



# **Incidence of Benign Paroxysmal Positional Vertigo in Head Injury Patients**

**Celastina Synthia<sup>1\*</sup> and Rameshwar<sup>1</sup>**

<sup>1</sup>SIMATS, India.

## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/JPRI/2021/v33i48A33237

Editor(s):

(1) Prof. John Yahya I. Elshimali, Charles R. Drew University of Medicine and Science, USA.

Reviewers:

(1) Rakshita Ramesh Kamath, Rajiv Gandhi University, India.

(2) Ali Sultan, Ahl al-Bayt University, Iraq.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/74955>

**Original Research Article**

**Received 06 August 2021**  
**Accepted 12 October 2021**  
**Published 06 November 2021**

## **ABSTRACT**

**Background:** Traumatic brain injury is a common secondary cause of Benign Paroxysmal Positional Vertigo(BPPV).

**Objective:** To determine the incidence and clinical profile of patients with BPPV in mild and moderate head injury.

**Materials and Methods:** A prospective observational study done in patients admitted with mild and moderate head injury who developed BPPV from January 2020 to March 2020 in a tertiary care hospital of South India. Demographic and clinical parameters were noted and were treated with canalith repositioning procedures.

**Results:** Among 42 patients admitted with mild and moderate head injury, 9(21.4%) were diagnosed with BPPV in the follow up. The male female ratio was 2.5:1. The mean age was 44 ±21.4years.Two wheeler accidents contributed to nearly half of (55.6%) traumatic BPPV. Posterior canal was commonly involved in 7(77.8%) followed by horizontal in 2 (22.2%).The type of head injury was mild in 7 (77.8%) and moderate in 2 (22.2%) in traumatic BPPV patients. 5 (55.6%) patients with BPPV had abnormal findings in neuroimaging. 4 (44.4%) patients developed recurrent BPPV in our cohort.

**Conclusion:** The incidence of traumatic BPPV was 21.4% in our study. Road traffic accidents due to two wheeler accidents were the common mode of head trauma. Posterior canal was commonly involved in three fourth of cases. Recurrence of vertigo was documented in 4 (44.4%).

*Keywords: Benign paroxysmal positional vertigo; head injury.*

## 1. INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is one of the most common causes of vertigo. It is characterized by brief attacks of vertigo, with associated nystagmus, precipitated by certain changes in head position with respect to gravity. The majority of patients have 10 to 30 second spells of rotational vertigo that are triggered by lying down, sitting up, turning over in bed, gazing up, or bending forward. Long-term and crippling drunkenness and light-headedness, which can lead to falls, have also been reported hence, the term "benign" for this condition in such patients appears to be a misnomer.

The most common causes of acquired or secondary forms of BPPV are head and labyrinth trauma, inner ear diseases such as viral labyrinthitis or vestibular neuritis, Meniere's disease, vestibulo basilar ischemia and anterior inferior cerebellar artery syndrome, or prolonged bed rest due to unrelated disease [1].

The patients with BPPV secondary to mild head trauma presented with the following features, in which they differed from the patients with idiopathic BPPV: (1) lower mean age, with more intense symptoms; (2) increased rate of horizontal and anterior semicircular canal involvement and frequent multiple canal and bilateral involvement; (3) greater incidence of canal paresis and presence of spontaneous nystagmus; (4) poorer treatment results, attributed mainly to coexisting canal paresis in many patients, and higher rate of recurrence.

In BPPV one or more of the semicircular canals are abnormally stimulated by otoconia displaced from the otolith organs [2]. There may also be damage to the membranous labyrinth as well as many other structures outside the ear. The estimated lifetime prevalence is between 3 and 10% of the population [3]. Traumatic injury plays a major role in BPPV. Even injuries that do not directly affect the head such as whiplash injury, have been reported to be associated with BPPV [4]. Though traumatic brain injury (TBI) has been reported to be a common cause of BPPV, only a few studies have investigated BPPV after TBI [5-7]. The causes of posttraumatic vertigo are not fatal, but they can be associated with significant morbidity. The amount of morbidity related to posttraumatic vertigo has not been well studied. Vertigo can cause further accidents and falls if

not treated appropriately more studies are needed to prove their assertions, owing to a current lack of well-designed studies with adequate cohorts. Hence this study was done to identify the incidence and clinical features of traumatic BPPV.

### 1.1 Objective

To determine the incidence and clinical profile of benign paroxysmal positional vertigo in patients with mild and moderate head injury.

## 2. METHODS

This prospective observational study was conducted at Saveetha Medical College, Chennai, a tertiary care referral hospital of South India from January 2020 to March 2020.

### 2.1 Inclusion Criteria

Those who developed BPPV following mild and moderate head injury were included in the study.

### 2.2 Exclusion Criteria

Patients with severe head injury and secondary causes of BPPV other than head injury were excluded from the study. Patients with a previous history of vertigo prior to head injury were also excluded from the study.

### 2.3 Methods

It was a prospective observational clinical study conducted from January to March 2020 at the Department of Neurosurgery and Department of Otorhinolaryngology in a tertiary care hospital in Tamilnadu after getting clearance from the Institutional ethics committee. Patients admitted in the hospital with mild and moderate head injury were followed up in the neurosurgery department. Those who were referred to the otolaryngology department with a history of vertigo following head injury were recruited. Data regarding age, gender, mode of head injury, Glasgow coma scale at the time of admission, canal affected, laterality and recurrence.

The Dix Hallpike maneuver, considered to be the gold standard for diagnosis of posterior canal BPPV and supine head rolling tests were done to find out cases of posterior and horizontal canal BPPV respectively [8,9].

Patients were managed with canal repositioning maneuver (CRM) and bed rest. Vestibular sedatives were given as well. If there was recurrence of symptoms, the repositioning maneuvers were repeated according to which semicircular canal was affected.

## 2.4 Statistical Analysis

All clinical information was recorded in a predesigned proforma and was managed with Microsoft Excel spreadsheet. Frequency was presented as number (n) and percentage(%).

## 3. OBSERVATION AND RESULTS

A total of 42 patients with mild and moderate head injury were admitted in our hospital during this period. Of these 42 patients, 9(21.4%) were diagnosed with BPPV (Fig.1).

Among 42 patients with head injury, there were 30 males (71.4%) and 12 females (28.6%) in the age group 10–70 years. Among the 9 patients diagnosed with BPPV, 5 (55.6%) were males and 4(44.4%) were females. The mean age was 44 ±21.4years with a range of 24-65 years. The commonest age group affected was 31-50 years in both categories (Fig 2).

Demographic and clinical details are represented in Table 1.

Road traffic accidents due to two wheeler accidents were the common mode of head trauma in 25 (71.4%) patients with head injury and in 5 (55.6%) patients with traumatic BPPV. The type of head injury was mild in 32 (76.2%) and moderate in 10 (23.8%) as a whole, and in 7 (77.8%) , 2 (22.2%) in traumatic BPPV patients respectively. 5 (55.6%) patients with BPPV had abnormal neuroimaging in the form of fracture in temporal bones in two, contusion in frontal region in one, extradural hemorrhage in one and subdural hemorrhage in one. Posterior canal was commonly involved in 7(77.8%) followed by horizontal in 2 (22.2%). Right side was involved in 5(55.6%), and the left and both sides were involved in 2 (22.2%) each. The clinical features of individual patients with traumatic BPPV have been represented in Table 2.

All patients with BPPV were treated with canalith repositioning procedures and post procedure restriction of movement was for 48 hours. 5(55.6%) were free from their symptoms dramatically following a single treatment,

another 3(33.3%) following two treatments and one (11%) needed three treatments.(Table 3). Patients with severe BPPV were given vestibular sedatives in addition. Symptoms resolved in 5(55.6%)patients within a week. For others it took 3 to 4 weeks for resolution of the symptoms. Recurrence of vertigo was documented in 4 (44.4%).

## 4. DISCUSSION

BPPV is said to be the most common vestibular disorder in patients after head trauma [10, 11].

It is due the dislodgement of otoconia from their normal location in the utricle, to their aggregation in the semicircular canals. In the present study, BPPV was diagnosed in 21.4% of patients with mild and moderate head trauma. This is in accordance with Ahn et al and Davies et al who have reported an incidence of 23% and 25% respectively[5]However, others have documented a lower incidence varying from 8.5% to 17%[7,10,12,13]. The commonest age group affected was 31-50 years group(44.4%) which is in agreement with Jozefowicz Korczynska et al and Haripriya et al [14,13].Males predominated in our cohort(55.6%). Similar observations have been made by others[14,13].

Head injury due to two wheeler accidents was the common cause of head injury in 5 of the 9 patients with BPPV (55.6%) followed by falls in 2 patients(22%), which is in agreement with the study by Haripriya et al[14]. Nearly three fourth patients with BPPV had mild head trauma. Ouchterlony et al have reported a similar percentage of 76.2% in their study[12].

Posterior canal was commonly involved in 7(77.8%) in our cohort followed by horizontal in 2 (22.2%). Similar views have been echoed by others.[14,13]. The posterior semicircular canal, being the most dependent part when the patient is in supine position, the dislodged otoconia becomes trapped and hence is commonly involved in BPPV.

Neuroimaging was abnormal in 5 (55.6%)patients, fracture in the temporal bone in 2, intracranial hemorrhage in 2, and contusion in one. Ouchterlony et al[14] have quoted a higher percentage of 76.2%, whereas Haripriya et al [14]have recorded a lower incidence of 36.4%. The intracranial pathology following head trauma depend on the mechanism, severity and extent of head injury and hence probably the variation in

the incidence of abnormal imaging findings in various studies.

Right side was commonly involved in 5(55.6%), left in 2(22.2%). Bilateral BPPV was recorded in 2(22.2%) in our cohort which is in agreement with Liu et al[6]. Researchers have shown that bilateral BPPV accounted for 14.3–19% of the post traumatic BPPV cases [10].

Patients with BPPV were treated with canalith repositioning maneuvers and post procedure restriction of movement was for 48 hours. 55.6% were free from their symptoms dramatically following a single treatment, another 3(33.3%) following two treatments and one (11%) following three treatments. 4(44.4%) had recurrence.

Similar incidence has been echoed by Haripriya et al(40.9%)[14]. However, some studies have quoted a higher incidence, Liu et al 67%[6], Gordon et al 57%[10], whereas study by Nunez et al. [15]found the recurrence rate at 26.8% and Ahn et al at 15.6%[5]. The study by Gordon et al found that traumatic BPPV required repeated repositioning compared to those with non-traumatic BPPV.

With an one fifth incidence of BPPV in patients with head injury and the management of this condition with simple measures such as canalith repositioning maneuvers, it is imperative that clinicians involved in the management of head trauma patients should diligently look for BPPV when they present with vertigo.

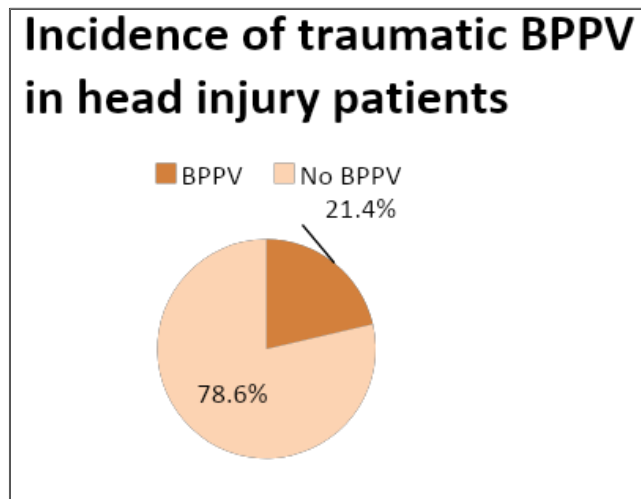


Fig. 1. Incidence of traumatic BPPV in head injury patients

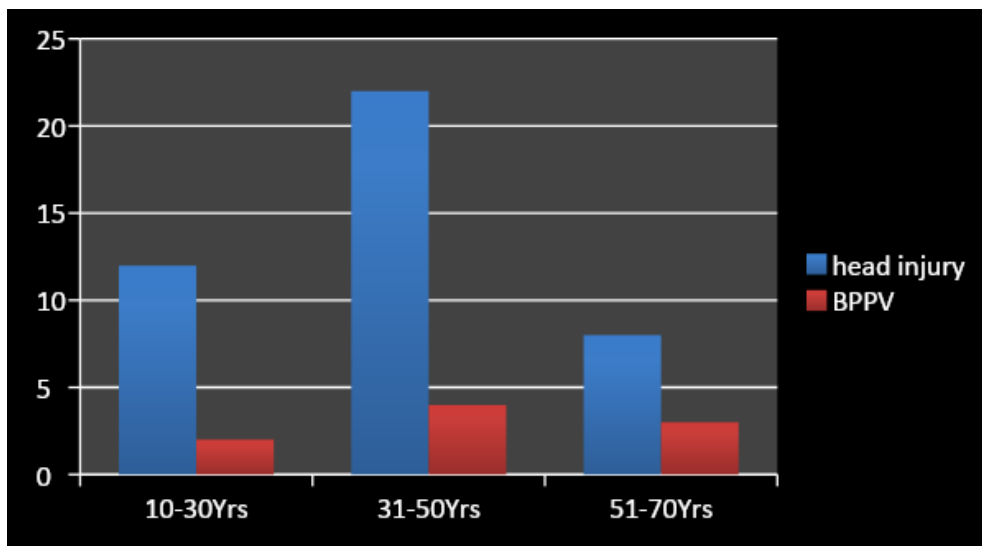


Fig. 2.

**Table 1. Demographic and clinical profile of patients with post traumatic vertigo**

| No. | Parameters             | Patients admitted with mild & moderate head injury (n= 42) | Patients diagnosed with BPPV (n=9) |
|-----|------------------------|--|------------------------------------|
| 1.  | Age                    | 10 - 30 years  | 2 (22.2%)                          |
|     |                        | 31 - 50 years  | 4 (44.4%)                          |
|     |                        | 51 - 70years   | 3 (33.3%)                          |
| 2.  | Sex                    | Male   | 5 (55.6%)                          |
|     |                        | Female   | 4 (44.4%)                          |
| 3.  | Cause                  | RTA - two wheeler  | 5 (55.6%)                          |
|     |                        | RTA - other vehicle  | 1 (11%)                            |
|     |                        | RTA - pedestrian   | 1 (11%)                            |
|     |                        | Fall   | 2 (22.2%)                          |
| 4.  | Type of head injury    | Mild (GCS 13-15)   | 7 (77.8%)                          |
|     |                        | Moderate(GCS9-12)  | 2 (22.2%)                          |
| 5.  | Neuro imaging          | Normal   | 4 (44.4%)                          |
|     |                        | Abnormal   | 5 (55.6%)                          |
| 6.  | Type of canal involved | Posterior  | 7 (77.8%)                          |
|     |                        | Horizontal   | 2 (22.2%)                          |
| 7.  | Laterality             | Right  | 5(55.6%)                           |
|     |                        | Left   | 2 (22.2%)                          |
|     |                        | Bilateral  | 2 (22.2%)                          |
| 8.  | Recurrence             |  | 4 (44.4%)                          |

**Table 2. Clinical profile of individual patients with traumatic BPPV**

| Pt No. | Age sex | Mode of Injury      | Neuro Imaging                    | Type of Head Injury | Type of BPPV | Laterality | Vision hearing   | Recurrence |
|--------|---------|---------------------|----------------------------------|---------------------|--------------|------------|------------------|------------|
| 1.     | 34 M    | RTA-Two wheeler     | Normal                           | Mild                | Posterior    | Right      | Normal<br>Normal | Once       |
| 2.     | 45 F    | RTA-two Wheeler     | Normal                           | Mild                | Posterior    | Right      | Normal<br>Normal | Nil        |
| 3.     | 60 F    | Fall                | EDH                              | Moderate            | Horizontal   | Left       | Normal<br>Normal | Nil        |
| 4.     | 24 M    | RTA - two Wheeler   | Fracture right temporal bone     | Mild                | Posterior    | Right      | Normal<br>Normal | Once       |
| 5.     | 26 M    | RTA - other vehicle | Fracture right squamous temporal | Mild                | Posterior    | Right      | Normal<br>Normal | Once       |
| 6.     | 65 M    | Fall                | SDH                              | Moderate            | Horizontal   | Right      | Normal<br>Normal | Nil        |
| 7.     | 54 M    | RTA - Pedestrian    | Normal                           | Mild                | Posterior    | Left       | Normal<br>Normal | Nil        |
| 8.     | 38 F    | RTA two wheeler     | Contusion right frontal          | Mild                | Posterior    | Right      | Normal<br>Normal | Once       |
| 9.     | 50 F    | RTA-two wheeler     | Normal                           | Mild                | Posterior    | Left       | Normal<br>Normal | Nil        |

**Table 3. BPPV participants and CRP requirements**

| BPPV status            | CRP requirement 1 | 2        | 3      |
|------------------------|-------------------|----------|--------|
| Resolution of symptoms | 5(55.6%)          | 3(33.3%) | 1(11%) |

## 5. CONCLUSION

The incidence of traumatic BPPV was 21.4% in our study, of which 77.8% had mild head injury. Road traffic accidents due to two wheeler accidents were the common mode of head trauma in nearly half of the cohort(55.6%) with traumatic BPPV. Posterior canal was commonly involved in 7(77.8%) followed by horizontal in 2 (22.2%) and bilateral involvement was seen in 2 (22.2%).All of them had resolution of symptoms within a month, however recurrence of vertigo was documented in 4 (44.4%). It is reasonable that physicians should think about and examine for BPPV, whenever a patient with traumatic brain injury presents with vertigo.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

We conducted our research after obtaining proper IEC approval.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
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