the last 2 weeks of the study. All in all, there are no statistically significant differences between the levamisole-treated group and the control group in the incidence of clinical recurrences. Although the shedding of virus might be studied in greater detail, we considered that clinical recurrences were the most important factor to study.

Levamisole is not a harmless drug. It has produced agranulocytosis5, 6 and other kinds of toxicity.7 Unless, therefore, some clear cut effect is found, it would seem unjustified to give such a drug to man.

In the past, we have studied other methods of nonspecifically stimulating CMI.8 Our studies have included the use of Staphylococcus phage lysate and BCG stimulation to activate macrophages and lymphocytes and stimulate the reticuloendothelial system. These did not reduce recurrences of herpes. Drugs like levamisole have been shown to be active in vitro9 and in some other situations in which CMI has been depressed. As with the other nonspecific CMI stimulation, we did not find levamisole active in preventing recurrences in experimental herpetic keratitis.

One of the frustrating problems in reviewing anecdotal information on recurrent herpetic keratitis appears to be that patients tend to have a variable recurrence pattern. Sometimes people will get recurrences very frequently for a period of time, and then these will spontaneously decrease, seldom maintaining a constant incidence throughout life. If such patients are treated at the attack peak with any agent thought to possibly reduce recurrence rate, then it appears that this agent has therapeutic activity, if only because of the spontaneous decrease in recurrence rate—which might be expected if someone has already reached peak recurrence frequency.

Because of the known toxicity of levamisole, this study would suggest that levamisole is not active in recurrent herpetic keratitis and should not be used in random cases of recurrent herpes outside of a carefully controlled double-blind clinical trial which might definitively answer the question of its possible activity in man.


Key words: herpesvirus, keratitis, cell-mediated immunity, levamisole.

REFERENCES


Tear calcium and magnesium levels of normal subjects and patients with hypocalcemia or hypercalcemia. R. AVISAR, H. SAIV, Y. SID, and J. PINKHAS.

Tear calcium and magnesium levels were measured in eight patients with hypercalcemia and two patients with hypocalcemia and compared to that of 72 subjects with normal serum calcium and magnesium levels. No correlation was found between tear and serum calcium and magnesium levels. Tear calcium level has no diagnostic importance.

The tear level of several substances such as lysozyme3 and lactic acid dehydrogenase3 (LDH1) have proved to be useful in the study of eye diseases. Uotila et al.4 found no apparent correlation between tear and serum calcium measurements. The aim of the present work was to study tear calcium levels in patients with a systemic disease such as sarcoidosis, hyperparathyroidism, or hypoparathyroidism which could alter the calcium excretion patterns. We examined whether calcium level in the tear fluid can be of more diagnostic importance than static calcium levels in blood.

Since calcium and magnesium transport are related to each other in various systems such as the intestinal epithelium or the renal tubule, it is of interest to measure with great accuracy both
Table I. Levels of calcium and magnesium in tear fluid and serum of the control group, patients with hypercalcemia, and patients with hypocalcemia.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. examined</th>
<th>Calcium (mg./100 ml.)</th>
<th></th>
<th>Magnesium (mg./100 ml.)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Serum</td>
<td>Tear</td>
<td>Serum</td>
<td>Tear</td>
</tr>
<tr>
<td>Control</td>
<td>72</td>
<td>9.83-0.7</td>
<td>2.82-0.6</td>
<td>2.2-0.3</td>
<td>2.0-0.35</td>
</tr>
<tr>
<td>Hypercalcemia</td>
<td>8</td>
<td>13.43-1.43</td>
<td>2.56-0.42</td>
<td>2.4-0.2</td>
<td>2.2-0.15</td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>2</td>
<td>7.03-0.07</td>
<td>2.76-0.23</td>
<td>1.8-0.11</td>
<td>1.8-0.09</td>
</tr>
</tbody>
</table>

calcium and magnesium levels in the tear fluid of normal subjects and of patients with hypocalcemia or hypercalcemia.

Materials and methods. Seventy-two healthy subjects, 39 men and 33 women, were used as a control group. The ages ranged from 14 to 80 years.

The patients group consisted of 10 patients (with normal serum albumin): eight patients with hypercalcemia (four due to hyperparathyroidism, three due to sarcoidosis, and one due to osteoporosis) and two patients with hypocalcemia after parathyroidectomy.

Tear samples. Each subject was told to stare straight ahead and to keep both eyes open during tear collection. The lower lid was pulled down, and tear fluid was drawn from the lower fornix of the right eye with the use of a plastic syringe.

Blood samples. Blood, 10 to 20 cc, was drawn from each subject with a plastic syringe and 20-gauge needle.

The level of calcium and magnesium in serum and tears of both groups was measured by atomic absorption spectrometer (Model 290 B; Perkin-Elmer Corp., Norwalk, Conn.).

Results. The results of calcium and magnesium measurements in serum and tear fluid are summarized in Table I. The serum calcium level of the control group was 9.83 ± 0.7 mg./100 ml.; of the hypercalcemia group, 13.43 ± 1.43 mg./100 ml.; and of the hypocalcemia group, 7.03 ± 0.07 mg./100 ml. The tear calcium levels, were 2.82 ± 0.6, 2.56 ± 0.42, and 2.76 ± 0.23 mg./100 ml., respectively.

The serum magnesium level of the control group was 2.2 ± 0.3 mg./100 ml. and of the hypercalcemia group 2.4 ± 0.2 and that of the hypocalcemia group was slightly decreased to 1.8 ± 0.09 mg./100 ml.

Discussion. Uotila et al. measured the tear calcium level of normal subjects and found no apparent correlation between tear and serum calcium measurements. The findings of the present study indicates that tear calcium level has no diagnostic importance in patients with systemic diseases which alter the serum calcium. In both groups there was a significant difference between calcium and magnesium concentrations, suggesting that these two ions share, or compete for, a common transport mechanism.

The concentration of serum magnesium is slightly decreased in hyperparathyroidism and falls after parathyroidectomy as was reported elsewhere. Increased loss of magnesium in the urine of patients with hyperparathyroidism is presumably due to the effect of the increased tubular load of a divalent cation due to hypercalcemia. No such effect is documented in tears.

Key words: electrolyte, human tears, hypercalcemia, hypocalcemia.

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REFERENCES


Na⁺-K⁺ and HCO₃⁻ ATPase activity in retina: dependence on calcium and sodium. BARRY S. WINKLER AND MICHAEL V. RILEY.

With the use of homogenates of whole rat retina, the activities of Na⁺-K⁺- and HCO₃⁻-stimulated