TUMOR LYSIS SYNDROME

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Tumor Lysis Syndrome

1. Background

Tumor lysis syndrome (TLS) in pediatric patients is an oncologic emergency that involves complications of hematologic or solid malignancies. Tumor destruction may be due to spontaneous or treatment-related causes, resulting in electrolyte and metabolic imbalances. Classically, tumor lysis is associated with cytotoxic chemotherapy, including treatment with corticosteroids.

Electrolyte disturbances, such as hyperkalemia, hyperphosphatemia, and hypocalcemia can result in life threatening conditions, as can hyperuricemia. Examples include renal failure and dysrhythmias. It is therefore crucial to identify patients at risk of TLS quickly and to proceed with treatment options in an effort to minimize complications.

2. Causes of Electrolyte Imbalance and the Resulting Symptoms

Hyperkalemia

Causes: Cell lysis results in increased potassium levels in the extracellular space, which destabilizes polarized membranes (e.g.: muscle cells), and may trigger life-threatening arrhythmias.

Signs & Symptoms: Patients may develop muscle cramps, muscle weakness, paresthesias, nausea, vomiting and diarrhea. Severely increased levels may lead to ECG changes, such as widened QRS complexes and peaked T waves, and ultimately ventricular dysrhythmias.

Hyperphosphatemia

Causes: Atypical lymphoblasts contain significantly higher concentrations of phosphate than normal lymhoblasts. Upon lysis, excess phosphate is released into the circulation, and is ultimately eventually excreted by the kidneys. Hyperphosphatemia, may be exacerbated by underlying renal insufficiency, uric acid crystal nephropathy, and metabolic acidosis. Hyperphosphatemia-related renal failure results when phosphate and calcium precipitate in the nephron or collecting system.

Symptoms: Seizures, lethargy, vomiting and diarrhea

Hyperuricemia

Causes: High turnover within tumor cells produces intracellular purine nucleic acids. With cell lysis, the uric acid that is produced from purine catabolism is released, and accumulates in the renal collecting duct. The resulting nephropathy may be further exacerbated by pre-existing renal insufficiency (i.e. calcium-phosphate salt crystallization, nephrotoxic medications, etc…)

Symptoms: Oliguria, anuria and lethargy

Hypercalcemia

Causes: Low calcium levels may result from calcium phosphate precipitation, and therefore often occurs concurrently with hyperphosphatemia.

Symptom & Signs: Rarely muscles cramps, tetany, seizures, prolonged QT intervals and resulting dysrhythmias may result.

3. Management of Tumor Lysis Syndrome

	Management Recommendation
Hyperkalemia	
Moderate/Asymptomatic (>6.0mmol/L)	Avoid IV or oral K+ ECG monitoring Sodium polystrene sulfonate (kayexalate)
Severe (>7.0mmol/L)	Above, plus: Membrane stabilization: i) 1 amp Calcium gluconate or Calcium chloride Potassium shift: i) Insulin bolus + sugar (D50W) ii) Sodium bicarbonate IV (never a line in which calcium was previously infused) iii) β agonist inhaled (e.g.: salbutamol) Potassium excretion: i) Furosemide (Lasix) ii) Kayexalate iii) Hemodialysis for refractory hyperkalemia
Hyperphosphatemia	
Moderate (>2.1 mmol/L)	Avoid IV phosphate administration Phosphate binder (oral/nasogastric aluminum hydroxide)
Severe	Hemodialysis
Hyperuricemia	
	Fluid hydration Increased uric acid excretion i) Allopurinol ii) Hemodialysis Increased uric acid breakdown i) Rasburicase

Clinical dehydration	
	Resuscitate with isotonic solution followed with D5 normal saline at increased maintenance rate (typically twice maintenance to maximizes GFR and excretion of uric acid, phosphate and potassium) * Be careful not to cause volume overload in renal failure patients

References

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