

BioRob Roma 2012

Workshop on Robot-Assisted Laryngeal Microsurgery

# State of art and future perspectives of laryngeal carcinoma surgery

*Department of Otorhinolaryngology  
University of Genoa, Italy*



*Prof. G. Peretti*



istituto  
italiano di  
tecnologia



Leibniz  
Universität  
Hannover

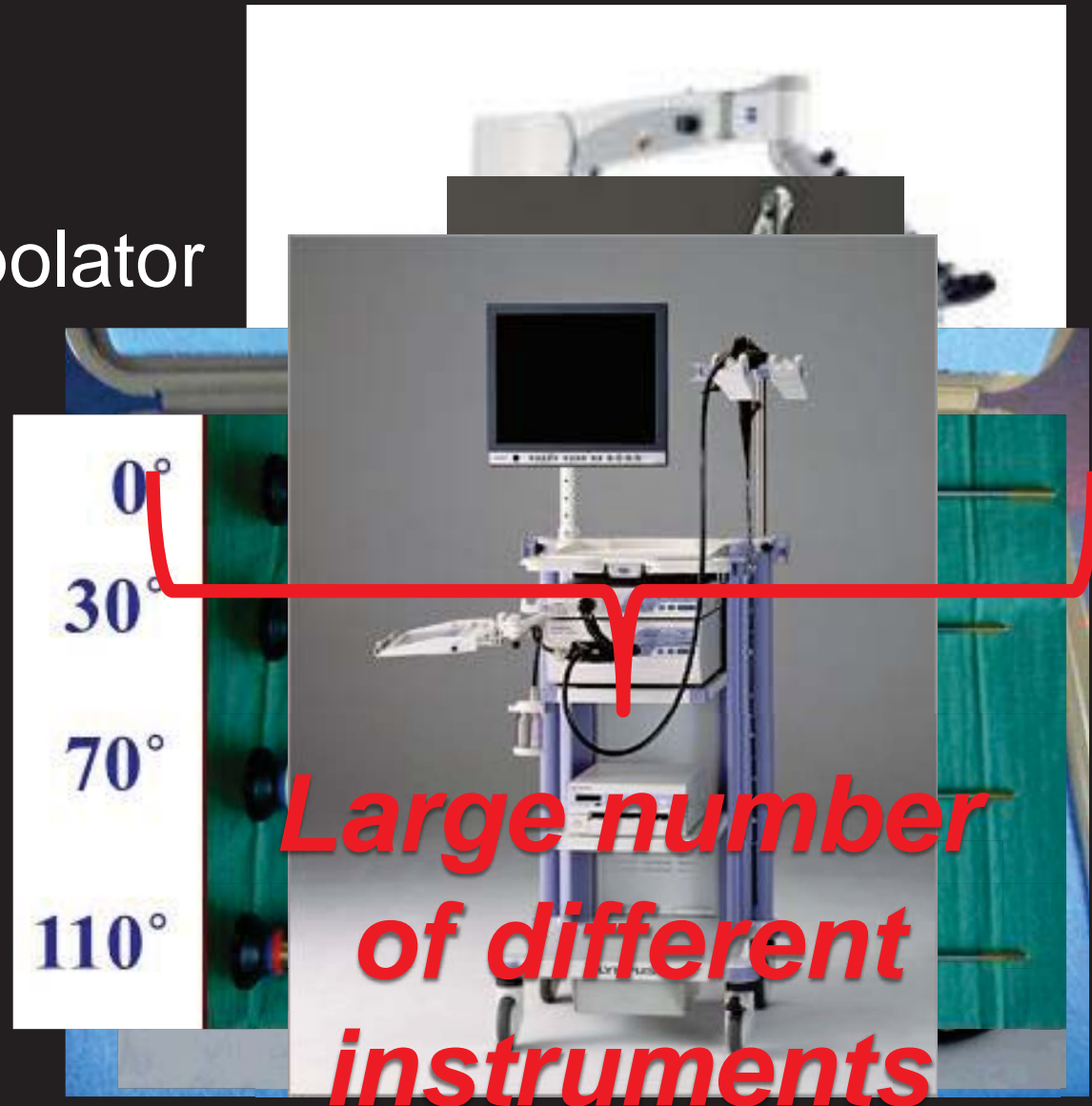


# TRANSORAL LASER SURGERY



## EQUIPMENTS

- ✓ Microscope
- ✓ Digital micromanipulator
- ✓ Laser
- ✓ Laryngoscope
- ✓ Endoscope
- ✓ NBI & HD camera



# PATIENT AND SURGEON POSITION



# TRANSORAL LASER SURGERY

## ADVANTAGES

- ✓ No tracheotomy
- ✓ Minimal morbidity
- ✓ Custom tailored resection
- ✓ Preservation of the laryngeal framework
  - ✓ Unchanged laryngeal position
- ✓ No preclusion to further treatments
  - ✓ Short hospitalization time
  - ✓ Good cost-effectiveness ratio

**BUT...**



# FOR ACHIEVING GOOD OUTCOMES



**PATIENT SELECTION**  
(in terms of compliance and  
TNM staging)

**ADEQUATE LARYNGEAL  
EXPOSURE**

**PREOPERATIVE  
DIAGNOSTIC  
WORKUP**

**IMAGING**



**INTRAOPERATIVE  
DIAGNOSTIC  
WORKUP**

**EXPERIENCED SURGEON  
AND MULTIDISCIPLINARY  
TEAM**

**POSTOPERATIVE  
FOLLOW-UP**

**EVERYBODY MUST BE STICKED TO ESSENTIAL  
REQUIREMENTS**

# TRANSORAL LASER SURGERY

## INDICATIONS

- ✓ Squamous cell carcinoma; Tis, T1, T2 and selected T3
  - ✓ Young and Elderly patients
  - ✓ Salvage surgery after RT for rT1 and rT2
    - ✓ Not radiosensible tumors

# TRANSORAL LASER SURGERY

## CONTRAINDICATIONS

- ✓ **Inadequate exposure of the endolarynx**



**“FOUR T”**  
 Superior paraglottic space involvement  
 crico-arytenoid joint fixation  
**TREATMENT**



Posterior commissure involve TRISMUS



Laryngeal framework infiltration  
TEETH  
TILT  
Transcommissural vertical extension



# DIAGNOSTIC WORK-UP

## PREOPERATIVE

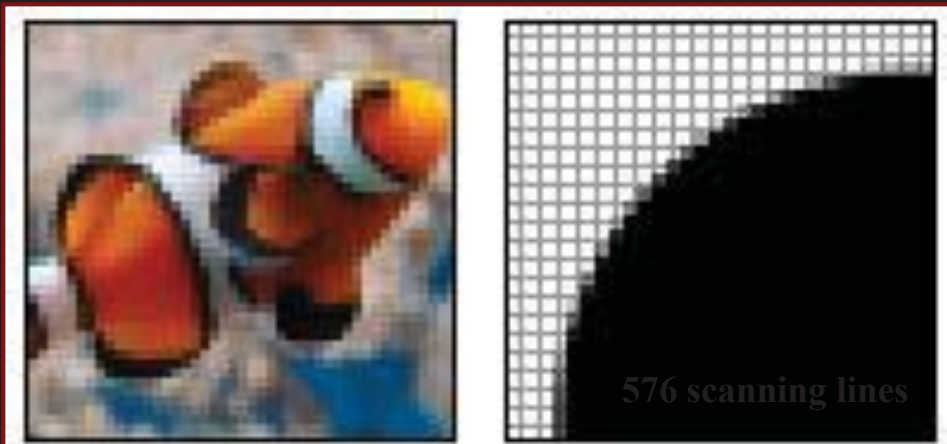
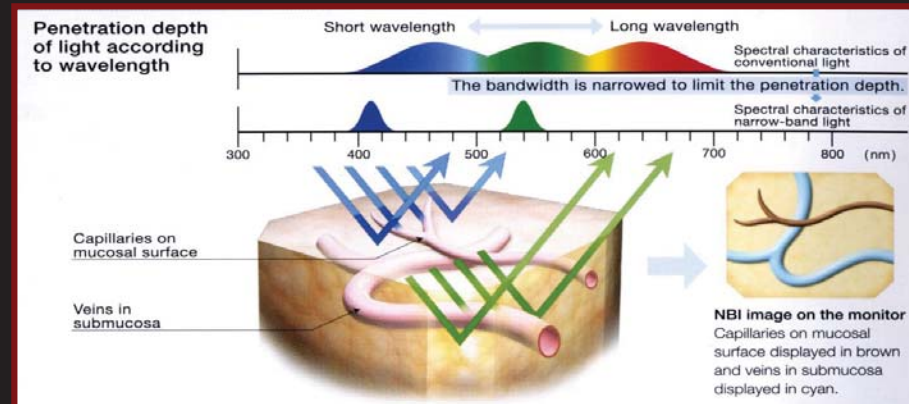
- ✓ Flexible panendoscopy
- ✓ Videolaryngostroboscopy
- ✓ Narrow Band Imaging
- ✓ Imaging



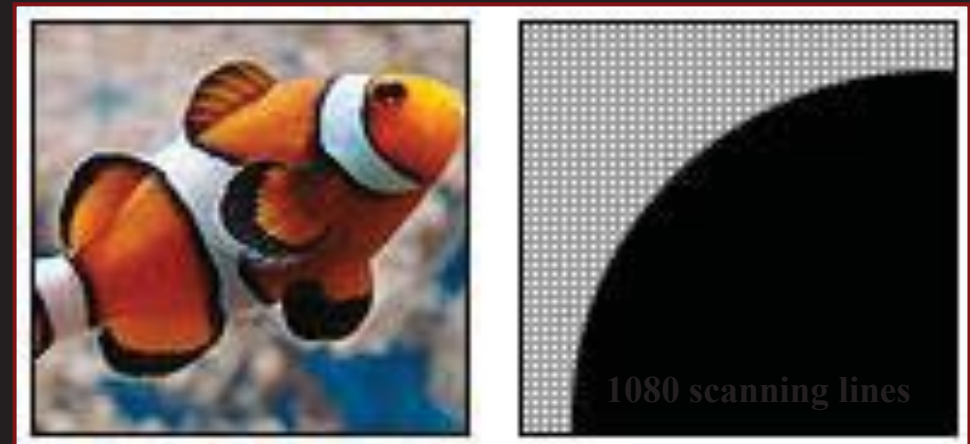
# DIAGNOSTIC WORK-UP

## PREOPERATIVE

### Narrow Band Imaging



**STANDARD TV IMAGE**

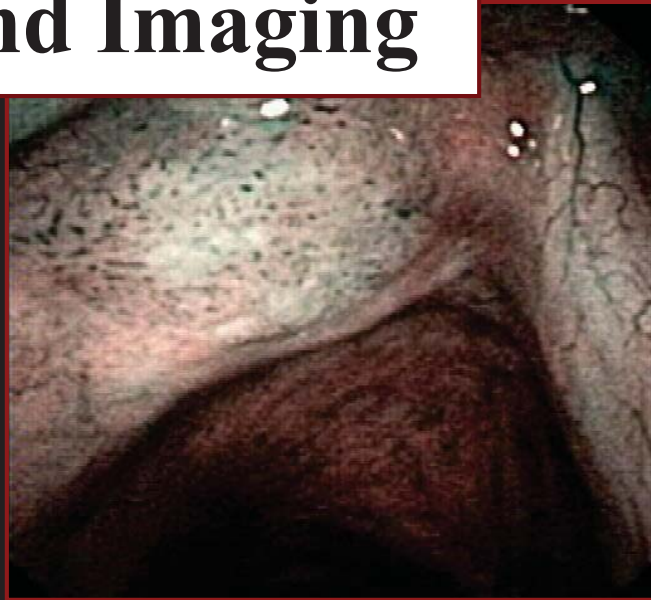


**HDTV IMAGE**

# DIAGNOSTIC WORK-UP

## ATYPICAL VASCULAR GROWTH PATTERN

### Narrow Band Imaging



#### **Type I:**

well-demarcated brownish area with thick dark spots



#### **Type II:**

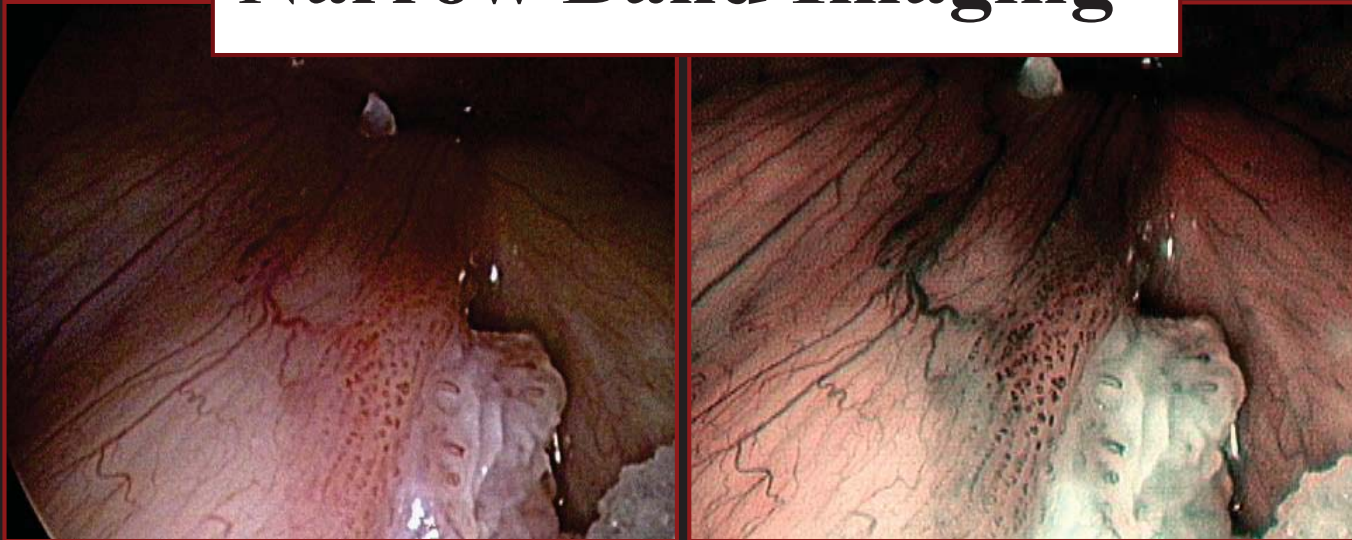
undemarcated area with scattered irregular and winding vessels



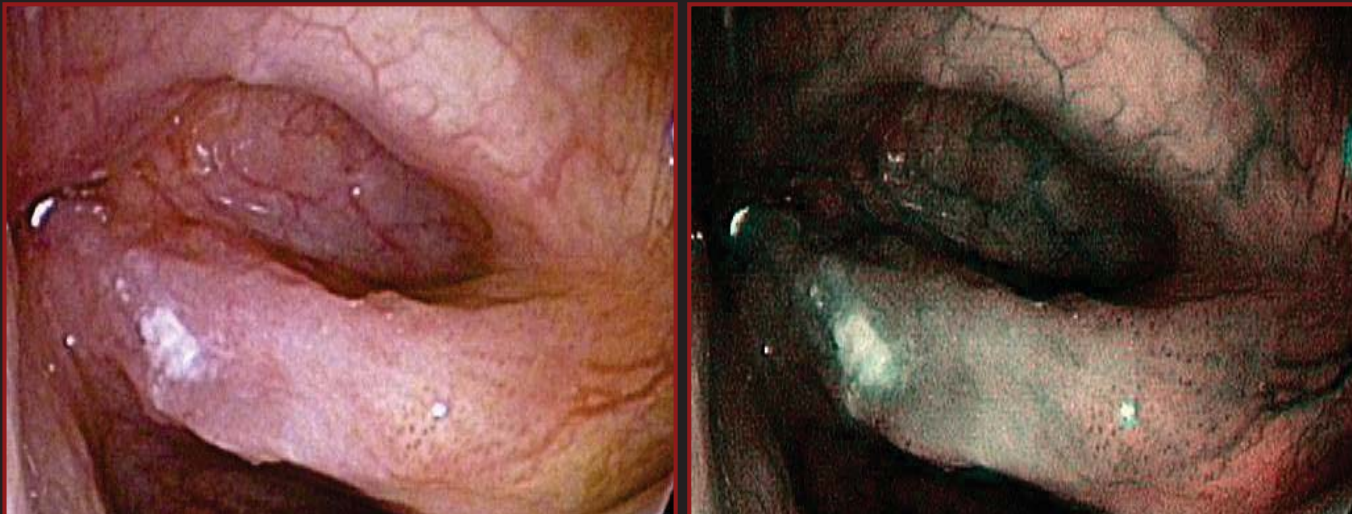
# DIAGNOSTIC WORK-UP

## ATYPICAL VASCULAR GROWTH PATTERN

### Narrow Band Imaging



**Type III:**  
presence of an afferent  
hypertrophic vessel  
branching out in small  
vascular loops in the  
context of the lesion



# DIAGNOSTIC WORK-UP

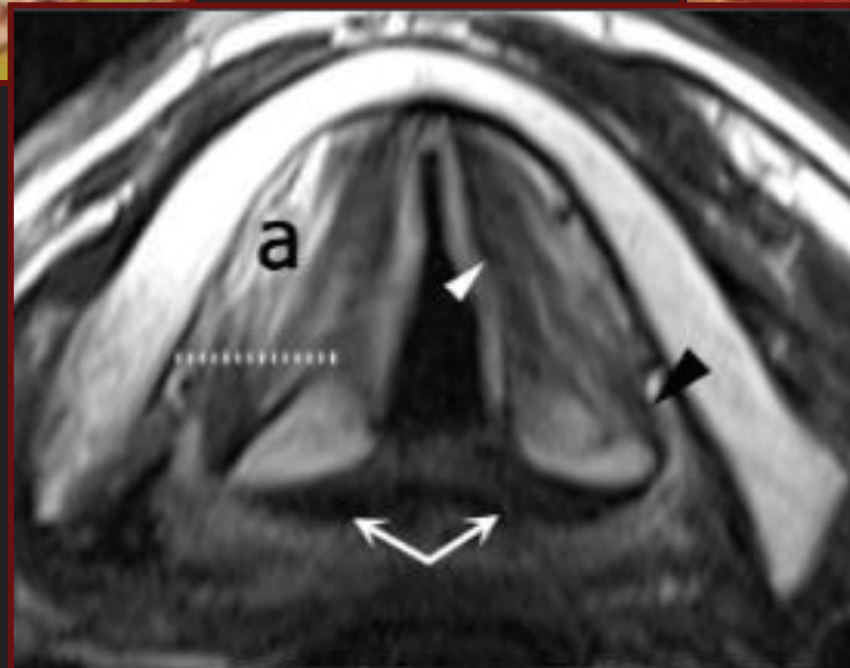
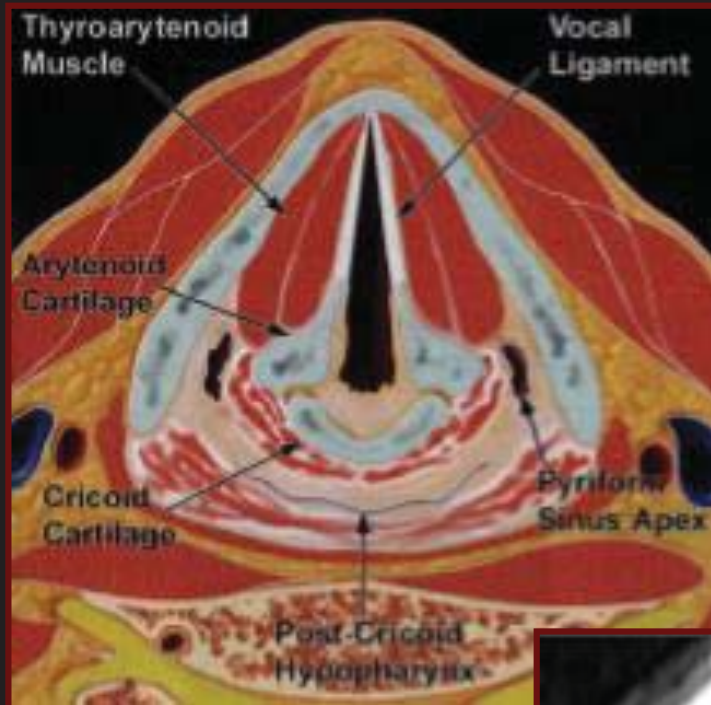
## PREOPERATIVE

### Imaging (CT, MR)

- ✓ Involvement of laryngeal framework
- ✓ Paraglottic and preepiglottic involvement
- ✓ Submucosal spread

# DIAGNOSTIC WORK-UP

## IMAGING

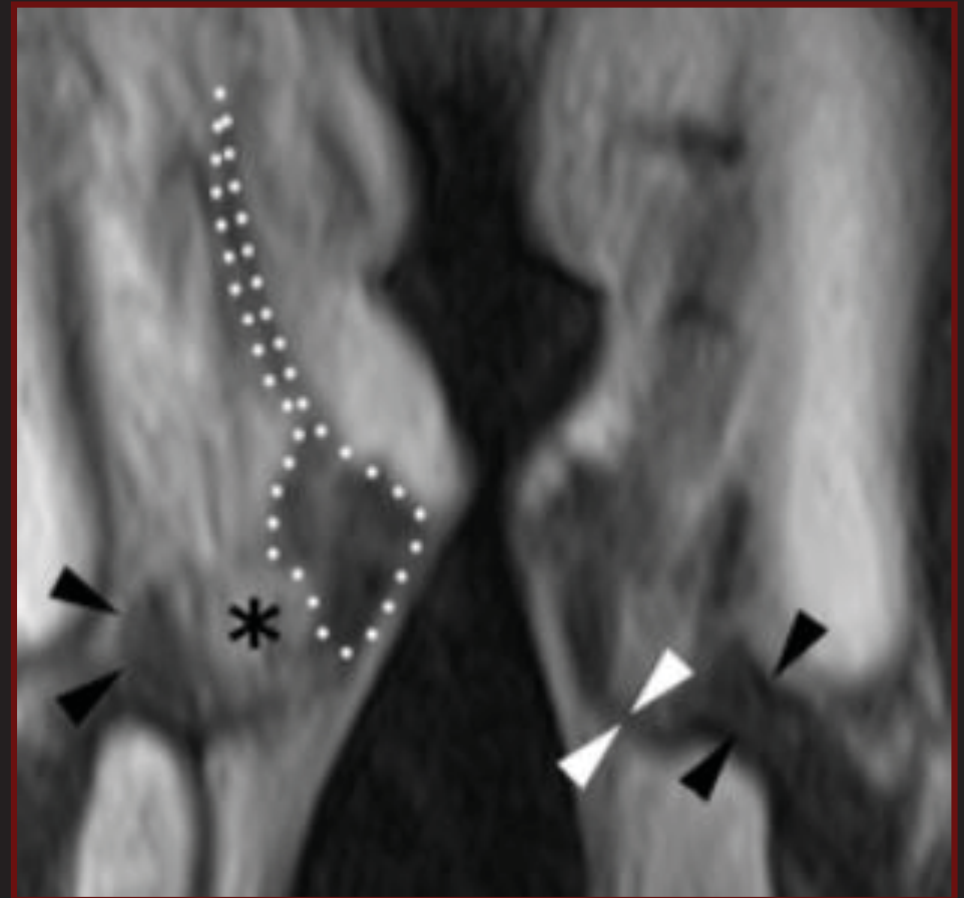
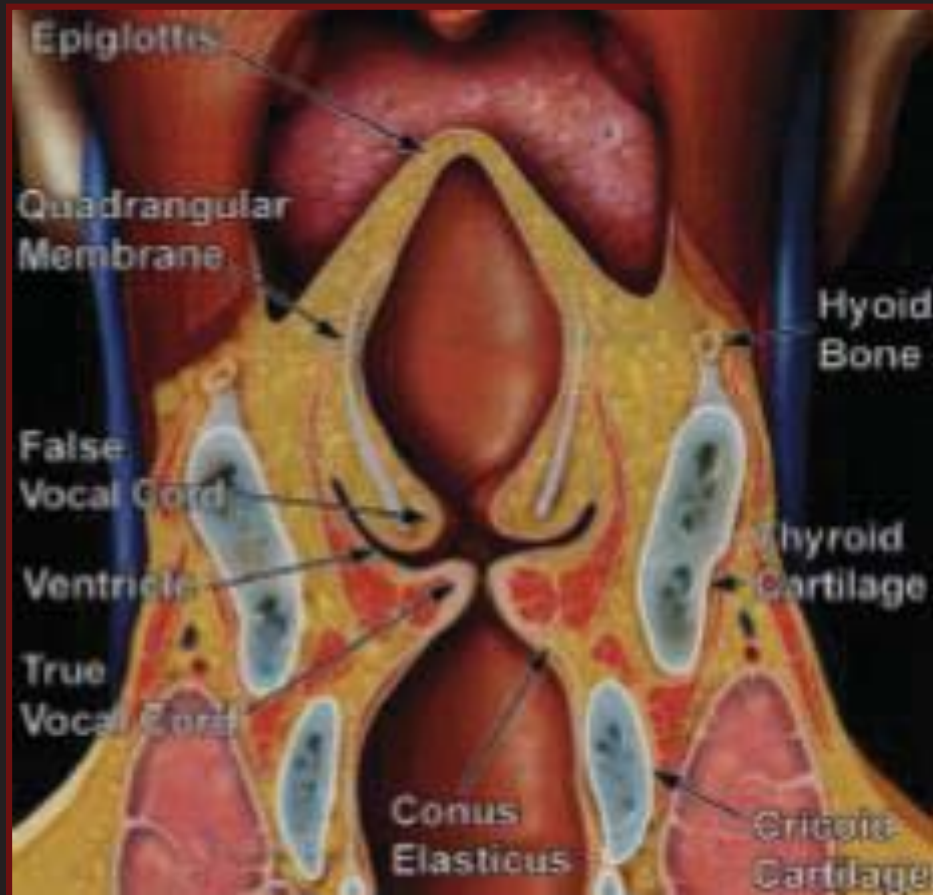


**NORMAL  
ANATOMY**



# DIAGNOSTIC WORK-UP

## IMAGING



**NORMAL ANATOMY**

# DIAGNOSTIC WORK-UP

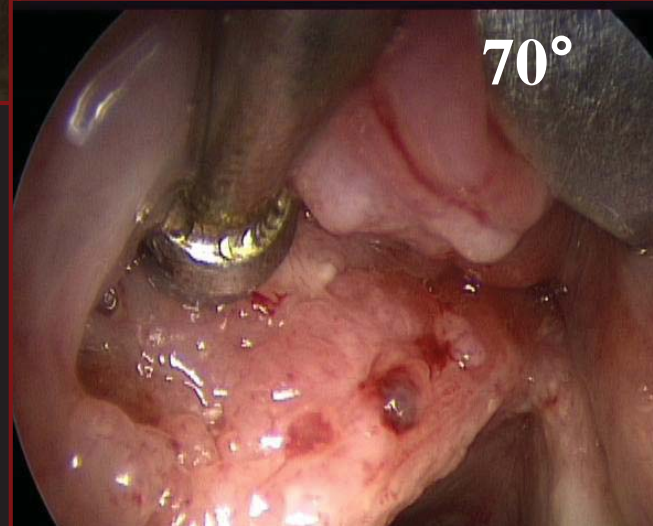
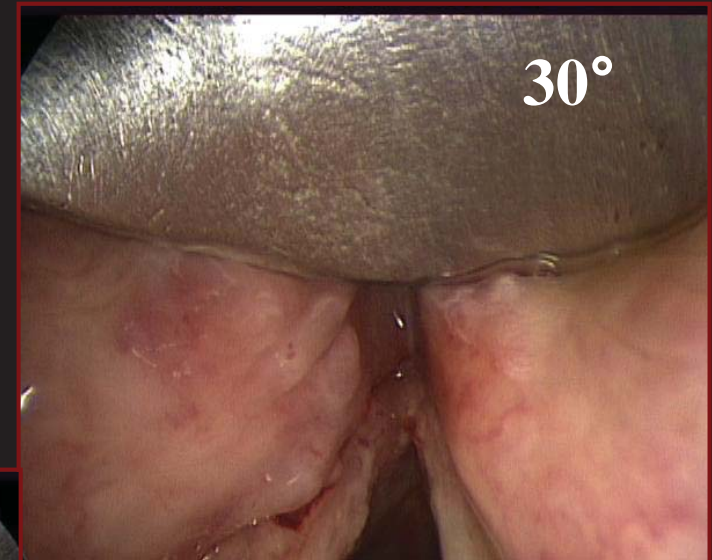
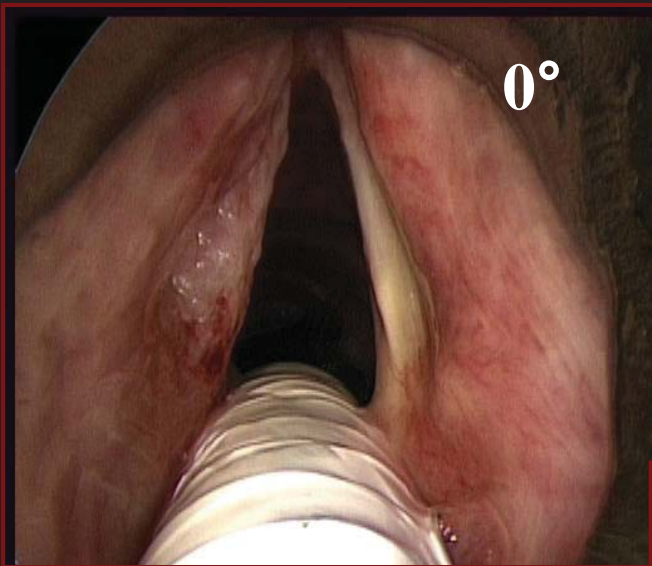
## INTRAOPERATIVE

- ✓ **Rigid intraoperative endoscopy with 0° and angled telescopes**
- ✓ **Narrow Band Imaging with HDTV**
- ✓ **Saline infusion into the Reinke's space**

# DIAGNOSTIC WORK-UP

## INTRAOPERATIVE

### Rigid intraoperative endoscopy

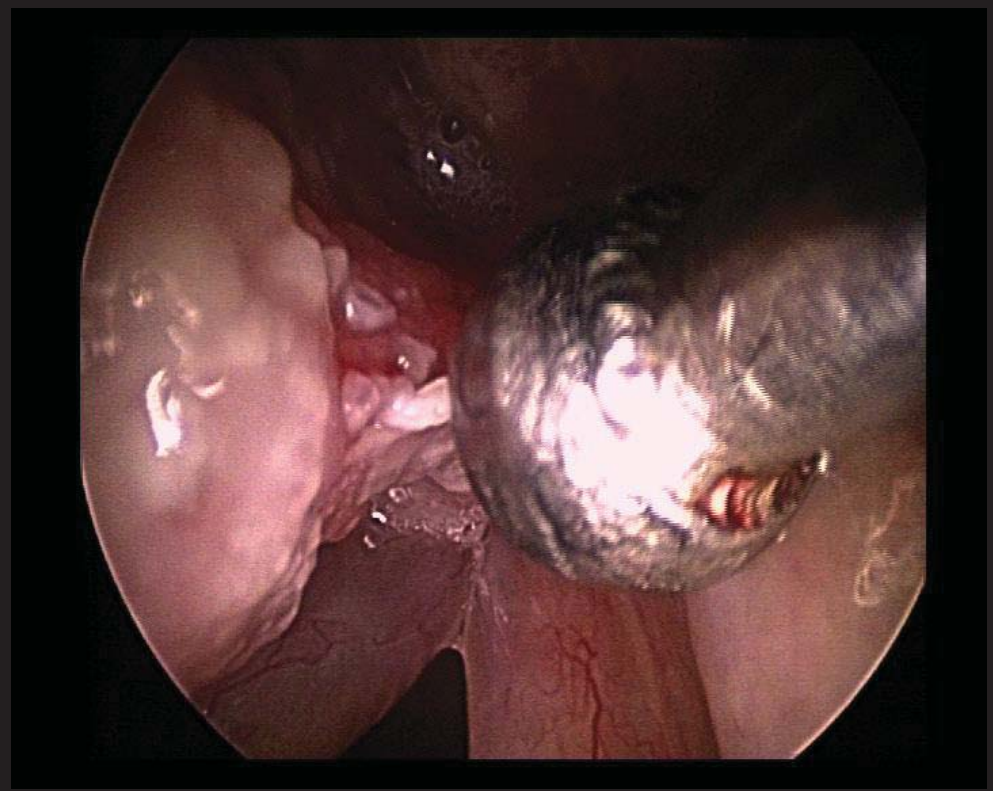
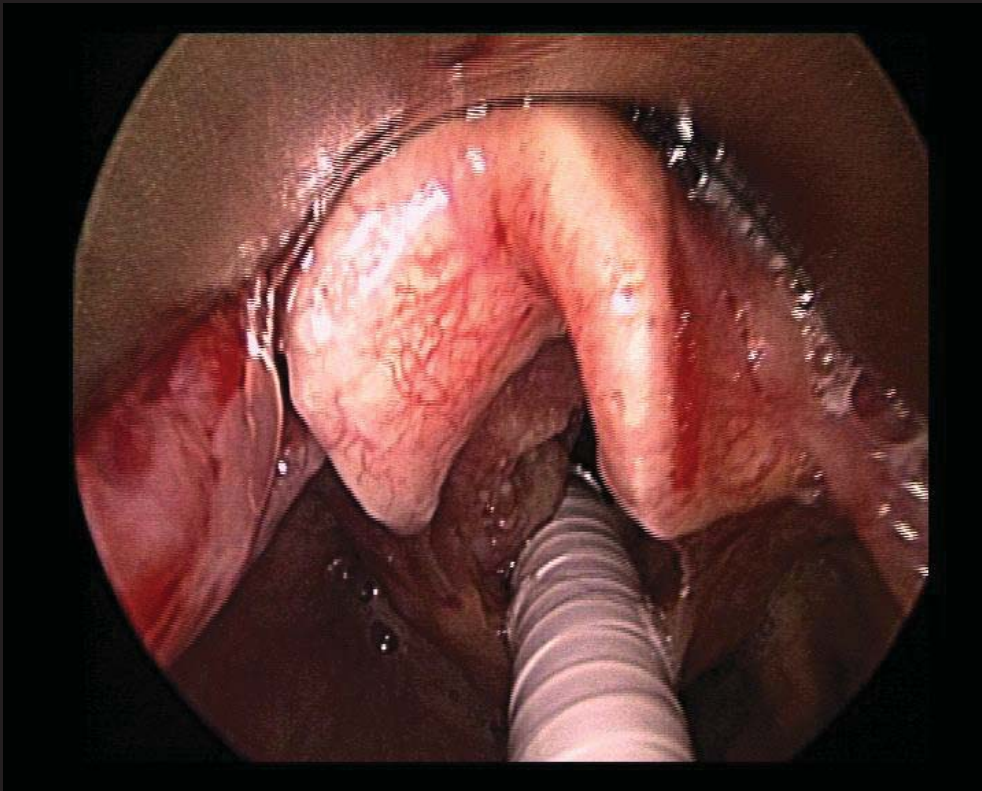




# DIAGNOSTIC WORK-UP

## INTRAOPERATIVE

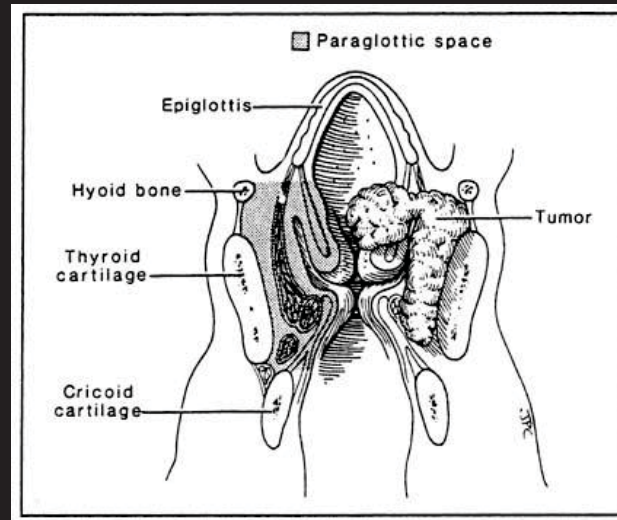
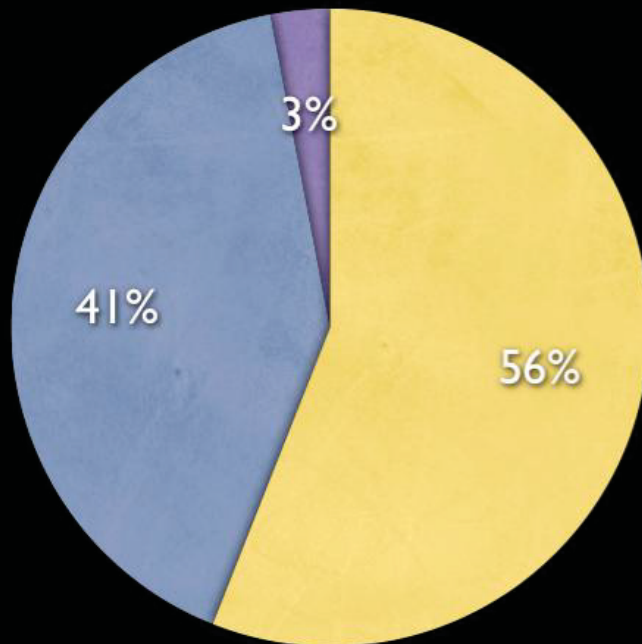
**Rigid intraoperative endoscopy**



# LARYNX



- Glottis
- Supraglottis
- Subglottis



- Mainly dysphagia and dyspnoea for supraglottic cancer
- Mainly dysphonia for glottic cancer
- Mainly dyspnoea for subglottic cancer



# TNM STAGING OF LARYNGEAL CANCER



**System for staging malignant neoplastic disease**

- ✓ **T:** Primary Tumor
- ✓ **N:** Regional Lymph Nodes
- ✓ **M:** Distant Metastasis

# PRIMARY TUMOR (T)



- T1** Tumor limited to the vocal cord(s) (may involve anterior or posterior commissure) with normal mobility  
**T1a:** tumor limited to one vocal cord  
**T1b:** tumor involves both vocal cords
- T2** Tumor extends to supraglottis and/or subglottis, and/or with impaired vocal cord mobility
- T3** Tumor limited to the larynx with vocal cord fixation, and/or invades paraglottic space, and/or minor thyroid cartilage erosion (eg, inner cortex)
- T4** **T4a:** tumor invades the thyroid cartilage and/or tissues beyond the larynx (eg, trachea, soft tissues of the neck including deep extrinsic muscles of the tongue, strap muscles, thyroid gland, or esophagus)  
**T4b:** tumor invades the prevertebral space, encases the carotid artery, or invades mediastinal structures

# ELS

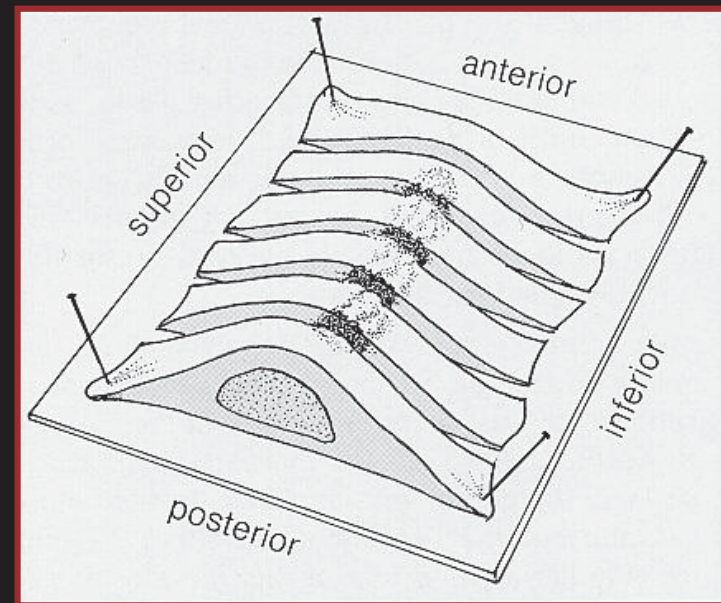
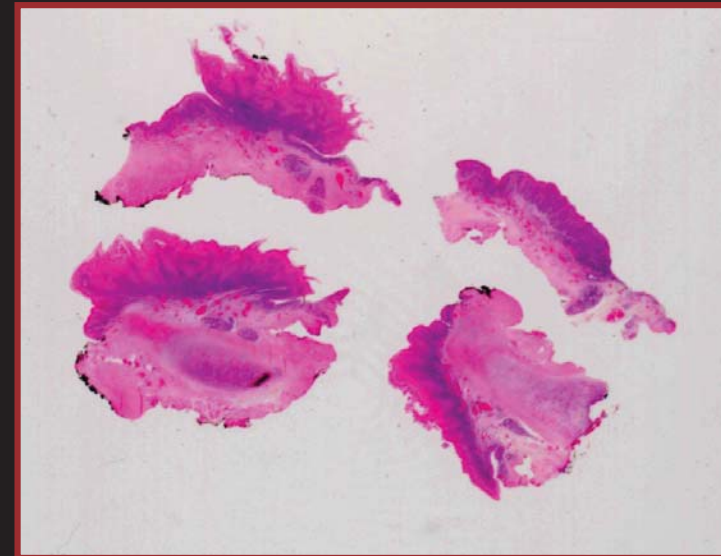
## CORDECTOMY CLASSIFICATION

- ✓ **Type I:** Subepithelial cordectomy ,only resection of the epithelium
- ✓ **Type II:** Subligamental cordectomy , resection of the epithelium, Reinke's space and vocal ligament
- ✓ **Type III:** Transmuscular cordectomy which proceeds through the vocalis muscle
- ✓ **Type IV:** Total cordectomy
- ✓ **Type V:** Extended cordectomy :
  - ➔ **Type Va:** encompasses the contralateral vocal fold and the anterior commissure
  - ➔ **Type Vb:** includes the arytenoid
  - ➔ **Type Vc:** encompasses the subglottis
  - ➔ **Type Vd:** includes the ventricle
- ✓ **Type VI**

# DIAGNOSTIC WORK-UP

## THE EXCISIONAL BIOPSY CONCEPT

**“En bloc” endoscopic  
removal of the entire  
erythroleukoplasic lesion  
within healthy margins**



**D. Blakeslee et al, 1984**

# TRANSORAL LASER SURGERY

## ENDOSCOPIC CORDECTOMIES



Type I



Type II



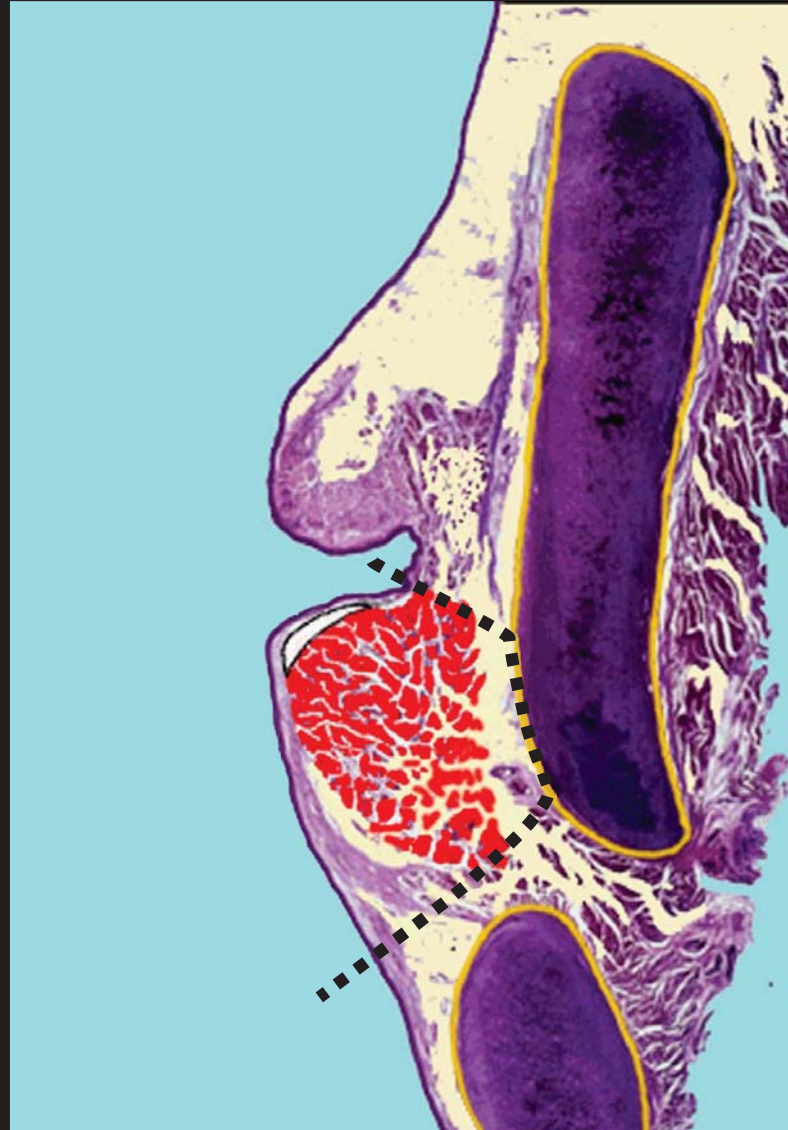
Type III





# ENDOSCOPIC CORDECTOMIES

## Type IV



*Remacle et al. 2000*  
*Remacle et al. 2007*

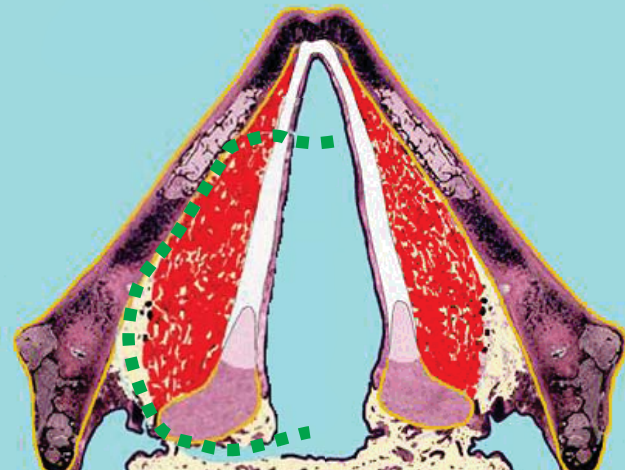
# TRANSORAL LASER SURGERY

## ENDOSCOPIC CORDECTOMIES

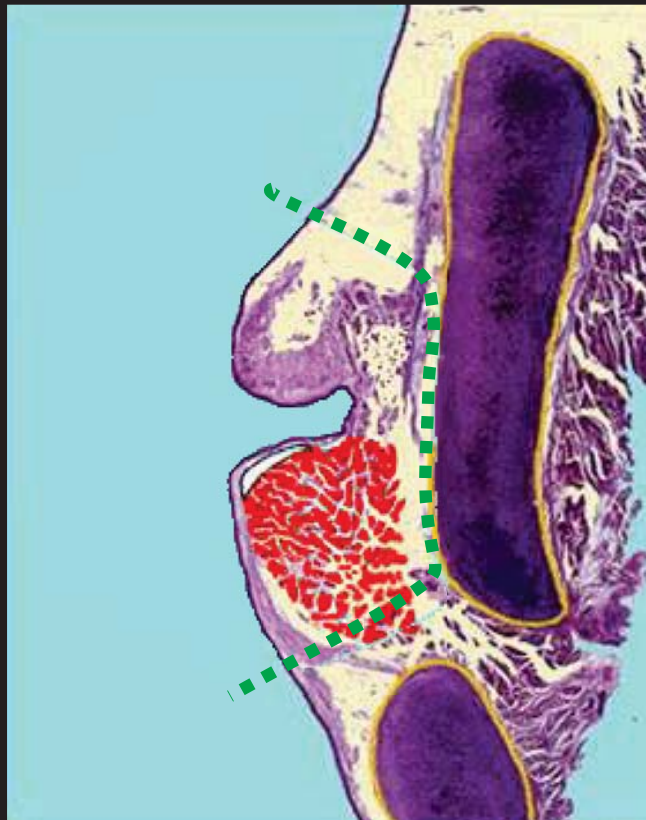
Type Va



Type Vb



Type Vc



Type Vd



*Remacle et al. 2000*  
*Remacle et al. 2007*

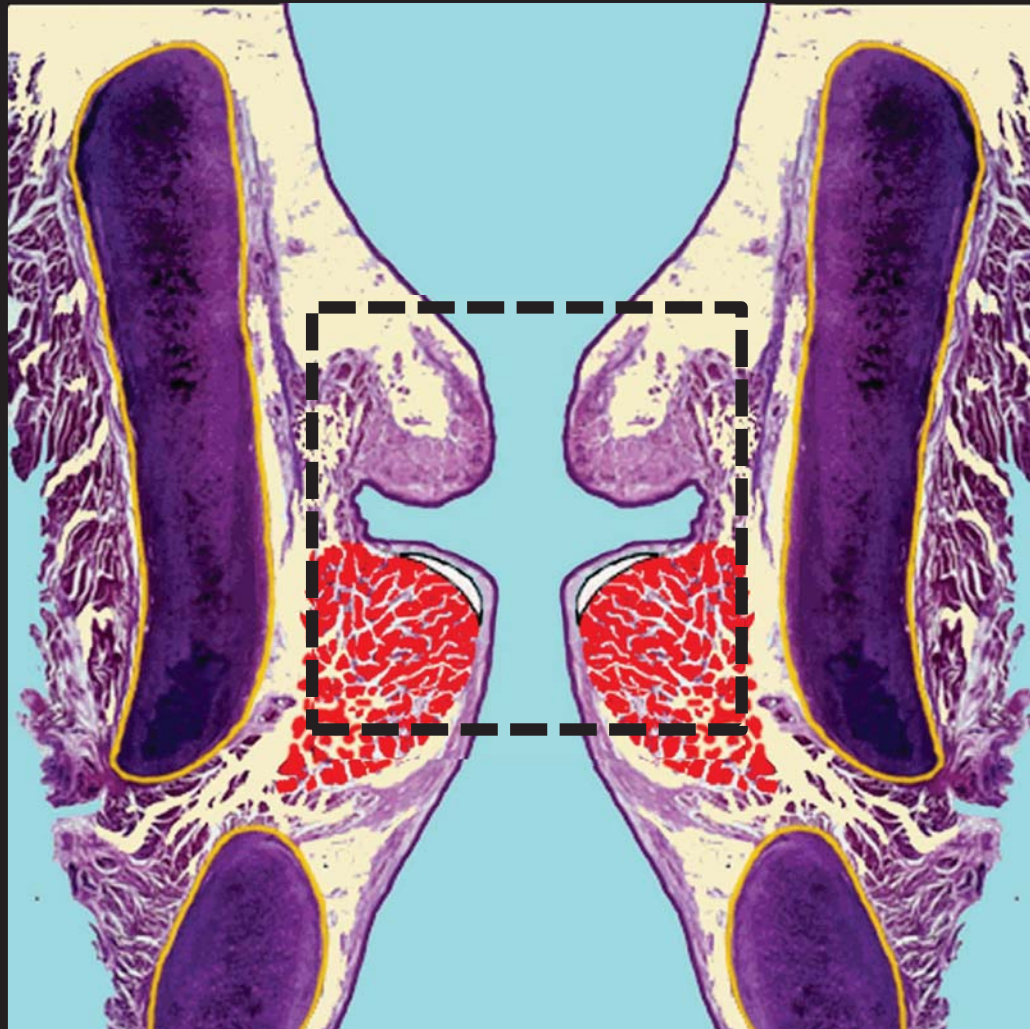


# TRANSORAL LASER SURGERY

## ENDOSCOPIC CORDECTOMIES



### Type VI

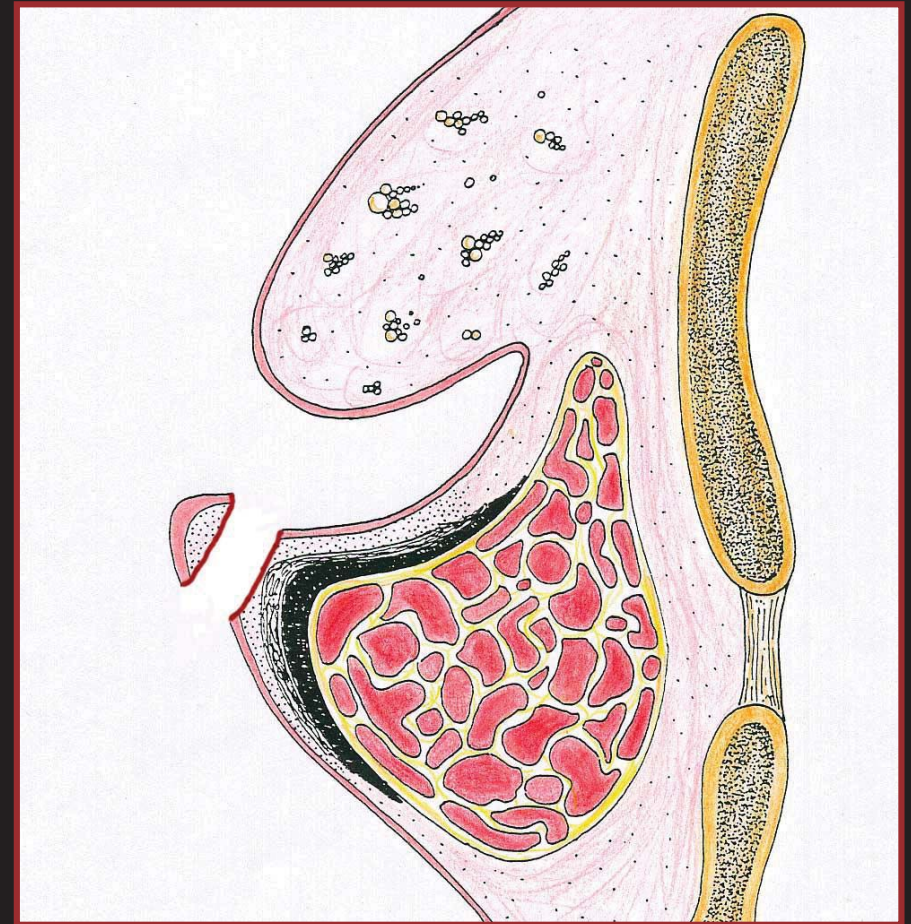
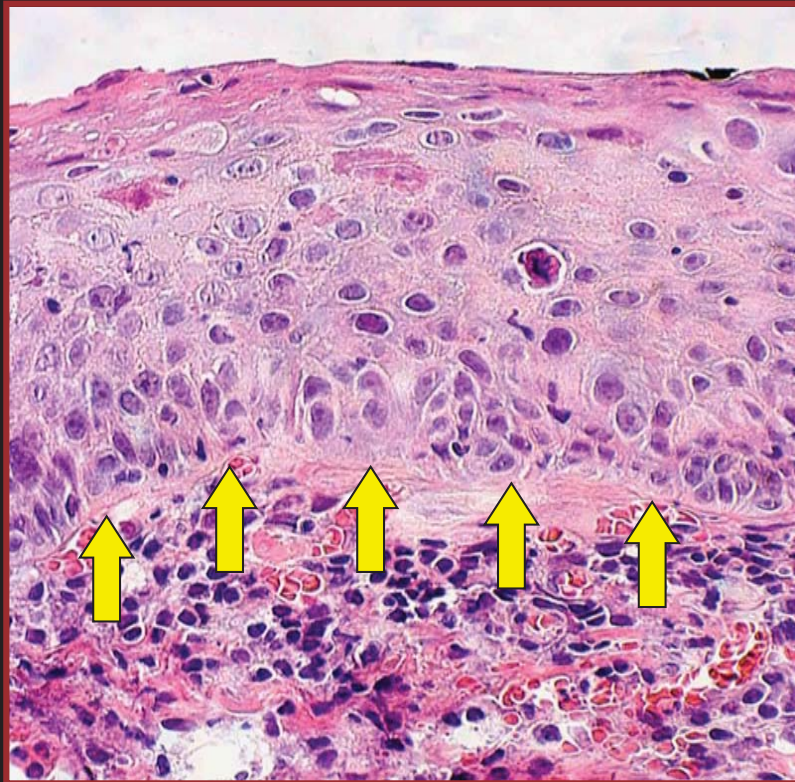


# TRANSORAL LASER SURGERY



## SUBEPITHELIAL CORDECTOMY (type I)

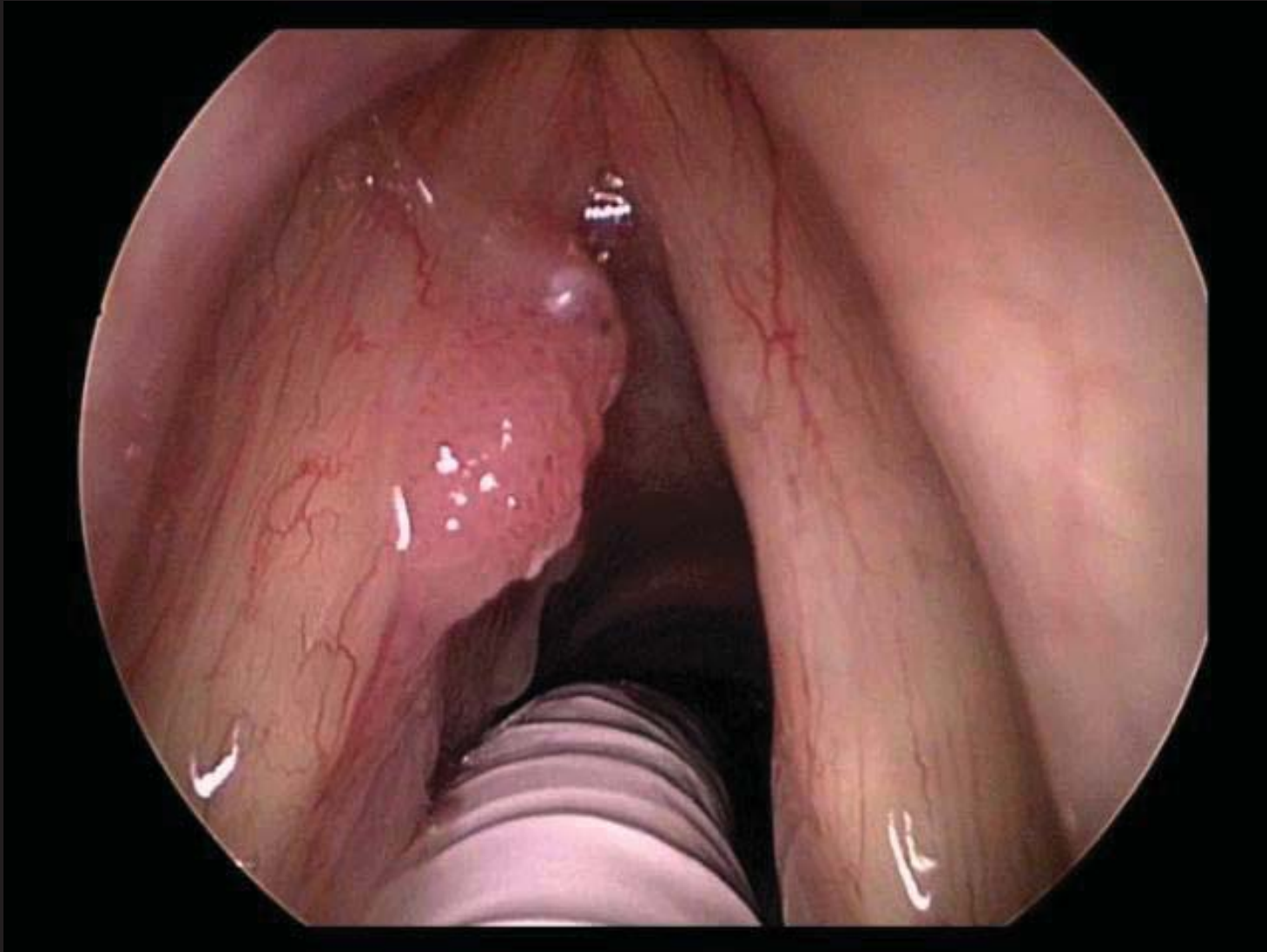
Lesions assumed not to extend beyond the basal membrane due to evident mucoligamentous hydrodissection and the presence of the mucosal wave





# TRANSORAL LASER SURGERY

## SUBEPITHELIAL CORDECTOMY (type I)





# TYPE OF CORDECTOMIES

## SUBEPITHELIAL CORDECTOMY (type I)



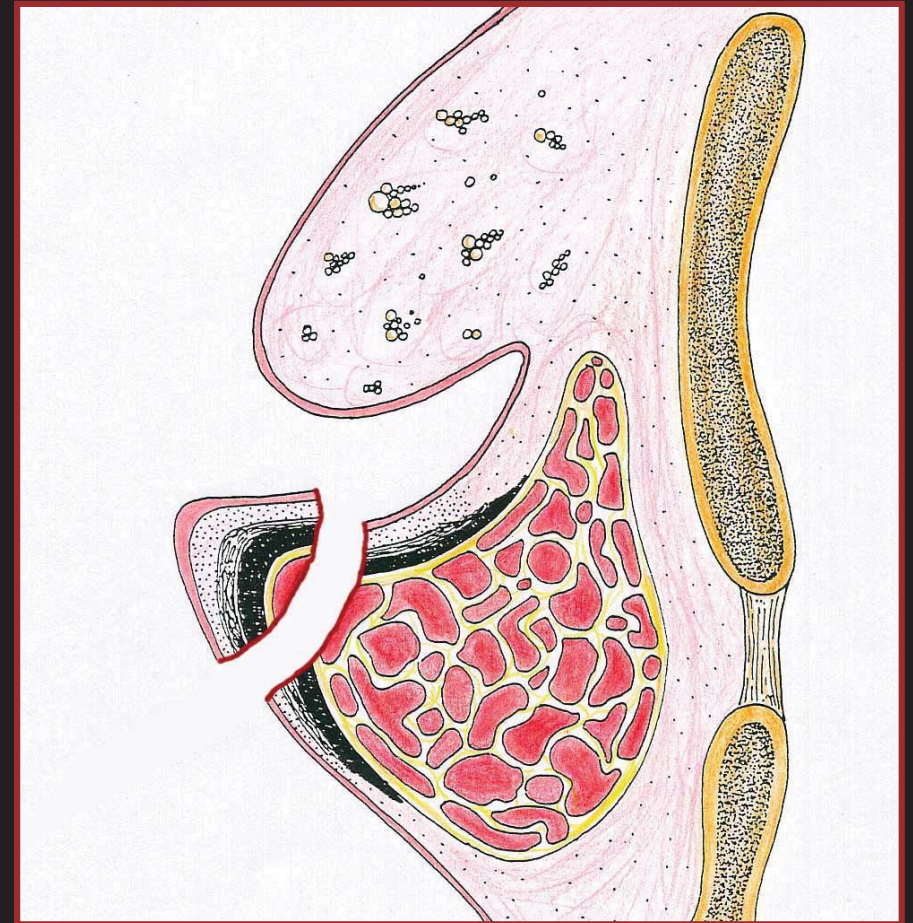
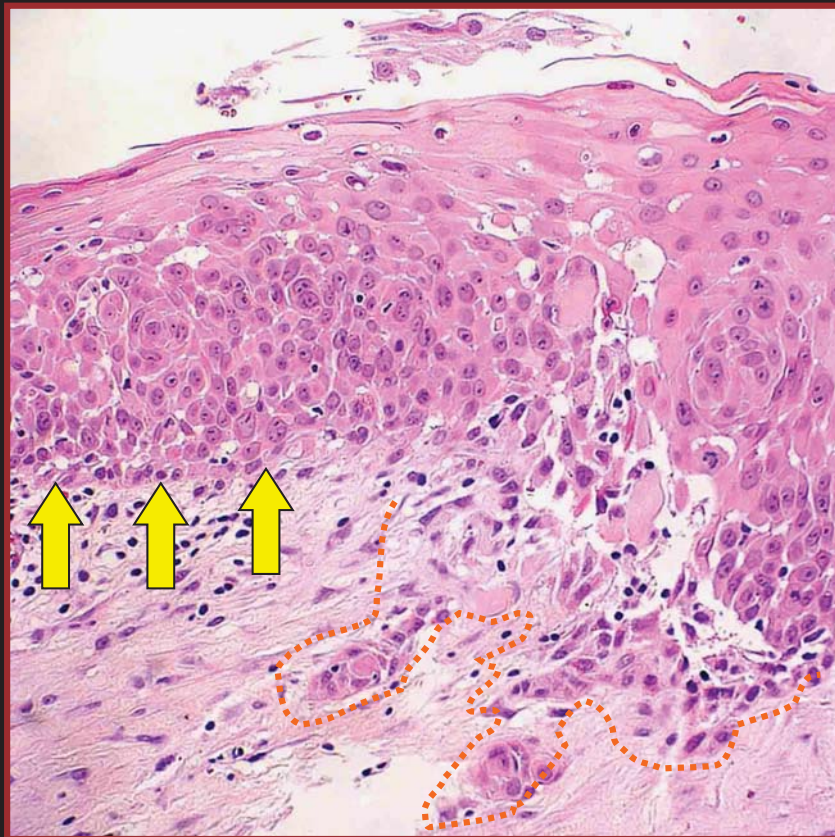
Postoperative result at 2 yrs  
(type I right corpectomy)

# TRANSORAL LASER SURGERY



## SUBLIGAMENTAL CORDECTOMY (type II)

**Lesions suspected to be microinvasive or invasive carcinoma because of the absence of hydrodissection and mucosal wave**

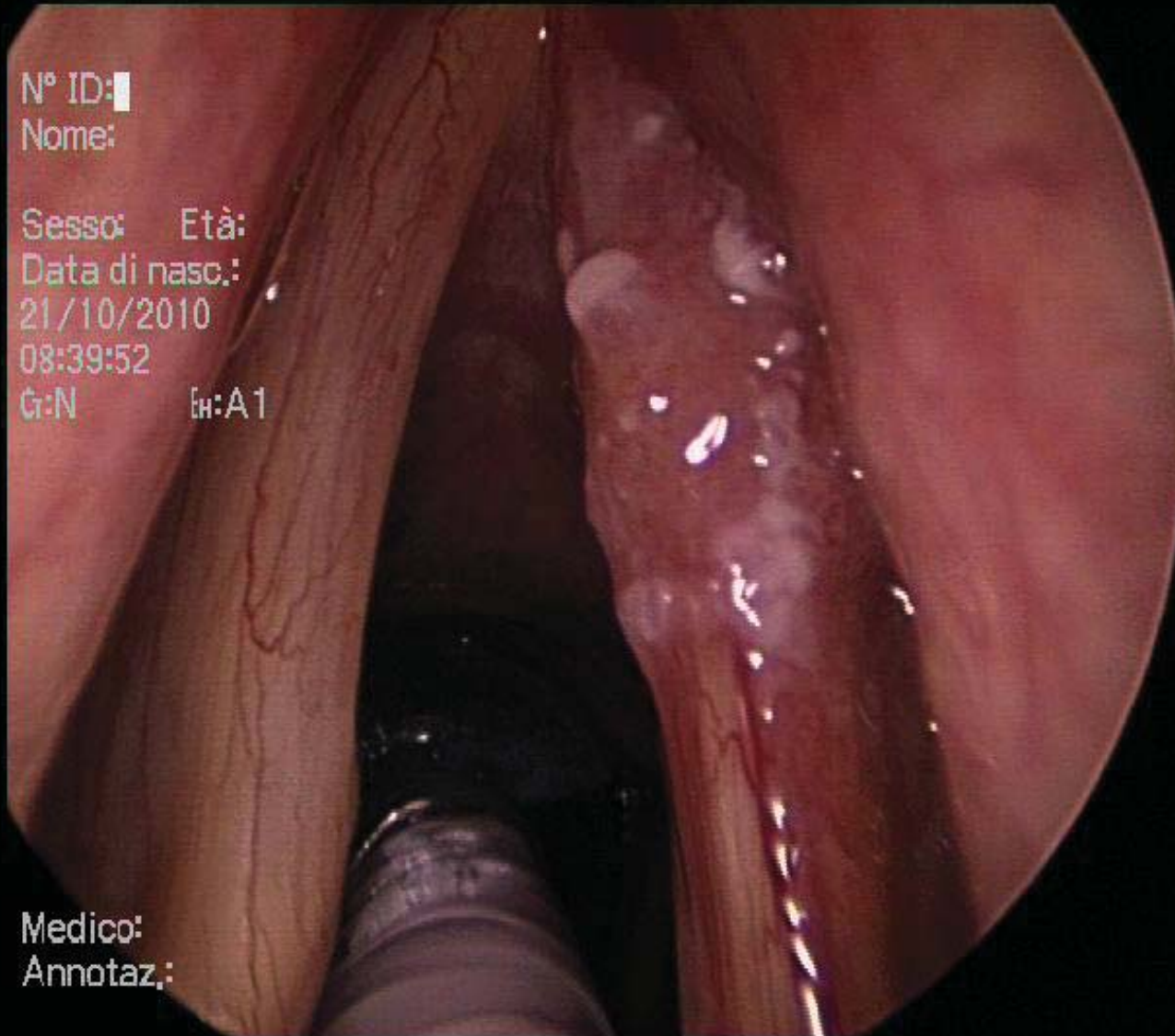




# TRANSORAL LASER SURGERY



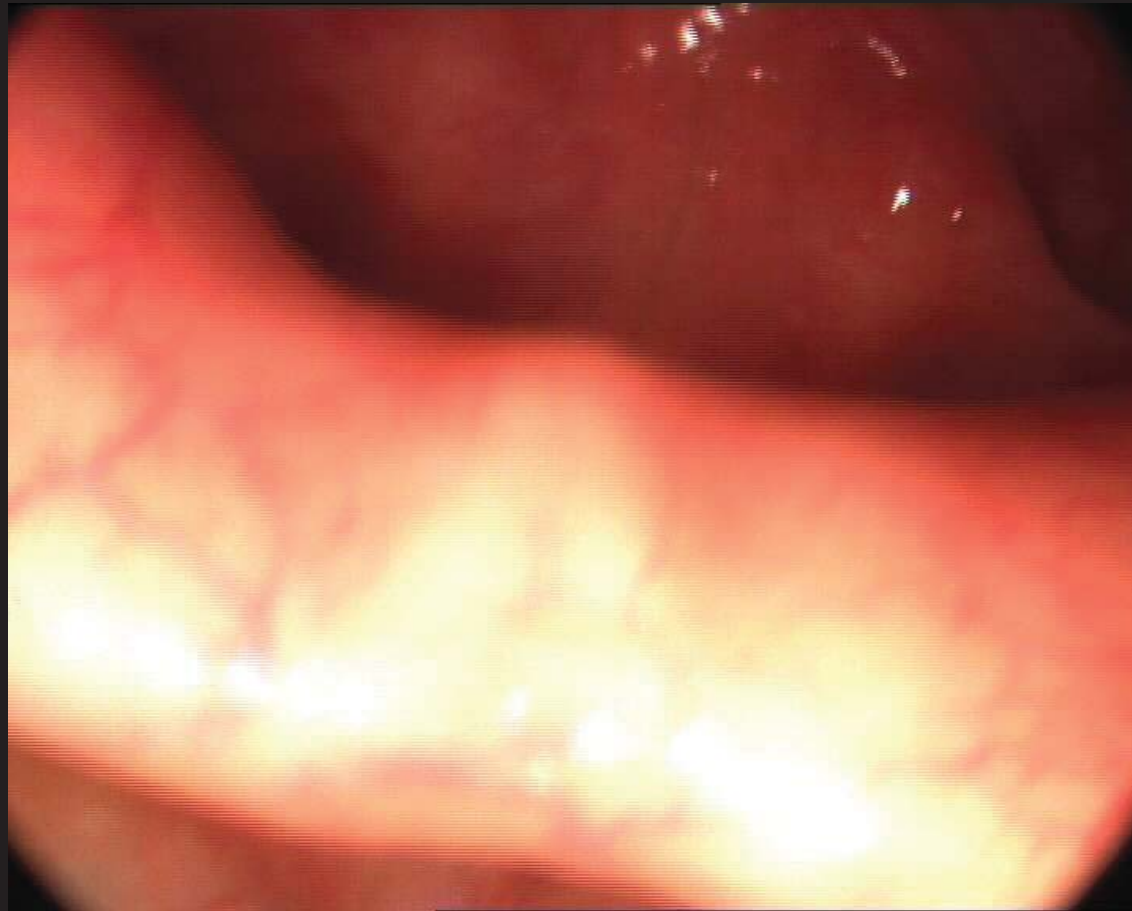
## SUBLIGAMENTAL CORDECTOMY (type II)



# TRANSORAL LASER SURGERY



## SUBLIGAMENTAL CORDECTOMY (type II)



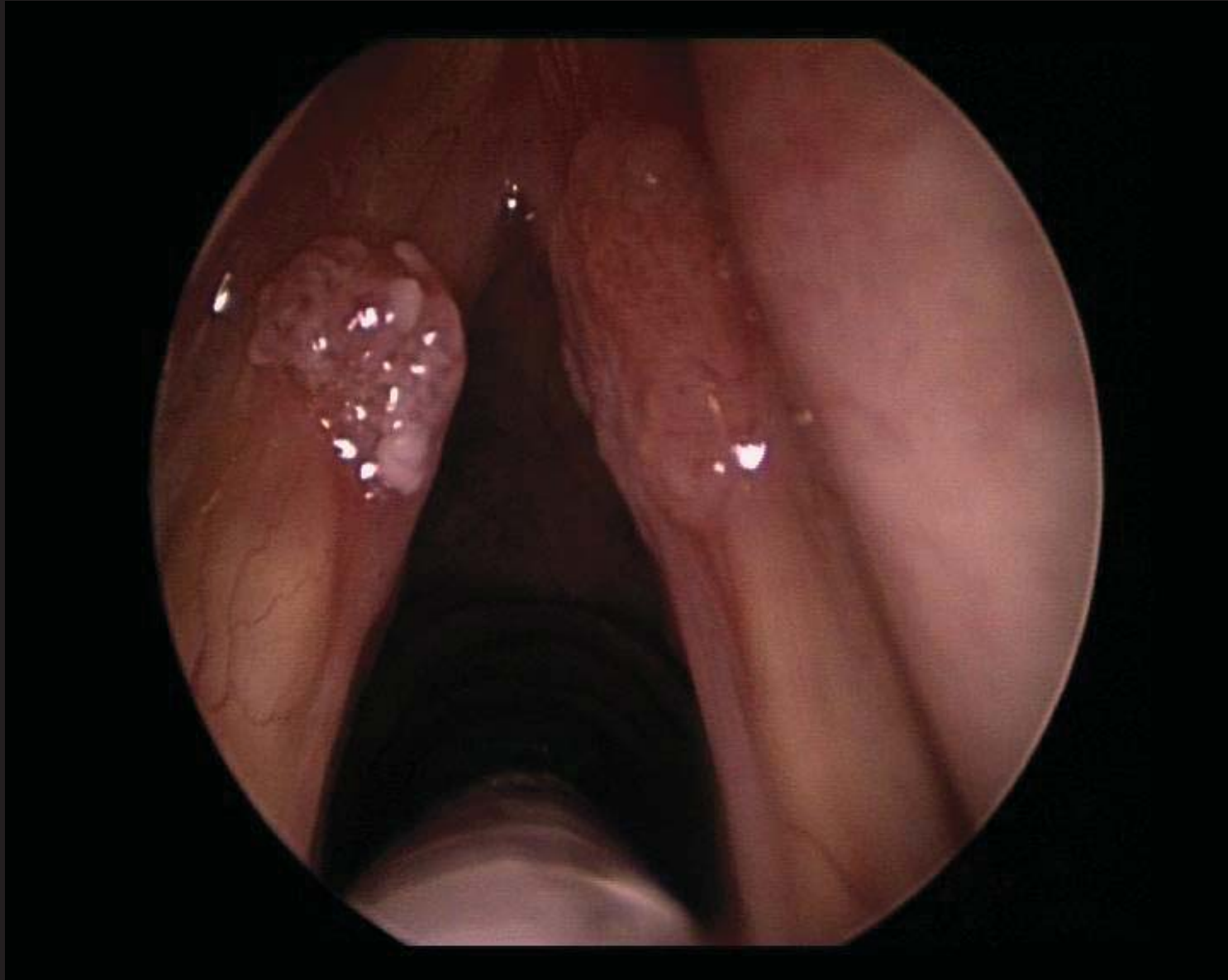
**POSTOPERATIVE RESULT AT 1 YEAR**



# TRANSORAL LASER SURGERY



## TYPE I and TYPE II CORDECTOMIES

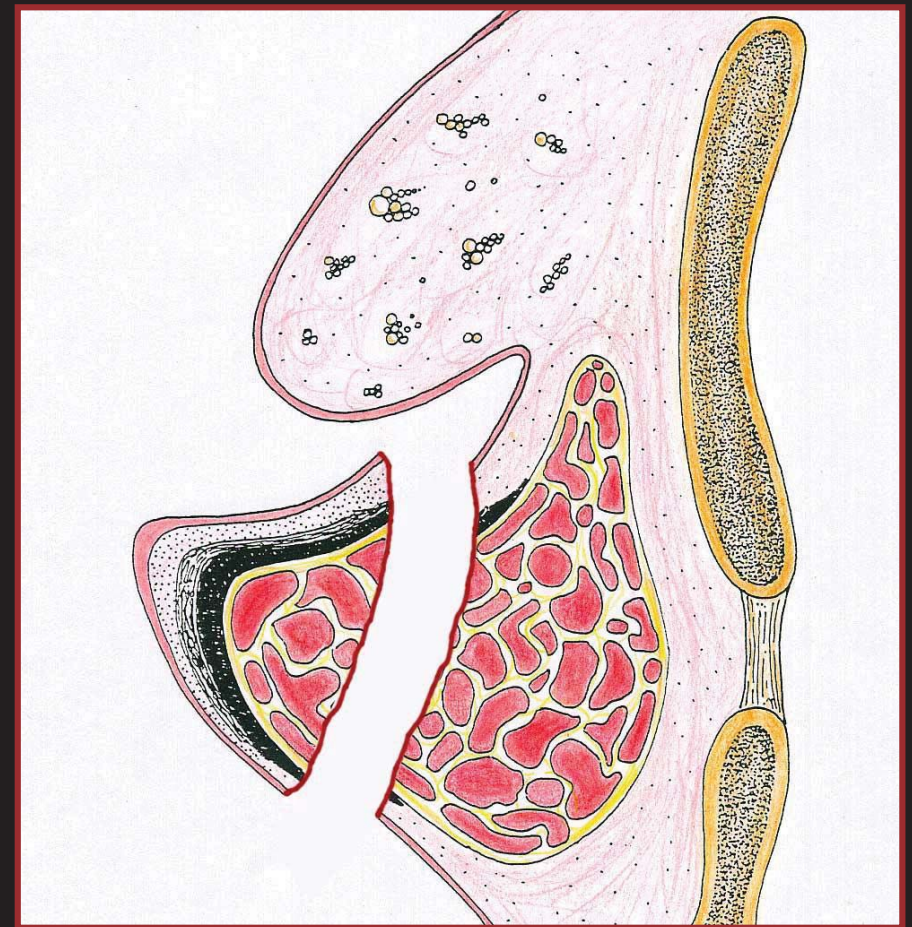
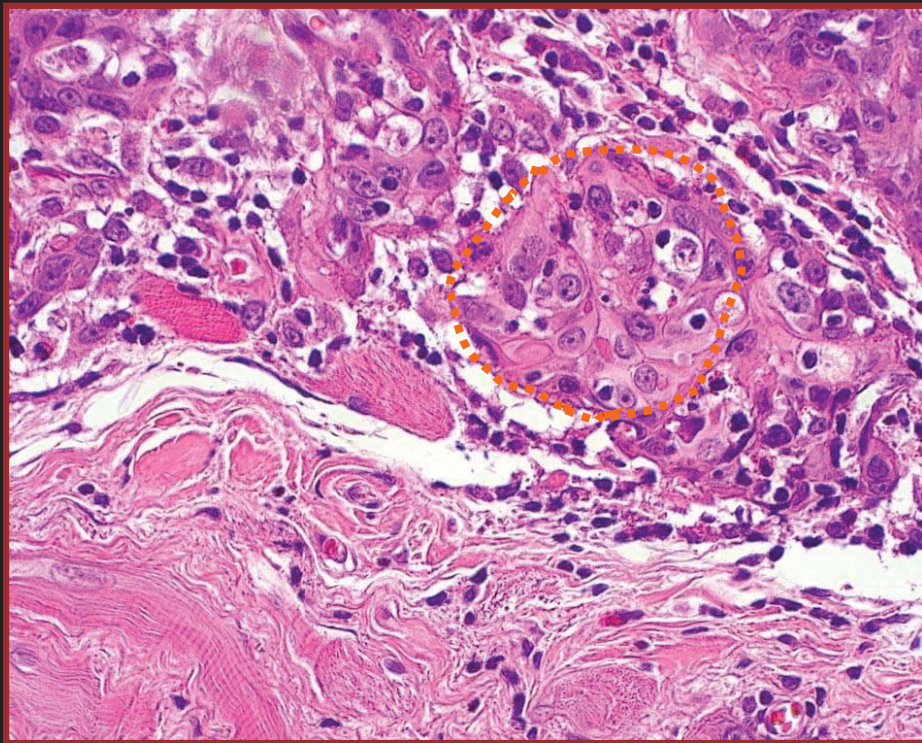


# TRANSORAL LASER SURGERY



## TRANSMUSCULAR CORDECTOMY (type III)

**Patients in whom changes due to a previous biopsy could have interfered with the accuracy of test battery results**

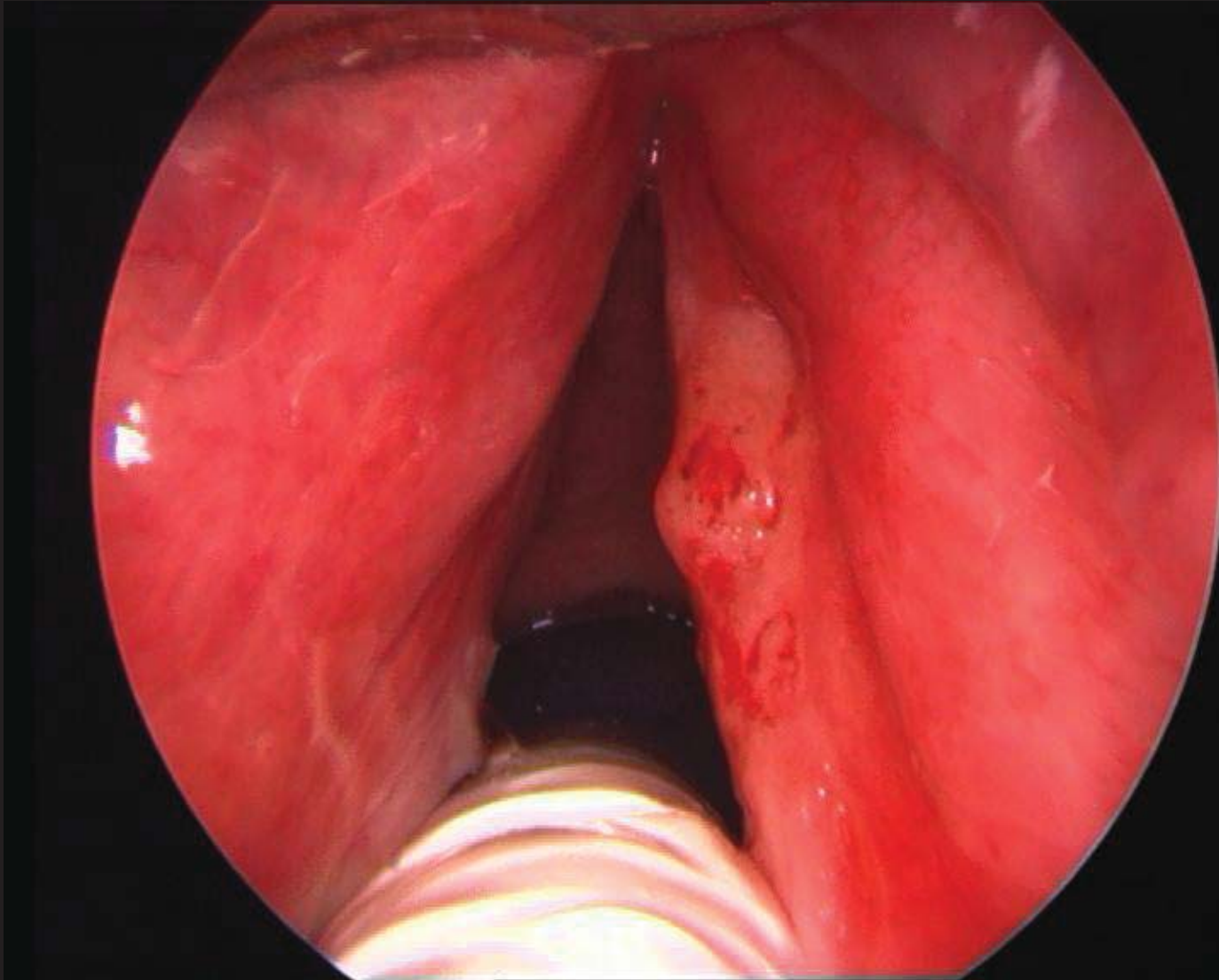




# TRANSORAL LASER SURGERY

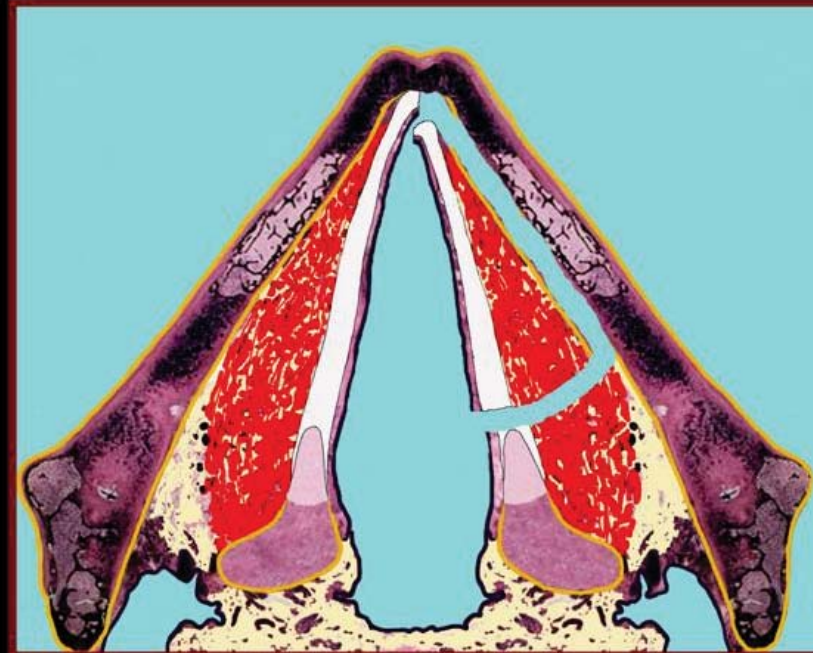
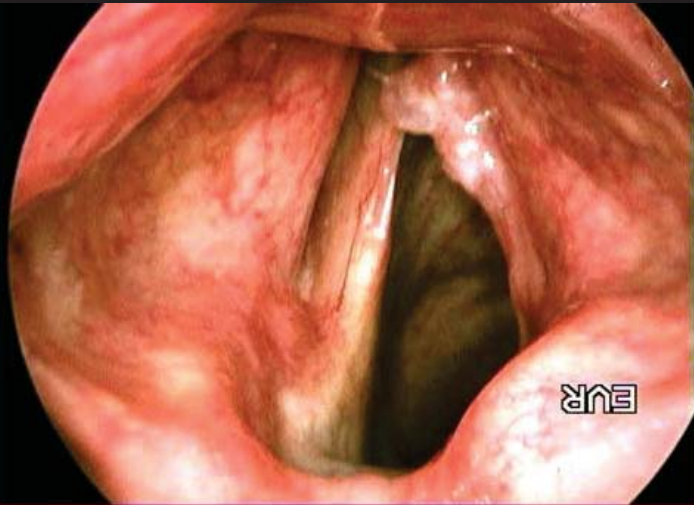


## TRANSMUSCULAR CORDECTOMY (type III)



# TYPE OF CORDECTOMIES

## TOTAL CORDECTOMY (Type IV)

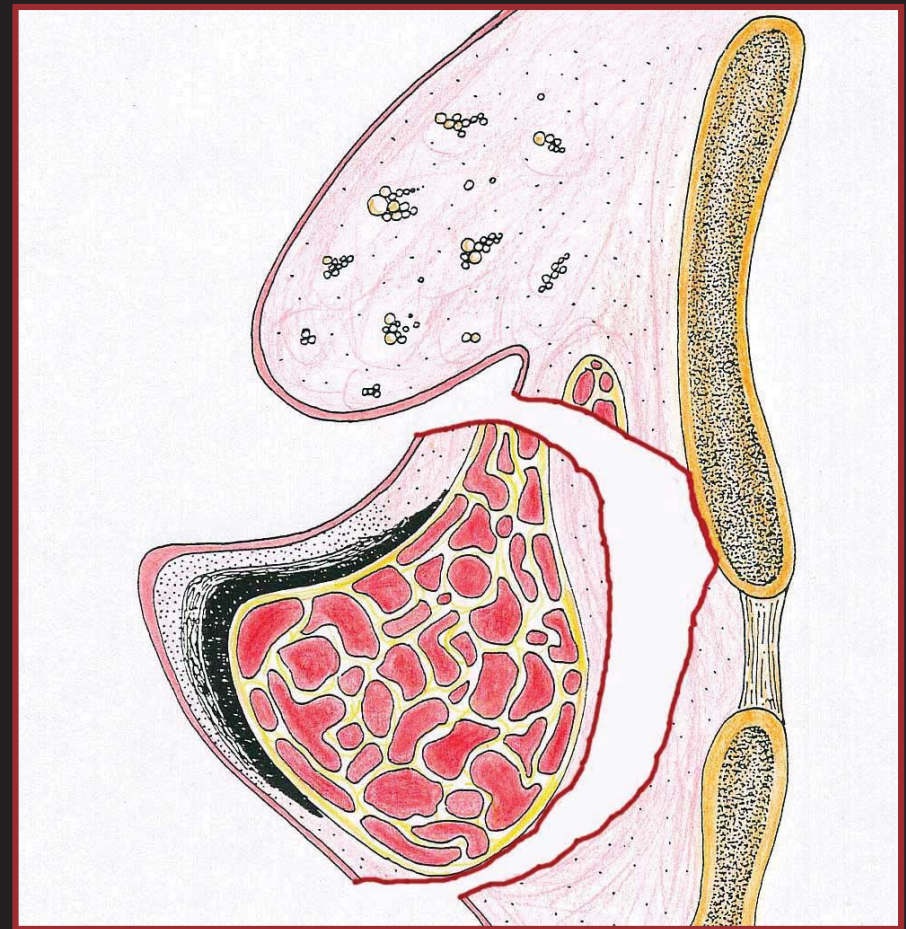
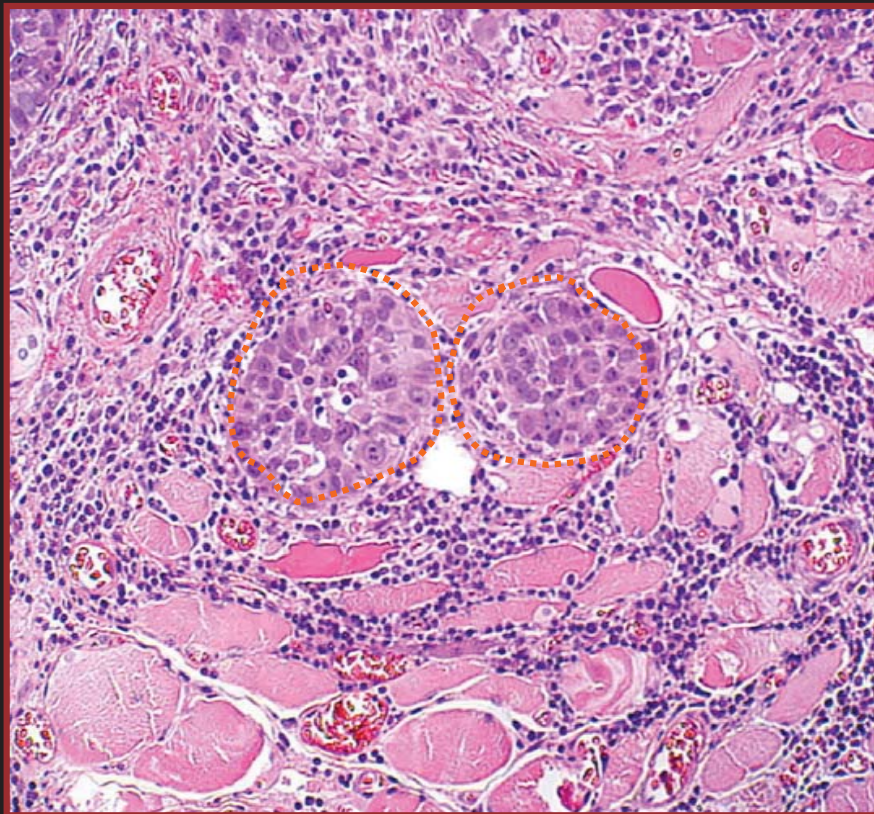




# TYPE OF CORDECTOMIES

## TOTAL CORDECTOMY (type IV)

Lesions extended to the entire vocal fold

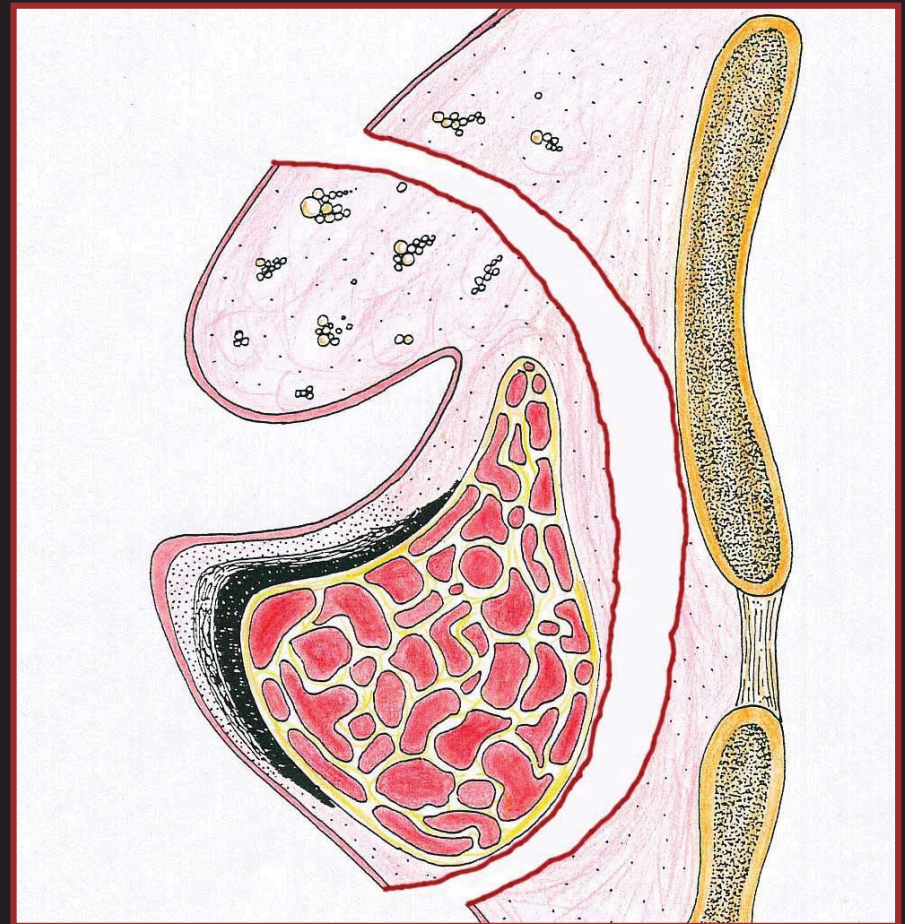
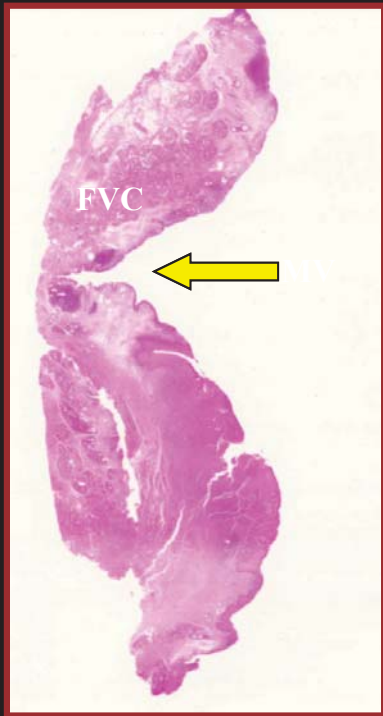




# TYPE OF CORDECTOMIES

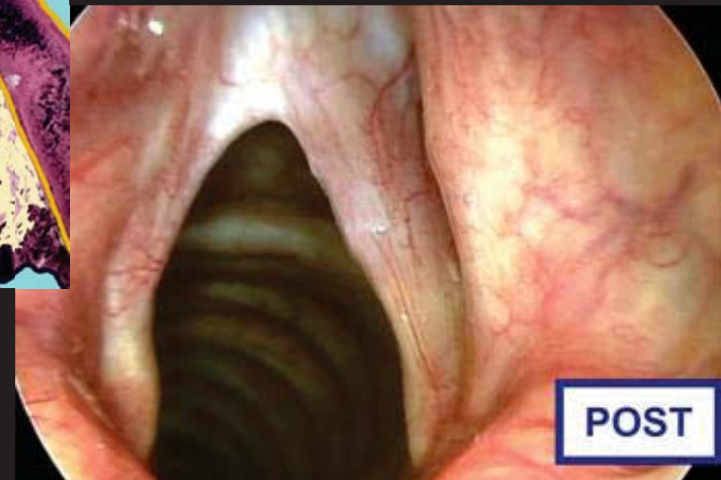
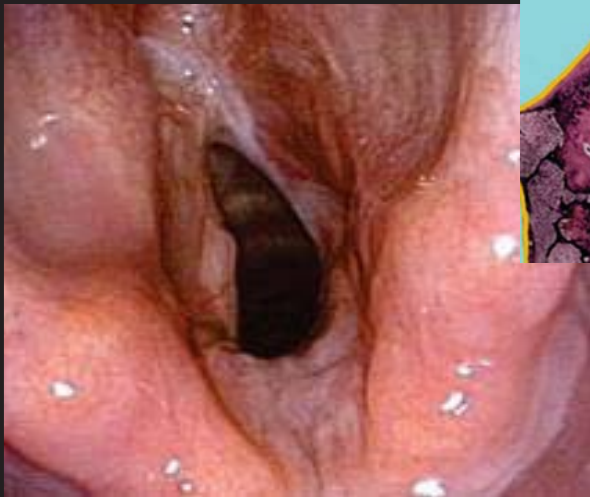
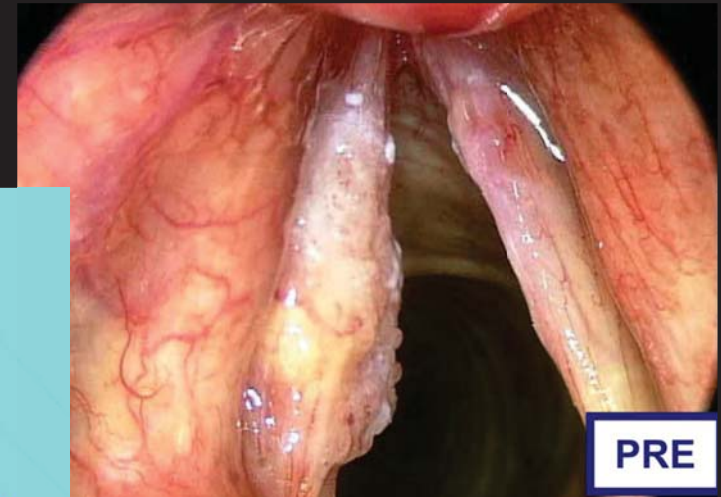
## EXTENDED CORDECTOMY (type V)

Vocal fold lesions involving the anterior commissure and/or the contralateral cord



# TYPE OF CORDECTOMIES

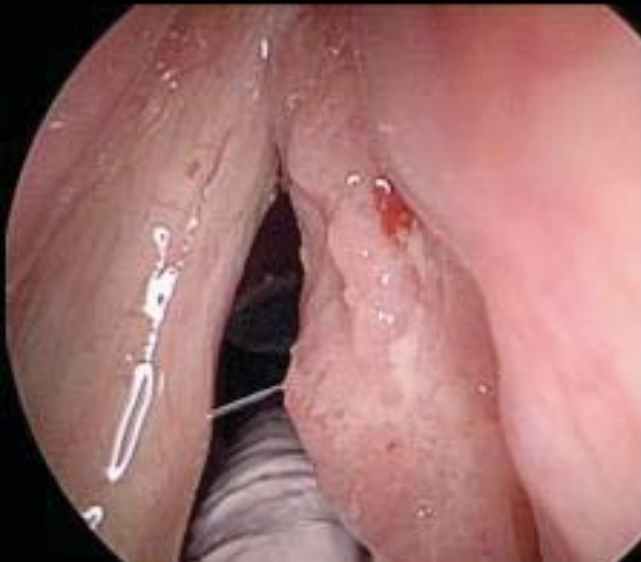
## EXTENDED CORDECTOMY





# TYPE OF CORDECTOMIES

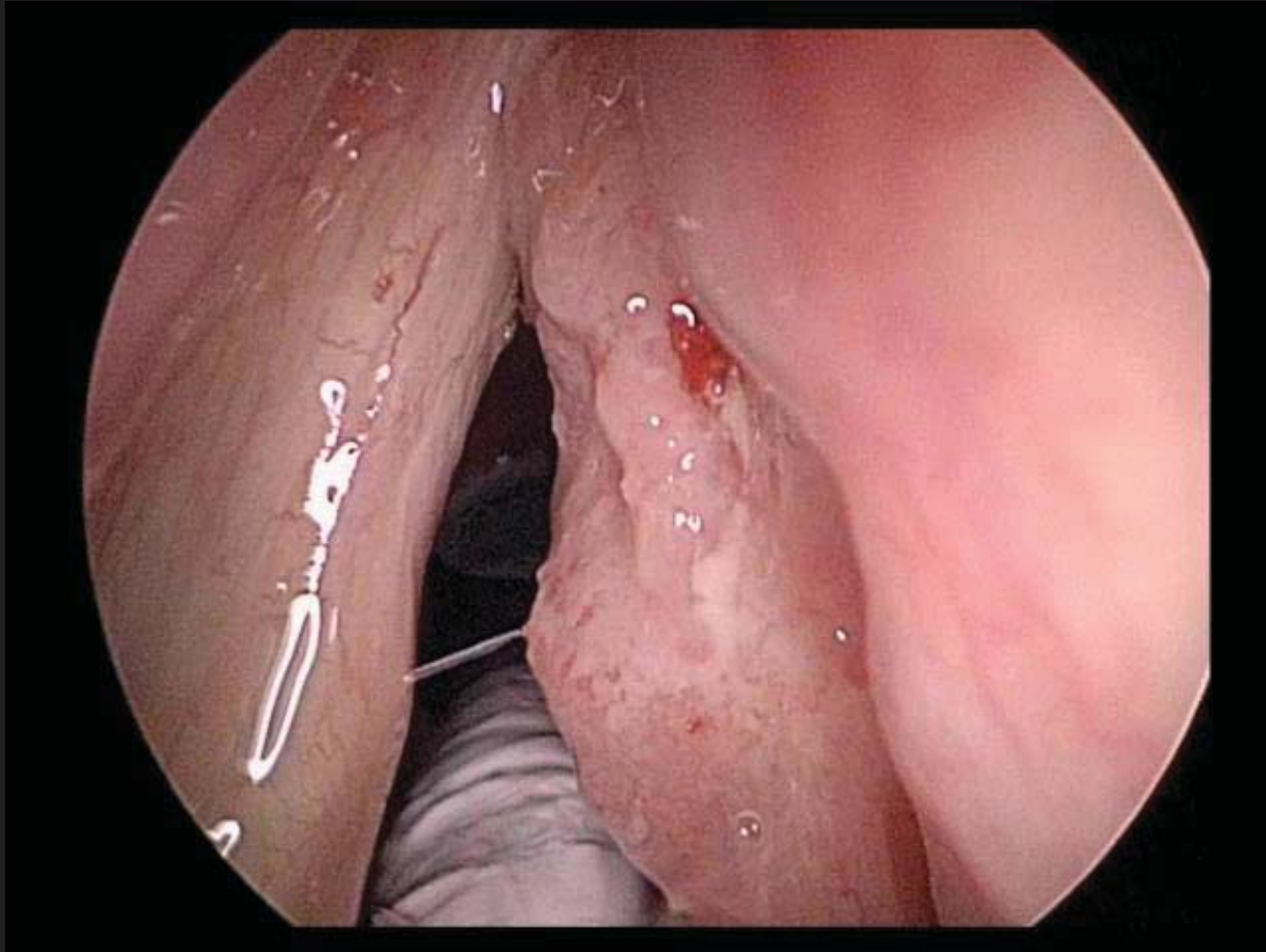
## PIECE MEAL CORDECTOMY





# TYPE OF CORDECTOMIES

## (TYPE V piece meal) □



# DAVINCI ROBOTIC SURGERY

- ✓ **Not designed for ENT surgery**
- ✓ **Bulky**
- ✓ **Long and specific learning curve**
- ✓ **Expensive**



# ROBOTIC SURGERY





# FUTURE ...

Future perspectives are the need to make an **innovative approach** not only based on the use of microscope coupled micro-manipulators but **on the use of the fiber guide laser controlled by the endoscopic devices**: in this way we will be able to link the better resolution of the endoscopic view with the better maneuverability and cut precision of the laser which at the present can only be used through the microscope.