THE PREVALENCE OF DIABETIC KETOACIDOSIS IN CHILDREN WITH NEW-ONSET TYPE 1 DIABETES MELLITUS

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Background

- Ketoacidosis (DKA) is a life-threatening complication of type 1 diabetes (T1DM) frequently present at its diagnosis.
- Younger children are at greater risk of developing ketoacidosis.
- The prevalence of ketoacidosis at diagnosis in children aged <5 years varies between 17.3-54.5%.
- This trend is alarming due to worldwide rise in type 1 diabetes incidence with the greatest increase in children aged <5 years.

Aims and Objectives

- We studied the prevalence of DKA at T1DM diagnosis and the frequency of partial remission (PR) in children.

Method

- The cohort comprised 735 children ((girls: 329; boys: 406) aged 0-18 years with newly diagnosed T1DM.
- Clinical and biological features were collected at diagnosis and during follow-up.
- DKA was defined as blood pH < 7.30 and considered mild, moderate, severe if pH was < 7.3, <7.2 and <7.1, respectively.
- To confirm autoimmune diabetes origin typical autoantibodies were tested (IAA, GAD-ab, IA2-ab, ZnT8).
- A questionnaire on diabetes from first symptom(s) to diagnosis was completed by children's caregivers.
- PR was defined as IDAA1C ≤ 9, according to definition: A1C(%) + [4 x insulin dose (U/kg/day)].
- The unpaired Student t-test was used to compare continuous variables, and the chi-square test was used to compare percentages among different patients subgroups.
- A P-value <0.05 was considered significant.

Results

- DKA was diagnosed in 36.0% of patients: 12.9% had mild form, while 14.5% and 8.7% moderate and severe, respectively.
- In children aged 0-4, 5-9, 10-14 and 15-18 years DKA was present in 48.5, 35.1 and 28%, respectively.
- In individuals aged <4 years DKA occurred significantly often (p=0.001).
- The highest severe DKA frequency was associated with symptoms’ duration (>28 days) (p=0.014) and diabetes misdiagnosis (p=0.001).
- ZnT8 autoantibodies was detected significantly often in children with DKA (p=0.44).
- Children with DKA had higher levels of blood ketones (p=0.0001), HbA1C (p=0.0004), blood glucose (p=0.00001) and lower levels of insulin (p=0.00001), c-peptide (0.0001).
- In the first year after diagnosis PR occurred in 62% patients. Individuals with DKA had lower PR incidence (24% versus 76% without DKA).

Comments

- The prevalence of DKA is high in children from Wielkopolska.
- Children aged < 4 years have the greatest risk of developing ketoacidosis.
- The highest frequency of severe DKA is related to symptoms’ duration and diabetes misdiagnosis.
- ZnT8 autoantibodies are associated with the worst general condition at the time of diagnosis.

### Clinical features of T1DM children at the onset of disease with and without DKA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Children without DKA (n=470)</th>
<th>Children with DKA (n=265)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose [mg/dl]</td>
<td>407 ± 178</td>
<td>474 ± 218</td>
<td>0.00001</td>
</tr>
<tr>
<td>Blood ketones [mmol/L]</td>
<td>2.3 ± 1.7</td>
<td>4.8 ± 1.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>A1C [%]</td>
<td>11.1 ± 2.2</td>
<td>11.6 ± 1.8</td>
<td>0.0004</td>
</tr>
<tr>
<td>Insulin [uIU/mL]</td>
<td>2.8 ± 1.8</td>
<td>1.8 ± 1.4</td>
<td>0.0001</td>
</tr>
<tr>
<td>C-peptide [pmol/ml]</td>
<td>0.57 ± 2.3</td>
<td>0.3 ± 0.16</td>
<td>0.0001</td>
</tr>
<tr>
<td>GAD U/ml positive [%]</td>
<td>72</td>
<td>70</td>
<td>0.59</td>
</tr>
<tr>
<td>IAA % positive [%]</td>
<td>51</td>
<td>52</td>
<td>0.8</td>
</tr>
<tr>
<td>IA2-AB U/ml positive [%]</td>
<td>78</td>
<td>79</td>
<td>0.7</td>
</tr>
<tr>
<td>ZnT8 U/ml positive [%]</td>
<td>79</td>
<td>93</td>
<td>0.044</td>
</tr>
<tr>
<td>Symptoms’ duration [days]</td>
<td>&lt; 28</td>
<td>&gt; 28</td>
<td>0.014</td>
</tr>
<tr>
<td>Diabetes misdiagnosis</td>
<td>GP visit &lt; 3</td>
<td>GP visit &gt; 3</td>
<td>0.001</td>
</tr>
<tr>
<td>Partial remission [IDAA1C ≤ 9]</td>
<td>76%</td>
<td>24%</td>
<td></td>
</tr>
</tbody>
</table>

(c-peptide normal range 0.59-1.54 pmol/ml)