

And What About The Baby? Virginia Apgar and the Apgar Score

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Newborn babies were often neglected in the delivery room until the Apgar Score was introduced in 1952 by anesthesiologist Virginia Apgar, M.D., (1909-1974). The Apgar Score was developed to determine which babies needed resuscitation but also led to many studies of possible factors causing poor neonatal outcome. So, the Apgar Score laid the groundwork for modern neonatology and our current practice of obstetric anesthesia. This article briefly reviews the pivotal studies and the many changes in practice which resulted from the Apgar Score.

A previous *ASA NEWSLETTER* article documented Dr. Apgar's life.¹ Briefly, she graduated from Columbia University's College of Physicians and Surgeons in 1933, started anesthesia training in 1936 and became Chief of the Division of Anesthesia at Columbia in 1938. After she established medical anesthesia at Columbia, research became a critical issue. Researcher-anesthesiologist E.M. Papper, M.D., came from Bellevue in 1949 as Division Chief, and Dr. Apgar entered obstetric anesthesia.

Dr. Apgar entered obstetric anesthesia at the right time and in the right place. At that time, obstetric anesthesia was a very neglected area. There were not enough anesthesiologists to meet obstetrical needs. Few, if any, residencies required training in obstetric anesthesia. Little was written on obstetric anesthesia so there was a great need. Apgar's location in New York City was also fortuitous. From 1915 through 1933, maternal mortality in the United States was among the worst in the world, and New York City was at the center of efforts to improve this. The 1933 report by a Subcommittee on Maternal Mortality of the New York Academy of Medicine was especially influential. Columbia's obstetricians were deeply involved in the subcommittee and the report.² Although the study was



Dr. Virginia Apgar with Dr. L. Stanley James in a delivery room.

over by the time Dr. Apgar went into obstetric anesthesia, the atmosphere at Columbia's Sloane Hospital for Women had to be one of concern for improving maternal mortality from all causes.

Once Dr. Apgar entered obstetric anesthesia in 1949, anesthesia residents began rotating in obstetrics. Apgar would teach informally at the bedside or in the hallway in her enthusiastic, outgoing teaching style. Teaching tools were a battered pelvis, a skeleton and Dr. Apgar's own anatomy. Palpating her caudal canal, which had an unusual angle, was standard. There were few reading assignments because there was little to read. No didactic teaching took place until 1958 when Frank Moya, M.D., who had rotated with Dr. Apgar in 1955, became head of obstetric anesthesia.

During this time, obstetric anesthesia practice at Columbia was spinal anesthesia or cyclopropane ("cyclo") by mask for cesarean sections. Caudals were occasionally used for labor. Saddle blocks, caudals and mask cyclo were used for vaginal delivery. Curtis L. Mendelson had published his report on aspiration of gastric contents in pregnant patients in 1946, and Dr. Apgar realized the risk of aspiration. She and most anesthesiologists of the time, however, felt that the airway could be managed adequately by competent anesthesiologists using cyclopropane, even if the patient was vomiting. It took another 10 years before intubation was common.³

The idea for the Apgar Score came in 1949 at breakfast in the hospital cafeteria. A medical student rotating in



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anesthesia made a chance remark about the need to evaluate the newborn. Dr. Apgar said, "That's easy, you would do it like this." She grabbed the nearest piece of paper, jotted down the five points of the Apgar Score and then rushed off to OB to try it out. The Apgar Score was presented at an International Anesthesia Research Society meeting in 1952 and published in 1953.⁴ Dr. Apgar originally intended that measurement be done one minute after birth to see how the infant was making the transition to extrauterine life. Others started measuring it at longer intervals to see how the baby had responded to resuscitation, and the one- and five-minute Apgar Scores became standard.¹ She also intended that it be measured by the anesthesiologist or circulating nurse. She felt the obstetrician always gave 10s and so should not score.

Ever curious and always dreaming up new projects, which she called "arbeits," Dr. Apgar identified other neonatal problems. She developed a test using a suction catheter to rule out choanal atresia, tracheo-esophageal fistula, duodenal atresia and imperforate anus soon after birth. This led to her observation that polyhydramnios was usually associated with congenital defects. This association was documented for the first time in a 1960 article.^{4,5}

Dr. Apgar was joined in 1955 by a New Zealand pediatrician, L. Stanley James, M.D. Their first project was to study acid-base and oxygenation in normal and asphyxiated

newborns, with laboratory support from researcher-anesthesiologist Duncan A. Holaday, M.D. He had developed a more precise method to measure blood pH. (The Astrup pH meter was not available until 1960.) Dr. James said:

*"People were astounded at how low the (pH) values were. The newborn infant had a metabolic acidosis as well as respiratory acidosis ... people did not even believe you could have both together! Of course you have both of them together in asphyxia! But those were the days when we were just finding that out. And we realized that all of these babies at birth were asphyxiated. No one had appreciated that before. The cord blood at birth was regarded as the normal intra-uterine environment, (so) it was concluded that there was no need to correct this state, as it was normal for the fetus. There was (also) a strong belief in the protection offered by anaerobic metabolism. Our observations played a major role in changing our approach to acid-base and how well we should be oxygenating."*⁶

Other studies followed. Their placental transfusion study led to important observations. One study baby was born screaming, then received placental blood and promptly stopped breathing. The mother was getting cyclopropane, and they realized it had to be the effect of the cyclopropane.⁶ Further studies on the effect of maternal anesthetics clearly demonstrated that cyclopropane was more depressant to the baby than other anesthetics. These led to the end of cyclo in obstetrics and also documented for the first time that regional anesthesia is safest for mother and baby.^{7,8}

The placental transfusion study also led to our present use of umbilical artery catheterization in neonates. Dr. James wanted to measure venous pressure in relation to placental transfusion. He said:

"We decided we would like to see what happened to the venous pressure at 24 hours. So we recatheterized some infants after the first day. The cord is somewhat dry at that time, and Virginia was poking around trying to locate the umbilical vein. Finally she inserted the catheter. I was recording. My god! The pressure went off the paper. It was just jumping off of the ceiling! I said, 'You are in the aorta!' And she said, 'Nonsense! Of course I'm not!' She pulled out the catheter and there was a great gush of blood. So we got the first recording ever of an umbilical artery catheterization. We demonstrated these tracings when vis-



Dr. Virginia Apgar teaching caudal anesthesia technique at Sloane Hospital.

iting the neonatology group in Boston. Shortly after we had made these observations, the Boston group used the method for monitoring sick babies and we followed shortly after that. But there was a great deal of resistance from the pediatricians and cardiologists.”⁶

Infant resuscitation was poorly understood, and many bizarre methods were used, as indicated by Dr. James’ description:

“In 1955, *half* the world believed that the only thing you needed to do to resuscitate a baby was to give him intragastric oxygen. We proved that intragastric oxygen was not effective. (We) taught (proper) techniques. Virginia took me along to the meetings of a special committee on Infant Mortality of the New York County Medical Society. We set out to review all resuscitation procedures. A monograph was prepared and published by the American Medical Association (AMA). Then we had an AMA convention in New York. We had a whole booth on resuscitation. Several hundred physicians went through to learn how to use the laryngoscope. Then we made the movie (on newborn resuscitation, sponsored by a drug company and widely circulated nationally).”⁶

These educational efforts led to improvement in infant resuscitation throughout the country.

In 1959, Dr. Apgar became Director of the new Division of Congenital Defects at the March of Dimes National Foundation. Her legacy lives on, however. Previous residents Frank Moya, M.D., and Sol M. Shnider, M.D., went on to become leaders in obstetric anesthesia. Every day, clinicians throughout the world use concepts developed from the research team’s work. For example, “depressed babies are acidotic and hypoxic and should be resuscitat-

ed.” “neonatal resuscitation should include airway management, including tracheal intubation” and “regional anesthesia is safest for mothers and babies” were all concepts developed by Dr. Apgar and her team. The effectiveness, simplicity and low cost of Dr. Apgar’s standard evaluation of the newborn and her check for common congenital defects are other examples of this legacy. Dr. Apgar received many awards for her work, including the ASA Distinguished Service Award in 1966.

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