CODING STAGE:
TNM AND OTHER STAGING SYSTEMS

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Otto Visser
OVERVIEW

PART I
- Introduction What is stage? Why stage?
- History and publications of TNM Classification
- Clinical and pathologic stage
- Stage group and prognostic grouping

PART II
- How to code TNM and other staging systems?
- T-, N- and M-categories, examples
- Other staging systems (extent of disease, Ann Arbor, …)
- How to assign T, N and M?
Classification of tumours:

- according to primary site
- according to tumour type (histology)
- according to grade of differentiation
- according to specific tumour characteristics such as hormonal status, mutations, etc.
- according to the anatomic extent of disease (clinically)
- according to the anatomic extent of disease histopathologically determined
- according to clinical symptoms
- according to sex of the patient... age of the patient
- etc.

→ All these factors influence the prognosis of the patient
WHAT IS STAGE?

- How far the cancer has spread in the body at time of diagnosis?

Example:

- 2.5 cm mass UOQ R Breast. No palpable axillary nodes. Remainder of exam within normal limits.
- Lumpectomy and axillary dissection: 1.8 cm ductal carcinoma. None of four nodes involved.
WHAT IS STAGING?

- Describing extent of disease
  - A common medical language
  - A way of describing or estimating prognosis
**Why Stage?**

- **Clinical**
  - Determine treatment
  - Standardize groupings
  - Evaluate and compare results
    - International comparisons
  - Estimate prognosis

- **Population surveillance**
  - Plan and evaluate cancer screening and prevention programs
  - Monitor cancer control efforts
CODING PRACTICES FOR STAGE IN EUROPE

- 2010 Questionnaire: Eurochip with ENCR
- 86 registries responded (32 countries)  50% response
- The indicator “stage at diagnosis” was gathered for at least one cancer site by 81% (using TNM in 39%).
  - 40-60% for all cancer sites

Availability of stage at diagnosis, cancer treatment delay and compliance with cancer guidelines as cancer registry indicators for cancer care in Europe: Results of EUROCHIP-3 survey.
The TNM System

- The most extensive staging system that exists
- Used all over the world by clinicians and epidemiologists
- Comparability of data
- Changes over time in order to incorporate new developments

Responsibility? Physician who disposes of the most complete information (clin/path.)
HISTORY OF TNM

- **1943-1952** TNM developed by the Frenchmen Pierre Denoix
- **1968** International Union Against Cancer (UICC): TNM classification of Malignant Tumours
- **1969** UICC TNM General rules
- **1974** UICC TNM Classification of Malignant Tumours, 2\textsuperscript{nd} edition
- **1978** UICC TNM Classification of Malignant Tumours, 3\textsuperscript{rd} edition
- **1982** UICC TNM Classification of Malignant Tumours, revised 3\textsuperscript{rd} edition
- **1987** UICC TNM Classification of Malignant Tumours, 4\textsuperscript{th} edition
- **1992** UICC TNM Classification of Malignant Tumours, revised 4\textsuperscript{th} edition
- **1997** UICC TNM Classification of Malignant Tumours, 5\textsuperscript{th} edition
- **2002** UICC TNM Classification of Malignant Tumours, 6\textsuperscript{th} edition
- **2009** UICC TNM Classification of Malignant Tumours, 7\textsuperscript{th} edition
- **2016** UICC TNM Classification of Malignant Tumours, 8\textsuperscript{th} edition
**HISTORY OF TNM**

**Evolution in**
- Scientific knowledge
- Therapeutic possibilities

**Better registration**
→ improved possibilities to analyse subgroups

**Evolution in TNM-classification**
- refining/disappearing subgroups
- changes within subgroups
- changes in stages

Some STABILITY over time is a prerequisite → only modifications in case of major progress

DOCUMENT the moment of adoption of a new version in a cancer registry
THE TNM SYSTEM

- Descriptors: T-, N- and M-categories
  - T = Tumours (extension and/or size)
  - N = Nodes (regional lymph nodes)
  - M = Metastasis (distant metastasis, also non-regional lymph nodes)

- Staging basis
  - **Clinical**: all information prior to start of treatment (including surgical exploration before the resection of the primary tumour)
  - **Pathological**: requires resection of the primary tumour / regional lymph nodes
THE TNM SYSTEM – STAGE GROUPING

- Combine T, N and M-category into a “Stage”
  - T = Tumor specific

- “Stage grouping” => “Stage” (8th edition)
  - **Stage 0**: (Tis) e.g. Stage 0 breast cancer (Tis)
    - => e.g. bladder Stage 0a (Ta), Stage 0is (Tis)
  - **Stage I-III**: localized/regional
    - Colon and rectum T2N0M0 = stage I
    - Breast T2N0M0 = stage IIA
    - SCC of skin: T2N0M0 = stage II
  - **Stage IV**: distant metastasis
    - Breast T2N1M1 = stage IV
    - Larynx T4bN0M0 = stage IVB

- TNM does not mention ‘unknown stage’ but if T and/or N are unknown it is in general not possible to classify as a specific stage => Avoid missing data as much as possible
AVAILABILITY OF cTNM STAGE FOR LUNG CANCER IN BELGIUM, 2010-2011

![Graph showing the availability of cTNM stage for lung cancer in Belgium from 2010 to 2011. The graph plots the number of cases per diagnostic centre against the proportion of cases with available cTNM stage, with different lines representing diagnostic centres and overall percentages with confidence intervals. The graph indicates variability across diagnostic centres and a general trend of increasing availability with a higher proportion at the higher end of the number of cases per centre.]
FIGURE 70 - LUNG CANCER: RELATIVE SURVIVAL BY STAGE IN MALES (BELGIUM, 2004-2008)

Survival time (years)

Source: Belgian Cancer Registry
**STAGING BASIS: PREFIXES**

- **cTNM** – clinical stage: essential to select and evaluate therapy options
- **pTNM** – pathologic stage: provides most precise data to estimate prognosis and plan further therapy
- **yTNM** – post-therapy classification, measures response to neoadjuvant treatment
- **rTNM** – recurrence stage: extent of tumor after recurrence
- **aTNM** – autopsy stage: determined at autopsy, no previous diagnosis of cancer
The TNM System – Prognostic Grouping
Example: Esophagus

### Stage Grouping

<table>
<thead>
<tr>
<th>Carcinomas of the oesophagus and oesophagogastric junction</th>
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</thead>
<tbody>
<tr>
<td>Stage 0</td>
</tr>
<tr>
<td>Stage IA</td>
</tr>
<tr>
<td>Stage IB</td>
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</table>

### Prognostic Grouping

#### Squamous Cell Carcinoma

<table>
<thead>
<tr>
<th>Group</th>
<th>T</th>
<th>N</th>
<th>M</th>
<th>Grade</th>
<th>Location*</th>
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<tr>
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<td>0</td>
<td>0</td>
<td>1, X</td>
<td>Lower, X</td>
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</table>

#### Adenocarcinoma

<table>
<thead>
<tr>
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<th>T</th>
<th>N</th>
<th>M</th>
<th>Grade</th>
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<tbody>
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<td>0</td>
<td>Tis</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
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<td>IB</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
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Source: doctorsgates.blogspot.com
TNM PUBLICATIONS

UICC TNM E-LEARNING MODULES

http://www.uicc.org/resources/tnm/publications-resources

8th edition

Introduction, Lip, oral cavity
Breast, Colorectal, cervix, prostate, lung
A new Cancer Staging Tool is now available for free access

An NICR, IARC and UICC collaboration.

A collaboration of the Northern Ireland Cancer Registry (NICR) and the International Agency for Research on Cancer (IARC) with the Union for International Cancer Control (UICC) has led to a new tool, CanStaging - a supportive web-based staging tool for cancer registrars.

The tool is designed to maximise the availability of TNM staging rules in order to aid standardisation and comparability of cancer staging internationally. The tool calculates the TNM staging classification from the basic factors on extent of disease, entered by the user in a controlled fashion. The tool implements UICC’s TNM Classification of Malignant Tumours (7th edition) and is available for non-profit use.

Find out more about the tool by reading the quick guide PDF.

Breast, cervix, colorectal, prostate, lung
NICR STAGING TOOL

User enters size of tumour in cm
User enters number of involved lymph nodes
Select metastatic status
TNM profile & stage group is calculated!
HOW TO CODE TNM AND OTHER STAGING SYSTEMS
T-TUMOR DIFFERENT CRITERIA FOR DIFFERENT CANCERS

- Mostly T1-T4 (ovary T1-T3)
- Sub classifications (T1a, T1b, etc.) are often used
- Tumor size
  - Breast, parotid gland, oral cavity
- Depth of invasion through wall of organ
  - Colon, bladder, melanoma
- Location and extension
  - Lung, larynx, pancreas
- Other factors
  - Tumor multiplicity (thyroid, liver)
  - Grade (sarcomas)
  - Prognostic factors (prostate, testis)
T-CATEGORIES: SIZE

Example: Breast

- **T1** ≤ 20 mm
- **T2** >20 mm, ≤ 50 mm
- **T3** >50 mm
- **T4** involving chest wall and/or skin
**T-CATEGORIES: DEPTH OF INVASION**

- **Example:** **Bladder**
  - **T1** subepithelial connective tissue
  - **T2** muscularis propria
  - **T3** perivesical tissue
  - **T4** beyond bladder
**T-CATEGORIES: EXTENSION**

- **Example: Larynx**
  - **T1** One/both vocal cords, normal mobility
  - **T2** Extension to supraglottis
  - **T3** Confined to larynx with vocal cord fixation
  - **T4a** Moderately advanced local disease
  - **T4b** Very advanced local disease
T-categories: combination of Clark level and Breslow depth of invasion

- Clark Level and Breslow Depth of Invasion

<table>
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<tr>
<th>Clark Level</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
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<td>Epidermis</td>
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<tr>
<td>Papillary region</td>
<td></td>
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<td></td>
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<tr>
<td>Dermis</td>
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<tr>
<td>Reticular region</td>
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<tr>
<td>Subcutaneous tissue</td>
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</tbody>
</table>

Breslow depth of invasion (in millimeters from skin surface)

- TX: Primary tumor cannot be assessed
- T0: No evidence of primary tumor
- Tis: Melanoma in situ
- T1: Melanomas 1.0 mm or less in thickness
- T2: Melanomas 1.01–2.0 mm
- T3: Melanomas 2.01–4.0 mm
- T4: Melanomas more than 4.0 mm

Adapted from www.med-ars.it/galleries/ various_2.htm
OTHER T-CATEGORIES

- **Tis** – carcinoma in situ
  - All epithelial cancers
- **Ta** – non-invasive papillary carcinoma
  - Bladder, renal pelvis, ureter, urethra
  - Penis
- **T0** – no evidence of primary tumor
  - Occult breast carcinoma
  - Accidental finding in a surgical specimen (gall bladder resection because of gall stones)
- **TX** – primary tumor cannot be assessed
  - It is impossible to assign the highest T-category
  - Do not code TX in case of doubt between 2 consecutive T-categories (code the lower one)
Absence or presence of metastases in primary lymph node drainage area of cancer
N – REGIONAL LYMPH NODES

- **N0**
  Regional lymph nodes have been clinically or pathologically proven to be free of metastatic disease

- **N1-N3**
  Increasing involvement of regional lymph nodes by number, location or size

- **NX** – regional nodes cannot be assessed
  No clinical or pathological investigations have been performed
**N-CATEGORIES: NUMBER**

- **Example:** *Stomach*
  - **N1** 1-2 regional nodes involved
  - **N2** 3-6 regional nodes involved
  - **N3** 7 or more node involved
**N-categories: Location**

- **Example:** Lung
- **N1** peribronchial and/or hilar and intrapulmonary nodes
- **N2** mediastinal and/or subcarinal nodes
- **N3** contralateral mediastinal, hilar, scalene or supraclavicular nodes
**N-CATEGORIES: SIZE AND NUMBER**

- **Example:** Renal pelvis and ureter
  - **N1** single node, 2 cm or less
  - **N2** single node 2-5 cm or multiple nodes <5 cm
  - **N3** any node >5 cm
M – DISTANT METASTASES: SYSTEMIC INVOLVEMENT

Categories

- **M0** absence of metastatic disease
- **M1** presence of at least one distant metastasis

M1 subcategory, example: prostate

- M1a non-regional lymph nodes
- M1b bone(s)
- M1c other site(s)

In case of multiple metastatic sites: always code to the highest value (M1c)

(Not any more available since TNM 7th edition

- **MX** – distant metastasis cannot be assessed)
OTHER STAGING SYSTEMS

- Condensed TNM \(\rightarrow\) essential TNM
- Extent of disease
- Dukes stage (obsolete)
- FIGO stage (almost equivalent to TNM)
- Ann Arbor stage (lymphoma)
- International Prognostic Scoring System (haematological malignancies)
ESSENTIAL TNM

- When T, and/or N, and/or M have not been explicitly recorded in the clinical/pathological records, the cancer registry should attempt to score essential TNM according to the following scheme:
  - **T**: L (localized) or A (advanced)*
  - **N**: R- or R+
  - **M**: M- or M+
  - Stage:
    - I: TL R- M-
    - II: TA R- M-
    - III: anyT R+ M-
    - IV: any T any R M+

*Subcategories L1/L2 and A1/A2 are also available
EXTENT OF DISEASE (SUMMARY STAGE)

- Simple to learn and use
- Requires minimal information
- Uses all information in record
- In widespread use since 1970s
- Applies to solid tumors
- Good for national surveillance

- Five main categories
  - In situ
  - Localized
  - Regional
    - to lymph nodes
    - by direct extension
    - to lymph nodes and direct extension
  - Distant
  - Unknown
**EXTENT OF DISEASE: IN SITU**

- “In place”
- No stromal invasion; no penetration of basement membrane

![Diagram of cancerous cell and surrounding tissues]

EXTENT OF DISEASE: LOCALIZED

- Confined to organ of origin
- Can be widely invasive within organ of origin
- Names of anatomic substructures important

A Localized Tumor with Vascular Invasion

EXTENT OF DISEASE: REGIONAL

- Difficult to categorize properly
- Tumor beyond limits of organ of origin
- Potential for spread by more than one vascular or lymphatic route
- Subcategories
  - Regional direct extension
  - Regional to lymph nodes
  - Regional both direct extension and lymph nodes
  - Regional, NOS
EXTENT OF DISEASE: DISTANT

- Tumor spread to remote area of body
- Four methods of spread
  - Distant direct extension
  - Distant lymph nodes
  - Hematogenous metastases
  - Implantation metastases
- Common sites of spread for solid tumors
  - Liver
  - Lung
  - Bones
  - Brain

EXTENT OF DISEASE: UNKNOWN

- No investigations were performed
- No information of the staging procedures is available
### Other Staging Systems – Gynecological Cancers

**Ovary – 7th ed TNM and Ovary, Fallopian Tube and primary peritoneal carcinoma FIGO 2014**

<table>
<thead>
<tr>
<th>TNM</th>
<th>1988 FIGO</th>
</tr>
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<tr>
<td>T3 and/or</td>
<td>Peritoneal metastasis beyond pelvis</td>
</tr>
<tr>
<td>N1</td>
<td>and/or regional lymph node metastasis</td>
</tr>
<tr>
<td></td>
<td>III</td>
</tr>
<tr>
<td>T3a N0</td>
<td>Microscopic peritoneal metastasis</td>
</tr>
<tr>
<td></td>
<td>IIIA</td>
</tr>
<tr>
<td>T3b N0</td>
<td>Macroscopic peritoneal metastasis ≤ 2 cm</td>
</tr>
<tr>
<td></td>
<td>IIIB</td>
</tr>
<tr>
<td>T3c or N1</td>
<td>Peritoneal metastasis &gt;2 cm</td>
</tr>
<tr>
<td></td>
<td>IIIIC</td>
</tr>
<tr>
<td>N1</td>
<td>and/or regional lymph node metastasis</td>
</tr>
<tr>
<td>M1</td>
<td>Distant metastasis (excludes peritoneal) IV IV metastasis</td>
</tr>
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</table>

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<tr>
<th>TNM Proposal 8th (2016)</th>
<th>2014 FIGO</th>
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</thead>
<tbody>
<tr>
<td>T3 and/or N1</td>
<td>Peritoneal metastasis beyond pelvis</td>
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<td></td>
<td>III</td>
</tr>
<tr>
<td>T1/T2 N1</td>
<td>Retroperitoneal lymph nodes only</td>
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<tr>
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<tr>
<td>T1/T2 N1b</td>
<td>&gt; 10mm</td>
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<td>IIIA1i</td>
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<tr>
<td>T3a N0/N1</td>
<td>Microscopic peritoneal metastasis</td>
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</tr>
<tr>
<td>T3b N0/N1</td>
<td>Macroscopic peritoneal metastasis ≤ 2 cm</td>
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<tr>
<td>T3c N0/N1</td>
<td>Peritoneal metastasis &gt;2 cm</td>
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<td>IIIC</td>
</tr>
<tr>
<td>M1</td>
<td>Distant metastasis (excludes peritoneal) IV IV metastasis</td>
</tr>
<tr>
<td>M1a</td>
<td>Pleural effusion positive cytology</td>
</tr>
<tr>
<td></td>
<td>IVA</td>
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<tr>
<td>M1b</td>
<td>Parenchymal metastases</td>
</tr>
<tr>
<td></td>
<td>IVB</td>
</tr>
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</table>
OTHER STAGING SYSTEMS - LYMPHOMA

- **Ann Arbor Staging**
  - **Stage I, IS, IE**
    - 1 nodal region or one extra-lymphatic site
  - **Stage II, IIE, IIS, IIIES**
    - ≥ 2 nodal regions or 1 extra-lymphatic site and its regional nodes, one side of diaphragm
  - **Stage III, IIIE, IIIS, IIIES**
    - Nodal regions/sites on both sides of diaphragm
  - **Stage IV**
    - Dissemination to extralymphatic visceral sites
**How to Assign T, N and M?**

- Determine primary site and histology
- Look up site chapter
- Is histology included in this chapter?
- Review list of regional lymph nodes
- Clinical versus pathologic stage
- Find staging information in the tables
- Determine T, N, M
- (Assign stage on the basis of the T, N and M)
**Coding TNM - Example**

- **2.5 cm mass UOQ R Breast. No palpable axillary nodes. Remainder of exam within normal limits.**
- **Lumpectomy and axillary dissection: 1.8 cm ductal carcinoma. None of four nodes involved.**

<table>
<thead>
<tr>
<th>Anatomical Stage/Prognostic Groups</th>
<th>cTNM: T2N0M0 = clinical stage IIA</th>
<th>pTNM: T1cN0M0 = stage IA</th>
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<tbody>
<tr>
<td>Stage 0</td>
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<td>Stage IA</td>
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<td>Tis</td>
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<td>T1*</td>
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<td>Stage IB</td>
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<td>Stage IIIA</td>
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<td>M1</td>
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</tbody>
</table>

**ANATOMIC STAGE/PROGNOSTIC GROUPS**

- **T1**: Tumor ≤ 20 mm in greatest dimension
- **T1mi**: Tumor ≤ 1 mm in greatest dimension
- **T1a**: Tumor > 1 mm but ≤ 5 mm in greatest dimension
- **T1b**: Tumor > 5 mm but ≤ 10 mm in greatest dimension
- **T1c**: Tumor > 10 mm but ≤ 20 mm in greatest dimension
- **T2**: Tumor > 20 mm but ≤ 50 mm in greatest dimension

**N0**: No regional lymph node metastases