

Review Article

Benign paroxysmal positional vertigo in pediatric age group: a review

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ABSTRACT

Vertigo is not common in the pediatric age group, but probably more often than was formerly thought. Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo. It consists of the short duration of vertigo attacks found in a definite head position. The exact cause of BPPV is related to the idiopathic detachment of otoconia from the utricular membrane. The prevalence of BPPV in children is lower than in the adult age group. In children with BPPV, the symptoms consist of transitory rotational vertigo and torsional/ vertical/ horizontal or mixed nystagmus, depending on the position of the intra-labyrinthine otoliths, with latency and intensity in a typical crescendo-decrescendo pattern and it is exhaustible, reversible and fatiguing similar to adults. The diagnosis of BPPV can be accurately done by taking a detailed medical history, audiogram, and by use of positional testing. In children, BPPV can be successfully diagnosed and treated. In most cases, pediatric patients could not express details of their symptoms, and clinicians cannot always obtain adequate medical histories and determine their objective signs. So, it is not easy to study the BPPV in children. There are only a few articles describing BPPV in the pediatric age group, and therefore this subject is not well known to most otolaryngologists and clinicians. This review article discusses the epidemiology, etiopathology, clinical manifestations, diagnosis, and treatment of BPPB in the pediatric age group.

Keywords: BPPV, Pediatric age, Vertigo, Dix-Hallpike test

INTRODUCTION

BPPV is the most common cause of peripheral vertigo, characterized by repeated short episodes of a spinning sensation occurred by postural changes.¹ BPPV can be caused by either canalithiasis or cupulolithiasis and theoretically can involve each of the three semicircular canals, although the superior semicircular canal is rarely affected.² It affects about one-third of patients with dizziness.² BPPV in children is often neglected by caregivers and physicians because of children's inadequate communication and expressive abilities. Children have usually poor vocabulary and are unable to describe their symptoms with appropriate words and tend to avoid playful activities with isolation of themselves from peers.³ The lower frequency of BPPV in the

pediatric age group is due to less common causes of otoconia detachment than in the adult age group (atherosclerosis, metabolic disorders, and hypertension).⁴ The correct information related to diagnosis and therapeutic assessment is mandatory to avoid panic and fear by children and their caregivers. Although BPPV is a disease with possible spontaneous resolution, especially in children, it is often important to get an accurate diagnosis as soon as possible for avoiding a diagnostic doubt and central pathology followed by implementation of effective rehabilitation or medical treatment with avoidance of certain daily activities.⁵ Children with BPPV often present with brief, episodic vertigo during performing the Dix-Hallpike test. There are very few reports of vertigo in the pediatric age available in the medical literature.

Methods of literature search

Research articles regarding BPPV in the pediatric age group were searched via multiple approaches. We started by searching the Scopus, Pub Med, Medline, and Google Scholar databases online. A search strategy using PRISMA (Preferred reporting items for systematic reviews and meta-analysis) guidelines was developed. This search strategy recognized the abstracts of published articles, while other research articles were discovered manually from the citations. Randomized controlled studies, observational studies, comparative studies, case series, and case reports were evaluated for eligibility. There were a total number of articles 54 (20 case reports; 12 cases series; 22 original articles) (Figure 1). This article reviewed the epidemiology, etiopathology, clinical profile, diagnosis and current treatment options of vertigo in the pediatric age group. This review article presented a baseline from which further prospective trials can be designed and which may help as a spur for further research in this clinical condition in children for which very few studies were performed.

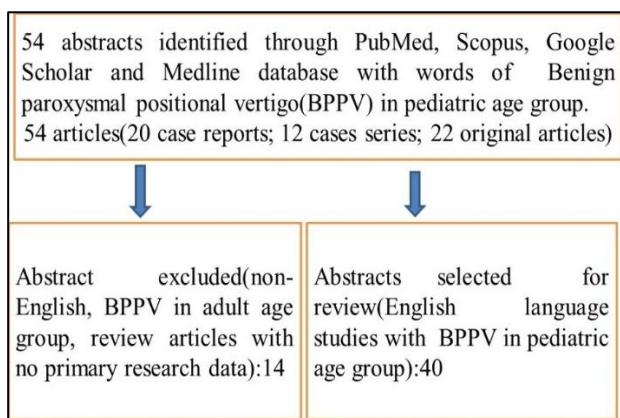


Figure 1: Flow chart of methods of literature search.

Epidemiology

BPPV is the most common cause of vertigo and represents 1% of all patients visits to neurologists and otolaryngologists.⁶ The commonest form of BPPV is posterior canalolithiasis (posterior canal BPPV) which has a lifetime prevalence of 2.4%.⁷ BPPV in the pediatric age group is rarely reported in the literature. One retrospective study showed that only 1% were diagnosed with BPPV using the Dix-Hallpike test.⁸ BPPV is one of the commonest forms of peripheral vertigo, with a lifetime and one-year prevalence of 2.4% and 1.6%, respectively, and a one-year incidence of 0.6%.⁷ The clinical description of BPPV was well described by Dix and Hallpike in 1952.⁹ The incidence of BPPV increases with the increase of age and this disorder is more common among females.¹⁰ Studies on BPPV in the pediatric age group are very less worldwide. This phenomenon may reflect the relatively lower prevalence of BPPV in the pediatric age group than in the adult

population.¹¹ One study showed that 19.8% cases of pediatric BPPV among dizzy patients who were 5 to 19 years of age.¹² The lower frequency of BPPV in the pediatric age group is due to less common causes of otoconia detachment than in the adult age group (hypertension, metabolic diseases, atherosclerosis).¹³ In one study, out of 923 patients with BPPV, the youngest patient was 12 years of age.¹⁴ Marcelli et al reported 8 cases of BPPV between 6 and 9 years of age.¹⁵

Etiopathology

The majority of BPPV are primary with an unknown etiology, although cases of secondary BPPV are related to comorbidities such as head injury and inner diseases.¹⁶ BPPV is thought to be an age-related degeneration of the peripheral vestibular organs.¹⁶ The frequent occurrence of BPPV has been seen in children with specific underlying conditions such as an enlarged vestibular aqueduct or a history of concussion.¹⁷ There are two important proposed theories for underlying mechanisms of BPPV, namely cupulolithiasis and canalolithiasis. Cupulolithiasis was first described by Schuknecht et al in 1969.¹⁸ In cupulolithiasis, the cupula of the semicircular canal becomes gravity sensitive when detached otoconial debris adheres to the cupula. In canalolithiasis, otoconial debris in the semicircular canal is displaced following head movement which results in the flow of endolymph in the semicircular canal and displaces the cupula leading to an attack of vertigo. Baloh et al suggested that otoconia are firmly attached to the macula and not dislocated at pediatric age whereas otoconia are more easily dislodged in elderly age owing to degeneration, causing vertigo with head movement.¹⁹ One study of temporal bone showed that cupular deposits seldom occur in childhood.²⁰ It also had been suggested that BPPV in children developed after vasospastic ischemia resulting in otoconia detachment.²¹ Uneri et al concluded that there might be an etiological connection between BPPV and migraine because of the high incidence of BPPV in children whose parents have a history of migraine.²² In one case with a cochlear implant, BPPV developed due to the use of fairground rides approximately 2 years after surgery.²³ Song et al reported a series of three children who developed BPPV due to large vestibular aqueduct syndrome.²⁴ BPPV secondary to large vestibular aqueduct affects multiple semicircular canals and the patients often present with recurrent attacks of vertigo. The posterior semicircular canal is usually affected in about 80% of cases of BPPV and the lateral semicircular canal in 20% of cases in children as in adults.²⁵ Anterior semicircular canal involvement is rarely affected.²⁵ There are certain risk factors associated with BPPV such as chronic otitis media, trauma to the head, prolonged bed rest, and osteopenia/osteoporosis.²⁶ The majority of cases of BPPV are of the posterior canal variant. The pathophysiology that causes most posterior canal BPPV is thought to be canalolithiasis. This is possibly due to free-floating endolymph debris tends to gravitate to the posterior canal, being the most gravity-dependent part of the

vestibular labyrinth in upright and supine positions. Once this debris enters the posterior semicircular canal, the cupular barrier at the shorter, more dependent end of the canal blocks the exit of the debris. So, the debris becomes trapped and can only exit at the end of the ampulla (common crus).

Clinical presentations

BPPV in children first described by Basser in 1964, is characterized by fleeting attacks of vertigo or imbalance lasting for a few seconds to minutes with a quick and complete return to normal activities.²⁷ The incidence of BPPV increases with the increase of age.²⁸ It often affects children from 3 to 6 years of age and is idiopathic in origin.²⁸ The symptoms of BPPV in children are often neglected by caregivers and parents. A child was initially misdiagnosed with acute gastritis because of vegetative symptoms and even admitted to the pediatric department but is found to have been diagnosed as BPPV following careful history taking and consultation by otolaryngologists. The clinical features of children with BPPV include recurrent vertiginous attacks, generally short-lasting and unpredictable without aura, with spontaneous and complete recovery between the vertigo attacks.²⁹ The classification of BPPV is based on the anatomical location or etiology. The most commonly involved semicircular canal is posterior, occasionally lateral semicircular canal, and rarely superior semicircular canal. Movements that may trigger vertigo in BPPV include turning in bed, getting in and out of bed; bending over and then straightening up; extending the neck to look up, such as reaching for an item from a shelf; or hanging up washing cloths. Head-turning from side to side while standing does not provoke vertigo, as the posterior canal BPPV is not stimulated by this action.³⁰ Other associate symptoms may include nausea and vomiting if BPPV is severe; and nonspecific dizziness similar to motion sickness that may occur throughout the day. A fear of falling backward is a unique complaint associated with BPPV.³¹ Patients may complain of unsteadiness of gait and postural instability during active and inactive phases of BPPV, and sometimes after treatment. The description is usually one of “walking on pillows” and may be classified as otolithic vertigo.³¹ BPPV of the horizontal semicircular canal is defined as a syndrome characterized by intense vertigo, nausea, and vomiting, and aggravated by movements of the head on the plane of the horizontal semicircular canal. BPPV of the horizontal semicircular canal has two types: geotropic, with transitory, paroxysmal, and bidirectional nystagmus, which is more intense when the head rotates towards the affected side.; apogeotropic was longer and more intense nystagmus when the head rotates to the unaffected side.³² BPPV is not directly related to deafness unless secondary to another condition like large vestibular aqueduct syndrome where the patient presents with bilateral sensorineural hearing loss.^{33,34} In children, BPPV is a disease associated with frequent spontaneous resolution, probably due to continuous movements of the

head during the playing of games and daily physical activity. So, the vestibular examination within 24 to 48 hours of the onset of symptoms is mandatory, unless they are frightened by the unusual symptoms.³⁵ Moreover, pediatric patient has an innate ability to move and the efficient plasticity of neural pathways allow them to better tolerate vertigo and rapidly overcome the intensity and duration of symptoms in comparison to adult patients.³⁴ This could explain the undescribed post-manuever residual vertigo/ dizziness in children.

Impact on quality of life

As patients of BPPV often present severe vertigo with changes of posture, so it undermines the quality of life of the children which results in heavy financial losses and is associated with a higher chance of falls.³⁵ The BPPV in children may further progress if not diagnosed early and treated appropriately which increase the medical expenses and parental concern as well as reduce the quality of life.³⁶ It has a significant impact on their emotional and physical states compared to those unaffected.³⁷ Children are often absent from school because of vertigo due to BPPV. They may need frequent visits to the pediatricians or clinicians/otolaryngologists for vertigo.

Diagnosis

Diagnosis of BPPV in children is not simple. In children, the diagnosis of the exact cause of vertigo is often difficult, as the children can show the typical signs of BPPV during vestibular attacks but report symptoms differently than the adult age group.³⁸ The inability of children to express their symptoms, often leads to inaccurate histories, especially in very young children.³⁹ As the younger children fear vertigo and lack of understanding regarding tests, vestibular investigations are not uniformly reliable on them. Faulty histories of vertigo in children may delay the diagnosis in children. Difficult to perform the clinical and neurophysiological vestibular tests may hinder the observation of typical nystagmus, which is needed for the diagnosis of BPPV.⁴⁰ The study of nystagmus by Frenzel-oculocopy or by infrared video-oculocopy is often the same as that carried out in adults. Positional and provocative maneuvers are helpful for the detection of nystagmus. Children need to participate in the vestibular assessment for attracting attention and avoid excessive concern or absence of cooperation. Parents or caregivers must be adequately informed about how and what is being evaluated during the consultation, as the unleashing of an intense BPPV with panic and crying of the child during the diagnostic or therapeutic maneuvers would lead to high alarm. Clinicians should take adequate time to perform a detailed examination and incorporate videonystagmography (VNG), including head roll tests and Dix-Hallpike tests, as part of their routine vestibular examination in a child-friendly environment, even in cases of nonspecific symptoms. A geotropic form of

posterior canal BPPV is diagnosed when a transient, geotropic, torsional, upbeat nystagmus is observed during the ipsilateral Dix-Hallpike maneuver, performed by bringing the patient from an upright to supine position with head turned 45 degrees to one side and neck extended 20 degrees.⁴¹ The lateral canal BPPV is diagnosed when the Dix-Hallpike test becomes negative and horizontal nystagmus is found bilaterally during the supine roll test and fast phases of the more intense nystagmus point to the affected side.⁴² Currently improved vestibular testing in children may also contribute to better clinical practice in this field.⁴³ Different laboratory tests, radiological investigations, and electroencephalogram (EEG) of the patients with BPPV are within normal limits.

Treatment

Children with BPPV can be diagnosed by positional nystagmus evoked by the Dix-Hallpike test and supine roll test, and successfully treated by particle repositioning maneuver and/or Brandt-Daroff exercise. The BPPV in children can be easily treated by canalith repositioning procedure (CRP) upon diagnosis. The delayed diagnosis of BPPV in children can lead to attention and behavior impairment.⁴⁴ The treatment is based on the use of the Epley's or Semont's maneuver for posterior semicircular canal BPPV and the Gufoni maneuver for horizontal semicircular canal BPPV.⁴⁵ The Epley maneuver is one of the most effective CRP for the treatment of the posterior canal BPPV. The response of Epley's maneuver to the BPPV varies with different factors such as types, single versus multiple canals BPPV, single or repeated cycles of head maneuvers in each session, and duration of the patients in their follow up. Bilateral posterior canal BPPV and multiple BPPV need a greater number of treatment maneuvers for getting resolution of the symptoms. These patients fail to respond to the repositioning maneuvers, further investigations are advised to exclude the central etiologies such as cerebellar pathology.⁴⁶ A Cochrane collaboration review showed that Epley's maneuver and five subsequent random controlled trials found significant success in comparison to nontreated controls.⁴⁷ Patients treated for BPPV may suffer from recurrence. There may be a short follow-up period after treatment of BPPV. In case of a longer follow-up period, the recurrence rate at one year is found to be 15%.⁴⁸ Unusual patterns of nystagmus and nonresponse to treatment may suggest a central cause.^{49,50}

CONCLUSION

BPPV is a relatively uncommon cause of vertigo in pediatric age group. Most cases of BPPV in children are idiopathic, although a few cases are secondary to certain conditions such as head trauma, and middle or inner ear diseases. It can be correctly diagnosed by taking a proper medical history and applying positional testing. The diagnosis is based on the history of short episodes of vertigo and positional nystagmus during the Dix-Hallpike

test. If it is diagnosed early and treated appropriately, BPPV can be resolved successfully in children. The particle repositioning maneuver or Epley's maneuver is an effective treatment for BPPV in children.

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