Prognostic Significance of CFU-GM and Karyotype Study in 103 Cases of Untreated Nonlymphocytic Leukemia

LI Chong-yu (~,~), WANG Bian-ming (王细胞),
CHEN Yian (陈 燕), SUN Guo-xian (孙国贤)
Research Division of Hematology, Xiehe Hospital, Tongji Medical University, Wuhan

Summary: The colony formation unit of granulo-monocytic progenitor cell (CFU-GM) growth pattern in the form of small clusters in 103 cases of untreated ANLL indicated favorable prognosis. These cases showed higher rate of complete remission, lower mortality rate and longer survival time than those with other three forms of growth patterns. Serial observations on the variations in number of CFU-GM colonies and in ratio of colonies to clusters are helpful in predicting the prognosis of leukemia. It was found that remission rate was not related to karyotype. However, the mortality rate in the patient group with normal karyotype was low, and the survival time was evidently prolonged. Serial studies of abnormal karyotypes can also help to predict the outcome of leukemia and to prove whether remission is achieved. Therefore, the combined study of CFU-GM and karyotype can provide early objective criteria which are more reliable than clinical parameters alone.

Key words: acute nonlymphocytic leukemia, colony formation unit of granulo-monocytic progenitor cell (CFU-GM), karyotype

A number of clinical parameters were used for judging the prognosis of acute nonlymphocytic leukemia (ANLL). However, it is difficult to predict the actual prognosis by the use of only one of the parameters. Colony formation unit of granulo-monocytic progenitor cells (CFU-GM) and chromosome banding technique of human marrow cells, developed in the early 70s, provide a possibility to predict the prognosis of ANLL by analysing the biological properties of leukemic cells. The purpose of the present study was to find out a correlation between serial observations on growth patterns of CFU-GM as well as on karyotypes in vitro and the prognosis of untreated ANLL in 103 cases.

MATERIALS AND METHODS

1. Subjects studied
103 cases of untreated ANLL ranging in age from 14—72 years were studied, among them 15 with M₁, 60 M₂, 15 M₃, 2 M₄, 9 M₅ and 2 M₆.

2. Treatment
Two regimens were used during the period of induction treatment. The first one consisted of a combined chemotherapy. In the second one a high dose of cytosine arabinoside was given. The therapeutic effects were evaluated according to the criteria proposed by the National Workshop on Leukemia.

3. Determination of CFU-GM
The semisolid culture method with
fetus muscle medium was used. It was performed in 269 patients in total.

4. Karyotype preparation

The chromosomes were prepared by the method of trypsin-G-banding.

RESULTS

1. Normal values of CFU-GM

In the normal control group (41 cases) the colonies were found to be 63.86 ± 5.35 in number, large clusters being 17.11 ± 1.64 and small clusters 41.25 ± 2.42 respectively. The ratio of colonies to clusters was 1:1.42 ± 0.04 (mean ± SE).

2. Relationship between remission rate and different clinical parameters

Among 103 patients with ANLL, 32 died or failed to complete the follow-up. Of the remaining 71 patients complete remission (CR) was achieved in 33, partial remission (PR) in 3, and no remission (NR) in 35. There was no significant difference between remission rate and most of the clinical parameters, such as FAB typing, therapeutic regimen, presence of hemorrhage, enlargement of liver, spleen and lymph glands, hemoglobin concentration, white blood cell count, thrombocyte count, number of marrow blasts, etc (P>0.05).

3. Growth patterns of CFU-GM

The pretreatment growth patterns in 103 patients with ANLL were: supernormal type (pattern I) in 2, large clusters (pattern II) in 3, small clusters (or with a small number of colonies; pattern III) in 56, and non-growth (pattern IV) in 12.

4. Growth patterns and prognosis

Follow-up of 79 patients with ANLL revealed that the short-term mortality rate (one month) was the lowest in those with pattern I (X² = 12.101; P<0.01). Further follow-up of 64 patients for half a year yielded the same result (P<0.01; table 1). The chemotherapy in 71 patients with ANLL showed an effectiveness rate of 64.78%. Among the 71 patients it was the highest in patients with pattern I (P<0.01; table 2).

5. Growth patterns and survival time

The survival time of the patients with pattern I and II (4 cases) was 58.5 ± 26.24 days; that of the patients with pattern III (24 cases), 261.52 ± 54.89 days; and that of the patients with pattern IV (28 cases), 124.36 ± 37.06 days. The patients with pattern I were proved to have the longest survival time (F = 3.373; P<0.05).

6. Serial observations on CFU-GM and prognosis

During the period of induction treatment two different growth patterns were seen (24 cases): (1) The growth pattern was keeping unchanged in 8 cases (2 with pattern I and 6 with pattern IV), all of which belonged to the NR group and died within a short period of time; (2) Early colony formation was seen in 16 cases (all with pattern I), of which 13 achieved CR and 3 PR. The length of time from the beginning of colony formation to the clinically identified CR was averagely 21 days (0—54). The number of colonies and the ratio of colonies to clusters at CR in patients with ANLL were compatible with normal values (P>0.05). The growth patterns of 8 patients in relapse resembled those before treatment.

---

**Table 1. Mortality rate of 64 patients (half a year)**

<table>
<thead>
<tr>
<th>Growth pattern</th>
<th>Cases</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I + I</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>I</td>
<td>32</td>
<td>43.7</td>
</tr>
<tr>
<td>III</td>
<td>28</td>
<td>85.7</td>
</tr>
</tbody>
</table>

**Table 2. Effectiveness rate of chemotherapy in 71 patients with different growth patterns**

<table>
<thead>
<tr>
<th>Growth pattern</th>
<th>Cases</th>
<th>Effectiveness (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I + I</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>I</td>
<td>38</td>
<td>73.6</td>
</tr>
<tr>
<td>IV</td>
<td>29</td>
<td>24.1</td>
</tr>
</tbody>
</table>