PENTOTHAL ANESTHESIA IN INFANTS AND CHILDREN

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MANY anesthesiologists consider intravenous pentothal sodium anesthesia to be contraindicated in children. Antipathy towards the agent arose with the early practice of using it in large doses and high concentrations. Since the limits of physiologic balance in infants and children during anesthesia are so narrow, only small deviations from the normal can be tolerated for any length of time.[1] The overwhelming quantities of pentothal which were introduced directly into the circulation produced prompt respiratory and subsequent circulatory collapse. A few catastrophies tended to discourage further clinical trial.

When small calculated amounts of pentothal are used in conjunction with a few precautionary measures, this agent not only affords safe anesthesia[2] but offers a technic which decreases operating time by permitting electrocoagulation and allows the anesthetist to be remotely placed from the patient. These factors are particularly advantageous during neurosurgical procedures and surgery of the head and neck.

METHOD

The infant or child is intubated under ether anesthesia by the open drop method. In the average child a combination of morphine and atropine sulfate according to age and weight is sufficient premedication. In the excitable child, supplementary agents such as pentobarbital or rectal pentothal may be required for sedation to avoid the psychic trauma of ether induction. To force an anesthesia mask upon the face of a terrified child is cruel, especially when such action can be easily avoided by adequate premedication.

In early third plane of surgical anesthesia, an oro-tracheal tube is inserted into the trachea at least 2 cm. beyond the larynx. The tube should be carefully selected because, if too large, it produces postoperative laryngeal edema, and if too small, it deprives the anesthetist of adequate control of the respiratory system by leakage and prevents use of positive pressure breathing.

The small larynx of the newborn child will accept an 18 fr. endotracheal catheter. For older children, a larger size is selected which approaches the size of the laryngeal introitus but does not produce unnecessary pressure upon the vocal cords. For a child one year of age a 20 fr. endotracheal tube is usually selected and for a child six years of age a 24 fr.

The trachea of a newborn infant is 4 cm. in length[3] (Tables 1 and 2). By inserting an endotracheal catheter 2 cm., the tip will lie midway between the

Table 1

Length of Trachea in Relation to Age of Patient

Age	Length in cm.
Birth	4.
1-2 yrs.	4.5
6-8 yrs.	5.7
14-16 yrs.	7.2
More than 16 yrs.	9-15

Table 2

Sagittal and Coronal Diameters of the Trachea in Relation to Age of Patient

Age	A-P diameter in mm.	Transverse diameter in mm.
Birth	5.7	6.
1-2 yrs.	9.4	8.8
6-8 yrs.	10.4	11.0
14-16 yrs.	10.7	13.5
More than 16 yrs.	16.5	14.4

larynx and the carina; the tip should never be inserted to or below the level of the carina. In most age groups, intubating the larynx 2 cm. is adequate. When the catheter is anchored satisfactorily, accidental extubation is rare and endobronchial intubation extremely unlikely.

Endobronchial catheterization causes insufficient aeration of the opposite lung, resulting in carbon dioxide retention. The usual signs of hypercarbia (e.g. hyperpnea) may be masked by the depression due to pentothal. The increase in respiratory rate may be interpreted as a sign of lightening of anesthesia and mistakenly controlled by giving additional pentothal. To anchor the endotracheal tube in its proper place and to prevent its slipping into a main stem bronchus, it is fixed at the lips by adhesive tape which binds the tube to the gauze bite block and extends across both sides of the face to the cap (fig. 1).

Pentothal is administered intravenously. A venotomy is performed under ether anesthesia on the saphenous vein at the anterior aspect of the internal malleolus (fig. 2). The vein is exposed and isolated from all surrounding structures. Two ligatures are placed around the vessel. Traction is made on the distal one, and a three-cornered incision is made in the lumen of the vein. A short length of plastic tubing (polyethylene) is threaded into the lumen for a distance of 7 to 10 cm. and secured by tying the uppermost ligature. The free end of the polyethylene tubing is then adapted to the disposable venoclysis set (dextrose 5 per cent in water—250 cc.) by inserting the proper sized needle into the intravenous polyethylene tubing (fig. 3). If blood is to be transfused, the larger intravenous tubing (No. 190) is preferred. For polyethylene tubing

No. 90, a 20 gauge needle is used and for No. 190, an 18 gauge needle. Tying the lower ligature prevents bleeding from the lower segment of the vein. To secure the intravenous polyethylene tubing adequately, the adapting needle hub is sutured to the skin (fig. 3). When the skin incision is closed, a gauze sponge is placed over the incision and the whole anchored with adhesive tape or roller bandage, and the venoclysis started at an extremely slow rate (20 to 30 drops per minute).

Pentothal is administered by the system illustrated in Figure 3. A 20 gauge needle is inserted through the latex rubber portion of the venoclysis tubing and the needle point advanced into the nylon tip. This needle is connected to the small white rubber tubing leading to the pentothal syringes. A series of clamps permits the infusion of finely graduated doses of a 1 per cent solution of pentothal sodium. The small (2 cc.) syringe is graduated in 1/10 of 1 cc., and contains a total of 40 mg. of pentothal. The large (30 cc.) syringe is filled with the pentothal solution and serves as a reservoir.

An injection of 10 mg. of pentothal is the initial trial dose, allowing the anesthetist to judge the individual tolerance of the patient. Since the pentothal enters the venoclysis system so close to the vein, only a few centimeters of the dextrose solution is necessary to carry it into the circulation.

The level of anesthesia under pentothal is judged by the rate and depth of

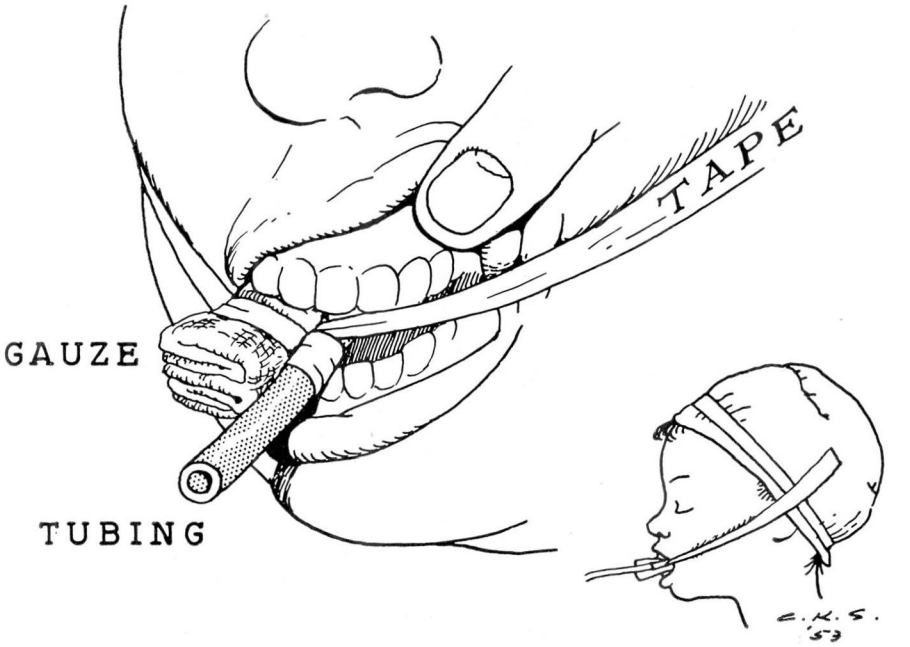

Fig. 1. Endotracheal tube is anchored at the lips. Gauze bite block is placed between the teeth to prevent biting tube and obstruction of the lumen.

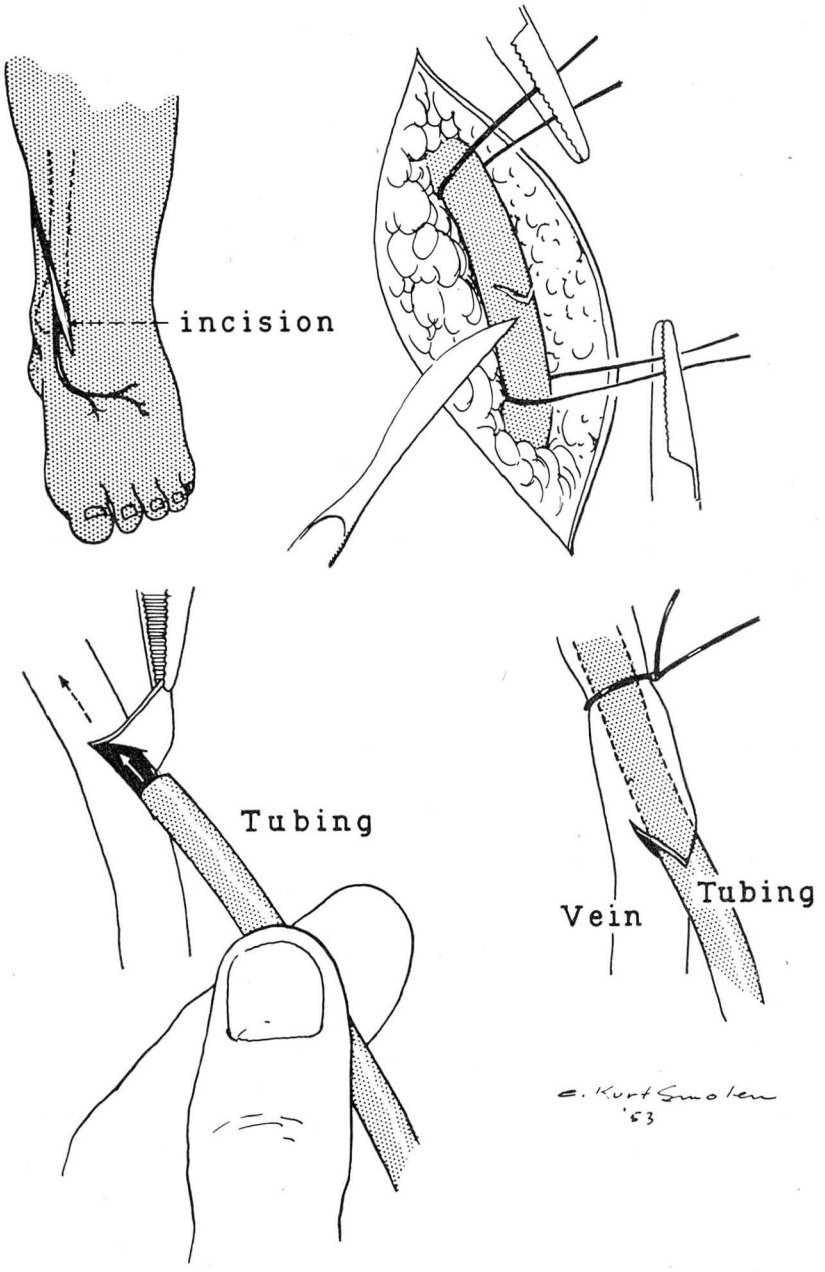

Fig. 2. The site of incision for cut-down on the saphenous vein at anterior aspect of the internal malleolus is shown. A three-cornered incision is made in the isolated segment of vein and a short length of polyethylene tubing inserted. A blunted needle adapts the venoclysis tubing to the polyethylene tubing.

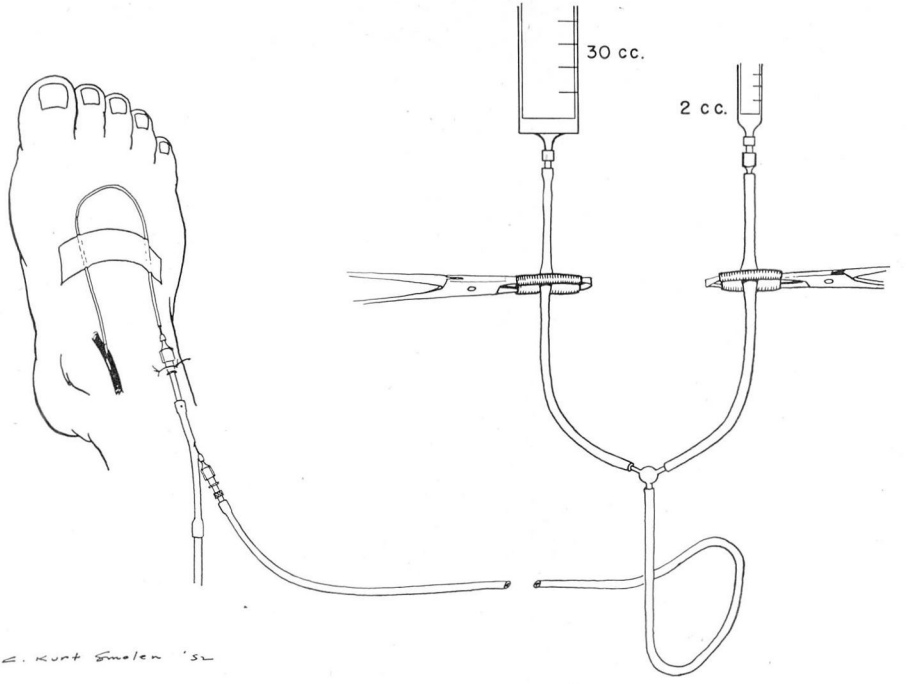

Fig. 3. The set-up for the administration of graduated dosages of pentothal includes a 30 cc. syringe or reservoir and 2 cc. syringe. The tubing is connected to the venoclysis set close to its entrance into the vein. An injection of pentothal then enters the circulation immediately.

respirations. Increasing rate denotes a light plane and too great a dosage causes apnea. Surgical anesthesia occurs when the respirations are slow (18 to 22 per minute) and of average depth. Once a desired level of hypnosis is acquired, maintenance doses are minimal and their effect more prolonged.

If apnea ensues, anoxia is prevented by artificial respiration. By means of the TO & FRO system (fig. 4), manual control of the respiratory system is maintained. This closed system allows the anesthetist to inflate the lung forcibly by positive pressure breathing. Should the contemplated surgical procedure necessitate the prone position, respiratory assistance must be given by aiding each respiration. Only in this way can adequate oxygenation and carbon dioxide exchange be guaranteed.

The endotracheal tube is removed as soon as the patient has reacted and while he is still in the recovery room. Early extubation may prevent laryngeal edema by eliminating further irritation of the mucous membrane of the trachea and larynx. Oxygen is made available by using a funnel directly in front of the infant's face. In most instances it is impossible to utilize a nasal catheter for oxygen.

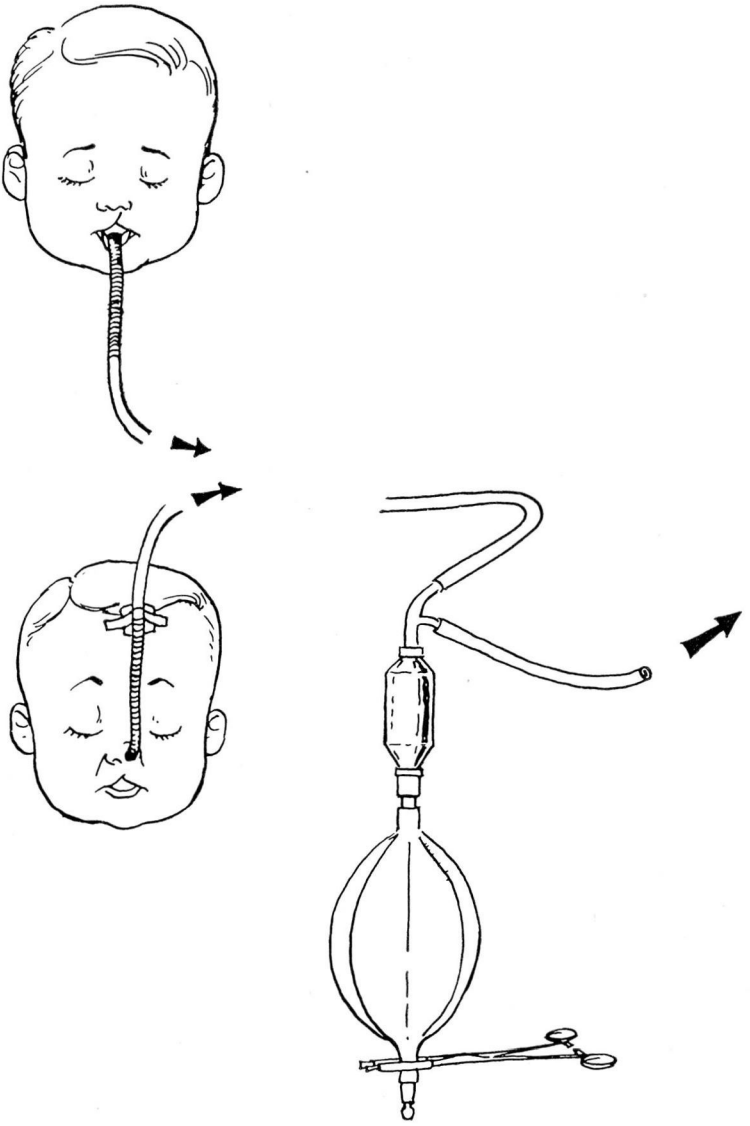

Fig. 4. A new longer endotracheal tube fits the contour of the face and extends out of the surgical field. No adapters and angle connectors are necessary. The distal end of the various sized tubes are all the same size and adapt snugly to the standard equipment.

COMMENT

Intravenous pentothal anesthesia in children is especially adaptable to surgery of the brain, head and neck. This method has been used in 133 neurosurgical cases at the Cleveland Clinic in the past two years (1951 to 1953) without serious anesthetic complications or death. The age distribution of these patients is presented in Table 3. The youngest patient was eight days old.

Table 3

Distribution According to Age Groups of Neurosurgical Patients Given Pentothal Anesthesia

(1951-1953)

Age Range	Incidence
Birth to 3 mo.	12
3 mo. to 1 yr.	41
1 yr. to 3 yrs.	33
3 yrs. to 6 yrs.	18
6 yrs. to 10 yrs.	29
TOTAL	133

With this type of anesthesia the anesthetist can be placed in a more remote position, allowing the surgeons more room and better exposure. Since explosive agents are not used, cautery and electrocoagulation may be employed freely without danger. When supplemented with local procaine infiltration for incision, light pentothal is used only to keep the child asleep and prevent movements. This results in less shock and rapid postoperative recovery. On the other hand if large amounts of pentothal are used indiscriminately, the postoperative recovery will be extended and the patient may not react for hours.

It has been found advantageous to use a tube longer than that of the usual endotracheal system, so that the head and face are not cluttered with anesthesia equipment. However, the respiratory dead space must not be increased beyond physiologic limits. The patient is under good control, the numerous metal endotracheal adapters are eliminated and the tube may be made to fit the contour of the face. The catheter is connected to the standard end of the TO & FRO canister. A spiral nylon filament supports the walls of the latex rubber catheter and prevents obstruction of the lumen when the catheter is acutely bent.

SUMMARY

1. Intravenous pentothal anesthesia is a safe and easily adaptable anesthesia for infants and children.

2. Oro-tracheal or nasotracheal intubation is necessary for safe pentothal anesthesia in infants and children.

3. A venous cut-down technic utilizing the polyethylene catheters is described for administration of venoclysis and pentothal.

4. An endotracheal tube, longer than the usual catheter, eliminates the numerous metal angles and adapters and allows the patient's head and face to be free of anesthesia equipment.

References

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