An Introduction to Cancer and Basic Cancer Vocabulary

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College Tuition Crisis • America on the Decline?

Breaking Cancer's Code

THE REVOLUTION IN DIAGNOSIS AND TREATMENT

NEW DISCOVERIES • NEW THERAPIES • NEW HOPE
Overview

Early Detection, Diagnosis, & Staging
Treatment Overview
What Is Cancer?

Abnormal and unregulated proliferation (growth) of cells, arising from cells of a specific organ

**General name for a group of more than 100 diseases**

- Although many kinds, they all start because abnormal cells grow (proliferate) uncontrolled

**Cancer cells have the ability to create their own blood supply, break away from the organ of origin, travel, and spread to other organs of the body**

**Morbidity and mortality arise** predominantly from organ damage caused by local growth and **metastases to distant anatomic areas**
Cancer Cell Basics

Difference between cancer cell and normal cell:

**Normal cell:**
- Knows and stays in its place of origin
- Knows when to replicate and when to die
- *2009 Nobel Prize* – telomeres help determine longevity

**Cancer cell:**
- Does not know when to stop growing and proliferating
- Can travel (metastasize) from organ of origin to any place within the body
How a Normal Cell Becomes Cancerous

What happens to the cell that allows cancer to develop?
Multistep Carcinogenesis

Initiation
- Normal Cell
  - Carcinogenic Exposure (Chemical, radiation, virus, etc.)
  - Initiated Cell
    - Selective clonal exposure
      - Preneoplastic Lesion
        - Genetic change
          - Malignant Tumor
            - Metastasis

Promotion

Progression
Major Risk Factors

Genetic predisposition
Tobacco use ± Alcohol excess
Lack of physical activity
Environment and Diet
Virus
Sun exposure
How Cancers Differ

Tumor Types
Cancer/Carcinoma (“solid” tumors)

Generally refers to cancers that arise from epithelial surfaces and cells that line glands:

- Skin/Epidermis
- Glands
- Intestines
- Bronchus
- Breast
- Prostate
- Pancreas
- Thyroid
- Kidney
- Testis
- Ovary
- Adrenals
- Liver
- Cervix
Major Types of Carcinomas

Adenocarcinoma
- Any gland (breast, prostate, lung, pancreas, ovary, colon...)

Squamous cell carcinoma
- Any surface or lining of mucous membrane
  (skin, lung, head and neck)

Others
- Urothelial (bladder), islet (pancreas)
The Hematologic Malignancies: Lymphomas and Leukemias

“Liquid” Tumors
Tumors of lymph nodes and blood cells
# Types of Lymphomas

<table>
<thead>
<tr>
<th>Hodgkin’s lymphoma</th>
<th>Non-Hodgkin’s lymphoma</th>
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<tbody>
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<td>Characteristic appearance and clinical presentation</td>
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**Hodgkin’s lymphoma**

- Characteristic appearance and clinical presentation
- Specific type of cell
- Various types
- Specific response to therapy

**Non-Hodgkin’s lymphoma**

- Wide variety of pathologic subtypes
- Wide range of presentations and outcomes
- Differing treatments than for Hodgkin’s lymphoma
The Leukemias

Malignant cells arising from cells of the bone marrow —

- **white cells** (myeloid cells, lymphoid cells, monocytes)
- **red cells** (erythroleukemia)
- **platelets** (megakaryocytic leukemias)
- **plasma cells** (myeloma)
Sarcomas

Neither carcinoma nor hematologic malignancy
Arise from **soft tissues or bone**
Wide spectrum of sites and presentations
**Osteosarcoma** (bone)
Chondrosarcoma (cartilage)
Synovial cell sarcoma (joint)
**Leiomyosarcoma** (muscle)
**Liposarcoma** (fat)
Rhabdomyosarcoma (primitive muscle)
Angiosarcoma (blood vessel, Kaposi’s) …
How Is Cancer Diagnosed?
(“7 warning signs”)

Symptomatic

• Cough
• Rectal bleeding
• Palpation of breast lump
• Weight loss
• Skin abnormality- change in a freckle or mole, red areas
• Coughing up blood/chest pain
• Change in bowel habits
• Abdominal pain
• Blood in urine
• Difficulty swallowing
• Hoarseness
How Is Cancer Diagnosed?

Asymptomatic

- Blood test – PSA, other markers
- Screening study(ies) – PAP, PSA, colonoscopy, mammogram, total-body CT scan
- Asymptomatic pick up on physical exam
- Leads to radiographic or surgical biopsy and then to pathology

✓ PATHOLOGIST MAKES THE DIAGNOSIS OF CANCER
Multidisciplinary Strategies

Primary Care
Physician/Internist/Family Practitioner
Surgeon
Radiologist
Pathologist
Medical Oncologist
Radiation Oncologist
Surgical Specialist

Nurse/Nurse Oncologist
Social Worker
Financial Planner
Tumor Registrar/Demographics
Clinical Trials Coordinator
Community Outreach and Support

“It takes a village”....

Multidisciplinary Clinic Concept
<table>
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<th>Major Cancers for Panel Discussion and What the NHC and BIDMC are Doing</th>
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<tr>
<td>Non–small-cell lung cancer</td>
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<td>Breast cancer</td>
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<td>Colorectal cancer</td>
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<td>Pancreatic cancer</td>
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<td>Hepatocellular cancer</td>
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<td>Prostate</td>
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<td>Skin</td>
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<td>Thoracic multidisciplinary MDC)</td>
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<td>Breast MDC</td>
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<td>Multidisciplinary Discussion at Tumor Boards</td>
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<td>MDC in formation; Seed program with Dr Kaplan</td>
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<td>In house expert, Dr Rodgers</td>
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Twice The Knowledge

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How Cancer Spreads

Metastases
Tumor Progression

Benign tumor

Malignant tumor

Clinically evident metastasis

Initiation

Primary tumor growth

Angiogenesis

Survival in circulation

Extravasation

Local migration

Sustained growth

Conversion

Promotion

Invasion

Intravasation

Arrest in new organ

Initiation of growth

Targeting Opportunities
Early Detection, Diagnosis and Staging
Frangioni JV. “New technologies for human cancer imaging.”
Lung Cancer Tumor

Staging Considerations
What Is Staging?

Process of finding out how far the cancer has spread
Vital step in determining treatment choices; also gives a clearer idea of the outlook for recovery

There is more than one system for staging

- **TNM system** is used most often
- **Biopsy, CT, MRI, PET, Ultrasound, blood tests** all help determine stage
Staging Using TNM and Group Staging

**T** = Tumor size

**N** = Node status

**M** = Presence or absence of metastases

**G** = Degree of differentiation

Letters or numbers after the T, N, and M give more details about each of these factors.

Once established, T, N, and M are then subgrouped into stage class (Stage I to Stage IV)
A Few Comments about Genomics and Genetics
Gene Expression for Breast Cancer

Tumors with Poor-Prognosis Signature

Tumors with Good-Prognosis Signature

Ratio (log scale)

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The Future

Chemoprevention – the ability to use drugs or lifestyle modifications to prevent cancer from developing

Improvement in staging – detecting many fewer cells or identifying blood tests that tell about the presence of cancer

Determining a specific “finger print” of an individual's cancer

Selecting a specific treatment, based upon the likelihood of the cancer to respond to that treatment AND minimizing the side effects of treatment
A Thought for the Day

“Tell me and I forget. Teach me and I remember. Involve me and I learn.”

– Benjamin Franklin