Original Articles.

BLOOD TRANSFUSION: INDICATIONS, METHODS AND RESULTS.*

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A REVIEW of the literature of Blood Transfusion, since the operation was placed on a practical basis by the work of Crile¹ and Carrel, shows that this procedure has not developed a wide use in medicine and surgery. While recent clinical experience confirms the great value of transfusion in some conditions, it has also emphasized the limitations of the operation. It is not my intention to discuss the whole subject at this time but I wish to consider a few practical points in regard to the use of transfusion and the best methods of operation.

INDICATIONS.

The broad indications for transfusion are based on the fact that transfused blood is a perfect substitute for blood lost in acute hemorrhage; in certain pathologic hemorrhages the blood has definite hemostatic properties, and in some secondary anemias it acts as a powerful stimulant to tide over a crisis in the disease.

ACUTE HEMORRHAGE.

To make good a direct loss of blood transfusion is invaluable in acute hemorrhage after injury or operation, in ectopic gestation and in the uterine hemorrhages of childbirth, miscarriages or fibroids. It is indicated in severe bleeding from ulcers in the stomach, duodenum or intestine. Typhoid patients, moribund from bowel hemorrhages, may be revived by transfusion but, even when an immune donor is used, the procedure does not seem to alter the course of the disease or prevent a recurrence of the bleeding.

SHOCK.

In severe shock which, in a sense, is allied to hemorrhage, if we consider the condition one of intra-vascular bleeding, the transfusion of blood is more effective than heat, stimulation, posture or salt solution in relieving the vaso-motor paralysis and raising the blood pressure.

GAS POISONING.

The use of blood transfusion in gas poisoning seems to be directly indicated by the experimental work of Crile and yet only a few cases of this kind have been reported. Carbon monoxide has a stronger affinity for hemoglobin than oxygen. When the oxygen is displaced by the formation of carbonic-oxide hemoglobin, the red corpuscle, as an oxygen carrier, is removed from the circulation as effectively as in acute hemorrhage. To restore the oxygen-carrying capacity of the blood normal red cells must be substituted for the damaged corpuscles. This

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requires bleeding before or during the transfusion. In gas poisoning the blood clots quickly and bleeding is not always easy in these cases.

PATHOLOGIC HEMORRHAGE.

In certain pathologic hemorrhages transfused blood has a remarkable hemostatic effect. The bleeding in these cases is supposed to be due to the lack of certain elements in the patient's blood. Transfusion corrects this deficiency and, at the same time, restores the blood already lost by the hemorrhage. In this latter respect transfusion has a distinct advantage over the injection of serum which has also proved to be valuable in these pathologic hemorrhages. In exsanguinated cases to simply check the bleeding may not be sufficient. Transfusion is required to restore the cellular elements of the blood.

Examples of this type of hemorrhage which may be benefited by transfusion are found in the bleeding which occurs in deeply jaundiced individuals, in hemophilia and in hemorrhagic disease of the new-born. As a prophylactic measure Wiley Meyer² advocates the injection of human serum before operation on jaundiced cases. When severe post-operative bleeding does occur, transfusion is probably the one procedure which can save these patients. It seems logical to suppose that the effect is only permanent in those instances in which the cause can be remedied by drainage or the removal of some obstruction. The following case, which I transfused on April 21, 1912, is a good example of the usefulness of this operation in icteric conditions.

The patient was a woman who had been deeply jaundiced for four weeks before an operation on April 8, by Dr. E. A. Codman, at which a greatly distended common duct was found. Both the duct and the gall-bladder were drained. There was no immediate bleeding from the operation wound. The jaundice persisted in spite of free discharge of bile. After developing a few subcutaneous ecchymoses the patient began to bleed, two weeks after the operation; the bile from the drainage tubes was replaced by red blood. At the same time there was profuse bloody discharge from the uterus which lasted four days. Transfusion was done with the patient in a serious condition.

The brother served as donor. An Elsberg canula was used and the blood flowed for forty (40) minutes. The transfusion caused an immediate improvement in the patient's condition and effectively controlled the hemorrhage; the discharge from the wound changed to bile and old blood. At times it seemed as if there was a little fresh bleeding but this was not enough to affect the patient's condition. The jaundice gradually disappeared and the bleeding had not recurred up to the time of the patient's discharge from the hospital, about one month after the transfusion.

In hemophilia transfusion is an effective temporary measure. It may save the patient in any

particular attack but it does not alter that individual's inherited tendency to bleed.

Welch,³ Schloss and Commisky,⁴ and others have reported excellent results with the injection of human blood serum and whole blood in hemorrhagic disease of the new-born. The value of transfusion in this condition has been conclusively proven by the clinical experience of several men.⁵ The writer has transfused nine (9) infants by means of glass tubes for this disease; six (6) of these cases have been reported.^{6,7}

The amount of blood to be transferred to the new-born infant is very small. In many cases the duration of the flow of blood varied from three to six minutes. A baby of eight pounds is estimated to have a total blood quantity of a little more than six ounces. Since a dog cannot always survive a loss of one-half the total quantity of blood, it is fair to conclude that the loss of an exsanguinated infant is less than one-half its total quantity. The amount to be transfused to a new-born infant, therefore, is always considerably under three ounces.

Viewed from another angle these figures also show why infants seem so susceptible to hemorrhage. In dealing with these cases it is not safe to temporize too long with measures which may check the bleeding after a time but cannot relieve the anemia. This advantage of transfusion over serum injections applies with equal force to any case of hemorrhage in which we have an exsanguinated patient.

SECONDARY ANEMIA.

Transfusion is less clearly indicated in the secondary anemias which are not due to the loss of red corpuscles from the body. The cause of the anemia is too often a pathological condition which is incurable or not altered by the transfusion of blood. Illustrations of the stimulating effect of transfused blood are found in its use as a preparatory measure before operations on weak patients, in pellagra⁸ and in certain cases of prolonged suppuration with profound anemia. In such instances the beneficial effect of the transfusion is obtained by increasing the patient's resistance and augmenting the natural forces which combat the progress of the disease.

In purpuric conditions of obscure etiology transfusion is not indicated by the results which have been secured up to the present time. It may prove to have a place in the treatment of the purpura when we have a better understanding of the diseases in which purpuric hemorrhages occur.

In pernicious anemia, leukemia, certain toxemias, acute infections and malignant disease the negative results are sufficiently definite to contra-indicate transfusion in these cases.

Properly safeguarded transfusion is not a dangerous operation. The withdrawal of too much blood from the donor and the dilatation of the recipient's heart are usually avoidable mishaps.

Embolism, sepsis, the transmission of disease and even hemolysis are of much less frequent occurrence than was formerly supposed. The danger of hemolysis has been exaggerated by most writers. Crile⁹ says that kinship between donor and recipient is apparently of no special advantage and the laboratory test may show hemolysis and yet the same blood be entirely safe in transfusion.

He did transfusion in eighteen tuberculosis cases and in most of these the donor's blood hemolysed the recipient's blood in the test tube but not in the patient. In spite of its comparative safety, however, transfusion should be considered a measure of last resort to be applied when simpler means have failed and only to those cases in which there is rational basis for its use.

METHODS.

The blood is transferred from donor to recipient in transfusion by uniting their vessels either directly or at a distance. Direct union is accomplished by Carrel's suture method or by the canula method of Crile. The best means of effecting union at a distance is by means of the Brewer glass¹⁰ tubes. Clotting of the blood is prevented in the method of direct union by approximating intima to intima. In glass tubes clotting may be delayed by coating the tubes with paraffin or some similar substance.

To be successful with any method requires special training in blood vessel work. These methods have been variously modified to simplify the operation but none of the modifications have removed all the technical difficulties of a transfusion.

The method of direct suture should not be attempted without a laboratory training in blood vessel surgery. The technic is simple but difficult and the result is the same whether the vessels are united with sutures of very fine silk or by means of a canula.

The Crile canula can be successfully used by any well-trained surgeon with a little blood vessel experience. This canula has been modified by Janeway,¹³ Elsberg,¹⁴ Soresi,¹⁵ Bernheim¹⁶ and Levin.¹⁷ The instrument described by Elsberg in 1909 seems to have been most successful in overcoming certain disadvantages of the Crile canula. When using the Crile canula the vessel must be introduced through the lumen before being cuffed back over the canula. With the Elsberg canula the vessel is slipped into the canula through a slit in the side. In the original Crile instrument the cuffed vessel was secured by a ligature. The Elsberg canula has four sharp hooks, which hold the vessel in place without a ligature. Finally the Crile canula must be carried in four sizes to fit the vessels of different calibre, while the Elsberg canula is adjustable like a monkey wrench. It can be made to fit any vessel and altered during the transfusion to increase or diminish the flow of blood. These are, on the whole, minor points

but probably of sufficient importance to make the difference between success and failure in some cases.

The value of tubes in transfusion depends upon the length of time blood will flow in the tubes without clotting. Even when glass tubes are coated with paraffin or some similar substance this time is definitely limited. If this limit always exceeded forty (40) or even thirty (30) minutes this method would be practical for all transfusions because a flow of this duration is sufficient in most cases.

Fauntleroy²⁰ and Williams¹² of the United States Navy have reported several cases successfully transfused with tubes. The flow of blood was maintained thirty (30) and forty-two (42) minutes in two of the cases. Fauntleroy¹¹ used coated tubes, shaped like an "S" or "U" with a lumen one eighth of an inch in diameter. The vessels were united on the vein to vein principle. Other men have tried the tubes and reported that clotting occurred before enough blood had been transferred. I have transfused, without difficulty, eleven infants by means of glass tubes modified to suit the small, inaccessible veins of these patients and am convinced that they are of real value in these cases.

The amount of blood to be transfused in the new-born is very small, certainly less than three ounces. In my experience the duration of flow, even when the current is checked from time to time to prevent dilatation of the heart, is never more than six minutes, which is well within the clotting time in these small tubes. Just how long the blood will run through the tubes I am unable to say. I have used them in transfusing a child of six years. The flow was interrupted after 9½ minutes and at the end of the operation the blood had not clotted enough to block the tube. The tubes made for new-born infants are 12 cm. long and 3 mm. in diameter. The end which is inserted into the infant's vein is about 2½ mm. in diameter. They are coated with a wax mixture consisting of stearin, vaseline and paraffin in 1-2-2 proportions. The length of the tube is important because, when tied to the infant's vein, it practically lengthens this vessel to such an extent that the final connection with the donor's artery is easily made.

The connection between the circulation of donor and recipient is made by uniting artery to vein or vein to vein. Dorrance and Ginsberg¹⁸ advocate the vein to vein method to simplify the operation. Hartwell,¹⁹ Soresi¹⁵ and Fauntleroy²⁰ also speak well of this procedure. The artery to vein is the older and more widely used method. The radial artery is connected with any vein of suitable size in the arm of the recipient. In infants the arm veins are so small that most operators have taken the femoral or long saphenous vein in the thigh. I have used the external jugular vein in my last eight cases in infants and find that this vessel is well adapted to the operation in these cases.

The merit of these various methods and de-

vices for transfusion can be summed up as follows:

Any one of them may be successfully employed, by an operator who has familiarized himself with the technic of that particular method or instrument. In other words, success in the operation of transfusion is more dependent upon adequate experience than any special method. In adults the Elsberg canula is evidently the best for the average surgeon. In infants the operation is done with the least difficulty by means of glass tubes of proper length and size.

RESULTS.

For the treatment of acute or traumatic hemorrhage in an otherwise normal individual, blood transfusion is the most effective measure at our command. When the bleeding occurs in such diseases as duodenal ulcer, typhoid fever or tuberculosis of the rectum, transfusion aids mechanically in restoring the blood and may prevent a death from hemorrhage but as a therapeutic agent it seems to have no effect on the disease.

The results in shock and gas-poisoning justify its use in these cases.

In certain pathologic hemorrhages transfusion is as valuable as in acute hemorrhage. In the hemorrhages of icteric conditions the tendency to bleed can be permanently checked if the underlying disease is relieved by suitable operative measures. Hemophilic bleeding may be arrested by transfusion but the disease is not cured. In hemorrhages of the new-born, a disease which was formerly credited with 50 to 75 per cent.^{21, 22} mortality, transfusion stops the bleeding, restores the blood and apparently transforms a very sick baby into a normal healthy infant.

Lespinasse and Fisher, in 1911, collected six cases of hemorrhagic disease treated by transfusion, with two deaths and four recoveries. In nine cases which I have transfused for this disease there have been eight recoveries and one death. Most of the patients were in poor condition at the time of the operation. The hemorrhages were usually from the bowels. In two instances large hematomas formed in the cheek. In one of the cases this was accompanied by extensive bleeding beneath the scalp. The convalescence in this case, contrary to the rule, was difficult and prolonged. The infant ran a very high temperature until the hematomas had been absorbed.

My most recent case was one of uncontrollable hemorrhage from the umbilical stump. The bleeding stopped within one-half hour after the transfusion and furnished a good illustration of the hemostatic properties of normal blood. In this case a positive Wassermann test showed that the etiologic factor may have been syphilis.

In the one case in which transfusion failed, the baby, when three days old, began passing bloody stools, apparently typical of hemorrhagic disease. Transfusion was followed by the usual

improvement. Eight hours later the child vomited and began to fail. There was no sign of fresh bleeding but at the time of death, fifteen hours after transfusion, it was supposed that the hemorrhage had recurred and would be found in the stomach or bowels. Autopsy showed a diffuse peritonitis which was undoubtedly present and undetected at the time of transfusion. No perforation of stomach or intestine could be found.

The value of transfusion in secondary anemia is based upon the stimulating effect of the donor's blood. The wisdom of its use in such cases will depend upon the cause of the anemia. In general, transfusions should not be employed to restore red cells which have been destroyed within the body unless the cause of this destruction can be remedied by subsequent treatment.

REFERENCES.

- ¹ Crile: Hemorrhage and Transfusion, N. Y., 1909.
- ² Meyer: Surgery, Gynecology and Obstetrics, 1911, vol. xiii, pp. 152-155.
- ³ Welch: Amer. Jour. of Obstetrics and Diseases of Women and Children, 1912, vol. lxxv, p. 412.
- ⁴ Schloss and Komisky: Amer. Jour. of Diseases of Children, 1912, vol. lxi, p. 216.
- ⁵ Lespinasse and Fisher: Surgery, Gynecology and Obstetrics, 1911, vol. xii, pp. 40-50.
- ⁶ Vincent: Amer. Jour. of Diseases of Children, 1911, vol. i, pp. 376-381.
- ⁷ Vincent: Bos. Med. and Surg. Jour., 1912, vol. clxvi, pp. 627-630.
- ⁸ Cole: Southern Med. Jour., April, 1912, no. 3, pp. 143-216.
- ⁹ Crile: Transactions of Amer. Surg. Asso., Philadelphia, 1909, vol. xxvii, pp. 80-86.
- ¹⁰ Brewer and Leggett: Surgery, Gynecology and Obstetrics, 1909, vol. lx, p. 293.
- ¹¹ Fauntleroy: Med. Record, New York, 1910, vol. lxxviii, p. 403.
- ¹² Williams: U. S. N. Med. Bulletin, Washington, 1910, vol. iv, p. 372.
- ¹³ Janeway: Annals of Surgery, Philadelphia, 1911, vol. liii, p. 720.
- ¹⁴ Elsberg: Jour. of Amer. Med. Asso., 1909, vol. lii, p. 887.
- ¹⁵ Soresi: Med. Record, New York, 1912, vol. lxxxi, pp. 835-839.
- ¹⁶ Bernheim: Annals of Surgery, 1909, vol. i, pp. 786-788.
- ¹⁷ Levin: Annals of Surgery, Philadelphia, 1909, vol. xlix, p. 320.
- ¹⁸ Dorrance and Ginsberg: International Clinical Jour., Philadelphia, 1910, vol. iv, pp. 65-70.
- ¹⁹ Hartshorn: Yale Med. Jour., Jan., 1912.
- ²⁰ Fauntleroy: U. S. N. Med. Bulletin, Washington, 1911, vol. v, pp. 47-50.
- ²¹ Townsend: Bos. Med. and Surg. Jour., 1891, vol. cxxv, p. 218.
- ²² Green and Swift: Bos. Med. and Surg. Jour., 1911, vol. clxiv, p. 454.

OTHER REFERENCES.

- Horsley: Amer. Jour. of Surgery, N. Y., 1911, vol. xxv, pp. 6-10.
 Gray: Med. Record, N. Y., 1911, vol. lxxix, pp. 198-201.
 Poole and McClure: Annals of Surgery, 1910, vol. lii, pp. 433-456.
 Hartwell: Med. Record, N. Y., 1910, vol. lxxvii, pp. 1003-1008.
 Hartwell: Amer. Jour. of Surgery, N. Y., 1909, vol. xxiii, pp. 92-96.

INTRA-RECTAL RUPTURE OF SUPPURATING SINUS FROM HIP JOINT DISEASE.*

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THIS paper is not intended to present something startling in the treatment of a particular condition, but rather to summarize the results of an investigation as to its frequency and the possibilities of alleviating the discomfort of a recent patient. The paths of proctologist and orthopedist cross at the point suggested by our title, and a problem arises of interest to either specialist, viz. the occurrence of para-rectal abscess, originating in tubercular disease of the

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hip joint, pointing into the rectum, and leaving a suppurating sinus of indefinite duration connecting the joint with the gut. This involves not only the question of an almost incurable discharge into it of pus of extra-rectal origin, but also the possibility that such a sinus will sooner or later rupture or be opened externally. The result is a complete fistula with the external opening nobody knows where, and the internal one usually large and ragged and very likely well above both sphincters. The operative uncertainties of such a fistula are great enough without the inroad of the infection via the sinus from the hip and still greater with that present. It is fair to infer too that the prognosis for the joint lesion is not so good, as long as the danger exists of a rather vicious mixed infection by a counter current of colon bacilli and other organisms reaching the joint via the same sinus. The proctologist would like to close his fistula and the orthopedist to close his sinus as soon as the primary focus in the joint can be quieted. Each wants to be rid of the other's infection. Can any surgical procedure separate fistula from sinus and simplify the question, or must this coxitic sinus be allowed to go on till it closes in its own good time, and leaves a fistula which will never close of itself?

The case which is my text was first seen March 13, and referred by Dr. W. R. MacAusland, orthopedist of Boston, and his home medical attendant, Dr. D. D. Pratt of New Bedford. The following summarizes his record then taken. Male, age 30, telephone clerk, English parentage, and family history negative except mother died of tuberculosis when he was seven years old. As an infant health was delicate. At age of five or six tubercular coxitis began and at times since has had abscesses and discharging sinuses. Seven months ago had para-rectal abscess which ruptured into the rectum. Same was later on account of urgent symptoms freely opened externally. For four months has been wearing a plaster spica. General health fair and maintaining weight, but unable to work and cannot walk without cane. The incision near anus discharges stercoraceous pus and some pus comes from anus and frequent dressings are required. Has persistent intra-anal soreness and pain when erect. His general appearance is good. His temperature range while in the Union Hospital, Fall River, has been 98 to 100. General physical examination negative except hip trouble and its sequences. Left leg is smaller than right, thigh flexed at an angle of 45 degrees and adducted, and joint partially ankylosed. There are five scars of past sinuses on front, side and back of thigh, some of which it is asserted have been closed by the therapeutic use of bismuth paste. Of active ones there are four, one below the anterior superior spine, another in the gluteal fold, the external incision about 6 cm. in left posterior direction from anal margin, and the intrarectal opening. This last is shown by digital and speculum examination