Imaging of Lung Cancer: A Review of the 8th TNM Staging System

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Do you have the 7th TNM Staging System memorized?

A. Yes
B. At one point I knew it, but not anymore
C. No, but I wish I did
D. No, and I have no intention of memorizing it
E. What is the TNM staging system?
The **EIGHTH** edition of the TNM classification for lung cancer became the worldwide standard January 1, 2017...

...except in the US, where it is to be adopted in 2018.¹


### 8th TNM Staging System

<table>
<thead>
<tr>
<th>Stage</th>
<th>T</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occult Carcinoma</td>
<td>TX</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage 0</td>
<td>Tis</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IA1</td>
<td>T1a(mi)</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IA2</td>
<td>T1b</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IA3</td>
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<td>N0</td>
<td>M0</td>
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<tr>
<td>Stage IB</td>
<td>T2a</td>
<td>N0</td>
<td>M0</td>
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<tr>
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<td>T2b</td>
<td>N0</td>
<td>M0</td>
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<tr>
<td>Stage IIB</td>
<td>T1a-c</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIIB</td>
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<td>N1</td>
<td>M0</td>
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<tr>
<td>Stage IIIC</td>
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</tr>
<tr>
<td>Stage IV</td>
<td>Any T</td>
<td>Any N</td>
<td>M1a</td>
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### Any metastases:
Stage IV

### N3 nodes:
Stage IIIB

Surgery rarely performed beyond IIIA

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### 8th TNM Staging System

**Any metastases:** Stage IV

**N3 nodes:** Stage IIIB

Surgery rarely performed beyond IIIA

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<td>N1</td>
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<tr>
<td>26</td>
<td>Stage IVB</td>
<td>Any T</td>
<td>Any N</td>
</tr>
</tbody>
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Objectives

• “Table” the table

• Letter-by-letter: findings that alter staging (and what should be in the report)

• Review changes for the 8th TNM system

Staging does not dictate management
Staging is a *guide* to management...

T4N0M0 – Stage IIIA

Pneumonectomy

Staging is a *guide* to management...

Radiation
Staging is a guide to management... and prognosis

Where does the TNM Staging Apply?

- Non-small cell lung cancer
- Small cell lung cancer
- Bronchopulmonary carcinoid*
T – primary Tumor

N – lymph Node involvement

M – Metastases

64-year-old man
What is the *minimum* M descriptor based on these images?

A. M0  
B. M1a  
C. M1b  
D. M1c
M – Distant Metastasis

- Thorax M1a
- Brain
- Bone M1b
- Liver Or
- Adrenal M1c
- Lymph nodes

M – Distant Metastasis

- Thorax M1a
- Brain
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- Lymph nodes
M – Distant Metastasis

M1a – intrathoracic

- Pleura
- Pericardium
- Contralateral lung

65-year-old woman

Pericardiocentesis (+) for adenocarcinoma

2.3 cm (T1c) adenocarcinoma referred for SBRT

Pleural fluid (+ adenocarcinoma) → M1a
Diffuse adenocarcinoma

Bilateral pulmonary disease → M1a

M1b → 8th TNM → M1c

One extrathoracic metastasis  Multiple extrathoracic metastasis

(in 7th TNM all extrathoracic metastases were M1b)
M1b

**One extrathoracic metastasis**

M1c

**Multiple extrathoracic metastasis**


40-50% of lung cancers have metastases at presentation\(^1\)

\(^1\)Niu FY et al. Distribution and prognosis of uncommon metastases from non-small cell lung cancer. BMC Cancer 2016; 16:149
ONE Extrathoracic Metastasis $\rightarrow$ M1b

M1c - Multiple Metastases in one organ
M1c - Multiple Organs

### M

- **Intrathoracic metastases (M1a)?**
  - Pleura/pericardium
  - Contralateral lung

- **Extrathoracic metastases?**
  - One metastasis → M1b
  - Multiple → M1c
27-year-old man with LLL squamous cell carcinoma

This patient’s N classification is likely?

A. N0  
B. N1  
C. N2  
D. N3
No Changes to N for 8th TNM Staging System
N1:

-Ipsilateral hilar
(or further out in the lung)

T1cN1M0

http://www.radiologiq.com/nodes/
N1 Nodes... but metastatic disease (M1c)

Subcarinal Nodes are N2
(regardless of side of cancer)
T2b LLL adenocarcinoma

N2:
- Subcarinal
- Ipsilateral mediastinal
N2:

- Subcarinal
- Ipsilateral mediastinal

Right lung cancer

Paratracheal – left versus right?

Left lung cancer

Left Lower Lobe Primary
The *LEFT* border of the trachea is midline.

Clinical (c) vs Pathologic (p) staging
Clinical (c) vs Pathologic (p) staging

cT2aN1M0

c = Data obtained ‘before definitive treatment’
- imaging
- physical exam
- biopsy/fluid analysis

At surgery:

2/2 level 4R lymph nodes → positive for adenocarcinoma
1/1 level 2R lymph node → positive for adenocarcinoma
Clinical (c) vs Pathologic (p) staging

cT2aN1M0
pT2aN2M0

p = Data obtained ‘from surgery as part of definitive treatment’

N3

• Contralateral mediastinal/hilar

• Supraclavicular/scalene
N3

- Contralateral mediastinal/hilar
- Supraclavicular/scalene (either side)

Other node chains still not included in 8th TNM staging
N

N0 – No mets

N1 – Same lung/same hilum

N2:
Subcarinal
Ipsilateral mediastinal

N3:
Contralateral mediastinum/hilum
Supraclavicular/scalene

66-year-old woman
What is the correct measurement and T-descriptor (8th TNM)?

A. 2.3cm, T=1b
B. 2.3cm, T=1c
C. 1.8cm, T=1b
D. 1.8cm, T=1c
### T – Tumor Size

<table>
<thead>
<tr>
<th>(cm)</th>
<th>7th</th>
<th>8th</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1</td>
<td>T1a</td>
<td>T1a</td>
</tr>
<tr>
<td>&gt;1-2</td>
<td>T1b</td>
<td>T1b</td>
</tr>
<tr>
<td>&gt;2-3</td>
<td>T1b</td>
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</tr>
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<td>&gt;3-4</td>
<td>T2a</td>
<td>T2a</td>
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<tr>
<td>&gt;4-5</td>
<td>T2b</td>
<td>T2b</td>
</tr>
<tr>
<td>&gt;5-6</td>
<td>T2b</td>
<td>T3</td>
</tr>
<tr>
<td>&gt;6-7</td>
<td>T3</td>
<td>T4</td>
</tr>
<tr>
<td>&gt;7</td>
<td>T3</td>
<td></td>
</tr>
</tbody>
</table>

Tumor Size: 2.3 cm
Two components of the T descriptor

**Size:**
- Longest dimension
- 1 cm increments

**Invasion:**
- T2 $\rightarrow$ Bronchus
- T3 $\rightarrow$ Chest Wall/Apex*
- T4 $\rightarrow$ Everything Else

*(Also includes phrenic nerve)*
T2 Invasion:

- Bronchus invasion/obstruction*

*Carina/trachea – T4
Distance from carina no longer important in 8th TNM*

**Both are T2 tumors**

T3 Invasion:
- Chest Wall
- Pancoast Tumor
- Phrenic Nerve

3.2cm tumor; chest wall invasion → T3
T3 Invasion:

- Chest Wall
- **Pancoast Tumor**
- Phrenic Nerve

T4 Invasion:
(everything else)

- Mediastinum
  - Heart
  - Great vessels
  - Trachea/carina
  - **Vertebral body**
  - Diaphragm
T4 Invasion:
(everything else)

- Mediastinum
  - Heart
- Great vessels
- Trachea/carina
- Vertebral body
  - Diaphragm

Left atrial invasion; tumor still resected
**T – Satellite Nodules**

- Same lobe – **T3**
- Same lung, different lobe – **T4**
- Other lung – **M1a**

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**Two components of the T descriptor**

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SPECIAL SITUATIONS:

Small Cell Carcinoma
TNM applies to Small Cell Carcinoma

Prior to 7th – staged as limited or extensive

Few SCC patients treated surgically

Underwent LLLectomy and PA resection
SPECIAL SITUATIONS: Adenocarcinoma

Mixed solid and groundglass nodule
Multiple Adenocarcinomas
Pneumonic Adenocarcinoma

• Mixed solid and GGO:
  – **Solid** (invasive component) measured separately
  – (total lesion diameter should also be reported)

‘Pneumonic’ type of mucinous adenocarcinoma

– T3 (same lobe)
– T4 (same lung)
– M1a if both lungs

(Often have better prognosis)
‘Pneumonic’ type of mucinous adenocarcinoma

- T3 (same lobe)
- T4 (same lung)
- M1a if both lungs

• For multifocal GGO:
  - T stage of largest nodule
• For multifocal GGO:
  – T stage of largest nodule

SPECIAL SITUATIONS:

Synchronous Lung Cancers
• Synchronous primaries

• Each TNM separate

Should you expect a stage in the report?
Glastonbury CM, et al. Do Radiologists Have Stage Fright? Tumor Staging and How We Can Add Value to the Care of Patients with Cancer. Radiology 2016; 278:11-12

“3.5 cm left upper lobe mass with possible mediastinal invasion” → T2a

“Enlarged, enhancing subaortic lymph node” → N2

“Left pleural effusion with enhancing nodularity” → M1a
Conclusion

• T and M have changed for the 8th TNM system
• T – Size, Invasion
• N – further away from primary, higher N
• M:
  — Intrathoracic – M1a
  — Extrathoracic –
    • One – M1b
    • Multiple – M1c

Thank You!

For references and more information please see my website (below)

Lymph node map app:  http://www.radiologiq.com/nodes/

travis.henry@ucsf.edu

THrads.com
References