

MENTZER INDEX AS A DIAGNOSTIC TOOL FOR SCREENING THALASSEMIC PATIENTS AND DIFFERENTIATING IRON DEFICIENCY ANEMIA FROM THALASSEMIA

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Abstract

Objective: The aim of our study was to evaluate the reliability of Mentzer index in the differentiation of iron deficiency anemia and beta-Thalassemia trait.

Materials & Methods: This cross sectional study was conducted in five different primary schools of district Peshawar. Sample collected were processed in pathology department of Khyber Teaching hospital and Khyber Medical College Peshawar. Duration of the study was six months which was started from June 2017 to December 2017 in which 500 blood samples were analysed. Permission from the parents were obtained through principles of the schools. The samples were obtained keeping full aseptic conditions and collected in EDTA anticoagulant tubes. Hb, MCV, MCH, MCHC and platelet RBC count along with RDW, were assessed on a Sysmex Hematology Analyzer. Peripheral smear of the participants with low Hb (<11gm/dl) and low MCV (<80fl) were examined to look for morphology of RBCs. Serum iron (SI), serum iron binding capacity, serum ferritin was estimated using Cobas of the participants who had hypochromic microcytic blood picture on peripheral smear.

Results: The participants in this study were both male (260) and female (240). Minimum age of the participants was 3.5 years and maximum age was 8 years. Minimum Hb was 7.6mg/dl and maximum Hb was 10.8 mg/dl with average Hb of 9.2mg/dl. All the participants had MCV below 80fl with minimum MCV of 50fl and maximum MCV of 80fl. RBC count was between 2.2 million and 6.2 million. The participants in this study were both male (260) and female (240). Minimum age of the participants was 3.5 years and maximum age was 8 years. Minimum Hb was 7.6mg/dl and maximum Hb was 10.8 mg/dl with average Hb of 9.2mg/dl. All the participants had MCV below 80fl with minimum MCV of 50fl and maximum MCV of 80fl. RBC count was between 2.2 million and 6.2 million.

Conclusion: Mentzer index can be used as initial screening tool in the diagnosis of IDA and beta thalassemia major.

Key Words: IDA iron deficiency anemia, β -TT beta thalassemia trait

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INTRODUCTION

For long, a number of complete blood count indices have been used for differentiating between β -TT and IDA which includes the Mentzer, Shine and Lal,

England and Fraser, Srivastava and Bevington, Green and King, Ricerca, Sirdah, and Ehsani indices. The Mentzer index is the simplest and most sensitive of all¹. A Mentzer index of less than 13 is suggestive of thalassemia trait, and an index of more than 13 is suggestive of iron deficiency anemia.

In IDA, the bone marrow cannot produce enough RBCs and also they are smaller (microcytic) in size, the result of which is low RBC count and low MCV, the Mentzer index will be more than 13. In thalassemia, the number of RBC's produced is normal as the defect is in synthesis of globin chain, the RBCs are smaller in size and with increased fragility. The RBC count is normal, but with low MCV, the Mentzer index will be lower than 13.

In microcytic hypochromic anemia MCV and MCH are low and the most common causes of this type of anemia includes Iron deficiency anemia, anemia of chronic disease, thalassemia, sideroblastic anemia². The reference range for MCV is 80-96 fL/red cell in adult which can be calculated directly by hematology analyzer. Low MCV indicate small size of RBC whereas low MCH indicate low hemoglobin content of RBC.

Anemia due to deficiency of iron to synthesize hemoglobin is the most common hematological disease in infants and children and it is present in 30% of the world population and people of the developing countries are mostly affected³. Microcytosis in thalassemia is due to defective synthesis of globin chain resulting in decreased hemoglobin (Hb) content of RBCs and thus causing microcytosis and hypochromia⁴. The genes for β -thalassemia population is present in about 1.5% of world. The beta thalassemia trait (β -TT) individuals are mostly symptoms free and usually diagnosed accidentally⁵. The most common type of hemoglobinopathy transmitted by heredity. More than 50% of the world's β -TT carriers are found in Southeast Asia⁶.

For diagnosis of these conditions various laboratory investigations are used. Level of serum iron, serum ferritin estimation and the result of HbA2 electrophoresis are used for exact differentiation between IDA and β -TT. The differentiation between the two has diagnostic, prognostic and treatment importance. The diagnosis of the alpha thalassemia trait is usually the diagnosis of exclusion.

AIMS AND OBJECTIVES

The aim of our study was to evaluate the reliability of Mentzer index in the differentiation of iron deficiency anemia and beta-Thalassemia trait

MATERIALS AND METHODS

This cross sectional study was conducted in five different primary schools of district Peshawar. Sample collected were processed in pathology department of Khyber Teaching hospital and Khyber Medical College Peshawar. Duration of the study was six months which was started from June 2017 to December 2017 in which 500 blood samples were analysed. Permission from the parents were obtained through principals of the schools. A clinical examination of the students were made and blood samples were collected from those who presented with pallor with no clinical symptoms of acute or chronic inflammation or infectious diseases. Not diagnosed for any of the hematological conditions. No history of blood transfusion or a history of bleeding episode in the last few months.. The samples were obtained keeping full aseptic conditions and collected in EDTA anticoagulant tubes. Hb, MCV, MCH, MCHC and platelet RBC count along with RDW, were assessed on a Sysmex Hematology Analyzer. Peripheral smear of the participants with low Hb (<11 gm/dl) and low MCV (<80 fl) were examined to look for morphology of RBCs. Serum iron (SI), serum iron binding capacity, serum ferritin was estimated using Cobas of the participants who had hypochromic microcytic blood picture on peripheral smear. Participants with low MCV and hypochromic blood picture with Mentzer index less than 13, their blood samples were also subjected to Hb electrophoresis by high performance liquid chromatography for determining the level of HbA2. The increased in HbA2 levels of more than 3.5% is considered as a significantly important parameter for diagnosis of beta thalassemia carriers. The data collected was analyzed with computerized statistical package for social sciences (SPSS) version 16.

RESULTS

The participants in this study were both male (260) and female (240). Minimum age of the participants was 3.5 years and maximum age was 8 years. Minimum Hb was 7.6mg/dl and maximum Hb was 10.8 mg/dl with average Hb of 9.2mg/dl. All the pa-

ticipants had MCV below 80fl with minimum MCV of 50fl and maximum MCV of 80fl. RBC count was between 2.2 million and 6.2 million.

The participants in this study were both male (260) and female (240) as shown in table 1. Minimum age of the participants was 3.5 years and maximum age was 8 years. Minimum Hb was 7.6mg/dl and maximum Hb was 10.8 mg/dl with average Hb of 9.2mg/dl. All the participants had MCV below 80fl with minimum MCV of 50fl and maximum MCV of 80fl. RBC count was between 2.2 million and 6.2 million.

Findings of hematological indices, value of Mentzer index and Hb electrophoresis were correlated and it was found participants with low Hb, HPLC findings suggestive of beta thalassemia had significant low Mentzer index (below 13) than those with low Hb, low serum ferritin levels and normal HPLC findings. Correlation between Mentzer index and serum ferritin level is shown in table 2.

DISCUSSION

Anemia, especially iron deficiency anemia is a common childhood problem for multiple reasons in our society. The diagnosis of iron deficiency requires assessment of iron stores by measuring serum ferritin level, which is a specialized test and not freely available. Mentzer index has not been used in this

region as a diagnostic tool.

In this study it was found that common causes of hypochromic microcytic blood picture (iron deficiency anemia and thalassemia) can be differentiated. Participants with IDA had mentzer index more than 13 while participants with thalassemia had significantly lower mentzer index than 13. A similar study conducted in Indonesia by Sri Lestari S. Alam had also found similar results⁶. In this study there was no significant difference between the gender who showed lower levels of serum ferritin. A study conducted by Domellof et al reported lower serum ferritin level in male infants than female infants⁷. Intestinal worms are one of the commonest cause of IDA in developing countries and before commencing iron replenishing therapy, patient should be dewormed.

In a study conducted by Aysei et al in Turkey in which Mentzer index was compared with other hematological indexes, it was concluded that Mentzer index calculated gave 91% of correct diagnosis of IDA in patients with microcytic hypochromic anemia⁸. In a study conducted by Suhailur Rehman in India showed that RDWI was a better and more accurate predictive marker for β -TT as a screening tool in comparison to Mentzer index⁹.

Abdul Hassan in his study concluded that if RBC count is low and mentzer more than 13, these

Table 1:

Characteristics	n(500)	%
Gender		
Male	260	52%
Female	240	48%
Age Group		
3-5 years	300	60%
6-8 years	200	40%
Nutritional Status		
Under nourished	280	56%
Optimal nourished	220	44%

Table 2: Cross tabulation between Mentzer index and serum ferritin level

Mentzer Index	S.Ferritin Level		Total
	<30ugm/ml	>30ugm/ml	
>13.0	325	25	350
<13.0	25	125	150
Total	350	150	500

findings go with iron deficiency anemia. While the findings of high RBC count and mentzer ratio less than 13, these result present in Thalassemia trait¹⁰.

In another study conducted by W Siswandari found that Mentzer index Odd Ratio value was 2.4 (0.5 - 11.5, CI95%). Mentzer Index sensitivity (Sn) was 0.36 with specificity (Sp) at 0.81, positive predictive value (PPV) at 0.44 and negative predictive value (NPV) at 0.75. Mentzer index could be used to predict the diagnosis of beta-thalassemia carrier¹¹.

CONCLUSION

It can be concluded that in our society where definite diagnostic tests are expensive and not freely available, Mentzer index can be used as initial screening tool in the diagnosis of IDA and beta thalassemia major.

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