Principles of Cancer Surgery

Surgery Grand Rounds
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Surgical Oncology 101

Outline
• History of surgical oncology
• The TNM staging system
• Tumor biology
• Integrating multidisciplinary care
• Surgical principles
• Future of surgical oncology
Occasionally the prince and princess try to overthrow the powerful forces of the King and Queen, sometimes with temporary apparent victories, usually to no long term avail.

Blake Cady, MD
History of Surgical Oncology

Radical Surgery vs. Time
Staging – the TNM System

American Joint Commission on Cancer (AJCC)
T = Tumor (size, grade)  N = Nodes (number)  M = Metastasis

Goals
• Estimate prognosis
• Facilitate treatment planning
• Allow comparisons between treatment groups

General Classification
Stage I - Superficial early cancer
Stage II - Locally advanced - nodes
Stage III - Regionally advanced + nodes
Stage IV - Metastatic beyond regional nodes
Staging – the TNM System

Advantages
- Each revision provides more accurate prognosis
- Allows for general estimates of survival

Disadvantages
- Each revision more complex
- Stage shifting over time
- Still lumping cancers by relatively crude descriptive characteristics
## Magnitude of the Problem

### Leading Sites of New Cancer Cases and Deaths – 2007 Estimates

<table>
<thead>
<tr>
<th>Estimated New Cases*</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td><strong>Female</strong></td>
</tr>
<tr>
<td>Prostate</td>
<td>Breast</td>
</tr>
<tr>
<td>218,890 (29%)</td>
<td>178,480 (26%)</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>Lung &amp; bronchus</td>
</tr>
<tr>
<td>114,780 (15%)</td>
<td>98,620 (15%)</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>Colon &amp; rectum</td>
</tr>
<tr>
<td>79,130 (10%)</td>
<td>74,630 (11%)</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>Uterine corpus</td>
</tr>
<tr>
<td>50,040 (7%)</td>
<td>39,080 (6%)</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>34,200 (4%)</td>
<td>28,990 (4%)</td>
</tr>
<tr>
<td>Melanoma of the skin</td>
<td>Melanoma of the skin</td>
</tr>
<tr>
<td>33,910 (4%)</td>
<td>26,030 (4%)</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>Thyroid</td>
</tr>
<tr>
<td>31,590 (4%)</td>
<td>25,480 (4%)</td>
</tr>
<tr>
<td>Leukemia</td>
<td>Ovary</td>
</tr>
<tr>
<td>24,800 (3%)</td>
<td>22,430 (3%)</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>Kidney &amp; renal pelvis</td>
</tr>
<tr>
<td>24,180 (3%)</td>
<td>19,600 (3%)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>Leukemia</td>
</tr>
<tr>
<td>18,830 (2%)</td>
<td>19,440 (3%)</td>
</tr>
<tr>
<td>All sites</td>
<td>All sites</td>
</tr>
<tr>
<td>766,860 (100%)</td>
<td>678,060 (100%)</td>
</tr>
</tbody>
</table>

| **Male**             | **Female**       |
| Lung & bronchus      | Lung & bronchus  |
| 89,510 (31%)         | 70,880 (26%)     |
| Prostate             | Breast           |
| 27,050 (9%)          | 40,460 (15%)     |
| Colon & rectum       | Colon & rectum   |
| 26,000 (9%)          | 26,180 (10%)     |
| Pancreas             | Pancreas         |
| 16,840 (6%)          | 16,530 (6%)      |
| Leukemia             | Leukemia         |
| 12,320 (4%)          | 15,280 (6%)      |
| Liver & intrahepatic bile duct | Liver & intrahepatic bile duct |
| 11,280 (4%)          | 11,280 (4%)      |
| Esophagus            | Non-Hodgkin lymphoma |
| 10,900 (4%)          | 9,060 (3%)       |
| Urinary bladder      | Urinary bladder  |
| 9,630 (3%)           | 7,400 (3%)       |
| Non-Hodgkin lymphoma | Non-Hodgkin lymphoma |
| 9,600 (3%)           | 9,060 (3%)       |
| Brain & other nervous system | Brain & other nervous system |
| 5,590 (2%)           | 5,590 (2%)       |

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.

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www.cancer.org
Scope of the Problem


www.cancer.org
# Scope of the Problem

## Lifetime Probability of Developing Cancer, by Site, Women, US, 2001-2003*

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites†</td>
<td>1 in 3</td>
</tr>
<tr>
<td>Breast</td>
<td>1 in 8</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1 in 16</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 19</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>1 in 40</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 55</td>
</tr>
<tr>
<td>Ovary</td>
<td>1 in 69</td>
</tr>
<tr>
<td>Melanoma</td>
<td>1 in 73</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 79</td>
</tr>
<tr>
<td>Urinary bladder‡</td>
<td>1 in 87</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>1 in 138</td>
</tr>
</tbody>
</table>

* For those free of cancer at beginning of age interval. Based on cancer cases diagnosed during 2001 to 2003.  
† Sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.  
‡ Includes invasive and in situ cancer cases.  

## Lifetime Probability of Developing Cancer, by Site, Men, US, 2001-2003*

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites†</td>
<td>1 in 2</td>
</tr>
<tr>
<td>Prostate</td>
<td>1 in 6</td>
</tr>
<tr>
<td>Lung and bronchus</td>
<td>1 in 12</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>1 in 17</td>
</tr>
<tr>
<td>Urinary bladder†</td>
<td>1 in 28</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 47</td>
</tr>
<tr>
<td>Melanoma</td>
<td>1 in 49</td>
</tr>
<tr>
<td>Kidney</td>
<td>1 in 61</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1 in 67</td>
</tr>
<tr>
<td>Oral Cavity</td>
<td>1 in 72</td>
</tr>
<tr>
<td>Stomach</td>
<td>1 in 89</td>
</tr>
</tbody>
</table>

* For those free of cancer at beginning of age interval. Based on cancer cases diagnosed during 2001 to 2003.  
† Sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.  
‡ Includes invasive and in situ cancer cases.  
Tumor Biology

Understanding tumor biology is critical for:
- deciding when to operate
- deciding what operation to do
Tumor Biology

General principles
Epithelial tumors (breast, melanoma, GI, lung)
  - invade lymphatic and vascular structures
Connective tissue tumors (sarcomas)
  - displace other structures
  - hematogenous spread
Ovarian & Testicular
Carcinoid tumors
Liquid tumors
What Does it Take to Make a Tumor?

Weinberg, RA. NEJM 2002; 347:1593-1603
Integrating a Multidisciplinary Approach
Biology of Cancer Recurrence

Recurrence of tumor

• Tumor environment is a wound that doesn’t heal
• ~75% of recurrences occur within the first 2 years of surgery
• 5 year mark for “cure” is arbitrary

• One third local recurrence alone
• One third local plus distant simultaneously
• One third distant alone
Imaging of Cancer Patients

Pre-op Imaging
- Apply tumor biology principles
- What would change the type or timing of your operation?

Post-op Imaging
- Selective
- Patient anxiety
- Salvage surgery for recurrence is rare
- No prospective trial for “routine” post-op testing has shown a benefit in survival
Statistics for Cancer Patients

- Median follow-up and survival
- Absolute differences vs. relative differences
- Overall survival
- Disease specific survival
- Disease free survival (recurrence free)
Surgery as Curative

• To cure a patient with surgery is still relatively rare
• Some percentage (one third?) cured
• Earlier detection is best chance for cure
• Clarify the goal of your operation
  (curative, debulking, palliative, preventative)
Surgery as Preventative

Prophylactic surgery to prevent cancer development

<table>
<thead>
<tr>
<th>Disease</th>
<th>Marker</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAP</td>
<td>APC</td>
<td>Colectomy</td>
</tr>
<tr>
<td>MEN 2</td>
<td>RET</td>
<td>Throidectomy</td>
</tr>
<tr>
<td>Familial Breast Cancer</td>
<td>BRCA 1,2</td>
<td>Mastectomy</td>
</tr>
<tr>
<td>Familial Ovarian Cancer</td>
<td>?</td>
<td>Oophorectomy</td>
</tr>
</tbody>
</table>
Surgery for Local Control

• Local control should be a top priority
• First operation is best chance for control
• Apply basic surgical fundamentals to reduce local recurrences
• Salvage surgery to achieve local control problematic
Principles of Biopsies

To biopsy or not to biopsy that is the question?

Answer:
• Know your tumor biology
• Will it change treatment plan?
• Biopsy options
  • Aspiration, Core, Incisional, Excisional
• Avoid hematoma
• Plan to excise needle or biopsy site
Principles of Margins

- Factor in tumor biology
- Factor in location
- Factor in other treatments
- In general 1cm gross margin is minimum necessary
- Wider margin preferable if it can be done with minimal additional morbidity
- Goal of margin is reduced local recurrence
Principles of Lymph Nodes

Function of lymph nodes

- Primarily for antigen recognition
- Not a filter
- Majority of tumor cells pass through
- Rare tumor cells can grow in lymph nodes
- Lymph nodes are indicators - not governors - of survival
Principles of Lymph Nodes

Lymph node dissection

• Harvest lymph nodes for:
  1 staging
  2 local control
  3 interrupt metastatic cascade

• Factor in risk/benefit ratio
Principles of Surgical Oncology

Colorectal cancer

- 5 cm margin when possible
- 1 cm margin for low rectal with XRT
- Take major vascular pedicle at origin along with lymph nodes
- Equivalent cancer outcomes from laparoscopic vs. open
Principles of Surgical Oncology

Melanoma

• 1 cm margin for <1mm deep primary
• 2 cm margin for >1mm deep primary
• Exceptions for hands and face
• Sentinel lymph node biopsy for staging
• Lymph node dissection for metastasis
Principles of Surgical Oncology

Gastric Cancer

• 5 cm margin when possible
• Take major vascular pedicle with lymph nodes
• Remove lymph node station beyond obviously involved nodes
• Splenectomy generally not indicated
• D2 dissection – no survival benefit
Principles of Surgical Oncology

Sarcomas

• 1-2 cm gross margin
• Preserve neurovascular structures
• No need for lymph nodes
• Radiation reduces local recurrence
• Chemotherapy of limited value
Carcinoids

- Slow growing
- Surgery for symptoms – obstruction, hormonal
- Debulking as a goal
- <1 cm – remove tumor only
- >2 cm – remove tumor and lymph nodes
- 1-2 cm – consider removing lymph nodes
Principles of Surgical Oncology

Liver Tumors

- Primary vs. metastatic
- Resectability
  - Eye of the beholder
  - Real estate
  - Defined by what will be left behind
Principles of Palliative Surgery

- One cannot palliate asymptomatic patients with cancer
- Address the highest priority symptom
- Manage expectations
- 25% will fail immediately
- 25% will recur with same symptom
Principles of Radiation Oncology

Radiation Therapy

- Rapidly dividing cells
- Can help reduce local recurrence rate
- Squamous cells tend to be sensitive

Breast cancer
Prostate cancer
Rectal cancer
Head & Neck
Sarcomas
Principles of Medical Oncology

Concepts of Chemotherapy

- Tumor doubling time
- Adjuvant vs. Neoadjuvant
- Targeting molecular pathways
- Biologic response indicators
- Drug development – phase I, II, III

![Graph showing tumor size and cell count over time](image)
Future of Surgical Oncology

- Growing opportunity
- 1 in 3 diagnosed with some form of cancer
- Aging population
- ↑ Need for surgical specialists with broad knowledge of cancer treatments
- Integration of multiple therapies
- Field wide open for basic and clinical research
- Intellectually stimulating – rapid progress
- Molecular evaluation of tumor