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Original Research Article

A Hospital Based Study to Evaluate Peripheral Smears with Hypersegmented Neutrophils and Classified the Etiological Factors

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Abstract

Aim: The aim of the present study to evaluate peripheral smears with hypersegmented neutrophils and classified the etiological factors.

Methods: The current investigation was carried out at the department of Pathology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India for one year from 1 May 2022 to 30 April 2023. Using geimsa stained peripheral smears, the hematology laboratory examined EDTA blood samples for neutrophil hypersegmentation. The presence of five or more neutrophils with five lobes per 100 or any neutrophils with six or more lobes is referred to as neutrophil hypersegmentation. 100 cases like these that met the inclusion criteria were used as the sample size.

Results: Males made up the majority of cases, and cases primarily between the ages of 40 and 60. 40% of cases had microcytic hypochromic anemia, which was a key contributor to the cases. Only 10 of the 40 individuals with normocytic, normochromic blood images had subnormal levels of either vitamin B12 or folic acid, according to the results. The remaining 30 individuals had normal levels of folic acid and vitamin B12. So it follows that 30% of the 100 individuals with hypersegmented neutrophils in the peripheral smear were pure microcytic hypochromic anemia without any vitamin B12 or folic acid deficiency.

Conclusion: The present study indicated that other than the already established causes of neutrophil hypersegmentation, microcytic hypochromic anemia, myelodysplastic syndromes and inflammatory conditions also can cause hypersegmented neutrophils in peripheral smears.

Keywords: Microcytic hypochromic anemia, Neutrophil hypersegmentation, Thrombocytosis.

Introduction

Hypersegmentation of neutrophils is defined as presence of 5% or more neutrophils with five or more lobes or single neutrophil with 6 lobes.[1] It is usually associated with deficiency of or failure to utilize cobalamin or folate and impaired DNA synthesis is the accepted mechanism for the morphological changes

seen in megaloblastosis.[2,3] Other causes of NH listed include microcytic hypochromic anemia but the evidence for this is based mainly on a limited number of case studies in which patients in whom the IDA complicated by coexistent cobalamin or folate deficiency were also included.[4,5] Hypersegmented neutrophils are also seen as a part of myelodysplastic syndromes which is usually designated as bone marrow (BM) failure are a heterogeneous group of myeloid clonal disorders caused by a failure of blood cells maturation. The co-morbidities result from a variable degree of cytopenia and clonal instability with a tendency to progression mainly into acute myeloid leukemia (AML).[6] Uremia, hyperthermia,drugs including chemotherapy, steroids, GCSF are also known to produce neutrophil hypersegmentation.[7] It is also known in a congenital condition (autosomal dominant) affecting 1% of the population.[8]

It is not a disease entity but a triad of findings that may result from a number of disease processes – primarily or secondarily involving the bone marrow.[9] The severity of pancytopenia and the underlying pathology determine the management and prognosis of the patients.[10] Pancytopenia is an important clinic-hematological entity encountered in our day-to-day clinical practice. There are varying trends in its clinical pattern, treatment modalities, and outcome.[11] It is a disorder in which all three major formed elements of blood (red blood cells, white blood cells and platelets) are decreased in number.[12] There is a wide disparity between clinical pictures gleaned from different studies.

Detailed complete blood count with peripheral film and reticulotcyte count is the basic investigation to be done. Bone marrow examination using biopsy is extremely useful in the evaluation of pancytopenia, as it enables complete picturization of the marrow architecture and the distribution of any abnormalities in the form of infiltrates and focal lesions.[13]

Here in the present study we evaluated 100 peripheral smears with hypersegmented neutrophils and classified the etiological factors. Patients with microcytic hypochromic anemia were further evaluated for underlying vit B12 and folic acid deficiency. This study also checks whether there is any association between neutrophil hypersegmentation in microcytic hypochromic anemia and thrombocytosis.

Methods

The present study was conducted in Department of Pathology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India for one year from 1 May 2022 to 30 April 2023. EDTA blood samples received in the hematology laboratory were analysed for hypersegmentation of neutrophils using geimsa stained peripheral smears. Neutrophils hypersegmentation is defined as the presence of five or more five-lobed neutrophils per 100, or any neutrophils with six or more lobes. 100 such cases which satisfied the inclusion criteria were taken as sample size.

Complete blood count of individual cases was obtained using Sysmex SE9000 analyser and peripheral smear picture was compared with blood counts. These 100 cases were classified according to the peripheral smear picture. Patients with microcytic hypochromic anemia were separately assessed for serum Vit B12 and folic acid values using ion capture assay and microparticle enzyme intrinsic factor assay.

Presence of thrombocytosis in pure microcytic hypochromic anemia cases were checked separately and it was compared with presence of thrombocytosis in cases with NH without microcytic hypochromic anemia. Patients with known

medical conditions like pregnancy, uremia, renal failure and exposure to drugs like chemotherapy, steroid and GCSF were excluded.

Results

Table 1: Age and gender distribution of all cases showing hyper segmented neutrophils in peripheral smears

Gender	Below 20	20-40	40-60	Above 60	Total
Male	10	10	20	15	55
Female	5	10	20	10	45
Total	15	20	40	25	100

Majority of cases were males and majority of cases were in the age group 40-60.

Table 2: Peripheral smear picture of cases with hyper segmented neutrophils

Macrocytic anemia	45
Microcytic hypochromic anemia	40
Normocytic normochromic blood picture	10
Myelodysplastic syndrome	5
Total	100

Cases were further analysed for associated peripheral smear picture. Although major cases were contributed by macrocytic anemia, 40% cases were having microcytic hypochromic anemia.

Table 3: Serum Vit B12 and folic acid values of cases with neutrophil hypersegmentation in microcytic hypochromic blood picture

Vit B12(in pg /ml)	Observed frequency	Folic acid (in ng/ml)	Observed frequency
<200pg/ml	7	<2ng/ml	3
200-500pg/ml	22	2-8ng/ml	8
500-700pg/ml	8	8-15ng/ml	18
700-900pg/ml	2	15-20ng/ml	11
>900pg/ml	1	>20ng/ml	0
Total	40		40

Table 3 clearly shows that out of the 40 cases with Microcytic hypochromic blood picture, only 10 had subnormal levels of either Vit B12 or folic acid values. Rest of the 30 cases had normal Vit B12 and folic acid levels. So we can come to the conclusion that out of the 100 cases with hypersegmented neutrophils in peripheral smear 30% cases were having pure microcytic hypochromic anemia without any vit B12 or folic acid deficiency.

Table 4: Correlation of neutrophil hypersegmentation and platelet count

Platelet count	Macrocytic anemia	Microcytic hypochromic Picture (Normal B12 and folic acid)	Microcytic hypochromic Picture (subnormal B12 and folic acid)	Myelo dyspl asia	Normocytic Normochromic Blood picture
<1.5 lakh/microlitre	1	0	0	2	0
1.5-4.5 lakh/microlitre	40	12	9	3	9

>4.5lakh/ microlitre	4	18	1	0	1
Total	45	30	10	5	10

1.5-4.5 lakh/microliter is considered as normal platelet count. Out of the 100 cases, only 3 had thrombocytopenia.73 cases had platelet count in the normal range. 24 cases had thrombocytosis. Out of the 40 cases with microcytic hypochromic anemia and neutrophil hypersegmentation, 19 cases had thrombocytosis. In all other cases majority were in normal range group.

Discussion

A disorder known as macrocytosis causes red blood cells that are bigger than usual. By measuring mean corpuscular volume, it is assessed. The normal MCV varies with age and reference laboratory and is typically between 80 and 100 femtolitres.[14]

This examination of 100 peripheral smear-positive cases revealed that, in addition to macrocytic anemia that had already developed, there were numerous alternative explanations for neutrophil hypersegmentation. The peripheral smear reveals neutrophil hypersegmentation in microcytic hypochromic anemia, myelodysplastic syndrome, and normocytic normochromic blood image. The acknowledged mechanism underlying the morphological abnormalities associated with megaloblastosis is a deficiency in, or failure to use, cobalamin or folate as well as decreased DNA synthesis.[7,12]

Uncertainty surrounds the underlying mechanism of neutrophil hypersegmentation in microcytic hypochromic anemia. Numerous studies have identified folic acid and vitamin B12 insufficiency as the cause of this.[4,5] That, however, is doubtful given that 30% of NH cases were purely microcytic hypochromic anemia without folic acid and vitamin B12 deficiency. According to earlier research that ruled out underlying vitamin B12 and folic acid deficiencies, there is a strong correlation between iron deficiency, which manifests as microcytic hypochromic anemia, and neutrophil hypersegmentation.[7] According to several additional research, iron shortage can decrease the enzyme Figlu transferase's ability to catalyze the folate-dependent breakdown of Figlu.[15,16]

In our investigation, 22 patients had hypersegmentation and neutrophil toxic granules. Vacuoles were visible in 18 instances. It is well recognized that the formation of toxic granules and vacuoles is a response to stress, infection, and inflammation.[17] In our investigation, toxic granules and vacuoles were found coupled with hypersegmentation, pointing to the appearance of inflammation-related hypersegmentation. Myelodysplastic syndromes were identified in three of the individuals in our investigation. Numerous earlier studies have shown that myelodysplasia can include neutrophil hypersegmentation.[18,19] In this investigation, hypolobated neutrophils and hyper segmented neutrophils were found in one myelodysplastic disease case.

Out of the 25 instances of thrombocytosis (>4.5 lakhs/ml) in the current investigation, 18 individuals also had microcytic hypochromic anemia with normal vitamin B12 and folic acid levels. However, more thorough research must be conducted to determine whether neutrophil hypersegmentation and thrombocytosis are related in any way.

Conclusion

The current investigation found that in addition to the previously known causes of neutrophil hypersegmentation, inflammatory diseases, myelodysplastic syndromes, and microcytic hypochromic

anemia can also result in hypersegmented neutrophils in peripheral smears. Particularly with reversible disorders like megaloblastic anemia, early detection and treatment can minimize mortality and morbidity, prevent complications, and reduce mortality. Therefore, more research should be done to create diagnostic criteria for evaluating patients who appear with pancytopenia and for additional treatment modalities.

References

1. Herbert V. Nutrition science as a continually unfolding story: the folate and vitamin B12 paradigm. Am J Clin Nut. 1987;46(3):387–402.
2. Agarwal KN. Indicators for assessment of anaemia and iron deficiency in community. Pediatr Oncall J. 2010;7(2):29–34.
3. Westerman DDA, Evans D, Metz J. Neutrophil hypersegmentation in iron deficiency anaemia: A case control study. Br J Haematol. 1999;107(3):512–5.
4. Doscherholmen KA, Muhamud D, Ripley. Hypersegmentation in iron deficiency anaemia. JAMA. 1974;229(13):1721–2.
5. Rao GB, Lokeswari V, Prasad PR. Hypersegmentation of neutrophils still a hallmark of macrocytic anemia? A prospective study. Int J Sci Res. 2018;7(4):49–50.
6. Steensma DP. Myelodysplastic syndromes: diagnosis and treatment. Mayo Clin Proc. 2015;90(7):969–83.
7. Im DD, Ho CH, Chan RY. Hypersegmented Neutrophils in an Adolescent Male with Heatstroke. J Pediatr Hematol Oncol. 2015;37(6):488.
8. Shinton NK. Desk Reference for Hematology. 2nd ed. United States: CRC Press; 2007.
9. Guinan EC. Acquired and inherited aplastic anemia syndromes. Wintrobe's Clinical Hematology. 2004:1396-419.
10. Tilak V, Jain R. Pancytopenia--a clinico-hematologic analysis of 77 cases. Indian journal of pathology & microbiology. 1999 Oct 1;42(4):399-404.
11. Kar M, Ghosh A. Pancytopenia Journal, Indian Academy of Clinical Medicine 2002;3:29-341.
12. Ishtiaq O, Baqai HZ, Anwer F, Hussai N. Patterns of pancytopenia patients in a general medical ward and a proposed diagnostic approach. J Ayub Med Coll Abbottabad. 2004 Jan-Mar;16(1):8-13.
13. Makheja KD, Maheshwari BK, Arain S, Kumar S, Kumari S. The common causes leading to pancytopenia in patients presenting to tertiary care hospital. Pakistan journal of medical sciences. 2013 Sep;29(5):1108.
14. Chanarin I, Metz J. Diagnosis of cobalamine deficiency: the old and new. Br J Haematology 1997; 97(4):695-700.
15. Chanarin I, Bennett MC, Berry V. Urinary excretion of histidine derivative in megaloblastic anemia and other conditions in comparison with the folic acid clearance test. J Clin Pathol. 1962;15(3):269–73.
16. Vitale JJ, Restrepo A, Riker JB, Hellerstin EE. Secondary folate deficiency induced in rat by dietary iron deficiency. J Nutr. 1966;88(3): 315–22.
17. Manonneaux S. Nonmalignant leukocyte disorders. In: Rodaks hematology clinical applications and principals. St. Louis, Missouri: Saunders; 2015. p. 475–97.
18. Yoshida Y. Physical Education. Myelodysplastic syndrome. Oncologist. 1996;1(4):284–7.
19. Abramson SD, Abramson N. Common' uncommon anemias. Am Fam Physician. 1999;59(4):851–8.