Transfusion through the Umbilical Vein
in Hemorrhage of the New-Born

Report of a Case

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The use of human blood as a therapeutic agent in melena or hemorrhagic disease of the new-born has been one of the gratifying advances in medicine during the last decade. Human blood has acted as a specific in this condition.

History

The first transfusion of blood for hemorrhagic disease of the newborn was performed in New York City by Dr. Alexis Carrel in 1908 [1]. The method was direct transfusion from the left radial artery to the right popliteal vein. The baby recovered. In 1909 Dr. Crile introduced the cuff and cannula method. In 1910 the Elsberg cannula was introduced, and during the same year, Vincent of Boston introduced the method employing the paraffin coated glass tubes.

In 1913 Lindemann aroused considerable interest in transfusion by introducing the syringe method, which simplified the procedure and, at the same time, gave a method by means of which the quantity given could be accurately measured.

In 1915 Lewisohn [2] reported two cases in which transfusion was performed by the citrate method. Since then many modifications of these methods have been reported with good results in all.
sake of brevity, they can be divided into two general groups, namely, direct and indirect. In one treated blood is used and in the other untreated blood.

In 1908 the first case of hemorrhagic disease of the new-born was treated with subcutaneous injection of whole blood by Schloss. Between 1908 and 1911, seven such cases were treated by him with one death [3]. In 1910 Welch [4] reported twelve cases treated by transfusion. Since then a large number have been treated with good results.

Routes

In infants the routes that have been used are the superficial veins of the arm, of the neck, of the scalp and the popliteal or femoral vein. In September, 1915, Helmholz [5] was the first to bring to our attention the employment of the superior longitudinal sinus as a route for the aspiration of blood as well as for injections. In the same year, Howard [5] used the superior longitudinal sinus, injecting citrated blood. Since then this route has been used very frequently on account of its accessibility in very young infants. In 1919 I used the umbilical vein in an infant 4 days old, giving 100 c.c. of whole blood by the syringe method, with satisfactory results.

Etiology

The etiology of this condition is not known. The following factors are thought to have some bearing:

1. Hypoplasia of the coagulating elements of the blood may be a factor. According to Schloss and Commiskey [6], "the cause for persistent bleeding in these cases must be due to some defect in the normal mechanism of the blood clotting time." They report ten cases which showed a coagulation time varying from normal to indefinite times, showing that the bleeding is not always dependent upon hemorrhagic diathesis. Another interesting point here is that the injection of blood cures these patients immediately and they have no return of symptoms. Transfusions do not cure patients with hemophilia.

2. From 2 to 6 per cent. of these cases are syphilitic, according to Holt.

3. Infection seems to act as a predisposing factor.

4. From observation, we note that babies that have been more or less asphyxiated have a tendency to bleed.

5. Trauma, such as is frequently suffered in difficult deliveries, and the common methods of resuscitation may well be exciting causes.

Rodda [7] has called our attention to the fact that as many as 50 per cent. of the necropsies in cases of stillbirth or on infants that die a few days after birth reveal hemorrhages in different parts of the body, many of which were not recognized before death.

According to Brown and Swift [8], these cases may be divided into three clinical types, namely: the
umbilical, the seromucous, and the purpuric, with a mortality of 60, 50, and 22 per cent., respectively. This was before the use of serum and blood transfusion.

Roddar [7] has shown that these babies have a prolonged bleeding time as well as a delayed coagulation time. This may be increased up to fifteen or twenty minutes, and, in some cases, even longer.

### Occurrence

At the Boston Lying-In Hospital, Townsend [9] reported that bleeding in the new-born occurred in thirty-two infants in 5,000 births. Ritter found 190 cases among 13,000 births at the lying-in hospital at Prague. Epstein found that it occurred in 8 per cent. of the cases at the New York Foundling Hospital. From Rodda's recent article, we must conclude that these figures are based mainly on clinical diagnoses, and that the occurrence is a great deal more frequent than their figures would indicate. Rodda [7] states that "statistics from the New-Born Clinic, University of Minnesota, show that postmortem examinations reveal cerebral hemorrhage in more than 50 per cent. of all infants that die inter partum or during the first few days of life. These findings often were made following noninstrumental, or even easy, deliveries." It was also noted that these hemorrhages occurred in other organs than the brain.

Here I want to emphasize one very important point. If these babies bleed they bleed early. The vast majority of them bleed within the first forty-eight or seventy-two hours, and practically all of them bleed within the first week of life. Lespinasse [10] reported fifteen cases treated with transfusion, and all but two patients were less than 4 days old. The umbilical vein is patent and accessible up to 4 days of life, as demonstrated by my case.

### Mortality

Before the use of human blood, the mortality in this condition was from 35 to 87 per cent [3]. Up to 1914, thirty-seven cases had been reported treated with human blood, either by injection under the skin, or by transfusion, or by both, with three deaths, or a mortality rate of 8 per cent. We now believe that all of them should recover if properly treated.

### Treatment

Lucas and Dearing [11] by the vital dye method demonstrated that the blood volume in infants was about one tenth of the body weight. If we use this as a basis, an infant has 1 ounce of blood to each pint in the adult. If we bear this relationship in mind, we may better appreciate what the loss of a few ounces of blood means to an infant. Any bleeding in the new-born baby should put us on our guard to the extent of securing a donor in case an immediate transfusion becomes necessary. In any event it is advisable to give a subcutaneous injection of from 15 to 20 c.c. of whole blood and repeat this in six or eight hours. If there is any further evidence of bleeding, transfusion should be repeated. In the intestinal case, the external manifestation is no index of the amount of blood lost. The baby may become exsanguinated by
bleeding into the intestinal tract, and only a small dark stool may be seen or even no stool at all. In these cases, immediate transfusion is the only hope.

It was once thought that the blood of the mother and of the infant were always compatible. Cherry and Langrock [12] tested thirty-four new-born babies against their mothers' blood. There was no agglutination nor any hemolysis in any of these tests. They started out to make 100 consecutive tests on as many babies born in the hospital, but they stopped when thirty-four gave no agglutination and no hemolysis.

According to the more recent work of Jones [13] on 197 specimens of blood from young infants, 78.8 per cent. could be placed in one of the four groups in accordance with the classification of Moss. He showed that the different groups occurred with approximately the same frequency in the new-born infant as they do in the adult. Iso-agglutinins have been demonstrated in the blood of a 7 months' fetus.

In 1920 Minot and Weld [14] examined 160 specimens of umbilical cord blood and found that 70 per cent. could be definitely grouped.

Happ [15] established the group by both serum and cell reaction in 22.7 per cent. of infants between 1 and 3 months of age, in 31.8 per cent. of infants from 4 to 6 months, and in 69.7 per cent. of infants from 6 months to 1 year. He states that after one year the group could be established in practically every case.

Unless time will not permit, every patient should be tested against the donor for agglutination and hemolysis before the transfusion is performed. Of course, the Wassermann reaction of the donor's blood should be known.

The injection and transfusion of whole blood will accomplish these results: (1) stop the hemorrhage; (2) replace lost blood, and, (3) overcome infection by giving new antibodies and new complement.

Report of Case

A boy, well nourished and well developed, was born, March 5, 1919, at 3 p.m. after normal labor, at the end of the fourth pregnancy. The baby weighed 9 pounds. There was no cyanosis, no jaundice and no history of any hemorrhagic tendency in the family. Three other children were living and well.

Very soon after the delivery, a dorsal slit was made on the penis, and the attending physician went to town, 12 miles away. Four hours later, the nurse telephoned the physician that there was bleeding from the incision in the penis. The incision was sutured tight, and a number of local applications to stop bleeding were applied during the next thirty-six hours, but to no avail. The baby was brought to the hospital the second day in very poor condition. Bleeding from the dorsal slit incision continued; the baby was pale and looked as if he had lost considerable blood. He noticed very little that went on around him. He was given 15 c.c. of whole blood from the father. This injection was repeated in eight hours.

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time of the second injection, the bleeding had practically ceased. Twelve hours later the blood injection was repeated, although there had been no bleeding since the second injection. At this time the baby's blood showed hemoglobin, 25 per cent.; erythrocytes, 2,000,000; coagulation time, 15 minutes. We were unable to determine the bleeding time. The baby had taken very little food and took water only by means of a medicine dropper. A transfusion of blood was decided to be advisable. The mother was brought to the hospital, and the baby was given 100 c.c. of whole blood by way of the umbilical vein. The cord was kept wet with a saturated boric acid solution for eight hours before the transfusion, or during the time required to bring the mother to the hospital and perform the transfusion.

Comment

Obtaining blood from one of the superficial veins of the new-born is often a difficult task and at times even impossible in the hands of an expert. The easiest route is by way of the superior longitudinal sinus; but this route should be employed only by one experienced in its use, and even the experienced worker may fail to enter the sinus because of its abnormal position, due to distortion from molding of the head. This is especially true during the first few days of life. We must admit also that the cranial cavity cannot be punctured with impunity; calamity will sooner or later ensue.

The psychic effect on the mother was one of the reasons for selecting another route than that by way of the superior longitudinal sinus in this case. I dare say that no mother could look on with impunity and see a needle thrust into her baby's head. To avoid this psychic effect on the mother, I chose this new and different route.

So far as I know this method has never been used before; but it appealed to me as a rational method for the baby had been receiving blood and nourishment through the umbilical vein exclusively until three days previously. I gave him 100 c.c. of blood through this channel. At the time I thought of the possibility of a clot in the umbilical vein, but I felt that its occurrence was unlikely in this type of case for we know that the blood from these patients remains in a fluid state for a long time when withdrawn from the body and kept in contact with foreign substances. Since then I have performed necropsies in two cases of hemorrhagic disease of the new-born and dissected out the umbilical vein to its entrance into the liver. It was perfectly smooth and clean throughout; no blood was present.

Method of Transfusion

The umbilical cord stump, which was of the usual length, about 2 inches, was surrounded by a gauze dressing which was kept wet with sterile saturated boric acid solution. This was continued for eight or ten hours until the mother could be brought to the hospital. This kept the cord from becoming too dry.

The baby was placed on the operating table, and the umbilical cord was exposed. The cut end of the cord presented the two patent lumens of the umbilical arteries and the collapsed umbilical vein, the latter, the largest of the three openings. The cord was then cut just proximal to where it had been previously tied off. This gave a fresh cross-section of these three blood vessels. The regular "record" transfusion needle
was inserted into the largest of these three vessels, the umbilical vein, and a ligature was tied over the cord to the needle to hold the needle in place. At this point a 20 c.c. record syringe was filled with physiologic sodium chlorid solution, and this was slowly injected into the umbilical vein. No resistance occurred and no obstruction was noted. An effort was made to withdraw the saline in order to see whether any sudden stoppage of the needle would occur, as the withdrawing of a clot into the needle. That was not noted. After this was done, it was felt that the vein was patent and that it was safe to proceed with the transfusion as planned. At this juncture the mother's arm was prepared as usual, and the median basilic vein was entered with a needle similar to the one used in the baby's vein. With the aid of an assistant who filled the 20 c.c. record syringes with blood from the mother's vein, I gave five 20 c.c. syringefuls of whole untreated blood direct from the mother's veins. After the fifth syringe was emptied in the umbilical vein, I injected 10 c.c. of physiologic sodium chlorid to rinse out the needle and the vein. The needle was then withdrawn from the umbilical vein, and the cord was again tied off as before.

If given earlier, this transfusion would have stopped the bleeding; but it was given primarily to replace the blood lost. It was believed that the baby had lost at least 4 or 5 ounces of blood and probably more. It was also believed that the baby was beginning his life with a considerable handicap, having lost probably a third or a fourth of his blood. To replace this lost blood would very probably make his first year uneventful. Following the transfusion, the hemoglobin increased to 80 per cent., and the erythrocytes to 4,500,000. He had a slight chill and a rise of temperature to 103, two hours after the transfusion. The temperature fell immediately, and the baby made an uneventful recovery. He weight 25 pounds at 12 months, 30 pounds at 2 years, and 38 pounds at 3 1/2 years. He is normal in every way.

Summary

This baby was transfused through the umbilical vein on the fourth day of life with the greatest ease. The fact that the great majority of cases of hemorrhagic disease of the newborn occur within the first three days of life should impress upon our minds the fact that if transfusion is necessary in these infants it may be performed through the umbilical vein with greater ease than by any other route. It is a common observation of Rodda [16], Warwick [17] and others who have performed necropsies on the new-born that the blood remains fluid hours after death in most of these cases.

Lucas [18] showed that there is a definite prolongation of coagulation time in the first few days. He says, "There is a definite and fairly constant condition in the blood of the new-born which favors the so-called hemorrhagic condition of the new-born." He found the coagulation time prolonged as much as forty minutes. He believes that the new-born infant normally has a prolonged coagulation time, whether hemorrhage occurs or not.

Conclusions

1. The umbilical vein may be patent and accessible for transfusion up to, and including, the fourth day of life.
2. The umbilical vein up to the fourth day is the most accessible vein in a new-born baby, if patent.
3. The probability of a clot in the umbilical vein is very unlikely because the blood is fluid many hours after death in these cases.
4. Transfusion through the sinus in cases of intracranial hemorrhage may increase intracranial pressure, which is not desirable.
5. Transfusion through the superior longitudinal sinus is comparatively simple for one experienced, while the umbilical route is simple for those inexperienced in the sinus route.
6. In my experience, the median basilic vein is always large enough to admit an 18 gage needle in infants as young as 2 or 3 weeks, and is preferable to the superior longitudinal sinus usually; but it is necessary to dissect it out.

Footnotes

10. Lespinasse, V.D. (Footnote 8).


