

Proficiency in the Care of a Child with Vestibular Dysfunction

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ABSTRACT

Objective: Vestibular dysfunction among children and adolescents has recently gained attention. Myriad novel studies and research pertaining to various causes of vestibular dysfunction have emerged. Yet, there is still a lack of awareness among most physicians, notably otorhinolaryngologists, which has led to the condition being overlooked and its prevalence being underestimated.

Methods: A cross-sectional Google-form survey involving all otorhinolaryngologists in Malaysia was conducted to determine the awareness of vestibular dysfunction among otorhinolaryngologists in Malaysia.

Results: A total of 137 from 156 otorhinolaryngologists answered the survey (87.8%). The majority of the participants were aged between 31 and 40 years old (59.1%), hailing from government hospitals (67.9%), with a working experience of fewer than 5 years (55.5%). A total of 79.6% of them work with children almost daily or frequently. The vestibular assessment was not routine in 91.2% of the participants, and no parental or patient complaint was the top reason behind this (81.0%). Only 16% were comfortable performing vestibular assessment in children. Oculomotor examination is the most favored assessment (71.5%). Otorhinolaryngologists practising longer tends to prescribe medications to children with vestibular dysfunction ($P = .025$). There is no statistical significance between years of experience, comfort level, or routine vestibular assessment.

Conclusion: Vestibular assessment is not routine in children among otorhinolaryngologists, albeit with longer working experience. Lack of assessment is attributed to the parents or patients who do not complain of vestibular dysfunction. The majority of otorhinolaryngologists are not comfortable with vestibular assessment in children. Medication is prescribed comfortably by senior otorhinolaryngologists. These findings suggest that education on vestibular assessment and management is imperative among otorhinolaryngologists to improve the overall care and quality of life in children.

Keywords: Awareness, balance, children, vestibular assessment, vestibular dysfunction

Introduction

The prevalence of vestibular dysfunction in children ranges between 0.7% and 15%.¹ Nonetheless, a higher prevalence of vestibular impairment has been reported among children with certain conditions, notably sensorineural hearing loss, which ranges between 20% and 70%.^{2,3}

Vestibular dysfunction in children translates into impairments of balance,⁴ gross motor delay,⁵ and a learning disability.⁶ Besides the increasing effort to stay upright and stabilize gaze, a child with a vestibular deficit may need to compete with other cognitive efforts, such as visuospatial performance.⁷ The intricate nature and close relationship between the vestibular

system, the proprioceptors, and the cerebellum that steers posture, balance, eye-motor coordination, muscle tone, and spatial orientation play a prominent role in school learning. As aforementioned, long-term effects of vestibular dysfunction may result in poor social skills in addition to impaired daily activities such as riding a bicycle or crossing streets,⁸ resulting in marred psychological well-being and quality of life.

Although various studies involving vestibular dysfunction in children have emerged, it involves only a small number of patients and focuses on only certain conditions such as hearing loss. In the same vein, prompt vestibular compensation in children may be condoned too seriously, resulting in overlooking vestibular loss in children. Parallel to that, despite the

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emerging studies surrounding vestibular dysfunction in children, proficiency in managing these children among otorhinolaryngologists is still lacking.

To date, there is no available data to investigate the awareness and proficiency of vestibular dysfunction in children among otorhinolaryngologists. This study aimed to highlight the level of understanding and ability to manage vestibular dysfunction in children among otorhinolaryngologists. We hypothesize that otorhinolaryngologists do not routinely assess vestibular function in children and face barriers to screening vestibular dysfunction in children. The current study is warranted to disclose and understand these limitations as well as to create awareness and proficiency in vestibular dysfunction management in children to ensure vestibular dysfunction is optimally diagnosed and treated by otorhinolaryngologists. This study aims to remind and stimulate the work still needed to advance scientific data about the pediatric vestibular system and the (motor and developmental) consequences of vestibular dysfunction.

Methods

This cross-sectional survey study was conducted among otorhinolaryngologists in Malaysia in December 2021 following ethics approval from the University Malaya Medical Centre (Ethics Committee MECID No. 2021626-10267). Participants were contacted and informed regarding the study objectives using Google forms sent via WhatsApp groups and emails. They were assured that participation was voluntary and the information obtained was confidential.

An 18-question Google-form survey was sent to all otorhinolaryngologists across Malaysia (Supplementary Material). The recipients were sent 1 message reminder 2 weeks before the survey closed. The survey was kept open for 1 month from the initial date sent to closing to reduce the bias of the outcome at a particular point. Informed consent is obtained from each participant prior to answering the survey. The initial part included demographic data of the participants, including age, gender, race, years in practice post-specialization, practice setting, and experience working with children. The second part of the survey focused on experience working with children with vestibular dysfunction, comfort level with vestibular assessment, conditions causing vestibular dysfunction in children, why vestibular assessment is not routinely performed, and to whom

Main Points

- Vestibular dysfunction in children is underreported following a lack of awareness among otorhinolaryngologists.
- The long-term consequence of vestibular impairment includes motor development delay, cognitive impairment as well as poor academic performance.
- Sole reliance on vestibular compensation results in detrimental ramifications which severely impair the quality of life in children.
- Early vestibular rehabilitation shows promising results among children.
- Education and knowledge on vestibular assessment and management in children should be emphasized during the postgraduate training program as a part of the curriculum.

Table 1. Demographic Characteristics of the Participants

Variables	Frequency (%)
Age	Medium_sup_Italic
Under 30	4 (2.9)
31-40	81 (59.1)
41-50	38 (27.7)
51-60	12 (8.8)
61-70	1 (0.7)
70 and above	1 (0.7)
Gender	
Female	69 (50.4)
Male	68 (49.6)
Race	
Malay	70 (51.1)
Chinese	29 (21.2)
Indian	34 (24.8)
Other	4 (2.9)
Practice setting	
Government	93 (67.9)
Academic	24 (17.5)
Private	20 (14.6)
Working experience post specialization	
Less than 5 years	76 (55.5)
5-10 years	26 (19.0)
More than 10 years	35 (25.5)
Experience working with children	
Daily	57 (41.6)
Rarely	7 (5.1)
Occasionally	21 (15.3)
Frequently	52 (38.0)

these afflicted children are referred. Finally, respondents were questioned regarding the medication prescribed.

Statistical Analysis

Descriptive statistics were used to present the survey responses, where the categorical variables were presented as frequency and percentage. Statistical analysis was performed based on the survey responses using the Pearson chi-square test and Fisher exact test. All the tests were 2-sided and statistical significance was denoted as $P < .05$. The reporting guideline was according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement guidelines.

Results

The Google-form survey invitation was sent to 156 otorhinolaryngologists practising in Malaysia. A total of 137

Table 2. Survey Responses Regarding Experience with Pediatric Vestibular Dysfunction

Questions	Frequency (%)
Is vestibular dysfunction assessment part of your routine examination of a child?	
No	125 (91.2)
Yes	12 (8.8)
How frequent do you encounter children with vestibular dysfunction?	
Never	38 (27.7)
Rarely (once every 2-3 month)	78 (56.9)
Occasionally (2-3 times per month)	20 (14.6)
Frequently (2-3 times per week)	1 (0.7)
What is the reason vestibular assessment is not part of your routine examination?	
Do not feel vestibular assessment is a priority	5 (3.6)
More pressing issues	3 (2.2)
Not comfortable evaluating vestibular function in a child	4 (2.9)
Not enough time	1 (0.7)
Patients or parents are not concerned	1 (0.7)
Patient/parents do not complain of imbalance/dizziness/vertigo	111 (81.0)
Unsure of expertise on pediatric vestibular dysfunction	5 (3.6)
Unsure of how to assess	7 (5.1)
What ENT condition do you think is commonly associated with vestibular dysfunction in children?	
Hearing loss	42 (30.7)
Otitis media effusion	61 (44.5)
Benign paroxysmal positional vertigo	32 (23.4)
Vestibular neuritis	40 (29.2)
Ototoxicity	35 (25.5)
Migraine	24 (17.5)
Cholesteatoma	47 (34.3)
Acute otitis media	39 (28.5)
Chronic otitis media	35 (25.5)
Temporal bone fracture	35 (25.5)
How often you refer a child with vestibular dysfunction for further assessment (if you encounter)?	
Always	34 (24.8)
Rare	58 (42.3)
Never	12 (8.8)
I have not encountered a child with vestibular dysfunction	33 (24.1)
Why do you think vestibular dysfunction among children is not widely encountered?	
Children tend to compensate faster than adults	52 (38.0)
It is not part of routine assessment	27 (19.7)
Lack of awareness	58 (42.3)
How comfortable are you assessing vestibular dysfunction in children?	
Not at all comfortable	35 (25.5)
Somewhat comfortable	78 (56.9)
Comfortable	22 (16.1)
Very comfortable	2 (1.5)

(Continued)

Table 2. Survey Responses Regarding Experience with Pediatric Vestibular Dysfunction (Continued)

Questions	Frequency (%)
What bedside vestibular assessment do you commonly perform in a child?	
Oculomotor examination	98 (71.5)
Head shake	34 (24.8)
Head thrust	35 (25.5)
Dynamic visual acuity	14 (10.2)
Romberg test	69 (50.4)
Unterberger/Fukuda test	26 (19.0)
Dix-Hallpike test	45 (32.8)
Heel-to-toe test	38 (27.7)
Other	15 (10.9)
When you encounter a child with vestibular dysfunction, who do you refer to?	
Audiologist	9 (6.6)
Otologist	43 (31.4)
Pediatric otorhinolaryngologist	51 (37.2)
Pediatrician	17 (12.4)
Rehab therapist	14 (12.4)
Audio vestibular services available at your center	
None	11 (8.0)
Otoacoustic emission (OAE)/automated auditory brainstem response (AABR)	5 (3.6)
Pure tone audiometry and tympanometry	11 (8.0)
Puretoneaudiometry and tympanometry, auditory brainstem response (ABR), OAE/AABR	100 (73.0)
Pure tone audiometry and tympanometry, OAE/AABR	7 (5.1)
Vestibular evoked myogenic response (VEMP)	1 (0.7)
Video-head impulse test (VHIT)	2 (1.5)
Do you perform imaging such as CT/MRI routinely in children with vestibular dysfunction	
No	68 (49.6)
Yes	69 (50.4)
Do you prescribe oral Betaserc in children with vestibular dysfunction	
No	117 (85.4)
Yes	8 (5.8)
I prescribe other medication	12 (8.8)

ENT, ear, nose & throat.

otorhinolaryngologists answered the survey and were recruited for the study (Table 1). The majority of the participants belonged to the Malay (51.1%) ethnicity. Most of the participants were aged between 31 and 40 years (59.1%) with working experience of fewer than 5 years (55.5%). Most participants work in a government hospital (67.9%). There was an almost equal proportion of male (49.6%) and female (50.4%) participants. Most of them had a good experience working with children, whereby approximately 80% of the participants work with children daily or frequently.

A total of 125 (91.2%) of the participants reported that vestibular assessment was not part of their routine assessment of a child, and they rarely (once every 2-3 months) encounter

children with vestibular dysfunction (56.9%) (Table 2). The top reason vestibular assessment is not a part of the routine examination is attributed to patients or parents who do not complain of any symptoms of vestibular dysfunction, such as imbalance, dizziness, and vertigo (81.0%). Approximately half of the participants rarely refer a child for further assessment (42.3%).

The reason vestibular dysfunction is not widely encountered include the tendency of children to compensate faster than adults (38.0%) and lack of awareness (42.3%). Notably, there were 35 (25.5%) participants who feel not at all comfortable assessing vestibular dysfunction in children. Most participants would refer a child with vestibular dysfunction to

either an otologist (31.4%) or a pediatric otorhinolaryngologist (37.2%).

A small percentage (8%) of participants did not have any audio-vestibular services or specialized vestibular assessment at their center. About half of the participants (50.4%) routinely perform either computed tomography (CT) or magnetic resonance imaging (MRI) in children with vestibular dysfunction. However, most participants do not routinely prescribe medication to children with vestibular dysfunction (89.8%), while only 5.8% prescribe oral betahistine hydrochloride, and 8.8% prescribe other drugs such as prochlorperazine, antihistamine, antiemetics, amitriptyline, and vitamin B12.

A significant association was observed between working experience and the person to refer to ($P=.021$) (Table 3). It was found that participants with more vast working experience tend to refer a child with vestibular dysfunction to either otologist or pediatric otorhinolaryngologist.

Apart from that, the working experience was associated with a higher likelihood of medication prescription ($P = .025$). It was found that participants with longer working experience tend to prescribe medications to a child with vestibular dysfunction. No significant association was observed between participants' work settings with survey responses ($P > .05$).

Participants responded that the common ENT condition associated with vestibular dysfunction in children included Otitis media effusion (44.5%), cholesteatoma (34.3%), hearing loss (30.7%), vestibular neuritis (29.2%), acute otitis media (28.5%), chronic otitis media (25.5%), ototoxicity (25.5), temporal bone fracture (25.5%), benign paroxysmal positional vertigo (23.4%), and migraine (17.5%). As for the bedside vestibular assessment, the oculomotor examination was favored (71.5%), followed by the Romberg test (50.4%), Dix-Hall Pike test (32.8%), Heel-to-toe test (27.7%), head thrust (25.5%), head shake (24.8%), Unterberger/Fukuda test (19.0%), dynamic visual acuity (10.2%) and others (10.9%). No

Table 3. Association between Working Experience with Survey Responses

	Working Experience			P
	<5 years	5–10 years	>10 years	
Who to refer				
Audiologist	2 (2.6)	5 (19.2)	2 (5.7)	.021 ^b
Otologist	25 (32.9)	3 (11.5)	15 (42.9)	
Pediatric otorhinolaryngologist	26 (34.2)	11 (42.3)	14 (40.0)	
Pediatrician	10 (13.2)	4 (15.4)	3 (8.6)	
Rehab therapist	13 (17.1)	3 (11.5)	1 (2.9)	
Comfort in assessment				
Not at all comfortable	20 (26.3)	7 (26.9)	8 (22.9)	.393 ^b
Somewhat comfortable	46 (60.5)	13 (50.0)	19 (54.3)	
Comfortable	10 (13.2)	6 (23.1)	6 (17.1)	
Very comfortable	0 (0.0)	0 (0.0)	2 (5.7)	
How often to refer a child for assessment?				
Always	16 (21.1)	7 (26.9)	11 (31.4)	.763 ^b
Rare	33 (43.4)	9 (34.6)	16 (45.7)	
Never	8 (10.5)	2 (7.7)	2 (5.7)	
Have not encountered	19 (25.0)	8 (30.8)	6 (17.1)	
Is VD part of routine assessment				
No	71 (93.4)	21 (80.8)	33 (94.3)	.142 ^b
Yes	5 (6.6)	5 (19.2)	5 (5.7)	
Perform CT/MRI routinely				
No	37 (48.7)	10 (38.5)	21 (60.0)	.267 ^a
Yes	39 (51.3)	16 (61.5)	14 (40.0)	
Prescription of oral Betaserc				
No	71 (93.4)	19 (73.1)	27 (77.1)	.025 ^b
Yes	2 (2.6)	3 (11.5)	3 (8.6)	
Other medication	3 (3.9)	4 (15.4)	5 (14.3)	

^aPearson chi-square test. ^bFisher Exact test. ENT, ear, nose & throat.

statistical significance was found between years of experience and bedside vestibular assessment ($P > .05$).

Discussion

From this cross-sectional survey, we gather that only 8.8% of otorhinolaryngologists incorporate vestibular evaluation as a part of the routine assessment of children. No parental-patient concern or complaint is the top reason listed for not evaluating vestibular dysfunction. Yet, this population may not be aware of the signs or symptoms of vestibular impairment, which requires the expertise of an otorhinolaryngologist, resulting in a large number of the concerned populations being overlooked. The identification of children susceptible to vestibular impairment rests primarily on the ability of Otorhinolaryngologists to assess and manage promptly.

Only 30.7% and 25.5% of otorhinolaryngologists responded that hearing loss and ototoxic medication could lead to impaired vestibular function in children. The parallelism between hearing loss and the vestibular deficit has been reported for decades. Prevalence of vestibular impairment in children with sensorineural hearing loss ranges between 15% and 85%,⁹⁻¹¹ whereby the wide range is attributed to how vestibular dysfunction is defined and the assessment techniques implemented.¹²

Vestibular dysfunction is found in children with hearing loss, especially those with severe or profound hearing loss, ensuing the close anatomy and ontogeny relation between the vestibular end-organs and cochlea. This close relation is believed to cause both the vestibular and hearing organ to be affected by the same embryological factor or infection.

Ototoxicity occurs following the usage of certain medication, which leads to auditory and vestibular complications known as vestibulotoxicity. Vestibulotoxicity ensuing ototoxic medication has been reported in the literature.¹³ Guinea pigs receiving platinum-based drugs revealed the decreased density of hair bundles in the central apex portion of the lateral semicircular canal when scanned with electron microscopy.¹⁴ Hence, children receiving ototoxic medication warrant vestibular evaluation and assessment.

The sole reliance on vestibular compensation in children is overestimated. Balance and maintenance depend on the complex relationship between 3 sensory systems: the vestibular, the visual, and the somatosensory systems. Over 50% of the otorhinolaryngologists in this survey responded that children with impaired vestibular function are rarely encountered owing to the swift vestibular compensation in children. However, the length of delay to accomplish the regular or full gross and fine motor function is still unknown.¹⁵ In addition, the question remains whether the child will eventually develop full or partial acquisition of motor function.

Several barriers limiting otorhinolaryngologists from evaluating vestibular assessment were discovered. Only approximately one-fifth of otorhinolaryngologists are comfortable with vestibular evaluation in children. The lack of knowledge and proficiency in assessing and managing vestibular dysfunction in children warrants serious attention. Hence, specialized training and courses focused on pediatrics vestibular assessment

should be advocated. Additionally, vestibular assessment needs to be incorporated into the otorhinolaryngology specialist training.

Lack of awareness is depicted as the most common reason why vestibular dysfunction is not widely encountered. Otorhinolaryngologists play a considerable role in inquiring about and assessing vestibular impairment in children. Nonetheless, social media, press, and conferences are recommended to create awareness of this entity among the general population and highlight the ramifications of delayed management in children.

Upon encountering a child with vestibular dysfunction, 12% of otorhinolaryngologists would prefer to refer to a pediatrician. Co-management of otorhinolaryngologists with other expertise is crucial, notably for pediatricians specializing in child development. The development of a pediatric vestibular clinic should incorporate a multidisciplinary team of experts from the pediatric unit, rehabilitation unit, audiologist, and child psychologist led by the otorhinolaryngologists. Referral to otorhinolaryngologists can be increased through improved education and outreach, especially to pediatricians and primary care physicians.

Vestibular assessment has been regarded as challenging in children owing to several factors: the child may not be aware of how to express the symptoms, a short attention span in children which makes assessment difficult, and choosing between the batteries of test that exists may be daunting for otorhinolaryngologists as not all the tests are required, and not all tests may be suitable for all children based on their age and vestibular system maturation.¹⁶ In our survey, 71.5% of the otorhinolaryngologists favor oculomotor examination, followed by the Romberg test (50.4%) as bedside assessment upon encountering children with vestibular dysfunction. As many otorhinolaryngologists were not comfortable with vestibular evaluation, the role of courses and teaching focused on vestibular assessment are required. Parallel to that, trained otorhinolaryngologists and audiologists to perform various quantitative assessments such as caloric tests, electronystagmography, video-head impulse tests, rotatory chair, and vestibular-evoked myogenic potential is crucial to aid in diagnosing and managing this entity. In addition to that, 49.6% responded that CT or MRI is routinely performed in children with the vestibular diagnosis. However, the role of imaging in children with vestibular dysfunction is limited and is more to rule out sinister causes such as intracranial or neurological conditions.

When enquired regarding treatment, nearly 15% responded that they prescribe pharmacological treatment, either oral betahistine hydrochloride or other medications such as anti-migraine. In addition, our study demonstrated statistical significance between years of experience and medication prescription, whereby senior otorhinolaryngologists were found to prescribe medication more comfortably as compared to their junior colleagues. Yet, it is worth noting that prior to thorough investigation and assessment, pharmacological treatment prescribed may mask the true nature of the disease.

There are several limitations that we recognize in our study. First, the survey is only limited to otorhinolaryngologists in

Malaysia and thus may not represent the entire otorhinolaryngologists globally, where practices differ. Additionally, only otorhinolaryngologists who were more interested in pediatric vestibular may have filled out the survey resulting in sampling bias. Albeit the limitations, our study provides insight into the evaluation and management and the need to increase awareness and education of vestibular impairment in children. In addition, a future direction of this work would be evaluating the ability of otorhinolaryngologists to correctly diagnose vestibular deficits in children and the type of training that could aid in improving the care of children with vestibular deficits.

Conclusion

Vestibular assessment is not a routine assessment in children. Lack of assessment is attributed to the parents or patients who do not complain of vestibular dysfunction. The majority of otorhinolaryngologists are not comfortable with vestibular assessment in children. Medication is prescribed comfortably by senior otorhinolaryngologists. These findings suggest that education on vestibular assessment and management is imperative among otorhinolaryngologists in Malaysia, improving the overall care and quality of life in children. These findings suggest that vestibular assessment and management education is imperative among otorhinolaryngologists in Malaysia to improve the comprehensive care and quality of life in children.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Malaya Medical Centre University, (Approval No: 2021626-10267).

Informed Consent: Informed consent is obtained from each participant prior to answering the survey.

Peer-review: Externally peer-reviewed.

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Supplementary Material

Questionnaire

Demographic data

1. Gender:
2. Age:
3. Race:
4. In what setting do you practise?
5. Working experience: ___ years post specialization
6. Experience working with children: Yes/No
7. Is vestibular assessment a part of your routine assessment? Yes/No
8. How frequent do you encounter children with vestibular dysfunction?
9. What is the reason vestibular assessment is not a part of your assessment?
10. What ENT conditions do you think is related to vestibular dysfunction in children?
11. How often do you refer a child with vestibular dysfunction?
12. Why do you think vestibular assessment is not routinely encountered?
13. What bedside vestibular assessment do you perform in a child?
14. When you encounter a child with vestibular dysfunction, who do you refer to?
15. Audiovestibular services available at your centre?
16. Do you perform imaging in a child with vestibular dysfunction? Yes/No
17. Do you prescribe medication in child with vestibular dysfunction? Yes/No
18. If yes, what medication do you prescribe?