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Balance disorders in childhood: Main etiologies according to age. Usefulness of the video head impulse test

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ABSTRACT

Balance disorders are common in adult patients but less usual in the pediatric population. When this symptomatology appears in children it is a cause for concern, both for parents and health-care professionals.

Objectives: To explain the balance disorders in children describing a case series and to discuss the main etiologies found according to age.

Study design: A retrospective, observational, descriptive, and cross-sectional study was conducted.

Population: Patients aged 1–18 years who consulted because of balance disorders at the otolaryngology department of a pediatric tertiary-care hospital between March 2012 and July 2015.

Results: Two hundred and six patients were included in the study. Median age was 10 years. The most common diagnoses were vestibular migraine in 21.8% of the children, ataxia in 9.22%, benign paroxysmal vertigo of childhood in 7.77%, and post-traumatic vertigo in 6.31%.Overall, 61 videonystagmographies– of which 46 were normal - and 55 video head impulse tests - which were normal in 45 and showed abnormalities in the vestibulo-ocular reflex gain in 10 - were performed.

Conclusions: In a child with balance disorders, the medical history and neurotological examination are essential. Vestibular migraine is the most commonly found disorder in every age group, and most of the patients have a family history of migraine. Ancillary studies, especially the video head-impulse test, provide important data to confirm the diagnosis.

1. Introduction

Balance disorders are very common in adult patients [1], but less usual in the pediatric population [2]. When this symptomatology appears in children it is a cause for concern, both for parents and health professionals [3,4].

The diagnosis of patients with vertigo is mainly based on the medical interview. This step is often difficult and demands a lot of patience when dealing with children. On the one hand, what the child says is usually imprecise as he or she cannot explain what has happened, and on the other hand the parents, who have not actually experienced the episode, may distort it according to their interpretation and concerns [5,6]. Thus, the medical interview, which is a basic tool, often becomes biased in children, especially younger ones. Making an accurate diagnosis requires a targeted anamnesis, a careful neurologic and physical examination, and audio-vestibular testing [7–9]. To correctly perform the usual balance tests active collaboration of the patients is necessary and therefore a pleasant and playful relation with the child should be established. There are significant differences in this population. The physical and instrumental exploration of a pre-school child is not the same as that of a school child or adolescent. The prevalent pathologies are not the same either.

The aim of this study was to describe our series of children with balance disorders with a focus on the prevalent etiologies and dividing the sample into age groups.

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2. Material and methods

A retrospective, observational, descriptive, and cross-sectional study was conducted in patients aged 1–18 years seen at the otolaryngology department of a pediatric tertiary-care hospital between March 2012 and July 2015 because of balance disorders (vertigo, dizziness, instability). They came to the department spontaneously or were referred from other hospital areas, such as neurology, emergency, cardiology, or pediatric clinical medicine.

All the patients underwent a full anamnesis as well as a physical and otoneurological examination (otomicroscopy, throat swab test, anterior rhinoscopy, Romberg, Bárány, Unterberger, and head-impulse test; evaluation of smooth pursuit and sacadic movements, and nystagmus, evaluation of dysmetria and adiadochokinesia and hearing testing).

The age distribution in this study is the one used by the World Health Organization (WHO) [10].

In July 2014 videonystagmography became available at our institution (*Ecleris* model: VNG-PLUS with double camera) to evaluate ocular movements: the optokinetic system and saccadic movements, positional testing and nystagmus evaluation without eye fixation.

In September 2014 we included the video head impulse test in the evaluation (*ICS Impulse*) provided by Otometrics for the special use in children. This test is based on the vestibulo-ocular reflex. This consists of a compensation of the head movements by the extraocular muscles, in which the vision remains fixed on an object, despite rapid head movements. The patient is asked to fix his or her eyes on a target while rapid horizontal low-amplitude head movements are generated (to evaluate the horizontal canals) at an angle of approximately 15° randomly to the right and left, thereby stimulating the function of the horizontal semicircular canal on the side towards which we perform the movement. At the same time, the stimulated vestibular system activates the extraocular muscles of both eyes (the medial rectus in the ipsilateral eye and lateral rectus in the contralateral eye, thereby inhibiting the antagonist muscles) to contract in a direct proportion to the head turn, and both eyes move to compensate and keep the vision fixed on the object. In a patient with vestibular dysfunction, this reflex is altered and diminished. As the vestibular system is not stimulated, there is no excitatory signal to the extraocular muscles, which remain still in relation to the head while the gaze moves away from the object on which it was fixed.

Since the advent of this new technology, we have been able to choose which procedure to perform according to the signs and symptoms of our patients: videonystagmography in positional vertigo and central disorders and vHIT in all patients to differentiate peripheral from central syndromes.

The data obtained were collected in an Excel 2010 data base and analyzed using the SPSS statistical package (version 15.0).

3. Results

Two hundred and six patients aged 1–18 years were included in the study; 99/206 (48%) were girls and 107/206 (52%) boys. Median age was 10 years.

The most frequent causes of balance disorders found in our series of children are shown in Tables 1 and 2.

Of all patients in this series 87/206 (42.23%) reported vestibular symptoms and headaches. Both the headache and the vertigo are non-specific symptoms that may be associated with different disorders. The Committee for Classification of Vestibular Disorders of the Bárány Society and the Migraine Classification Subcommittee of International Headache Society defined criteria to categorize headaches within vestibular migraine (VM) [11](see Table 3).

Table 1
Peripheral causes of balance disorders.

Etiology	Number of patients	Percentage
Post-traumatic vertigo	13	6.31
BPPV	8	3.88
Labyrinthitis	6	2.91
Vestibular neuritis	4	1.94
OME	4	1.94
Vertigo of non-specific cause	16	7.77
kinetoses	2	0.97
Autoimmune hearing loss	1	0.48
Complicated cholesteatoma	1	0.48
CI recalibration	1	0.48
Bilateral vestibulopathy	1	0.48
Dehiscence of the SSC	1	0.48
Total	58	28.15

BPPV: benign paroxysmal positional vertigo. OME: otitis media with effusion. CI: cochlear implant. SSC: superior semicircular canal.

Table 2
Non-peripheral causes of balance disorders.

Etiology	Number of patients	Percentage
Headache	87	42.23
Ataxia	19	9.22
BPVC	16	7.77
Emotional origin	9	4.37
Seizures	7	3.40
CNS tumor	4	1.94
Syncope	2	0.97
Instability	3	1.46
Dizziness	1	0.48
Total	148	71.84

BPVC: benign paroxysmal vertigo of childhood; CNS: central nervous system.

In this series, 34/87 (39.08%) met the diagnostic criteria of defined VM and 11/87 (12.64%) met the criteria of probable VM, totaling 45/87 (51.72%) patients with VM accounting for 21.85% (45/206) of the total sample. In five patients (5.75%) the diagnosis has not yet been established, and 37/87 (42.53%) did not meet any VM criteria.

A family history of migraine was found in 75.5% (34/45) of the patients who met the VM criteria had that history. Those with defined VM diagnosis: 26/34 (76.5%) and in the group of patients with probable VM: 8/11 (72.7%).

3.1. Patients 1–5 years old

Overall 54/206 (26.21%) patients between the ages of 1 and 5 years were evaluated; 23 (42.6%) were girls and 31 were boys (57.4%). (Fig. 1 and Table 4).

To make a diagnosis in children so young a detailed interview with the parents is essential objectively looking for specific symptoms. In cases, such as laberynthitis, OME, and seizures, diagnostic tests will confirm the diagnosis while in cases such as BPVC the interview will be the diagnostic tool of choice. When a child presents with ataxia, the symptoms are better defined and the onset of the disorder is acute. Cerebellar ataxias a neurological sign that points to an alteration of the coordination of voluntary movements and postural control, that may be associated with other signs of cerebellar dysfunction such as intentional tremor, dysmetria, nystagmus, dysarthria, and hypotonía. Of the patients who were diagnosed with ataxia eight had post-viral ataxia, two intermittent ataxia, one ataxia telangiectasia, and one ataxia with