PHARMACOLOGY

THE EFFECT OF DIBASOL* ON THE AUDITORY ADAPTATION

A. P. Velitskii

From the Department of Pharmacology, Pharmacy and Pharmacognosy (Head – Honored Scientist Prof. N. V. Lazarev) and the Department of Otolaryngology (Head – Honored Scientist Prof. K. L. Khilov) of the S. M. Kirov Order of Lenin Military Medical Academy, Leningrad

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The majority of research workers now consider that adaptive changes in the sensation of hearing are mainly regulated by processes taking place in the central nervous system. According to G. V. Gershuni [2], O. L. Nemtsova [6], and G. I. Grinberg and F. Kh. Fridlyand [3], auditory adaptation is due to the development of an inhibitory process in the cortical end of the auditory analyzer.

In view of reports in the literature [1, 5, 7 and others] that dibasol has the power of abolishing certain forms of inhibition in the central and peripheral nervous system and of preventing its development, in the present investigation we set out to study the effect of dibasol on the character of the adaptive changes in the sensation of hearing which developed in persons with normal hearing and with various lesions of the auditory analyzer under the influence of excessive noise.

EXPERIMENTAL METHOD AND RESULTS

We carried out 2 series of observations: the first series on 13 healthy young persons with normal hearing and the second on 20 persons with normal hearing and 39 persons with various forms of deafness. The investigations were made in the acoustics laboratory of the Leningrad Research Institute of Diseases of the Ear, Throat, Nose, and Speech, using an Atlas audiometer. In the first series of observations the method of investigation was as follows. The threshold of audibility of the subjects was measured for frequencies of 512, 2048 and 4096 cps monaurally, in the right ear; each then took a dose of 0.12 g of powdered glucose. After a rest of half an hour; an excessive sound of frequency 2048 c/sec and intensity 100 db above threshold level of audition was applied to the subject's right ear through an air telephone for 4 minutes. Immediately after the cessation of the sound stimulus, the acuity of hearing a sound of 512 cycles/sec was determined. Measurements of the thresholds of audibility of this sound were repeated at intervals of 30 seconds until the threshold value had returned to its initial level. After repetition of the excessive noise, just as at the beginning of the observations the acuity of hearing and the time taken for reversion of the adaptation to a frequency of 2048/sec, and then for one of 4096/sec, were determined by the method described above.

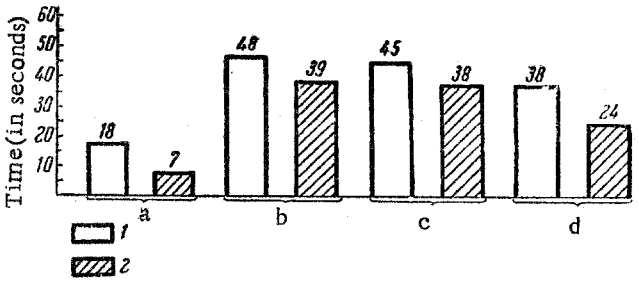
At the conclusion of these control observations with glucose, after 4-5 days the action of dibasol was tested on the same subjects. Observations were carried out by the same method, but instead of glucose the subject received a mixture of 0.1 g glucose with 0.01 or 0.005 g dibasol. The subjects were unaware of the composition of the powder.

The results obtained are shown in the table, which gives the values of the maximum loss of the sensation of hearing in decibels and the time of reversal of adaptation in seconds. Under the influence of dibasol in doses

* Dibasol is a vasodilator drug – 2-benzyl-benzimidazol hydrochloride (Translator's note).

The Action of Dibasol on the Adaptive Changes in the Sensation of Hearing

Investigation		Control						Experiments					
		maximum loss of sensation of hearing in db			time of reversal of adaptation (in seconds)			maximum loss of sensation of hearing			time of reversal of adaptation (in seconds)		
		frequency (beats/sec)											
name	age (in years)	512	2048	4096	512	2048	4096	512	2048	4096	512	2048	4096
		Dibasol in a dose of 0.005 g											
A-n	19	—5	5	5	420	240	240	—5	5	10	300	120	300
K-v	20	0	10	15	30	270	330	0	7	15	30	120	180
K-v	19	0	10	5	30	390	270	—10	5	5	60	150	60
A-v	19	—5	5	10	90	300	660	—5	10	15	90	210	570
N-n	19	—5	5	10	180	240	240	—5	5	10	240	120	270
Z-v	22	5	10	5	120	210	180	5	5	5	60	120	150
V-n	19	10	5	10	240	180	330	10	5	10	150	90	150
		Dibasol in a dose of 0.01 g											
M-v	23	10	10	5	240	210	150	2	10	5	150	120	90
A-v	22	15	15	5	240	270	90	5	5	0	90	90	30
M-n	21	5	10	15	60	210	240	0	5	5	30	90	120
B-v	22	5	5	10	120	330	180	5	5	5	60	360	60
K-n	19	15	5	10	600	60	60	5	0	10	90	30	120
I-v	21	—5	10	15	60	210	270	0	10	5	30	60	60



Changes in the time of reversal of adaptation in healthy subjects and in persons suffering from auditory neuritis and stages I, II and III otosclerosis, after taking glucose (0.1g) and a mixture of dibasol (0.01 g) with glucose (0.1 g). 1) Action of glucose; 2) action of a mixture of dibasol and glucose; a) Healthy subjects; b) auditory neuritis; c) stage III otosclerosis; d) stages I and II otosclerosis.

of 5 and 10 mg, the value of the maximum loss of hearing of the frequencies tested, and of the time of reversal of adaptation, were lowered by comparison with the controls in the majority of cases. The thresholds of audibility in both control and experimental series were changed not only to the stimulating tone (2048/sec), but also to tones of mixed frequency (512 and 4096/sec). Furthermore, with an increase in the dose of dibasol, the time for reversal of adaptation was correspondingly shortened for all the test frequencies.

The results of these observations also showed that the value of the maximum loss of the sensation of hearing and of the time of reversal of adaptation were, in the majority of cases, directly proportional to each other. On account of the laboriousness of the method which we have described, in the second series of observations we accordingly confined ourselves to an investigation of the time of reversal of adaptation alone.

The second series of observations was made on 20 healthy persons aged from 20 to 30 years, with normal hearing, and on 39 patients. The latter group was composed as follows: 14 persons with diseases of the auditory nerves, 14 with stage III otosclerosis and 11 with stage I or partly stage II otosclerosis. By age the patients were subdivided as follows: from 20 to 30 years — 10 persons, from 31 to 40 years — 10, from 41 to 50 years — 8 and over 50 years — 11 persons.

The subject's audiogram was taken, after which he was given the glucose powder (0.1 g), and then 30 minutes later a sound of frequency 1024/sec and intensity 50 db above the threshold of audibility was applied for 2 minutes to the right ear. The time of reversal of adaptation to a tone of 1024/sec was then measured in the same ear. After resting for one hour and reapplication of the excessive sound, the other ear was tested. After 4-5 days observations were carried out by the same method but after the preliminary administration of a mixture of glucose (0.1 g) and dibasol (0.01 g). In this series of observations too, the subjects were unaware of the composition of the powders.

The results of the investigation of the time of reversal of adaptation in the second series are shown in the figure. Here are shown the mean values of the time of reversal of adaptation for the 4 groups of subjects: those with normal hearing, those with diseases of the auditory nerves, those with stage III otosclerosis and those with stages I and II otosclerosis.

It will be seen that the greatest value of the time of reversal of adaptation (48 seconds) was found in the group of subjects with diseases of the auditory nerves. In the group suffering from stage III otosclerosis the mean value of the time of reversal of adaptation (45 seconds) was longer than that in stages I and II of otosclerosis (38 seconds). The time of reversal of adaptation was least in healthy subjects (18 seconds).

After administration of a single dose of 10 mg of dibasol, the average value of the time of reversal of adaptation (45 seconds) was decreased in all 4 groups of subjects. Its maximum decrease as a result of the drug was found in patients with stages I and II of otosclerosis (by 14 seconds), and its minimum in stage III otosclerosis (by 7 seconds). The degree of shortening of the time of reversal of adaptation in the group with diseases of the auditory nerves was insignificant (9 seconds). The average shortening of the time of reversal of adaptation in the group of healthy subjects was 11 seconds.

Our results confirm those of G. M. Komarovich's research [4], that the time of reversal of adaptation is longer in lesions of the nervous apparatus of the auditory analyzer, and also O. F. Zakharova's findings that during otosclerosis there is observed not only a disturbance of the conduction of sound but also a well-marked state of inhibition of the cortical division of the auditory analyzer, and this is diminished by dibasol. Accordingly, we consider it desirable to use dibasol in order to ascertain the character of the state of inhibition of the central divisions of the auditory analyzer, and hence to decide whether or not to operate in a certain stage of otosclerosis.

Our results concerning the property of dibasol, in doses of 5 and 10 mg, to shorten the time of reversal of adaptation after an excessive noise suggest that the drug may prevent the development of inhibition in the auditory analyzer and bring about a more rapid removal of the inhibition. This drug may therefore be recommended in persons exposed to the action of prolonged and intensive noise. Dibasol may also be used therapeutically in certain forms of deafness — neuritis, otosclerosis and so on; in these cases functional disturbances of the nature of obstructive inhibition are often observed along with organic disturbances in the auditory analyzer.

SUMMARY

The author studied the effect of dibasol on the adaptive changes of hearing in healthy individuals and in patients suffering from diseases of the auditory nerves and otosclerosis. As established, dibasol reduced the level of the maximal loss of the auditory sensitivity and the period of reverse adaptation. On these grounds the author recommends dibasol administration to persons exposed to noise for prolonged periods of time and suffering from some forms of a partial loss of hearing.

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