INTRODUCTORY NOTES

Chapter VII of the book 'Hemorrhage and transfusion' by George Washington Crile, published in 1909 in the USA [one of the first books on blood transfusion] is called 'A Brief History of Transfusion' (pp. 151-158).

The book has been digitised and can be viewed at:
https://babel.hathitrust.org/cgi/pt?id=coo1.ark:/13960/t03x8t98w&view=1up&seq=169

Although it is believed that due to its age this book is out of copyright, this article is presented in this format for personal study only and must not be downloaded, copied, modified or reproduced further – it is provided here as an additional source of information relating to the history of blood transfusion.

Due to the age of this publication it is thought likely that it is rarely considered as a source of information, even though it was a milestone publication by one of the foremost advocates of direct blood transfusion in the USA at the beginning of the 20th century. Following his extensive experiments on dogs, Crile performed his first direct (artery-to-vein) transfusion in 1905, performing a total of 61 transfusions on 55 patients between 1905 and 1909. In December 1906 Crile developed a cannula that could be used to unite the inner surfaces of the donor's artery and recipient's vein thereby avoiding the difficulties of blood clotting, a difficult surgical technique that was to be used later in the UK by Berkeley Moynihan.

At the beginning of the text, Crile identifies that "much of the material for this short historical account has been taken from Oré's excellent monograph" [the reference for which is given at the end of the chapter].

A BRIEF HISTORY OF TRANSFUSION

George Washington Crile

CHAPTER VII

It is impossible to say when and where the idea first originated of transferring blood from an animal or a person to the veins of a person suffering from the loss of blood or afflicted with disease. That the ancient Egyptians knew about it and practiced it is probable from allusions made in their history. In the "Book of Wisdom" of Tanaquila, the wife of Tarquin, mention is made of the custom, and Herophilus clearly refers to it in his treatise on anatomy. In the sacred book of the priests of Apollo it is also referred to, and it is mentioned in the researches of Eubages, the works of Pliny and of Celsus, where it is condemned, and in the Metamorphoses of Ovid. At a much later time La Martiniere, in writing to M. de Colbert, says that transfusion was experienced by Martel Ficin, Abbot Trithème, and Fra Paola.

What is probably the earliest authentic case on record is that of Pope Innocent VIII, who was operated on in April, 1492. "The vital powers of Innocent VIII rapidly gave way; he had for some time fallen into a kind of somnolency, which was sometimes so profound that the whole court believed him to be dead. All means to awaken the exhausted vitality had been resorted to in vain, when a Jew doctor proposed to do so by the transfusion, by a new instrument, of the blood of a young person – an experiment which had hitherto only been made in animals. Accordingly,

the blood of the decrepit old pontiff was passed into the veins of a youth, whose blood was transferred into those of the old man. The experiment was tried three times, and at the cost of the lives of three boys, probably from air getting into their veins, but without any effect to save that of the pope" (Villari's "Life of Savona rola"). This case, besides being the first authentic one, is the first in which death was ascribed to air embolism.

In 1615 transfusion is accurately described by Libavius without there being evidence that he practiced it. The author of a book entitled "Relatione de l'Expérience faite in Engleterra, Francia, etc.", cites the passage from Libavius and goes on to say that he did not propose it seriously, for on being questioned as to what should be done to prevent the donor of the blood from becoming weak, he replies that there is more need of protecting the physician who proposes the operation, and that while the former should have some good broth, the latter should be given hellebore!

In 1628 Giovanni Colle, of Padua, in speaking of foods and medicines which would be likely to prolong life, mentions transfusion as a means of doing so.

Francesco Folli gave a reading before Ferdinand II of Tuscany in which his intention of performing transfusion was stated, and in 1652 he wrote the following: "I have read William Harvey's book, which treats of the movement of the heart and of the blood. This reading, with some ideas I had on the grafting of plants, gave rise in my mind to this third problem, that, the circulation of the blood existing, it would be possible to perform transfusion, by means of which one could not only cure but rejuvenate and make robust" (translated from Oré). Folli used two cannulas in performing transfusion – one of bone and the other of silver. They were connected by a piece of intestine or by a piece of prepared artery, and there was a side branch which permitted the escape of air.

It was not until about the middle of the seventeenth century that transfusion began to have an established place in surgery. Harvey's discovery of the circulation of the blood stimulated research, first on animals and then man, and gave a reasonable basis on which to account for the successes which occurred. New ideas were originated, new apparatus was invented, and an era of marked progress was inaugurated. Workers in France, Germany, and England were particularly active at this time, and it is difficult or impossible to say to whom belonged the greatest credit.

In January, 1667, there appeared in the *Philosopher's Journal* an article by Richard Lower in which he gave the first complete detailed account of the method of performing transfusion. According to this method, the carotid artery of one dog was freed, and, by means of quills, connected to the lower end of the jugular vein of another dog. When the blood was allowed to pass over, the upper end of the jugular vein of the recipient was unligated so that, as it received the new blood, it lost an equal amount of its own blood, a balance being thus maintained between inflow and outflow. By this method the donor of the blood was allowed to die.

In the same year Denys, of Montpellier, wrote concerning experiments which he performed on animals. He followed Lower's method in a general way except that he did not withdraw enough blood from the donor to cause death. He also tried transfusion from three calves to three dogs with success in each case. In a letter to M. de Montmore he describes two transfusions which he made on patients. His idea was that "In practicing transfusion one can only imitate the example of nature, which, in order to nourish the fetus in the uterus of the mother, makes a continuous transfusion of the blood of the mother into the body of the infant through the umbilical vein. In performing transfusion it is nothing else than nourishing by a shorter road than ordinary – that is to say, placing in the veins blood all made in place of taking food which only turns to blood after several changes" (Oré).

His first patient was a young man sixteen years old who was in a stupor following a fever which had lasted two months, and in the course of which he had been bled 20

times. Denys withdrew 3 ounces of his blood and transfused 9 ounces of arterial blood from a lamb. The result was a complete cure.

In the second case the transfusion was apparently performed purely for experimental purposes, as the subject was well and strong and received a consideration for permitting it. About 10 ounces of blood were removed from a vein and an equal amount transfused from a lamb. The man experienced an agreeable sense of warmth, but had no unpleasant sensations and no ill effects occurred. Encouraged by these two successes, Denys tried a third time. The patient was a man thirty-four years old who had had intermittent insanity for eight years. In a violent attack he escaped from his place of confinement 12 miles from Paris and arrived in the latter place naked. After he was placed in confinement again Denys, with the help of Emmeretz, transfused 5 or 6 ounces of blood from a calf, and as soon as he became calm a still larger quantity. These operations took place toward the end of 1667, and the patient did not have a return of his symptoms until January, 1668.

While transfusion had its advocates, it also had its opponents, and among the most powerful were the Faculty of Medicine of Paris, who did not recognize Harvey's discovery of the circulation of the blood, and who opposed any progress being made in medicine. They stooped to publishing anonymous pamphlets against Denys and Emmeretz, and were even accused of having bribed the widow of the above-mentioned insane man (who had died under circumstances pointing to her having poisoned him shortly after a third transfusion was attempted) to falsely accuse them of having caused her husband's death. A complaint was made by Denys to the authorities, and after a review of the case it was ordered that the woman should appear in court in person for further examination, and also that “A l'avenir la transfusion ne pourrait être faite chez l'homme sans l'approbation d'un médecin de la Faculté de Paris” (Antoine Daubray, Chatelet, April 17, 1668). As a result of this decree interest in transfusion was discouraged, and it was almost forgotten by all but a few observers until early in the nineteenth century.

In 1683, at Frankfort-on-the-Oder, the surgeons Kaufman and Purman are said to have cured a leper by transfusing into his veins blood from a lamb (Oré).

In 1682 Ettenmuller, of Leipsic, recommended transfusion in fevers, scurvy, and hypochondriasis. He said that small amounts of blood should be injected at different times.

In 1714 Nuck gave the history of transfusion in his book entitled “Operationes et Experimenta Chirurgica”, saying it should not be forbidden, but that it might be of great value in wounds followed by hemorrhage of considerable amount. He did not approve of using the blood of animals in transfusing to man.

In 1749 Cantwell, a member of the Faculty of Paris, was of the opinion that transfusion should not be forbidden in desperate cases, as it had previously occasionally proved to be of value. Apparently either opinion was changing in the Faculty or he alone possessed the courage of his convictions.

In 1783 Michel Rosa, professor and president of the Faculty of Medicine of Modena, made some experiments, and apparently proved (1) that the vessels of a normal living animal can receive much more blood than they contain without being filled, (2) that the transfusion of blood of an animal of another species can be performed without danger to life, and (3) that the reanimation of an exsanguinated animal can be accomplished by the introduction of arterial blood from an animal of another species (“Lettere fisioligiche,” Naples, 1783).

In 1792, in Cambridge, Harwood reanimated an exsanguinated dog before an audience by means of transfusion.

In the same year at Eye, in the county of Suffolk, where there was an epidemic of hydrophobia, Russell first bled a young boy who was afflicted with the disease, and then transfused into his veins the blood of two lambs. Recovery resulted.

In 1796 Darwin extolled transfusion of the blood of man, sheep, or donkey in putrid fever, scirrhous of the esophagus, or in cases where there were obstacles to the proper nutrition of the patient due to any cause.

The beginning of a new era was signalized by the work of Blundell in England. After witnessing the death of a woman from uterine hemorrhage, he came to the conclusion that her life might have been saved by transfusion. As it would have been difficult from the circumstances of the case to have employed the ordinarily used immediate method, he thought that in a similar case the blood could be injected from a syringe. Fearing, however, that the blood would be changed by coming in contact with the interior of the syringe, he performed experiments on dogs for the purpose of investigating this point.

In his first experiment (*Medico-Chirurgical Transactions*, 1818, ix, 56) he withdrew 8 ounces of blood from the femoral artery of a dog. Most alarming symptoms soon showed themselves – difficulty of breathing, convulsions, loss of sensibility, and complete relaxation of the abdominal muscles. After some seconds 6 ounces of blood were taken from another dog and injected into the femoral vein, with the result that recovery was complete. From this Blundell concluded that the use of the syringe did not affect the blood.

In his second experiment, tubes were introduced into the femoral vein and femoral artery of a dog, and as the blood escaped from the latter into a vessel it was at once injected into the former. This was continued for twenty-four minutes without the animal suffering any harm.

Blundell also tried other experiments to determine the effect of leaving the blood in the vessel a longer time, and of the effect of using dissimilar blood. He injected human blood into dogs after it had stayed in a vessel from thirty to sixty seconds, and found that they all died either immediately or in several days. He came to the conclusion that if air in not too large amount were injected into the veins the animal did not die. He found that venous human blood did not act better than arterial human blood in reanimating dogs after bleeding them. In particular he noticed that a much less amount of blood was necessary to reanimate a bled dog than the amount of blood lost by the dog.

In 1825 Prevost and Dumas said that: “If one takes the blood which one injects from an animal of different species, but whose corpuscles may be of the same shape although of different dimensions, the animal is only imperfectly bettered, and can rarely be saved more than six days. ... If one injects blood with circular corpuscles into a bird, the animal ordinarily dies in the very midst of violent nervous manifestations comparable to those caused by the strongest poisons” (Ore).

About ten years later Bischoff began a series of experiments in which he tried the effect of transfusing defibrinated blood from mammals into birds, and repeated, using whole blood. He also tried to ascertain whether exsanguinated animals could be reanimated by transfusing blood from an animal of another species. He concluded that defibrinated mammalian blood did not exercise a deleterious influence on birds, while if not defibrinated it caused death, and that defibrinated similar blood would not reanimate exsanguinated animals. He also concluded that the fibrin contained a harmful substance which was the immediate cause of death. In 1838 he has an account of further experiments in Műller's *Archives* (page 351) and concludes that the arterial blood of a mammal does not cause death when it is introduced into the veins of a bird, and that only venous blood leads to a fatal termination.

In 1875 Guérin tried connecting the arteries of two dogs so that their blood would circulate in common. He joined the central end of the severed femoral artery of Dog No. 1 with the peripheral end of the severed femoral artery of Dog No. 2 by means of a short rubber tube. Then he connected the peripheral end of the artery of Dog No. 1 with the central end of the artery of Dog No. 2 in the same way.

This gave a continuity of blood path which could rarely be maintained more than half an hour without clotting in the tubes. On trying the experiment on two horses the

relation could apparently have been maintained indefinitely without clotting, but as the smaller horse became so plethoric that blood oozed from the intestinal mucous membranes the experiment was stopped. Beyond this oozing no other harm resulted. There is no record of this method ever having been tried on human beings.

Oré, P.C. Études historiques, physiologiques, et cliniques sur le transfusion du sang. Paris, 1876, 704
Guerin, A. La communauté de circulation. In Lapeyrère, B.J. Notes d'un journaliste. Paris, 1875, 92-7