DE LA TRANSFUSION DU SANG

BY: Dr JOSEPH CASSE

A TRANSLATION OF PAGES 56-67 BY PHIL LEAROYD

'PROCEDE OPERATOIRE'

The book 'Blood Transfusion' by Joseph Casse was published in 1874 in Brussels by Henri Manceaux. A copy of this 182 page book can be viewed at or downloaded from the following websites:

https://wellcomecollection.org/works/jh3v98g5

https://books.google.co.uk/books/about/De_la_transfusion_du_sang_Extrait_des_M.html?id=tSeoGMQijcEC&redir_esc=y

I have translated the 'Operating Procedure' section of this book, i.e. pages 56-67, as I believe that this section contains historically interesting information of the author's own method of transfusing blood. Unlike other authors of the same period, Casse only describes his own transfusion device and not those of others. In doing so he provides interesting historical practical points as to its use, describing the transfusion of defibrinated blood. In doing so he also provides information regarding the defibrination method, which again is something that other authors of the period do not provide.

I have translated this section of Casse's book from the original French into English in the hope 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 purposely produced this translation to be 'un-interpreted' as possible, in that I wanted to maintain the author's original meaning / wording as much as possible. Whilst some words / terms originally used are obviously open to interpretation, I have attempted wherever possible to hopefully maintain the author's meaning, intent and detail. 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.

There are three 'references / comments' listed within this section of the book, which are presented at the bottom of the pages where they appear. I have re-numbered and translated these and list them at the end of the translation. The use of italics by the author as well as the paragraph settings have been reproduced within the translation.

OPERATING PROCEDURE

Transfusion has been made by means of numerous devices, constantly tending to maintain the heat of the blood, and to preserve it from contact with the air in order to avoid coagulation. Most of them being very complicated and useless today, it seems to us of little use to give a description of them.

The ordinary injection syringe, the Guérin syringe, etc., are the devices most often used in transfusion. This is easily understood when we consider the circumstances in which most of these operations were carried out. It is indeed in cases of uterine haemorrhage after childbirth that they have been practiced the most; the indication was urgent, the surgeon not often having the complicated devices that were used, used the simplest one, that is constantly and widely available, the syringe, the end of the cannula of which was introduced into the vessel through which the injection was pushed. But if the ease of finding instruments of this nature everywhere greatly helps the person who performs the transfusion, there are numerous disadvantages in their use, the main ones of which are the following:

1° *The jerks in the introduction of the blood*. - However well the piston slides in the cylinder of the instrument, and whatever regularity one tries to bring to the pressure, there are always small jerky movements, the result of which is to push the blood unevenly instead of letting it penetrate continuously into the vessel. To remedy this defect, the only means to employ is to regulate the movement of the piston, by making it a rack moved by a toothed wheel, analogous to the movement of a clysopump, (of Cristoforis) or even by making a screw pitch on this same piston rod, which can then move in a mobile nut, or formed by a double spring fitting the thread of the rod. The spacing of the two parts makes it possible in this case to easily remove the latter. Under these conditions the piston moves slowly, and the introduction of blood becomes continuous, more or less slow and regular.

2° *The impossibility of seeing what is happening in the syringe*, where air can easily become lodged without the operator suspecting it. It is true that this accident is not fatal when the air is introduced only in small quantities, but it seems to us at least pointless to do something similar.

This inconvenience can only be avoided by using a syringe whose cylinder is of glass. Only then will the operator be able to see if air bubbles are being pushed into the vessel.

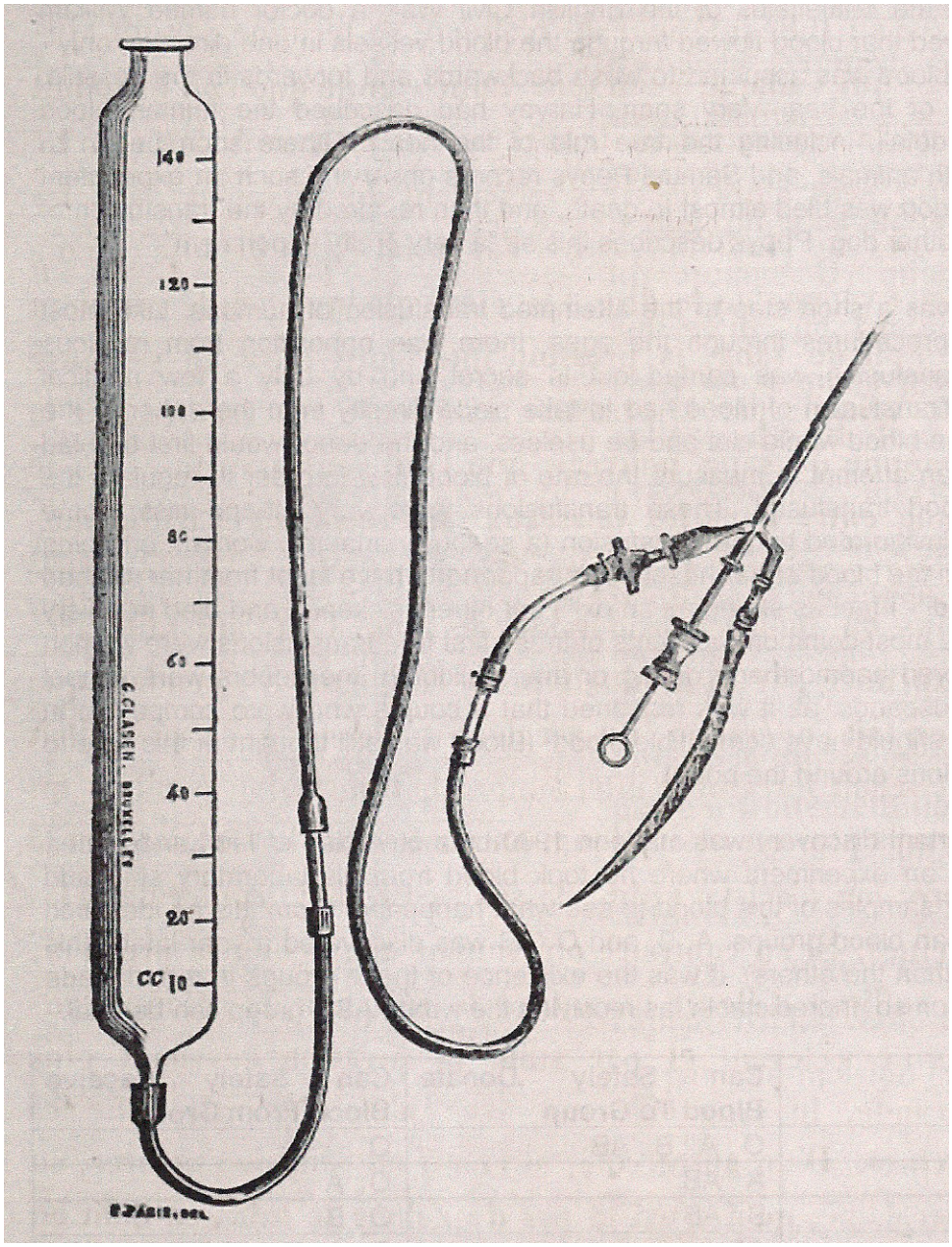
The articulation of the various parts of the syringes between them constitutes a serious drawback. Indeed, because of the difficulty of cleaning these instruments, dust and impurities easily lodge in the seals and can be introduced with the blood. Moreover, it is very difficult to find good syringes, the piston of which adheres perfectly to the walls of the cylinder, while allowing the first to move properly.

Add to these disadvantages the more or less difficulty of handling, the impossibility for the patient to move the limb, etc., and it is easy to see that other means can render services more perfectly.

We thought that we could achieve a real result, by simplifying things and putting ourselves in the most favourable conditions. For this purpose we started from this physiological fact that the pressure in the veins being excessively low, only a minimal force is needed not only to balance it, but to overcome it easily. We see, in fact, that it is at most only 4.1; it is therefore necessary to overcome it only a column whose pressure is equivalent to this quantity; by increasing the external pressure somewhat, the internal being overcome, the liquid enters the vessel (1).

To obtain this data, we composed our device from an elongated cylindrical container, 30 centimetres in length and graduated in such a way as to allow the quantity of liquid introduced to be measured. Each end of the container is narrowed. The upper opening of a larger diameter than the lower allows the introduction of a funnel through which the blood is poured from the vessel that contains it into the container. At the lower end, on the contrary smaller, a rubber tube 60 to 70

centimetres in length is fitted, whose end opposite to that which is fixed to the lower tube of the container ends in a nozzle, which adapts in turn to a cannula that is introduced into the vessel in which the transfusion is made (2).



The blood can then pass directly from the container into the veins of the individual, for if the device being arranged as we have just said, the container filled with blood is raised somewhat, the normal interior venous pressure is overcome by the external pressure represented by the column of new blood that one wishes to transfuse, and the blood enters the vessels without jerks and in a continuous manner. We can thus introduce a more or less considerable quantity of blood. This quantity will be expressed by the graduation of the container. If, while the operation is being carried out, some accident occurs and necessarily interrupts the transfusion for a more or less long time, the container is lowered, and the pressure no longer existing, the blood will cease to flow into the veins. If, on the contrary, we wanted to increase the pressure, it would suffice to raise the container further, rising the blood column and consequently the pressure becoming greater, the blood would flow with

more energy into the veins. On the other hand, if care has been taken to ensure, beforehand, that there is no air in the tube, of which one is certain when at the time of fixing the nozzle we saw the blood flowing through the lower orifice of the rubber tube, we will be convinced that the least quantity of air could have been introduced. In addition, to be perfectly sure of countering this accident, it suffices to interpose on any point of the tube, but preferably near the cannula, a piece of glass tube serving as an index, the transparency of the material would allow to see the slightest bubble of air pass, and this one coming to show itself, one would only have to undo the nozzle and let the blood flow, until the bubble of air is out.

As we can see, the device we use is extremely simple, of inexpensive construction, easy to handle and capable of perfect cleaning. It facilitates the regular flow of blood at the same time as it allows the pressure to be moderated at will and finally gives all the guarantees for the non-introduction of air. In all our experiments with defibrinated blood we have never used any other device, and as we have seen we have injected enormous quantities of blood through it.

We have also used it with great success in the eight transfusions we have performed in man.

The blood to be used for transfusion should, as we have already said, belong as much as possible to a strong, well-constituted individual, showing no defects of conformation and above all free from dyscrasias. One receives in a basin the blood of the bleeding that is made to him, and at the same time as it flows out of the vein, it is beaten by means of a stick, a baleen, twisted glass rods or a small rod, objects whose cleanliness will have been checked beforehand with the greatest care, so that the slightest impurity cannot remain fixed there. The threshing of the blood is done for about ten minutes, taking care not to produce too much foam. It must be done carefully, in order to prevent elements of fibrin from remaining in the blood, which, by coagulating, would come to obstruct the cannula used for the introduction of the blood. This is what happened to us in an experiment where the introduction of blood had lasted for quite a long time.

When the threshing is finished, the blood is thrown on a woollen filter, cloth or a fine-mesh silk sieve, so as not to let the slightest coagulum pass. No need to add that the filter should also be extremely clean. It has been advised, when using a flannel or cloth filter, to soak it beforehand for a few moments in hot water, to avoid too great a cooling of the blood. It only seems to result in one advantage, which is that the wet linen allows the blood to pass through more easily. Other operators want the blood to be filtered before defibrinating it, still others that after defibrination and filtration, it is beaten a second time and passed again. This additional precaution is not useless, but it is far from being indispensable; however we believe that it is prudent to wait twenty to thirty minutes before introducing the blood into the device, in this way one will certainly avoid any coagulation which could still take place.

While we are preparing the blood (something that we can entrust to an assistant while supervising the filtration ourselves, etc.), we seize the limb on which we want to make the transfusion in such a way as to make the veins protrude, of which one chooses the most apparent and furthest from the heart, preferably taking the lower limb where the saphenous vein is in the conditions required for the operation. When, as a result of circumstances, it is impossible to use the lower limb, it will be necessary to take the basilica or the cephalic or finally the vein that can best be reached. This rule will vary for the newborn to whom, in the case of apparent death, it will be necessary to make the injection through the umbilical vein.

The vein being chosen, the direction of the vessel is noted, the skin is slid laterally and it is incised over a length of about three centimetres and parallel to the vessel. The tissues returning to their place leave the vein completely uncovered. This done, it is more or less isolated and a ligature thread is passed under it to the peripheral part of the incision. This ligature is intended to prevent the arrival in the vessel of blood from the extremities. A second thread is then passed under the vein,

this thread will be used for a second ligature intended to keep the cannula fixed in the vessel. If necessary, these threads could be removed, but I have seen a case where, unfortunately, the blood came to flow through the lips of the wound of the vein into which the cannula was introduced, Mr. De Cristoforis, who was doing the transfusion, was obliged to have a peripheral ligature thrown in to prevent the arrival of blood.

In a number of injections we have used a glass cannula, the olivary end of which is bevelled and edged with a lamp, to avoid injuring the vascular wall.

Here is how we act in this case: the device containing the blood being ready, we let the liquid flow to the end of the cannula, then, by means of a continuous pressure clamp or a ligature forceps, or even simply by the pressure of the fingers, the blood is prevented from flowing, and the cannula full of blood is introduced into the vessel after a puncture has been made there. The introduction made, the pressure is removed and the blood flows directly from the receptacle into the vessel.

There is a great advantage in using these cannulas, because they can be made very fine, so as to be able to introduce them into the smallest vessels, and they enable one to see if air is introduced. The fragility of the glass may be objected to, but you have to squeeze very hard to break them in a ligature; I would even say that in several attempts we never managed to do it. Another advantage resulting from their use is that, owing to the small calibre of the cannula, the slightest clot that would have formed would be fatally stopped. The simplest means for their introduction is to grasp the peripheral ligation of the vein, which being thus stretched, allows it to be easily punctured by a scalpel, and the plane of the bevel being placed in the same direction as the section plane of the vessel, the cannula is introduced, so to speak, by itself.

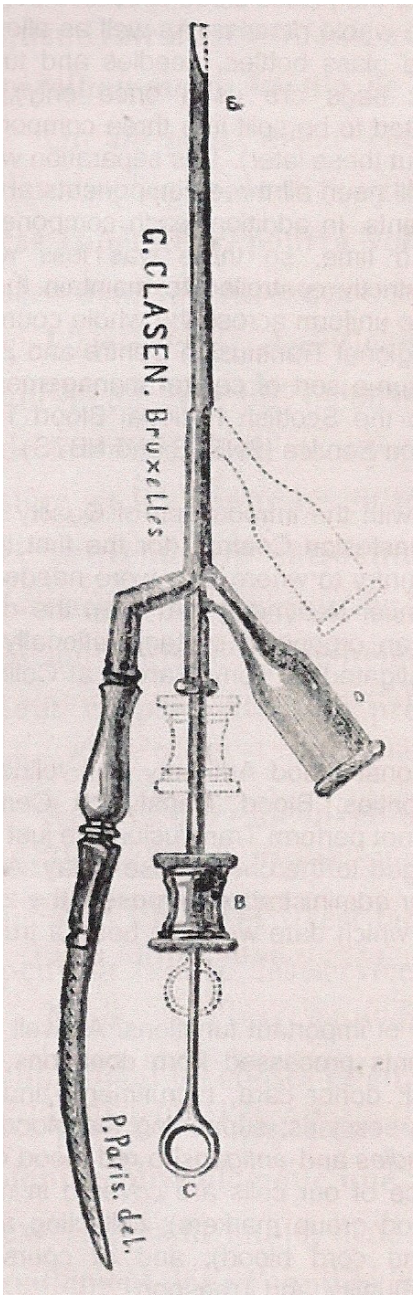
As soon as its end is introduced, we push it in the direction of the vessel under which passes a ligature which we tighten, and to see if it is well maintained, we pull in the direction of the extraction, if it resists, we immediately begin the transfusion.

If one is not familiar with the operation it sometimes happens that the blood no longer flows, even when one uses syringes, in spite of the energetic impulse of the piston. In researching the causes of these stops, we have noticed that the inclination of the cannula singularly impedes the entry of blood and even stops its flow. We immediately restored the current by putting it in a suitable direction, by a slight traction exerted on it, traction which had the effect of putting the opening directly in relation with the interior of the vein and not with the walls. It will be understood that in the use of these cannulas, the ligature intended to maintain it in the vessel is almost indispensable. When the operation is completed, the two ligature threads are removed and the dressing is made as in a simple wound.

We also used an explorer trocar with fairly strong walls, slightly curved, on the plane of curvature of which is fixed at an acute angle a second tube opening into the cannula of the trocar, and into which the nozzle terminating the rubber tube of our device. The instrument being introduced into the vessel, if the mandrel is withdrawn beyond the point of welding of the two tubes, the communication that exists between them makes it possible to pass through the cannula of the trocar, a liquid into the vein. The necessary removal of the mandrel is indicated by a darker coloration of the stem obtained by the soaked. Should one, on the contrary, want to interrupt the course of the injection, it suffices to push back the mandrel which, by blocking the internal orifice of the second tube, no longer allows liquids to pass. The mandrel by sliding with gentle friction in a rubber sleeve, located at the end of the tube on the side of the handle, intercepted any communication between the outside air and the inside of the cannula. We cannot advise the use of this instrument, because however well it is done, one always experiences difficulty in introducing it into the vein.

In the presence of this obstacle, which is due to the cannula of the trocar abutting against the walls of the vessel, and the difficulty that will be experienced in having the

glass cannula accepted, we have endeavoured to find an easy means of introducing into the vessels, and which can satisfy all requirements.



For this purpose we have devised an instrument which is the only one we use today for our transfusions in humans. It consists of a hollow needle E, fenestrated over part of its extent and terminated by a handle slightly bent at the end opposite the point. It contains a second tube B to which has been welded at an acute angle a nozzle D, which slides into the interior of the needle and into the opening which has been left there. This nozzle is intended to receive the end of our device and allows the blood contained therein to escape through the tube into the vessel where it is introduced. This same tube B is terminated by a box in which passes gently a mandrel C the length of the instrument.

Now let's see how this device acts. The vein is exposed by an incision (3), the vessel is pricked with the needle, and this being introduced, as it would be difficult to make it penetrate quickly without risking injuring the vascular walls and perforating them, we slide the inner tube which then hides the tip of the needle and allows the instrument to enter at the desired distance. This done, the mandrel is removed which closes the internal opening of the nozzle, and the blood passes easily from the device into the vessel through the internal tube.

In this way we believe we obtain several advantages: 1° Easy penetration into the vessel; 2° Easy introduction of the instrument without injuring or perforating the vascular wall, something that is easily done with needles; 3° Possibility of stopping the flow of blood, if an accident occurs during the operation.

REFERENCES

(1) This resistance is sometimes so low that a difference in level of 10 to 20 centimetres is enough to make the blood penetrate very easily.

(2) We have already described this device in the *Presse médicale belge*, 13 May 1873.

(3) We always believe it necessary to incise the skin whereas it is extremely difficult, if not impossible, to prick the vein directly through it, especially in people with chronic anaemia where only excessively small vessels are most often encountered.