

## LABYRINTH SURGERY AND NYSTAGMUS

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It is curious to observe that otologists on one hand and cranial surgeons on the other have simultaneously been practising ablation of the labyrinth or section of the acoustic nerve for the relief of vertigo (Dandy in 1928, Portmann in 1927). Since then Day in 1943, Cawthorne in 1943, Wright in 1938, Mollison in 1935, and Schuknecht in 1957 were described technique and results of labyrinthine surgery.

In 1953 S. Honjo reported his effective surgical method of labyrinth surgery for treating vertigo. The present research was undertaken to study the effect of his method using preoperative and postoperative nystagmus of patients performed on surgery.

### METHODS

This study is based on results of examining patients on whom the operation of the labyrinth was performed unilaterally to treat vertigo at the Department of Otolaryngology, Yamaguchi Medical School, during the period 1953 to 1956. The total of patients examined numbered 54, male 31, female 23. The diagnosis were: Labyrinthine trauma 36, Ménière's disease 15, uncertain 3.

The object was to study the vestibular response before and after operation of the labyrinth, and the effect of the operation. The interval between the operation and the examinations varied considerably in the different cases. The earliest postoperative examinations were made 2 weeks after operation, but in some cases they took place as much as 2 years or more after operation.

To study nystagmus rotatory and caloric tests were employed. The rotation tests were carried out by Bárány's method, the patients being rotated 10 times in 20 seconds, that is at an angular velocity of  $180^{\circ}/\text{sec}$ . A rotatory chair devised by Dr. Honjo was used; it rotates easily on ball bearings and has an adjustable support for the position of the head.

The patients were tested in the sitting posture with the head tilted about  $30^{\circ}$  forward, and they were directed to pass the head against. The tests were thus primarily designed to determine the reactions of the horizontal semicircular canals. During

turning the patients kept their eyes closed; on stoppage of the rotation the eyes were instantly opened and the gaze was turned straight ahead in order to eliminate the possible effect exerted the nystagmus by jerky eye movements. At the same time the patients were to make the conditions in each test as far as possible similar, all patients were tested behind high powered spectacles (about + 10 D.), which facilitated observation of nystagmus especially when the response was weak. In principle there was an interval of at least 5 minutes between each test in different directions.

Caloric tests with cold water were arranged by routine method of clinic: quantity introduced 10 c. c., temperature 20°C. Irrigation lasted 5 sec. The patients tilt the head backward 60°. The tests were carried out using high-powered glass (+ 10 D.). Generally there was an interval of at least 10 minutes between each caloric test at the same patient.

After rotation or calorization eye movement (nystagmus) was recorded with watch.

## RESULTS

### 1. Results of preoperative rotation tests.

Of total of 54 patients the duration of nystagmus was equally long in both ear in 14 cases (group I), longer to the side of the ear subsequently operated in 4 cases (group II) and longer to the side of the non-operated ear in 36 cases (group III), if duration of nystagmus on both ears at the same patients differing less than 5 sec. considered for the present purposes as of equal length (Table I).

Table 1. Duration of post-rotational nystagmus before operation (54 cases).

Duration of nystagmus	Cases (Total 54)	%
Group I Equal on both ears	14	25.9%
Group II Longer to the operated ear	4	7.4%
Group III Longer to the non-operated ear	36	66.7%

Table 2 compares the side of subsequent operation and the non-operated side as regards to duration of nystagmus; the cases in which the difference between the two sides was 1-4 sec., 5-9 sec., and 10 sec. or more, are grouped together. It is found that the difference was in 14 cases 1-4 sec., in 7 cases 5-9 sec., and in 33 cases 10 sec. or more. The greatest difference observed in the same patient was 15 sec., and the nystagmus was then longer to non-operated ear. The longest duration of nystagmus was 43 sec. and the shortest 5 sec. The average duration on nystagmus was 10.8 sec. to the subsequent operation and 23.9 sec. to the non-operative ear.

Table 2. Comparison of the results of rotation tests on the basis of differences in duration of nystagmus to the sides.

Difference	Nystagmus longer	
1-4 sec.	(to the operative side	5
	(to the non-operative side	9
5-9 sec.	(to the operative side	0
	(to the non-operative side	7
10 sec. or more	(to the operative side	0
	(to the non-operative side	33

## 2. Results of postoperative rotation tests.

The first postoperative rotation test was made on 2 weeks after operation and follow-up test was done on one month after operation in each unilateral operated patients. In 8 cases the results of the first and follow-up tests were the same to the pre-operative results, except that usually duration of nystagmus in the first test was usually the same to the follow-up test results (group II). In 9 cases of the follow-up test lasted equally long to the preoperative one, while the first test results results showed hyperexcitability on operated ear (Table 3).

Table 3. Duration of the postoperative rotation nystagmus on the operated ear (54 cases).

		Case's	%
Group I Preoperative Postoperative the first follow-up	are same	8	14.8%
Group II postoperative the first follow-up	are same	37	68.5%
Group III Preoperative follow-up	are same	9	16.7%

## 3. Results of preoperative caloric tests.

Table 4 shows the average length of the latent period of nystagmus averaged 55.2 sec. from the subsequently operated ear and 31.5 sec. from the non-operated ear, the difference being 23.7 sec. The average duration of nystagmus on the subsequently operated ear was 30.5 sec. and on the non-operated ear was 158.6 sec. The difference was thus 128.1 sec.

Table 4. Average length of latent period and duration of nystagmus on caloric stimulation before operation (54 cases).

	Subsequently operated ear	Non-operated ear
Average length of latent period (sec).	55.2	30.5
Average duration of nystagmus (sec).	30.5	31.5

Simultaneous caloric stimulation of both ears was carried out on 20 cases (Table 5). Nystagmus was then directed to the subsequent operated side in 12 cases and

to the non-operated side in cases. There was vertical nystagmus in 2 cases. In 3 cases there was no nystagmus.

Table 5. Simultaneous caloric stimulation of both ears before operation (20 cases).

	Cases	%
Nystagmus to the subsequently operated side.	12	60%
Nystagmus to the non-operated side.	3	15%
Vertical nystagmus	2	10%
No nystagmus	3	15%

#### 4. Results of the postoperative caloric tests.

Caloric tests were done one month after operation because in every case operative wound on the external canals was clear at this time.

After operation latent period of nystagmus on the subsequent operated ear lasted shorter than that before operation in 31 cases and were of similar length from both ears in 23 cases (Table 6).

Table 6. Latent periods of nystagmus in operated ears.

	Cases	%
Latent period longer from postoperative tests.	31	57.4%
Latent period of similar length.	23	42.6%

Postoperatively the duration of nystagmus was longer than before operation in 35 cases and were of similar length from both ears in 19 cases (Table 7).

Table 7. Duration of caloric nystagmus after operation in operated ears.

	Cases	%
Duration longer from postoperative tests.	35	64.8%
Duration of similar length on both ears.	19	35.2%

Simultaneous caloric stimulation of both ears was performed on a total of 20 cases. Nystagmus was directed to the side of the operated ear in 5 cases, to the side of non-operated ear in 2, and there was no nystagmus in 10 cases.

In addition, there was in 3 cases a vertical nystagmus upward in the front gaze position. Moreover, there were three cases in which nystagmus did not appear when the head was bent backward but appeared when it was bent forward. The results show that no nystagmus was appeared about twice as after as nystagmus after operation (Table 8).

Table 8, Simultaneous caloric stimulation of both ears after operation (20 cases).

	Cases	%
Nystagmus to the operated side.	5	25%
Nystagmus to the non-operated ear.	3	15%
No nystagmus.	10	50%
Nystagmus to vertical.	2	10%

### DISCUSSION

It has been generally accepted that conservative therapy for vertigo caused by Ménière's diseases and labyrinthine trauma seldom cures, although it often alleviates the condition and enables the patient to tolerate it. There are many cases, however, which do not respond to conservative measures, and the condition is so incapacitating that patients become desperate and are willing to undergo any surgical procedure which might one them.

As mentioned above, the accepted surgical procedure at present is section of the vestibular nerve and has been quite successful in a few cases; however, the results have sometimes been disappointing.

S. Honjo believes that any surgical procedure performed should be upon the labyrinth itself and should include opening the labyrinth. There have been a few reports of labyrinth surgery for this condition. Portmann's endolymphatic sac operation has relieved some case, although the relief has often been temporary. In England, the operation of choice seems to be alcohol injections into the labyrinth as reported by Wright and Mollison. This procedure causes complete destruction of the cochlea and vestibule and not infrequently has caused facial paralysis. Recently S. Honjo in 1953 described the following effective technique for labyrinth surgery. A partial simple mastoidectomy is performed by endaural route, opening the antrum widely and removing the out wall of the aditus far enough to expose the short process of the incus. With a small motor-driven burr, the horizontal canal is opened medially to the short process.

The opening is made in this portion of the horizontal canal on the labyrinthine capsule in order to reduce the pressure of the perilymphatic space. He carried out this procedure on the patients suffering from vertigo, which had good results after operation.

As shown in the present paper, there are some difference in the results from rotatory and caloric test in the same subject, although duration of nystagmus on the operated ear increases after operation. Physiologically the rotation test has much more significance in relation to the labyrinthine function than any other test, because turning acts as the only adequate stimulus for the semicircular canals. On the other hand, it is a disadvantage that both labyrinths are stimulated together.

This is in contrast to caloric test, by which each side can be tested separately and can be compared exactly. It is believed that simultaneous caloric stimulation of both ears represents an exact method for disclosing slight difference in the excitability of the two labyrinths, even in cases where the unilateral method has failed.

Judging from the results of the present study, it is considered that after operation labyrinthine response improves in cases of Meniere's disease and labyrinth trauma.

### SUMMARY

1. In 54 cases suffering from vertigo nystagmus were studied by rotatory and caloric tests before and after labyrinth operation.
2. After operation, nystagmus duration on the operated labyrinth increases on a level with normal ear.

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