Blood Levels of Glucose and Insulin in Meniere’s Disease

M. V. KIRTANE, S. B. MEDIKERI
and P. RAO
From the Department of Otolaryngology, K.E.M. Hospital,
Bombay, India

It has been reported that a very commonly overlooked cause of vertigo is disorder of glucose metabolism. This may not be reflected in the glucose tolerance test alone, but becomes obvious when the insulin levels in blood are evaluated simultaneously. Thirty-one patients with Meniere’s disease underwent a 5-hour glucose tolerance test with radio-immune assay of insulin. The results were compared with the normal and abnormal patterns suggested by Kraft. On this basis, it was found that 67.7% of our patients showed some abnormality in the relationship between the blood levels of glucose and insulin. These patients were put on a special diet with a limited carbohydrate content prescribed by a qualified dietitian. The effect of this diet was highly variable and the possible reasons for this are also discussed.

Over the past years, much interest has been generated by the relationship of metabolic disorders to Meniere’s disease. The relationship between diabetes and vertigo (Powers, 1972), and between hypoglycaemia and vertigo (Weille, 1968) is well known. However, various workers (Updegraft, 1977; Updegraft, 1979) have shown that a large number of patients with Meniere’s disorder may show normal glucose levels and yet have impaired glucose–insulin metabolism. In these cases, it appears that the normal parallel relationship between blood levels of glucose and insulin is disrupted as a reflection of the disorder. Updegraft (1979) has reported that almost 90% of such patients can be relieved of their symptoms by mere regulation of their diet. Since the Indian diet pattern is markedly different from the Western one, we decided to test the applicability of this hypothesis and therapy to our patients of Meniere’s disease.

MATERIAL AND METHODS

Of the 350 cases of vertigo treated by us in the last calendar year, 31 patients were diagnosed as having Meniere’s disease after undergoing a complete neurootological examination and a battery of tests including audiometry, ENG, vestibulospinal tests, radiography, blood chemistry, serology, etc. The diagnosis of Meniere’s disease was based on the clinical history of episodic vertigo and fluctuating hearing loss, and also investigative evidence of 1) cochlear type of hearing loss with fluctuating threshold levels, 2) labyrin-thine hypoactivity on caloric test, and 3) other causes being ruled out.

Each case was then subjected to a 5-hour glucose tolerance test (GTT) using 100 g of glucose orally. A simultaneous radio-immune assay of insulin was also done. Blood samples were collected, both fasting and at 1, 1½, 2, 3, 4 and 5 hours after glucose ingestion. In order to establish a control reading, 30 normal volunteers also underwent the same test.

The results of the 5-hour GTT were evaluated according to the standardized norms of our laboratory. The results for the patients and the control group for insulin were classified according to the patterns suggested by Kraft (1975, 1975), viz.
Pattern I: Normal
1. Fasting levels between 0 to 30 micro-units
2. Peak insulin production at 1 hour
3. Return to fasting at 2–3 hours

Pattern II: Normal peak but delayed return
Pattern III A: Second-hour delayed peak
Pattern III B: Third-hour delayed peak
Pattern IV: High fasting insulin level
Pattern V: Low insulin response

RESULTS

Of the 30 normal volunteers, all had a normal 5-hour GTT, and yet 5 showed marginally abnormal insulin patterns. Of these, 4 showed a delayed return pattern (II), and one showed a flat curve of pattern V. However, on calculating the mean value with standard deviation for insulin levels, the control group showed a normal, type I pattern (Fig. 1).

The 31 patients with Meniere’s disease, of whom 23 were males and 8 were females, showed a unilateral disorder in 22 cases and bilateral in 9. Highest incidence appeared in the 4th and 5th decades of life, as shown in Table I.

Only 2 of the 31 patients had an abnormal or diabetic 5-hour GTT, the other 29 being reported as normal. Yet, the 5-hour insulin levels were abnormal in 21 patients (68%) with delayed return pattern II in 18 cases (58%) and delayed peak at 2 hours, i.e., pattern III A in 3 cases (10%). The mean and standard deviation of insulin values for the group of patients of Meniere’s disease showed a definitely pathological curve with a higher insulin peak and delayed return to normal, viz. pattern II (Fig. 2).

The difference in the corresponding insulin levels of the two groups, viz., controls and patients with Meniere’s disease, was evaluated statistically by applying Student’s t-test and was found to be highly significant except for the fasting levels as shown in Table II.

DISCUSSION

The incidence of Meniere’s disease in Bombay is low, viz., 8.85%. As Bombay is a highly cosmopolitan city, this incidence may be considered as a representative of a cross-section of the Indian population. Our preliminary study reiterates the findings of previous workers (Updegraff, 1977; Updegraff, 1979) that impaired glucose–insulin metabolism plays a major role in the etiopathogenesis of the so-called Meniere’s disease, which by definition is thought to be idiopathic. The commonest abnormality appears to be a relatively high blood level of insulin on glucose intake and its delayed return to normal. This suggests an impaired glucose–insulin metabolism which would interfere with the generation of the ATP.

Table I

<table>
<thead>
<tr>
<th>Age</th>
<th>No of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 20 years</td>
<td>1</td>
</tr>
<tr>
<td>21 to 30 years</td>
<td>6</td>
</tr>
<tr>
<td>31 to 40 years</td>
<td>9</td>
</tr>
<tr>
<td>41 to 50 years</td>
<td>11</td>
</tr>
<tr>
<td>Over 50 years</td>
<td>4</td>
</tr>
</tbody>
</table>
Fig. 1. Graph showing mean and standard deviation values of insulin levels in blood during the 5-hour GTT in the control group. The vertical axis represents insulin levels in micro-units per ml.

Fig. 2. Graph showing mean and standard deviation values of insulin levels in blood during the 5-hour GTT in the group of patients with Meniere’s disease. The vertical axis represents insulin levels in micro-units per ml.

by the Krebs cycle. This leads to a drop in the energy supply available for the sodium-potassium pump in the cell membrane of the vestibular or cochlear end organ, followed by sodium retention in the endolymph, and consequently, endolymphatic hydrops.

The generation of energy in the cell is further reduced by diminished blood supply. This is likely to occur at persistently high insulin levels, which are believed to lead to sub-intimal deposition of lipids and, therefore, narrowing of blood vessels. Updegraff (1979) has suggested that patients with such an impaired glucose-insulin metabolism should be treated with a low carbohydrate diet (2005 calories, with 120 g carbohydrate, 145 g protein and 105 g fat). Most of our patients who were prescribed such a diet by the dietitian had marked worsening of symptoms and hence gave up this diet in favour of their original one. Fig. 3 shows the glucose and the insulin levels of one such patient, a 43-year-old male, with unilateral Meniere’s disease of 2 years’ duration. The glucose levels in the 5-hour

<table>
<thead>
<tr>
<th>Sample</th>
<th>t-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>1.76</td>
<td>NS</td>
</tr>
<tr>
<td>1 hour</td>
<td>2.23</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>1½ hours</td>
<td>2.90</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2 hours</td>
<td>2.77</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>3 hours</td>
<td>4.52</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>4 hours</td>
<td>3.10</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>5 hours</td>
<td>3.56</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
GTT were normal. The insulin peak was delayed, high, and sustained, with a delayed return to normal. In view of the exaggerated insulin response, he was put on a low carbohydrate diet as mentioned above, but had marked worsening of symptoms. He obtained relief only on eating a sweet preparation with a very high sugar content.

The non-acceptability of the low carbohydrate diet is probably due to the extremely high carbohydrate content of the average diet in our area, where two to three meals with large quantities of rice are common. Addiction to tea, with plenty of sugar adds significantly to the daily carbohydrate intake. Under these circumstances we have to evolve our own solution to the problem of diet regulation which will be suitable to our patients and our conditions.

The above study was a preliminary attempt to determine whether impaired glucose-insulin metabolism is a major etiopathogenic factor in our patients diagnosed as suffering from Meniere’s disease. Having confirmed this, we plan to include the 5-hour GTT with radio-immune assay of insulin as a routine investigation for patients suspected to be suffering from Meniere’s disease and also those patients with vertigo who remain undiagnosed.

REFERENCES

M. V. Kirtane, Department of Otolaryngology, K.E.M. Hospital, Bombay 400 008, India.