# Local Anesthesia in the Inner Ear for Diagnosis and Treatment of Vertigo

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Labyrinthine origin vertigo is usually attackwise and severe with rotatory sensation, nausea and vomiting, so-called typical vertigo[1]. In practically, even though the patient compalined of these typical symptomes, the differential diagnosis of the diseases, especially to detect the cause and origin of vertigo, is not always easily made.

As a first step of diagnosis, we have to consider whether the pathologic origin is in central or in peripheral of the vestibular system. In case the cause of vertigo is suspected as originating in the peripheral labyrinth, more keen diagnosis about lateralization and about condition of excitability in the labyrinthine organ will be requested for more effective treatment.

Ordinary oto-neurological tests, including routine vestibular function test and audiological examination, are not always satisfactorily work to decide the affective side (lateralization) and even to suggest excitability, i. e. from paralyzed, irritative to hypersensitive in condition, in the labyrinth.

Meanwhile, up-to date surgical treatment for the labyrinthine vertigo is successfully aiming to selective neurectomy of only single ampullary nerve in the inner ear.

Answering this demand, a new test for more fine differential diagnosis will be expected to be available in clinic; and here, application of pharmacological labyrinthectomy (reversible stoppage of the peripheral labyrinthine function, in other word, transient cessation of the neuronal activity in the vestibular nucleus and nerve[2]) will be proposed for this procedure, proved distinctly in clinical case by Suzuki, et al[3),4),5),6)].

In this paper, case studies in otoneurological Clinic by means of local anesthesia in the ear with Xylocaine are present and some brief comment was done.

## METHOD OF LOCAL ANESTHESIA IN THE INNER EAR

After the topical anesthesia was applied on the tympanic membrane injection of 4% Xylocaine (Lidocine) solution, about 0.5ml, was made into the tympanic cavity through the eardrum with a fine needle. The progress after injection and change in subjective symptoms such as vertiginous sensation or tinnitus and objective symptoms such as nystagmus or hearing test was observed and recorded with the deepest care.

The initial objective symptom is paretic nystagmus beating to the un-anesthetized side observed.

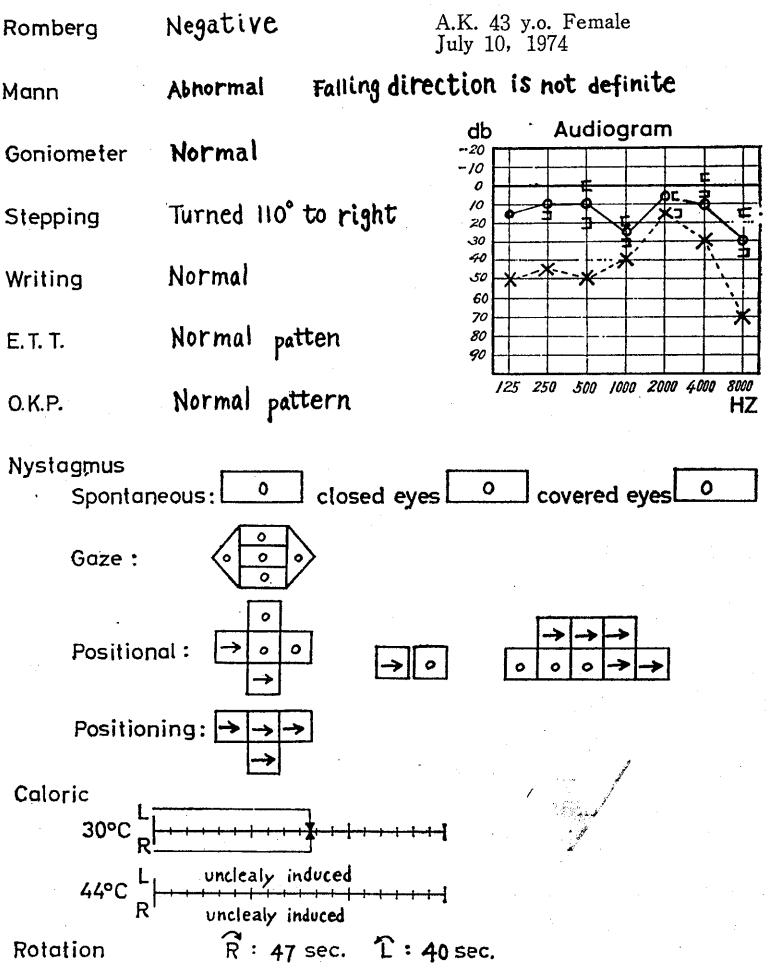



Fig. 1. Case 1. Otoneurological Examination

Follow-up recording was done for about 10 hours successively and on the 24 hours later at least to detect any influence of local anesthesia in the inner ear.

## CASE REPORTS

Case 1. A 43-year-old house wife. History of present illness; As the first attack, this patient experienced rotational vertigo suddenly combined with nausea, tinnitus and hearing loss on the left side on having a hair set under electrical hair dryer in August, 1971. She was treated by an

A.K. 43 y.o. Female
September 18, 1974

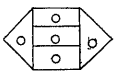
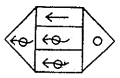
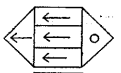
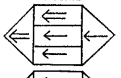
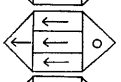
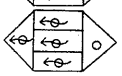
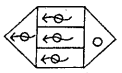
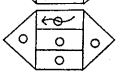
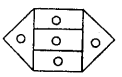
| Progress Note | Spont. & Positional nyst. | Subjective symptom | | Note |
|---|---|---|---|---|
| | | Vertigo | Tinnitus | |
| Before |  | (−) | (+) | |
| Injection of xylocaine | | | | |
| 1 hour |  | (−) | (+) | |
| 2 |  | (−) | (+) | |
| 3 |  | (卄) | (+) | |
| 4 |  | (+) | (+) | |
| 5 |  | (±) | (+) | |
| 6 | | | | |
| 7 |  | (−) | (+) | |
| 8 |  | (−) | (+) | |
| 9 | | | | |
| 10 |  | (−) | (±) | |

Fig. 2.

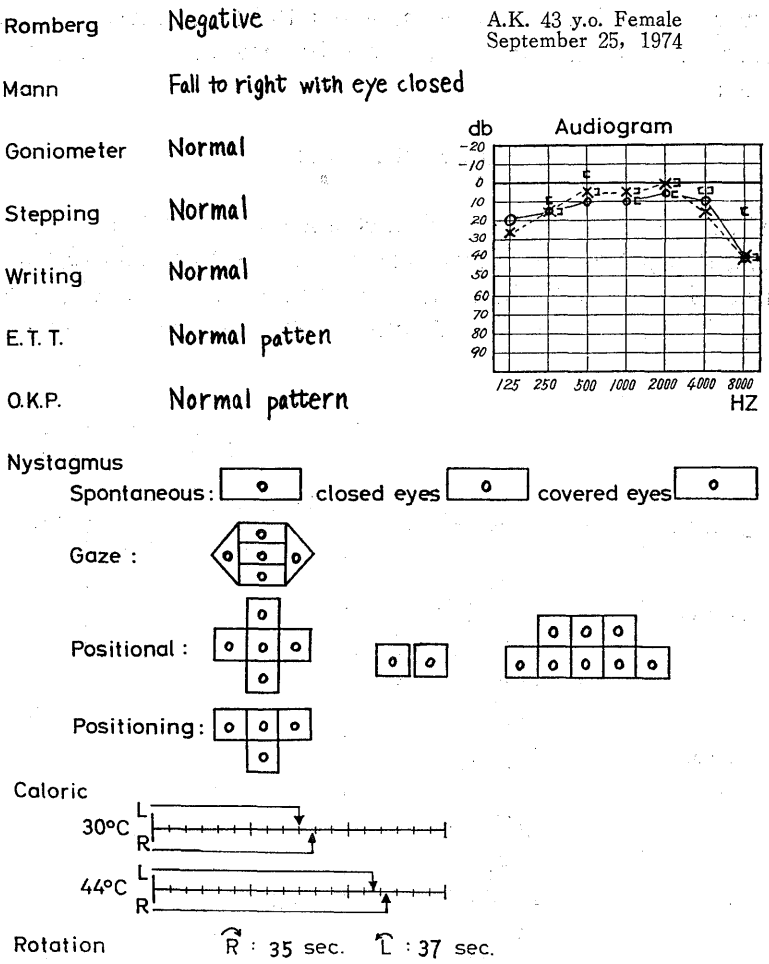



Fig. 3. Case 1. Otoneurological Examination

OB-GYN doctor and these symptoms subsided in a few days. Since then, she had the similar attacks 4 times until the admission on July 8, 1974. Results of otoneurological examination performed on 2 days after admission was shown in Fig. 1. It showed a left-beating positional and positioning nystagmus of moderate intensity and those had always the same direction. Hearing test showed the perceptive hearing loss on the left side. So, the function in the left inner ear of this patient was suspected that the inner ear was in the mixed condition of hypofunction and irritative satge.

Therefore, in order to confirm the affected side and to control the

tinnitus, local anesthesia in the inner ear by injection of Xylocaine into the tympanum was done on Septber 18. The finding of nystagmic reaction after the injection of Xylocaine into the tympanum was shown in Fig. 2. Paretic nystagmus, i. e. right-beating nystagmus was first observed about one hour after injection and it continued about 8 hours. After then, this patient was freed from vertigo attacks and tinnitus. No spontaneous nystagmus was observed objectively until hospital discharge on October 5, 1975. Results of otoneurological examination performed on September 25 was shown in Fig. 3. It revieled no sign of abnormal labyrinthine function.

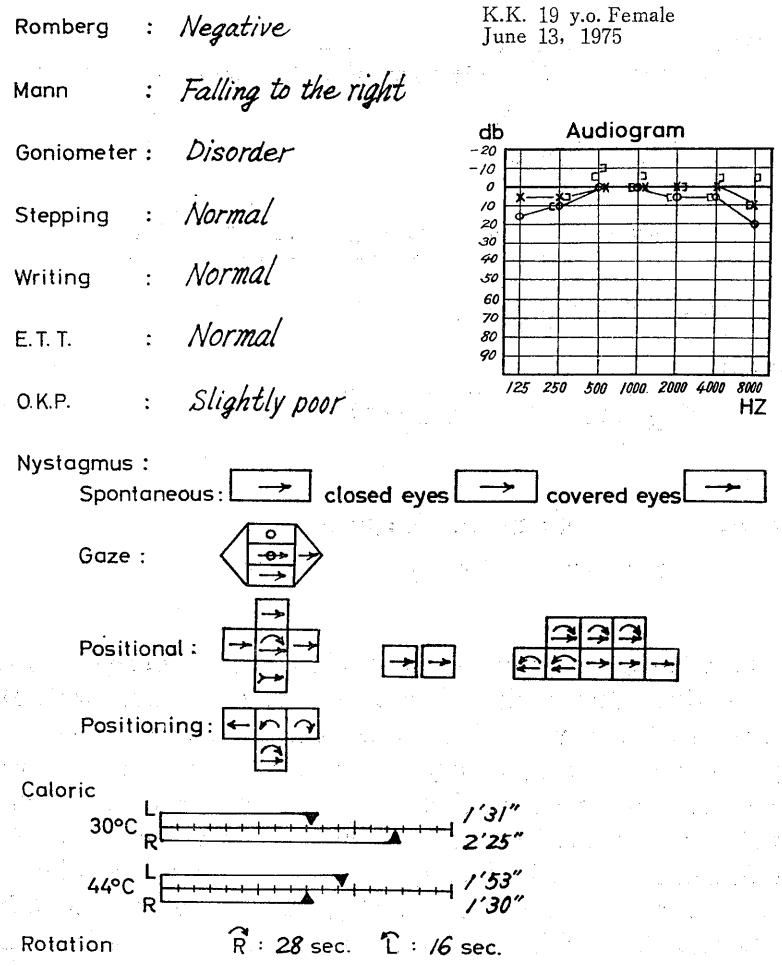



Fig. 4. Case 2. Otoneurological Examination

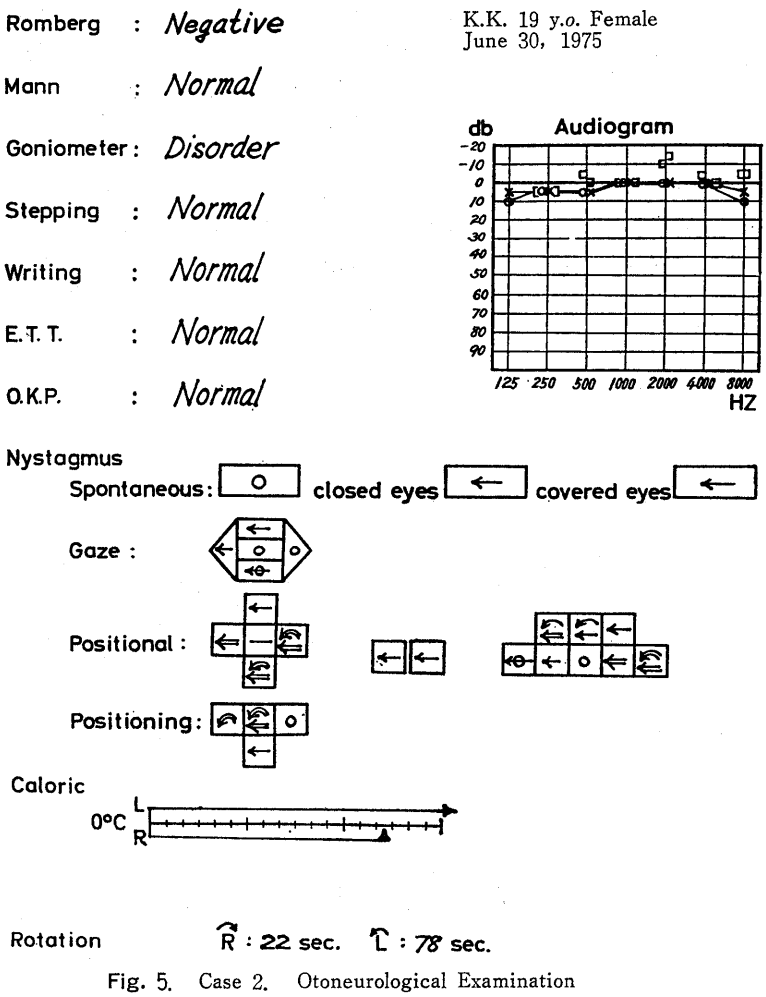



Fig. 5. Case 2. Otoneurological Examination

Case 2. A 19-year-old female was suffered from benign paroxismal positional vertigo. This patient had had vertigo attacks with floating sensation on rapid changing of head position in bed or waking up in morning since the beginning of June, '75. These fit of dizziness occurred acompanied with tinnitus (high pitch tone in character) on the right side. Findings of otoneurological examination on admission (June 13, '75) was shown in Fig. 4. The notable finding was DP to the left side, which would be due to affections of spontaneous nystagmus beating to the left side. On the other hand, in this case, otoneurological examination (June 30) showed the different results on the direction of nystagmic reaction, of which the opposite direction of nystagmus was observed beating to the

K.K. 19 y.o. Female
July 1, 1975

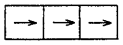
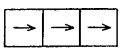
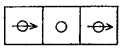
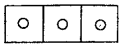
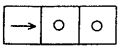
| Progress note | Spont. & Posiitional nyst. | Subjective symptom | | Note |
|---|---|---|---|---|
| | | Vertigo | Tinnitus | |
| Before | Frenzel SP.  | (±) | (+) | Nausea (−) |
| | Injection of xylocain | | | |
| 1 hours |  | (±) | (+) | (+) |
| 2 | | | | |
| 3 |  | (±) | (卄) | (+) |
| 4 | | | | |
| 5 |  | (−) | (卄) | (−) |
| 6 | | | | |
| 7 | | | | |
| 8 |  | (−) | (卄) | |
| 9 | | | | |
| 10 | Supine position | | | |

Fig. 6. Case 2.

right side shown in Fig. 5. From the results mentioned above, the cause of disequilibrium will be suspected as due to vestibular disorders. But it was difficult to make any decision on the affected side, and so local anesthesia of the inner ear was done on the right side depending upon the side of tinnitus on July 1.

The progress of effectiveness on the dizziness probably due to the inner ear anesthesia was shown in Fig. 6. Left-beating nystagmus, which was seen at the pre-anesthetic check, was well suppressed showing reduced amplitude and frequency of nystagmus, but there was no direction changing through the post-injection progress. This favorable condition continued about 5 hours. This results suggested that the right sided inner ear might be in hypersensitive condition. After that anesthetic

management, only occasional right-beating nystagmus on supine position was noted about one week. She was completely freed from dizzy sensation and spontaneous nystagmus until hospital discharge on July 11.

Case 3. A 20-year-old female, school girl, felt faint for a few seconds during telephone conversation suddenly on March 25, '75. Since then, she had had an attack of vertigo with nausea intermittently and she was treated under the diagnosis of anemia by doctor of Internal medicine at Shimonoseki, but not effective. So, she was admitted to our clinc from April 28 to May 15, '75. During this admission, no vestibular disorders was detected, and she was completely released from vertiginous attacks by conservative treatment and bed rest. After that, she had recurrence of

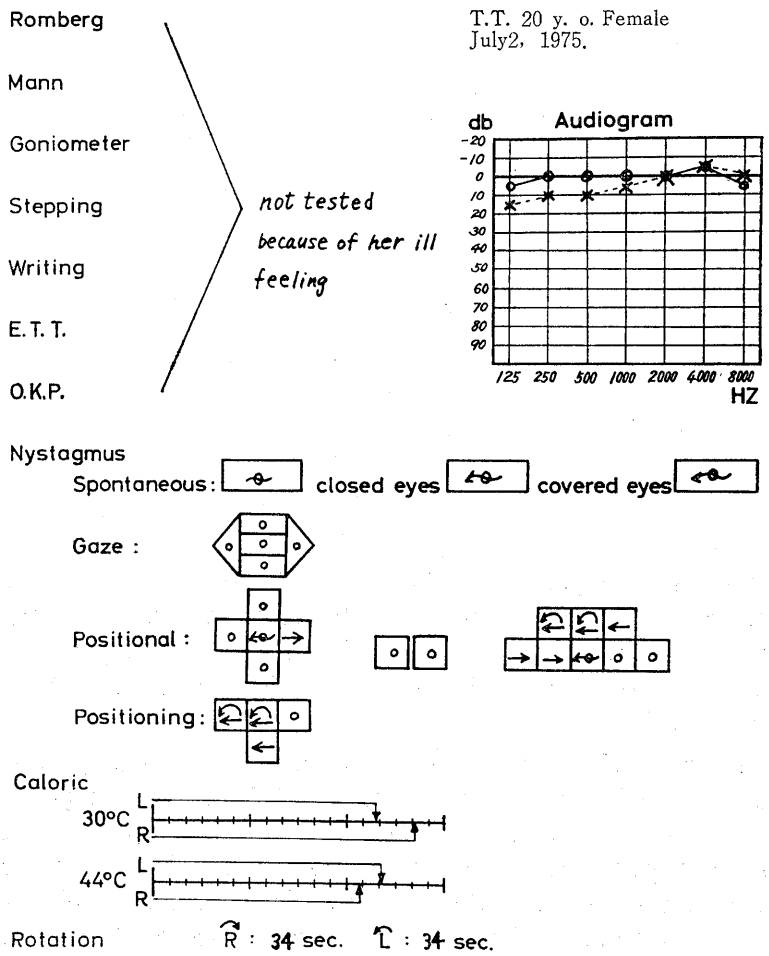



Fig. 7. Case 3. Otoneurological Examination

rotatory vertigo combined with nausea when she changed her head position. No cochlear symptoms were complained except for the ear obstructive sensation on the left side. So, she was re-admitted here on July 30, '75. Findings of otoneurological examination on admission was shown in Fig. 7.

According to the results above mentioned, the cause of vertigo was suspected due to hypersensitivity in the inner ear. To confirm the laterality of lesion, local anesthesia in the inner ear was done on July 8. The left ear was selected for local anesthesia because obstructed ear sensation remained. The course of paretic nystagmus was shown in Fig. 8. Eight hours after injection of Xylocaine, all of nystagmus, vertigo and nausea were subsided. The patient was in these desirable condition until

T.T. 20 y.o. Female
July 8, 1975

| Progress note | Spont. & Pos itiona nyst. | Subjective symptom | | Note |
|---|---|---|---|---|
| | | Vertigo | Tinnitus | |
| Before | | (−) | (−) | |
| | Injection of xylocaine | | | |
| 1 hours | | (+) | (−) | |
| 2 | | (卄) | (−) | |
| 3 | | (卄) | (−) | |
| 4 | | (+) | (−) | |
| 5 | | | | |
| 6 | | (±) | (−) | |
| 7 | | | | |
| 8 | | (−) | (−) | |
| 9 | | | | |
| 10 | | | | |

Fig. 8. Case 3.

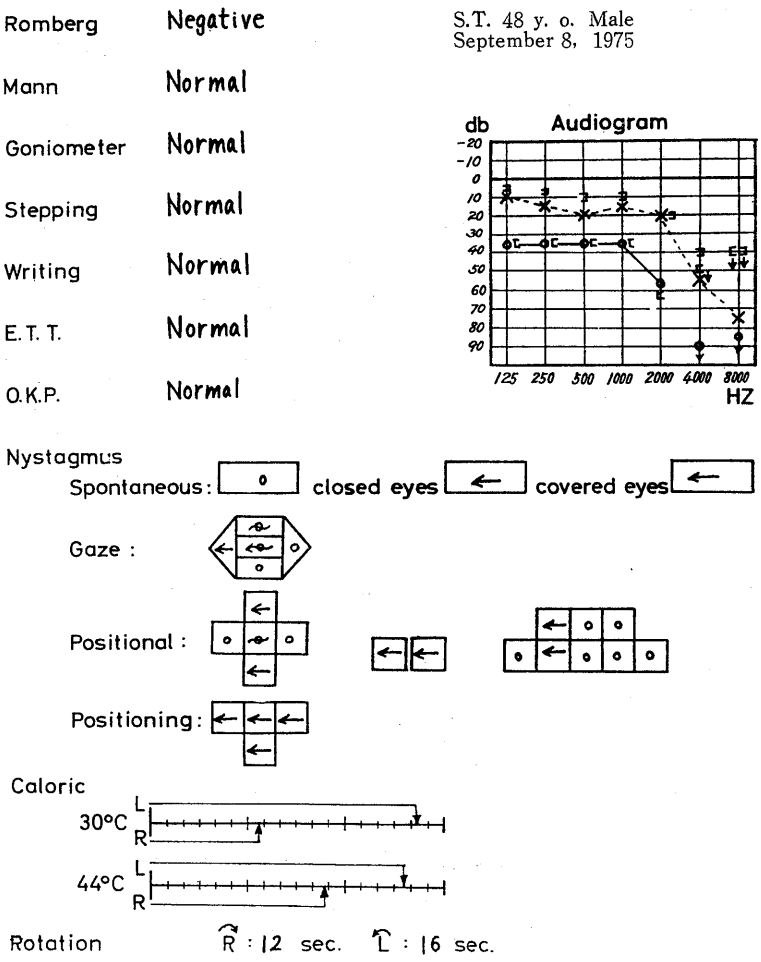



Fig. 9. Case 4. Otoneurological Examination

hospital discharge on July 30. After local anesthesia in the inner ear, she was completely released from vertiginous attacks in any head positions.

Case 4. A 48-year-old man who was diagnosed as suspicion of Meniere's disease on the right side. This patient never had any episodes of vertigo until March 5, '75 when he had the sudden attack of vertigo on waking up in morning. This vertigo was accompanied with rotatory sensation, nausea and vomiting. Tinnitus on both sides preceded this attack about one month before. His rotatory vertigo was fairly well subsided after the short period of treatment with the medicine per os.

However, he was bothered with floating sensation on walking even

S.T. 48 y.o. Male
September 10, 1975

| Progress noth | Spont. & positional nyst. | Subjective symptom | | Note |
|---|---|---|---|---|
| | | Vertigo | Tinnitus | |
| Before | Frenzel sp. ← o o | (−) | (+) | |
| | Injection of xylocaine | | | |
| 1 hours | ← o o | (−) | (+) | |
| 2 | → → → | (−) | (±) | |
| 3 | ↷ ↷ ↷ | (+) | (−) | |
| 4 | ⇄ ↷ → | (+) | (−) | |
| 5 | ↭ ↭ ↭ | (−) | (−) | |
| 6 | ← ← ← | (−) | (+) | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | Supine position | | | |

Fig. 10. Case 4.

after 20 days admission at Shimonoseki Kosei Hospital. Otoneurological examination on admission on September 8 was shown in Fig. 9. Right-beating nystagmus and CP on the right side were the peculiar findings, showing the mixed condition of both irritative condition and hypofunction of the right sided inner ear. He was performed on the inner ear anesthesia on the right side on September 10. The course of influence was shown in Fig. 10. Paretic nystagmus was elicited about 70 minutes after injection of Xylocaine, persisting for 7 hours and 35 minutes and the nystagmus returned to the previous stage. In order to suppress the irritated condition of the right sided inner ear, injection of Streptomycin Sulfate was done and good results was obtained.

## COMMENTS

Some reports[2),7),8),9)] on experimental study of the production of labyrinthine paralysis by application of local anesthetics transtympanically into the middle ear are available up-to-date.

Clinically, Togi[10)] et al tried the transtympanal injection of Procaine hydrochloride combined with Hyaluronidase, and gained a fairly good results. Later on, Suzuki et al[3),4),5),6)] applied this method for differentiating the vertigo and for deciding the affected side in the inner ear and its localization of lesions. When one side of the inner ear might be in irritative or hypersensitive stage, these diseased condition would be suppressed temporarily with the local anesthesia in the inner ear.

As the consequence that the sensory cells and nerve endings in the inner ear are anesthetized, inner ear anesthesia yields the paretic nystagmus. So, this mechanism to elicit nystagmus is fundamentally different from that of caloric test which examines whether the sensory cells of the lateral semicircular canal are reactive to the optimal stimulation or not.

This method of the inner ear anesthesia will be mentioned as transient reversible pharmacological labyrinthectomy.

As we presented case reports of four patients, the labyrinthine response by acute pharmacological labyrinthectomy was monitored by both direct observation and electronystagmographic recordings.

In all cases, the diagnosis of the affected side was confirmed. Except one patient (Case 4), three patients in this series were released from the troubles with only single injection of anesthetics into the middle ear cavity yielding the inner ear anesthesia on the affected side. It is unexplainable why the transient inner ear anesthesia make the patients to be free from vertigo. These results which we obtained from the cases seem to be very important The possibility of recurrence, of course, remained and a large number of follow-up observations are needed.

## SUMMARY

Xylocaine (Lidocaine) instillation into the middle ear cavity was described as local anesthesia in the inner ear for testing the peripheral labyrinthine function, and for treatment.

Four cases with labyrinthine disorders were studied. The results from this test will be useful for making a fine diagnosis of the inner ear function and will give some information about treatment of choice.

Grateful acknowledgement is made to Prof. Shoichi Honjo, M.D. for his kind guidance and his careful review of manuscript. And thanks Toru Sekitani, M.D., Associate Professor for his helpful discussion.

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