International Journal of Pediatric Otorhinolaryngology 77 (2013) 1561–1566

Contents lists available at SciVerse ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Study of audiovestibular dysfunction in children with systemic lupus erythematosus

Ghada Ibrahim Gad [a,*], Somaia Tawfik Mohamed [b], Khaled Salah Awwad [a], Rehab Fetoh Mohamed [c]

[a] Pediatrics Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[b] ENT Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[c] Pediatrics Hospital, Ain Shams University, Egypt

ARTICLE INFO

Article history:
Received 11 April 2013
Received in revised form 2 July 2013
Accepted 3 July 2013
Available online 2 August 2013

Keywords:
Systemic lupus erythematosus
Audiovestibular
Antiphospholipid antibody

ABSTRACT

Objective: Inner ear dysfunction in systemic lupus erythematosis patients has been reported but audiovestibular involvement is not well documented especially in pediatrics. This study was designed to evaluate silent audiovestibular dysfunction among SLE children.
Methods: Case control study examined in allergy and immunology clinic; pediatrics hospital and audiovestibular clinic; Ain Shams University from January 2009 to December 2010. Thirty-five systemic lupus erythematosus children (diagnosed according to American College of Rheumatology); age group 8–16 years, were randomly selected. Five of them were excluded due to one or more exclusion criteria (previous otitis media, stroke, lupus cerebritis, meningitis or encephalitis, audiovestibular symptom). Ten of them refused enrollment or could not complete full battery. Seventeen females and three males, mean age 12.9 ± 2.6 years, completed the study. Control group included 20 normal subjects, age and sex matched. Full clinical assessment, basic audiological evaluation and vestibular testing (videonystagmography VNG and computerized dynamic posturography CDP) were conducted for children included in the study.
Results: Five systemic lupus erythematosus patients had sensorineural hearing loss strongly associated with +ve antiphospholipid antibody and two had conductive hearing loss. Two children in control group had conductive hearing loss ($p = 0.05$). Abnormal VNG findings was significantly higher among systemic lupus erythematosus children (40%) compared to controls (0%) and associated with +ve antiphospholipid antibodies ($\chi^2 = 10$, $p = 0.002$, Fisher exact test = 0.003). Twenty-five percentage of systemic lupus erythematosus children had abnormal CDP findings reflecting impaired balance function associated with positive antiphospholipid antibodies showing significant statistical difference compared to controls (0% affection) ($\chi^2 = 5.7$, $p = 0.017$, Fisher exact test = 0.047).
Conclusion: Silent audiovestibular dysfunction is prevalent among systemic lupus erythematosus children especially those positive for antiphospholipid antibodies necessitating routine regular evaluation.

1. Introduction

Systemic lupus erythematosus (SLE) is increasingly recognized in pediatrics population. Immune complexes and autoantibodies are the main causes of multiorgan involvement characteristic of the disease. Sensorineural hearing loss (SNHL) and inner ear dysfunction in SLE patients were first identified by Kastanioudakis et al. [1] and Sperling et al. [2]. Inner ear damage in SLE patients has been occasionally reported but frequency and extent of audiovestibular involvement are not well documented especially in pediatrics.

Previous studies were conducted for audiovestibular function in adults with SLE [2,3]. They were conducted using basic audiological evaluation and electronystagmography (ENG). However, evaluation of audiovestibular function in pediatric patients with SLE was not thoroughly investigated. In addition, functional evaluation of balance was not previously investigated. This can be conducted by computerized dynamic posturography which is the only method validated by controlled research studies to isolate the functional contributions of vestibular inputs, visual inputs, somatosensory inputs, central integrating mechanisms, and neuromuscular system outputs for postural and balance control [4].

* Corresponding author at: Department of Pediatrics, Ain Shams University, Ramses Street, Cairo 11566, Egypt. Tel.: +20 1145746064.
E-mail address: ghadawael2006@yahoo.com (G.I. Gad).

0165-5876/$ – see front matter © 2013 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ijporl.2013.07.004

Accordingly, this study was designed to assess audiovestibular functions as a part of systemic autoimmune disorder in children with SLE.

2. Methods

The present study was carried out in allergy and immunology clinic in pediatrics hospital and audiovestibular clinic, Ain Shams University.

The study was a case–control one, 35 SLE patients (diagnosed clinically and laboratory according to American College of Rheumatology [5]) in the age group 8–16 years were randomly selected and approached (simple randomization). Five of them were excluded due to one or more of exclusion criteria, and 10 refused enrollment or could not complete the full battery. A control group consisting of 20 healthy children age and sex matched with the study group were recruited over a period of 24 months from January 2009 to December 2010.

Patients with history of otitis media with effusion, chronic suppurative otitis media (CSOM), previously diagnosed as having stroke or lupus cerebritis, meningitis or encephalitis, any audiovestibular complaint (tinnitus, hearing problem, vertigo, etc.) were excluded from the study.

The study was approved by the ethical committee of Pediatrics Hospital, Ain Shams University. An informed consent was taken from parents of all children before enrollment in the study.

The study & control groups were subjected to the following:

(1) Full history taking, thorough clinical examination with special emphasis on duration of illness, type of medications and SLE disease activity index (SLEDAI) score.
(2) Record of SLE investigations (already registered in the file)
- Stranded deoxyribonucleic acid antibody.
- Antinuclear antibody.
- Antiphospholipid antibodies.
(3) Otological examination:
- *Audiological evaluation:* Pure tone audiometry by air conduction and bone conduction and speech audiometry were done using two Channel Audiometer Madsen model Orbiter 922.
- Immittancemetry to assess middle ear function using interacoustic Imittancemeter model AZ7.
(4) *Vestibular evaluation*:
I *Videonystagmography (VNG) Test battery*:

Using computerized VNG Micromedical, Meta 4, with a light bar designed to ensure a large visual field at both horizontal and vertical planes. Water caloric irrigator model, Hortman was used to do caloric testing. The test was done as follows:

- The patient sat on the test chair 1 m away from the center of the light bar with infrared goggles on his eyes and then started the VNG subtests to measure.
1. Spontaneous/gaze nystagmus.
2. *Oculomotor tests:* including random Saccade test, tracking test and optokinetic test.
3. Positional and positioning testing.
4. Bithermal Caloric testing.

II *Computerized dynamic posturography (CDP):* During CDP testing, the patient stands on a movable, dual forceplate support surface within a moveable surround (enclosure). Under control of a computer, the force platform can either move in a horizontal plane (translate), or rotate out of the horizontal plane [6]. Standardized test protocols expose the patient to support surface and visual surround motions, during which the patient's postural stability and motor reactions are recorded. These test protocols include: (Fig. 1)

1. *Sensory organization test (SOT):* testing for six challenging conditions.
2. *Motor control test (MCT):* testing for forward and backward movements.
3. *Adaptation test (ADT):* testing for toes up and toes down movements.

During the SOT, the utility of visual, vestibular, and proprioceptive inputs in controlling spontaneous sway is eliminated without provoking motor reactions by moving the support surface and the visual enclosure *in response* to the patient's postural movements. During the motor control protocols (MCT and ADT), reactions are provoked by unexpected abrupt movements of the support surface. Because the measures of postural stability, as well as the motions of the support surface and visual surround, are precisely controlled and calibrated relative to the patient's height and weight, standardized graphical summaries can compare the patient's results to those of age-matched asymptomatic (normal) individuals.

2.1. Statistical analysis

Standard computer program SPSS for Windows, release 13.0 (SPSS Inc., USA) was used for data entry and analysis. All numeric variables were expressed as mean ± standard deviation (SD). Comparison of different variables in various groups was done using Mann Whitney test for nonparametric variables. Chi-square (χ^2) test was used to compare frequency of qualitative variables among the different groups with Fisher exact test if indicated. Spearman's correlation test was used for correlating non-parametric variables. For all tests a probability (p) less than 0.05 was considered significant.

3. Results

Demographic characteristics of studied children are shown in Table 1. Pure tone audiometry revealed that 5 cases (25%) suffered from moderate sensorineural hearing loss (SNHL) and 2 (10%) with mild conductive hearing loss (CHL) among SLE patients. Control group showed normal hearing in all children except 2 cases with mild CHL (Table 2). All subjects had speech reception threshold matched with pure tone average with excellent speech discrimination scores proportionate to degree of hearing loss. They showed type A tympanograms reflecting normal middle ear function except 2 patients with conductive hearing loss who showed type B flat reflecting middle ear effusion.

Non-significant statistical association was detected between either sex ($\chi^2 = 1.9$, $p = 0.168$) or type of medications whether steroids alone or with cytotoxic drugs ($\chi^2 = 0.64$, $p = 0.42$) and hearing loss among SLE patients. SLEDAI score (active or inactive) showed non-significant association with SNHL ($\chi^2 = 1.1$, $p = 0.29$). All SLE patients with +ve antiphospholipid antibodies had SNHL (100%).

Vestibular test results revealed abnormal video nystagmography in 40% of SLE children compared to controls (0%) with peripheral affection (involving end organ in labyrinth and peripheral nerve) in 1 (5%) patient and central affection (starting at relay station between vestibular nerve and vestibular nuclei in brain stem) in 3 (15%) patients, and combined in 4 (20%) patients.

Regarding VNG subset results, 7 (35%) patients had abnormal oculomotor subset (4 of them had abnormal saccade, 6 abnormal tracking), 2 (10%) had abnormal positional subset and 3 (15%) had abnormal caloric subtest.

Active SLEDAI was significantly associated with abnormal peripheral vestibular testing ($\chi^2 = 4.444$; $p = 0.035$), but not with central one ($\chi^2 = 2.96$; $p = 0.085$).