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Original Research Article **Haematology**

Acute Tumor Lysis Syndrome: A Review of 100 Patients with Acute Lymphoblastic Leukemia

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Abstract

Background: ALL is a malignancy of B or T lymphoblasts which is characterized by unrestrained spread of abnormal, immature lymphocytes and their progenitors which results in the replacement of bone marrow and other lymphoid organs subsequently. ***Methods:*** This study was a observational cross sectional study conducted at the Department of Hematology, in Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. The study period was from October 2019- September 2020. The sample size for this study was 100. ***Result:*** Most of the respondents 53(53%) were from <20 years and the mean age was 30±11.18. The female was 68(68%) and male was 32(32%). Fever was found in 100% cases and Progressive pallor in 98%. Bony tenderness was found in 58 cases and followed by Splenomegaly 48, Lymphadenopathy in 46, Oral ulcer in 46, Hepatomegaly in 36. The range of Total WBC count (x109/L) was (6-435) and the Mean±SD was 52.51±78.70 and followed by Hb% (gm/dl) was (4.1-13.4) and 9.25±1.49, Platelet (x109/L) was (5-20000) and 505.20±2815.29. S. uric acid (mg/dL) was (1.40-30.03) and 5.76±4.61. S. inorganic phosphate (mg/dL) was (2.30-7.70) and 4.19±1.20. S. potassium (mmol/L) (2.50-5.40) and 3.92±0.56. S. calcium (mg/dL) was (1.10-11.80) and 8.33±2.08. S. creatinine (mg/dL) was (0.19-3.59) and 89±0.55. In 72% TLS was absent and in 28% was present. ***Conclusions:*** Rapid spread of TLS often causes severe toxic effects on organs, which leads to renal impairment, epilepsy, cardiac arrhythmias, pulmonary edema, and even death.

Keywords: Acute Tumor Lysis Syndrome, Acute Lymphoblastic Leukemia.

INTRODUCTION

Acute lymphoblastic leukemia (ALL) is a form of cancer which prevails in 25% of all pediatric malignancies and mostly developed before age of 15 [1, 2]. ALL is a malignancy of B or T lymphoblasts which is characterized by unrestrained spread of abnormal, immature lymphocytes and their progenitors which results in the replacement of bone marrow and other lymphoid organs subsequently [3]. ALL prevails in nearly 2% of the lymphoid neoplasms in the United States and most frequently occurs in males than females, and three times as often in Whites than in Blacks [3]. Among the complications of ALL, tumor lysis syndrome (TLS) is the most frequent and fatal, particularly in newly diagnosed patients. TLS denotes to a potentially fatal clinical condition which results from the quick release of intracellular substances from lysed cells [4]. The Characteristics of TLS can be defined by the clinical findings of hyperuricemia, hyperkalemia, hyperphosphatemia, and hypocalcemia [5, 6]. The prevalence of ALL is approximately 3.3/100,000 cases and the survival rates for ALL had enhanced intensely since the 1980s, for example, a recent five-year overall survival rate was seen more

than 85% [3]. But around 20% Diagnosis is done with the incidence of 20% or more lymphoblasts in the bone marrow or peripheral blood [7]. Besides, it is estimated that engrossment of extramedullary sites usually arises and may origin lymphadenopathy, splenomegaly or hepatomegaly in 20% of patients [7]. Moreover, CNS involvement at time of diagnosis happens in 5–8% of cases and present most frequently as cranial nerve deficits or meningismus [8]. ALL patients may face treatment failure, mostly because of relapse, secondary tumor, chemotoxicity, or severe complications [9]. Some studies had acknowledged genetic syndromes which influence to a minority of cases of ALL, like Down syndrome, Fanconi anemia, Bloom syndrome, ataxia telangiectasia and Nijmegen breakdown syndrome [10, 11]. Further predisposing factors comprise revelation to ionizing radiation, pesticides, certain solvents or viruses like Epstein - Barr virus and Human Immunodeficiency Virus [12]. Clinical findings suggest that TLS inclines to develop from highly proliferative malignancies, like Burkitt's lymphoma and ALL, where the tumor burden is heavy, or else in response to previous therapy [13]. Hence, TLS has become a great challenge for ALL management. However, several studies had initiated some risk factors and management standards for TLS [14, 15]. The purpose of this study was to know about 100 patients as case that had acute lymphoblastic leukemia.

OBJECTIVE

This retrospective study was carried out to know about 100 patients as case that had acute lymphoblastic leukemia.

MATERIALS AND METHODOLOGY

This study was an observational cross sectional study conducted at the Department of Hematology, in Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. The study period was from October 2019- September 2020. The sample size for this study was 100.

Inclusion criteria

- All newly diagnosed Acute Lymphoblastic Leukemia patients with the prevalence of Acute Tumor Lysis Syndrome.
- The patients who were willing to give their consent after knowing the study purpose.

Exclusion criteria

- Relapsed and secondary case of Acute Lymphoblastic Leukemia
- Patients epilepsy and other convulsive disorder
- Patients with chronic kidney disease

Clinical history was taken and physical examination was evaluated with due consent of the respondents. All the documents necessary to confirm the diagnosis were collected from the hospital authority. To determine the levels of serum phosphate, potassium, uric acid, creatinine, calcium, albumin and serum lactate dehydrogenase (LDH) venous blood samples were drawn in lithium heparin coated vacutainers. These samples were run on NOVA biomedical-4 automated analyzer for serum potassium and on Hitachi 911 automatic analyzer for serum uric acid, creatinine, calcium, phosphate, albumin and 30 LDH. Data was analyzed with the software SPSS version 21. Multivariate logistic regression analysis was done to detect odds ratio of independent variables to predict development of TLS among ALL patients.

RESULTS

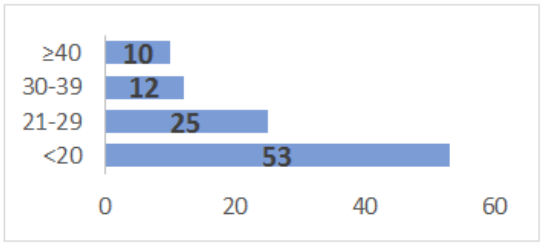

Fig-1: Age distribution of the study patients (N=100)

Figure-1 shows the age distribution of the study people. There were 53(53%) respondents from <20 years and followed by 25(25%) from 21-29 years, 12(12%) from 30-39 years and 10(10%) from ≥40 years. Mean age was 30±11.18.

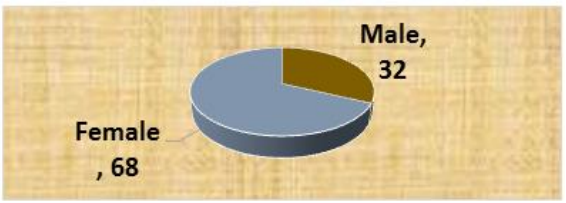

Fig-2: Gender distribution of the study patients (N=100)

Figure-2 shows the gender distribution of the study people where female was 68(68%) and male was 32(32%).

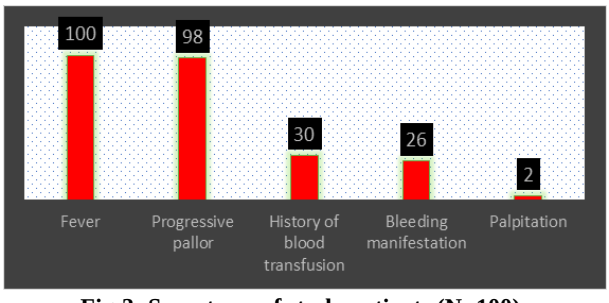

Fig-3: Symptoms of study patients (N=100)

Figure 3 represents the distribution of the study people according to the following symptoms where Fever was found in 100% cases and followed by Progressive pallor in 98%, History of blood transfusion

in 30%, bleeding manifestation in 27% and Palpitation in 2%.

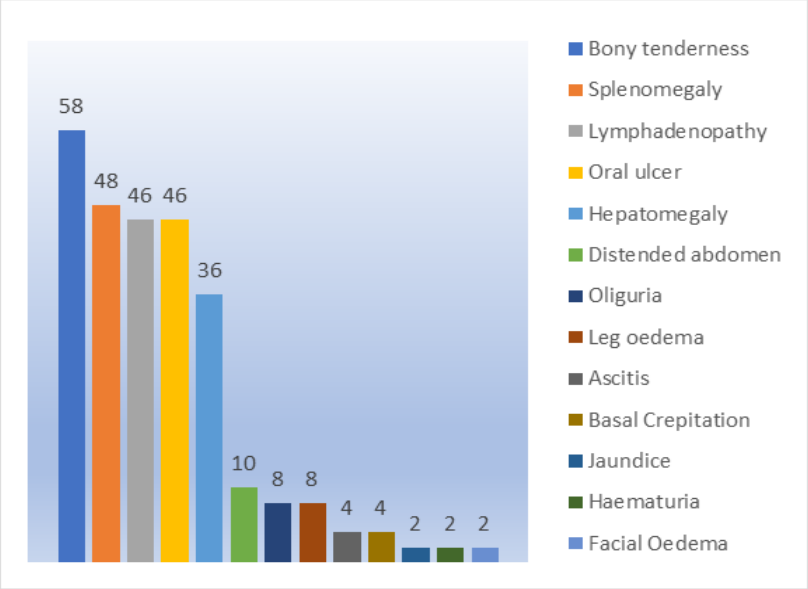

Fig-4: Clinical findings of study patients (N=100)

Figure 4 shows the clinical findings of the study patients' where Bony tenderness was found in 58 cases and followed by Splenomegaly 48, Lymphadenopathy in 46, Oral ulcer in 46, Hepatomegaly in 36, Distended abdomen in 10, Oliguria in 8, Leg o edema in 8, Ascitis in 4, Basal Crepitation in 4, Jaundice in 2, Haematuria in 2 and Facial Oedema in 2 cases.

Table-1: Biological feature of the study patients (N=100)

Parameters	Range (minimum-maximum)	Mean±SD
Total WBC count (x109/L)	6-435	52.51±78.70
Hb% (gm/dl)	4.1-13.4	9.25±1.49
Platelet (x109/L)	5-20000	505.20±2815.29
Blast in PBF (%)	Oct-90	53.80±21.251
S. LDH (U/L)	198-11863	1591.53±2195.47
S. uric acid (mg/dL)	1.40-30.03	5.76±4.61
S. inorganic phosphate (mg/dL)	2.30-7.70	4.19±1.20
S. potassium (mmol/L)	2.50-5.40	3.92±0.56
S. calcium (mg/dL)	1.10-11.80	8.33±2.08
S. creatinine (mg/dL)	0.19-3.59	89±0.55

Table-1 shows the biological feature of the study patients. The range of Total WBC count (x109/L) was (6-435) and the Mean±SD was 52.51±78.70 and followed by Hb% (gm/dl) was (4.1-13.4) and 9.25±1.49, Platelet (x109/L) was (5-20000) and 505.20±2815.29. Blast in PBF (%) was (Oct-90) and 53.80±21.251. S. LDH (U/L) was (198-11863) and 1591.53±2195.47. S. uric acid (mg/dL) was (1.40-30.03) and 5.76±4.61. S. inorganic phosphate (mg/dL) was (2.30-7.70) and 4.19±1.20. S. potassium (mmol/L) (2.50-5.40) and 3.92±0.56. S. calcium (mg/dL) was (1.10-11.80) and 8.33±2.08. S. creatinine (mg/dL) was (0.19-3.59) and 89±0.55.

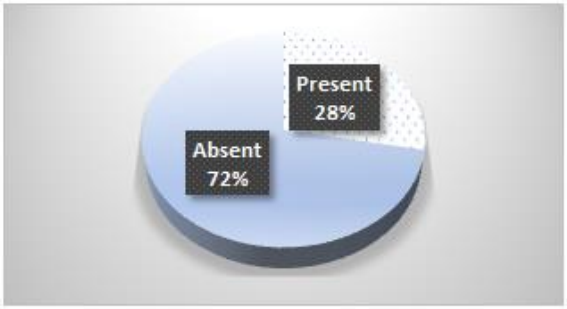

Fig-5: Prevalence of TLS among ALL patients (n=100)

Figure-5 shows the prevalence of TLS among all patients where in 72% TLS was absent and in 28% was present.

DISCUSSION

There were 53% respondents from <20 years and followed by 25% from 21-29 years, 12% from 30-39 years and 10% from ≥40 years. Mean age was 30±11.18 [Figure 1]. A related study in this field which was conducted among 91 children showed that 80.21% of the respondents were <10 years and 19.78% were >10 years where the mean age was 6.39±3.08 [16]. Another study showed there were 49 patients in age group 1-10 years, 27 were ≥10 years and 7 were <1 year [17]. Among the all participants the female was the most 68% and male was 32% [Figure 2]. But the study of Blum *et al*. found the male participants were the most 69% where the female was 31% [18]. The study of Bilquis Naeem *et al*. showed that the male was 57.14% and female was 42.85% [16].

The most common symptom fever was found in 100% cases and followed by Progressive pallor in 98%, History of blood transfusion in 30%, bleeding manifestation in 27% and Palpitation in 2% [Figure 3]. A similar result was found in the study of Sultana *et al*. where fever was also common in all the 100% respondents with ALL and bleeding manifestation was also found in 46% respondents [19]. Bony tenderness was found in 58 cases and followed by Splenomegaly 48, Lymphadenopathy in 46, Oral ulcer in 46, Hepatomegaly in 36, Distended abdomen in 10, Oliguria in 8, Leg o edema in 8, Ascitis in 4, Basal Crepitation in 4, Jaundice in 2, Haematuria in 2 and Facial Oedema in 2 cases [Figure 4]. In a related study the bony tenderness was found in 76.7% cases and followed by splenomegaly in 96.29%, lymphadenopathy in 70.0% cases with ALL [19] Davidson *et al*. and Hagino *et al*. in their study showed similar results concerning the clinical observation [20, 21].

The range of Total WBC count (x109/L) was (6-435) and the Mean±SD was 52.51±78.70 and followed by Hb% (gm/dl) was (4.1-13.4) and 9.25±1.49, Platelet (x109/L) was (5-20000) and 505.20±2815.29. Blast in PBF (%) was (Oct-90) and 53.80±21.251. S. LDH (U/L) was (198-11863) and 1591.53±2195.47. S. uric acid (mg/dL) was (1.40-30.03) and 5.76±4.61. S. inorganic phosphate (mg/dL) was (2.30-7.70) and 4.19±1.20. S. potassium (mmol/L) (2.50-5.40) and 3.92±0.56. S. calcium (mg/dL) was (1.10-11.80) and 8.33±2.08. S. creatinine (mg/dL) was (0.19-3.59) and 89±0.55 [Table 1]. A similar study by Bilquis Naeem *et al*. showed the mean serum creatinine (mg/dl) 0.46±0.17 which ranged from (0.12-1.16) and followed by the mean eGFR ml/min/1.73 m2 was 142.66±58 (34-375), mean serum uric acid (mg/dl) was 4.12±2.0 (1.4-10.9), mean serum phosphate (mg/dl) was 4.24±1.34 (1.1-8.4), mean serum potassium (meq/l) was 4.1±0.72 (2.3-7.7) and mean serum calcium (mg/dl) was 9.4±1.02 (6.4-11.7) [16]. In this study, in 72% cases TLS was absent and in 28% TLS was present [figure 5]. In a related study by Ethiopia by Michu H *et al*. there was 29.5% prevalence of TLS among the leukemia patients [22].

CONCLUSION

TLS is a life-threatening complication related to ALL. With the advancement in cancer treatment, the number of patients with TLS is also increasing as a side effect of chemotherapy. Rapid spread of TLS often causes severe toxic effects on organs, which leads to renal impairment, epilepsy, cardiac arrhythmias, pulmonary edema, and even death. After the chemotherapy the clinician should be more concern about the adequate hydration, use of uric acid for lowering therapies, use of phosphate binders, and the minimization of potassium intake and do all the tests to identify the prevalence of TLS and start the treatment accordingly. Hence, a profound knowledge of TLS may make the overall treatment process more fruitful and also lower the risk of TLS with ALL patients.

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