THE USE OF CURARE IN SODIUM PENTOTHAL–NITROUS OXIDE–OXYGEN ANESTHESIA

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SINCE Griffith and Johnson reported the use of curare (Intocostrin, Squibb) in anesthesia in 1942 (1), many additional papers have appeared in the literature to substantiate their work (2, 3, 4, 5). The history of curare and its pharmacologic and physiologic activity have been adequately reviewed by numerous writers (2, 3, 5, 6). Cyclopropane has been the anesthetic agent of choice in these reports. Hudon reported thirteen cases in which he used curare in sodium pentothal anesthesia (7). In this paper is reported the use of curare in sodium pentothal-nitrous oxide-oxygen anesthesia for 50 consecutive surgical operations in which relaxation was essential.

TECHNIC

When the surgeon is ready to prepare the field, the initial dose of sodium pentothal is injected intravenously in an amount sufficient to produce narcosis to a level at which there is no response to questions by the anesthetist. The inhalation of 2 liters of nitrous oxide and 2 liters of oxygen by the semiclosed carbon dioxide absorption technic is then started and is continued during the operation.

During the preparation of the operative field, small repeated doses of sodium pentothal are given so that by the time the skin incision is made the patient has reached the stage of surgical anesthesia. A pharyngeal airway is inserted, if necessary, to establish an unobstructed airway. The total time from the start of anesthesia to the skin incision averages about three minutes.

When the skin is incised, an initial dose of 60 to 80 units of curare is given intravenously from a small syringe separate from that used for the sodium pentothal. This amount is usually sufficient to produce good relaxation in the average adult in good physical condition. Small initial doses are preferred for poor risk patients, the aged, or for children. In a few cases it was necessary to give an additional 20 units when the peritoneum was opened. If the intraperitoneal portion of the operation is completed in twenty to thirty minutes, supplementary injections of curare are not usually necessary. It was necessary to add more curare for closure of the peritoneum in only a few of the cases taking less than thirty minutes. In operations taking longer than thirty to forty-five minutes, supplementary doses of 20 to 40 units

were given at intervals to maintain the desired relaxation. Sodium pentothal was injected intermittently during the operation to maintain anesthesia.

The character of respiration must be watched carefully for change in rate and amplitude and for evidence of obstruction. Overdosage of curare is manifested by a decrease in the amplitude of the inspiratory and expiratory phases of breathing. The inspiratory phase of respiration becomes shorter and gasping in nature with the development of intercostal paralysis. Complete respiratory paralysis may ensue with overdosage of curare. Artificial respiration is then accomplished by gentle manual compression of the breathing bag until spontaneous respiration is resumed. It may be necessary to complement the inspiratory phase when there is inefficient respiration owing to partial intercostal paralysis. The curare depression can be effectively overcome by the intravenous use of 1 to 2 cc. of the 1:2000 solution of prostigmine, but it was not used in any of these patients. There were no cases of complete paralysis. There was partial intercostal paralysis in a few of the patients. In no case was it deemed necessary to complement respiration since 50 per cent oxygen was being supplied, and no unfavorable changes were noted in the pulse or blood pressure. Inefficient respiration, when present, lasted only two to five minutes.

It was the opinion of the surgeon that the relaxation of muscles and peritoneum was comparable to that seen in spinal anesthesia. In no case was it necessary to add cyclopropane or ether to the inhaled mixture. In those cases in which the surgeon felt that the patient was too tense or "blowing," a complementary injection of 20 to 40 units of curare was immediately given, with good result.

The youngest patient in this series was 12 years old and the oldest 77. Table 1 shows the number of patients in each decade of life.

TABLE 1

NUMBER OF PATIENTS ACCORDING TO DECADES

Decade	Number of Patients
0–10 years	0
11–20 "	8
21–30 "	9
31–40 "	9
41–50 "	14
51–60 "	4
61–70 "	3
71–80 "	3

The operations are listed in table 2. The shortest operation, an appendectomy, lasted eight minutes, and the longest, a gastric resection, lasted two hours and forty-five minutes.

Thirty-five patients (70 per cent) were females, and fifteen patients (30 per cent) were males.

Preanesthetic medication was employed in every case. Except in emergency operations, each patient was seen the day before operation

and an evaluation made of the metabolic activity. At that time it was decided how much sedation should be used for sleep the night before operation, and how much morphine sulfate and atropine sulfate should be used for preanesthetic medication. Nembutal capsules in doses of ¾ to 1½ grains were used for sleep and sedation the night before operation. No barbiturates were used for preanesthetic medication the morning of the operation. Morphine sulfate and atropine sulfate

TABLE 2

LIST OF OPERATIONS

	Number of Patients
Appendectomy	17
Hysterectomy	12
Nephrectomy	1
Cholecystectomy	7
Ileocolectomy	1
Gastric Resection	2
Gastroenterostomy	1
Abdominoperineal Resection	1
Cecostomy	1
Exploratory Laparotomy	4
Ventral Hernia	1
Combinations	3

were given hypodermically one and one-half hours before the scheduled time for operation. The ratio of 25:1 was used generally unless the dose of morphine sulfate was less than 1/8 grain. Morphine sulfate in dose of 1/12 to 1/6 grain and atropine sulfate in dose of 1/200 to 1/150 grain were employed. None of the patients were asleep on arrival in the operating room. All complained of dryness of the mouth and many of itching of the nose. Most of the patients felt more relaxed than when seen the day before operation.

The smallest dose of sodium pentothal was 12 cc. The largest dose was 56 cc. The average dose was 23 cc. Only the 2.5 per cent solution was used in this series. The amount of sodium pentothal required was 10 to 12 cc. less than the amount used in a large series of lower abdominal operations in which anesthesia was obtained by the author with sodium pentothal-nitrous oxide-oxygen in the last two years. Reduction in dosage, I believe, is the result of the use of curare.

The smallest dose of curare was 40 units, and the largest was 190 units. The average dose was 80 units. Seventy units seemed to be the optimum initial dose and was sufficient for the entire operation in the majority of cases.

The duration of postoperative narcosis was minimal. All but four of the patients left the operating room either awake enough to open their eyes and respond or with an active lid reflex. The patients usually responded rationally to stimulation within ten to twenty minutes after return to bed. If left alone, they dropped back to sleep. Their reflexes were present. No analeptic drugs were necessary.

Postoperative nausea and vomiting were rare as in sodium pentothal-nitrous oxide-oxygen anesthesia without curare.

The only complication during anesthesia (aside from the respiratory depression mentioned previously) was hiccups. This occurred in two patients. One patient had had a gastric resection and the other an abdominoperineal operation. In the latter case the hiccupping went on intermittently for a week after the operation.

There were no deaths in the operating room. Three patients died in the hospital during the postoperative period. Two were patients with inoperable carcinoma. One of these died on the fourteenth day, and the other died in three weeks. The third patient was 77 years old and had gangrene of the cecum. He died on the seventh postoperative day from generalized peritonitis.

SUMMARY AND CONCLUSIONS

My experience with sodium pentothal-nitrous oxide-oxygen anesthesia indicates that this combination of agents can produce satisfactory relaxation for lower abdominal operations. The use of curare in conjunction with these agents offers several advantages:

1. Relaxation is enhanced in lower abdominal operations.
2. Upper abdominal operations, undertaken only with great difficulty and poor relaxation without curare, can now be done with excellent relaxation.
3. The total dosage of sodium pentothal is diminished.
4. The period of postanesthetic narcosis is considerably shortened.

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