A Case of Tumor Lysis Syndrome Complicated by Disseminated Intravascular Coagulation – Case Reports of the LifePACT Critical Care Transport Team

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ABSTRACT

Hematologic/Oncologic emergencies are rarely seen in the critical care transport environment but must be recognized and treated without delay. We report such a patient transported from a referring hospital to a tertiary care center by the LifePACT team, a 52-year-old male with a history of acute myeloid leukemia (AML). The patient presented to the referring hospital with known laboratory test abnormalities, suffered cardiac arrest, was resuscitated, accepted for transfer to a tertiary care center, and LifePACT was requested to perform the transport.

KEYWORDS: hyperkalemia, tumor lysis syndrome, ambulance, emergency medical services, critical care transport

BACKGROUND

The LifePACT Critical Care Transport team is operated by Rhode Island Hospital and Hasbro Children's Hospital in Providence, Rhode Island. It includes emergency medical technicians, critical care paramedics, nurses, and physicians (emergency medicine attendings, fellows and residents, pediatric and emergency medicine residents for pediatric patients) who treat and transfer acutely ill and injured pediatric and adult patients throughout southern New England. LifePACT differs from standard advanced life support ambulances in that a higher level of training, experience, skill, pharmacologic and procedural interventions are available. Second- and third-line seizure medications, antibiotics, insulin, vasopressors, paralytics and other rapid sequence induction medications are standard. Transvenous pacing, balloon pump or Impella support, hemodynamic monitoring, and hospital ICU equivalent oxygenation/ventilation support can be continued during transport.

Most LifePACT transports are for acute medical, cardiac, neurologic, and traumatic emergencies; oncologic transports are rare. While most LifePACT patients have brief bedside times prior to transport, the patient described in this report required extensive stabilization efforts from the LifePACT team at the referring hospital prior to transport.

CASE PRESENTATION

LifePACT was dispatched to transfer a 52-year-old male with a history of acute myeloid leukemia (AML) from a referring hospital to a tertiary care facility for further care and possible plasmapheresis. He had been seen earlier in the day by his primary care physician with complaints of fatigue and dyspnea. He was last treated with hydroxyurea one week prior to presentation. Laboratory work revealed a WBC of 245 k/cu mm, hemoglobin of 6.7g/dl and platelets of 28 k/cu mm. He was referred to a local hospital emergency department where he was noted to be ill appearing, with shortness of breath and abdominal pain. Laboratory testing was notable for a Na of 131 meq/l, Cl of 94 mEq/l, BUN of 81 mg/dl, creatinine of 2.7 mg/dl, Bili of 1.7 mg/dl, glucose of 40 mg/dl, pH less than 7, bicarbonate of 3.4 mEq/dl, and base excess of –27. A chest X-ray revealed pneumonia, for which he was given a gram of cefepime. CT scan of the abdomen was notable for splenic infarcts and ischemic bowel. The patient deteriorated and developed hypoxic respiratory distress requiring intubation. He was referred to an area tertiary care center and an advanced life support (ALS) (a lower level of care than critical care transport) ambulance was requested. However, just before that team's departure, the patient's QRS began to widen, he became bradycardic and lost pulses. CPR was started by the ambulance crew, who returned him to the referring hospital for resuscitation. Return of spontaneous circulation (ROSC) occurred after CPR, atropine, and epinephrine administration. A post-ROSC blood gas revealed a pH of 6.93, CO2 of 16 mmHg and O2 of 68 mmHg. The patient was completely unresponsive even in the absence of paralytics or sedation. A sodium bicarbonate infusion was started, and LifePACT was requested for transfer. Shortly after LifePACT arrival, the patient again became bradycardic and hypotensive. The team initiated a norepinephrine infusion along with a fluid bolus, and administered calcium chloride given concern for hyperkalemia. The bradycardia worsened, but responded to push-dose epinephrine and atropine. The LifePACT transport physician placed a femoral triple lumen catheter under ultrasound guidance. Point-of-care testing using LifePACT's iStat (Abbott Laboratories, Princeton, NJ) revealed pH 6.6, PCO2 71.9 mmHg, PO2 25 mmHg, Base Excess –30, HCO3– 7.4,Na 130 meq/l, K 7.8 meq/l, Ca 1.32 mg/dl and glucose 56 mg/dl. The mixed acidosis was

felt to be secondary to the patient's recent cardiac arrest. His hyperkalemia was treated with intravenous dextrose and insulin, with infusions of insulin and epinephrine prepared. Blood glucose improved on re-testing. During transport preparation, copious oropharyngeal, nasal, and IV-site bleeding developed. Further hospital laboratory results revealed elevated uric acid and phosphorus levels, and an INR of 9. Given these results, the CT findings, and the bleeding diathesis, disseminated intravascular coagulopathy (DIC) related to tumor lysis syndrome and/or AML was suspected by the LifePACT team. DIC is associated with both AML and tumor lysis syndrome.[1,2]

During transport, the patient displayed QRS widening, prompting additional calcium, dextrose, and insulin administration. He remained critically ill but otherwise unchanged during transport. Upon arrival at the tertiary center, he had emergency hematology/oncology consultation, but given his rapid deterioration, prognosis was felt to be very poor. His family decided to implement comfort measure goals of care, and he died shortly afterwards.

DISCUSSION

Tumor lysis syndrome is a group of metabolic disturbances caused by treatment of rapidly proliferating and drug-sensitive malignancies.[3] It is characterized by hyperkalemia, hyperphosphatemia, hypocalcemia, and hyperuricemia. This combination occurs when a large number of tumor cells are lysed, discharging their contents into the circulation. This development can lead to cardiac arrhythmias, acute kidney injury, neurological deterioration including seizures, and uric acid nephropathy.[3] It is the most common disease-related emergency that physicians encounter while caring for individuals with hematologic cancers.[3]

Risk Factors

Cancers with a high proliferation rate, large tumor burden, a lactic dehydrogenase level more than twice normal, pre-existing renal disease and/or volume depletion are all risk factors for TLS development. Cancers most frequently associated with TLS include non-Hodgkin's lymphomas, ALL, AML and CLL. This patient was considered at high risk for this condition given his AML with a white count of over 250,000.[1]

Diagnostics

The Cairo Bishop Definition of Tumor Lysis Syndrome combines laboratory and clinical features including:[3]

- Serum uric acid level ≥ 8 mg/dL, or 25% increase from baseline
- Serum potassium level ≥ 6 mEq/L, or 25% increase from baseline
- Serum phosphate level ≥ 6.5 mg/dL in children and ≥ 4.5 mg/dL in adults, or 25% increase from baseline
- Serum calcium level ≤ 7 mg/dL, or 25% decrease from baseline

It further defines clinical Tumor Lysis Syndrome as two of the laboratory abnormalities plus any of the one of the following:

- Increase in serum creatinine level ≥ 1.5 times the upper limit of normal
- Cardiac arrhythmia/sudden death
- Seizures

These potentially lethal ramifications can be managed effectively with prompt treatment.

TREATMENT OF SUSPECTED TUMOR LYSIS SYNDROME

Electrolyte abnormalities should be treated aggressively to avoid EKG changes and arrhythmias. Hyperkalemia is treated with insulin, dextrose and calcium, sodium bicarbonate and albuterol. Dialysis may be required. Hyperphosphatemia can also be managed with dialysis. It should be corrected before calcium administration unless arrhythmia or tetany is present. Renal dysfunction should be treated with fluid and electrolyte management, appropriate drug dose adjustment, and, if necessary, dialysis.[3] Rasburicase, usually considered a preventive measure, can be given if severe acute kidney injury develops. Rasburicase is a recombinant urate oxidase enzyme used to reduce existing plasma uric acid by converting it to allantoin, which is more soluble in urine.

SUMMARY

We present a case of complicated tumor lysis syndrome requiring critical care transport. LifePACT provided significant stabilizing care prior to departing the referring hospital, including placement of a central venous line, bedside laboratory testing, treatment of hyperkalemia, and ventilator management. Time spent stabilizing patients at the referring hospital must be balanced against the benefit of advanced treatment available at the receiving hospital.

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Disclosures

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