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A NEW METHOD OF BLOOD TRANSFUSION.

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THE discovery by Arthus and Pages of the possibility of keeping the blood permanently liquid by precipitating the lime salts in it in the form of insoluble oxalates has opened a way for improving the methods of transfusion as at present practised. The demerits of the method in use can be very easily summarised. The injection of defibrinated blood is a dangerous method, since intravascular coagulations have been often observed to follow it. On the other hand, the method of arm-to-arm transfusion is one of extreme difficulty, and requires, if it is to be successful, the careful preparation of somewhat complicated apparatus. The merits of the decalcified blood of Arthus and Pages for purposes of transfusion, on the other hand, appear to me to be perfectly unique, as such blood is, as far as can be discovered, perfectly normal blood, except for the fact that it no longer contains any lime in a form available for the formation of fibrin, and the further fact that it has undergone a very trifling dilution (not more than one-tenth of its volume). It is therefore not a disintegrated blood like defibrinated blood, and, on the other hand, it will not clot unless we intend it to clot, and unless we, for that purpose, restore to it the lime salts which have been removed from it by receiving it into a solution of a soluble oxalate. In order now to ascertain whether these theoretical merits of decalcified blood for purposes of transfusion would be confirmed by experimental evidence, I undertook transfusion experiments with decalcified blood in three dogs.

The blood, after being decalcified, was in two¹ of the experiments drawn off from the animal upon which the transfusion was to be made, and was decalcified in the ordinary manner, and was then, after the lapse of ten minutes, reinjected into the circulation through the jugular vein. In the third case² the blood of another dog was employed. The operation, which was in each case performed under antiseptic precautions, was then terminated by the application of the necessary ligatures, and the closing of the wound. No pathological symptoms whatever were observed. In the case of one of the animals, who was twice operated upon by the reinjection of

¹ The quantities of blood injected in these experiments was the amount of blood which it was found possible to draw off without causing the death of the animal by hæmorrhage.

² The amount of blood injected in this experiment was 100 c.c., and corresponded to the addition to the circulating blood of about a third of its volume.

his own blood in the course of a fortnight, a rise of temperature of only 0.4°F . was recorded on the day following the second operation, and no changes in the blood corpuscles were detected upon microscopical examination. In the other cases the temperature observations were unfortunately omitted, but the animals were very lively, and fed well after the operation.

In suggesting the application of this method of transfusion in the human subject in cases where transfusion is indicated, a certain amount of caution will, of course, have to be observed. The blood would have to be collected in small portions from the vein of the person supplying it. I would further suggest that until information has been obtained as to the precise amount of soluble oxalate necessary to complete the precipitation of the calcium in human blood, small samples of blood should be drawn off as a preliminary operation into one-tenth of their volume of a 1, a $1\frac{1}{2}$, and a 2 per cent.³ solution of oxalate of sodium. The blood should be thoroughly mixed with the oxalate solution as it flows from the vessel, for where this point has not been attended to, coagulation will often occur in blood, even in the presence of an excess of oxalate. When the correct addition of oxalate has thus been determined (the correct amount being naturally the least amount that will keep the blood perfectly liquid), the actual operation might be proceeded with. Even then, however, it will be expedient to draw off the blood in successive portions, and to keep these portions in separate vessels for some ten minutes at the temperature of the body before proceeding to the injection. By this method any portions which showed any sign of coagulation can be easily eliminated, while the other portions are injected into a vein. An excess of free oxalate is to be avoided, though it need not, as far as I have been able to judge, be over-anxiously avoided. To the pharmacologist the method of transfusion here suggested would appear to be of an obvious utility, as the decalcified blood might be used as a vehicle for administration of drugs in pharmacological experiments.

³ A solution of this last strength I have found to be quite strong enough to keep bullock's blood perfectly liquid when properly mixed with it. It is therefore hardly to be anticipated that we should have to resort to any stronger solution in the case of human blood.