15549

Effect of Some Atropine-like Drugs on Swing Sickness.

PAUL K. SMITH* AND ALLAN HEMINGWAY.†

From the Departments of Pharmacology and Biochemistry and of Biophysics, AAF School of Aviation Medicine, Randolph Field, Texas.

This study was undertaken primarily to find remedies of value in the prevention of airsickness. Any drug to be of value in the treatment of airsickness should fulfill the following criteria; it should be effective immediately following oral administration; it should not impair the capacity of treated personnel to perform duties; it should not be toxic, habit forming, or cause disagreeable symptoms.

Methods. The drugs tested included atropine, scopolamine, hyoscyamine, homatropine, benzoyltropine, benzoyloscine, and pavatrine (B-diethylaminoethyl fluorene-9-carboxylate hydrochloride). All drugs or lactose placebos were contained in No. 1 pink capsules. The drug was given approximately one hour before swinging.

The swing test consisted of being swung in the sitting position through an arc of 150° on a swing with a radius of 14 feet from the center of the swing to the seat. The head was fixed with the plane passing through the lateral canthus of each eye and the external auditory meatus of each ear horizontal to the ground when the swing was at rest. Swinging was continued until the subject vomited or for a maximum of 20 minutes. Further details of the procedure have been described[1] in which it was shown also that there was a fair correlation between swing sickness and airsickness.

Drugs were studied in 3 ways: In the first, unselected subjects were swung and those that vomited within 20 minutes were used later for tests of the drug or placebo. In the second procedure, the subjects who vomited the first time were divided into 2 groups and before they were swung the second time half were given the drug and half placebos while the third time the order was reversed. In the third procedure, the subjects before having been swung were given either the drug or placebo and the incidence of vomiting in the various groups recorded.

The subjects were all either aviation cadets or aviation students. When the same subject was used repeatedly an interval of several days was allowed to elapse between swings and attempts were made to equalize the average interval between swings for the groups receiving drugs and groups receiving placebos. This was done because subjects swinging repeatedly with short intervals between may become accustomed to the motion.

The tests for side effects were chosen because they might reveal undesirable effects, such as dry mouth, interference with normal vision, etc. The subjects used for studies of these effects were selected without regard to susceptibility to swing sickness. Before being given a drug, each subject lay quietly for at least 5 minutes at which time his pulse rate and blood pressure were measured. Each man was given some paraffin to chew and told to salivate as much as possible into a small graduated cylinder during a 4-minute interval. The near point of accommodation was measured by means of a Prince rule. In this procedure, a piece of paper with a fine black line on it was first moved out from the eye until the line was no longer blurred and then from out to near the eye until the line appeared blurred. The mean of these 2 measurements was recorded. Each eye was tested separately. The drug or placebo was then given and 1½ hours later the observations were repeated.

Results. The results of the swing tests are given in Table I. They have been analyzed merely on the basis of the percentage of subjects in each group that vomited. Of the drugs tested scopolamine hydrobromide, 0.75

* Now at Department of Pharmacology, George Washington University School of Medicine.

† Now at Department of Physiol., University of Minnesota School of Medicine.

[1] Hemingway, A., submitted for publication.

TABLE I.
Swing Tests on Subjects After Atropine-like Drugs.

		Drug		Placebo			
	mg	No. Tested	No. Vomited	No. Tested	No. Vomited	Estimated protection %	P§
Scopolamine hydrobromide	0.5	21‡	5	21	9	44	0.18
" "	0.75	21*	5	21*	10	50	0.11
" "	0.75	21‡	9	21†	20	55	<0.01
Atropine sulfate	1.0	20‡	11	21†	20	42	<0.01
l-Hyoscyamine hydrobromide	1.0	20‡	7	21†	20	63	<0.01
Homatropine hydrobromide	12.0	20‡	14	21†	20	26	0.03
Benzoyltropine hydrochloride	50.0	20‡	14	21†	20	26	0.03
Benzoyloscine hydrochloride	50.0	20‡	13	21†	20	32	0.02
Demerol	100.0	8‡	7	21†	20	10	0.46
Pavatrine	250.0	20‡	11	21†	20	42	<0.01
"	250.0	52	18	365†	98	—	>1.00
Scopolamine hydrobromide	0.75	146	16	365†	98	59	<0.01
Atropine sulfate	1.0	106	15	365†	98	47	0.01

* Subjects acted as own controls, receiving the drug the second or third time swung and the placebo the other time.

† Those subjects receiving placebos were used at the same time several of the drugs were being studied and are grouped together.

‡ These subjects receiving drugs and the corresponding control group vomited on the initial selection swing.

§ Probability that observed difference could have occurred by chance.

TABLE II.
Parasympathetic Depressant Effects of Drugs.
Differences and standard deviations of differences between effects 1½ hours after administration of the drug and prior to administration.

Drug	No. subj.	Salivation cc	S.D.	Pulse rate per min	S.D.	Systolic blood pressure mm Hg	S.D.	Diastolic blood pressure mm Hg	S.D.	Accommodation cm	S.D.
Placebos	58	1.0	1.8	— 9.6	6.0	—5.9	4.6	—2.8	5.8	—0.1	0.8
Scopolamine	20	—0.8	1.5	—15.4	4.0	—9.7	8.5	—3.0	6.5	0.4	1.4
l-hyoscyamine	20	—4.4	2.4	— 0.8	11.6	—5.2	5.6	—1.2	6.4	0.6	1.4
Pavatrine	23	0.5	2.6	— 9.9	4.7	—4.4	6.7	—0.9	4.6	—0.1	0.8
Atropine	20	—2.1	2.3	— 9.6	5.8	—4.8	8.2	—1.5	6.4	0.2	0.6
Benzoyltropine	21	—0.3	2.7	—10.8	4.0	—5.2	5.3	—0.1	4.6	0.3	1.0
Benzoyloscine	20	0.5	1.4	— 9.2	6.3	—5.7	5.2	—0.4	4.9	—0.1	0.9
Homatropine	20	—0.3	2.4	—13.2	4.4	—6.4	7.4	—0.3	7.0	0.6	1.6

mg, and atropine sulfate, 1.0 mg, were effective by 2 methods. Hyoscyamine hydrobromide, 1.0 mg, was effective by the only method it was studied. (The probability of the difference occurring by chance was less than 1 in 100). Homatropine, benzoyltropine and benzoyloscine were also moderately effective (the probability of the difference occurring by chance was less than 1 in 20). The effectiveness of Demerol was negligible and in some subjects caused nausea before they were swung. The study on Pavatrine in unselected subjects failed to confirm the earlier work on selected subjects and the incidence of vomiting after Pavatrine was even slightly higher than after lactose. There were no obvious factors to account for this difference. From the calculation of the estimated protection, it is obvious that not all of the drugs were of equal value but due to the limited number of subjects it was not possible to determine whether or not statistically valid difference in effectiveness existed. In general it may be said that scopolamine, atropine, and *l*-hyoscyamine were effective whereas homatropine, benzoyltropine and benzoyloscine were of a lower order of usefulness.

With the exception of Pavatrine, comparable results were obtained by the methods