4. G. Franksson and C. A. Gemzell, Acta Chir. Scand., 106, 24 (1953).
5. A. A. Dandberg, D. M. Neilson, J. Palmer, et al., J. Clin. Endocrinol., 13, 629 (1953).
6. G. Sayers and M. Sayers, Endocrinology, 40, 265 (1947).

# A PHENOMENON IN VESTIBULAR COMPENSATION

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The role of spinal afferentation from the lower half of the body in compensation of the sequelae of unilateral loss of vestibular function was studied in experiments on guinea pigs. Division of the spinal cord at the thoracic level under local anesthesia had no appreciable effect on the development of compensation after simultaneous or subsequent destruction of the labyrinth and did not disturb compensation in previously labyrinthectomized animals. Division of the spinal cord in labyrinthectomized animals under ether or chloroform anesthesia was accompanied by a sharp disturbance of compensation. These substances evoked a similar picture of decompensation in unilaterally labyrinthectomized animals with an intact spinal cord also. The results indicate that the disturbance of vestibular compensation discribed in the literature after division of the spinal cord under ether anesthesia is not the result of removal of spinal afferentation from the lower half of the body, but is due to the direct effect of inhalational anesthetics on compensation mechanisms.

KEY WORDS: vestibular system; compensation of disturbed functions; effects of general anesthesia.

The role of spinal afferentation in compensation of the effects of unilateral labyrinthectomy has been studied in experiments on animals: Division of the spinal cord in guinea pigs at the thoracic level under ether anesthesia was accompanied by a significant disturbance of compensation mechanisms [3]. However, in earlier experiments on rabbits the present writer found that processes of vestibular compensation are very sensitive to the action of ether and chloroform. Inhalation of these anesthetics led to a marked disturbance of compensation for a long time after unilateral labyrinthectomy [1].

The object of the present investigation was to verify whether removal of spinal afferentation from the lower half of the body does in fact weaken compensation of the effects of unilateral loss of vestibular function.

## EXPERIMENTAL METHOD

Experiments were carried out on 85 adult guinea pigs of both sexes. The animals were divided into several groups. In group 1 (six animals) the spinal cord was divided 10 days before unilateral labyrinthectomy, in group 2 (seven animals) the spinal cord was divided simultaneously with destruction of the labyrinth, in group 3 (27 animals) it was divided at various times after labyrinthectomy: 1 week in six animals, 1 month in eight, 2 months in seven, and 2.5 months in six animals. Groups 4 and 5 were controls: In the 31 animals of group 4 labyrinthectomy alone was performed, and in those of group 5 (nine animals) only the spinal cord was divided. A further five intact guinea pigs (group 6) also were used. The labyrinth (usually the right) was destroyed mechanically through the middle ear under local anesthesia. Postoperative nystagmus was recorded in the horizontal derivation by an electrooculographic method on a Mingograph [2] apparatus and the animals also were photographed on motion picture film. The spinal cord was divided with a spatula after exposure at the level of segments T5-7 and preliminary infiltration of the surrounding tissues with 1% procaine. The animals of all groups inhaled ether and chloroform until a state of complete anesthesia developed: The unilaterally labyrinthectomized animals inhaled the anesthetics 1 week and 1, 2, and 6 months after destruction of the labyrinth.

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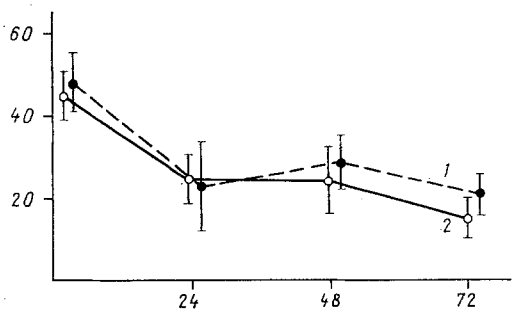


Fig. 1

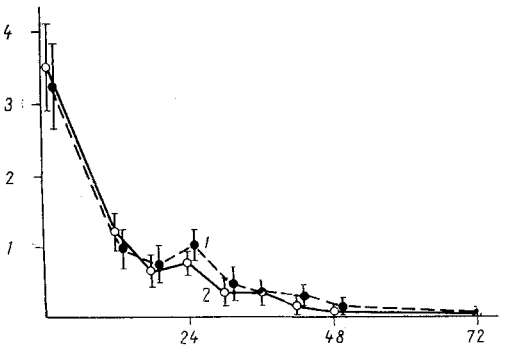


Fig. 2

Fig. 1. Frequency of postoperative nystagmus in unilaterally labyrinthectomized guinea pigs with the spinal cord intact (group 4, curve 1) and divided at level T6 (group 1, curve 2). Abscissa, time after destruction of right labyrinth (in h); ordinate, frequency of nystagmus, in jerks/sec.

Fig. 2. Rotation of the head in unilaterally labyrinthectomized guinea pigs with the spinal cord intact (group 4, curve 1) and divided at level T6 (group 2, curve 2). Abscissa, time after destruction of right labyrinth (in h); ordinate, rotation of the head (in deg).

## EXPERIMENTAL RESULTS

The aftereffects of unilateral labyrinthectomy in the guinea pigs varied in character: repeated rolling and stepping movements, turning the head and tilting it toward the side of destruction of the labyrinth, asymmetrical position of the limbs, deviation and nystagmus of the eyes. Quantitative estimates of extinction of some responses during the first 3 days are given in Figs. 1 and 2. When the animals were examined 6 months after labyrinthectomy, they still turned their head toward the side of the destroyed labyrinth by 10-20° in the sitting position and showed definite deviation of their eyes.

Inhalation of ether and chloroform on the 7th day after labyrinthectomy caused a clear disturbance of developing compensation. A few minutes after the end of inhalation asymmetry of posture of all the animals was sharply increased: The left forelimb and right hind limb were extended and abducted, rotation of the head to the side of the destroyed labyrinth was increased to 50-90°, and at the same time the head was tilted in the same direction by 30-90°. Some animals were for a long time unable to sit up and lay on their right side. Then placed on their back or left side, two or three rolls to the right could be provoked. Nystagmus toward the side of the intact labyrinth was observed for 5-15 min, with a maximal frequency of 0.5-1.0 jerks/sec. The following picture was observed during inhalation of ether or chloroform 1 month after labyrinthectomy: Rotation of the head was increased to 50-70° and tilting of the head by 40-50° appeared. Rolling movements of the animals and swinging of the head were observed. Nystagmus was present in all animals, with a maximal frequency of 0.6-1.0 jerks/sec, and it disappeared in the course of 10-20 min. From time to time rotation of the head increased and the animals lay on their right side. Clear asymmetry of the body was observed during sitting and stepping movements were performed on the side of the destroyed labyrinth. After 2 months these anesthetics induced an increase in rotation of the head to 40-60°, accompanied by the same amount of tilting of the head. Postural asymmetry was clearly distinguishable for 1 h. Some animals showed nystagmus for 5-10 min with a maximal frequency of 0.2-0.3 jerks/sec. Six months after labyrinthectomy, inhalation of ether and chloroform caused an increase in rotation of the head to 50-90° and the appearance of tilting the head to the same side by 20-30°. The limbs assumed the asymmetrical position characteristic of the acute stage. Individual animals lay completely on their right side, but two of them could be induced to roll once or twice, when placed on their back, to their right side and beyond. Several jerks of nystagmus could be recorded in three of the 11 animals for 1-1.5 min, to the side of the intact labyrinth. In four animals postural nystagmus also was observed when they lay on their left side, and this was absent immediately after inhalation.

Division of the spinal cord in animals with an intact labyrinth as a rule was not accompanied by responses similar to those observed after unilateral labyrinthectomy. Destruction of the labyrinth in animals after preliminary division of the spinal cord evoked typical re-

sponses of ablation of the labyrinth: stepping movements, rotation and tilting of the head toward the side of the destroyed labyrinth, extension of the left forelimb, deviation and nystagmus of the eyes. The intensity of these responses and the dynamics of their extinction were indistinguishable from those in labyrinthectomized animals with an intact spinal cord. A pattern similar to that described above was observed in the animals of group 2, in which the spinal cord was divided at the same time as labyrinthectomy (Figs. 1 and 2). However, division of the spinal cord at various times after labyrinthectomy caused no signs of disturbances of compensation in any of the animals: nystagmus and tilting the head were absent, rotation of the head and the position of the forelimbs remained unchanged. Subsequent inhalation of ether or chloroform by these animals, however, led to the development of the typical picture of decompensation. Inhalation of ether and chloroform by guinea pigs with intact labyrinth and spinal cord revealed no changes resembling the pattern of unilateral labyrinthectomy.

The experiments showed that spinal afferentation from the lower half of the body has no appreciable effect on compensation of the sequelae of unilateral loss of vestibular function and decompensation due to inhalation of general anesthetics. The results thus show that the disturbance of compensation in unilaterally labyrinthectomized guinea pigs in Azzena's experiments [3] was not the result of removal of spinal afferentation from the lower half of the body, but was an artifact caused by division of the spinal cord under ether anesthesia.

Under the influence of inhalational anesthetics decompensation probably arises as a result of depression of electrical activity of the vestibular nuclei on the side of labyrinthectomy, which disappears after destruction of the labyrinth but is restored in the course of compensation. This pehnomenon, in turn, leads to an imbalance of activity between the vestibular nuclei on the two sides, and, consequently to the reappearance of the extinguished responses [1]. It is not quite clear how ether and chloroform block the processes maintaining activity of the deafferented vestibular nuclei. One way may perhaps be through the inhibitory effect of these substances on the activity of certain brain enzymes [4].

LITERATURE CITED

1. G. I. Gorgiladze, Dokl. Akad. Nauk SSSR, 240, 223 (1978).
2. G. I. Gorgiladze and G. S. Kazanskaya, Fiziol. Zh. SSSR, No. 1, 45 (1971).
3. G. B. Azzena, Arch. Ital. Biol., 107, 43 (1969).
4. G. Ungar, Nature, 207, 419 (1965).

# INCREASED SENSITIVITY OF ADIPOSE TISSUE OF SPONTANEOUSLY HYPERTENSIVE RATS TO ACTH. THE ROLE OF CALCIUM

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The action of ACTH on lipolysis was studied in the adipose tissue of rats with spontaneous and renal hypertension and also in normotensive rats of corresponding control groups. The sensitivity of the adipose tissue of SHR rats to ACTH was shown to be higher than in the normotensive control. Evidence was obtained that this increase in sensitivity is due to the state or quantity of intracellular calcium. In rats with renal hypertension no such increase in sensitivity of their adipose tissue to ACTH was found.

KEY WORDS: hypertension; ACTH; lipolysis; calcium.

Changes in the response of the adipose tissue to insulin and adrenalin have been found in rats with spontaneous and renal hypertension compared with their normotensive control [2,

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