FALL VON DIRECTER ARTERIELLE THIERBLUT-TRANSFUSION

By: Dr. P. SCHLIEP

A TRANSLATION BY PHIL LEAROYD

The paper 'Case of direct arterial animal blood transfusion' by Dr. Paul Schliep, was published in 1874 in the journal *Berliner Klinische Wochenschrif* (reference Vol. 11, No. 3, pages 25-28), a copy of which can be viewed or downloaded from the following site:

https://babel.hathitrust.org/cgi/pt?id=mdp.39015049764577&seq=35

I have translated this paper by Schliep because it is one of very few to suggest direct transfusion from artery to artery as a practical option, especially given the date that it was written. He initially describes failed attempts at performing a direct blood transfusion initially from the artery of a sheep to the vein of the patient, who was suffering suppuration following a gunshot wound, due to the blood clotting within the device tube and cannulas. He then describes the next transfusion attempt as being between a sheep artery and the patient's radial artery, using a direct transfusion device that he has devised, which includes a syringe between the donor and recipient tubes.

The author describes and illustrates this device, identifying that it enables the blood flow from the animal artery to be regulated, as well as being able to identify the amount of blood actually transfused – both of which are identified to be problems related to direct transfusion methods.

He describes that having transfused the patient with this device, the patient produced a number of reactions as a consequence the procedure, severe enough in fact to cause the transfusion to be stopped. Schliep discusses the possible reasons for these effects but appears to dismiss the possibility of cross-species incompatibility.

He then looks briefly from an historical viewpoint as to the different methods of transfusion, both direct and then indirect, as well as identifying the general preference for using whole blood and not defibrinated donor blood. He then broadly discusses the various methods of transfusion using either an animal or human donor, whilst still maintaining the idea of using a donor artery and a recipient artery – the practical difficulties of which in a human donor and/or a human recipient he appears to largely dismiss as apparently only 'inconvenient'.

I have produced a translation of this paper from the original German into English to hopefully enable its content to be appreciated by a wider audience. Whilst I am obviously aware that instantaneous computer generated translation is available, this process however struggles with accurately reading the original text and interpreting specialist terminology, as well as producing a 'colloquial style' not always representative of the original text. In addition, an 'automatic translation' may either purposely or inadvertently alter the wording to 'make it read better' but in doing so there has to be an element of interpretation involving something on the lines of 'I believe that this is what the author is actually trying to say'. I want to avoid that as much as possible and try to present what the author actually wrote and as a result the reader may find that the English text does not 'flow' as well as it could. Although I have taken great care in accurately identifying the original text and producing a true representative translation of the author's original wording I cannot guarantee that this work does not contain 'translational errors' and the reader is recommended to check specific details against the original text.

I have reproduced the original paragraph settings and general layout as accurately as possible. The two references to the text are included at the bottom of separate pages in the original publication; I have sequentially re-numbered these and reproduced them as originally written at the end of the translated text. NOTE: The body of the text Schliep refers to a 'Gesellius' monograph, The Transfusion of the Blood', the reference to which is not given, but which is as follows:

Gesellius, F. (1873) Die Transfusion des Blutes, eine historische, kritisch und physiologische Studie. [The transfusion of blood, an historical, critical, and physiological study] St Petersburg: Eduard Hoppe / Leipzig: Franz Wagner.
https://wellcomecollection.org/works/c4p6wp9f

NOTE: This paper elicited a response from Joseph Roussel – the reference to which is:
Roussel, J. (1874) Bemerkungen zu dem Aufsatze des Herrn Dr Schliep über directe Thierblut-Transfusion. [Comments on Dr Schliep's essay on direct animal blood transfusion] *Berliner klinische Wochenschrift*, 11, 14, 167–168.
https://babel.hathitrust.org/cgi/pt?id=mdp.39015049764577&seq=177
[I have also translated this paper as well – PL]

From the Augusta Hospital in Berlin

CASE OF DIRECT ARTERIAL ANIMAL BLOOD TRANSFUSION

communicated by

Dr. Paul Schliep.

To the kindness of the directing physician of the surgical department of the Augusta Hospital in Berlin, Dr. E. Küster, I owe the opportunity of being able to test the value of a modified method of transfusion on a first case, and I take the liberty of first presenting this case to the readers, in order to make some remarks on the previous transfusion procedures and to indicate some new points of view which, after trials, seemed to me worthy of attention.

H. H., 28 years old, suffered a gunshot fracture of the left thigh at St. Quentin on 19 January 1871, which was treated conservatively and gradually healed, but was followed by necrosis of the femur, which caused the patient protracted and abundant suppuration during the whole of the time that followed. Surgical interventions had not been undertaken, since no sequester had become detached. On 8 September 1873, he was admitted to Augusta Hospital. He had several prolapsed abscesses on his thigh, was very weak and pale. Pulse fast, but full. On 13 September the abscesses were opened and crisscrossed with drainage tubes, on 26 the ball still in the thigh was discovered with Nélaton's probe near the trochanter, and it was extracted on 3 October. But the suppuration persisted, and the strength decreased. In mid-November, albuminuria set in. As his condition gradually worsened, he was offered a transfusion in order to prolong his life, to which he agreed.

The first attempt was made on 9 December, but the actual transfusion was not carried out until 22 December. The first time the procedure was followed, as described by Gesellius in his monograph, "The Transfusion of the Blood," p. 81. A glass cannula was inserted into the carotid of a sheep towards the heart and fixed with a ligature. Then the median basilic vein of the patient's left arm was exposed to an extent of 1 inch, another glass cannula filled with

water was inserted into it, held there, and after it was satisfied that the stream of blood flowed vigorously from the sheep, the two were united by an interposition tube of rubber in the prescribed manner. Judging from the slight effect this produced on the patient, we had to assume that the resistances in the vein very soon caused a congestion of the sheep's blood in the connecting tube, so that when the interposition tube was removed from the patient's cannula for testing, there was no flow at all, but rather clot formation had occurred throughout the entire device. Both cannulas therefore had to be removed and thoroughly cleaned in order to relieve the patient of the risk of embolism. After the union was restored, the patient thought for a moment that he felt something warm running up his arm, a feeling that soon disappeared. When examined, the blood flow was again blocked and the cannulas and the tube were again filled with long clots. The operation was therefore interrupted as too dangerous, the vein was tied, the piece that had been in contact with the cannula was re-sectioned, and the wound was closed with a few stitches.

Preparations had been made for a depletoric bloodletting on the other arm, but it was not carried out because no symptom indicated it. The patient's temperature remained unchanged in the following days, usually 37 degrees in the morning and 38 degrees in the evening. The pulse, which had shown some fluctuations in number and strength during the operation, also remained unchanged; also the albuminuria.

On 22 December, another transfusion was carried out, and at my suggestion another plan was adopted, namely, to make the transfer from the artery of the lamb directly to the patient's radial artery, but not counting on the driving force of the pressure under which the blood is in the carotid artery of the lamb but, according to the principle of the gastric pump, to use a syringe specially made for this purpose, whereby the transfer was not only to be effected more quickly and safely, but also in a quantity that could always be determined, which was so unpleasantly lacking in the ordinary procedure.

The device consists of a small syringe made in the style of the English stomach pump with 2 openings along with rubber tubes and 2 silver cannulas.

The lockable silver cannulas were filled with distilled water. The carotid of the sheep was laid bare to an extent of about 2 inches, its peripheral end was tied, a second thread was placed round the vessel, and the two ends were passed from the outside through the eye of the ligation needle and tightened, causing temporary compression of the central end of the exposed artery made possible at the opening. A fold was then raised on this with hooked tweezers, a lobe was cut out with Cowper's scissors, and while this was raised, the cannula was inserted with ease and without loss of blood, and tied by a ligature with the previously only compressed silk thread, close to its conical and centrally opened end.

The patient's cannula can also be closed off by a tap, but differs from the sheep cannula in that it is ground at an angle at the front, which makes insertion easier, and secondly, in that the tap is also drilled on the side, in the shape of a T, so that all the liquid that flows in the direction of the patient can be drained outwards at any moment by turning the tap just before it actually reaches the patient. In this way, one can always satisfy the indication to interrupt the operation, and at the same time be safe from the danger that coagulation will form in the device during a break and may hinder the continuation of the operation.

This cannula was also filled with water and inserted into the peripheral end of the right radial artery, the central end of which had previously been ligated, and handed over to the assistant. The approximately 8-inch-long rubber tubes were then attached to the cannulas, which were again connected to the two openings of the syringe by metallic, airtight attachments. This had previously been filled with water for the purpose of expelling air, and had been lying on ice, which I would only recommend in contrast to the usual keeping warm, without attaching too much importance to it. But blood coagulation is accelerated by keeping it warm, as has been proved by Oré in particular, and as has been confirmed to me by my comparative experiments on dog and sheep blood, and this is to be avoided if possible.

After these preparations, we began the transfusion by opening the tap of the sheep cannula and by manipulating the pump accordingly, took some blood from the carotid artery, which during the systole of the syringe it was emptied with the water to the outside, through the side tube leading into a basin. When pure arterial blood began to flow down the side

tube, the assistant guarding the patient's cannula turned the tap over, directing the bloodstream into the interior of the artery.

In intervals of 5 to 5 seconds, 2 drachms were injected with each systole, without any particular resistance being perceived at the plunger, an experience that I had previously had with the relatively small area of the canine femoral artery. The patient stated that he felt it warm in his hand and running up his arm. In one minute, 3 ounces of blood were thus added to the patient's vascular system in this way.

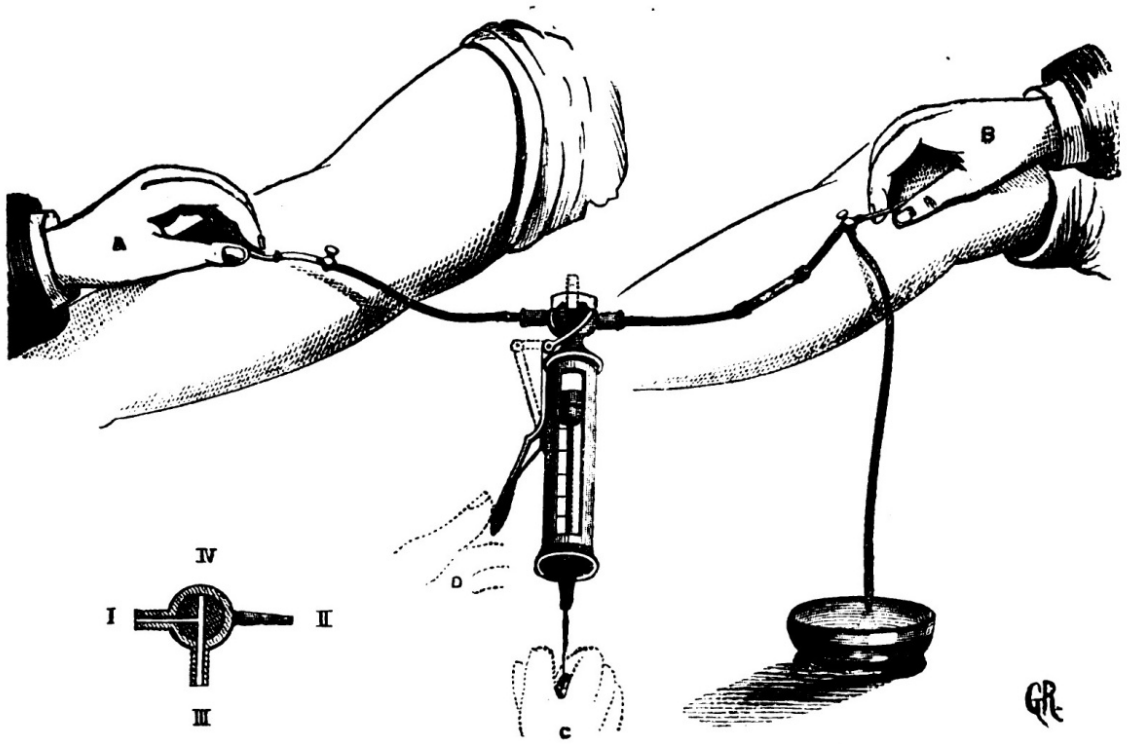
After the patient had received about 2 ounces of it, he developed some shortness of breath and severe redness of the face, which is why Dr. Küster performed a venesection, which gave only a little blood, because the otherwise convenient vein of the left arm had become impassable during the first transfusion attempt, and therefore had to be tried on a smaller one. At 3 ounces, the anxiety increased, the face now became pale, and the patient complained of severe pain in the kidney area, which is why the blood stream was turned away from the patient and slowly maintained to the outside. As the sheep still had a lot of blood left, we were ready at any moment to continue the transfusion, but as the disturbing symptoms did not soon subside, we decided to leave it at the 3 ounces, removed the device, and bandaged the patient. The hand was very slightly swollen, but this was only visible when compared very closely with the other. Two or three small petechiae had appeared on the side of the thumb and the veins were more visible than usual. The tightness of the chest, the pallor of the skin continued and half an hour later passed into a slight chill, whereupon the temperature was 39.6 after 2 hours, 39.0 2 hours later, and 38.0 again 2 hours later. Pulse small and fast. In the following days and so on until now, well-being and the usual temperature. There were no further consequences of circulatory disorder in the hand. Suppuration and albuminuria have remained unchanged so far.

It would be very interesting to be able to answer the question of where the constricting symptoms came from. The ingress of air was absolutely out of the question, as was any formation of clots that would have led to symptoms on the hand. The most probable cause was the sudden increase in lateral pressure, which could perhaps arise quickly in the more hyperemic than anaemic patient, and then had the liveliest precise effect in the circulation and respiratory centres. If a depletoric bloodletting had been made before the operation, this malady might perhaps have been prevented. Unfortunately, however, the opening of the vein after the onset of the disturbing symptoms also yielded very little blood. Therefore, this assumption retains the most probability.

Another possibility would still remain, but it could only be assumed after the exclusion of the above-mentioned ones, that these symptoms were caused by the specific effect of sheep blood. But I would only hint at this, and not yet represent it as probable, as it would throw a peculiar light on those animal blood transfusions in which these symptoms have not been reported, and which would then all be on a par in positive value with the transfusion attempt of 9 December described at the beginning, which would be on a level about the significance of which we had no illusions.

Since the technical interest in today's communication precedes the physiological one, I only want to hint at these questions and will now try to give an approximately correct idea of the device through the drawing, and note that it represents a type of transfusion that will be mentioned later, from the vein of one arm at A to the vein of another at B. The small additional drawing explains the drilling of the cannula tap at B, the importance of which will be clear to everyone.

The syringe contains one ounce and is divided into sections, since you only need small quantities, about two drachms are transferred at a time, in order to leave the imaginary amount of blood outside the vessel for as short a time as possible, in order to remain as close as possible to the volume which nature itself drives through the region of the vessel receiving blood in a given unit of time. The cylinder must be very well made; the ancillary parts must be airtight, requirements which my copy, supplied by Messrs. Krohne and Sesemann in London (1), completely corresponds to.



The surgical procedure described above with this device has proved itself to me in numerous experiments on dogs, which I carried out in the German hospital in London with my colleague Nieden there, to whom I am grateful for many a good tip. To explain the thought process that led to this, I would like to add the following.

In the years 1667-68 transfusions were carried out directly from the artery of the animal into the vein of man, a procedure which fell into oblivion as suddenly as it began to be practiced at the same time in four countries (England, Germany, France, and Italy), and it was forgotten for about 150 years.

In 1820-30 Blundell transfused whole (un-defibrinated) human blood indirectly into the patient's vein, and he was joined by a series of almost 100 surgeons, who, until recent times, though with different devices, have practiced transfusion with the same idea more with than without success.

Next to this is the group of defibrinating transfusors who began with Dumas and Prevost in 1821, and whose followers, though less numerous (about 30 surgeons) and less fortunate, continue up to the present time, of which Leisrink's lecture, to which there is no space to go into here, bears the final testimony to this (2).

Only two proposals from the sixties represent phenomena that deviate from these main directions: firstly, the direct transfer of whole venous blood from man to man (Moncoq, Oré, Aveling,); secondly, Hüter's proposal to inject defibrinated blood into an artery.

The work of Gesellius must be described as a return to the old, but not to the good old days, who again defends the direct transfusion of animal blood, and whose book, in so far as it pursues this purpose, will always be recognized by all who are interested in the question of transfusion in its great reformatory significance. He certainly had a forerunner in Albini in 1872, but that does not diminish his merit, and he had the satisfaction of hearing from Hasse at the last meeting of German naturalists that he did not preach to deaf ears.

If we summarise all that the authors, especially Gesellius, have given with good reason for the transfusion of whole blood, we consider the oft-quoted statement of Magendie that fibrin facilitates the passage of the blood through the capillaries, and we also see the new perspective opened up by Hüter's proposal for the arterial transfusion of this operation, and finally, if we examine the results of the previous transfusions of animal blood, it is natural to

try to unite the good of these principles, and to recommend the direct transfer from the artery of a suitable animal to the human artery as being the safest type of transfusion, all things being equal. The objections to this will consist chiefly in the fact that the necessary animals are not always at hand, or at other times not the necessary devices, then no assistance. Well, these are things that can be objected to in almost every operation, and we must leave it to each surgeon to consider the possibility of one or the other method in each individual case and to choose it according to the circumstances.

If there is a man who wants to sacrifice his blood, perhaps the husband for his bleeding wife, he shall be more welcome to me than a sheep. However, I know of various references to literature where the transfusion had to be omitted due to lack of a blood donor, and when I think of the last war with its frequent indications for transfusion, and of the columns of sheep that followed our troops, and whose blood probably only benefited the enemy's earth, I must declare it to be an enrichment of therapy that should not be underestimated if the use of animal blood is spoken of again today. Suppose, however, that it is to be transfused from one person to another, the next question is: direct or indirect? And if, as is likely, we opt for direct transfusion in the first instance, the further question arises: should the cannula be placed in the blood donor's artery or vein? Gesellius, it is true, says with regard to the drawing of blood from the artery: What foolish philanthropist will give himself up to it? If, however, I were once philanthropist enough to give my own blood rather than have a sheep injected into someone, I would, after weighing the dangers which the opening of the vein and that of the artery cause, make up my mind to open my artery, and would also be obliged to my clients to describe this type of sacrifice as the decidedly less dangerous one, despite the fact that the inability to work after this would last a little longer than after the vein was opened. In this case: the direct transfusion from one person's artery to the other's artery.

If, however, someone thinks he has reasons for having his vein opened and a cannula inserted into it for a short time, this may also be as it has already been done, and we would then transfuse directly from the vein of one person to the artery of another.

If we go one step further, we have arrived at Aveling's method of directly transferring from vein to vein, a procedure that has already had successes.

If, for practical reasons, all these procedures appear to be impracticable in the individual case, only then would I consider myself justified in taking the ordinary paths, all of which may lead to the goal, under appropriate conditions, but in descending order until the defibrination procedure involves increasing dangers to the patient's life.

Each surgeon can decide for himself to what extent he wants to make use of the double-acting pump when carrying out one or another procedure according to the principle stated above. The small instrument has been useful for this, but also for other surgical purposes, e.g. proven to be quite practical as an aspirator.

1. 8 Dukestreet Manchesterquare London.
2. No. 41. der klinischen Vorträge von Volkmann.