**Introduction**: Oncologic emergencies are a relatively common cause of mortality in malignancy, and therefore must be addressed urgently in coordination with Hem/Onc teams. This Smart Bomb will cover the major high yield, deadly, and board-relevant conditions ED providers run into.

**Tumor lysis syndrome**
Massive tumor cell lysis with release of large intracellular contents into the circulation. Electrolytes like K+, phosphorous, and nucleic acids/uric acid lead to inflammatory reactions and end organ damage.

Can happen in any neoplastic process being treated with cytotoxic therapy, but is most common in leukemia/lymphoma, especially Burkitt.

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**Hyperuricemia** (>8 mg/dL): urate is a poor solute. Precipitates in renal tubules causing severe AKI \(\rightarrow\) ATN.
Prevention: Allopurinol or Rasburicase prophylaxis has dramatically reduced uricemia complications.

**Hyperphosphatemia** (>4.5 mg/dL): neoplastic cells produce lots of phosphorous (high mitotic rates). When phosphorous enters the blood, there is a correspondingly major decrease in calcium. Calcium and phosphorous precipitate in the renal tubules causing AKI.

**Hypocalcemia** (<7 mg/dL): hallmark symptoms and signs are related to muscle: tetany, muscle cramps, perioral numbness, paresthesia of hands/feet \(\rightarrow\) carpopedal spasm, laryngospasm, seizures. Classic but rare signs are Chvostek’s (cheek tap) and Trousseau’s (BP cuff carpopedal spasm).

Myocardial dysfunction is the most concerning sign, and attention should be paid to monitoring the QT interval.

**Hyperkalemia** (>5.5 mg/dL): straightforward. Most concerning effects are on the heart. Symptoms are usually nonspecific and unhelpful like general weakness or palpitations.

Presentation: abstract, varied. Patients already appear ill from their malignancy in addition to receiving cytotoxic therapy. Most common symptoms are nausea/vomiting, malaise, anorexia, lethargy, diarrhea.

Symptoms in the renal/urinary tract are usually absent.

Cardiac dysrhythmias can occur in the setting of hypocalcemia, hyperkalemia along with muscle cramps, tetany, syncope, sudden cardiac death.

Diagnosis: fairly obvious with basic labs. Everyone needs an EKG.

HyperK⁺ EKG findings: “the lupus of EKG changes”.
- Tall, skinny peaked T waves with shortened QT interval \(\rightarrow\) lengthened PR interval and QRS duration \(\rightarrow\) P wave disappears \(\rightarrow\) QRS widening to sine wave pattern.
- More often than not, the classic pattern does not appear, much less in a distinct order.
- Sometimes a “Brugada-like pattern” is seen.
- It cannot be understated how many different EKG abnormalities K⁺ can be responsible for.

HypoCa²⁺ EKG findings: prolonged QT with unchanged T waves.

Prevention/Treatment: aggressive IV hydration prior to and after treatment. If patients are in the ED, IV fluids should be aggressively used as well (however with close monitoring as these patients are likely frail in their ability to tolerate fluid overload). The goal: promote GFR and renal perfusion, thus inducing higher urinary output.

Urinary output goal: 80-100 mL per hour.
Consider furosemide as an option to assist with diuresis although data is unclear.

IV fluid of choice: Lactated ringers vs normal saline. You know our answer... LR of course. It does contain potassium, but it has been demonstrated LR does not raise serum potassium levels.

Measure electrolyte levels every 4 hours.
Always the wrong answer: urinary alkalization with bicarbonate or acetazolamide. Bicarbonate can also worsen hyperphosphatemia.

When to do dialysis: prognosis of complete renal recovery is excellent if dialysis is started early. Phosphorous and uric acid should be rapidly reduced as they are most harmful for kidney function.
- Refractory hyperuricemia
- Persistent hyperkalemia >6 mg/dL
- Phosphorous >10 mg/dL
- Symptomatic hypocalcemia
- Patient cannot tolerate IV fluids
- Oliguria/anuria.

**Hyperleukocytosis**: defined as >50,000 leukocyte count. Most common in AML or CML crisis.

Extremely elevated counts \(\rightarrow\) poor circulation \(\rightarrow\) end organ ischemia.

Untreated 1-week mortality up to 90%, on average 20-40%.
Oncologic Emergencies

Presentation: mainly neuro and respiratory. Dyspnea and hypoxia, diffuse chest x-ray infiltrates. Neuro symptoms vary (headache, lethargy, dizziness, somnolence, gait instability, confusion, etc). High risk of intracranial hemorrhage.

Less common symptoms: priapism, stroke, limb ischemia, bowel infarction.

DIC can occur in up to 40% of patients.

Diagnosis: CT scan (to rule out other pathology based on neuro symptoms). EKG can show myocardial ischemia or RV strain.

Treatment: Cytoreduction via either chemotherapy or leukapheresis. Only chemo actually destroys cells and improves survival. -In the ED, IV fluid hydration. Refrain from transfusions unless absolutely necessary, follow coagulation studies. -Many patients will have a fever due to inflammation but cannot rule out infection. Empiric antibiotics should be given.

Waldenström’s macroglobulinemia is another form of hyperviscosity syndrome that requires prompt care. Here, there is a high degree of circulating IgM molecules. The only effective treatment is prompt plasmaphoresis. High rates of recurrence within weeks unless definitive management of malignancy is initiated.

Disseminated intravascular coagulation

Most commonly seen in acute promyelocytic leukemia (APL), but also in other leukemias/lymphomas. Can present at time of diagnosis or after chemotherapy begins.

Pathogenesis is poorly understood. Basically, APL blast cells die, releasing inflammatory factors which increase coagulation cascade consumption.

If left untreated, pulmonary hemorrhage is a complication in up to 40% of patients, with 20% dying early on.

Presentation/diagnosis: bleeding form IV sites, petechiae, thrombocytopenia, jacked-up coagulation panels.

If neurological or pulmonary symptoms, suspect intracranial hemorrhage or alveolar hemorrhage, respectively.

Treatment: expectant management with repeat monitoring of PT, aPTT, CBC, fibrinogen. Chemotherapy reduces mortality. Platelet transfusion goals >20,000 (some studies suggest >50,000), fibrinogen goals >150. Avoid any invasive procedures.

Epidural spinal cord compression

Relatively common complication of cancer. Any metastatic tumor, most commonly the obvious ones: prostate, breast, lung.

In fact, in about 20% of patients this condition is the initial presentation.

Interestingly, vertebral mets are found in 90% of those dying of cancer on autopsy. Only a small proportion actually lead to cord compression.

In ESCC, tumors invade the epidural space and compress the thecal sac. This can range from asymptomatic to paralysis.

Presentation: back pain is the most common, in about 80-90% of patients. Motor > sensory findings represent advanced stages of ESCC.

About 60% of patients who present initially are ambulatory. Urinary retention, ataxia are less common, maybe about 50% of patients.

Diagnosis: urgent MRI of entire spine. Don’t skimp on the spine, patients can experience pain and sensory changes nearly 5 levels below the actual pathology. CT myelography is reserved for patients who cannot undergo MRI.

Treatment: degree of compression determines urgency for therapy. Surgical technique vs radiotherapy is determined by the type of tumor. Steroids can be given for pain after consultation with experts.

Prognosis: those with severe weakness, inability to lift leg against gravity, or non-ambulatory >48 hours are less likely to regain function.

Hypercalcemia

Produced by a variety of disorders, malignancy is by far the most common along with primary hyperparathyroidism. Major range of clinical symptoms and based on serum Ca^2+ levels. Malignancy more commonly raises serum levels >13 mg/dL.

Mild: <12 mg/dL are asymptomatic or nonspecific symptoms.

Moderate: 12-14 mg/dL begins the changes in mental status along with polydipsia, polyuria, dehydration, nausea, myalgias.

Severe: >14 mg/dL severe neuropsychiatric disturbances, nephrolithiasis/renal insufficiency, CV symptoms (shortened QT and arrhythmias).

Treatment: those with mild hypercalcemia or those asymptomatic with moderate classification do not require immediate therapy.

Those with severe hypercalcemia and are asymptomatic need a more aggressive approach.

- 1V fluids (NS vs LR) with goal of UOP to 100-150 mL/hour. Difficult in fluid overloaded patients, if cannot tolerate discuss dialysis.

- Loop diuretics are typically NOT the right answer, as these can increase bone resorption in the malignancy patient.

- Calcitonin IM/SQ administration with repeat calcium measurement in 6-8 hours. Calcitonin increases renal excretion and decreases bone resorption by inhibiting osteoclasts. Safe drug, no major side effects. Expect a decrease in calcium levels by 1-2 mg/dL in about 4-6 hours. Due to tachyphylaxis, it is really only effective when Ca^2+ levels >14.

- Administer bisphosphonates, Zoledronate or pamidronate IV. Inhibit Ca^2+ release by blocking osteoclast resorption. Max benefit is seen in about 24-48 hours. Major short-term side effects are “flu-like” symptoms (myalgias, aches, arthralgias).

Long term complications include jaw osteonecrosis and renal insufficiency.

Resources

Oncologic Emergencies