

THE CORRELATION BETWEEN ANAEMIA AND BENIGN PAROXYSMAL POSITIONAL VERTIGO

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Abstract

Objective: To assess the correlation between the prevalence of anaemia, particularly iron deficiency anaemia, and benign paroxysmal positional vertigo (BPPV) in the general population of Puducherry.

Methodology: This observational study was conducted among patients presenting with positional vertigo at the vertigo clinic of IGGGH&PGI, Puducherry, between May 2021 and May 2022. BPPV was diagnosed through standardized positional tests. Confirmed cases of BPPV underwent laboratory evaluation, including haemoglobin levels, peripheral smear, serum ferritin, lipid profile, and renal function tests. Patients with systemic comorbidities such as diabetes mellitus, systemic hypertension, and hyperlipidaemia were excluded. A total of 230 confirmed BPPV cases were included in the study.

Results: A significant positive correlation was identified between iron deficiency anaemia and the incidence of BPPV, indicating that IDA may play a contributory role in the pathophysiology of BPPV.

Conclusion: Iron deficiency anaemia appears to be an independent risk factor for BPPV. Routine evaluation and timely correction of IDA could potentially reduce both the occurrence and recurrence of BPPV. These findings underscore the importance of considering iron status as part of the diagnostic and therapeutic approach in patients with BPPV.

Keywords: Benign Paroxysmal Positional Vertigo (BPPV), Iron Deficiency Anaemia (IDA), Vertigo, Risk Factors, Haemoglobin, Serum Ferritin, Peripheral Smear.

1. INTRODUCTION

Benign paroxysmal positional vertigo (BPPV), a common peripheral vestibular disorder, its prevalence is almost 17 % of patients presenting with dizziness or vertigo. BPPV commonly manifests as paroxysm of vertigo and nystagmus lasting for several seconds which is self-limiting followed by symptom free period [1]. BPPV is due to inappropriate stimulation of vestibular labyrinthine structures in response to changes in head position, with respect to gravity, by the sequestered otoconia [2]. dislodgement of otoconia from the utricle in to the semicircular canals (most commonly the posterior canal) is one of the accepted theories of pathogenesis of BPPV [3].

Diagnosis of BPPV can be done based on history and examination. Patients usually report episodes of spinning sensation evoked by certain movements such as getting out of bed, turning in bed, or while lying in back, looking up or straightening after bending over. Episodes usually last for 10 to 30 seconds and may be associated with nausea without any other additional symptoms. The diagnosis can be confirmed by observing nystagmus in various positional maneuver. Several manoeuvres are there in that most used maneuver for posterior

canal BPPV and anterior canal BPPV is by dix-Hallpike maneuver. Most reliable for horizontal canal BPPV is supine head turn maneuver [4].

Even though canalith repositioning manoeuvres (CRM) remains the mainstay of treatment for BPPV with high success rate in reducing symptoms, even then the recurrence of BPPV is high which significantly affects patients' quality of life and increase anxiety, as these patients are more prone for fall because of imbalance caused by vertigo. also, BPPV patients are hesitant to get out of their home for their regular social work because of fear of fall.

Therefore, understanding the risk factor for BPPV and its recurrence is imperative for the betterment of patient's life.

Several studies have showed several risk factors were associated with BPPV like female gender, vit D deficiency, osteoporosis, migraine, head trauma, poor physical activity, prolonged recumbent position, hyperlipidaemia, hypertension, diabetes [5-8]. Only very few studies showed association of anaemia in BPPV patients as a part of multivariate analysis [5,9].

To best of our knowledge there are no separate studies done on association of anaemia and BPPV as of now.

Thus, our study will be helpful to find the association of anaemia in BPPV patients, and to find out whether the anaemic patients are prone for recurrence and whether the recurrence is related to severity of anaemia will be discussed in our study.

We assessed the severity of anaemia by the haemoglobin levels of an individual as recommended by WHO according to age and severity [10].

Table 1. severity of anaemia classification as recommended by WHO

population	Non-anaemia	Mild anaemia	Moderate anaemia	Severe anaemia
6-59 months of age	≥11	10-10.9	7-9.9	<7
5-11 years of age	≥11.5	11-11.4	8-10.9	<8
12-14 years of age	≥12	11-11.9	8-10.9	<8
Non-pregnant women(≥ 15 years)	≥12	11-11.9	8-10.9	<8
Pregnant women	≥11	10-10.9	7-9.9	<7
Men (≥15 years)	≥13	11-12.9	8-10.9	<8

The probable mechanism of association of anaemia with BPPV is that, anaemia will lead to reduced oxygenation of tissues via microcirculation in the inner ear, which might lead to degeneration of neuroepithelium of utricular macula or semicircular canal leading to consequent detachment of otolith causing benign paroxysmal positional vertigo [11].

While the role of iron on inner ear has not been established, blood supply to the inner ear is highly sensitive to ischemic damage. IDA has been demonstrated to be a potential risk factor for developing ischemic stroke due to lower hemoglobin levels leading to impaired oxygen carrying capacity. Another potential vascular mechanism linking IDA is the increased risk of IDA patients for reactive thrombocytosis. Iron is the regulator of thrombopoiesis [12].

Within cells, iron participates in many enzymatic reactions, as it is involved in several metabolic functions, mainly in protection against damage by free radicals. Also among the inner ear, iron is involved in the function of mitochondrial enzymes such as

peroxidase;13,14,30. in case of iron deficiency, it has been reported that its reduced activity generates increased intracellular levels of reactive oxygen species. Similarly, succinic dehydrogenase is another enzyme containing iron involved in the mitochondrial respiration and present within the cochlea. A disorder that reduces the activity of this enzyme, nor an iron depletion, has been reported to cause increased reactive oxygen activity, cellular/tissue damage¹¹ and possibly may be the cause for otoconial detachment.

2.AIMS AND OBJECTIVE

1. to analyse the association of anaemia in BPPV patients.
2. to analyse the recurrence of BPPV at 1 month and its association with severity of anaemia.

3.MATERIALS AND METHOD

The study done after getting ethical clearance from the institute and patients were included in the study after getting informed written consent.

3.1 Inclusion criteria: BPPV patients of all age group confirmed by positional vertigo tests.

3.2 Exclusion criteria: patients with systemic comorbidities like diabetes mellitus, systemic hypertension and hyperlipidaemia were excluded from our study.

All the patients confirmed of BPPV will undergo routine complete blood count, blood sugar, lipid profile and BP monitoring. After excluding the patient with above said comorbidities, other patients will be included in the study. Peripheral smear, serum iron, serum ferritin, TIBC are taken from patients having anaemia according to WHO classification. And the results were evaluated for the presence of iron deficiency anaemia. Patients will have their routine treatment with canalith repositioning maneuver (CRM). These patients were evaluated at 1 month interval and looked for recurrence of BPPV.

The success of the treatment was defined as the absence of vertigo and nystagmus on their positional testing. The recurrence was defined as after successful treatment the patient had similar positional vertigo as the primary attack and a positive positional test were confirmed¹

3.3 Statistical Analysis

The collected data were entered and analyzed by SPSS version 20.0 (Armonk, NY: IBM Corp). Continuous data were expressed in mean and standard deviation and categorical variables were expressed in frequency and percentage. Association between categorical variables were analysed using chi square test and mean difference between independent group was tested by student's t test, p-value less than 0.05 was statistically significant.

4.RESULTS

Table 2. Frequency distribution of study participants Age with Gender (N= 230).

Age (in years)	Male (%) (n=82)	Female (%) (n=148)	Both Male and Female (%) (n=230)
≤20	04 (05)	02 (01)	06(2.6)
21-40	25 (30)	51 (34)	76(33)
41-60	27 (33)	69 (47)	96(41.7)
61-80	26 (32)	26 (18)	52(22.6)

Total of 230 participants were involved in the study. Table 2, shows the frequency distribution of study participants age with gender. More common age group involved in our study is 41 to 60 years (41.7%), this age group was most prevalent in BPPV for both male and female. Youngest age recorded in our study is 17 years and highest age recorded in our study is 79. 64% of study participants were female suggesting prevalence of BPPV is more towards female gender.

Table 3. Frequency Distribution of Study participants Anaemia classification.

Classification of Anaemia	Male (%) (n=82)	Classification	Female (%) (n=148)	Both (%) (n=230)
Non Anaemia (≥13)	35 (43)	Non Anaemia (≥12)	39 (26)	74 (32.2)
Mild Anaemia (11-12.9)	31 (38)	Mild Anaemia (11- 11.9)	54 (36)	85 (37)
Moderate Anaemia (8-10.9)	15 (18)	Moderate Anaemia (8-10.9)	49 (33)	64 (27.8)
Severe Anaemia (<8)	01 (01)	Severe Anaemia (<8)	06 (04)	7 (3)

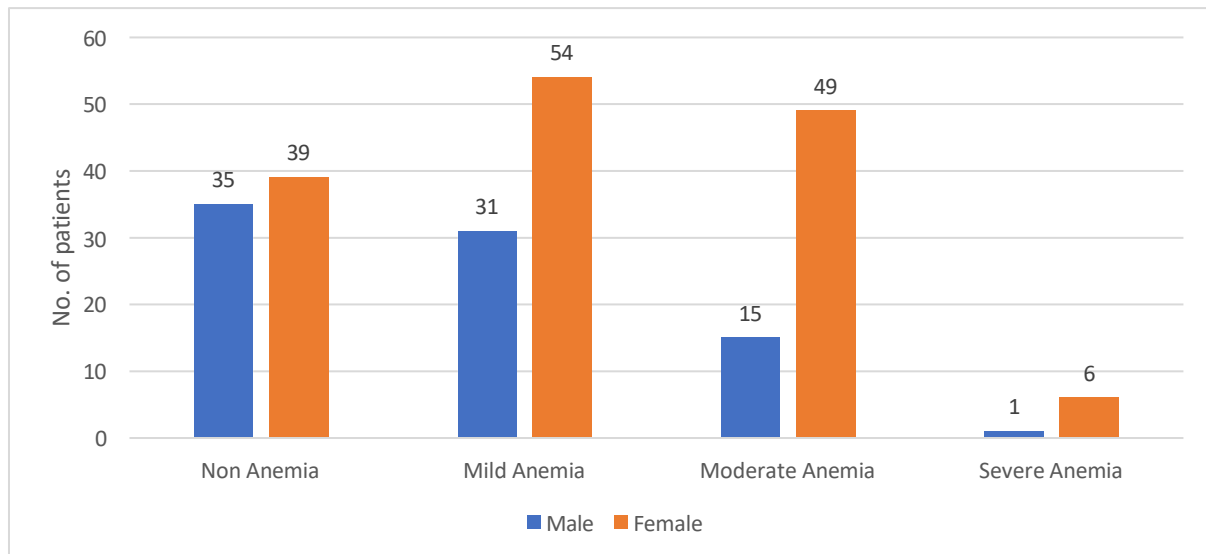


Figure 1. Frequency distribution of Anaemia classification among study participants.

Table 3 and Figure 1, shows the frequency distribution of study participants Anaemia classification. 32% of our study population were non anaemia rest of our study population were anemic which accounts for 68% either mild, moderate or severe anaemia. Maximum of male participants were accounts for Non anaemia with 43%.

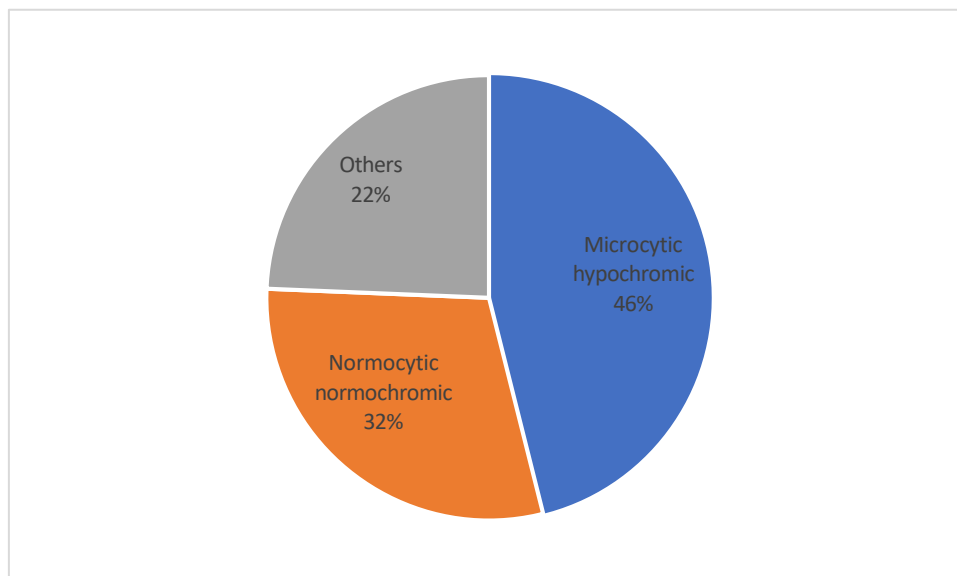


Figure 2. Frequency distribution of study participant's Peripheral smear.

Figure 2, shows the frequency distribution of study participant's Peripheral smear. Among study participants maximum of Microcytic hypochromic observed and accounts for 46%, with

32% being normocytic normochromic. 22% of slide shows other types of anaemia.

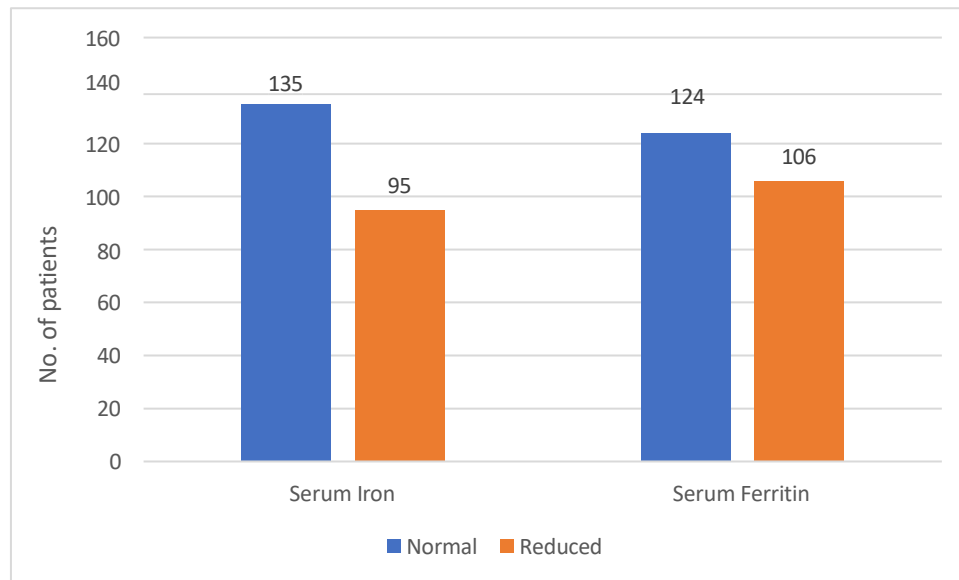


Figure 3. Frequency distribution of study participants Serum Iron and Ferritin.

Figure 3, shows the status of serum Iron and Ferritin among study participants. 41.3% of our study population has reduced serum iron and 46% shows reduced ferritin value.

Table 4. Frequency distribution of Total Iron-Binding Capacity (TIBC).

TIBC	Male (%)	Female (%)	Both male and female (%)
Normal	47 (57)	77 (52)	124 (54)
Increased	35 (43)	71 (48)	106 (46)

Table 4, shows the Total Iron Binding capacity among study participants. 46% of our study population has increased TIBC.

Comparing results of figure1,2,3,4 of table 2 results suggests 32% of study population were non anemic and 68% of study population were anemic in that 37% were having mild anaemia, 27.8% of study population were moderately anemic and 3% of study population is severely anemic. Out of 68% in anemic population, 46% of participants had iron deficiency anaemia and 22% of study participants having other types of anaemia. The results show P value is <0.05, showing positive association of anaemia in BPPV patients.

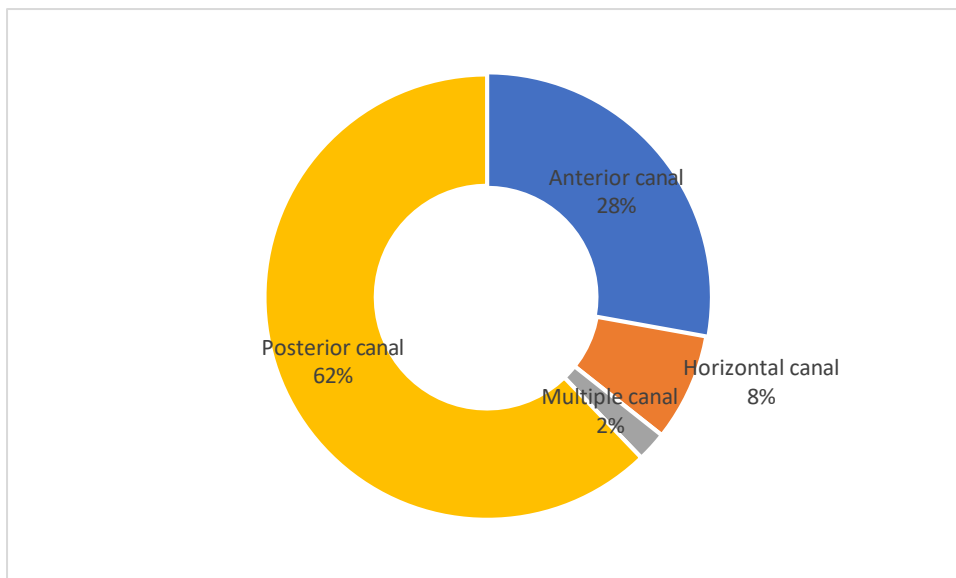


Figure 4. Frequency distribution of observed Canal involvement among study participants.

Figure 4, shows the distribution of canal involvement among study participants. Posterior canal was commonly involved with 62% and horizontal canal being less commonly involved with 8%. Multiple canal involvement was observed in 2% of the subjects.

Table 5. Frequency distribution of canal involvement with recurrence of Benign paroxysmal positional vertigo (BPPV).

Observed Canal Involvement	Nil (%)	Persistent (%)	Recurrent (%)	p- value
Anterior Canal	41 (64.1)	05 (7.8)	16 (25)	0.82
Horizontal Canal	13 (72.2)	00 (00)	05 (27.8)	
Multiple Canal	03 (60)	01 (20)	01 (20)	
Posterior Canal	88 (61.5)	10 (07)	36 (25.2)	

Table 5, shows the distribution of canal involvement with recurrence. Among 230 participants 11 were lost to follow up and there was no significant association exists between canal involvement and recurrence of BPPV.

Table 6. shows 1 month follow up results.

total population	lost to follow up (%)	Nil recurrence (%)	Persistent (%)	Recurrent (%)
230	11 (4.8)	145 (63)	16 (7)	58 (25.2)

Table 6, among 230 population 11 were lost to follow up. 58 patients showed recurrence i.e., 25.2% of our study population showed recurrence at 1 month. 16 patient showed persistent

disease which needs further evaluation and management.

Table 7. Association between Anaemia and Recurrence of Benign paroxysmal positional vertigo (BPPV).

Classification of study population (n=230)	Male with recurrence	Female with recurrence	Both male and female (%)	p- value
Anemic (156)	15	32	47 (30)	<0.01
Non- Anemic (74)	13	07	20 (27)	

Table 7, shows the association between Anaemia and Recurrence of Benign paroxysmal positional vertigo (BPPV). The recurrence rate in anemic group is 30% while in non-anemic group it is 27%. The recurrence in BPPV was higher in presence of anaemia. There was significance association found between anaemia and BPPV recurrence with p value <0.01.

Table 8. Association of BPPV recurrence with severity of anaemia.

Classification of study population (n=230)	Male with recurrence	Female with recurrence	Both male and female with percentage of recurrence in each group	p- value
Non anaemia (74)	13	07	20 (27%)	<0.01
Mild Anaemia (85)	09	13	22 (25%)	
Moderate Anaemia (64)	05	17	22 (34%)	
Severe Anaemia (7)	01	02	3 (42.9%)	

Table 8, illustrated the number of recurrences in non-anaemia, mild anaemia, moderate anaemia and severe anaemia patients and the statistics shows the percentage of recurrence increases as severity of anaemia increases. 25% recurrence seen in mild anemic population, 34% in moderate anaemia patient and the highest recurrence rate of 42.9% were seen in severe anaemia patients. The results showed p value < 0.01, thus our study shows positive correlation between BPPV recurrence with severity of anaemia.

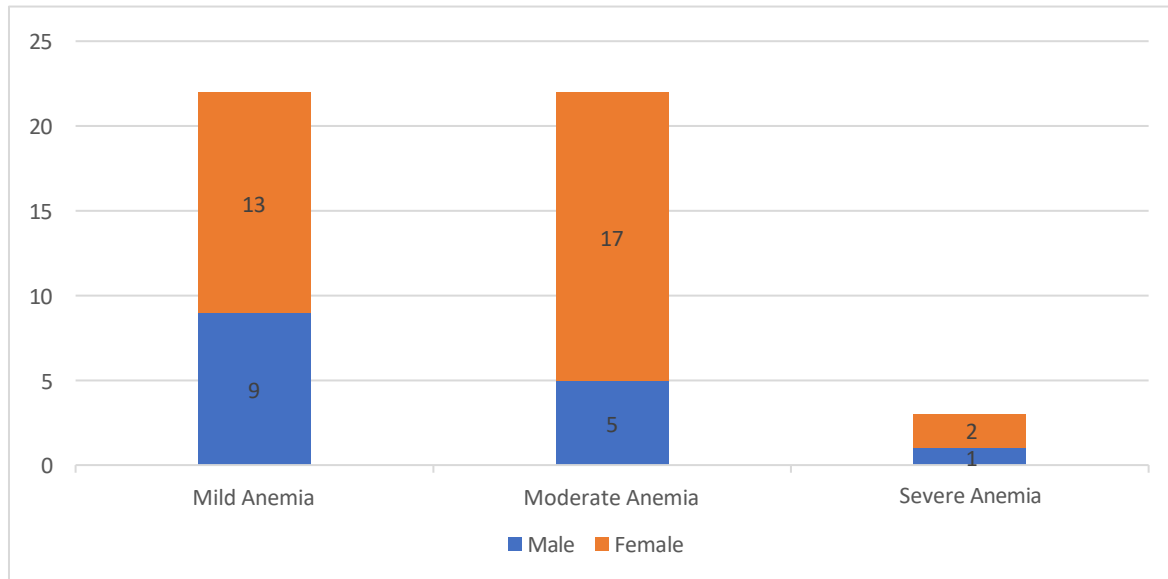


Figure 5. Distribution of Anaemia in Recurrence of Benign paroxysmal positional vertigo (BPPV).

Figure 5, shows the Distribution of Anaemia in Recurrence of Benign paroxysmal positional vertigo (BPPV). Among study participants 28 male patients has recurrence of BPPV and among them 15 were anemic and recurrence of BPPV was observed among 39 female patients, out of them 32 were anemic. There was association exists between Anaemia and recurrence of BPPV.

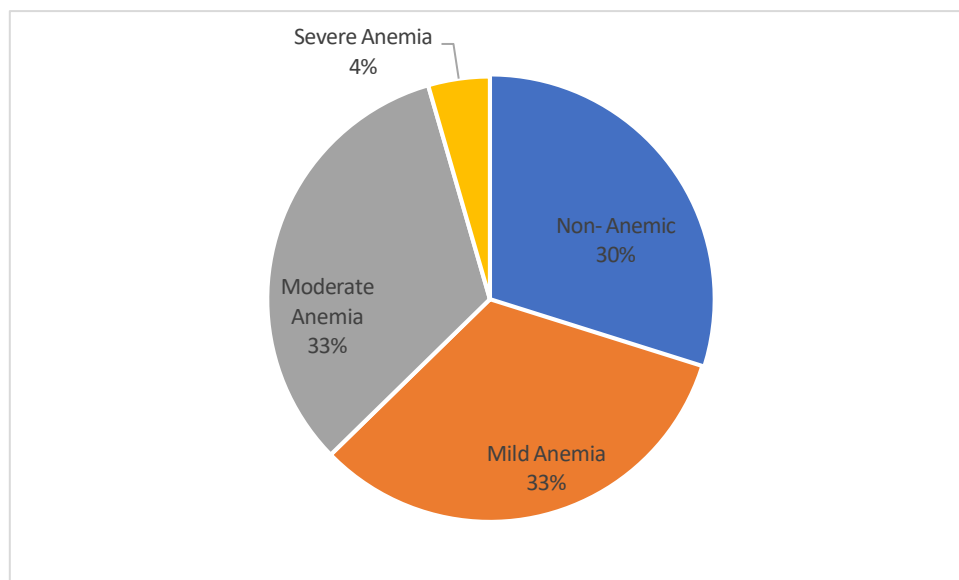


Figure 6. Distribution of Anaemia in Recurrence of Benign paroxysmal positional vertigo (BPPV).

Figure 6, shows the distribution of anaemia in recurrence of Benign Paroxysmal positional vertigo (BPPV). Out of 67 patients in recurrence of benign paroxysmal positional vertigo (BPPV) 4% has severe anaemia and mild and moderate anaemia were observed in common among 33% of patients.

5.DISCUSSION

To the best of our knowledge, this is the first univariate analysis done between anaemia and BPPV patients. Our prospective study shows positive association exist between anaemia and BPPV which is statistically significant with p value <0.05, thus an independent risk factor for BPPV.

Our study results were similar with others studies, park et al study results showed Serum hemoglobin, creatinine, and triglyceride levels correlated significantly with BPPV [9].

The study by yetiser reports the incident of BPPV was higher in female and older patients. The lower incidence in children than adult suggest that the accumulation of deposit could be due to aging of vestibular labyrinth [13]. Our study result also shows incidence increases as age increases; more common age group involved in our study is between 40 to 60 years of age.

It has been hypothesized the otolith detachment in anemic BPPV patients could be secondary to microvascular problem, as it might affect the utricular macular or semicircular canals and ischemia of their neuroepithelium can facilitates its degeneration with consequent detachment of otolith [10].

As anemic patients are more prone for otolith degeneration, the recurrence seems to be higher as the severity of anaemia increases. Zhu et al, study showed 1 year recurrence rate as 28.8% [1]. In our study 67 patients showed recurrence at 1 months that is around 29% of study population. Recurrence increases as severity of anaemia increases, 25% recurrence in mild anemic group while 42.9 % showed recurrence from severe anemic group which significant result implicating that anaemia treatment will reduce the recurrence rate in BPPV patients.

As considering the harms and poor quality of life experienced by the BPPV patients, understanding every single risk factor is imperative to reduce its occurrence and recurrence.

As per our study results, anaemia shows positive correlation in BPPV patient which should be kept in mind as she be managed for the betterment of patient's life.

6.CONCLUSION

In conclusion we find that anaemia shows positive correlation with BPPV, also anaemia patients exhibit a higher risk of recurrence compared to non-anaemia patients and recurrence rate increases as severity of anaemia increase. Most of our anemic patients were having iron deficiency anaemia which is to be considered. These results provide some insight which might be helpful in reducing the occurrence and recurrence of BPPV.

Conflict of Interest

The authors have no conflict of interest

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