UEBER DIE TRANSFUSION BEI BLUTUNGEN NEUENTBUNDENER.

BY: EDUARD MARTIN

A TRANSLATION BY PHIL LEAROYD

A copy of the book 'On transfusion in bleeding patients after childbirth' by Dr. Eduard Martin, published in 1859 in Berlin by Verlag von August Hirschwald, can be read or downloaded from the following sites:

https://books.google.co.uk/books/about/Ueber_die_transfusion_bei_Blutugen_Neven.html?id=_dU-AAAAcAAJ&redir_esc=y

https://www.digitale-sammlungen.de/en/view/bsb11451508?page=,1

The author Eduard Martin is stated within the title page of his book to be a Professor of Obstetrics and Director of the Royal Clinical Institute for Obstetrics and Gynaecology, which identifies him to be more than qualified to write about the transfusion of women who are bleeding to death during and after delivery – a situation that moved James Blundell to experiment with blood transfusion.

As well as an interesting Preface, where Martin argues that there is sufficient evidence for transfusion to be used for the 'replacement treatment' of blood loss especially in women after delivery and not for 'certain diseases', the book comprises seven sections, the first of which is a short historical summary that includes material regarding the development and subsequent demise of transfusion experiments in France, England and Italy and its 'revival' in the 19th century especially by Blundell in England, and the experiments performed especially by Dieffenbach in Germany and Dumas and Prevost in France.

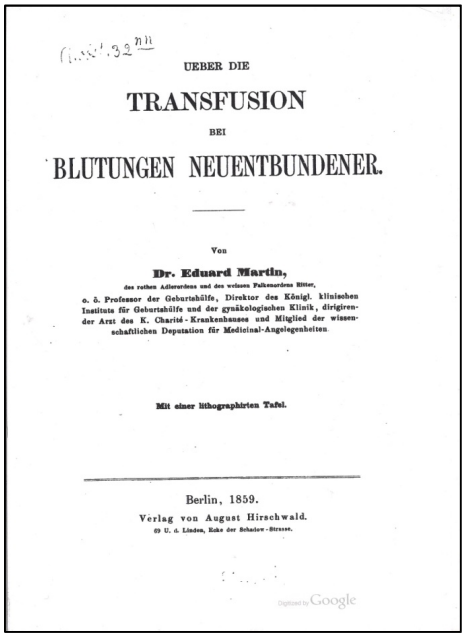
In the second section, Martin relates his own experiences of transfusing an anaemic newly delivered woman with chronic stomach catarrh, which prevented the use of oral treatments, medicines and foods post delivery. The third section extensively tabulates 57 cases of transfusions to women (between 1824 and 1857) during and after childbirth that the author has compiled, which details the patient's previous condition, symptoms, type of transfusion, amount transfused and the outcome.

The fourth section contains information relating to the effects of transfusion, concentrating on a discussion as to whether the transfused blood acts as a replacement for lost blood or as a stimulant to vascular and cardiac action, or both. The fact that relatively small volumes of blood, i.e. less than 4 ounces in 18 of the cases identified in section three, proved successful suggests a stimulatory effect, that is also seen in animal experiments. The author then discusses the evidence that 'blood corpuscles' are the element that produces these effects and that there is insufficient evidence regarding the importance of fibrous material, identifying that to date very little defibrinated blood has been used in transfusions to humans.

In section five, the 'dangers associated with transfusion', Martin concentrates on the effects attributed to the entry of air into the patient's circulation during the transfusion process and the possible transfusion of blood clots leading to thrombosis, concluding from the information has collected that "the risk of blood clotting when transfusing unbeaten blood does not appear to be as great as was feared.". This section concludes with a discussion as to the possible dangers of phlebitis, which due to its low incidence and available treatment, the author dismisses as very low, especially when balanced against the risk to life of not transfusing a bleeding anaemic patient.

In section six the author examines the ‘indications for transfusion’ in which he states that he restricts himself to that associated with the specific patient group of newly delivered women, identifying that “in no other state of life is the danger of bleeding to death more frequent”. Having identified the possible causes of the bleeding in these patients, Martin is at pains to state that in the vast majority of cases the bleeding can be stopped by a variety of treatment options and recovery initiated by stimulants and foods, but also adds that when this is unsuccessful, transfusion is the only life saving option. He especially discusses the timing of the transfusion (“not too late”) in relation to the patient’s symptoms, such as ‘deathly pallor’, general coldness, lack of pulse, loss of consciousness, insensibility, etc.

Finally the author describes how to perform a transfusion using a syringe and provides a description and illustration of his own transfusion equipment, stressing the need to inject the transfused blood slowly so as to reduce the effects on the heart.



UEBER DIE

TRANSFUSION

BEI

BLUTUNGEN NEUENTBUNDENER.

Von

Dr. Eduard Martin,

des rothen Adlerordens und des weissen Falkenordens Ritter,
o. ö. Professor der Geburtshülfe, Direktor des Königl. klinischen Instituts für Geburtshülfe und der gynäkologischen Klinik, dirigirender Arzt des K. Charité-Krankenhauses und Mitglied der wissenschaftlichen Deputation für Medicinal-Angelegenheiten.

Mit einer lithographirten Tafel.

Berlin, 1859.
Verlag von August Hirschwald.
69 U. d. Linden, Ecke der Schadow-Strasse.

Digitized by Google

Title page – ‘Ueber die transfusion bei blutungen neuentbundener’ by E. Martin (1859)
(Image credit – Google-books)

I have produced a translation of this book from the original German into English to enable its content to be appreciated by a wider audience. Whilst I am aware that instantaneous computer generated translation is available, this process 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 and general layout of each part of the book as accurately as possible. The spelling of the names of people and places are printed in italics in the book – I have not reproduced this effect, but their spelling is as printed. I have been unable to translate a small number of words – these have been included within

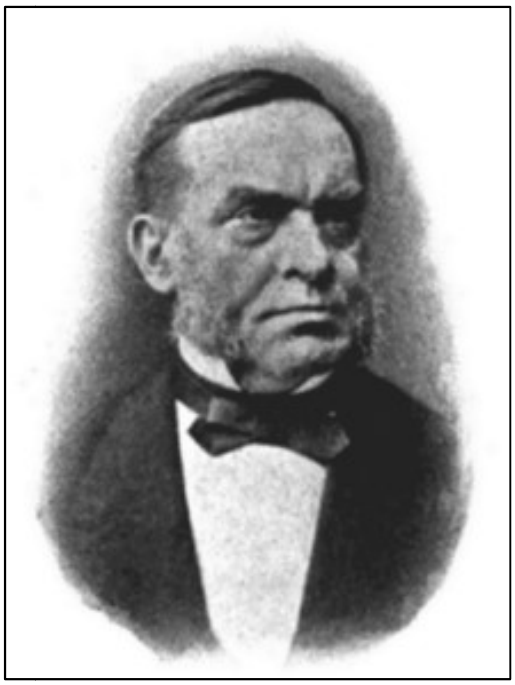
the translation within square brackets. I have reproduced the tables included within this book as accurately as possible (though in a different format) especially since some of the words with the text are written in a 'shortened' format presumably to fit the available space. The 'citations' within these tables have been reproduced as printed. Note: The tables variously include the symbol ʒ (i.e. which is equivalent to one ounce) which, where it occurs in the original table, I have reproduced in the translated table.

The references and authors comments listed within the original text are identified by numbers and placed at the bottom of the relevant pages where they occur. I have sequentially re-numbered these and placed them at the end of the translation, reproduced as originally printed. I have also included an English translation of the comments and titles of referenced work; these are included in italics within square brackets after the German text.

As identified on the title page of the book, there is a 'lithographed plate' included at the end of the book that illustrates Martin's transfusion apparatus. I have repositioned this within Section VII, i.e. to where the author is describing his transfusion technique, even though the illustration is not in fact referenced anywhere within the text.

Dr. EDUARD MARTIN

Eduard Arnold Martin was born in Heidelberg on the 22nd April 1809. He started his medical studies at the University of Heidelberg then moved to the University of Jena, receiving his doctorate in 1833 at the University of Göttingen. Having travelled in Germany and also to England and France, he settled in Jena in 1835. In 1837 he became an associate professor at the University of Jena, where during the following year he was named sub-director of the university maternity hospital. In 1846 he became a full professor as well as director of the maternity hospital and in 1858 he moved to Berlin to become the Director of the Maternity Hospital at the Charité, where he established a department of gynaecology and in 1873 founded the Gynaecological Society in Berlin and published his 'Atlas of Obstetrics and Gynaecology' which was translated into English after his death. He died in Berlin on the 5th December 1875.



Eduard Arnold Martin (1809-1875)
(Image credit – Wikipedia)

ON TRANSFUSION IN BLEEDING PATIENTS AFTER CHILDBIRTH

Dr. Eduard Martin,

Preface

The doctrine of transfusion has had the remarkable fate of being made the subject of careful and extensive study by two distinguished authors of modern times, with the intention of publishing a complete treatise on this method of healing, which was sometimes unduly praised and sometimes condemned by the state, but none of them has received much more than a historical treatment, with one only publishing what he had found in the writings of his predecessors, the other, after a long interval, only devoting a short section of a larger work to transfusion. In 1802 and 1803 Paul Scheele published two volumes in Copenhagen, "On the Transfusion of Blood and Injection of Medicines into the Veins," in which, however, he only compiled and critically examined all the literary material available to him concerning the doctrine in question, while the dogmatic part has not been written or at least not published. J. F. Dieffenbach joined him in collecting the progress of this doctrine up to 1827 in a work also referred to as the third part of Scheel's work. Eighteen years later, in his famous work, “Surgical Operations,” we find two sections on infusion and transfusion, which, however, apart from a careful description of the procedure, which do not contain a well-founded judgment on the applicability and indications of these operations, which is based on sufficient consideration of recent experience. It is striking that Dieffenbach does not name J. Blundell, but Doubleday, who began to bring the transfusion out of the darkness of oblivion and used it with decisive success on women who having recently given birth, almost bled to death.

But not only must infusion and transfusion be worked on separately from each other, so that one can arrive at clarity about the indications as well as about the methods of execution of each of these two operations, but also the field of transfusion itself should have to be divided in order to be able to fully understand and investigate each individual section. The use of transfusion for certain diseases still presupposes in part preliminary investigations, e.g., on the quality of the blood and relative quantity of blood, which must be expected in the future. Until these questions are resolved - and this will probably take decades - transfusion certainly cannot be used in such conditions. Cases of considerable blood loss, especially as a result of the separation of considerable vessels, behave completely differently in otherwise healthy individuals. Here, immediate replacement appears to be such an obvious remedy that one wonders how it was possible to have neglected this operation for so long. The most common such bleeding undoubtedly occurs during and after birth, and the peculiar situation is that mechanical closure of the separated vessels by ligature or in a similar manner to that in amputations and the like appears to be impossible. Although it is justified that women giving birth generally bear considerable blood loss more easily than women who have not given birth, one also encounters exceptions to this rule and sees that women fall into the greatest weakness with minor bleeding. In addition, the contraction of the uterus, which is so necessary for haemostasis in the newly delivered, depends on the quality of the blood and the quantity of blood itself, the presence of a properly constituted blood being one of the main conditions of muscular action. If one considers this ratio, it is precisely here, in the case of the bleeding of the newly delivered, that the indication for transfusion is most obvious, and it would explain why doctors in the recent past have most frequently resorted to transfusion under these conditions. –

If doubts have been expressed here and there as to the life-saving effect of the transfer of small quantities of blood, they are not in the least more justified than the doubt as to the usefulness of any medicine. For in part, one cannot deny the ability of many of the doctors who described the symptoms under which the transfusion was successfully carried out in newly bleeding patients announcing imminent death, does not deny the ability to judge the danger to the life of the sufferer in a specific case, in part there is no physiological reason for

which a few ounces of healthy blood introduced into the veins of the anaemic cannot produce a beneficial stimulation of the vascular system. Let us leave the doubters and stick to the experience that out of 57 cases of transfusion in newly delivered patients who have bled to death, 45 recoveries, and indeed under circumstances in which experienced doctors declared death to be imminent, while in the 12 remaining cases illnesses that occurred later, which had no connection with the operation, mostly caused death.

But just as Monneret may declare transfusion to be an "opération antiphysiologique" because one can only inject the carcass of the blood and cannot know how the blood of one organism affects the another organism, and furthermore because such insignificant amounts of injected blood cannot be successful; in fact, this can only be explained by the annoyance that he may have felt when a transfusion of defibrinated blood on a patient failed. I did not discover a scientifically sound reason for that assertion in his reasoning.

The experiment on a newly delivered woman who was extremely at risk of bleeding and who could not be saved in any other way because of severe gastric catarrh, convinced me of the benefits of transfusion, so that I found myself compelled to make the operation the subject of a more detailed study and now, based on the results of this more detailed investigation, my colleagues strongly recommend it for those cases where it appears to be indicated according to the following.

With regard to carrying out the transfusion, I consider the simplest methods to be the best, because the means for this must be available immediately and easily in the moment of danger. Accordingly I have specified such an apparatus which is easily transportable and can be used by any trained physician without special study, while on the other hand it offers the greatest certainty of success. In addition to this apparatus, every obstetrician carries a lancet or bistouri necessary for making a skin incision. –

If, through the following presentation, I have succeeded in helping to preserve the life of some women who were brought to the edge of the grave by the flow of blood in the prime of their years, then I will consider my efforts richly rewarded.

Berlin, 24 April 1859.
Dr. Ed. Martin.

A = Original text
B = Translation

I
Historical remarks on transfusion in general and in anaemic newly delivered in particular.

If only according to P. Scheel's careful research (1), the proposal to transfer blood from one person to another in order to rejuvenate the latter, to cure them of diseases, etc., apart from Ovid's well-known poem about the sorceress Medea, was already publically expressed at the end of the sixteenth and at the beginning of the seventeenth century by the doctor of medicine and professor of mathematics Magnus Pegelius in Rostock and by Andreas Libavius, doctor of medicine and director of the Coburg High School, which specifically stated that blood should be transferred from an open artery into any artery of another person through silver tubes, but Timotheus Clarke and Dr. Henshaw (around 1664) were the first to attempt transfusion experiments on animals, albeit in vain, and not Wren and Boyle, who had, however, carried out infusions on animals in 1656. The first successful attempt at transfusion by transferring blood from an artery of one dog into a vein of another was carried out by Richard Lower at Oxford in 1666 with brilliant success, so that the Philosophical Society in London now devoted the greatest attention and encouragement to these experiments.

In France, Jean Denis and Emmerez carried out the first transfusions on animals in 1667 and on 15th June of the same year also on a human being, in which they let blood flow from the carotid of a lamb into an open vein. Although this and another experiment on a paralyzed woman had a favourable outcome, the fierce opponents of transfusion made it so that on 17th April 1668 the Criminal Lieutenant of the Chatelet in Paris made the practice of transfusion dependant in any case on the permission of a physician of the Parisian Faculty. Because of this and through the dispute among physicians about the benefits and harms of transfusion, which was carried out in many writings, this operation fell out of favour in France and also in England; although in London in November 1667 the transfusion of lamb's blood was performed twice on a fool by Dr. King without any harmful consequences. In Germany, where a lot of work was done on infusion experiments, Balthasar Kaufmann from Küstrin and Gottfried Purman in Frankfurt and others undertook the first transfusions with lamb's blood, on a leprous and two scorbutic soldiers in 1668 with partly favourable results (2). Similar transfusions of animal blood to sick people were carried out in Italy by Joh. Guil. Riva (3) and in 1667 Paulus Manfredus in Rome (4). Nevertheless, the transfusion of animal blood into humans is said to have been banned by the authorities in Rome around this time (1668) (5).

In the following century transfusion was used exclusively for physiological experiments, namely by Rosa in Modena (1783) and by Bichat and Portal in Paris. However, the latter attempts did not become known until 1800. While in the present century in Germany Hufeland, father and son (6), recommended transfusion for certain diseases, especially in the case of bleeding, and the latter therefore carried out experiments on sheep, and C. Fr. Graefe specified a composite apparatus for transfusion, which Fr. Math. Stan. Val Hoefft described and illustrated in 1819 (7); the eminent physiologist and obstetrician at Guy's Hospital in London, James Blundell, had carried out numerous and successful transfusion experiments on animals after being inspired by a case of a young, strong woman bleeding to death after childbirth, and this was communicated to the Medico-surgical Society by Cline on 3 February 1818 (8), the transfusion of human blood was tested in a person suffering from scirrhus ventriculi, who was very decrepit.

James Blundell was the first to perform the transfusion on a newly delivered woman in Doubleday's practice, who had been on the verge of death by bleeding in September 1825, with the most brilliant success (9), after he had previously made two unsuccessful experiments on women who had recently given birth who had bled to death (10). Blundell first demonstrated through his experiments that human blood, namely blood from veins, could be successfully used for transfusion, and furthermore that the transfer had to take place by means of an injection (11), two propositions which first made transfusion practically useful. In fact, therefore, Blundell deserves to be named as the one who not only brought transfusion out of oblivion, but also introduced it into practice by his numerous experiments

and successful application. For however much this operation was disputed, partly in the bosom of the Medical and Surgical Society of London, and partly outside it, we soon see after J. Blundell and Uwins had again performed the operation with the happiest success (beginning of November, 1825) on a bleeding newly delivered woman (12); especially through the efforts of Doubleday and Waller, transfusion became more and more popular. The latter not only wrote 'Observations of the Transfusion of Blood', London 1825, but also a dissertation Inaugur. med. de sanguinis in periculosa haemorrhagia uterina transfusione, Erlangae 1832, in which he strongly recommended the operation on newly delivered women who had bled to death on the basis of Blundell's and his own observations.

In Germany however, Bernh. Fried. Aug. Tietzel (13) published a diligent dissertation on transfusion in 1824 and in it stated a slight change to Blundell's syringe. A few years later, the much more comprehensive work of J. F. Dieffenbach followed, which, as a continuation of Scheel's work, continued the history of transfusion and infusion until 1828. The interesting physiological experiments on animals, which Th. Bischoff published in 1835 and 1838, had no significant success in practice, despite the author's warnings (14). In 1845, Dieffenbach (15) recommended indirect transfusion only in cases of bleeding and asphyxia after he reported his unfavourable experiences with one hydrophobic and three cholera patients. In 1852, Mathias Vitalis Schiltz in Bonn subjected transfusion to prudent consideration (16).

In France, Dumas and Prevost had carried out various experiments on transfusions in animals, but had come to the conclusion that transfusions in humans should be rejected until the active principle in the blood was known exactly (17). D. Patissier, in his article on transfusion in the Dictionnaire des Sciences Médicales, judged transfusion even more unfavourably and in 1844 Ch. Philips (18) said that transfusion would only remain as a historical fait accompli. In 1850, a French judicial officer is said to have asked his higher authority in Paris whether he should take criminal action against a doctor in the provinces who had attempted transfusions several times in vain! (19)

In spite of these and other unfavourable judgments, the practice in England, as well as in France and Germany, has often made use of transfusion, especially in the case of newly delivered women who had come to the brink of the grave through bleeding, so that in 1852 J. Soden was already able to compile 36 published cases of mostly successful transfusions in women who had recently given birth (20).

These and the observations that became known later, although they were mostly published in various journals accompanied by more or less detailed comments about the operation in question, I do not want to list them in detail here, but rather present them to the reader in tabular form so that he himself may easily obtain an overview of the latest results of transfusion in women who have recently given birth and compare them with the comments I will make later. I limit myself exclusively to transfusions to the newly delivered, but I will first provide a detailed description of a successful transfusion in an anaemic newly delivered woman, which I myself carried out on 23rd February 1857 in the obstetric clinic in Jena.

II
Successful transfusion in an anaemic newly delivered.

The 21-year-old wife of the stocking weaver Eisler of Lobeda near Jena, a moderately nourished but very flabby blonde who had suffered from rickets in childhood and had only menstruated regularly since she was 18, became pregnant around the middle of June 1856 and felt the first movements of the child after the middle of December. As a result of a scabies cure she had survived in December, she fell ill with an inflammation of both unusually large mammary glands, and was therefore admitted to the gynaecological clinic in Jena on 4th February 1857, but at the request of her husband she was released back to her homeland on 11th February, before the division had been completely successful. Late in the evening of 18th February 1857 she first suffered a flow of blood; initially there was a lot of liquid, later also coagulated blood. Since the assistant from the obstetric polyclinic who was

called in, diagnosed the presence of the placenta, the apartment being in a town an hour away from Jena, as well as the other circumstances of the pregnant woman, did not give rise to any hope of successful treatment, the sufferer was carefully driven on 19th February, accompanied by the assistant, to the Grand Ducal Maternity Hospital in Jena, where she arrived at midday on the 19th without any new bleeding. The part of the vagina formed a petite cone about ¾" long, above which the present part of the child could not be discovered. It was not until midday on the 20th that a new, considerable bleeding occurred, despite absolute rest in a horizontal position, but this stopped after the internal use of acidum sulphuricum. In the afternoon oleum ricini eliminated the lack of evacuation of stools. On the evening of the 21st, contraction-like pains began, which were followed by quite heavy bleeding at 2:30 a.m. on the 22nd; the cervix appeared to be slightly open, the part of the vagina had not yet passed, and a present part could not be discovered. The colpeurynter that was filled with cold water and inserted because of the bleeding had to be removed at 6 a.m. because it caused severe pain. When the bleeding resumed ½ hour later, the bladder tampon was reinserted and the same procedure was repeated, after it was also removed at noon because of the sensitivity of the circulatory tubes, three hours later a new considerable bleeding appeared, although the vaginal part was not yet sufficiently passed and the cervix was barely found accessible to the finger. The heart sounds of the fruit were clearly heard in the mother's left side. - After stronger contractions occurred during the following night, the cervix appeared dilated almost an inch in diameter at 8 a.m. on 23rd February, but still unyielding. Since the considerably full bladder did not contract spontaneously, the urine was emptied using the catheter and the colpeurynter was then applied again. At 11 o'clock in the morning, increasingly powerful contractions drove the colpeurynter out of the vagina and burst the encroaching amniotic sac, so that the rump and the feet of the fruit to the right were discovered in the cervix, which was now dilated to over 2" in diameter. At 11.15 a.m. the 2½ pound boy, 10" from head to rump and 15" from head to heels, was forced out past his hips, and the upper half of his body was immediately carefully extracted. The fruit, barely 7 months old, breathed for a while, but only rarely, and died ¾ hour later. During the expulsion of the child the blood loss was small, but the very flaccid and pale cervix already appeared very weak and bloodless; furthermore, when a not insignificant amount of blood had flowed out before and during the removal of the afterbirth, which was stuck to the edge of the internal cervix on the right, which was brought about after ¼ hour without any effort, fainting spells, coldness of the extremities and small pulse to the point of disappearance occurred and made a rapid replacement of the lost blood appear urgently necessary. However, the chronic stomach catarrh that Ms. E. which had already been noticed earlier, prevented the effectiveness of the medicines given (Tinctura Cinnamomi, Tinctura Opii, Spir. sulphurico aether. ferruginos. etc.) as well as that of the prescribed meat broth, egg potion, etc., because all of these things were soon broken out again. The pulse became barely perceptible after 1 o'clock in the afternoon, the skin and lips became very pale, the apathetic, almost unconscious patient complained from time to time of ringing in the ears and yawned frequently; the immediate replacement of the blood mass and the stimulation of vascular and cardiac action seemed urgently required. One of the interns present, Dr. Paul from Weimar, a healthy, strong, young man, when I asked, agreed to have a bloodletting done, which was carried out immediately. While I exposed the median vein on the left arm of the newly delivered woman and inserted the trocar intended for this purpose into the vein, my assistant, Dr. Melchior at the same time made the venesection of the median vein of Dr. Paul and caught the abundant flowing blood with a cup, which was in a basin full of warm water at 40°C. I immediately sucked this blood into a syringe, warmed with warm at 40°C, and injected it into the median vein of the woman who was delivered using the aforementioned trocar tube. This injection was repeated three times within barely four minutes, so that casually 4-5 ounces entered the circulation of the sufferer. Ms. E. soon appeared brighter, less exhausted, and no longer complained about ringing in her ears or the feeling of fainting. The strong thirst was quenched by milk in small quantities, the only drink that the patient kept down. In the afternoon she slept intermittently, complained only of a headache, sweated profusely and had a pulse rate of 130-140. In the early morning of 24th

February, the patient felt better, the headache had subsided after she slept for about 4 hours; the pulse, although still very frequent, appeared stronger; the skin colour is very pale, the tongue has a yellowish coating. Bleeding had not recurred. Milk remains the only food. - The day passed without any disturbances and towards the morning of 25th February, a peaceful sleep returned again, after which the pulse appeared to have dropped to 112 and the thirst was also somewhat reduced. Towards the evening, pulling pains in the abdomen, which became sensitive to pressure on the left side, as well as new headaches in the forehead, increased heat in the skin, and a pulse rate of 130 caused new concerns. Vinegar compresses were applied to the head and a decoct. fruct. tamarindorum prescribed. On the morning of the 26th, after repeated short sleeps, the headache appeared to be more moderate, the pulse calmer (120), but the skin was still noticeably hot, the abdomen somewhat painful and distended. An enema caused the emptying of hard faeces. Painful urge to urinate with burning sensation when emptying, and dark colour of the released urine, the dull percussion tone spread over the entire abdomen, the persistence of the fever symptoms testify to the existing abdominal inflammation, against which an emulsio papaverina c. Liquor Ammon. acet. and potassium acet. is prescribed. A restless night followed with lots of dreams and fantasies. On the morning of the 27th the pain in the body and headache had almost disappeared; the skin is moist, the pulse shows 108. The following night, refreshing sleep also ensued, the pulse drops to 100. 1st March: Except for great pallor and weakness, feeling better, some appetite with little coating on the tongue, moderate thirst, and plentiful urination. After a cold contracted through careless exposure, a very painful urge to urinate arose on the night of 3rd March, which only subsided after vaginal injections of lukewarm linseed mucus; pulse 96, thirst moderate. In the afternoon, for no apparent reason, frequent vomiting of a greenish liquid, which finally stops with the use of effervescent powder, so that the patient later sleeps long and peacefully. - 4th March: Well-being except for a headache. In the afternoon the compulsion to urinate occurs again, internal exploration reveals a painful swelling of the anterior lip of the cervix and the anterior wall of the uterus that can be felt through the vaginal vault. The urine appears very cloudy. Extractum hyoscyami in decoct. althaeae. mild injections, and since the urge to urinate had not yet stopped on the following days, warm poultices on the hypogastrium. - 7th March: Except for the great pallor and tongue coating, as well as a headache in the back of the head, improvement; the pulse is still small and fast. On 9th March, the painfulness of the hardness of the considerably swollen mammary gland, which had already been noticed during pregnancy, appeared again, upwards and inwards from the nipple: brushing with iodine and iodine potassium solution. As a result of sitting up out of bed for a longer period of time without permission to write a letter, blood is released from the genitals on 13th March, so that blood clots are even lost on the 14th. The vaginal part now appears quite regressed, the cervix is small, but the uterus is dilated more than usual; atony of the placental site. Secale cornutum, later acidum sulphuricum and a cold injection stop the bleeding. The patient, who was still anaemic in any case, appears exhausted to a high degree, all the more so since on the 16th and 17th she was joined by a lack of appetite and diarrhoea, which gave way to a decoct. salep with acidum muriaticum. On the 19th the abscess formed in the right mammary gland is emptied and gradually closed with the application of emplastrum saponatum rubrum. On the 22nd the patient was able to leave her bed for the first time and on 30th March she was discharged, recovered to her home, where a few weeks later the left mammary gland, which had already been inflamed during the pregnancy, was abscessed and thus complete recovery took place.

Mrs. Eisler in the spring of 1858 has already been happily delivered of a living child.

III

Tabular overview of the known cases of transfusion in newly delivered patients.

Tabular overview of 57 transfusions in bleeding patients after childbirth.						
Number and Time	**Previous condition**	**Symptoms, under which the operation is made**	**Type of transfusion**	**Amount of injected blood**	**Result**	**Citation**
1. Before 1824 (?)	Uterine bleeding during the fifth birth period.	The respiration was already 5-6 minutes stopped when a transfusion was started.	Injection	16 ʒ of blood from two men.	-	James Blundell, physiological researches. 1824. p. 136. Soden, med. chir. Transact. Vol. XXXV. p. 428.
2. Before 1824 (?)	Uterine blood flow in the fifth birth period.	The respiration had not yet completely stopped, but the patient was on her last legs.	-	3-4 ʒ from a woman	-	James Blundell, physiological researches. 1824. p. 136. Soden, med. chir. Transact. Vol. XXXV. p. 428.
3. 1825	Uterine bleeding after delivery confinement with a stocky Irish woman.	Speechless, blurred vision; accelerated breathing with sighing; pulse not felt. Stimulants in vain.	Injection of 2 ounces each 6-7 times	14 ʒ from husband	Recovery without significant impact.	Blundell and Doubleday, Lancet 8 Oct. 1825. Compare. Ch. Waller's Observations on the Transfusion of Blood. London 1825.
4. 1825	Violent maternal blood flow lasting 1½ hours after expulsion of the afterbirth (on the day after the birth of the child).	Pale face, great weakness, pulse small, 130-140	Only 4 hrs after the bleeding was admitted, the transfusion started; Improvement; if weakness develops, repeat the transfusion.	2 times 6 ʒ in 2 hours by 2 different men (Dr. Wright & Dr. Uwins).	Recovery; the pulse soon dropped from 140 to 110 beats. Because of an inflammation of the vein, leeches placed.	Blundell and Uwins, Lancet 1825. vol. IX. p. 205 19 Nov. (Dieffenbach, the transfusion of blood. Berl. 1828, p.124.)
5. 1825	Maternal haemorrhage after expulsion of the placenta in a scrofulous, weak, 25-year-old primiparous woman after a slow birth.	Cheeks and lips pale, like a corpse; breathing weakly; pulse can hardly be felt; the most powerful stimulants had no effect; violent vomiting.	4 hours, then injection into the cephalic vein of blood from her husband's arm vein.	2 ʒ from husband without success; recurrence after fainting and vomiting; the pulse increased slightly and gradually fell from 120 to 100.	Recovery went smoothly, but the wound on the arm healed slowly.	Blundell & Waller, Dissert. med. Erlang. 1834, p. 22. Observations on the Transfusion of Blood. London 1825. Medico Chirurgical Review. vol. VIII. 1826. Edinburg med. and surg. Journal, 1826. p. 353. Dieffenbach, a. a. O. S. 217.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
6. 1825. Manchester.	A 40-year-old woman who had given birth for the eighth time experienced maternal bleeding three hours after the afterbirth was expelled.	Visible weakness five hours after bleeding begins; the patient was no longer able to speak.	Injection of 2 ounces with a regular syringe into the median vein; was repeated several times after 10-20 minutes.	10-12 ounces.	After the third injection, raised the pulse after it had initially become weaker.	Brigham, Medico-Chirurgical Review, vol. IX. 1826. Froriep's Notizen, Bd XV. Dieffenbach, a. a. O. S. 216.
7. 1826. (?)	Uterine bleeding.	The woman was already cold and numb.	-	-	-	Doubleday, Lancet, vol. IX. p. 782. 4 March. 1826. Dieffenbach, S. 215.
8. 1826	The patient, a 32-year-old woman, had spent 3 weeks before her delivery in bed because of violent vomiting, and was so weak that she appeared unable to turn over in bed without assistance. Shoulder position. Turn.	Collapse. Coldness and complete insensibility despite consumption of brandy and egg yolk; Vomiting, laboured breathing, annoying tossing around.	2 hours after delivery injection of 13-18 drachms every 5 minutes with a simple syringe. After the first transfusion the restlessness subsided.	Almost 9 ʒ blood from the median vein of a man and his nephew of 14 years. The lips reddened, speech returned.	Recovery in 12 days.	Waller and Doubleday, Lancet 1826. 29 April. Carol. Waller, dissertation. in. med. De sanguinis in periculosa haemorrhagia uterina transfusione. Erlangae 1832, p. 24-27. Dieffenbach, p. 218.
9. 1826	Violent flow of blood 5 hours after abortion at the end of the third month; 10 hour heavy maternal bleeding.	-	Transfusion 10 hours after bleeding has stopped. Injection.	4 ounces	In a few minutes there was revival; recovery.	Ralph, Lanc. 1826. 29 May.
10. 1826	A delicate little woman was exhausted by a laborious delivery of a dead child and the removal of the afterbirth due to haemorrhage.	Half an hour after delivery, chill, barely perceptible pulse, cold extremities. Laudanum and stimulants to no avail.	Since the arm vein could not be found, they opened the external jugular vein and injected 3 ʒ blood 16 times in 20 minutes and finally the cannula was disturbed by a movement of the patient.	About 4 ʒ of husband's blood.	Death after ½ hour; in the section there was a small amount of air on the right half of the heart.	Jewell, Medico-chirurgical Review. 1826. London medical and physical Journal. 1826. Dieffenbach, S. 221.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
11. 1827 (?)	A woman giving birth for the 10th time experienced heavy bleeding before the afterbirth was expelled. With the introduction of the hand and removal of the afterbirth, the bleeding stopped.	The collapse was controlled by stimulants, but three seizures occurred, each of which resulted in a most alarming degree of collapse. Pulselessness; coldness of the extremities, weak rattling breathing, dilation and insensitivity of the pupils, trembling of the lips.	Transfusion 2¼ hours after birth. 3 injections of 10 to 10 minutes. The fourth injection failed.	5 ʒ in 3 injections of 13 drachms each.	Recovery after a violent reaction.	Barton Brown, London med. and physical Journal, 1827. Feb. Edinb. med. and surg. Journal, 1828. p. 451.
12. 1827 (?)	Uterine bleeding followed a premature delivery in the 6th month. Retention of the placenta due to stricture. Removal of the afterbirth.	Although the bleeding stopped, the patient remained in a state of extreme exhaustion.	Injection.	4 ounces.	Recovery	Douglas Fox, London medical and physical Journal, July 1827.
13. 1827	In a 30-year-old woman who had given birth for the 9th time and who had suffered from copious atonic bleeding abundant during all births, the afterbirth had to be removed by insertion of the hand because of severe maternal bleeding.	Because of extreme exhaustion, large doses of brandy were given. Despite this, the face resembled that of a dead woman. Marble coldness of the extremities, laboured respiration, insensitivity of the eyes to light, inability to swallow, pulselessness	The first transfusion of 15 ʒ made the pulse palpable. It was repeated after 5-10 minutes. The sick woman came to. During the operation, 2-3 teaspoons of cognac were instilled.	8 ounces	Slow recovery from headache and hysteria. Coincidences	Carol. Waller, dissertation. in. med. De sanguinis in pericul. haemorrh. uterine transfusions. Erlangae 1832. p. 27-29.
14. 1828 (?)	Abortion with profuse bleeding.	-	A vein was opened in each arm and injected.	15 ʒ from a healthy, strong man.	Noticeable improvement in just a few minutes; recovery.	Clement, Lanc. 2 Feb. 1828.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
15. 1828 (?)	Maternal blood flow early in labour when the membrane had ruptured, return of contractions 3 hours later and continued moderate bleeding.	Extreme weakness, pulse cannot be felt.	It was injected intermittently over 50 minutes.	15 ℥ blood from the strong healthy husband.	After the first 5 ounces, the pulse was felt; after 1 hour the contractions returned and expelled a dead child. Recovery.	Howel, Ravis and Doubleday. Lancet, 9 Feb. 1828.
16. 1828 17 Jan. Heilbronn	Maternal bleeding in the 3rd month of pregnancy in a 41-year-old multiparous woman lasted 18 hours and was only still after the transfusion.	Great exhaustion, barely perceptible pulse, coldness of the extremities, nausea, sobbing, weakness of the face, pale as death.	After injecting 2 ounces, the patient opened her eyes. The pulse became palpable, the marble cold quickly disappeared.	2 ounces of husband's blood.	Recovery.	Klett und Schrägle, Würtemberg. Correspondenzblatt 1834, No. 16. Archives générales vol. VI. 1834. Schmidt's Jahrb. III. S. 292.
17. 1826 17 Feb.	Maternal bleeding in a 30-year-old woman for 10 hours; only status after the transfusion.	Considerable collapse	Injection using a small tin syringe with one curved tube.	2½-3 ounces blood of the healthy husband.	Recovery.	Klett, Würtemb. med. Correspondenzblatt 1834, No. 16. Schmidt's Jahrb. 1834. Band III S. 292.
18. 1829 (?)	Maternal bleeding after expulsion of the afterbirth.	-	Repeated transfusion in 3 hours.	8 ounces.	Recovery.	Blundell, Davis, Pointer, Lambert. Lancet, 3 Jan. 1829; Soden's Tabelle in med. chir. Transactions. Vol. XXXV. p. 428.
19. 1929 (?)	Maternal bleeding in the 3rd month of pregnancy in a 36-year-old multipara.	Repeated deep and persistent fainting, freezing cold, pulselessness.	Injection with a usual 8 ℥ - syringe that was ⅔ full.	4 ounces.	Recovery	Goudin, Journal des Progres. 2nd Series. I. p. 236. 1830. Archives générales de Médec., vol. XXIV. 1830. Froriep's Notizen. Band 28, No. 612.
20. 1829 (?)	Severe blood loss during delivery due to plac. previa through the accouchem. force. Bleeding stopped.	Collapse, extreme pallor, very frequent, barely perceptible pulse.	Transfusion with Read's syringe.	4 ounces of husband's blood.	Quick success, gradual recovery.	Bird, Midland med. a. Surg. Repository, February 1830. Froriep's Notizen. 27th Vol., No. 592, p. 320.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
21. 1830 (?)	Uterine bleeding in the third month of pregnancy.	-	Transfusion.	-	Recovery.	Journal Universel. 1830. American Journ. of med. Sciences. 1830. (Soden's Tabelle).
22. 1830 20 Sept.	Repeated heavy uterine bleeding after an easy birth due to relaxation of the uterus.	Sign of the greatest bloodlessness.	Transfusion using a metal syringe.	2-2½ ounces blood from a healthy, strong woman.	Temporary dizziness and anxiety were eliminated with cold compresses. Recovery in 17 days.	H. Fz. Kilian, see Math. Vit. Schiltz, Diss. in. De transfusione sanguinis. Bonnae 1852, p. 18.
23. 1830 (?)	A very delicate little tertiary woman, who had already suffered a haemorrhage in a previous birth, suffered from heavy flow of blood before the membranes ruptured and after the expulsion of the placenta.	Despite all kinds of stimulants, she was in the greatest danger 4 hours after the birth; she tossed around in fear for an hour, bathed in sweat, with rattling breathing, very frequent, and hardly able to feel anything. Pulse. Laudanum brought calm, but the insensibility continued.	Injection into the vena mediana dextra 6 hours after delivery.	4 ounces of venous blood from the husband.	Within 5 minutes the pulse in the left arm increased and after 20 minutes consciousness returned. Recovery.	John T. Ingleby, a pract. treatise on uterine haemorrhage in connection with pregnancy and parturition. Lond. 1832. p. 262 - 66.
24. 1831 2 Jan.	A 29-year-old woman suffered heavy maternal bleeding 24 hours after a birth disturbed by cramps, which repeated 4 times.	Great weakness and signs of complete anaemia.	Transfusion using a metal syringe.	2 ounces of her husband's blood.	Recovery within 2 weeks.	H. Fz. Kilian, M. V.Schiltz, Diss. in. De transfusione sanguinis, Bonnae 1852. p. 18.
25. 1831 13 Mar.	A 34-year-old woman, whose afterbirth had been separated due to bleeding, suffered severe bleeding due to relaxation of the uterus.	Increasing exhaustion.	Transfusion using a glass syringe.	3 ounces of blood from her sister.	On the following days improvement, on the 11th day recovery.	H. Fz. Kilian, M. V.Schiltz, Diss. in. De transfusione sanguinis, Bonnae 1852. p. 19.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
26. 1832 (?)	A 37-year-old woman had lost a lot of blood for 3 weeks due to placenta previa. Birth by turning.	Paleness, exhaustion, cold; pulse can hardly be felt.	Transfusion.	10 ounces of blood from husband.	Death an hour later.	Crosse, Cases in midwifery. s. Soden's Tabelle.
27. 1833 Liverpool	Twelve-day bleeding after abortion.	-	Transfusion with Blundell's apparatus.	-	After five syringes had been fully injected, chest tightness occurred; When, after a pause, two more syringes were injected, anxiety began again.	Banner, Archives générales. vol. III. 1833. s. Soden's Tabelle.
28. 1833	Maternal blood flow in a woman who has recently given birth.	Sign of inanition,	-	-	Recovery.	Höring (in Neuenstadt), Würtemb. med. Correspondenzblatt. 1834. No. 16. Schmidt's Jahrb. III. Bd. S. 293.
29. 1833 (?)	Severe intrauterine bleeding in the 8th month of the 4th pregnancy of a 30-year-old woman. Confinement.	Death already seemed near.	Injection 2 hours after the bleeding into the right median vein using a Read syringe.	10 ounces from the patient's sister-in-law.	Within 2 minutes the person being operated on opened her eyes again and showed signs of life. Recovery.	Bickersteth, Liverpool med. Journ. 1834. No. 1. Med. Gaz. vol. XIV. Schmidt's Jahrbücher IV. S. 276.
30. 1834 (?)	Placenta previa. Turn.	Great exhaustion due to bleeding, which returned the following morning after exertion.	Injection twice within an hour.	14 ounces.	Rapid improvement, but temporary; she died an hour after the last transfusion.	Lever, Tweedie, Ashwell, Guy's hospital reports. vol. II. p. 256. s. Soden's Tabelle.
31. 1834 (?)	Twenty hours of painful labour for the 13th child. Heavy internal and external maternal bleeding in the postpartum period; resolution of a retained placental residue.	The greatest weakness, coldness of extremities, pulselessness, vomiting, and restlessness lasted 16 hours, despite copious amounts of stimulants given (more than a pint of port and ⅔ of a bottle of brandy).	Transfusion with Read's apparatus.	10 ounces. Women's blood.	Death occurred a few minutes later.	Collins, a practical treatise on Midwifery. London 1835. p. 127.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
32. 1834 27 Jul.	A multiparous woman, who had suffered bleeding at every birth, noticeably deteriorated with heavy bleeding the day after the birth; the bleeding repeated after two days.	Great weakness, ringing in the ears, facial illusions, slight seizures.	Repeated transfusion.	4-6 ounces blood from a 34-year-old sister.	Slow recovery.	H. Fz. Kilian, S. Math. Vit. Schiltz, Diss. in. De transfusione sanguinis. Bonnae 1852. p. 18.
33. 1835 (?)	A weak, 40-year-old woman with a goitre suffered a maternal haemorrhage with retention of the afterbirth.	Six-hour collapse.	Injection.	4 ounces blood from the healthy, strong husband.	Rapid improvement, complete establishment in an hour.	Healey and Fraser, Lancet. March 1835. s. Soden's Tabelle.
34. 1838	Maternal blood flow returned in bursts for 14 days after birth.	Signs of bloodlessness.	Injection into the basilic vein of the left arm.	2½ ounces of blood from a healthy man.	Came to her senses again, the pulse became stronger.	Berg (in Ingelfingen), Würtemb. med. Correspondenzblatt VIII. 1838. No.1. Schmidt's Jahrb. Bd. XXX. S. 140.
35. 1840 (?)	A 42-year-old seventh parturient suffered severe uterine bleeding.	Complete coma, no pulse was felt in the carotids for 2½ hours.	Injection 12 hours after delivery in portions as the first 12 ounces was unsuccessful.	22 ʒ blood from 3 different people.	Recovery.	Richard Olivier, Edinb. med. and surg. Journal, No. 145. p. 40. Oct. 1840. Hufeland's Journal, St. 5. 1840. S. 122.
36. 1840 (?)	A woman who was pregnant for the 5th time suffered from initially light bleeding and later heavier bleeding since the 2nd month. The expulsion of the egg was promoted in the 5th month by Secale cornutum. The bleeding had continued alarmingly for 4 hours.	Great weakness, barely perceptible pulse.	Transfusion with Blundell's apparatus; after 8 ounces some improvement.	24½ ounces of blood from 4 strong men.	Improvement, finally a violent pulsation of the carotids occurred, but this soon subsided. The behaviour. However, placental residue was not expelled until the 5th day. New bleeding. Death while delirious.	Georg May, Lancet. 5 Sept. 1840. Hufeland's Journal, 1840. St. 5. No. 123.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
37. 1845 (?)	A 37 year old epileptic. Sudden, life-threatening weakness during birth, immediate delivery through craniotomy.	Very frightening weakness.	Injection.	4 ounces.	Immediate improvement and recovery.	Brown, Northern Journal of Medicine, Dec. 1845. Breithwaites Retrospect. 1846. s. Soden's Tabelle.
38. 1848 (?)	Blood flow in the 8th month of pregnancy, there was an accumulation of blood clots in the vagina. Placenta previa.	Great exhaustion.	Injection of 5 ʒ brought improvement. After 2½ hours new aggravation, tossing and turning, 4 ounces of the same blood brought no improvement. Then injection of 9 ounces in portions.	22 ʒ blood from a woman, then from a husband, to whom a glassful of grog had been given.	Recovery and after a few hours of sleep, labour pains and happy delivery.	Greaves and Waller, Medic. Times, January 1848. s. Soden's Tabelle.
39. 1849 7 Jan	A second-time mother had a precipitated birth, which was followed by inversion of the uterus, with haemorrhage and fainting. The reduction was carried out immediately after detachment of the adherent placenta by the attending physician Ormond. No more bleeding.	Insensibility, cold, pulse cannot be felt, short, intermittent respirations with rales, despite the use of stimulants for half an hour. After another half hour the patient could no longer swallow and her respirations became less frequent and rattling.	Injection with a 7 ounce nickel silver syringe after the cephalic vein was exposed through a 2" long incision.	1 ounce of husband's blood.	The success was very rapid; initially a violent seizure, restlessness, cardiac activity slowly returned, but one could only feel the pulse after an hour. Consciousness only appeared the following morning. A slight inflammation followed at the injection site. Recovery.	J. Soden, Ormond, Norman. Medico-chirurg. transactions. vol. XXXV. 1852. p. 422. u. ff.
40. 1850 13 Dec	A 20-year-old primiparous woman suffered a 7-hour pregnancy due to placenta previa. profuse bleeding. Delivery by turning onto the feet.	The anaemia increases after delivery despite various stimulants.	Injection into the exposed median vein with an ordinary hydrocele syringe using 2 loops of thread.	9½ ounces blood from an intern (M. Dufour) on 2 occasions.	Successful, until the appearance of a metroperite. puerper. on the 7th day, to which the woman succumbed. The arm vein was not inflamed.	Nélaton, Archiv. générales vol. XXV. 1851. Gazette des hôpitaux 1850, S. 150. Prager Vierteljahrsschrift 1851. Annal. S. 16. Schmidt's Jahrb. 70. S. 103.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
41. 1851	A delicate 38-year-old woman had an abortion with heavy bleeding in the 4th month, after the fetus had already died 2 months before.	Two hours of insensibility.	After a transfusion of 3 ounces consciousnesses appeared but temporarily and also after another 3 ounces were injected ½ hour later. After the third injection, recovery 1 hour later.	9 ounces blood from a strong maid.	Recovery from inflammation of the vein below the elbow.	Masfen, Lanc. 19 Apr. 1851. (Bellarsier Malfin?) Bulletin générale de therapeutique. 15 May 1851), s. Soden's Tabelle.
42. 1851 Doméne (Isére)	After giving birth through the turn, profuse bleeding.	-	Injection with a children's syringe, which held about 70 grams and was inserted twice. No assistance.	About 3 ounces (90 grams).	Recovery.	Marmonier, Revue médicale March 1851. Gazette médicale de Paris. 1851, 5 July. Gaz. des hôpitaux. 1881. 15. Schmidt's Jahrb. 70. S. 102.
43. 1851 26 Oct. Lyon	A 27-year-old worker had suffered a premature birth with severe bleeding 27 days ago and came to the Hôtel-Dieu in Lyon on 25 October, bloodless.	Fatal weakness, conscious but unable to speak. Lips and oral mucosa very pale; general cold, pulse small, 130. Vomiting when drank greedily	Transfusion into the right median vein, which was elevated with a ligature. Some air bubbles are said to have been injected.	180 grams. Blood of an Intern (Lardet).	Pulse immediately rose to 138 and the bruise disappeared. Genes. after temporarily. On the excitement and phlegmasia alba dolens of the right thigh on the 17th day. Recovery.	Devay and Desgranges, Gaz. médicale de Paris. 1851. p. 5 ff.
44. 1852 (?)	a. Maternal blood at plac. prev.	-	Transfusion.	-	Happy success.	Schneemann, in Hannover. Schmidt's Jahrb. 80. Bd. S. 288. 1853.
45. 1852 (?)	b. Maternal blood at plac. prev.	-	Transfusion.	-	Happy success.	Schneemann, in Hannover. Schmidt's Jahrb. 80. Bd. S. 288. 1853.
46. 1852 (?)	c. Maternal blood at plac. prev.	-	Transfusion.	-	Unlucky ending.	Schneemann, in Hannover. Schmidt's Jahrb. 80. Bd. S. 288. 1853.
47. 1852 (?)	d. Maternal blood at plac. prev.	-	Transfusion.	-	Unlucky ending.	Schneemann, in Hannover. Schmidt's Jahrb. 80. Bd. S. 288. 1853.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
48. 1852 13 Dec. Minchin-hampton.	A 39-year-old woman who gave birth for the 9th time; due to transverse positioning of the child by twisting suffered severe blood loss and the afterbirth was retained due to adhesion.	Pulse no longer palpable; patient believed she was going to die; great fear, oppression, pressure on the chest, constant fainting, pale lips.	Transfusion in the left arm after the syringe could not be inserted into the cut vein in the right arm.	3 ounces of husband's blood.	After a few hours the pulse became palpable; the following morning consciousness returned. Carbuncle on the posterior surface of the left arm, which had already shown hardening 14 days before birth. Death on the 10th day.	W. Turner and Wells, Lancet, 26 Feb. 1853. Schmidt's Jahrb. 80. Bd. S. 55.
49. 1856 (?)	Sudden heavy maternal bleeding after birth with expulsion of the afterbirth.	Complete exhaustion.	Transfusion with a special Instrument.	10-12 ounces of blood from the sister of the sufferer.	Immediate surprising improvement, without any unpleasant symptoms.	H. Higginson, Liverpool med. chir. Journal 1857. Jan. Archives générales. Sept. 1857. p. 346.
50. 1856 (?)	Maternal bleeding due to premature separation of the placenta, before expulsion of the fruit. The fetal head was in the cervix.	Sudden exhaustion. The skin had a bluish, livid colour, like those of cholera sufferers.	Transfusion.	6-8 ounces from a maid.	During the transfusion, the cannula came out of the vein as a result of the patient's movement, the blood turned and the operation ended with death after ½ hour.	H. Higginson, Liverpool med. chir. Journal 1857. Jan. Archives générales. Sept. 1857. p. 346.
51. 1856 (?)	Maternal bleeding as a result of adhesion of the placenta.	-	Transfusion.	12 ounces.	The person operated on died 7 days later. The uterus was filled with pus, but not the veins.	H. Higginson, Liverpool med. chir. Journal 1857. Jan. Archives générales. Sept. 1857. p. 346.
52. 1856 (?)	Maternal bleeding as a result of partial separation of the placenta.	-	Transfusion, followed by injection v. warm salt water.	5-6 ounces of thick black blood.	The birth then proceeded quickly, but the woman died before it was completed.	H. Higginson, Liverpool med. chir. Journal 1857. Jan. Archives générales. Sept. 1857. p. 347.

Number and Time	Previous condition	Symptoms, under which the operation is made	Type of transfusion	Amount of injected blood	Result	Citation
53. 1856 (?)	The placenta was separated by external force, removal of the afterbirth.	Violent bleeding.	Transfusion.	-	Improvement, but then the bleeding returns and death.	H. Higginson, Liverpool med. chir. Journal 1857. Jan. Archives générales. Sept. 1857. p. 347.
54. 1856 (?)	Maternal bleeding after birth.	-	Transfusion.	-	The patient recovered and enjoyed herself.	Simpson, Memoirs and observations I. p. 812.
55. Oct. 1857 Cennock (Stafford-shire)	Maternal bleeding after birth.	Unconsciousness after saying goodbye to her surroundings. (The woman was literally drained of all her blood.)	Transfusion.	17 ounces of the blood from the strong man.	Speedy recovery.	D. Wheatkroft, Union méd 1858, No. 1. 5 Feb. Gazette med. de Paris 1857. 26 Dec.
56. 1857 22 Oct.	Repeated heavy maternal bleeding in a 32-year-old woman during a muthmaassl.* Abortion in the 3rd month.	Repeated tamponade.	Transfusion.	2 pounds of husband's blood.	Recovery.	D. Wheatkroft, Lanc. 1857 Union méd. 1858. 5 Jan. 25 Mar.
57. 1857 23 Feb. Jena	Uterine bleeding as a result of placenta previa in a 20-year-old primiparous woman.	General extreme pallor, coldness of the extremities; pulse can hardly be felt. A long-standing gastric catarrh prevents restoration by internal means.	Transfusion into the left median vein.	4-5 ounces of blood from the left median vein of a strong young man (Dr. Paul).	Recovery.	Eduard Martin, S. 11. s. oben.

* This word does not translate - PL

IV
On the effect of transfusion.

There have been many disputes about the manner in which the transfer of blood from one animal to another, from one human being to another, works. Apart from some mystical explanations of the mode of action that have been put forward in ancient and modern times, the question that remains to be discussed is whether the transferred blood acts as a replacement for the lost blood, or as a stimulus for the vascular walls and especially for the heart, so that its activity, which threatened to cease as a result of blood loss, is stimulated anew by the injected blood, so that the heart continues its action until the lost content is replenished elsewhere.

The latter opinion however, is supported by the numerous cases of transfusions in anaemic patients, in which very small quantities, e.g. one to two ounces, of blood were transferred, and yet a favourable result still occurred. In other cases, improvement of the condition, return of consciousness, etc. were seen to occur after the first injection of a few drachms (e.g. thirteen). The following table shows the quantities of blood transfused in women who have recently given birth, as far as they are stated, and their success:

Amount of blood injected	Authors	Outcome	
		Favourable	Unfavourable
1 ounce	Soden	1	-
2 ounces	Waller, Klett, Kilian	3	-
2-2½ ounces	Kilian	1	-
2½-3 ounces	Berg, Klett	2	-
3 ounces	Marmonier, Turner, Kilian	3	-
3-4 ounces	Blundell	1	-
4 ounces	Jewell	-	1
	Goundin, Ralph, Ingleby, Brown, Healay, Douglas-Fox, Bird	7	-
4-5 ounces	Kilian, Ed. Martin	2	-
5 ounces	Barton-Brown	1	-
5-6 ounces *	Higginson	-	1
6 ounces	Devay and Desgranges	1	-
6-8 ounces	Higginson	-	1
8 ounces	Waller, Blundell	2	-
Nearly 9 oz.	Waller-Doubleday	1	-
9 ounces	Masfen	1	-
9½ ounces	Nelaton	1	-
10 ounces	Collins	-	1
10-12 ounces	Bickersteth, Brigham, Higginson	3	-
	Crosse	-	1
12 ounces	Blundell and Uwins, Higginson	2	-
14 ounces	Blundell, Doubleday	1	-
15 ounces	Clement	1	-
16 ounces	Blundell	-	1
17 ounces	Wheatkroft	1	-
22 ounces	Greaves	1	-
24 ounces	Wheatkroft	1	-
24½ ounces	May	1	-
		38	6

* Followed by salt water

In 18, or nearly half, of the successful cases in which the quantity transferred is known to me, no more than 4 ounces of blood were found.

In the same way, in the numerous transfusion experiments on animals, it was not uncommon for a small amount of blood to be sufficient to revive the declining life. The completely exhausted, dead-lying animals quickly became alert and lively after a small quantity of blood was injected into their vascular system, so that Blundell, one of the most experienced experimenters in this regard, candidly explains:

“It must be confessed, that it is not necessary in cases of haemorrhage to throw into the vessels as much blood, as they have lost; a very small supply, although it will not restore the energies of the animal, will preserve its life."

The sequence of symptoms following the operation also supports this stimulating effect of the transfusion. The majority of those operated on, if they were not unconscious, stated that they felt a pleasant warmth spreading from the injection site (usually the median vein on one arm or the other) to the heart; in some cases this feeling of warmth permeated the entire body. At the same time, the fading consciousness usually reappeared; the patients seemed to be waking up from their sleep; the dead eyes became more expressive, the pulse became palpable again when it had disappeared; when it appeared weak and thread-like, it became fuller and stronger, and the bruit de diable, which had been noticed in individual cases in anaemic patients, disappeared.

Finally, the stimulating power of the injected blood on the vascular and cardiac action is also demonstrated by Blundell's observation (21), according to which the transfusion of fresh blood into the vein of a dog that had bled to death from a cut femoral artery caused such cardiac and vascular action that the plug, that had meanwhile formed, was thrown out of the artery. Of course, it must be noted that in experiments on animals, arterial blood was usually injected into the veins, and this possibly caused a more violent excitation of cardiac and vascular action than venous blood, although Blundell claims after his experiments that “arterial blood no longer appears to invigorate more than venous blood."

On the other hand, the successful attempts of Blundell and others to preserve animals for days, and once even for three weeks, by transfusion to the exclusion of other food prove beyond doubt that the stimulus exerted by the blood injected into the veins is not the only mode of action of the transfusion, but that also a real restitution of lost mass can take place.

If one considers that the medium and small calibre arteries contract when there is significant blood loss, while the peripheral veins are compressed by the air pressure, then there is no doubt that even small amounts of blood brought into the circulation can not only have a stimulating effect, but also a have a relatively filling and nourishing effect. Accordingly, a strict separation of the stimulating and restorative effects of the transfusion is not appropriate, but rather it is appropriate to recognize both types of effects. In any case, the fact that many anaemic patients have recovered from apparently very small amounts of transfused blood has been wrongly used by some to cast doubt on the effectiveness of transfusion in general.

The effect of injecting blood into muscles, as determined by experiments by Brown-Sequard (22) and others, as a result of which the latter's already lost ability to contract, is restored, is particularly important in explaining the healing effect of transfusion, especially in newly delivered patients because the regular contraction of the uterus is a cardinal point not only for stopping the bleeding from the uterus (23), but also for the happy course of the postpartum period. Whether this ability to produce muscular activity is tied to the oxygen in the blood, while carbonic acid stimulates the tissues to action, as Brown-Sequard claims (24), remains to be determined by further investigations. For the time being, I would like to remind you that Nysten's injections of oxygen gas did not have harmful consequences, but they did not preserve life either (25).

A question that arises when considering the mode of action of transfusion is: which component of the blood primarily has the inherent stimulating power. It was probably decided by the experiments carried out by Dumas and Prevost (26) and repeated by Dieffenbach and Bischoff (27), in which it was seen that water or serum heated to 30° was injected into the veins of an animal drained of blood to the point of fainting, but did not revive

them; if, on the other hand, blood of the same kind was injected, the animal was noticeably revived and finally restored by each push. The same effect also occurred when the fibrous substance was removed by beating and the mixture of blood cells and serum that no longer clotted was injected (28). The few healing experiments with defibrinated blood that I know of that have been carried out on humans are not yet numerous enough to allow a firm conclusion. Monneret's unfortunate result in a 28-year-old woman who had suffered from frequent and violent bleeding since childhood and was in the highest degree of anaemia after repeated violent blood losses when her 120 grams of defibrinated blood, warmed to 38°C, were injected into the cephalic vein, cannot alone be decided by itself, since the pulse indeed increased, but after a few hours of intense excitement and burning thirst the extremities became cold again and death occurred with increasing exhaustion, whereupon the autopsy revealed numerous petechiae on the internal organs in addition to the lack of blood (29). Also the observation of Fenger (30), who injected a 22-year-old sick woman suffering from scorbutic haemorrhages, especially metrorrhagia and colic pain, with seven times 10 ounces of blood defibrinated by beating, and yet only achieved a very temporary improvement, in that vomiting soon resumed and after new genital bleeding, death occurred 48 hours later, gives no information as to the mode of action of the defibrinated blood. Nor did Giovanni Polli's transfusions on a 16-year-old stupid girl, who suffered from epileptic seizures, and to whom he gave defibrinated, un-warmed blood from both a 41-year-old woman and 4 ounces of his own blood, just drained, cooled to 12°C injected without any harm; and an 18-year-old girl who had survived 300 bloodlettings and was suffering from chlorosis; she is said to have recovered after a transfusion of 7 grams of blood, which had been taken from a doctor and defibrinated (31). It is worth noting that Polli stated that dogs and horses that had bled to death through arterial wounds could be saved by injecting their defibrinated blood into a vein; likewise by injecting blood from another animal of the same species, which had been drained 24 hours previously and defibrinated by beating and strained and stored in a metal cylinder at 9°C, then reheated to 40°C, although I do not have the original available, I must leave the value of this information to itself.

The statement by H. Nasse (32) that defibrinated blood is tolerated better by another species of animal than blood that has not been beaten is probably based on Bischoff's experiments, which seem to speak in favour of this, although I cannot at the moment consider the matter to be completely settled. According to Nasse, the transfusion of blood-water from dog to dog is said to be very dangerous; it is said to be followed by disturbance of cerebral activity and irritation of the intestinal mucosa. This should only apply to those cases in which transfusions of blood-water have been undertaken without withdrawing blood, and in this case do not testify to the harmful effect of blood-water as such, since it is known that injections of too large quantities of blood produce similar consequences.

On the other hand, the great importance of blood cells in transfusion is demonstrated by the experiments carried out by Dumas and Prevost, Dieffenbach and others with blood, the globules of which have the same shape but are either larger or smaller. Such transfusions, in which it is said to have made no difference whether fresh blood or blood that had stood for 24 hours (?), and whether it had been freed of fibrous material by beating or kept liquid by caustic soda (?), was injected, produced only incomplete results; despite this, death followed before the sixth day, after the pulse had always increased, the breathing had been normal, but the temperature had steadily fallen (33).

Even if, according to the above, the blood corpuscles may be the actual restorers of the declining vital activity, we are still do not find ourselves in a position to deny the involvement of blood serum and in any case, based on the numerous favourable successes of transfusions of undivided blood in women who have recently given birth, which are listed in our table, the advice of Johannes Müller (34) that one should inject beaten blood at the appropriate temperature is not yet justified in the case of women who have bled to death. –

In individual cases, the anaemic women who had recently given birth, whose lives were saved by the transfusion, became ill in the following days with symptoms of puerperal inflammation and several of these died as a result of metritis, etc. When recounting these outcomes, the authors say that it was the transfusion did not cause these diseases, but only

awakened their dormant germs, then I accept the former without hesitation in those cases in which the arm wound was not the starting point of the inflammation, but not the other claim that the transfusion awakened the germs of puerperal inflammation, since I am convinced that the transfusion is connected with the disease only in so far as the puerperal inflammation could not have developed without the saving of the lives of the bleeding from the anaemia.

Since I will be talking about the effect of the different types of blood on reviving those who have bled to death when considering the execution of the transfusion, especially the choice of blood to be injected, I do not want to go into this in more detail here. The latest, interesting results of the experiments of Brown-Sequard and Claude-Bernard in this regard will also be acknowledged there.

V
On the dangers of transfusion.

The dangers associated with transfusion have been estimated by some authors to be so high that this operation has been completely discouraged even in recent times; they therefore undoubtedly require special consideration.

There can be no more talk here about the imaginary danger that evil characteristics are transferred from one person to another through the injected blood than about the question that was often raised in earlier times as to whether diseases could not be communicated to the individual concerned with the injected blood, since the seat of diseases in the blood is still a very dark field that awaits elucidation through pathological chemistry, and every conscientious doctor who undertakes the transfusion will carefully select the person from whom he borrows the blood for the transfusion.

The numerous physiological experiments of the older and newer doctors (King, Prevost and Dumas, Bischoff, H. Nasse) on animals have, as already mentioned, only shown that injections of blood, which contains blood cells of a different form than the animal which is transfused into, can cause death (35). Even if the blood globules of one species are only larger or smaller than those of the one into which the blood is injected, death occurs, if not immediately, but after a few days, but always before the sixth day, although the animals had recovered from the anaemia (36). However, this very well-founded danger does not come into consideration here either, because only human blood will be chosen for transfusion into sick people, especially into women who have recently given birth and bled to death.

According to Brown-Sequard's experiments (37), there is no doubt that a greater content of carbonic acid in the injected blood is detrimental, even fatal. According to this author, if the animal is injected with arterial or venous blood containing more than usual carbonic acid, the animal will die, provided that the quantity of blood transfused is more than its body weight. This observation appears particularly important in conjunction with Claude-Bernard's observation (38) that the venous blood does not always return from the organs in the same quality, but is more black or red, depending on whether the secretion in them is taking place properly or not, and that the secretion of the organs is disturbed during painful operations and the like.

Accordingly, given the known great influence that emotional movements have on secretion, and in view of the results of the above table overview, one should not choose blood for transfusion from people who were themselves exposed to violent emotional movements before the withdrawal of blood, as will be discussed in more detail in the discussion of the execution of the operation.

The main dangers of transfusion to be discussed here consist partly in the possible penetration of air into the circulatory system of the person being operated on, partly in the formation of clots there, partly in causing phlebitis at the injection wound and in its spread.

1. The danger of air entering the vascular system, an event which, as a result of some unfortunate outcomes of surgical operations, even under the skilful hands of a Dupuytren, attracted the attention of doctors (39), has become the reason for many experiments on

animals carried out in both ancient and more modern times (40). These experiments, which consisted partly of injecting air somewhere into the vascular tube and partly of allowing it to enter by opening the veins in the neck, just like the more closely examined accidents in surgical operations, have shown:

1) That the entry of a not entirely insignificant amount of air through the veins into the heart could cause a more or less rapid death.

2) That death proceeds from the filling of the right half of the heart with air and from the interruption of the circulation that this entails, initially in the lungs. Since the atrioventricular valves do not close airtight, part of the air that has entered is always pushed back into the right atrium, even into the large veins, thus hindering the entry of blood into the right heart; on the other hand, the flow of blood in the pulmonary capillaries is made more difficult and even impossible as a result of the interruption of the blood column. So the patient who has had a large amount of air enter into the heart dies of cardiac death, not as if the atmospheric air directly paralyzes the action of the heart - which is already evidenced by the presence of the blood turned to foam in the right half of the heart - but rather because the heart cannot handle the air. - If the air enters the heart slowly and in batches, then individual air bubbles probably pass through the pulmonary capillaries into the left heart and into the arteries, even of the brain, although this is an exception and can only be seen in cases of slow death due to air entering the vascular system, but is by no means the rule, as Bichat said (41).

3) The spontaneous entry of air into the circulation is linked to the opening of veins in the neck and armpit region, in which the direct effect of inspiration is exerted (42); however, the possibility is not excluded that respiratory aspiration, favoured by special circumstances, such as dilatation of the veins or straining of the opened venous wall, can bring about spontaneous entry to a somewhat greater extent.

4) There is no spontaneous entry of air into the open veins in the extremities; not even because the stems are compressed by the pressure of atmospheric air when they are emptied (43).

5) The injection of small quantities of air into the vascular system is not dangerous, especially if it is done in stages and at such a distance from the heart that the air can mix intimately with the blood before it enters the heart (44).

If, after these results of numerous physiological experiments on animals, we ask the experience given in the table above with regard to transfusion in women who have recently given birth, it is evident that out of 57 transfusions only one death has occurred under suspicion of air entering the heart. This unfortunate operation by Jewell is related by Dieffenbach, op. cit., p. 221, in the following manner (45):

“The woman was of small stature and had given birth to a dead child with much difficulty; because of heavy bleeding, the afterbirth was quickly removed. After half an hour, cold set in as the bleeding still continued. The pulse was rapid and barely palpable, the extremities cold. The patient received 40 drops of laudanum with spiritus ammonii aromaticus. Upon examination through the vagina, Jewell discovered only insignificant coagula in the uterus, which he removed and bound the womb even more tightly. The patient was now given carbonate of ammonium. But since the hands and feet remained cold and the death sweat had already broken out, it was decided to try the transfusion. But, since the patient's arm vein was too small for the thickness of the syringe’s cannula, Jewell opened the jugular vein. The blood that the person was to receive was drained from her husband and collected in a vessel placed in warm water. The syringe used for the operation was small and only held 3 drachms. Sixteen syringes full of blood were injected within 20 minutes; but since some blood always remained in the instrument and other things flowed past, the patient probably only received 4 ounces of blood in total."

"During the operation the condition changed little, only occasionally some nausea set in, and towards the end the cannula was somewhat removed from its position by some restless movements of the patient. All apparitions pointed to an imminent death, which actually occurred after a quarter of an hour."

“The section was only permitted after 3 days. Particular attention was paid to whether some air had not been forced into the vein through the syringe, thereby causing the patient's

rapid death. The superior and inferior vena cava along with the pulmonary artery were therefore ligated and removed along with the heart. All these were placed in a vessel with water and covered with an inverted cup filled with water, the heart was punctured under water and about a drachm of air was seen to rise in it. The heart cavities contained only a small amount of coagulated blood. The uterus was empty. The conjugata measured 3½ inches; the other pelvic diameters were also very small. The promontorium formed a sharp, angular projection."

Since in the present case the transfusion was carried out through the opened jugular vein, this case - provided that death is everywhere explained by the entry of the air found in the heart (of which no symptom in life testifies) and not with difficulty by the considerable loss of blood of the woman who has recently given birth - can only prove the danger of air entering during the transfusion by means of the opened jugular vein. Since in the 56 remaining cases in which, as far as my investigations go, the blood transfer was made by injection into the cutaneous veins of the arm, a symptom of air entering the vascular system was not observed, it may well be asserted that the danger of air entering must be very small in this operation if the injection site just mentioned is chosen; be it that in this way the amount of air necessary to cause dangerous symptoms is not introduced into the circulation (46), or that it reaches the heart so gradually and therefore so intimately mixed with the blood that a significant disturbance of the circulatory system is not thereby produced. –

According to all that has been said, the danger of air entering the circulation in the case of transfusion into the median vein should not be considered any further.

2. A further danger of transfusion, rightly recommended for consideration by some physiologists (Magendie, Joh. Müller (47)) is the possibility that the fibrous substance in the blood may coagulate during the transfer, and thus the worrying consequences of thrombosis and embolism can occur. The experiments on animals, however, as far as I know, have not proved this danger true, for the statements of Bischoff, which may be referred to here, (48), that birds are killed by the injection of unbeaten mammalian blood, but not by beaten blood, are refuted by his own later experiments (49) and also by the experiments of Brown-Sequard, in which they showed that an excess of carbonic acid caused the poisonous effect.

In the present experience of transfusion in humans, too, there is a lack of any reliable evidence for the concern in question. For the phenomena of temporary dizziness and chest tightness in Kilian's first (50) and Banner's (51) cases are by no means to be related with certainty to the injection of blood clots, since they can also depend on many other factors (52). Only in Higginson's first unfortunate case (53) is it said: "During the transfusion the cannula came out of the vein in consequence of a movement of the patient, the blood coagulated, and the operation ended in death after half an hour." Here, however, we are not talking about the injection of coagulated blood; rather that the death most likely occurred because the injection could not be completed to its full effectiveness because of the coagulation of the blood. Even in the other unfortunate case of Higginson (54), in which the injected blood is said to have been so thick and black that warm salt water was immediately injected, it remains very doubtful how and why death occurred (moreover before the birth was completed) since an autopsy report is not available. In the other 10 unsuccessful or unfortunate outcomes of the transfusion listed in the table, the entry of blood clots into the circulation is not mentioned as a cause of death. It is much more obvious to accuse the preceding life-threatening loss of blood, the late rendering of assistance, and undoubtedly most often the subsequent other illnesses as the cause of death. - The ones in Devay's and Desgranges? In the case of phlegmasia alba dolens (55), which occurred on the seventeenth day after the operation, no one will want to attribute blood clotting caused by the injection, since such a thing is not at all too rare, especially after bleeding of women who have recently given birth, and in the present case only after such a long interval followed the transfusion..

The risk of blood clotting when transfusing unbeaten human blood does not appear to be as great as was feared. Blundell already noted (56) that healthy human blood does not clot as quickly as sheep, ox and dog blood, so this danger is lower when human blood is transfused

3. The risk of inflammation of the vein at the injection wound site, however, has been proven in a number of cases; in the majority of cases, however, this event was of no significant importance (as in Blundell and Uwins (57), Soden (58), Masfen (59). The patients recovered without worrying symptoms of general spread of inflammation. - In the observation of Turner (60), the death on the tenth day, which was caused by a carbuncle on the posterior surface of the left arm, cannot possibly be attributed to the transfusion, since induration at the relevant site had already existed 14 days before delivery. Since the original description (61) of this case does not mention a syllable of phlebitis, and no autopsy is reported, it is inexplicable how the reporter in Schmidt's yearbooks on this case can attribute the death to phlebitis. If, in this case, which was favourable for transfusion, cell tissue necrosis had occurred on the right arm, in which some blood was injected into the subcutaneous cell tissue instead of into the venous opening, this could rightly be blamed on the operation. But there is no question of this, and Turner moreover praises the success of the transfusion until the fifth day, when the carbuncle began to develop rapidly. - In any case, Blundell's remark that the risk of phlebitis is very low in comparison with the danger to life of the individuals in whom the transfusion is carried out seems very correct (62). Moreover, phlebitis is sometimes observed even after simple bloodletting of the median vein, especially at the time of such an epidemic, such as a widespread one, for example, in 1842 among women who had recently given birth and who had not given birth. However, with the timely application of lead water or ice compresses, such patients usually recover without any general illness.

Therefore, this risk of transfusion must also appear small in relation to its value in saving the lives of those who are bleeding to death.

As in Turner's case, the other fatal outcomes or more correctly deaths after a successful transfusion can also be shown in the table above, e.g. after early or later recurrent bleeding as a result of subdued placental remains (G. May (63), Higginson (64)), after metroperitonitis (Nelaton (65) on the seventh day), or due to endometritis (Higginson (66)), because the connection between these accidents and the transfusion has not been proven, and these outcomes are also observed frequently enough in women who have recently given birth, especially after considerable metrorrhagia.

Considering the foregoing, it is evident that, according to the experience available at present, the operation of transfusion cannot be described as a particularly dangerous one; on the contrary, if it is carried out properly, it must be recognized as being of little, if any, danger, since, apart from the reprehensible transfusion through the opened jugular vein (Table No. 10. Jewell), no death can be deduced from the transfusion as such.

VI
On the Indications for transfusion in newly delivered patients.

To determine in general the field of pathological conditions in which transfusion is likely to be salutary is beyond the limits of this treatise. For although there are individual examples in the literature which undoubtedly demonstrate the benefit of transferring healthy blood into the veins of sick people, especially in anaemic patients, yet, apart from the manifold preliminary studies necessary for this purpose, some of which are impossible in the present state of organic chemistry, an investigation of all the cases in which transfusion has been or is said to be useful would be necessary, distract me far from my goal. I confine myself to determining the circumstances under which transfusion promises healing in newly delivered patients (67).

This restriction appears to be necessary partly because there is currently only sufficient, practical material for assessing transfusion in sick people, and partly justified by the fact that those conditions that are most frequently encountered during and after birth are those which initially lead to urge transfusion. In no other state of life is the danger of bleeding to death so frequent and so often in the physiological conditions themselves, as in that of a person who has just given birth. Here, it is not only the inadequate contraction of the placental area of

the uterus, although this is the most common cause, but also, although less common, deeper tears in the cervix, especially after placenta previa, or bleeding in the vagina and the labia minors, which are partly caused by the sudden, very considerable depletion that occurs, partly due to the persistent trickling of blood, especially from the latter sources, which sometimes only occurs hours after birth has been completed, poses the most decisive danger to life (68). Sometimes it is probably the excessively stimulated cardiac action caused by joy or hot drinks, e.g. wine, coffee, etc., in other cases the accumulation of the blood in the abdominal veins, which also does not clot properly due to enlargement of the liver or spleen, which causes bleeding with regular contraction of the uterus.

Although the first task of the doctor is to combat these bleedings quickly and in an appropriate manner, depending on the various underlying conditions of the birth tract or the heart, etc., the second task also remains important enough, to replace the loss of blood as quickly as possible, especially if the anaemia persists to a threatening degree after successful haemostasis. In the vast majority of cases this is achieved through appropriate foods, egg drink, broth, milk, etc., especially when these are combined with an appropriate stimulation of the vital activities, which the latter is often achieved with advantage through wine, mulled wine, cinnamon tincture, etc. Under certain circumstances, these stimulating agents are combined with other medicines appropriate to the current conditions of the uterus, e.g. with opium tincture, combined healingly, while in other cases to ward off the evil consequences of anaemia, China tincture and the tinctura ferri chlorati aethereus have shown me excellent effects on many occasions.

However, the effect of these foods and stimulants is sometimes hindered, especially by the presence of gastric catarrh, which causes an immediate release of all medicines and nutrients, as in the case of transfusion that I have reported in detail, to which I could add others from my experience, even if not so urgent.

Under these circumstances, in which the other means of rescue are deserting us, a way seems very welcome to bring new vitality and stimulation into the body directly and immediately, bypassing the suffering digestive organs. This is where the transfusion is indicated and where it should never be missed if there is danger to life due to bleeding.

Therefore, where vomiting everything that has been eaten causes the hope of replacing the lost masses in the usual way through the stomach and of revitalizing the weakening activities to disappear, one should not wait until the very end, until the respiration itself stops, not until the irregular respiration occurs, but undertake the transfusion as soon as the signs of anaemia manifest themselves in certain symptoms, which are of course modified in many ways by the individual circumstances, as a result of considerable blood loss. Transfusion is then indicated if there is a risk of uterine bleeding with developed gastric catarrh.

Quite analogous to the above-mentioned obstacle to restoration by internal means is the inability to swallow in women who have recently given birth, as mentioned in several of the cases collected in the table above. Here, too, the transfusion appears to be indicated as soon as anaemia occurs, although it is probably self-evident that not every fainting patient who is bleeding gives the indication, but only those cases of extreme weakness which make the intake of food seem impossible.

Whether the bleeding occurs after a preterm or premature birth, according to the available experience, is of no influence on the indication for surgery, since in both cases happy successes are listed in sufficient numbers.

With regard to the time at which the transfusion should be carried out, once the indication has been established, an urgent warning should be given that it is “too late”. However, the table above still gives happy results where there is already deathly pallor, general coldness, and lack of pulse, repeated fainting, loss of consciousness and insensibility, inability to speak, sighing, annoying tossing around, convulsions had occurred, but the more vital activities have already been suspended or disturbed, the more doubtful the rescue must appear.

If signs of high-grade anaemia have occurred, general paleness of the skin, coldness of the extremities, small barely distinguishable pulse, fainting changes due to the re-eruption of the corresponding nutrients and medicines, and the impossibility of restoration by means of

the mouth and stomach arises, I consider the time to have come for a transfusion and advise to stop delaying this almost safe operation any longer.

The question that should finally be discussed here is whether the transfusion should also be carried out in the case of the symptoms mentioned even if the bleeding has not yet stopped. In general, haemostasis will be allowed to precede the transfusion and the doctor's next concern will have to be directed towards this, so that, depending on the various causal conditions of the semi- or new-born, the contraction of the uterus will soon be necessary by internal or external means, even after previous loosening and removal of the uterus restrained afterbirth, sometimes the coagulation of the blood in the lacerations of the cervix or the vaginal opening is promoted by injection of styptic drugs or the tampon, etc., sometimes the excited heart action is moderated by the internal use of ipecacuanha or opium acids. But since the transfusion does not prevent the use of the above-mentioned means of haemostasis, but rather must promote the desirable activity of the uterus through the beneficial effect of a properly prepared blood on the contraction of the muscle fibres, there seems to be no reason not to use the transfusion during a period of threatening bleeding, provided that nothing is missed that can contribute to stopping the bleeding itself. This has also been done successfully in numerous cases, as the above table shows.

If, according to Soden's testimony (69), transfusion is least effective in those anaemias gradually brought about by multiple or persistent minor bleeding, as sometimes occurs in placenta previa or in overlooked tares, this in no way limits the indications for the operation, but only shows that its saving power has limits. In the cases mentioned, they are probably due to the acute hydropsies of the pleural sacs, the pericardium, and the oedema of the lungs themselves, which occur so frequently in chronic anaemias. Where such changes can be demonstrated, transfusion should understandably not promise very much.

VII
On the execution of the transfusion.

An operation which, like transfusion, has been so widely discussed and tested on animals, and which, moreover, with the possible exception perhaps of the quantity of blood to be injected, needs so little to be modified according to individual circumstances, should have long since established its technical aspects. However, this is not the case; perhaps because too much has been asked about it artificially, because only a few authors have carried it out more than once, and because the misgivings have been sought in other points than where they are to be found. The danger does not lie so much in the operation, as we have shown above, as in the condition of the person to be operated on, and in the haste required by it. The operation must therefore be reduced to the simplest possible techniques, easy to carry out, with instruments that are easy to obtain and handle.

As far as the instrument apparatus is concerned, we have for a long time been familiar with the silver tubes used in the first experiments (Rich. Lower) which were connected to one another by the prepared carotid of a horse, by means of which the blood can be transported from the veins of the healthy body into that of the sick body. The fact that venous blood clots easily in these tubes, made it necessary to take the blood from a cut artery, which made this procedure, apart from other inconveniences, unusable in practice, given the undeniably greater danger of arteriotomy than venesection.

Already Major (1667) recommended a syringe to transfer the blood, which Franziscus Follius (1650) wanted to replace with an animal bladder. All modern people have made use of a syringe, be it a simple ordinary one made of tin, or a specially designed one made of brass or silver, and only Blundell has, in addition to the syringe he used previously, one with an apparatus for collecting and carrying away the blood into which the patient is connected by a double-drilled tap (70), a recommended special device, his gravitator (71). It consists of a blood catcher, which collects the blood flowing out of the arm of a healthy person and directs it into an elastic tube that can be shut off by means of a tap and can be screwed to a table or chair using a movable support arm. From the elastic tube the blood flows into a

narrower, flexible tube made of pure silver at the lower end, which ends in a hollow tip and is fastened with a pair of clamps to the forearm of the person receiving the blood. With this apparatus, the blood is transferred by its own gravity according to hydraulic laws, not driven into the receiving vascular system by syringe pressure.

C.F. von Graefe recommended, in addition to a silver syringe, a special trocar, that he called a phlebotom, in order to open the exposed vein and inject the blood through the trocar tube (72).

Dieffenbach's infusion syringe made of tin, which holds 2 ounces, together with a somewhat knee-shaped infusion tube, the lower end of which is cut off at an angle and around the front quarter of which, which is to be connected to the vein by ligature threads inserted under it, with several ring grooves running around it, is depicted by R. Froriep alongside the instruments just described (73), just such a simple transfusion device from Lloyd in London (74). This consists of a collecting funnel for the blood, a tin-plated brass syringe, in which the handle of the plunger can be adjusted by a movable ring slide with an adjusting screw in such a way that the syringe should only hold ½-2 ounces. The end of the syringe fits snugly into the winged tube that is inserted into the opened vein.

Sotteau's modification of Blundell's first syringe apparatus, so that the blood is collected in a reservoir surrounded by warm water, and then runs under the syringe for transfusion (75), presents no less inconvenience than Blundell's syringe apparatus.

Bougard's apparatus, as Devay and Desgranges (76) report, is completely connected to the gravitator specified by Blundell, because the triangular collecting tube to avoid the rotation of the blood as it flows in, was also present in Blundell. Devay and Desgranges, however, reject this device, which I was unable to examine in detail myself.

To carry out the transfusion, I had the following apparatus (77) constructed in a small portable case about 8" long and 2" wide and used it with convenience and benefit. It consists of:

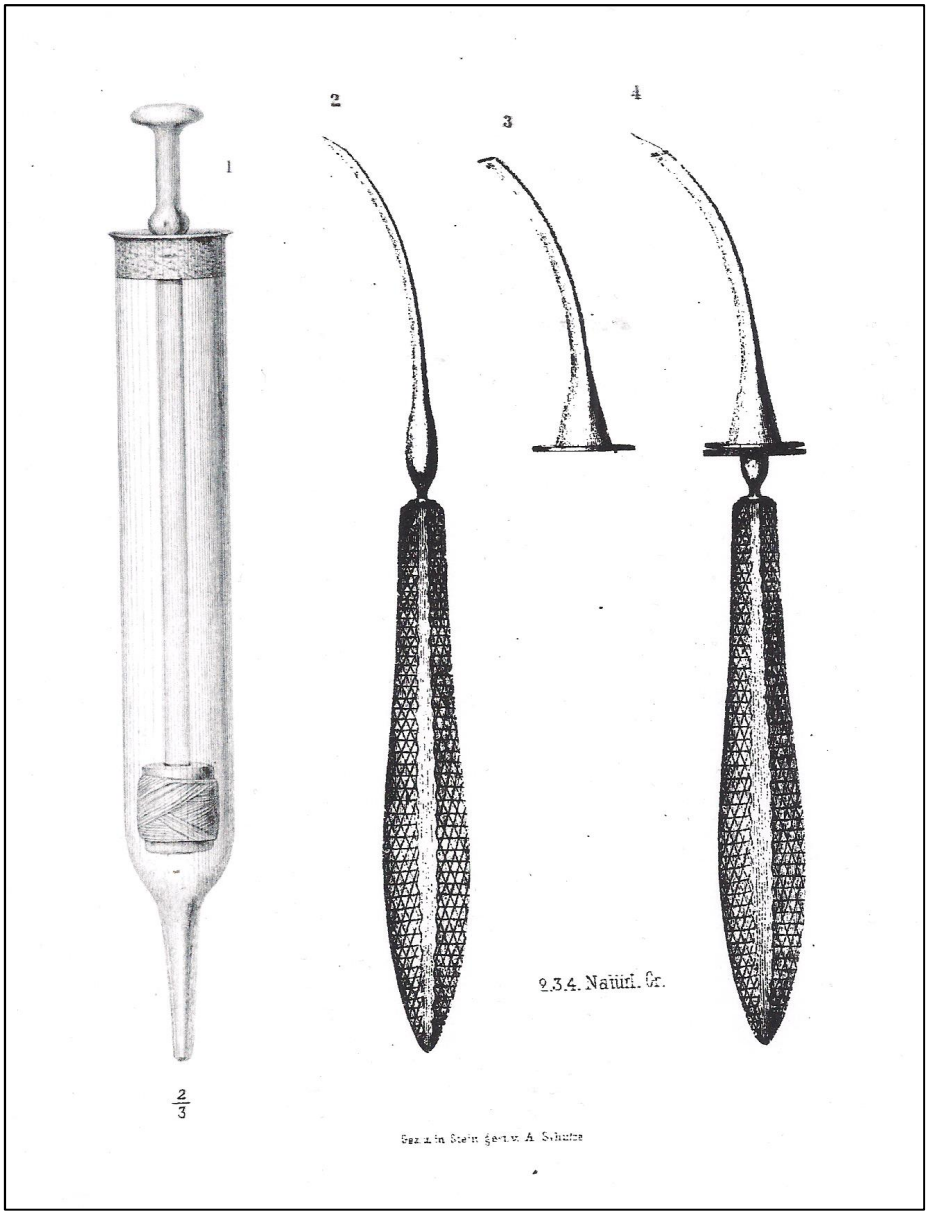
1) From a trocar with a smooth tip and a moderate curve, for opening the exposed vein and injecting the blood. It is 4½″ long, 1½″ wide from the tip, ¾” thick, casually curved to a radius of 2”. The square ground tip of the trocar protrudes 2" from the opening of the silver tube. The handle is 3" long. The silver tube has a funnel-shaped attachment at the top, which is wide enough to accommodate the tip of the syringe. This mouth is covered with a thin black rubber plate, partly to hold the syringe more firmly and partly to prevent the blood from regurgitating during the operation.

2) The syringe is made of glass, 7″ long, holds a generous 2 ounces and has a glass embolus wrapped with cotton thread. I prefer this glass syringe to all metal syringes because our operation is less dependent on a significant pressure force than on the amount of fluid to be injected and the fluid that has already been injected, as well as its properties, e.g. can constantly see whether it contains air bubbles. The glass syringes also have the preference; that it is easy to clean, and in this respect its condition can be constantly and easily controlled. The fact that the embolus must be wrapped with fresh cotton threads after use needs no mention.

With regard to the choice of blood to be injected, it follows from the available experience and experiments that the most expedient and safest choice is human blood for transfusion into newly delivered women. Arterial blood will be excluded because of the danger of arteriotomy, especially since venous blood has proven to be completely effective in numerous cases. Since in several of the cases compiled in our table the blood taken from strong men showed a more salutary effect (78) than that taken from women, one might feel compelled to choose blood from strong men wherever possible. Devay and Desgranges argue that, according to Becquerel and Rodier, a man's blood contains more blood globules; nay, they go so far as to recommend the blood of a grown man; because, according to Denis, the number of blood cells increases until the age of 40. - However, such small differences do not seem to matter, since the operation was beneficial in many cases in which blood from young men or women had been injected.

Based on the facts at hand, it seems more important that blood should be chosen for transfusion in newly delivered women from healthy, well-being people who are not

emotionally agitated, since mental and physical pain seems to have an influence on the transformation of the blood in the colatorium, and therefore also the blood returning from the skin is probably less purified and less invigorating in depressing emotional states (79).



Explanation of the illustrations:
1. Glass transfusion syringe
2. The trocar's stylet
3. The silver tube without a rubber plate
4. The trocar

In agreement with Devay and Desgranges, I must advise against the defibrination of the blood, partly because much time is lost on it, which is so precious under the given circumstances, and partly because the previously published transfusions of unbeaten blood have not shown any disadvantage. I would not like to place too much emphasis on the unfortunate outcome of Monneret's transfusion (80) with defibrinated blood on a sick woman, especially since there is no careful medical and autopsy report on this case. - In order to prevent the clotting of the blood, which is wrongly feared according to the above, one also has additives of natrum sulphuricum or carbonicum that are suggested, of which the former

achieves the purpose at 14 per thousand, the latter at 7 per thousand; nevertheless, at the present time, when there are no examples of harm caused from the coagulation of the transfused blood, I could not feel compelled to recommend such an addition. On the other hand, I advise that the blood flowing out of the open vein should be collected in a smooth porcelain dish, e.g. a cup, which stands in a larger vessel with water heated up to 30°R, and that the glass syringe should also be filled with equally warm water immediately before use. The fact that the blood to be injected must not stand in the bowl for a long time but must always be drawn fresh from the vein where possible hardly needs special mention.

As far as the amount of blood to be transferred is concerned, the observations made partly during transfusion experiments on animals and partly during transfusions on humans show that one should in any case start with small quantities, and that it seems more advisable to repeat small quantities, perhaps only two or three ounces at a time into the opened vein, rather than causing a sudden overfilling of the heart and thus danger to life. Already Denis and many others after him, saw the injection of too large an amount of blood is followed by difficulty breathing, fear, discomfort, and later blood urine (81). George May reports that after transferring 24 ounces of blood from 4 strong men, violent pulsations of the carotids occurred (82). Blundell, the most experienced author on transfusion, strongly warns against transfusing too much blood at once (83), calling this a point of utmost importance. During the operation, according to his advice, the patient's face should be observed and as soon as small twitches appear in it, the operation should be interrupted. As long as no change is noticed in the condition of the patient, the injection is repeated from time to time, approximately every 3-10 minutes, even if one is forced to borrow blood from several people, as has happened in quite a few cases with lucky success. Dieffenbach says: "The total amount of blood transferred probably did not exceed six ounces" (84).

Finally, one injects slowly; for rapid, violent injection brings death, as Brown-Sequard also believes, through sudden expansion of the right atrial appendage (85).

Finally, in order to make the transfusion procedure quite clear, I will describe it here in the way I consider it appropriate and have tried it out.

Once the necessity of the operation has been ascertained, one should first choose a strong, healthy, willing man, or, if this should be lacking, a strong, resolute, not frightened or depressed woman, from whom one wishes to draw the blood; at the same time, one or more competent assistants should be provided, whose assistance one cannot do without. Further, a washbasin with 30-32°R warm water, a few cups for collecting the blood, and fill the glass syringe with equally warm pure water. Then, at the same time, the median vein, or, if it should appear too small, the cephalic or basilic vein, is exposed by means of an incision in the skin 1 to 1½ inch long, and the flat trocar should be inserted into the vein, which can also be lifted up a little with two threads inserted under it, in the direction of the heart to a depth of $^1/_2$ inch, while at the same time an assistant carries out the bloodletting on the arm of the subject, from which the blood is to be drawn. As the blood flows into the cup, which has also been rinsed out with warm water, the syringe is emptied of the warm water it contains and the fresh blood is quickly sucked up from the cup, whereby one can easily check that the blood is liquid and not foamy through the glass. Without hesitation, the tip of the filled syringe is placed in the funnel-shaped, rubber-covered opening of the trocar tube standing in the vein and fixed there by a reliable assistant after removing the grain from it, and the plunger is slowly pushed downwards. After removing the syringe, clean it immediately with warm water, unless you consider it advisable to fill it again with the freshly flowing blood and repeat the injection immediately. By examining the pulse and heart, as well as by observing the facial features, you can be convinced of success. If this is not yet the desired one, repeat the entire procedure after making sure that there are no clots in the syringe or tube.

Since it is not always easy to find the collapsed median vein in a person who has bled to death, it may sometimes be necessary to look for it in the other arm as well, and it has occasionally happened without any disadvantage that the transfusion was first carried out in one arm and then in the other.

When the necessary quantity of blood has been transferred, the cannula of the trocar is removed from the vein and the wound is bandaged in the same way as after an ordinary

bloodletting. It goes without saying that the greatest attention should be paid to this small wound in the following days and at the first signs of inflammation, cold compresses of lead water or with snow, ice, etc., should be applied, but in general the person being operated on should be carefully observed.

REFERENCES

1. Paul Scheel, die Transfusion und Einspritzung der Arzneien in die Adern. 2 Bändchen. Copenhagen 1802 und 1803.
2. Math. Gottfried Purman, Chirurg. Lorbeerkranz. Halberstadt 1684. 4.
3. Acta Nat. Cur. An. 1. p. 325.
4. Paulus Manfredus, de nova et inaudita medico-chirurgica operatione sanguinem transfundente. Romae 1668. 4.
5. G. Abrah Merklin, de ortu et occasu transfusionis sanguinis, Norimb. 1674. Cap. VI, p. 83.
6. E. Hufeland, Diss. in. de usu Transfusionis sanguinis praecipue in asphyxia. Berol. 1815. 8.
7. Hoefft, Diss. de sanguinis transfusione. Berol. 1819.
8. Medico-chirurgical Transactions. Vol IX, part. I. 1818. p. 56-92.
9. Doubleday, Lancet 1825. 8 Octob. Vol. IX, p. 134.
10. J. Blundell, physiological and pathological Researches. 1824.
11. J. Blundell's Vorlesungen über Geburtshülfe von Thom. Castle, deutsch von Ludw. Calman, 2. Abthlg. Leipzig 1838, S. 6. 7.
12. Lancet. Vol. IX, p. 205. 1825. 19. Novemb.
13. Diss. inaug. de transfusione sanguinis, Beaol. 1824. 8.
14. Müller's Archiv, Bd. II. 1835. S. 360 und Bd. V. 1838. S. 352.
15. Die operative Chirurgie. I. Band. Leipzig 1845.
16. Diss. in. de transfusione sanguinis ejusque usu therapeutico. Adjunctae sunt 2 tabulae instrumentorum. Bonnae 1852. 8. 84 S.
17. Aus der Bibliotheque universelle bei Dieffenbach, die Transfusion des Blutes, Berlin 1828. S. 186.
18. Archives de méd Belges, Janv. 1844. Schmidt's Jahrb. IV. Supplementband, 1845. S. 25. 26.
19. L'Union med. 1850. p. 3. 5. Schmidt's Jahrb. 70. Bd. S. 105.
20. J. Soden, a case of haemorrhage from inversion of the uterus, in which the operation of transfusion was successfully performed. Med. chir. transactions. Vol. XXXV. London 1852. p. 422 ff.
21. J. Blundell, Med. chir. transact. Vol. IX. p. 56 ff. Exp. 2.
22. Journal de physiologie, 1858. No. 1. Archives générales de médecine, 1858. Mai, p. 354–359.
23. In Klett's ersten und zweiten Fall (s. Tabelle Nr. 16 u. 17) stand die Blutung erst nach der Transfusion. [In Klett's first and second cases (see Table Nos. 16 and 17) the bleeding only started after the transfusion]
24. Journal de physiologie, 1858.
25. Dieffenbach: Die Transfusion, S. 94 ff.
26. Aus der Bibliotheque universelle bei Dieffenbach, S. 186.
27. Müller's Archiv, 1835, S. 350-356.
28. J. Müller's Handbuch der Physiologie, 4. Aufl. 1844. S. 124.
29. Gazette méd. de Paris, 1851. p. 664.
30. Middelelser 1853, Bd. VI. Schmidt's Jahrbücher. 8. S 207.
31. Annal. univers. di med., Vol. 139, Mayo 1852. Schmidt's Jahrbücher 75. S. 88. 89.
32. Wagner's Handwörterbuch der Physiologie, I., S. 209.
33. Dieffenbach, die Transfusion, S. 186.
34. Handbuch der Physiologie, 4. Aufl. 1844. S. 124.
35. Dumas u. Prevost, Bibliotheque universelle. Einspritzungen von Blut mit Kreiskügelchen, z. B. Schaafblut in die Adern eines Vogels, bewirkten heftige, der stärksten Vergiftung ähnliche Nervenzufälle. Der Tod erfolgte immer plötzlich, ausser wenn man das Thier vorher durch Blutlassen in einen Schwächezustand versetzt hatte. [*Injections of blood with circular spheres, e.g. sheep's blood entering the veins of a bird, caused violent nervous attacks similar to severe poisoning. Death always occurred suddenly, unless the animal had previously been reduced to a state of weakness by bleeding*.] S. Dieffenbach S. 186. 187. H. Nasse in Rudolph Wagner's Handwörterbuch der Physiologie, I. 1842. S. 209.

36. Dumas und Prevost, bei Dieffenbach, a. a. O. S. 186. In vielen Versuchen, in welchen Rinder- oder Schaafblut Katzen und Kaninchen eingespritzt wurde, fand zwar Wiederbelebung statt, doch starben die Thiere bald darauf. Blundell sah, dass Transfusion von Menschenblut in Hunde dieselben zwar wieder belebte, allein bis auf zwei gingen dieselben nach kürzerer oder längerer Zeit zu Grunde, bei längerem Leben entwickelte sich Herzbeutelwassersucht. [*In many experiments, in which bovine or sheep blood was injected into cats and rabbits, resuscitation took place, but the animals died soon afterwards. Blundell saw that the transfusion of human blood into dogs revived them, but with the exception of two of them, perished after a shorter or longer time period, and if they lived for a longer time, pericardium dropsy developed.*] Blundell, med. chir. Transactions, Vol. IX. p. 60–62. Bischoff's Versuche an Fröschen in Müller's Archiv, 1835. S. 360 ff.
37. Comptes rendus hebdom. des Séances de l'academie des sciences. 1857, 30 Nov. No. 22. p 925. Bischoff fand, dass nur venoses, nicht aber arterielles Blut der Säugethiere, [*Bischoff found that only venous, but not arterial blood of mammals, killed birds instantly.*] Vögel auf der Stelle tödte. Müller's Archiv 1838, S. 852. Damit scheint das a. a. O., X. Band, 1835, S. 365 von Bischoff supponirte “unmaterielle leidende Princip” erledigt.
38. Comptes rendus hebdom. des Séances de l'academie des sciences. 1858, p. 259.
39. S. Velpeau, Leçons orales de Clinique chirurgicale, Paris 1840, p. 451-491. - von Wattmann, sicheres Heilverfahren bei dem schnellgefährlichen Lufteintritt in die Venen. Wien 1843.
40. Um der älteren Versuche von Brunner (1682), Harder (1684) und von Joh. Jac. Wepfer und Camerarius (1685), bei welchen sie Thiere durch heftiges Einblasen von Luft in die Vena jugularis tödteten, während dieselben bei mässigem Einblasen sich wieder erholten, so wie der von der Société médicale d'émulation de Paris veröffentlichten Versuche, welche bei Scheel II. S. 241-248 zu lesen sind, nicht weiter zu gedenken, hebe ich nur hervor, dass Scheel nach eigenen Versuchen, a. a O. S. 240, sagt: Das Eindringen einer kleinen Quantität Luft in die Adern ist nicht gefährlich; in die Adern gebrachte Luft tödtet nur dann, wenn sie in so grosser Quantität auf einmal in's Herz kommt, dass der Blutumlauf dadurch unterbrochen wird. P. H. Nysten (Recherches de Physiologie et de Chimie pathologiques, Paris 1811) beobachtete bei vielen sorgfältigen Versuchen, dass Einspritzungen von geringen Mengen Luft in die Jugularvene das Thier nicht sogleich, sondern erst nach Wiederholung tödtete, ja dass Wiederentleerung der eingebrachten Luft durch Compression der Brust nach Eröffnung der Vena subclavia die Herstellung der Gesundheit bewirkte. Bei Einspritzung grösserer Luftmengen ist die Todesursache die gewaltsame Erweiterung der rechten Herzhöhle und der verhinderte Eintritt des Blutes in die Lungen, während die linke Herzkammer mit Blut überfüllt ist. Hertwig's Injections versuche mit atmosphärischer Luft bei fünf Pferden und bei mehreren Hunden ergaben Ausdehnung der rechten Herzhälfte durch Luft, nebst blutigem Schaum, Blutanhäufung in der linken Herzhälfte; Aorta blutleer; Vena cava sup. und inf., so wie die Vena jugul. dextra und Vena portae enthielten an einigen Stellen schaumiges, flüssiges, mit vielen Luftblasen gemischtes Blut, in den blutreichen Hirn- und Rückenmarksgefässen fanden sich keine Luftblasen; die Lungen erschienen blutleer. Bei Injection von warmer Luft erfolgte der Tod langsam, bei Injection von kalter binnen 3-5 Minuten unter Convulsionen. Bei geringen Mengen der 20° R. warmen Luft erholten sich die Thiere unter Begiessungen mit kaltem Wasser. s. Dieffenbach, die Transfusion des Blutes, Berlin 1828. S. 37 - 43. [*In order to take into account the older attempts of Brunner (1682), Harder (1684) and Joh. Jac. Wepfer and Camerarius (1685), in which they killed animals by violently blowing air into the jugular vein, while the latter recovered with moderate blowing, as well as the experiments published by the Société médicale d'émulation de Paris, which can be read in Scheel II. pp. 241-248, I only emphasize that Scheel, according to his own experiments, op. cit., p. 240, says: The penetration of a small quantity of air into the veins is not dangerous; air brought into the veins kills only when it enters the heart in such large quantities at once that the circulation of blood is thereby interrupted. P. H. Nysten (Recherches de Physiologie et de Chimie pathologiques, Paris, 1811) observed in many careful experiments that injections of small quantities of air into the jugular vein did not kill the animal immediately, but only after repetition, and that the re-emptying of the introduced air by compressing the breast after opening the subclavian vein brought about the restoration of health. When large quantities of air are injected, the cause of death is the violent expansion of the right heart cavity and the prevented entry of blood into the lungs, while the left ventricle is overflowing with blood. Hertwig's injections experiments with atmospheric air in five horses and several dogs resulted in expansion of the right side of the heart by air, along with bloody foam, and accumulation of blood in the left side of the heart; aorta bloodless; vena cava sup. and inf., like the jugular vein, and in some places, the dextra and vena portae contained foamy, liquid blood mixed with many air bubbles; there were no*

air bubbles in the blood-rich brain and spinal cord vessels; the lungs appeared bloodless. When warm air was injected, death occurred slowly; when cold air was injected, death occurred within 3-5 minutes with convulsions. In small amounts of air at 20°R the animals recovered by being sprayed with cold water. See Dieffenbach, the transfusion of blood, Berlin 1828. pp. 37-43.] Später haben: J. C. Cormak, Diss. in. On the presence of the air in the organs of circulation, Edinburg 1837; Mercier und Poiseuille (Gazette méd. de Paris, 1837, 5. Août. 21. Oct.); Amussat, Recherches sur l'introduction accidentelle de l'air dans les veines, Paris 1839 und Barthélemy durch Versuche an verschiedenen Thieren den Eintritt von Luft in das Gefässsystem beleuchtet. S. v. Wattmann, sicheres Heilverfahren u. s. w.

41. Valentin, Lehrbuch der Physiologie, I. Band, 1844, S. 504, erklärt die unglücklichen Folgen des Eintritts einer grösseren Menge atmosphärischer Luft in die Jugularvene dadurch, dass, wenn Luftsäulen zwischen die Blutsäule eingeschoben werden, theils die Reibung an den Gefässwänden viel grösser werde, theils die Compressibilität der Luft die Druckkraft absorbire. Die Herzkraft werde ausser Stande sein, die Luft durch die Lungencapillaren hindurch zu treiben. Sei nur wenig Luft eingedrungen, so habe diess entweder gar keine Folgen, weil der Verstopfungsbezirk der Lungengefässe zu gering sei, oder es erzeugen sich momentane Athembeschwerden, und Ohnmacht, wenn er zwar grösser ausfalle, aber noch überwunden werden könne. v. Wattmann's, a. a. O. S. 75 ff., Erklärungsversuch des tödtlichen Ausganges ist sehr künstlich und zusammengesetzt. [*Valentin, Lehrbuch der Physiologie, Vol. I, 1844, p. 504, explains the unfortunate consequences of the entry of a greater quantity of atmospheric air into the jugular vein, by the fact that, when columns of air are inserted between the blood columns, the friction on the vessel walls becomes much greater, and partly the compressibility of the air absorbs the compressive force. The power of the heart will be unable to drive the air through the pulmonary capillaries. If only a little air has penetrated, this either has no consequences at all, because the area of obstruction of the pulmonary vessels is too small, or momentary breathing difficulties and fainting arise, if it is larger, but can still be overcome. v. Wattmann's, op. cit., pp. 75 ff., attempt to explain the fatal outcome is very artificial and complex*.]
42. Poiseuille im Journal hebdom. 1831. Bulletin de l'academie des sciences, Tom. II. p. 186. Velpeau, Leçons orales de Clinique chirurgicale, Paris 1840, I. p. 453. Bérard weist nach, dass die Vena jugul. int., subclavicularis und axillaris durch feste Bänder so innig an die benachbarten Knochen und Muskeln angeheftet seien, dass sie bei Eröffnung und Entleerung klafften. Archives générales de méd., T. XXIII. p. 169. 171. Velpeau a. a. O. S. 454. Amussat (a. a. O. vergl. v. Wattmann S. 22) bezeichnete mit 2 elliptischen, unter und über dem Schlüsselbein in der Achselhöhle jeder Seite in ein an der übergehenden Linien am Halse und obersten Theile der Brust die Gegend, in welcher Luft spontan in die Venenwunden constant und mit eigenthümlichen Geräusch eintrete, als “die gefährliche Region.” Innerhalb dieser Gegend bemerke man oft an den Venen eine wellenförmige Bewegung. Durch Einlegen von elastischen Röhren in eine geöffnete Vene, ausserhalb der bezeichneten Grenze, konnte man bei Versuchen den Umfang der gefährlichen Gegend erweitern. [*Bérard proves that the jugul. int., subclavicularis and axillary are so intimately attached to the neighbouring bones and muscles by fixed ligaments that they gape when opened and emptied. Archives générales de méd., T. XXIII., p. 169. 171. Velpeau, op. cit., p. 454. Amussat (op. cit., cf. Wattmann, p. 22) designated with 2 elliptical lines, under and above the clavicle in the armpit of each side, in one at the passing lines on the neck and uppermost part of the chest, the region in which air spontaneously enters the venous wounds constantly and with a peculiar noise, as "the dangerous region." Within this area, one often notices a wave-like movement in the veins. By inserting elastic tubes into an open vein, outside the designated limit, the circumference of the dangerous area could be extended in experiments*.]
43. Soden, med. chir. transactions, Vol. XXXV. p. 430.
44. Blundell, med. chir. transactions, London, Vol. IX. part. I. p. 65. 66, berichtet zu Folge mehrfacher Experimente, welche D. Haighton bestätigte, dass wiederholte Einspritzungen von wenig Luft (3 j-iij) in die Femoralvene, zumal wenn dieselbe mit dem Munde eingeblasen wurde, keine erhebliche Zufälle veranlasse. Die Mittheilung v. Wattmann's (Sicheres Heilverfahren etc. Wien 1843. S. 18), dass Czermak bei Experimenten an Thieren Luft durch die verwundete Schenkelvene mit nachfolgendem Tetanus und Tod eindringen gesehen habe, ist zu vag und unbestimmt, als dass sie gegen die vielfachen direkten Experimente Andrer zeugen könnte. [*Blundell, med. chir. transactions, London, Vol. IX. part. I.p. 65. 66, reported as a result of several experiments, which D. Haighton confirmed, that repeated injections of a small amount of air (3 j-iij) into the femoral vein, especially when it was blown in with the mouth, did not cause any significant accidents. The statement of von Wattmann (Sicheres Heilverfahren etc., Vienna 1843. p. 18), that Czermak, during experiments on animals, saw air entering through the wounded*

femoral vein with subsequent tetanus and death, is too vague and indefinite to testify against the multiple direct experiments of others could.]

45. Aus dem London med. a. phys. Journ. 1826. S. die Tab. No. 10.
46. Devay und Desgranges sahen in ihrem glücklich endigen den Falle von Transfusion (s. Tabelle No. 43) kleine Luftblasen ohne Nachtheil in die geöffnete Vene eintreten und behaupten dasselbe von einem mir nicht zugänglich gewesenen ebenfalls glücklichen Falle des D. Bougard. Gazette méd. de Paris, 1842. p. 31-33. [*Devay and Desgranges saw in their happily ending case of transfusion (see Table No. 43) small air bubbles enter the open vein without any disadvantage, and assert the same of an equally fortunate case of D. Bougard, which was not accessible to me. Gazette méd. de Paris, 1842. p. 31-33.*]
47. Joh. Müller's Handb. der Physiologie, 4. Aufl. 1844. S. 124.
48. Müller's Archiv, 1835. S. 350 ff.
49. Müller's Archiv, 1838. S. 352 ff.
50. Siehe Tabelle No. 22.
51. Siehe Tabelle No. 27.
52. So z. B. entstehen nach Magendie's Versuchen Athmungsbeschwerden von Einspritzungen zu vielen Blutes. [*So, for example, after Magendie's experiments, breathing problems arise from injections of too much blood*.] S. Valentin's Lehrbuch der Physiologie, I. Band. 1844. S. 757.
53. Siehe Tabelle No. 50.
54. Siehe Tabelle No. 52.
55. Siehe Tabelle No. 43.
56. Med. chir. transactions, Vol. IX. part. I. p. 66.
57. Siehe Tabelle No. 4.
58. Siehe Tabelle No. 39.
59. Siehe Tabelle No. 41.
60. Siehe Tabelle No. 48.
61. The Lancet. 25 Febr. 1853.
62. Waller in Edinburgh med. a surg. Journal, 1826. p, 354.
63. Siehe Tabelle No. 36.
64. S. Tabelle No. 53.
65. S. Tabelle No. 40.
66. S. Tabelle No. 50.
67. Nach Soden's in dem Med. chirurg. transactions, Vol. 35, p. 434 enthaltenen Citat erzählt Dr. Routh in der Med. Times for August 12, 1849, dass man die Transfusion bei Blutverlusten aus Wunden mit Vortheil gebraucht habe; Prichard und Clarke hätten auch Anämie nach Dyspepsie und anhaltendem Erbrechen durch Transfusion geheilt. Higginson machte die Transfusion mit Erfolg bei Erschöpfung einer Frau durch übermässiges Säugen von Zwillingen. [*According to Soden's included quote in the Med. surg. transactions, Vol. 35, p. 434, relates Dr. Routh in the Med. Times for August 12, 1849, that transfusion was used with advantage in cases of blood loss from wounds; Prichard and Clarke would also have cured anaemia secondary to dyspepsia and persistent vomiting by transfusion. Higginson performed the transfusion successfully when a woman was exhausted from excessive nursing of twins*.] (Liverpool med. chir. Journ. 1857, January).
68. Eine ganz ungewöhnliche Quelle eines tödtlich gewordenen Gebärmutter - Blutflusses bei einer sehr kräftigen Mehrgebärenden, welcher die dummdreiste Hebamme nach einer raschen und glücklichen Geburt eines tüchtigen Knaben, um die Nachgeburt zu entfernen, den Nabelstrang herausgerissen hatte, entdeckte ich bei der Section. Die Halbentbundene hatte von Abends 12 Uhr bis zum folgenden Morgen 7 Uhr fortdauernd einen geringen Blutabgang erlitten, der von der Hebamme nicht hoch angeschlagen war, bis um 5 Uhr früh Gähnen, Obnubilationen und Gehörstäuschungen auftraten. Bevor ich den Wohnort der Unglücklichen erreichen konnte, war sie verschieden. Die Section ergab neben gänzlicher Anämie eine allgemeine, mehr als gewöhnlich feste Verwachsung der Placenta mit dem Uterus und eine mit Blutgerinseln gefüllte Risswunde, da, wo die Nabelschnur sich, ziemlich in der Mitte des an dem linken Seitenrande der Gebärmutterhöhle sitzenden Mutterkuchens eingesenkt hatte. Die Halbentbundene hatte sich aus dieser Rissstelle verblutet. [*I discovered a quite unusual source of fatal uterine blood flow in a very strong multiparous woman, whose umbilical cord had been torn out by the stupid midwife after a quick and successful birth of a capable boy in order to remove the afterbirth during the autopsy. The half-delivered woman had continued to suffer a small amount of blood loss from 12 o'clock in the evening until 7 o'clock the following morning, which the midwife did not rate as high until yawning, obnubilation and auditory illusions occurred at 5 o'clock in the morning*. *Before I*

could reach the place of residence of the unfortunate woman, she had died. In addition to complete anaemia, the autopsy revealed a general, more than usual firm adhesion of the placenta to the uterus, and a laceration filled with blood clots, where the umbilical cord had sunk in the middle of the placenta sitting on the left side of the uterine cavity. The half-delivered woman had bled to death from this tear.]

69. Med. chir. transactions, Vol. XXXV. p. 424.
70. Med. chir. transactions, London 1818, Vol. IX. Abbildg. p. 68, Geburtshülfliche Demonstrationen, XI. Heft, Weimar 1832. Tafel 44. Fig. 11.
71. The Lancet 1829. June No. 302. S. Geburtshülfliche Demonstrationen, XI. Heft, Weimar 1832, Tafel 44, Fig. 12-15.
72. E.A. v. Graefe, Dissert. in. De nova infusionis methodo Berol. 1817. c. tab. aen. S. auch Geburtshülfliche Demonstrationen, Heft XI. Taf. 44. Fig. 5. 6. 7.
73. Geburtshülfliche Demonstrationen, Heft XI. Taf. 44, Fig. 1-4.
74. Ebendaselbst Fig. 16 - 29.
75. Gazette méd. de Paris, 1847, p. 787.
76. Gazette méd. de Paris, 1852, p. 33.
77. Derselbe ist bei den Instrumentenmachern Besemann in Jena und Birck in Berlin, Dorotheenstr. 22 zu haben. [*The same is available from the instrument makers Besemann in Jena and Birck in Berlin, at Dorotheenstrasse 22.*]
78. So z. B. in Greaves und Waller's Fall. Tabelle Nro. 38.
79. Zur Unterstützung dieser Angabe ziehe ich die Untersuchungen Brown-Sequard's und Claude Bernard's hier an: Brown Sequard (Comptes rendus hebdom. des séances de l'academie des sciences, 1857, 30. Nov, No. 22. p. 925) fand bei seinen Versuchen der Transfusion an Thieren: 1) dass das Blut eines Wirbelthieres für ein andres Wirbelthier sogar von sehr verschiedener Gattung kein Gift sei; 2) Dass die nachtheilige Wirkung des injicirten Blutes, wenn sich dergleichen zeige, von der Anwesenheit einer grösseren Menge von Kohlensäure abhänge; 3) dass die beobachteten Symptome von Beklemmung, Angst, Convulsionen und plötzlichen Tod dieselben sind, wie bei Asphyxie durch Kohlensäure; 4) dass ähnliche Zufälle eintreten, wenn man zu schnell und zu viel Blut injicirt, als Folge plötzlicher Ausdehnung des rechten Herzohrs; 5) Arterien- und Venenblut haben gleiche Wirkungen, je nachdem man sie mit Sauerstoffgas oder mit Kohlensäure schwängert. Der Tod folgt im letzteren Falle, wenn die Quantität des injicirten Blutes nicht unter des Gewichts des Thieres beträgt; 6) Injicirt man Kohlensäurehaltiges defibrinirtes Blut so langsam, dass das Uebermaass von Kohlensäure durch die Lungen ausgeschieden werden kann, bleibt die giftige Wirkung aus. Auch lässt sich durch künstliches Lufteinblasen in die Lungen die Wirkung der Kohlensäure beschränken; 7) Treibt man die Kohlensäure im Blut durch hineingeleitetes Sauerstoffgas aus, so wirkt dasselbe nicht mehr giftig; umgekehrt kann man das einem Thiere entzogene Blut durch Hineinleiten von Kohlensäure für dasselbe giftig machen. Claude Bernard (Comptes rendus hebdom. 1858. p. 159) fand, dass das Blut in manchen Venen, z. B. in den Nierenvenen, gewöhnlich roth sei, wenn die Harnabsonderung gehörig vor sich gehe, dagegen bei Störungen der Urinabsonderung, wie sie schmerzhafte Operationen und Vivisectionen begleiten, schwarz werde, wie das Blut in der Vena cava. Gleiches ergab sich an der Vena, welche das Blut aus der glandula submaxillaris zurückführt: das Blut war schwarz, wenn die Drüse nicht secernirte; wurde roth, sobald man die Secretion durch in den Mund gebrachten Essig oder durch galvanische Reizung der Drüsen nerven erregte. Der Uebergang von Schwarz zu Roth machte sich allmählig; auch floss das Blut bei Reizung der Drüsen absonderung reichlicher. Das Blut, welches aus einer functionirenden Drüse kommt, ist aber nicht allein hellroth, sondern auch flüssiger, als das dunkle Blut, welches aus einer nicht functionirenden Drüse kommt; im letzteren giebt es bald consistente Gerinnsel. Ueberhaupt muss man das Venenblut nunmehr bei den verschiedenen Zuständen der Organe, aus welchen dasselbe stammt, untersuchen, wenn diese thätig sind und wenn nicht. Denn das Blut, welches aus einem sich zusammenziehenden Muskel fliesst, ist schwarz. Die verschiedenen Zustände der Organe sind aber bedingt durch das Nervensystem. [*In support of this statement, I refer here to the investigations of Brown-Sequard and Claude Bernard: Brown Sequard (Comptes rendus hebdom. des séances de l'academie des sciences, 1857, Nov. 30, No. 22, p. 925), in his experiments on transfusion on animals, found: 1) that the blood of one vertebrate animal is not poison for another vertebrate animal, even of a very different species; 2) That the harmful effect of the injected blood, if such a thing occurs, depends on the presence of a larger quantity of carbonic acid; 3) that the observed symptoms of anxiety, fear, convulsions and sudden death are the same as in asphyxia due to carbonic acid; 4) that similar accidents occur if one injects too quickly and too much blood, as a result of sudden expansion of the right atrial appendage; 5)*

Arterial and venous blood have the same effects, depending on whether they are impregnated with oxygen gas or with carbon dioxide. Death follows in the latter case if the quantity of blood injected is not less than the weight of the animal; 6) If carbonated, defibrinated blood is injected so slowly that the excess carbonic acid can be excreted through the lungs, the toxic effect does not occur. The effect of carbonic acid can also be limited by artificially blowing air into the lungs; 7) If the carbonic acid in the blood is expelled by introducing oxygen gas, it no longer has a poisonous effect; conversely, the blood extracted from an animal can be made poisonous by introducing carbonic acid into it. Claude Bernard (Comptes rendus hebdom. 1858. p. 159) found that the blood in some veins, e.g., in the renal veins, is usually red when the secretion of urine is proceeding properly, but in disturbances of urine, such as accompany painful operations and vivisections, it becomes black, like the blood in the vena cava. The same was true of the vein, which returns the blood from the submaxillary gland: the blood was black if the gland did not secrete; became red as soon as the secretion was stimulated by vinegar placed into the mouth or by galvanic stimulation of the glandular nerves. The transition from black to red was gradual; also, when the glands were irritated, the blood flowed more abundantly. The blood which comes from a functioning gland, however, is not only light red, but also more liquid than the dark blood which comes from a non-functioning gland; in the latter there are soon consistent clots. In general, the venous blood must now be examined in the different conditions of the organs from which it originates, if these are active and if not. This is because the blood that flows from a contracting muscle is black. The different states of the organs, however, are determined by the nervous system.]

80. Gazette médicale de Paris, 1851, p. 664.
81. Nach der zweiten Transfusion an dem geisteskranken Antoine Mauroy, welchem Denis nur zwei bis drei Unzen Blut entzogen, dagegen ein Pfund Blut eingespritzt hatte, klagte der Kranke über ungewöhnliche Wärme in dem betreffenden Arm, bekam kalten Schweiss über das Gesicht und gab dann Uebelkeit und Beklemmung bis zum Ersticken, sowie Schmerz in der Nierengegend an. Das Blutharnen sah Denis unter 50 Transfusionen an Thieren 2mal. Vergl. Scheel a. a. O. I. S. 128. Exsudationen von Serum und Blutkörperchen beobachtete man vorzüglich bei Einspritzung von Thierblut, welches in Gestalt und Grösse abweichende Blutkörperchen zeigt. (Blundell, Bischoff.) Auch Valentin, Lehrbuch d. Physiolog. I. Band, 1844, S. 757 warnt vor dem Einspritzen zu vielen Blutes; denn bei Uebermaass entstünden Athmungsbeschwerden, Traurigkeit und Ueberfüllung der Lungen mit Blut, welches alsdann nach dem Tode im ganzen Körper nicht geronnen erscheine (Magendie, J. Budge, Allgem. Patholog. Bonn 1843, S. 244). Nach dem Ersteren soll sich bisweilen ein vollkommen typhöser Zustand einstellen, man beobachte sogar Exsudate, blutige Stühle, Darmgeschwüre und ähnliche Entartungen nach übermässigen Mengen eingespritzten Blutes. [*After the second transfusion on the mentally ill Antoine Mauroy, from whom Denis had only withdrawn two to three ounces of blood and injected a pound of blood, the patient complained of unusual warmth in the arm in question, developed a cold sweat over his face and then experienced nausea and anxiety to the point of suffocation, as well as pain in the kidney area. Denis saw blood urination twice out of 50 transfusions in animals. Compare Scheel a. a. O. I. P. 128. Exudations of serum and blood cells are observed particularly when injected with animal blood, which shows blood cells of different shape and size. (Blundell, Bischoff.) Also Valentin, Lehrbuch d. Physiolog. Vol. I, 1844, p. 757 warns against injecting too much blood; for with excessive amounts there is breathing problems, sadness and overfilling of the lungs with blood, which then does not appear to have coagulated in the whole body after death (Magendie, J. Budge, Allgem. Patholog. Bonn 1843, p. 244). According to the former, a completely typhoid condition is sometimes said to set in, even exudates, bloody stools, intestinal ulcers and similar degenerations are observed after excessive quantities of injected blood*.]
82. Lancet, Sept. 5. 1840. S. Tabelle Nr. 36.
83. Lancet, Juin 1829. Nr. 302.
84. Die operative Chirurgie, I. Band, Leipzig 1845. S. 110
85. Comptes rendus hebd. des séances de l'academ. des sciences, 1857. 30. Nov.