TRANSFUSION DIRECTE DU SANG VIVANT

BY: JOSEPH ROUSSEL

A TRANSLATION BY PHIL LEAROYD

A copy of this 32 page pamphlet/booklet 'Transfusion directe du sang vivant' (Direct transfusion of live blood) by Joseph Roussel, published as an extract of the Gazette des Hôpitaux on the 18th February 1882 [by Asselin, Paris] can be viewed at the following sites:

https://wellcomecollection.org/works/jm7e7mka

https://archive.org/stream/b22280893/b22280893_djvu.txt

I have translated the content of this pamphlet/booklet from the original French into English so that the content may be appreciated by a wider audience. Whilst I am obviously aware that instantaneous computer-generated translation is possible, this process struggles with specialist terminology and also produces a 'colloquial style' not always representative of the original text. I have attempted wherever possible to hopefully maintain the author's meaning, intent and detail, so as to make the translation as 'un-interpreted' as possible. Although I have taken great care not to misrepresent 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 French text. I have kept the same sentence structure as in the original document.

Roussel spent many years travelling around Europe essentially acting in part as a salesman, demonstrating and promoting his blood transfusion device, which he called the 'transfuseur'. The content of this publication to a large degree reflects this as it appears to be essentially a 'promotional publication'. It does contain extensive details of a successful case of a blood transfusion following a post-partum haemorrhage that was given to a Mrs. Maloigne, taken from a blood donor called Adrien Renaud, on the 7th February 1882. The case study provides clinical details of the patient and her recovery, practical details regarding performing the transfusion, as well as comments relating to blood donors and their safety. This latter point is especially relevant given that Roussel's device is able to provide a single transfusion of a large quantity of blood (i.e. normally between 150-300 grams) rather than repeated infusions of small amounts, which was normal at that time due to the donor blood clotting within the various other devices that were used for giving a blood transfusion.

The author describes the 'shivering normally seen' in patients 20-30 minutes after the transfusion has been given and comments on the problems of blood clotting, which in the absence of anticoagulation the transfuseur attempts to eliminate by ensuring that the donor blood does not come into contact with the air.

The case report is followed by an extract of a paper by Roussel published in the monograph 'La Transfusion' in 1876 detailing the 'conditions for a successful transfusion' that also provides an illustration of his device, together with details of how it is used, and a drawing of a transfusion being performed. This is followed by a series of transfuseur 'product endorsement' comments by different people.

A further case of transfusion performed in April 1882 using the author's device is provided, that was apparently requested by a Dr Noel, which in itself is interesting in that he had also devised his own blood transfusion instrument but appears to have

preferred to use Roussel's device instead. Finally, the author presents a summary of the results of 60 blood transfusions using his device that were given between 1863 and February 1882, that are summarised by the patient's clinical condition / reason for the transfusion and what Roussel considers to have been the outcome (i.e. mainly based on the patient's physical condition and other subjective/physiological changes). These are summarised as 30 being "completely successful", i.e. the patient recovered, 13 as "semi-successful", i.e. the transfusion produced an improvement but the patient died of their primary disease, and 17 as "unsuccessful", i.e. the transfusion did not produce any marked improvement "even though it was perfectly performed".

At a time in the history of blood transfusion when debate was still occurring as to what source (animal or human) and what type (whole blood or defibrinated) of blood should be used for a transfusion, not to mention which of the large number of different devices should be used to perform either a direct or indirect blood transfusion, Roussel came forward as a strong supporter of the direct transfusion of unaltered venous human blood. To promote this belief he conducted a systematic marketing campaign aimed at the general public as well as doctors / surgeons across Europe, which also included the armies of Austria-Hungary, Belgium and Russia. Not only was this a key element of introducing blood transfusion into clinical practice in the last quarter of the 19th century but was also obviously commercially successful.

For additional information regarding Roussel and his marketing campaign see:

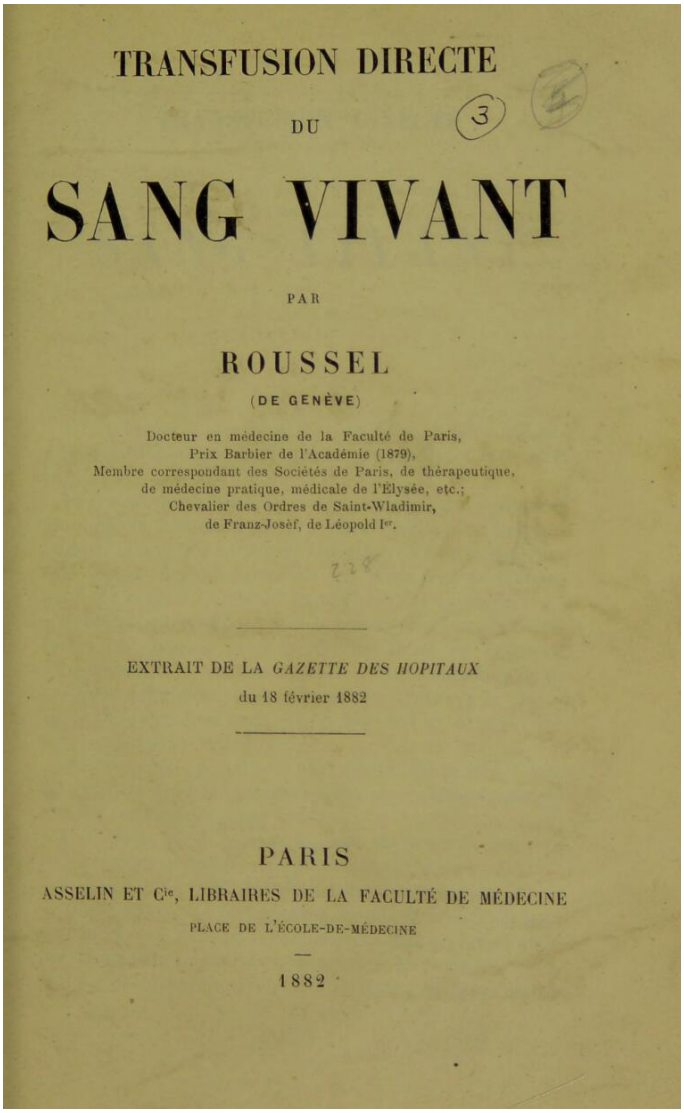
Berner, B. (2020) Strange Blood: The rise and fall of lamb blood transfusion in 19th century medicine and beyond. Medical Humanities (Volume 5). Verlag: Bielefeld. (See pages 35-42 and 45-48)
https://library.oapen.org/bitstream/handle/20.500.12657/39503/9783839451632.pdf?sequence=1

Sergeeva, M., Panova, E. (2020) The studies of blood transfusion and the attempts of its implementation into medical practice in 1800–1875: the fate of J.-A. Roussel's device in Russia. Medicina Historica, Vol. 4, N. 2: p.1-9
https://mattiolihealth.com/wp-content/uploads/2020/11/Med-Histor-2-2020.pdf

Sergeeva, I.M., Panova, E. (2021) Brilliant promotion for a doubtful invention – the blood transfusion device of Doctor Joseph-Antoine Roussel (1837-1901) in European medical science and practice in 1860-1880. Bylye Gody.
https://www.researchgate.net/publication/350374618_Brilliant_Promotion_for_a_Doubtful_Invention_the_Blood_Transfusion_Device_of_Doctor_Joseph-_Antoine_Roussel_1837-1901_in_European_Medical_Science_and_Practice_in_18601880

BIOGRAPHICAL INFORMATION

Very little information appears to have been published regarding Joseph-Antoine Roussel other than in the references listed above, which state that he was born in Geneva in 1837 and studied medicine in Paris. He travelled extensively as a marine surgeon, before returning to Geneva where he established a clinic that promoted alternative / non-standard treatments and devised his blood transfusion apparatus in 1864, which was initially tested on animals and first used for a human transfusion in December 1865. Roussel died in 1901.



TRANSFUSION DIRECTE

DU

SANG VIVANT

PAR

ROUSSEL

(DE GENÈVE)

Docteur en médecine de la Faculté de Paris,
Prix Barbier de l'Académie (1879),
Membre correspondant des Sociétés de Paris, de thérapeutique,
de médecine pratique, médicale de l'Élysée, etc.;
Chevalier des Ordres de Saint-Wladimir,
de Franz-Josèf, de Léopold Ier.

EXTRAIT DE LA *GAZETTE DES HOPITAUX*

du 18 février 1882

PARIS

ASSELIN ET Cie, LIBRAIRES DE LA FACULTÉ DE MÉDECINE

PLACE DE L'ÉCOLE-DE-MÉDECINE

1882

Title page: Transfusion directe du sang vivant – Roussel
(Image credit: wellcomecollection.org)

DIRECT TRANSFUSION OF LIVING BLOOD
BY
ROUSSEL

The history of transfusion is well established today; everyone knows it. His trial is heard and judged.

Transfusion has come into practice; it is absolutely essential, as much by its own efficacy as by the impossibility of supplying it by any other equivalent means, in all cases of extreme anaemia by recent and abundant loss of blood, where life is immediately threatened.

However, it is essential under the condition of being done with all possible chances of success and by carefully removing the chances of setbacks, that is to say by using procedures which protect the transmitted blood from coagulation, cooling, contact with air and substances it may contain.

Two methods, among all those that have been proposed in recent times, seem to us more particularly to fulfil these conditions; these are:

1. That of Doctor Roussel (of Geneva), of which our readers know the description and the manual;
2. The process of Dr. Oré (from Bordeaux).

We did not have the opportunity to see Mr. Oré's procedure at work, but we already knew a great number of successful applications of that of Mr. Roussel.

A few days ago, it was given to us, not to have directly witnessed the new application that has just been made, but to be able to appreciate firsthand, in the person who was the subject, its marvellous effects.

One of our editors, happier than us, was an active part in this brilliant operation.

Here is this interesting observation, as kindly gave to us by Mr. Roussel.

Dr. B…

Twin pregnancy, abortion at six months, secondary haemorrhages, extreme anaemia, colliquative diarrhoea, hectic fever; transfusion of 170 grams of whole blood; very fast healing.

By doctors Mr. Roussel and Mr. Brochin Jr.

Mrs. Maloigne, 7, rue de Viarmes, poultry trader in La Halle, of good constitution, aged thirty-one, had five living children and two miscarriages.

In December 1881, she was about six months pregnant; she had felt the child's movements, but her belly was huge; she felt in great pain and very oppressed.

Two doctors consulted, believing her to have a cyst, had her transported to Doctor Péan's department. This recognizes a pregnancy and the onset of preterm labour. The woman, refusing to give birth in the hospital, is transported to Ternes, to a midwife. The latter, having received the patient, immediately ruptured the membranes: an abnormal quantity of amniotic fluid, evaluated at twenty litres, flowed out.

Two children, male and female, at six months of gestation, are born successively and easily; one of them lived for a few hours.

During the delivery, the blood loss was only normal, and everything appeared to be in good order.

1st January 1882. On the eighth day after childbirth, this woman was seized with metrorrhagia; the outflow gave way to tamponade, but the haemorrhage still continued in the dilated uterus.

12th January. The patient, being alone, recovers from an abundant metrorrhagia which begins at four o'clock and does not end until half-past seven in the evening; repeated syncope, convulsive movements, etc.

Horizontal position, sprays of cold water, ergotine. The loss is stopped; but the patient, who has been cooled, is seized with a continuous cough and fever.

Pulse, 130-140; absolute inappetence; very frequent vomiting, diarrhoea. She is being treated by her doctor, Doctor Chauvin, by Doctor Brochin Jr. and Doctor Péan. The latter suspects some uterine fibroid as the probable cause of the haemorrhages.

31st January. Getting worse and worse, she is lying in a car and driven home.

Doctor Chauvin resumes the treatment, and successively orders bismuth, morphine, iron, peptones, oxygen inhalations, etc.

1st February. The patient did not have a new haemorrhage, but she weakened rapidly; absolute inappetence, frequent vomiting; she hardly takes a few spoonfuls of broth, milk, a little raw meat. Complete sleeplessness, daydreams, inertia, indifference, colliquative diarrhoea, fifteen to twenty times in twenty-four hours.

Hectic fever, anaemic; frequent syncope when lifted. Threadlike pulse, 130-140; frequent cough in fits, shallow breathing, insufficient. No noticeable pain. Cadaveric face, death very soon. Doctors Péan and Brochin indicate a transfusion as a last resource, they advise Roussel's method of direct transfusion of living and whole blood.

5th February. Mr. Brochin comes to the Grand Hotel to ask for my assistance; I see the patient inert, almost unconscious, without heat, without breathing, as pale as a corpse, veins invisible, pulse threadlike at 140.

The heart and lungs appearing to me healthy, I agree to perform the transfusion.

7th February, four in the evening. The patient is in the condition described above; today she has had diarrhoea nineteen times; pulse threadlike, trembling, at 150.

The patient's sister and husband offer me their arms; after examination, I prefer to choose elsewhere; I am told in the street, at No. 17, a shopkeeper employing a large number of strong workers.

M. Z… understands immediately the importance of my request, and calls his men, to whom I explain that it is a question of saving a mother of a family by giving her a little blood that I will take on the arm of the one of them by a simple injection of which I affirm the complete harmlessness.

Several accept. I choose a young man of about thirty, robust and healthy, named Adrien Renaud.

We go back to the patient's house; Doctors Brochin and Chauvin, the husband, the sister and other relatives are present. The transfuseur is washed in hot water with the addition of a little soda. I find the patient's chest; his left arm is stretched out on the edge of the bed.

I place R... seated, his left arm extended parallel and surrounded by a bleeding band which makes his veins swell. After having carefully sought and noted in ink the path of the humeral artery to the crease of the elbow, I mark 2 centimetres outside the path of the artery, a dot of ink on the median vein which is protruding and well swollen with blood. Pressing the initial cylinder of the transfuseur so that it represents the circumference of this central point, I make the annular suction cup adhere by pressing on its balloon.

Then, turning to the patient, I notice that her veins are invisible, so bloodless are they. I can recognize them by placing a band on the arm. I lift a fold of the skin, transverse to the middle vein; I cut it with a scalpel; the vein appears bluish and very narrow. I prick it with a fine ergne, then, disengaging my arm, I entrust to Doctor Brochin the care of incising a flap on the vein with the point of fine scissors and of introducing the cannula into the narrow calibre of the vessel. A few drops of pale, very diffuse and incoagulable blood flowed out.

During this time, I immersed the bell of the suction tube of the instrument in a vase of hot water at about 40°. By manoeuvring the pump-balloon, this water filled

the entire transfusion unit by heating its walls and expelling the air it contained. It was when all the air was expelled by the water that Doctor Brochin introduced the afferent cannula into the patient's vein.

The latter is in such a state of inertia and anaemic anaesthesia that it does not even twitch, either during the incision of the skin or during the preparation of the vein.

Our two subjects are therefore, at this moment, united by an uninterrupted channel full of water, and therefore void of air.

A sharp blow on the head of the lancet opens R's vein ...; his blood soon appears at the opening of the tubes, after pushing the water back in front of it. The water suction tube, as well as the expulsion tube to the outside, is closed, and the direct blood flow is established. Slowly, not taking my eyes off the patient, I squeeze the balloon pump, the blood easily penetrates in doses of 10 grams at a time; at the tenth systole of the balloon, the patient breathes more deeply and faster; when questioned, she replies that she does not feel any discomfort, but perceives a heat which rises from her arm to her chest.

Doctor Brochin easily notices under his finger that the blood swells the rubber tube and the vein with each pressure exerted on the balloon; besides, we all see the vein becoming more apparent and turgid up to the armpit.

At the seventeenth dose of 10 grams, perceiving resistance in the balloon and a little agitation in the patient, I stop the transfusion after 170 grams of Renaud's blood has passed through Mrs. Maloigne's veins.

The preparations for the operation were somewhat prolonged by the absolute lack of comfort and space in the room; it was difficult to be well lit; Doctor Chauvin was kind enough to support the lamp to alternately illuminate one or the other subject.

The transfusion itself did not last five minutes.

R..., who has only experienced a legitimate emotion, is bandaged with a simple strip of cloth, returns to his work, very happy with the service rendered,.

I announce that the transfusion is usually followed by a shiver, all the more violent as the operated one was more weakened; that this shiver is produced by the vasomotor system, regaining its equilibrium, and distributing new blood throughout the body. I add that the shiver often lasts twenty to thirty minutes, and that it is followed by a period of heat and sweat, then a deep and restful sleep.

Hot rum tea is prepared, which the patient drinks eagerly.

Half past five. The shiver begins; the skin, which had warmed up, becomes colder; the pulse, which at the end of your transfusion was full, active, at 100, becomes tighter, small, at 140.

Although aware of this phenomenon, the assistants are very worried about it; but I cover the bed, in which hot water bottles have been placed, with eiderdowns; I give plenty of hot tea to drink and order deep breaths that interrupt the shivering.

After twenty-five minutes of this state, which is only apparently serious, the operated woman warms up, her face becomes red, vultuous; the eyes shine, the breathing is deep; the pulse widens, becomes regular at 100; the skin begins to cover with sweat.

Eight PM. The patient is calm, very much alive; her voice is strong and sonorous; she is still sweating, she feels no pain; the lips are strongly coloured.

Ten o'clock. Same perfectly satisfactory condition; she says that she wants to sleep very much, but that she is too hot, that she is still sweating, etc., that she has no pain.

8th February, in the morning. The patient slept, although waking up several times; she always complains of being too hot.

The urine is absolutely normal, containing no blood, albumin, or blood cells; this very important fact proves that the transfused blood is not eliminated by the body, that this blood was very much alive, and that it continues to live in the veins into

which it has been introduced. The urine every day, for two weeks, was carefully examined, it was always absolutely normal.

This is *the criterion* for a perfect transfusion method. It proves, without possible dispute, the error of Professor Hayem, according to which the transfused blood would only stay for a short time, then that it would be destroyed and eliminated.

I know that, if elimination occurs, it proves that the blood was already altered by contact with air or by handling it in a poorly designed and poorly constructed device. About a hundred operations allowed me to affirm this capital difference between good and bad methods.

On this day of 8th February, the patient, who had had diarrhoea twenty times the day before, had only one wardrobe. She ate six times, she received visitors, she spoke loudly and sharply, she did not feel the slightest pain.

Pulse full, strong, at 100; respiration, 35; coloured lips, warm skin, shiny eyes.

9th February. The patient got a good night's sleep: it's the first time in six weeks.

At five o'clock in the morning she ate a hearty vegetable and potato soup, bread and a diviner's glass; at seven o'clock, a cocoa, butter and bread; at eleven o'clock, a whole steak with potatoes, a half-bottle of bordeaux; at four o'clock, cookies soaked in wine; at half past six, several dishes from the family dinner, in the meantime a litre of milk; at eleven o'clock in the evening she asked for more to eat.

She is cheerful, lively; the face is of a warm pallor, under which one sees circulating the blood. She speaks strongly, in a well-timed voice, happy to live, thanking her saviours. Pulse full, at 95; respiration, 32; normal temperature, soft skin. No pain, barely a little numbness in the hand of the operated arm.

10th, 11th February. The same assured and rapid state of convalescence, the same tremendous appetite, the same good sleep at night, the same gaiety and liveliness during the day. I would gladly allow her to get up, if I did not fear that she would cool down in her little apartment, which was very uncomfortable and deprived of the sun. She is so well cured of her colliquative diarrhoea that I must advise her to have enemas.

12th, 13th February. Mrs M... got up yesterday for two hours, today for four hours, with the greatest pleasure and without the slightest discomfort. (Six days ago, she would pass out every time she was lifted onto her bed.)

She is surely healed; in a few days she will return to her place at the Halle.

The pulse is full, regular, at 88 per minute. However, she still has a few fits of the cough which was caused by the chill during her second haemorrhage.

By examining it carefully, I see that the matrix is sound and well retracted; the heart and lungs are normal.

Now she can do without my care.

Mr Péan and Mr Brochin had immediately indicated that it would be necessary to operate several successive transfusions and in small doses. It would be absolutely unnecessary.

I was able to tell them in advance that such was not my forecast, based on experience. I said, without having seen the patient, that if she could be saved by transfusion, she would be saved by a single operation in which I would give her 150 to 200 grams of blood; that she could withstand this dose, considered by me as average; that the blood would not be eliminated; that it would vivify the brain, the lungs and the stomach, and that finally the patient would pass, of a jump, from the most serious state to a frank and rapid convalescence, during which she would complete remaking her own blood.

Mr Péan's opinion (which is that of French doctors and which I aspire to modify) was based only on the observation of the insignificant results obtained by the old methods, according to which one could only transfuse very-low doses, 10, 20 or 40 grams, of blood altered by contact with air or by its passage through defective

devices; blood, most of which was quickly eliminated. The effect being almost zero and not very durable, it was therefore necessary to start again.

Their opinion was also based on the lessons of Béhier and Oré, and on the theories born of transfusions by the so-called indirect or instantaneous method of Moncocq, Mathieu, Gollin, etc., still recently applied in Lyon, Le Havre and Paris, with zero results, or by overpaid blood donors.

With each attempt of operation according to these methods, two major reasons came to force the surgeons to leave the incomplete transfusion and to be satisfied with the small doses which one wanted, later, to declare sufficient and even necessary.

The first reason was the appearance of very serious phenomena of asphyxia and general congestion presented by the patient, and that from the first moments.

The second reason, also major, was that the blood offered by the donor, coagulated incessantly in the funnel and the pump of the devices; that we were obliged to shed this altered blood in order to collect more; that in this way, the loss suffered needlessly by the donor becoming excessive, no greater sacrifice could be asked of him.

A similar fact just happened recently at Gochin hospital.

Doctor Th. Anger, having to operate a transfusion in extremis on a casualty, was forced, for lack of a better solution, to use the Gollin apparatus for indirect transfusion. He took 500 grams of blood from his pupil, Mr Lassègue, and an even larger dose from Mr Bataillard.

On several occasions, the clots formed in the funnel forced him to empty and wash the apparatus; other clots formed in the afferent trocar: each time the operation had to be interrupted. Finally, the difficulty of manoeuvring the trocar forced the surgeon to dissect, one after the other, the median vein of the injured person's right arm; that of the left arm; finally, the saphenous vein of the only leg left to the injured person after his accident. The patient could only receive an uncertain dose of a blood already certainly altered by the air and by the contact of the apparatus: he soon succumbed.

It is said that the Director of Assistance, moved by the sacrifice, unfortunately useless, supported by the two courageous students, sent them letters of congratulation with an academic reward; this is only fair, but it would have been better to provide Cochin Hospital with the two direct transfusion instruments long requested by Mr Th. Anger and Mr Marchand.

Hopefully this will be the last time we will be forced to employ such cruelly defective methods and apparatus.

Everything else is my practice.

Adrien R..., in the present case, did not give more than 180 grams of blood for the 170 that I transfused to the patient.

At the beginning, the blood hardly appeared pure at the end of the tubes, when I closed its external exit, and I sent it in the vein without losing more than four drops.

In addition, the blood was absolutely invisible during the operation; the patient felt it come in and warm her chest; we have all seen the vein swell and ripple up to the armpit. But Adrien R... did not see his blood flow, he barely noticed the shot of the lancet; he could not be moved by it.

I thus obtain an immense saving of blood, which is an advantage of first importance; then I absolutely remove any moral impression from the mind of the giver, which is not to be sneezed at, since I have to address the public, and a large number of people are affected when they see their blood flow, especially if it flows to waste.

Finally, I am always certain that I do not have to interrupt the operation, and I can give the patient the entire dose that I have deemed necessary.

(I have just had another opportunity to give public and conclusive proof of this.

On 18th February, in Saint-Louis, Mr Péan at noon extirpated an enormous abdominal sarcoma from a cancer patient who was already very exhausted. Although the blood loss was minimal during this long operation, the surgeon, predicting that his operation had little chance of survival, asked me to attempt direct transfusion, as a last resource.

At seven in the evening, I gave a transfusion of 120 grams; it was useless, the patient died out slowly in the night; but the young worker who gave the blood did not provide more than 130 grams in total; he was not affected at all, and returned to work the next morning.

As I washed the transfuseur, I showed the many assistants that it did not contain any clots and that the wash water was barely pink. I had given the injured man even the last dose contained in the pump balloon.

This demonstration, made two days after Mr. Th. Anger's operation, was all the more conclusive for the comparison between the two methods.)

On 5th March, in Tournan, I operated a new transfusion on a seven-year-old girl, dying from repeated epistaxis, while convalescing from severe measles. I gave her 90 grams of the blood of a sturdy twenty-five-year-old worker. This provided only 110 to 120 grams. His bleeding healed in twenty-four hours, without the slightest damage.

The child, whose veins contracted and invisible contained only fluid, yellowish, incoagulable blood, whose threadlike pulse was barely perceptible, presents today, the fifth day after the transfusion, the pulse strong and full to 100, and well-coloured, fibrinous blood, which is no longer lost outside.

She is a scrofulous child, suffering from coxalgia of the right hip, puny, and of little hope.

Doses – I take it for certain that, in order for the patient to derive all the benefits that they can expect from the transfusion, the doses must be regulated as follows, in adults:

In acute hypohaemia with recent severe haemorrhage, 200-300 grams;

In chronic anaemia, hypoglobulia, following previous hypohaemia, 150-200 grams;

In anaemia, chlorosis, without noticeable haemorrhage, at least 100 grams.

Any method which does not allow these doses to be given regularly and at will, any method which allows some part of the blood offered to be lost and cannot be used totally for the safety of the patient, is a bad method.

Conclusions – Numerous laboratory experiments, my transfusion studies on animals, as well as more than sixty direct transfusions operated on humans without any accident, and with more than 50 p. 100 of complete success, led me to the following conclusions:

1. The injection into the veins of a liquid other than living and whole blood is only very exceptionally useful; it is always harmful, if this liquid alters the blood or dilutes it, and if this liquid is itself capable of producing pulmonary or renal infarctions, etc.
2. The transfusion of blood from an animal of a foreign species is always harmful.
3. The transfusion of blood of the same species, by indirect, instantaneous, or defibrination methods, is most often harmful.

   In all these cases, if the bloodless subject has been revived by the transfusion, his survival is never more than very short. The liquids thus injected, as well as the parts of the clean blood which have been altered by contact with the liquid, are eliminated from the first hour, by all the routes of excretion.
4. Only blood of the same species, complete and alive, can ensure the definitive survival of the transfused; it is not eliminated, and its red blood cells continue to

live in the organism which received them. It causes the formation of young blood cells (haematoblasts) which soon become red blood cells.

5. In clinical practice in humans, live blood transfusion can ensure survival in the following cases:
   Acute hypohaemia by recent haemorrhage;
   Severe anaemia with or without previous haemorrhage;
   Poisoning of the blood, if the toxicant is likely to be partially eliminated by a strong preliminary bleeding.

_____

EXTRACTS OF THE TREATISE *TRANSFUSION*
By Dr ROUSSEL. (Asselin, Paris. 1876.)

Conditions that must be met by a rigorous method and a good transfusion instrument.

Transfusion is the return of new blood to a debilitated body by lack of quantity or quality of its own blood.

This new blood must live and circulate in the body producing all its normal physiological effects.

It is impossible to create artificial blood, as well as to artificially preserve living blood.

Each animal species has its own particular blood, different by its physical, chemical and physiological properties, from the bloods of other animals, and unsuitable for any mixture or substitution.

So, to achieve the goal, it is human blood, complete and living, which alone can be transfused into man, and it must be done directly from vein to vein.

A vigorous adult can lose a certain amount of blood without suffering. This amount is more than enough to restore life to a dying haemorrhagic or anaemic. There, are the limits of the transfusion: to take from one, without harming him, the quantity of blood necessary to save the other.

The only method by which blood can be taken from a man, without harming him, is simple classical venous bleeding. Cannula or trocar should not be introduced into this vein, nor should it be loaded with ligatures. Only the precise amount that can be received by the patient should be taken from the blood donor.

In order not to harm the transfused, only living blood, complete, unaltered, without clots, air bubbles, dust or foreign bodies should be provided.

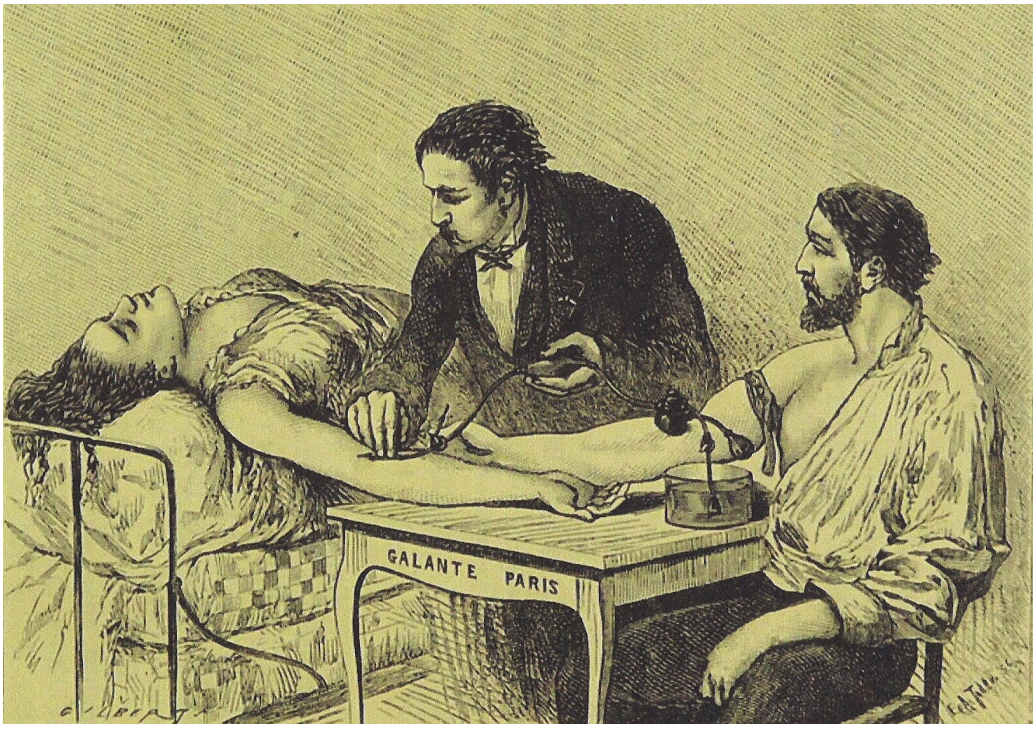
To be useful to the transfused, the blood current must be measured in its quantity and speed; its pressure, its temperature, its gases, its movement, must be preserved; it must be transfused in divided doses, successive, adjusted to the capacity of the heart. The total dose, designated by the indication, must be able to be provided in full.

Doses. - In fatal haemorrhages, 200 to 300 grams, added to the blood remaining in the veins, are sufficient to ensure the functions of the heart and the brain.

In severe anaemia, hypoglobulia, with or without previous haemorrhage, 100 grams are needed to restore the depleted blood to sufficient vitality.

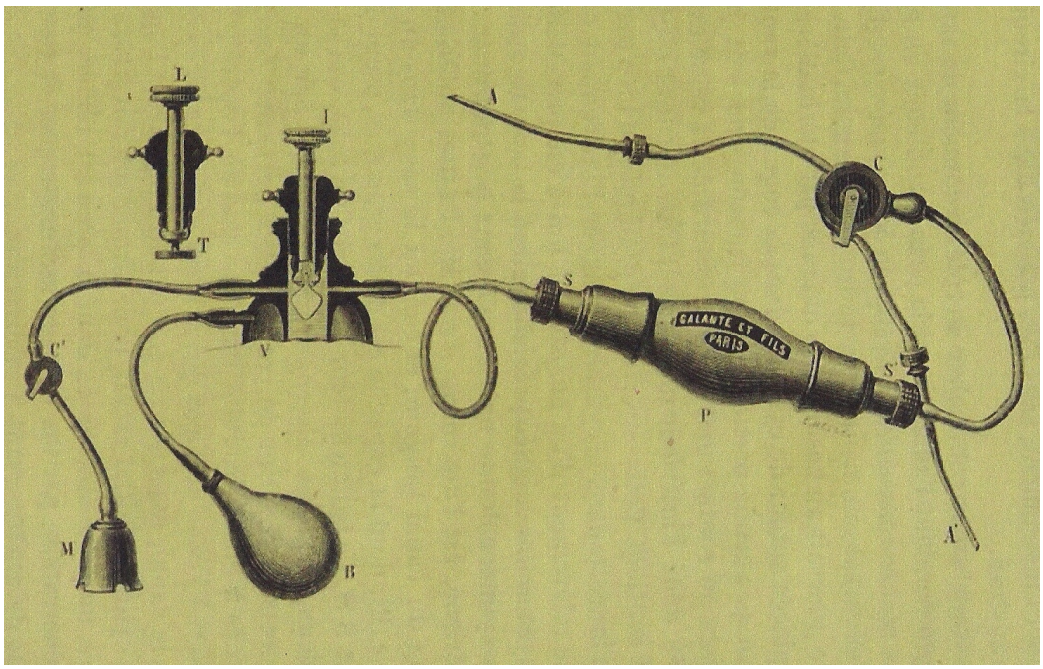
It is therefore a question of making a simple bleeding of the blood donor, but in such a way that the blood is not lost outside, neither exposed to the air, nor subjected to any harmful contact. This blood must remain alive and intact, and be transfused directly in measured doses.

Position of the characters during direct transfusion.



The patient is lying on her bed, her head low, her breast uncovered, her arm stretched out on a small table; the blood donor is seated; the arm, tightened by the bleeding band, is extended on the table parallel to that of the patient, and carries the suction cup. The hot water jug is nearby. The surgeon is standing between the two subjects; with one hand he fixes the cannula in the patient's vein, with the other he squeezes the balloon. He looks at the face of the patient to follow her expressions.

Description of the direct transfuseur.



The transfuseur consists of a tubular channel, soft, elastic, warm and humid, like the vessels, intended to be placed as an anastomosis between the vein which gives blood and that which receives it. This channel carries a suction and pressure pump, which must give the impulse of the venous blood by measuring its quantity and speed.

Two bifurcations, connected one at the origin, the other at the end of the channel, allow the entry and the exit of a current of hot water, designed to expel the interior air and to heat the instrument, without being pushed into the blood of the transfused.

The transfuseur begins on the side of the blood donor with a *cylinder* whose adhesion to the skin is obtained by means of an *annular suction cup* (V) having its own *suction balloon* (B); it is absolutely distinct from the blood channel. This adhesion could if necessary be obtained by an adhesive material placed around the cylinder in the shell of the suction cup.

So that no part of the transfused blood is ever exposed to contact with air, the opening of the vein is made inside the instrument itself and under the water it contains. This opening is made either by the play of the lancet in the initial cylinder of the instrument, or by raising a *pad* (T) which was previously pressed on a prior bleeding made with an ordinary lancet.

The cylinder gives rise to two *lateral tubes*: one, posterior, is the *water aspirator* (M) the other, anterior, is part of the blood channel, and leads the blood in a *pump balloon* (P), of which the capacity is ten grams, provided with valves S S'. This motor balloon is followed by a tube, which is divided into two branches alternately closed by a compressor *clamp* (C). One of these branches carries a *cannula* (A) intended to be introduced into the vein of the patient; the other (A') is for the *outlet* of the water which has been used to expel the air contained in the channel, but which must not be injected into the patient.

The initial cylinder receives, to close its upper opening, a *lancet holder* (I), the blade of which is adjusted, as to its penetration, by a millimetre cursor, and by two reference points as to its direction.

Instead of a lancet holder (I), the cylinder (L) can receive a *pad holder* (T) which can be extended to the level of the skin, and which, by releasing a bayonet nail, goes up and hides in the top of the cylinder to give free passage to the blood.

If there is concern that the patient's blood will be lost during the preparation of the vein, it is good to wrap the limb in Esmarch's compression bandage.

Bleeding the blood donor.

The preparation of the patient's vein, the operating manual for transfusion, its subsequent phenomena and its results are described in the above observation.

Here are the times:

First step – Prepare the patient's vein.

Second step – Bandage the donor's arm, fix the suction cup on the protruding vein, place the lancet holder whose blade has been adjusted according to the depth of the vein (or, alternatively, bleed with the free hand, place the suction cup fitted with the extended pad holder).

Third step – Pump the water to expel the air from the device; introduce the afferent cannula, full of water, into the patient's vein; close this cannula, close the water aspirator.

Fourth step – Hit a sharp blow on the head of the lancet (or, alternatively, raise the buffer); blood drives away water; it appears red at the exit tube; close the outlet tube by opening the afferent cannula.

Fifth step – Transfuse slowly, in doses of 10 grams, five to six times per minute, until a complete dose.

Here is the operation of the *pad-holder*, which can be used instead of the lancet-holder:

The *pad-holder* allows a variant in the second stage of the operation, for use by surgeons who prefer to bleed the donor with the free hand.

Having marked the point to bleed and having made sure that the suction cup will adhere easily to this place, the surgeon bleeds the vein with an ordinary lancet; he immediately covers the jet of blood with the cylinder closed by the tampon holder. The elongated pad presses on the bleeding as would the tip of the finger, and the blood temporarily stops flowing.

The manoeuvring of the water is carried out as usual to expel the air contained in the transfuser and, moreover, to expel the blood from the first jet which has touched the air.

In the fourth step, instead of hitting the lancet, the operator only has to unhook the pad, which is hidden in the top of the cylinder and allows free passage to the blood.

You can also remove the lancet and the pad, and cover the bleeding with a cylinder closed from above.

These procedures lose, it is true, the first draft of the donor's blood, but they ensure, perhaps, a more immediate and wider opening of the vein.

Dressing – After the transfusion, the cannula is removed from the patient's vein, the suction cup is detached from the donor's arm; the two arms are simply dressed with an figure 8 bandage without ligatures; the two incisions are healed by first intension without any incident.

Comparison of the two transfusion methods.

On 25th February, I saw the patient again on rue de Viarmes. Many doctors came to visit her. She says she is as good as she was a year ago. Her arm shows only a faint pink scar. On 8th March, she returned from the countryside and resumed her place in the Halle.

I saw Adrien R… again; as well as the worker of the Saint-Louis hospital and that of Tournan, one who gave 180 grams, the other 120 grams of blood; they were not indisposed for one moment.

Conversely, I hear that one of the two students at Cochin Hospital weakened by their unnecessarily excessive bleeding has not yet returned to his previous health.

Almost a year ago, Mr. Siegfried, mayor of Le Havre, exhausted by typhoid fever, received 60 grams of blood transfused by the indirect method. To provide him with this weak dose, we had to bleed a robust gardener whose blood was entirely lost; the next morning, the patient's nephew provided an enormous quantity of blood, the fifteenth part of which alone passed through the Gollin apparatus. The exhausted gardener still receives a pension from his master.

In Paris, rue Legoff, near Val-de-Grâce, was so named, a few years ago, in honour of Romain Legoff, a young military doctor who provided his blood in a transfusion, without success for the patient, attempted at Val-de-Grâce using the indirect method. This unfortunate young man lost such a quantity of blood that he was seized with hectic fever, and died in less than a year.

His mother, stricken by what she had most dear, receives a state pension; but the honour of seeing her son's name given to one of our streets did not dry her tears. The operator, one of the good military surgeons, died a short time later, undermined by the grief he caused by using the Gollin device.

This detestable instrument, composed of a funnel and a syringe superimposed, was supplied to hospitals and to the military health service, and this without comparative examination, although I have in 1867, 1870, 1872, etc., presented my *transfuser* and the method of *direct transfusion of live blood*.

These absolutely exact facts: the safety, never denied, of my method, relative to the donor of blood who never has to provide a very weak dose, compared to that which one drew at the time when the repeated bleeding of 4 to 6 ounces was in fashion; the curative results of the transfusion of living blood, set out in the table below; make any comment on the comparative value of the two methods superfluous.

And yet, in 1882, despite petitions from doctors and surgeons, despite approvals given to *direct transfusion* by the commission responsible for the choice of surgical instruments for Public Assistance, as well as by the Military Health Council, not a *direct transfusion* device has yet been supplied to French ambulances and hospitals.

I have been struggling for fourteen years, and I am not discouraged.

EXTRACTS FROM REPORTS AND APPRECIATIONS ON THE DIRECT TRANSFUSEUR

After many comparative experiments and operations on humans, we conclude that:

The transfusion of whole blood is the only legitimate operation, and the Roussel transfuseur is the only authorized and justified instrument; it achieves the desired ideal of a transfusion instrument both in theory and in practice; it meets all possible requirements.

Each hospital, each military division must receive a sufficient quantity of devices.

(Neudorfer, Chief of Staff Surgeon, protractor for the committee of experts.
Vienna (Austria), 10th January 1874.)

It has been proven that transfusion is a useful operation for the sick and wounded of war...

With the Roussel device, transfusion has become easy and safe ... it responds better than any other to the physical and physiological laws and requirements of transfusion. It deserves to be adopted in military medicine... Each regiment, each military hospital must have a working copy and another in reserve. Military doctors must be trained to use them.

(O. Heyfelder, Chief of Staff, protractor for the commission of experts.
St. Petersburg, 2 14th March 1875.)

Mr. Roussel's instrument is perfect in all respects ... it will be supplied to all regiments and hospitals... I personally thank Mr. Roussel for having introduced military personnel in the use of his ingenious transfuser, the usefulness of which cannot escape anyone who has seen it work.

(Inspector General, Dr Fromont. Brussels, 28th July 1876.)

The device that Dr. Roussel invented and that he describes here fulfils better than any other, to my knowledge, the conditions required for the transfusion of pure blood, unaltered in transit. By its use, transfusion can be performed safely by every competent surgeon.

It is to be hoped that the greater ease and safety of the operation will lead to its more frequent execution in cases of peril of death by haemorrhage. In these cases, the usefulness of transfusion has been established and probably possible; now one can only hope to find it truly useful in certain cases where the blood is depleted or insufficient by disease. Certainly, there is still a choice to be made in these cases; I believe Doctor Roussel is qualified to affirm the usefulness of transfusion in these indications.

As for the risks that people who donate blood could run, no fear will be felt by all those who, like me, have, for many years, bled, without any damage, an immense number of able-bodied people. For a healthy person the loss of a few ounces of blood by bloodletting is, I am sure, absolutely harmless.

(James Paget. Preface to the book *Transfusion of Human Blood*, by Roussel. London (Churchill), 1877).

The undersigned heads of departments ask the Administration to place the Roussel direct transfusion device in their rooms:

Paris, 17th May 1881 (Signed): Ch. Fernet, Duplay, Le Dentu, Féréol, M. Raynaud, Cusco, Dujardin-Beaumetz, Proust, Blachez, Péan, L. Labbé, Ch. Lassègue, L. Desnos, G. Sée, E. Besnier, Tillaux, Oulmon, L. Grencher, Dumontpallier, C. Paul, E. Mesuet, Terrillon, Moutard-Martin, Siredey, J. Voisin, de Saint-Germain, Bouchut, Triboulet, C. Monod, P Berger, A. Milard, Liouville, Bourneville, A. Marchand, Jaccoud, Potain, L. Gosselin, Th. Anger, Guyot, Tarnier, Desprès, Hayem, Vulpian.

I would be happy to have Mr. Roussel's device at my disposal to use it if necessary in my department.

Hardy. (May 1881.)

Mr. Roussel's instrument is very ingenious, and I do not know of any which are preferable to it.

Alph. Guerin. (June 1881.)

When there is not enough blood left for the maintenance of life, in cases of truly imminent death from absolute anaemia, only whole blood can bring about lasting recovery and definitive survival of the animal.

(G. Hayem, *Scientific Review*, 7th January 1882. Therapeutics course at the Faculty of Paris: Usefulness of blood transfusion.)

_____

P. S. During the printing of this notice, I had the sorrow to learn of the death of Tournan's little girl. This puny child was seized with a chill while being changed of bed, on the eleventh day of the transfusion. The fever reappeared, the lungs became engorged, and she died on the twelfth day. The transfusion had saved her; nature and medicine were powerless to continue the work begun.

On the other hand, the woman in the rue de Viarmes is in perfect condition and two new transfusions have been requested from me by colleagues, friends of scientific progress. One in Montsouris, on a client of Doctor Reuet, pluriparous, eight months pregnant. She gave birth prematurely as a result of terrible haemorrhages, which were repeated for a whole week. In addition, she suffered from generalized oedema, which had invaded the heart and lungs. I found her dying, absolutely bloodless and suffocated with pulmonary oedema, the respiration was over 60 and the carotid pulse over 150 per minute. The search for the median was very laborious in the midst of a very fatty and very infiltrated cellular tissue.

A young mason worker gave, without the slightest damage, about 150 grams of blood, but the transfusion was unnecessary. The poor woman succumbed to the rapid progress of the engorgement of the lungs.

The other transfusion, which is the fifth in the past few weeks that I have lived in Paris, was requested of me by Doctor Noël, who himself is the author of a transfusion instrument, presented in 1872 to the Academy by Broca.

It was about a rich son of a family from the surroundings of Beauvais (Oise), aged twenty-four, dying of excessive and repeated haemorrhages, caused by an accidental rupture of the cavernous bodies, during acute urethritis. In the first night and during the day, three times it fills more than half of a night vessel with blood; in the following days he had three less losses, and a last more severe on 21st April, the day on which I was called. With the assistance of Doctors Noel and Brochin Jr., I performed an easy transfusion of 120 grams of blood offered by Mr. Belony Herselin, friend of the patient.

Transfusion on 22nd April at 11 a.m. – The threadlike pulse, at 140, rises and falls to 110 after the operation. No trouble, no pain; after thirty minutes a moderate shivering begins which is accentuated and lasts thirty minutes with pallor of the face, concentration of the pulse and prostration. I heat the bed and administer alcoholic tea; the hot reaction is slowly established, and soon becomes very marked; very profuse sweat, lively thirst, agitation, vultuous faces, high, rapid, intermittent words, tumultuous pulse at 120.

2 hours evening – He wants a cold drink, he is too hot, constantly uncovers himself, he waves his arms so violently to push back the covers, that he has a little blood flow from the open vein, and that I see myself obliged to bind his arm to the body, in a triangular handkerchief over a tight bandage.

4 hours – Better, quieter; I order a cold broth, he dozes off. Pulse 110. Profuse sweat.

7 hours – Calm, new broth, water and brandy. Pulse 110. I gradually uncover the bed.

10 hours – Good. Pulse 120. Sleep.

During the night a small, hard stool; *normal urine*, abundant, clear. No traces of haemorrhagic blood, no albumin from transfused blood.

23rd April, 6 a.m. – The night has been good. Pulse 115, clear, regular; coloured lips, feeling of life, well-being, well-tolerated egg broth.

11:00. – Sleep. I order that he be fed several times and abundantly. Potassium bromide against possible erections, dangerous, given the condition of the penis. This organ, which was very swollen and infiltrated when I arrived, has returned to normal. The patient and family, terrified at the thought of a possible haemorrhage, object to a

local examination. I do not insist, trusting in a healing provided by the fibrin of the new blood.

I left my patient after having devoted nearly forty-eight hours to him, and entrusted him in as good condition as possible to the care of Doctors Noël and Brochin.

DISPATCHES RECEIVED: *24th April* – Pulse 100 in the morning, 106 in the evening.

25th April – Charles is better; Doctor Noël authorized two chops today.

29th April – He is doing quite well, but yesterday he returned a chop in the evening, he had eaten two in the morning; he sleeps well enough, ice cream on the penis. The arm is a little swollen.

30th April – The best is accentuated, the arm is still swollen.

Today is the eighth day of the operation, the patient did not have eight hours of life ahead of him when he received the transfusion; "the best is accentuated", and despite the swelling of the arm, which the patient can only blame for his indocility and the brutality of his gestures of the first day, I have every right to count a new success at the assets of transfusion. It accomplished all that was expected of it; it warded off imminent death and prevented further haemorrhages. Now it is the turn of competent science to treat the genitourinary organs.

During this week, three of the premiere doctors in Paris informed me of their intentions to apply the transfusion, one on a young man suffering from very serious epistaxis, the other on a childbirth who had had an abundant haemorrhage, the third on a young girl suffering from intestinal bleeding after typhoid fever. I immediately replied to everyone that I am at their disposal at all times. All three waited too long and had the sorrow of having their patient die, without the heroic help that I hoped to bring them.

A fourth colleague told me the day before yesterday that, in a recent case of puerperal haemorrhage, he was absolutely determined to have a transfusion, but that he looked for my home in vain, and that his patient died.

I repeat here that death by haemorrhage is frequent and rapid, that the operation of the transfuseur, although difficult, is easy for the one who has studied it, and that if necessary I am at the entire disposal of all my colleagues. I would like to add that I currently live and for a few months in Paris, 16, rue de Richelieu.

30th April 1882

_____

TABLE OF SIXTY DIRECT TRANSFUSIONS

Operated by Dr. Roussel, *from* 1865 *to February* 1882,

IN SWITZERLAND, AUSTRIA, RUSSIA, BELGIUM, ENGLAND, FRANCE.

Subjects – 42 men, 16 women, 2 children.

Results – 30 complete successes.

13 semi-successes: the transfusion produced a prolonged improvement, but the primary disease recurred and resulted in death.

17 without success: the transfusion, perfectly performed, did not produce any marked effects.

3 experimental transfusions:

1 on a corpse, transfusion with electric current;

2 human transfusions of sheep blood;

In this case, the death was not caused by the transfusion.

(A). ACUTE HYPOHEMIA.

Puerperal haemorrhage – 7 cases.

6 complete successes: 310, 250, 260, 150, 250, 170 grams of blood; average, 230 grams;

1 half success, 200 grams. The hypohemia was cured, but peritonitis led to death after nine days.

Acute haemorrhage from war wounds or surgical operations – 8 cases: 7 men, 1 woman.

4 complete successes: 210, 250, 260, 280 grams; average, 250 grams of blood;

1 semi-success: amputation of the breast; the transfusion, 200 gr., cured the hypohemia, but a secondary haemorrhage through the subclavian artery led to death ten days later;

3 unsuccessful: after disarticulation of the hip, resection of the knee (tetanus), removal of a huge abdominal sarcoma.

(B). HYPOGLOBULIA FROM CHRONIC BLEEDING.

Haemophilia – 3 cases, men.

2 complete successes: 300 and 250 grams of blood;

1 unsuccessful: haemophilia and tuberculosis; 180 grams; dead at the end of the seventh day.

Uterine haemorrhage – 2 cases.

2 complete successes; 120 and 200 grams.

Intestinal haemorrhage – 1 case, male.

1 complete success, 300 grams.

Stomach haemorrhage – 2 cases, men.

1 complete success: simple ulcer; 200 grams;

1 half-success: 120 grams; cancerous ulcer; died after three months.

(C). ANAEMIA WITHOUT BLEEDING.

Acute chloroanaemia – 2 cases, women.
2 complete successes: 260 and 160 grams.

Starvation anaemia, tumour of the pharynx.
1 half-success, male; 200 grams. The anaemia was cured, but the tumour was inoperable.

Starvation anaemia – Stupid melancholy: 3 cases, men.
1 complete success: 310 grams; the reason reappeared during the operation and persisted. (Published by Leidesdorf, Vienna.)
1 half-success: 200 grams; cure of anaemia, improvement of mental state for seven days. The transfusion was to be repeated (Published by Rhys-Williams, London.)
1 without success: 60 grams; slight improvement. Incomplete transfusion by the indocility of the insane person.

Starvation anaemia – Dementia and general paralysis, 2 cases: 1 man, 1 woman.
2 semi-successes: great improvement in anaemia; the general condition persists.

Scurvy anaemia – 3 cases, men.
2 complete successes: 250 and 300 grams; cured scurvy.
1 half-success: scurvy and nephritis; 200 grams; dead after a month.

Anaemia by severe fevers – 6 cases: 4 men, 1 woman, 1 child.
2 complete successes: typhoid fever; 160 and 200 grams.
1 half-success: 180 grams; death of unknown cause after eight days.
3 unsuccessful: 140, 120 grams, died after forty-eight hours; a one-year-old child, 60 grams, died after six hours.

Anaemia by inexhaustible suppuration – 5 cases, men.
3 complete successes: 220, 240 and 500 grams in 2 transfusions.
2 half-successes: 120 grams, dead after a month; 200 grams, dead after two weeks.

Prolonged asphyxia – 3 cases, men; large bleeding before transfusion.
2 complete successes: one submersion, 220 grams; carbon monoxide asphyxiation, 310 grams,
1 unsuccessful: prolonged submersion, no bleeding blood.

UNCERTAIN INDICATIONS.

Haemorrhage from gangrene of the lung – 1 case, female.
1 complete success with two transfusions of 115 and 240 grams.

Algid cholera – Last period, 2 cases, men; whole blood mixed with hot water.
1 half-success: 260 grams of blood, 200 grams of water; cure of cholera attacks, death after seventeen hours.
1 without success: 150 grams of blood, 60 grams of water.

Huge burn – 1 case, female.

1 half-success; bleeding and first transfusion of 150 grams, great improvement; seven days later, second transfusion of 120 grams; three days later, sudden death in a bath.

Syphilitic cachexia – 1 unsuccessful, male; 200 grams.

Cancerous cachexia – 2 without success, men: 110 grams, rectal cancer; 120 grams, generalized diathesis.

Septicemia – 3 cases, men.
1 half-success; dead after fourteen days.
2 unsuccessful: 300 grams, dead after five days; 60 grams, dead after two days.

Acute Glanders – Generalized gangrene.
1 case, male, unsuccessful: 228 grams; dead after seventeen days.

Acute rage – 1 case, man, without success.
300 grams after bleeding, rabies suspended for five days.

EXPERIENCES.

1) Soldier killed by multiple haemorrhages (dynamite explosion). Ten minutes after death, transfusion of 250 grams of blood, accompanied by an electric current in the device; the heart beats and blood flows through it.
2) Congenital idiocy with contractures, severe anaemia, 1 case, man: 60 grams of *venous sheep blood*.
   Slight excitement, no results.
3) Scrofulosis, psoas suppuration, iliac bone caries, agony, 1 case, man: 240 grams of *sheep arterial blood*.
   Considerable excitement, awakening of knowledge, dead after fourteen hours.

I cannot count an attempted transfusion in which the cannula was placed in the vein sheath by my colleague and the blood pushed only under the skin. Phlebitis.

_____