CHANGES IN SERIAL PLATELET COUNTS FOLLOWING MASSIVE BLOOD TRANSFUSION IN PEDIATRIC PATIENTS

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INTRODUCTION

Massive transfusion, defined as transfusion of >1 blood volume (BV), commonly occurs in young
children undergoing major corrective surgery or burn wound debridement. No adequate data exist for
children examining the serial changes in platelet counts during massive blood loss. Such information
is essential to predict the need for and timing of platelet replacement. To clarify the problem of
dilutional thrombocytopenia in children, we undertook the present prospective study, with approval of
the Human Studies Committee.

METHODS

Twenty-three pediatric patients age 1-17 years
undergoing major surgical procedures were examined.
Estimated blood volume (EBV) was assumed to be
75 ml/kg for burned patients and children under 1 yr.
For all others, EBV was calculated at 70 ml/kg. In
addition to routine monitoring, urine output was
observed in all patients; directly transduced
arterial (n=23) and central venous catheters (n=21)
were also utilized. Patients were anesthetized with
halothane-N₂O-O₂ or N₂O-N₂-muscle relaxant-narcotic
technique. Controlled ventilation maintained PaCO₂
at 35-45 torr. Baseline samples for platelet count,
prothrombin time (PT), and partial thromboplastin
time (PTT) were taken prior to the surgical incision;
baseline central venous (CVP) and arterial pressures
were noted. Efforts were made to maintain a constant
CVP. One BV was considered lost when a volume equal
to the EBV had been transfused. Blood was replaced
with frozen packed cells, 5% albumin, fresh frozen
plasma, and lactated Ringer's as indicated to
maintain normal cardiovascular parameters. All data
are expressed as mean ± S.E.

RESULTS

The age of patients studied was 5.6 ± 1.2 yrs;
weight, 25.9 ± 5.9 kg. All patients lost at least
1 BV; ten lost 2 BV; three lost 3 BV; two lost 4 BV;
and one lost 5 BV. Fifteen had burn wound excision;
six, scoliosis repair; one, tumor excision; one,
Whipple procedure. The time (hrs) for loss of the
first BV was 2.3 ± 0.3; the second BV, 1.3 ± 0.2;
the third BV, 0.9 ± 0.1. Serial platelet counts are presented in Table 1. Figure 1 presents the
reduction in platelet counts as a per cent of baseline ± S.E. After one BV replacement the platelet
count was reduced 42 ± 2.5% (range 19-62%); 2 BV,
64.6 ± 2.5% (51-71%); 3 BV, 70 ± 3.2% (65-76%).
Clinical bleeding occurred in 3 patients and all had
a normal PT and PTT; two had platelet counts below
50,000/mm³ and responded to platelet transfusion.
The third had a count of 90,000. This last patient
had abdominal compression (slipped off support during
Harrington rod insertion), and increased venous
pressure probably accounted for the abnormal bleeding
observed. Three other patients whose platelet counts
fell < 100,000 received a platelet transfusion
before clinical bleeding was evident. In these

patients considerably more blood loss was anticipated.
One patient lost 5 BV and did not require platelets
(final count 136,000).

DISCUSSION

Studies in adults have always correlated serial
platelet counts with units of blood transfused. This
study correlates platelet counts with blood volumes
transfused, an important concept for all patients,
but particularly for children. The per cent fall in
platelet count parallels similar studies of adult
patients. Likewise, clinical bleeding occurred when
counts fell below 50,000 despite normal PT and PTT
values and stopped after platelet transfusion.
Knowledge of the initial platelet count related to
predicted or measured blood loss makes it possible
to estimate the point at which exogenous platelets will
be needed. If a child has a high initial platelet count,
he may not need exogenous platelets despite
massive losses. Some patients in this series who
lost 3 to 5 BV did not bleed abnormally. Anticipa-
tion of platelet needs allows for more efficient in-
teraction with the Blood Bank. If abnormal bleeding
occurs despite a platelet count above 50,000, other
causes such as increased venous pressure, disseminated
coagulopathy, or thrombocytopenia must be considered.

Table 1: Platelet count in 1000/mm³ ± S.E.M.
versus blood volumes transfused

<table>
<thead>
<tr>
<th>Blood Volumes Transfused</th>
<th>Baseline +/−</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients</td>
<td>23</td>
<td>23</td>
<td>10</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Platelets</td>
<td>379 ± 40</td>
<td>213 ± 23</td>
<td>122 ± 25</td>
<td>124 ± 48</td>
<td>124 ± 24</td>
</tr>
</tbody>
</table>

Figure 1

CHANGE IN PLATELET COUNT
PERCENT OF BASELINE

BLOOD VOLUMES LOST

0 1 2 3 4

N=23
N=10
N=3
N=2