Annals of Otolaryngology

Lisotskaya VV, et al, Annl Otolarinl 2018 2: 1
2: 008

Research

Rehabilitation of patients with Central Auditory Processing Disorders

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Abstract

Introduction

The most common reason of CAPD is stroke. Stroke affects all levels of the auditory system- from the inner ear to the central tracts. Rehabilitation of patients after a stroke is performed by neurologists and internists, but at the same time, hearing loss worsens their quality of life, which in turn exacerbates arterial hypertension.

Object

30patients with Central Auditory Processing Disorders (CAPD) rehabilitated at ENT department of 11 City Clinical Hospital of Minsk, State Institution "The Republican Center for Research and Practice in Otolaryngology", from 2016 to 2018 year.

Aim and Methodology

The aim of our study was to determine the most effective method of rehabilitation patients with CAPD, which provides increasing auditory function and improving quality of life.

The methodology: mathematical statistics, Student t-test, Fisher test

Results

Patients after stroke (N=30) divided into 2 groups for undergoing rehabilitation in our hospital. The principle of division into groups, based on the nature of rehabilitation activities. All the patients with hearing impairment was diagnosed in about the same number of men (N=16) and women (N=17) at the average age of 52.33±10 (t≥0.95) years old. All patients underwent DPOAE, tympanometry and acoustic reflexes, auditory brainstem response, pure-tone audiometry, word recognition. The first group(N=15) received standard medication (Sol. Emoxipini 0,5%-100ml, Sol.Pyracetami 20,0%-10ml ,Sol.vit B1, B6 1.0, Neuromedini 20 mg, Betagestini 16 mg), lessons with speech-language pathologist. The second group (N=15) received standard medication, lessons with speech-language pathologist, neuropsychologist, music therapist, auditory training used personal FM systems. All patients underwent a standard battery of tests: DPOAE, tympanometry and acoustic reflexes, auditory brainstem response, pure-tone audiometry, word recognition. DPOAE with multiple stimulus frequencies per octave from 500 to 8000 Hz was passed at frequencies from 500 to 4000 Hz at 90%±5% (t≥0.95) before and after rehabilitation in two groups. Tympanogram type A was registered in all the patients with CAPD (N=30) under study on tympanometry before and after rehabilitation. One-sided otoacoustic reflexes were recorded in 66.7% (N = 10) patients, bilateral low-amplitude ones in 26.63% (N = 4), were not recorded in 6.67% (N = 1) patients after stroke before rehabilitation in all groups Bilateral low-amplitude reflexes were noted in 80% (H = 12), unilateral in 13.3 (H = 2), were not recorded in 6.7% (H = 1) 1 year after rehabilitation in the second group. The structure of the first group did not change. Pure tone average (PTA) before rehabilitation at 500, 1000, 2000, 3000, 4000, 6000 Hz bore the character of a downward line and was 26.5±15 Db. But the recovery of hearing thresholds was seen at 10± 4.5 Db at 500, 1000, 2000, 3000, 4000,6000 Hz in the second group (t≥0.95) after 1 year of rehabilitation. Abnormal ABR were registered before and after rehabilitation in two groups. Word recognition increased by 5.5±3.5% in the second group .

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Sub Date: March 23rd, 2018, **Acc Date:** May 08th, 2018, **Pub Date:** May 09th, 2018.

Citation: Merkulova EP, Greben NI, Eremenko UE, Lisotskaya VV (2018) Rehabilitation of patients with Central Auditory Processing Disorders. Annl Otolarinl 2: 008.

Conclusion

Complex multidisciplinary approach in the rehabilitation of patients with Central Processing Auditory Disorders significantly improves auditory function, enhances speech intelligibility and improves quality of life.

Keywords: Central Auditory Processing Disorders (CAPD), rehabilitation of patients, Distortion product otoacoustic emissions (DPOAE), Pure-Tone Audiometry (PTA), Auditory Brainstem Response (ABR).

Introduction

Disorders of the auditory central nervous system and its perceptual functions have traditionally been called central auditory processing disorders (CAPD) (Central) auditory processing disorders [(C)APD], as defined in the 2005 Technical Report by the American Speech-Language and Hearing Association (ASHA), are "difficulties in the perceptual processing of information in the central auditory nervous system (CANS) and the neurobiological activity that underlies that processing and gives rise to the electrophysiological auditory potentials. "In addition, it should be noted that CAPD is a deficit in the neural processing of auditory stimulithat is not the result of higher order language, cognition, or related factors (ASHA, 2005) [1]. It causes by wide variety of factors: arterial hypertension, age-related deterioration, congenital and/or hereditary disorders, degenerative and demyelinating diseases, stroke, head trauma, infections (meningitis, encephalitis), chemical or drug induced problems of CANS, kernicterus, tumors, surgically induced lessons, metabolic disturbances. It should be noted, that central auditory disorders are associated with chronic inflammation of the middle ear and auditory deprivation. And it is usually accompanied by such conditions as speech disorders, attention deficit, hyperactivity syndrome and different others [2].

In patients with CAPD, the auditory mechanisms, for which the central nervous system is responsible, are affected, namely: auditory discrimination, auditory temporal processing and patterning, dichotic listening, low-redundancy speech perception. Consequently, the ability of patients to differentiate similar acousticstimuli, to analyze acoustic events overtime (temporal ordering/sequencing and temporal resolution), to separate and integrate disparate auditory stimuli, to perceive degraded speech andspeech-in-noise fall out. The main complaint of patients is the violation of speech intelligibility, especially in noise [3]. Further, the problems of hearing can involve the temporal integration, temporal resolution or discrimination, temporal masking and temporal ordering.

Methods

A prospective chart review was performed for patients who are diagnosed with Central Auditory Processing Disorder after stroke at "THE REPUBLICAN CENTER FOR RESEARCH AND PRACTICE IN OTOLARYNGOLOGY" of Republic of Belarus and treated at Neurological department of 11 City Clinical Hospital of Minsk during 2017 year [4]. Eligibility criteria includes, the age of patients elder than 18 years old with hearing impairment with the development 6 months after stroke. All patients underwent a standard battery of tests: DPOAE, tympanometry and acoustic reflexes, auditory brainstem response, pure-tone audiometry, word recognition (AC 40; Inter acoustics, middle fart, Denmark). In pure-tone audiometry, hearing thresholds 500, 1000, 2000, 3000, 4000, 6000 Hz frequencies were received. The pure tone average (PTA) was determined by calculating the arithmetic mean of amount of the 500, 1000, 2000 and 4000 Hz thresholds before and after treatment [5,6]. The audiograms could be characterized like a curve downward line at different thresholds. All patients underwent a rehabilitation course 3 times a year, the effect was evaluated after 1 year. To assess the subjective feeling, a test was used THI test recommended by Hearing Loss Association of America. One-way ANOVA and Kruskal–Wallis tests were used for comparing numerical variables. For subgroup analyses, t-Student and Fisher tests and Mann–Whitney U tests were chosen for parametric and nonparametric evaluations, respectively. Criteria for improvement of patients' well-being were subjective assessment of hearing, change of hearing thresholds to 10 dB and above [7-9].5.

Results

Patients after stroke (N=30) divided into 2 groups for undergoing rehabilitation in our hospital. The principle of division into groups based on the nature of rehabilitation activities. All the patients with hearing impairment was diagnosed in about the same number of men (N=16) and women (N=17) at the average age of 52.33± 10 (t≥0.95) years old. All patients underwent DPOAE, tympanometry and acoustic reflexes, auditory brainstem response, pure-tone audiometry, word recognition. The first group (N=15) received standard medication (Sol. Emoxipini 0,5%-100ml, Sol. Pyracetami 20,0%-10ml ,Sol.vit B1, B6 1.0, Neuromedini 20 mg, Betagestini 16 mg), lessons with speech-language pathologist. The second group (N=15) received standard medication, lessons with speech-language pathologist, neuropsychologist, music therapist, auditory training used personal FM systems. All patients underwent a standard battery of tests: DPOAE, tympanometry and acoustic reflexes, auditory brainstem response, pure-tone audiometry, word recognition. DPOAE with multiple stimulus frequencies per octave from 500 to 8000 Hz was passed at frequencies from 500 to 4000 Hz at 90% ±5% (t≥0.95) before and after rehabilitation in two groups. Tympanogram type A was registered in all the patients with CAPD (N=30) under study on tympanometry before and after rehabilitation. One-sided otoacoustic reflexes were recorded in 66.7% (N = 10) patients, bilateral low-amplitude ones in 26.63% (N = 4), were not recorded in 6.67% (N = 1) patients after stroke before rehabilitation in all groups Bilateral low-amplitude reflexes were noted in 80% (H = 12), unilateral in 13.3% (H = 2), were not recorded in 6.7% (H = 1) 1 year after rehabilitation in the second group. The structure of the first group did not change. Pure tone average (PTA) before rehabilitation

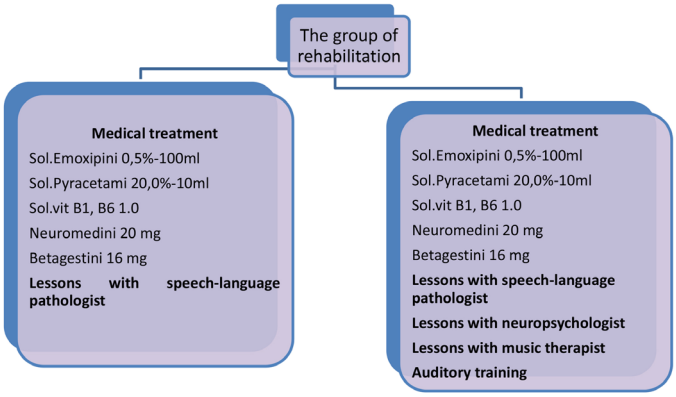

Figure 1: The Group of Rehabilitation

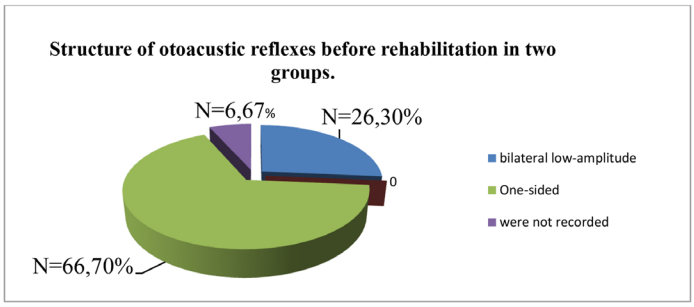

Figure 2: Structure of otoacustic reflexes beforerehabilitation in two groups

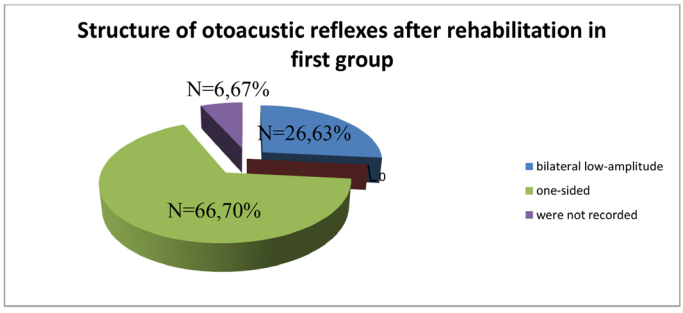

Figure 3: Structure of otoacustic reflexes after rehabilitation in the first group

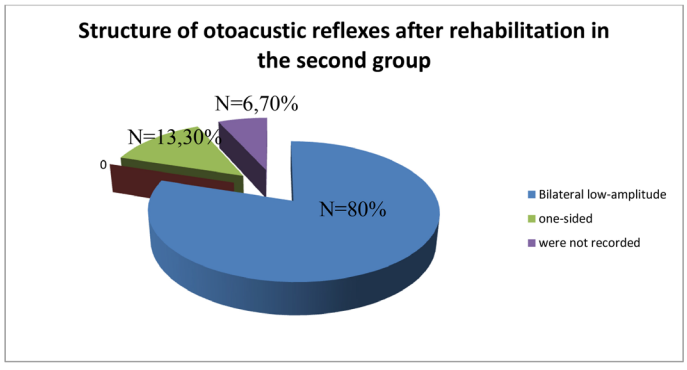

Figure 4: Structure of otoacustic reflexes after rehabilitation in the second group

at 500, 1000, 2000, 3000, 4000, 6000 Hz bore the character of a downward line and was 26.5±15 Db. But the recovery of hearing thresholds was seen at 10±4.5 Db at 500, 1000, 2000, 3000, 4000,6000 Hz in the second group (t≥0.95) after 1 year of rehabilitation. Abnormal ABR were registered before and after rehabilitation in two groups. Word recognition increased by 5.5±3.5% (t≥0.93) in the second group .

Complications

All patients tolerated the procedure well. There were no episodes of vertigo. Increasing of blood pressure higher 160/90 mm of hg due examination was not observed.

Discussion

In this study, we established that thecomplex multidisciplinary approach in the rehabilitation of patients with Central Processing Auditory Disorders significantly improves auditory function, enhances speech intelligibility. The treatment of this disease with using complex multidisciplinary approach improves quality of life of the patients. We divided intervention group into 2 subgroups to determine the most effective method of rehabilitation, which will increase improves auditory function, enhances speech intelligibility, quality of life. Patients in the second subgroup of complex multidisciplinary approach occasionally experienced more adverse events typically associated with increased physical activitythan in another subgroup. These included unpleasant, but not disabling, constitutional symptoms, such as sleep and abnormal complete blood count, increased blood pressure not higher 160/90 mm of hg. The highest effectiveness of rehabilitation was achieved in the second subgroup ofcomplex multidisciplinary approach in patients who had no more than 10 every days auditory training from the start of rehabilitation six months after stroke.

Conclusion

Complex multidisciplinary approach in the rehabilitation of patients with Central Processing Auditory Disorders significantly improves auditory function, enhances speech intelligibility and improves quality of life.

Disclosure

No financial support was provided for this study. No author has any financial interest in the companies or products reported in this paper has any financial disclosures related to this work.

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