**Assessing and Preventing Critical Situations**

### Emergencies Relate to Type of Malignancy

- **Solid tumors**
  - Masses that grow by cell-to-cell transfer.
  - Invade soft tissue and vessels with infection and bleeding.
  - Interfere with organ function by mass effect.
  - Long-term chronic illness despite multiple metastatic sites.
  - Pain a common problem.
  - Tumors cause hypercoagulability

- **Hematologic malignancies**
  - Diffuse body-wide disease at the onset.
  - Generalized multi-system failure common.
  - Hematopoietic cell abnormalities lead to infection, bleeding, debilitated condition.
  - More rapidly proliferative disease.

*Source: Shelton, 2000*

### Classifying Oncologic Emergencies

- **Mechanism of injury**
  - Hematologic complications
  - Organ toxicity
  - Structural abnormalities
  - Unrelated to cancer or its therapy
  - Metabolic abnormalities

- **Timing of Emergencies**
  - At diagnosis (D)
  - During Treatment (T)
  - With Progressive disease (P)
  - Late effects of therapy (L)

*Source: Shelton, 2000*

### Oncologic Emergencies

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Dyshrhythmias</th>
<th>Hemorrhagic cystitis</th>
<th>Sepsis</th>
<th>Pancreatitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast cancer</td>
<td>T, L</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>Head/ Neck cancer</td>
<td>T</td>
<td>-</td>
<td>T, P</td>
<td>-</td>
</tr>
<tr>
<td>Leukemia</td>
<td>D, T, P</td>
<td>T, L</td>
<td>D, T, P</td>
<td>-</td>
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<tr>
<td>Lung cancer</td>
<td>D, T, P, L</td>
<td>-</td>
<td>D, T, P</td>
<td>-</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>D, T, P, L</td>
<td>T, L</td>
<td>D, T, P</td>
<td>T</td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>T</td>
<td>-</td>
<td>D, T, P</td>
<td>D, T, P, L</td>
</tr>
<tr>
<td>Renal cell cancer</td>
<td>T</td>
<td>-</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

D: at diagnosis, T: during treatment, P: with progressive disease, L: late effect
Crisis Unrelated to Cancer Diagnosis

- How reversible is the problem in a patient without cancer?
- How does cancer affect the ability to treat this complication?
- What is the patient’s current physical condition and ability to recover from treatment?

Medical-Surgical Conditions Affected by Cancer/Cancer Treatment

- Diabetes mellitus—affected by nutrition and activity, corticosteroids.
- Newer antineoplastic agents—more cardiotoxicity, hypertension, exacerbating existing cardiac disease.
- Hypercoagulability of malignancy—increased risk of thromboses not obvious in PMH.
- Fluid and electrolyte imbalances—due to renal dysfunction, chemotherapy and supportive medications.
- Gastrointestinal malignancies—affect vagus nerve and blood pressure/heart rate.
- Lung disease—frequent atrial dysrhythmias.

Reasons why patients don’t look as sick as they are....

- Progressive decline in condition
- Long-term abnormalities diminish symptoms
- Low WBC count (lack of inflammatory cytokines) makes patients less symptomatic
Framework for Considering Complications in Patients with Cancer

- Cancer involvement of body structures
- Toxicity of therapy
- Interaction of comorbidities and cancer or treatment
- Incidental critical illness
- Reversibility of event/cancer
- Projected life expectancy
- Recovery potential
- Other factors
- Decision to treat:

  - Reversibility of event/cancer
  - Projected life expectancy
  - Recovery potential
  - Other factors

Sepsis

Sepsis Statistics

- 10th leading cause of death in US, most common cause nonmalignant death in oncology
- 750,000 cases/year; 250,000 deaths/year
- Severe sepsis occurs in 14% oncology patients
- Mortality from severe sepsis and/or septic shock 30-40%
- Early recognition saves lives
- Nurses as the bedside practitioners are often the first to recognize the onset of sepsis

http://www.bing.com/videos/search?q=sepsis+alliance+video&FORM=VIRE2&View=detail&mid=D1B58A028C89F3311110CD1B58A028C89F3311110CD
Definitions

**SIRS**
- Systemic Inflammatory Response Syndrome (SIRS) is two or more of the following: Temp >38.3°C or <36°C, HR >90, RR >20, WBC >12 or <4 K/cu mm or >10% bands

**SEPSIS**
- Is two or more of the following criteria PLUS a known or suspected bacterial, viral, or fungal infection

**SEVERE SEPSIS**
- Septic shock is present if systolic BP <90 mm Hg or MAP <65, prior to fluid resuscitation

**SEPTIC SHOCK**
- Dellinger et al, 2013

Blood Pressure
**Concerns for Practice**

- Non-ICU settings use Systolic/Diastolic BP, not Mean arterial pressure (MAP)
- Low diastolic BP most common in early, warm (febrile) sepsis - low diastolic BP lowers mean (perfusing) pressure.
  - MAP = 2D + S/3
  - 90/50 = (50 X 2) + 90 / 3
  - 190/3 = 63 mm Hg
  - Normal mean BP is >65 mm Hg

Organ Dysfunction
**new onset**

- Signs/ Symptoms
  - Altered mental status
  - Low urine output
  - Capillary refill > 3 seconds
  - Mottling
  - Weight gain > 20 mL/kg or ~ 2 kg previous 2 days

- Laboratory Abnormalities
  - Bilirubin > 2 mg/dl
  - Creatinine > 2.0 mg/dl
  - Glucose > 140 mg/dl
  - Hypoxemia requiring BiPAP
  - INR ≥ 1.5
  - Lactate > 2 mmol
  - Platelets < 100,000/mm$^3$
Surviving Sepsis Recommendations:

1st 6 hours
- Screen for sepsis first encounter/defined intervals
- Blood cultures and lactate if positive screen
- Assessment organ function
- First antimicrobial dose within 60 min of triage
- Oxygen if O₂ sat < 90%
- Initial fluid bolus at least 30 mL/kg if hypotensive

6 hours
- Assessment of source
- CVP line- goal 8-12 mm Hg/
  Mechanically ventilated- 12-15 mm Hg
- MAP ≥ 65 mm Hg
- Central venous oxygen saturation (ScvO2) ≥ 70%
  (obtained via blood gas from central line)
- Urine output ≥ 0.5 mL/kg/hr

Implementing Sepsis Bundle Interventions:

Challenges in Evaluation
- Excluded from most studies (Claessens, Aegerter, Boubaker, Guidet, Cariou, & Cub Rea-Network, 2013):
  - CHF (35%)
  - Cancer patients (30%)
- Bundle variability among Quality Measurement Organizations (Fong, Cecere, Unterborn, Garstad, Klee, & Devlin, 2007).
  - The Joint Commission (TJC)
  - Institute for Healthcare Improvement (IHI)
  - Voluntary Hospitals of America (VHA)

Generalizability of Sepsis Bundle Interventions
- Initial landmark study showed 7% mortality reduction if bundle elements completed 37% of time (Rivers et al, 2001)
  - Unclear which interventions most important
- Patients do not receive same care in all settings
  - “Time zero” recently revised- problematic since many interventions are time sensitive
  - Variables affecting timely antimicrobials- initially a different diagnosis, waiting for cultures to be obtained, younger patients, women, care by non-ED physician (Cullen, Fogg, Delaney, 2013; Madsen & Napoli, 2014)
  - Prompt sepsis management activation systems not consistently available
Antimicrobials

Every hour delay beyond the first 60 minutes, increases mortality about 7.6%.

Corticosteroids in Sepsis
Volbeda, Wetterslev, Gluud, Zijlstra, van der Horst & Keus, 2015, Int Care Med, 41, 1220-1234

- Cochrane methodology
- 35 RCT trials evaluating sepsis in adults; 4682 patients
- Outcomes:
  - Mortality
  - Serious adverse effects (SAE)
- All trials except two had high risk of bias

- Findings:
  - No statistically significant effect of any dose steroids versus placebo on mortality or SAE
  - Low risk bias trials confirmed findings
  - No difference in steroid dose on outcomes
  - No difference in days of treatment on outcomes

Sepsis Management Algorithm

Screen → Evaluate → Identify → Source → Perfuse → Diagnostic tests → Seek source and manage → Ensure organ perfusion

Oncology Nursing Society 41st Annual Congress
April 28–May 1, 2016
Dysrhythmias

Cancer Patients Needing Monitoring

- Respiratory compromise
- Hypotension
- Bleeding
- Extremely low hemoglobin
- Dysrhythmias
  - QT prolonging medications (Vtach)
  - Electrolyte abnormalities
- Toxicities of therapy
  - Interstitial lung disease
  - Cardiomyopathy
- Glucose abnormalities
- Mental status changes
- Fluid and Electrolyte disturbances
  - Platinols, cetuximab-induced hypomagnesemia
  - Antibiotic-induced hypokalemia
  - Dehydration / fluid overload enhances atrial automaticity
  - Prolong QT
- Oxygen free radicals
  - Ara-C
  - Fluoropyrimidines (e.g. 5FU)
  - Topoisomerase inhibitors
  - Tyrosine/multikinase inhibitors
  - Cytokines
- Direct irritation/damage to conduction pathways
  - Arsenic trioxide
  - Acute and chronic effects of radiation
  - Tumor compressiatria
  - Taxanes
  - Esophagectomy, pneumonectomy

Sources: Hinkle, 2011; Jolobe, 2010; Mottram & Svenson, 2011; Polovich, Olsen & LeFevbre, 2014; Shelton, 2013a
Dysrhythmias
“abnormal heart rate or rhythm”

- Symptomatic vs. asymptomatic
  - Heart
  - Lungs
  - Brain
- Slow vs. fast
- Origin of rhythm disturbance
  - Lethality
  - Risk of death
- Etiology of rhythm
  - Reversible vs. irreversible

QT Prolongation Syndrome

- Prolonged time for myocardial recovery
- Corrected for heart rate = QTc
- Congenital or acquired
- Detection by 12 lead ECG
  - Bradycardia
  - Prolonged QT interval
- Biggest risk- sudden death from ventricular arrhythmias
- Etiologies- e.g. electrolytes, phenothiazines, serotonin antagonists, tyrosine kinase inhibitors,

Sources: Attin & Davidson, 2010; Cahoon, 2009; Drew et al, 2010

ECG Abnormalities with Common Health Problems

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Abnormality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary embolism</td>
<td>Tachyarrhythmias, prominent P waves, new right bundle branch block (BBB)</td>
</tr>
<tr>
<td>Hypokalemia</td>
<td>Slow rate, U waves, PVCs</td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>Short PR interval, PVCs</td>
</tr>
<tr>
<td>Hypercalcemia</td>
<td>Bradycardia/ Junctional/ Heart block, prolonged PR interval</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Non-specific ST changes</td>
</tr>
<tr>
<td>COPD</td>
<td>Large or biphasic P waves, right BBB, right ventricular strain ST changes</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>Low voltage, nonspecific ST changes</td>
</tr>
<tr>
<td>Pericarditis/ effusion</td>
<td>Low voltage, precordial lead ST elevation</td>
</tr>
</tbody>
</table>
Management of Conduction Disturbances

- **Acute**
  - Pharmacologic
    - K⁺ >4.0, Mg²⁺ >2.0
    - Correct fluid/ acid-base imbalances
    - Correct hypoxemia
    - Adenosine
    - Calcium channel blockers
    - Beta blockers
    - Amiodarone
  - Electrical
    - Emergent cardioversion
    - Temporary transcutaneous pacing

- **Chronic**
  - Pharmacologic
    - Digoxin
    - Calcium channel blockers
    - Amiodarone
    - Beta blockers
  - Electrical
    - Permanent pacers
    - AICD
  - Interventional
    - Biphasic cardioversion
    - Ablation therapy

Amiodarone (Cordarone)

- Anti-dysrhythmic agent with mixed clinical actions

- **Indications**
  - Tachycardia (any origin)
  - Intrinsic atrial rhythms
  - Ventricular ectopy

- **Adverse effects**
  - Hypotension, bradycardia, nausea, vomiting, corneal microdeposits, photosensitivity, hypothyroidism
  - Peripheral neuropathy, pulmonary fibrosis (high dose or prolonged therapy), hepatic transaminase elevations, uveitis

Hemorrhagic Cystitis

Sources: Hazinski, Samson, Strensley, 2010; Santangeli et al, 2012
Hemorrhagic Cystitis

- Erosion of the inner mucosal lining of the bladder due to exposure to toxic metabolites.
- Etiologies: medications (cyclophosphamide, ifosfamide), viral infection (j-c virus, CMV)
- Signs and symptoms
  - Hematuria
  - Dysuria
  - Bladder spasms
  - Fever
  - Retained bloody urine

Management: Hemorrhagic Cystitis

- Intravenous fluids
  - High volume
  - Brisk rate
  - Normal saline
- Continuous bladder irrigations
  - Normal saline
  - Alum
  - Prostaglandin E5
- Interventional procedures
  - Cystoscopy
  - Cautery
  - Silver nitrate
- Mesna

**CONCLUSION:**

- Hemorrhagic cystitis (HC) in pediatric hematopoietic stem cell transplant (HSCT) is correlated most strongly to elevated urinary viral load of BKV (BK virus) and to acute GVHD, but less strongly to BK viremia.
Pancreatitis

An inflammation of the pancreas with a wide range of clinical manifestations ranging from mild disorders to hemorrhagic disease

Pancreatitis Classifications

- Acute Pancreatitis - single attack from a previously normal gland
- Recurrent Acute Pancreatitis - repeated episodes of pancreatitis without long-term functional damage
- Recurrent Chronic Pancreatitis - recurring episodes of pancreatitis with progressive damage to the gland
- Hemorrhagic pancreatitis - auto-necrosis of the gland with erosion and bleeding of vessels from within

Pancreatitis Epidemiology

- 25,000-40,000 cases, 20,000 U.S. deaths/yr
- Men 40-45 years with alcohol history
- Women 50-55 years with biliary tract disease
- Chronic pancreatitis: avg 36-40 years old
- 70-85% have mild disease
- 15-30% become critically ill
- First episode hemorrhagic has 20% mortality, 80% mortality if a second episode
Pancreatitis Etiologies

- Biliary tract disease - most common cause of acute
- Alcohol - most common cause of chronic
- Medications - antimicrobials, antiretrovirals, estrogen, immunosuppressives, thiazide diuretics
- Infections - candida, viruses
- Postoperative complications - after endoscopy, biliary tract, gastrectomy or major abdominal surgery
- Ischemia/shock
- Familial/hereditary
- Neoplasms

Pancreatitis Pathophysiology

- Pancreatotoxin or injury
- Activation of exocrine proteolytic enzymes trypsin, chymotrypsin, and elastase
- Diffuse inflammation and capillary leak syndrome causes fluid shifts
- Enzymes autodigest pancreatic tissue and worsen inflammation

Pancreatitis Clinical Findings

R/T lack of pancreatic function

- Food intolerance
- Anorexia
- Vomiting
- Jaundice
- Weight loss
- Alkalosis
Pancreatitis Clinical Findings
R/T inflammation

- Epigastric or substernal pain radiating to the back
- Fever
- Abdominal distention
- Fluid shifts - edema, ascites, pleural effusion, hypotension
- Paralytic ileus

Pancreatitis Clinical Findings
R/T hemorrhagic disease

- Grey-turner’s sign - bruising on flank
- Cullen’s sign - bruising around umbilicus
- Hypocalcemic tetany
- Hyperglycemia/ hypoglycemia
- Life-threatening electrolyte imbalances - hypocalcemia, hypokalemia, hyperkalemia, hypomagnesemia
- GI bleeding

Complications R/T Pancreatitis

- Severe inflammatory response and pancreatic dysfunction cause direct myocardial dysfunction (via myocardial depressant factor [MDF]) and multisystem failure.
- Cardiac failure
- Disseminated intravascular coagulation
- Hepatic failure
- Renal failure
- Respiratory distress syndrome
- Shock
Diagnostic Tests for Pancreatitis

- **LABORATORY**
  - Serum and urinary amylase
  - Serum and urinary lipase
  - Glucose
  - WBCs
  - Calcium
  - Albumin
  - Transaminases
  - Alkaline phosphatase

- **OTHER**
  - Endoscopic retrograde cholangio-pancreatotomy (ERCP)
  - Abdominal ultrasound
  - Abdominal flat plate x-ray
  - Abdominal CT scan

Using Amylase and Lipase to Diagnose Pancreatitis

<table>
<thead>
<tr>
<th>Test</th>
<th>Peak Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum amylase</td>
<td>12-24 hours</td>
</tr>
<tr>
<td>Urine amylase</td>
<td>1-2 days</td>
</tr>
<tr>
<td>Serum lipase</td>
<td>3-5 days</td>
</tr>
<tr>
<td>Urine lipase</td>
<td>5-7 days</td>
</tr>
</tbody>
</table>

Ranson’s Poor Prognostic Factors

- **ON ADMISSION**
  - Age > 55 years
  - WBC > 16,000/ cu mm
  - Glucose > 200 mg%
  - LDH > 350 units
  - SGOT > 250 units

- **WITHIN 48 HOURS**
  - > 10% drop in HCT
  - BUN increase > 5 mg%
  - Serum calcium < 8 mg%
  - Arterial oxygen < 60 mm
  - Base deficit > 4 mEq
  - Fluid sequestration > 6L
Jacobs’ Poor Prognostic Factors

**PHYSICAL**
- Hypotension < 100 systolic
- Tachycardia > 120/min
- Temperature > 101F
- Positive lung findings
- Presence of abdominal mass

**LABORATORY**
- Albumin < 3 mg
- PT > 14 sec (INR 1.2)
- WBC > 20,000/ cu mm
- Creatinine > 2 mg
- Calcium < 8 Mg%
- BUN > 30 mg%
- Bilirubin > 4 mg%

Management of Pancreatitis

- Promote pancreatic blood flow
- Inhibit pancreatic secretion- NPO, NG tube to suction
- Counteract pancreatic enzymes
- Ensure adequate circulating volume- IVF, measure CVP, monitor urine out
- Prevent complications: sepsis, pancreatic abscess, pancreatic pseudocyst
- Comfort- central nutrition, pancreatic extracts as begin to eat, nausea and pain control

Current Research

- Macrophages play role in acute and chronic pancreatitis and pancreatic stellate cells play role in fibrosis.
- When macrophages and stellate immune pathway is blocked then fibrosis diminishes. (Stanford university, funded by NIH, National pancreatic foundation, Department of Veterans Affairs).
- We have blocked this pathway so there is a mechanism for treatment.
Critical Care


Sepsis


Dysrhythmias


