CIRCULATORY RESPONSES TO ENDO-TRACHEAL INTUBATION. THE EFFECT OF CARBOCAIN - T SPRAY

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Induction of anesthesia always is the most important problem for the anesthetist, because during this period the patient is susceptible to dangers and complications.

Furthermore, the cardiovascular state during this period is so unstable that any stimulation, either due to anesthetic or surgical procedures, inadequately added, will deteriorate it; the tracheal intubation or even insertion of the laryngoscope into the mouth, will often cause remarkable circulatory responses during this period.

The responses, notably the pressor response, could be followed by a mishap particularly in the aged or hypertensive patients, and poor risk patients with cardiovascular dysfunction.

Although the circulatory responses to tracheal intubation have been observed by many investigators and variously interpreted^{1) 2) 3) 4) 5)}, almost no report is available on the problem of prevention or inhibition of the responses⁶⁾.

Therefore, we have used five percent solution of Carbocain in an attempt to anesthetize the laryngeal, and the pharyngeal areas and the base of the tongue with spray prior to tracheal intubation and discussed its inhibitory effect on the pressor reflex mechanism mediated over the sympathetic which is innervated in these areas.

METHODS

1) The circulatory responses to tracheal intubation have been observed in fifty adult patients including the heart-diseased or hypertensive, and the aged, (over 60 years of age), by measuring the blood pressure during tracheal intubation.

2) The five percent carbocain contained in a push-button spray bottle was used at least five sprays were applied about five minutes prior to induction of anesthesia in order to obtain a satisfactory anesthesia of the laryngeal and the pharyngeal surfaces and the base of the tongue in an attempt to inhibit the pressor reflex mechanism during tracheal intubation.

3) In order to investigate its inhibitory effect, the blood pressure changes obtained during tracheal intubation in the Carbocain-sprayed group, 23 cases, were com-

TABLE 1

Blood Pressure Change During Intubation of the Control Group

Age	Sex	kg	Dose of Thiopental in Induction (mg)	Dose of S. C. C. in Induction (mg)	Blood Pressure before Induction (mmHg)	Immediately after Thiopental I. V.	1 min. later	Immediately after S. C. C.	1 min. later	At the Time of Intubation	Immediately after Intubation	1 min. later	2 min. later	3 min. later
57	♂	47	210	50	130-90	-5	-10	0	+10	+50	+78	+74	+60	+54
33	♀	48	200	40	140-85	-5	-10	-5	-5	+60	+20	-10	-28	-5
65	♂	50	250	50	120-80	-8	-10	0	+30	+45	+50	+10	-15	-15
34	♀	57	150	60	135-75	-5	+15	+35	+25	+25	+35	+35	+45	+15
21	♀	59	250	60	120-90	-10	-10	+20	+30	+40	+20	0	0	0
54	♂	66	250	60	140-85	-10	-15	+5	+10	+2	+20	+15	+15	-5
25	♂	43	200	40	130-80	0	0	-2	+10	+30	+20	0	+5	+10
15	♂	45	200	45	120-80	+5	-5	0	0	+25	+30	+5	+5	0
55	♂	45	250	40	170-100	0	-10	+10	-10	+30	+50	+60	+40	+30
46	♂	44	275	44	100-70	-2	0	+5	+30	+70	+60	+40	+20	+10
15	♂	44	250	40	120-80	-10	-20	-10	0	+40	+30	+30	+20	+20
42	♀	44	200	44	110-70	-3	-14	-5	+15	+65	+30	-10	-10	-10
48	♀	40	200	40	160-110	-20	-15	+7	+10	+50	+60	+50	+50	+40
13	♀	44	200	50	110-70	+5	+5	+30	+20	+40	+35	0	+10	+10
70	♂	52	175	50	90-60	+15	+5	+35	+35	+50	+40	-10	-5	0
31	♂	55	300	55	120-80	+5	-3	+10	+5	+37	+40	+20	+10	+5
42	♂	56	250	40	90-65	0	-2	+10	+10	+30	+20	+20	+5	+10
28	♂	45	175	50	100-60	-16	-10	-8	+5	+24	+30	+18	-2	0
32	♂	56	350	56	110-80	-12	-16	-20	0	+22	+28	+10	+5	+5
22	♀	43	250	40	120-85	+7	+5	+5	+5	+30	+35	+20	+10	+10
43	♂	83	450	60	180-100	-5	0	0	+5	+40	+70	+30	+20	+10
22	♂	46	250	50	110-80	-5	-5	+5	+5	+35	+15	-5	0	0
48	♂	65	250	60	140-80	+5	0	+5	+5	+34	+30	+40	+30	+8
28	♂	51	200	50	120-95	-10	-20	+5	+5	+12	+15	+20	+10	+10
60	♂	50	200	60	135-100	-25	-25	-45	-5	+15	+70	+50	+55	+20
67	♂	31	250	40	110-80	-10	-10	-30	-20	+15	+30	+20	+10	+5
75	♂	50	150	50	130-80	-20	-20	-10	+10	+10	+20	+20	+10	+10
Average			234.4	48.9		-5.1	-5.4	-1.9	+8.9	+34.3	+36.3	+20.8	+13.9	+13.2

pared with those in the control group, 27 cases.

4) Induction of anesthesia was performed with a slow intravenous injection of Thiopental (2.5 percent Isozol). Its initial dose was determined by administering directly into the vein at the rate of 5 mg per second until loss of consciousness had been obtained. Half of the initial dose was added later.

5) Tracheal intubation was routinely made by Macintosh's laryngoscope until good muscle relaxation was obtained by succinylcholine chloride 1 mg/kg I. V. and good oxygenation was produced by ventilating with 100 percent oxygen under a well-fitting mask for several minutes.

6) Blood pressure was taken by Riva-Rocci's sphygmomanometer with the cuff applied to the left upper arm. It was taken as a control value at the time of arrival at the operating theater and again approximately 45 minutes later, after the regimen-involved Demerol 1 mg/kg and atropine 0.1 mg/10 kg were given intramuscularly. It was then taken immediately after and one minute after the

TABLE 2

Blood Pressure Change During Intubation of the Carbocain-sprayed Group

Age	Sex	kg	Dose of Thiopenthal in Induction (mg)	Dose of S. C. C. in Induction (mg)	Blood Pressure before Induction (mmHg)	Immediately after Thiopenthal I. V.	1 min. later	Immediately after S. C. C.	1 min. later	At the Time of Intubation	Immediately after Intubation	1 min. later	2 min. later	3 min. later	Side effects
59	♀	50	250	60	130-100	+10	+10	+10	+4	+10	+20	0	0	+5	Nausea
44	♂	74	250	80	130-94	0	+10	+15	+20	+22	+20	+5	+2	0	
47	♀	55	300	40	110-70	+4	+4	-20	-10	+30	+20	+20	+20	+10	
54	♀	38.5	250	40	120-70	0	0	+5	+5	+20	+30	+20	+30	+10	
22	♀	66	350	60	134-86	-10	-10	-4	+5	+10	+10	+15	+6	+4	
33	♂	51	200	40	115-62	+5	+5	+15	-9	+25	+7	-5	-9	+5	
17	♀	50	300	50	120-78	+5	+5	+10	+20	+35	+30	+20	+10	+10	
17	♂	45	250	40	120-65	+6	+10	0	0	0	0	+5	+5	0	
48	♀	40	300	60	170-110	+10	+10	+10	0	+20	+5	0	-30	-20	
56	♂	50	225	50	150-90	0	+20	0	+20	+30	+30	+22	0	-10	
67	♂	50	250	50	102-68	+8	+8	-2	-2	+8	+4	0	+18	+18	
68	♂	43	300	40	160-90	0	-40	-30	-20	-20	-20	-20	-30	-30	
47	♀	58	250	60	170-90	-5	-5	+10	+10	+20	+25	+15	+10	+10	
23	♀	42	225	40	114-70	-2	-2	+6	+10	+14	+14	+8	+8	+5	
47	♀	62	250	60	120-80	+8	+8	0	+5	+20	+40	+10	+5	+5	
62	♂	33	250	50	106-78	-1	-6	+14	+14	+14	+34	+14	+14	+14	
35	♂	60	200	60	110-75	-5	-5	+15	+10	+35	+35	+20	+10	+5	
36	♂	47	250	50	140-80	0	-15	+10	+10	+30	+10	0	0	0	
48	♀	48	250	50	180-110	0	-25	-5	-10	+10	+15	+15	+10	+5	
49	♀	39	250	40	170-100	0	-20	-10	0	+10	+30	+20	0	+20	Nausea
62	♂	40	250	50	106-78	0	+4	+4	+24	+20	+30	+10	+20	+10	
60	♂	46	250	40	160-80	-10	-15	0	+5	+10	+20	+30	+5	+10	
41	♀	42	225	40	95-65	+5	-10	-5	+10	+5	+5	+10	+10	+5	
Average			255.4	49.1		+1.2	+2.8	+2.3	+5.3	+16.3	+18	+9.9	+4.9	+3.9	

respective administrations of thiopenthal and succinyl choline chloride and at the time of endo-tracheal intubation and then one, two and three minutes after intubation.

RESULTS

1. The fifty patients, 13 to 75 years old, almost all showed the pressor response to the tracheal intubation as shown in Table 1 and Table 2.

2. In the Carbocain-sprayed group, 23 cases, the rise of blood pressure during tracheal intubation was significantly diminished with the range of the values zero to 35 mmHg, averaging 16.3 mmHg. In the control group, 27 case, at the moment of tracheal intubation the blood pressure rose with the values ranging from 2 to 70 mmHg, averaging 34.3 mmHg.

3. The aged patients, over 60 years of age, were particularly investigated in respect to circulatory responses to the tracheal intubation. All the patients had a favourably marked rise of blood pressure during intubation except one hypertensive patient who showed a slight fall of blood pressure. Carbocain was used for

Fig. 1. Blood Pressure Change During Tracheal Intubation.

TABLE 3

Blood Pressure Change During Intubation of the Aged Patients

Age	Sex	kg	Dose of Thiopenthal in Induction (mg)	Dose of S. C. C. in Induction (mg)	Blood pressure before Induction (mmHg)	Immediately after Thiopenthal I. V.	1 min. later	Immediately after S. C. C. I. V.	1 min. later	At the Time of Intubation	Immediately after Intubation	1 min. later	2 min. later	3 min. later
1. Carbocain-sprayed Group														
67	♂	50	250	50	102-68	+8	+8	-2	-2	+8	+4	0	+18	+18
68	♂	43	300	40	160-90	0	-40	-30	-20	-20	-20	-20	-30	-30
62	♂	33	250	50	106-78	-1	-6	+14	+14	+14	+34	+14	+14	+14
62	♂	40	250	50	106-78	0	+4	+4	+24	+20	+30	+10	+20	+10
60	♂	42	225	40	95-65	+5	-10	-5	+10	+5	+5	+10	+10	+5
Average			255	46		+2.4	-8.8	-3.8	+5.2	+5.4	+10.6	+2.8	+6.4	+3.4
2. Control Group														
65	♂	50	250	50	120-80	-8	-10	0	+30	+45	+50	+10	-15	-15
70	♂	52	175	50	90-60	+15	+5	+35	+35	+50	+40	-10	-5	0
60	♂	50	200	60	135-100	-25	-25	-45	-5	+15	+70	+50	+55	+20
67	♂	31	250	40	110-80	-10	-20	-30	-20	+15	+30	+20	+10	+5
75	♂	50	150	50	130-80	-20	-10	-10	+10	+10	+20	+20	+10	+10
Average			205	50		-9.8	-12	-10	+10	+25	+40.2	+18	+11	+4

the five cases in this group and it was noted that in the control group the blood pressure had markedly risen as much as 5 to 8 times higher than in the Carbocain-sprayed group. (Table 3, Fig.2)

TABLE 4

Blood pressure Change of the Patients with E. C. G. Abnormalities

Age	Sex	kg	Dose of Thiopenthal in Induction (mg)	Dose of S. C. C. in Induction (mg)	Blood pressure before Induction (mmHg)	Immediately after Thiopenthal I. V.	1 min. later	Immediately after S. C. C. I. V.	1 min. later	At the time of Intubation	Immediately after Intubation	1 min. later	2 min. later	3 min. later	E. C. G. Findings
1. Carbocain-sprayed Group															
56	♂	50	225	50	150-90	0	+20	0	+20	+30	+30	+22	0	-10	{right bundle block
67	♂	50	250	50	102-68	+8	+8	-2	-2	+8	+4	0	+18	+18	flat T wave
47	♀	58	250	60	170-90	-5	-5	+10	+10	+20	+25	+15	+10	+10	{coronary insufficiencies
23	♀	42	225	40	114-70	-2	-2	+6	+10	+14	+14	+8	+8	+5	{right ventricular hypertrophy
47	♂	62	250	60	120-80	+8	0	-25	-25	+20	+40	+10	+5	+5	∕
35	♂	60	200	60	110-75	-5	-5	+15	+10	+35	+35	+20	+10	+5	{atrial fibrillation
62	♂	40	250	50	106-78	0	+4	+4	+24	+20	+30	+10	+20	+10	low voltage
Average		235.7	53			+0.9	+2.9	+1.1	+6.9	+21	+25.4	+12.1	+10.1	+6.1	
2. Control Group															
21	♀	59	250	60	120-90	-10	-10	+20	+30	+40	+20	0	0	0	{lowered S-T segment
25	♂	43	200	40	130-80	0	0	-2	+10	+30	+20	0	+5	+10	∕
70	♀	52	175	50	90-60	+15	+5	+35	+35	+50	+40	-10	-5	0	∕
31	♂	55	300	55	120-80	+5	-3	+10	+5	+37	+40	+20	+10	+5	{atrial fibrillation
42	♂	56	250	40	90-65	0	-2	+10	+10	+30	+20	+20	+5	+10	∕
28	♂	45	175	50	100-60	-16	-10	-8	+5	+24	+30	+18	-2	0	Mitral-P
32	♂	56	350	56	110-80	-12	-16	-20	0	+22	+28	+10	+5	+5	{atrial fibrillation
22	♀	43	250	40	120-85	+7	+5	+5	+5	+30	+35	+20	+10	+10	∕
22	♂	46	250	50	110-80	-5	-5	+5	+5	+35	+15	-5	0	0	∕
28	♂	51	200	50	120-95	-10	-20	+5	+5	+12	+15	+20	+10	+10	extrasystoles
Average		240	49.1			-2.6	-5.6	+6	+11	+31	+26.3	+6.3	+3.8	+5.0	

4. The same investigation was conducted on 17 patients who preoperatively had the abnormalities of electrocardiogram, such as right bundle block, supraventricular premature beats, flat or inverted T wave, lowered S-T segment, and mitral P. etc.

The rise of blood pressure markedly diminished in the seven patients in this

group who had the Carbocain sprayed prior to induction while it was increased in the control group.

5. None of the untoward reactions related to the carbocain spray were noted except for two patients who become nauseated immediately after it was sprayed.

DISCUSSION AND CONCLUSION

The circulatory responses to tracheal intubation under thiopental general anesthesia have been observed in order to investigate whether the circulatory responses would be inhibited by anesthetizing the pharyngeal and laryngeal area and the base of the tongue with a topical spraying of five percent Carbocain.

Although the mechanism of the circulatory responses to tracheal intubation has been variously interpreted, it is generally recognized that the reflex mechanism mediated over the sympatheticus at the base of the tongue would cause a pressor response due to the mechanical stimulation to the base of the tongue with a tip of the laryngoscope during tracheal intubation⁵⁾.

The circulatory reflex due to tracheal intubation frequently exhibited a pressor response and may be less significant to an ordinary patient under the satisfactory level of general anesthesia, for the responses are usually transient and easily restored without any untoward reactions⁶⁾⁷⁾.

However, for the aged, hypertensive or poor-risk patients, especially those with cardiovascular diseases, circulatory responses to tracheal intubation will deteriorate the cardiovascular status of the patient and the danger of cerebral vascular damage or cardiac failure would be frequently anticipated⁴⁾⁶⁾.

Accordingly, the attempt to prevent or inhibit the circulatory response due to tracheal intubation; notably, the rise of blood pressure is extremely significant to such patients.

We have noted that the pressor responses to tracheal intubation were satisfactorily inhibited by spraying five percent Carbocain to the pharyngeal area prior to induction. This result indicates that the pressor reflex mechanism mediated over the sympatheticus, and that the vagus has been blocked by spraying the carbocain at the pharyngeal, and the laryngeal areas and at the base of the tongue.

Five per cent Carbocain possesses as much potent and excellent action as an adequate topical anesthesia which has been obtained within a few minutes without any particular side-effects.

In conclusion, the maneuver to spray the mouth with five per cent Carbocain in order to obtain an anesthesia of the pharyngeal, and the laryngeal surfaces and the base of the tongue would be recommended in order to prevent the circulatory responses which may be followed by serious cardiovascular complications, especially in the case of the aged, hypertensive, and poor-risk patients.

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