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LEUKOCYTE ALKALINE PHOSPHATASE ACTIVITY IN DISEASES

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ABSTRACT

Study of leukocyte alkaline phosphatase activity in diseases by the semiquantitative histochemical technic of Kaplow[27]. It found that the leukocyte alkaline phosphatase score markedly increased in patients with carcinoma of lung, liver, gall bladder, stomach, colon, rectum and cervix and in bacterial infection but slightly increased in viral infection. Whereas this enzyme activity was lower than normal in acute myeloid leukemia.

INTRODUCTION

Leukocyte alkaline phosphatase (LAP) is an enzyme capable of hydrolyzing a wide variety of phosphomonoesters[1]. The activity of this enzyme has been exhibited by both histochemical and biochemical assays [2,3]. By numerous cytochemical studies in healthy human leukocytes indicated that this enzyme can be detected only in the cytoplasm of a few band or segmented polymorphonuclear neutrophils[4]. The alteration of enzyme activity may be take place in those cells by a variety of physiological and pathological conditions.

This enzyme leukocyte has been found much lower than normal in the neutrophils of chronic granulocytic leukemia[5-11], paroxysmal nocturnal hemoglobinuria [12], and sickle-cell anemia[13]. The absence of this enzyme activity was also found in hypophosphatasia [14], however it is greatly increased in polycythemia vera [8,9,

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11,15), myelofibrosis (8,9), thrombocytopenia (8). Hodgkin's disease (16), physiological leukocytosis (17, 18), leukemoid reaction (10, 19), acute inflammation (20), pregnancy (21-23) and following the administration of ACTH (24,25).

Jedwab, G.A., et. al. (26) found that the mean leukocyte alkaline phosphatase score is highly elevated in seven patients with ovarian tumors and in six pateints with cervical cancer, but moderately elevated in seven cases of well-differentiated adenocarcinoma of the endometrium, and slightly elevated in eleven postmenopausal women with benign leiomyomas. However, the study of leukocyte alkaline phosphatase activity in patients with neoplasm is still required more evidences. In this experiment, we determine the qualitative alteration in the leukocyte alkaline phosphatase activity of diseases, particularly in patients with various neoplasms.

MATERIAL AND METHOD

Blood samples were obtained from the finger tips of 30 normal healthy adults as well as from 84 patients with various diseases as shown in Table 1. Those blood samples estimated for total white cell count, routine white blood cell differential count and the leukocyte alkaline phosphatase staining. The LAP staining and scoring technic were those described by Kaplow (27). For the concentration of white blood cell smears, the modification of Kaplow was performed by using buffy coat blood collected from heparinized microhematocrit tube after the centrifugation. The freshly prepared buffy coat blood smear was fixed with cold formalin methanol (0-5°C), and then incubated with the substrate those consisting of sodium - alpha - naphthyl phosphate and Fast Blue R R in propanediol buffer. After the incubation, the blood smear was counterstained with Mayer's Hematoxylin stain. The scoring technic was carried out by counting a 100 consecutive neutrophilic granulocytes and rating each count from 0 to 4 score based on the intensity and appearance of the precipitated dye in the cellular cytoplasm. The total of the rating of 100 cells is considered as the "LAP score" of each sample.

RESULTS

Leukocyte alkaline phosphatase scores and absolute numbers of the neutrophil count in normal healthy adults and patients with various diseases were summerized in Table 1. In normal healthy individuals, the average LAP score of 30 cases was 51.4 $\pm$ 44.6, ranging from 20-82 and the absolute number of neutrophil was 4802.9,

however, the average, LAP score of 20 cancereous cases was 185.3 ± 44.7, ranging from 128 - 268 and the absolute number of neutrophil was 4802.9. The cases of carcinoma were categorized into 7 distinctive groups (also showed in Table 1.), such as carcinoma of lung with the average LAP score of 6 cases was 179.3 ± 46.3, ranging from 138-235 and the absolute number of neutrophil was 8330.03. The carcinoma of liver exhibited the average LAP score of 4 cases as 236.5 ± 29.6 within the ranges of 199 and 268, and the absolute number of neutrophil was 10586.6. Only one carcinoma of gall bladder was tested and showed the LAP score of 152 with the absolute number of neutrophil was 7336.5. Three cases of carcinoma of stomach demonstrated the average LAP score of 186.0 ± 48.1, ranging from 136-232 and the absolute number of neutrophil of 8831.2. Only one carcinoma of colon was tested. His LAP score and the absolute number of neutrophil were 138 and 6621 respectively. A case of carcinoma of rectum had the LAP score of 162 with the absolute number of neutrophil

Table 1. Comparison of LAP scores and absolute numbers of neutrophil in various diseases.

Diseases	Number of cases	LAP score			Absolute number of neutrophil count/cu. mm.
		Range	Mean	S. D.	
Normal Adult	30	20-82	51 4	44.6	4802.9
C.A. (Over all)	20	128-268	185.3	44.7	4802·9
C.A. Lung	6	138-235	179.3	46.3	8330.03
C.A. l iver	4	199-268	236.5	29.6	10586.6
C.A. Gall Bladder	1	152	–	–	7336.5
C A. Stomach	3	136-232	186.0	48.1	8831·2
C.A. Colon	1	138	–	–	6621.0
C.A. Rectum	1	162	–	–	7724 0
C.A. Cervix	4	128-168	145.25	17.7	7149.0
Bacterial Infection	28	102-212	134.0	23.6	6937.5
Viral Hepatitis	7	50-76	61.0	9.89	3045.0
A.M.L.	9	0-17	10.0	6.0	2176.0

C.A. = Carcinoma
LAP = Leukocyte alkaline phosphatase
A.M.L. = Acute myeloid leukemia

of 7724. Four carcinoma of cervix demonstrated the average LAP score of 145 25 ± 17.7 with ranges between 128 and 168, and the absolu e number of neutrophil was 7149.

Besides the cancereous cases were studied, samples were also tested on bacterial infected individual as well as on viral hepatitis patients. In bacterial infection, the average LAP score of 28 cases was 134.0 ± 23.6, ranging from 102-212 and the absolute number of neutrophil was 6937.5. Whereas, the viral hepatitis patients, the average LAP score of 7 cases 61.0 ± 9.89, ranging from 50-76 and the absolute number of neutrophil was 3045. In acute myeloid leukemia (AML), nine cases were studied and showed the average LAP score of 10.0 ± 6.0, ranging from 0-17 with the absolute number of neutrophil of 2176.

The comparison of the average LAP scores and the absolute numbers of neutrophil in various diseases were shown in Figure 1. From histograms, the values of the average LAP scores and the absolute numbers of neutrophil of neoplastic patients were markedly higher than normal healthy individuals. The highest value, however, was indicated in carcinoma of liver but the lowest value was exhibited in carcinoma of colon. Also showed in figure 1, patients with bacterial infection demonstrated the value higher than viral hepatitis but acute myeloid leukemia revealed lower value than normal healthy individuals.

DISCUSSION

From this experiment, the average LAP score of normal adults was closely corresponded with Kungswanich, V., et. al. [28]. The studies of leukocyte alkaline phosphatase activity in carcinoma of lung, liver, gall bladder, stomach, colon, rectum as well as the carcinoma of cervix were markedly higher than normal. The neutrophils in patients with carcinoma exhibited very high enzymatic activity. This may be depend on the elevation of alkaline phosphatase in the cells [18] and the increased number of neutrophil counts [29]. In carcinoma of cervix, the LAP value was lower than those from the study of Jedwab, G.A., et. al. [26]. It may be due to our patients had treated with x-ray and radioisotope.

The leukocyte alkaline phosphatase activity exhibited above the normal range in leukemoid reaction and bacterial infections and these remain normal or below normal in some viral infections has been widely accepted [10,19,20,31]. In this study, viral hepatitis revealed the slightly increment of the leukocyte alkaline phosphatase activity. This

enzyme activity are markedly decreased in acute myeloid leukemia whereas the absolute number of neutrophil count from the same group are slightly lower when comparing to normal. It may due to the genetic abnormality, e. g., the chromosome which controled the enzyme synthesis in neutrophilic leukocytes was defected (30).

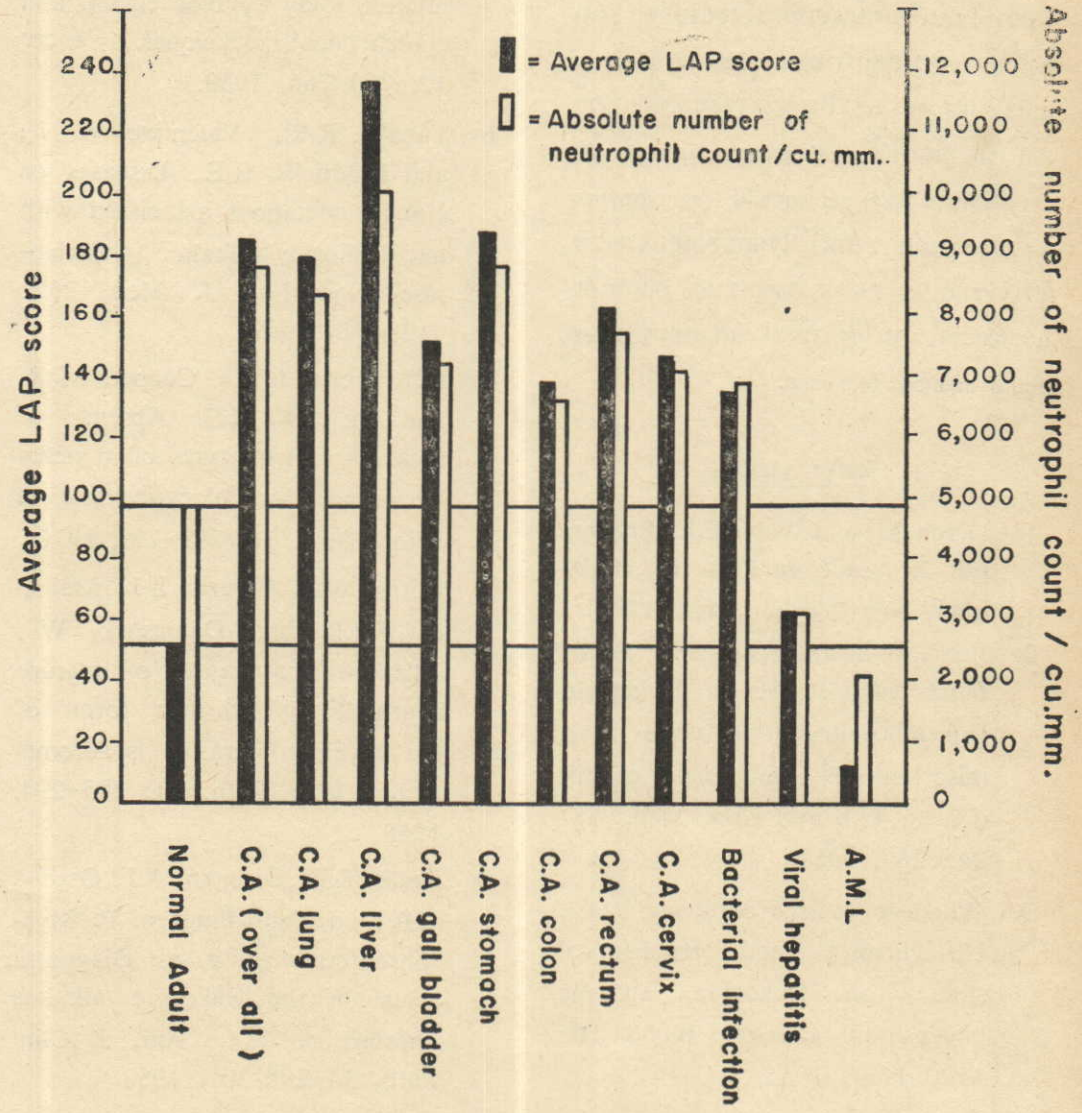

FIGURE 1. Histograms show the comparison of the average LAP scores and the absolute numbers of neutrophil count in various diseases.

ย่อเรื่อง

จากการศึกษาเอ็นซัยม์ alkaline phosphatase ในเม็ดเลือดขาว ชนิด neutrophilic granulocytes ของคนไข้ที่เป็นโรคต่าง ๆ โดยวิธี semiquantitative histochemical technic พบว่า ในคนไข้ที่เป็นโรคมะเร็งของปอด ทับถุงน้ำดี กระเพาะอาหาร, Colon, Rectum และปากมดลูก และในคนไข้โรคติดเชื้อแบคทีเรีย จะมีเอ็นซัยม์ alkaline phosphatase ในเม็ดเลือดขาว ชนิด neutrophilic granulocytes สูงขึ้นอย่างมาก คนไข้โรคตับอักเสบจากเชื้อไวรัสจะมีเอ็นซัยม์ดังกล่าวสูงกว่าปรกติเล็กน้อย และต่ำมากในคนไข้มะเร็งของเม็ดเลือดขาวชนิด acute myeloid leukemia.

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