

order to insure the best possible airway. Two lively infants in close proximity could have greatly hampered the procedure of intubation. This was avoided by careful premedication. As soon as one twin was intubated, anesthesia was slowly and carefully induced in her. Then the twins were turned 180 degrees, and the procedure was repeated on the other one. (There did not seem to be any "spill over" of anesthesia, clinically, from one twin to the other.) After both twins were intubated and had quieted from the induction, they were placed on a specially designed table in the operating room.

The second consideration was that of maintaining adequate ventilation. Because of the light plane of anesthesia maintained, assisted ventilation was not deemed necessary, and the twins breathed spontaneously throughout operation. This was confirmed by the clinical observation of good chest expansion, good color of the skin, and stability of the pulse. Because of the severe limitation of space, small Ayres Y tubes were connected directly to the endotracheal tubes (12 and 14 French, Cole) and were supplied by extra long hoses from the anesthetic machines. Since electrocautery was used, and the distance from the Ayres Y tubes to the surgical field was short, a nonexplosive anesthesia technique was mandatory. Venesections were done on both infants the day before operation, and the patients were maintained on small amounts of intravenous one per cent sodium thiopental, together with nitrous oxide, 5 liters, and oxygen, 2 liters, per minute. Additional doses of sodium thiopental were not administered until the infants became so active as to prevent good ventilation by breath-holding and was done only after other causes of irregular respiration, such as position of endotracheal tube, were ruled out. Movement of their extremities, which was observed throughout the procedure, was not considered an indication for deepening the anesthesia.

It is interesting to note that in spite of the extensive anatomical connection, there seemed to be an indication of physiologically separate circulations. In support of this suggestion are the facts that the twins were given premedication at different times and responded individually and that one twin was given nitrous oxide with a soporific result while the other twin remained awake and vigorous.

The third problem was one of maintaining correct fluid balance, electrolyte pattern, and blood volume throughout operation for both infants. The twins were well nourished, and blood electrolytes were within normal range preoperatively. Oral feedings were restricted throughout the night before surgery, but an adequate level of hydration was maintained with intravenous fluids (mostly 5 per cent dextrose in water). During operation, blood was replaced in measured amounts by means of a 10-cc. syringe, with a graduated 50-cc. buret reservoir as a check. Virtually no fluids other than blood was given during operation, but this deficiency was corrected gradually postoperatively. A weighed sponge count was made, and hematocrit readings were taken at regular short intervals. The infants' respirations, pulse rates, body temperatures, and hematocrit determinations remained within desirable limits during and after both stages of the operation.

The twins are doing well three months postoperatively. The dural grafts took well, and except for a slight wound infection one week postoperatively, there have been no serious complications.

The authors wish to thank Dr. Maitland Baldwin, who performed the surgical procedures on the twins, for his assistance in the preparation of this paper and for permission to use the photographs of the patients.

CASE REPORT: ANESTHESIA FOR A PROLONGED OPERATION

Lts. John R. Jones and Thomas B. Clay, Jr., and Lt. Comm. William H. Schwab, United States Naval Hospital at Portsmouth, report an operation lasting twenty-four and one-half hours. As part of the management of the patient, they used Arfonad to prevent hypertension and maintain blood pressure at normal levels during the period that the thoracic aorta was clamped.

The patient was a 35-year-old man (weight—182 pounds, height—6 feet, 3 inches). Three years before the present hospitalization he had fallen a distance of 20 feet, striking

his left anterior chest wall. A chest roentgenogram in 1952 demonstrated a mass in the left upper mediastinum. A repeat film in May 1955 showed the same mass, and subsequent study led to the diagnosis of a traumatic aneurysm of the aortic arch.

The proposed operative procedure was excision of the aneurysm and replacement with a freeze-dried aortic graft. A temporary shunt from the left subclavian artery to the aorta below the aneurysm was then made, utilizing two pig aortas. The aneurysm was then removed and a reconstituted homologous aortic graft was inserted. The temporary shunt was then removed and the incision closed. Details of the operative procedure may be found in a previous report (Storey, C. F., Nardi, G. L., and Sewell, W. H.: *Ann. Surg.* 144: 69, 1956).

On June 9, 1955, the patient received pentobarbital sodium, 100 mg., at 6:30 a.m., and morphine sulphate, 15 mg., with scopolamine, 0.6 mg., at 7:00 a.m. Anesthesia was induced at 7:40 a.m., with fractional doses of thiopental sodium and *d*-tubocurarine. Anesthesia was maintained through an endotracheal catheter during the succeeding twenty-four and one-half hours with nitrous oxide (3 liters per minute) and oxygen (2 liters per minute) with partial rebreathing and soda lime absorption. This was supplemented with a total of 4 Gm. of thiopental sodium, 99 mg. of *d*-tubocurarine, and 24 mg. of morphine sulphate including the induction dosages. Respiration was assisted or controlled throughout the procedure by manual pressure on the rebreathing bag of the anesthetic machine. The lungs were periodically inflated. The soda lime was changed midway through the procedure. Thirty-two pints of whole blood were given through two large needles as replacement for the continuous loss of blood from the many adhesions and dense scar tissue. There was no rapid loss at any time. Eight grams of calcium gluconate were used to counteract the possible untoward action of the citrate in the blood. Total fluids included 2,000 cc. of 5 per cent dextrose in water in addition to the blood.

An indwelling catheter was inserted at the end of twelve hours and 1,300 cc. of clear urine was obtained. An additional 1,200 cc. was collected during the second twelve and one-half hour period.

The preoperative blood pressure was 120/80, with a pulse rate of 90 per minute. The blood pressure ranged from 120/80 to 140/90, and the pulse rate from 70 to 90 per minute, for the first twelve hours during the dissection and isolation of the aneurysm. The application of clamps to the great vessels in the thorax ordinarily causes a sharp rise in the blood pressure in vessels proximal to the clamps. In anticipation of the need to counteract hypertension with the resultant danger of cerebral hemorrhage, several drops of a 0.1 per cent solution of Arfonad were administered to note the patient's reaction to the ganglionic blocking agent. His systolic pressure dropped from 150 to 80 mm. of mercury, while the pulse rose to 160 beats per minute. Both blood pressure and pulse returned to pretrial levels in ten minutes. It was decided that the change in the pulse indicated inadequate blood replacement. Therefore, one additional pint of blood was administered rapidly, following which another trial of Arfonad was given. This time the pulse rate rose to 130 beats per minute.

When the clamps were applied to the aorta just proximal to the left subclavian artery, the blood pressure in the right arm rose to 190 to 200 mm. of mercury, systolic. The Arfonad was then allowed to drip at a rate which lowered the blood pressure to 140 mm. of mercury and maintained it at this level. The Arfonad was discontinued approximately ten minutes before the removal of the clamps in order to eliminate the possibility of a severe hypotension at that time. As a result of this precaution the systolic pressure never fell below 100 mm. of mercury. A total of 1.0 Gm. of Arfonad was used at intervals for the remainder of the procedure. The patient's pupils became large and fixed to light following the use of Arfonad, and remained so for several hours after he regained consciousness.

The patient was taken to the recovery room at 8:15 a.m. on the following day, twenty-four and one-half hours after the procedure was begun. Curare antagonists, analeptics and vasopressors were not utilized at any time during or following the procedure. He left the operating room with a blood pressure of 120/80, a pulse rate of 64 beats per minute, and a respiratory volume estimated at 500 to 600 cc. per breath. During ten

hours in the recovery room, his blood pressure was between 100/60 and 110/60, with a pulse rate of approximately 60 beats per minute and a respiratory rate of 20 to 30 per minute with an adequate tidal volume. He had marked edema of the face, conjunctiva, and arms as a result of his position on the operating table. This edema disappeared during the first four hours postoperatively.

The patient's rectal temperature at the time of admission to the recovery room was 93.6 F. This marked temperature reduction was attributed in part to the heat lost from the open chest in an operating room, the temperature of which was 68 F. Another important cooling effect was the administration of cold blood in an amount equal to almost three times his total circulating blood volume. After two hours in the recovery room, his rectal temperature was 94 F. and at the end of ten hours it had risen to 99 F., although no external heat was applied.

The patient moved his extremities in one hour, and he was extubated three hours postoperatively. He spontaneously opened his eyes at that time. Seven hours postoperatively he responded to his name and was aware of his surroundings. After nine hours he talked to his wife.

Eight hours postoperatively the hemoglobin was 12.5 Gm. and the hematocrit reading was 41 per cent in contrast to preoperative values of 12 Gm. and 40 per cent, respectively. The hemoglobin and hematocrit reading remained approximately at these levels until the patient was discharged.

The urine became positive for bile on the third postoperative day and remained so for five days. A slight jaundice appeared on the second to fifth postoperative day and gradually cleared. His only complaint was hoarseness owing to the surgical interruption of the left recurrent laryngeal nerve which was necessary because it was incorporated in the scar tissue around the aneurysm. The patient returned to full duty in four months.