An Ultracentrifugal Analysis of Synovial Fluid

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SUMMARY

Synovial effusions aspirated from patients with rheumatoid disease or osteoarthritis or following trauma have been fractionated by equilibrium sedimentation in caesium chloride density gradients. The relative concentrations of hyaluronate and chondroitin sulphate have been quantitated and compared to the respective concentrations of these substances in normal ox synovial fluid. Chondroitin sulphate concentration was significantly raised in rheumatoid arthritis and osteoarthritis; there was a less marked drop in hyaluronate concentration. Cartilage damage appears to be associated with high concentrations of chondroitin sulphate in the synovial fluid.


The presence of small quantities of chondroitin sulphate in synovial fluid has been confirmed by Silpananta et al.1 As a result of the marked difference in density between hyaluronate and chondroitin sulphate, it was possible to separate and quantitate the two polysaccharides. Separation was achieved by equilibrium sedimentation in a caesium chloride density gradient.

The chondroitin sulphate in synovial fluid can only have originated in articular cartilage. Mankin has shown the half-life of cartilage protein-polysaccharide to be of the order of 8 days; chondrocytes continually replace matrix constituents which diffuse out into the synovial fluid or are enzymatically degraded. It has been suggested elsewhere that the integrity of the hyaluronic molecule and its concentration may be important in resisting the rapid diffusion of protein-polysaccharide from cartilage, and that one might expect higher than normal concentrations of chondroitin sulphate in dilute synovial effusions. Protein-polysaccharides might also be lost from articular cartilage as a result of the action of proteolytic enzymes released into rheumatoid joints.

The purpose of this study was to determine the relative concentrations of hyaluronate and chondroitin sulphate in synovial effusions.

MATERIALS AND METHODS

Synovial fluid was aspirated from the knee joints of 26 patients with synovial effusions: 14 patients had rheumatoid arthritis without significant radiological features of joint destruction; 6 had rheumatoid arthritis with joint destruction; 4 had osteoarthritis; 1 had a post-traumatic effusion and 1 had a torn meniscus. The specimens were centrifuged at 22 000 × G for 30 minutes to remove particulate matter before being stored at −15°C. When sufficient specimens had been collected they were thawed and duplicate analyses performed. Total uronic acid analyses1 were performed on aliquots of each specimen. Equilibrium sedimentation of each specimen was carried out as described by Silpananta et al.1 with the following modifications. Ultracentrifuge tubes (2 ml) in appropriate adaptors were used in a Spinco type 65 angle rotor. Synovial fluid (0.15 ml) was added to 23.5 ml caesium chloride solution and dialysed to give a final density of 1.67 g/ml. A 2-ml aliquot of the solution was used for the analysis. At the
end of the run, the tube contents were fractionated as described, and the uronic acid content of each fraction was quantitated. Synovial fluids from 3 apparently normal oxen were obtained, for comparison.

**TABLE I. EQUILIBRIUM SEDIMENTATION OF SYNOVIAL EFFUSIONS IN CAESIUM CHLORIDE DENSITY GRADIENTS**

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Chondroitin sulphate</th>
<th>Hyaluronate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatoid arthritis</td>
<td>85·8</td>
<td>44·6</td>
</tr>
<tr>
<td>Rheumatoid arthritis with joint destruction</td>
<td>145·0</td>
<td>17·6</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>120·6</td>
<td>50·6</td>
</tr>
<tr>
<td>Post-traumatic effusion</td>
<td>12·0</td>
<td>23·8</td>
</tr>
<tr>
<td>Torn meniscus</td>
<td>112·8</td>
<td>54·8</td>
</tr>
<tr>
<td>Normal (ox)</td>
<td>18·0</td>
<td>85·6</td>
</tr>
</tbody>
</table>

* The mean concentration of hyaluronate and chondroitin sulphate in the effusions are represented as micrograms per 0·1 ml of synovial fluid.

**RESULTS**

The average concentration of chondroitin sulphate in ox synovial fluid is 18·0 µg/0·1 ml and that of hyaluronate 85·6 µg/0·1 ml. The mean concentration of chondroitin sulphate in synovial fluids taken from rheumatoid joints without appreciable radiological evidence of joint destruction was 85·8 µg. In the group of rheumatoid joints with significant radiological changes the mean concentration was 145·0 µg, and in osteoarthritic joints 129·6 µg. The post-traumatic effusion contained 120 µg/0·1 ml and the fluid taken at menisectomy 112·8 µg/0·1 ml respectively. The mean concentration of hyaluronate in the effusions were all lower than in ox synovial fluid.

**CONCLUSIONS**

Those effusions associated with joint damage have the highest concentrations of chondroitin sulphate. Even a torn meniscus appears to shed a considerable quantity of chondroitin sulphate into the synovial fluid. The lowest concentrations of hyaluronate are found in those patients with rheumatoid arthritis and significant joint destruction; the effusion in these joints contained the most chondroitin sulphate. This suggests that a fall in hyaluronate concentration may permit a more rapid diffusion of chondroitin sulphate from articular cartilage. Other possible explanations are that severely damaged joints may be unable to produce sufficient hyaluronate, or that the high concentration of chondroitin sulphate in the synovial fluid may resist the diffusion of hyaluronate into the joint.

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**REFERENCES**


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**Invasive Amoebiasis: Circulating Antibody Levels by Latex Agglutination Test**

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**SUMMARY**

Sera from 97% of 200 patients with invasive amoebiasis and 15% of 100 general medical patients gave positive results when quantitatively tested with a latex agglutination test. All degrees of agglutination were observed and no correlation was found between latex agglutination results and non-invasive amoebae in the gut. Follow-up sera obtained over a period of 6 months from 8 patients showed reactions of varying intensity. It was concluded that individual variation in antibody production was such that the test could not be used as an index of severity but should simply be read as either positive or negative.


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Entamoeba histolytica is an organism which gives rise to easily detectable specific antibody when human tissues are invaded and several serological tests have thus been devised. Most are capable of quantitation by dilution of the serum to the point at which antibody activity is no longer detectable and the titre thus obtained reflects the level of circulating antibody in the subject being tested. A range of antibody levels is observed in any population where invasive amoebiasis is endemic. Queries arising from previous publications, and experimental material provided to workers in other parts of the world suggest that a low titre often raises doubts when making a differential diagnosis as one is tempted to correlate the intensity of the observed reaction with the severity of the disease being considered.

This study seeks to show the relationship between the various stages of invasive amoebiasis, both before and