Adenosine deaminase activity in rheumatoid pleural effusion

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SUMMARY  The activity of adenosine deaminase was studied in nine cases of rheumatoid pleural effusion, showing an increase in enzyme activity in all. Rheumatoid arthritis seems unique, however, as it cannot be differentiated from pleural tuberculosis on the basis of this test. Selective increase of adenosine deaminase in both conditions is attributed to stimulation of T lymphocytes in the pleural fluid.

Key words: nucleoside deaminases, arthritis (rheumatoid), tuberculosis (pleural).

In previous studies we confirmed a sensitivity of 100% and a specificity of 95% for the assay of adenosine deaminase (EC 3.5.4.4.) enzyme activity in early diagnosis of tuberculous pleuropericardial, peritoneal, and meningeal effusions. The adenosine deaminase increase has been attributed to the maturative stage or degree of stimulation of T lymphocytes as a response of cell mediated immunity to mycobacterial antigens.

In our first study we observed a case of rheumatoid pleural effusion which exceptionally showed adenosine deaminase increase in the pleural fluid. This observation was later confirmed in two other cases. Rheumatoid pleural effusion seemed to be unique as it could not be differentiated from pleural tuberculosis on the basis of this test.

This prospective report evaluates the adenosine deaminase test in patients with pleural effusion caused by rheumatoid arthritis.

Patients and methods

We studied the activity of adenosine deaminase enzyme in the pleural fluid of 586 patients with pleural effusion who were admitted to the hospital over a period of five years. The pleural effusions were grouped according to the definite diagnosis as follows: group I, tuberculous (170 cases); group II, neoplastic (126 cases); group III, parapneumonic (76 cases); group IV, miscellaneous (60 cases); group V, non-specific effusions (45 cases); group VI, transudates (100 cases); and group VII, rheumatoid pleural effusions (nine cases).

In this report we have focused our attention exclusively on the nine patients with rheumatoid pleural effusion in group VII. Patients were included in a previously established prospective protocol. This protocol evaluated clinical data (medical history and physical examination), chest roentgenograms, tuberculin test (5 IU of purified protein derivative of tuberculin), and results of a series of diagnostic procedures such as (a) chemistry profile of pleural fluid (protein, glucose, lactic dehydrogenase, and adenosine deaminase activity); (b) tests for rheumatoid arthritis (latex agglutination and Waaler-Rose test); (c) qualitative and quantitative cytology of the pleural fluid in regard to the ratio of lymphocytes to polymorphonuclear leukocytes; (d) cultural identification of micro-organisms from pleural fluid (Ziehl-Neelsen stain, cultures in agar and Löwenstein-Jensen medium); and (e) histological examination of pleural biopsy specimens (Abrams' needle).

Determination of adenosine deaminase in the pleural fluid was carried out by the colorimetric method of Galanti and Giusti. A diagnosis of rheumatoid pleural effusion was made by exclusion of all other causes of pleurisy in patients with
rheumatoid arthritis diagnosed according to the
criteria of the American Rheumatism Association.8

The Mann–Whitney test was used to analyse the
data for statistical significance.

Results

Eight men and one woman with an average age of
55.4 years (range 33–68) were studied. In all cases
pleural effusion had been preceded by characteristic
clinical manifestations of rheumatoid arthritis (RA)
for a mean period of 5.5 years, though in one case
pulmonary involvement occurred at the onset of the
disease. In seven cases pleural effusion was
accompanied by fever and swollen, painful joints. Tests for
rheumatoid factor were positive in eight of nine
patients; eight patients had subcutaneous nodules.

Pleural effusion was left sided in four patients and
right sided in the other five. In two patients pleural
effusion occurred in association with nodular
changes in the pulmonary parenchyma. The tuberculin
test was positive (diameter of skin thickness
>10 mm read 48 hours later) in five cases.

The effusion was invariably an exudate (mean
protein content 55.8 g/l) with low glucose
concentration (mean 0.56 mmol/l, range 0.02–2.11 mmol/l)
and very high lactic dehydrogenase (LDH) levels
(mean 2991 IU/l, range 1275–5290 IU/l). In four
cases a glucose load test did not produce significant
changes from baseline in glucose concentration in
the pleural fluid. Rheumatoid factor was positive in
all cases.

Cytological examination showed an exudative
effusion with predominant polymorphonuclear cells
in six cases and predominant lymphocytosis in the
remaining three. Pleural biopsy confirmed the
presence of non-specific pleuritis in seven cases,
pleural fibrosis with carbon dust and silica deposits in
one case, and fibrinopurulent pleuritis in the
other case.

In all patients the activity of adenosine deaminase
enzyme was >43 U/l (the lower value found in the
group of tuberculous pleural effusions); mean (SD)
enzyme values were 77.55 (15.62) U/l (range 52–97
U/l).

Clinical and laboratory data of the nine patients
with rheumatoid pleural effusions are summarised in
Table 1.

In patients with tuberculous and rheumatoid
pleuritis the enzyme value was significantly higher
than in the rest of the groups (p<0.001). The
differences in adenosine deaminase activity between
the groups of patients with tuberculous and rheuma-
toid conditions, and among the patients of groups II
to V were not significant. Table 2 gives the
adenosine deaminase activity in the different
groups; individual results are shown in Fig. 1.
Table 2 Results of the adenosine deaminase (ADA) test in the pleural fluid (median values)

<table>
<thead>
<tr>
<th>Group</th>
<th>Aetiology of effusion</th>
<th>Cases (n)</th>
<th>ADA (U/I)</th>
<th>Range (U/I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Tuberculous</td>
<td>170</td>
<td>83*</td>
<td>43–190</td>
</tr>
<tr>
<td>II</td>
<td>Neoplastic</td>
<td>126</td>
<td>8</td>
<td>0–54</td>
</tr>
<tr>
<td>III</td>
<td>Parapneumonic</td>
<td>76</td>
<td>14</td>
<td>0–83</td>
</tr>
<tr>
<td>IV</td>
<td>Miscellaneous</td>
<td>60</td>
<td>5</td>
<td>0–38</td>
</tr>
<tr>
<td>V</td>
<td>Non-specific</td>
<td>45</td>
<td>8</td>
<td>0–45</td>
</tr>
<tr>
<td>VI</td>
<td>Transudate</td>
<td>100</td>
<td>0</td>
<td>0–17</td>
</tr>
<tr>
<td>VII</td>
<td>Rheumatoid</td>
<td>9</td>
<td>80*</td>
<td>52–97</td>
</tr>
</tbody>
</table>

*Adenosine deaminase activity (mean (SD) was significantly higher than in the rest of the groups (p<0.001).

Fig. 1 Individual distribution of adenosine deaminase activity in the different groups of exudate pleural effusion: group I, tuberculous pleuritis; group II, neoplasms; group III, parapneumonic pleuritis; group IV, miscellaneous; group V, non-specific pleuritis; group VII, rheumatoid pleuritis.

Discussion

Pleural effusion occurs in 3–5% of patients with rheumatoid arthritis with or without nodular changes in the pulmonary parenchyma or on the pleural surface. Patients are most often men, usually having subcutaneous nodules. Pulmonary involvement in the form of pleural effusion is commonly preceded by several years of characteristic clinical manifestations of active disease, though it may appear before or together with the onset of rheumatoid arthritis.

A distinguishing characteristic of rheumatoid pleural effusions is their low glucose concentration (<2.22 mmol/l) due to impaired glucose transport into the pleural fluid or increased utilisation by pleural cells, and high LDH concentrations. Also, the pleural fluid pH and complement level are low, tests for rheumatoid factor are positive, and crystals of cholesterol are often present.

Pleural fluid has a turbid appearance because of increased numbers of polymorphonuclear leucocytes and mononuclear cells. Cytoplasmic inclusions in polymorphonuclear cells, containing ingested immune complexes (RA cells), are also observed. Empyema may complicate the course of rheumatoid pleural effusion, and is the result of direct infection of the pleural space due to broncho-pleural fistulas from necrotic subpleural rheumatoid nodules.

In rheumatoid pleurisy 'blind pleural biopsies' most often show non-specific inflammatory changes, and in most cases the purpose of the biopsy is to exclude other diseases. Specific rheumatoid lesions in the pleura corresponding to those found in subcutaneous rheumatoid nodules are seldom seen. Recently, Faurschou et al described a characteristic thoracoscopic picture of a gritty, granular parietal pleural surface in nine patients with rheumatoid pleurisy. Characteristic changes were identified histopathologically in material obtained by biopsy (a pseudostratified layer of epithelioid cells and small papillae containing branching capillaries).

Rheumatoid pleurisy is a diagnosis reached by exclusion. Although the assay of adenosine deaminase enzyme activity in pleural fluid offers a supplement to other laboratory data, increased enzyme activity is also found in tuberculous pleural effusion. Rheumatoid arthritis seems to be the unique entity that cannot be differentiated from pleural tuberculosis on the basis of this test. The abundance of polymorphonuclear cells in rheumatoid pleural effusion may account in part for the adenosine deaminase increase. On the other hand, the predominance and degree of stimulation of T helper/inducer lymphocytes as a response of cell mediated immunity in rheumatoid and tuberculous pleural effusions may explain the selective increase of adenosine deaminase activity in both conditions.

In conclusion, the biochemical changes in the pleural fluid from our patients did not differ from
those described in cases of tuberculous pleurisy. Clinical and immunological features of pleural effusion in rheumatoid arthritis are highly diagnostic, however, and offer an important supplement to other laboratory data. Furthermore, pleural biopsy may confirm the diagnosis, especially when pathognomonic lesions of pleural tuberculosis are found.

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