Resuscitation of the Asphyxiated New-Born

ALBERT MATHIEU, M.D.
AND
ALBERT HOLMAN, M.D.
PORTLAND, ORE.

Reprinted from The Journal of the American Medical Association
June 8, 1929, Vol. 92, pp. 1917 and 1918

COPYRIGHT, 1929
AMERICAN MEDICAL ASSOCIATION
535 NORTH DEARBORN STREET
CHICAGO

Reprinted from The Journal of the American Medical Association
June 8, 1929, Vol. 92, pp. 1917 and 1918

RESUSCITATION OF THE ASPHYXIATED NEW-BORN *

ALBERT MATHIEU, M.D.
AND
ALBERT HOLMAN, M.D.
PORTLAND, ORE.

A recital of the methods of resuscitation of the asphyxiated new-born in vogue at present sounds like a chapter from "Mother India." Nowhere in present-day medicine can one see such antiquated, unscientific and haphazard procedures as those practiced in the attempt to induce the new-born child to take its first breath.

The constantly repeated dictum that childbirth is a normal physiologic function has led to the belief that any method of resuscitation practiced by animals or by the ancients should suffice in the case of the human offspring. We hold that, in most places, attempts at resuscitation as practiced in present-day obstetrics are either futile gestures or actual deterrents that defeat their own purpose, and we insist that beating, slapping and manhandling a delicate human body in its first fifteen minutes of life is not only needless but, indeed, extremely harmful. Dashing a new-born infant into ice-water, swinging it through the air, or crushing its head against its symphysis can do nothing more than lower the baby's body heat, rupture a viscus or blood vessel, or entail other severe injury. The babies who have lived after having been subjected to present-day methods of resuscitation have not been saved by these methods; they have lived in spite of such treatment, and the percentage of living babies would be greater had they been left entirely alone.

In studying the available statistics, we find that in postmortem examinations of the new-born who were living at birth, 20 per cent had atelectasis as a cause of death without any other demonstrable pathologic

* Read before the Portland Society of Obstetricians and Gynecologists, Sept. 26, 1928.

condition. It is not unreasonable to suppose that of this number a large percentage would have been amenable to a proper means of artificial respiration provided there were no other lesions responsible for the baby's failure to survive. In asphyxia, shock is a predominating factor and may of itself be the chief cause of the cerebral ischemia directly contributing to the condition, or of the increased threshold of response on the part of the respiratory center which prevents these babies from responding to that external stimulation which is physiologically adequate for the majority.

Henderson [1] says:

> After birth the infant breathes in response to the same stimulus and by the same mechanism as those which the modern physiology of respiration has shown obtained in adults, in children, and in all mammalian animals. In all these, and in the infant no less, the maintenance and regulation of breathing depend on the carbon dioxide brought to the respiratory center in the blood. Oxygen is requisite if the center itself is to be maintained in normal condition, and if the tissues are to produce carbon dioxide, for deprivation of oxygen necessarily decreases the production of carbon dioxide. But the center may be quite normal and also quite inactive in the presence of ample oxygen if the blood is deficient in carbon dioxide. If the center has become inactive, or if its activity is subnormal, there is one, and only one, stimulus that will both restore and maintain normal activity: an increase of carbon dioxide in the blood. . . . It is as certain as anything in the whole range of modern science that respiration is under a chemical control by the more or less direct action of the arterial blood, chiefly through its content of carbon dioxide, on the respiratory center in the brain. It has been proved also that oxygen is not a stimulant, a fact which clinicians seem to find extremely hard to appreciate. . . . Asphyxia is usually thought of as a condition of oxygen deficiency and excess of carbon dioxide. This is a misconception; asphyxia usually, as in the typical condition of carbon monoxide poisoning, involves both low oxygen and low carbon dioxide content in the blood and tissues. . . . It is the carbon dioxide carried by the blood from the tissues to the brain that is the physiologic stimulant to respiration. When the center is depressed, it requires more than the normal amount of this stimulant to induce activity.

Henderson advises the use of 5 per cent carbon dioxide in oxygen for resuscitation of the new-born, with the gas made available to the infant by means of

1. Henderson, Yandell: Prevention and Treatment of Asphyxia in New-Born, J. A. M. A. **90:** 583 (Feb. 25) 1928.

a tank and face mask. This arrangement is satisfactory for resuscitation of adults but lacks practicability when applied to the new-born. Its impracticability is anatomic and economic. In the adult, the larynx and trachea are firm structures formed by cartilage and supported by bone, their lumens remaining patent when subjected to stress because of the rigid formation of their supporting framework. In the infant, the larynx and trachea are weak structures and easily collapsible; their shape is maintained by cartilaginous tissue as yet not ossified, and positive pressure in the pharynx and esophagus easily collapses them, obliterating the patency of their lumens and causing a physiologic obstruction which prevents air or gas from entering the bronchi. Any force of gas not applied directly into the larynx would be likely to cause the opening to collapse and allow the gas to pass into the larger and more easily entered esophagus. The economic impracticability of having a gas tank and a mask at each accouchement is obvious.

For this reason, with Henderson's observations as a basis, in the new-born at least, some more practical device is necessary to place the mixture of carbon dioxide and oxygen where it may be used by the infant, in order to overcome the collapsibility of the embryonic larynx and trachea, and to prevent the gas from going into the stomach. This device should be simple, cheap, easy to keep in order and easily accessible at all times. The tracheal catheter meets all of these requirements.

Expired air contains nitrogen 79, oxygen 16.02, and carbon dioxide 4.38 per cent—sufficient oxygen and carbon dioxide to meet the needs of the asphyxiated infant. By means of the tracheal catheter all mucus, blood and amniotic fluid can be withdrawn from the mouth, pharynx and larynx before resuscitation is attempted. After the air passages are freed from foreign material, the gas to be used for resuscitation (expired breath of the operator) can be placed at a location in the child's body where it will be readily available for use. Positive pressure here is of value, as it is delivered into the trachea and inflates the lungs; the air is warm and helps to maintain the body temperature.

The tracheal catheter is used with a glass saliva-trap at the lips of the operator. The trap is so constructed that any mucus or fluid withdrawn from the child is

kept from the mouth of the operator and any droplets of saliva are prevented from being forced into the respiratory apparatus of the child.

TECHNIC

As soon as the baby's head is born it is our custom to remove with the finger any débris from the mouth, and to milk the trachea, so that the first inspiration will not draw foreign material into the lungs. After the body is born, before the cord is clamped or cut, the child is suspended by its feet, the trachea and larynx are again milked gently toward the mouth, and the finger is again inserted to withdraw any material forced from the trachea into the buccal cavity. When the airway is apparently free from obstruction, the baby is placed on its right side and the cord is clamped and cut. No external stimulation is used except the gentle wiping of the blood and amniotic fluid from the baby's body. If the baby soon starts attempts at respiration without evidence of obstruction in the air passages, all is well, and as soon as the respirations are rhythmic it is handed to the nurse to be placed in its crib. If after a short time, however, the baby does not make any attempts at respiration, or if the attempts at respiration are evidenced by marked retraction at the costal margins without lessening of the cyanosis, the child is placed in a warm blanket on a suitable table and the tracheal catheter is used to remove mucus and fluid from the buccal cavity and the throat. It is then inserted into the larynx and trachea to withdraw any obstructing material and to administer carbon dioxide and oxygen as a respiratory stimulus.

Introduction of the catheter is a procedure which, if done gently, is comparatively simple and lends itself easily to expertness. We have been able to teach interns and supervising nurses to do the intubations. P. J. Flagg [2] uses an electric lighted tongue depressor and visualizes the opening into the larynx before the intubation. We have found this also unpractical and unnecessary.

The baby, wrapped in a warm blanket, is placed with its head over the edge of a table. The head is steadied by an assistant. After sterile water has been drawn

2. Flagg, P. J.: Treatment of Asphyxia in New-Born, J. A. M. A. **91**: 788 (Sept. 15) 1928.

into the catheter to prove its patency, the index finger of the right hand depresses the tongue and at its base locates the tiny slit that is the opening into the larynx. The small fiber catheter is inserted with the left hand, so that its tip eventually finds itself beneath the end of the finger at the small slit opening into the larynx. Then, by slight depression of the tip of the catheter with the index finger of the right hand, the catheter readily finds its way into the opening of the larynx. The position of the catheter can be easily proved by advancing the finger of the right hand slightly into the esophagus. The catheter is inserted 3 or 4 cm. farther, and suction is made to extract mucus from the larynx and upper trachea. (We have on three occasions removed pieces of mucus from 2 to 3 cm. in diameter). The catheter [3] is then removed and cleared by blowing through it. The catheter is again inserted into the trachea and artificial respiration is started. This technic has long been advised by De Lee.[4]

Before the application of the respiratory stimulant is described, a brief consideration of the physiologic condition to be overcome is in order. The lungs are in a state of atelectasis, a condition in which there has been no inflation of the pulmonary tissues; the alveoli are collapsed, and the bronchi and small bronchioles have their walls in a state of physiologic adhesion. The first impulse through the catheter should be gentle and of small volume. As the tidal air in the respiration of the average new-born child is only 45 cc., the first inflation through the catheter should be not more than from 10 to 15 cc. and the subsequent ones gradually increased. This calls for nicety of judgment on the part of the operator and is the only part of the maneuver in which there is likelihood of doing gross harm to the infant. In the new-born infant, the respiration is at first diaphragmatic because of the weakness of the intercostal muscles and the horizontal position of the ribs. Breathing is shallow, because in a recumbent position the abdominal viscera press firmly against the diaphragm; hence, it is approximately from 40 to 45 inspirations a minute. There is no pause between inspiration and expiration or between expiration and inspiration. Bearing these facts in mind, the

3. The catheter and trap are made by V. Mueller & Co., Chicago.
4. De Lee: Textbook of Obstetrics, Philadelphia, W. B. Saunders Company, p. 850.

operator should puff, very gently, into the catheter through the trap about forty times a minute in order to simulate as closely as possible the normal respiration of the new-born. The force to be used would, with the lips pursed to whistle, be felt on the wet finger about 3½ to 4 inches (9 or 10 cm.) from the mouth, or would be about the same force one would use in blowing small smoke rings.

Negligence in maintaining the baby's body heat is undoubtedly the cause of some failures. A basin of warm water or soft warmed blankets are adequate.

The effort at resuscitation should be continued as long as the heart beats, and may be supplemented with three minimum doses of solution of pituitary and epinephrine.

After the establishment of regular respiration, the child should be kept warm and observed closely for several hours in order to guard against any subsequent respiratory failure. One should not hesitate to repeat the maneuver should respiratory failure recur.

The tracheal catheter is not a panacea which will overcome failure of a baby to breathe because of cerebral injury or ischemia, or of congenital anomalies. It is a method, however, that will, if used intelligently, aid in the establishment of regular respiration in infants with atelectasis.

Contrary to several expressed opinions, the insertion and use of the tracheal catheter is simple and easy of performance. It is not the formidable procedure commonly supposed, and any person who is capable of conducting an accouchement should be able to use the tracheal catheter in the manner described.

545 Medical Arts Building.

Copyright, 1929
American Medical Association, 535 N. Dearborn St., Chicago