# ANESTHETIC AND POSTANESTHETIC RESPIRATORY PROBLEMS IN AN INFANT OPERATED ON FOR TRACHEO-ESOPHAGEAL FISTULA (CASE REPORT)

W. H. Cassels, M.D.,* and Helen E. Yeager, M.D.*

*Chicago, Illinois*

A full term infant weighing 3,800 Gm. was delivered spontaneously in this hospital. Labor had lasted for fifteen hours and the second stage was prolonged. Hydramnios was the only apparent complication. Because the baby did not respond immediately after delivery, a tracheal catheter was introduced and a large amount of thick viscid material removed. In the succeeding twelve hours it was necessary to aspirate material from the pharynx repeatedly, and a tracheal catheter for suction was passed again several hours after birth because of cyanosis and rales throughout the lungs. Because the persistence of large amounts of fluid in the tracheo-bronchial tree suggested the diagnosis of atresia of the esophagus and tracheo-esophageal fistula, the child received no feedings by mouth. The diagnosis was confirmed by roentgenologic examination with a radio-opaque catheter in the esophagus which was stopped at the level of the second thoracic interspace. No lipiodol or other radio-opaque fluid was used in confirmation of the diagnosis. A transpleural operation for repair of the anomaly was decided on and the child was brought to the operating room at the age of thirty hours. At this time he had only moderate cyanosis of face and body but the extremities were extremely cyanotic. His mental responses seemed about normal.

The question of intubation was discussed with the surgeon and it was agreed that in spite of the hazard of causing laryngeal edema an endotracheal technic should be used.

Anesthesia was begun with open drop ether but the baby very soon became cyanotic. The open drop method was discontinued and ether was administered with oxygen by open technic until anesthesia was established. Fifteen minutes after the induction was started, a number 00 Magill endotracheal tube was inserted under direct vision.

Anesthesia was continued with the open method. The baby was turned on the right side and the operation commenced twenty-eight minutes after induction was started. The baby's condition remained good for twenty minutes. At this time the pleura was opened after which marked cyanosis and gasping inadequate respirations rapidly

* From the University of Illinois Research and Educational Hospitals, Chicago, Illinois.

developed. Apparatus already prepared for the administration of intermittent positive pressure was immediately attached and oxygen and ether administered by artificial respiration. The color rapidly improved.

The apparatus used may be described as follows. The oxygen and ether were delivered into the tail of a 2-liter breathing bag. The other end of the bag was attached to a piece of small rubber tubing about 2 inches long which fitted over the tip of the endotracheal tube. A tight fit was provided by wrapping the end of the endotracheal tube with several layers of adhesive before inserting it. A large hole had been cut in the 2 inch length of tubing which provided for a free escape of the atmosphere. When positive pressure was applied, the anesthetist's thumb was lightly pressed over this opening and used as a valve.

It was difficult to carry out artificial respiration at the rate of the baby's own breathing. The anesthetist felt afterwards that the artificial respiration had been too slow and perhaps too much pressure had been used. About an hour after artificial respiration was started, it was stopped for one minute while a tube was passed into the esophagus. The baby became very cyanotic and it took three minutes of artificial respiration to restore normal color. After about two hours of operation the baby became progressively more cyanotic and the lungs failed to expand adequately when positive pressure was used. The heart rate became slow. The endotracheal tube was removed and was found to be plugged with thick bloody secretion, and at the open end these secretions had dried and hardened. A fresh tube was inserted, artificial respiration resumed and the patient's color immediately improved. Again, just before the end of the three-hour operation the color became poor and it was difficult to inflate the lungs. The surgeon was asked to hurry the closure, and immediately after the dressings were applied the tube was removed and found to be plugged again. Another tube was inserted but this one was too short to connect with the breathing apparatus. Mouth to tube respiration was used until one of the original tubes was cleaned, after which it was inserted and the lungs inflated with oxygen. The color improved. Ten minutes after the operation was completed the endotracheal tube was removed. A small airway was inserted and oxygen administered. The total time of anesthesia was three and a half hours. The operation had consisted of closure of a tracheo-esophageal fistula and anastomosis of the esophagus in the area where there had been atresia.

The baby appeared to be in fairly good condition and was returned to the ward. He was put in an oxygen tent but this did not prove satisfactory because it was difficult to give him attention and watch him adequately. Two hours postoperatively he was removed from the tent and oxygen was administered by airway. Three and a half hours later the baby was not in good condition. The left chest was not

expanding. He was turned on his right side in an effort to expand the left chest. He rapidly became cyanotic and stopped breathing. Intubation was performed and artificial respiration instituted with the same apparatus used during anesthesia. Occasional inflation of the lungs by artificial respiration seemed to help.

After the endotracheal tube had been in for fifty minutes it was removed. Fifteen minutes later the breathing became shallow, the baby became cyanotic and respirations stopped. Again the endotracheal tube was inserted, artificial respiration with oxygen was used and normal respirations were resumed. The breathing apparatus was left attached so that the baby would receive 100 per cent oxygen.

During the next forty-nine hours of the baby's life, the endotracheal tube was left in constantly except that it was changed from time to time. Including the intubations in the operating room, intubation was carried out twelve times. The tube was left in place to permit occasional artificial respiration, which seemed to help the child. There was no evidence of respiratory obstruction.

Twice during the child's postoperative course the heart stopped but activity was restored by artificial respiration. On four other occasions the heart stopped and failed to respond to artificial respiration, but activity was restored by injection of epinephrine into the heart. It was noticeable that the child's tolerance to oxygen want progressively diminished. For instance, when the endotracheal tube was changed on the last few occasions, the heart action slowed or ceased.

On one occasion it was decided to try helium-oxygen (80–20) to determine whether this mixture would facilitate inflation of the lungs. After about two minutes of administration the baby became very cyanotic and the heart stopped. This was one of the occasions when epinephrine was used to restore activity. When the heart stopped on the final occasion, artificial respiration was used but no effort made to restore activity with epinephrine. Death occurred fifty-six hours after operation.

During the postoperative period there was very little evidence of cerebral activity. Occasionally the baby moved his arms or opened his eyes and sometimes he had a wink reflex but otherwise there was no evidence of conscious behavior. With all the periods of anoxia which he suffered it would seem almost inevitable that there would be serious cerebral damage. Throughout the baby's postoperative course, one of the four surgical interns was with him constantly. All intubations were done by the anesthetist.

The autopsy findings of interest were:

1. Recent anastomosis of esophagus for congenital atresia and tracheobronchial fistula with a defect at one point in the anastomosis. Microscopic examination showed intact mucosa but varying degrees of hemorrhage and necrosis in the thinned muscularis layers around the anastomosis.

2. Atelectasis of the lung. At autopsy the lungs were found to be partially expanded in both pleural cavities. In the left lung (the lung retracted during the operation through the left pleural space) only one small area had the light pink appearance of usual aeration. In other portions the lung was subcrepitant in consistency and sections cut from these areas all sank when placed in water. The microscopic examination of lung sections showed the walls in practically all of the sections to be thicker than normal, and although in a few instances this was due to a minor degree of congestion, in most instances the thickening was of typical fetal appearance. In one section there was evidence of torn alveolar walls.

3. The larynx was patent but the glottis had an annular configuration as a result of the presence of the intubation tube. On microscopic examination of sections through the cords at the site where the tube passed into the larynx, the squamous epithelium of the cord was found to be completely necrotic and on the denuded surface there was a mixture of fibrin, clumps of bacteria and scattered inflammatory cells which extended into the deeper tissues.

4. Early fibrinous pleuritis with early hemorrhagic effusion.

5. Early fibrinous mediastinitis.

6. Small amount of clotted blood in the pericardial sac.

7. Horseshoe kidney.

8. No gross or microscopic changes in the brain.

## COMMENT

This case presents many points of interest.

1. The difficulty with the open drop ether induction is a matter we have noted on previous occasions with very young infants, and seems to be relieved by changing to open oxygen carrying ether vapor. It was not caused by obstruction but by respiratory depression. Possibly the tendency to irregular breathing during induction leads to oxygen want and depression of the respiratory center. This is particularly likely when there is some congenital atelectasis. When a high oxygen atmosphere is administered, moderate irregularities in breathing do not lead to oxygen want.

2. The cyanosis and gasping respirations which developed immediately after the pleura was opened were probably the result of poor aeration of the lungs, especially in view of the congenital atelectasis. If means of providing constant artificial respiration throughout the operation had not been immediately available, the child would probably have died very quickly. Later, a one minute interruption of artificial respiration produced an alarming degree of oxygen want. The use of an endotracheal tube seemed justified since it made the artificial respiration efficient.

3. There was no evidence of laryngeal edema seven hours after

operation in spite of the use of the tube throughout the operation and the repeated intubations. Subsequent to this time the tube was in place constantly except when it was being changed. After intubation for a total period of fifty-three and one-half hours there was definite microscopic evidence of serious damage to the vocal cords. It would seem that a tracheotomy would have been indicated when it was found that the child could not survive without some artificial access to the tracheobronchial tree. A tracheotomy, although adding certain hazards, would have given all the advantages of the endotracheal tube plus better opportunity for aspiration of tracheobronchial secretions, and would have avoided the danger of damage to the larynx.

4. Six cardiac arrests with resuscitation in a period of about forty-eight hours would seem to be something of a record.

5. Cerebral damage due to anoxia must surely have occurred. The child's lack of spontaneous activity postoperatively would support this conclusion. The lack of evidence of cerebral damage at necropsy was probably due to the fact that time had not permitted the changes to become demonstrable.

6. Apparently some emphysema was caused by artificial respiration. Greater care should have been exercised in regard to the amount of pressure used.

7. Microscopic studies of the lungs demonstrated considerable fetal atelectasis. No doubt, additional areas of atelectasis developed postoperatively. This would seem to account partly for the progressive intolerance to oxygen want which was so evident in the postoperative course.

## SUMMARY

A thirty-hour-old infant was operated on for tracheobronchial fistula. He was anesthetized with ether and an endotracheal tube inserted. Artificial respiration was required to maintain oxygenation after the pleura was opened. Postoperatively, oxygen want and respiratory failure threatened repeatedly. An endotracheal tube was used to permit occasional artificial respiration and continuous oxygen administration. Total intubation time was fifty-three and one-half hours. The tube was inserted twelve times. On six occasions the heart stopped but was restored to activity, twice by artificial respiration and four times by intracardiac injection of epinephrine. Death occurred fifty-six hours after operation. Among other autopsy findings were extensive atelectasis (mostly congenital) and serious damage to the vocal cords.