the transfusion and was followed by nausea, vomiting, hemoglobinuria, jaundice, oliguria, stupor and uremia. Leukocytosis was present in all cases in which the leukocytes were counted. Of 6 cases in which the blood grouping and cross matching were rechecked the blood in 4 was shown to be definitely incompatible. Of the remaining 2, in 1 warmed, hemolyzed, stored blood 8 days old was given. Isohemolysis unaccompanied by isoagglutination was found in 2 cases. This accounted for the error in cross matching and caused the hemolytic reaction. More careful cross matching of the blood of donor and recipient by the use of tube preparations incubated at 37.5 C. for one hour will prevent some of the errors and save lives. Citrated plasma should probably replace whole blood in the treatment of secondary shock and hemorrhage. Alkalis should be administered to all patients prior to transfusion. The pathologic changes in the kidneys in 4 fatal cases consisted of interstitial edema, leukocytic infiltration, degeneration and necrosis of the tubular epithelium and the deposition in the renal tubules of granular pigment derived from hemoglobin. One case showed central, focal necrosis of the liver cells." 18 references.

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HARPER, S. B.; OSTERBERG, A. E.; PRIESTLEY, J. T., AND SELDON, T. H.: *Changes in Serum Protein and Hemoconcentration in Man Following Transfusion of a Solution of Dried Blood Plasma.* J. A. M. A. **116**: 1760–1762 (Apr. 19) 1941.

"Recently a simple method for the preparation of dried plasma and the result of its experimental use were reported from this laboratory. Accordingly, at this time the results of the clinical use will be presented. . . . The plasma used in this study was obtained from freshly drawn group IV (O) blood and was dried to a flaky residue by the method previously described. This consists, briefly, in continuous simple distillation of fluid plasma while it is sprayed into a distilling flask maintained at a reduced pressure of approximately 15 mm. of mercury and at 45 C. It is possible to obtain very rapid dehydration of the plasma at a minimal cost for equipment or operating expense. Before removal of the plasma residue from the drying flask and after completion of the drying process about 20 Gm. of dry sterile dextrose is added to the residue of 1 liter of plasma. When the flask is shaken nearly all the plasma residue falls from the sides and becomes well mixed with the dextrose. The dry dextrose added after drying the plasma serves as a dispersion medium and greatly increases the rate of solubility of the product. Plasma solution sufficient for a transfusion can be prepared in a few minutes after the addition of sterile water. Dried plasma prepared by this method has a residual water content of 3 to 8 per cent. Further drying occurs during storage at room temperature in open containers protected from contamination by a covering of several layers of gauze. After ten weeks' storage in this manner there has not been deterioration, as evidenced by changes in physical or chemical properties or by untoward effects following clinical use. . . .

"An arbitrary dose of plasma-dextrose mixture consisting of approximately 40 Gm. of plasma residue and 8 Gm. of dextrose is dissolved in 400 cc. of sterile distilled water for each transfusion. This solution is the equivalent of about 450 cc. of fresh plasma in protein content. The addition of 600 mg. of sodium sulfathiazole serves as a satisfactory preservative. Solutions of plasma used as long as twelve days after preparation are not attended by untoward effects. Samples of

plasma known to be contaminated with a variety of organisms have been sterile on subsequent culture a few days after the addition of sodium sulfathiazole in the amounts indicated. Studies directed at determining the effectiveness of a solution of dried plasma in increasing the plasma volume and protein concentration were performed on a series of 14 patients who received a total of nineteen transfusions of the plasma solution. The indications for transfusion of plasma varied from postoperative vascular collapse to hypoproteinemia dependent on a number of causes. The hematocrit, the total serum protein and the albumin-globulin ratio were taken as criteria of the concentration of the cellular elements of the blood stream and of the plasma proteins, respectively. Blood samples for these determinations were drawn immediately before and ten minutes after the transfusion and again during the first few days following transfusion. In addition, frequent determinations of the blood pressure, pulse and respiration were performed. In a few cases urinary excretion of nitrogen and protein was studied. . . .

"The hematocrit level following transfusion is lower than the initial level in all cases, indicating dilution of the cellular elements of the blood and an increase in the volume of plasma. A comparison of the protein levels before and immediately after transfusion shows that a corresponding diminution of the serum protein concentration does not occur. It would appear that the increase in plasma volume as interpreted from the lowering of the hematocrit depends on the addition of protein as well as fluid to the circulating plasma. Since in the plasma solution injected the concentration of protein was always slightly higher than in the plasma of the recipient, a rise in the serum protein level after transfusion can be understood. In those instances in which the concentration of serum protein is lowered following transfusion, the percentage drop is never as great as the percentage drop in the hematocrit. Thus there is actually a rise in the relative amount of protein and undoubtedly in the absolute amount of total circulating plasma protein. Hematocrit and serum protein determinations taken from twelve hours to several days after plasma transfusion indicate that the initial changes are maintained for some time. From the values observed in this study it is not possible to determine the exact duration of the changes in plasma volume which depended on the transfusion of plasma, since an accurate record of fluid intake by other means was not obtained. However, in those cases in which the patient did not receive other intravenous fluids following the transfusion the hematocrit remained below the level before transfusion for a period up to four days. At the same time the serum protein level showed a gradual, but slight, rise after transfusion. It will be seen from the wide variation of degree and duration of the changes observed that the results are not to be explained by simple addition and dilution as in vitro. . . . There are a number of determining factors. As has been pointed out, a portion of the injected protein is lost from the blood stream and simultaneously water is drawn into the circulation from the tissues. The loss of protein as determined in this study may be more apparent than real. The increase in plasma volume following the injection of plasma may be partially compensated for by the addition of more cellular elements to the active circulation from regions in the body where circulation is slow. . . .

"That a loss of protein does occur is apparent from the values for serum

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.

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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