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Pathological and Non-pathological Irregularities of Nystagmus

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A B S T R A C T

Irregularities of nystagmus can be found almost in every electronystagmographic record, but only a few are pathological. In this investigation, the authors try to define the border line between pathological and nonpathological irregularities of nystagmus and according to this measure the diagnostic use of findings of irregularities of nystagmus.

***Key words**: caloric reflex test, disequilibrium, electronystagmography, nystagmus, vertigo, vestibulometry*

Introduction

Irregularities of nystagmus are found almost in every electronystagmographic record. Physicians, audiologists and vestibulologists, most frequently do not mention it because they are unsure of how to interpret them correctly[1]. Figure 1 shows some examples of irregular nystagmus. The aim of this investigation was to contribute to better understanding, interpretation and diagnostic use of irregularities of nystagmus which occur in the most frequent record – the caloric test[2]. The hypothesis was that irregularities of nystagmus occur when the strength of the interference overcomes the strength of regular nystagmus. The term strength of nystagmus is a measure proportional to the speed of the slow component and inversely proportional to the length of the length of nystagmus. The form of the irregularities has no specific significance[3].

Patients and Methods

All the electronystagmographic examinations were carried in the Department of Diagnostic and rehabilitation of Hearing and Speech, Clinic of Otorhinolaryngology Head and Neck Surgery, at the Clinical Hospital Centre University of Rijeka. For the investigation a VO425 (Interacoustics, Denmark) three-canal nystagmograph was used. All examinations were performed during 2008 and 2009. In that period 6000 electronystagmographic records were examined and 140 patients with irregularities in nystagmographic record randomly extracted and classified according to sex (70 male and 70 female subjects) and age (subjects were divided into 7 age groups: younger than 20, 20–29, 30–39, 40–49, 50–59, 60–69 and older than 70). The control group comprised 42 healthy volunteers with no audiological or vestibular disorders (three males and three females in each group).

Results

It is well known that in the case of strong nystagmus the irregularities are not easy to detect due to the fact that strong nystagmus is difficult to obstruct[4].

On the other hand, when the cause of the irregularity is strong, it will penetrate faster and deeper into the record.

Pathological disturbances which manifest as irregularities of nystagmus will occur at the place in the record when the strength of the irregularities overcomes the strength of regular nystagmus. The speed of the slow component at which the penetration of irregularity in the record begins can be taken as the point of equilibrium/balance between the strength of regular nystagmus and the strength of irregularity of nystagmus[5].

We measured the threshold of irregularity of nystagmus in relation to the speed of the slow component:

The results obtained show that in healthy subjects the penetration of irregularity is greater in the older age

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groups, although there is no marked regularity. In subjects with disturbed balance the penetration of irregularity is much stronger and increases with age, although in this case also complete regularity cannot be determined (Table 1).

TABLE 1
AVERAGE/MEAN VALUES OF IRREGULARITIES OF NYSTAGMUS (IN) FOR AGE GROUPS

Group (age)		v	IN-t	IN%
	F	11	25	41
I (<20)	M	13	37	17
	FM	12	31	39
	F	16	18	43
II (20–29)	M	12	21	31
	FM	14	20	37
	F	20	27	36
III (30–39)	M	11	20	43
	FM	16	24	40
	F	21	27	45
IV (40–49)	M	14	10	39
	FM	18	19	42
	F	19	21	34
V (50–59)	M	24	19	41
	FM	22	20	38
	F	22	13	45
VI (60–69)	M	17	9	41
	FM	20	11	43
	F	19	11	61
VII (>70)	M	16	10	68
	FM	18	11	65

v – speed of the slow component of nystagmus in degrees per second (°/s), IN-t – period from beginning of nystagmus to beginning of irregularities of nystagmus in seconds, IN% – percentage of IN, M – male, F – female, FM – total (male+female)

The threshold of regularity of nystagmus in relation to the duration of nystagmus:

In the group of healthy subjects the result show a trajectory type curve which regularly falls after the age of 20 years, i.e. in the older group irregularities of nystagmus begin much earlier than in the younger age group (Figure 2).

Note: In the group of subjects younger than 20 years irregularities of nystagmus also occurred slightly earlier – which was due to the fact than small children aged 5–6 years were included in the study, in whom the neuromuscular program is not completely developed and neither are all vestibular mechanisms proficient.

The threshold of nystagmus in relation to the amount of irregularities:

In the healthy subjects the amount of irregularity did not exceed 10% in any of the age groups (Figure 3). The amount of irregularities in subjects with disturbed balance in the younger age groups was four times more frequent, and in the older aged groups six times more frequent (Figure 4).

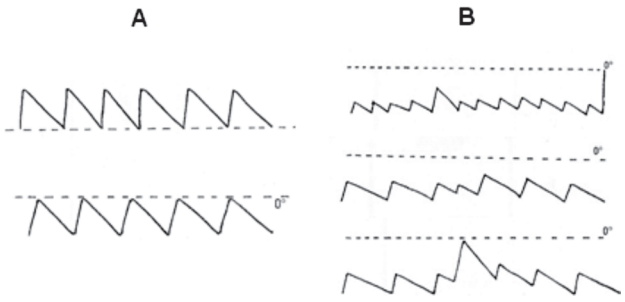

Fig 1. A – normal nystagmogram, B – examples of irregularities of nystagmus.

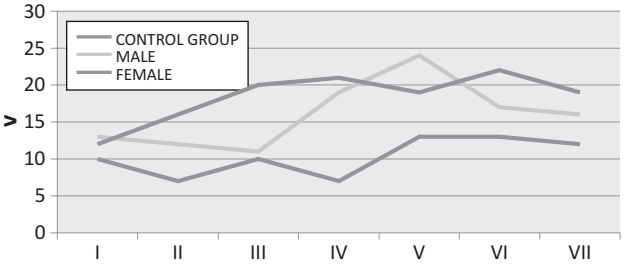

Fig. 2. The threshold of irregularities of nystagmus in subjects in relation to the speed of the slow component in groups I–VII. v – speed in degrees/second (°/s).

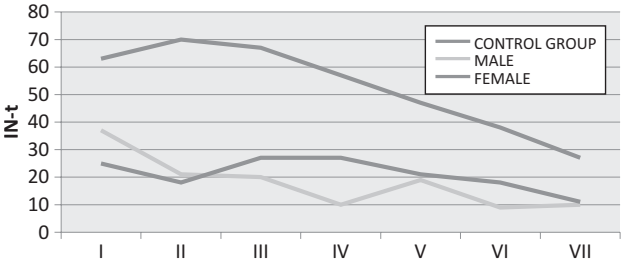

Fig. 3. The threshold of irregularities of nystagmus (IN) in subjects in relation to the duration of nystagmus. IN-t – Period from beginning of nystagmus to beginning of irregularities of nystagmus in seconds.

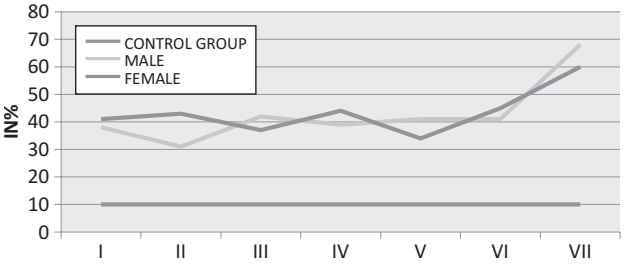

Fig. 4. The percentage of irregularities of nystagmus (IN) in subjects from age groups I to VII. IN% – percentage of IN.

Discussion

This investigation demonstrated, already in the control group of healthy subjects, that the strength of nystagmus is stronger when the speed of the slow component is greater. However, is this really so?

It is usual for the physiological speed of the slow component to range from 10/s to 50/s, and therefore if the speed of the slow component is greater this is considered nonpathological finding (hypernystagmus). However, should nystagmus with speed of the slow component of, for example, 55/s always be considered pathological? It could be that suppressive mechanisms are merely weaker, which is not a pathological condition. Only when there is a complete lack of suppressive mechanisms should the finding be considered pathological[6].

In persons exposed to stronger vestibular irritations (sailors, ballerinas, gymnasts, etc.) suppressive mechanisms are more developed, resulting in a very low speed of the slow component of nystagmus, which does not mean, however, that the strength of their nystagmus is smaller[7].

Initially strong in almost every caloric reflex test nystagmus gradually weakens as the intensity of the irritation decreases, until it completely disappears. With the weakening of nystagmus, the speed of the slow component decreases. However, in this investigation the strength of the induced nystagmus was much weaker in relation to the duration of nystagmus, than in relation to the decreased speed of the slow component. In our experience we have observed that weak nystagmus can last much longer than strong nystagmus.

Thus, priority should be given to the time threshold (i.e. time elapsed from the start of nystagmus to the occurrence of irregularities in the record) in relation to the threshold of speed of the slow component.

Heat induced nystagmus is a time integrated movement which has a predetermined motoric program which, once started, continued as a trajectory type towards its cessation/end, and is difficult to obstruct or halt. The structure of the nystagmus is a much more constant resistant value than the speed of the slow component, and is therefore much easier to express and thus measure the strength of irregularities of nystagmus (than on the speed of the slow component. In other words, the speed of the slow component (while in physiological ranges) does not reflect the strength of induced nystagmus as much as the location/place within the time span of the integral nystagmus response.

The boundary of physiological penetration of irregularities in the electronystagmographic record can be determined for every age[8,9]. Irregularities which exceed this boundary i.e. occur earlier than normal for a particular age. They enter the area of the pathological and point to the need for further diagnostic examinations, as they indicate some central vestibular disorder[10].

In this investigation it was also noticed that certain forms of irregularities occurred in the same age groups, both in the healthy subjects and in those with disturbed balance. Clearly, such irregularities should not be considered pathological.

Conclusion

On the basis of the obtained results, the following parameters could be of practical clinical use for determination of the border between physiological and pathological irregularities in the electronystagmographic record:

1. Exceeding the age time threshold – if certain irregularities occur in the record earlier than normal for a particular age, the finding should be considered pathological;

2. Frequency of irregularities in the record greater than 10% (up to 15%) definitely indicates a pathological finding;

3. Occurrence of nonphysiological form of irregularity – if there is a form of irregularity in the electronystagmographic record which is not usually found in healthy persons of a particular age, the finding should be considered pathological.

We believe that if the above recommendations were observed in everyday routine clinical practice irregularities in nystagmographic records be better understood and used as a diagnostic method for detection of central vestibular disorders.

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PATOLOŠKE I NEPATOLOŠKE NEPRAVILNOSTI NISTAGMUSA

S A Ž E T A K

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