

## Epidemiology, Imaging of Head & Neck tumors

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Sommerschule 2012



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Head & Neck cancer  
epidemiology HSC

## Epidemiology

- variable incidence (5-45/100'000)
- USA & UK: HNSCC 3% of all malignancies
- USA: thyroid cancer 2%
- UK: thyroid cancer 0.5%
- ethnic aspects, industrialisation, environment, social network
- most common: oral cavity
- male : female ratio: 2-15:1 (HNSCC)
- male : female ratio: 1:3 (thyroid)
- lower incidence in developing countries (!? <sup>1)</sup>)



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## Epidemiology

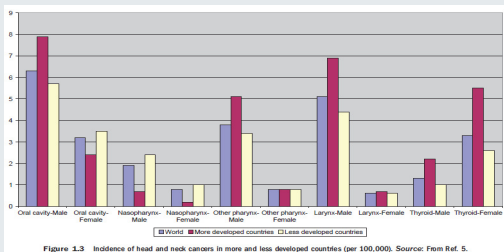


Figure 1.3 Incidence of head and neck cancers in more and less developed countries (per 100,000). Source: From Ref. 5.



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Epidemiology

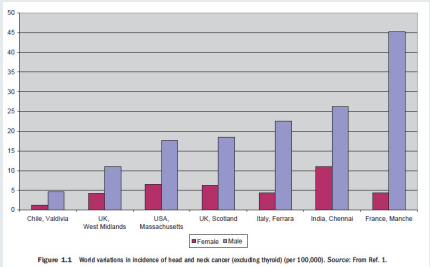


Figure 1.1 World variations in incidence of head and neck cancer (excluding thyroid) (per 100,000). Source: From Ref. 1.



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Epidemiology

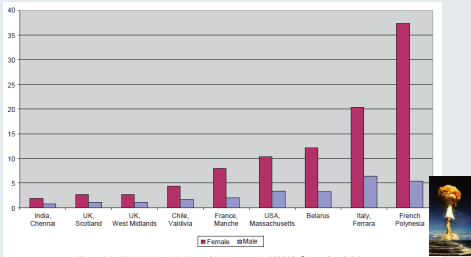


Figure 1.2 World variations in incidence of thyroid cancer (per 100,000). Source: From Ref. 1.



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Table 1.1 Incidence and Mortality of Cancer Worldwide 2002 (b)

Rank	Cancer	Number of cases	Deaths
1	Lung	1,262,132	1,178,918
2	Breast	1,151,296	410,712
3	Colon and rectum	1,023,152	528,978
4	Stomach	933,937	700,349
5	Prostate	679,023	221,002
6	Liver	626,162	598,321
7	Cervix uteri	493,243	273,905
8	Oesophagus	462,117	385,892
9	Bladder	356,557	145,009
10	Non-Hodgkin lymphoma	300,571	171,820
11	Leukaemia	300,522	222,506
12	Oral cavity	274,289	127,469
13	Pancreas	232,206	227,051
14	Kidney etc.	208,480	101,895
15	Ovary etc.	204,499	124,860
16	Corpus uteri	198,783	50,327
17	Brain, nervous system	189,485	141,050
18	Melanoma of skin	150,177	40,781
19	Larynx	159,241	89,956
20	Thyroid	146,013	38,375
21	Other pharynx	130,296	83,993
22	Multiple myeloma	85,104	62,535
23	Nasopharynx	80,042	50,232
24	Hodgkin lymphoma	62,329	22,812
25	Testis	48,613	8,878



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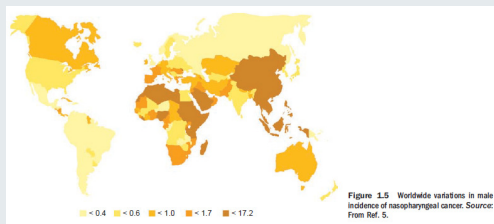
### Epidemiology

- increasing numbers of carcinomas of the oral cavity and pharynx in Germany, Denmark, central- and eastern Europe <sup>1)</sup>
- Nasopharyngeal-Ca  
high incidence in Southern China and Hong Kong  
moderate incidence: Southeastern Asia, Northern Africa, Inuits
- Laryngeal-Ca stable
- Thyroid-Ca  
High incidence in USA and UK, Belarus und French Polynesia



Head & Neck cancer  
nasopharynx, larynx

### Epidemiology



Head & Neck cancer  
nasopharynx, larynx

### Ethiology

- exposition to «environmental pollutions»
- smoking, drinking (90%)
  - synergism (35x)
  - comp. risk with non-smokers
  - reverse smoking
  - not smoked tobacco: chewing, snuff, khaini, Betelnuts and tabaco (increased risk for oral cavity-Ca, Leukoplakia, Fibrosis, Lichen planus).
- ? pollution, toxic substances in work, nutrition, viral infections, genetic predisposition



Head & Neck cancer  
nasopharynx, larynx

### Ethiology

- Low vitamin diet (no fruit and vegetables) independent risk factor for carcinoma of the oral cavity
- High intake of salted meat or fish = co-factor for Nasopharynx-Ca
- genetic predisposition
- levels of IgA against EB Capsid AG as tumor marker, EBV in tumorcells but not in normal nasopharyngeal epithelium
- HPV-DNA in 36% of all oropharyngeal tumors (87% HPV16)  
24% oral cavity tumors (68% HPV16)  
24% laryngeal cancer (69% HPV16)  
9% normal specimens  
randomly integrated in the human genome (2 oncogenes: E6, E7)



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Head & Neck cancer  
nasopharynx, oral

### Ethiology

- Normal tissue -> dysplasia -> CIN -> invasive carcinoma
- „field cancerization“
- risk of metachronic 2. Ca \*

Agent	Site(s)
Current and former	Larynx (38)
Former	Larynx (38-39)
Radon	Larynx (38-39)
Chemical	Pneumoconiosis (40)
Occupational	Osteosarcoma of the jaw (41)
Therapeutic	Salivary glands (42)
Acute, late etc.	Thyroid (43)
Therapeutic	Larynx, non-Hodgkin's lymphoma (44)
Genetic	Thyroid (45)
Genetic	Larynx, non-Hodgkin's lymphoma (46)
Genetic	Uterine cancer (47)
Genetic	Thyroid (48)
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Genetic	Thyroid (100)



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nasopharynx, oral

### Natural course

Small tumor -> large tumor -> lymph node metastasis -> distant-metastasis\*

Site	All Stages %	Local %	Regional %	Distant %
Larynx	64.1	83.5	50.4	13.7
Oral cavity & pharynx	58.8	81.3	51.6	26.4
Thyroid	96.7	99.7	96.9	56.4

Relative 5-year survival in Bezug auf Stadium bei primärer Diagnose; 1996-2002; U.S.A.

Beziehung zwischen  
T & N-Stadium

Direct size relation  
Larynx  
Oral cavity  
Salivary glands  
Lip  
Nasal cavity and sinuses  
No size relation  
Oropharynx  
Nasopharynx  
Hypopharynx  
Thyroid



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nasopharynx, oral

### Development of therapeutical options

1900	Radioactive Radium cures some tumors
20-er	Combination of surgery and radiation
40-er	more aggressive treatment (transfusions, Abx) MSKCC
70-er	random & axial pattern flaps*
1979	PML -> one step reconstruction
1979	Speaking valve (Blom)
80-er	free tissue transfer (chinese flap)
90-er	transoral Laser surgery
90-er	Chemotherapy integrated in a curative concept**
>2000	Robot assisted surgery
>2000	Immunotherapy***
>2000	functional organ preservation



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### Improvement of survival

Earlier treatment = better Outcome ?!  
Patients delay (58%) vs. Doctors delay (24%)

feasability:

radiation\*: 13% did not complete RT  
interruption of RT, per day:  
3.3% increase of risk of local recurrence  
2.9% decrease of probability of disease-free survival

begin of RT: 5-year survival:  
73% within 4w, 62% (4-6 w), 54% >6w



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### Improvement of Survival

Centralisation  
(at least 100 cases/year).

Predictive factors:  
Tumorstage, deprivation

Key words:  
Minimal invasive surgical techniques, „targeted“ therapy  
„tailored“ therapy, interdisciplinary treatment, centralised treatment

Worldwide almost 800'000 newly diagnosed HNSCC/year

aims: prevention / early detection / improved treatment

1-, 5-, und 10-Jahres-Überleben Larynxkarzinom / England



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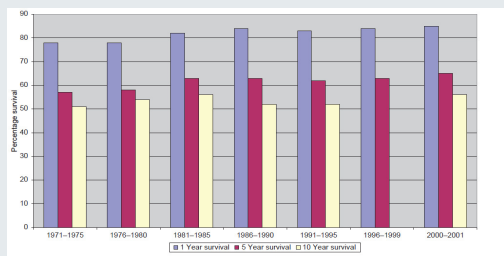
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### Improvement of Survival



1-, 5-, und 10-Jahres-Überleben Larynxkarzinom / England



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Head & Neck cancer  
imaging: PET

### Imaging of Head & Neck tumors

- SCC most common
- different clinical presentation and tendency of metastatic disease
- Staging:
  - inaccessible tumors
  - submucosal spread
  - deep extension
  - local invasion
  - 2<sup>nd</sup> primaries and distant metastasis



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Head & Neck cancer  
imaging: PET

### Imaging of Head & Neck tumors - Larynx

- CT & MRI equal for staging (availability, preference & patient compliance)
- All patients >T1a need a staging scan\*
- UICC, AJCC 2009, 7<sup>th</sup> ed.



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Head & Neck cancer  
imaging: PET

### Imaging of Head & Neck tumors - Larynx

- Minor cartilage involvement does not preclude RT\*
- Clear invasion favors surgical approach
- Limits of detection:
  - early T1 cancers
  - subtle ant. commissure invasion



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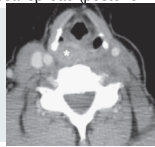
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### Imaging of Head & Neck tumors - Hypopharynx

- risk of late detection and understaging
- incidence of syn. and metachronous tumors very high (12%), distant disease (18%)
- nodal involvement often first sign (~75%; Level IV).
- incidence of occult metastatic disease up to 30%
- consequently bad prognosis
- Preferential submucosal spread (posterior wall & postcricoid location)



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### Imaging of Head & Neck tumors - Hypopharynx

- piriform sinus -> spreading in
  - lateral cervical compartments
  - glottic or paraglottic space
- imaging important for defining true extension of disease



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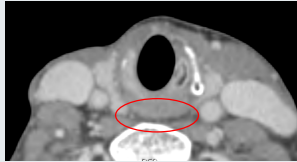
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### Imaging of Head & Neck tumors - Hypopharynx

- Involvement of prevertebral fascia:
- CT: NPV of 82% / prevertebral fat plane




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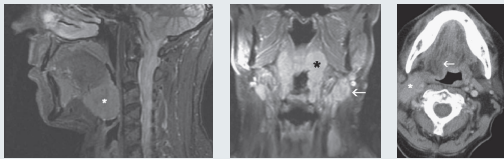
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### Imaging of Head & Neck tumors - Oropharynx

- ant. tonsillar pillar or tongue base
- Early detection difficult (small primaries: CUP, HPV)
- Physiological FDG-uptake, common asymmetry
- Tongue base cancers often underestimated in CE
- Tonsillar cancer with involvement of the parapharyngeal space




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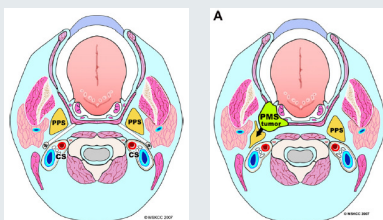
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### Imaging of Head & Neck tumors - Oropharynx

- encasement of internal carotid artery (prestyloid compartment)




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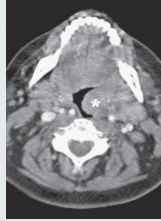
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### Imaging of Head & Neck tumors - Oropharynx

- NH-lymphoma important differential diagnosis



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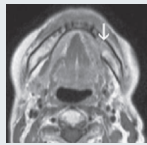
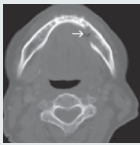
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### Imaging of Head & Neck tumors – oral cavity

- In tongue imaging essential (staging / operability)
- Coronal MRI preferred
- Bone involvement (T4) / CT superior to MRI
- Don't forget salivary gland malignancies (ACC, MEC)\*



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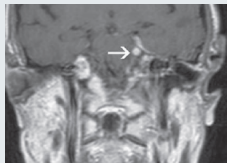
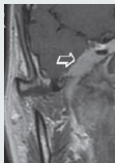
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### Imaging of Head & Neck tumors – Nasopharynx

- Distinctive geographical and environmental risk profile
- Early nodal spread / aggressive local behavior
- Skull base / internal carotid artery
- Involved cranial nerves\*



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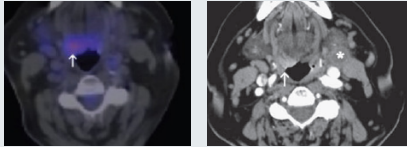
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### N and M staging

- 23% of normal shaped and sized nodes contain metastases (CT).
- Sensitivities of CT and MRI between 41 and 96%.
- PET detects additional 40% / >90% sensitivity
- Problem of micrometastatic disease and necrotic nodes, low specificity



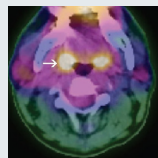
### N and M staging

- Macro- AND microscopic ECS reduces 5y DFS by 50%
- Microscopic ECS difficult to detect by all diagnostic modalities
- Synchronous distant metastases and 2<sup>nd</sup> primaries in 21%.
- Another 9% metachronous metastases
- Sensitivity of cross-sectional imaging only 50%
- PET more sensitive: Haerle et al.
- Standard of care if available in advanced Stage III/IV tumors



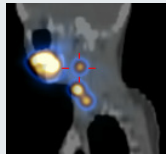
### The Unknown Primary; CUP

- Traditional workup: X-sectional imaging, Panendo, TE and multiple biopsies
- More targeted approach with PET-CT
- Problem: PET before Biopsy or Tonsillectomy / small lesions



### Clinically N0 neck

- micrometastatic disease under detection threshold of PET/CT
- US
- FNAC
- SNB




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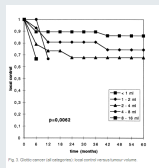
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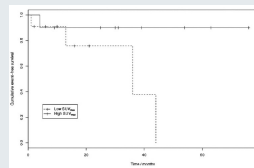
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### morphological prognostic factors

- ...apart from TNM Stage
- tumor volume\*
- SUV (Lymphoma\*\*; SCC controversial)



Hermans et al. 1999



Schreyer, Haerle et al. 2010

Fig. 3. Overall survival rates according to the standardized uptake value (SUV<sub>max</sub>)




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