



ORIGINAL RESEARCH PAPER

Pathology

STUDY OF CASES OF ERYTHROID HYPERPLASIA IN BONE MARROW EXAMINATION AND THEIR CORRELATION WITH VITAMIN B12, FOLIC ACID AND IRON LEVELS, IN RIMS, RANCHI

KEY WORDS: Anemia, Bone Marrow, Nutritional deficiency

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ABSTRACT

INTRODUCTION: Nutritional anemia is very prevalent in India, especially in rural parts of Jharkhand. These nutritional anemias can be pretty accurately diagnosed using biochemical tests, still these are largely being diagnosed on bone marrow aspirations, which is an invasive process having its own risks.

OBJECTIVE: To study the cases of erythroid hyperplasia in bone marrow examination and its correlation with levels of iron (ferritin), vitamin B12 and folic acids.

MATERIALS & METHODS: 100 cases of erythroid hyperplasia were taken and 100 controls without erythroid hyperplasia. Their serum levels of ferritin, vitamin B12 and folic acid were taken. A correlation was then made between occurrence of erythroid hyperplasia and nutritional deficiencies of iron, vitamin B12 and folic acid.

RESULTS: Cases had significantly higher incidence of nutritional deficiencies as compared to controls.

CONCLUSION: Nutritional anemias of iron, vitamin B12 and folic acid deficiencies, which are very common in India, can be pretty accurately diagnosed by biochemical tests. Bone marrow aspiration should be reserved for atypical presentations.

INTRODUCTION:

Anaemia is defined as an insufficient RBC mass to adequately deliver oxygen to peripheral tissues. For practical purposes any of the three concentration measurements performed on whole blood can be used to establish the presence of anaemia^[1]:

- Hb concentration, expressed as gm/dl
- Hematocrit (packed cell volume or value of packed cells), expressed as percentage
- RBC concentration, expressed as number of cells per microliter ($n \times 10^6 / \mu\text{L}$)

All the above parameters can be measured using electronic cell counters. Most physicians rely on Hb% to define anaemia, but hematocrit is also an equally reliable parameter for practical purposes.

Anaemia affects all age groups, but pre-school & school going children^[2,3,4,5], pregnant women^[6,7] and non-pregnant women^[8,9,10] of child bearing age are the most susceptible ones.

Erythroid hyperplasia means an increase in number of red cell precursors in the bone marrow. It is the response of bone marrow to various conditions of low hemoglobin to increase the number of red cells to compensate for anaemia, like hemolytic anaemias, hemoglobinopathies, high altitude or hypoxia of any cause, renal diseases, or in our country more commonly due to nutritional deficiencies of vitamin B12, folic acid and/or iron. We will be focused on erythroid hyperplasia caused due to nutritional deficiencies.

Normal Myeloid : Erythroid precursors ratio ranges from 3:1 to 15:1 and reflects hyperplasia or hypoplasia of the affected lineage^[11].

India being a developing country, has a huge population having nutritional deficiencies, deficiency of either single or multiple nutrients. These deficiencies are either due to low socio-economic status or dietary habits.

In our part of the country, the deficiency of iron, folic acid and vitamin B12 is quite common. This cannot be attributed alone to a low socio-economic status. A lack of knowledge of the nutritional values of the diet along with lack of proper hygiene also contributes to anaemia^[12].

Falciparum malaria being endemic in this region, is also responsible for low hemoglobin in significant fraction of

population, since the clinicians tend to focus on treating pyrexia only and usually don't prescribe B12, folate or iron supplements after treatment.

WHO has estimated that prevalence of anaemia in developed and developing countries in pregnant women is 14 percent in developed and 51 percent in developing countries and 65-75 percent in India alone^[13]. It is estimated that about half of the global maternal deaths due to anaemia occur in South Asian countries and India alone contributes to 50% of global maternal deaths and about 80 per cent of the maternal deaths due to anaemia in South Asia.

On request of the clinicians the patients undergo bone marrow examination, only to reveal erythroid hyperplasia. Though bone marrow aspiration is a very safe procedure in the hands of a skilled doctor, it is very painful to the patient and also time consuming.

Deficiency of vitamin B12, folic acid and iron can be detected on biochemical tests, thereby avoiding the painful procedure of bone marrow examination. Bone marrow examination should be done only when these tests are non-informative.

MATERIALS & METHODS:

Study Design: A prospective study

Study Period: 1 year

Sample size: 200

Cases: 100, with erythroid hyperplasia

Controls: 100, without erythroid hyperplasia

Iron(sFerritin), vitamin B12, Folic acid Estimation: Using Abbott Architect i1000 SR Immunoassay

Comparative results: As charts

A correlation will be made between occurrence of erythroid hyperplasia and nutritional deficiencies.

OBSERVATIONS AND RESULTS:

This was a prospective study done in Department of Pathology, Rajendra Institute of Medical Sciences, Ranchi, on patients undergoing bone marrow aspiration for various causes. The study included 200 patients from all age groups.

1.FREQUENCY OF DIFFERENT DIAGNOSIS IN BONE MARROW EXAMINATION:

DIAGNOSIS	TOTAL	MALE	FEMALE
ALL	07 (3.5%)	03	04
AML	10 (5%)	09	01

CML	16 (8%)	10	06
EH	100 (50%)	49	51
HYPOPLASTIC	22 (11%)	12	10
ITP	04 (2%)	01	03
LRM	03 (1.5%)	02	01
MM	07 (3.5%)	07	00
MYELOFIBROSIS	01 (0.5%)	00	01
NORMAL	30 (15%)	19	11

Apart from erythroid hyperplasia, which formed 50% of the cases, the most common diagnosis was a normal marrow, followed by hypoplastic marrow, CML and AML.

2.DEFICIENCY OF MICRONUTRIENTS IN CASES AND CONTROLS:

	CASES (%)	CONTROLS (%)
DEFICIENT	89 (89)	12 (12)
NON-DEFICIENT	11 (11)	88 (88)
TOTAL	100 (100)	100 (100)

It was observed that out of 100 cases of erythroid hyperplasia, 89 patients had deficiency of either a single or multiple micronutrients.

Among controls (non-erythroid hyperplasia), only 12 patients had deficiency or either single of multiple micronutrients.

3.OVERALL DEFICIENCIES IN CASES(100) OF ALL THE AGE GROUPS

	IRON	VITAMIN B12	FOLIC ACID
NUMBER	38	54	40
PERCENTAGE	38	54	40

Most common deficiency throughout the cases was of vitamin B12, followed by folic acid and iron.

4.CORRELATION BETWEEN OVERALL DEFICIENCY AND ERYTHROID HYPERPLASIA

	ERYTHROID HYPERPLASIA		TOTAL	p Value = 0.001
	NO	YES		
DEFICIENT	12	89	101	
NON-DEFICIENT	88	11	99	
TOTAL	100	100	200	

For this, cases of erythroid hyperplasia with and without deficiency were compared with controls with and without deficiency..

CONCLUSION:

It was observed that both the techniques have their own advantages and disadvantages. In one hand bone marrow examination is the gold standard in demonstrating stainable iron, it is invasive, time consuming and requires technical expertise. On the other hand biochemical tests for iron, though don't give the exact estimation of iron available iron to erythroid precursors, it give a fair estimate of the iron storage & other parameters and is also non-invasive and widely available.

The use of a battery of biochemical tests to diagnose iron deficiency proves to be of less value than the use of the ferritin level alone.

Similarly megaloblastic anaemias can be suspected on CBC & peripheral smear and confirmed by vitamin B12/folate assay. An MCV of >101.5 fl is said to be 100% sensitive for megaloblastic anaemia, whereas an MCV of >121 provides >95% specificity.

Thus in cases clinically presenting with anaemia, it is wise to initially go for CBC, RBC indices and biochemical tests for nutritional deficiency keeping in mind the wide prevalence of these deficiencies in our society and do bone marrow

examination in cases with atypical presentations like concomitant fever, organomegaly and fever.

This approach will effectively minimize the number of cases requiring bone marrow aspirates, thereby preventing the patients from undergoing an invasive procedure to diagnose a condition which could have been diagnosed using simple biochemical tests.

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