Malignancy/Cancer

Cancer is a common medical problem for which patients present to the OR; assessment of the cancer patient requires an understanding of the specific malignancy, its complications, and treatments; due to the vast diversity of malignancies a focused approach based on the 4M's is appropriate (Mass, Mets, Meds, Metabolic) and specific attention must be made to assuring aseptic technique and postoperative pain management

ANESTHETIC CONSIDERATIONS:

- Mass (local mass effects)
  - E.g. ↑ ICP, airway compromise, vascular obstruction
- Metastases (multi-organ involvement, e.g. brain, bone, liver, lung)
  - Palliative vs. curative procedures
- Medication / Therapy
  - Anemia / thrombocytopenia (2° to malignancy vs. myelosuppression from medications)
  - Immunosuppression – infection risk (possible without systemic features)
  - Chemotherapy (systemic effects / organ dysfunction)
    - Steroids - perioperative adrenal insufficiency
    - Bleomycin – O_2 toxicity and risk for pulmonary fibrosis – minimize FiO_2, lung protective ventilation
    - Doxorubicin – cardiomyopathy, history, physical, ECHO
    - Cisplatin – nephrotoxicity – (lytes BUN, Cr)
    - Vincristine – neurotoxicity – peripheral, cranial and autonomic
  - Radiation (regional tissue involvement / fibrosis)
    - Potential difficult airway
    - Pulmonary fibrosis
    - Pericarditis (acute / chronic – restrictive)
- Metabolic / Paraneoplastic syndromes
  - SIADH
    - Common with brain, lung ca
    - Euvolemic hyponatremia, hypo-osmolar
  - Hypercalcemia
    - Secondary to bony mets – lung, breast, kidney, prostate cancer and multiple myeloma
    - Ectopic PTH-like hormone production (lung, pancreatic carcinoma)
  - Tumor lysis syndrome (lymphomas with chemotherapy)
    - Hyperuricemia, hyperkalemia, and hyperphosphatemia and may precipitate acute renal failure
    - Hypocalcemia – secondary to hyperphosphatemia
  - Ectopic Cushing's (ACTH secretion)
    - Associated with: small cell lung cancer, neuroendocrine tumors
    - Hypokalemia, hyperglycemia, hypertension, edema, and muscle weakness
  - Eaton–Lambert syndrome (IgG to presynaptic Ca^{++} channel, proximal muscle weakness)
    - Associated with small cell lung carcinoma, ovarian
    - Sensitivity to SCh & NDMR
- Co-morbid medical conditions
- Acute / Chronic Pain
  - Narcotic tolerance

ANESTHETIC GOALS:

- Thorough perioperative workup and optimization
- Aseptic technique
- Postoperative pain control

HISTORY & PHYSICAL

- Full set of VITALS
- Evidence of **Mass Effects**:
  - Dyspnea, hoarseness, hemoptysis, positional A/W obstruction, increased JVP, increased ICP, upper body plethora & edema
  - Soft heart sounds, friction rub
  - Decreased A/E, increased A/W pressures, dull percussion
  - Sensory or motor deficits
- Evidence of **Metastases**:
  - Brain: raised ICP, focal neurological deficits
  - Pathological fractures
- Evidence of **Paraneoplastic Syndromes**:
  - Fever and weight loss & functional capacity
  - Hematologic abnormalities such as infections, DVTs or bleeding diathesis
  - LEMS: neuromuscular weakness that improves w/ activity & NO bulbar involvement
  - Evidence of wide variety of ectopic hormones (essentially an endocrinology fellowship of info on history and physical):

Hormone	Associated Cancer	Manifestations
Corticotropin	Lung (small cell) Thyroid (medullary) Thymoma Carcinoid Non-beta islet cell of pancreas	Cushing's Syndrome

ADH	Lung (small cell) Pancreas Lymphomas	Water intoxication
Gonadotropin	Lung (large cell) Ovary Adrenal	Gynecomastia Precocious Puberty
Melanocyte-stimulating hormone	Lung (small cell)	Hyperpigmentation
Parathyroid hormone	Renal Lung (squamous) Ovary Pancreas	Hyperparathyroidism
Thyrotropin	Choriocarcinoma Testicular (embryonal)	Hyperthyroidism
Thyrocalcitonin	Thyroid (medullary)	Hypocalcemia
Insulin	Retroperitoneal tumors	Hypoglycemia

  - Hypercalcemia: lethargy, polyuria, dehydration, coma
  - Tumour Lysis Syndrome: recent treatment with index of suspicion
  - Carcinoid: See Carcinoid Seminar
- **Medical Management**:
  - Previous surgeries & scars
  - Radiation courses and physical effects on A/W, H & N, or lungs / heart
  - Medications: bleomycin, adriamycin, doxorubicin, MTX, cyclophosphamide, steroids

INVESTIGATIONS

- **Labs**
  - CBC for infection, altered cells, & anemia
  - E-lytes, PO_4, Ca, Mg for metabolic derangements
  - LFTs and renal function for chemo S/E
  - ABG for A/W compromise & lactic acidosis
- **Imaging**
  - CXR for mass & pulmonary changes
  - CT
  - ECG for electrical alternans
  - PFTs if any respiratory involvement
  - ECHO if any cardiac involvement or concern regarding PFO in face of DVTs

OPTIMIZATION

- Is the patient having the right procedure?
  - i.e. for tissue diagnosis, a peripheral lymph node biopsy vs. anterior mediastinal mass biopsy
- Correction of metabolic derangements:
  - Nutrition
  - Anemia
  - Coagulation
  - E-lytes
- Will steroids or radiation shrinkage of tumour increase patient's safety or success?
- Steroid and antibiotic coverage
- DVT prophylaxis or filter if concerns w/ thrombosis / PFO

ANESTHETIC OPTIONS

- Guided by patient & procedure

ANESTHETIC SETUP

- **Drugs**
  - Standard & guided by patient & procedure
- **Equipment**
  - Standard CAS
  - Others guided by patient & procedure

MANAGEMENT OF ANESTHESIA

- **Induction**
- **Maintenance**
- **Emergence**
  - All guided by patient and procedure

DISPOSITION & MONITORING

- Dependent on patient and procedure

COMPLICATIONS

- N & V very common
- Pain management is more complex
- Paraneoplastic syndrome management - avoidance of triggers & prepare to treat beforehand
- DVTs & PEs or paradoxical emboli

PATHOPHYSIOLOGY

- Epidemiology:
  - 1 in 3 suffer
  - 20% of sufferers die from cancer
- Pathophysiology:
  - D/t abnormal cell growth & proliferation

- Usual rule of thumb is that it takes 2 defects in cellular control to allow a cancer to occur
- Mixture of genetic & environmental factors

- Can occur in any organ system
- Management = chemotherapy, radiation, or surgery & may be used for cure or palliative for decreasing suffering, extending life, or increasing organ function
- Common presentations to OR:
  - Treatment = surgical resection
  - MAC for imaging diagnostics (i.e. kids)
  - Biopsies for tissue diagnosis
- Mass effects:
  - SVC Syndrome:
    - Treatment = radiation, chemo, or steroids
    - Avoid surgery or A/W manipulation if possible until symptoms improve
  - Pericardial effusion / tamponade:
    - Very common
    - Malignant effusion = most common cause of electrical alternans
  - A/W obstruction: see Anterior Mediastinal Mass Seminar
  - Pleural effusion
  - Spinal cord compression
- Metastases:
  - Usually occur to highly vascularized organs: lungs, brain, breast, liver, bone
- Metabolic = Paraneoplastic Syndromes:
  - Fevers / weight loss:
    - Seen w/ mets to the liver and in rapidly proliferating tumors like lymphoma or leukemia
    - May have an associated lactic acidosis
    - The cachectic patient is at an increased risk for perioperative morbidity
  - Hematologic abnormalities:
    - Anemia secondary to bleeding, chemotherapy, acute hemolytic anemia w/ lymphoproliferative disorders
    - Pancytopenia seen w/ some solid tumors
    - Polycythemia w/ nephroma or hepatoma
    - DIC in advanced cancers, especially hepatic mets
    - DVTs
  - Lambert-Eaton Syndrome: See MG / LEMS Seminar
  - Ectopic hormone production: corticotrophin, ADH, gonadotropin, PTH, TSH, calcitonin
  - Hypercalcemia: See Hypercalcemia Seminar
    - Reflects osteolytic activity from bone mets, especially breast
  - Tumor lysis syndrome:
    - D/t treatment
    - Seen commonly in ALL
    - Hyperkalemia, hyperuricemia, renal failure
    - Hyperphosphatemia can lead to hypocalcemia and cardiac arrythmias
- Management & Medications:
  - Radiation is associated w/ structural tissue changes including contractions & damaged, friable tissues
  - Medications = poisons w/ goal = kill the cancer before killing patient
    - Most cause variable degrees of pancytopenia & hepatic / renal toxicity
    - Bleomycin induced interstitial pneumonitis and fibrosis
      - Non-productive cough, CXR similar to PCP pneumonia
      - Treatment = corticosteroids
    - Doxorubicin (adriamycin) or daunorubicin induced cardiomyopathy
      - Occurs in 1-5% of treatments
      - Has been observed up to 3 years after treatment
      - Note that 10% of patients will get non-specific ST-T changes on ECG not necessarily reflective of underlying pathology
    - Vincristine causes neurotoxicity
    - Cisplatin is associated w/ nephrotoxicity

Systemic Side Effects of Chemotherapeutic agents

Drug	*Immunosuppression*	*Thrombo-cytopenia*	*Leukopenia*	*Anemia*	*Cardiac Toxicity*	*Respiratory Toxicity*	*Renal Toxicity*	*Hepatic Toxicity*	*CNS Toxicity*	*PNS toxicity*	*ANS toxicity*	*Stomatitis*	*Plasma Cholinesterase Inhibition*
<u>Alkylating Agents</u>													
Busulfan	+	+++	+++	+++		++	++	+				+	+
Cyclophosphamide	++++	+	++	+		+	+					+	++
Melphalan	+	++	++	++		+							+

Antimetabolites													
Methotrexate	+++	+++	+++	+++		+	++	+				+++	
6-mercaptopurine	+++	++	++	++			++	+++				+	
5-fluorouracil	++++	+++	+++	+++					+			+++	
Plant Alkaloids													
Vinblastine	++	+	+++	+						+	+	+	
Vincristine	++	+	++	+			+		+	++	++		
Antibiotics													
Doxorubicin		+	+++	++	+++			+				++	
Daunorubicin	+	++	+++	++	+++							++	
Bleomycin		+	+	+		+++						+++	
Mithramycin	+	++++	++++	+++			++	++				+++	
Nitrosoureas													
Carmustine		++	++	++		+	+					+	
Enzymes													
L-Aspariginase	++	+	+	+			+	+++	+			+	

REFERENCES

- Barash Chapter 50 CANCER THERAPY AND ITS ANESTHETIC IMPLICATIONS
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