Development of Head and Neck cancer management during the last 50 years

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**Development of Multimodal Therapy for H&N Cancer**

- Surgery
- Chemotherapy
- Radiotherapy
- Targeted Therapies
- Gene Therapy?

Shah J., IFHNOS 2010, Seoul
Head and Neck Surgery

- Surgery, especially head and neck surgery, is a very specific kind of surgery because of specific anatomical conditions.
- Sense organs:
  - Sight
  - Taste
  - Smell
- Very good vascularization and innervation.

Head and Neck Surgery

- Restricted surgical field.
- Difficult to view some anatomical structures, requires application of additional visual equipment (endoscope, microscope).
- Common part of upper respiratory and alimentary tract determines operational and post-operative procedure.
INTERDISCIPLINARY SURGERY TEAM

- laryngology
- maxillo-facial surgery
- neurosurgery
  (skull base surgery)
- ophthalmology
- plastic surgery

strong cooperation with:

- radiotherapy
- clinical oncology
- patomorphology
- radiology
- physiotherapy
- psychology
- oncological surgery (common reconstructive surgeries, ie. gastric pull-up)
Milestones in head and neck surgery in the last 50 years

- The 20th century – golden age of otolaryngology.

- Great researchers, advances in anaesthesia and chemotherapy, and the explosion of technology helped to give the speciality its present status.
The middle of the 20th century can be characterised as a period of PARTIAL LARYNGECTOMIES.

The beginning to the partial laryngectomy period was allowed for by knowledge gained about the anatomy of the larynx, its individual compartments and lymphatic sourcing, which led to an understanding of the spreading of the tumour in the larynx and into the regional lymphatic system.
The first classical partial horizontal laryngectomy was described in the 1920's, the current technique is mainly associated with the name of Alonso, who developed this operation in the 1940's.

An excellent technique of reconstruction was introduced by Sedláček who described the reconstruction of a defect of a constricted epiglottis.

Gluck (1912), Alonso (1947), Ogura (1948), and Som (1953) described conservative surgical techniques for the management of cancer of the larynx.

Leroux-Robert, Trotter, Gluck-Soerensen, Friedman, Piquet, Pearson

Surgical treatment of laryngeal cancer

- Partial laryngectomy
  - A. Cordektomy via laryngofissure
  - B. Vertical or frontolateral
  - C. Horizontal
    - 1. Supraglottic
    - 2. Supracricoid
  - D. Combinations and extensions of A, B and C with or without involvement of the ventricle, ventricular bands, aryepiglottic fold, and juxtaposed limited portion of medial wall of pyriform sinus

- Supracricoid laryngectomy with CHEP
  - resection of whole thyroid cartilage and paraglottic space
  - connection of cricoid cartilage with hyoid bone and epiglottic space

- Total laryngectomy
  - A. Narrow field
  - B. Wide field
Surgical treatment of laryngeal cancer

- Partial laryngectomy
  A. Cordectomy via laryngofissure
  B. Vertical or frontolateral
  C. Horizontal
    1. Supraglottic
    2. Supracricoid

- Combinations and extensions of A, B and C with or without involvement of the ventricle, ventricular bands, aryepiglottic fold, and juxtaposed limited portion of medial wall of pyriform sinus

- Total laryngectomy
  A. Narrow field
  B. Wide field

Supracricoid laryngectomy with CHP
- resection thyroid cartilage and epiglottis (vocal, vestibular folds, vestibule)
- connection of cricoid cartilage with base of the tongue and hyoid bone
Surgical treatment of laryngeal cancer

- Partial laryngectomy
  - A. Corpectomy via laryngofissure
  - B. Vertical or frontolateral
  - C. Horizontal
    1. Supraglottic
    2. Supracricoid
- D. Combinations and extensions of A, B and C with or without involvement of the ventricle, ventricular bands, aryepiglottic fold, and juxtaposed limited portion of medial wall of pyriform sinus

- Total laryngectomy
  - A. Narrow field
  - B. Wide field

1954 development of optic fibers endoscopes by Hopkins – a new era in endoscopy with flexible fibroscopes, used to examine the larynx, nasopharynx, nose and pharynx

Currently, larynx examination has been greatly developed thanks to the pioneer work of physicians, such as Karl Storz and Harold Hoppkins.
1960 – Kleinsasser revolutionized the diagnostic and therapeutic approach to treatment of cancer of the larynx by applying microdiagnostic and microsurgical techniques

1972 – introduction and development of fiberoptic laryngoscopes

1972 Strong and Jako introduced the laser into laryngeal surgery and developed a laryngoscope specifically designed for endoscopic laser surgery

Burian and Höfler were the first in Europe to successfully treat glottic cancer with the laser

1980’s Steinert expanded the indications for curative laser treatment to all regions and all tumor types
1991 – publication of a study known as the VA protocol (Veterans Affairs Laryngeal Cancer Study Group) – A breakthrough work in the attempt to treat a widespread carcinoma of the larynx without its removal (concomitant chemo-radiotherapy)

The results of the VA study were later supported by the result of EORTC Study.

Another advance was gained by the RTOG 91-11 Study.

At present, large number of various studies are being conducted, which compare further treatment combinations (preservation protocol) using various cytostatics, radiotherapy regimes or combination with modern biological treatment.
From the 1980’s – plastic reconstruction of the pharynx, larynx and oral cavity using stomach transposition, myocutaneous flaps and microvascular anastomoses have succeeded in providing patients with acceptable levels of appearance and function after the most radical of operations.

1998 – first larynx transplant was carried out in Cleveland, however - numerous problems, especially related with organ rejection by the patients immune system.

Transoral laser surgery for oral and pharyngeal cancer

(J. Werner)
1976 – the concept of phonosurgery, as a procedure to improve or reestablish voice, introduced by **Von Leden** was restricted to laryngeal microsurgery to remove lesions on the top of the vocal folds, which projected to the glottal space.

Minimum structural alterations were not part of the diagnostic routine.

Currently, with more sophisticated microsurgery material and with better physiopathological material, endolaryngeal microsurgery has become more efficient.
There is no treatment more effective for resectable neck metastases, than surgery.

- 1888: The Polish surgeon F. Jawdynski performed a radical neck dissection using a surgical technique similar to that described by G.W. Crile in 1906 – their experience was a milestone in the development of neck dissection in the 20th Century.

1963: The first description of an effective technique of modified radical neck dissection – **Suárez**

In 1967 **Bocca** described the modified neck dissection.

1972: **Lindberg** described the incidence and topographical distribution of cervical lymph node metastases in relation to the location of the primary tumor.

1981: **J. Shah** recommended modified neck dissection for N0 neck and radical neck dissection for clinically positive necks.
1988: The American Academy of Otorhinolaryngology – Head and Neck Surgery (AAO-HNS) initiated the neck dissection classification project. An ad hoc committee of the newly formed American Head and Neck Society (AHNS) was convened to review, at regular intervals, the classification scheme.

1990: J. Shah classified the deep lymph nodes of the neck into five different levels assigned Roman numerals from I to V.

1991: AAO-HNS made the first attempt to standardize neck dissection terminology. This classification added level VI to the topography of cervical lymph nodes, and included radical neck dissection, modified radical neck dissection, extended neck dissection and selective neck dissections which were subdivided into supraomohyoid, anterolateral, lateral and posterolateral neck dissections.

1992: van den Brekel first used immunohistochemical investigations to detect the presence of micrometastases in cervical lymph nodes from head and neck squamous cell carcinoma in neck dissections specimens.
2000-2001: **T. Soahib** and **F. Chiesa** reported their experience in Sentinel Node Biopsy, on head and neck squamous cell carcinoma (SCC), and proved its reliability.

2001, **Dulguerov** performed ten endoscopic neck dissections on five human cadavers and found that the majority of neck lymph nodes can be removed by this approach.

2003 **Kitagawa** and 2004 **P. Miccoli** and **G. Materazzi** - Endoscopic neck surgery with lymph node dissection for thyroid neoplasms

2005: **Robbins** believed that selective and superselective neck dissections, which spare function and minimize morbidity, are viable therapeutic alternatives for patients with residual disease confined to one level after intra-arterial chemoradiation treatment, and possibly for other chemoradiation protocols.

2006 – **De Cicco** published a paper on the use of dynamic lymphoscintigraphy (Lymphatic Mapping) to identify the nodes reached by the lymphatic stream from the tumour in order to tailor a selective dissection on each patient with clinically negative necks (cN0).
1950’s Messerklinger brought back the use of endoscopes, using it for diagnostic and surgical procedures in the nose.

The use of new technologies caused an advance in endoscopic techniques, especially with the development in 1954 of the optic fiber endoscopes by Storz Fiberoptic Company. Such progress, added to CT scan - developed in 1969 by Geoffrey Hounsfield made it possible to have a detailed analysis of the nasal cavity, especially the lateral wall and the ostium-meatal complex.
1990s - first reports use of transnasal endoscopic surgery as a stand-alone procedure or in combination with frontal craniotomy (cranio-endoscopic resection)

1997 – TNM Classification for Sinonasal tract tumors proposed by L.H. Sobina (accepted by UICC and AJCC)

When to use the conventional surgical technique?

When to use the endoscopic technique?
Surgery

- Is the fundamental rule of oncological surgery, removal of the whole tumor with a margin of neoplasm-free tissues, possible to fulfill when using the endoscopic techniques?

“Craniofacial resection” for tumors located within cribrum and skull base

- Smith 1954 – malignant tumors developing from upper part of nasal cavities, ethmoidal sinuses (posterior ethmoidal complex) and structures of orbital cavity

- Non-malignant but clinically aggressive tumors: meningioma, chordoma, juvenile adenofibroma penetrating to the inside of the skull
“Craniofacial resection” for tumors located within cribrum and skull base

- Ketchum 1963 – reported the first series of patients treated with an anterior craniofacial resection for tumors arising in the ethmoid sinuses;

- an en bloc resection of tumor, including the ethmoid sinuses, superior nasal septum, and floor of the anterior cranial fossa, corresponding to the interorbital area (i.e. anterior craniofacial resection) or extended laterally to include part of the bony orbit or its soft tissue contents (anterolateral craniofacial resection)

Endonasal endoscopic tumor removal:

- “Multilayer centripetal technique”
Modern thyroid surgery owes much to one man called Theodor Kocher, professor of Surgery at Berne, Switzerland. He can be called father of thyroid surgery.
- Thyroid surgery has come a long way but the best days are still to come.

- This millennium is of minimally invasive techniques. This century has seen new development of video assisted thyroidectomy by Micoli in Italy. MRI and PET scans are new developments in assessment methods.

- The first description of a minimally invasive approach to the thyroid gland was an endoscopic thyroidectomy performed by Gagner and Inabnet in 1996.

- Endoscopic parathyroidectomy was first performed and described by Gagner in 1996 video-assisted thyroid lobectomy by Hüschel et al. in 1997.
Transoral robotic surgery (TORS)

- Tongue Base Resection
- Radical Tonsil
- Supraglottic Partial Laryngectomy

Pharynx
- Nasopharynx
- Oropharynx
- Laryngopharynx
Modern imaging

- shows detailed anatomy and function
- is a precise tool in head and neck cancer staging
- may predict treatment outcome
- shows early tumour response in case of non-surgical treatment
- has potential in determining treatment failure and differentiates between tumour recurrence and post-treatment tissue changes
- imaging studies (performed) are the single most important positive predictive factor in estimating 5-year survival for patients with laryngeal cancer
high-resolution CT of temporal bone

high-resolution MRI of skull base
small IAC schwannoma
comparison between histologic and CT image of post-cricoid area

perfusion CT and diffusion MR have the power to accurately determine tumor response during any non-surgical treatment.

this is the hallmark of individualized therapy

functional studies: perfusion CT and diffusion MRI are able to differentiate between post - RCHT changes and local/distant recurrence
Megavoltage era

*first linear accelerator, Stanford,*

1951: *First cobalt installation* (Victoria Hospital - London - Ontario)

1934: Publication of 23% cure rate in head and neck cancer by X-Rays (Dr Henri Coutard - Institut Curie)

1952: *First linear accelerator* (Henry S. Kaplan, Stanford U., California)

The generation of higher energy radiation beams is more effective in cancer treatment.

Conformal 3D Radiotherapy

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Intensity Modulated Radiotherapy era

The combination of radiotherapy and advanced mapping methods of internal scanning technology resulted in the Intensity Modulated radiation therapy also known as IMRT machine. This machine integrates mapping data and information from devices which are capable of performing Computer Tomography (CT) scans.

IMRT allows better coverage of the target by radiation dose and sparing the organs at risk.
Surgery & postoperative radiotherapy
Radio-chemotherapy era

Combined therapy is a standard of care for Locally advanced head&neck ca.

Image Guided Radiotherapy era

The latest advancement in scanning technology within the radiation therapy is a system called Image Guided Radiation Treatment.

The IGRT machine is a delivery system that uses dynamic CT images of the body that actually compensates for any movement the tumor may have.
Future: Molecular Biology & Radiotherapy era

Molecular prognostic factors
HPV status

Targeted therapy:
Cetuximab
Panitumumab and others

ROLE OF CHEMIOTHERAPY

- increasing the cure rate
- after definitive locoregional therapy
  (elimination of suspected micrometastases)
- preserving organs
- palliation from symptoms
- life prolongation
Systemic Therapy in SCCHN

- **1970s** active cytotoxics
- **1980s** randomized trials of neoadjuvant therapy
  - Correlation chemosensitivity with radiosensitivity
  - Decrease in distant metastases
  - No improvement in locoregional control or survival
- **1990s** randomized trials of chemoradiation
  - Locoregional and survival improvement
- **2000-2009**
  - Cetuximab/radiation: improved LRC/survival
  - Chemoradiation superior in post-op high-risk setting

Contemporary H&N Surgery
MULTIDISCIPLINARY SPECIALTY & MINIMALLY INVASIVE SURGERY

- larynx / pharynx – endo / laser
- parathyroid
- thyroid
- parotid
- neck nodes
- skull base

The Head and Neck Oncologist of the future will need to be a specialist with working knowledge of rapidly advancing technology and the fields of basic research in genetics, gene therapy and biological agents aimed at treatment and prevention of cancer.

However, in spite of all the technological advances and improved outcomes in organ preservation with multidisciplinary treatments, surgery remains the mainstay of treatment for patients with head and neck cancer.

Jatin Shah