

Calcium, Phosphorus & Alkaline Phosphatase Levels in Acute Lymphoid Leukemia

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Abstract— Acute lymphoblastic leukemia (ALL) is a malignant transformation and proliferation of lymphoid progenitor cells in the bone marrow, blood and extra medullary sites. While 80% of ALL occurs in children, it represents a devastating disease when it occurs in adults. The leukemias are best viewed as malignant neoplasia of white blood cells precursors. The present study is undertaken to evaluate the serum Calcium, Phosphorus & Alkaline phosphatase in ALL. These biochemical parameters have significance and will help in the differential diagnosis of the disease. The diagnosis of ALL is confirmed by hematological and histological examinations. The Levels of Calcium, Phosphorus & Alkaline phosphatase in ALL were estimated and were found to be elevated significantly. The estimation of these was conducted in our biochemistry laboratory and requires no extra cost & can be performed in our daily routine investigation and thus will be helpful for further diagnosis of the disease.

Keywords— Acute lymphoblastic leukemia (ALL), Calcium (Ca), (Phosphorus (P), alkaline phosphatase, Leukemia.

I. INTRODUCTION

Acute lymphoblastic leukemia (ALL) is a cancer of the lymphoid line of blood cells characterized by the development of large numbers of lymphocytes [1]. Leukemia is a cancer of blood cells characterized by the abnormal increase in the number of white blood cells in the tissues [2, 3]. It is characterized by anemia, thrombocytopenia and loss of normally functioning leucocytes, incident to the replacement of normal bone marrow elements by leukemic cells. It is particularly devastating in children under age 15 years and peak incidence occurs at about 4 years and age. Acute lymphoblastic leukemia (ALL) is the most common malignancy of childhood, accounting for approximately 25% of all childhood cancers. Acute myeloid leukemia dominates in the 15-39 years of age range [4, 5]. During the last decade investigators have reported favorable outcomes for children with acute lymphoblastic leukemia (ALL), with long-term event-free survival rates for unselected patient populations ranging from 60% to 80% [6,7].

II. MATERIAL AND METHODS

The present short study was conducted on patients admitted in Govt. Medical College & Hospital, Aurangabad during the year 2015-2016. Thirty one (31) healthy males & females of different age group were taken as control for comparison. The diagnosis was made on the brief clinical history with hematological and bone marrow aspiration examination and by biochemical examination. Estimation of serum calcium by method Clark and Collip [8]. Serum phosphorus by Fiske and Subbarow [9]. Estimation of serum alkaline phosphatase were carried out by method - King and King [10] using 4-aminoantipyrine,

III. RESULT AND DISCUSSION

In this study the healthy control of various age groups and either sex were included. For biochemical parameters 31 normal individuals assessed to establish average level in control group for each parameter and considered for comparison with test group (Table I).

Serum Calcium, Phosphorus & alkaline phosphatase levels found to be elevated significantly (Table II, graph I, Table III, graph II & Table IV, graph III). The elevated level of Calcium may probably due to:- i) Extensive infiltration of leukemia cells in the bone. ii) May be due to PTH or serum calcium binding substance responsible for carrying out excess of calcium, vitamin D intoxication etc. iii) May be due to rapid osteolysis due to destructive metastases. It may also be due to decrease tubular reabsorption. iv) May be also due to disturbed calcium metabolism, secondary to bone involvement. The increased level in the present study may be due to:- i) Direct release of calcium from bone as a result of extensive infiltration with malignant cells, ii) elevated serum calcium level may be due to disturbed calcium level secondary to neoplasia. This finding is similar to that obtained by kniseley, R.E [11]. Most of the abnormalities of serum phosphate levels have been associated with abnormal serum calcium levels [12]. Use of certain anticancer drugs may also cause electrolyte disorders which may raise the levels of phosphorus [13].

In the present study serum alkaline phosphatase levels were significantly increased in patients of Acute lymphoblastic leukemia (ALL). (Table IV, graph III). The probable explanations are: i) leukemia causes bony abnormalities, leukemic cells infiltrates into bone causes osteoclastic activities, so bony ALP is released into extracellular circulation causes increase in enzyme activity. ii) It may be due to cortisone treatment, which lowers calcium levels with increase in enzyme activity. iii) The increase in

enzyme activity may be related to degree of bone deterioration in disease processes, the enzyme activity is maximum in advance stages of the disease. iv) Damage to hepatic cells, due to leukemia cell infiltration may release ALP into circulation. v) Elevated levels may be due to elevated calcium levels. The probable cause might be – i) due to increase relationship between serum calcium and alkaline phosphatase level and ii) may be due to osteoblastic activity lesions in Hodgkin’s disease [14]. In general, thus, abnormalities of serum phosphate levels are associated with abnormal serum calcium levels.

the individual parameter could not be helpful for the differential diagnosis of the disease, as most of the cancers do not show any symptoms till they detect only in II or III stage directly. Therefore we had tried to perform simple biochemical investigations of serum Calcium, Phosphorus & alkaline phosphatase which are performed in our laboratory & which will cost less and can show the progress of the disease. This work was undertaken to perform simple cost effective tests which shows the severity and progression of the disease without using more sophisticated instruments which may increase the cost of the same.

IV. CONCLUSION

Serum Calcium, Phosphorus & serum alkaline phosphatase levels were found to be elevated significantly in Acute lymphoblastic leukemia (ALL). We conclude that even though

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TABLE I. Showing various parameters (Average level in Control)

	Serum Calcium (mgs %)	Serum Phosphorus (mgs%)	Serum Alk.Phosphatase(KAU)
Average level in control	9.77-10.29 =10.03	2.77-3.37 =3.07	6.54 – 8.18 = 7.36

TABLE II. Serum Calcium Level in ALL

	Mean Calcium Level (mg %)	‘t’ (P)	Remarks
Control N=31	10.03 ± 0.34		
Acute lymphocytic leukemia N=13	11.22 ± 0.35	3.99(P<0.01)	Highly significant

Graph-I

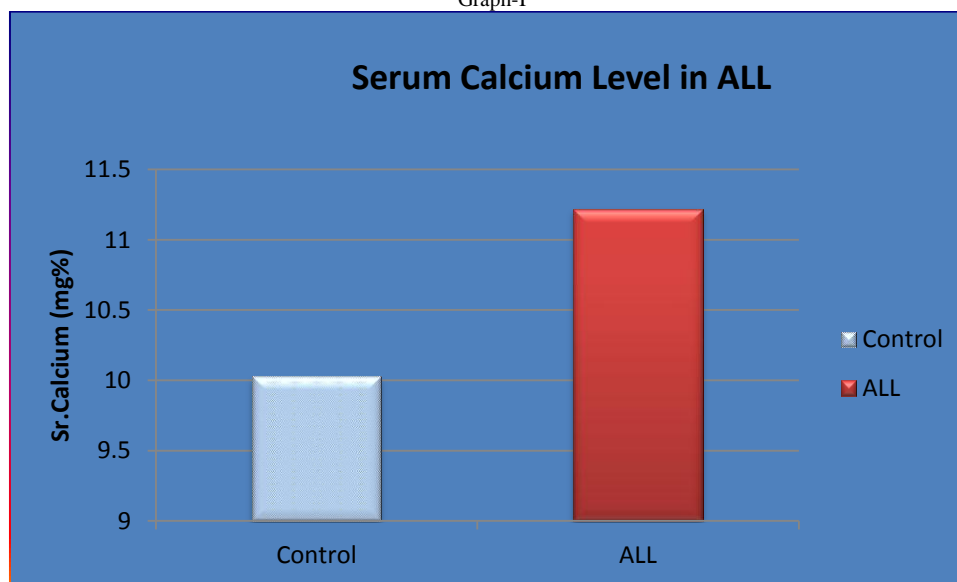


TABLE III. Serum Phosphorus Level in ALL

	Mean Phosphorus level (mg %)	‘t’ (P)	Remarks
Control N=31	3.07 ± 0.15		
Acute lymphocytic leukemia N=13	3.60 ± 0.24	3.33(P<0.01)	Highly significant

Graph-II

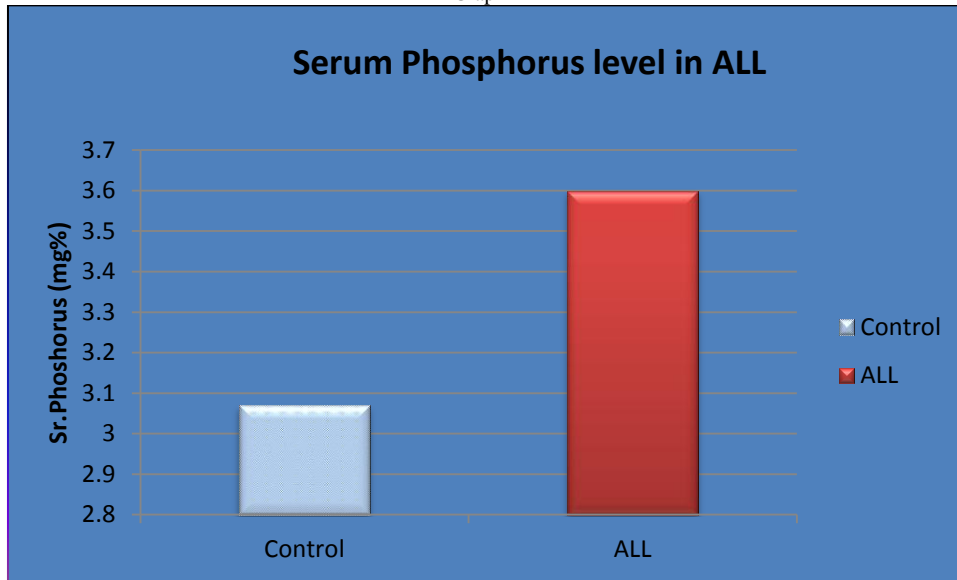
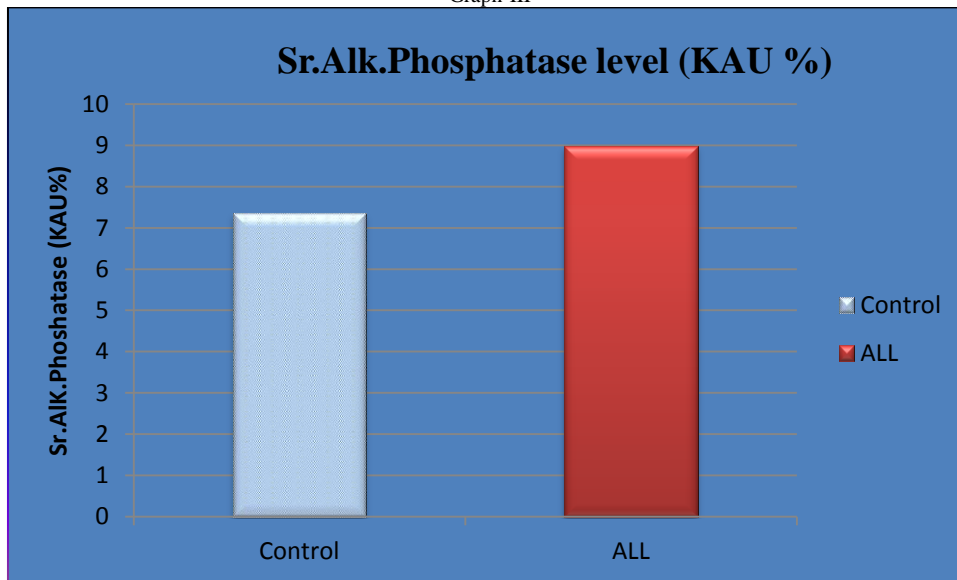


TABLE IV. Sr.Alk.Phosphatase level (KAU)

	Mean Alk.Phosphatase level (KAU %)	't' (P)	Remarks
Control N=31	7.36 ± 0.41		
Acute lymphocytic leukemia N=13	8.98 ± 0.82	2.01(P<0.05)	Significant

Graph-III



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