‘Pediatric cardiac anesthesia in its infancy!’

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Introduction: Since the first successful repair of a congenital cardiovascular lesion by Robert Gross in 1938, pediatric cardiac anesthesia has advanced tremendously. A wide choice of anesthetic agents and monitoring techniques are available to the pediatric cardiac anesthesiologist today. The following is a tribute to those pioneering anesthesiologists who have contributed their expertise to the development of this field at a time when no such resources were in their armamentarium.

History: In 1945, Merel Harmel and Austin Lamont, anesthesiologists at the Johns Hopkins Hospital, Baltimore provided the anesthetic care for Alfred Blalock and Helen Taussig's palliative procedure for Tetralogy of Fallot. Their experience with 103 anesthetics in 100 patients undergoing the shunt operation is discussed in their 1946 article. Their patients ranged from 10 weeks to 20 years in age and had congenital pulmonic stenosis or atresia as part of the Tetralogy. As in today's pediatric anesthesia practice, pre-anesthetic assessment was given great importance; this involved the anesthesiologist trying to gain the child's confidence and introducing the face-mask as a 'toy' before it was encountered at induction. Morphine and atropine were the commonest premedicants. Painful procedures like venous cannulation were done after induction to avoid distressing the child and precipitating a 'spell'.

Anesthetic Techniques: While cyclopropane was the common induction agent, 'vinethene’ (divinyl ether) and nitrous oxide were used too. The airway was secured with an endotracheal tube in all but 6 cases. Harmel and Lamont tried the Ayre's T-piece for ventilation (Dr.Philip Ayre, 1938), but found the anesthetic depth to vary considerably. Anesthesia was maintained with cyclopropane in 56 cases, ether in 15 and both in 32 cases. The technique of 'controlled respiration' was used (use of muscle relaxants not specified). In order to provide a quiet operative field, phrenic nerve blockade with procaine was considered. A Foregger apparatus equipped with a water manometer set to blow off at 8-12 cm of water pressure was used as a safety valve during controlled respiration, though 'one's eyes and sensitivity of hands were employed as a safer guide'. Thus, most of the monitoring was done based on observed clinical signs alone. The Van Slyke technique of arterial blood gas analysis was used in some patients.

Complications: Tachycardia, hypertension and irregular respiration occurred commonly, to which hypercarbia could have been partly contributory. Myocardial depression appeared to be the commonest serious complication with cyclopropane and ether. Coramine (nikethamide) was injected into the heart or superior vena cava of 11 patients in response to a weak pulse, though the effects were inconsistent. Digitalis was used to treat pulmonary edema accompanying cardiac failure. Attempts at pre-operative normovolemic hemodilution with plasma resulted in one death due to cardiac failure, possibly due to a reaction to the injected plasma. Glucose or saline were used as fluids, though glucose was much preferred.
A suction catheter was not left in the pleural cavity in any patient beyond the intra-operative period. Usual practice was to gradually reduce the high concentration of oxygen in the inspired gases to that in room air, usually by the addition of nitrous-oxide during closure, or with helium at the end. The majority of patients were conscious enough to cry or obey commands before transfer from the operating room.

Outcomes: 23 out of the 100 patients died. The operation duration had no influence on mortality rate. Fewer children died following anesthesia with cyclopopropane only. Half of the patients had evidence of a hemothorax, 33 of whom underwent thoracenteses. 11 amongst these 33 patients had a hemo-pneumothorax. Tension pneumothorax occurred on 5 occasions, three of which resulted in death. The positive pressures used during ventilation were thought to be partly responsible for this.

Conclusion: The ground-breaking work of pioneers such as Harmel and Lamont has set the stage for the current advanced practice of pediatric cardiac anesthesia.

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