TRANSFUSION WITH CONSERVED BLOOD

BY

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Despite its many obvious advantages the routine use of stored blood for transfusions has failed to achieve any popularity. Whether this is due to an inherent objection to conserved material where fresh is available or whether to the fact that reactions after its use have been described is debatable. It was thought, however, that an extended trial might be of practical value.

The use of stored blood is by no means new. The work of Rous and Turner (1916) on animal transfusions suggested to Captain Oswald Robertson (1918) the employment of preserved blood for transfusions during the war, and his technique involved the dilution of 500 c.cm. of blood with 800 c.cm. of a citrate dextrose solution. He performed twenty-two transfusions with only one slight reaction, and that in a case of gas gangrene. He kept the blood as long as twenty-six days, with an average of ten to fourteen days, but discarded any that showed signs of haemolysis. In the decade following the war transfusions were comparatively few, but the increase during the last ten years has renewed attention to the possibility of using stored blood.

Figures for East Suffolk and Ipswich Hospital

Year	Blood Transfusions	Year	Blood Transfusions
1929	48	1934	49
1930	35	1935	53
1931	35	1936	137
1932	34	1937	124
1933	35	1938	145

Yudin (1937), working on some experiments done by Shamov (1937), performed 1,000 transfusions with stored cadaver blood with entirely satisfactory results. Fantus and Schirmer (1938) report on the technique used at the "blood bank" of the Cook County Hospital, Chicago. Tuohy (1938), Wilson and Jamieson (1938), and Mingazzini (1938) all record satisfactory results with stored blood. In a personal communication Dr. Reginald Saxton, who has had experience of transfusion work under war conditions in Barcelona and elsewhere, informed me that he had given up using stored blood because of the reactions it produced. However, on reverting to fresh blood equally numerous reactions had been noticed, and it is possible that these were due to the poor physical condition of the donors.

The advantages of stored blood are: (1) blood is available at very short notice; (2) it is typed leisurely and examined to exclude syphilis; (3) it is drawn from the donors at their convenience; (4) it is possible to restock blood taken from "list" donors by that from relatives when they become available; (5) with a choice of time for the withdrawal of blood it becomes possible for the same person to be constantly responsible for the operation.

Apparatus

A desirable technique should ensure the following points: (a) the minimum amount of exposure to air and aerial contamination; (b) a small needle for the donor's veins which necessitates either previous "heparinization" of the donor or negative pressure to assist the flow;

(c) samples available for testing without opening the main container. The apparatus has been designed with these objects in view, and consists of a transfusion needle 1.5 mm. in diameter connected by an adapter and about eight inches of pressure-tubing to a chromium-plated two-way screw cap which fits a 20-oz. screw-capped U.G.B. medicinal (Fig. 1).

FIG. 1.—Showing on the left the bottle containing 50 c.cm. of 5 per cent. citrate before use, but attached in readiness to the electric rotary suction pump. On the right is shown the same bottle full of blood and with the aluminium screw cap in position. The label on the second bottle has been filled in with all the essential details, and attached to the bottle are two small tubes, one for serum and the other for a cell suspension.

The exit tube of the cap runs via an air filter of cotton-wool and an adjusting valve to an electric rotary suction pump such as is available in most operating theatres. The accessories consist of an aluminium screw cap to fit the bottle which is wrapped in paper and sterilized, a conical centrifuge tube for serum for Wassermann or other test, and a small tube with about 1 c.cm. of citrate in saline for cross-matching.

Technique

The donor, in a fasting state, is taken to the theatre, where strict aseptic technique is observed. The veins are compressed with a sphygmomanometer cuff, and a small amount of local anaesthetic is injected. About 50 c.cm. of 5 per cent. sodium citrate solution is used as the anti-coagulant, and is drawn into the bottle through the needle and tubing. To ensure a satisfactory flow of blood the needle is inserted unconnected with the tubing. The bottle is agitated gently during withdrawal, and with moderate suction a steady stream of blood fills the bottle in from four to seven minutes. The required amount of blood is then allowed to run into the accessory tubes, the needle removed, caps changed, and tubing washed out with water. A Laughlen flocculation test is done soon after withdrawal, and is confirmed later by Wassermann and Kahn reactions. No positive reaction has so far been obtained with any donor's blood. A cross-matching of the donor's cells and the patient's serum is always performed, and only if this is satisfactory is the blood issued for use.

During the past ten months 150 transfusions have been made with stored blood, and the following figures are worth recording:

Maximum period of storage..	..	..	..	14 days
Average	..	..	..	4.4 "
Pints discarded as "out of date"	..	..	..	8.6%
Number of Group IV (O)...	..	..	..	66%
" " II (A)...	..	..	..	31%
" " III (B)...	..	..	..	3%

The red and white cells of several samples have been frequently examined over a period, and a composite curve is reproduced here (Fig. 2). It shows a rapid decrease of white cells practically confined to the polymorpho-nuclears and a very gradual diminution of the red cells.

FIG. 2.—Graph showing cell counts on citrated blood.

Donors

Because donors come up when convenient and suffer little or no discomfort we have no difficulty in getting adequate numbers of volunteers; but it is important that they should be treated considerately, and it is a great advantage if withdrawal of blood is done by one person: not only does practice make perfect, but the operator establishes personal contact with his donors.

Of the 150 transfusions sixty-three pints were obtained from relatives and eighty-seven from voluntary donors. We have 152 donors on our list, and could easily increase this if necessary. They receive no payment except travelling expenses when these are requested. At most of the large firms in Ipswich there is a responsible individual to whom we telephone and so arrange appointments.

A Report on Use of Stored Blood

Stored blood is used in the East Suffolk and Ipswich Hospital for all transfusions. For small ones a simple tube-and-funnel method is employed, and it is often possible to avoid cutting down upon a vein by the use of a 1-c.cm. syringe fitted with a side-tapping to which the rubber tube leading from the funnel is attached. When patients require repeated transfusions, or the veins are impalpable, it is necessary to cut down under local anaesthesia. We have found that the glass cannula of the Marriott and Kekwick type is the most convenient, and it gives the least trouble in either intermittent or continuous transfusions. Up to six pints of stored blood have been transfused by the continuous-drip method of Marriott and Kekwick. Some points in the technique of using stored blood are:

1. Agitation of the refrigerated blood is carefully and thoroughly performed by inversion of the bottle and a rocking or swinging motion, but shaking is never done, as it has been shown to cause haemolysis.

2. Warming of the blood is always performed cautiously. If possible it is allowed to stand for a period in the room to reach that temperature gradually, and the bottle is then immersed in warm water at a temperature not exceeding 100° F. The thickness of the glass bottle ensures a slow and safe warming, and the bottle is gently rocked during the procedure. I have seen no ill effects resulting from the warming, and if the blood is to be administered at the rate of a pint in half an hour, as is usual, I consider that it is desirable to raise its temperature towards that of body heat, although there is no necessity for any exact temperature to be reached provided it does not exceed 98° F.

3. The blood is always filtered, using four to six thicknesses of sterile gauze through which it is poured directly from the bottle into the receptacle used for the transfusion. Care is taken to avoid any of the warming water from running down

by wrapping a layer of sterile gauze round the neck of the bottle. A useful two-way stopper recently marketed by the Bush Manufacturing Company allows the blood to be given by inverting the bottle and connecting it up directly with a filter and drip connexion.

Complications

We are convinced that complications are no more frequent than with the usual citrate methods of transfusion with fresh blood. Approximately 10 per cent. of patients have developed slight transient rises of temperature, but in one case only did this cause alarm. It is not impossible that this reaction, which came on six hours after the transfusion, was due to some other cause; at any rate, the patient made a good recovery. A few develop rigors, but it is rare to see more than one rigor in any patient, and the incidence is not more than 5 per cent. There has been no case of embolism, pyaemia, haemoglobinuria, haematuria, or suppression of urine. No anaphylactic or delayed serum reactions have occurred.

One patient had eleven blood transfusions with quantities of from six ounces to three pints over a period of less than a month without any ill effects. A man who had sustained multiple injuries in a motor-cycle accident—fractures of the skull, first rib, and clavicle, and metacarpal and minor injuries—was received here three hours later after a twenty-six-mile journey in an ambulance. On admission his symptoms were suggestive of a ruptured spleen. At operation this proved to be the case, and the spleen and three pints of blood were removed from the abdomen. During the operation he received one pint of stored blood, and subsequently another while he was still on the table. He made a good recovery. It is true that this patient might have been given an autotransfusion; but this would have considerably delayed the operating-time, and in view of his other complicating injuries any delay would probably have meant death upon the operating-table.

We are well satisfied that stored citrated blood produces no more complications than does fresh citrated blood, and the advantages of the former cannot be exaggerated.

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The report for 1937 on Native Affairs in Kenya Colony and Protectorate (H.M. Stationery Office, 3s.) includes an interesting chapter on medical and public health matters. Small-pox was imported into one district by refugees from Ethiopia, but thanks to the comprehensive precautions taken no widespread epidemic resulted. Only 158 cases of plague were reported, as compared with 239 in the previous year, and there was an even larger drop in the incidence of cerebrospinal meningitis (227 cases against 319). The number of cases of syphilis (4,837) and yaws (13,131) treated at the dispensaries was much the same as in the preceding years. In some districts, however, yaws appears to be practically extinct, and it is rare now to see typical ulcerative yaws in, for example, Nairobi. Again, there is reason to believe that the intensity of helminthic infestation is decreasing, though the number of cases actually coming under treatment is still about 60,000. Much has been achieved by propaganda and educational endeavour, but much remains to be done. Thus in the Keruguya area female circumcision is still so commonly performed that episiotomy is necessary in 90 per cent. of first labours.