

ANESTHESIA LIX: EFFECT OF ANESTHESIA WITH ETHER, FLUOROMAR, AND THIOPENTAL SODIUM ON INDOKLON-INDUCED CEREBRAL CORTICAL SEIZURES

ALFRED S. C. LING, M.S., EDWARD B. TRUITT, JR., PH.D., JOHN C. KRANTZ, JR., PH.D.

HEXAFLUORODIETHYL ETHER (Indoklon) has been shown to produce convulsive seizures in various laboratory animals and man.^{1, 2} Owing to the similarity between the seizures induced by the inhalation of Indoklon and those evoked by electroshock, Indoklon has found application in the treatment of mentally ill patients.^{3, 4} The purpose of this investigation is to study the effect of anesthesia under tri-fluoroethyl vinyl ether (Fluoromar), ether, and thiopental sodium upon the Indoklon-induced cerebral dysrhythmia in the *Rhesus macacus* monkey. This animal responds rapidly and violently to the inhalation of Indoklon.

METHODS

Prior to anesthesia each monkey received intravenous atropine sulfate 0.1 mg./kg. For anesthesia under ether and Fluoromar the closed circuit technique was employed. The animals were lightly (plane 1 of stage 3) or deeply anesthetized (plane 4 of stage 3) as determined by the anesthetic index technique.⁵ Another group of monkeys was lightly or deeply anesthetized with thiopental sodium (4 per cent solution) administered intravenously. For light thiopental anesthesia an initial dose of 10 mg./kg. was given supplemented with a booster dose equal to the initial dose when necessary. For deep anesthesia this agent was infused to a point where respiration was just arrested. These animals were then allowed to recover to the plane immediately preceding respiratory arrest. To obviate the muscular movements caused by Indoklon, succinylcholine chloride (20 mg./cc.) was administered by intravenous drip to the point of respiratory arrest. The animals were maintained with artificial respiration, using oxygen.

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Electroencephalograms were recorded from bilateral frontal and temporal scalp electrodes, using a Grass 4-channel, Model 5 polygraph. Cortical activity was recorded following pre-

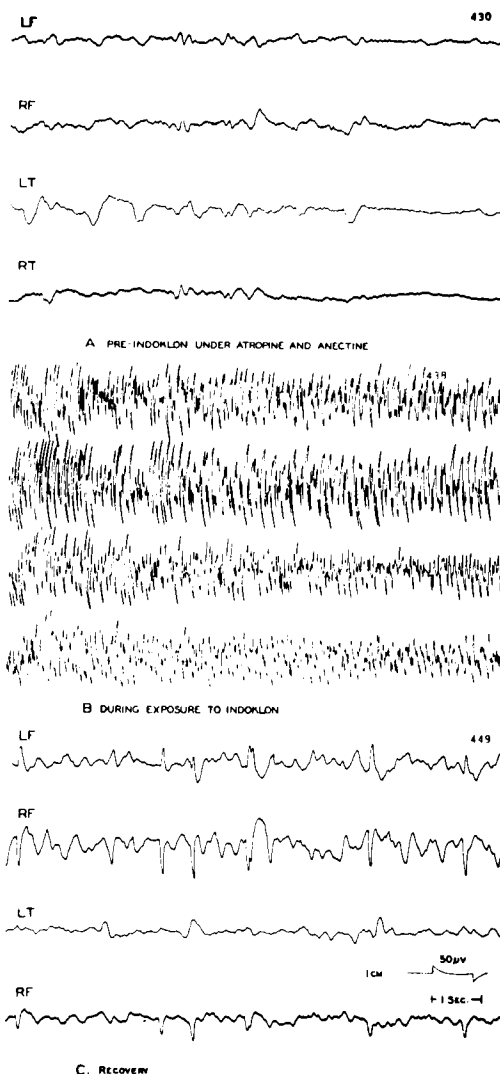


FIG. 1. The effect of atropine, Anectine and Indoklon on EEG (monkey).

medication, during exposure to Indoklon, and during recovery. A control series was conducted, in which the animals were treated in the foregoing manner with the exception that no anesthetic agent was given.

RESULTS

Indoklon and Fluoromar Anesthesia. It was demonstrated under light Fluoromar anesthesia in six experiments that 0.25 cc. of Indoklon will produce a cortical dysrhythmia which is only slightly modified by the anesthesia. In the unanesthetized monkey a *grand-mal*-type

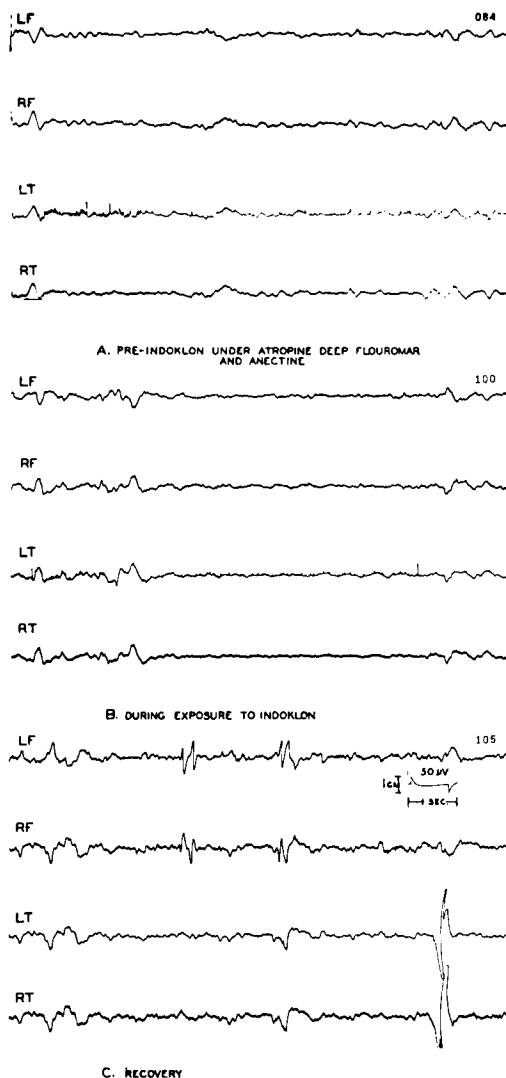


FIG. 2. During deep Fluoromar anesthesia and exposures to Indoklon (monkey).

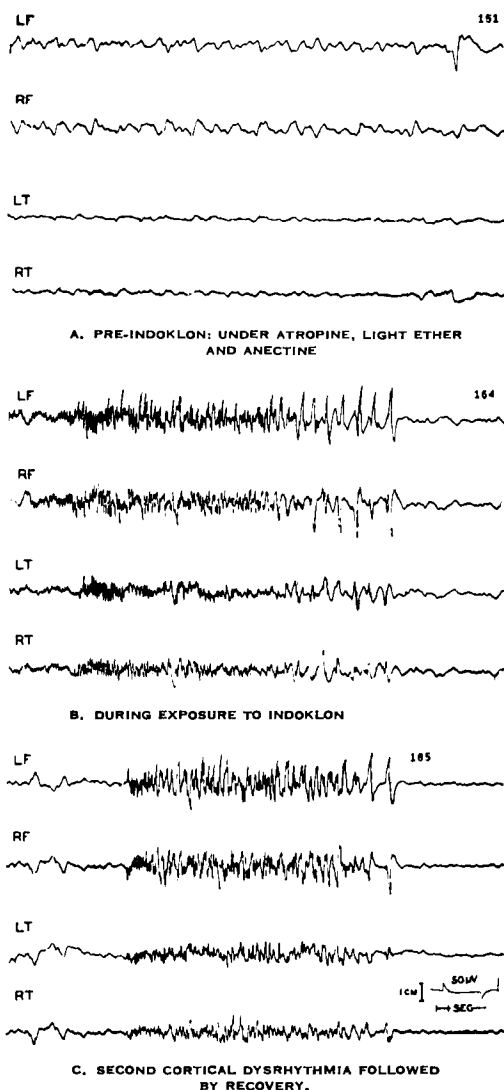


FIG. 3. The effect of light ether anesthesia and exposure to Indoklon (monkey).

of seizure is elicited by Indoklon as shown in figure 1.

Under deep anesthesia with Fluoromar in six experiments, 0.25 to 0.50 cc. of Indoklon failed to evoke cortical dysrhythmia (fig. 2).

Indoklon and Ether Anesthesia. We were interested to observe whether or not the same Indoklon electroencephalographic activity which was obtained under Fluoromar anesthesia prevailed under ether anesthesia. This was of special interest since ether is the non-fluorinated analogue of Indoklon. Three ex-

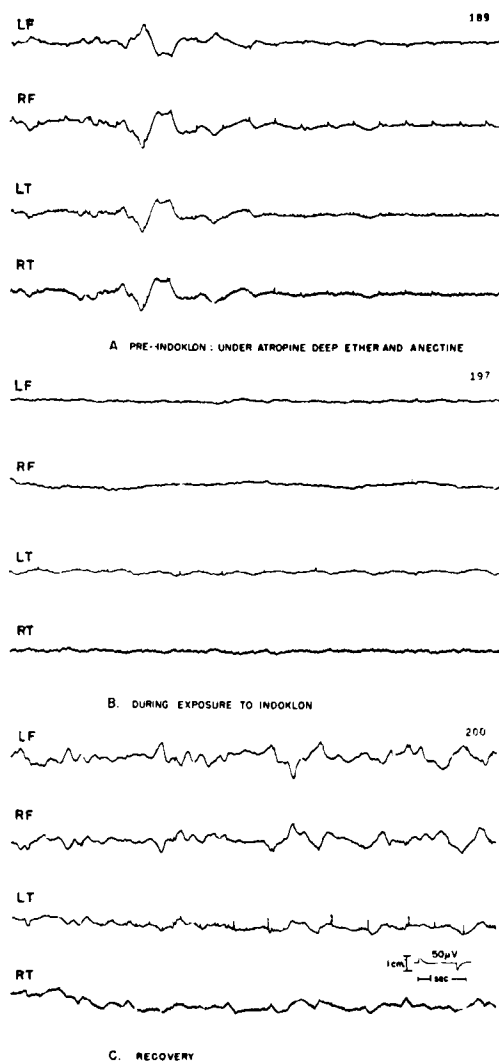


FIG. 4. The effect of deep ether anesthesia and exposure to Indoklon (monkey).

periments each were conducted under light and deep ether anesthesia. Results similar to those observed under Fluoromar prevailed, namely, the cortical activity elicited by Indoklon was slightly modified during the light ether anesthesia, and was abolished under deep ether anesthesia. These effects are seen in figures 3 and 4 respectively.

Indoklon and Thiopental Sodium Anesthesia. Owing to the fact that thiopental sodium light anesthesia is an established adjuvant to electroshock therapy,⁶⁻⁸ and has been em-

ployed in Indoklon-convulsive therapy, we were interested to determine its effect upon the Indoklon-induced cortical dysrhythmia. In three experiments under light thiopental anesthesia the cortical seizure prevailed, and the amplitude of the activity was slightly less than that observed for the unanesthetized animal (fig. 5). In three experiments deep thiopental anesthesia obliterated the cortical dysrhythmia evoked by Indoklon.

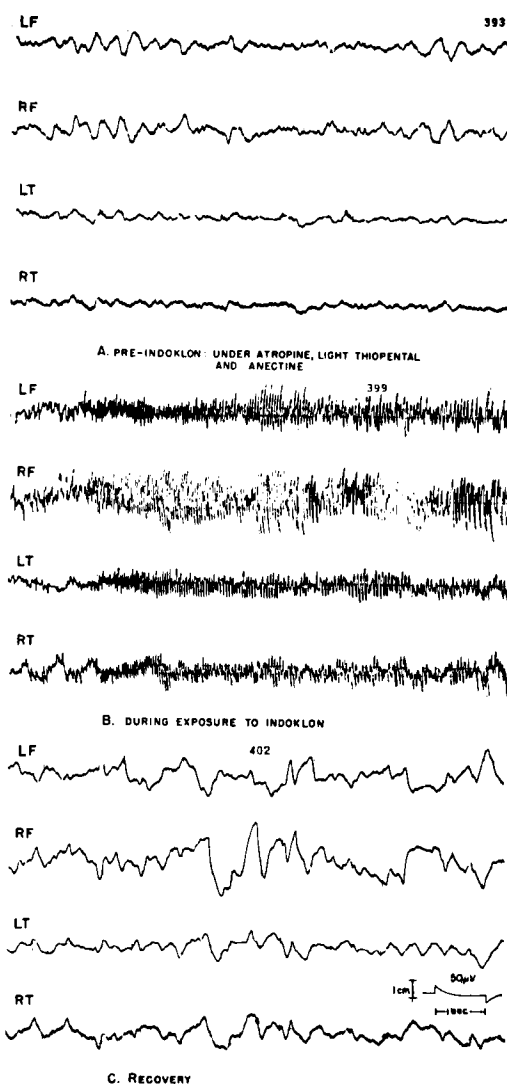


FIG. 5. The effect of light thiopental anesthesia and exposure to Indoklon (monkey).

DISCUSSION

From these experiments on *Rhesus macacus* monkeys it is clear that the cortical dysrhythmia induced by the inhalation of Indoklon is blocked by deep surgical anesthesia. This occurs with the fluorinated volatile anesthetic, Fluoromar, with ether, and with thiopental sodium. Light surgical anesthesia, which is capable of slightly modifying the seizure, does not obliterate the cortical dysrhythmia of Indoklon. There does appear, however, to be some reduction in the amplitude of discharge from the cortex under light surgical anesthesia as compared with that evoked in monkeys receiving atropine sulfate and succinylcholine chloride only. This can be modified so that the amplitude of discharge in the two animals is essentially the same by increasing the dosage of Indoklon.

The practical aspects of these experiments are suggested in the use of Indoklon in the treatment of mentally ill patients. It appears that light anesthesia induced with ether, Fluoromar or thiopental sodium, followed by the inhalation of Indoklon through the anesthetic mask, is a feasible method of administering shock therapy. This procedure also will probably be less fraught with anxiety and apprehension than the classical methods of electroshock therapy extant today.

SUMMARY

Light surgical anesthesia with the volatile anesthetics, Fluoromar and ether, and with the barbiturate, thiopental sodium, modified the convulsive seizure induced by Indoklon in the *Rhesus macacus* monkey by slightly decreasing the amplitude of discharge activity.

Deep surgical anesthesia with each of these agents obliterated the cortical dysrhythmia.

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