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ORIGINAL ARTICLE

Audiological Findings in Acromegaly Patients

Muzeyyen Yildirim Baylan, Deniz Gokalp, Yusuf Celik, Alpaslan Tuzcu, Faruk Meric, Ismail Topcu

Dicle University Faculty of Medicine, Department of Otolaryngology, Diyarbakir, Turkey, (MYB, FM, IT)
Dicle University Faculty of Medicine, Department of Endocrinology, Diyarbakir, Turkey, (DG, AT)
Dicle University Faculty of Medicine, Department of Biostatistics, Diyarbakir, Turkey, (YC)

Objective: The aim of this study was to evaluate otologic problems in patients with acromegaly.

Materials and Methods: This retrospective study was performed on 26 patients with acromegaly and 27 age-matched healthy controls. Otoscopic examination, pure tone odiometry, tympanometry, otoacoustic emissions, and stapes reflex were performed in all cases. Hearing thresholds of air and bone conduction (AC and BC), middle ear function, cochlear function, tympanic membrane compliance, gradient, peak pressure, and external ear canal volume were researched in patients with acromegaly.

Results: The hearing thresholds for all frequencies except Right-AC 4000 frequencies were found to be significantly higher in patients with acromegaly as compared to the control group ($p<0.05$). Also, significant correlation coefficients were calculated among disease duration, hearing thresholds, and tympanometric variables ($p<0.05$). There was a significant difference in tympanometry results between the two groups in regard to external ear canal volumes of the right and left ears ($p\leq0.05$). No differences were observed between the two groups in their type of tympanometry, stapes reflex, and otoacoustic emissions (OAE) ($p>0.05$).

Conclusions: We have determined that patients with acromegaly have lower levels of hearing in both bone and air conduction compared with the normal population. This may be ascribed to deformation of hearing physiology related to hypertrophy in the temporal bone.

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Introduction

Growth hormone (GH) hyper secretion is usually caused by a GH-secreting pituitary adenoma and leads to acromegaly, which is characterized by high bone turnover. Growth hormone and Insulin-like growth factor 1 (IGF-1) are important regulators of bone homeostasis and are central to the achievement of normal longitudinal bone growth and bone mass.[1] In response to both increased GH and IGF-1, periosteal new bone formation leads to an increase in skeletal growth, especially in the facial bones. Prognathism in the mandible, jaw thickening, teeth separation, frontal bossing, malocclusion, and nasal bone hypertrophy are the most common facial bone deformities seen in acromegaly. [2,3] Also, chronic exposure to GH and IGF-1 hyper secretion leads to soft tissue swelling of the tongue, heart, kidney, colon, and vocal cords, and periarticular and cartilaginous thickening. [4] However, we could not find enough information in the literature on the impact of this disease on the ear. New bone formation or hypertrophy of the temporal bone and ossicular chain may be seen as a result of increased GH and IGF-1, and problems in the middle and inner ear may be seen as well. Several studies addressed these issues previously, however the results of these different studies are not conclusive. A few studies showed that audiological evaluations of acromegaly patients are not different from healthy individuals, whereas some studies proposed that a variety of differences might be seen in acromegaly patients. [5,6,7,8]

In the current study, we aimed to determine whether patients with acromegaly have otologic problems.

Corresponding address:
Muzeyyen Yildirim Baylan
Dicle University Faculty of Medicine, Department of Otolaryngology, Diyarbakir, Turkey
Phone: 90- 412-2488001/ 4543 • Fax: 90- 412-2488440
GSM 90 536 798 04 97
E mail: muzeyyenyldrm@hotmail.com

Materials and Methods

This prospective case-control study was conducted between December 1, 2006 and December 1, 2009 in the Departments of Endocrinology and Otolaryngology. This cross-sectional study was performed on 26 patients with acromegaly and 27 age-matched controls selected from hospital staff and/or their relatives. Patients who had renal diseases, chronic hypertension, diabetes or other metabolic disorders, thyroid malfunction, rheumatologic disorders, history of ototoxic drug consumption, ear disease, and/or temporal bone fracture were excluded from the study.

A detailed medical history was obtained from both patient and control groups. Otoscopic examinations were conducted for all participants. Hearing thresholds were assessed using the Clinical Audiometer AC33 (Interacoustics A/S, Assens, Denmark). In addition, bone and airway conduction (BC and AC) thresholds were measured at frequencies of 250, 500, 1000, 2000, 4000, and 8000 Hz. The outer ear canal volume, membrane compliance, and gradient and pressure parameters were recorded using the Clinical Impedance Audiometer AZ26 (Interacoustics A/S, Denmark). Tympanometry results were classified into Types A, B, and C, as set out by Liden[9] and Jerger.[10] Type A denotes the normal tympanometry whereas types B and C were evaluated as "pathological or abnormal". Stapes reflex was also recorded using the Clinical Impedance Audiometer AZ26 (Interacoustics A/S, Denmark). Otoacoustic emissions were evaluated by measuring transient evoked otoacoustic emissions (TEOAE) from 1000–4000 Hz at an intensity of 80±3 dB, using the ILO288 (Interacoustics, Assens, Denmark) otoacoustic emission device. The two groups were compared in terms of the presence of abnormality in otoscopic examination, stapedial reflex, and otoacoustic emission, as well as in terms of the pressure, compliance, volume, and gradient values in the tympanometric test, and by air and bone conduction threshold levels at all frequencies. In addition, the correlation between the duration of illness and the threshold of air and bone conduction was evaluated.

Statistical Analysis

Mean and standard deviation (SD) were calculated for continuous variables. The normality of the variables were analyzed by Kolmogorov–Smirnov test. Chi-square (χ^2) test with Yates' Correction and Student's t test were used to evaluate associations between the categorical and continuous variables. Pearson correlation coefficients and the level of significance were calculated among the disease duration, hearing thresholds, and tympanometric variables. Two-sided p values were considered statistically significant at $p<0.05$. Statistical analyses were carried out by using the statistical packages for SPSS 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

Results

This study was performed on 26 patients with acromegaly (16 females and 10 males, mean age 42.04± 12.77 years; range 17–62 years) and 27 age-matched controls (17 females and 10 males, mean age 37.85± 13.07 year; range 23–69 years). Mean duration of disease since the first diagnosis of acromegaly was 6.47± 4.2 years. According to pituitary magnetic resonance imaging all cases had macroadenoma and are still being treated. The incidence of otologic symptoms in these patients were as follows: otalgia 19.2%, ear fullness 21.1%, tinnitus 34.6%, and hearing loss 38.5%. .

The mean hearing thresholds for all frequencies except Right-AC 4000 were found to be significantly different between controls and patients with acromegaly ($p<0.05$) (Figure 1). Significant correlation coefficients ($p<0.05$) among disease duration, hearing threshold, and tympanometric variables were calculated. However, as seen in Table 1 no differences were observed between the two groups in terms of type of tympanometry, stapedial reflex, and otoacoustic emissions ($p>0.05$). According to the results of Table 2, the right ($p=0.008$) volume of the external ear canal in the tympanometric evaluation was significantly different between controls and patients with acromegaly.

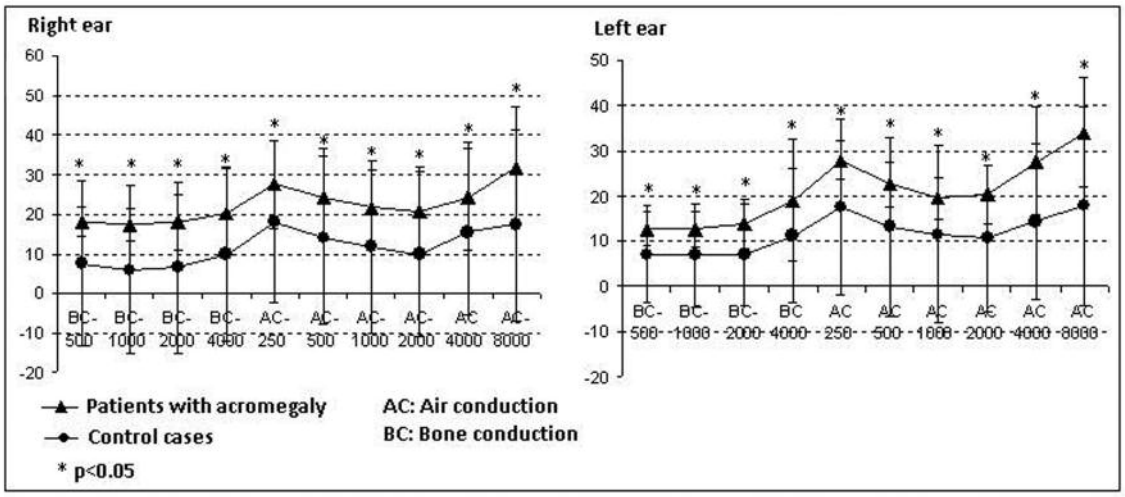

Figure 1. Graph showing the comparison of bone and airway thresholds in acromegaly and control cases. Vertical short lines stands for Standart Deviation, * marked for p value.

Table 1. Comparison of acromegaly and control cases

	Control (n=27)	Patients with Acromegaly (n=26)	χ^2	p
Abnormal tympanometry (type b-c) (right)	0	4	0.10	0.106
Abnormal tympanometry (type b-c) (left)	2	4	0.36	0.366
Stapedial reflex (right)	1	4	1.14	0.146
Stapedial reflex (left)	1	3	0.28	0.280
OAE (right)	3	7	0.14	0.141
OAE (left)	2	8	0.03	0.280

Table 2. Comparison of tympanometric values in acromegaly and control cases

	Control $\bar{\chi}$ ± SD	Acromegaly $\bar{\chi}$ ± SD	t	p
Right tympanic volume	1.21±0.25	1.48±0.41	2.78	0.008*
Right tympanic compliance	0.67±0.24	0.76±0.64	0.71	0.47
Right tympanic pressure	51.56±33.2	61.92±76.8	0.64	0.52
Right tympanic gradient	0.33±0.15	0.43±0.49	1.04	0.30
Left tympanic volume	1.20±0.29	1.36±0.27	1.94	0.057
Left tympanic compliance	3.22±13.34	0.76±0.55	0.92	0.36
Left tympanic pressure	57.63±51.8	45.60±46.20	0.88	0.38
Left tympanic gradient	0.32±0.18	0.49±0.52	1.59	0.11

*p<0.05

Discussion

Growth of the temporal bone is likely to occur in acromegaly patients. In addition, growth in the ossicular chain and cartilage might be seen; also related hearing problems such as tinnitus and hearing loss are expected to occur. Nathanson and Losner [11] presented a case which had ossification of both external ears associated with advanced acromegaly. The current study indicated that the main complaints of patients with acromegaly were tinnitus and hearing loss. Additionally, it showed a decrease in the hearing levels of air and bone conduction.

Studies evaluating the audiological problems in acromegaly patients are limited and their results are not conclusive. Menzel [12] reported a bilateral hearing loss related to narrowing of the internal acoustic canal in a patient with acromegaly. Babic et al. [5] evaluated the middle ear functions in 30 cases with acromegaly. It was observed that middle ear aeration problems are more prevalent in acromegaly patients than in healthy individuals, and hypertrophy in bones contributed to these aeration problems. We assessed the functions of the cochlea and the middle ear in patients using audiological test battery. We found that there is a significant difference in the threshold of air and bone conduction of patients with acromegaly compared with the normal controls. However, there is no consensus on the subject in the literature. Babic et al. [5] reported a conductive type of hearing loss, whereas Doig et al.[7] did not mention any significant hearing loss among 56 cases. We determined significant decreases in the thresholds of the air and bone conduction. Furthermore, we found that in some frequencies, the decrease in hearing levels correlates with the duration of the illness. Patients with a longer duration of involvement had significant decreases in hearing levels. When the high levels of GH prevail for a long period of time, new bone formation develops in patients, and consequently a larger hypertrophy in the bone occurs too. Moreover, the existence of the correlation between hearing and the duration of the illness may indicate that the hearing loss may be the result of new bone formation.

We did not detect a significant difference in tympanograms that were classified as types A, B, and C between disease and control groups. Also, we did not observe a statistically significant difference of tympanic membrane compliance, pressure, and gradients in acromegaly patients ($P>0.05$). The volume of the external ear canal of acromegaly patients was significantly larger than those of the control group ($p\leq0.05$). Graham et al.[6] found that the cortical mastoid bone and posterior canal wall were hypertrophied in 3 patients with acromegaly who were operated on, leading to the conclusion that the middle and inner ear functions are normal in spite of these hypertrophies. In addition, Crosara et al. [8] studied 15 patients with acromegaly and showed that the tympanogram was normal in all patients.

Conclusion

The effect of acromegaly, which is thought of as a disease affecting the whole body, on ear functions is not yet fully understood. We presented that acromegaly affects hearing levels, which is correlated with the duration of the disease. It is possible that the decreasing of hearing levels occurs due to the hypertrophy in the temporal bone.

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References

1. Giustina A, Mazziotti G, Canalis E. Growth hormone, insulin-like growth factors, and the skeleton. Endocr Rev 2008;29:535-59.

2. Chanson P, Salenave S. Acromegaly. Orphanet Journal of Rare Diseases 2008;3: 17.

3. Rajasoorya C, Holdaway IM, Wrightson P, Scott DJ, Ibbertson HK. Determinants of clinical outcome and survival in acromegaly. Clin Endocrinol (Oxf) 1994; 41:95-102.

4. Melmed S. Acromegaly pathogenesis and treatment. J Clin Invest 2009;119:3189-202.

5. Babic BB, Petakov MS, Djukic VB, Ognjanovic SI, Arsovic NA, Isailovic TV et al. Conductive hearing loss in patients with active acromegaly. Otol Neurotol 2006; 27: 865-870.

6. Graham MD, Brackmann DE. Acromegaly and temporal bone. J Laryngol Otol 1978; 92: 275-9.

7. Doig JA, Gatehouse S. Hearing in acromegaly. J Laryngol Otol 1984; 98: 1097-101.

8. Crosara C, Colletti V, Sittoni V, Bonanni G, Motta RG. Analysis of auditory and brain stem functions in acromegalic patients. In: Colletti V, Stephens SDG, editors. Disorders with Defective Hearing, Advances in Audiology. Basel: Karger; 1985. p.152-60.

9. Liden G. The scope and application of current audiometric tests. J Laryngol Otol 1969; 83: 507-520.

10. Jerger J. Clinical experience with impedence audiometry. Arch Otolaryngol 1970; 92:311-24.

11. Nathanson L, Losner S. Ossification of auricles of external ears associated with acromegaly. Radiology. 1947; 48:66-8

12. Menzel OJ. Hearing loss secondary to acromegaly: case report. Eye, Ear, Nose Throat Mon 1966; 45: 84-85.