Diagnostic Test Validity of MCV for Determination of Thalassaemia Carrier in Bangladesh

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[Received: 12 February 2016; Revised: 3 March 2016; Accepted: 19 May 2016; Published: 1 July 2016]

Abstract

Background: Mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) of red blood cell is the useful diagnostic test which is performed during routine blood examination. Objective: The purpose of the present study was to measure the diagnostic test validity of MCV for the determination of thalassaemia carrier. Methodology: This analytic cross-sectional study was carried out in the Department of Pediatrics and Department of Medicine at MAG Osmani Medical College Hospital, Sylhet, Bangladesh from September 2007 to January 2009 for a period of one year and five months. Siblings and cousins of beta Thalassemia major and Hb-E -beta Thalassemia satisfying the selection criteria were enrolled. The detailed history and thorough physical examination were done meticulously. Five (5) mL blood was drawn from each case and control for determination of MCV and Hb-Electrophoresis. Result: Total 63 were enrolled as cases and total 65 were enrolled as controls. Sensitivity, specificity, positive and negative predictive value of MCV in determination of thalassemic carriers were 92%, 89.2%, 89.2% and 92% respectively. The area under the curve value was 0.094 (0.035 to 0.152). Conclusion: In conclusion the diagnostic test validity of MCH and MCH is high in determination of Thalassemic carrier. [Journal of National Institute of Neurosciences Bangladesh, 2016;2(2): 94-97]

Keywords: Diagnostic test; validity; mean corpuscular volume; mean corpuscular haemoglobin

Introduction

Hemoglobinopathies are a major health problem in many areas of the world1. Two of the most prevalent hemoglobinopathies are sickle hemoglobin (HbS) and beta thalassemia. Thalassemia is a molecular abnormality with underproduction of one of the globin chains2. In Bangladesh 7% population is thalassemic carrier3. Determination of Thalassemia carrier is the mainstay of prevention.

Red cell indices provide valuable tool for preliminary screening of thalassemia traits4. Thalassemic traits in general have reduced mean corpuscular volume (MCV) and reduced mean corpuscular hemoglobin (MCH) with normal mean corpuscular hemoglobin concentration (MCHC). Specific cut off points for each index varies from laboratory to laboratory. Some laboratories
concentrate on both reduced MCV and MCH and some on MCV or MCH alone. The purpose of the present study was to determine sensitivity, specificity, positive & negative predictive values of MCV in the determination of thalassemia carrier like Beta thalassemia major and haemoglobin E beta thalassemia.

**Methodology**

This present study was designed as analytical cross-sectional study. This study was carried out in the Department of Pediatrics and Department of Medicine of Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh from September 2007 to January 2009 for a period of one year and four months. The siblings and cousins of diagnosed cases of beta thalassemia major and Hb E beta thalassemia with the age group of 1 to 20 yrs who were presented with the HbA2 level more than 3.5% were selected as case group and those who were presented with HbA2 less than 3.5% were selected as control group. Iron deficiency anaemia diagnosed clinically by moderate to severe pallor, angular stomatitis, smooth tongue, koilonychias, hepatomegaly and subjects below 1 year were excluded from this study. Both case and control groups were selected by systematic random sampling by choosing every 2nd case. Siblings aging more than 1 year, first degree cousins of the patient diagnosed as beta thalassemia, E-beta thalassemia by Hb-Electrophoresis were interviewed and detailed history was taken and thorough physical examination were done; 5ml blood was taken for MCV measurement and Hb-electrophoresis. Two (2) mL was introduced into automated cell counter in haematology laboratory of private diagnostic centre in Sylhet (Medinova Medical Service Ltd., Sylhet and Popular Diagnostic Center Ltd., Sylhet) for MCV & MCH and three (3) mL anti-coagulated blood was sent to Dhaka in two private diagnostic laboratories (Medinova Medical Service Ltd., Dhanmondi, Dhaka and Popular Diagnostic Center Ltd., Dhanmondi, Dhaka) by air incubated in freeze for Hb electrophoresis. MCV test was carried out by SYSMEX XT1800i cell counter. Hemoglobin electrophoresis is carried out by Serbia Automated System on agarose gel (Hydragel). Controls were also investigated for MCV and Hb-Electrophoresis. Sensitivity, Specificity, positive and negative predictive values were calculated. Data were collected by a structured questionnaire were analyzed and interpreted duly using computer software SPSS 20.0. Informed written consent was taken before data collection. Permission from the local Ethical committee of SMAGMOC was taken.

**Results**

A total number of 128 subjects were recruited for this study of which 63 subjects were in case group and the rest 65 subject were in control group. MCV in cases and control group were 68.2±2.3 fl and 86.2±3.2 fl respectively. There was no significant difference between case & control group in MCV (p=0.995) (Table 1).

<table>
<thead>
<tr>
<th>Variables (Mean±SD)</th>
<th>Group</th>
<th>Control</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCV (fl)</td>
<td>68.2±2.3</td>
<td>86.2±3.2</td>
<td>0.995</td>
</tr>
</tbody>
</table>

fl= femtolitre,

Among the 63 cases MCV was positive in 58(92.1%) cases and negative in 5(7.9%) cases. Again, among 65 control group MCV was positive and negative in 7(10.8%) cases and 58(89.2%) cases respectively. The association between these two group was statistically significant (p=0.0001) (Table 2).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case</th>
<th>Control</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>58(92.1%)</td>
<td>7(10.8%)</td>
<td>65(50.8%)</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>5(7.9%)</td>
<td>58(89.2%)</td>
<td>63(49.2%)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Total</td>
<td>63(100.0%)</td>
<td>65(100.0%)</td>
<td>128(100.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity and Specificity of MCV in the diagnosis of thalassemic carriers were found 92% and 89.2% respectively & were high. The Positive predictive value and Negative predictive value of MCV in the diagnosis of thalassemic carriers were found 89.2% and 92% respectively (Table 3).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>92.0%</td>
<td>82.4 to 97.4%</td>
</tr>
<tr>
<td>Specificity</td>
<td>89.2%</td>
<td>79.1 to 95.6%</td>
</tr>
<tr>
<td>Positive Predictive Value</td>
<td>89.2%</td>
<td>80.4 to 94.4%</td>
</tr>
<tr>
<td>Negative Predictive Value</td>
<td>92.0%</td>
<td>83.3 to 96.4%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>90.6%</td>
<td>85.5 to 95.7%</td>
</tr>
</tbody>
</table>

*95% CI=95% Confidence Interva

**Discussion**

It is very difficult task to detect the thalassemic carrier by screening test. These are related to the heterogeneity of beta thalassaemia. The absence of a
Hemoglobinopathies are a major health problem in beta thalassemia. Thalassemia is a molecular mainstay of prevention from laboratory to laboratory. Some laboratories have reduced mean corpuscular hemoglobin concentration and reduced mean corpuscular volume (MCV) with general have reduced mean corpuscular volume (MCV). MCV is used in determination of thalassemic carriers which is considered high. A similar study was performed on 1286 antenatal women in India using MCV (<77fl) for determination of thalassemic carrier, where sensitivity and specificity was 98% and 92% respectively. The increased sensitivity in this study group is probably due to large sample size and selective study group (women). The result of this study supports the result of current study. During the past few years, several new discoveries mostly arising from human patients or mouse models have highlighted the implication of iron metabolism. Components in hereditary microcytic anemia are transported from intestinal absorption to its final inclusion into heme. Degree of reduction of MCV and MCH in iron deficiency tends to parallel the severity of the anemia which contrasts with most cases of heterozygous thalassemia in which the MCV and MCH are disproportionately low.

Carrier diagnosis involves the accurate measurement of MCV, MCH, HbA2 and HbF values. Thalassemic traits in general have reduced mean corpuscular volume (MCV). MCV is used in determination of thalassemic carrier in high rate. The present descriptive study showed that MCV alone was 92% sensitive, 98.2% specific, positive predictive value was 89.2% and negative predictive value was 92% for determination of thalassemic carriers which is considered high. A similar study was performed on 1286 antenatal women in India using MCV (<77fl) for determination of thalassemic carrier, where sensitivity and specificity was 98% and 92% respectively. The increased sensitivity in this study group is probably due to large sample size and selective study group (women). The result of this study supports the result of current study.

In conclusion sensitivity, specificity and predictive values of MCV is high in detection of thalassemia carriers like beta thalassemia major and Hb-E beta thalassemia in the age range of 1 year to 20 years. Further large scale study should be carried out to see the real scenario of the validity of the test.

**References**

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