

Management and Immediate Outcome of Common Pediatric Oncological Emergencies from a Single Centre

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The first presentation of children with a malignancy is often an emergency. Pediatric oncological emergencies need to be recognized and managed early and effectively for a better outcome. In this prospective study of children, with oncological emergencies, we aimed to study the nature of oncological emergencies, emergency management and immediate outcome. There were 83 patients with 110 visits with median age of 6 years. Leukemia constituted 50.6% and 92.8% was acute lymphocytic, 26.5% intracranial malignancies 59% of them posterior fossa tumors. 36.4%, presented with fever, 18% severe anemia and 16.45% febrile neutropenia, 8% TLS (tumor lysis syndrome) and 4.5% had respiratory distress as the presentation. Presenting symptoms in 31% were neurological. 42.7% required parenteral antibiotics and 16.4% packed cell transfusion. 90.4% of blood cultures were negative. 26.5% needed intensive care, 12 required neurosurgical procedure.

Introduction

Aim

To study the type, clinical presentation, emergency management and immediate outcome of oncological emergencies.

Method

Prospective study including children, 1 yr to 18 years of age, presenting with oncological emergencies to the emergency department between January 2019 and October 2021. Clinical presentation, laboratory and treatment details were documented and analysed.

Results

There were 83 patients, 110 visits and 27 readmissions. 61.44% (n=51) were males 38.5% (n=32) females. Median age was 6 and 37.34% (n=31) between 1- 5 yrs, 2.4% (n=2) < 1yr. Leukemia constituted 50.6% (n=42), 92.8% (n=39) of these were acute lymphocytic. 7 had leukemic relapse, one of them after BMT (bone marrow transplant). 26.5% (n=22) were intracranial malignancies 59% (n=13) of these were posterior fossa tumors. 50% (n=11) of intracranial tumors were



medulloblastomas. Lymphomas and Ewings sarcoma formed 6% (n=5 each) of total patients. Fever was the presenting complaint in (n=40) 36.4% of 110 visits to the emergency, 18% (n=20) had severe anemia and 16.45 % (n=18) febrile neutropenia, 8% (n=9) with TLS, 4.5% (n=5) had respiratory distress as the presentation Neurological symptoms such as seizures, abnormal neurologic manifestations, headache & vomiting were presenting symptoms in 31% (n=34) of visits. Parenteral antibiotics were administered in 42.7% (n=47) of visits. 90.4% (n=38) of blood cultures were negative (n=38). Packed red cells were transfused for 16.4% (n=18). Intensive care was needed in 26.5% (n=22), 12 children underwent a neurosurgical procedure, 8.4% (n=7) of them required emergency neurosurgical procedure. There were 2 deaths, none in the emergency setting (Table 1).

Type of malignancy	
Leukemia	42
Acute lymphocytic leukemia	38
CML	1
AML	2
JMML	1
Others	
LCH	3
Hodgkins	2
non hodgkins	3
Ewings	5
Hepatoblastoma	1
Neuroblastoma	1
Osteosarcoma	1
Rhabdomyosarcoma	2
Wilms	1
Emergency presentation	
Fever	40
Severe anemia	20
Febrile neutopenia	18
Abd pain, distn,diarrhea	14
Tumor lysis	9
Bleeds	6
Resp emergencies	5
Shock	2
Treatment	
Intravenous antibiotics	47
Blood products transfusion	18
Dexamethasone	8
Intercostal drainage	3
Blood culture	
Culture negative	38
Aspergillus niger	1
Enterobacter	1
Kleibsiella	2
Galactaomannon serum	
Pseudomonas	2
COVID positive	1
CNS TUMORS	
Type of malignancy	
Intracranial tumors	22
Posterior fossa tumors	13

Meduloblastoma	11
Brainstem glioma	3
Pituitary non germcell tumor	2
Non germinomatous tumor	2
Pilocytic astrocytoma	1
parieto occipital glioma	1
Germinoma	1
CNS TUMORS	
Anaplastic ependymoma	1
Symptoms at presentation	
Neurological symptoms	13
Seizures	11
Headache & vomiting	10
Treatment & Outcome	
Neurosurgical procedure	12
To OT from ER	7
Dexamethasone	8
PICU	22
Deaths	2

Table 1. Types of Malignancies, Clinical Presentation, Treatment and Outcome.

Discussion

Cancer is diagnosed in approximately 2 in every 10,000 patients in pediatric emergency department [1,2]. Oncological emergencies can either be complications of the malignancy or its treatment. Early recognition and prompt management of these emergencies is crucial for an optimal outcome. Leukemias are most common among childhood malignancies presenting to hospital and we observed 50% of oncologic emergencies were in children with leukemia, especially acute lymphocytic leukemia (93%) [3]. Children with leukemias present to the emergency department either with fever, severe pallor, febrile neutropenia or gastrointestinal symptoms. Possibility of febrile neutropenia should be considered in children with malignancies especially those who are on chemotherapy and appropriate antibiotics should be commenced in the emergency department without delay, after obtaining cultures to prevent progression to life threatening systemic sepsis. Antibiotic can be individualized based on clinical findings and local susceptibility or at least broad- spectrum beta-lactam with antipseudomonal coverage must be started once the diagnosis is made [1,4]. Only 10-30% of neutropenic fevers yield a microbiologic diagnosis [5]. A study conducted by Mohamed WA, Daef EA, Elsherbiny showed that blood stream bacterial infection was detected in 29.4%. However, our study showed 9.6% of culture positivity [6]. Siddaiahgari S reported Ecoli and pseudomonas being common gram negative and both methicillin sensitive and methicillin resistant staphylococcus common gram positive bacteria in oncologic patients with febrile neutropenia in a single tertiary care center study [7]. Severe anemia a life threatening complication of pediatric leukemia requires emergent blood transfusions and platelet transfusions are indicated when there is a risk of serious bleeding [8]. Easy access to leucodepleted and irradiated blood products is vital in the emergency setting. TLS defined as hyperkalemia, hyperphosphatemia, hyperuricemia, and hypocalcemia. is an emergency in about 30% of patients with non-Hodgkin lymphoma [9]. It occurs following initiation of therapy or as the first presentation even before the diagnosis and has to be identified and managed without delay. Hyperleucocytosis commonly defined as a WBC count of greater than 100,000/mL (>100 10⁹/L). causes leukostasis and decreased tissue perfusion and is a high risk for tumor lysis. Immediate and appropriate intervention prevents lifethreatening neurologic and pulmonary complications, cardiac failure, arrhythmias, DIC and renal failure [10-12]. Fluid management and initiating allopurinol or rasburicase should be carried out in the emergency setting with serial monitoring of the serum TLS

markers like electrolytes, uric acid, phosphate and renal function. Respiratory emergencies occur either due to airway compression by mediastinal mass, pneumothorax, pneumonia or CNS causes such as seizures or altered sensorium. The first presentation of an anterior mediastinal mass can be a respiratory emergency and often the severity of airway compromise is not proportionate to the degree of symptoms. Compression of the superior vena cava presents as orthopnea. Diagnosis and treatment involves least disturbance to the child and may require empirical corticosteroids and support from airway specialists. This critical condition necessitates prompt recognition, preparation and planning to manage a difficult airway [10-13]. CNS (Central nervous system) tumors are common next to leukemias in children and constituted 26.9% [14]. Headache is a common symptom in CNS tumors, however nonspecific and intermittent symptoms can delay diagnosis and these children with raised intracranial pressure are at a risk of deteriorating rapidly [15,16]. Posterior fossa tumors, commonly medulloblastoma, obstruct the CSF pathway and recognizing early subtle signs and symptoms of this emergency ensures a better outcome. Availability of neuroimaging and neurosurgical and pediatric intensive care facilities is vital for the golden hour management of ICP (Intra cranial pressure) in the emergency setting. Parenteral steroids and measures to reduce ICP is imperative. Emergency presentation of solid tumors that arise in the abdomen are uncommon and include hypertension in neuroendocrine tumors and paraneoplastic syndromes [1].

In conclusion, multicentric study to identify challenges faced in the emergency management of children with oncological disease will contribute towards better management and outcome.

Acknowledgments

We acknowledge Ms Gothai Nachiyar, Kanchi Kamakoti CHILDS Trust Hospital, Chennai for contributing to the statistics, Mail ID Statements and Declarations

Contributions

Radhika Raman- study conception, design, supervision, data collection, analysis, manuscript writing and review.

Sreenidhi Ramakrishnan - data collection, analysis, manuscript writing and review
Lakshmi Muthukrishnan- data collection, analysis, manuscript design and review.

References

References

1. Jefferson MR, Fuh B, Perkin R, Hernandez DA. Pediatric oncologic emergencies. *Pediatr Emerg Med Rep*. 2011; 16(5):57-72.
2. Kundra M, Stankovic C, Gupta N, Thomas R, Hamre M, Mahajan P. Epidemiologic findings of cancer detected in a pediatric emergency department. *Clinical Pediatrics*. 2009; 48(4)[DOI](#)
3. Stephanos K, Dubbs SB. Pediatric Hematologic and Oncologic Emergencies. *Emergency Medicine Clinics of North America*. 2021; 39(3)[DOI](#)
4. Uygun V, Karasu GT, Ogunc D, Yesilipek A, Hazar V. Piperacillin/tazobactam versus cefepime for the empirical treatment of pediatric cancer patients with neutropenia and fever: a randomized and open-label study. *Pediatric Blood & Cancer*. 2009; 53(4)[DOI](#)
5. Meckler G, Lindemulder S. Fever and neutropenia in pediatric patients with cancer. *Emergency Medicine Clinics of North America*. 2009; 27(3)[DOI](#)
6. Mohamed WA, Daef EA, Elsherbiny NM, Abdel-Raady BE, Abdela AT. Effect of some Efflux

- Pump Inhibitors on the Resistance of some Escherichia coli Strains to some Antimicrobial Agents. *The Egyptian Journal of Medical Microbiology (EJMM)*. 2016; 25(4)
7. Siddaiahgari S, Manikyam A, Kumar KA, Rauthan A, Ayyar R. Spectrum of systemic bacterial infections during febrile neutropenia in pediatric oncology patients in tertiary care pediatric center. *Indian Journal of Cancer*. 2014; 51(4)[DOI](#)
 8. Cannas G, Thomas X. Supportive care in patients with acute leukaemia: historical perspectives. *Blood Transfusion*. 2015; 13(2)[DOI](#)
 9. Klustersky J, Naurois J, Rolston K, Rapoport B, Maschmeyer G, Aapro M, Herrstedt J. Management of febrile neutropenia: ESMO Clinical Practice Guidelines. *Annals of Oncology: Official Journal of the European Society for Medical Oncology*. 2016; 27(suppl 5)[DOI](#)
 10. Kaplan JA. Leukemia in Children. *Pediatrics in Review*. 2019; 40(7)[DOI](#)
 11. Cairo MS, Bishop M. Tumour lysis syndrome: new therapeutic strategies and classification. *British Journal of Haematology*. 2004; 127(1)[DOI](#)
 12. Seth R, Bhat AS. Management of common oncologic emergencies. *Indian Journal of Pediatrics*. 2011; 78(6)[DOI](#)
 13. Shamberger RC, Holzman RS, Griscom NT, Tarbell NJ, Weinstein HJ. CT quantitation of tracheal cross-sectional area as a guide to the surgical and anesthetic management of children with anterior mediastinal masses. *Journal of Pediatric Surgery*. 1991; 26(2)[DOI](#)
 14. Rheingold SR, Lange BJ. Oncologic emergencies. In: Pizzo PA, Poplack DG, editors. *Principles and Practice of Pediatric Oncology*, 5th edition. Philadelphia: Lippincott Williams & Wilkins; 2006:1202-1230.
 15. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA: a cancer journal for clinicians*. 2020; 70(1)[DOI](#)