The impact of maternal socioeconomic class on maternal measles antibodies of mother-infant pairs at birth in a Nigerian city

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Accepted 25 March, 2013

Background: Maternal measles antibodies (MMA) are passed from mother to child across the placenta. Comparison of MMA of mother-infant pairs and maternal socioeconomic class (SEC) in previous studies has not been consistent. In this study, the relationship between maternal SEC and MMA of mother-infant pairs at birth was investigated. Methods: One hundred and seventy seven mother-infant pairs were enrolled using systematic random sampling method. Maternal SEC and MMA of mother-infant pairs were determined and mean MMA was compared using the Student t test. Results: Significant correlation existed between MMA of mother-infant pairs at birth (r = 0.208, p = 0.006). However, comparison of mean MMA of mother-infant pairs and maternal SEC was not significant (p = 0.718) for mothers and (p = 0.565) for newborn infants. Conclusion: Data from present study revealed that majority of mothers belonged to low SEC whose mean MMA was higher than those of high SEC mothers. But this relationship was not significant. Further study on this subject matter is hereby recommended.

Keywords: Maternal socioeconomic class, Maternal measles antibodies, Mother-Infant pairs, Maiduguri, North-Eastern Nigeria.

INTRODUCTION

Measles is still a significant cause of childhood morbidity and mortality in Maiduguri, North-Eastern Nigeria (Ampofo et al., 1987; Hamidu et al., 2003). This region has many hard-to-reach populations, causing difficulties in the provision of adequate immunization coverage. More so, this region is measles endemic having low measles immunization rate and most of its populace are poor belonging to low socioeconomic class (SEC) (Hamidu et al., 2003; WHO 2006; Oyedeji 1985). Measles has been associated with impaired humoral immunity, and can be devastating especially in the population of low SEC due to increased susceptibility to secondary infections (Belmaker et al., 2008). In 1996, Guilherme de Almeida Goncalves in Portugal found that mothers who belong to high SEC had increased measles antibodies. This differs from the publication by Markowitz et al (1996) in the United States, who found out those mothers of low SEC had elevated MMA. Mothers who belong to high SEC are usually well educated, gainfully employed and have better nutritional habits. These could generate high levels of MMA in them. On the other hand, mothers who belong to low SEC may have high MMA from repeated contact with MV (Victor et al., 2000).

Significant number of children early in infancy responded with high levels of measles antibodies from measles immunization in areas of low per capita income (Black et al., 1986). In retrospect, the levels of MMA in low income populations are low and does not last long compared to that of wealthier populations. As such, measles immunization could generate increased levels of
measles antibodies. Furthermore, low per capita income countries, like Nigeria, have majority of its population earning less than a dollar a day (Ampofo et al., 1987; WHO 2006). This could create a vicious cycle of poverty which in turn may give rise to a low SEC population. Therefore, this paper aimed at assessing the relationship between maternal SEC and MMA of mother-infant pairs at birth. Extensive literature search revealed no such study was performed before in Maiduguri, Borno State, and the entire North-East sub-region of Nigeria. Knowledge gained from this work could bridge the gap on the lack of information on the relationship between maternal SEC and MMA.

MATERIALS AND METHODS

The study was conducted on 177 mother-infant pairs at the University of Maiduguri Teaching Hospital (UMTH), Borno State. After clearance from the Medical Research and Ethics Committee of UMTH, informed consent from parent was obtained. Maternal SEC was assessed based on their occupation and educational attainment using the Oyedeji scoring model (Oyedeji, 1985). Maternal SEC that is Class I-III was considered as high SEC, with class I higher than class II and class II higher than class III. Class IV-V was considered to be low SEC with class V being lower than class IV. Each mother-infant pair was allotted a serial number at birth.

Three millilitres of maternal and cord blood were collected in a sterile bottle and sera separated by centrifugation at 5000 rpm for five minutes. The serum that was collected was stored in a refrigerator at -20°C until the time of MMA assay. On completion of collection, the samples were assayed for MMA using ELISA in accordance with standard laboratory practice (Victor et al 2000). Optical densities (OD) of reactions in the well plates were read in an automated analyzer at 450 nanometre (nm) wavelength, MMA titres were obtained by plotting graphs of OD against measles IgG concentrations.

Data analysis

Means and standard deviations (SD) of MMA of mother infant pairs were calculated and their correlation coefficient was estimated. Student t test was used to investigate the effect of maternal SEC on mean MMA of mother-infant pairs. Statistical analysis was performed using statistical package for social science (SPSS) statistical software version 16, Illinois, Chicago USA. Statistical significance was defined as a p value <0.05. Tables were used for illustrations.

RESULTS

One hundred and seventy seven mother-infant pairs were enrolled in this study; with most of the mothers 148 (83.62%) belonging to low SEC as shown in Table 1. Of the 177 (100%) newborn infants, 90 (50.85%) were males as shown in Table 2. The male to female ratio is approximately 1.03:1.

The mean MMA levels of mother-infant pairs were 136.62 ± 93.32 and 181.58 ± 88.89 respectively in a ratio of 1:1.3 (Table 3). Correlation coefficient (r) of MMA of mother-infant pairs at birth was found to be significant (p = 0.006).

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Table 4 shows the distribution of maternal SEC and mean MMA of mother-infant pair. Comparison of mean MMA of mother-infant pairs and maternal SEC was, however, not significant (p = 0.718) for mothers and (p = 0.565) for newborn infants.
Table 3. Mean maternal measles antibody distribution of mother-infant pairs at birth

<table>
<thead>
<tr>
<th>Mother-infant pairs</th>
<th>Maternal measles antibodies (U/ml)</th>
<th>Mean ± SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers</td>
<td>136.62 ± 93.32</td>
<td></td>
<td>122.77 – 150.46</td>
</tr>
<tr>
<td>Newborn infants</td>
<td>181.58 ± 88.89</td>
<td></td>
<td>168.39 – 194.76</td>
</tr>
</tbody>
</table>

r = 0.208   p = 0.006   SD = Standard deviation   CI = Confidence interval

Table 4. Comparison between maternal socioeconomic class and mean maternal measles antibody of mother-infant pairs

<table>
<thead>
<tr>
<th>Maternal SEC</th>
<th>Mean maternal measles antibodies ± SD (U/ml)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mothers</td>
<td>Newborn infants</td>
</tr>
<tr>
<td>High</td>
<td>130.86 ± 88.24</td>
<td>172.86 ± 91.31</td>
</tr>
<tr>
<td>Low</td>
<td>137.74 ± 94.53</td>
<td>183.28 ± 88.62</td>
</tr>
<tr>
<td>p value</td>
<td>0.718</td>
<td>0.565</td>
</tr>
</tbody>
</table>

SEC= Socioeconomic class   *= p value < 0.05 (significant)

DISCUSSIONS

Current study showed high MMA in mother-infant pairs at birth, and the newborn infants are having higher MMA than their corresponding mothers. Similar observation was made in south western Nigeria and in India (Harry et al., 1981; Joshi et al., 2003). Recruitment of more placental receptors for MMA that binds more MMA would enable these newborn infants to have higher MMA than their mothers (Scott et al., 2005). Possible exposure of mothers to measles virus (MV) in this study is another reason for the high MMA. This is because our study population is located in measles endemic region and past studies have linked high MMA to boosting effect of MV in an exposed population (Ampofo et al., 1987; Hamidu et al., 2003; WHO 2006; Victor et al., 2000; Joshi et al., 2003).

Comparing mean MMA of mother-infant pairs and maternal SEC revealed higher levels of mean MMA in low SEC mother-infant pairs. However, this comparison was not significant. This agreed with the finding of Markowitz et al., (1996) in the United States. Boosting effect of MMA by MV in low SEC setting to near or slightly higher than those of high SEC could explain this observation. Workers in Chicago and Kenya have argued on the relationship between MMA and maternal SEC, with each of them having a divergent view in their separate report. (Victor et al., 2000; Scott et al., 2005). In the report from Chicago, adequate maternal nutrition was associated with increased MMA in high SEC mothers. While that from Kenya found high MMA in mothers of low SEC due to increased measles cases from greater exposure to MV.

Newborn infants are expected to be naive to MV exposure because they are shielded from the external environment in their mother’s womb. Thus, the slightly higher but insignificant mean MMA seen in newborns of low SEC mothers in this study could arise from increased placental receptor binding sites for MMA, which is similar to that observed with newborns of high SEC mothers (Scott et al 2005).

Limitations

Caution may be needed in generalizing the results of the current study because the study group was obtained from only one health facility (UMTH), and was found to be skewed in favor of low SEC mothers. More so, the findings may be attributed to a range of causes that may be difficult to prove in our measles endemic setting. For instance, the determinants of MMA are wild type MV infection, or its boosting effect or that induced by measles vaccination. But most mothers in this study have no knowledge of contracting measles in the past or their measles immunization statuses.

CONCLUSION

The results of present work showed that majority of mothers belonged to low SEC whose mean MMA was higher than those of high SEC mothers; however, this comparison was not significant.

RECOMMENDATIONS

It is recommended that a multicenter study involving many health facilities would be more appropriate in the
state to make the study more representative of the vast population of Maiduguri. Considering the relative study population bias that favored low SEC mothers, it is recommended that subsequent study methodology should incorporate more numbers of mothers from high SEC, and to exclude other cofounders like MV infection or measles vaccine antibodies where possible.

ACKNOWLEDGMENT

We are grateful to all staffs of the labor ward, Paediatric and Immunology departments for their help.

REFERENCES

