Outcome measures for voice in the treatment of early glottic carcinoma

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List of abbreviations

AJCC	American Joint Committee on Cancer
CT	Computerized tomography
dB	Decibels
FFL	Flexible fiberoptic laryngoscopy
Gp	Group
Gy	Gray
H :N R	Harmonic to noise ratio
Hz	Hertz
M	Metastasis
MRI	Magnetic resonance imaging
N	Regional lymph node
Pt	Patient
QoL	Quality of life
Scc	Squamous cell cancer
SCPL	Supracricoid partial Laryngectomy
T	Primary tumor
TLM	Transoral laser microresection
VPL	Vertical partial laryngectomy

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Introduction

Cancer of the larynx represents approximately 0.7% of the total cancer risk in 2001 and is the most common head and neck cancer (skin excluded). The incidence being much higher among males than among females. More than 95% of all laryngeal malignancies are squamous cell carcinomas ***(Greenlee et al., 2001).***

Smoke and alcohol represent the major behavioural risk factors. Several carcinogens and occupations have been associated with laryngeal cancer ***(Licitra et al., 2003).***

Prevention and early diagnosis of laryngeal carcinoma is the most effective means for maximizing cure rates and preserving function ***(Chu and Kim, 2008).***

Because patients who have cancers affecting their true vocal fords often present with persistent hoarseness, most are identified in the early stages: T1 or T2 ***(Hoffman et al., 2006).***

Early-stage laryngeal cancer is defined as Tis (carcinoma in situ) as well as T1– T2 N0 (stage I and stage II) malignancies ***(Hinerman et al., 2002).***

The management of early glottic cancers is controversial. The options include external beam irradiation and endoscopic or external surgical approaches ***(Hinerman et al., 2002).***

Surgery and radiotherapy offer the same results in the treatment of early glottic carcinoma, with a cure rate of approximately 90% ***(Jepsen et al., 2003).***

The introduction of endoscopic CO2 laser surgery in early glottic carcinoma has added controversy to the standard treatment choice ***(Batalla et al., 2008)***

Laser surgery is quicker, which reduces cost considerably. However many institutions prefer to use radiotherapy in the belief that the voice will be better preserved after treatment. Surgery, on the other hand, presents a whole range of treatment options ***(Delsupehe et al., 1999).***

In order to decide which treatment is preferable, parameters other than survival should be assessed. An important parameter is the quality of life as it is related to voice characteristics. Post-treatment voice quality is therefore an important parameter in choosing between the competitive treatments ***(Wedman et al., 2002).***

Aim of the work

The aim of this study is to analyze the voice outcome measures after treatment of early glottic carcinoma, in order to determine the impact of various treatment modalities on voice by systematically reviewing the English language literature.

Review of Literature

Chapter 1: Anatomy of the larynx and glottis

Effective treatment and understanding of laryngeal cancer requires fundamental knowledge of the complex anatomy of this region ***(Chu and Kim, 2008).***

Anatomically the larynx extends from the tip of the epiglottis at the level of the lower border of the C3 vertebra to the lower border of the cricoid cartilage at the level of the C6 vertebra ***(Kumar, 2005).***

The larynx (fig. 1) is a hollow tube lined by mucosa and adapted for protection of the airway and phonation. The cartilaginous scaffolding of the larynx is composed of the thyroid, cricoid, and arytenoid cartilages surrounded by connective and muscular tissue that form its walls ***(Blitz and Aygun, 2008).***

The thyroid cartilage maintains a dominant presence in the laryngeal skeleton and encloses the larynx anteriorly and laterally. The hyoid bone is located superior to the thyroid cartilage and is connected to the thyroid cartilage by the thyrohyoid membrane. This bony landmark forms the upper boundary of the laryngeal framework and serves as an important point for extrinsic laryngeal muscular attachments ***(Lee, 2003).***

The thyroid cartilage articulates posterolaterally with the cricoid cartilage, which is shaped like a signet ring and lies inferior to the thyroid cartilage. The cricoid cartilage is required for maintenance of the enclosed airway because it is the only complete annular support of the laryngeal skeleton .The cricoid cartilage also provides support for the two arytenoid cartilages on its posterosuperior aspect ***(Lee, 2003).***

Based on its embryologic development, the larynx can be divided into three levels: supraglottic, glottic, and subglottic, with each level containing a number of subsites. These divisions have clinical relevance in that they help predict the clinical behavior and pattern of spread of the tumor ***(Chu and Kim, 2008).***

The supraglottis extends from the tip of the epiglottis superiorly to the apices of the ventricles and undersurface of the false folds and includes both the lingual and laryngeal surfaces of the epiglottis, the arytenoid cartilages, the aryepiglottic folds, and the false folds. The supraglottis develops from the midline buccopharyngeal anlage from branchial arches 4 and 6 with rich bilateral lymphatics ***(Chu and Kim, 2008).***

The glottic larynx encompasses the floor of the ventricle, the true vocal folds extending to 0.5 cm below the free edge of the cord, the anterior commisure, and the interarytenoid area. In contrast to the supraglottic structures, the glottis develops from the midline fusion of lateral structures derived from the tracheobronchial anlage from arches 4, 5, and 6 and has a relative dearth of lymphatics. Consequently, this embryologic boundary limits submucosal spread to adjacent sites within the larynx for early stage cancers, and the paucity of lymphatic in the glottis allowing glottic cancers to remain localized to the larynx for longer periods of time ***(Chu and Kim, 2008).***

The subglottis continues from the inferior limit of the glottis to the inferior edge of the cricoid cartilage. It develops from the 4 and 6 pharyngeal arches and because of its location has a propensity for extralaryngeal extension ***(Chu and Kim, 2008).***

The paired vocal cords (vocal folds) stretch between the vocal process of the arytenoid cartilage and the inner surface of the thyroid cartilage at the junction of its lower and the middle thirds ***(Iro and Waldfahrer, 2006).***

The true vocal cords are on average 2 cm long and are thinnest anteriorly and posteriorly where they insert into the thyroid cartilage and the vocal processes of the arytenoids, respectively ***(Million and Cassisi, 1994).***

Each of the inferior horns of the thyroid cartilage articulates with the cricoid cartilage, forming the hinged cricothyroid joint, which permits titiling movements in the sagittal plane .Each of the arytenoid cartilage has an anterior vocal process which attaches to the posterior end of the corresponding vocal cord, and a posterolateral muscular process. The base of the arytenoid cartilage articulates with the superior border of the cricoid cartilage, forming a cricoarytenoid joint of variable shape which permits rotation and gliding movements. The muscles that attach to the muscular process are particularly active in rotating the arytenoid cartilage about its longitudinal axis .Changing the position of the vocal cords alters the shape and size of the opening (glottis) between the two vocal folds ***(Heinrich and Frank, 2006).***

Vocal fold shape and movement are primarily the result of intrinsic laryngeal muscle activity. To a lesser degree, extrinsic laryngeal muscles also affect vocal fold shape and movement. The muscles that act to adduct or close the vocal folds are the lateral cricoarytenoid, thyroarytenoid, and interarytenoid muscles ***(Noordzij and Ossoff, 2006).***

The posterior cricoarytenoid muscle is the only muscle that abducts or opens the vocal folds. It originates from the posterior surface of the cricoid

cartilage and inserts onto the muscular process of the arytenoid. The cricothyroid muscle narrows the gap between the thyroid and cricoid cartilages, thereby stretching of the vocal folds ***(Noordzij and Ossoff, 2006).***

The vagus nerve provides motor and sensory innervation to the larynx through two branches, the superior and recurrent laryngeal nerves. The superior laryngeal nerve has two branches, the external branch of the superior laryngeal nerve, which provides motor innervation to the cricothyroid muscle, and the internal branch of the superior laryngeal nerve, which provides sensory innervation of the supraglottis and the glottis ***(Noordzij and Ossoff, 2006).***

The recurrent laryngeal nerves provide motor innervation for the remaining intrinsic laryngeal muscles (thyroarytenoid, lateral cricoarytenoid, posterior cricoarytenoid, and interarytenoid) and sensory innervation to the upper trachea and subglottis ***(Noordzij and Ossoff, 2006).***