

THE USE OF HYPOTENSIVE DRUGS DURING ELECTRICAL ANAESTHESIA IN DOGS*

D. F. CAMERON, M.D., AND J. W. R. MCINTYRE, F.F.A.R.C.S.

DURING THE LAST FIFTY YEARS interest has been taken in the production of general anaesthesia by electrical current. In 1954 Knutson¹ described the use of a device consisting of an oscillator providing a sine wave signal of variable amplitude and frequency 20–20,000 cycles/second to the amplifier, which was capable of producing currents up to 300 ma. through a load resistance of 200–300 ohms. An alternating current of 50–100 ma., 700 cycles/second, and approximately 15 volts was found to be most satisfactory for producing electrical anaesthesia in dogs, using this apparatus, but the technique had many disadvantages. One of the undesirable side-effects was hypertension. This finding was confirmed by McNeil, Turner, and Hardy² and by Hardy, Carter, and Turner³ using a modification of Knutson's apparatus, and in this department. Hardy and his associates found a marked rise in circulating catecholamines and plasma steroids during the passage of the current, epinephrine being increased to a greater extent than *l*-Norepinephrine. Phentolamine prevented or abolished this rise in blood pressure. The use of phenoxybenzamine, trimethaphan, and reserpine in an attempt to abolish this hypertensive response is reported here.

Dogs were anaesthetized using thiopentone 20 mg./kg., atropine 0.1 mg./kg., and an intravenous drip of 1.0 per cent succinylcholine. The animals were intubated and hyperventilated with room air using a mechanical ventilator. The electrodes were applied fronto-occipitally and the current used as recommended by Knutson. Blood pressure tracings were obtained from a cannulated femoral artery. The current was started at 35 ma., and, after the blood pressure had become stabilized, it was increased to 50 ma. and then by increments of 10 ma. to 100 ma. When the current had been cut off and the pressure had become stabilized at its normal level the phenoxybenzamine or trimetaphan was administered. Reserpine was given intraperitoneally 24 hours previously. The current was then reapplied and arterial pressures recorded as before.

The results are given in Table I. One or more drugs were administered at weekly intervals to the same dog so that comparisons could be made. In the experiments with reserpine the control pressures for the same dog in other experiments were used. Trimetaphan was administered by intravenous drip and owing to technical difficulties encountered the dosage could not be calculated accurately. Its effectiveness in preventing a rise in pressure was limited, and in one animal who was rendered severely hypotensive the electric current was used to restore the pressure to near normal level. It appeared that phenoxybenzamine 5 mg./kg. given intravenously was the most effective way of preventing the rise in blood pressure.

*From the Departments of Pharmacology and Anaesthesia, University of Alberta, Edmonton, Alberta.

TABLE I
Dog, 6

Milliamperes	Phenoxybenzamine 1.0 mg./kg.		Trimethaphan 0.01%		Reserpine 0.1 mg./kg. intraperitoneally	
	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug
35	178	136	190	128	184	142
50	200	138	188	128	194	145
60	189	138	196	135	193	151
70	216	149	190	140	203	157
80	225	167	200	142	213	169
90	250	208	214	153	232	198
100	280	246	226	160	252	223

Dog, 7

Milliamperes	Phenoxybenzamine 1.0 mg./kg.		Trimethaphan 0.01%		Phenoxybenzamine 5 mg./kg.	
	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug
35	167	117	203	135	170	119
50	173	131	234	182	176	120
60	195	145	256	202	—	—
70	—	—	—	—	—	—
80	—	—	—	—	—	—
90	—	—	—	—	204	124
100	—	—	—	—	219	120

Dogs 9 AND 11

Milliamperes	Phenoxybenzamine 1.0 mg./kg. Dog 9		Trimethaphan 0.01% Dog 11		Reserpine, 0.1 mg./kg. intraperitoneally Dog 11	
	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug	Control pressure, mmg.	After drug
35	152	147	—	—	160	152
50	223	183	—	—	180	165
60	230	222	—	—	189	185
70	274	225	199	177	212	199
80	280	240	218	198	—	—
90	—	—	234	183	—	—
100	—	—	—	—	—	—

SUMMARY

A sine wave alternating current of 50–100 ma., 700 cycles per second, and approximately 15 volts, applied to a dog with fronto-occipital electrodes, produces anaesthesia. Hypertension is an undesirable side-effect. Phenoxybenzamine 5 mg./kg. given intravenously was superior to reserpine 0.1 mg./kg. given intraperitoneally 24 hours previously, trimethaphan 0.01 per cent by intravenous drip, or the same drug in smaller dosage, in preventing this hypertensive response.

REFERENCES

1. KNUTSON, R. C. Experiments in Electronarcosis: A Preliminary Study. *Anesthesiology* 15: (1954).
2. MCNEIL, C. D.; TURNER, M. D.; & HARDY, J. D. Electrical Anesthesia: Some Metabolic Observations and Comparisons. *Sci. Forum* 9: 394 (1959).
3. HARDY, J. D.; CARTER, T.; & TURNER, M. D. Catechol Amine Metabolism: Peripheral Plasma Levels of Epinephrine (E) and Nor-epinephrine (NE) during Laparotomy under Different Types of Anaesthesia in Dogs. *Ann. Surg.* 150: 666 (1959).