CSF Electrophoresis: An Adaptation Using Cellulose Acetate for the Identification of Oligoclonal Banding

D. W. PATY, M. DONNELLY AND M. E. BERNARDO

SUMMARY: An adaptation of cellulose acetate electrophoresis for studying concentrated cerebrospinal fluid is described. Two hundred and twenty-one patients have been studied, and the specificity for multiple sclerosis and sub-acute sclerosing panencephalitis is discussed. This has been positive for oligoclonal banding (OB) in 79% of patients with clinically definite multiple sclerosis.

RESULTS:

A number of studies in the literature in the last 10 years have shown that the cerebrospinal fluid (CSF) proteins in multiple sclerosis (MS) have a characteristic qualitative change in the gamma globulin region (Link & Muller, 1971). This characteristic change has been referred to as the oligoclonal banding (OB) pattern of the CSF proteins. Most studies of this phenomenon have used agar gel or agarose preparations. We have adapted cellulose acetate electrophoresis with photographic enhancement for increasing contrast. The use of cellulose acetate rather than agar gel will make this procedure available to any clinical biochemistry laboratory that is now doing serum electrophoresis using cellulose acetate strips. Since this procedure has an 80% to 95% diagnostic accuracy for multiple sclerosis, it will be an important procedure to have in any general hospital laboratory.

MATERIALS AND METHOD:

Patients:

Two hundred-twenty-one patients were studied. These patients came from the wards of the University Hospital, London, Ontario. Patients with clinically definite multiple sclerosis were identified according to Schumacher criteria (Schumacher, et al., 1965).

Methods; Laboratory:

CSF samples were centrifuged to remove debris. Proteins were concentrated x100 by use of a minicon B 15 concentrator (Amicon, Lexington, Mass.). Cellulose acetate electrophoresis was performed using a tris-barbital-sodium barbital buffer at PH 8.8 for 40 minutes at 200 volts. The strips were stained with ponceau S, de-
positive for OB. This gives an 89% positive rate in technically satisfactory studies. There is a 79% overall positive rate for all MS patients studied.

One hundred-eleven (111) patients with suspected MS have been studied. Forty-two (42) of these were positive for OB (38%).

DISCUSSION:

The diagnosis of multiple sclerosis is generally a clinical one. Most investigators would recognize the Schumacher criteria (Schumacher, et al., 1965), for making a diagnosis of clinically definite MS. For many years it has been known that there is an increased percentage of gamma globulin in the cerebrospinal fluid protein in patients with MS (Kabat, Landow & Moore, 1942). The incidence of this quantitative abnormality is thought to be about 70%. The electrophoretic study of cerebrospinal fluid proteins has now shown that somewhere between 80 and 95% of Multiple Sclerosis patients probably have a qualitative change in the CSF proteins, and this is now referred to as oligoclonal banding (OB).

Most studies of cerebrospinal fluid for OB have utilized agar or agarose as the medium for the electrophoresis. Since most hospital laboratories have the ability to perform serum electrophoresis using cellulose acetate strips, we thought we would try to adapt cellulose acetate for the study of CSF proteins as well. This procedure has proved to be relatively simple, and reliable. Visual inspection of the photographic transparency clearly shows an oligoclonal banding (OB) pattern in a majority of patients with clinically definite MS. This should now become a routine study for the investigation of patients with suspected MS. This combination of relatively simple electrophoresis techniques with photographic enhancement of image could make the search for oligoclonal banding in the CSF more widely available.

CSF changes of OB are not yet an accepted criteria for making a clinical diagnosis of MS. Clinical criteria of typical history with dissemination of lesions in time and space will remain the mainstay of the diagnosis. With greater availability, CSF electrophoresis should provide substantiating support...
TABLE 1
CSF ELECTROPHORESIS IN 221 PATIENTS

<table>
<thead>
<tr>
<th>Patient Category</th>
<th>N</th>
<th># Pos for OB</th>
<th>% Pos for OB</th>
<th>One Band Seen</th>
<th>% With One Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS total</td>
<td>62</td>
<td>49</td>
<td>79%</td>
<td>6</td>
<td>10%</td>
</tr>
<tr>
<td>TS**</td>
<td>55</td>
<td>49</td>
<td>89%</td>
<td>6</td>
<td>11%</td>
</tr>
<tr>
<td>Suspected MS</td>
<td>111</td>
<td>42</td>
<td>38%</td>
<td>13</td>
<td>18%</td>
</tr>
<tr>
<td>Non MS</td>
<td>95</td>
<td>2</td>
<td>2%</td>
<td>20</td>
<td>21%</td>
</tr>
<tr>
<td>SSPE+</td>
<td>2</td>
<td>2</td>
<td>100%</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* OB = Oligoclonal Banding.
** TS = Technically Satisfactory.
+ SSPE = Subacute Sclerosing Panencephalitis.

in making a diagnosis in doubtful cases. The finding of OB in an adult with chronic spinal cord dysfunction, double vision, loss of vision, or incoordination of limb and gait should provide strong support for a diagnosis of MS. Early accurate diagnosis is going to become increasingly important in substantiating clinical investigation, establishing prognosis, and for institution of appropriate therapy when it becomes available.

REFERENCES