Serum levels of 25(OH) vitamin D and immunoglobulin E in infants with bronchiolitis

Article in The Gazette of the Egyptian Paediatric Association - March 2016
DOI: 10.1016/j.epag.2016.02.002

4 authors, including:

Doaa Refaey Soliman
Benha University
6 PUBLICATIONS 3 CITATIONS
SEE PROFILE

Mohamed Suleiman
Ministry of Health, Egypt
1 PUBLICATION 0 CITATIONS
SEE PROFILE

Sahar Mohamed
Al Galaa Teaching Hospital, Egypt, Cairo
1 PUBLICATION 0 CITATIONS
SEE PROFILE

Some of the authors of this publication are also working on these related projects:

inhibin,CD99 and vimintin in ovarian granulosa cell tumor View project
Serum levels of 25(OH) vitamin D and immunoglobulin E in infants with bronchiolitis

Bahaa El Din Mohamed Hassanein a, Doaa Refaey Soliman a, Sahar Mohamed Abd Elhameed Fayed b, Mohamed Mosaad Mohamed Suleiman a,*

a Pediatric Department, Faculty of Medicine, Benha University, Benha, Egypt
b Clinical Pathology Department, Faculty of Medicine, Benha University, Benha, Egypt

Received 11 September 2015; accepted 1 February 2016

KEYWORDS
Bronchiolitis;
25(OH) D;
IgE

Abstract
Vitamin D status has a great effect on respiratory health throughout the lifespan. The aim of this study was to estimate and find the relationship between both 25(OH) vitamin D and immunoglobulin E serum levels and bronchiolitis in infancy.

Methods: We quantified serum 25(OH) D and serum immunoglobulin E using (ELISA) in 50 infants with bronchiolitis and 31 healthy controls of matched age and sex.

Results: The mean serum 25(OH) vitamin D was significantly lower in cases than in controls; it was (12.3 ± 3.9 & 26.2 ± 10.0 ng/ml, respectively with \( p = 0.003 \)). The mean serum IgE was significantly higher in cases than in controls; It was (170 ± 66 & 43.8 ± 14.2 IU/ml, respectively and \( p = 0.01 \)). Serum IgE showed a non-significant negative correlation with serum 25(OH) vitamin D (\( r = -0.141, \ p = >0.05 \)).

Conclusions: Serum 25(OH) vitamin D was found in decreased quantities in infants with bronchiolitis and it was negatively correlated with serum IgE, suggesting that vitamin D may play a role in the pathogenesis of bronchiolitis.

Introduction
Bronchiolitis is the most common lower respiratory tract disease and the most common reason for hospital admission in infants. In addition to the role of vitamin D in bone metabolism, it has been found that vitamin D status has a great effect on respiratory health throughout the lifespan. And there is emerging evidence of the potential importance of vitamin D deficiency in susceptibility to acute respiratory infection.\(^2\)

Immunoglobulin E (IgE) was first described by Ishizaka in 1967. It has the lowest serum concentration of all circulating immunoglobulin isotypes. And it has found to be involved in the pathogenesis of many diseases.\(^3\) Immuneglobulin E mediates Type 1 allergic reactions that play role in the pathogenesis of bronchiolitis.\(^4\)

Aim of the work
We aimed to estimate and find the relationship between both 25(OH) vitamin D and immunoglobulin E serum levels and bronchiolitis in infancy.
Subjects and methods

Subjects

This case control study was conducted on 81 infants in Benha University Hospital and Toukh Fever Hospital; 50 infants with first episode of acute bronchiolitis as described by the American Academy of Pediatrics statement, which states that children with bronchiolitis typically have “rhinitis, tachypnea, wheezing, cough, crackles, use of accessory muscles, and/or nasal flaring”. Their age ranged from 2 months to 2 years and 31 healthy infants of matched age and sex were selected as controls. Patients were excluded from the study if they had one or more of the following characteristics: history suggestive of chronic cardiopulmonary disease, history of previous attacks of chest wheezing, immunodeficiency, on corticosteroid therapy, malnutrition or rickets, any chromosomal, genetic or endocrinal disorders, renal or hepatic disorders, malignancy and atopy.

Methods

The study protocol received approval of the research ethics committee of the pediatric department at Benha University. All infants included in this study were subjected to the following; Full medical history with special emphasis on chest symptoms and thorough clinical examination including chest examination and diagnosis of cases of bronchiolitis on the basis of history and physical examination according to the American Academy of Pediatrics recommendation. Blood sample was taken from each subject, about 2 ml of venous blood, withdrawn into a plain tube, left to clot then centrifuged and the separated serum stored at $-20^\circ C$. Then serum levels of 25(OH) D and immunoglobulin E were measured using Enzyme Linked Immunosorbent Assay technique (ELISA).

Statistical analysis

Data were analyzed using Statistical Package of Social Science program (SPSS) 16 software package under Windows 8 enterprise edition 2013 operating system & statistics package BS3 on android 4.4 ice cream sandwich operating system. Graphic presentation of data was done by using EXCEL 2007 and SPSS 16 software package software.

Results

Demographic and laboratory data for cases and controls are demonstrated in Tables 1 and 2, respectively. The mean serum 25(OH) vitamin D was significantly lower in cases than in controls; it was $(12.3 \pm 3.9 \text{ ng/ml})$ and $(26.2 \pm 10.0 \text{ ng/ml})$, respectively with $p = 0.003$ as shown in Table 3. Table 4 shows that the mean serum IgE was significantly higher in cases than in controls; It was $(170 \pm 66 \text{ IU/ml})$ and $(43.8 \pm 14.2 \text{ IU/ml})$, respectively and $p = 0.01$. And there was a non-significant negative correlation between serum 25(OH) vitamin D and serum IgE ($r = -0.141$, $p = > 0.05$) as seen in Fig. 1.

Discussion

In addition to the role of vitamin D in bone metabolism, it has been found that vitamin D status has a great effect on respiratory health throughout the lifespan. And there is emerging evidence of the potential importance of vitamin D deficiency in susceptibility to acute respiratory infection. Immunoglobulin E (IgE) was first described by Ishizaka in 1967. It has the lowest serum concentration of all circulating immunoglobulin isotypes. And it has been found to be involved in the pathogenesis of respiratory allergy.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Analysis of basic characteristics and laboratory data of cases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male 31 (62)</td>
</tr>
<tr>
<td></td>
<td>Female 19 (38)</td>
</tr>
<tr>
<td>Age (mean ± SD)</td>
<td>7.2 ± 3.3 months</td>
</tr>
<tr>
<td>Residence</td>
<td>Rural 32 (64)</td>
</tr>
<tr>
<td></td>
<td>Urban 18 (36)</td>
</tr>
<tr>
<td>Social class</td>
<td>Low 17 (34)</td>
</tr>
<tr>
<td></td>
<td>Medium 32 (64)</td>
</tr>
<tr>
<td></td>
<td>High 1 (2)</td>
</tr>
<tr>
<td>Sun exposure</td>
<td>Adequate 17 (34)</td>
</tr>
<tr>
<td></td>
<td>Inadequate 33 (66)</td>
</tr>
<tr>
<td>Vitamin D supplementation</td>
<td>Adequate 12 (24)</td>
</tr>
<tr>
<td></td>
<td>Inadequate 38 (76)</td>
</tr>
<tr>
<td>Serum 25(OH) vitamin D</td>
<td>Minimum 6.67 (ng/ml)</td>
</tr>
<tr>
<td></td>
<td>Mean 12.3 (ng/ml)</td>
</tr>
<tr>
<td></td>
<td>Maximum 28.4 (ng/ml)</td>
</tr>
<tr>
<td>Serum Immunoglobulin E</td>
<td>Minimum 11.8 (IU/ml)</td>
</tr>
<tr>
<td></td>
<td>Mean 170.3 (IU/ml)</td>
</tr>
<tr>
<td></td>
<td>Maximum 604.22 (IU/ml)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Analysis of basic characteristics and laboratory data of controls.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male 14 (45.2)</td>
</tr>
<tr>
<td></td>
<td>Female 17 (54.8)</td>
</tr>
<tr>
<td>Age (mean ± SD)</td>
<td>6.6 ± 1.6 months</td>
</tr>
<tr>
<td>Residence</td>
<td>Rural 18 (58.1)</td>
</tr>
<tr>
<td></td>
<td>Urban 13 (49.9)</td>
</tr>
<tr>
<td>Social class</td>
<td>Low 4 (12.9)</td>
</tr>
<tr>
<td></td>
<td>Medium 22 (71)</td>
</tr>
<tr>
<td></td>
<td>High 5 (16.1)</td>
</tr>
<tr>
<td>Sun exposure</td>
<td>Adequate 27 (87)</td>
</tr>
<tr>
<td></td>
<td>Inadequate 4 (13)</td>
</tr>
<tr>
<td>Vitamin D supplementation</td>
<td>Adequate 25 (80.6)</td>
</tr>
<tr>
<td></td>
<td>Inadequate 6 (19.4)</td>
</tr>
<tr>
<td>Serum 25(OH) vitamin D</td>
<td>Minimum 15.3 (ng/ml)</td>
</tr>
<tr>
<td></td>
<td>Mean 26.2 (ng/ml)</td>
</tr>
<tr>
<td></td>
<td>Maximum 51.8 (ng/ml)</td>
</tr>
<tr>
<td>Serum Immunoglobulin E</td>
<td>Minimum 2.35 (IU/ml)</td>
</tr>
<tr>
<td></td>
<td>Mean 43.8 (IU/ml)</td>
</tr>
<tr>
<td></td>
<td>Maximum 148.5 (IU/ml)</td>
</tr>
</tbody>
</table>

Please cite this article in press as: Hassanein BEDM et al. Serum levels of 25(OH) vitamin D and immunoglobulin E in infants with bronchiolitis. *Egypt Pediatr Assoc Gazette* (2016), http://dx.doi.org/10.1016/j.epag.2016.02.002
Serum levels of 25(OH) vitamin D and immunoglobulin E in infants

unknown. Malik et al.8 explained that the high incidence of bronchiolitis occurs 1.25 times more frequently in males than in females and infants in rural areas were more likely to have bronchiolitis than children in urban areas. This finding is supported by the study done by Vissing et al.14 who found that low socioeconomic status increases the risk of bronchiolitis. Grimwood et al.15 attributed the high incidence of bronchiolitis in low socioeconomic communities to the household crowding which facilitate infection spread, and to the decreased access to health care facilities.

In our study we found that the incidence of bronchiolitis was higher in the lower social class than in high class. Similarly Caballero et al.13 found that the incidence of bronchiolitis is higher in low socioeconomic communities. Also Vissing et al.14 found that low socioeconomic status increases the risk for bronchiolitis. Grimwood et al.15 attributed the high incidence of bronchiolitis in low socioeconomic communities to the household crowding which facilitate infection spread, and to the decreased access to health care facilities.

Our study revealed that most of bronchiolitis cases were not adequately exposed to the sun. This is in agreement with Chen et al.16 who reported that children who are not adequately exposed to the sun are more liable to have RSV bronchiolitis and also in agreement with Linday et al.17 who found that acute lower respiratory infections, including bronchiolitis, are more frequent in children lacking sun exposure. And Mansbach and Camargo18 noted that almost all cases of bronchiolitis occur in winter months where sun exposure is inadequate.

We found that most infants with bronchiolitis had inadequate vitamin D supplementation. This came in concordance with Leis et al.19 who found that vitamin D intake of children with bronchiolitis was low. Bergman et al.20 in their meta-analysis study found evidence that supplement with vitamin D reduced significantly the risk of respiratory tract infections including bronchiolitis. And El-Mazary et al.21 found in their study that bronchiolitis is less common in infants supplemented with vitamin D than those not supplemented, and they attributed that to the immunomodulatory effect of vitamin D which may lead to an increased resistance to infection.

In this study we found that the mean serum 25(OH) vitamin D was significantly lower in cases than in controls; it was (12.3 ± 3.9 & 26.2 ± 10.0 ng/ml, respectively with p = 0.003). These data came in concordance with the study done by Moreno-Solis et al.22 who examined the prevalence of hypovitaminosis D in Spanish infants with acute bronchiolitis compared with control subjects. They found that 25(OH) D levels in infants with acute bronchiolitis were significantly lower than in the control group (median 29.9 ng/ml versus median 38.2 ng/ml). Golan-Tripto et al.23 found that 25(OH) D was significantly lower in the bronchiolitis cases than in controls; (11.2 ± 5.6 ng/ml vs. 31.2 ± 4 ng/ml, p < 0.001). Rodriguez et al.24 reported that vitamin D deficiency is prevalent in infants with bronchiolitis. Watkins et al.25 found that mean 25 (OH) D levels were lower in children with bronchiolitis than healthy controls. Roth et al.26 showed that children admitted for acute lower respiratory tract infections including bronchiolitis had lower 25(OH) D levels than age-matched healthy controls. But McNally et al.27 found that no difference was observed in vitamin D levels between the acute lower respiratory tract infection (ALRI) group and control groups when they compare serum 25(OH) D levels in a group of young children with ALRI with a diagnosis of bronchiolitis or pneumonia (n = 55 or 50, respectively), to an age-matched group.
without respiratory symptoms \((n = 92)\). The mean vitamin D level for the entire ALRI group was not significantly different from the control group. But we can note here that the study of McNally et al.\(^2\) compared the mean vitamin D levels for the entire ALRI including pneumonia with that of controls and not only bronchiolitis cases as our study did.

In the present study we found that the mean serum level of immunoglobulin E was significantly higher in cases than in controls. It was \((170 \pm 66 \& 43.8 \pm 14.2 \text{ IU/mL})\) respectively and \(p = 0.01\). That came in concordance with the study done by Jiang et al.\(^28\) who estimated the changes in immunoglobulins in children with bronchiolitis. They found that serum IgE levels were significantly higher in cases than in controls \((p < 0.05)\). Also Chary et al.\(^29\) found that total serum IgE was significantly higher \((p < 0.01)\) in patients with bronchiolitis than compared to the control group. This was in agreement with the study done by Zhu et al.\(^30\) who found significantly increased total serum IgE level in both atopic \((241.2 \pm 102.5 \text{ IU/mL})\) and nonatopic children \((125.5 \pm 63.2 \text{ IU/mL})\) with bronchiolitis compared with that in the control group \((27.2 \pm 10.5 \text{ IU/mL})\) \((p < 0.01)\).

In our study, serum IgE showed a non-significant negative correlation with serum 25(OH) vitamin D \((r = -0.141, p = > 0.05)\). This was in agreement with the study done by Jiang et al.\(^28\) who found a negative correlation between serum IgE and serum vitamin D and also with the study done by Demirel et al.\(^31\), who found that there was a negative relationship between 25(OH) D level and IgE values in both wheezy infants with Vitamin D deficiency and the control group. And Luong\(^32\) found a negative relationship between 25(OH) D and total serum IgE in cases with bronchiolitis.

In conclusion, serum 25(OH) vitamin D was found in decreased quantities in infants with bronchiolitis and it was negatively correlated with serum IgE, suggesting that vitamin D may play a role in the pathogenesis of bronchiolitis.

Recommendations

We recommend adequate vitamin D supplementation and encouragement of adequate exposure to sunlight as a natural source for vitamin D, to achieve sufficient levels of 25(OH) D, which may help to reduce the burden of bronchiolitis during infancy. Further studies are needed to assess the correlation between nutritional status and vitamin D status among healthy infants and to assess vitamin D status among infants and children with recurrent respiratory tract infections and also to determine potentiality of vitamin D for therapy /and or prophylaxis, with outcome measurement and pre-post estimation of vitamin D levels in infants with bronchiolitis.

Conflict of interest

There is no conflict of interest.

References


