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Tumor Markers

Conflicts of Interest

- No disclosures

Objective

- To enhance and update participants' understanding of the role of tumour markers in cancer care and their impact on diagnosis and treatment

Tumor Markers

- Substance (usually protein) found in the blood, urine or body tissues that may be used in cancer for:
 1. Screening
 2. Diagnosis
 3. Prognosis or Staging
 4. Following response to treatment
 5. Detecting tumor recurrence

Types of Tumor Markers

Types	Examples
Protein / Glycoprotein	CA125, CA15-3, CA19-9
Enzymes	PSA, LDH
Oncofetal antigens	CEA, AFP
Hormones	hCG, calcitonin, gastrin, prolactin
Receptors	ER, PR, EGFR
Oncogenes	Ras, myc, bcr-abl
Tumor suppressor genes	BRCA1, p53, Rb

Common Tumor Markers

- CEA
- CA19-9
- CA15-3
- CA125
- PSA
- AFP
- bHCG
- LDH



Colorectal
Pancreas
Breast
Ovary
Prostate
HCC, Germ cell
Germ cell
Lymphoma

CEA

- CEA = carcinoembryonic antigen
- Glycoprotein involved in cell adhesion
- Practical use in colorectal cancer:
 1. Screening – no role
 2. Diagnosis – no role
 3. Prognosis / Staging – preoperative elevated CEA neg prognostic factor

BENIGN

- IBD
- Cirrhosis
- Hepatitis
- Pancreatitis
- Gastritis
- PUD
- Smoking
- COPD
- Hypothyroidism
- NORMAL (3%)

MALIGNANT

- CRC
- Gastric ca
- Pancreatic ca
- Breast ca
- Lung ca
- Ovarian ca

CEA

- Practical uses in colorectal cancer

- 4. Detecting tumor recurrence

- Stage II/III CRC – CEA q3 months x 3 years
 - Adjuvant chemo can falsely elevate CEA, thus wait until chemo finished
 - Rising CEA should prompt reevaluation

- 5. Following response to treatment

- Metastatic CRC – CEA q 1-3 months during active treatment
 - Persistently rising CEA should prompt restaging
 - Caution if rise is within 4-6 weeks of new treatment

CA19-9

- Glycoprotein involved in adhesion of colon, pancreas and gastric cells to endothelium
- Practical use in pancreatic cancer:
 1. Screening – no role
 2. Diagnosis – no role
 3. Prognosis / staging – no roleAlso not used to determine operability

BENIGN

- Pancreatitis
- Liver failure

MALIGNANT

- Pancreatic cancer
- Cholangio-carcinoma
- Colorectal cancer
- Gastric cancer
- Ovarian cancer
- Lung cancer

CA19-9

- Practical uses in pancreatic cancer
 4. Detecting tumor recurrence
 - Cannot provide definitive evidence of recurrence
 - May help guide need for followup imaging +/- biopsy
 5. Following response to treatment
 - Present data insufficient to recommend routine CA19-9 alone for following response
 - Suggest CA19-9 for locally advanced or metastatic pancreatic cancer q1-3 months during active treatment
 - If elevated CA19-9, confirm with other imaging studies

CA15-3

- Detects circulating MUC-1 (cell surface associated mucin) antigen
- Not specific: breast, ovarian, lung, liver
- Practical use in breast cancer:
 1. Screening – no role
 2. Diagnosis – no role
 3. Staging / Prognosis – no role

CA15-3

- Practical use in breast cancer
 4. Detecting tumor recurrence
 - Not currently recommended, but used by some clinicians
 5. Following response to treatment
 - 75-90% with metastatic breast ca have elevated MUC-1 levels
 - Monitor CA15-3 when on active treatment
- CA27.29 also a marker for circulating MUC-1
- May also consider CEA in metastatic breast ca

CA-125

- Expressed in tissues derived from coelomic and mullerian epithelia
- Practical use in epithelial ovarian cancer:
 1. Screening – studies ongoing, but no role currently
 2. Diagnosis – no role
 3. Prognosis / Staging – no role

BENIGN

- Ascites
- Peritonitis
- Cirrhosis
- Endometriosis
- Heart failure
- Benign ovarian tumors

MALIGNANT

- Epithelial ovarian cancer
- Breast cancer
- Colorectal cancer
- Pancreatic cancer

CA-125

- Practical use in epithelial ovarian cancer:
 4. Detecting tumor recurrence
 - No consensus, but is clinically used in followup
 - May help guide further tests/imaging
 5. Following response to treatment
 - Useful for advanced ovarian cancer patients on active treatment

PSA

- Glycoprotein expressed by both normal and neoplastic prostate tissue
- Practical use in prostate cancer:
 1. Screening – controversial
 2. Diagnosis – may be helpful to narrow differential but biopsy still standard
 3. Prognosis / Staging – no role

BENIGN

- BPH
- Prostate infection
- Prostate inflammation
- Perineal trauma

MALIGNANT

- Prostate cancer

PSA

- Practical use in prostate cancer
 - 4. Detecting tumor recurrence
 - Routinely used in followup after treatment for localized disease
 - 5. Following response to treatment
 - Routinely used to assess treatment response
 - May increase in first 8 weeks on chemotherapy
 - Those patients with poorly differentiated or neuroendocrine features may have low PSA

AFP

- Produced by fetal liver and yolk sac
- Practical use in hepatocellular carcinoma
 1. Screening – high risk patients
 2. Diagnosis – high levels may be diagnostic, but only in high-risk patients

BENIGN

- Pregnancy
- Chronic liver disease
- Cirrhosis
- EtOH
- Drugs

MALIGNANT

- Hepatocellular carcinoma
- Germ cell tumors
- Gastric cancer

AFP

- Practical use in hepatocellular carcinoma
 3. Staging / Prognosis - no role
 4. Detecting tumor recurrence
 - Used following definitive therapies to monitor for recurrence
 5. Following response to treatment
 - Used while patient on active treatment for HCC

bHCG

- Glycoprotein produced by trophoblasts
- Used in germ cell tumors
 - Non-seminomas
 - Seminomas

BENIGN

- Pregnancy
- Marijuana
- Pituitary disorders
- Hypogonadal states

MALIGNANT

- Germ cell tumors
- Gestational trophoblastic disease
- Trophoblastic differentiation of lung or gastric cancer

bHCG and AFP in NSGCT

- Practical use in NSGCT
 1. Screening – no role
 2. Diagnosis – measured prior to orchiectomy
 3. Prognosis/Staging – part of TNM staging criteria
 4. Following response to treatment – measured before, during and after treatment to determine response
 5. Detecting tumor recurrence – measured routinely at each followup visit

bHCG and AFP in Seminoma

- Practical use in seminomas
 - Pure seminomas don't have elevated AFP
 - Rest of the guidelines remain the same as for non-seminomas
- LDH also used along with bHCG and AFP
 - Elevated in 40-60% germ cell tumors

LDH

- Cytoplasmic enzyme present in most body tissues
- Very non specific, but mostly a marker of cell turnover
- Practical use in lymphoma
 1. Screening – no role
 2. Diagnosis – no role
 3. Staging / Prognosis – used in prognosis in IPI prognostic scoring system

BENIGN

- RBC hemolysis
- MI
- Hepatic disease
- Skeletal injury

MALIGNANT

- Germ-cell tumors
- Lymphoma
- Fast growing tumors (SCLC)

LDH

- Practical use in lymphoma
 4. Detecting tumor recurrence
 - Used routinely in followup after definitive treatment
 5. Following response to treatment
 - Used while patients on active treatment for lymphoma

Less Common Tumor Markers

Tumor Marker	Malignancy
Chromogranin A (CGA)	Pheochromocytoma, carcinoid
Thyroglobulin	Thyroid cancer
Immunoglobulins	Multiple myeloma, LPL, other lymphomas
Catecholamines / vanillylmandelic acid (VMA)	Adrenal tumors
S100	Melanoma

Summary

- Reviewed common tumor markers and their role in
 1. Screening
 2. Diagnosis
 3. Prognosis / Staging
 4. Detecting tumor recurrence
 5. Following response to treatment

Tumor Markers

- CEA
- CA19-9
- CA15-3
- CA125
- PSA
- AFP
- bHCG
- LDH

Thank You!
