

protein concentration taken several days after transfusion. In several of the cases reported here the 40 Gm. of plasma residue injected contained more than half as much protein as the amount of protein calculated to be circulating in the plasma. The slightness of the rise in concentration of serum protein can be accounted for only by the assumption that some protein must have left the blood stream. The loss of protein is understood more easily by realizing that the proteins of the plasma are probably in a state of equilibrium with the tissue proteins. The changes in serum protein and hematocrit following the injection of plasma are not predictable and depend on many factors which are not well understood. . . .

"In three instances untoward symptoms were noted following the transfusion of solutions of dried plasma. Two patients complained of slight backache during the administration of plasma at a rate of about 25 cc. a minute. Following slowing of the rate the remainder of the transfusion was administered without further complaints. In both of these cases fever developed, the temperature reaching a maximum of 102 F. three hours after the transfusion and returning to normal four hours later. It was thought that in these cases the rapid administration of plasma obtained from group IV (O) blood to recipients having II (A) blood may have been an important factor in producing the reaction. . . . One patient had extensive edema and ascites and was moribund at the time of transfusion. Pulmonary edema developed after the administration of 150 cc. of solution of dried plasma at a rate of 2 cc. a minute. Although this patient died fifteen hours later, it was felt that the development of progressive pulmonary edema represented the terminal extension of the ascites and edema to the pulmonary system

rather than an acute process dependent on a sudden increase in the blood volume due to the small transfusion of plasma. Since a number of patients were febrile at the time of plasma transfusion it was not possible to determine in all instances the degree of fever following transfusion of solutions of dried plasma. However, in those cases in which there was no fever at the time of transfusion there was a variation of only 0.5 degree F. in the twenty-four hour period following transfusion of 400 cc. of plasma solution." 11 references.

J. C. M. C.

HOXWORTH, PAUL, AND SKINNER, CALVIN: *Improvement in Blood Transfusion Service. II. Establishment and Operation of a Blood Transfusion Service.* Arch. Surg. 42: 480-497 (March) 1941.

"The selection and artificial preparation of high-titered test-serums, the study of the cause and prevention of hemolytic transfusion reactions, the consideration of the role of subgroups and intragroup agglutinins in transfusion accidents, and the adoption of a simple, accurate technic for determination of blood grouping and compatibility have been described. All are parallel actions directed toward a single purpose: the transfusion of blood with the greatest simplicity and the least possible delay in laboratory procedure, with observance of the best known standards of safety. Another major obstacle to the dispatch of blood transfusion service in large municipal hospitals is the inaccessibility of blood donors. . . . Any innovation in blood transfusion service which abolishes these delays results in a decreased morbidity and the saving of lives. It becomes another parallel force designed to accomplish the same purpose as the technical improvements and considerations mentioned. Such an innovation is

the establishment of the American Red Cross Blood Transfusion Service at the Cincinnati General Hospital. This service consists of a blood bank and a volunteer donor bureau. In this paper will be presented the details of organization and method of operation of this service. . . .

"At the Cincinnati General Hospital, use of the cadaver as a source of blood was investigated only from the standpoints of obtaining the blood in sterile culture and of determining how much blood could be obtained. . . . Efforts toward obtaining blood from this source were abandoned because the amount obtainable was too small to be of value to a transfusion service which required approximately 4,000 cc. of blood per day and also because it was believed that patients would not be willing to accept the transfusion of blood from a cadaver. With the technic outlined by Goodall and in cooperation with the obstetric department, fetal cord blood as a source of supply was investigated. . . . The experience in this clinic is that an equal amount of blood can be obtained with much less difficulty from friends and relatives and from other volunteer donors. For this reason, placental blood obtained from fetal cords is regarded here as an impractical source of supply.

"In regard to the changes which occur in preserved blood, the following contributions are of interest. Using Kjeldahl nitrogen determinations on properly refrigerated blood as indexes of proteolysis, Kremerman concluded that blood stored for twenty-one days is not toxic to the recipient as far as the degree of proteolysis is concerned. Scudder observed a shift of potassium ions from cells to plasma and stated that care should be taken in using it in certain types of cases. It seems doubtful, however, that the amount of free potassium is sufficient to cause

toxic symptoms. . . . DeGowin has shown that the addition of 13 parts of 5.4 per cent of dextrose solution and 2 parts of 3.2 per cent of sodium citrate solution to each 10 parts of blood prevents rapid hemolysis and delays diffusion of the potassium ion into the serum. It is obvious, however, that this mixture should not be added routinely to all bank blood, since the dilution would reduce the blood efficiency of the fluid transfused to 40 per cent per unit volume. The result of DeGowin's work may find practical application in those cases in which the volume of fluid transfused can be raised to the point desired without contraindication. Certainly in the treatment of shock, in which the plasma is the desired element and the erythrocytes are generally considered inconsequential, any dilution of bank blood is undesirable, because of the diminution in the hydroscopic action of the plasma which results.

"Rhoads and Panzer stated the belief that bank blood is an unsatisfactory source of plasma prothrombin for treatment of the hemorrhagic diathesis associated with jaundice. . . . A carefully controlled study of the effects of bank blood of various ages on the prothrombin time of patients with jaundice has never been made and would be of extreme value at present in order to determine this particular limitation of bank blood. Another question of interest as to the limitations of bank blood is that of sterility. . . . It is generally agreed that, provided careful technic is exercised in the drawing of the blood in a closed system, it is not desirable routinely to culture bank blood before it is transfused. The mere taking of the sample for culture subjects the specimen to increased opportunity for contamination. . . . Drew and Scudder carefully determined the fate of thrombocytes in bank blood and found that they rapidly fall to less

than 100,000 for each cubic millimeter in twenty-four hours and to 40,000 at the end of three days. Kolmer also demonstrated the instability of platelets. Because of this, bank blood should not be used as a source of thrombocytes.

Numerous workers have demonstrated the degree of spontaneous hemolysis in properly refrigerated bank blood. The results of their studies indicate that preserved blood is a good source of erythrocytes up to five days and should not be used for this purpose after eight days. The age limitation that should be placed on preserved blood which is used in the treatment of infections, septic states and septiciemias is not yet clear and must necessarily depend on the component or components of blood desired in a particular case. The supportive value of the elements contained in plasma for nutrition and of the red cells in combating the anemia associated with these conditions is well known. Since the value of immune substances, both specific (antibodies) and nonspecific bactericidal (leukins and plakins), even in fresh blood in 200 to 500 cc. amounts is debatable, deterioration of these substances in preserved blood as shown by Kolmer may or may not be a limitation to its use. . . .

Schaefer and Wiener traced the fate of the erythrocytes of bank blood after transfusion and found that the result when five to eight day old blood was used was about the same as when fresh blood was transfused. The period of survival of the erythrocytes was from three to four months. However, four specimens of ten to twenty day old blood were transfused, and the erythrocytes given could not be demonstrated in the circulation of the recipient after from one to three weeks. In the operation of the blood bank at the Cincinnati General Hospital it has been ordinary practice to dispense

units of blood with regard to the known limitations of preserved blood for the particular cases, the age of the blood issued depending on the diagnosis submitted for the patient. Although it is constantly subject to change as more is learned concerning these limitations, a guide to the members of the house staff is posted at the time of this writing. . . . Experience of sixteen months' duration, during which time more than 3,500 transfusions of preserved blood have been given, has shown that these time limitations have not interfered with the practical operation of the blood bank service. . . .

The American Red Cross Blood Transfusion Service, consisting of a blood bank and a volunteer donor bureau with headquarters at the Cincinnati General Hospital, is the first of its kind. . . . The service is known as the American Red Cross Blood Transfusion Service. The medical direction and administration are responsibilities of a service committee appointed by the Cincinnati and Hamilton County Chapter of the American Red Cross, subject to the approval of the directing medical staff of the Cincinnati General Hospital. The interests of hospitals other than the Cincinnati General are represented by two memberships on this committee. There are a director and an assistant director of the service from the department of surgery at the Cincinnati General Hospital and the University of Cincinnati, who are also members of the service committee. This committee meets periodically to determine the policies of the service. The director or the assistant director is constantly available for normal operation. . . . Early in the conception of this service it was considered highly desirable to incorporate into the service headquarters all the activities possible pertaining to the transfusion of blood. . . . The blood transfusion service consists of two al-

most independent divisions, a blood bank and a volunteer donor bureau, operating under the same direction from the service headquarters. . . .

"The volunteer donor bureau operates for the benefit of all hospitals in Hamilton County, not only the Cincinnati General Hospital. . . . It is the experience of any hospital that in the majority of instances in which blood transfusion is desired the proper donor may be found among friends and relatives of the patient without undue delay. The volunteer donor bureau was organized as a second division of the Red Cross Blood Transfusion Service to serve all hospitals in Hamilton County when friends or relatives of the patient cannot be located or are not of the compatible blood group or when an emergency exists which does not permit waiting for laboratory search. For this purpose the service maintains a list of certified blood donors which is available by telephone call day or night. The membership of this list was originally acquired through newspaper publicity. Its members are given a thorough physical examination. In addition, they are qualified each six months from the standpoints of age, good general health, negative Kahn reaction, absence of primary or secondary lesions of syphilis, accessible arm veins and normal hemoglobin content of the blood. Periodic examinations are performed by volunteer physicians from the resident staff of the Cincinnati General Hospital. Each donor has expressed his willingness to respond at once to a service call, whether it be for an indigent patient or for one who is able to pay for the blood. Each member of the list, when properly qualified, is issued a blood donor's identification book, which is his certificate of registration with the service. . . .

"Experience shows that to maintain a satisfactory list of donors it is neces-

sary to give them every consideration to which they are entitled. For this reason the hospital staffs have been charged that the donor should be courteously received when he arrives at the hospital, that the blood should be drawn as promptly as possible and that he should be dismissed with an expression of appreciation by the attending physician or nurse. They have also been asked not to call for a donor unless it is reasonably certain that he is to be used. After each transfusion the donor receives a letter of appreciation from headquarters. . . . In any instance of emergency the circumstances are such that the volunteer donor list service is not entirely adequate, bank blood is sent by taxicab. Such conditions are encountered only very occasionally." 19 references.

J. C. M. C.

HONWORTH, PAUL, AND SKINNER, CALVIN: *Improvement in Blood Transfusion Service. III. Results of 3,077 Transfusions of Bank Blood; a Statistical Analysis.* Arch. Surg. 42: 498-507 (March) 1941.

"An important method of approach to the study of the value of preserved blood is an analysis of the results of transfusion of such blood. Just as some questions which arise as to the limitations of bank blood are answered by inquiry into the changes which occur in various components of blood when preserved, other, equally important questions, such as the effect of age of blood on the incidence and type of transfusion reactions, can be answered only by accurate recording of the results obtained from a long series of transfusions of bank blood. It is from this standpoint primarily that a statistical analysis of 3,077 consecutive transfusions of bank blood at the Cincinnati General Hospital becomes of interest. . . . Of 3,487 donors who gave blood to the bank in the