“ASSESSMENT OF THE EFFECT OF BODY MASS INDEX ON EFFICACY OF EPLEY’S MANOEUVRE FOR BENIGN PAROXYSMAL POSITIONAL VERTIGO -A ONE YEAR OBSERVATIONAL STUDY.”

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LIST OF ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
ASCC	Anterior Semi-Circular Canal
BMI	Body Mass Index
BPPV	Benign Paroxysmal Positional Vertigo
CRM	Canalolith Repositioning Maneoeuvre
ENT AND HNS	Ear Nose and Throat and Head and Neck Surgery
LSCC	Lateral Semi-Circular Canal
PSCC	Posterior Semi-Circular Canal
ROC	Receiver operating characteristic
SCC	Semi-Circular Canal
VN	Vestibular Nerve
VNG	Videonystagmography
VOR	Vestibulo-Occular reflex
WHO	World Health Organisation

ABSTRACT

Background:

Benign paroxysmal positional vertigo (BPPV) is the most common form of vertigo and happens when otoconia is displaced into one or more semi-circular canals. BPPV is characterized by an intense brief duration of vertigo when the patient's head is moved into a gravity dependent position. While medication is ineffective for Benign Paroxysmal Positional Vertigo, treatment manoeuvres like Epley's manoeuvre have been proven to be highly efficacious.

Objectives:

- To compare the efficacy of Epley's manoeuvre in patients of Benign Paroxysmal Positional Vertigo of different Body Mass Index groups

Methodology:

Observational study with sample size of 48 patients presenting with dizziness who underwent Dix-Hallpike manoeuvre for BPPV diagnosis and their BMI was noted. Epley's manoeuvre was administered, and patients were followed until symptom resolution.

Number of cycles of Epley's required for complete resolution of symptoms was calculated in both groups and compared to assess the effect of BMI on efficacy of Epley's manoeuvre for Benign Paroxysmal Positional Vertigo

Results:

The study showed that the no. of cycles of Epley's given is similar in obesity groups and that, the BMI scores and no. of cycles of Epley's given are independent on each other in the study.

Conclusion:

The study concludes that BMI may not have any significant role in predicting the number of cycles of Epley's manoeuvre required for complete resolution of symptoms in patients of Benign Paroxysmal Positional Vertigo. However, further study with a larger sample size is required to make a proper conclusion.

Key Words:

Benign Paroxysmal Positional Vertigo, Dizziness, Body mass index, Dix-Hallpike manoeuvre, Epley's manoeuvre

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INTRODUCTION

BENIGN PAROXYSMAL POSITIONAL VERTIGO

Benign paroxysmal positional vertigo (BPPV) is a common type of vertigo and occurs when otoconia is displaced into one or more semi-circular canals. Dislodged otoconia become adherent to Cupula (Cupulolithiasis) or may be free floating (Canalithiasis) in the canal. BPPV is characterized by an intense short duration of vertigo on moving patient's head into a gravity dependent position.

While medication is less effective for BPPV, treatment manoeuvre like Epley's manoeuvre has proved to be highly effective.[1]

Evidence-based reviews by the American Academy of Neurology and the American Academy of Otolaryngology – Head and Neck Surgery Foundation recommend the use of the canalolith repositioning manoeuvre (CRM).

Based on the "Canalolithiasis" theory, Epley introduced the Canalolith repositioning technique in 1992 with the goal of directing the displaced particles from the posterior canal into the utricle through the common crus.[2]

BODY MASS INDEX

The standard metric for defining height and weight features in humans and grouping them into several categories is body mass index, or BMI.

It is also widely recognized as a risk factor for various health conditions and plays a key role in shaping public health policies. In population-based studies, BMI is frequently used to identify body mass as a health risk.[3]

Patients presenting with vertigo and diagnosed with BPPV come from diverse demographic backgrounds, with BMI being one of the influencing factors.

While the efficacy of the Epley manoeuvre in treatment of BPPV is well established, exploring the impact of a patient’s BMI on the success of this repositioning technique could provide valuable insights.

AIMS AND OBJECTIVES

OBJECTIVE:

The aim of the study is to bridge the knowledge gap by examining relationship between BMI and the efficacy of Epley's manoeuvre in managing BPPV.

NEED OF THE STUDY:

The results of the earlier literature were inconclusive and no similar study is published on Indian population. Therefore, there is a need to do this research study to assess the effect of BMI on Epley's manoeuvre in BPPV.

Any correlation, if found significant between the BMI of the patient and the use of Epley's manoeuvre in patients of BPPV, can be used for patient management. Weight reduction can be advised to the patient as a non- pharmacological modality in BPPV.

REVIEW OF LITERATURE

ANATOMY OF INNER EAR

The inner ear is made up of several bony chambers, known as bony labyrinth, and a network of membranous ducts and sacs called the membranous labyrinth. These ducts and sacs are housed within the petrous portion of temporal bone. This area is located between the middle ear laterally and the internal acoustic meatus medially. The vestibule, three semicircular canals, and the cochlea are all parts of the bone labyrinth which are lined with periosteum and filled with perilymph. The membranous labyrinth lies within the perilymph, but does completely occupy the bony labyrinth, which includes the semicircular ducts, cochlear duct, and two sacs—the utricle and saccule. Spaces within the membranous labyrinth contain a fluid known as endolymph.[4]

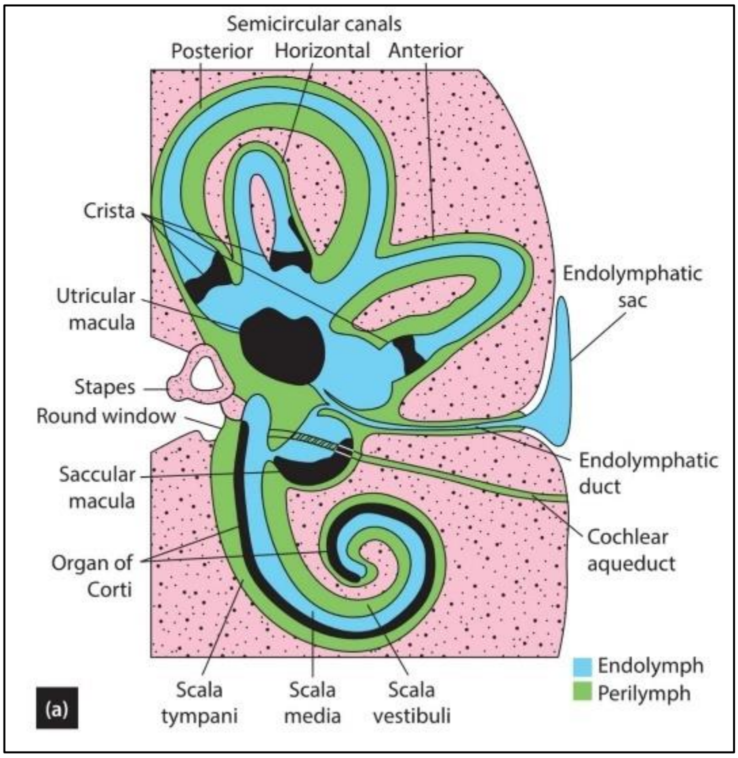


Image1: Representation of the human inner ear showing the different compartments[5]

Bony labyrinth

The central part of the osseous labyrinth is the vestibule which connects to the cochlea anteriorly and to semicircular canals posterosuperiorly. The vestibular aqueduct extends from vestibule and opens on posterior surface of petrous part of temporal bone.[4]

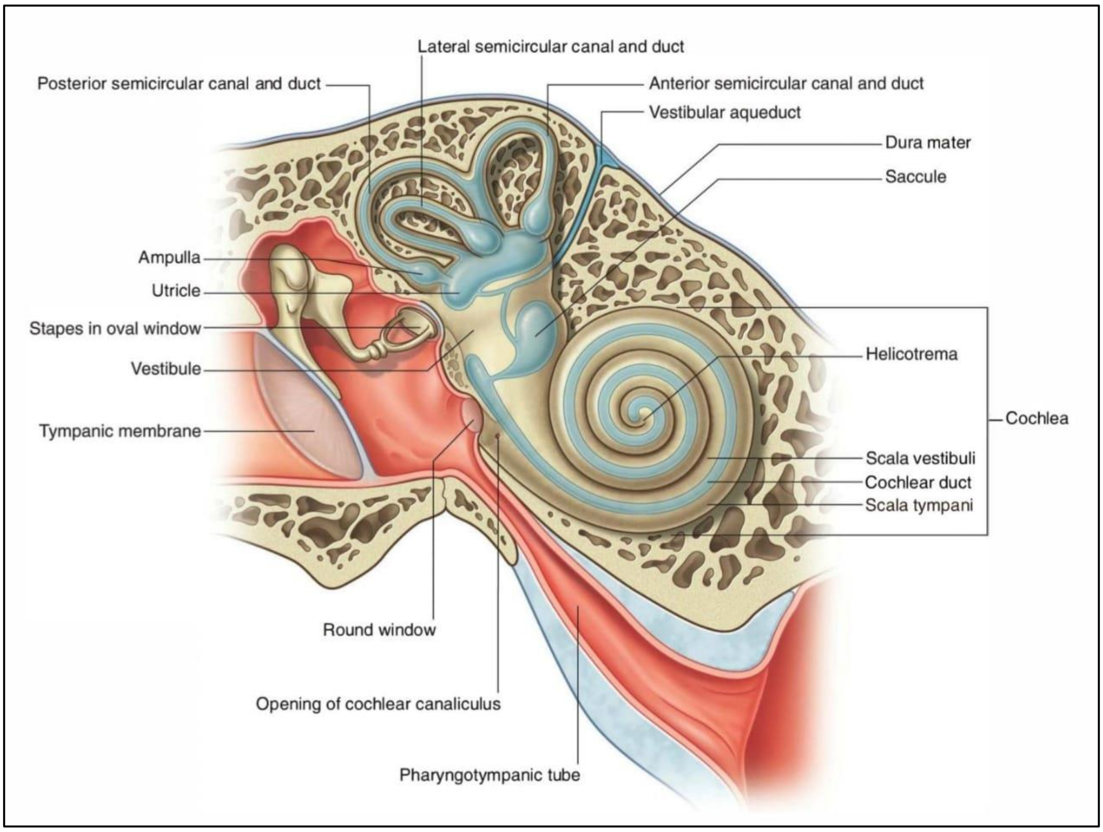
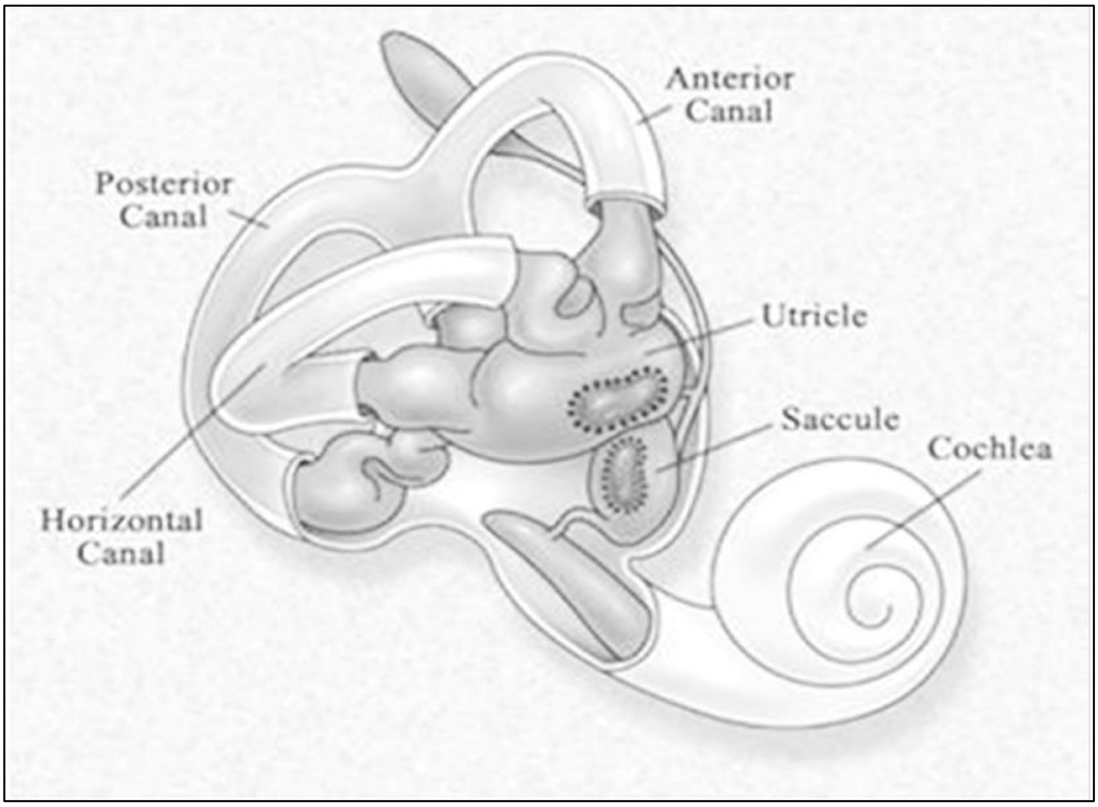


Image 2: Bony labyrinth[4]

Semicircular canals

The anterior, posterior, and lateral semicircular canals extend from vestibule in posterosuperior direction. Each canal forms two-thirds of a circle and is positioned at right angles to each other. Each canal has two ends: an ampullated end and a non-ampullated end. The non-ampullated ends of the posterior and anterior semicircular canals merge, forming the crus commune, which then opens into the vestibule.[4]



Imagee 3: Semi circular canals[6]

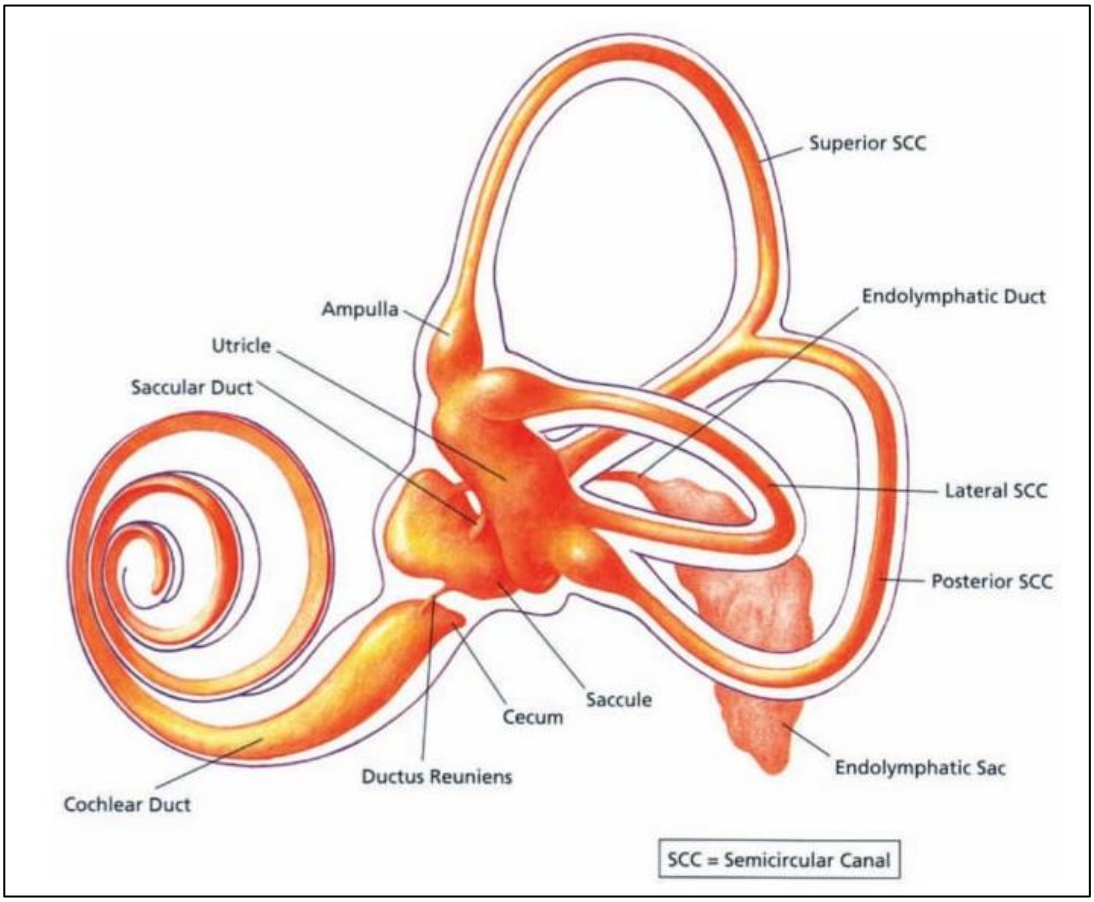


Image 4: Orientation of semi circular canals[7]

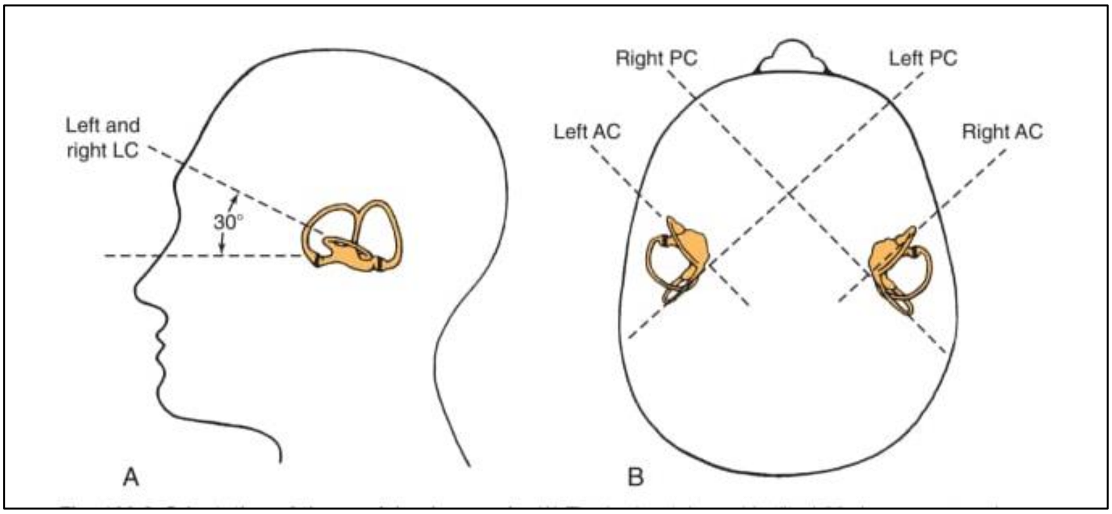


Image 5 : Orientation of semi circular canals in relation to each other[8]

Cochlea

Cochlea is an osseous structure extending from vestibule in an anterior direction. It turns around itself two and one-half to two and three-quarter times around the modiolus. It functions as the organ of hearing.[4]

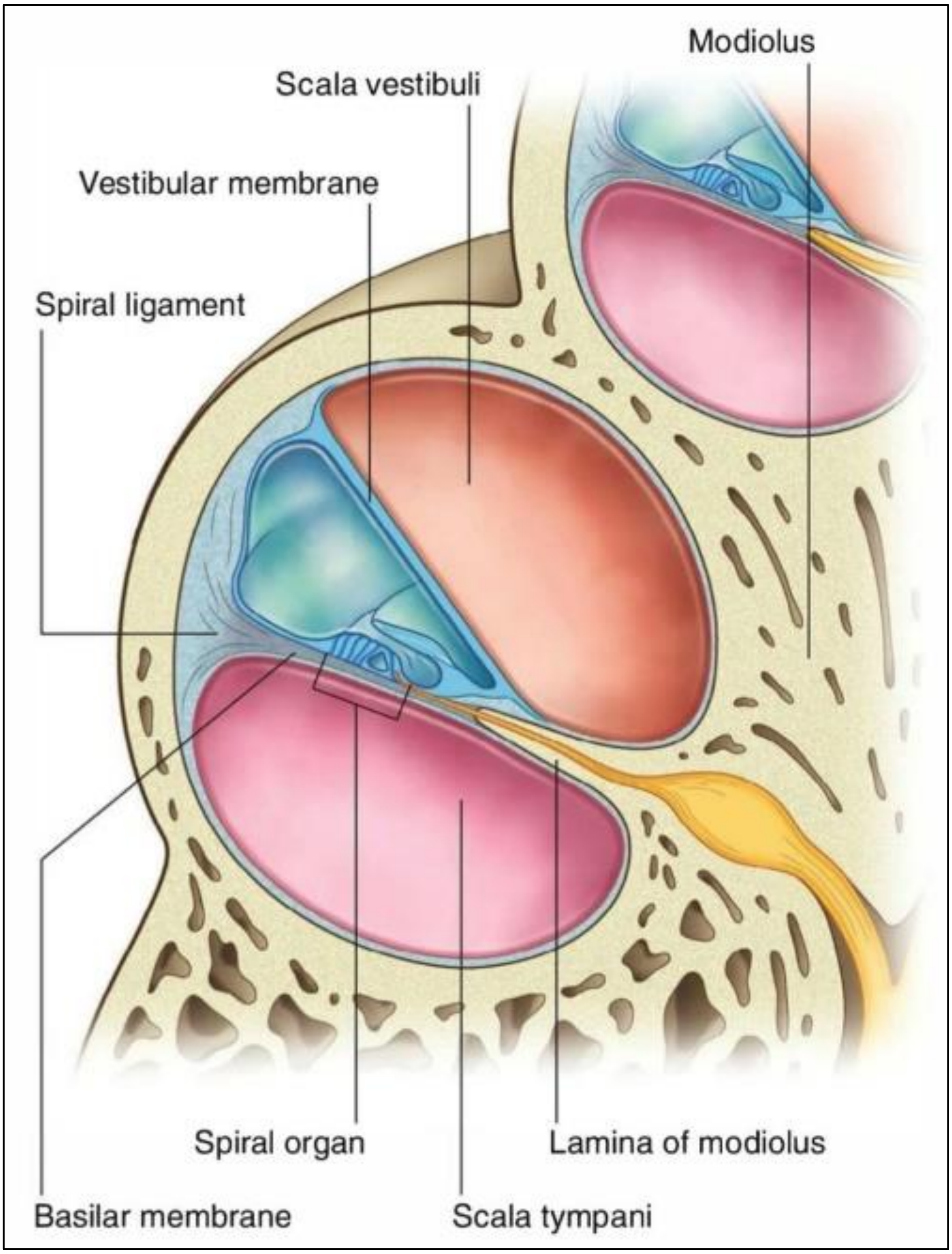


Image 6: Cochlea[4]

Membranous labyrinth

Membranous labyrinth comprises of two sacs, utricle and saccule, along with three semicircular ducts and the cochlear duct.[4]

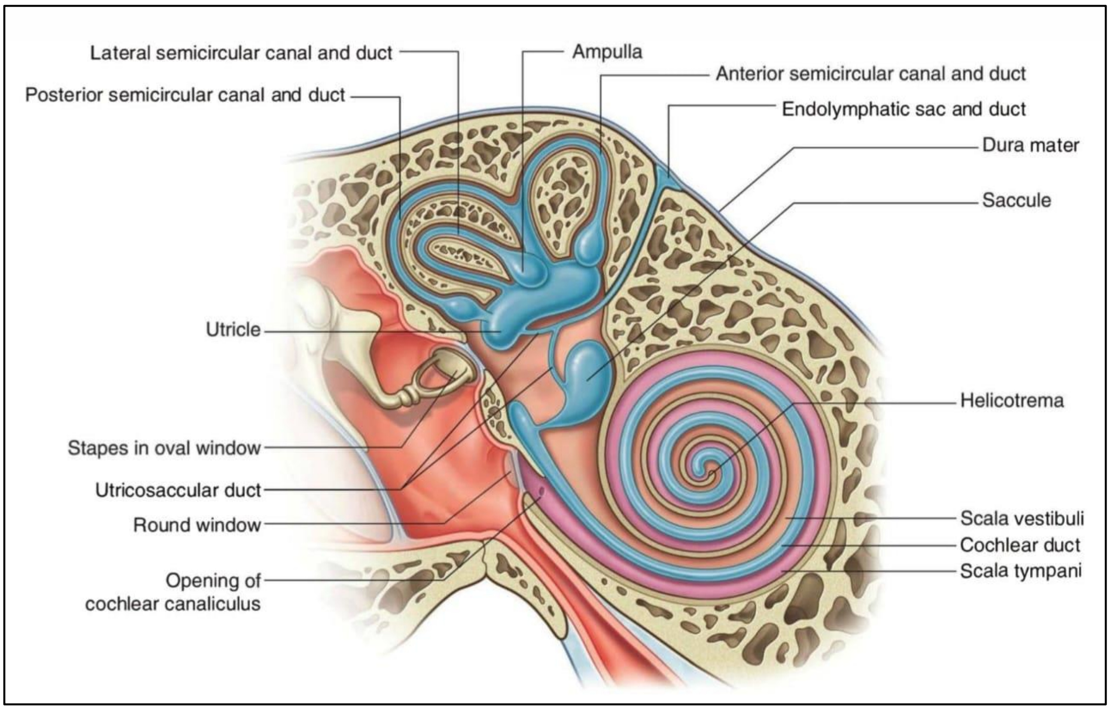


Image 7: Membranous labyrinth[4]

Utricle, saccule, and endolymphatic duct

The utricle, the bigger sac, is located in the bone labyrinth in the posterosuperior part of the vestibule and has an uneven, oval, and elongated shape. It receives three semicircular ducts, each resembling the shape of its corresponding bony semicircular canal, including a dilated end called the ampulla, though the ducts are significantly smaller.

The saccule, on the other hand, is rounded and smaller, and it is situated inside the bone labyrinth at the anteroinferior portion of the vestibule. The saccule receives the drainage from the cochlear duct.[4]

The utriculosaccular duct forms a connection among all parts of membranous labyrinth, linking the utricle and saccule. From this duct arises the endolymphatic duct. This duct passes through the vestibular aqueduct (passage in the temporal bone) and exits on posterior surface of petrous part of temporal bone in the posterior cranial fossa. This is where the endolymphatic channel widens into the endolymphatic sac, an extradural pouch where endolymph is absorbed.[4]

Sensory receptors

The sensory receptors responsible for balance are arranged within specific structures in each part of the vestibular system. In utricle and saccule, these sensory organs are called macula of the utricle and the macula of the saccule, respectively. Each ampulla within these semicircular ducts houses the crista as its sensory organ. The utricle detects centrifugal and vertical acceleration, while the saccule detects linear acceleration. Meanwhile, the receptors in the semicircular ducts are sensitive to movement in any direction.[4]

The maculae of utricle and saccule consist of flat epithelial sheets oriented at right angles to one another, with the utricle arranged in anterior–posterior plane and saccule in the superior–inferior plane.[5]

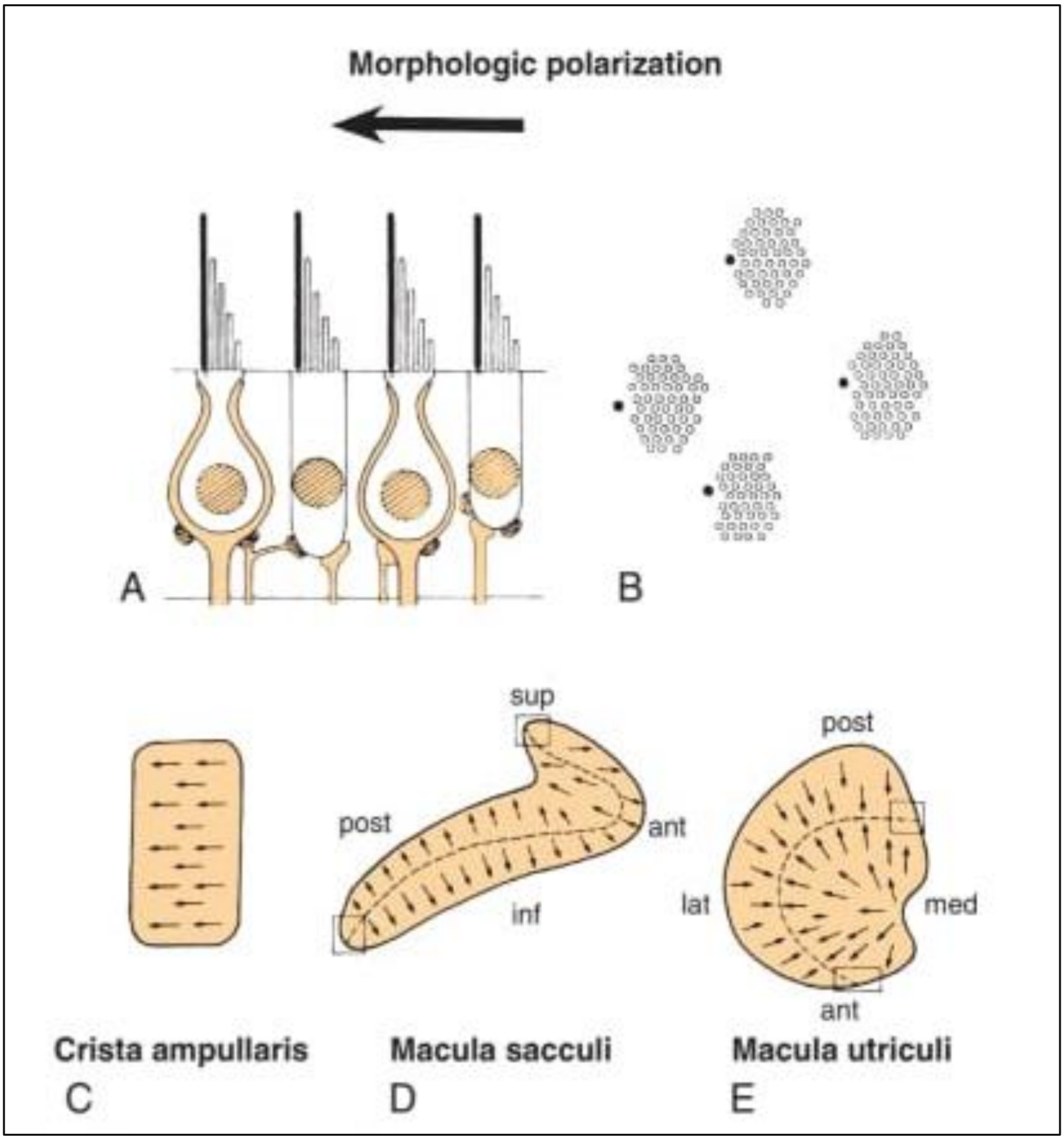


Image 8: Morphologic polarisation of sensory cells and polarisation arrangement of vestibular sensory epithelia. A. Section perpendicular to epithelium. B. Section parallel to epithelium. C.Sensory cells on crista are polarised in the same direction. D.Macula sacculi and Macula utriculi have opposite polarisation.[8]

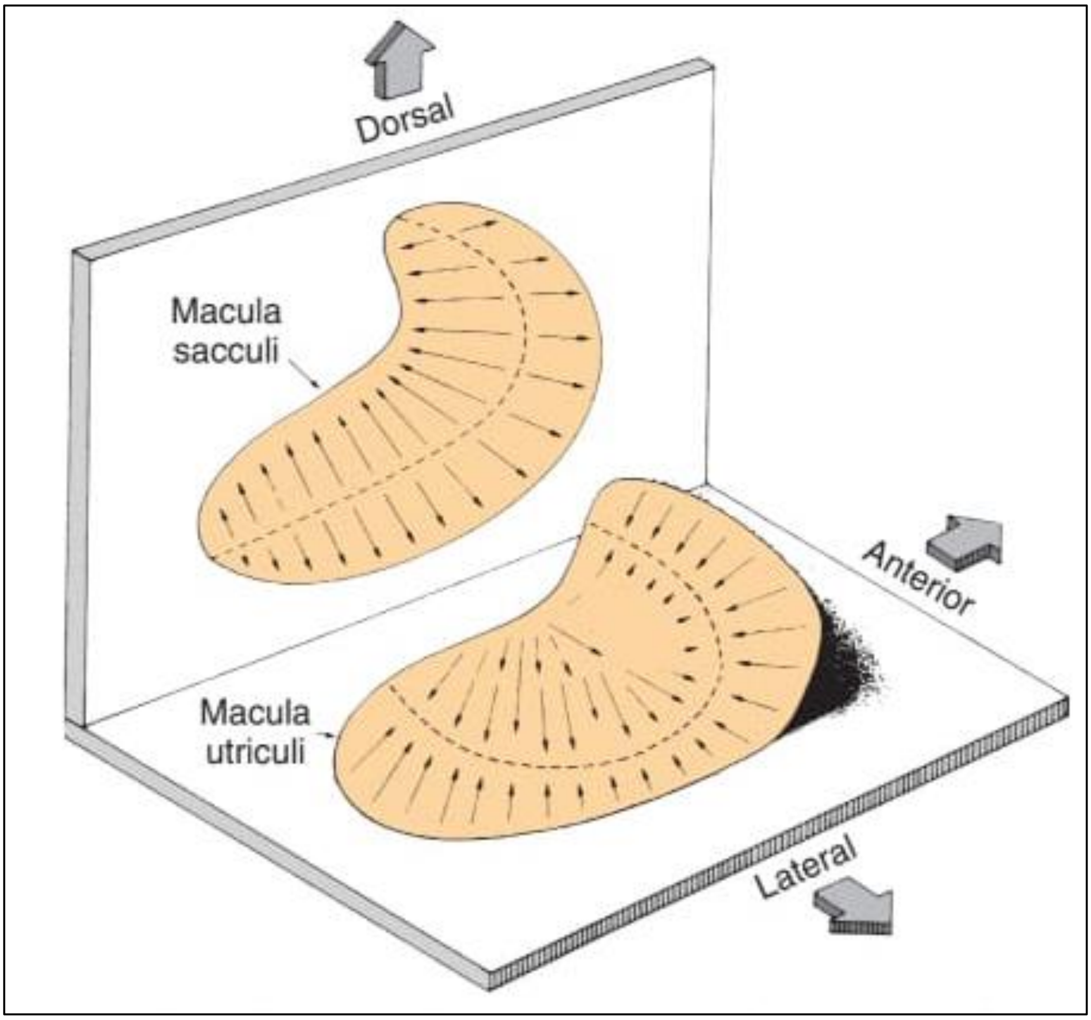


Image 9 : Orientation of two maculi: The utricle macula is in the horizontal plane and the saccular macula is in the vertical plane.[8]

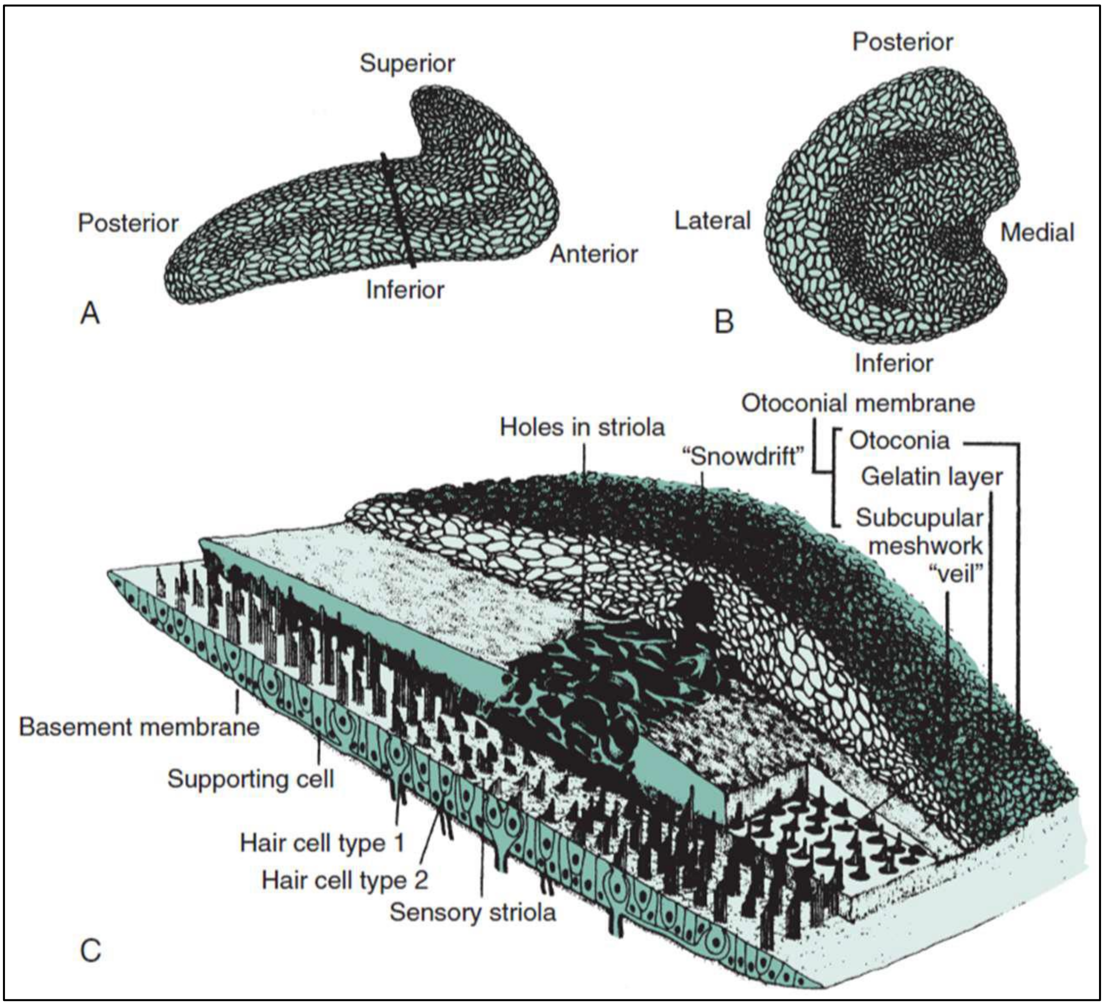


Image 10: (A) Otoliths arrangement in Saccule. (B) Otoliths arrangement in Utricle. (C) Cross section of the saccule [9]

Otoconial Membranes and Cupula

Maculae of the utricle and saccule are covered by an "otoconial membrane," which contains numerous otoconia crystalline calcium carbonate particles with a protein core. These particles rest on a perforated, honeycomb-like sheet composed of a non-collagenous fibrillar extracellular matrix.

Maculae of the utricle and saccule detect head movement in vertical and horizontal directions when there is a relative shift between the epithelium and the otoconial membrane. During linear motion, the movement of the epithelium follows the movement of the head without any inertia. But the otoconial membrane, due to its mass, lags slightly behind. This delay causes deflection of stereocilia, causing stimulation of the hair cells.

On head tilt, gravity acts on the otoconial membrane, creating a relative displacement between the otoconial membrane and the tilting epithelium. This displacement results in the deflection of the stereocilia.[5]

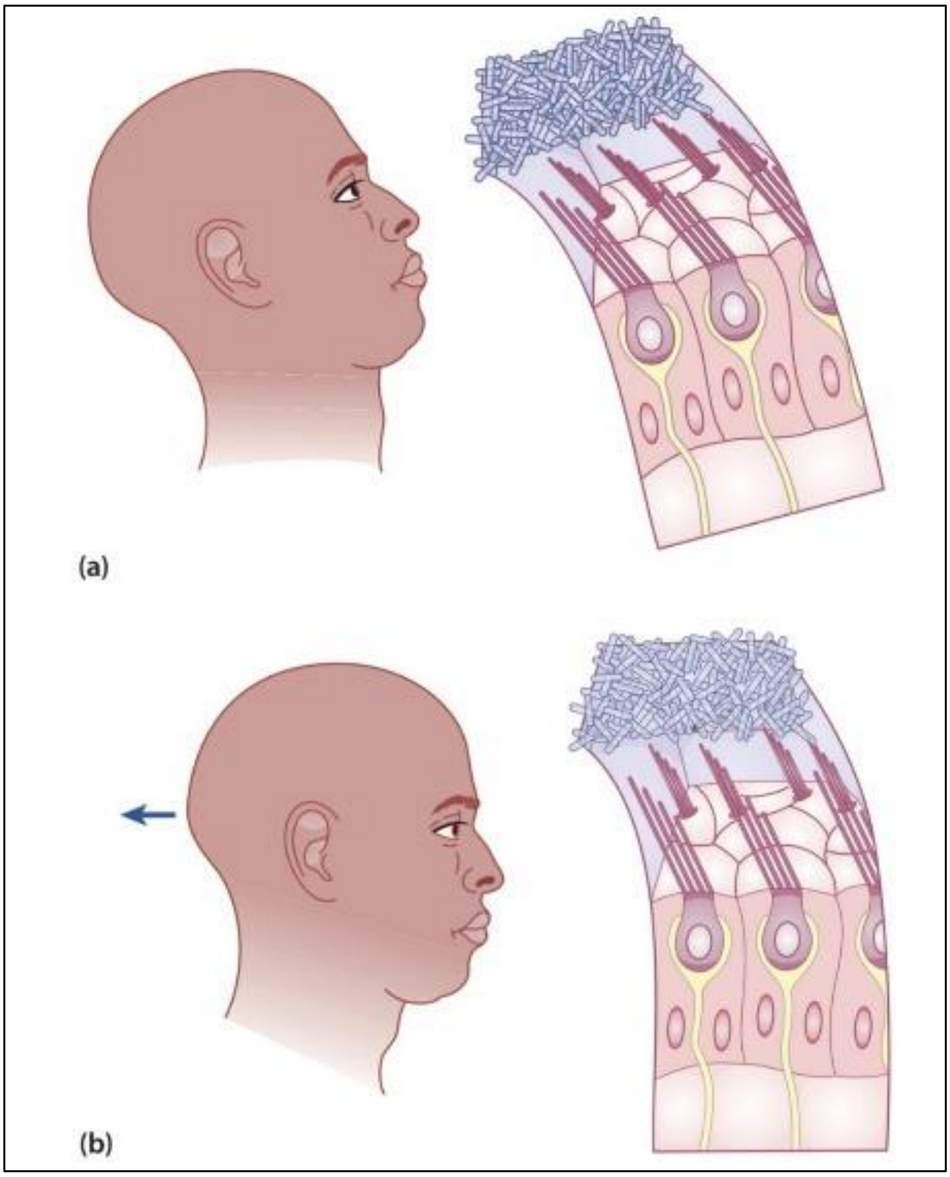


Image 11: Deflection of the otoconial mass causes hair cell depolarisation;

(a)Tilting backwards: (b) Accelerating forward[5]

Vessels

The blood supply to inner ear is by vessels that supply the bony labyrinth and those that supply the membranous labyrinth. The bony labyrinth receives blood from arteries that also supply the surrounding temporal bone, including:

- The anterior tympanic branch of the maxillary artery,
- The stylomastoid branch of the posterior auricular artery,
- The petrosal branch of the middle meningeal artery.

The membranous labyrinth is supplied by the labyrinthine artery originating either from the anteroinferior cerebellar artery or directly from the basilar artery. This artery joins the vestibulocochlear (VIII) and facial (VII) nerves as they enter the internal acoustic meatus and divides into:

- A cochlear branch, which travels through the modiolus to supply the cochlear duct,
- Vestibular branches, which provide circulation to the vestibular apparatus.

Venous drainage of the membranous labyrinth is by the vestibular and cochlear veins, which accompany the arteries. These veins join into labyrinthine vein, which subsequently drains into inferior petrosal sinus or the sigmoid sinus.[4]

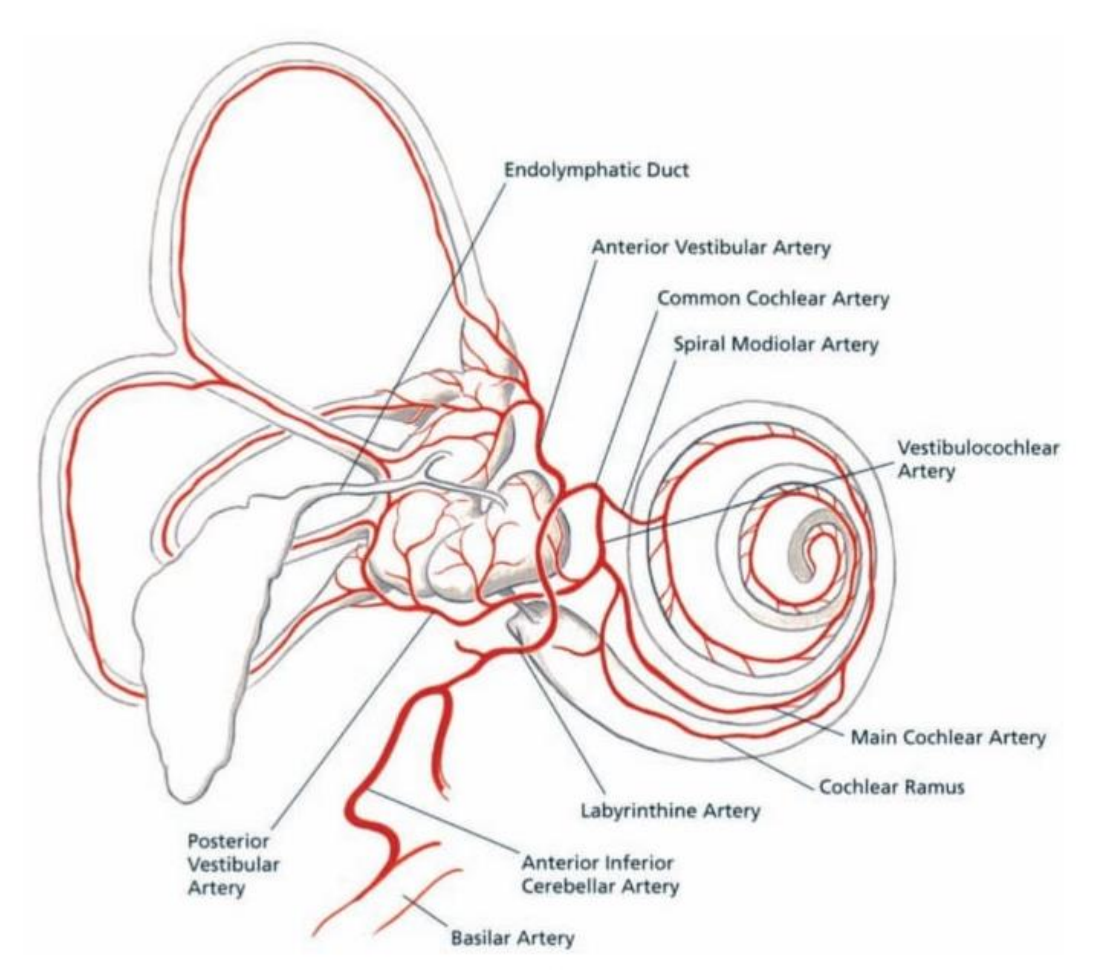


Image 12: Blood supply of inner ear[7]

Innervation

The vestibulocochlear nerve (VIII) contains specialized afferent fibers for both hearing (cochlear component) and balance (vestibular component). It exits the temporal bone via the internal acoustic meatus, traverses the posterior cranial fossa, and enters the lateral surface of the brainstem between the pons and medulla.

Within the temporal bone, at far end of the internal acoustic meatus, the vestibulocochlear nerve divides into:

- The cochlear nerve
- The vestibular nerve

The vestibular nerve forms the vestibular ganglion, which then divides into superior and inferior branches. These branches supply the semicircular ducts, as well as the utricle and saccule. The cochlear nerve enters the base of the cochlea and ascends through the modilus. Its ganglion cells are located in the spiral ganglion at the base of the modiolus, which spirals around it. The cochlear nerve branches extend through the modiolus to innervate the sensory receptors in the spiral organ.[4]

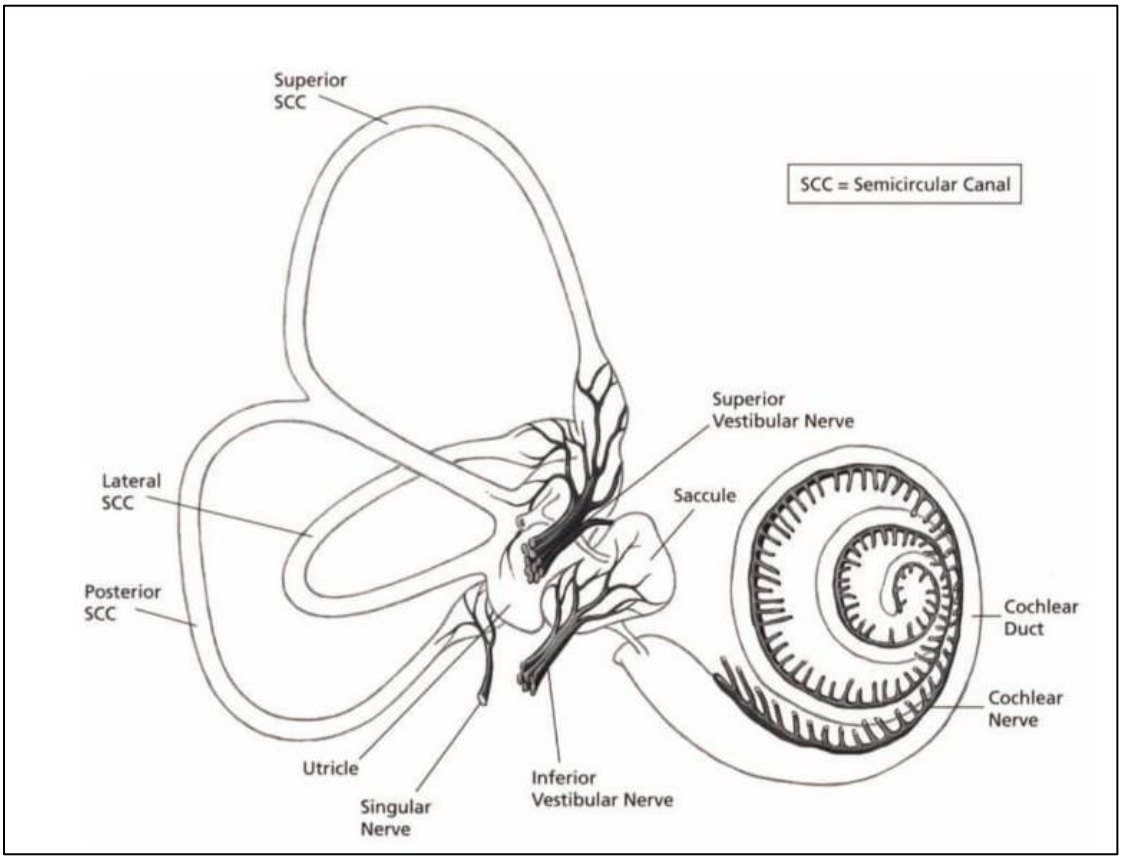


Image 13: Innervation of inner ear[7]

VESTIBULO-OCULAR REFLEXES (VOR)

The vestibulo-ocular reflex (VOR) is stimulated by displacement of cupula within the semicircular canals, leading to compensatory contractions of the extraocular muscles. The reflex allows the eyes movement in the direction opposite to head turn with a one-to-one gain, ensuring image stability on the retina. When cupular deflection is sustained while the person is conscious, the parapontine reticular activating system initiates a reflex that produces rapid compensatory movement of eye in opposite direction. This results in rhythmic, repetitive eye movements known as nystagmus.

The vestibulo-ocular reflex is component of the overall vestibular response, which integrates eye movement coordination, perception, and posture control in response to body motion or accelerations.[10]

Vestibulo-ocular reflexes (VOR) helps stabilize vision by transmitting signals through vestibulo-ocular pathways to motor neurons that control the extraocular muscles, enabling eye rotation during head movements such as tilting, rotating, or translating.

Six extraocular muscles, arranged in pairs, control horizontal, vertical, and rotational eye movements. The nerve supply of these muscles is by cranial nerves III, IV, and VI. The vestibular nerve (VN) transmits signals to cranial nerve nuclei, facilitating coordinated eye movement in response to head motion. Vestibular signals direct motor neurons to contract or relax specific eye muscles, allowing the eyes to move in the opposite direction of the head.

The VOR stabilizes vision by compensating for head movements. For instance, during horizontal head rotation, the VN activates motor neurons that drive eye movements to counterbalance the head's motion.

Nystagmus is characterized by involuntary eye movements and may indicate pathology in the vestibular system. It consists of a slow phase that follows head movement and a quick phase that resets the eyes.

The vestibulo-ocular reflexes work alongside optokinetic reflexes, which respond to visual stimuli and contribute to stabilizing vision during head rotation.

VOR gain which is defined as the ratio of eye velocity to head velocity, is typically near to 1, and disruptions in these pathways can provide insights into vestibular disorders.

Any movement detected by the vestibular organ is compensated by a coordinated series of muscle contractions and relaxations. Since body movement has a wider range of motion than the eyes, numerous muscles participate in this reaction chain to maintain stability and an upright posture.

These reflexes are mediated by vestibular nuclei onto the medial and lateral vestibulospinal tracts, which extend to the neck and lower limb muscles to support balanced locomotion and posture. Gravity, detected by the otolith system, serves as the primary input, but proprioceptive and visual information are also necessary to determine body position, as gravity is sensed only in the head, irrespective of trunk and limb orientation.

The Vestibulo-Ocular Reflex (VOR) consists of a smooth eye movement in one direction, known as the slow phase of ocular nystagmus, followed by rapid corrective movements, or saccades, in the opposite direction. However, standard vestibular tests that record nystagmus do not fully capture the VOR response. To accurately evaluate VOR, Videonystagmography (VNG) is used to measure the amplitude and frequency of eye movements.

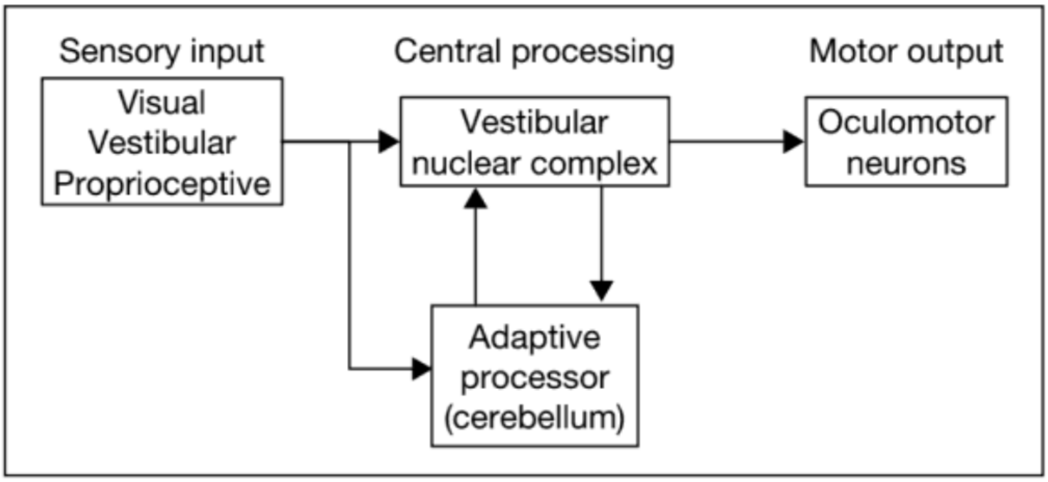


Image 14: Schematic drawing illustrating the VOR[31]

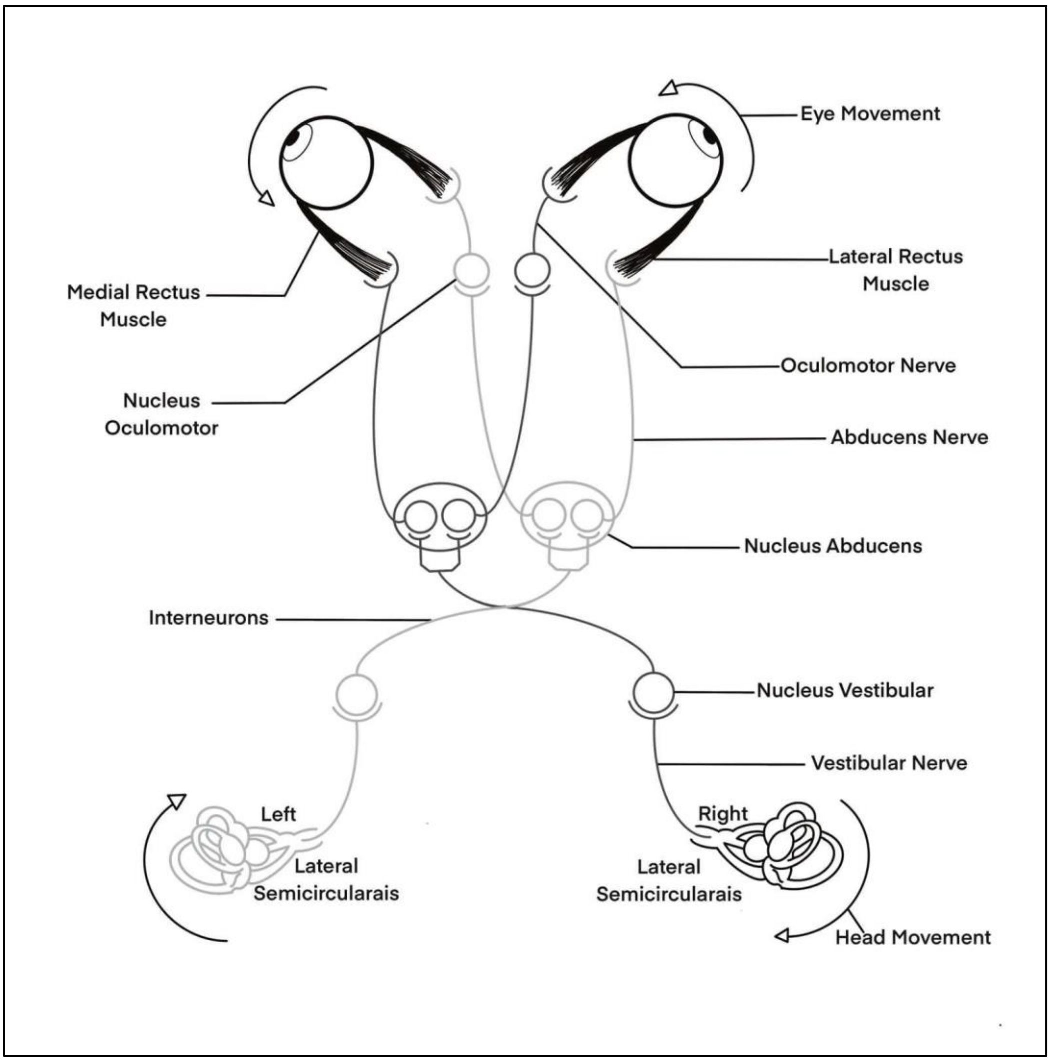


Image 15: Vestibulo-Ocular Reflex (VOR)

BENIGN PAROXYSMAL POSITIONAL VERTIGO

Benign paroxysmal positional vertigo (BPPV) is an idiopathic vestibular disorder characterized by brief episodes of vertigo and nystagmus stimulated by head position changes.[11]

BPPV is classified as a peripheral vestibular condition, marked by sudden and short-lived vertigo episodes induced by specific head movements. The condition was first documented by Barany in 1921.[12]

History

Barany provided the earliest clinical description of positional vertigo in 1921. Later, in 1952, Dix and Hallpike systematically identified the manoeuvres that provoke the condition.

Pathophysiology

Otoconia are calcium carbonate crystals embedded in the macula of the utricle and saccule. Their higher density compared to the surrounding endolymph allows the macula to detect linear acceleration and gravitational changes. While semicircular canals primarily respond to angular acceleration, BPPV occurs on accumulation of otoconia from the utricle in the SCCs, making them overly sensitive to gravity. Consequently, head movements in relation to gravity, lead to abnormal cupula displacement, overstimulating vestibular afferents and resulting in vertigo and abnormal eye movements.

Theories

One theory for BPPV is **Canalolithiasis**, in which otoconia move freely within the SCC. On change in head position relative to gravity, these particles shift, leading to abnormal stimulation of the affected inner ear. This movement creates conflicting signals between the two labyrinths, causing vertigo.

Another theory, **Cupulolithiasis**, suggests that degenerative otoconia adhere to the cupula, making it sensitive to gravity. When subjected to gravitational forces, the otoconia settle at the lowest point of the canal, altering endolymph pressure and displacing the cupula. This change in endolymph pressure occurs due to a "plunger effect," where otoconial debris functions like a piston, generating endolymph flow that deforms the cupula.[13]

BPPV most commonly affects the Posterior semicircular canal (p-SCC). Less frequently, the Horizontal semicircular canal (h-SCC) is involved, while the Anterior semicircular canal (a-SCC) is rarely affected.

<u>VIDEONYSTAGMOGRAPHY</u>

This device typically integrates software with a small video camera embedded in goggles to record eye movements during visual or vestibular stimulation, as well as during changes in position. The captured eye movement data is transmitted to a computer, where the signal is analysed in relation to the types of stimulation to provide a quantitative assessment. [12]

VNG involves a set of tests designed to assess if a vestibular disorder is responsible for balance or dizziness issues. It helps distinguish between central and peripheral vestibular lesions and is used for diagnosis of unilateral or bilateral vestibular dysfunction.[14]

DIX – HALLPIKE MANOEUVRE

Dix-Hallpike manoeuvre, introduced in 1952, remains the most important diagnostic test for posterior semicircular canal BPPV.[12]

During this test, both the posterior and anterior semicircular canal pairs are stimulated. The patient seated on the examination table with their legs extended and feet up on the table. The patient's head is then turned at a 45 - degree angle towards the tested side, which aligns the vertical canals with the sagittal plane. Then, the head is rapidly lowered off the edge of the table until it is positioned 30 degrees below horizontal while maintaining the 45- degree angle towards the tested side. Patients should be informed in advance about the possibility of dizziness and encouraged to keep their eyes open throughout the examination.[1]

Image 16: Dix – Hallpike manoeuvre[5]

EPLEY'S MANOEUVRE

In 1992, Epley introduced the canalolith repositioning procedure (CRP) based on the canalolithiasis theory to relocate particles from the posterior canal to the utricle via the common crus. This non-invasive procedure is well-tolerated, and patients should be informed about the procedure and the possibility of vertigo before starting.[1]

1. The patient is made to sit upright on the examination table, facing away from the examiner.
2. The head is turned 45 degrees toward the affected side, and the patient is reclined with the head extended over the table's edge, similar to the Dix-Hallpike manoeuvre.
3. The head is then rotated 90 degrees to the opposite side and the body is turned 90 degrees, so the patient lies on their side, maintaining head position.
4. The head is further rotated 90 degrees until the patient is looking obliquely downward.
5. Patient is asked to hang their legs over the table's side to prepare for the next step.
6. Patient is made to a sit with their head turned 45 degrees toward the normal side.
7. Procedure ends with the patient sitting upright, and head tilted forward by 20 degrees.[1]

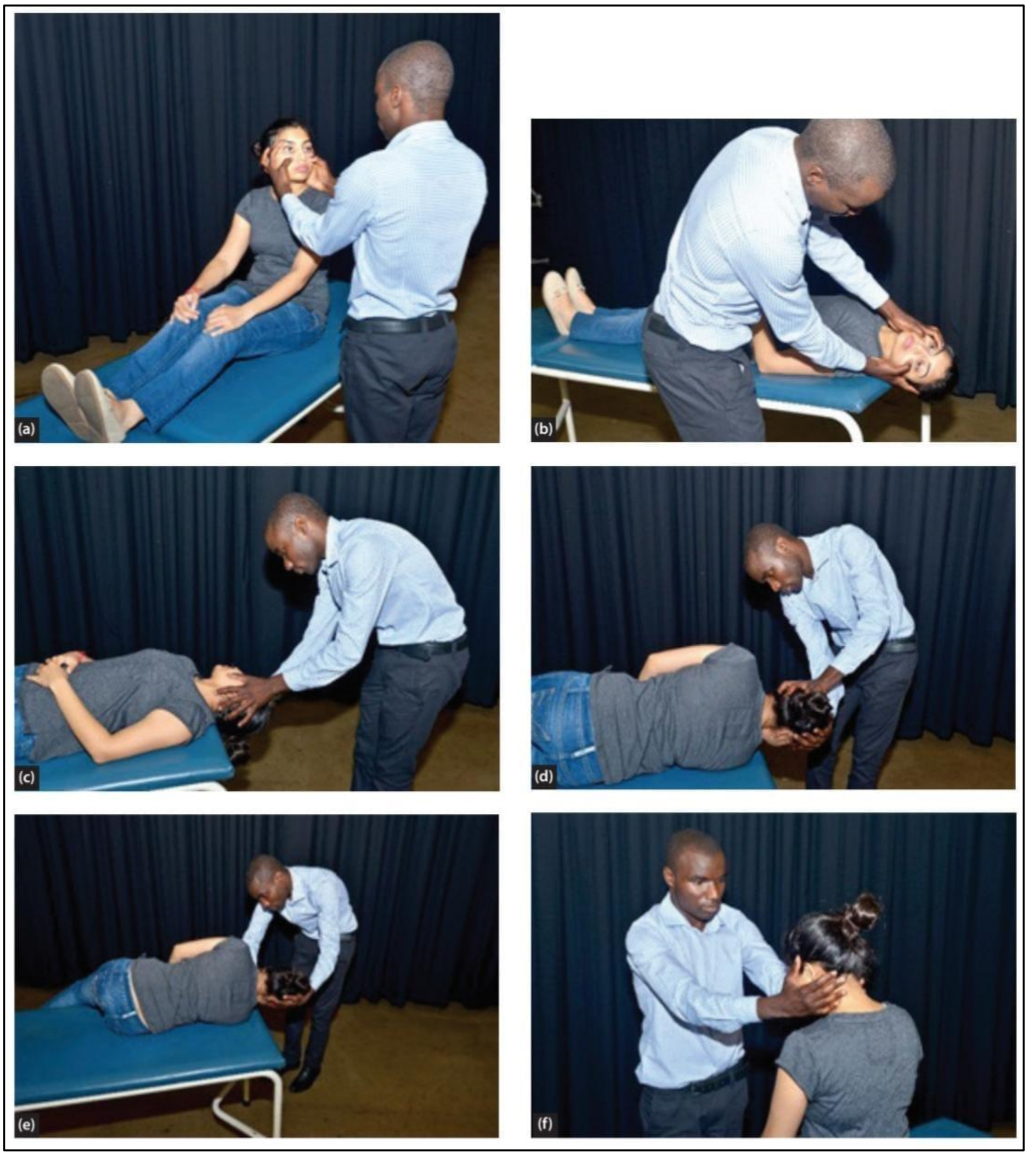


Image 17: Epley's Manoeuvre[5]

BODY MASS INDEX

Body mass index is standard measure for defining anthropometric height-to-weight ratio for adults and classify them into categories. It is also widely recognized as a risk factor for various health conditions and plays a crucial role in shaping public health policies. Due to its wide acceptance, BMI has proved to be instrumental in population-based studies as it provides a standardized measure to categorize body mass as a health concern.[3]

BMI is calculated as ratio of a person’s weight to square of their height (kg/m^2) and serves as an estimate of weight-related health risks. While BMI measures excess body weight relative to height, it doesn’t assess body fat but has correlates with it. It remains the most commonly used indicator of weight-related health risks because direct methods of measuring body fat—such as skinfold assessments or underwater weighing—are more invasive and costly. BMI, on the other hand, is a simple, inexpensive, non-invasive, and quick assessment tool.[15]

WHO CLASSIFICATION OF WEIGHT STATUS

WEIGHT STATUS	BODY MASS INDEX (BMI), kg/m^2
Underweight	<18.5
Normal range	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	≥ 30
Obese class I	30.0 – 34.9
Obese class II	35.0 – 39.9
Obese class III	≥ 40

Image 18: Classification of BMI[16]

MATERIALS AND METHODS

OBJECTIVE: The Aim of the study is to bridge the knowledge gap by examining relationship between BMI and the efficacy of Epley's manoeuvre in managing BPPV.

SOURCE OF DATA: Patients presenting to Otorhinolaryngology OPD at Dr Prabhakar Kore Hospital, Belagavi diagnosed as Benign Paroxysmal Positional Vertigo of age group 18 to 80 years, age falling into inclusion criteria

STUDY DESIGN: Observational study

STUDY PERIOD: 1 year

SAMPLE SIZE: 24 + 24 = 48 = Total Sample size

The minimum sample size formula based on proportions

$n= (Z_{\alpha/2}+Z\ \beta)^2\ X\ (p_1q_1 + p_2q_2) / (p_1 - q_1)^2$

p_1 = proportion of 1st group; $q_1 = 1 - p_1$

p_2 = proportion of 2nd group; $q_2 = 1 – p_2$

p_1 = effective rate of manual repositioning in

Low BMI group = 58.7 = 0.587 $q_1 = 100 - 58.7 = 0.413$

p_2 = effective rate of manual repositioning in

High BMI group = 14.75 = 0.1475 $q_1 = 85.25 = 0.8525$

For α =05% = 0.05, $Z_{1-\alpha/2}$= 1.96

β= 10% = 0.10, Z_β= 1.282

$n= (1.96+1.282)^2\ X\ (0.587\ X\ 0.413 + 0.413 + 0.1475\ X\ 0.8525)/ (0.587 – 0.1475)^2$

n = 20.02 by taking attrition as 20% i.e. 20.02 x 1.2 = 24 in each group

Sampling technique: Simple random sampling

INCLUSION CRITERIA:

- Clinically diagnosed BPPV patients having symptoms more than 4 to 6 weeks
- Patients in the age group of 18 to 80 years
- Patients who gave consent to participate in the study

EXCLUSION CRITERIA:

- All children <18 years and adults > 80 years
- Patients who underwent medical treatment for BPPV
- Patients who underwent Epley's manoeuvre earlier for BPPV
- Patients not giving consent for participation in the study

STUDY PROTOCOL: Patients coming to Otorhinolaryngology OPD at Dr Prabhakar Kore Hospital, Belagavi diagnosed as Benign Paroxysmal Positional Vertigo of age group 18 to 80 years, age falling into inclusion criteria were selected. ENT clinical examination was be done followed by Dix – Hallpike manoeuvre using VNG. Patients were divided into two groups based on BMI. Epley's manoeuvre was applied using VNG. The results were gathered and assessed for effect of BMI on efficacy of Epley's manoeuvre in BPPV.

DATA COLLECTION PROCEDURE:

- The patients visiting the ENT and HNS OPD with the complaints suggestive of Benign paroxysmal positional vertigo was examined, a detailed history was taken.
- Patient were examined in detail.

- After the clinical diagnosis of Benign paroxysmal positional vertigo was made using Dix-Hallpike manoeuvre using VNG, patient were explained in their own vernacular language about the condition (BPPV) and were counselled for Epley's manoeuvre.
- After Epley's manoeuvre, the patients were divided into two groups, Group A with low to normal BMI (BMI = < 23kg/$m^{2)}$ and Group B with high BMI (BMI >23kg/m^2).
- Both the groups were assessed at weekly intervals for 3 months using a questionnaire
- Patients having residual symptoms of BPPV after Epley's manoeuvre were again treated with another cycle of Epley's manoeuvre using VNG and followed up until complete resolution of symptoms.
- Number of cycles of Epley's required for complete resolution of symptoms was calculated in both groups and compared to assess the effect of BMI on efficacy of Epley's manoeuvre for BPPV.

Image 19: Dix- Hallpike manoeuvre[5]

Image 20: VNG in the Neuro Vestibular Clinic at our hospital

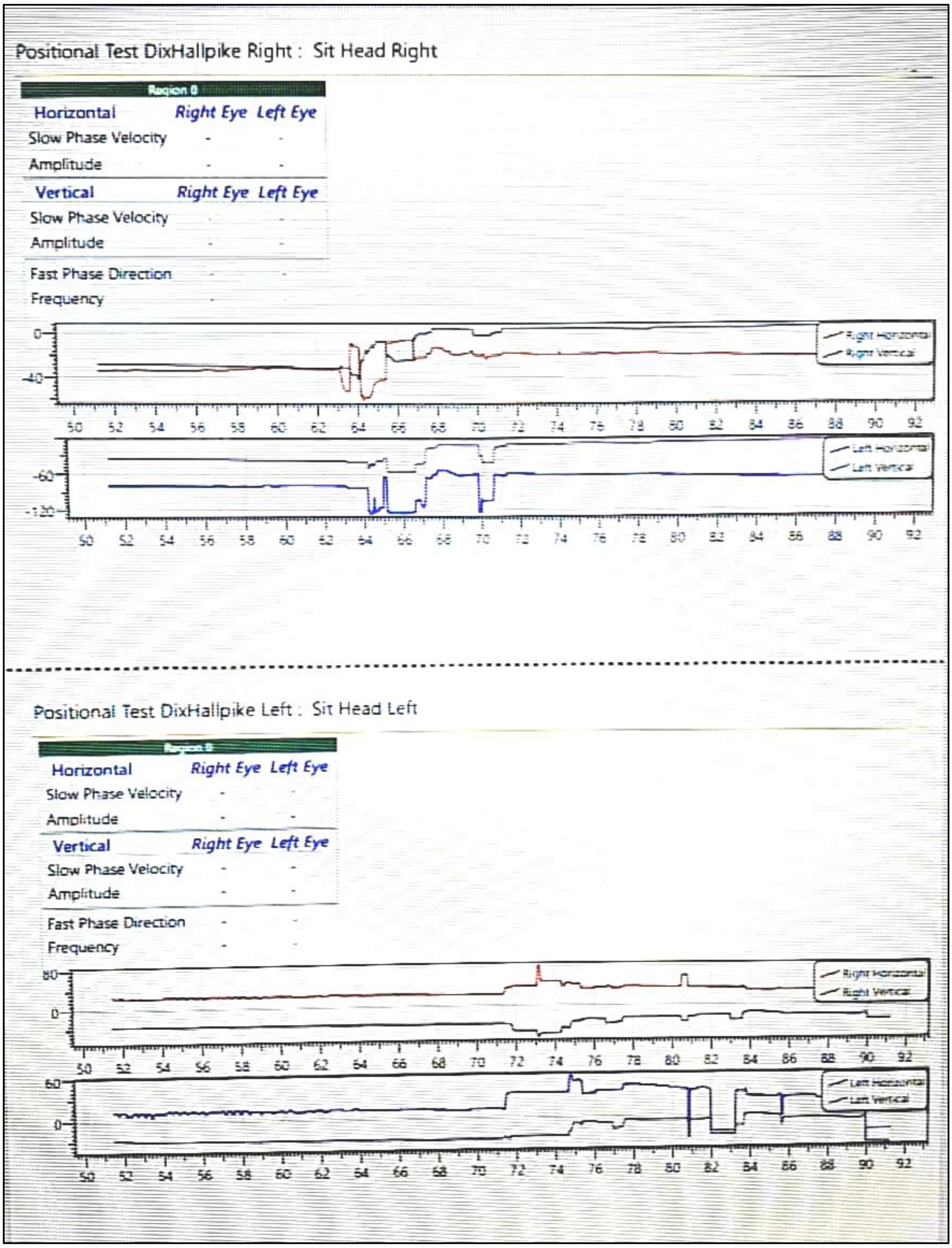


Image 21:Graph of VNG during Dix- Hallpike manoeuvre

Interpretation of VNG

Diagnosis of BPPV:

- **Posterior/Anterior Semicircular Canal BPPV**
    - Right torsion: Right posterior canal
    - Left torsion: Left posterior canal
    - Upbeat: Right posterior canal
    - Downbeat: Left anterior canal
- **Horizontal Semicircular Canal BPPV** (diagnosed by roll test)
    - Head right:
        - Canalolithiasis (geotropic): Pure horizontal right beat
        - Cupulolithiasis (ageotropic): Pure horizontal left beat
    - Head left:
        - Canalolithiasis (geotropic): Pure horizontal left beat
        - Cupulolithiasis (ageotropic): Pure horizontal right beat

Data processing and analysis/statistical analysis: Descriptive statistics were mentioned; Chi square test was carried out to find association between variables.

RESULTS

The study group was recorded at KLES Dr. Prabhakar Kore Hospital ENT Outpatient Clinic.

Patients who came with complaints of dizziness and were clinically suspected to have BPPV were enrolled into the study. The study had a total of 48 participants.

DEMOGRAPHIC ANALYSIS:

I. AGE DISTRIBUTION:

The study group included 48 participants with ages ranging from 19 years to 75 years.

The age range of the patients and the percentage of participants in each age group that were enrolled in the study are shown in Table 1.

AGE GROUPS	Number	%
<=30yrs	13	27.08
31-40yrs	11	22.92
41-50yrs	9	18.75
51-60yrs	8	16.67
>=61yrs	7	14.58
Total	48	100.00
Mean	42.13	
SD	15.36	

Table 1: Age wise distribution

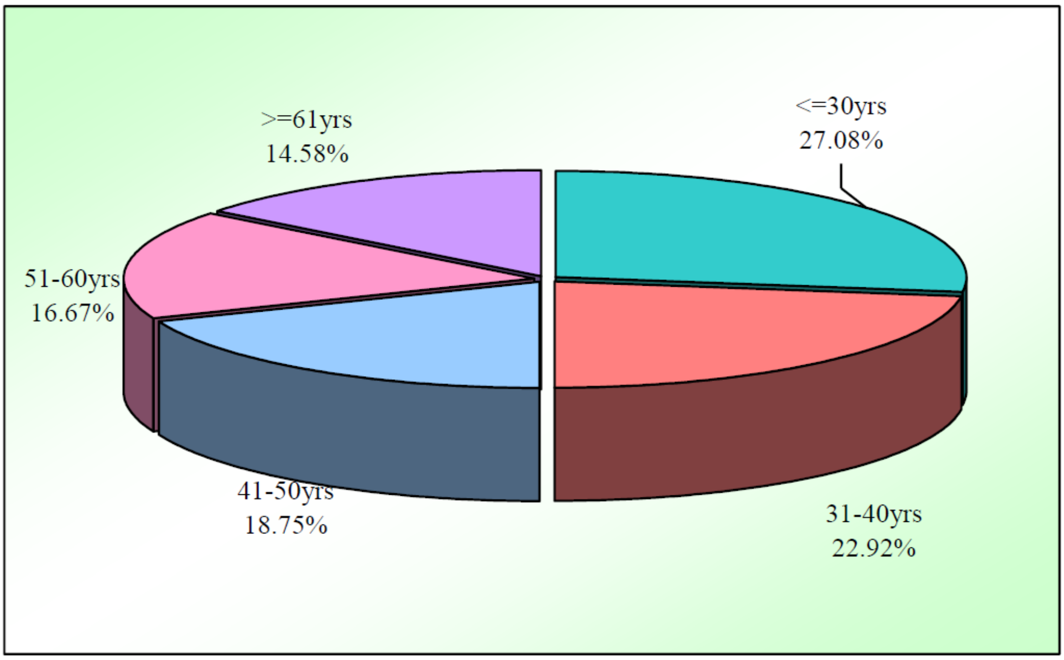


Figure 1: Age wise distribution

From the above Table 1 and Figure 1, we can see that out of the 48 patients included in the study patients that presented to ENT OPD with vertigo and diagnosed as having benign paroxysmal positional vertigo, maximum number of patients i.e. 13 patients (27.08 %) were less than or equal to 30 years of age i.e. 2nd and 3rd decade of life. On the other hand, 7 patients (14.58 %) included in the study were in the age group of more than or equal to 60 years.

Patients between the ages of 19 to 40 years combined contributed to almost 50% of the study group.

The average age of the study population was 42.13 ± 15.36 years. According to this study, it can be inferred that BPPV is quiet common among people in 2nd to 4th decade of life.

II. SEX DISTRIBUTION:

In our study out of 48 patients, there were 15 men and 33 women.

Table 2 and Figure 2 shows the gender wise distribution of the study population.

GENDER	NUMBER	%
Male	15	31.25
Female	33	68.75
Total	48	100.00

Table 2: Gender wise distribution

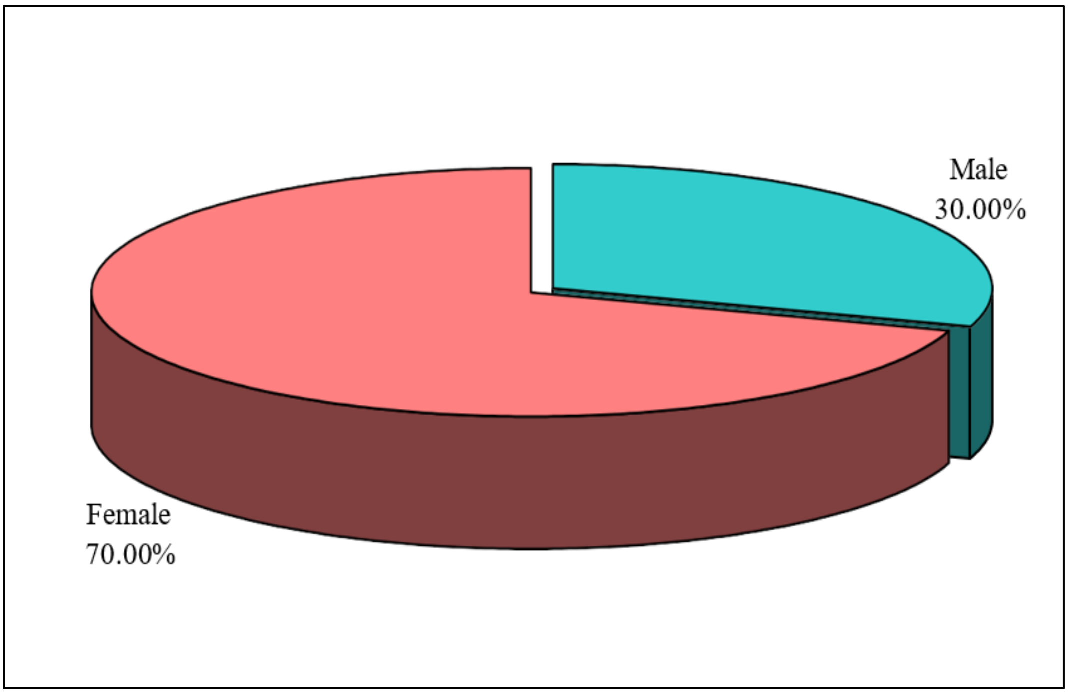


Figure 2 : Gender wise distribution

Our study group had a female preponderance with males contributing to 31.25 and females constituting 68.75 % of the total study population. So, we can infer that BMI is more common in females than males.

III. <u>AGE AND BMI</u>

Table 3 shows summary of age and BMI in the study population.

Variables	Minimum	Maximum	Mean	Std. dev.	Median	Quartile
Age	19.00	75.00	42.13	15.36	40.50	23.50
Weight	44.00	96.00	57.65	11.53	55.00	13.50
Height	150.00	182.88	160.27	7.91	158.40	10.50
BMI	16.70	31.80	21.99	3.04	21.45	2.25

Table 3: Summary of age and BMI

Age of the patients ranged from 19 years to 75 years with mean age of 42.13 ± 15.36.

Weight of the patients varied between 44 kgs to 96 kgs with mean weight of 57.65 ± 11.53.

Height of the patients varied between 150 cms to 182.8 cms with mean height of 160.27 ± 7.91. Body Mass Index (BMI) of the patients varied between 16.70 kg/m^2 to 31.80 kg/m^2 with mean weight of 21.99 ± 3.04. This study concludes that BPPV is more common in people with low or normal BMI than those with higher BMI.

IV. GENDER BY AGE GROUPS

Table 4 shows gender by age groups distribution of the study population

Age groups	**Male**	**%**	**Female**	**%**	**Total**	**%**
<=30yrs	4	30.77	9	69.23	13	27.08
31-40yrs	3	27.27	8	72.73	11	22.92
Age groups	**Male**	**%**	**Female**	**%**	**Total**	**%**
41-50yrs	1	11.11	8	88.89	9	18.75
51-60yrs	5	62.50	3	37.50	8	16.67
>=61yrs	2	28.57	5	71.43	7	14.58
Total	15	31.25	33	68.75	48	100.00
Mean	43.07		41.70		42.13	
SD	15.59		15.47		15.36	

Table 4: Gender by age groups

Out of the 15 males included in the study, maximum number of males i.e. 5 (62.50 %) were in the age group of 51 -60 years and the maximum number of females i.e. 9 (69.23 %) were in the age group of less than or equal to 30 years.

According to this study, BPPV is common in males in 5^{th} and 6^{th} decade of life and in females in 2^{nd} to 3^{rd} decade of life.

V. SIDE AFFECTED WISE DISTRIBUTION

Table 5 and Figure 3 shows the Side affected wise distribution of the study population

Side affected	**Number**	**%**
Left side	17	35.42
Right side	31	64.58
Total	48	100.00

Table 5: Side affected wise distribution

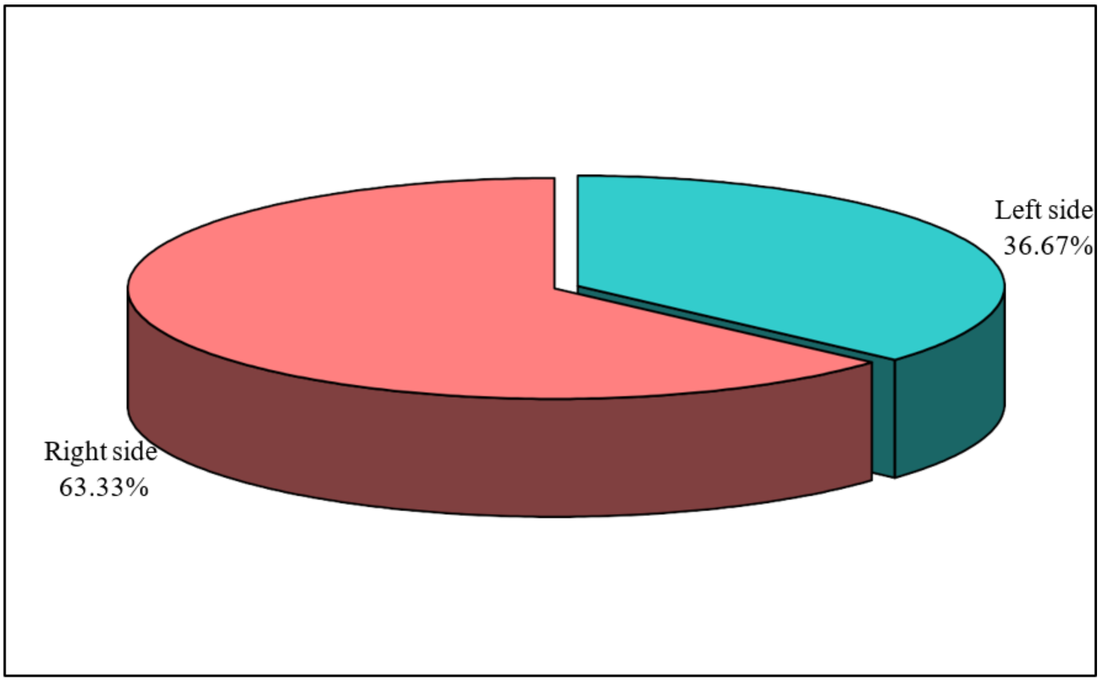


Figure 3: Side affected wise distribution

Out of the 48 patients included in the study, 17 patients (35.42 %) were diagnosed to have Benign Paroxysmal Vertigo affecting the left side while 31 patients (64.58 %) were diagnosed to have Right BPPV. This study concludes that right BPPV is more common than left BPPV.

VI. OBESITY WISE DISTRIBUTION

Table 6 and Figure 4 shows the Obesity wise distribution of the study population

Obesity	**Number**	**%**
Under weight	3	6.25
Normal	40	83.33
Overweight	5	10.42
Total	48	100.00
Mean	21.99	
SD	3.04	

Table 6: Obesity wise distribution

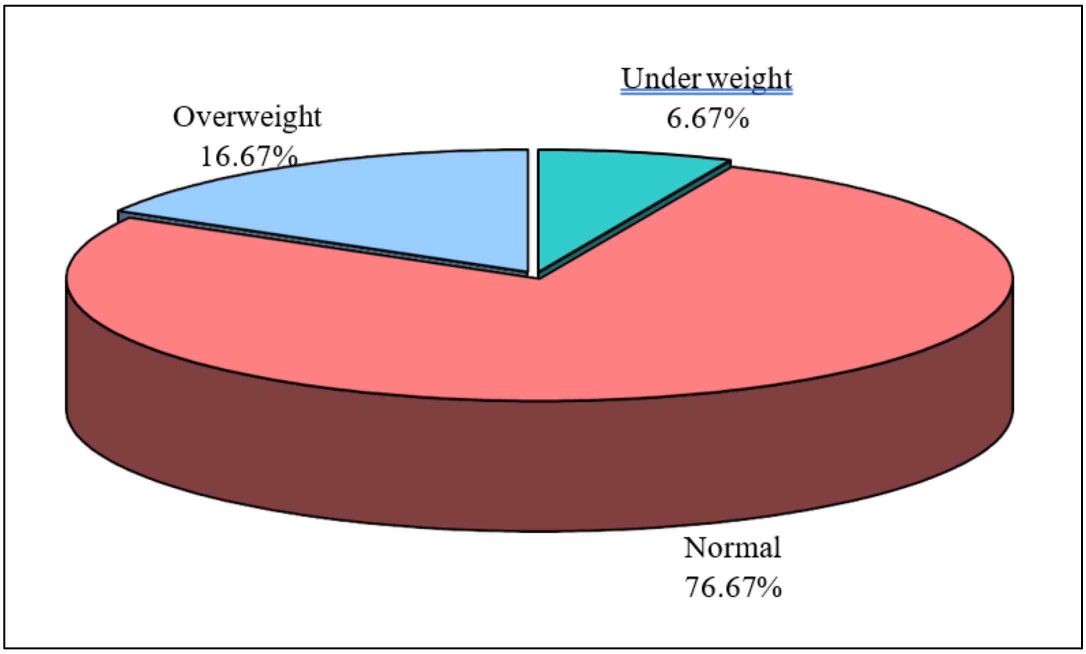


Figure 4: Obesity wise distribution

Out of the 48 patients included in the study, maximum number of patients i.e. 40 patients (83.33 %) were found to be in the normal category of BMI. 3 patients (6.25%) were found to be in the underweight category and 5 patients (10.42%) were found to be in the overweight category. Mean Body Mass Index of the study population was 21.99 ± 3.04.

This study shows that BPPV is less common in people of extreme BMI categories (underweight and overweight).

VII. NYSTAGMUS CYCLE WISE DISTRIBUTION

Table 7 and Figure 5 shows the nystagmus cycle wise distribution of the study population

Nystagmus cycle	Number	%
Epley's cycle 1	48	100.00
Epley's cycle 2	29	60.42
Epley's cycle 3	5	10.42
Epley's cycle 4	0	0.00
Total	48	100.00

Table 7: Nystagmus cycle wise distribution

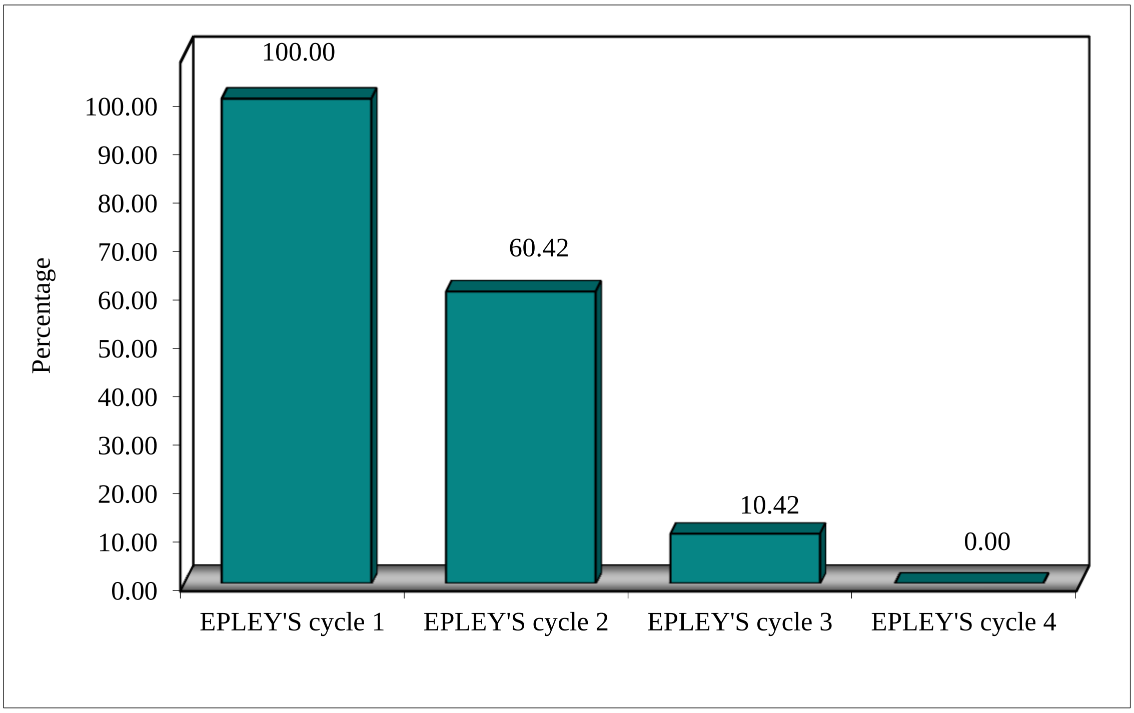


Figure 5 : Nystagmus cycle wise distribution

The above Table 7 and Figure 5 shows the total number of cycles of Epley's manoeuvre required by the study population for complete resolution of symptoms.

All 48 patients (100 %) underwent the first cycle of Epley's manoeuvre, 29 patients (60.42 %) underwent the second cycle of Epley's manoeuvre and 5 patients (10.42 %) underwent the third cycle of Epley's manoeuvre.

According to this study, 1^{st} cycle of Epley's manoeuvre is effective in 40 % (100 – 60.42 %) of patients in reducing symptoms. 2^{nd} cycle is quite effective in reducing symptoms in around 50 % (60 – 40 %) of cases of BPPV.

VIII. ASSOCIATION BETWEEN BMI AND NYSTAGMUS CYCLES:

Table 8 and Figure 6 shows the association between BMI and nystagmus cycles in the study population.

Nystagmus cycles	Underweight	%	Normal	%	Over weight	%	Total	p-value
Epley's cycle 1								
Negative	0	0.00	0	0.00	0	0.00	0	1.0000
Positive	3	6.25	40	83.33	5	10.42	48	
Epley's cycle 2								
Negative	1	5.26	16	84.21	2	10.53	19	0.9874
Positive	2	6.90	24	82.76	3	10.34	29	
Epley's cycle 3								
Negative	3	6.98	37	86.05	3	6.98	43	0.0670
Positive	0	0.00	3	60.00	2	40.00	5	
Epley's cycle 1								
Negative	3	6.25	40	83.33	5	10.42	48	1.0000
Positive	0	0.00	0	0.00	0	0.00	0	
Total	3	6.25	40	83.33	5	10.42	48	

Table 8: Association between BMI and Nystagmus cycles

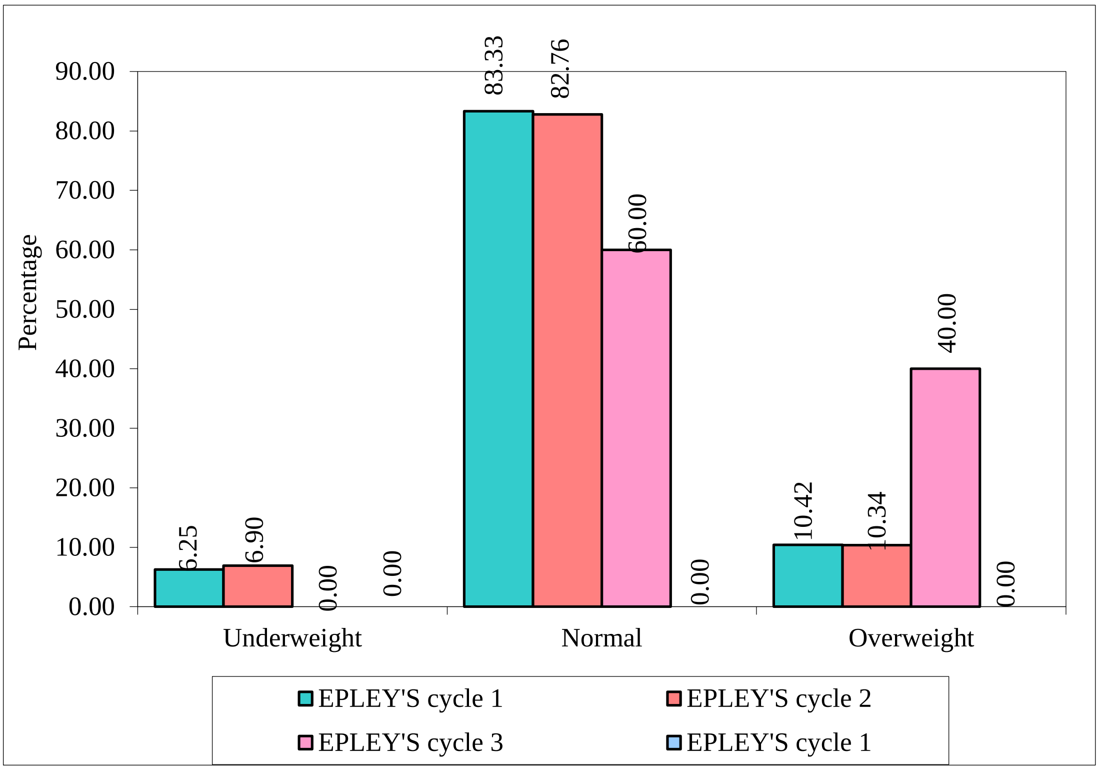


Figure 6: Association between BMI and nystagmus cycles

Out of 3 patients in the underweight category, nystagmus was positive in all 3 patients on undergoing the first cycle of Epley's manoeuvre, became negative after 2 cycles in 1 patient and after 3 cycles in the remaining 2 patients.

Out of 40 patients in the normal category, nystagmus was positive in all 40 patients on undergoing the first cycle of Epley's manoeuvre, became negative after 2 cycles in 16 patients and in 21 patients after 3 cycles. The remaining 3 patients required four cycles of Epley's manoeuvre for nystagmus to become negative.

Out of 5 patients in the overweight category, nystagmus was positive in all 5 patients on undergoing the first cycle of Epley's manoeuvre, became negative after 2 cycles in 2 patients and in 1 patient after 3 cycles. The remaining 2 patients required four cycles of Epley's manoeuvre for nystagmus to become negative.

This study infers that all patients, regardless of BMI category, initially exhibited nystagmus upon undergoing the first cycle of Epley's manoeuvre. However, the number of cycles required to resolve nystagmus varied among different BMI groups.

- **Underweight Patients:** Nystagmus resolved relatively quickly, with one patient improving after two cycles and the remaining two after three cycles.
- **Normal BMI Patients:** The majority (92.5%) experienced resolution within three cycles- 16 patients after two cycles and 21 after three cycles. A small subset (7.5%) required four cycles.
- **Overweight Patients:** Resolution took longer compared to other groups, with only 60% improving within three cycles. Two patients (40%) needed four cycles, indicating a trend toward prolonged persistence of nystagmus in this group.

This pattern suggests that higher BMI may be associated with a longer resolution time for nystagmus following Epley's manoeuvre, whereas underweight individuals tend to respond slightly faster. However, further investigation is needed to confirm whether BMI significantly influences treatment response.

IX. NO. OF CYCLES OF EPLEY'S GIVEN WISE DISTRIBUTION

Table 9 and Figure 7 shows number of cycles of Epley's given wise distribution

No. of cycles of Epley's given	**Number**	**%**
1	0	0.00
2	19	39.58
3	24	50.00
4	5	10.42
Total	48	100.00
Mean	2.71	
SD	1.96	

Table 9: No. of cycles of Epley's given wise distribution

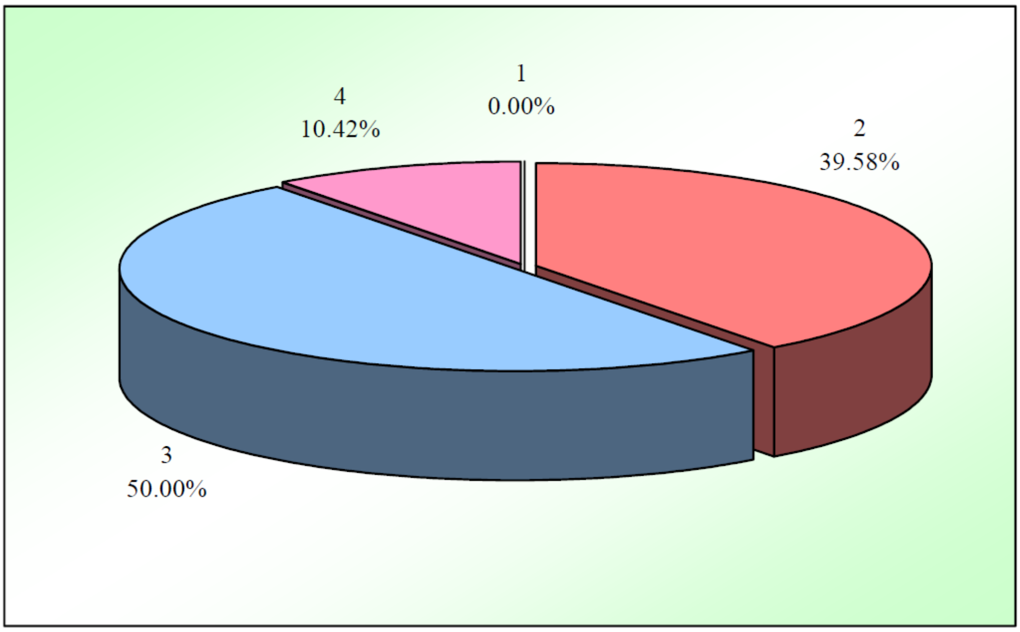


Figure 7: No. of cycles of Epley's given wise distribution

Out of 48 patients diagnosed with BPPV who underwent Epley's manoeuvre, symptom resolution occurred in none of the patients after first cycle. 19 patients (39.58 %) had symptom resolution after 2 cycles. In 50 % of patients, symptom resolution occurred after 3 cycles whereas 5 patients required 4 cycles of Epley's manoeuvre for complete resolution of symptoms.

Thus, this study shows that none of the 48 patients with BPPV experienced symptom resolution after the first cycle of Epley's manoeuvre, suggesting that a single cycle is generally insufficient for treatment.

- **39.58% of patients (19 out of 48)** achieved symptom resolution after two cycles, showing that a significant proportion responded relatively quickly.
- **50% of patients (24 out of 48)** required three cycles for symptom resolution, making this the most common response time.
- **10.42% of patients (5 out of 48)** needed four cycles for complete symptom resolution, indicating a smaller group with more persistent symptoms.

These findings suggest that while two to three cycles of Epley's manoeuvre are effective for most patients, some require additional treatment cycles. This reinforces the need for repeated maneouvres in managing BPPV and highlights potential variability in patient response.

X. <u>COMPARISON OF OBESITY WITH NO. OF CYCLES OF EPLEY'S GIVEN</u>

Table 10 and Figure 8 shows the comparison of obesity with no. of cycles of Epley's given by Kruskal Wallis ANOVA

Obesity	**Min**	**Max**	**Mean**	**SD**	**Median**	**Quartile Range**
Under weight	2.0	3.0	2.7	0.6	3.0	1.0
Normal	2.0	4.0	2.7	0.6	3.0	1.0
Overweight	2.0	4.0	3.0	1.0	3.0	2.0
Total	2.0	4.0	2.7	0.7	3.0	1.0
H-value	0.6205					
P-vale	0.7332					
Pair wise comparisons by Mann-Whitney U test						
Under weight vs Normal	P=0.9808					
Under weight vs Overweight	P=0.7656					
Normal vs Overweight	P=0.4626					

<u>Table 10: Comparison of obesity with no. of cycles of Epley's given by Kruskal Wallis ANOVA</u>

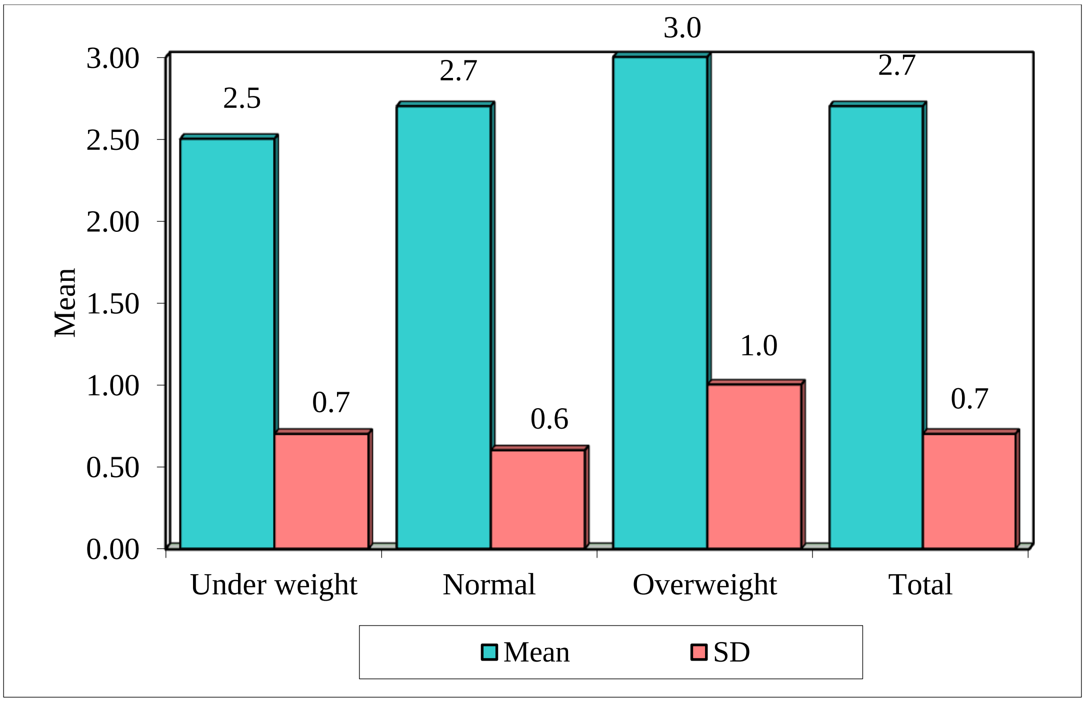


Figure 8: Comparison of obesity with no. of cycles of Epley's given

No significant difference was observed between obesity groups with no. of cycles of Epley's given (H=0.6205, p=0.7332). It means that, the no. of cycles of Epley's given is similar in all obesity groups.

XI. CORRELATION BETWEEN BMI AND NO. OF CYCLES OF EPLEY'S GIVEN

Table 11 Figure 9 shows the correlation between BMI and no. of cycles of Epley's given

Variables	Correlation between BMI with			
	N	Spearman R	t-value	p-value
No. of cycles of EPLEY'S given	48	0.0562	0.3816	0.7045

Table 11: Correlation between BMI and no. of cycles of Epley's given by Spearman's rank correlation

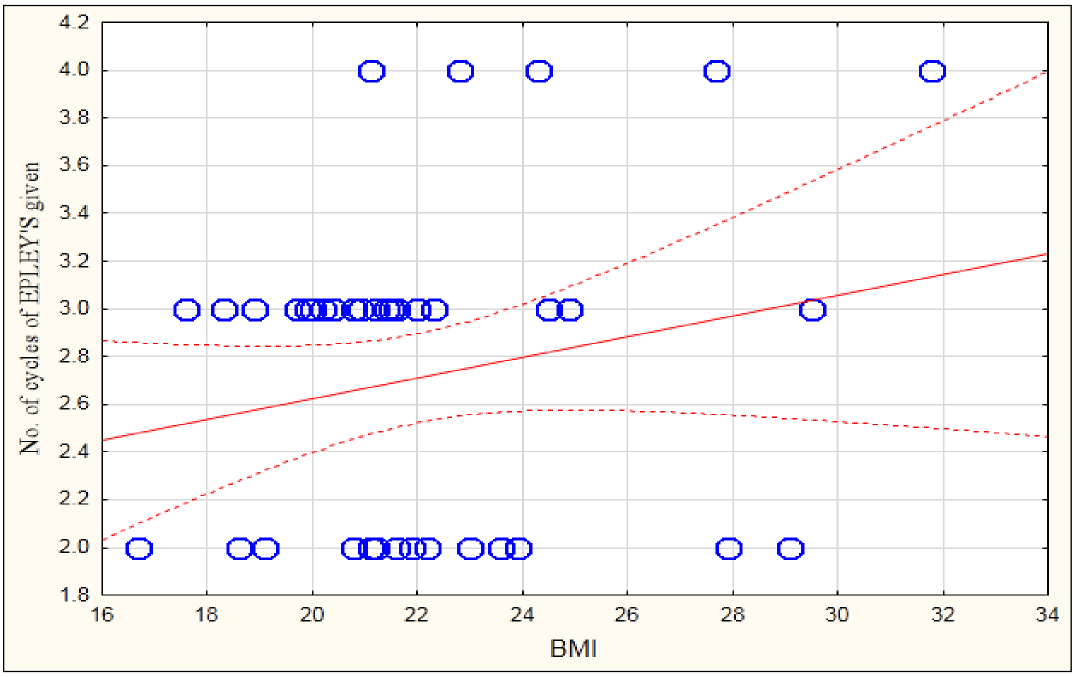


Figure 9: Scatter diagram of correlation between BMI and no. of cycles of Epley's given

No significant correlation was observed between BMI scores and no. of cycles of Epley's given (Spearman R=0.0562, p=0.7045). It can be inferred that, the BMI scores and no. of cycles of Epley's given are independent of each other in the study.

Table 12 and Figure 10 shows simple logistic regression of cycles of Epley's given by BMI

Independent variable	**Exp(B) or OR**	**95% C.I. for OR**		**P-value**
		Lower	Upper	
BMI	1.02	0.99	1.05	0.1520

Table 12: Simple logistic regression of cycles of Epley's given by BMI

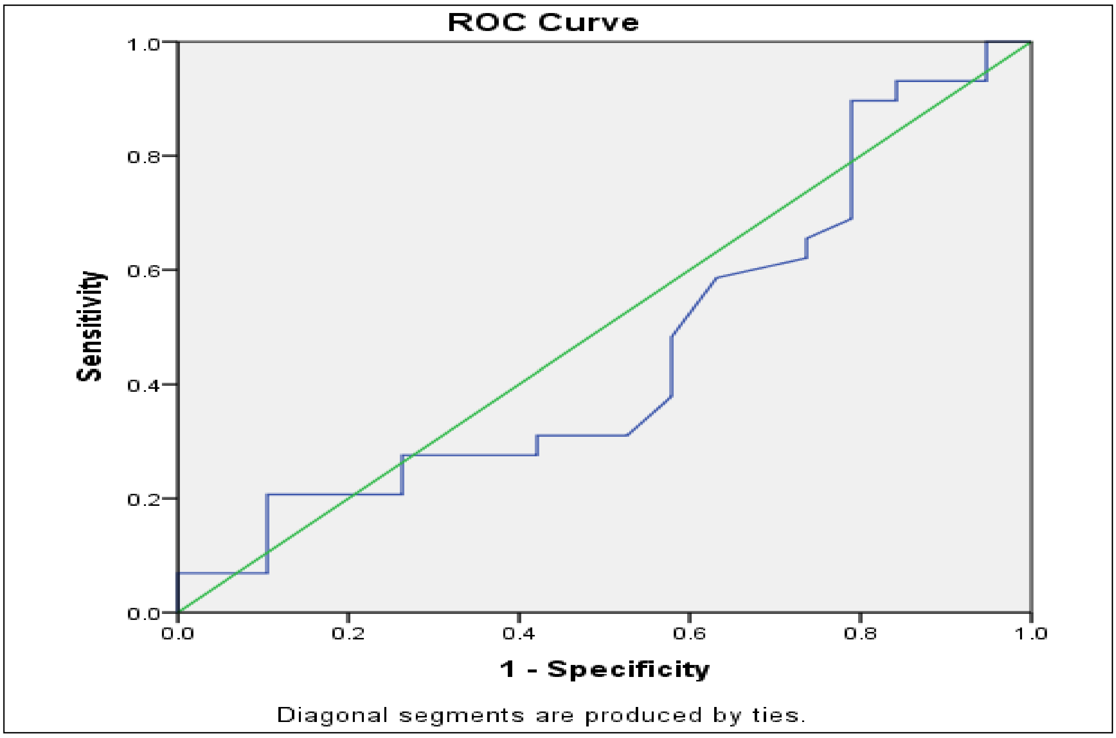


Figure 10: ROC curve of predicting no. of cycles of Epley's given

No significant ODDs of BMI were seen (i.e. OR= 1.02, 95% CI=0.99-1.05) with p=0.2750.

The accuracy of prediction of predicting no. of cycles of Epley's given by BMI is 0.4590 (45.90%) by ROC curve. The ROC is given in Figure 10.

DISCUSSION

Benign paroxysmal positional vertigo (BPPV) is one of the most common recognized vestibular disorders encountered in a neuro-otology clinic and it accounts for nearly 20% of all the vestibular complaints.[17]

It can be defined as a transient vertigo induced by rapid change in head position associated with a characteristic paroxysmal positional dizziness.[18]

Epley developed the Canalolith repositioning procedure in 1992 based on the theory of 'Canalolithiasis' in order to move the particles from the posterior canal into the utricle via the common crus.[2]

The pathophysiology of BPPV is explained by the theories of Canalolithiasis and Cupulolithiasis. Canalolithiasis states that otoconia are calcium carbonate crystals floating freely in the semi-circular canals. Abnormal stimulation of the affected inner ear occurs due to movement of otoconia during change in orientation of head in relation to gravity.[13]

According to the Cupulolithiasis theory, degenerative otolith sticks to the cupula, making it sensitive to gravity.[13]

AGE:

BPPV, which was earlier considered to be a disease of the elderly has recently been found to involve age groups, especially with increased incidence seen in middle age groups. This may be attributed to increased stress in life, sedentary lifestyle, increased incidence of metabolic disorders, diabetes mellitus, increased noise exposure, increased incidence of allergy diseases, etc. Also increased awareness among population as well as availability of diagnostic manuevers.[19]

The elderly tend to have multiple comorbidities which can compromise autonomy and cause a worsening of quality of life. Coincidentally increased age is proportional to the presence of several neurotological disorders associated with deterioration in equilibrium and hearing function (e.g. BPPV, sensory-neural hearing loss, tinnitus, changes in body balance). [17]

Studies of temporal bone specimens showing increased deposition of basophilic deposition in cupula with increasing age may be implicated in increased incidence of BPPV with age in population.[20]

The participants in our study ranged in age from 19 to 75 years with mean age of 42.13 ± 15.36. Almost half of the study population was in the age group of 19 to 40 years.

According to this study, BPPV is more common in people in 2nd to 4th decades of life.

GENDER:

According to studies conducted previously, BPPV is found to be more common in females than males.[16] Similar sex predilection is seen in our study also, where out of the total study population of 48 patients diagnosed with BPPV, 33 (68.75 %) were females and 15 (31.25 %) were males.

According to this study, BPPV is more common in females than males.

SIDE OF CANAL INVOLVED:

According to previous studies, BPPV side affected in most patients correlates with the side on which the patients usually prefer to sleep at night. Inclination to lying on the right side of bed by most people can be considered a factor for increased prevalence of right side being affected in BPPV.[18] Our study shows 31 patients (64.58%) being affected by Right side BPPV as compared to 17 patients (35.42%) having Left BPPV. These results are consistent with the literature.

According to this study, right BPPV is more common than left BPPV.

BODY MASS INDEX:

Keys et al, developed the Quetelet Index for measurements of height and weight proportions referred to as the body mass index (BMI) for use in population – based studies.[3]

BMI is widely used as a risk factor for determining the prevalence of several medical conditions in patients and the role of weight control measures in reducing incidence of chronic disorders.[3]

BMI is an indirect measure of body fat calculated as a ratio of weight to height squared (kg/m2) of an individual.[15]

DIX – HALLPIKE MANOEUVRE:

Dix- Hallpike test is used as a diagnostic test for benign paroxysmal positional vertigo.[22]

The test involves movement of the patient rapidly from sitting to head hanging position (with patient's head hanging at least 10 degrees from the horizontal).[22]

The test is performed once the patient is reassured that patient will be held securely in case of dizziness and any vertigo, if occurs will be transient.[22]

The Dix-Hallpike manoeuvre is carried out by moving the patient from a sitting position to lying down with the head turned 45 degrees to the side of testing and slightly extended. The test is considered positive if the patient has an upward beating, rotatory nystagmus towards the down facing ear. There is a short latency period of usually less than 15 seconds before the onset of the nystagmus, and the total nystagmus usually lasts for less than 60 seconds.[23]

Patients who have positive results on diagnostic manoeuvres like Dix-Hallpike are administered appropriate treatment manoeuvres like Epley's manoeuvres, while patients who have negative Dix-Hallpike are referred to other departments to rule out central or other peripheral causes of vertigo.[24]

Additional tests including Videonystagmography (VNG) may further aid in diagnosis and treatment.[21] These also serve as a record for follow up purposes.

EPLEY'S MANOEUVRE:

Epley's described a canalolith repositioning procedure (CRP) known as Epley's manoeuvre that has been used successfully in patients with posterior canal BPPV and has proven to be an important keystone in the treatment of p-BPPV.[25]

The Epley manoeuvre, which may sometimes be associated with mild side effects like nausea, fainting or stiffness of the neck is considered a cost – effective treatment option.[25]

The success of these canal repositioning procedures (CRP) provides strong evidence supporting the overall theory that debris in the semicircular canal, particularly the posterior canal, plays a role in the cause of BPPV.[26]

In our study we have used Epley's manoeuvre as the main treatment modality for patients diagnosed with BPPV and attempted to find the correlation between BMI of the patients and the number of cycles of BPPV required for complete resolution of their symptoms.

VIDEONYSTAGMOGRAPHY:

Videonystagmography (VNG) is a comprehensive diagnostic system that records, analyses, and reports eye movements through video imaging technology, utilizing advanced video goggles equipped with infrared cameras.[27]

VNG consists of a series of tests designed to identify if a vestibular disorder is causing balance or dizziness issues. It can distinguish between central and peripheral vestibular lesions, and, in the case of a peripheral issue, it can differentiate between unilateral and bilateral vestibular loss. VNG evaluates the function of each ear individually.[27]

In our study we have used Videonystagmography to diagnose patients of BPPV as well as to perform Epley's manoeuvre as a therapeutic measure.

Studies correlating the diagnosis of BPPV in patients with their anthropometric characteristics like age, sex and history of comorbidities have been found in the literature, but there is not enough research done to compare the effect of Epley's manoeuvre in patients in relation to their body mass index.

In our study, we aim to assess the relationship between the number of cycles of Epley's manoeuvre required for complete resolution of symptoms in patients diagnosed with BPPV their BMI.

CONCLUSION

Benign Paroxysmal Positional Vertigo is one of the most common peripheral vestibular disorder which is characterised by sudden, brief episodes of vertigo due to positional change in relation to gravity.[28]

Dix – Hallpike manoeuvre is the standard modality used for diagnosis of BBPV by observing the nystagmus that occurs while performing the procedure.[29]

Use of video goggles (in videonystagmography), helps in getting the best resolution effect of nystagmus and provides documentation for follow up purposes.[28]

Epley's manoeuvre, which an easy and cost effective therapeutic manoeuvre serves a better treatment modality than anti-vertigo drugs commonly used.

Body mass index (BMI), another easy to calculate attribute is generally used as a measure of health in population-based study.

In our study aimed to assess the effect of Body Mass Index on Epley's manoeuvre in patients of BPPV, we come to the conclusion that number of cycles of Epley's manoeuvre required for complete resolution of symptoms in patients diagnosed with BPPV does not vary significantly in patients of different BMI groups.

We therefore conclude from our study that BMI does not have a statistically significant effect on Epley's manoeuvre in BPPV and patients of all BMI groups respond similarly to this therapeutic modality.

SUMMARY

Vertigo is a common presenting complaint in patients presenting to ENT OPD in daily clinical practice. Inspite of less awareness among the population about this problem, it is repeatedly reported and complained by the patient due to its debilitating effects on the daily life of people suffering with dizziness. BPPV was first reported by Barany in 1921 and confirmed later by Dix and Hallpike who also developed a diagnostic test for BPPV. This test, as popularly known as Dix-Hallpike manoeuvre is in use even today and is considered the standard diagnostic modality for BPPV. Newer developments like Videonystagmography further increases its diagnostic accuracy helping in more precise diagnosis. Therapeutic modalities like Epley's manoeuvre are regularly used and have proven to be effective in resolution of symptoms of BPPV. Studies have been conducted to correlate the anthropometric characteristics of patients with BPPV and effectiveness of various treatment modalities. Our study aimed at assessing the correlation between BMI and efficacy of Epley's manoeuvre is relevant as literature in this regard is lacking.

LIMITATIONS AND SCOPE OF STUDY:

1. Smaller sample size
2. Single centre study
3. The study can be multicentric and can be taken with larger sample size for further evaluation

The study, by assessing the correlation between BMI and BPPV, we can evaluate the effectiveness of weight reducing exercises in patients in BPPV.

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ANNEXURES

ANNEXURE – I - INFORMED CONSENT FORM

TITLE: "ASSESSMENT OF THE EFFECT OF BODY MASS INDEX ON EFFICACY OF EPLEY'S MANOEUVRE FOR BENIGN PAROXYSMAL POSITIONAL VERTIGO: A ONE YEAR OBSERVATIONAL STUDY"

Name of Student/Principal Investigator: _________

Name of Guide/Co Investigators: ___________________

Introduction: Benign paroxysmal positional vertigo (BPPV) is the commonest cause of vertigo. It can be managed by simple treatment manoeuvres like Epley's manoeuvre. In this study the effect of BMI on the efficacy of Epley's will be assessed.

Explanation of procedure: The baseline data will be collected, as per proforma, after being included in the study. The subject will undergo Epley's manoeuvre and will be followed up weekly till symptoms subside. And the number of cycles of Epley's manoeuvre required for symptoms to subside will we compared between different BMI groups.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will not get any additional benefits by participating in this study. The data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Cost of investigations: Any expenditure done during the course of study will be paid by the principal investigator.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: If you have any question or complaints with regard to your right as study participant you may contact Dr. Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study "Assessment of the effect of body mass index on efficacy of Epley's manoeuvre for benign paroxysmal positional vertigo- A one year observational study" My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE- II

PROFORMA FOR DATA COLLECTION

PROFORMA

Name and Signature of the student/principal investigator:

Signature of the guide: **Date:**

"ASSESSMENT OF THE EFFECT OF BODY MASS INDEX ON EFFICACY OF EPLEY'S MANOEUVRE FOR BENIGN PAROXYSMAL POSITIONAL VERTIGO -A ONE YEAR OBSERVATIONAL STUDY."

Date: I.P. No:

Name: Occupation:

Age: Phone No:

Sex:

Address:

CLINICAL PROFILE:

Chief Complaint:

History of Present Illness:

Past History:

Personal History:

Family History:

I) General Physical Examination -

Blood Pressure:

Pulse:

Respiratory Rate:

Pallor

Icterus

Clubbing

Cyanosis

Lymphadenopathy

Oedema

II) ENT Examination

1. EAR EXAMINATION:

	Right	Left
Pinna		
Pre auricular area		
Post auricular area		
Tragal Tenderness		
Mastoid Tenderness		
External auditory canal		
Tympanic membrane		

TUNING FORK TESTS:

Rinne's test: 256 Hz

512 Hz

1024 Hz

Weber's test:

Absolute Bone Conduction test

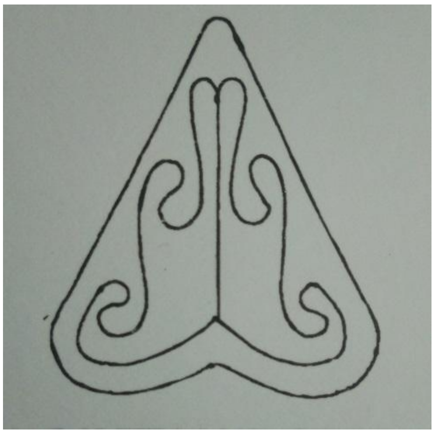
2. NOSE EXAMINATION:

External appearance

- Root
- Bridge
- Dorsum
- Alae
- Tip
- Columella

Cold spatula test

Anterior Rhinoscopy



Posterior Rhinoscopy

Paranasal Sinus Examination

	Right	Left
Frontal Sinus		
Ethmoidal Sinuses		
Maxillary Sinus		

3. **THROAT EXAMINATION:**

Oral cavity:

- Lips
- Labial and buccal mucosa
- Gingivolabial and gingivobuccal sulci
- Gingiva
- Teeth
- Hard palate
- Floor of mouth
- Anterior 2/3rd of tongue
- Retromolar trigone

Oropharynx:

- Soft palate
- Uvula
- Anterior pillar
- Tonsills
- Posterior pillar
- Posterior and lateral pharyngeal wall

Indirect Laryngoscopy

4. NECK EXAMINATION:

5. TARGETED TEST EVALUATION:

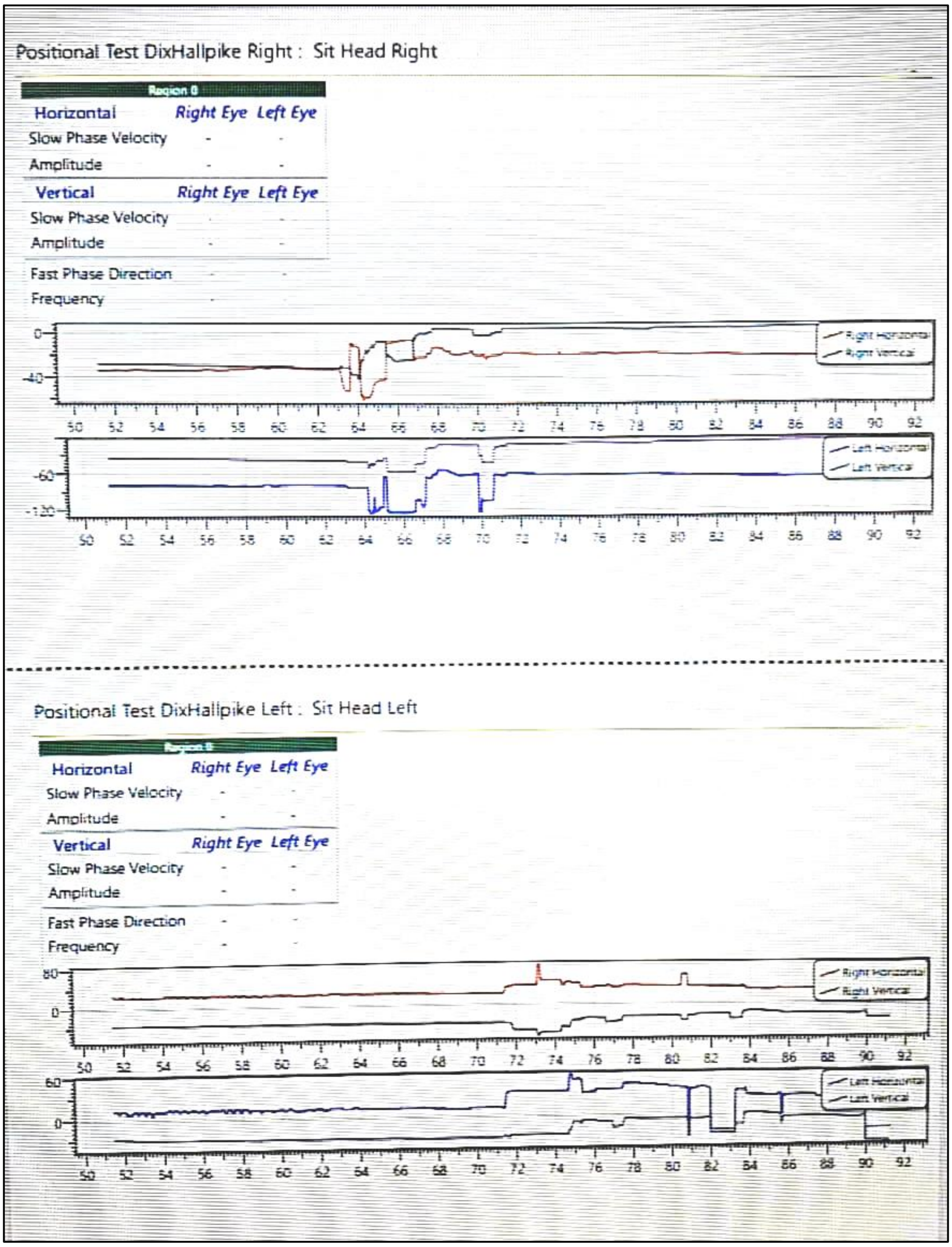
a) Diagnostic Dix Hallpike's Test:

b) Diagnosis:

c) Therapeutic Manoeuvre:

ANNEXURE- III

PHOTOGRAPHS



Graph of VNG during Dix- Hallpike manoeuvre

ANNEXURE – IV

KEY TO MASTER CHART

Age: in years

Sex: Male & Female

Dix Hallpike: Positive or Negative for nystagmus

Right and left side

VNG 1 : Dix Hallpike test done with VNG

Positive or Negative for nystagmus

Side: Right or Left or Bilateral

Diagnosis: Posterior Canal or Lateral Canal BPPV or other non BPPV causes

Therapeutic Manoeuvre

Epley's for BPPV

ANNEXURE-V

MASTER CHART

S NO.	I P NO. OF PATIENT	AGE	SEX	SIDE AFFECTED	WEIGHT	HEIGHT	BMI	DATE	NO. OF CYCLES OF EPLEY'S GIVEN
1	1144561	54	MALE	RIGHT	52 kg	154 cm	21.9 - NORMAL	25-05-2023	2
2	1144570	33	MALE	RIGHT	72 kg	173.7 cm	23.9 - NORMAL	03-06-2023	2
3	1144589	33	FEMALE	RIGHT	65 kg	161.5 cm	24.9 - NORMAL	28-06-2023	3
4	1144600	29	MALE	RIGHT	89 kg	173.7 cm	29.5 - OVERWEIGHT	02-08-2023	3
5	1144621	40	FEMALE	RIGHT	56 kg	161.5 cm	21.9 - NORMAL	05-08-2023	2
6	1144634	25	MALE	RIGHT	56 kg	173.7 cm	18.6 - NORMAL	09-08-2023	2
7	1144678	62	FEMALE	RIGHT	76 kg	161.5 cm	29.1 - OVERWEIGHT	18-08-2023	2
8	1144689	26	FEMALE	RIGHT	56 kg	164.5 cm	20.4 - NORMAL	24-08-2023	3
9	1144711	72	FEMALE	RIGHT	60 kg	164.5 cm	22.2 - NORMAL	24-08-2023	2
10	1144981	24	FEMALE	RIGHT	70 kg	158.4 cm	27.9 - OVERWEIGHT	25-08-2023	2
11	1145012	75	FEMALE	LEFT	50 kg	158.4 cm	19.9 - NORMAL	28-08-2023	3
12	1145023	50	FEMALE	RIGHT	44 kg	152.4 cm	18.9 - NORMAL	27-09-2023	3
13	1145035	19	FEMALE	LEFT	55 kg	161.5 cm	21.1- NORMAL	30-09-2023	4
14	1145043	32	FEMALE	RIGHT	63 kg	170.6 cm	21.6 - NORMAL	03-10-2023	3
15	1145058	25	MALE	RIGHT	71 kg	182.88 cm	21.2 - NORMAL	04-10-2023	2
16	1145120	69	FEMALE	LEFT	64 kg	161.5 cm	24.5 - NORMAL	07-10-2023	3
17	1145231	48	FEMALE	LEFT	50 kg	152.4 cm	21.5 - NORMAL	14-10-2023	3
18	1145327	26	FEMALE	RIGHT	52 kg	161.5 cm	19.9 - NORMAL	18-10-2023	3
19	1145661	67	MALE	RIGHT	96 kg	173.7 cm	31.8 - OBESE	22-11-2023	4
20	1145710	51	FEMALE	LEFT	65 kg	166 cm	23.6 - NORMAL	02-12-2023	2
21	1145772	41	FEMALE	RIGHT	45 kg	164.5 cm	16.7 - UNDERWEIGHT	11-12-2023	2
22	1145849	59	FEMALE	LEFT	50 kg	154 cm	21.2 - NORMAL	12-12-2023	3
23	1145883	53	MALE	RIGHT	80 kg	170 cm	27.7 - OVERWEIGHT	13-12-2023	4
24	1145936	37	FEMALE	LEFT	49 kg	152 cm	21.2 - NORMAL	20-12-2023	3
25	1146010	44	FEMALE	LEFT	60 kg	157 cm	24.3 - NORMAL	30-12-2023	4
26	1146134	37	FEMALE	RIGHT	48 kg	156 cm	19.7 - NORMAL	05-02-2024	3
27	1146240	68	MALE	LEFT	55 kg	160 cm	21.5 - NORMAL	05-02-2024	3
28	1146349	39	FEMALE	RIGHT	44 kg	158 cm	17.6 - UNDERWEIGHT	05-02-2024	3
29	1146444	60	FEMALE	LEFT	50 kg	154 cm	21.1 - NORMAL	08-02-2024	2
30	1146567	53	MALE	LEFT	63 kg	170.6 cm	21.6 - NORMAL	26-02-2024	2
31	1146672	65	FEMALE	RIGHT	48 kg	154 cm	20.2 - NORMAL	02-03-2024	3
32	1146771	25	FEMALE	RIGHT	50 kg	150 cm	22.2 - NORMAL	14-03-2024	2
33	1146782	30	FEMALE	LEFT	48 kg	152 cm	20.8 - NORMAL	14-03-2024	3
34	1146790	19	MALE	RIGHT	50 kg	154 cm	21.2 - NORMAL	28-03-2024	3
35	1146812	48	FEMALE	LEFT	50 kg	152 cm	21.6 - NORMAL	06-05-2024	3
36	1146825	43	FEMALE	LEFT	55 kg	158 cm	22 - NORMAL	06-05-2024	3
37	1146835	23	FEMALE	LEFT	44 kg	155 cm	18.3 - UNDERWEIGHT	08-05-2024	3
38	1146842	23	FEMALE	RIGHT	48 kg	152 cm	20.8 - NORMAL	08-05-2024	2
39	1146849	45	MALE	RIGHT	52 kg	156 cm	21.4 - NORMAL	25-05-2024	3

40	1146911	28	FEMALE	RIGHT	54 kg	154 cm	22.8 - NORMAL	25-05-2024	4
41	1146936	32	FEMALE	RIGHT	56 kg	156 cm	23 - NORMAL	25-05-2024	2
42	1146990	33	MALE	LEFT	60 kg	173 cm	20 - NORMAL	11-06-2024	3
43	1147121	51	MALE	RIGHT	52 kg	167 cm	18.6 - NORMAL	19-06-2024	2
44	1147231	36	MALE	RIGHT	49 kg	153 cm	20.9 - NORMAL	22-07-2024	3
45	1147335	31	FEMALE	RIGHT	70 kg	162 cm	19.1 - NORMAL	22-07-2024	2
46	1147348	41	FEMALE	LEFT	50 kg	150 cm	22.2 - NORMAL	22-07-2024	2
47	1147350	43	FEMALE	RIGHT	55 kg	151 cm	22.3 - NORMAL	23-07-2024	3
48	1148021	55	MALE	RIGHT	70 kg	160 cm	21.1 - NORMAL	23-07-2024	2