Vocal fold & Arytenoid mobility in Cancer larynx
A clinico-pathological study

Thesis
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Abstract

This study included 20 cases of cancer larynx that were thought to be unfit for organ preservation surgery (OPS) by surgeons highly skilled in performing such procedures and underwent total laryngectomy as an alternative procedure.

Preoperatively, the vocal fold, arytenoid & cricoarytenoid joint (CAJ) of each case were examined clinically and radiologically.

The total laryngectomy specimens were subjected to whole organ sectioning and the glottic area of each case was examined histopathologicaly to detect tumor invasion of thyroarytenoid muscle (TAM) and cricoarytenoid joint (CAJ).

This study showed that the causes of vocal fold fixation, in order frequency, were: Deep Thyroarytenoid muscle (TAM) invasion, CAJ invasion, weight effect and invasion of arytenoid cartilage.

The results of the study show that 45 % of the cases would have been good candidates for organ preservation surgery (OPS).

During preoperative assessment of patients to select candidates for organ reservation surgery (OPS) 3 different types of arytenoid fixation need to be differentiated: Primary arytenoid fixation, secondary arytenoid fixation and false arytenoid fixation.

In light of results of this study we present a specific check list "traffic light check list" with easy to use color codes that we believe can help us to better choose candidates for OPS and decrease the number of unnecessary total laryngectomies.

Key Words: Cancer larynx - Vocal fold- Arytenoid- Mobility

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Dedication

To Mai: It is all because of you.
To Omar, Mostafa and Yahia: may your future be much better than what I dream for you.

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List of Abbreviations

Abbreviation	Word
CAJ	Cricoarytenoid joint
CAU	Cricoarytenoid unit
ETT	Endotracheal tube
Hx&E	Hematoxylin-eosin stain
LCAM	Lateral cricoarytenoid muscle
OPS	Organ preservation surgery
PCAM	Posterior cricoarytenoid muscle
TAM	Thyroarytenoid muscle
TVF	True vocal fold
VS	Versus

Introduction

The primary goal in treating laryngeal squamous cell carcinoma is to achieve local control of the tumor while preserving functions of speech and swallowing without a permanent tracheostomy **(Katilmiş et al, 2007)**. Any surgical procedure that achieves such goal should be considered as an organ preservation laryngeal surgery (OPS) **(Tufano, 2002).**

There is a variety of organ preservation laryngeal surgeries however; the most commonly used nowadays are vertical partial laryngectomy, supraglottic laryngectomy, and supracricoid laryngectomy **(Tufano, 2002)**.

All patients with laryngeal cancer should be evaluated for organ preservation surgery from their initial visit (**Tufano, 2002)**.

Organ preservation surgery (conservation laryngeal surgery) for laryngeal cancer is an art. The art is in determining which patients are eligible for an organ preservation surgical procedure and which patients are not. One must delicately balance the need for maximizing local control with a good functional outcome (**Tufano, 2002)**.

Answering such question and achieving successful outcome in conservation laryngeal surgery depends on a thorough knowledge of the surgical anatomy and understanding of the behavior and three dimensional spread of the malignancy in a particular anatomic site (**Tufano et al, 2005)**.

Much of that knowledge has been derived from clinico-pathologic studies in which the entire total laryngectomy specimens was sectioned and compared with preoperative clinical assessments i.e. physical examination with indirect and direct laryngoscopy as well as imaging techniques **(Kirchner, 1989)**.

These whole organ section studies are the basic science foundation for clinicians performing conservation laryngeal surgery (**Tufano et al, 2005)**.

Vocal fold immobility has been considered to be a contraindication for conservation surgery of laryngeal carcinoma for many years. And the majority of the authors adhere to the presence or absence of vocal cord mobility in order to perform conservation laryngeal surgery **(Katilmiş et al, 2007)**.

However with the aid of clinico-pathological studies a major shift occurred in the decision making and preoperative assessment of laryngeal cancer patients. Many authors nowadays have accepted maintenance of arytenoid cartilage mobility as adequate clearance for oncological safety of organ preservation surgery outside the setting of significant subglottic extension **(Sparano et al, 2005).**

It is now believed that the cricoarytenoid unit is the basic functional unit of the larynx. The cricoarytenoid unit consists of an arytenoid cartilage, the cricoid cartilage, the associated CAJ & musculature, and the superior and recurrent laryngeal nerves for that unit. The paradigm shift from the vocal fold to the cricoarytenoid unit is essential for the head and neck surgeon to be able to use the full spectrum of organ preservation surgeries.

It is the cricoarytenoid unit, not the vocal folds, that allows for physiologic speech and swallowing without the need for a permanent tracheostomy. As long as one cricoarytenoid unit can be preserved, the patient is a potential candidate for organ preservation laryngeal surgery **(Tufano, 2002)**.

This is a foreign concept for many surgeons who rely on the TNM system for staging laryngeal cancer which focuses on the vocal fold rather than the cricoarytenoid unit **(Tufano, 2002)**.

The commonest cause of fixation of the true vocal fold (TVF) in glottic carcinoma according to **Hirano et al** resulted from extensive involvement of the thyroarytenoid muscle with paraglottic space invasion **(Hirano et al, 1991)**.

Other causes of vocal fold fixation include invasion of the CAJ or involvement of the recurrent nerve or lateral or posterior cricoarytenoid muscles. These patterns of infiltration are usually seen with advanced tumors, which are surely not candidates for conservation surgery **(Katilmiş et al, 2007)**.

Brasnu et al in 1990 found that there are two major causes of arytenoid fixation the first cause is involvement of the arytenoid-related intrinsic laryngeal muscles or the cricoarytenoid joint or both. In such cases, vocal fold mobility is always affected but may only be secondary to arytenoid immobility.

The second one is immobilization of the arytenoid by the weight of the tumor covering it. What they have called the "weight impact". In such case only the top of the arytenoid cartilage is immobilized while its base, invisible on indirect laryngoscopy, remains mobile. **(Brasnu et al, 1990)**.

From the above mentioned data, we can see that a laryngeal tumor classified as T3 does not always imply total laryngectomy **(Katilmiş et al, 2007)**.

The T3 lesion describes a fixed vocal fold. This may be secondary to paraglottic space invasion or cricoarytenoid joint involvement. The former would be a candidate for OPS versus the latter, where the cricoid cartilage is involved with tumor **(Tufano, 2002)**.

In other wards a fixed cord associated with a mobile arytenoid cartilage does not represent a contraindication to conservation laryngeal surgery in the absence of a subglottic extension **(Brasnu et al, 1990)**.

Aim of the work

To compare preoperative assessment (clinical & radiological) of cases of cancer larynx with fixed vocal fold(s) to the tumoral involvement of the cricoarytenoid joint (CAJ) & thyroarytenoid (TA) muscle, in whole organ sections of postoperative total laryngectomy specimens.
This will help us to accurately specify the indications for organ preservation laryngeal surgery (OPS) and to increase the ratio of partial/total laryngectomies performed in our department.