PENTOBARBITAL SODIUM–CURARE INDUCTION FOR ENDOTRACHEAL INTUBATION *

H. Carron, M.D., V. K. Stoelting, M.D., and S. C. Cullen, M.D.

Iowa City, Iowa

Received for publication May 26, 1947

The purpose of this paper is to describe the use of pentobarbital sodium † and curare ‡ introduced intravenously for endotracheal intubation by the oral route prior to nitrous oxide anesthesia. This procedure has been used in the intubation of most thoracic and abdominal surgical cases at the University Hospitals, State University of Iowa, since February 1947.

Harroun, Beckert, and Hathaway (1) presented the advantages of curare and nitrous oxide anesthesia for lengthy operations. Following publication of their article, the use of curare as an adjunct to nitrous oxide anesthesia in those surgical procedures requiring excellent relaxation was revived in this institution. However, it was found that the technic of intubation as described by these authors was not satisfactory in our hand because several patients who were difficult subjects for intubation developed cyanosis as a consequence of the respiratory paralysis accompanying the large doses of curare required, and many recovered from their nitrous oxide anesthesia prior to insertion of the endotracheal tube. Intubation under nitrous oxide was then discarded in favor of induction and intubation under cyclopropane or ether anesthesia with maintenance of the anesthesia by nitrous oxide.

Following publication of the article by Baird (2) on the use of a pentothal-curare mixture with nitrous oxide for general surgery, and for passing an endotracheal catheter prior to the administration of cyclopropane, pentothal and curare were used for oral intubations at this institution. However, it was found that the quantity of pentothal required to produce the necessary anesthesia for intubation frequently resulted in respiratory depression and cyanosis as well as laryngospasm, as intubation was attempted. Difficulties encountered in this procedure caused return to the use of cyclopropane or ether for induction prior to intubation. While this technic proved satisfactory in most cases, it seemed expedient to search for a more rapid method of induction for nitrous oxide anesthesia.

* From the Division of Anesthesiology, Department of Surgery, State University of Iowa College of Medicine, Iowa City, Iowa.

† Nembutal (Abbott).

‡ Intocostrin (Squibb).

It had been observed that patients given pentobarbital sodium intravenously had a fifteen to thirty minute period of deep narcosis and anesthesia during which time they failed to respond to painful stimuli. Gruber (3) has reported on the difference in activity of the barbiturates as compared with the thiobarbiturates and indicated that the coughing, hiccuping and serious laryngospasm accompanying the administration of thiobarbiturates did not occur as frequently with the non-sulphurated barbiturates. Feitelberg and Pick (4), in an article on curare action on brain, report that there is a synergistic hypnotic action with the combination of pentobarbital and curare. In view of the clinical observations and the pharmacological data, there seemed merit in the trial of the combination of pentobarbital sodium and curare intravenously for endotracheal intubation. The technic herein described depends on this short period of anesthesia produced by intravenous pentobarbital sodium, combined with the relaxing property of curare for the production of conditions suitable for endotracheal intubation under direct vision. The patients are premedicated with morphine and scopolamine (or atropine) in doses equivalent to those that would be used for cyclopropane anesthesia. For facility in administration of the drugs, intravenous fluids are started. Pentobarbital sodium in 5 or 6 per cent solutions is slowly administered through a three-way stopcock in fractional doses, to the point where the patient fails to respond to questioning and the lid reflex is lost. Oxygen is administered with a bag and mask, and curare is then introduced in fractional doses until relaxation of the jaw develops. When this point is reached, intubation under direct vision is accomplished.

On visualization of the larynx the vocal cords are found to be either in the abducted position or normally active. Rarely is persistent adduction observed, and in the occasional instance where it is present, the endotracheal catheter may be passed between the cords without difficulty. Coughing, following intubation, is not infrequent but may be minimized by prior cocainization of the pharynx and larynx with an atomizer or nebulizer.

While apnea with these doses of pentobarbital sodium and curare was not observed in this series of cases, assistance to respiration may be required for a few minutes and may be accomplished by manual compression of the rebreathing bag.

Slight elevation over preanesthetic values of systolic and diastolic blood pressures was noted immediately following intubation.

The dose of pentobarbital sodium used in the patients reported ranged from 1½ to 4½ grains (98 to 293 mg.) with an average dose of 3¼ grains (211 mg.) and that of curare from 50 to 200 units with an average dose of 107 units. A few of the reported cases required additional hypnosis and anesthesia and this was obtained by the addition of small doses of pentothal (50 to 200 mg.). Experience with the last several cases of this series would indicate that doses of pento-

barbital sodium slightly larger than described are required to produce the desired effect and that the pentobarbital anesthesia should be allowed to develop fully before the curare is introduced. Undoubtedly, further experience with this technic will result in additional refinements.

Following intubation, nitrous oxide is delivered in concentrations of 70 to 80 per cent by the semi-closed to-and-fro absorption method. Further small doses of curare (20 to 60 units) are administered as necessary during the course of the procedure to provide the required relaxation. Additional doses of morphine ranging from 1/12 to 1/6 grain (5 to 10 mg.) may be required for maintenance of nitrous oxide anesthesia.

Recovery from this combination of agents is rapid, patients responding and recovering control of their pharyngeal reflexes within a few minutes of discontinuance of the nitrous oxide. Recovery to the point of orientation is complete usually within three hours of the onset of anesthesia.

In table 1 are listed the types of surgical procedures for which this technic of intubation was employed in 50 cases. Ages of these patients ranged from 17 to 84 years. Duration of the procedure varied from thirty to four hundred and thirty minutes.

TABLE I

Resection of colon (abdomino-perineal, end-to-end, colostomy)	9
Exploratory laparotomy (inoperable lesions, palliative procedures)	7
Exploratory thoracotomy	7
Gastric resection	5
Pulmonary lobectomy	5
Pneumonectomy	3
Closure enteric fistulae	2
Bilateral ureterosigmoidostomy	2
Total hysterectomy	2
Block excision of chest wall	1
Esophageal resection with esophago-gastrostomy	1
Transthoracic hiatal hernia repair	1
Total cystectomy	1
Cholecystogastrostomy	1
Thoraco-dorsal sympathectomy	1
Ileo-colostomy	1
Cholecystectomy	1

The apparent advantages of this method of induction for oral intubation prior to nitrous oxide anesthesia are (1) rapid induction of anesthesia, (2) lack of or minimal degrees of laryngospasm, and ease of intubation, (3) absence of explosive hazard, and (4) rapid recovery from anesthesia.

It should be emphasized that this procedure requires that the airway be sufficiently patent for oxygenation with a bag and mask, if required, and that the anesthetist be adequately trained in the process of intubation under direct vision laryngoscopy. This technic is of particular

value in prolonged abdominal surgical cases and in all transthoracic procedures.

SUMMARY

The use of pentobarbital sodium and curare intravenously for endotracheal intubation under direct vision laryngoscopy prior to nitrous oxide anesthesia, is described and discussed. This method of induction for intubation has been used at the University Hospitals, The State University of Iowa, since February 1947. The apparent advantages of this technic are (1) rapid induction of anesthesia, (2) lack of or minimal degrees of laryngospasm and ease of intubation, (3) absence of explosive hazard, and (4) rapid recovery from anesthesia.

REFERENCES

1. Harroun, P.; Beckert, F. E., and Hathaway, H. R.: Curare and Nitrous Oxide Anesthesia for Lengthy Operations, Anesthesiology 7: 24–28 (Jan.) 1946.
2. Baird, J. W.: Pentothal-Curare Mixture, Anesthesiology 8: 75–79 (Jan.) 1947.
3. Gruber, C. M.: The Barbiturates and Thiobarbiturates, J. A. M. A. 117: 1147–1151 (Oct. 4) 1941.
4. Feitelberg, S., and Pick, E. P.: Action of Curare on Temperature Changes in the Brain in Combination with Pentobarbital Narcosis, Proc. Soc. Exper. Biol. & Med. 64: 345–348 (Mar.) 1947.