APPARATUS FOR TRANSFUSION.

ASPHYXIA IN NEW-BORN CHILDREN

Considered from a Medical and á Legal Stand-point.

PAPERS READ BEFORE THE NEW YORK OBSTETRICAL SOCIETY

BY

J. C. GARRIGUES, M.D.

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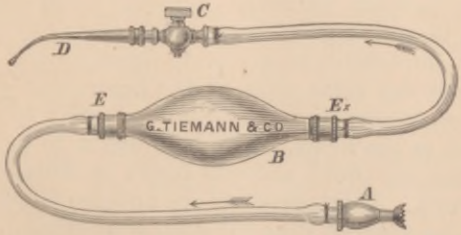
APPARATUS FOR TRANSFUSION.

"In presenting a transfusion apparatus to the society, I do not lay claim to any originality. The chief characters of the instrument I am going to show you are found in that submitted as early as 1853 to the French Academy of Sciences by *Mathieu*, that of *Roussel*, of Geneva (Switzerland), which took a prize at the International Exhibition of Vienna, and *Playfair's* improvement on *Aveling's* apparatus. My only merit, if merit there be, consists in calling Tiemann & Co.'s attention to the subject, and in helping them in certain details of the construction.



Construction.—The instrument is essentially a diminutive Davidson's syringe. It consists of two rubber tubes united by a rubber bulb with two metal cup valves opening the same way. At one end of the instrument is a tin plunger, at the other a nickel-plated stop-cock and canula. The canula is of small calibre, tapering, probe-pointed, and flexible.

Operation.—A healthy individual, preferably a strong man, is bled, if possible in an adjoining room, and about eight or ten ounces drawn into a perfectly clean vessel. Whilst the blood is collecting, it is stirred or whipped continually with a silver fork or a wooden stick, by which process the fibrin is made to coagulate separately on the implement used for whipping the blood. This separation takes about five minutes. Next the whipped blood is strained once or twice through a perfectly clean piece of old linen, into a vessel standing in another vessel with lukewarm water (at about 105°). If

there be no warm water at hand, it may be dispensed with, for the blood may lose 30° before any untoward symptom due to its loss of temperature appears. If possible, the syringe should be warmed, and then filled by compressing the bulb until the blood flows through the canula, when the stop-cock is turned.

The next stage is to open a vein on the patient, most conveniently one at the elbow bend (never on the neck, in order to avoid the danger of air being absorbed.) If none be visible, they can be made so by compression above. The skin that covers the vein is lifted up in a fold, and an incision made perpendicularly to the vein. In order not to lose the vein, if by chance the canula should slip out, it is advisable to pass a probe or a double thread under it. The best way of opening it is to lift its anterior wall with a pair of fine forceps or a hook, and make a nick in it with a pair of fine scissors. Thus a minute flap is formed, under which the point of the canula is easily introduced. If these instruments are not at hand, the vein may simply be slit open with a lancet, care being taken not to perforate the posterior wall. Before introducing the canula, the operator convinces himself, by pressing slightly on the bulb, that all air has been chased from the syringe.

The most important of all is to *inject slowly*, in order to avoid dilating the right side of the heart, and stopping the free flow from other veins, and in order to give the blood time to be purified in the lungs. The bulb ought to be compressed so slowly that the fluid scarcely forms a stream, but comes almost in drops. Thirty seconds are not too much, and three seconds are the shortest time for each compression. The bulb contains about three drachms, but by moderate pressure about two drachms only are expelled from it, and consequently, by counting how often it is emptied, we may calculate how much blood has been injected. The quantity to be used must depend on the supply at hand, on the amount of blood lost, and on the time elapsed since the loss, for the quantity lost is in a very short time replaced by lymph and water, and overfilling the vessels is dangerous. In most cases four to six ounces will do, but eleven have been injected with success. If a resistance be felt in working the bulb, the operator must first ascertain that it does not come from compression of the vein. If this is not the case, the resistance is probably due to overfilling of the right side of the heart. Therefore he must interrupt the operation or end it altogether, according to circumstances. The same rule applies when dyspnea or other unpleasant symptoms appear.

After the operation the wound is dressed as after phlebotomy.

As often as the instrument is used, it must be completely separated, in order to clean it. Even the fittings must be taken off by undoing the wires. Else a little blood will be left between the interior part of the fittings and the wall of the bulb, where it will dry and corrupt. Neglecting this precaution has caused acute septicemia and death.

It will be seen that the operation here described is the *indirect transfusion of defibrinated human blood.*

The *indirect transfusion* presents great advantages over the direct. The blood-donor need not see the patient, nay, not even come into the sick-room, where sometimes he faints, so that no blood can be obtained from him. No canula is introduced into his veins, which exposes him much less to dangerous consequences.

The use of *defibrinated blood* presents also great advantages over the use of the entire blood. The danger of injecting coagula which may put an end to the patient's life is avoided, and the operator can work at his ease. By being whipped, the blood is delivered from carbonic acid and saturated with oxygen. Numerous experiments have proved that defibrinated blood is quite as efficacious in every respect as the entire blood.

According to the repeated investigations of Panum, Ponfick, and Landois (1875), it does not seem justifiable to inject blood from animals into the vessels of man.

It will be known to the society that Dr. T. Gaillard Thomas and others have successfully injected milk into the veins of patients (see the *American Journal of the Medical Sciences*, January, 1876). The instrument may, of course, be used for this substance as well as for defibrinated blood.

Bulb apparatus, in general, are preferable to syringes with a piston, because this rarely fits when the syringe is not constantly used. All instruments of glass and hard rubber are also apt to break.

A special advantage in the method proposed is that the whole apparatus is filled with blood before it is introduced. Thus the trouble of chasing the air from the canula after introduction is avoided. The instrument is so small and light that it easily can find room in the obstetric bag, and, accordingly, *always be at hand.* It is easily managed even without skilled assistance, and is not likely to get out of order. Finally, it is so cheap that every practitioner can afford to buy it, and as transfusion may enable him to save life when all other means fail, some instrument for its performance ought to form a part of the obstetric apparatus."

Asphyxia in New-born Children

Considered from a Medical and a Legal Stand-point.

Case.—(*Hydramnion, brow presentation, forceps delivery, large child, cord compressed, deep asphyxia, inspiration two and a half hours after birth, death seven hours after birth.*)

"Mrs. B., 37 years old, has borne two children, eight and three years ago. No miscarriage. Both children were very large, but were born without instrumental help.

The last menstruation began on the 26th of April. Each menstrual period lasts generally six or seven days. The movements of the fetus were felt for the first time four months later. When I first saw her, about a month before her confinement, I diagnosed hydramnion on account of the uncommon prominence of the abdomen, the very marked fluctuation, and the quantity of water that could be felt between the fetus and the uterine wall. The vaginal examination did not reveal anything abnormal. During the latter half of her pregnancy, she suffered much from back-ache, which became so intense during the last sixteen days that she could barely move. When I was called, February 2d, 1878, true pains had already been present for twenty-four hours, and had been shooting down for two hours. I saw her at 5.30 A.M. The abdomen was uncommonly distended with water. The fetal heart beat 120, and the sounds were unusually clear, extending from the level of the umbilicus down all over the left side. As this seemed to be contrary to hydramnion, I examined very carefully, and was able to exclude twins by making out the configuration of the whole body, a diagnosis that was corroborated by the absence of any heart-sound in other parts of the abdomen. The un-

commonly clear and extended sounds are easily accounted for by the uncommon size of the child. The os was about an inch from side to side, and scarcely a finger breadth wide in the antero-posterior direction. The cervical canal had the length of the third phalanx of the index.

The vertex was felt presenting. As the pains continued without forwarding the delivery, I gave her at three separate times fifteen grains of hydrate of chloral with an interval of twenty minutes, and later a fourth dose. She had some sleep, and the pains became better. At 9.30, the fetus had turned on its long axis, so that the back with the heart-sound was found in the right side. At 10.15, the os was as large as a silver dollar, when I ruptured the bag with a wire above the os, but in spite of the great quantity of liquor amnii present, only a couple of ounces escaped. The brow was then found presenting—both eyes, the nose, and the nostrils were felt above the horizontal branch of the left os pubis, the whole anterior fontanelle in front of the right ilio-sacral symphysis. I tried in vain to change the presentation into a vertex presentation, by pressure on the lower part of the forehead with two fingers. The heart-sounds became weaker, and the fetus made violent movements, like a seal in its little tank in a zoological garden. At the same time the mother suffered intensely. I therefore gave her chloroform and applied the forceps to the head, which was still at the superior strait. This was at noon. It was rather difficult to get the large head down. It bent and turned in the forceps, and emerged in the R. O. A. position.

The face was violet. It was very difficult to make the large shoulders follow. An assistant pressed the uterus powerfully down, whilst I pressed on the head from side to side, and finally hooked a finger into the posterior axilla. As soon as the head advanced somewhat, a loop of the umbilical cord appeared compressed between the neck and the right branch of the pubic arch. The head had a normal form, and the forceps had left no mark on it, except a small scratch on the back of the nose.

The child, a boy, was born in a state of profound asphyxia. Only a few slow and feeble beats of the heart showed that life was not extinguished. The child was entirely flaccid, the face violet, and the hands and feet blue. The cord was as thick as my thumb. I ligated it immediately and severed it. Compression of the womb was kept up by an assistant, and the placenta expelled by Crédé's method. She lost about a pint of blood, and there appeared even some little arterial blood, probably due to laceration of the imperfectly dilated cervix.

Whilst others took care of the mother, I bestowed my whole attention on the child in order to restore it to life, and I had the opportunity to try most of the means recommended for this purpose. I slapped its buttocks, shook it, rubbed it, put it in a warm bath, and threw cold water over it alternately. Next I tried Sylvester's method, alternately lifting the arms along the sides of the head, and pressing the elbows against the hypochondria. Then I covered the face with a piece of linen, with a hole corresponding with the mouth, compressed the nose and the abdomen, and blew through the mouth, but found that the air scarcely entered the lungs. After that, I introduced a flexible catheter through the larynx. No fluid could be withdrawn, but the insufflation of the lungs was easily performed and kept up for two hours, whilst the child was constantly covered with hot cloths. The pulsations of the heart were brought up to 120, and were of normal strength, but, *two hours and a half* having elapsed without a single other sign of life, I was about to give up the case as hopeless, when it made the first respiratory gasp. Encouraged by this I went on with the insufflation, combining it with other stimulants, such as vapor of ammonia, tickling the interior of the nose with a feather, and the introduction of lumps of ice into the rectum, and the frequent application of ice and hot cloths alternately to the abdomen, this last measure, which had a very marked effect, being suggested to me by Dr. Stub. During the first hours the progress was very slow: at 2.30 P.M., the boy made the first inspiration, and at 4 o'clock he had only come to five double inspirations in the minute—that is to say, two inspirations followed one another immediately, and then there came a pause of about ten seconds before the next double inspiration occurred. At 5 o'clock, he made eight double inspirations. Now I ceased inflating the lungs, and during a whole hour he respired alone through the catheter. The short pause became longer, so that the respiration approached more the normal rhythm. In order to give him the benefit of warmed air, I held the end of the catheter in my open mouth. Several times the catheter was withdrawn in order to try if any fluid could be aspired, but it brought up only a little blood, probably due to a slight abrasion caused by the introduction of the instrument, or perhaps to the asphyxia itself, a state in which the lungs become filled with blood, and ruptures take place.

At 6 P.M., I withdrew the catheter and left it out, the respiration lost in frequency, being only six or seven double inspirations per minute, and had a stertorous sound. Twelve minutes later he opened both eyes. The conjunctiva covering

the sclerotica was injected. Suddenly he ceased breathing altogether. I reintroduced the catheter and repeated insufflation, but now he could only be brought to make a few gasps, the pulsation of the heart grew weak, and at a quarter past seven, seven hours after birth, he died.

He weighed 11 pounds, his length was 21¼ inches, the circumference of the head 15 inches, and that of the shoulders 16½. The placenta measured 8 inches in length by 7½ in transverse diameter. It was covered with blood-clots. The mother had very slight parametritis, and has been out walking every day this last fortnight.

Commentary.—My object in publishing this case is to impress upon the mind of all who may not know it, that *if only the heart beats, the life of the child may be saved even if spontaneous respiration does not appear for hours.* Many may be ignorant of the fact, as many text-books on obstetrics are apt to lead the practitioner into error on this point. The most recent German work, Spiegelberg's voluminous treatise,[1] gives only the advice not to despair of success *immediately* even in the worst cases. Stadfeldt,[2] professor at the university of Copenhagen, says that *half an hour or an hour* may elapse before respiration becomes regular. Playfair[3] speaks of the numerous authenticated instances of success after the lapse of *an hour or more.* Older writers, however, such as Nægele and Siebold, give more trustworthy information by stating that children have been revived, although they did not respire for two or three hours. I regret that I withdrew the catheter before the child respired quite normally and tried to cry, for from the great progress it had made, I feel confident that it would have been entirely restored to life, so as to be able to respire without any help, to cry and to move freely, even though perhaps it might have died after a few days, as is so often the case with children born in a state of asphyxia.

The hydramnion was probably due to the large size of the fetus. As often happens, it produced an unfavorable presentation and prolapse of the umbilical cord, which again was the cause of the asphyxia. The latter probably commenced when the fetus made such violent movements, and its heart-sounds became weaker. The forceps was first applied after this, and the entirely normal configuration of the head and absence of any kind of impressions on it show that the asphyxia could not be due to compression of this part.

Generally, we find the mouth, the throat, the larynx, and

[1] Spiegelberg, Lehrbuch der Geburtshülfe, 1878, p. 675.
[2] Stadfeldt, Det mekaniske Misforhold, 1872.
[3] Playfair, Midwifery, London edition, II., 256.

even the deeper parts of the air-passages more or less filled with aspired liquor amnii. The absence of fluid in this case can easily be explained by the brow presentation. The mouth was pressed against the wall of the uterus, and thus the fluid was prevented from entering, in spite of the efforts at respiration made by the child.

As for the comparative value of the different means employed to induce respiration, as on former occasions, I found the insufflation of air through an elastic catheter to give better results than anything else. Of the other means used, the irritation of the mucous membrane of the nose by a feather and by the vapor of ammonia, and that of the skin by momentary application of ice, had the most marked effect. An electric apparatus was not at hand. It might, perhaps, have been well to let some blood escape; but the opinions are much divided on that subject. Spiegelberg[1] goes so far as to condemn even the tying of the cord, because by it the chi d loses the blood retained in the placenta, which is its due.

Cases like the one I have submitted to you present a great *medico-legal interest.* I suppose that there is no member of this Society who will not agree with me that this child lived seven hours after its birth.

Where circulation, respiration, and motion are present, no man with the physiological knowledge of our age will deny the existence of life. But it has not always been so, and there are still countries in which this child would have been declared by law not to have lived. A double interest attaches to the question, what is to be regarded as a living child: on the one hand, the criminality of maltreating the child, on the other hand, its capability of inheriting and transmitting property to others depends on its being alive.

As it is likely that the opinion of the members of this Society would be more frequently asked, and have more weight than that of many others, it may perhaps not be altogether superfluous to make ourselves acquainted with the perplexities of a question that at first sight must seem so exceedingly simple to everybody acquainted with the laws of physiology. The laws of different ages and different countries are at variance as to the conditions required of a child in order to be able to inherit. The Roman law required that it should be perfectly alive, but it needed not to have made its voice heard.[2] In France, a capitulary of King Dagobert prescribed that it should live an hour and be able to see the four walls and the ceiling of the chamber. This law was altered by Louis IX., who ordered

[1] L. c., p. 672.
[2] Beck, Medical Jurisprudence, 12th ed. Philadelphia, 1863, I., p. 412.

that it should cry. The present French law requires that the child shall be born *viable*, and the interpretation of the word *life* and *born alive* is complete and perfect respiration. According to Scotch law, the child must cry.[1] Thus in Scotland and in France our child would be declared not to have lived, and consequently not be able to inherit. The English law, influenced by the Roman law, is much more in accordance with science. 'Crying,' says Blackstone, 'is the strongest evidence of life, but it is not the only evidence."[2] Coke says, 'Crying is but a proof that the child was born alive, and so is motion, stirring, and the like.' In the case of Fish, or Fisher *vs.* Palmer, in 1806, in which action was brought ten years after the birth of the child, it neither cried nor moved nor showed any symptoms of life; but while in a warm bath, there twice appeared a twitching and tremulous motion of the lips. Denman thought it had not been alive, but two other physicians declared that it had been, and so found the jury.[3] Dunlope lays down the right principle that, where there is power of being affected by stimuli (other than galvanic or electric), this, in common sense, must be held to constitute vitality.

In several cases of alleged infanticide, the English judges, in charging the jury, said that a child may be born alive and live for some time without breathing. In fact it would appear that breathing is regarded as only *one* proof of life; and the law will therefore receive any other kind of evidence which may satisfactorily show that a child has lived.[4] A child that is born alive, or has come *entirely* into the world in a living state, may, by the English law, inherit and transmit property to its heirs, even although its death has immediately, and perhaps from morbid causes, necessarily followed its birth.[5] Although the mere warmth of the body would not be evidence of live birth, yet the slighest trace of *vital* action, in its common and true physiological acceptation—such as crying, breathing, pulsation, or motion—observed after entire birth and separation from the mother, would be deemed in English law a sufficient

[1] Beck, l. c., p. 417. [2] Ib., p. 413. [3] Beck, l. c., p. 414.

[4] Taylor: Principles of Medical Jurisprudence, 2d edition. Philadelphia, 1873, II., p. 324.

[5] Taylor, II., p. 206.—It is to be noted, however, that in *prematurely born children*, the time elapsed since the conception of the child makes a difference. After six months of pregnancy, it is enough to prove that the child is born *alive*, but children born within the first six months after conception are presumed to be incapable of living, and therefore cannot take and transmit property by descent, unless they actually survive long enough to rebut that presumption. In such a case, therefore, the medical expert will not only have to answer the question if the child is born alive, but if it is born *viable*, that is to say, if it would be able to continue life. (See Chancellor Walworth in the case of Marcellis *v.* Thalhimer, Taige Chancery Reports, Vol. II., p. 35.)

proof of the child having come into the world alive.[1] In the case of *Brock vs. Kelly*, the only sign of life was pulsation of the cord. The question of its having been alive or not came up twenty years later. At the time of its birth, it was declared alive by Dr. Freeman. Dr. Tyler Smith supported his opinion, considering that the fact that pulsation was observed in the umbilical cord after delivery was physiological proof that the child was not born dead. On the other hand, Drs. Lee and Ramsbotham gave their opinion that nothing less than breathing could establish the fact of live birth. The child, therefore, in their judgment, was not born alive. The chancellor decided that proof of breathing was not necessary, and held that there was sufficient legal evidence of life after birth in the pulsation observed by the accoucheur.[2]

That life may be prolonged even for a considerable time without breathing appears from a case observed by Bouchut. During twenty-three hours, feeble but distinct pulsations of the heart were heard at long intervals, but there was no motion of the ribs. Attempts to induce respiration failed. The post-mortem examination showed that the lungs had not received any air.[3] In a case which occurred at Turin, in 1818, the Cesarean operation was performed after the death of the mother. Motion of the child's head and feet were discovered during and after the operation; it opened its hands, which were closed; blood sprang out of the umbilical cord on being cut, and pulsations were felt in the cord, the carotid arteries, and the region of the heart; water being poured on its head in administering baptism, a motion of the lips and mouth was perceived, and an impression which produced an inspiration; the natural heat remained; after having lived about thirteen or fourteen minutes, some drops of blood came from its nose, it became pale, stretched its limbs, closed its eyes, and died. During the procedure pending before the senate of Turin, some distinguished members of the medical faculty proposed the question, whether the child had been alive, to the faculty of Strasburg, which declared that it was born alive.

In this country, no case of the kind has come before the courts, except one in this State, in 1830 (Marselis *vs.* Thalhimer), in which there was no proof at all of the child having been born alive. It was claimed that, upon establishing the fact of birth, the legal presumption was that the child was born alive. The court decided, of course, that the existence of life at birth was to be proved by the party seeking benefit from it.[4] But if

[1] Taylor, II., p. 209. [2] Taylor, II., p. 210. [3] Taylor, l. c., p. 213.
[4] Beck, l. c., II., 422.

cases should come up, the decisions of the English courts would be considered the law.

However this may be, we are not jurists, but physicians, and it is for us only to testify if, in a given case, the child was born alive. The term *born* implies, that it has come *entirely* out of the body of its mother. If any part of it is still contained within the cavities of the mother, it is not considered by law as born. As to the term *alive*, we should stand on strictly scientific ground, and not repeat the errors committed by men who, in other respects, range among the best of our profession, such as Denman, Ramsbotham, Orfila, Dubois, Pelletan, Roux, etc. As long as active motion goes on, such as pulsations felt or heard in the heart, pulsation of the cord after the child has been entirely expelled from the body of its mother, the faintest respiratory gasp, or a movement of the lips or the eyelids or a limb, life is not extinct, and according to the wise laws which this country has inherited from England, any maltreatment of the child is a crime, and it has the right of inheriting and transmitting property.

As practitioners we should use every effort to make the child cry, this being, to the popular mind, the convincing proof of its being alive, which will perhaps save even the trouble and expense of a lawsuit, and which also gives hopes of keeping it alive, but as witnesses we must remember that life may be manifested in many other ways. In my case, the undertaker sent me a certificate for a still-born child, which, of course, I refused to sign. The cases alluded to above show that the question may come up ten or twenty years after the death of the child. It is, therefore, an imperative duty to be very exact in all our statements in such cases."