POSTTRANSFUSION REACTIONS: A REVIEW OF 190 TRANSFUSIONS PERFORMED AT THE WOMAN'S HOSPITAL, NEW YORK CITY

By M. C. Souter, A.B., M.D., and Garrett D. Duryea, A.B., M.D.

We have reviewed 190 transfusions performed on 167 patients from July 1, 1922, to April 1, 1924. This is the total number of transfusions done at the Woman's Hospital during that period, with the exception of 12 transfusions given to obstetrical patients, which were not considered in this series. Of the 167 cases 161 were operated upon.

BLOOD GROUPING

The Moss classification is used as the standard and the grouping of all patients is done by laboratory technicians who use the Moss hanging drop method. The test is easily performed; the apparatus is quickly set up; and the presence or absence of agglutination is observed under the microscope. Half an hour is allowed to elapse after the preparation of the drop before concluding that there is no agglutination. Furthermore, in all the cases except three, the donor's

and recipient's blood were matched directly. A hanging drop preparation is made with the recipient's serum and the donor's cells in a 1:20 dilution with 3 per cent sodium citrate solution. This is examined after half an hour for evidences of agglutination. In the three emergency cases which were not directly matched severe reactions followed. It was found that the reactions had been due to misgrouping. This shows that unless a reliable laboratory is at hand to carry out accurate grouping the direct testing of donor's and recipient's blood is the only way to be sure of their compatibility.

TRANSFUSION TECHNIC

The method of transfusion used in all cases is the syringe cannula method of Unger for the transfusing of whole unmodified blood.

* * * *

The frequency in appearance of the various manifestations of reaction was represented as in Table I.

TABLE I

MANIFESTATIONS OF REACTION	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Chill	40	81.6
Temperature rise of at least 2.5 degrees	27	55.1
Edema	3	6.1
Nausea or vomiting	5	10.2
Urticaria	5	10.2
Headache	4	8.1
Respiratory distress	2	4.0
Pain in joints	2	4.0
Diarrhea	1	2.0
Unconsciousness	1	2.0

The time elapsing before the appearance of symptoms varies widely as shown in Table II which represents 43 cases in which the time was recorded.

TABLE II

TIME	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Immediately	8	18.6
Less than 4 hours	23	53.4
4 to 12 hours	2	4.6
12 to 24 hours	2	4.6
24 to 36 hours	8	18.6

Table II indicates that the majority of reactions occurred in less than 4 hours from the time of transfusion.

Chills were present in 40 cases. There was a great variation in degree of severity, from a chilly sensation lasting a very few minutes to a severe chill lasting one hour. Tables III and IV indicate the type and the duration of chills.

TABLE III

TYPE OF CHILL	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Chilly sensation	3	7.5
Moderate	32	80.0
Severe	5	12.5

TABLE IV

DURATION OF CHILL	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
1 to 5 minutes	8	21.6
5 to 15 minutes	12	32.4
15 to 30 minutes	7	18.9
30 to 60 minutes	10	27.0
Not recorded	3	

It is evident that the greater number of chills were moderate and lasted from 5 to 15 minutes.

In 27 of the cases there was a rise of temperature of at least 2.5 degrees, the average rise being 3.7 degrees. The duration of the temperature varied widely, the greatest number lasting for less than four hours as shown in Table V.

TABLE V

DURATION OF TEMPERATURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Less than 4 hours	9	33.3
4 hours to 8 hours	7	25.9
8 hours to 12 hours	2	7.4
12 hours to 24 hours	6	22.2
24 hours to 36 hours	1	3.7
36 hours to 72 hours	2	7.4

As has been stated, of the 190 cases transfused 49 cases or 25.7 per cent had reactions. Therefore, these figures are used as the basis for determining the factors which may cause reactions. The factors to be considered are:

I. *Blood Relationship.*—The relative frequency of reactions in cases where donor and recipient were or were not blood relatives is shown in Table VI.

TABLE VI

BLOOD RELATIONSHIP	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Yes	68	15	22.0
No	102	32	31.3
Not recorded	20	2	....

II. *Blood Groups.*—Table VII shows a comparison between the percentage of reactions when a universal or group IV donor was used and when the recipient and donor were in the same group.

TABLE VII

GROUPING	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Not recorded	8	..	....
Donor and recipient of same group	147	41	27.8
Universal donor	35	5	14.3
(Donor Recipient)			
(IV I)	1	0	0.0
(IV II)	22	4	18.1
(IV III)	12	1	8.3

It is evident that using a universal donor does not increase the number of reactions.

The relative number of reactions in the different blood groups of 190 cases transfused are shown in Table VIII.

TABLE VIII

BLOOD GROUP	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
I	3	1	33.3
II	52	15	28.8
III	22	4	18.1
IV	105	29	27.6
Not recorded	8	..	....

There is practically no difference in the percentage of reactions in each group. If a factor of incompatibility does influence reactions it is one which is not detected by ordinary laboratory methods of grouping individuals.

III. *Operator.*—Does the causative factor of reactions lie in the skill and ability of the one who performs the transfusion? Table IX shows that there is a wide variation in the percentage of reactions in transfusions performed by different operators.

TABLE IX

OPERATOR	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
A	28	4	14.2
B	28	7	25.0
C	17	1	5.8
D	14	4	28.0
E	13	4	30.0
F	1	1	100.0
G	7	2	28.5
H	9	5	55.5
I	21	5	23.8
J	24	4	16.6
K	5	3	60.0
L	11	1	9.0
M	12	8	66.0

If one accepts the theory of Drinker and Brittingham, that reactions are due to the formation of abnormal proteins as the result of

destruction of the blood platelets during the operation, the skill and deftness of the operator surely would be a factor of considerable importance. It is shown in Table IX that some operators do have a higher percentage of reactions. It would be difficult to estimate the importance of this factor as a cause.

IV. *Time.*—The transfusions were either preoperative, performed during the operation, or postoperative.

Table X shows that the highest percentage of reactions occur in cases which were transfused before operations. This is probably due to the fact that the patient is at that time better able to respond to the introduction of a foreign substance.

TABLE X

TIME	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Preoperative	91	34	37.3
During operation	13	0	0.0
Postoperative	53	15	28.3
Not recorded	33		

V. *Amount of Blood Given.*—The relative frequency of reactions following the transfusion of varying amounts of blood is shown in Table XI.

TABLE XI

AMOUNT	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
Less than 300	10	3	30.0
300 to 500	30	7	23.3
500 to 700	135	35	25.9
700 to 900	8	1	12.5
Not recorded	7		

From Table XI it would appear that up to a certain point the larger the amount of blood transfused at one time the greater the number of reactions. It is a question whether small amounts of blood (less than 500 c.c.) given frequently would be followed by fewer reactions than are large amounts given at one time. The comparative ease of the technic makes the former possible now whereas it was not possible a few years ago. This problem falls into the scope of the discussion of the next factor.

TABLE XII

TRANSFUSIONS	NUMBER OF TRANSFUSIONS	NUMBER OF REACTIONS	PERCENTAGE OF REACTIONS
First	147	42	28.5
Second	17	6	35.2
Third	3	2	66.6
Not recorded	23	..	....

VI. *Repeated Transfusions.*—Table XII shows the increase in the number of reactions in subsequent transfusions. It may be noted here that no patient had more than one reaction.

* * * *

What effects do posttransfusion reactions have upon the general condition of the patient as indicated by her pulse and blood pressure, and upon the benefits which the patient should derive from the transfusion? Change in pulse rate is the first thing to be considered. Tables XIII and XIV are a comparison between the rise and fall of the pulse rate in the patients who had had no reactions and those who had had reactions. The time period for the rise or fall was forty-eight hours.

TABLE XIII

PATIENTS WITH NO REACTIONS

PULSE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	AVERAGE VARIATION IN POINTS
Rise	33	32.0	12.1
Fall	57	55.3	13.9
No change	13	12.6	....
Not recorded	87	....	....

TABLE XIV

PATIENTS WITH REACTIONS

PULSE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	AVERAGE VARIATION IN POINTS
Rise	24	55.8	13.5
Fall	15	34.8	12.8
No change	4	9.3	....
Not recorded	6	....	....

From Tables XIII and XIV it is evident that after transfusion the pulse rate had a tendency to fall except in cases where reactions caused a rise. The average actual rise or fall in pulse rate was practically the same both in cases with and without reactions.

There was a somewhat constant variation in blood pressure in those cases which had reactions and those which did not. In the greater percentage of cases with reactions the blood pressure was raised. In the majority of cases without reactions the blood pressure fell. This is shown in Tables XV and XVI. When the systolic pressure was raised and the diastolic fell or vice versa, that case was classified as irregular. In other cases both the systolic and diastolic pressure either fell or rose together.

As indicated in Tables XV and XVI reactions have a tendency to raise the blood pressure. In patients who have a very high blood pressure before transfusion this fact gains importance and may cause serious results.

TABLE XV

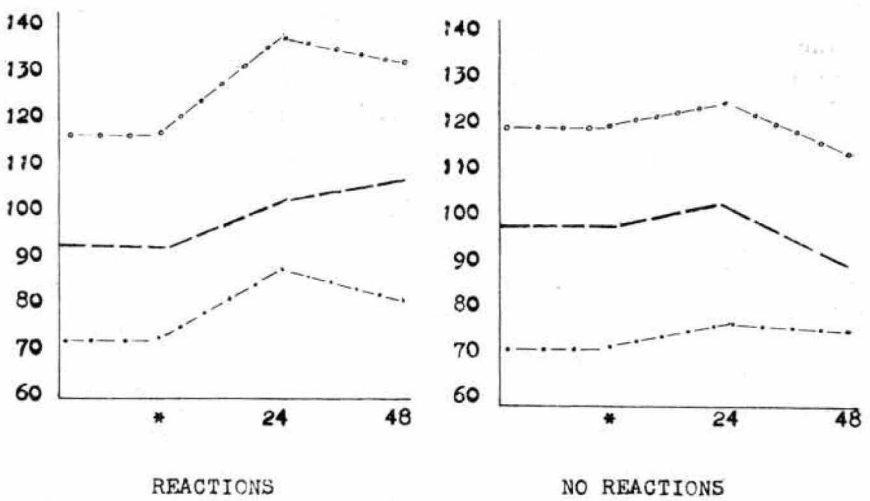
PATIENTS WITH NO REACTIONS

BLOOD PRESSURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Rise	28	32.2
Fall	33	37.9
Irregular	22	25.2
Not changed	4	4.5
Not recorded	54	....

TABLE XVI

PATIENTS WITH REACTIONS

BLOOD PRESSURE	NUMBER OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS
Rise	13	30.9
Fall	12	26.1
Irregular	14	33.3
Not changed	3	7.1
Not recorded	7	....



Graphs 1 and 2.

In order to illustrate the average rise and fall in points of the pulse and the systolic and diastolic pressure Graphs 1 and 2 have been made. The first represents such curves for those patients with reactions—the second for those without reactions.

It is interesting to note the results of investigation in order to discover what influence reactions have on the desired benefits of transfusion—that is, upon the hemoglobin determination and red blood cell count. The data available cover observations of these two

points only during a period of forty-eight hours. The ultimate benefits to the patient after this short period were not recorded.

Table XVII shows the percentage of cases with and without reactions which had either an increase or a decrease in hemoglobin. It also shows the average percentage of increase or decrease.

TABLE XVII

HEMOGLOBIN	NO. OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	NO. OF CASES WITH REACTIONS	PERCENTAGE OF CASES WITH REACTIONS	NO. OF CASES WITHOUT REACTIONS	PERCENTAGE OF CASES WITHOUT REACTIONS
Rise	138	87.3	42	91.3	96	85.7
Fall	20	12.6	4	8.6	16	14.2
Not recorded	32	....	3	....	29	....

In the total number of transfusions there was an average rise of 29.8 per cent in the hemoglobin and an average fall of 16 per cent. In the cases with reactions the average rise of hemoglobin was 35.6 per cent, the average fall 13.7 per cent, while in those cases without reactions the average rise and fall were 27.2 per cent and 16.6 per cent respectively.

TABLE XVIII

RED BLOOD CELL	NO. OF TRANSFUSIONS	PERCENTAGE OF TRANSFUSIONS	NO. OF CASES WITH REACTIONS	PERCENTAGE OF CASES WITH REACTIONS	NO. OF CASES WITHOUT REACTIONS	PERCENTAGE OF CASES WITHOUT REACTIONS
Rise	134	84.2	42	93.3	92	80.7
Fall	25	15.7	3	6.6	22	19.2
Not recorded	31	....	4	....	27	....

Table XVIII shows a comparison in the rise and fall of the red blood cell count in cases with and without reactions. In the total number of transfusions there was an average rise of 26.1 per cent in the red blood cell count and an average fall of 12.8 per cent. In the cases with reactions the average rise in the red blood cell count was 30.5 per cent, the average fall 13.5 per cent, while in those cases without reactions the average rise and fall were 24.1 per cent and 12.7 per cent respectively.

Tables XVII and XVIII show unexpected and interesting results. The fall in hemoglobin and red blood cells is chiefly found in cases which were transfused either during operation or following operation. It is evident from the tables that there is a higher percentage of cases with an increase in both hemoglobin and red blood cells among those patients who had reactions than among those patients who did not have reactions. Also the average percentage increase in both hemo-

globin and red blood cells is greater in patients with reactions. In reviewing the literature on this subject no report has been found showing the actual effect of reactions on the red blood cell count and hemoglobin determinations. Therefore, it cannot be stated whether these findings are unusual or not. One might naturally expect to find that reactions delayed the rise in hemoglobin and red blood cells and lessened the benefits of transfusion. From this investigation it would seem that reactions had the opposite effect. The process which brought about these results may be similar to that occurring when foreign protein injections are given. The injection of proteins, such as milk in cases of chronic infection, stirs up the natural body defenses and increases the individual's resistance. In the same way the blood forming organs may receive stimulation from posttransfusion reactions as well as from the transfused blood itself.