

Correlation of Eosinophilia with WHO Grading of Anaemia among Patients with Parasitic Infections

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Abstract

Introduction: Eosinophilia is often identified as part of a complete blood count (CBC) done either routinely or as part of an evaluation for a particular symptom complex. Association of eosinophilia with anaemia most commonly denotes the presence of parasites infection. Parasites relationship with anemia and eosinophilia has been rarely reported due to limited health care access, especially in adult age group. **Materials and Methods:** A retrospective study was started after obtaining the approval from the ethics committee. Patients with parasitic Infections associated with eosinophilia were correlated with their hemoglobin concentration. This study was conducted during the period of January 2020 and March 2021 in Saveetha Medical College and Hospital, Tamil Nadu. Hematological parameters like hemoglobin, eosinophil count and Absolute eosinophil count were obtained using Sysmex -XN 1000 automated analyser. **Results:** Out of 83 patients with parasitic Infections associated with eosinophilia, on gender distribution we found 49 were male and 34 were female. 25 patients were anemic and 58 patients were non anemic. On grading of anaemia, according to WHO classification 58 cases were grade 0 (not anaemic), 18 cases were grade I, 6 cases were grade II and only one case was grade III. **Conclusion:** Our study concludes, eosinophilia act as marker for parasitic infections. Degree of anaemia and increased eosinophil count in peripheral blood smear denotes severity of parasitic Infections especially in helminths infection.

Keywords: Parasitic Infections, Eosinophilia, Anaemia, Absolute eosinophil count.

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INTRODUCTION

Eosinophilia is a condition in which the eosinophil count in the peripheral blood exceeds $5 \times 10^8/L$ ($500/\mu L$). Eosinophilia is often identified as part of a complete blood count (CBC) done either routinely or as part of an evaluation for a particular symptom complex. It is helpful to know whether the eosinophilia has developed acute or is chronic condition [1, 2]. Eosinophilia is a major feature of the host response to parasitic infection [13]. During infections with tissue-invading parasites, large numbers of pluripotent hemopoietic stem cells are generated, and mobilized to extra medullary hemopoietic sites such as the liver, where they become mature eosinophils in response to the increased demand [12, 13]. The degree of eosinophilia in patients with helminthic infections may vary according to distribution, migration, maturation, and burden of the parasite. Larval stages of parasitic worms are killed in vitro by eosinophil cells in

the presence of specific antibodies or complement. Studies have demonstrated suppression of peripheral eosinophil counts in patients during acute bacterial and viral infections, whereas in parasitic infection eosinophil count is elevated [16]. Association of eosinophilia and anemia is one of the clue for parasitic Infections. The helminthic infection causes anemia deficiency by reducing iron uptake from the intestine, directly feeding the blood, and interfering directly and indirectly in iron metabolism. Protozoa impact anemia by destructing the intestine mucosal structure that influences in micronutrients absorption. According to WHO, grade 0 anemia (normal) 12.5 to 16 g/dl in male and 12.1 to 15.1 g/dl in female. Grade 1 anemia (mild) 10 – 12 g/dl, grade 2 anaemia (moderate) 8 to 10 g/dl and grade 3 anemia (severe) less than 7.9 g/dl hemoglobin concentration respectively. Chronic parasitic infection affect host and leads to decreased hemoglobin concentration and then alter their leukocyte

distribution. Parasite detection in stool can be helpful in diagnosing some parasitic infection but it is take certain duration to detect [4, 5]. Our study aimed to assess correlation eosinophilia with degree of anemia in patients with parasitic infection in tertiary care centre.

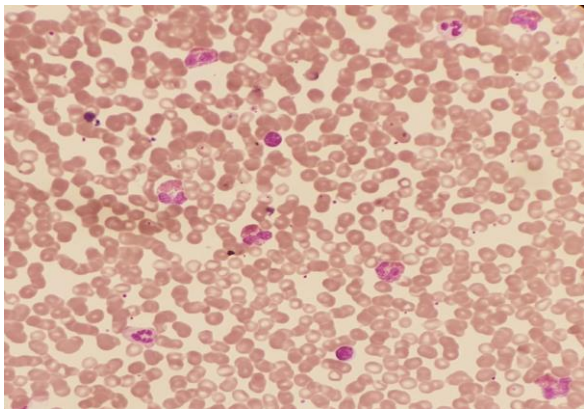


Figure 1: Peripheral smear of eosinophilia

Inclusion Criteria: Includes all age group of patients of parasitic infections with eosinophilia.

Exclusion Criteria: Includes patients with eosinophilia with other than parasitic Infections.

MATERIAL AND METHODS

A retrospective study was carried out in line with research regulations, including the approval of the Ethical Committee. Patients with parasitic Infections associated with eosinophilia were correlated with their hemoglobin concentration. This study was conducted during the period of January 2020 and March 2021 in Saveetha Medical College and Hospital, Tamil Nadu. Hematological parameters like hemoglobin concentration and eosinophil count were obtained using Sysmex -XN 1000 automated analyser from the hematological department. Patients diagnosed with parasitic infections associated with eosinophilia were obtained from patients medical records. These patients hemoglobin concentration were correlated to check the degree of anemia.

Statistical Analysis

Microsoft word and Excel were used to generate graphs, and tables. Statistical methodology were used to evaluate the significance of differences degrees of anemia in parasitic infection associated with eosinophilia. The study was approved by the Saveetha institutional ethical committee.

RESULTS

On gender distribution, out off 83 patients 49 were male and 34 were female (Fig 3). In our study majority of the patients with parasitic infections associated with eosinophilia were diagnosed with parasite like *Ancylostoma duodenale*, *Necator americanos* and *Strongyloides stercoralis* (Fig 2). Out

off 83 patients, 25 patients (30.1%) were anemic and 58 patients (69.9%) were non anemic with parasitic Infections associated with eosinophilia (Fig 4). On hemoglobin concentration 58 patients were grade 0 (not anemic) above 13 g/dl , 18 patients were grade I anemic 10 – 12 g/dl, 6 patients were grade II anemic (8 to 10 g/dl) and only one patients was grade III less than 8 g/dl (Fig 5).



Fig 2a: Ancylostoma duodenale



Fig 2b: Strongyloides stercoralis

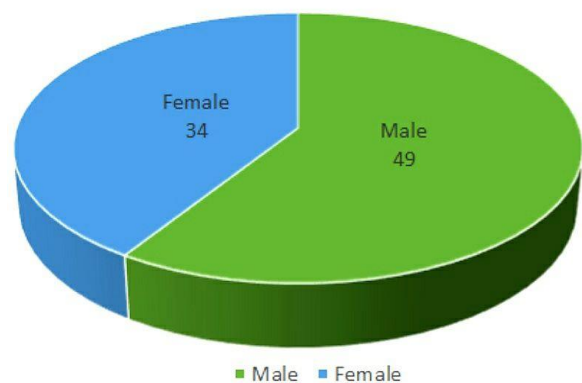


Fig 3: Gender distribution

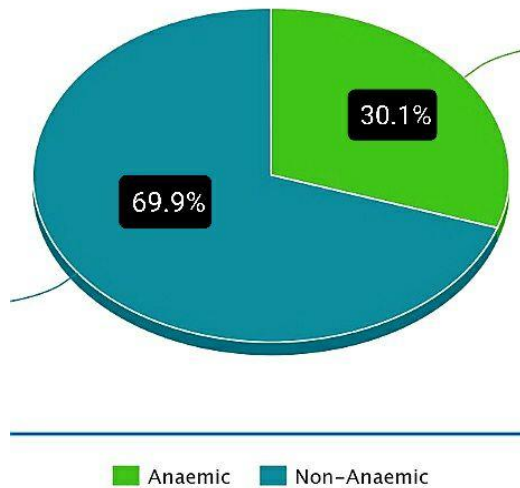


Fig 4: Percentage of patients with anemia

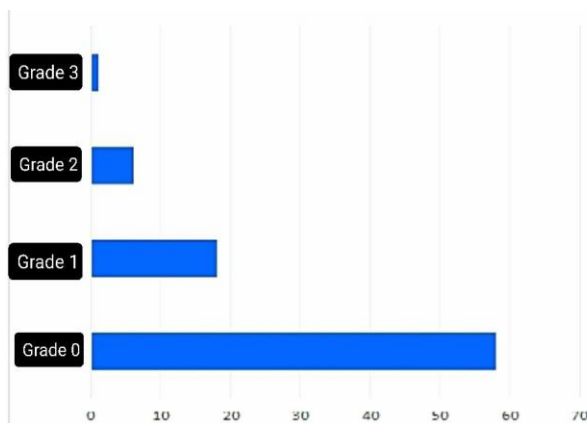


Fig 5: Grade of anemia in patients with parasitic infection associated with eosinophilia

DISCUSSION

Anaemia is the global health problem that affects many people in each socioeconomic status, age, and sex all over the world. There are many factors contribute to anemia, but the most prevalent are iron deficiency anaemia, around 50% cases [4, 5]. Eosinophilia associated anemia with are a striking feature of many parasitic diseases. Helminthic infections are the most common parasitic diseases that produce eosinophilia. In developing countries, parasitic infections are the most common cause of iron deficiency anaemia, particularly in children. Parasites can invade human and cause anemia in few ways. Hookworm caused intestinal blood loss through mechanical rupture of blood vessel in the intestine then leading to iron deficiency and protein malnutrition. This worm also secretes some anticoagulant and antiplatelet agents that increase the amount of the blood loss. Helminthic even invades directly into the large intestine and causes blood loss [6]. While attacking the mucous, it also sucks micronutrients from the intestine. Usually, people with trichiuriasis infection has anorexia which can decrease intake of nutrition. These processes lead to iron deficiency anaemia [6]. *Ascaris lumbricoides* may

impair micronutrient absorption such as iron in duodenum and jejunum that leads to iron deficiency anemia. Protozoa infection has its other ways; it interacts to small intestine mucous that make villous atrophy in various degree, along with causing inflammatory infiltrate and crypt hypertrophy [19]. These processes break the enterocytes and alter bile acid metabolism that impacts to poor absorption of macro and micronutrient essential for body function, such as vitamin, iron, zinc, and folic acid [20].

Eosinophils are multinucleated leukocytes with granules that are rich in basic proteins; Eosinophils are the source of a large number of cytokines, including interleukin-2,3,4,5,7,13,16 tumor necrosis factor-alpha, transforming growth factor-beta [1, 2]. In addition to these cytokines, eosinophils are a source of several cationic proteins like eosinophil cationic protein, eosinophil peroxidase, lysophospholipase, major basic protein and eosinophil-derived neurotoxin, that also contribute to their immunologic responses [13]. Eosinophilia in the bloodstream can be diagnosed by a simple blood test. A thorough patient history is the most important part of the evaluation for blood eosinophilia, and it should guide the extent and type of laboratory tests performed the numbers of these cells increase in blood and sites of inflammation during allergic reactions and helminth infections [13, 14]. Interleukin - 5 secretion from Th2 cells and ILC2s is important for eosinophil proliferation and survival. Th2 cells and ILC2s also produce IL-13, which facilitates recruitment of eosinophils to the site of infection or the site of allergen entry by stimulating the production of chemokines from various cells [7]. IL-33 is produced by various cells, such as epithelial cells, endothelial cells, and fibroblasts; this cytokine strongly stimulates the production of Th2 cytokines from Th2 cells and ILC2s. IL-33 also has the capacity to directly activate recruited eosinophils at sites of infection and allergen entry [8, 15, 16]. Regarding the eosinophil-mediated mechanism of defence against parasites, binding to the worm larvae through antibody or complement, followed by release of intracellular granules, is presumed to cause injury to invading worms [9].

However the present study, we could not show a major differences among the correlation of anemia with eosinophilia in parasitic infection, but few patients with parasitic infection associated eosinophilia show different grades of anemia. Also gives a clue for the clinician in suspect of parasitic infection, when hematological parameters investigation shows combined decreased hemoglobin concentration and elevated eosinophil count A study done by Galvao in Brazil that stated there was an association among hemoglobin concentration, Mean corpuscular volume, Mean corpuscular hemoglobin, and erythrocyte account compared to parasitic infection [19]. However, in another study done by Alagoas, Brazil, Silva could not

show any association between hemoglobin concentration with parasitic infection. There are so limitations in our study firstly a single measurement of hemoglobin and eosinophil count may not provide the significant results. So, parasitic infection associated with eosinophilia status of an individual over a longer time-period is essential. However, confounding factors are always present at any point of period, more large scale studies with longer duration of time would contribute more towards the understanding the correlation between anaemia and eosinophilia in parasitic infection.

CONCLUSION

The prevalence of parasitic infection is still high in countries like India and other Asian countries, so we recommend to pay more attention to sanitation and personal hygiene to prevent spreading and developing of parasitic agents. In our study we conclude, 30.1% of cases were anemic with parasitic infection. Eosinophilia associated with anaemia, gives clue to clinician in suspect of parasitic infection because the prevention of morbidity by the diagnosis and promoting the treatment of parasitic infections is an important task for these patients.

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Statement of Ethics

This study was approved by Ethics Committee of Saveetha Medical and Hospital. As this study was a retrospective study, there was no patient's privacy data such as patient name, ID number, telephone and address were involved. Only demographic information and laboratory testing data of patients were collected and analyzed in this study.

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