TRANSFUSEUR POUR LA TRANSFUSION DIRECTE DE VEINE À VEINE DU SANG ENTIER ET VIVANT

By: J. ROUSSEL

A TRANSLATION BY PHIL LEAROYD

The paper 'Transfuser for direct vein-to-vein transfusion of whole and live blood' by Joseph Roussel, published in 1881 in the journal *L'Union médicale* [reference: Vol. 31, No. 81, pages 985-987] can be viewed or downloaded from the following site:

https://archive.org/details/BIUSante_90068x1881x31/page/984/mode/2up

This article is essentially another one of Roussel's opportunities to publicise his 'transfuser' blood transfusion device, published in the Paris journal 'The Medical Union'.

Roussel starts by stating that animal blood acts 'as a foreign body' in the human circulation, which when transfused 'remains harmful until it is completely eliminated', thereby identifying that animal must not be used for transfusion to humans. He continues by briefly explaining the role of fibrin in coagulation and its presence in blood transfused via a syringe or other transfusion devices due to its activation by contact with air and foreign surfaces. He stresses that when either whole blood altered by contact with air or defibrinated blood are transfused, it results in congestion in the lungs and kidneys and the presence of deformed red cells, haemoglobin and/or albumin in the patient's urine.

He stresses that a transfusion device must therefore obtain sufficient amount of blood with the necessary rapidity, not waste any, or harm the donor, at the same time avoiding the transfer of air bubbles and fibrous clots, whilst maintaining its quality. He then describes how his device achieves all of these desired requirements.

Although a drawing of Roussel's device is not included, the article lists ten points that comprise his 'operating manual', which basically identifies how to use his device. Finally he briefly summarises the numbers of transfusions he has performed in different clinical situations.

See also:
Roussel, J. (1876) Presentation d'un appareil pour opérer la transfusion directé de bras à bras, du sang vivant et intact. [Presentation of a device to operate direct transfusion from arm to arm, living and intact blood] *Bulletin de l'Académie Royale de Médecine de Belgique*, 10, 624-641.
https://books.google.co.uk/books?id=9m01AQAAMAAJ&pg=PA17&hl=fr&source=gbs_toc_r&cad=4#v=onepage&q&f=false

I have produced a translation of this article from the original French into English to 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, line spaces within the text and the general layout as accurately as possible.

JOSEPH-ANTOINE ROUSSEL

Very little biographical information appears to have been published regarding Joseph-Antoine Roussel other than in the references listed below, 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 device in 1864, which was initially tested on animals and first used for a human transfusion in December 1865. Roussel died in 1901.

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

Mr. Roussel (of Geneva) presented a *transfuser for the direct transfusion of whole and living blood from vein to vein*, and read the following note:

The transfusion of blood is very far from rendering even a small part of the services that we are entitled to ask of it, and this because it has never been operated according to the rules of physiology. To restore blood to one who is about to die for having lost it is a conception so simple that traces of it can be found already in pre-scientific times, and that they can be followed throughout the studies of the art of healing.

But the blood coagulates with such great rapidity, and for such minimal causes, that this coagulation has always been an obstacle to the happy completion of the operation.

Unable to successfully use the blood, without the fibrin coagulating, Panum of Copenhagen and the Germans imagined its defibrination; experience quickly did justice to the alleged virtues of filtered and heated serum, containing a few globules beaten to death, then injected into the veins of a bloodless person.

Experience also quickly condemned the transfusion of animal blood to man. At first sight, this operation seemed attractive in that it made it possible to directly connect the animal's

artery to the vein of man and to avoid the coagulation of the blood by its very simple and rapid transport. But it is now incontestably proved that the blood of one species differs as much in the size of its globules, as in its intimate composition, from that of another species; that the mixture of the two bloods is incompatible with the life of one of them, and that the blood of the animal injected into the veins of man behaves there, if not as a poison, at least as a foreign body which remains harmful until it is completely eliminated.

It is not possible for us to inflict on man, who offers his blood for the salvation of another, the serious consequences of the opening of an artery. It is from one vein only that we can take the blood to be transfused; but venous blood is devoid of the impulse of the heart, which must be supplemented by an artificial motor which pushes it into the patient's circulation.

It is the necessity of this external motor, and the many and very delicate conditions which it must fulfil in order to avoid the coagulation of fibrin, which have hitherto been the pitfall against which the numerous experimenters of transfusion have failed.

Fibrin, a liquid in its normal state, becomes solid or coagulated by various causes, the principal ones of which are: contact with air or altering bodies, the loss of its own temperature, that of gases, of movement, and the loss of the normal pressure that the blood supported in the vessels.

The blood exposed to the air is altered by this very fact, although it is not yet possible to distinguish fibrinous filaments which become perfectly perceptible at the end of a second. If this blood is injected, the altered part of it will be immediately eliminated by the kidney and will be found in the urine in a quantity that is all the more abundant the more the blood has been injected in worse conditions.

As a result of animal blood transfusions, artificial serum injections of defibrinated blood, or whole blood already altered by contact with the air, the patient experiences a greater or lesser painful congestion of the lungs and kidneys, his first urine after the operation contains a greater or lesser quantity of whole blood or deformed globules, haemoglobin or albumin.

This elimination, often accompanied by very serious phenomena, continues until the foreign substance has completely disappeared from circulation. The examination of the urine is the most certain criterion of the perfection of the transfusion operated.

All the transfusion devices used in France to the present day expose the blood to contact with the air and let it lose its pressure, temperature and gases; they are all incapable of giving serious and consistent results; the best of them allow only the injection of 60 or 80 grams of blood with great difficulty, and yet the man who supplied it has uselessly lost 500 or 600 grams in the clots that clutter the device. The 60 grams that were injected were already altered blood, since the urine of the operated patient inevitably contained a notable quantity of albumin.

The many failures which have been caused by these different devices have unfortunately compromised transfusion for a long time in the eyes of practitioners; they have prevented the search for and evasion of these various indications; moreover, they have been the cause that we did not even think about transfusion in the most obvious indications.

The happiest operators have prided themselves on having injected 60 or 80 grams, the effect of which has often been almost zero, because 150 or 300 grams would have been necessary.

250 grams is the average dose that I have applied, and by which I have obtained complete and persistent effects.

I have remarked several times that the dose could have been even greater, and I do not remember having observed the contrary.

In order to be able to transfuse blood in such a large dose, it is absolutely necessary that no coagulation should be formed during the operation, and also that no part of the blood supplied by the donor should be lost in vain.

Although the number of my transfusions is already relatively considerable, I do not know whether I dare to give precise indications, because I have not been able to encounter the same case as often as would be necessary to establish an assertion.

Acute haemorrhage from war or surgical wounds provided me with 4 complete successes and 1 failure. Puerperal haemorrhage the same number: 4 successes and 1 failure.

These are indications that no one disputes. The body is healthy except for the loss of blood; to restore blood to him is therefore to restore him to health.

Chronic haemorrhages, by which I mean repetitive, uterine, intestinal, stomachal or haemophilia, have provided me with 6 successes out of 8 operations.

These indications are beginning to be accepted by the majority of practitioners.

I have operated 22 times in cases of acute anaemia without haemorrhage and in various forms: pernicious anaemia, severe chlorosis, anaemia by prolonged suppuration, by scurvy, as a result of serious fevers, or dothienentery, and by starvation.

I have obtained 11 successes, plus 2 successes in cases of apparent death by vitiation of the blood, caused by asphyxiation or submersion.

In these 2 cases, I preceded my transfusion by large depletive bleedings, in order to reduce the mass of the blood overloaded with carbonic acid and to make room for the new blood which was to go and awaken the heart and brain.

It is in these indications that I will say new, of anaemia without haemorrhage, that the transfusion seemed to me the most interesting. In fact, blood no longer acts by its quantity replacing a lost quantity, but by its quality of blood, coming from a body in full vigour and improving the inferior quality of the blood of a sick body.

It is especially these indications that I point out to your Society of Physicians, so that some of you may help me to elucidate them.

The care that must be taken to avoid the multiple and subtle causes of blood coagulation, the necessity of obtaining this blood in sufficient doses and with the necessary rapidity, the obligation not to lose any of the blood supplied by the donor and that of not harming this man either by a ligation of his vein, or by a puncture with a trocar and the prolonged stay of the latter in the vein, not to mention the absolute necessity of sending the patient neither air bubbles nor fibrinous clots; all these obligations together already give rise to a sense that the transfusion of blood is far from being as simple and as easy as has been supposed, and that, consequently, its device must be something more than a simple syringe accompanied by a bowl.

In order that the transfused blood should never be subjected to contact with the air, and that it should not be exposed to any loss of its temperature, its gases, or its normal pressure, and that one subject may receive all that the other gives him, I have imagined anastomosing the two circulations by a direct channel closed on all sides and full of water; therefore, without air; then to bleed under water and to empty this water outside, as the blood comes to replace it in the instrument.

On the blood donor's side, my transfuser starts with a cylinder that sits on the skin above the vein to be bleed, so that it stays in place. This cylinder is surrounded by an outer annular suction cup that produces the adhesion of the device's mouth to the blood donor's arm.

The circulation of water which must expel the air from the interior of the device is obtained by a suction tube connected to the initial cylinder, and by an expulsion tube connected to the final cannula.

The lancet which is to pierce the vein under a layer of water inside the initial cylinder is mounted on a micrometric screw with which its depth of penetration is regulated in a mathematical way, while the direction of the blade is shown by two external reference points.

The motor located between the initial cylinder and the final cannula, is a pump-balloon, each movement of which sends 10 grams of liquid, which is used to measure it.

The entire device is constructed of part hardened, part elastic, non-sulphurised rubber, without any part of metal or glass. The water used to expel the air is at 30 degrees, in order to warm the instrument. Some people have criticised my hidden lancet, which is nevertheless very easy to direct in a precise way and which, moreover, operates only on a vein distant from an artery. I have very recently found a way to satisfy this criticism; I have substituted a stamp holder for the lancet-holder. The surgeon bleeds the chosen vein by hand, then he applies the pad fixed by the suction cup to the opening of the vein, he expels

the air with the current of water and the first drops of blood mixed with water, then he gets the stamp just when he needs the pure blood.

OPERATING MANUAL.

1° *Prepare the injured person's vein*. Uncover it by cutting a fold of the skin, grasp it with an erigne or pliers, and make an incision with a triangular flap.

2° *Place the suction cup*. Above the blood donor's turgid vein away from the artery. The median or cephalic are preferable.

3° *Place the lancet holder*. To close the cylinder after adjusting the projection of the blade by the micrometric screw, and its direction using the reference buttons.

4° *Pump the hot water* to expel the air until the water gushes out of the final cannula.

5° *Insert the final cannula* under the raised flap, in the vein of the injured person, close the cannula by means of the clamp, the water outlet tube remains open.

6° *Bleed the blood donor* by a sharp blow on the head of the lancet.

7° *Close the water vacuum*; to expel the water and the mixed blood through the outlet tube.

8° *Open the afferent cannula* by closing the outlet tube, when the blood has appeared pure.

9° *Transfuse* by regular pressure on the balloon pump containing 10 grams 7 to 8 times per minute up to the average dose of 250 grams.

10° *Remove the device*, wash it immediately, place a simple figure 8 bandage on each arm, lay the patient down warmly, give him hot rum tea to drink; not to be frightened by a chill which becomes pronounced after half an hour.

Transfusions followed by recovery of the primary disease: acute haemorrhages, cases of war or surgery, 4; - puerperal haemorrhages, 4 - out of 10.

Chronic haemorrhages: haemophilia, 2; - uterine haemorrhages, 2; - intestinal haemorrhage, 1; - stomach haemorrhage, 1 - out of 10.

Anaemia without haemorrhage: chloro-anaemia, 2; - starvation anaemia (pharyngeal tumour) 1; - anaemia, stupid dementia, refusal of food, 1; - anaemia due to scurvy, 2; - anaemia due to severe fever, 2; - anaemia due to prolonged suppuration, 3; asphyxia (depletive bleeding), 2.

In addition, 14 semi-successes, life extension from 8 days to 1 month, 10 without prolonged success, always with improvement.