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Obstetrics: The Science and the Art - Part IV. The History and Diseases of the Young Child; Chapter XXIV. Cyanosis Neonatorum

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CHAPTER XXIV.

CYANOSIS NEONATORUM.

In the month of November, 1832, during the prevalence of Asiatic cholera here, I had charge of the case of Mrs. Taylor, of North Fourth Street, No. 503. She was seized with symptoms of the epidemic, being at the time about seven and a half months advanced in her gestation. The attack was violent, and led to the premature expulsion of the child, which was born living, though very feeble. It soon began to turn blue, in consequence of its being affected with cyanosis, commonly at that time called blue disease, and as its hue grew darker and darker, its lessening respiration, and the coming on of convulsions, caused me to think it could not long survive; indeed, it came apparently to the point of death.

The young mother, who was still ill with her cholera, could not be insensible to the danger of the child, and I perceived that the complication of a moral shock with her other irritations, might render the cure of her own malady more difficult, if not impossible. It became, then, in view of the mother's position, a matter of great moment to rescue the child from apparently imminent death. These reflections, which I made at the time, gave me great pain; for while I deemed the state of the child one of partial asphyxia from the mixture of its venous with its arterial blood, the mixture being made by injection through the foramen ovale of the auricular septum, I could devise no treatment upon which to rely for obviating that injection.

I was deeply concerned, and knew not what to do. Suddenly, I reflected upon the structure of the foetal heart, and the route of the foetal circulation, and I said, if I bring the septum auricularum into a horizontal position, will not the blood in the left auricle press the valve of Botalli down upon the foramen ovale, and thus save the child, by compelling all the blood of the right auricle to pass by the iter ad ventriculun, and so to the lungs, to be aerated?

Having practised Midwifery for many years, I had, on many occasions, witnessed the fatal termination of cyanosis neonatorum, both
in the premature and the mature child. I had seen children at five, and at five and a half, at six, and at seven months, vainly attempting to carry on respiratory life, and observed them to perish with the signs of cyanosis, whether from too large a foramen ovale, or from imperfect development of the respiratory machinery of the lungs from atelectasis.

In the case now under consideration, I placed the child, which seemed nearly dead, upon a pillow, on its right side, the head and trunk being inclined upwards about twenty or thirty degrees.

Upon placing it down in this manner it became quiet—began to breathe more naturally; to acquire a better hue of the face, hands, and feet; until, in a very short time, it was quite well again, and did well, having no further returns of the attack of cyanosis neonati.

I shall not conceal the satisfaction I derived from the successful result of my reflections, thus put into practice in the case; for I thought, and I still think, that the child would have died inevitably, had I not thus closed the valve. In very many instances, during a long obstetric experience, I had never made such a reflection upon the means of saving the blue child, of which I had seen many cut off. I believed, and I still believe, that I was the first to invent the treatment; and the first case in which I put it in practice, was thus eminently successful. I am not now aware that any other person had before suggested it, though in his account of cyanosis, M. Gintrac gives, in case 5th, an account of Dr. Wm. Hunter's patient, aet. 8, who obtained relief from a paroxysm, by lying still upon his left side, which always relieved him. After his death, the ventricular septum was found to be wanting, or rather perforated near the base of the heart, so that the aorta received the injection of the right, as well as of the left ventricle.—Vide Gintrac, p. 33.

Six years later, in my Philad. Pract. of Mid., edit. 1838, I published some remarks on cyanosis, or blue disease, which being written in much haste, I did not at the time remember the circumstances of the above case, which occurred in Nov. 1832, in Fourth Street above Poplar, No. 503, in a child of Mr. Taylor, a builder, formerly of this city.

Since the date of my first application of this method, twenty-four years ago, I have had numerous occasions to put it in practice, and not a few opportunities of examining the state of the heart after death; in some of which, after vainly applying the treatment, I had come to the conclusion that other causes, not patency of the foramen ovale, must exist, to contravene the curative tendency of the method.

My publications—and my explanations to friends—with the lectures
on the subject that I have now delivered to many hundred Students of Medicine, have rendered this treatment of mine a popular one—to such an extent that in various States of the Union, the treatment is become familiar to the profession. Many monthly nurses have become acquainted with it, and I presume it is so divulgated throughout the land, that children suffering from the malady will very generally have the advantage of its application, if it be really advantageous, and this the more probably, since no reasonable objection can be found to the putting of it in practice.

I make these remarks, founding them upon letters I have received from gentlemen in the different States of the Union; from conversations, and from statements made to me by Medical Students on their arrival here, in the autumn, of cases treated by their instructors.

This explanation will show that I am warranted to say, that my invention has become extensively known, and is to a considerable extent understood and practised in this country; the more especially as it has been reported by many hundred Medical Students, that are now settled in the North, the South, the East, and the West.

The following is extracted from a letter to me dated Pittsburg, Dec. 7, 1838, from Dr. W. F. Irwin.

**Case.**—"The second item of information derived from your work is that in which you lay down the only rational explanation and mode of treatment for that formidable disease of infants, called 'morbuse cæruleus.' During a practice of twenty-five years, I have had about twelve cases. In one family I lost two cases in succession, with an interval of two years. In this family there appeared to be a singular tendency to the disease. From the mother's account, I should conclude that out of six deaths in her family, five must have died of morbus cæruleus. In deference to authority, I have generally pursued the plan recommended by the late Dr. Hosack, which may be seen in the Appendix to Thomas's Practice; and I must say that I was never satisfied with it, as it appeared to me to have no sort of adaptation to the then received pathology of the disease. In some cases, I have thought that a tepid salt-bath produced a beneficial change in the color of the skin, and in the respiration. In two cases, a tablespoonful of blood drawn from the cord seemed to have a good effect. In a case that occurred in August last—the child, which had been well for five or six days, suddenly changed color—had laborious and interrupted respiration at long intervals. I was sent for immediately, and ordered a warm salt-bath, in which the change of color from blue to the healthy tint was remarkably rapid. The attending physician came into the room while
I was engaged, gave some powders, and the infant died. In October last, I had a strongly-marked case in the afternoon at about six o'clock. As soon as the nurse announced the condition of the child, I had the washing suspended, and ordered the child to be placed on its right side, and to be left undisturbed until the following morning. At my visit next day, I found the infant healthy in every particular, and it has continued so until the present time. I have been so pleased with what I deem your philosophical mode of treatment, and its success in the above case, that I could not refrain from communicating the result."

On the 22d September, 1856, I superintended the birth of a well grown male child at term. It was badly cyanosed from the moment of its birth. The cyanosis did not arise from atelectasis of the lungs, for the infant cried aloud. It depended on open foramen ovale. I placed it on the right side, and it was left so for seven hours. When laid down it was blue as indigo, and when taken up was perfectly well, and is so now, which is Sept. 26th.

CASE.—I have before me a letter from Paul F. Eve, M. D., then Prof. of Surgery in the Medical College of Georgia, dated Augusta, Feb. 2, 1848. In this letter, Dr. Eve informs me that he was in attendance 22d Nov., 1847, upon Mrs. C., then affected with premature labor of an uncertain date of gestation. The child, a male, which was born after an easy travail, weighed between five and a half and six pounds. The testes were not yet in the scrotum. The respiration was at first carried on by sighs repeated once in five minutes. The child was once supposed to be dead, and given up as lost; but by breathing into the lungs it revived; and then, upon being laid upon its right side, where it was kept during four days, it perfectly recovered, and was healthy at the date of the letter. It was not dressed for three days. Every motion, for some time after its birth, would produce the cyanosis. Dr. Eve is inclined to believe it was six and a half months in the womb.

CASE.—Feb. 11, 1848. Mr. S. C.'s son, æt. 11 weeks. Very stout and healthy since his birth. Was vaccinated on the 3d instant, and has now a full-sized vesicle and areola; slept badly last night. This morning was much agitated and cried long—became blue as to the whole face—moaned for a long time. His mother supposed he "was going into a fit," and could not otherwise account for his strange appearance. (She has had six children.)

The child was crying when I arrived. The upper lip was very-
livid, and the countenance wore an air of distress. I laid it down upon its right side; it became quiet, and the livid areola vanished. I turned it on the left side, and the dark livor of the upper lip reappeared. Upon rolling it on the right side again the color disappeared, but returned when I replaced the infant on its left side. I gave it a teaspoonful of oil, with orders to lay it on the right side. Feb. 12th. Had a good night, and seems well to-day. In dressing it, the mother says, it became livid. She observed that it was on the left side, but upon turning it on the right it recovered, and has been well ever since. Jan. 3d, 1849, I believe this child has had no indisposition since the foregoing date.

CASE.—In March, 1848, I attended Mrs. G. T——, who was at the time delivered of a child at six months and ten days. It was deeply cyanosed for four days after its birth. The nurse kept it almost wholly reclined on its right side, and the infant, now about nine months old, presents a good prospect of a successful rearing of it. In this case, the child was certainly relieved when laid upon the right side.

CASE.—In the early part of the year 1848, I delivered Mrs.——, Thirteenth Street, of a foetus at six months. It breathed well at first, and uttered loud cries. But cyanosis came on the third day. I many times caused the livor to disappear by turning it on the right side, and made it return by rolling the child gently over to the left side, and vice versa, as often as I repeated the experiment. It died after some days. The foramen ovale was slightly open, and the lungs were partially affected with atelectasis.

CASE.—"Mrs. A. S——r was delivered on Tuesday, Jan. 11, 1848, at 7 P. M., of a male infant. Nothing peculiar transpired during the gestation or delivery. Parents healthy; mother quite lusty. Supposed weight of the child about eight pounds; it seemed of full age, healthy, and well to do. About 9 P. M., it seemed to have a violent attack of colic; cried violently. All attempts to pacify it were vain, until about midnight, when it became quiet, and was laid in bed behind the mother, where it remained until about 8 A. M. on Wednesday. At that time the mother awoke, and thinking it breathed strangely, asked the nurse to take it up, to see what was the matter. She did so, and observed that it was of a dark-purple hue; the breathing
seemed to cease; it was strongly convulsed, the fingers being clenched firmly against the palms of the hands.”

Dr. S. informs me that the child was now removed from the lying-in chamber in order that the mother, after she had been told it was dying, might not witness its last agony.

“Upon remaining so for some time, it gasped for breath, the purple discoloration faded from it, and the paroxysm was over. It remained quiet, without any motion whatever for about three hours, when the fit returned again; and again it did so, each paroxysm continuing longer and increasing in intensity until Thursday (the following day), between four and five P.M., at which time I first saw it. During this time it had seventeen attacks, the duration of the last one being over forty minutes. The attacks returned at intervals of a little more than an hour.

“Its appearance, when first seen, was as follows: It laid motionless upon a pillow in the nurse’s arms: pulse irritable; cheeks suffused with a scarlet flush; respiration short and quick (it seemed as if fever was present); dusky color of the skin, except the bright spot on the cheeks. Soon its face, then its body and limbs, became of a dark purple or nearly black color; respiration, a short gasp at long intervals, gradually increasing until it was altogether suspended for twenty minutes; pulse grew fainter and fainter, until it ceased at the wrist, and the heart only gave a heavy throb at long intervals. Gradually, the pulse became (again) perceptible at the wrist—the discoloration vanished, and the paroxysm was over.

“Though the parents and all present declared there was no use in attempting anything for its relief, they consented that a trial should be made. I had it laid in the position recommended by you in your course of lectures, and in your Phil. Prac. of Mid., upon the right side, at an angle of 30°, enjoining strict adherence to the position.

“From its flushed appearance, and the congestion seemingly present, I should have recommended leeches, had they been at command. I remained long enough for another paroxysm to have taken place, judging from the previous intervals, but it did not take place. During this time it attempted to cry, but made no sound whatever, though it seemed to cry violently. After this it passed some meconium, and took a little milk and water which it sucked from a rag placed in its mouth. I was told these were the first motions of the kind it had made for twenty-four hours. They had before poured some nourishment down its throat, but it appeared to bring on a fit, and they desisted. I saw it again the next morning. It had two returns of the disease: so very slight, however, as only to be observed by the face
becoming darker; but they continued only a few minutes. I should not forget to mention that, after each of these, perspiration ensued; slight attacks first, but after the second very copious.

“Pulse at this time appeared normal; respiration easy, but somewhat quick. I saw it again to-day. Has had no return of the paroxysm, and is in excellent health, with the exception of an occasional attack of colic.”

I beg the Student here to reflect upon the nature of the foetal circulation, and remember that it tends to undergo a constant change, from an early period of embryonal existence up to the time of the complete uterine development. For example, in the commencement, the embryo has no lung at all, and of course, all the blood of the right or pulmonic heart, passes over to the left or systemic heart, by means either of the foramen ovale or the ductus arteriosus. In proportion as the child approaches its viable age, its lungs become more and more fitted for their breathing office, and the pulmonary artery and veins acquire power to transfer larger and still larger quantities of blood through the lungs. As the pulmonary artery increases in power, the ductus arteriosus grows less, so as to be ready to transfer the whole of the work to the pulmonary artery as soon as the foetal lung, freed by the act of respiration from its foetal atelectasis, is also liberated from what might be perhaps properly denominated its atelectasis of pulmonary vessels, or vascular atelectasis.

Previous to its birth, the lungs of the child are solid—or rather the air-tubes of them are in a collapsed state—but, the descent of the diaphragm, and the expansion of the lungs, opens all those air-tubes to the atmosphere, down to their lowest cell. In the same manner, the pulmonary artery, with its branches, is at the same moment set free from its quasi collapse or atelectasis; and the blood of the right ventricle finds an easy escape by the pulmonary circulation; whereas, a major part of that blood had, antecedently, been accustomed to flow off by the ductus arteriosus. The blood of the right ventricle, in taking its new route to the lungs, does so, by virtue of a sudden increase of the diastolic power. Previously to the establishment of respiration, the ventricle could be said to expand for only one-half of the sum of the pulmonic circulation, since the foramen ovale had always, before, carried its moiety of the blood into the left auricle. The right auricle was, from the beginning, fully expanded in diastole; not so as to the right ventricle. It is a curious fact that, though the auricle was ab origine in full possession of diastolic power, the pulmonary artery, capillaries, and veins—as well as the pulmonic, ventricle, were left in a state of partial atelec-
tasis, from which they could be delivered only by the act of respiration, which at the same instant put an end to the fetal atelectasis pulmonum.

This sudden expansion of the thorax serves as the means of instantly converting the fetal characteristics into those of the respiring mammal; and when the conversion is plenary, or complete, the function may be said to be established.

It often happens, however, that instead of this complete establishment of the circulation, it is only partially effected, and the child fails to acquire the bright or florid tint that results from a full and perfect aeration of its blood. It remains in a torpid condition, and the hue of its skin is, perhaps, only less livid than it was when it depended for its aeration upon the placenta alone.

Many causes may serve to bring about this failure in the conversion. All those that act in such a way as to compel the blood, in part, to pass, as before birth, through the foramen ovale, can be cured by any method that shall be able to close the valve of the foramen ovale; and this is evident, because if the foramen ovale be shut by its valve, all the blood of the right auricle must pass beneath the tricuspid valves, and so by the right ventricle and pulmonary artery, to be aerated in the lungs.

The publications I have in various ways made of this doctrine have had the effect to institute far and wide in the land the knowledge of the method which I discovered, and which I humbly here claim to be my own. I do not believe that any physician ever thought of it or put it in practice before that occasion, which I have mentioned at page 727, to wit, in November, 1832. I look upon it as an important discovery, which, I have no doubt, has already saved, and will in future save many lives that could not by any other means be preserved.

Many persons have asserted that my explanation is erroneous, and that the lift of the valve of Botalli is not the cause of cyanosis, but that stricture or contraction of the orifice of the pulmonary artery is the cause, and that when the pulmonary artery cannot deliver with sufficient rapidity what it receives, the current is backed on the venous system, and so gives rise to the cyanotic hue and the other symptoms.

After carefully weighing these objections to my rationale, I am compelled to reject them, and hold fast to my own, not, I trust, from pride of opinion, or a wish to arrogate a vain and undeserved merit as a discoverer, but because I find, in my own rationale, encouragement to apply my method, while the other rationale gives no such
encouragement, and does not, indeed, offer a suggestion of treatment, but leaves us where we were before November, 1832.

I shall here set forth many other reasons that compel me to adhere to the views I have long maintained, and—

1. If the foramen ovale could remain after parturition of the same size as before the birth, the orifice of the pulmonary artery would also retain its embryonal or fetal diameter. Indeed, the pulmonic ventricle would continue in its state of partial ante partum atelectasis; for nobody, I think, will pretend that the heart dilates to compel the blood to enter as by a suction power, or exhaust-power. It is always dilated by the blood forced into it and distending its walls. But if half the blood flows off by the foramen ovale, it cannot receive, with the remainder, a quantity sufficient to compel a full diastole.

2. This condition serves to keep the foramen ovale open, the edge of the valve being driven off to the left by the stream.

3. If the valve be now shut down, the ventricle must yield, and make a complete diastole. Its contraction driving its contents through the orifice of the pulmonary artery serves as a dilator, and the stricture vanishes, sooner or later, under this dilating force. To shut down Botalli's valve, then, is to open the ventricle and its pulmonic orifice, while to constringe either the ventricle or the orifice is to lift the valve.

4. The difference between me and my objectors is simply this, that according to them, the pulmonic constriction causes the cyanosis, but the lift of the valve allows the constriction, according to my view.

5. In the cases I have cited at pp. 727 to 733, I have shown that my explanation gives a foundation of a successful method; and I am convinced that many hundreds of lives have already been preserved by it. If this be true, then, it ought to sustain my position, since so many children have been at once and completely rescued by closing the valve. If they were rescued, it could only be by the closure of the valve; and even if the cyanosis arose from the want of expansion of the ventricle, or of its pulmonic aperture, the close of the valve completed that expansion and cured the patients.

6. My objectors seem almost to lose sight of Botalli's valve in this discussion, and forget that it is a reality, and must have the function to close the foramen. Either it does this or it does nothing. If it does this in order to establish the pulmonary circulation, but sometimes fails to do its office, let us help it, or compel it to do its duty, by laying the child on the side to shut the valve down.

The disorder produced by these accidents used to be called morbus coeruleus, or blue disease, now known as cyanosis. Let us inquire
what is the real nature of this cyanosis, and the causes why it produces its peculiar symptoms.

The blood is either venous or arterial, or, as Bichat denominates it, black or red blood. The red blood of the arteries is transferred to the veins by the channels of the capillaries. It is in traversing the capillaries that the red blood deposits its oxygen, and so, when arrived on the venous segment of the circle, has become black. The capillaries may be regarded then as a sort of strainers or filters, whose office, in part, it is, to take oxygen out of the blood for the service of the tissues. Whenever the tissues are capable of taking oxygen from the capillary blood, the tissues in which capillaries exist have their normal hue or coloration; but if there be none, or an insufficient supply of oxygen, they become livid. Cyanosis, therefore, is not due to any backing of the venous circulation by a check received at the orifice of the pulmonary artery. Such backing would produce engorgement of a red, not of a cyanose hue. Cyanosis is black blood from want of aeration in the lungs, and not from backing of the current. Rokitanski is in error in maintaining his view of the backing up of the blood.

I maintain that cyanosis, as a disease, is essentially of the same nature as asphyxia.

But the question now recurs, as to what is asphyxia. In my opinion asphyxia, essentially considered, is black blood in the capillaries of the brain. Some physicians insist that asphyxia is black blood in the lungs. The lungs always contain black blood, which is reddened in the lung-capillaries; therefore I contend that asphyxia is black blood in the brain. Asphyxia is a state of the brain in which that organ cannot extricate, or give out the life-force—the innervative force—the stream or current of nervous force—the biotic force—and I contend that it fails to do so, for want of oxygen to react upon the neurine. Cyanosis is the sign of the presence within the brain-capillaries of non-oxygeniferous blood, which is dark or purple or black blood, as Bichat calls it. The purple, or dark hue of cyanosis, is caused by the presence of black blood only in the capillaries. But, when this dark hue of the cutaneous capillaries is seen, it is evidence of a similar hue of all the capillary blood, whether in the abdominal, the thoracic, or the cephalic cavities and organs. This purple state of the blood is not fatal, except it exist in the brain, whose power it suspends. If it be chased out of the brain, by oxygeniferous streams of arterial blood, all the organs and tissues that lie under the control and domination of the nervous system, immediately recover their power. If the brain dies, they all perish in its fall. If a man die, therefore, with asphyxia, he dies because he
has black blood in the brain, not because he has it in his leg or arm or skin.

A man may die from fainting, or lypothymia; and in this case he loses life, because the action of the brain is suspended. The suspension, in this instance, appears to me to depend upon lessened tension of the encephalic mass from the sudden withdrawal of a portion of the blood that ordinarily distends its vessels, as in sudden violent hemorrhage, in certain pathemata mentis, sudden changes of posture, &c. &c.; it is an anæmia of the brain.

Asphyxia is lessened or suspended somatic innervation from privation of the oxygen-reagent. Fainting is a similar suspension from reduced tension and pressure, or anæmia of the brain; either may be fatal; but each requires its appropriate treatment, which is different in each case. In a certain sense, therefore, fainting is asphyxia, or soon leads to it.

Asphyxia is not a status of the trunk or members; it is a status of the brain, and only of the brain. The livid hue is a result, or an incidence of the asphyxia.

If the vessels of the brain be injected by the carotids and vertebrals with carboniferous blood, the intellectual or perceptive, and the co-ordinating and motion-giving brains cease to do their office; if new injections fill these same vessels with oxygeniferous blood which chases out the former, the powers of the brain are reinstated, provided the mischief have not already gone too far.

A man etherized, or affected with chloroform, is, to a certain extent, asphyxiated, besides being poisoned; the same is true of him as of the well-digger, who descends into a well containing carbonic acid gas. The man in the well dies, not because his glottis is closed by spasm, as has been asserted, but because there is no oxygen in the well to be carried to the brain. It is indifferent to him whether his glottis be shut or open, since there is nothing to enter in that can do him good or harm; he dies from want of oxygen; and it may be, that the carbonic acid, if it enter his lungs, may do some mischief there; an indifferent mischief in the greater mischief.

I said that asphyxia is black blood in the brain—not in the sinuses and veins of the brain, but in the capillary part of the vascular system of the brain.

The greater part of the whole sum of the blood, variously computed to be about thirty pounds, exists in the systemic part of the vascular circle. Only a small portion of it is in the venous side. In the lungs, for example, where the pulmonary artery is a vein, and the pulmonary veins arteries, there is a great excess of the aërated, over the quantity
of carboniferous blood, for not only is the capillary system full, but
the venous system is full. But the carboniferous blood of the femoral,
of the iliac, of the portal vein, and the cava, produces no asphyxia;
nor is it true that, in death from carbonic acid inspired in a well, the
demise depends upon the presence of black blood in the trunk or
members; it depends upon its presence in the brain, particularly the
respiratory, oxygenating brain, whose pneumogastric branches, and all
other sources of respiratory innervation, are suspended and cut off
indeed, of their force, because their neurine is flooded with carbonife-
rous blood in which there is no power to extricate the biotic force—
the nervous force, or neurosity, as M. Cerise denominates it.

If it be true that there is a valve on the left side of the auricular
septum, it must be that its purpose is to prevent regurgitation of the
blood from left to right. It could have no other use or design.

Even in a case where greater power of the right auricle impels a
portion of the black blood through the valved orifice, any resistance
offered by the valve must tend to diminish or prevent the transit from
right to left.

If in any such cases, the plane of the septum auricularum be ren-
dered horizontal, by placing the child upon its right side, the blood of
the left auricle must tend to close the aperture by pressing the valve
down, and keeping it down. The blood has gravitation, and its law
of gravitation is as rigorous in the auricle as it would be in a cup, or
in the air. Its weight must shut the valve, or tend to shut it, if any
valve exist. But, with a shut valve, all the blood of the auricle must
pass to the right ventricle, and so to the lungs to be aerated. It cannot
pass the lungs without becoming aerated if the nervous power is
intact. But, if the blood becomes truly aerated, it becomes oxygeni-
erous, and, transferring the oxygen to the capillaries of the brain,
will there extricate the biotic force in a normal manner. All the
irregular and diseased innervations depending upon the antecedent
carboniferous quality of the blood in the encephalic capillaries must
vanish before the steady innervative streams that proceed from a
healthy brain, duly supplied with its quantum of oxygen.

There are many of my medical brethren who deny that my expla-
nation of cyanosis neonati is correct, or even philosophical; contending
that cyanosis is a status of the lung, or of the vessels of the heart,
bringing about a modality of the lung alone; or a backing of the
blood into the whole venous side of the circle, and a detaining of it
in the capillaries; while I aver that the condition of the lung, or of
the trunk and members, is nothing in the category, or rather a mere
accident, which relates, in fact, only to the state of the brain.
I am quite conscious that a man's opinion cannot determine the least of Nature's laws to operate this way or that; and St. Matthew tells us, "Neither shalt thou swear by thy head, because thou canst not make one hair white or black." While, therefore, one gentleman sees only in a contracted pulmonary artery, or in a transposition of vessels, a cause of cyanosis, I am not to expect that he will come over to my way of thinking, because I think thus or so, even had I the authority and power of the man of Pergamus, who ruled us for fifteen hundred years. I am, however, less concerned to witness the acceptation of my rationale, than the adoption of my precept. If they will turn the cyanosed neonatus upon its right side and shut down the auricular valve, I ought to be satisfied; and, indeed, my distinguished friend, Prof. Wood, recommends the practice, while he dispraises the principle upon which it is founded.

Nevertheless, I admit that I sincerely desire to find a reasonable acceptation of my rationale; less perhaps on account of its application to the undeniable self-demonstrating instances of blue disease, than to the treatment of certain obscure, and more questionable forms of the accident, which I shall now proceed to mention.

In order to explain my meaning more clearly, I shall relate cases that occurred to me a few years since, and upon which I put a construction that perhaps will not be admitted by those who oppose my rationale of cyanosis, either as to its mechanism or its real nature.

A lady had given birth to a child, apparently healthy. She was soon afterwards attacked with fever, which produced in her a series of distressing nervous symptoms. The young child, after many days, became indisposed with what seemed to be a bronchial catarrh, which was rebellious under the treatment. Dr. Bridges saw the child with me several times. It grew alarmingly ill. It was affected with a vast, troublesome collection of unexpectorated bronchial mucus, that threatened speedy suffocation by filling the air-tubes and trachea. Upon entering the apartment on one occasion, I found it in the arms of the monthly nurse, sorely oppressed and nearly insensible. It was dying—or rather, I deemed it dying.

My impression from inspecting the child was, that it was moribund; and I still believe that the condition was that of the moribund, and that its life could not have been protracted beyond one or two hours, but for remedies employed to rescue it.

After observing it for some time, and noticing a livid areola about its mouth, I took it from the nurse to inspect it more closely.

The precise processes of thought by which I arrived at a conclusive opinion, have now escaped me; but I was led to imagine that the
whole of the phenomena ought to be referred to a state primary in the brain, and not to a state primary in the bronchial mucous-membrane. I supposed that the sources of innervation becoming modified by the presence of carboniferous blood in the brain-capillaries, the organs had suffered in consequence of the cessation or the irregular action of the administrative power.

Upon cutting, in a surgical operation, certain branches of the trifacial nerve, the eye becomes instantly inflamed. Dr. J. Warren says that, under etherization, the conjunctiva is often injected with blood. The same thing occurs in asthenic fevers. So, in any hindrance of the current of the pneumogastric nerve-force, the lung might likewise become the seat of consecutive disorder. I was convinced that the child's foramen ovale admitted its venous blood to the systemic side of the circle thus vitiating the life power of the nervous mass of the child. I turned it on its right side, and kept it there. In a few moments it was relieved, and in a very short time gave no further reason for alarm, or concern of mind. In fact, the right lateral decubitus cured it, and that right speedily. This is a fact.

In the month of January, 1846, I attended Mrs. H, at the Indian Queen, South Fourth Street, in a confinement in which she gave birth to a healthy child.

As she was ill many days with a fever, I gave but little attention to the child. It was between two and three weeks old, when I was summoned to it by three rapidly repeated messages. I found it insensible; affected at intervals of one or two minutes with convulsions, in which the head rotated to the right in strong extension; the right arm, stiffened, was elevated as strongly as possible by spasmodic innervation of the deltoid and triceps, while the left arm, also stiffened, was pointed downwards and outwards. The inferior extremities were also affected with rigid spasm. The mouth was open, and could not be closed, but by force. The pulse was feeble, and the respiration low, except when troubled by the recurring spasm. Many persons surrounded the infant, which was lying on its back on a pillow, supported on the lap, and supposed to be nearly dead.

The child had been well but a short time before. The attack had been a sudden one.

Upon contemplating the infant, which had two or three attacks of this spasm or convolution while I was looking on it, I reasoned with myself as to the probable cause. There was no assignable hygienic causation.

Its mouth was bluish, though not in a very marked degree.

I took the child on its pillow, and laid it on my knees, in order the
better to inspect it. I reflected as follows: here is a faulty innervation of the muscles of the head, neck, arms, legs, and lower jaw; with suspended consciousness. Are the parts in fault, or is the brain in fault? Whence these irregular intromissions of nerve-force into the organs? Is the nervous mass imperfectly oxygenated because the child sends its carboniferous blood into the left auricle, and so to the brain? Let us try that point.

I laid it on its right side in the cradle, its trunk elevated at about 15°, and I said, "Leave it in this position until I return. Perhaps it will die very soon; but I have some reason to hope it may be saved, if you should not change its position. I shall be absent three hours. Do not venture to move it, until I come again." In the mean time while I remained, it changed its appearance speedily and visibly for the better; it had no return of the spasm. It fell into a calm sleep, and was perfectly well when it awoke. It required no further cure!

Was this a *post hoc*, and not a *propter hoc* cure? Who can say so? The treatment was reasoned beforehand, and the result looked for.

As well might it be said that every therapeutical cure by emetics, cathartics, or narcotics, or diuretics, is a *post hoc*, and not a *propter hoc* cure.

The blood in the auricle or ventricle is not exempt from the laws of matter; it gravitates as absolutely there as in a teacup, or in the air. When I lay a child upon its right side, gravitation of the blood is inevitable; and since the valve is as delicate as the arachnoid, and light as thistle-down, the smallest drop resting upon it could close, as the slightest force could open it.

In this case, I brought the plane of the septum auricularum to be a horizontal plane; I compelled the blood of the inferior cava to rise in a vertical current to the fossa ovalis, and thus lessened the power of Eustachi's valve, to direct it upon the fossa ovalis. When I shut the valve down by the weight of the superincumbent blood, all the blood of the right auricle passed through the iter ad ventriculum, in order to be breathed upon in the lungs. It is probable that half a dozen systoles of the heart had scarcely been effected, before the oxygeniferous streams had reached the neurine, and waking into orderly and healthful force, the before hebetized innervations of the child, all the dependent organisms and organs resumed their healthful movements and life-manifestations.

Nov. 20, 1847, I was called to the child of Mr. H——, in Pine Street below Eighth. This child, a female, was born in October, 1847, and was now six weeks old. Upon reaching the rendezvous, I was pained to find the infant dangerously ill with catarrho-pneumonia, so
far advanced, that I informed its mother it was probably too late for me to do it any good service.

The bronchial tubes and the trachea were oppressed with a great quantity of mucus, which so obstructed the respiration, that the child coughed at every breath, which was very scant, saccadée, and repeated sixty or seventy times per minute. Percussion and auscultation of the chest—careful examination of the abdomen—inquiries into the rate of the pulsations, both by feeling the radial pulse, and by auscultation of the heart, led me to the painful expectation that my friends were about to suffer the loss of their daughter. I prescribed for it, under a diagnosis of catarrho-pneumonia. Some hours afterwards I repeated my visit. It was no better.

Upon taking the child, which was on a pillow, and resting it on my knees in order to see it better, I found it in great danger of suffocation. Every breath was that compound of coughing and crying, which I cannot describe, but which every physician has observed. Upon inspecting it, I observed a livid areola about the mouth. The feet were bluish, as well as the finger-nails. It is true that such blueness might depend, and did in part depend, on the saburral state of the pulmonary mucous membrane—smeared as it was with mucus, and the tubes partly filled up. But, as the attack has been sudden—too sudden to be conformable to the normal march of such maladies, I reflected that the fault might not be primary in the respiratory mucous membrane, or pulmonary texture, but rather in the brain, which had lost its power of maintaining the status sanitatis in the lungs. I deposited the infant on its side, as for the treatment of cyanosis neonati. It seems to me that the valve of Botalli instantly fell down upon the foramen ovale, and that the carotid and vertebral injections of the brain immediately began to be thoroughly oxygeniferous. The administrative nervous mass commenced anew its government of its provinces, and, in a short time, the symptoms of the disease had vanished; I found, in the morning of Nov. 21, that no further treatment was necessary. I cured the broncho-pneumonia by shutting Botalli's valve, just as I should cure a conjunctivitis, by restoring the integrity of the trifacial branch cut off in a surgical operation on the face, and the loss of whose innervative current might have determined the conjunctival inflammation.

The objectors do not deny that the foetal circulation, up to the first act of respiration, is chiefly directed through the foramen ovale and the arterial duct, and that it is so indispensably, and only because the operculum is raised. They cannot deny that the aperture virtually
exists after birth, even for many days—nay, in some, during a long lifetime.

To deny that the two symmetrical halves of the heart may act asymmetrically and asynchronously, is to deny an admitted truth. To deny the effect of such dissidence in time and force appears to me to be but a mere denial.

I had many years ago charge of the health of a young woman, who labored under frequent attacks of cyanosis. She was often threatened with sudden death. In the intervals she appeared to be in good health, earning her bread by the needle.

One day, while much indisposed, she sat up in bed, eating a dinner of codfish. She suddenly fell on her side dead, in her 28th year. I found a foramen ovale, into which I could put a swan-quill.

In the heart of the Archduke Joseph, the cyanosis had coincided all his life long with an open foramen ovale.—See Gintrac, p. 228.

If in my own heart there be an aperture as large as the end of my finger, it is indifferent to me in respect of my health, while the two auricles contract symmetrically. But if asymmetrically, then I am liable to sudden illness, or even sudden death. My patient probably flooded her medulla oblongata with carboniferous blood, and ceased to breathe in consequence of the annihilation of that peculiar force that is evolved from the medulla.

How often have we seen similar states of the system brought about in attacks of puerperal eclampsia?

In this disease, an impetuous sanguine circulation gives rise to unmeasured, I had almost said explosive, evolutions of biotic force. In eclampsia, the spasm and convulsion of the whole system, and particularly of the diaphragm, which often, during the paroxysm, makes aspirations of only three or four cubic inches of air, allow the carboniferous streams to overflow the encephalon. Under this want of aeration, the face gathers blackness apace—the protruded tongue is of a deep purple, and a true asphyxia intervenes to save the life of the patient; so that the sooner the blackness of the features and tongue come to assure us of the arrest of the cerebral excitation, the sooner is the patient to be extricated from her perilous predicament.

If the medulla oblongata be overwhelmed with black blood she dies; sometimes this is the case, and she dies outright, no trace of lesion being discoverable in the brain.

Here we have no good and reliable sources of medication, save those that serve most rapidly and powerfully to diminish the momentum of the sanguine circulation in the encephalon, of which venesection is to be before all others preferred.
A proper venesection, executed before the asphyxia is established, in general prevents that consummation, by substituting a state of deliquium for the otherwise inevitable asphyxia of the eclampsic paroxysm; a far less dangerous and more speedy way of escape: less dangerous, since the sanguine engorgements and retardations coincident with the cyanosed state of the brain in eclampsia, expose the sufferer to inconvenient effusions or extravasation.

As to the right lateral decubitus for the new-born child in cyanosis, no doubt rests on my mind, after multiplied experience since 1832, now twenty-four years. I am not disappointed by finding the treatment sometimes unsuccessful, because, when it is so, I can with confidence believe that failure to change the blood is effected through some other agency than that of an open and used foramen ovale.

In the son of Mr. A. B——, I detected the existence of cyanosis neonati, and relieved the child, but could not cure it by my method. A series of diseased innervations, bringing the whole constitution into ill-health, continued to manifest themselves, notwithstanding all the precautions I could devise, and I announced, long before the death of the infant, which lived for several months, in addition to an open foramen ovale, the existence of an aperture in the septum ventriculorum, which was verified by the examination of its heart after its decease.

In a similar manner I announced in Mr. J. B——'s child, an open foramen ovale, as the cause of convulsive attacks which led at last to an effusion within the encephalon with separation of the sutures, and evident fluctuation, which opinion was verified necroscopically.

Professor Wood will bear me witness of the sudden and marked and indubitable relief and cure of Mr. H. W——'s infant, apparently dying with cyanosis, when it was placed in position.

In the eldest son of Mr. S. B——, jun., the respirations were but four to the minute; the pulse was gone, and the child within two or three minutes of its death, nay, deemed by some to have breathed its last. The recovery was almost instantaneous.

The same is true of Mr. H. K——'s son, with the exception that the case was not so extreme; so also of Mr. Rich's child, Mr. J. W——'s, and many others.

I beg leave to refer again to the letter from Prof. Eve, at p. 730, reciting a case of cyanosis treated by him. A letter from Dr. Casey, of Hartford, Conn., informs me of a violent case successfully treated by the position. Dr. Hains, of this city, and many others, have succeeded in like manner. Prof. Charles A. Lee, of Geneva College, informs me that the treatment is well known in Western New York.
I can by no means adopt the views as to the essential nature of the malady, set forth in Prof. Wood's late work on the Practice of Physic. That author, like others, appears to me to have mistaken the symptom, to wit, blue color for the disease, which, as I have so often said, is essentially a failure of innervation from absence of oxygen in the brain. He doubts the causation as dependent on the mixture of the two kinds of blood in the heart.

I cannot understand that the leg or arm should suddenly die for want of oxygeniferous blood; and I cannot perceive how the constitution can live, if the nervous mass, which is the essential Ens, be dead or inert, as it certainly is when only the carbonized blood of the veins circulates in its capillary vessels. M. Gintrac himself, who originally made four kinds or species of cyanosis—of which the first consists of the mélange du sang noir et du sang rouge, and the second a coloration bleue également constituée par ce mélange—comes to the true conclusion at last, that, instead of four species, there is but one, although he calls that one two.

Prof. Rokitansky, in his Patholog. Anatomy, vol. ii. Part I. p. 510, gives an article on cyanosis, in which he treats at large of the various kinds of that affection, whether as depending on faulty development of the heart, or on causes extrinsic as to that organ. He says: "A distinction is generally drawn between an organic disease of the heart acquired in the later periods of life, occasioned by disease of the lung, and that form of cyanosis dependent upon congenital malformation of the organ. The latter is called cardiac cyanosis. It will appear that the essential cause and character of both are the same. Cyanosis occurring in cases of congenital malformation of the heart has been mostly attributed to the mixture of the two kinds of blood, or rather to the passage of the venous blood into the arteries either by way of the ventricles, or the auricles, or the vessels themselves; but, it has been common to refer this commingling of the currents and the accompanying symptom of cyanosis to deficiency as to the septa of the heart. We are of the opinion that cyanosis always depends, not upon the mixture of the two kinds of blood, which is in many cases problematical, and in some takes place in a directly opposite direction to what is supposed, but on the impeded reflux of the venous blood into the heart, and a consequent habitual, or, in some instances, intermittent engorgement of the venous and capillary systems; and that herein all the varieties of cyanosis, however differing as to their original and acquired abnormal conditions of the heart and lungs, coincide, and may without violence be classed together."

I shall not here reproduce all M. Rokitansky's arguments and state-
ment of facts ingeniously brought to the support of this doctrine. I shall merely state that the opinions set forth in this chapter as to the consecutive nature or accidental nature of those contractions of the pulmonary and other orifices of the heart, appear to me undeniable, and that it is always reasonably to be expected that an uncurled attack of cyanosis neonati will lead to a constriction of the pulmonary artery, just as the free expansion of the pulmonary artery, after the first aspirations of the neonatus, leads to the abandonment of the ductus arteriosus and its early conversion into a ligamentum teres.

Should this page be at some future day honored by the regard of that distinguished writer, the author would beg leave to direct his attention to the events and phenomena that occur in those cases in which a sudden coagulation of blood fills the right auricle and ventricles with a clot that is moulded by the cavities which it fills. Many examples are to be met with of these coagulations, some of which prove instantly fatal, while others admit of the prolongation of an ineffectual struggle for life during a period of from one to twenty days, according to my own clinical observation.

Now in the instance of a cardiomorphous clot, as above proposed, the blood is most effectually detained in the venous side of the circle, far more so than can be pretended of the intermittent forms of cyanosis, of which M. Rokitansky speaks. Yet, as long as the patient continues to survive, he continues to thrust betwixt the outer superficies of the clot, or false polypus, and the inner walls of the auricle, tricuspid valve and ventricle, as well as the pulmonary artery, portions of blood that become thoroughly oxygenated in the lungs—for the respiratory effort is one of desperation—and the blood is probably charged to its very highest capacity with oxygen. It receives enough to maintain in the neurine the extrication of innervative force until the gradual augmentation of the clot cuts off the power of the circulation. In these cases the blue color, the cyanosis, the blausucht, is scarcely to be discovered, the patient being, on the contrary, ghastly pale and sunken. If this be a true representation, I am right in denying that cyanosis depends on backing the blood on to the venous segment; for such a heart-clot as I have seen, can obstruct the venous tide as effectually as a ligature cast around the cava and drawn almost tight could do.

If Prof. Rokitansky and Prof. Wood's views are just, then we ought to have in the case of the pre-enanthasial clot the most striking example of the cyanosed state, for, when the heart becomes thus tamponed with a cardiomorphous coagulum, the whole of the venous side of the circle is stopped, and the black blood backed into the capillaries. A small endocardial clot must have the same power to produce me-
chanical obstruction as contraction of the pulmonary artery; a large one is equivalent to a ligation of the cava.

I deny not that a constriction of the pulmonary artery may produce cyanosis. Whatever restricts the action of the venous heart must do so. Great collections of fluid in the thorax produce it. Pressure upon the heart from dropsy of the pericardium; extensive injuries of the lungs from tubercular degeneration; suppurations, and large vomicae; cyananche-trachealis, or pseudo-membranous laryngitis; pneumothorax; atelectasis pulmonum; a host, indeed, of accidents and diseases that ruin or disable the respiratory machinery, may produce cyanosis. But of these I have not spoken. I confine my observations and my method to the persistent use of the foramen ovale after birth, a case in which the blood of the veins takes the course originally followed by that of the placenta.

There is no other treatment for cyanosis neonati than that I have suggested; at least, there is no other reasonable treatment. Vene-section, emetics, purgatives, diuretics, soporifics, baths, counter-irritants, cannot cure it.

When cyanosis has introduced epiphenomenal affections they may be treated. These affections will be found to relate chiefly to a state of the pulmonary circulation and excretions.

In some instances, I have applied a large leech or two to the region of the heart, in order, haply, to assist in overcoming the pulmonary or cardiac engorgement, so apt to coincide with failure or disorder of the biotic power of the medulla oblongata. In general, however, when the malady has depended on the injection through Botalli's foramen, I have been content to place the infant in the proper position, and trust to that alone for the cure.