Alterations of Balance in Patients Under 16 Years of Age Distributed by Age Groups

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Objective: To evaluate the prevalence and clinical characteristics of children with altered balance, as well as to establish the level of importance of the audiological, balance, and imaging studies in the diagnosis of infantile vestibular pathology.

Patients and method: We report a descriptive, retrospective, and non-randomized study performed at the Otorhinolaryngology Department of the Complejo Hospitalario Universitario de Santiago de Compostela (Santiago de Compostela University Hospital, Santiago de Compostela, Spain). The study included 125 patients under 16 years of age who consulted due to alterations in their balance over a period of 12 years (1996 to 2007); they are distributed into 3 groups based on age: 0 to 5, 6 to 10, and 11 to 15 years.

Results: Childhood benign paroxysmal vertigo (64%) is the most frequent syndrome in our series, with 32.5% of patients associating common migraine. Together with diagnoses of infantile positional vertigo and psychogenic vertigo, was more frequently found in the 11 to 15 year-old age group ($P<.05$). Age, gender, and the results of the imaging studies (computerized tomography of the brain and magnetic resonance of the head) were not related to the presentation of associated migraine nor to the diagnosis ($P>.05$).

Conclusions: Clinical history and the neuro-otological examination are the key elements of the diagnosis of infantile vestibular pathology; it is also important to standardize and group patients by age. Imaging studies only contribute high diagnostic performance in children presenting neurological symptoms, persistent headache or who have sustained head trauma.

Key words: Infantile vertigo. Age group. Migraine. Vestibular screening.

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Alteraciones del equilibrio en pacientes menores de 16 años distribuidos por grupos de edad

Objetivo: Evaluar la prevalencia y las características clínicas de las alteraciones del equilibrio en los niños, así como establecer el grado de importancia de los estudios audiológicos, equilibriométricos y de imagen en el diagnóstico de la afección vestibular infantil.

Pacientes y método: Presentamos un estudio descriptivo, retrospectivo y no aleatorizado, realizado en el Servicio de Otorrinolaringología del Complejo Hospitalario Universitario de Santiago de Compostela. Se incluyó a 125 pacientes menores de 16 años que consultaron por alteraciones del equilibrio a lo largo de 12 años (1996-2007); que se distribuyeron en 3 grupos en función de su edad: 0 a 5, 6 a 10, y 11 a 15 años.

Resultados: El vértigo paroxístico benigno de la infancia (64 %) es el cuadro más frecuente In our series, en el 32,5 % se asoció migraña común. Éste, junto a los diagnósticos de vértigo posicional infantil y vértigo psicógeno, se encontró con más frecuencia en el grupo etario de 11 a 15 años ($p < 0,05$). La edad, el sexo y los resultados de los estudios de imagen (tomografía computarizada cerebral y resonancia magnética encefálica) no se relacionaron con el hecho de presentar migraña asociada ni con el diagnóstico ($p > 0,05$).

Conclusiones: La historia clínica y la exploración otoneurológica son las piezas clave en el diagnóstico de la afección vestibular infantil; es importante protocolizarlas y sistematizarlas por grupos de edad. Los estudios de imágenes sólo aportan alto rendimiento diagnóstico en niños que presenten clínica neurológica, cefaleas persistentes o el antecedente de traumatismo craneoencefálico.

Palabras clave: Vértigo infantil. Grupo etario. Migraña. Cribado vestibular.

INTRODUCTION

Vertigo is a frequent symptom among the adult population, but very unusual among children; its prevalence is less than 1%.[1,2] Although the literature on balance alterations in childhood is not very abundant, there seem to be substantial differences with respect to what happens in adults; these differences refer to both aetiological aspects and clinical and diagnostic peculiarities.[3-5]

There are different aetiopathogenic classifications of balance disorders. The most widespread is the one subdividing them by origin of the disorder, distinguishing between central and peripheral processes.[6] The causes of balance disorders in childhood are extremely varied, and occasionally overlap in specific patients. Several trigger entities have been described. The most frequent ones are: childhood benign paroxysmal vertigo (CBPV), vertigo childhood positional vertigo (CPV), Ménière's disease, and vestibular neuritis.[3,4,7]

As in the case of adults, differential diagnosis requires the elimination of a long list of entities that can produce vertigo. A correct diagnosis requires scrupulous otological, neurological and general physical examinations, as well as a joint assessment of the audiovestibular evaluation. This is often difficult in adults and is even more so in children. The correct performance of many of the usual tests for examining balance require the active collaboration by patients, and children (especially the youngest ones) are not always "co-operative."[8]

We know that examining a child of pre-school age is not the same as examining a school pupil or a teenager. Even when it is possible to perform the instrumental tests for vestibular examinations, we must still interpret the results with caution. It would be important to be able to decide which of the tests included in the normal battery for balance verification are important for the vestibular examination of children and which ones could be left out.

The goal of the present paper is to review our portfolio of cases of childhood balance alterations and so we have distributed the patients by age groups. We intend to assess the prevalence of the different clinical entities and establish the degree of importance of complementary audiological, balance and imaging tests in vestibular examinations in children.

PATIENTS AND METHOD

We present a non-randomized, descriptive, retrospective study of a transverse cohort which recruited patients attending the clinic due to balance alterations over a period of 12 years (from January 1996, to December 2007) at the Otoneurology Unit of the Otorhinolaryngology Department of a level three hospital (Complejo Hospitalario Universitario de Santiago de Compostela [Santiago de Compostela University Hospital, Santiago de Compostela, Spain]). The study included 125 patients, all under 16 years of age, who were distributed in 3 groups by age: group A, under 6 years of age; group B, from 6 to 10 years of age; and group C, those between 10 and 16 years of age.

The clinical history of all patients was taken, making allowance for their age, including prior illnesses (answered by the patients and, where necessary, complemented by their parents), otoscopy and a clinical neurological and vestibular examination. This implied the performance of the following tests: examination of cranial pairs, observation of the presence or absence of spontaneous nystagmus (using Frenzel goggles and staring), Halmagyi's test, the head-shaking test, Romberg's test, Unterberger's test, and positional tests (those of Dix and Hallpike and McClure's test).

For the purposes of this study, the following parameters were analyzed: gender, age, route of arrival at the clinic, personal and family medical history, characteristics of the balance alteration, presence or absence of associated vegetative symptoms, duration of the crises, result of the audiovestibular and imaging examination, and the final diagnosis.

Depending on the age of the patients and the suspected diagnosis established on the basis of the clinical history, the following audiovestibular tests were carried out:

– Pure tone audiometric (PTA) threshold

– Tympanometry and determination of the reflexes in the stirrup muscle

– Electronystagmography (ENG) and/or video-nystagmography (VNG). The ENG was performed with a computerized electronystagmograph, Nicolet make, Nystar Plus® model. As for the VNG, we used a Veonys computerized videonystagmograph, IMV model, from the firm Biodigital®

– Computerized dynamic posturography (CDP), using a "Smart Balance Master" posturographic platform by Neurocom®

– Craniocorpography (CCG). A graphic record was taken of the Romberg and Unterberger tests using an Eymasa craniocorpograph, CCG600 SE®; model; for the development of the images, Polaroid PRO 100 Polacolor® photographic films were used

The complementary examinations most often requested were: *a)* brainstem auditory evoked potentials (BAEP) by the electrophysiology department; and *b)* imaging tests, especially computerized tomography (CT) and encephalic magnetic resonance (EMR), by the radiodiagnostic department.

The diagnostic outcomes of our series were established according to the algorithm used at our department (Figure 1). For the diagnosis of CBPV the criteria of Basser[9] were used and this group included patients with migraine (classified according to The International Classification of Headache Disorders; 2004).[10]

The data obtained were recorded in a database prepared using the Excel for Windows XP application and analyzed with the SPSS statistics package (version 15.0). For the comparison of diagnoses with regard to age, gender, and results of the complementary examinations, the means of the Mann-Whitney test were used and the χ^2 test for ratios. Statistical significance was deemed to be when $P<.05$.

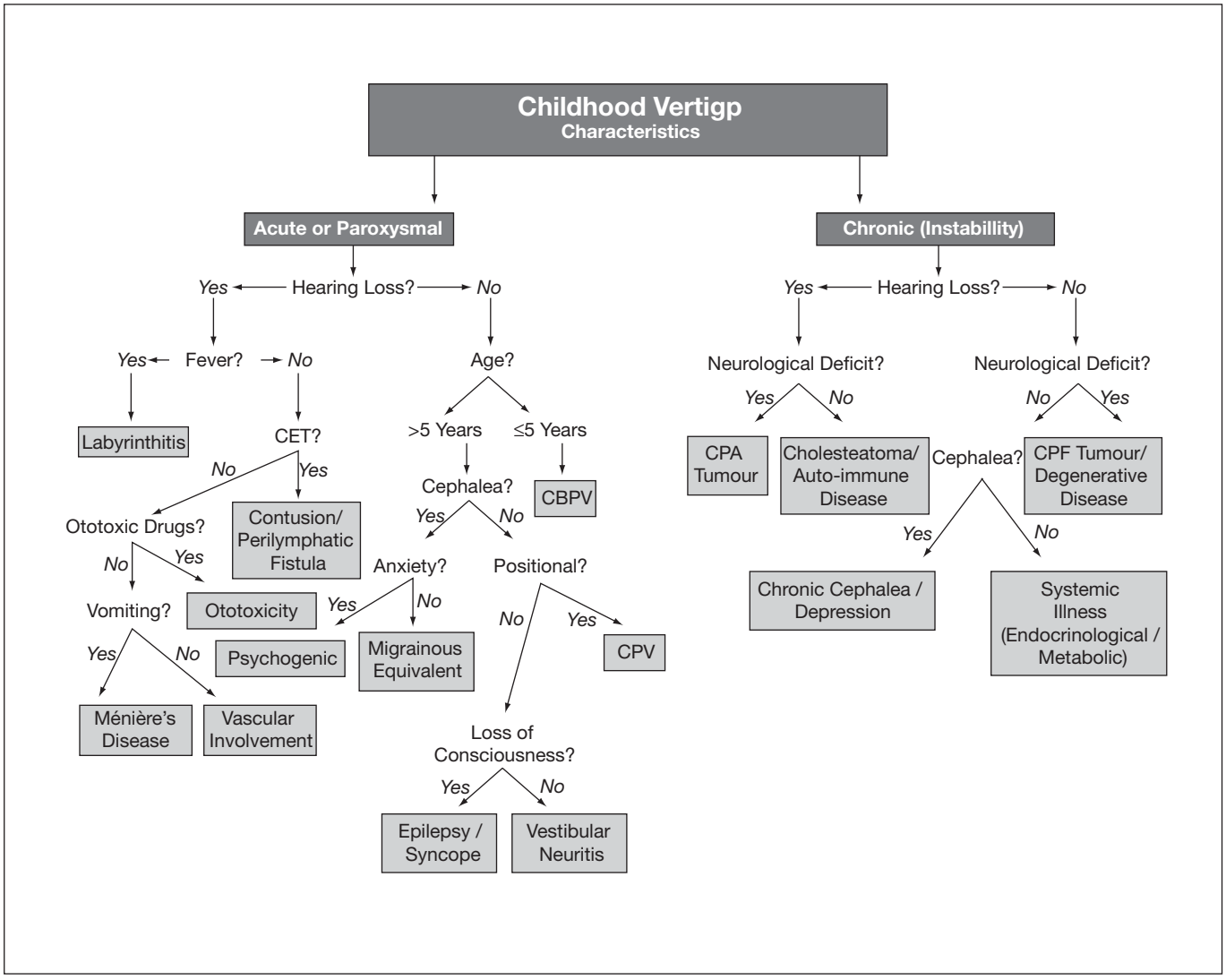

Figure 1. Diagnostic algorithm for childhood vertigo. CBPV indicates childhood benign paroxysmal vertigo; CET, cranioencephalic trauma; CPA, cerebellopontine angle; CPV, childhood positional vertigo; PCF, posterior cranial fossa.

Authorization was obtained from the parents or legal tutors of the patients for the performance of the different complementary tests; all data collected have been treated in confidence.

RESULTS

Out of the total of 8329 patients seen at the otoneurology unit at our department between January 1996, and December 2007, 6756 (81.1%) presented balance alterations. Of these, 125 (1.9%) were under 16 years of age. Figure 2 shows the demographic distribution of our population.

The mean age (95% confidence interval [CI]) for the total number of patients was 11 years (range, 2-16); there were 62 males (49.6%), and 63 females (50.4%). The proportion of females to males was greater in groups A and B: 3.5/1 and 1.5/1, respectively.

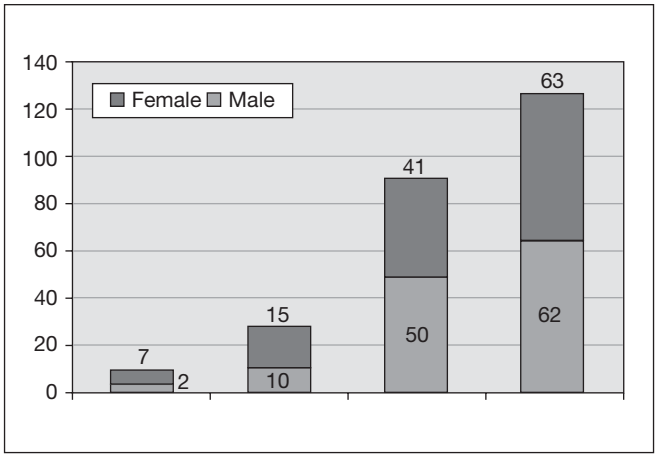

Figure 2. Distribution by age groups. Group A, 0-5 years (n=9); mean, 3 years. Group B, 6-10 years (n=25); mean, 9 years. Group C, 11-15 years (n=91); mean, 13 years. Total, 0-15 years (n=125); mean, 11 years.

Table 1. Origin of the Patients

	Group A (0-5 Years)	*Group B (6-10 Years)*	*Group C (11-15 Years)*	*Total*
Paediatrics department	3	9	35	47 (37.6%)
General paediatrics	3	8	32	43 (34.4%)
Neuropaediatrics	0	1	2	3 (2.4%)
Paediatric allergology	0	0	1	1 (0.8%)
Emergency department	2	7	24	33 (26.4%)
Health centre paediatrician	2	6	20	28 (22.4%)
Health centre otorhinolaryngologist	2	3	12	17 (13.6%)

As for the route taken to access the otoneurology unit, the most frequent origin was our hospital's paediatric department; the distribution of patients by origin can be seen in Table 1.

As far as family history is concerned, the most common was migraine, in 29 patients (3 in group A, 6 in group B, and 20 in group C), ie, 23.2%; 6 patients (4.8%) reported a family history of epilepsy (1 in group A, 2 in group B, and 3 in group C). Another 5 children (4%) had relatives with sensorineural hearing loss of unknown origin (1 in group A, 2 in group B, and 2 in group C) and one of the patients (in group B) reported a history of vertigo in his family. The remaining 84 individuals (67.2%) did not report any family history of note.

As for personal history, migraine is the most frequent, seen in 26 children (20.8%), followed by anxiety in another 10 (8%); these prior conditions were detected most frequently in group C. Other less frequent histories included lightheadedness (3 children; 2.4%), seromucous otitis (2 patients; 1.6%), acute otitis media (2; 1.6%), epileptic seizures (2; 1.6%), ototubaritis (2; 1.6%), and multiple sclerosis, acoustic trauma, sudden-onset deafness, and chronic otitis media with 1 case (0.8%) each.

The patients reported symptoms accompanying their vertigo in 34 cases (27.2%): 16 patients (12.8%) presented symptoms in the cervical column; 11 wryneck (2 in group A, 1 in group B, and 8 in group C), and 5 pain in connection with cervical sprains; 18 patients (14.4%) reported tinnitus (2 in group A, 5 in group B, and 11 in group C), and 65 (52%) vegetative cortex associated with vertigo (13 in group B and 52 in group C).

On analyzing the characteristics of the vertigo, 44 patients (5 in group A, 5 in group B, and 34 in group C) (35.2% of the total) described it as predominantly rotating, always associated with instability and/or lateropulsion. In 5 children, the condition began with clinical signs of dizziness and instability (4 in group B and 1 in group C). The duration of the crises was, in most cases, minutes or seconds, except for 2 patients (1 in group A and 1 in group B) in whom the symptoms remained continuously over months. These 2 children were finally diagnosed as having vertigo of central origin.

The results of the instrumental tests for audiovestibular examination and the complementary tests requested are summarized in Table 2. For the audiological evaluation, the following tests were carried out: behavioural audiometry in 5 cases (group A) and pure tone audiometry threshold in 97 children (77.6%) (10 in group B and 87 in group C). Except for 35 children (28%) who did not co-operate appropriately (28 in group A and 7 in group B), tympanometry and determination of the stapedial reflex was performed in the other patients. In the imaging studies, computerized tomography of the petrous apex was also performed on 15 patients (12%) (8 in group A, 1 in group B, and 6 in group C); it was normal in all cases. No statistically significant association was seen in the results of these complementary examinations requested and the final diagnosis (P>.05).

With regard to the diagnoses, their distribution is analyzed in Table 3. CBPV was the most frequent diagnosis in our series, affecting 80 children (64% of the total); of these, 26 (32.5%) also had a diagnosis of common migraine. No statistically significant association was found between the age group, gender and the presence or absence of migraine (P=.55).

The second most frequent diagnosis was childhood positional vertigo, found in 16 children (12.8%). Next, psychogenic vertigo was present in 8% (10 patients) and vestibular neuritis in 3.2% (4 patients). The rest of the entities found, already listed in the said Table 3, only affected 1 or 2 children. The 3 most common presenting entities (CBPV, CPV, and psychogenic vertigo) were significantly more frequent among patients in group C than among younger patients (P<.05).

DISCUSSION

Balance alterations in childhood present with heterogeneous symptoms that hinder its diagnosis. The determination of the real prevalence of this entity is subject to factors that are not easy to control. For example, it depends on the disability caused by the symptom and this, to a large extent, is constrained by the child's age; for this reason, it may go unremarked on many occasions. It also depends on the characteristics of the department patients go to, which may cause biases in the evaluation of the results.[7,11]

Table 2. Diagnostic Tests

Test	*Result*	*No. (%)*	*Group A (0-5 Years)*	*Group B (6-10 Years)*	*Group C (11-15 Years)*
Audiometry (n=102; 81.6%)	Normal	84 (82.35)	4 (4.76%)	7 (8.33%)	73 (86.91%)
	Mild-moderate hearing loss	15 (14.7)	1 (6.67%)	3 (20%)	11 (73.33%)
	Severe-profound hearing loss	3[a] (2.95)			3[a] (100%)
BAEP (n=8; 6.4%)	Normal	5 (62.5)	4 (80%)	1 (20%)	
	Retrocochlear SNHL	1 (12.5)	1 (100%)		
	Cochlear SNHL	2 (25)	1 (50%)	1 (50%)	
Tympanometry (n=90; 72%)	Type A curve	58 (64.5)	6 (10.35%)	6 (10.35%)	46 (79.3%)
	Type B curve	2 (2.2)	1 (50%)		1 (50%)
	Type C curve	30 (33.3)	5 (16.67%)	6 (20%)	19 (63.33%)
Stapedial reflex (n=90; 72%)	Present	58 (64.5)	6 (10.34%)	6 (10.34%)	46 (79.32%)
	Absent	32 (35.5)	7 (21.87%)	9 (28.12%)	16 (50.01%)
Imaging studies (n=49)					
Cervical x-ray (n=12)	Normal	5 (41.6)			5 (100%)
	Correction	6 (50)			6 (100%)
	Hyperlordosis	1 (8.4)			1 (100%)
EMR (n=37)	Normal	34 (91.9)			
	Altered	3[b] (8.1)			3[b] (100%)
ENG (n=33;26.4%)	Normal	20 (60.6)	1 (5%)	2 (10%)	17 (75%)
	HPL	12 (36.36)			12 (100%)
	Central nystagmus	1 (3.04)			1 (100%)
CCG (n=36; 28.8%)	Claussen type I	8 (22.22)	1 (12.5%)	2 (25%)	5 (62.5%)
	Claussen type II	28 (77.78)			28 (100%)
CDP (n=33; 26.4%)	Normal	24 (72.73)			24 (100%)
	Altered	9[c] (27.27)		3 (33.33%)	6 (66.67%)

BAEP indicates brainstem auditory evoked potentials; CCG, craniocorpography; CDP, dynamic posturography; EMR, encephalic magnetic resonance; ENG, electronystagmography; HPL, hyporeflexia of the posterior labyrinth; SNHL, sensorineural hearing loss.
[a]Unilateral (2), bilateral (1).
[b]Cyst in the carotid plexus (1), alterations in the carotid flow (1), areas of demyelinization (1).
[c]Alteration in conditions 4, 5, and 6 of the sensorial organization test.

Table 3. Diagnostic Results

Illness	*Group A (0-5 Years) (n=9; 7.2%)*	*Group B (6-10 Years) (n=25; 20%)*	*Group C (11-15 Years) (n=91; 72.8%)*	*n=125*	*%*
CBPV	3 (3.75%)	16 (20%)	61 (76.25%)	80	64
Without common migraine	2 (3.7%)	11 (20.37%)	41 (75.93%)	54	67.5
With common migraine	1[a] (3.85%)	5 (19.23%)	20 (76.92%)	26	32.5
CPV	1 (6.25%)	2 (12.5%)	13 (81.25%)	16	12.8
Psychogenic vertigo	1 (10%)	3 (30%)	6 (60%)	10	8
Vestibular neuritis			4 (100%)	4	3.2
Ménière's disease			2 (100%)	2	1.6
Seromucous otitis	1 (50%)		1 (50%)	2	1.6[d]
Ototubaritis		1 (50%)	1 (50%)	2[d]	1.6
Acute otitis media	1 (50%)	1 (50%)		2	1.6
Epileptic conditions		1 (50%)	1 (50%)	2	1.6
Central vertigo	1[b] (50%)	1[c] (50%)		2	1.6
Simple chronic otitis media			1 (100%)	1	0.8
Labyrinthitis	1 (100%)			1	0.8
Multiple sclerosis			1 (100%)	1	0.8

[a]Diagnosis of migrainous equivalent.
[b]Cerebellitis.
[c]Vertebrobasilar insufficiency.
[d]Of the 30 patients with tubaric dysfunction (Table 2, type C curve), 2 were not associated with the diagnoses cited.

In our series, the distribution by gender is similar (49.6% males and 50.4% female). There is a strikingly higher proportion of females with respect to males in groups A and B: 3.5/1 and 1.5/1, respectively. Although there are, as in our study, publications which find no differences in gender incidence,[12] the results are, in general, extremely varied.[4,13] For this reason we believe that there is probably no predilection in this symptom for either gender in childhood.

Considering the general causes of balance alterations in childhood, there is a strikingly wide variability of their incidence as reflected in the series reviewed.[1,2,14,15] Some of these come from neurological clinics, thus justifying the high rate of reported central nervous system involvement; in our series, as occurs in other publications,[4,16] there is a predominance of peripheral involvement, representing 82.4% (103 patients).

Fenichel[17] established the association between familial migraine and CBPV. Since then, several authors have published their series with association figures ranging from 34% to 65%.[11,18,19] Our figures (32.2%, 29 children) are around that range. CBPV is the most frequent condition in our series and in the majority of the series reviewed; it has been related with an early form of migraine that generally occurs before 4 years of age (as shown in The International Classification of Headache Disorders; 2004).[10] Nonetheless, the age of onset of migraine in patients with CBPV is controversial.[12] While some authors have reported the age of onset from as young as 4 years old,[13,20] our series only has 1 child in which the diagnosis was established at an earlier age (at 3 years of age to be precise). In fact, migraine and CBPV were included in the same aetiological group in our series because, when CBPV presents with cephalea, the differential diagnosis with migraine becomes difficult.[10] Of the 80 children (64%) diagnosed as having CBPV, 26 (32.5%) presented common migraine symptoms, mostly (20 children, 76.92%) in group C. No statistical association was found between age, gender, and the fact that they presented associated migraine ($P>.05$). This concurs with the hypothesis in the literature that its clear association points more to a migrainous equivalent than a purely vestibular clinical condition.[7,10,11] The fact that the caloric tests showed vestibular hyporeflexia in 18.2% of cases (6/33 patients in group C) is noteworthy. This hyporeflexia, as well as the hyperreflexia found in 2 patients, has already been described in this condition.[15,21] The CBPV usually remits spontaneously in a few years, with a cure by about 8 years of age.[7]

The incidence of CPV falls between 0.8% and 3.9% of balance alterations in children; it is therefore much less frequent that benign paroxysmal positional vertigo in adults.[2,21-23] In our series it occurred in 16 patients (12.8%), most often in group C. The mean age for this involvement is around 7 or 8 years of age[22]; ie, higher than in CBPV (around 3 or 4 years of age).[10,12,13,20] The audiological and vestibular examinations were normal in all 16 children, except for a discreet bilateral labyrinthine hyporeflexia in one of them.

Psychogenic vertigo in childhood has an incidence of 13%; it is generally detected in children over 5 years of age (Figure 1). The fundamental symptom characterizing it is anxiety manifestations, a dominant feature of this condition; it may be accompanied or not by cephalea, but without loss of consciousness.[2,24] In our series, 10% (8 patients) had a diagnosis of psychogenic vertigo, most frequently in group C. We were struck by the fact that this diagnosis was also established in a 4-year-old patient.

We noted that the diagnoses of CBPV, CPV, and psychogenic vertigo are more frequent in group C (Table 2); this association with age is statistically significant ($P<.05$). In fact, most patients in our series fall into this age group (91 patients; 72.8%). This may be due to the fact that the incidence of balance alterations increases with age, or else that these patients have a greater capacity for attention and oral expression. Thus they are better able to explain their symptoms and are more co-operative during the otoneurological examination[8].

The incidence of vestibular neuritis among children varies from one series to another between 4% and 7%.[25,26] We recorded an incidence of 3.2% (4 children, all in group C). Reports of indicative clinical symptoms, together with clinical and radiological signs of upper airway infections (sinusitis in most cases), as well as vestibular hyporeflexia in the affected ear in the 4 cases were the data leading to this diagnosis.

The incidence of Ménière's disease in childhood is much lower (4.5%-5.7%) than in adults, perhaps because most of the cases are not diagnosed as such until several years have elapsed since the onset of symptoms.[16,27] In our series, the incidence is 1.6% (2 patients in group C). In these patients, a dynamic posturography test was performed and was mainly altered in conditions 4, 5, and 6 of the sensorial organization test.

Labyrinthitides are another classical diagnosis of a possible cause of vertigo in childhood. In particular, a purulent labyrinthitis, due to bacterial or mycotic infection, is usually very destructive and may even cause ossification of the labyrinth. On the other hand, viral or serous labyrinthitides present a less colourful set of vestibular signs and less serious hearing loss.[4,16] In our series, this diagnosis was established in only 1 patient (0.8%) in group A. Obviously, he presented severe hearing loss in the affected ear, accompanied by the vestibular syndrome. The scant incidence recorded leads us to think that the improvements in health care and the availability of effective treatments against infections of the middle ear will make labyrinthitis (if they haven't already done so) in an exceptional diagnosis.

More than a thousand genetic syndromes have been identified in connection with hereditary peripheral vestibular malformations[8], so it is important to rule out, among congenital problems, isolated malformations of the ear (such as Mondini syndrome, Scheibe's deafness, Usher's syndrome, or the enlarged vestibular aqueduct syndrome, among others) or those related to a wider range of syndromic conditions. A computerized tomography study was performed on the petrous apices of 15 patients (12%), without significant findings. On the other hand, an encephalic magnetic resonance scan was requested for 37 patients (29.6%); only one of them was found to have multiple sclerosis. Several

publications have reported more frequent findings of inner ear malformations, cerebral tumours, infections or multiple sclerosis; in any case, these conditions appear in less than 2.3% of the imaging tests requested ($P<.05$).[28,29] In our series, we have not found any statistical association between the results of the imaging studies (CT and EMR) and the diagnosis ($P>.05$).

For this reason, in terms of diagnostic cost-effectiveness, imaging studies should only be requested in children with neurological signs, persistent cephaleas or when faced with a history of major cranioencephalic trauma. Nonetheless, there are other factors that are more difficult to quantify when it comes to deciding in which cases it is appropriate to perform an imaging test: doubts about the accuracy of the anamnesis (in view of the scant age of these patients and therefore the difficulty to express themselves); the anxiety generated in the relatives by the fear of a serious cause behind the balance alteration; an interaction that is not always straightforward with the paediatric departments (which often demand we give confirmed diagnoses in a field, vestibular pathology, in which diagnostic certainties are not as frequent as we would like); these are all factors that, in our opinion, warrant a request for imaging tests in the face of the slightest diagnostic doubt.

As for equilibriometric tests, these do not provide very relevant in the light of the results of our series. The most frequent entities (CBPV and CPV) are fundamentally clinical diagnoses (based on the medical history and the physical examination). The results obtained by these patients in their equilibriometric tests are not very significant as there have been descriptions of contradictory findings (normofunction, hyporeflexia, and hyperreflexia) in these entities. Therefore, in view of the difficulty involved in performing some of them (especially on small children), they should be reserved for selected cases in which the anamnesis and the clinical examination alert us to a clearly labyrinthine lesion as the origin of the condition.

On the other hand, it is known that 90% of sensorineural hearing losses detected in childhood are already present at birth, in 50% of cases without risk factors. For this reason, an auditory screening test is carried out in our setting on all newborn babies during the first few days of life, in order to ensure early detection of hearing losses that might later go unnoticed.[30] Many studies have confirmed the strong relationship between sensorineural hearing loss in childhood and impairment of the vestibular function[8,31,32] (children with a significant hearing loss are at greater risk of vestibular dysfunction).[8] Thus, a vestibular examination should be performed on all children whenever sensorineural hearing loss is detected. This might help avoid disorders in their long-term psychomotor development, as early therapeutic intervention on the audiovestibular system improves the patient's outcome.[8,30]

It is important to bear in mind that childhood vertigos are dynamic conditions and there is no pathognomonic test for their correct diagnosis, which can only be reached by considering the whole constellation of examinations together with a meticulously detailed clinical history.

By way of conclusion:

– The clinical history and the otoneurological examination are the key elements for the diagnosis of vestibular involvement in childhood; it is important to follow a systematic protocol by age groups

– Diagnoses of childhood benign paroxysmal vertigo, childhood positional vertigo and psychogenic vertigo are the most frequent, especially in children aged from 11 to 15 years

– In childhood benign paroxysmal vertigo, age and gender are not related to the presentation of associated migraine

– A systematic vestibular examination must be carried out on children where sensorineural hearing loss is detected

– In view of the scant diagnostic relevance of the equilibriometric examinations in most patients, these should be reserved for selected cases

– From the standpoint of diagnostic cost-effectiveness, imaging studies should only be requested in children with neurological signs, persistent cephaleas or when faced with a history of cranioencephalic trauma

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