Asphyxia Neonatorum: Causation and Treatment.

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This is a subject of daily interest to the general practitioner, of special interest to the obstetrician; it is acquiring importance in the eyes of the alienist and pediatrician, and to the general hygienist its consideration has become of great moment.

The highest mortality that befalls the human race in one day occurs on the day of birth. Schultze [1] estimates that five per cent. of children are still-born, dying during labor, and one and a half per cent. die shortly after birth, the result of the trauma of labor. Brothers [2] said that in New York City, in the four years 1889 to 1892, over 16,000 children were born dead or died immediately after birth. I believe these figures are not too large. It is said that the most important period of the life of a human being is the time spent in utero. The most trying ordeal a human being sustains is the ordeal of birth.

The fetus receiving food and oxygen from the mother while in the uterus is suddenly made dependent on outer conditions for these necessities. While during the short period of labor the absence of food will have no influence, the withdrawal of oxygen becomes of immediate and serious moment to the fetus.

Many children die in the first days because too little food is taken or it is not assimilated, but as many more die during labor because of the interruption of the respiratory function -- die of asphyxia.
It is a fact that can be clinically attested daily that during the uterine contraction -- the labor pain -- the heart-tones of the fetus sink in frequency and force. During a long pain the beats may become very few or even inaudible. While this in part is due to the muscular sound of the uterus interfering with the transmission of the fetal heart-beats, one can notice as the pain passes off a rapid return to the normal frequency and force. After the rupture of the bag of waters this effect of the pain is much intensified. This action of the uterine contraction on the heart has been long known and is constant. The circulation of the blood in the placenta is interfered with as a result of the compression of the uterine contents, the interchange of gases between the fetal and maternal blood is stopped, the absence of oxygen in the fetal blood irritates the vagus -- the pneumogastric nerve -- and the heart is therefore slowed. Experiments on dogs show this; by interrupting the respiration of the dog put in a state of apnoea by artificial respiration with the bellows, the heart is slowed.

Toward the end of the second stage the heart-tones are much diminished by the pains, and during the passage of the head through the vulva they may be sixty per minute. This is due to the great compression of the placenta, especially marked after the rupture of the bag of waters; to the beginning separation of the placenta, which normally occurs at the end of the second stage of labor; and to a certain extent to compression of the brain. We have here the common cause of asphyxia. Too frequent and powerful labor pains, prolonged, with short intervals of relaxation, are very dangerous to fetal life. Very striking in this regard is the bad effect of ergot. This drug lengthens the pains, lessens the intervals, and increases the force of the uterine contraction; it sometimes even produces tetanus uteri, under which fetal life is quickly extinguished. The same dangers menace the fetus when from too frequent manipulation or attempts at delivery the pains assume a tetanic character.

Since in cases of suffocation of the pregnant woman the fetus dies first because the mother abstracts oxygen from the fetal circulation, this and other conditions in the mother -- as anemia, acute and chronic, heart and lung disease, asphyxiation by gas and so forth -- are dangerous for the child. It is this that makes the prognosis bad for children delivered by Caesarian section from women who die slowly. After the sudden death of the mother the fetus may live fifteen minutes, and if promptly extracted may recover. Only six per cent. of the hitherto reported cases have lived.

Premature separation of the placenta normally implanted may happen during pregnancy, and then is almost always fatal to the child; or it may occur near the end of the second stage of labor, when the child may be born alive. The death of the second twin in utero is often caused by too early separation of the common placenta. Besides the signs of asphyxiation shown by the fetus, external hemorrhage in the interval between the births gives warning of the danger. Separation of the placenta when it is praevia, or compression of the forelying placenta by the breech, or colpeurynter used to stop hemorrhage, causes asphyxia. When the placenta is torn by manipulation anemia is added to the asphyxia, and these are further aggravated by the anemia of the mother -- all of which explain the high fetal mortality in placenta praevia.

All those conditions which cause a compression of the cord will obviously cause asphyxia, and in degree and rapidity according to the degree and suddenness of the compression. Prolapsed cord comes first in order of frequency. When the cord is coiled around the neck or any part of the child the danger is great.
from compression or tension [3] of the cord, or compression of the vessels of the neck, and in the latter instance the tip of the forceps may directly compress the cord. This point deserves special emphasis and sounds the warning to carefully auscultate the heart-tones during forceps delivery. In breech cases the funis may be compressed between the trunk and the passages, but here compression of the placenta by the relatively hard head has something to do with the asphyxia.

Finally compression of the brain brings about asphyxia. During the passage of the head through the vulva the slowing of the fetal heart is observed and is due partly to this cause. When the head is being forced into a contracted pelvis by strong pains, or when the head is compressed in the blades of the forceps, even in easy deliveries a marked slowing of the pulse can be noted. This is due to irritation of the pneumogastric [vagus nerve]; as a result of the slowed circulation the fetal blood becomes venous and a state of asphyxia is inaugurated. In some cases of brain compression the acting cause is so slow that the fetus dies without making any attempt at respiration in the uterus. A fracture of the skull or an intracranial hemorrhage brings the same result; but should the injury involve the medulla the effect is worse, usually soon fatal. It is remarkable how in these cases, while the respiratory center is paralyzed, the heart will continue beating as long as oxygen is supplied by artificial respiration.

While a fetus in the state of apnoea does not respond with respiratory efforts to external stimuli, I have felt these motions on introducing the hand to do a version, and have seen respiratory motions follow traction on the foot in footling cases. Anesthetics have been said to cause asphyxia, but extended experience with them in both obstetric and surgical degrees has not demonstrated this.

The Treatment. -- Paramount in importance is the recognition of asphyxia beginning while the child is still in utero, and fortunately this is almost always possible. The cases are very few where accurate information regarding the condition of the child cannot be obtained. One of the first signs of fetal danger is the decrease in the number of the heart-beats. A steady slowing to one hundred per minute, and certainly if below this, points to impending fetal danger. In some cases there is an increase in the number to 160 or more. This usually comes on after the diminution has been pronounced and betokens impending death from paralysis of the vagus. It may be primary, however, and then should be accorded the same significance as slowed heart's action. Irregularity of the heart-tones occurring in the intervals between pains is also of significance, and impurity of the first sound of the fetal heart carries important information to the experienced ear.

The second diagnostic sign is the passage of meconium. In breech cases this is of little value unless the breech is high up, and in the other presentations the sign should be accorded significance only when the meconium is fresh. It may easily happen that a transient asphyxia has caused the fetus to lose its meconium, which may have occurred weeks before. Liquor amnii stained with old meconium is olive green in color, appears more watery, and the meconium is thoroughly mixed with it. Fresh meconium is dark green, is lumpy, and is not thoroughly mixed with the liquor amnii. Healthy fetuses have passed meconium during labor. I once saw meconium come from the mouth and nose of a child as the face escaped over the perineum. Quinine is said to cause its discharge into the liquor amnii. Where the meconium is passed as a result of asphyxia it is brought about, not by paralysis of the sphincter ani, but
by a hyperperistalsis caused by the deoxygenated condition of the blood, and is analogous to the involuntary bowel-movements so often observed in death by drowning, strangling, etc.

In obstructed labors the passage of meconium may long precede the slowing of the pulse, and thus is a valuable sign of beginning danger. Until the discovery of the heart-tones this was the only means possessed by the obstetrician to determine the condition of the child.

Another sign, but one that shows that the asphyxia has already become serious, is feeling, seeing, or hearing respiratory movements made by the child. Where the breech is delivered one often sees the gasps made by the child. After podalic version the foot is sometimes seen to move with the respiratory action. In one case the effect of fetal hiccough was thus observed. [4] During a forceps delivery I once felt and saw the shoulders above the pubis move in inspiration and expiration. One of the early signs of asphyxia may be undue violent movements on the part of the child, felt by the mother and attendant. Ordinarily the child is quiescent during labor.

As everywhere else in medicine, but particularly in obstetrics, prevention plays the most important rôle, and by it one can accomplish much more than by treatment. One should recognize the causes of asphyxia and avoid them. The bag of waters should not be ruptured unnecessarily. While it is in the main true that the fetus is in no danger of asphyxia in an intact sac, I have seen cases where the heart-tones gave warning of fetal danger before the escape of the waters. Upon rupturing the membranes meconium escaped, and the fetus was delivered asphyxiated. Still these cases are few.

Ergot should not be given till after the placenta has been expelled. In spite of the many pages that have been written against the use of ergot during labor, it is still used, particularly by midwives, to the destruction of many women and children. No attempt should be made to hasten normal labor. The necessary manipulations in many ways jeopardize the child. Particularly in breech and footling cases should premature attempts at delivery be avoided. The extraction begun before the cervix is fully dilated is usually complicated by the stripping of the arms above the head, and the delay caused in bringing them down is likely to be fatal. [5]

Watch the heart-tones throughout the labor, especially toward the end of the second stage and in all delayed labors. In operative deliveries be ready to treat asphyxia neonatorum -- that is, have hot water, hot towels, a bath, and the necessary instruments near at hand.

When you have diagnosed asphyxia beginning in utero the child must be delivered as rapidly as possible consistent with the safety of the mother. Should the delivery be difficult the heart-tones should be watched carefully, and should the fetal heart cease beating before the delivery is accomplished embryotomy is to be performed.

When a child is born apparently dead it is of instant importance to determine whether the asphyxia be mild or severe. In mild asphyxia -- asphyxia livida -- the child is rigid, blue, with turgid lips, slight exophthalmos, and makes a few attempts at respiration, but the mucus in the passages prevents air from
entering the alveoli. A finger in the throat provokes a reaction, and the heart beats strongly. In severe asphyxia -- asphyxia pallida -- the child is limp, the extremities hang down, the surface is pale except the lips, the jaw falls or is jerked by an occasional gasp, the throat does not react to the finger, the heart beats faintly or is only perceptible to the ear. These are not different forms of the asphyxia, but different degrees.

It is true that anemia of the fetus and compression or hemorrhage into the brain present symptoms similar to those of asphyxia pallida, but the treatment is the same since these conditions can usually not be surely diagnosed. I have seen a case of morphine poisoning in a child born of an eclamptic mother to whom large doses of the narcotic had been given.

There are three grand principles governing the treatment of asphyxia neonatorum: first, maintain the body heat; second, free the air passages from obstructions; third, stimulate respiration, or supply air to the lungs for oxygenation of the blood.

The importance of keeping the baby warm is not generally appreciated. The infant is wet, exposure is often prolonged, evaporation is rapid, the body temperature sinks rapidly. This is very depressing; indeed, it has occasionally happened that an infant wrapped up and put away as dead has recovered by the influence of warmth alone. Therefore the baby should be wrapped in warm towels or put in a warm full bath.

At the same time the air passages must be cleared. It is fruitless to attempt to resuscitate a baby when the trachea, bronchi, and sometimes the alveoli are full of amniotic fluid, meconium, blood, or vaginal secretions. These must be removed before any attempt is made to bring air into the lungs; otherwise the foreign substances would be forced still farther down and give rise to atelectasis, pneumonia, and sepsis.

In the mildest cases it is sufficient to wipe the throat with the little finger covered with the corner of a soft towel while the child is held up by the ankles. This also excites cough, and the mucus is expelled. Attention is to be called to the statement of a recent German observer [6] that there forms normally in the glottis some mucus which is expelled after the birth of the child, but which when sucked into the trachea may suffocate it. In a forensic light this acquires some importance.

In the more severe cases -- asphyxia livida -- the deeper passages must be cleared, and this is best done by means of a soft woven catheter open at the end, No. 14 French. This little instrument ought to be found in the satchel of every obstetrical attendant. With a little practise its use becomes easy. The index finger of the left hand pulls the epiglottis forward and comes to touch the arytenoid cartilages. The catheter is then passed along the finger, the end is pulled against the posterior surface of the epiglottis with the finger, and is then pushed into the trachea with a gentle twisting motion of the right hand. A slight suck draws the contents of the trachea into the tube, it is withdrawn, and the mucus blown out on a towel. This is repeated until the passages are clear.

In asphyxia livida this is almost always sufficient, the irritation of the throat eliciting respirations. If
these are slow in coming a brisk rubbing of the back with a warm towel or in a hot bath will stimulate them. Slapping on the back, cold water on the chest, the cold plunge-bath, are almost never necessary, and the latter two are distinctly harmful.

In the severest cases -- asphyxia pallida -- the diagnostic criterion of which is the absence of reaction in the throat, this simple treatment does not suffice. One must waste no time with trying the skin reflexes, but immediately after the air passages are cleared artificial respiration must be begun. Of all the methods of artificial respiration only three have proven of service in my hands -- rhythmical compression of the chest, the Schultze swingings, and mouth-to-mouth insufflation with the tracheal catheter.

The child is held suspended by the ankles, the forehead resting lightly on a table so as to deflex the chin, and with the other hand the chest is gently squeezed anteriorly and posteriorly, with sudden relaxation of the pressure. This may be repeated twenty times a minute and kept up a short time, but should the heart's action be weak I believe there is no method that gives as quick and permanent results on both the heart and lungs as the swingings of Schultze properly carried out. This method helps to clear the alveoli, relieves the congestion in the lungs, stimulates the heart, and is also a strong external irritant. The child is grasped with the thumbs over the front of the chest, the index fingers in each axilla, the three other fingers of the hand distributed over the back. The head is held steady by pressure with the wrists. Planting the feet firmly, wide apart, the child is slowly swung up over the head so that its feet fall downward. This is expiration, and often foreign bodies are emptied from the air passages. No the child is swung out, forward, and then down between the legs, letting the motion begin and end very evenly and gently. An audible inspiration must accompany this movement. The child is now put in a hot bath or wrapped in a warm towel to watch the effects. The heart is felt to beat powerfully, and a gasp usually rewards the effort. If the air passages are clear, which can be determined by the sound of the gasp and the movement of the thorax, do nothing but supply heat to the babe and wait. If another gasp succeeds this is additional reason for waiting; if not, and the heart grows weaker, the process may be repeated. It is rare that more than six swingings are needed.

Mouth to mouth insufflation may be practised with the catheter after the passages are clear. The catheter is inserted into the trachea, the operator fills his lungs and mouth with air, and applying the lips to the catheter, with the glottis closed, the air in the mouth, pure and warm, is forced gently by action of the cheeks into the lungs. Compression of the chest causes the air to escape; and this may be repeated twenty times a minute. The advantage of this method is that it may be long kept up, which cannot be done with the swinging.

There are many other methods and maneuvers. Some are: Laborde's rhythmical tractions of the tongue, dilatation of the spincter ani, electricity to the phrenic nerve; Prochownik's, Byrd's, Marshall Hall's, and Sylvester's methods of artificial respiration, of which four the last is the best and may be used to succeed those given above. My experience has been that in the mild cases they succeed as do the simple methods I have been given, but in the severe cases they are inefficient and do harm by the time consumed in replacing more successful methods of resuscitation.
Asphyxiated children, and children delivered by severe operative procedures, should always be watched for the first hours and days after labor; their lungs not seldom fill up and cause secondary asphyxia (Marshall Hall). Such children are often found dead in their cribs. Or they may never have cried vigorously, whining pitifully until death, when a more or less extensive atelectasis pulmonum is found. These children are much more subject to icterus and sepsis, particularly the intestinal and bronchial forms. Unless they can have mother's milk they often die simply from exhaustion -- from "weak life" as the Germans say.

It is thus evident that the duties of the medical attendant are by no means at an end upon the successful completion of an operative labor.

Footnotes


