THE CARDIAC ARRHYTHMIAS WHICH OCCUR SPONTANEOUSLY IN CATS DURING CYCLOPROPANE ANESTHESIA *

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If normal unpremedicated dogs are anesthetized with a mixture of 30 per cent cyclopropane in oxygen, the intravenous injection of .01 mg. of epinephrine per kilogram will cause the sinus rhythm to change to ventricular tachycardia. This arrhythmia abruptly changes to ventricular fibrillation in some of the dogs. Since the injection of a similar dose of epinephrine into the unanesthetized dog does not precipitate these arrhythmias, the conclusion is that cyclopropane sensitizes the heart of the dog to injected epinephrine (1). The sudden collapse which immediately followed the accidental administration of epinephrine to a patient anesthetized with cyclopropane (2) suggests a similar sensitization of the human heart.

The injection of epinephrine, however, is not necessary in order to produce cardiac arrhythmias in the human while he is under the influence of cyclopropane. Taylor (3) reports that during 33,777 administrations of cyclopropane cardiac arrhythmia occurred 2,202 times. If the electrocardiograph had been employed for the detection of all cardiac arrhythmias instead of the procedure of merely noting changes in the peripheral pulse, the percentage of cases showing abnormal rhythms probably would have been higher than the 6.5 per cent reported. This view is borne out by the electrocardiographic studies made by Kurtz, Bennett and Shapiro (4).

There is evidence then for believing that as measured by arrhythmias the human heart gives a greater response to cyclopropane than does that of the dog. In light of this it seemed desirable to investigate the action of cyclopropane on the heart of another laboratory animal, the cat. Ever since the work of Levy, the cat's heart has been thought to be very sensitive to chloroform. If a similar irritability to cyclopropane should be found, it would not only be an interesting fact in itself but it would suggest the use of the cat's heart in testing agents which might reduce ventricular tachycardia.

We have therefore investigated the cardiac arrhythmias that occur in unpremedicated cats during cyclopropane anesthesia; the cardiac re-

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sponse to the intravenous injection of epinephrine; the significance of the arrhythmias; their relation to the oxygenation of the blood; and the prevention of these cardiac irregularities.

PROCEDURE AND RESULTS

The cats were anesthetized by rebreathing a mixture of cyclopropane in oxygen from a child's-size face mask attached to a 5 liter rubber bag. An endotracheal tube was then inserted to insure an open airway and the animal connected through a 100 cc. capacity soda lime carbon dioxide absorber to a 1 liter rubber bag which was in turn connected to a 100 liter reservoir containing the desired concentrations of the anesthetic mixture. The 1 liter bag was emptied and refilled from the reservoir every five minutes in order to subject the animal to a constant concentration of the anesthetic agent.

Forty-three normal unpremedicated cats were anesthetized and maintained on a mixture consisting of 30 per cent cyclopropane in oxygen for a period of thirty minutes. This concentration of cyclopropane will maintain cats in deep surgical anesthesia with partial or complete intercostal paralysis. Three of the cats subjected to this concentration required artificial ventilation in order to assure adequate oxygenation. The cardiac response to the anesthetic agent was obtained through constant observation of the beam of the electrocardiograph, with electrocardiograms (lead II) being taken whenever the cardiac rhythm changed. Usually the cats presented a normal sinus rhythm for one or more minutes after the induction, intubation, and connection to the constant mixture of cyclopropane in oxygen. Various cardiac arrhythmias then occurred. The ventricular arrhythmias which occurred were periods of a few scattered ventricular extrasystoles, periods during which many ventricular extrasystoles appeared, periods of bigeminal rhythm consisting of alternate auriculo-ventricular nodal and ventricular beats, and ventricular tachycardia. In most instances there was an auriculo-ventricular rhythm when ventricular extrasystoles occurred. At times the sinus would reassert itself and the normal rhythm prevail for a few minutes or for the duration of the thirty minute period of anesthesia. Table 1 presents the summary of the arrhythmias that occurred in each cat. The two animals which died because of ventricular fibrillation during their induction and intubation are not listed in the table. During the thirty minute period of anesthesia Cats 14, 16, and 23 gave the most severe responses to the cyclopropane. Their hearts were in ventricular tachycardia for periods of twenty-seven, twenty-eight, and twenty-five minutes, respectively. Cat 4 was the only animal that failed to develop an arrhythmia during its thirty minute period of anesthesia. One week later 9 of these cats were again subjected to a 30 per cent concentration of cyclopropane for a thirty minute period. The results of the latter period may be compared with those obtained during the first anesthetization by observing table

TABLE 1

SPONTANEOUS VENTRICULAR IRREGULARITIES IN CATS DURING THIRTY MINUTE PERIODS OF CYCLOPROPANE ANESTHESIA

Cat No.	30% Cyclopropane		20% Cyclopropane		30% Cyclopropane		35% Cyclopropane		40% Cyclopropane	
	Total irreg. min.	Types of Irregularities	Total irreg. min.	Types of Irregularities	Total irreg. min.	Types of Irregularities	Total irreg. min.	Types of Irregularities	Total irreg. min.	Types of Irregularities
1	13	5′ VT, 5′ M VEx	2	1′ VR, 1′ Trigem. (also 24′ AVR)			11	7′ M VEx, 4′ F VEx (also 7′ AVR)		
2	26	8′ VT, 5′ Bigem, 8′ M VEx, 5′ F VEx	1	1′ M VEx			19	10′ M VEx, 3′ F VEx		
3	22	5′ VT, 7′ M VEx, 10′ F VEx	17	6′ VR, 11′ M VEx			13	3′ VR, 10′ F VEx		
4	0		0				20	2′ VT, 15′ M VEx, 3′ F VEx		
5	15	15′ F VEx	0							
6	10	6′ VT, 4′ M VEx (also 11′ AVR)	3	3′ F VEx			6	6′ F VEx		
7	17	12′ M VEx, 5′ F VEx	15	15′ M VEx*			21	6′ VT, 11′ M VEx, 4′ F VEx		
8	2	2′ F VEx* (also 5′ AVR)	0							
9	22	10′ M VEx, 3′ F VEx	0				24	7′ VT, 10′ M VEx, 7′ F VEx		
10	1	1′ VT (also 20′ AVR)	0	(also 20′ AVR)			12	12′ F VEx		
11	27	2′ VT, 25′ M VEx								
12	21	14′ VT, 5′ M VEx*, 2′ F VEx*			7	2′ M VEx,* 5′ F VEx*			20	20′ M VEx*
13	27	27′ VT								
14	30	30′ Bigem			25	25′ VT			10	10′ M VEx
15	28	28′ VT								
16	15	9′ M VEx, 6′ Bigem			25	5′ VT, 17′ M VEx				
17	19	2′ VT, 4′ M VEx, 13′ F VEx*			22	5′ VT, 17′ M VEx			5	5′ M VEx*
18	2	2′ F VEx			30	20′ VT, 10′ M VEx				
19	24	14′ VT, 10′ M VEx								
20	29	4′ VT, 18′ M VEx, 7′ F VEx			21	21′ M VEx				
21	21	3′ VT, 13′ M VEx, 5′ F VEx*							30	30′ VT
22	30	25′ VT, 5′ F VEx							28	7′ VT, 21′ Bigem.
23	15	10′ VT, 5′ Bigem			17	4′ M VEx, 13′ F VEx				
24	5	5′ VT (also 24′ AVR)			15	5′ VT, 10′ VR				
25	20	18′ VT, 2′ M VEx*			19	17′ M VEx, 2′ F VEx				
26	15	5′ VT, 10′ M VEx								
27	10	10′ M VEx								
28	10	7′ M VEx, 3′ F VEx								
29	15	1′ VT, 11′ M VEx, 3′ F VEx								
30	17	17′ M VEx								
31	26	4′ VT, 5′ M VEx, 17′ F VEx*								
32	11	8′ M VEx, 3′ F VEx								
33	24	24′ M VEx	10	13′ M VEx, 6′ F VEx						
34	27	12′ VT, 15′ M VEx	23	23′ Trigeminal R (SA+V)						
35	22	22′ M VEx	6	5′ M VEx, 1′ F VEx						
36	21	21′ Bigem.	13	13′ M VEx						
37	27	13′ Bigem. (SA+V), 14′ M VEx*	0							
38	23	10′ VT, 8′ Bigem, 5′ M VEx								
39	25	8′ VT, 17′ M VEx								
40	11	4′ M VEx, 7′ F VEx*								
41	11	8′ M VEx, 3′ F VEx*								
42	4	4′ Bigem.								
43	16	2′ VT, 14′ M VEx								

Key: VT = ventricular tachycardia (rate over 150) Bigem = bigeminal rhythm (AV+V) M VEx = many ventricular extrasystoles
F VEx = few ventricular extrasystoles (less than 1 V. Ex. to 4 supraventricular beats). AVR = auriculo-ventricular rhythm
* = sino-auricular rhythm at the time of the extrasystoles. In all of the other experiments there was A—V rhythm when extrasystoles occurred.

1. The duration and the type of ventricular irregularities of each cat for this period were not always similar to those shown in the previous experiment, but all of the animals did show spontaneous ventricular arrhythmias both times.

Since the heart of the cat develops spontaneous ventricular arrhythmias when it is subjected to anesthetic concentrations of cyclopropane and the heart of the dog while under a similar influence does not, it was decided to see if the cat's heart would also show a greater response to injected epinephrine during cyclopropane anesthesia than does the heart of the dog under these conditions. The intravenous injection of a dose of .01 mg. of epinephrine per kilogram into the normal dog while it is anesthetized with 30 per cent cyclopropane is regularly followed by the production of ventricular tachycardia. In at least 10 per cent of all dogs subjected to this procedure the ventricular tachycardia terminates immediately in ventricular fibrillation. We believe that a dose of .04 mg. of epinephrine per kilogram will fibrillate all normal dogs during deep cyclopropane anesthesia provided the adrenolytic action of the cyclopropane (5) has not developed. Six cats anesthetized with 30 per cent cyclopropane were injected intravenously with .01 mg. of epinephrine per kilogram. Some of the hearts were arrhythmic at the time of the injection. The cardiac responses to the injections are summarized in table 2. None of the hearts fibrillated. Ten minutes after the

TABLE 2

CARDIAC RESPONSE OF CATS TO INTRAVENOUS INJECTIONS OF EPINEPHRINE DURING DEEP CYCLOPROPANE ANESTHESIA

Cat No.	Adrenalin Dose	Cardiac Rhythm	
		Before Injection	After Injection
	mg./kg.		
13	.01	SA	20" bundle branch block; SA
29	.01	AV+M VEx	no change
33	.01	SA+M VEx	AV+M VEx
34	.01	AV+M VEx	60" VT; SA
35	.01	SA	no change
37	.01	VT	no change
29	.04	AV+M VEx	no change
33	.04	VT	60" VT; AV+M VEx
34	.05	SA	120" VT; SA
35	.05	SA	60" VT; AV+M VEx
37	.05	SA	65" VT; SA

first injection 5 of the cats were again injected. The dose this time was .04 or .05 mg. of epinephrine per kilogram. The heart of Cat 29 was in a bigeminal rhythm and the heart of Cat 33 was in ventricular tachycardia before and during the injection. None of the 5 cats fibrillated. These results are also summarized in table 2. While a total of 11 epinephrine injections into 6 cats is too small a number to justify

a conclusion, the results at least suggest that the heart of the cat is no more sensitive and probably less sensitive to injections of epinephrine during cyclopropane anesthesia than is the heart of the dog.

It is generally believed that cats spontaneously develop cardiac arrhythmias during light chloroform anesthesia. We decided to compare the effects of this agent in a constant mixture with the cardiac effects of cyclopropane under similar conditions. Six cats were inducted with chloroform by the open-drop technic, intubated, and connected through a carbon dioxide absorber to a bag containing an anesthetic mixture consisting of 12 cc. of chloroform vaporized in 80 liters of oxygen. This mixture is satisfactory for maintaining cats in very light surgical anesthesia. After thirty minutes of light anesthesia the cats were subjected to higher concentrations of chloroform which were administered by the open-drop technic. The animals were maintained by this method in deep surgical anesthesia as evidenced by partial or complete loss of intercostal muscular activity. After ten minutes of deep chloroform the anesthesia was suddenly reversed by administering 100 per cent oxygen. The summary of the results of this investigation and the comparison with the arrhythmias that occurred in the same cats during cyclopropane anesthesia may be found in table 3. Our impres-

TABLE 3

SPONTANEOUS CARDIAC ARRHYTHMIAS IN CATS DURING CYCLOPROPANE AND DURING CHLOROFORM ANESTHESIAS

Cat No.	30′ of 30% Cyclopropane in O_2	30′ of Light Chloroform	10′ of Deep Chloroform (Following Light)	During Reversal of Anesthesia with 100% O_2
28	7′ M VEx, 3′ F VEx	None	AVR	45″ M VEx; SA
29	1′ VT, 11′ M VEx 3′ F VEx	3′ bigem. (SA+V)	4′ bigem. (AV+V)	6′ SA+F VEx; SA
30	17′ M VEx	AVR	AVR	none; SA
31	4′ VT, 5′ M VEx, 17′ F VEx	None	None	none; SA
32	8′ M VEx, 3′ F VEx	25′ AVR	10″ bigem. (AV+V)	45″ bigem. (AV+V); SA
40	4′ M VEx, 7′ F VEx	None	None	3′ VT; SA

sion was that the arrhythmias that occurred during chloroform anesthesia appeared following changes of the anesthetic concentration, especially after reversal with 100 per cent oxygen. When the cats were subjected to constant mixtures of chloroform and oxygen very few arrhythmias occurred. These findings confirm the earlier observations of Goodman Levy (6) that "if a cat be anesthetized gradually with chloroform and kept quiet and undisturbed the whole time, the heart continues to beat regularly even when the anesthesia is light."

Five cats, numbers 33 through 37, were anesthetized with diethyl ether for a period of thirty minutes. No ventricular irregularities occurred. The arrhythmias in these cats during cyclopropane anesthesia are recorded in table 1. The tendency of cyclopropane to pre-

cipitate ventricular irregularities in cats seems to be much stronger than either that of chloroform or that of ether.

In order to see whether low blood oxygen concentrations existed during spontaneous arrhythmias arterial blood samples were drawn over mercury while the animals were presenting ventricular irregularities. Table 4 summarizes the results of the blood gas studies. On

TABLE 4

BLOOD GAS STUDIES IN CATS WITH SPONTANEOUS VENTRICULAR IRREGULARITIES ON A 30% CYCLOPROPANE IN O_2 MIXTURE

Cat No.	Blood O_2 Vol. %	Hemoglobin Grams %	% Saturation	Blood Vol. %	Cyclo mg. %	Blood CO_2 Vol. %	Cardiac Rhythm
2	11.8	10.6	76	11.3	21.3	55.	Many v. ex.
3	13.7	10.2	91				Many v. ex.
6	10.9	8.4	85	10.2	19.1	61.2	V. R.
7	10.9	8.0	89	10.9	20.5	49.9	Many v. ex.
9	12.3	9.2	89	11.1	20.9	43.4	Many v. ex.
20	13.0	9.2	94	11.1	20.9	44.	V. T.
21	17.4	14.2	85	13.1	24.7	41.2	Many v. ex.
24	16.3	13.0	86	11.9	22.4	45.7	V. T.
25	18.3	15.0	94	14.2	26.7	41.	A. V. to V. T.
26	11.6	10.8	72.5	13.0	24.5	48.3	V. T.

Duplicate analyses on arterial blood samples in all cases. In calculating percentage saturation of hemoglobin, oxygen content in physical solution was calculated as 1.6 vol. per cent (corresponding to an alveolar oxygen concentration of 65 per cent).

other occasions some of the cats were hyperventilated while their hearts were in ventricular tachycardia. The ventricular tachycardia persisted. We believe that there is no correlation between the spontaneous cardiac arrhythmias that occur in cats during cyclopropane anesthesia and hypoxemia.

The effects of different anesthetic concentrations were next observed. The results are presented in table 1. Fifteen cats were subjected to a concentration of 20 per cent cyclopropane in oxygen for the thirty minute test period. This concentration of the anesthetic agent produces light surgical anesthesia in the unpremedicated cat. Six of the cats showed no ventricular irregularities at all, and in 7 of the 9 cats remaining the arrhythmias that did occur were less severe. Eight cats were subjected to 35 per cent and 5 other cats to 40 per cent cyclopropane for a thirty minute period. Adequate artificial ventilation was produced throughout these experiments. The ventricular irregularities that occurred at these higher concentrations of the anesthetic agent were not significantly worse than when the cats were subjected to 30 per cent cyclopropane. Twelve cats were changed abruptly from a 30 per cent cyclopropane mixture to a 60 per cent mixture and maintained on the latter for ten minutes. The arrhythmias that existed immediately before the change usually persisted. The cardiac irregularities did

not become worse nor did they tend to disappear at this higher concentration of cyclopropane.

To ascertain whether surgical manipulations may project a heart that is already arrhythmic into ventricular fibrillation various maneuvers were employed. Sensory stimulation by repeated dilations of the rectum with a hemostat was applied to 43 cats, many of which were showing ventricular arrhythmias at the time. In 7 of the experiments the heart was already in ventricular tachycardia at the time of stimulation, and in each case this cardiac arrhythmia persisted. In 17 experiments, however, the rectal stimulus of fifty seconds' duration was followed by more severe ventricular irregularities than existed at the beginning of the stimulation.

Each of 3 cats had its abdomen opened and traumatic insults applied while the heart was showing spontaneous cardiac arrhythmias. The peritoneum was scraped and stretched and the gall bladder, urinary bladder, and uterus squeezed and vigorously pulled upon during successive intervals of the period of cyclopropane anesthesia. The adrenals were massaged. Although the arrhythmias after some of these procedures became worse, we feel that too much emphasis should not be placed on such changes because of the tendency of the cardiac rhythm to change spontaneously. In no cat was sensory stimulation or adrenal massage followed by ventricular fibrillation.

The prevention of the spontaneous ventricular arrhythmias was next studied. Beattie, Brow and Long (7) observed that the cardiac arrhythmias of cats during chloroform anesthesia would change to a sinus rhythm following forced lung distention. Neither held forced lung distention nor vigorous hyperventilation was effective in abolishing the cardiac arrhythmias due to cyclopropane.

F883 (diethyl-amino-methyl-benzo-dioxane) in doses of 2.0 mg. per kilogram will prevent the appearance of cyclopropane-epinephrine tachycardia in dogs. Thirteen cats were injected intravenously with doses of 2 or 5 mg. of F883 per kilogram ten minutes before the cyclopropane anesthetic was administered. One other cat had 20 mg. of F883 injected subcutaneously. In table 5 the cardiac rhythm in the cat when subjected to F883 and 30 per cent cyclopropane may be compared to the cardiac response that occurred when the heart was subjected to 30 per cent cyclopropane alone. The protection was not always complete, especially when doses of 2 mg. per kilogram were used. When a dose of 5 mg. of F883 per kilogram was given to 9 cats, 6 of the cats developed no arrhythmias during the thirty minute period of anesthesia, 1 cat was partly protected, and 2 cats showed no evidence of protection from cyclopropane arrhythmias.

Previous work on dogs (8) demonstrated that if a mixture of 20 per cent cyclopropane in oxygen has sufficient diethyl ether added to it to maintain that animal in deep surgical anesthesia with partial or complete intercostal paralysis that animal does not have ventricular tachy-

TABLE 5

PROTECTIVE ACTION OF F883 AGAINST SPONTANEOUS ARRHYTHMIAS IN CATS DURING DEEP CYCLOPROPANE ANESTHESIA

Cat No.	F883 Dose	Duration of Ventricular Arrhythmias in Thirty Minute Periods	
		Without F883 Premedication	With F883 Premedication
	mg./kg.		
3	2.0	5′ VT, 7′ M VEx, 10′ F VEx	2′ M VEx, 9′ F VEx
12	2.0	14′ VT, 5′ M VEx, 2′ F VEx	none
14	5.0	30′ bigem. (AV+V)	2′ M VEx, 4′ F VEx
16	2.0	6′ bigem. (AV+V), 9′ M VEx	none (10′ AVR)
18	2.0	2′ F VEx	8′ M VEx
24	2.0*	5′ VT (24′ AVR)	none (8′ AVR)
25	5.0	18′ VT, 2′ M VEx	none
26	5.0	5′ VT, 10′ M VEx	none
27	5.0	10′ M VEx	none
28	5.0	7′ M VEx, 3′ F VEx	none
29	5.0	1′ VT, 11′ M VEx, 3′ F VEx	9′ M VEx
30	5.0	17′ M VEx	none
31	5.0	4′ VT, 5′ M VEx, 17′ F VEx	none
32	5.0	8′ M VEx, 3′ F VEx	15′ M VEx

* F883 was injected subcutaneously in Cat 24. The intravenous route was used for all other injections.

cardia following the injection of the usual dose of .01 mg. of epinephrine per kilogram. Twelve cats were anesthetized and maintained on such a cyclopropane-ether-oxygen mixture for thirty minutes. Table 6 presents the response of the cat heart during thirty minute periods of exposure to a 20 per cent cyclopropane in oxygen mixture, to the cyclopropane-ether-oxygen mixture, and to a 30 per cent cyclopropane in

TABLE 6

COMPARISON OF SPONTANEOUS CARDIAC ARRHYTHMIAS IN CATS DURING LIGHT CYCLOPROPANE, LIGHT CYCLOPROPANE PLUS ETHER, AND DEEP CYCLOPROPANE ANESTHESIAS

Cat No.	Duration of Ventricular Arrhythmias in Thirty Minute Periods			
	20% Cyclopropane in Oxygen	20% Cyclopropane Plus Ether in Oxygen	Ether %	30% Cyclopropane in Oxygen
1	1′ VR, 1′ trigem., (24′ AVR)	4′ F VEx (20′ AVR)	3	5′ VT, 8′ M VEx
2	1′ M VEx	(25′ AVR with 1 VEx/60″)	3	8′ VT, 5′ bigem., 8′ M VEx, 5′ F VEx
3	6′ VR, 11′ M VEx	22′ F VEx	3	5′ VT, 7′ M VEx, 10′ F VEx
6	3′ F VEx	16′ M VEx, 3′ F VEx	3	6′ VT, 4′ M VEx (11 AVR)
7	15′ M VEx	6′M VEx, 7′ F VEx	3	12′ M VEx, 5′ F VEx
9	none	none	3	19′ M VEx, 3′ F VEx
10	none (26′ AVR)	12′ F VEx	3	1′ VT, (29′ AVR)
33	13′ M VEx, 6′ F VEx	4′ trigem. (2AV+1V)	4½	24′ M VEx
34	23′ trigem. (2SA+1V)	7′ M VEx	4½	12′ VT, 15′ M VEx
35	5′ M VEx, 1′ F VEx	none	4½	22′ M VEx
36	13′ M VEx	none	4½	21′ bigem.
37	none	none	4½	13′ bigem., 14′ M VEx

oxygen mixture. The advantage of using the cyclopropane-ether-oxygen mixture for anesthesia in the cat is that it affords deep surgical anesthesia without the spontaneous arrhythmias that would be present if the necessary 30 per cent concentration of cyclopropane were used and no ether added. Since this cyclopropane-ether-oxygen mixture appears to retain the speed of induction and of recovery that accompanies cyclopropane yet has the added advantages of stimulating respiration and of giving more complete abdominal relaxation in both cats and dogs, this anesthetic mixture is preferred to either agent alone.

SUMMARY

1. Normal cats develop cardiac arrhythmias consisting of ventricular extrasystoles, bigeminal rhythms, and ventricular tachycardia when anesthetized with cyclopropane concentrations amounting to 30 per cent or more. In unpremedicated cats subjected to 20 per cent cyclopropane the incidence of arrhythmia is markedly reduced.

2. Ventricular fibrillation did not occur in the cats that were anesthetized with 30 per cent cyclopropane and then injected intravenously with doses of .04 or .05 mg. of epinephrine per kilogram. Since ventricular fibrillation regularly follows a similar treatment of the dog, it appears that the cardiac response of the cat to injected epinephrine during deep cyclopropane anesthesia is less than that of the dog.

3. Spontaneous ventricular arrhythmias occur much more frequently during cyclopropane anesthesia than during light or deep chloroform anesthesia, and rarely occur during ether anesthesia.

4. Ventricular irregularities in cats anesthetized with 30 per cent cyclopropane are not due to hypoxemia.

5. Ventricular fibrillation did occur spontaneously in 2 cats during induction and intubation. Once the cat has equilibrated to the constant mixture the spontaneous arrhythmias that occur are not apt to terminate in fibrillation spontaneously, or as the result of increased cyclopropane concentrations, or as the result of sensory stimuli produced by surgical insults.

6. The spontaneous arrhythmias were not abolished by forced lung distention nor by vigorous hyperventilation.

7. F883 in doses of 5 mg. per kilogram afforded partial protection against the arrhythmias.

8. When a mixture consisting of 20 per cent cyclopropane and 4.5 per cent diethyl ether in oxygen was employed as the anesthetic agent the depth of anesthesia was similar to that obtained when 30 per cent cyclopropane in oxygen was used and the spontaneous cardiac arrhythmias that did occur were less severe than those that occurred when 20 per cent cyclopropane in oxygen without ether was used.

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MEETINGS OF THE NEW ENGLAND SOCIETY OF ANESTHESIOLOGY

WHITE AUDITORIUM, MASSACHUSETTS GENERAL HOSPITAL, BOSTON, MASS.

October 13, 1942—8 P.M.

The Role of an Anesthesiologist in the Army.

By Major Stevens J. Martin, M.C., Chief of the Section on Anesthesia, Tilton General Hospital, Fort Dix, N. J.

AUDITORIUM, MASSACHUSETTS GENERAL HOSPITAL, BOSTON, MASS.

November 10, 1942—8 P.M.

New Concepts of Morphine Analgesia.

By Dr. Donald Slaughter, Professor of Pharmacology, College of Medicine, University of Vermont, Burlington, Vt.