Survival of Radiochromium-labeled Platelets in Thrombocytopenias

By Yves Najean, Nicole Ardaillou, Jacques Caen, Marie-José Larrieu and Jean Bernard

Various isotopic methods have been used to label platelets in an effort to clarify the pathogenesis of the thrombocytopenias. The suitability of radiochromium as a platelet label has been well established. The present study represents an attempt to correlate radiochromate platelet survival with the clinical picture in thrombocytopenic patients, as well as with the effects of treatment and the results of certain immunologic studies. In addition, data are presented concerning the correlation between the sites of platelet destruction with the subsequent therapeutic value of splenectomy.

Methods and Materials

Radiochromium labeling of platelets was accomplished as previously described. Sterilized siliconized glassware was used. Centrifugation procedures were performed at 4 C. One hundred ml. of blood was collected into ACD solution (citric acid 1.66 Gm., sodium hydroxide 0.60 Gm., glucose 3 Gm., distilled water 100 ml.) to give a final anticoagulant concentration of 0.33 Gm. per cent of citric acid. Platelet-rich plasma was obtained by centrifugation for 20 minutes at 800 rpm (55 g); the supernatant was then re-centrifuged for 30 minutes at 3000 rpm (1200 g) to obtain a platelet button. The platelet sediment was suspended in 20 ml. of Tyrode’s solution, 0.2 or 0.3 mc. of sodium chromate (specific activity greater than 5 mc./mg.) were added, and the mixture was incubated for 1 hour at room temperature. Additional Tyrode’s solution was then added to give a final volume of 60 ml., and the platelets were again sedimented as before. The platelets were finally suspended in 20 ml. of Tyrode’s solution containing EDTA (final concentration: 3 per cent). An aliquot of this suspension was kept for a radioactive standard. The entire labeling procedure was accomplished within 3 hours.

The platelets used for injection were about 25 per cent contaminated with unbound radiochromium. This fraction was not removed by further washing as such manipulation caused undue platelet damage. However, previous studies showed that the unbound chromium did not tag other cells in the recipient, and it quickly disappeared from the plasma. To determine the amount of radiochromium bound to platelets, an aliquot of the platelet suspension was removed, the platelets washed 3 times and counted. A few erythrocytes were present in the platelet sediment, but these contributed less than 5 per cent of the platelet radioactivity, as determined by studies on isolated red cells of recipient subjects. The injected material contained about 5-15 per cent of the initial chromium and amounted to about 20-50 μc. of radioactivity.

Following injection of the platelet suspension, blood was collected from the recipient daily. A 10 ml. aliquot was used to obtain “separate” preparations of the platelets, cell-free plasma, and plasma-free erythrocytes. These separate preparations were obtained in the following manner: 2 ml. of a 5 per cent solution of high molecular weight dextran was added to 10 ml. of blood to accelerate red cell sedimentation, which was accomplished.
in one-half hour; the platelet rich supernatant was removed and platelets isolated by centrifugation. The results were highly reproducible, about 80 per cent of the total blood platelets being easily obtained by this method. Each of the fractions obtained was evaluated for radioactivity on the same day in a well-type scintillation counter. The background was usually about 20 cpm and the statistical error of counting was always less than 10 per cent. The radioactivity of the platelets was expressed as per cent of the total radioactivity injected. The calculations were based on the patient's total theoretical blood volume according to the following formula: percentage of platelet-bound radioactivity remaining in the circulation = radioactivity of platelet button of 1 ml. of blood × yield of separation (usually 80 per cent) × theoretical blood volume ÷ total injected platelet-bound radioactivity. In normal subjects, the percentage of the platelets accounted for in this manner, 20 hours after injection, varied from 20 to 50 per cent of the total quantity injected.

Measurements were continued until either the platelet radioactivity was not significantly above background, or until at least 7 days from the time of injection. In the latter case, the survival time was computed by extrapolation with the possibility that a 1-day error might prevail. Thus, the normal curve shown in figure 1 represents an estimate survival time of 9 or 10 days.

In normal subjects, the slope obtained by this method is not a single exponential; usually the curves appear to be the sum of an exponential and a linear component. The importance of the exponential component varies from one normal subject to another. It was not possible to determine whether the exponential component was due to an elution of the Cr51 label from the cell or to random destruction or utilization.

The maximum level of circulating platelets could not be accurately determined since it occurred at a variable time following injection, i.e., between 4 to 36 hours. Platelet production was estimated by means of the following formula:

\[
\frac{Ps}{Pn} = \frac{Sn}{Ss} \times \frac{P_{-s}}{P_{-n}},
\]

where \( \frac{Ps}{Pn} \) = ratio of subjects' platelet production over “normal” platelet production; \( \frac{Sn}{Ss} \) is the ratio of the normal survival (9 days) over patient's determined platelet survival; and \( \frac{Ps}{P_{-s}} \) is the ratio of the subject's platelet count to the normal platelet count (arbitrarily taken as 300,000/cu. mm.). The accuracy of this index is subject to criticism on two main counts: the normal platelet count (Pn) shows important variation from one normal subject to another (250,000 to 350,000/cu. mm. in this laboratory); and the exact value of the patient’s platelet survival time (Ss) is subject to error, particularly in those patients with severe thrombocytopenia in whom isologous platelets must be used, when the survival time of these platelets are different from those of the patient. We estimate a range of error of approximately ± 50 per cent in patients with low survival time of platelets, and ± 20 per cent in patients with a survival time of more than 3 days.

To determine the sites of platelet sequestration, radioactivity was measured over the splenic, hepatic and precordial areas. We used a crystal 2 inches in diameter with mobile lead screens in order to obtain good collimation. An attempt was made to use the same areas in each patient and to closely approximate comparable areas among the various patients. In successive experiments in the same subject, results were quite reproducible. Determinations were made an hour after injection and at daily intervals thereafter. Only patients without clinical splenomegaly were utilized in this study; splenic sequestration was assumed when the ratio of radioactivity in spleen/heart increased as the liver/heart ratio remained constant.

In order to compare results of platelet survival and certain immunologic studies, antiglobulin consumption tests were made by Dr. J. Dausset in most of the patients simulta-
neously with the isotopic test. Generally two tests were performed: the "indirect test" utilizing the patient's serum and, if possible, the "direct test" utilizing the patient's platelets.21,22,41,54,56

As shown in table 1, 280 patients were studied: of these 236 were thrombocytopenic either at the time of the study or prior to it.

**RESULTS**

**Platelet Survival Studies**

*Control subjects:* As shown in table 2, using this technic, the average platelet survival time in normal subjects was 9 days; similar results were obtained with either homologous or autologous platelets. The findings also confirm the observation that shortened homologous platelets may occur in the absence of demonstrable platelet antibodies.7,17,20 One woman with a normal platelet count and a history of five transfusions and one delivery gave a survival time of
Table 1.—Cases Studied by the Method of Platelet Labeling with Radiochromium in Vitro

<table>
<thead>
<tr>
<th></th>
<th>Number of Cases</th>
<th>Auto(A) - or Homo(H) - Transfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>17</td>
<td>A</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>H</td>
</tr>
<tr>
<td>ITP without any treatment (less than 120,000 platelets/cu.mm.)</td>
<td>85</td>
<td>H (73) - A (12)</td>
</tr>
<tr>
<td>ITP during steroid treatment</td>
<td>39</td>
<td>H or A</td>
</tr>
<tr>
<td>ITP after splenectomy</td>
<td>30</td>
<td>H or A</td>
</tr>
<tr>
<td>ITP after spontaneous remission (complete or incomplete)</td>
<td>39</td>
<td>H or A</td>
</tr>
<tr>
<td>ITP with hemolytic anemia</td>
<td>5</td>
<td>H or A</td>
</tr>
<tr>
<td>Lupus</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>Thrombocytopenia with splenomegaly</td>
<td>10</td>
<td>H or A</td>
</tr>
<tr>
<td>Other thrombocytopenias</td>
<td>20</td>
<td>H or A</td>
</tr>
<tr>
<td>von Willebrand's disease and thrombocytopenias</td>
<td>9</td>
<td>A</td>
</tr>
<tr>
<td>Thrombocytosis (after splenectomy or myeloid chronic leukemia)</td>
<td>5</td>
<td>H or A</td>
</tr>
<tr>
<td>Various diseases</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td><strong>Total number</strong></td>
<td><strong>280</strong></td>
<td></td>
</tr>
</tbody>
</table>

less than 1 day; on the other hand, another patient gave normal survival figures despite 15 transfusions and three deliveries. Thus, although the same subject given multiple platelet transfusions may present progressively reduced platelet survival, there is poor correlation between the number of possible immunizations and platelet survival figures. No variations were noted which could be attributed to age or sex.

Untreated ITP: Studies were performed on 85 patients with idiopathic thrombocytopenic purpura (ITP) whose platelet counts were below 120,000/cu. mm. and who had adequate or increased megakaryocytes in the marrow. As shown in table 3, and figure 2, there was good correlation between the platelet count and the platelet survival time; acute and chronic cases gave similar results. That is, the more depressed the circulating platelet concentration, the shorter the platelet survival time.

Platelet production in ITP patients was between 0.5 and 2 times the normal value, with a mean of 1.3. Although the computation of platelet production from survival time is admittedly approximate, particularly in patients with counts below 50,000/cu. mm. and survival figures of 1.5 days or less, these figures do not show markedly increased production in these cases of ITP. This was the case whether or not the disease was of recent or long duration and irrespective of the degree of platelet depression.

Treated ITP: Thirty-nine patients having ITP were studied during administration of prednisone (0.5 to 2 mg./Kg.) In those patients who responded with increased platelet levels, there was a corresponding increase in platelet survival time. No differences in platelet production could be demonstrated relative to the normal; the changes found were within the range of experimental error (values from 0.5 to 2 times the normal rate, mean 1.4).
Table 2.—Survival of Platelets in Normal Subjects

<table>
<thead>
<tr>
<th>Studied Subjects</th>
<th>Auto(A)- or Homotransfusion</th>
<th>Number of Cases</th>
<th>Extreme Values</th>
<th>Mean Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>A</td>
<td>17</td>
<td>7–11</td>
<td>9.2 days</td>
</tr>
<tr>
<td>Control</td>
<td>H</td>
<td>14</td>
<td>7–11.5</td>
<td>9 days</td>
</tr>
</tbody>
</table>

Table 3.—Correlation between the Platelet Count and the Survival Time in ITP

A. Evolutive Stage

<table>
<thead>
<tr>
<th>Number of Subjects</th>
<th>Rate of Platelets 10^9/cu.mm.</th>
<th>Used Platelets</th>
<th>Survival of Platelets (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>30–55 (m:40)</td>
<td>homotransfusion</td>
<td>1.0 days</td>
</tr>
<tr>
<td>18</td>
<td>60–80 (m:74)</td>
<td>homotransfusion</td>
<td>1.7 days</td>
</tr>
<tr>
<td>13</td>
<td>90–120 (m:96)</td>
<td>homotransfusion</td>
<td>2.4 days</td>
</tr>
<tr>
<td>7</td>
<td>90–120 (m:102)</td>
<td>autotransfusion</td>
<td>2.6 days</td>
</tr>
</tbody>
</table>

B. Complete or Incomplete Remission

<table>
<thead>
<tr>
<th>Number of Subjects</th>
<th>Mode of Remission</th>
<th>Rate of Platelets 10^9/cu.mm.</th>
<th>Used Platelets</th>
<th>Mean of Survival of Platelets (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>corticotherapy</td>
<td>100–200 (m:160)</td>
<td>homotransfusion</td>
<td>4.1</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>100–200 (m:160)</td>
<td>autotransfusion</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>&gt; 200 (m:260)</td>
<td>homotransfusion</td>
<td>6.2</td>
</tr>
<tr>
<td>9</td>
<td>—</td>
<td>&gt; 200 (m:250)</td>
<td>autotransfusion</td>
<td>6.2</td>
</tr>
<tr>
<td>7</td>
<td>splenectomy</td>
<td>100–200 (m:140)</td>
<td>homotransfusion</td>
<td>3.4</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>100–200 (m:150)</td>
<td>autotransfusion</td>
<td>4.3</td>
</tr>
<tr>
<td>9</td>
<td>—</td>
<td>&gt; 200 (m:530)</td>
<td>homotransfusion</td>
<td>7.3</td>
</tr>
<tr>
<td>3</td>
<td>—</td>
<td>&gt; 200 (m:600)</td>
<td>autotransfusion</td>
<td>8.5</td>
</tr>
<tr>
<td>7</td>
<td>spontaneous remission</td>
<td>100–200 (m:160)</td>
<td>homotransfusion</td>
<td>5.0</td>
</tr>
<tr>
<td>8</td>
<td>—</td>
<td>100–200 (m:130)</td>
<td>autotransfusion</td>
<td>5.3</td>
</tr>
<tr>
<td>10</td>
<td>—</td>
<td>&gt; 200 (m:260)</td>
<td>homotransfusion</td>
<td>7.4</td>
</tr>
<tr>
<td>14</td>
<td>—</td>
<td>&gt; 200 (m:240)</td>
<td>autotransfusion</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Data were obtained from 30 patients who underwent splenectomy. Six of these patients had no favorable response to splenectomy (platelet counts less than 70,000/cu. mm.). In each of these six cases, following splenectomy we found a short survival time of foreign platelets (less than 2 days). Twenty-four patients had a favorable response to splenectomy (platelet count more than 150,000/cu. mm.). In three of these cases we found a shortened survival time of foreign platelets; however, these patients received several transfusions which made isoimmunization possible. In the remaining 21 cases, following splenectomy, the platelet survival time of foreign platelets (11 experiments) or patient's own platelets (10 cases) was more than 4 days. In these cases the degree of platelet increase and the improvement in survival time paralleled each other. In several patients splenectomy was followed by supranormal platelet counts. In this group there was no instance of prolonged platelet survival, suggesting that increased platelet production was the effective mechanism.

Spontaneous remissions: Platelet survival time was studied in 39 patients after spontaneous recovery. Most of them (24 patients) were children under
PLATELET SURVIVAL STUDIES

Fig. 2.—Correlation between number of platelets and survival time in ITP.

15 years of age. The approximate duration of the remission was 1 month to 2 years at the time of the study.

Restoration of platelet counts to normal was accompanied by normalization of the survival times; in a few patients who presented counts persistently between 100,000 and 200,000/cu. mm., near normal platelet survival times were obtained. Remission was always associated with thrombopoiesis in the normal or even somewhat subnormal range (0.5 to 0.8 the normal range) and thus appeared to be a result of normalization of platelet destruction, apparently as in the splenectomized patients. Two facts were noted in patients with spontaneous or therapeutically induced incomplete remission (platelet counts from 100,000 to 200,000/cu. mm.): the percentage of platelets recovered 20 hours after injection was generally less than in normal subjects (fig. 3); this is in accordance with the observation of other authors.24 The sequestration
of platelets in the liver or in the spleen was significantly higher in these subjects, whereas it was not significant in normal subjects.

**Other thrombocytopenias:** In addition to patients with ITP, other types of megakaryocytic thrombocytopenic purpura were studied. There were five cases of associated thrombocytopenia and severe acquired hemolytic anemia. These patients presented a pattern similar to that of ITP; platelet survival was reduced without augmented thrombopoiesis in contrast to a strikingly increased erythropoiesis, as appreciated by reticulocyte counts and isotopic methods. As in the case of ITP, these patients showed improved platelet survival when remission occurred, as evidenced by normalization of their platelet count. Two patients with disseminated lupus erythematosus had platelet counts between 100,000 and 200,000/cu. mm. Their platelet survival times were modestly shortened.

In 10 patients showing thrombocytopenia associated with splenomegaly (liver cirrhosis with splenomegaly and moderate thrombocytopenia, two
cases of thalassemia major, one case of splenic sarcoma and one case of Gaucher's disease with a platelet count about 100,000/mm\(^3\), platelet production was 0.3–0.9 times the normal value. Since the platelet survival data was normal or only slightly abnormal, it would appear that these patients were in contrast to those previously noted and represented mainly a deficiency in platelet production. In 9 of these 10 patients the studies were performed using the patient's own platelets, thus eliminating the variable reactions of foreign platelets from these studies.

There were 20 patients whose thrombocytopenia resulted from bone marrow failure. These included patients with acute leukemia and those with marrow depression due to chloramphenicol, benzol, Myleran, or of undetermined origin. In these patients, platelet survival was normal when autologous platelets were used (12 cases). Shortened survival times were encountered for homologous platelets only when multiple transfusions appeared to make iso-immunization quite likely. In two case of acute leukemia, the patient's platelets were isolated when their count was still 100,000/mm\(^3\); survival of these platelets was normal (8 and 10 days) despite a simultaneous drop in the patient's platelet count to 30,000/mm\(^3\) as a result of their megakaryocytopenia. Platelet production was reduced to 0–0.4 times normal values.

Most of the thrombocytopenic patients were studied for the presence of antiplatelet antibodies. These studies were kindly performed by Dr. J. Dausset. Among the patients with ITP in relapse, 32 had completely negative results in the direct test on platelets and the indirect test on serum. Eighteen patients showed positive reactions with either or both of these tests. Five patients with positive tests responded to steroid therapy, whereas 13 of the patients with negative tests had steroid-induced remission. There was poor correlation between the presence of platelet antibodies and the response to splenectomy. Of 15 patients who responded to splenectomy, five had positive and 10 had negative serologic tests. A poor response to splenectomy was found in three patients with platelet antibodies and four patients without them. Positive serologic findings were obtained in three of 13 patients with thrombocytopenia resulting from leukemia, cirrhosis and aplastic anemia. In none of the patients could the presence of platelet antibodies be correlated with either the patient's clinical picture or the survival time findings.

**Thrombocytopenias:** There were two patients with thrombocytopenic dystrophy (J. Bernard and J. P. Soulier type) who had platelet counts of approximately 90,000/cu. mm. In these patients the survival times were 1 and 3 days respectively. Normal platelet survival times and normal platelet counts were obtained in three patients with von Willebrand's disease, three with Glanzmann's thrombasthenia and one with a poorly defined thrombocytopenic. Five patients with various forms of thrombocytopenia, including chronic granulocytic leukemia, polycythemia vera and splenectomy for hereditary spherocytosis, had platelet survival times of 8–11 days. Platelet production was estimated to be 2–3 times normal.

**Site of Platelet Destruction**

Attempts to localize sites of platelet sequestration by external body counting
were beset with difficulties. In normal subjects, there was a significant disappearance of labeled platelets within the first half-hour (fig. 4) with sequestration in the liver, spleen and presumably the lungs. This immediate loss could be appreciated by external counting over the precordial area. The curve thus obtained had an initial exponential slope followed by a plateau one-half hour after injection (fig. 4). This immediate loss was probably the result of irreversible damage to some platelets in the process of manipulation and labeling. In an attempt to obviate this difficulty, initial surface counting was accomplished over the hepatic, splenic and precordial areas an hour after platelet injection. The subsequent counting considered the initial values as a reference point to better evaluate the fate of viable platelets. The possibility was considered that the initial distribution of labeled platelets might differ in patients with thrombocytopenic purpura from the normal values. In patients with thrombocytopenic purpura, radioactivity measured over splenic and hepatic areas an hour after the injection of labeled platelets was higher than in normal subjects. After partial or even total cure of thrombocytopenia, the same fact was often noticed.

Duplicate studies performed at different times in selected patients for sites of sequestration were in excellent agreement in 28 patients, good in eight and no patient gave conflicting data. Eleven patients were splenectomized within 3 weeks after isotope studies and in these the localization of radioactivity in the resected spleen agreed with the data obtained by external body counting. In patients whose external counting data had shown hepatic localization, only 10–20 per cent of the injected radioactivity was found in the spleen (four cases), whereas in those who had shown splenic localization, 60–80 per cent of the injected radioactivity was recovered in the spleen (7 cases).

In 98 patients with ITP, there was no relationship between the presence or absence of splenic sequestration and any aspect of the disease, including degree of acuteness, severity and response to steroids. In patients who underwent partial or even complete remission spontaneously or with steroid therapy, no alteration of sequestration pattern (predominance of splenic or of hepatic sequestration) was noted. The persistence of splenic or hepatic localization in some patients suggests that even in the presence of remission, an abnormality remains (fig. 5).

One finding appears to be of interest in that the presence of splenic localization showed good correlation with subsequent response to splenectomy. As shown in table 4, almost all patients with splenic localization responded to splenectomy. Three of these cases were patients with thrombocytopenia and somewhat decreased megakaryocytes in the bone marrow (2–5 per 10,000 nucleated cells). These patients underwent splenectomy solely because of the results from these isotopic tests, showing decreased survival of normal foreign platelets and splenic sequestration of the labeled cells. They obtained complete cure. Results were less certain in the relatively few patients whose splenic localization was less pronounced or absent. This fact suggests that
Integrated radioactivity

Normal subject
Homo-transfusion

background
time (min.)

Fig. 4.—Radioactivity over the precordial area during 30 minutes after injection of Cr$^{51}$-labeled platelets.

the spleen might have several functions in the pathogenesis of ITP, the excessive destruction of the platelets being only one of them.

DISCUSSION AND CONCLUSIONS

Estimation of platelet survival with radiochromium labeling is a technic which compares favorably with other methods, giving platelet life-span in normal subjects of 7–11 days.$^{39,42,47}$ Similar findings have been obtained in subjects who have not developed immunization to platelets with autologous and homologous platelets. Nevertheless, the technic has several serious limitations: (1) autologous studies cannot be effectively performed in patients with platelet counts below about 80,000/cu. mm.; untreated patients with ITP are not suitable candidates for this method. (2) In studies with homologous platelets, misleading results may be obtained in the presence of immune platelet isoantibodies. These antibodies may not be susceptible to detection by serologic technics and their development correlates poorly with the number of previous transfusions or pregnancies.$^{16,18}$ (3) Probably because many platelets are irreversibly damaged during the process of labeling, only about 20–50 per cent of them continue to circulate in normal subjects and even fewer circulate in subjects with thrombocytopenia (5–30 per cent). Survival studies concern only this restricted population.

Despite these limitations, certain conclusions may be drawn from the data obtained in our studies:

1. Thrombocytopenias associated with reduced bone marrow megakaryocytes have normal survival of foreign platelets until isoimmunization de-
Fig. 5.—Determination of platelet sequestration site by external counting. Splenic sequestration (ITP, incomplete spontaneous recovery).

velops. These findings are in accord with those of earlier studies. Investigators who have reported diminished survival in these patients have probably neglected isoimmunization. Thus, as expected, the thrombocytopenia in these patients appears to be due to diminished platelet production.

2. In thrombocytopenia associated with splenomegaly, platelet survival was normal or slightly shortened. Failure of effective platelet production seems to be the decisive factor despite the presence of adequate marrow megakaryocytes. These findings are in conformity with the view that there may be a
Table 4.—Correlation between Site of Cr⁴¹ Sequestration and Late Effect of Splenectomy

<table>
<thead>
<tr>
<th>Splenic sequestration of labeled platelets</th>
<th>Excellent</th>
<th>Incomplete</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic and hepatic sequestration</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Hepatic sequestration</td>
<td>2</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

Splenic factor which depresses bone marrow activity as suggested by earlier investigators. Studies with thrombocythemic patients have confirmed the findings of others that the increased platelet levels represent excessive platelet production rather than prolonged platelet survival.

4. In ITP, the platelet reduction was always the result of increased platelet destruction. All patients in relapse gave striking shortening of the platelet survival time. No patient in the present series showed a normal platelet survival time as did a few reported by Cohen and Gardner. The various types of remission showed normalization of this parameter rather than evidence of increased platelet production. As soon as 7 days following splenectomy, platelet survival was normal. We have not noticed a progressively increased platelet survival, as has been reported previously. In every case, the bone marrow had abundant megakaryocytes but these appeared to be "inert" by morphologic appearance, as well as by their failure to yield augmented platelet production according to the above calculations. This picture is in contrast to that encountered following experimental thrombopheresis which shows increased megakaryocyte counts with platelet production augmented two- to five fold. The megakaryocytic hyperplasia of ITP would thus appear to coincide with megakaryocytic impotence, whereby the agent which damages the circulating platelets may well impair megakaryocytic function as well.

5. Despite the limitations already noted, surface scanning to determine the site of platelet sequestration appeared to be a useful procedure in patients with ITP. The method gave reliable results when repeated in the same subject, and the presence of significant splenic uptake appeared to predict good results from splenectomy. The converse was not found to be true; however, some patients with uncertain splenic localization also responded.

It would thus appear that the radiochromium method of platelet survival determination has limited but definite value in the study of thrombocytopenic patients. It has proved to be of value in clarifying the pathogenesis of the thrombocytopenia and in certain situations it may help in determining the advisability of splenectomy.

SUMMARY

Platelet survival studies were performed by the radiochromium method in 280 patients. Although various types of patients were studied, markedly ac-
Accelerated platelet destruction was encountered only in those with ITP. No thrombocytopenic patient was found with accelerated platelet production and changes in platelet count with therapy reflected corresponding changes in survival. The use of surface scanning showed that patients with significant splenic localization were more suitable candidates for splenectomy than those without this localization.

**Summario in Interlingua**

Studios del longevitáte de plachettas esseva effectuate in 280 patientes per medio del methodo a chromo radioactive. Ben que varie typus de patientes esseva studiate, un marcatamente accelerate destruction del plachettas esseva incontrate solmente in subjectos con idiopathic purpura thrombocytopenic. Un intensificate production de plachettas non esseva trovate in ulle del patientes thrombocytopenic, e alterationes del numeration plachettal in le curso del tharapia reflecteva correspondente alterationes del longevitáte. Le uso del tastage a! superficie monstrava que patientes con significative localisation splenic esseva candidatos plus appropriate pro splenectomia que patientes sin iste localisation.

**ACKNOWLEDGMENTS**

The authors wish to thank Drs. J. Dausset, C. Michaux, L. Schwarzenberg, C. Scialom and Mrs. C. Thorin for their cooperation in this study, and Dr. T. H. Spaet and Dr. H. S. Winchell for aid in preparation of the manuscript.

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Survival of Radiochromium-labeled Platelets in Thrombocytopenias

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