Transfusions in WWI American Military Medicine

Transfusion therapy was the first form of effective human-to-human transplantation. Karl Landsteiner developed blood typing in 1900. During WWI, American Army labs testing blood divided it into Groups I through IV. Group IV was the universal donor, now known as type O. Group I was the universal recipient, type AB. Group II is type A and Group III is type B. The Rh system (which we now refer to as “positive” or “negative”) was not discovered until 1937.

Transfusion donors were found among the wounded without significant blood loss. Gas victims were an important donor group. These were primarily those who had skin damage from mustard gas. Those with infections or lung damage were not used. Gas hospitals were commonly located close to surgical hospitals for this reason. Those with syphilis, malaria, trench fever, and other infections were not used as donors.

There were no blood banks in WWI. The Red Cross was not in the transfusion business at that time, either. Blood banking methods didn’t develop until after 1929 and were not widely available until the late 1930s. Thus, blood for transfusion in WWI was taken from the donor and almost immediately transfused. The transfusion was not direct: where blood is transfused from donor straight into the recipient. Rather, blood was donated in one location and taken to another for transfusion.

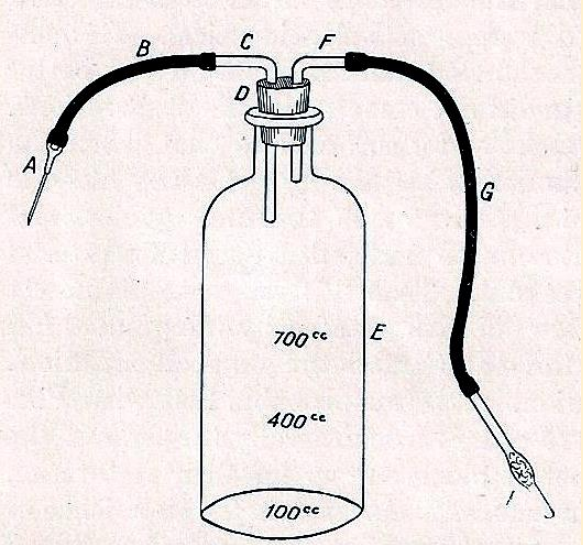

FIG. 106.—Transfusion apparatus. *A*, Transfusion needle *B*, rubber tube; *C*, glass tube; *D*, rubber stopper; *E*, bottle of liter capacity; *F*, glass tube; *G*, rubber tube; *H*, glass tube for suction, with cotton in bulb

The above apparatus was sterilized by either autoclaving or boiling it. The reusable steel needles were sharpened first, then sterilized in boiling liquid petrolatum or albolene and left in the oil until needed. The bottle is citrated (with a final concentration of the citrate at 0.6% with a total bottle volume of 700 ml) and 100 ml of normal saline (0.9% salt water) is added before blood collection. Citrate prevents the blood from clotting in the equipment and the saline dilutes the blood to make it easier to transfuse. A Davidson syringe could be applied to the glass tube at the end of the rubber tube, “G”. This glass tube is labelled “H” in the original , but that letter didn’t reproduce well in the above diagram.

The collection process was as follows:

1. Tourniquet on arm to identify the best veins for use.
2. Tourniquet is released, and the skin over the selected vein is washed with soap and water, then scrubbed with alcohol.
3. A small amount of Novocain or cocaine is injected subcutaneously.
4. A small nick with a scalpel is made to pierce the skin surface
5. The tourniquet is reapplied to dilate the vein.
6. The vein is punctured with the needle. The needle operator holds the needle in place through the blood harvesting procedure.
7. The operator rotates the bottle every few seconds to mix the harvested blood with the citrated saline solution.

8. Suction on the glass tube “H” could be done in two ways. First, by used of a Davidson syringe (which I think would require an assistant to manipulate), or by placing the glass tube “H” in the operator’s mouth, and creating suction.

Blood so collected was usually transfused immediately, but could sit for several hours before transfusion. It could not be banked, however.

The total volume of blood removed in this procedure was 600 ml. If more blood was required, a second donor and a second apparatus were used. The blood was kept warm for transfusion.

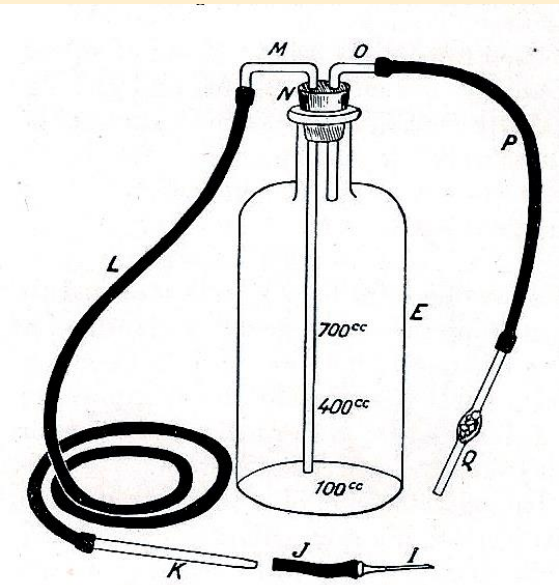

FIG. 107.—Transfusion apparatus. *J*, Rubber tube; *K*, glass tube; *L*, rubber tube; *M*, glass tube; *N*, rubber stopper; *O*, glass tube; *P*, rubber tube; *Q*, glass tube for exerting compression (cotton in bulb)

The transfusion process was as follows:

1. The stopper “D” was removed along with the attached tubing.
2. A new stopper “N” with attached sterilized tubing are connected.
3. The operator places the glass tube “Q” in his mouth and blows. This forces blood into glass tube “M” and the attached patient limb of the apparatus.
4. A pinchcock is applied to tubing “L” when blood has filled glass tubing “K”.
5. The needle “I” is then inserted into the recipient patient’s vein (identified and prepped as in the donor, above). When blood drips from tube “J” (which was attached to the needle before the needle was inserted), the assistant holds the

needle in place while the operator connects glass tube “K” into rubber tube “J”.

6. The bottle is then raised to the height allowed by rubber tube “L” and the pinchcock is opened. The blood then infuses into the recipient by gravity.
7. The infusion rate may be increased by attaching a blood pressure apparatus or Davidson syringe to the glass tube “Q” to add pressure to the infusion bottle. The transfusion rate is to not regulated by any particular volume per minute or hour. The transfusion should not be completed any faster than 15 minutes. The ideal was to infuse the blood over 40-70 minutes.
8. During transfusion, the recipient was observed for signs of distress, such as chills, fever, rapid heart rate. Overly rapid infusion was associated with a drop in blood pressure in many cases and was therefore avoided.

Reference:
Ireland, Maj. Gen. M.W, Editor. *The Medical Department of the United States Army in the World War.* Volume XI; Surgery, Washington D.C.: Government Printing Office, 1927. Pages 197-205.

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