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Review article

Prevalence and diagnosis of vestibular disorders in children: A review

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ABSTRACT

Objectives: To systematically review and discuss the main pathologies associated with vertigo and dizziness in children, paying particular attention to recent advances in diagnosis and therapy.
Methods: One appropriate string was run on PubMed to retrieve articles dealing with the topics mentioned above. A cross-check was performed on citations and full-text articles found using the selected inclusion and exclusion criteria. A non-comparative meta-analysis concerning the rate of singular vertiginous forms was performed.
Results: Ten articles were identified comprising a total of 724 subjects. Overall, the articles we analyzed indicated benign paroxysmal vertigo of childhood (18.7%) and migraine-associated vertigo (17.6%) as the two main entities connected with vertigo and dizziness in children. Head trauma (14%) was the third most common cause of vertigo. The mean (95% CI) rate of every vertiginous form was also calculated in relation to the nine studies analyzed with vestibular migraine (27.82%), benign paroxysmal vertigo (15.68%) and vestibular neuritis (9.81%) being the three most common forms. There appeared to be a paucity of recent literature concerning the development of new diagnostic methods and therapies.
Conclusions: On the basis of the literature study, when evaluating a young patient with vertigo and dizziness, the otolaryngologist should be aware that, in children, these symptoms are often connected to different pathologies in comparison to the entities observed in the adult population.

Contents

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Introduction

Episodic vertigo and dizziness are less frequent symptoms in children than in the adult population and have been studied less extensively. The prevalence of vestibular disorders in the pediatric population ranges between 0.7% and 15%, with the higher values obtained from studies using a patient questionnaire as the primary method of data collection [1–3].

In their retrospective review of 561,151 patients, O'Reilly et al. [4] found a cumulative prevalence of diagnosis related to a balance of 0.45% (2546/561,151). Between these 2546 patients, only 159 were diagnosed with a clearly defined peripheral vestibular pathology while the majority of them were considered affected by an "unspecified peripheral vertigo".

If vertigo is present in a child, various peripheral and central vestibular syndromes may be implicated and exhaustive clinical and laboratory work-up is needed to obtain a correct diagnosis [5].

Nevertheless, despite the most significant technological achievements in the development of diagnostic tools since then, diagnosis is still based mainly upon the patient's history and physical examination. Moreover, the differential diagnosis of childhood vertigo differs from that of adults because several etiologies are unique to the pediatric population while the occurrences of other pathologies are rather different in children and adults [6].

The predominant forms of vertigo in children are benign paroxysmal vertigo of childhood (BPV), vestibular migraine (VM), and otitis media (OM)/middle ear effusion (MEE)-related dizziness [1].

Analyzing the more recent articles focusing on this topic, the aim of this review was to define and discuss the main clinical entities causing vestibular symptoms during childhood.

Material and methods

In July 2013, a literature search was performed using the following search string on PubMed:

- "Child"[Mesh] AND "Vertigo"[Mesh] OR "Dizziness"[Mesh].

The initial search returned a total of 4165 results. Abstracts and titles obtained were screened independently by two of the authors (FMG and MR) who subsequently met and discussed disagreements on citation inclusion.

Concerning the rate of singular vertiginous forms, we performed a non-comparative meta-analysis and the between-study heterogeneity was assessed with the χ^2-based Cochran's Q statistic test and I^2 metric. Heterogeneity was considered significant at $P < 0.01$ for the Q statistic (to assess whether observed variance exceeded expected variance). For the I^2 metric ($I^2 = 100\% \times (Q - \mathrm{df})/Q$), the following cut-off points were used: $I^2 = 0$–25%, no heterogeneity; $I^2 = 25$–50%, moderate heterogeneity; $I^2 = 50$–75%, large heterogeneity; $I^2 = 75$–100%, extreme heterogeneity. All analyses were performed with the statistical package STATA12 (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP).

Results

After an initial check, full-text retrieval, and manual cross-checking of references included in the articles, nine studies comprising a total of 724 subjects were chosen for analysis. The characteristics of these selected studies are included in Table 1. A further study, in which more than 2000 patients were analyzed, is also reported in Table 1 although the authors of this article only indicated the percentage incidence of each pathology.

Between the 724 subjects grouped in this review, the most commonly diagnosed pathologies were benign paroxysmal vertigo and VM with rates of 18.7% and 17.6%, respectively. Head trauma with a rate of 14% was the third most common cause of vertigo.

Concerning middle ear effusion, it must be noted that this entity was not considered by many authors of the studies analyzed in our review. This observation suggests that the rate of middle ear effusion and otitis media causing vertigo (3%) is highly underestimated in our review.

Overall, psychogenic vertigo accounted for 4.1% of all cases while benign paroxysmal positional vertigo (BPPV; 1.8%), Ménière's disease (1.5%) and orthostatic hypotension (1.2%) were rarer causes of vertigo in children.

The audiometric examinations with the different vestibular tests performed in the analyzed studies were summarized in Table 2.

The mean (95% CI) rate of every vertiginous form was calculated in relation to the nine studies analyzed. This gave, respectively, 27.82% for VM (Fig. 1), 15.68% for benign paroxysmal vertigo (Fig. 2), 9.81% for vestibular neuritis, 4.08% for Ménière's disease, 2.12% for BPPV, 8.28% for psychogenic vertigo, 4.1% for middle ear effusion and otitis media, 3.82% for head trauma, and 0.58% for orthostatic hypotension.

On the basis of the literature analyzed in our study, we have proposed an algorithm comprising the main pathological entities that should be suspected in a child presenting with vertigo or dizziness (Fig. 3).

Table 1
Literature reports of the most common causes of vertigo/dizziness in children.

	n	Mean ages	Migraine	BPV	Vestibular neuritis	Meniere's disease	BPPV	Psychogenic vertigo	MEE/OM	Head trauma	Orthostatic hypotension
Bower and Cotton [2]	34	10.6	4 (12%)	5 (15%)	3 (9%)	2 (6%)	0	0	5 (15%)	3 (9%)	0
D'Agostino et al. [31]	282	N/A	15 (5%)	60 (21%)	3 (1%)	0	0	0	x	85 (30%)	0
Weisleder and Fife [13]	31	13	11 (35%)	6 (19%)	0	2 (6%)	0	3 (10%)	0	0	0
Ravid et al. [46]	62	11.8	24 (39%)	10 (16%)	9 (14%)	0	0	8 (13%)	x	2 (3%)	5 (9%)
Choung et al. [25]	55	11.8	17 (31%)	14 (25%)	1 (2%)	2 (4%)	2 (4%)	0	x	4 (7%)	0
Riina et al. [1]	119	10.9	17 (14%)	23 (19%)	14 (12%)	2 (2%)	1 (1%)	6 (5%)	12 (10%)	6 (5%)	4 (3%)
Erbek et al. [47]	50	11.5	17 (34%)	6 (12%)	2 (4%)	1 (2%)	6 (12%)	5 (10%)	x	0	0
Balatsouras et al. [5]	54	8.9	11 (20%)	9 (17%)	15 (28%)	1 (2%)	4 (7%)	0	5 (9%)	3 (5%)	0
Gruber et al. [6]	37	14	12 (32%)	3 (8%)	8 (22%)	1 (3%)	0	8 (22%)	x	1 (3%)	0
Total subjects	724		128 (17.6%)	136 (18.7%)	55 (7.6%)	11 (1.5%)	13 (1.8%)	30 (4.1%)	22 (3%)	104 (14%)	9 (1.2%)
Wiener-Vacher [48]	>2000	N/A	25%	20%	5%	N/A	N/A	N/A	N/A	10%	N/A

BVP: benign paroxysmal vertigo; BPPV: benign paroxysmal positional vertigo; MEE: middle ear effusion; OM: otitis media; N/A: not available. Some studies excluded children with otitis media (denoted with x).