

SENSITIVITY OF MEAN CORPUSCULAR VOLUME IN DETECTING MEGALOBlastic ANEMIA

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ABSTRACT

Objective: To determine sensitivity of Mean Cell Volume (MCV) in detecting megaloblastic anemia.

Study design: It was a Cross Sectional Descriptive study.

Setting: The study was done in Pathology Department, Khyber Teaching Hospital, Peshawar.

Duration: The study was done from January 2016 to December 2016 (one-year period)

Material and Methods: A total of 337 patients underwent bone marrow biopsy during the study period, out of which 46 patients were diagnosed as having megaloblastic anemia on the basis of bone marrow aspirate examination and Vit B12 levels. The cut off value of MCV was taken as 100 f L for macrocytosis. Mean cell volume of cases diagnosed as megaloblastic anemia were recorded in a proforma and sensitivity was calculated. All cell counts were done on automated cell counter machine.

Results: Out of 337 patients referred to pathology department for bone marrow aspiration, about 46 cases were diagnosed as megaloblastic anemia on basis of bone marrow examination and serum B12 levels. These 46 cases were included in the study. Age of the patients ranged from 1 year to 90 years (mean 32.2 years \pm 12.1 SD). There were 36 (78%) males and 10 (22%) females, with male to female ratio of 3.5 :1. Out of 46 patients of megaloblastic anemia, about 15(32%) cases had MCV above 100 fL. So, sensitivity of MCV was calculated to be 32%.

Conclusion: MCV had poor sensitivity in our study. So, it is an unreliable screening parameter to be used for giving the presumptive diagnosis of megaloblastic anemia. If MCV is raised, it only warrants that further workup should be done to find the cause of macrocytosis.

Keywords: Mean corpuscular volume, Megaloblastic anemia, Sensitivity, Bone marrow aspiration

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INTRODUCTION

Megaloblastic anemia is a hematological disorder that is caused due to deficiency of vitamin B-12 and folic acid [1-7]. It is a macrocytic anemia in which there is megaloblastic change in the erythroid cells of the bone marrow [8,9]. The presence of megaloblasts in the bone marrow is necessary for the diagnosis of megaloblastic anemia [10,11]. Megaloblasts are large sized red cell precursors in the bone marrow, in which maturation of nucleus is delayed as compared to the cytoplasm [10]. These cells were termed as Megaloblasts by Ehrlich in 1880 [10].

The laboratory findings in patients of megaloblastic anemia include a raised mean corpuscular volume above 100 femtolitre, decreased serum Vit B-12 and folate levels [7,12,13,14]. Bone marrow biopsy is necessary for the diagnosis of megaloblastic anemia [1,7,12,13,14,15]. Bone marrow shows characteristic megaloblasts and giant

metamyelocytes [2,12].

The normal mean cell volume (MCV) ranges from 80 - 100 femtolitres [16]. MCV greater than 100 fl indicates macrocytosis [16,17]. In megaloblastic anemia, there is macrocytosis so MCV is raised above 100 femtoliters [7,12,16]. For differential diagnosis, MCV is useful to classify anemias, which is calculated from red blood cell count, hemoglobin concentration, and hematocrit, based on the concept of anemia classification proposed by Wintrobe [18]. The MCV is calculated as hematocrit (%) \times 10/RBC count (10 / μ l) [17].

In routine clinical practice, if the patient has raised MCV, the clinician advises bone marrow biopsy, serum Vit B12 levels and folate levels to get definitive diagnosis of megaloblastic anemia [19]. Macrocytosis is integral element of megaloblastic anemia, and MCV can easily be obtained from blood count [19]. Yet, literature suggests that there is no significant association between MCV and megaloblastic anemia [19,20,21,22]

The present study was done to determine the sensitivity of MCV in detecting megaloblastic anemia, and to find out if it can be used as a screening tool for

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giving presumptive diagnosis of megaloblastic anemia.

MATERIAL AND METHODS

This cross-sectional descriptive study was done in Khyber Teaching Hospital, Peshawar, from January 2016 to December 2016. A total of 337 patients underwent bone marrow biopsy during the study period, out of which 46 patients were diagnosed as having megaloblastic anemia on the basis of bone marrow aspirate examination and B12 levels. The cut off value of MCV was taken as 100 f L for macrocytosis [16,17]. Mean cell volume of cases diagnosed as megaloblastic anemia were recorded in a proforma and sensitivity was calculated. All cell counts were done on automated cell counter machine. The qualitative data was analyzed in terms of frequency and percentages

RESULTS

A total of 337 patients underwent bone marrow biopsy during the study period, out of which 46 patients were diagnosed as having megaloblastic anemia on bone marrow aspirate. The age of the study sample ranged from 1 year to 90 years, with mean of 32.2 ± 12.1 SD. Out of 46 cases, about 36 (78 %) cases were male and 10 (22%) cases were females. Male to female ratio was 3.5:1.

The sensitivity of MCV in 46 cases of megaloblastic anemia is given in table-1.

Table-1: The sensitivity of MCV in 46 cases of megaloblastic anemia.

Haematological index	Number of cases having MCV above 100 f L. (true positives)	Number of cases having MCV below 100 f L. (False negatives)	Sensitivity
MCV	15	31	32.6%

DISCUSSION

An increase in mean cell volume (MCV) above normal values suggest macrocytosis [16,23]. Macrocytosis is a feature found on peripheral blood smear in patients having megaloblastic anemia [16]. Yet it is not diagnostic of megaloblastic anemia as so many other conditions also lead to macrocytosis [16,23]. It is megaloblasts in the bone marrow aspiration that is diagnostic of megaloblastic anemia [2,11,23].

Megaloblastic anemia is a common hematological disorder [23,24]. It is caused due to vitamin B-12 deficiency [1,20,25]. Conditions leading to vitamin B12 deficiency are malabsorption syndromes, intestinal worms like Fish tapeworm, ileal resection, gastrectomy, strict vegetarianism, use of cytotoxic drugs, anticonvulsants and alcohol intake [2,20]. Vitamin B12 deficiency lead to pancytopenia, lethargy, neurological symptoms and subacute combined degeneration of the spinal cord as well [26,27]. Megaloblastic anemia has features of raised MCV, macrocytes in peripheral smear, and megaloblastosis in the bone marrow [2,23].

The mechanism of formation of macrocytes and megaloblasts in megaloblastic anemia is diverse [16]. In Vitamin B12 or folate deficiency, there is a defective maturation of the nucleus of cells [16]. Nuclear maturation lags behind the cytoplasmic maturation [16]. This results in cells that are larger in size than normal red cells [16]

In the present study, out of 46 diagnosed cases of megaloblastic anemia, only 15 patients had raised MCV. So, the sensitivity of MCV in detecting megaloblastic anemia was 32.6%. This low sensitivity of MCV means that a lot of cases of megaloblastic anemia will be missed if MCV is used as screening modality for megaloblastic anemia. Literature also suggests that there is no significant association between raised MCV and megaloblastic anemia [19,20,21,22,28].

In a study done by Bhatia P in India in 2012, out of 104 diagnosed cases of megaloblastic anemia, about 26 had increased MCV [23]. Thus, sensitivity of MVC was as low as 25% [23]. Bhatia suggested that MCV was a non-reliable parameter for presumed diagnoses of megaloblastic anemia [23]. In another study done by Osterhuis, the sensitivity of MCV was reported to be 30% in diagnosed cases of megaloblastic anemia, suggesting that MCV cannot be used to screen patients with megaloblastic anemia owing to its poor sensitivity [19]. This value is somewhat close to that in the present study. In another study done by Gupta M, out of 96 diagnosed cases of megaloblastic anemia, only 12 had raised MCV [29]. So, sensitivity of MCV in that study was 12.5%, suggesting that MCV was a poor screening tool for detecting megaloblastic anemia [29]. Similarly, Rajashekar also suggested MCV to be a poor tool to give presumptive diagnosis of megaloblastic anemia [13].

So, the present study showed that MCV should not be used as sole screening test for megaloblastic anemia due to its poor sensitivity.

Significant number of megaloblastic patients will remain undiagnosed if MCV is used as a sole parameter [19]. Therefore, MCV should not be used as the only parameter ruling out the diagnosis of megaloblastic anemia [19]. A raised MCV only justifies the measurement of serum B12 levels [19]. Physicians must keep megaloblastic anemia in their differential diagnosis if they find a raised MCV, and must confirm the diagnosis by doing serum B12 and folate levels, and only in selected cases, bone marrow aspiration should be done.

CONCLUSION

MCV has low sensitivity in detecting patients with megaloblastic anemia. Therefore, it is unreliable screening parameter for the presumptive diagnosis of megaloblastic anemia.

AUTHORS CONTRIBUTION

Muhammad Ihtesham Khan: Main idea, write-up and result compilation

Saman Waqar: Results, Discussion, review of literature

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