Medicina Historica 2019; Vol. 3, N. 3: 181-184

Review article: history of medicine

Heterogenic transfusion in Italy. Historical review of a medical practice

Ilaria Gorini[1], *Omar Larentis*[1], *Rosagemma Ciliberti*[2], *Barbara Pezzoni*[1]

[1]Centre of Research in Osteoarchaeology and Paleopathology, Department of Biotechnology and Life Sciences, Insubria University, Varese, Italy; [2]Section of Forensic Medicine and Bioethics, Department of Health Sciences, University of Genoa, Italy

Abstract. In our paper, we present a brief historical review of the transfusion practice, with a particular emphasis on the Italian research between 17th century and the end of the 19th century. Centuries of experiments, attempts and hard achievement have marked the paths toward the comprehension of the transfusion practice. The blood types discovery was possible only thanks to hundreds of attempts. In our paper, we retrace part of the work of enlightened scientists, which leads to one of the most important discovery of the last centuries.

Key words: history of medicine, transfusion, blood type

Blood is an important fluid in human body that arouses our curiosity from ancient times. It was soon understood that the loss of blood could bring to death. Conversely, receiving blood could give new strength to a weakened body. Countless iconographic sources show blood in direct connection with an individual's health. Emblem of life and death, it was studied with both a scientific and a magical approach. In the history of medicine, it had often been the jumping off point for the study and the comprehension of the mechanisms behind human body.

First Hippocrates in the classical Greece and then Galen in the ancient Rome used blood in order to have insights into human physiology and into the onset of illness, within the framework of the so called humoralism (1). This theory was accepted and teached by the scientific community until the beginning of the 17th century (2). A turning point in the history of medicine resides in the discovery of the circulatory system and the cardiac activity by William Harvey (3). In his treaty "*Exercitatio anatomica de motu cordis et sanguinis in animalibus*", written in 1628, he refused the physiological system theorized by Galen. According to Harvey, the heart was the pump at the basis of the arterial and venous system, whereas Galen recognized to the liver this role. Two centuries later, in 1844 in Bruxelles, the *"Dictionnaire de Médicine et de Chirurgie Pratiques"* was published. It asserted that the circulation system of superior animals was based on a *fluide particulier* that moved without interruption in the best system by its own. That fluid was called *sang* and the system of vessels, which it flowed in, *appareil circulatoire*.

In vertebrates and in the human body the heart, a muscular organ, pumps blood trough divergent veins, called arteries, and collects it from convergent veins, called vessels. Arteries and blood vessels were connected to each other by small vessels called capillaries. This interpretation of the human circulatory system demonstrates how Harvey's theories were well received in the human physiology of the half of the 19th century.

Continuous researches during the century laid the foundation for a medical and surgical handbook for physicians containing the instructions for blood removal and transfusion. Bloodletting, intended as poured blood, in the light of its extensive use, was one of the most important practices in the history of medicine. It fell into oblivion only with the experience in the transfusion practice, intended as offered blood (4).

Physicians tried to transfuse blood into patients from animals, other humans and dead bodies. This bizarre transfusion attempts outline how this practice remained not well understood. An ancient reference of the use of blood comes from the "*Metamorphoses*", wrote by the ancient Rome writer Ovidio. In the seventh book named Medea, Cephalus and Procris, the witch, rejuvenate the old Aeson:

"Medea, when she saw this wonder took her unsheathed knife and cut the old man's throat; then, letting all his old blood out of him she filled his ancient veins with rich elixir. As he received it through his lips or wound, his beard and hair no longer white with age, turned quickly to their natural vigor, dark and lustrous; and his wasted form renewed, appeared in all the vigor of bright youth, no longer lean and sallow, for new blood coursed in his well-filled veins."

This myth allows us to comprehend that also in ancient times blood and transfusions were probably used for healing, even for the most intractable diseases, as reported in the *"Dictionarie des Sciences Médicales"* of the 1820.

It is worth mentioning the so called "world's first blood transfusion" performed in 1492 in Rome by Giacomo di San Genesio in order to save Pope Innocenzo III's life. The attempt ended with the death of three 10 years old donors and of the Pope himself. The Italian physician Francesco Folli made another attempt of transfusion in 1654 by inserting a silver cannula in the harm of the donor and a cannula made of bone in the arm of the recipient, connecting each other by an animal vessel. Folli was the first medician that proposed to transfuse nutrient and medicines directly in the circulatory system. Despite all experiments, until the discovery of blood type, transfusion remained a dangerous treatment with a mortality rate greater than 50% due to clots, bacteria, toxins and incompatibility reaction (5).

Geminiano Montanari in 1667 in Bologna conducted what was, probably, the first "real" transfusion in Italy. It was between two lambs and the experiment was replicated between a dog and a lamb the following year in Udine (6). Michele Rosa, at the end of the 18th century, in his *"Lettere Fisiologiche"*, demonstrated scientifically that it was possible to reanimate a bleeding animal, transfusing in its body an adequate quantity of blood. In the light of his discoveries, he proposed to use the transfusion practice in case of haemorrhage during childbirth, both for the mother and the child, and for the treatment of injured soldiers (7). This practice remained in use for over 200 years in the attempt to treat a wide range of diseases, such as anaemias, deficiency diseases, malaria, typhus, leprosy and haemorrhages. Finally, in 1818, James Blundell performed the first successful transfusion of human blood to a recipient for the treatment of a haemorrhage.

Thanks to the renewed confidence in transfusion due to Blundell, Giuseppe Albini, in 1871 in Naples, reintroduced the lamb blood transfusion, which was abandoned for over 200 years (8). In 1872, he wrote about the need to bring lambs to the battlefront so as to have fresh blood for the soldier's transfusions:

"I was in Milan in 1866, directed to the civil Medical-Surgical Ambulance camp. I firmly asked for one or more living lambs in my Ambulance, so as to use their hart or blood in transfusions with my emodrometro, saving soldiers life (9)." Albini described in detail that only the regiment physician was able to do the operation. He provided technological innovations such as the use of an elastic rubber tube connecting the two cannulas and a protocol to avoid the entry of air into the vessels and the blood coagulation.

Other Italian and European physicians supported this practice. Let us mention the Italian Luigi Luciani, the French Mathieu Moncoq and the German Ferdinand Heyfelder (10, 11). The latter in 1874 proposed to the European government the presence of flocks of sheep on the battlefields for the emergency transfusions of the soldiers. Luigi Luciani, the most known Italian physiologist of those times, conferred to Albini the value of the revival of the human-animal direct transfusions, the so-called heterogeneous blood transfusion. He developed in 1874 an instrument for this type of direct blood transfusions. A glass cannula was inserted in the carotid artery of a sheep or a goat and another blunt tip cannula was inserted in the human recipient vessel. Between the cannulas, a two-way valve allowed to control the blood transfer. Moreover, it was possible to choose the calibre of the instruments depending by the recipient's vessel and sodium bicarbonate was used as an anticoagulant. Luciani described every step of the procedure: how to choose the right

vessel, how to do the transfusion and how to do the post-surgical therapy that comprehended the measurement of body temperature, of cardiac and respiratory activity, of blood pressure and an analysis of urine. Even if his proposal was original and valuable for the military medicine of the second half of the 19th century, clinical records showed that his method was often ineffective.

Despite many physicians disagreeing with this practice, considering it too dangerous for human's life, Luciani was always a strong supporter of it. To him, the danger resided in the fact that the practice had still to be consolidated among physicians, who were not always completely aware of it. Reporting his words:

"The unfounded risks and complexity of direct transfusion were only due to the scarse knowledge of its procedure."

Enrico Morselli wrote in 1876 *"La trasfusione del sangue"*, in which he transcribed the most important articles on transfusions published in the second half of the 19th century: all the scientific knowledge of this practice and the numerous attempts made by the physicians were summarized in his book. Despite his remarkable work on the subject, Morselli was sceptical towards transfusion. Indeed, even though he considered Luciani's work excellent, he affirmed that only few pathologies could be treated with this practice and that lamb's blood has "*the fewest analogies and the greatest number of dissimilarities with human blood*". Giuseppe Colasanti believed that heterogenic transfusion was too dangerous and suggested banning it from surgical practices (12). On the other hand, he was in favour of homogeneous transfusion. In the same years an eclectic Italian physician performed some new experiments in blood transfusion (13, 14)

Mario Giommi, chief surgeon in the Italian hospital of Gubbio, described in 1878 his direct experience with a patience suffering of scurvy, a pathology whose aetiology was unclear (15). The lack of knowledge of this illness leaded physicians to believe that the patient's physical decay was related to the blood and transfusion was seen as the only possible effective treatment. It seemed to reactivate the centres of the central nervous system, to improve the tissue remodelling and to change hematic parameters. Moreover, although other data of patients affected by pellagra or malaria showed how transfusion did not lead to a complete healing, it was possible to highlight a clear RBCs and HTC increasement. Giommi, in October 1877, performed a direct transfusion from a lamb to a woman affected by scurvy. He was fully satisfied by the results: the patient healed in twenty days. For this reason, he was in favour of this practice, even if it was not possible for him to assert that the transfusion was the main cause of the woman's healing. Indeed, the patient followed a healthy lifestyle: a rich and varied diet, plenty of wine, long outdoor walks, iron lactate and calcium phosphate powder consumption and a decoction saturated with Haller's elixir, also called "*acidum sulfuricum alcoholisatum*", composed from a part of sulfuric acid and three parts alcohol at 90°. In conclusion, he asserted that:

"*I cannot affirm to have improved blood's quality. Only an 80 g blood transfusion, even if arterial, cannot allow us to assert that.*"

A fundamental innovation for haematology came at the beginning of the 20th century thanks to Karl Landsteiner, a young researcher at the Institute of Anatomical Pathology of Wien that discovered blood types (16). This new knowledge has leaded to the abandon of the heterogeneous transfusion and animal blood has found other methods to be employed (17).

When transfusion was not a dangerous hazard anymore, blood could be safely donated. At the beginning of the 20th century, the foundation of the modern haematology was laid thanks to scientific researches on compatibility rules, thus opening new branches of research.

References

1. Lo Presti R. The theory of the circulation of blood and (different) paths of Aristotelianism. Girolamo Franzosi's De motu cordis et sanguinis in animalibus pro Aristotele et Galeno adversus anatomicos neotericos libri duo: teleology versus mechanism? Gesnerus 2014; 71(2):271-89.
2. Di Segni M. Il contributo italiano alle origini della trasfusione del sangue e della iniezione dei medicamenti nelle vene. La rassegna di clinica, terapia e scienze affini. 1936; (29):179-99.
3. Ribatti D. William Harvey and the discovery of the circulation of the blood. J Angiogenes Res 2009; 1:3.

4. Weinberg F. Bloodletting. Can Fam Physician 1994; 40:131-4.
5. Ewald DR, Sumner SCJ. Blood Type Biochemistry and Human Disease. Wiley Interdiscip Rev Syst Biol Med 2016; 8(6):517-35.
6. Montanari G. Copia di lettera intorno a una esperienza di trasfusione fatta in Udine. Relazione delle esperienze fatte in Inghilterra, Francia e Italia intorno alla celebre e famosa trasfusine del sangue. Bologna: Emilii Mariae & fratrum de Manolessiis; 1668.
7. Vaglini M, Gennai C. Storia delle Istituzioni Sanitarie in Italia dalla fine del '700 ai giorni nostri. Pisa: Primula editore; 2002.
8. Luciani L. Metodo sicuro per la trasfusione diretta del sangue da animale ad uomo. Rivista Clinica di Bologna. Bologna; 1874:206.
9. Albini G. Relazione sulla trasfusione diretta di sangue di agnello praticata due volte in una signora. Napoli: Rendiconti dell'Accademia delle Scienze;1872.
10. Heyfelder O. Zur Lehre von der Bluttransfusion. Deutsche Zeitsch für Chirurgie 1874;4:369-81.
11. Stroppiana L, Spallone D. Terapia emotrasfusionale prima della scoperta dei gruppi sanguigni. Atti del primo congresso nazionale di storia della terapia. Roma 15-16 ottobre 1961. Roma: Cossidente; 1963:620-9.
12. Armocida G. Giuseppe Colasanti. Dizionario Biografico degli italiani. Roma: Treccani; 1982.
13. Mosso A. Sopra alcuni sperimenti di transfusione des sangue. Sperimentale 1872; 30:369-75.
14. Larentis O. Angelo Mosso (1846-1910). Brain's rule in physiognomic. A new face of pathological diagnosis. Neurol Sci 2019; 40(4):895-7. Doi 10.1007/s10072-018-3652-3
15. Giommi M. Trasfusione diretta di sangue arterioso in un caso di scorbuto cachettico. Rivista Clinica di Bologna 1878; 8(1):15:18.
16. Landsteiner K. Uber agglutinationserscheinungen normalen menschlichen Blutes. Wien: Wiener Klin Wochnschr 1901;14:1132-4.
17. Anstee DJ. Lessons from the blood of sheep. Blood 2008; 112(12):4369.

Correspondence:
Omar Larentis
Centre of Research in Osteoarchaeology and Paleopathology
Department of Biotechnology and Life Sciences
Insubria University, Varese, Italy
E-mail: olarentis@uninsubria.it