGINAL ARTICLE

Imaging for Laryngeal Malignancies: Guidelines for Clinicians

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Abstract
Radiology has always been an important component in the evaluation of patients with head and neck cancers. Images that are appropriately acquired and systematically interpreted provide comprehensive information on local, regional, and distant disease extent. This impacts treatment decisions for primary or recurrent disease, and aids in prognostication and patient counselling. The recent significant advances in technology and instrumentation for treatment of head neck cancers have taken place in parallel with an increasing sophistication in radiodiagnostic systems. This is especially true for laryngeal neoplasms where there is now greater focus on functional outcomes and personalised treatment, thus expanding the scope and value of imaging. Purpose: To formulate evidence-based guidelines on imaging for cancers of the larynx, from diagnosis and staging to monitoring of disease control after completion of treatment. Methods and materials: A multidisciplinary analysis of current guidelines and published studies on the topic was performed. Results: On the basis of evidence gathered, guidelines were drawn up; optimal suggestions were included for low-resource situations. Conclusion: These guidelines are intended as an aid to all clinicians dealing with patients of laryngeal cancers. It is hoped that these will be instrumental in facilitating patient care, and in improving outcomes.

Keywords Cancer · Larynx · Imaging · Guidelines · Recommendations · Diagnosis · Staging · Treatment

Introduction

Epidemiology: Cancers of the larynx (along with that of the hypopharynx) stand at rank 22 in terms of incidence and at rank 18 in terms of prevalence worldwide [1]. As contributors to global cancer related mortality, they are at position 18 [1]. Laryngeal cancers are predominantly squamous cell cancers (SCCS) [2, 3]. SCCs of the larynx are the commonest head neck malignancies in South Korea; these are also the among the three major head neck cancers in Japan and the incidence in these nations is rising [4]. In India (where the leading head neck SCC is Oral cancer), laryngeal cancers occupy place 11 in incidence as well as in terms of cancer-related mortality among all cancers [5].

The larynx and the hypopharynx are contiguous structures anatomically- a lesion arising in one region will, in the course of time, involve the other. However, it is well known that both cancers differ distinctly in terms of disease progression, treatment paradigms and outcomes despite having a shared pathogenesis, symptomatology and histopathology

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[6–8]. Cancers of the hypopharynx of any stage are known for their aggressive tumour biology with a less predictable treatability and a definite higher propensity for distant spread as compared to laryngeal cancers. Imaging algorithms for these two regions, hence, cannot be formulated together; this paper therefore focusses only on laryngeal malignancies.

The evolving role of imaging: The laryngopharynx is a complex subsite of the head and neck; intricate and dynamic synergisms between its mucosal, muscular, bony and cartilaginous components are essential for the maintenance of the vital functions of respiration, phonation and deglutition. The management of laryngeal malignancies is based on the evaluation of all these anatomical elements; the mucosal extent is assessed by examination and endoscopy, while deeper involvement is ascertained by imaging [6, 9]. Direct examination and imaging complement each other [10], and in combination with other relevant information such as patient factors and previous history, aid clinicians in arriving at a treatment decision.

The evolution of the role of imaging in the assessment of laryngeal malignancies has coincided with the transformation in management protocols for these cancers. The radiologist's role now no longer remains restricted to assigning patients to a surgical versus a non-surgical modality of management [11] consequent to very significant advancements in surgical [12] and imaging technology [13, 14] as well as growing insights into the epidemiology of these cancers [15, 16]. There is new focus on imaging as a means to patient selection and outcome improvement [17, 18].

As described above, imaging is important; however, it must be necessarily preceded by a complete clinical examination [6]. Endoscopic evaluation is a pre-requisite in the evaluation of morphology and disease extent in patients with cancers of the larynx. An office based indirect laryngoscopy or Hopkins telescopy is usually a preliminary but valuable investigation. Subsequent assessment for glottic cancers include, whenever feasible, video laryngoscopy with narrow band imaging (NBI)/i-scan along with stroboscopy, with the patient awake and phonating, to ascertain cord morphology and mobility [19, 20]. Awake endoscopy can also be crucial for determining the extent of smaller or subtle lesions that may be revealed when the patient swallows and phonates [6]. Image enhanced endoscopy is found useful in determining esophageal involvement and of the presence of a second primary in the cervical esophagus [6, 21].

Purpose

We aimed to draw up a set of evidence-based recommendations for the imaging of cancers of the larynx, intended to aid clinicians at each step of their management.

The specific details of clinical features of these cancers along with nuances of all aspects of their management can be studied in depth from the various treatises referred to in this paper. The practical implications of specific radiological findings in terms of treatment decisions for the various regions of the larynx is well explained in other works [22–25]. In addition, elegant descriptions of the salient CT and MRI features of all stages and subsites of the region have been published [26]. Our objective is to provide the clinician with concise *referenced* guidelines on the subject of imaging for these cancers. We aim to enlist indications for radiological evaluation at various stages of disease management, its timing, the choice of imaging modality and possible alternatives for lower-resource settings.

Materials and Methods

A multi-disciplinary review of literature on the topic was carried out; the members of the group included surgical, medical and radiation oncologists and a radiologist, all involved in the management of patients with head neck cancers. The search was focused on recommendations from expert panels and consensus documents (Table 1). The meta-analyses or systematic reviews, and original prospective or retrospective cohort studies on which these guidelines were based were examined. Additionally, practice based papers by groups of experts, published after 2010 were studied. Articles based upon comparisons between radiological, clinical and histological findings, published from 1990 onwards were also considered. The guidelines were reached upon after discussion and consensus.

Results

Recommendations (Table 2).

1. Recommendations on Imaging For Initial Evaluation For Primary.

(The discussion for each subpoint is to be found at the completion of the section).

1a). Is imaging indicated for all cases: Imaging is recommended for the evaluation of laryngeal cancers of all stages and all subsites (regions).

1b). Exceptions to Recommendation 1a: For T1a cancers on a mobile cord slated for radiotherapy, a thorough clinical assessment and a microlaryngoscopy under general anaesthesia can be considered optimal for evaluation, and imaging may be omitted.

1c). Timing of imaging: Imaging should precede biopsies.

Table 1 List of existing Guidelines/Expert Panel Recommendations on imaging of laryngeal cancers

S no	Name of expert panel/group	Year
1	Guidelines of the French Society of Otorhinolaryngology (SFORL) [27]	2012
2	Tata Memorial Hospital Evidence Based Medicine Guidelines on Head Neck Cancer [28]	2012
3	Tata Memorial Hospital Evidence Based Medicine Guidelines on Imaging [29]	2014
4	European Laryngeal Society guidelines for follow up of patients of laryngeal cancer [30]	2014
5	United Kingdom National Multidisciplinary Guidelines on imaging [31]	2016
6	United Kingdom National Multidisciplinary Guidelines on hypopharyngeal cancer [32]	2016
7	Indian Council of Medical Research Consensus Statement [33]	2017
8	Korean Society of Thyroid-Head and Neck Surgery Guidelines [34]	2017
9	National Cancer Grid (India) Head and Neck Cancer Management Guidelines [25]	2019
10	European Laryngological Society Checklist [35]	2020
11	Guidelines of European Head and Neck Society (EHNS), European Society for Medical Oncology (ESMO) & European Society for Radiotherapy & Oncology (ESTRO) [36]	2020
12	National Comprehensive Cancer Network (NCCN) Guidelines [37]	2022

1d). Imaging modality: Computed tomography (CT) with a multidetector CT scanner or MDCT is the preferred modality for all subsites and stages. Magnetic Resonance Imaging or MRI with contrast is a complementary or corroborative investigation in select cases—i) doubtful erosion of laryngeal cartilages ii) need for assessment of the pre-epiglottic space and paraglottic space especially when considering larynx conservation surgery/ transoral laser resection in intermediate advanced laryngeal cancers c) evaluation of submucosal spread of hypopharyngeal cancers to the paraglottic space, the esophagus or the oropharynx. Further explanations may be found in the discussion below.

Discussion (1a-1d)

Cross-sectional imaging (CT or MRI) improves diagnostic efficacy when combined with clinical and endoscopic/ laryngoscopic assessment [27, 34, 38]. Radiology helps in revealing possible involvement of deeper spaces and hidden areas of the larynx that may not be apparent on endoscopy alone, such as the paraglottic and pre-epiglottic spaces and the subglottis [39]. Non-squamous malignancies of the subsite, such as chondrosarcoma, minor salivary gland cancers and metastases [39] may only be seen as submucosal bulges; here imaging is also helpful in directing biopsies [26]. Imaging can identify subtle areas of infiltration of submucosa and cartilage in early cancers [40, 41], which is important since the extent of even minor progression is known to impact radiotherapy planning especially for early cancers [41, 42].

Preoperative evaluation for transoral microsurgeries, such as laser resections, is hinged on accurate mapping with imaging [35]. These procedures are based upon a systematic endoscopic and radiological evaluation of the extent of disease; which in turn impacts surgical planning and performance, and also influences outcomes [35]. Information on minor degrees of involvement of anterior and inferior paraglottic spaces and detection of early cartilage erosion in lesions involving the anterior commissure are especially essential for planning conservation surgery [10, 43]. In addition, planning for salvage procedures if required later, is facilitated by this initial data [35]. Pre-operative imaging with either CT or MR is important in confirming the absence of (though not equivocally establishing the presence of) prevertebral space invasion, in cases of planned for surgery [44].

Impact of imaging on radiation planning and outcomes: In addition to staging and evaluation of extent, imaging is valuable in planning [45] and in the prediction of response to radiation using key variables such as degree of cartilage invasion and disease volume [46, 47]. Imaging is vital for mapping [48] and treatment planning in cases with submucosal spread of disease, known to be a grey area for endoscopy.

A special case that may be fully evaluable without pretreatment imaging is the early T1 glottic lesions with a mobile cord. Radiology has been found to be less critical in such a case; a complete examination with endoscopy and microlaryngoscopy can be stated to be adequate [47, 49–51]. Existing guidelines have validated the same [31, 33].

Choice of imaging modality – CT versus MRI: Both are complementary investigations [29, 33, 37], and have their own strengths and drawbacks. The decision to use one or another or both will depend upon the case in question, the treatment strategy, availability and expertise and on institutional protocols. While CT may be considered as the most widely accepted imaging modality, a contrast enhanced MRI is a valuable addition to be used when the expertise is available for specific clinical situations [23]. In such cases, both investigations are additive [23, 37].

Table 2 Recommendations in outline

S.No	Stage of evaluation	Candidates for imaging	Exceptions if any	Timing of imaging	Modality	Additional or alternate imaging modality	Comments
1	Initial Evaluation of primary disease (diagnosis and staging)	All	Early T1 glottic cancers with mobile cords	Prior to biopsy	Contrast enhanced multi-detector CT	Contrast MRI as trouble-shooting investigation in a) paraglottic space involvement b) laryngeal cartilage invasion	Both CT and MRI are complementary and come with their own advantages and disadvantages
2	Initial evaluation for neck nodes	All	Early glottic cancers	Along with imaging for the primary	As for the primary-usually CECT	-	MRI has a comparable accuracy to CT for nodal assessment
3	Initial evaluation for chest and distant metastasis	Loco-regionally advanced cancers, heavy smokers	Not mandatory in early node-negative glottic and early node-negative low volume supraglottic cancers	Along with primary	CECT	PET-CT for cases with advanced nodal disease, large primary (T4b)	Non-contrast CT is adequate for screening of lung but sub-optimal for assessment of mediastinal nodes In early glottic cancers, a Chest X-ray would suffice
4	Early post-treatment period—advanced stages	Advanced disease treated with chemoradiation or surgery with concern for residual or early recurrent disease; symptomatic patients	–	–	CT/MRI < 12 weeks PET-CT > 12 weeks	Ultrasound with guided biopsy or cytology for neck disease	In the very early post-treatment period i.e. < 12 weeks, PET-CT would be less accurate for assessment due to high false-positives
5	Early post-treatment period—early or intermediate stages	Baseline for future reference	–	Case based; 6–12 weeks	CT/MRI	–	This imaging is useful for future comparisons and for planning salvage if required
6	Follow-up imaging in asymptomatic patient (intermediate or long term)	As per early imaging when done; otherwise as per merits of each case	–	Case based	Case based	USG neck for nodal status	Periodic Imaging is not mandatory and can be individualised
7	Recurrent disease	On occurrence of symptoms or evidence of recurrence on clinical examination	–	–	PET-CT	Multi-parametric MRI or DW MRI	Imaging will reveal loco-regional and distant disease status as well as eligibility for salvage surgery

Practical considerations and comparisons between CT and MRI are well established. Imaging with CT provides the advantages of availability, familiarity, patient compliance and ease of post-imaging reconstruction [14]. In addition, the chest can be imaged simultaneously with the neck in the same sitting [14, 31, 36]. However, CT scans provide poorer soft tissue delineation; there may also be over or understaging of key radiological features such as cartilage erosion and extra-laryngeal extension [52].

MRI comes with the advantage of anatomical multiplanar imaging, better soft tissue delineation and higher sensitivity. However, it is less easily available, requires a longer image acquisition time with consequent patient discomfort [31, 35], and is prone to motion artifacts owing to breathing and swallowing [53]. For early lesions, acquiring an MRI scan for a mobile larynx can be challenging [54]. In addition, although MRI has a multiparameter feature (such as T1, T2, post contrast, diffusion weighted MR and several fat suppression techniques); which make tissue contrast better, these require to be interpreted by an experienced radiologist [55].

Relative accuracies of CT/MR– deep spaces of the larynx: The involvement of the pre-epiglottic and paraglotttic spaces determines the T-stage, propensity for transglottic spread and nodal metastases, as well as response to radiation [40, 53]. In addition, the presence or absence of involvement of these areas and the extent of invasion determines the choice of open laryngeal conservation surgery [22, 53]. CT and MRI are both sensitive for assessment of the paraglottic space, however specificities are intermediate owing to an over or under-estimation of spread [40, 53, 56]. CT has been found to have low specificity in detection of the inferior paraglottic space [49]. MRI may help to overcome this pitfall when Diffusion weighted (DW) images with contrast coupled with specific diagnostic criteria are put to use [40]. DW sequences have the potential of a more precise discrimination of peritumoral edema from neoplastic tissue, which may lead to a finer assessment of the paraglottic space [53].

CT and conventional MRI both have good accuracy rates for the detection of the involvement of the pre-epiglottic space [34, 39, 40]. However, it has been noted that there have been no direct comparisons between the newer techniques of MRI with CT for evaluating this space [40].

Relative accuracies of CT/MRI– cartilage erosion and extra-laryngeal spread: Identification of laryngeal cartilage invasion—especially the thyroid cartilage, and evaluation of the extent of such invasion is vital to management decisions and prognostication. The determination of any degree of erosion helps resolve issues such as feasibility of an endoscopic transoral resection versus open partial laryngectomy procedures as also the kind of open surgery envisaged [55, 56]. The appropriateness of a non-surgical organ preservation protocol over total laryngectomy [23] hinges on findings of cartilage erosion and or extra-laryngeal spread [23, 57]. Despite technological advances, there remain difficulties in predicting invasion both with MRI and CT scan; with possibilities of over and under-estimation of involvement [57]. MRI can be decisive in cases with uncertain findings of invasion seen on CT. In cases with suspicious or equivocal cartilage erosion (or extra-laryngeal spread) seen on CT scan, the MRI finding may be accepted as confirmatory for a positive or negative spread of disease. This holds good for invasion of the inner perichondrium, minor inner thyroid cartilage erosion as well as full thickness involvement with extra-laryngeal spread, all of which may be contentious on the initial CT [23, 28, 58, 59]. The application of MR interpretation using recently defined variables has been shown to override the drawbacks of CT in this respect [55]. Dual energy CT has been shown to have advantages over conventional CT for assessment of the status of laryngeal cartliages; it is seen to have accuracies comparable to MRI in this respect [60–63]. CT and MRI are complementary investigations in the assessment of less common malignancies of the larynx such as neuroendocrine tumours and paragangliomas. MR angiography and diffusion weighted imaging can add important information in vascular tumours such as the latter [63, 64].

Technical Recommendations for Image Acquisition

Image acquisition protocols must to be adhered to for optimum results. Guidelines and recommendations have been laid out for these [13, 26, 35, 39]. Briefly, CT scans must acquire thin slice sections with reformation at narrow intervals and appropriate planes for viewing. Viewing should be done both at the soft tissue and bone window settings [13]. Scans should be performed during quiet respiration. Patients should be instructed not to swallow during the evaluation [32]. Magnetic resonance imaging scanning should be done using a combination of axial, sagittal and coronal T1W and T2W sequences, with contrast enhancement and spectral fat suppression to assess the extent of soft tissue involvement and cartilage invasion [13, 32]. Newer advances such as radiofrequency coils for MRI could reduce motion artifacts [13]. In addition, dynamic manoeuvres—such as Valsalva or prolonged phonation—may be followed for better delineation [13, 27]. Finally, it has been recommended that the imaging be reviewed by a multi-disciplinary head neck disease management team that would include a dedicated head neck radiologist, using DICOM software (with multiplanar reconstruction in case of CT) [35].

Recommendations on Imaging for Initial Evaluation for Secondaries

2a). Imaging for nodal metastasis: The neck is to be imaged with the same modality as the primary, usually a contrast enhanced CT scan for most patients; an MRI has comparable accuracy [36].

In the case of an early glottic cancer as described in the Sect. 1a). Is imaging indicated for all cases: Imaging is recommended for the evaluation of laryngeal cancers of all stages and all subsites (regions)."b, this is an optional investigation for lower resource centres.

2b). Imaging for the chest: The lung is to be evaluated to rule out metastatic disease in a subset of patients [8, 36, 65]. *Contrast CT of the chest* is recommended (along with the primary and the neck) in case of advanced cancers, node positive disease and in heavy smokers, to rule out a metastatic focus and or a synchronous second primary. This investigation also aids in ruling our mediastinal lymphadenopathy and lung metastases in subglottic cancers*[66].

Chest X-Ray alone may be done in early cases of glottic cancers as baseline [33].

A non-contrast CT scan is an effective screening tool for the chest, however, it is less accurate for the detection of mediastinal adenopathy which may be a concern for cases with initial N2/N3 disease, lower or bulky nodes and bilateral neck node positivity [62].

2c). Role of PET-CT: Recommended specifically in patients with high probability of distant metastasis – (N3 node, multiple/bilateral neck nodes, lower cervical neck nodes or a large primary lesion (T4b) [25, 28, 34, 37].

Where a PET-CT is not available, a contrast CT of the chest would be considered optimum [28, 33].

As stated above, though PET-CT has higher accuracy over CT and MRI, for the detection of distant metastases and synchronous primaries in the setting of initial evaluation, it is not yet incorporated within existing guidelines [67].

Recommendations on Imaging for Post-treatment Response Assessment

3a). Recommendation on need and timing for short-term post-treatment imaging: Decisions on the requirement of imaging in the very early / early post-treatment period depend upon the initial disease status and modality of treatment.

A definite indication for very early imaging—at 1–2 months post- therapy—is the patient with symptoms[37], where persistence of disease or development of a new metastatic focus has to be determined.

Very early imaging would also be indicated in locoregionally advanced cases treated with concurrent chemoradiation where there is definite concern for incomplete response and residual disease on clinical assessment[28, 29, 37].

Early imaging- at 3–4 months post-therapy- is recommended for advanced disease where there is concern for residual or early recurrent disease (but not as high as in the scenarios mentioned above) [4, 28, 37].

Following laryngeal conservation surgery with consequent significant anatomic alterations, imaging as a baseline for future reference is recommended on a case-to-case basis and can be 6 to 12 weeks post-procedure [28, 34, 35].

3b). Modality of imaging for early / very early post-treatment evaluation: *Whenever imaging is indicated for cases treated with organ preservation protocol, as elucidated above, the modality of choice would be a PET-CT;* this must be done not before 12 weeks after completion of treatment to reduce false positive results. In such cases, the role of PET-CT would be to rule out local, regional as well as distant recurrence [28, 34, 62].

CT/MRI as per institutional practice is recommended in case an earlier assessment is indicated (< 12 weeks)[28, 30, 68]. In resource constraint centres with no facility for a PET-CT, if follow is being done using a CT/MRI, the lower positive predictive values of both modalities for detecting recurrences or metastases must be kept in mind [68].

When imaging is being carried out as baseline for facilitating follow-ups, such as that done after conservation surgery for early stage disease,as mentioned above, a CT/MR is recommended [28, 35].

In the case of patients who are treated initially with induction (neo-adjuvant) chemotherapy, imaging for response assessment (either CT or MRI) is best done 2 weeks after the second or third cycle [28, 37].

3c). Imaging for restaging: Apart from the specific situations enumerated above, imaging may also be performed for routine restaging subsequent to organ preservation protocols. The choice of timing and modality of radiology for this purpose depends upon a clinical estimation of disease response [37, 68].

PET–CT is the investigation of choice for detection of disease in the post-treatment period provided it is carried out after 12 weeks [34]. *For earlier scans, or If PET-CT is not available, a CT or an MR as per institutional practice is to be carried out [446,56,66].*

In order to carry out solely an assessment of post treatment nodal status, an ultrasound of the neck with guided sampling of suspicious areas is an efficacious modality [37, 69].

Recommendations on Imaging for Follow -Up (Intermediate and long-term)

4a). *When very early or early imaging has been performed (as per* Sect. "Recommendations on Imaging for Post-treatment Response Assessment"*), subsequent imaging will be done accordingly* [37].

4b). Imaging for asymptomatic patients on follow-up. *The choice and frequency of imaging is as per merits of the case; factors to be considered are tumour differentiation, initial stage, completeness of treatment and ease of evaluation* [31, 37].

For asymptomatic patients in the intermediate (4–6 months) and long-term (> 6 months) follow up, imaging facilitates assessment of disease status where there has been significant distortion of anatomy due to treatment induced changes, wherein a clinical and or endoscopic/microlaryngoscopic evaluation is not feasible or is inconclusive [28, 37]. These changes may represent post-treatment fibrosis, edema and strictures.

4c).*Follow-up assessment of the initial node positive neck may be done optimally with an ultrasound (with a guided fine needle aspiration if required)*. This is especially true for treatment centres with resource constraints, where the status of the primary is being confirmed clinically and endoscopically [37, 69].

4d). Long term imaging: *Existing guidelines do not include long-term / regular imaging for routine follow up*. There have been cost–benefit studies of prolonged surveillance with imaging for head neck cancers in general, the results of which supported regular imaging in the first 5 years [70]. However, several audits by follow-up clinics have revealed a very low probability of recurrence in asymptomatic patients [71]. In addition, survival benefits of the detection of recurrence in clinically disease-free patients has remained doubtful [72]. These may be the reasons why periodic radiological tests for asymptomatic patients on long term follow-up is not considered to be a mandatory part of evaluation of disease-free status.

Recommendations on Imaging for Recurrence

5a). Pain is the predominant symptom of relapse, especially in advanced cases and must not be ignored. In earlier stages, recurred hoarseness or dysphagia will be the main symptom that will prompt further investigation to rule out recurrent disease [71]. Mapping of recurrences with imaging can be effective since it has been seen that salvage surgeries for recurrent laryngeal cancers (treated initially with radiotherapy alone or with laser resection) can result in 5-year overall survival rates of 57–70 percent [73].

PET-CT is optimum for both loco-regional and distant metastatic assessment [28, 37].

5b). Post- treatment changes and sequelae (such as chondronecrosis) may prove to be equally persistent and symptomatic as recurrences [74].

PET-CT and MRI done with a multi-parametric approach are both valuable in differentiating between disease recurrence and treatment sequelae [57].

Identification of recurrence within an area of chondronecrosis may prove complex in both MRI and CT; a DW MR may be valuable here [40]. Perfusion weighted imaging (MRI) has also been shown to be of corroborative value in this respect [62].

Lacunae

There are certain limitations in the submissions above that must be mentioned.a) Contemporariness and quality of guiding documents: The recommendations above are based on consensus statements and guidelines formulated by multi-disciplinary oncology boards from renowned institutions. Some of these could be seen to be less contemporary (Table 1), considering ongoing technological advances.

A quality assessment study published in 2018 based on the 'AGREE' tool for the appraisal of guidelines [75] found most of the existing guidelines for imaging of head and neck cancer to be heterogeneous and of average to low quality.

Finally, since several of these guidelines were generalised for all head neck cancers, we had to extrapolate some recommendations to the larynx. (b) Guidelines for adoption of new advances: We were unable to include specific guideline statements on newer developments in CT and MRI, such as Dual CT [60–62], Diffusion weighted MRI [55] and Radiomics [76]. These techniques are still being evaluated and they will possibly find mention in future consensus documents. (c) Guidelines on other aspects: Lack of recommendations on imaging for issues related to functional outcomes such as speech and swallowing is also one area where this document could be seen as lacking. These are important determinants of post-treatment quality of life. Imaging for factors influencing speech and swallowing outcomes [77] and procedures for dynamic phonation and swallowing evaluation [78] are valuable resources in this respect. The inclusion of guidelines on these aspects would add significantly to the completeness of the utility of imaging of laryngeal cancers.

Conclusions

Imaging is an effective tool for better evaluation and improved outcomes in patients with cancer of the larynx. Radiological and clinical assessments for this subsite of the head and neck require to be nuanced, and subtle observations can be decisive. For an individualised treatment approach, especially when conservation strategies are planned, the collaboration between the oncologists and the head-neck radiologist plays an important role. The suggestions presented here will doubtless require revision in the near future in view of continuing developments in all relevant fields. However, we hope that in the present form they will be of value at all stages of evaluation of these patients.

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Author Contributions PSR MD conceptualized the paper. PSR did the literature search. All authors participated in the discussion of the text. CSD, PSR and MD revised the draft. All authors read and approved the final version.

Declarations

Conflict of interest The authors have nothing to declare.

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