"STUDY OF THE EFFECT OF ANTERIOR NASAL PACKING ON MIDDLE EAR PRESSURE"

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LIST OF ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
BIPP	Bismuth Iodoform Paraffin Paste
ENT	Ear, Nose and Throat
HNS	Head and Neck Surgery
OPD	Out-Patient Department
TM	Tympanic membrane
TT	Tensor tympani
ICA	Internal carotid artery
M	Head of malleus
SCC	Superior semicircular canal
MC	Mandibular condyle
OT	Osseus eustachian tube
PAP	Petrous apex
V2	Maxillary division of trigeminal nerve
V3	Mandibular division of trigeminal nerve
COCH	Cochlea
FOV	Foramen Ovale
FRot	Foramen Rotundum
MMA	Middle Meningeal Artery

PB	Petrous Bone
SB	Sphenoid Bone
TMJ	Temporomandibular Joint
GF	Glenoid Fossa
MCF	Middle Cranial Fossa
LL	Lateral Cartilaginous Lumen
L	Luminal Gas
ML	Medial Cartilaginous Lamina
SD	Standard Deviation
Vea	External Ear Canal Volume
Ytm	Peak- Compensated Static Acoustic Admittance
ANSI	American National Standards Institute
Hz	Hertz
daPa	Decapascals

ABSTRACT

INTRODUCTION: Middle ear pressure changes may arise from various conditions including eustachian tube malfunction and middle ear pathologies such as otitis media with effusion leading to chronic otitis media. Eustachian tube dysfunctions are caused by nasal pathologies such as rhinosinusitis, nasal polyposis, etc. The study's objective is to evaluate the changes in middle ear pressure brought on by anterior nasal packing causing altered eustachian tube performance.

METHODS: 72 patients that are undergoing nasal surgery participated in this observational prospective study. All patients having normal impedance audiometry preoperatively were included and again assessed postoperatively twice, once with the pack in situ and once 6 hours after pack removal. All nasal packs were removed 24 hours following surgery.

RESULTS: The observations obtained were analysed and tabulated. All patients showed Type A impedance audiogram in both ears prior to their respective surgeries. A significant change was seen between preoperative impedance audiogram versus post-operative impedance audiogram with pack in situ with respect to the impact of middle ear pressure on anterior nasal packing in all ears on both sides. Significant change was seen in six patients between preoperative impedance audiogram versus postoperative impedance audiogram after pack removal in right ear while left ear showed no significant changes. A significant change was seen between post-operative impedance audiogram with pack in situ versus post-operative impedance audiogram after pack removal in both ears.

CONCLUSIONS: From the above-mentioned results, it is concluded that the middle ear pressure variations caused due to the anterior nasal pack were resolvable. It is also concluded that the period of 24 hours of placing the anterior nasal pack is safe and will not lead to chronic middle ear pathology even after pack removal.

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INTRODUCTION

Middle ear pressure changes may arise from various conditions including eustachian tube malfunction and middle ear pathologies. Recurrent middle ear infections, nasopharyngeal pathologies including adenoid hypertrophy, nasopharyngitis, chronic rhinosinusitis with or without nasal polyposis, chronic nasal obstruction, nasogastric tubes, intubation, anterior nasal packing and recurrent throat infections may lead to auditory tube malfunction leading to below zero middle ear pressure changes which will invariably cause further tympanic cavity diseases such as otitis media. One of the main purposes of the auditory tube is to equilibrate the tympanic cavity pressure to that of the barometric or atmospheric pressure and one of the most useful ways to analyse/ screen the tympanic cavity pressure for below zero pressure is tympanometry.[1]

Eustachian tube anatomy and functions:

The eustachian tube is also known as the auditory or pharyngotympanic tube and is divided into 2 parts, namely the bony and fibrocartilaginous part. Functions of the auditory tube includes aeration or ventilation of middle ear, protection against refluxes, organisms and drainage. The simultaneous sealing and unsealing of the auditory tube is done with the help of tensor palati muscle and this coordinated muscular coordination help is in simultaneous ventilation and drainage of the eustachian tube. [2, 3]

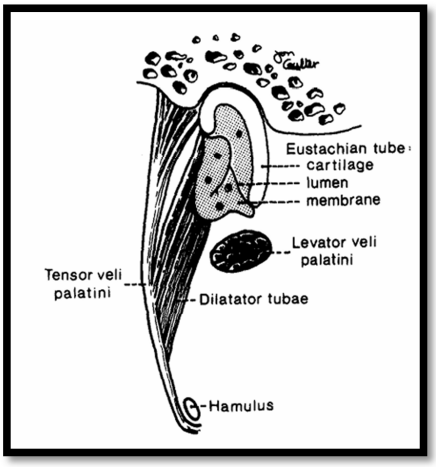


Fig 1- Image showing cross section of eustachian tube and its relation to tensor veli palatini muscle[2]

The Fig 1 describes the image of cross section of pharyngotympanic tube.[2] The pharyngotympanic opens and closes simultaneously with the help of the profound and superficial portions of the tensor palati muscle and this muscular coordination helps in the simultaneous ventilation and drainage of the pharyngotympanic tube as shown in Fig 2.[3]

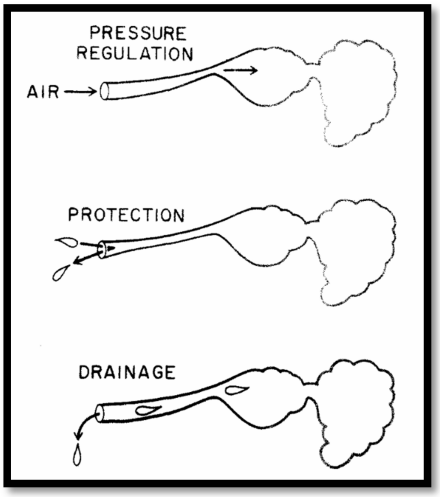


Fig 2- Image describing the primary purposes of auditory tube, namely, middle ear pressure equalization, defence of middle ear from ascending infections, drainage of secretions.[2]

The levator veli palatini muscle induces upward pull of the palate and causes medial rotation of the torus tubarius. Torus tubarius is considered a more stronger muscle as it provides a stable platform because of which tensor veli palatini muscle contracts causing unsealing of the auditory tube as shown in Fig 3.[3,4]

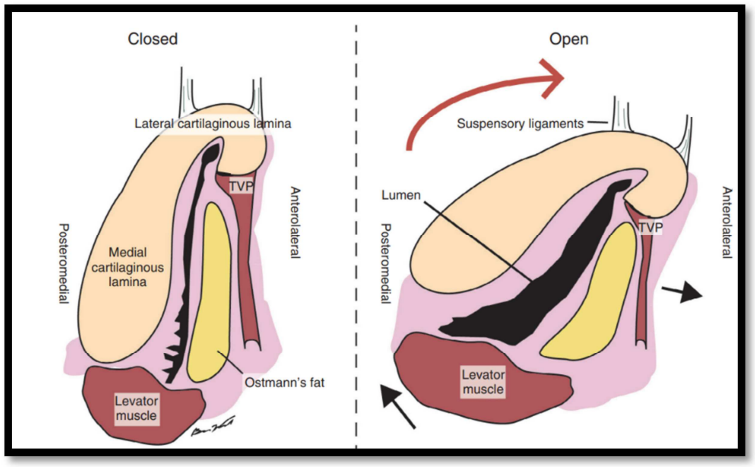


Fig 3 Image showing the sealing and unsealing of auditory tube showing the direction of action of muscles.[4]

Impedance Audiometry:

It is an objective screening test useful for measuring the middle ear function. The other functions involve assessing the mobility of the tympanic membrane, acoustic stapedial reflex done by brief pure tones.[3] It is expressed graphically with the variables being measured are the static compliance- reciprocal of stiffness of the middle ear along the vertical y- axis, peak pressure along the horizontal x- axis as shown in Fig 4.[1]

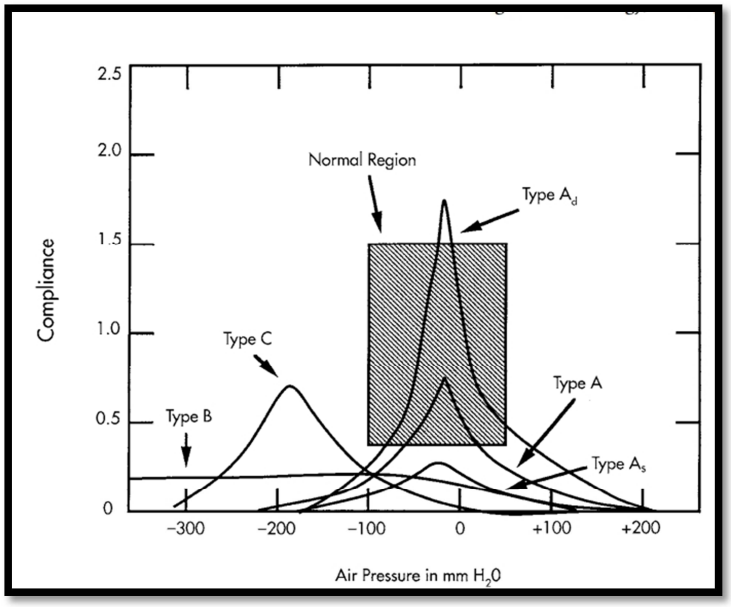


Fig 4: Types of impedance audiogram [1]

Interpretation of impedance audiometry results:

Type A: indicates a normal tympanogram with a normal middle ear function and represented as a large, inverted V on graph.

Type A_S: indicates stiffness of stapes and will give a graph like type A but shallower

Type A_D: seen in cases ossicular discontinuity where the compliance is increased, and the curve is unusually high or discontinuous indicating the flaccidity of the tympanic membrane.

Type B: This type being most seen in cases of middle ear effusions, will show no peak in compliance. The graph shows a flat pattern with no compliance peak.

Type C: seen in cases of eustachian tube dysfunction, there is a distinctive compliance peak but with the graph showing a leftward displacement as there is negative pressure less than -100 mm. H_2O.[1]

AIMS AND OBJECTIVES

To study the effects of anterior nasal packing on middle ear pressure and the safe time period to keep the anterior nasal pack in situ.

NEED FOR THE STUDY

This study aimed to measure the impact of nasal packing done anteriorly on tympanic cavity pressures and what time duration of nasal pack can result in reversible or irreversible middle ear dysfunction with the help of impedance audiogram. Long standing conditions that contribute to auditory tube dysfunction have shown to have tympanic cavity dysfunction and decreased quality of life. Anterior nasal packing is almost invariably required following most nasal surgeries, it is of utmost importance to be vigilant during the period a patient has anterior nasal pack in situ. Fig 5 shows an inflamed eustachian tube opening which could cause or act as a precursor for ascending infection to middle ear causing otitis media with effusion.[4]

Fig 5: Inflamed eustachian tube opening [4]

REVIEW OF LITERATURE

The Eustachian Tube:

The eustachian tube initially developed as a diverticulum from the foregut into a complex organ serving to the ventilatory needs of the tympanic cavity and mastoid along with the clearance. This necessitates as to how the health of the tympanic cavity and mastoid (which are gas filled cavities to aid in hearing) are maintained. Failure or dysfunction of this need will eventually lead to acute or chronic middle ear effusions.[5]

Anatomy:

It is 31-44 mm in adults with 45-degree axis to the skull and in children it is about half the length of adult auditory tube and more horizontally inclined. It is an osseocartilaginous structure with the cartilaginous portion being more flexible and collapsible and the latter being more rigid.[6] The osseous portion develops from the squamous and the petrous parts of temporal bone along with greater wing of sphenoid bone and is directed backwards, upwards and laterally to end in the anterior wall of middle ear (anterior mesotympanum).[7, 4] There is a shallow angulation between the bony and the cartilaginous parts. Thus, the eustachian tube is imagined as two conical structures fused together by a narrow ring called isthmus and is compared to a bellows. The cartilaginous part is directed forwards, downwards and medially and is actively opened with the help of tensor veli palatine muscle. The tensor tympani muscle, dilator tubae and the levator palitini develop from the mesenchyme of the first arch and form the muscles of mastication. [4]

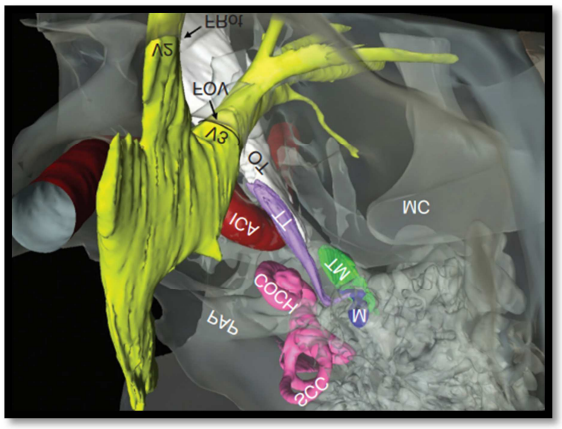


Fig 6: Superior view of left eustachian tube coursing through skull base (TM- tympanic membrane, TT- tensor tympani, ICA- internal carotid artery, M- head of malleus, SCC- superior semicircular canal, MC- mandibular condyle, OT- osseus eustachian tube, PAP- petrous apex, V2- second division of trigeminal nerve (maxillary), V3- third division of trigeminal nerve (mandibular)), COCH- cochlea, FOV- foramen ovale, FRot- foramen rotundum)[4]

The osseus part of the tube is related to many critical structures through its course in the skull base surrounded by the petrous bone as shown in Fig 6.

Relations: Inferiorly and laterally- glenoid fossa of temporomandibular joint

Superior- middle fossa dura

Medial- internal carotid system

The middle cranial fossa dura is situated 3.6 mm on average from the lumen of the tube. The anterior carotid portion and the posterior labyrinthine portion make up the tube's medial wall. A thin layer of bone covers the petrous carotid artery's horizontal section. In 2% of typical adult specimens, this bone has been discovered to be dehiscent, while in 22.2%, it has been shown to be abnormally thin. The margin of the torus tubarius anteriorly and the margin closest to the internal carotid system were

found to be separated by an average of 23.5mm, with considerably smaller distances observed in patients with abnormal carotid arteries. [4]

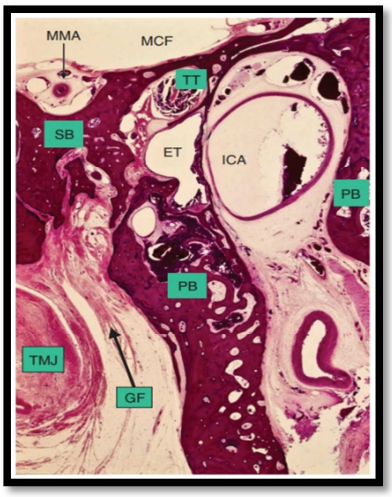


Fig 7: Photomicrograph of the osseous part of the eustachian tube (MMA- middle meningeal artery, PB- petrous bone, TT- tensor tympani, ICA- internal carotid artery, SB- sphenoid bone, TMJ- temporomandibular joint, GF- glenoid fossa, MCF- middle cranial fossa)[4]

The cartilaginous part of the tube reflects the subtleties of its function. When seen from the side, it is made up of two separate rhomboidal plates: the apical hinge area connects the large medial lamina with the relatively smaller lateral lamina. The cartilage has a maximum transverse diameter of 9 mm. The fibrocartilage has a characteristic “crook” structure when viewed from the nasopharynx, with the longer arm situated medially. A layer of respiratory mucosa covers its protrusion into the nasopharynx, which is clearly visible on nasopharyngoscopy as the torus tubarius. Even though fibrocartilage makes up the majority of the laminae, the hinge region has a large amount of elastic cartilage to enable effective tubal opening.[4]

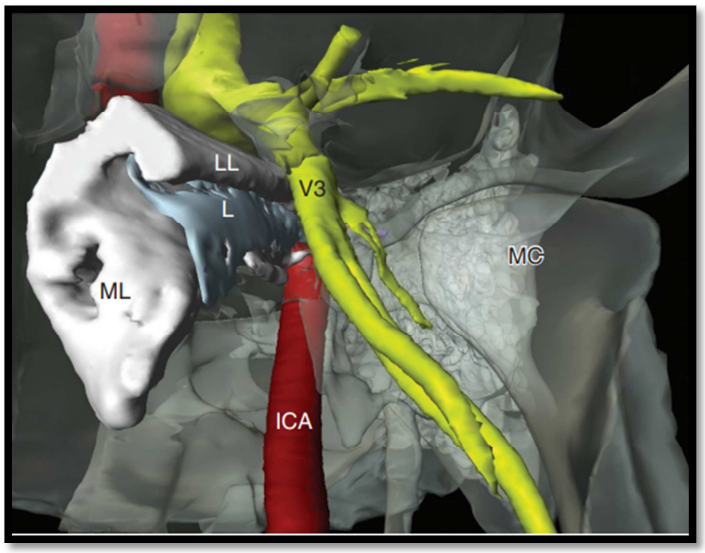


Fig 8: Anterior view of the chondrogenic part of the auditory tube (LL- lateral cartilaginous lamina, ICA- internal carotid system, L- luminal gas, MC- condyle of mandible, ML- medial cartilaginous lamina, V3-third division of trigeminal nerve(mandibular))[4]

Gas exchange from nasopharynx to middle ear:

Gas flows from one chamber to another depending on the pressure differences in each chamber. However, here the ventilation of middle ear does not depend on the partial pressures of each gas.

The air passing through the eustachian tube

⇩

Hindered at the isthmus

⇩

Some air finally passes the isthmus

⇩

Reaches the middle ear

⇩

The quantity of air that reaches the tympanic cavity through the isthmus

⇩

Function of the pressure difference between the middle ear and epipharynx.

For only about 1000 times in a day, the eustachian tube opens during activities like yawning, swallowing or movements of the jaw every 1-2 minutes. The difference in pressure between the tympanic cavity and nasopharynx is maintained by a small loss of gas (1-2 microliters) into the middle ear circulation. Different mixture components of the gases and their partial pressures in the middle ear, atmosphere and venous circulation is shown in Fig 9.[4]

Since the passage of air through the auditory tube is not a passive process, when there is even a loss of 1-2 microlitre, a negative pressure of 1-2 mm H_2O in the tympanic cavity. Because of the narrow isthmus, the velocity of air is high indicating that much time is not required for the air to pass through. This indicates that there is an active air gradient at work rather than a passive movement. This is also further assisted by the contraction of the levator palatini muscle.[7]

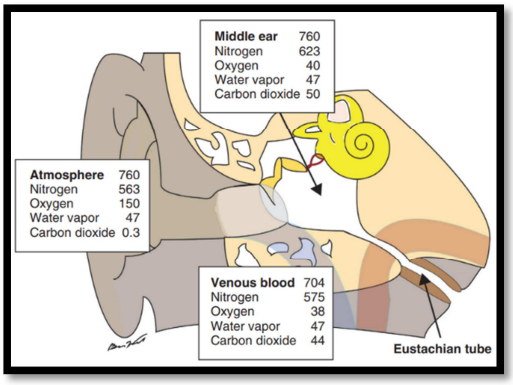
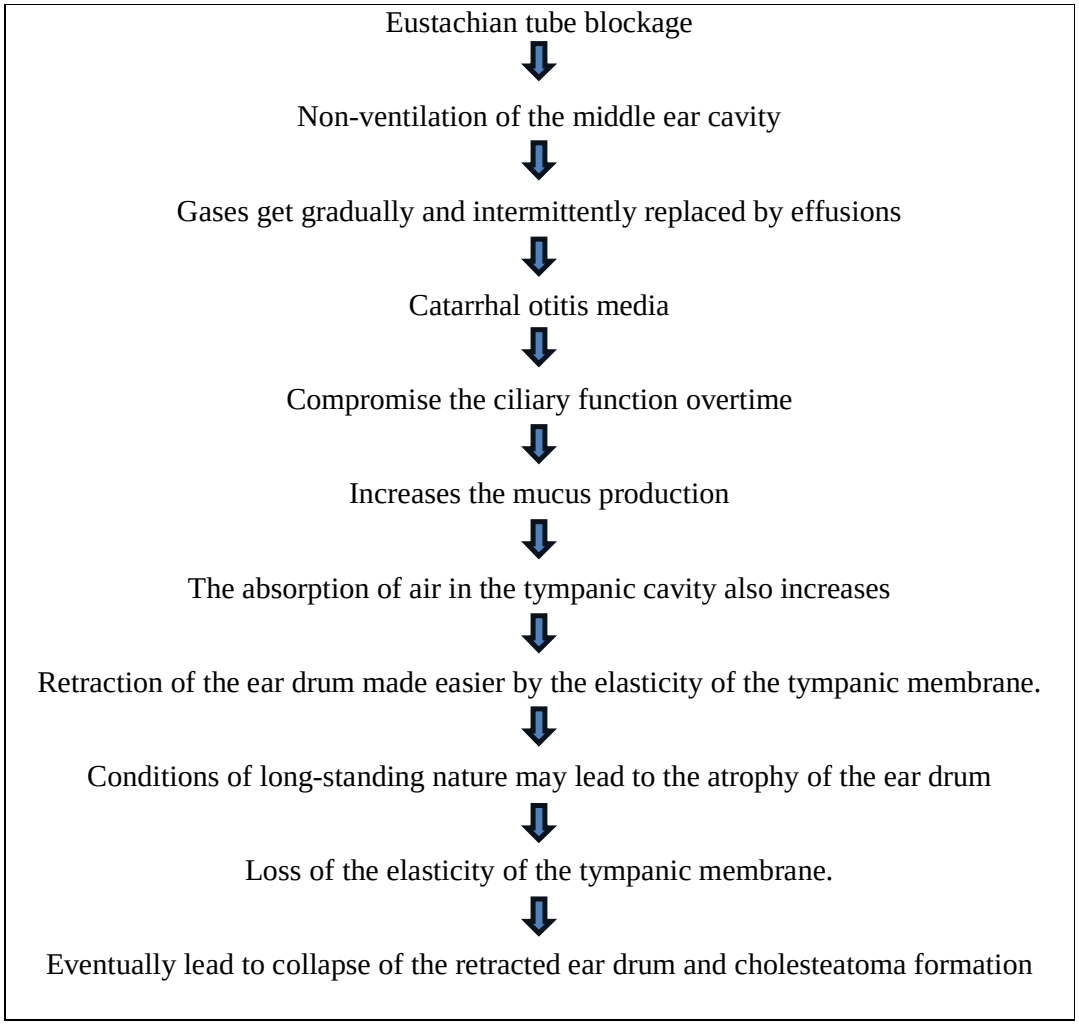


Fig 9: Comparison of partial pressures of gaseous contents in the atmosphere, middle ear and in venous circulation.[4]

Dysfunction of auditory tube:

Functional impairment of auditory tube that may or may not lead to detectable middle ear diseases is known as eustachian tube dysfunction. It may be acute or chronic. Aetiology includes allergic rhinitis with mucosal hyperplasia, adenoid hypertrophy, nasopharyngeal tumours, nasopharyngeal acid reflux, nasopharyngitis,

constant and recurrent sniffing, eustachian tube blockage by nasal packing hindering ventilation and clearance, chronic rhinosinusitis, scarring or adhesions in the nasopharynx, posteriorly deviated nasal septum, stenosis of auditory tube, cleft palate or palatal muscle palsy.[7, 8]



This atrophy of tympanic membrane is caused by the enzymes that are produced by the persistent effusion, that include collagenase resulting in the polymerization of the middle and fibrous layers of the tympanic membrane. Thus, the duration of conditions that result in eustachian tube dysfunction plays a crucial factor for the non- development of the middle ear disease sequalae.[8]

Fig 10: Otitis media with effusion with air bubbles noted on tympanic membrane. [8]

Symptoms of eustachian tube dysfunction:

A cracking sound heard on yawning or opening the mouth, feeling of aural fullness, pain- a common complaint in children, tinnitus (pulsatile or continuous) are some of the common symptoms of eustachian catarrh. Although, the condition may proceed to cause vertigo in some patients. Other common symptom is autophony causing one to hearing one's own voice.[8, 9]

Nasal packing:

Nasal packings may anterior or posterior depending on the need for packings. Anterior nasal packings are placed extending from anterior to posterior nares and are usually done following epistaxis from Little's area, following nasal surgeries like septoplasty, submucous resection (SMR) and functional endoscopic sinus surgery (FESS).

For centuries, anterior nasal packing has been commonly practised for anterior epistaxis. Earlier BIPP (Bismuth Iodoform Paraffin Paste) soaked ribbon gauze was layered throughout the entire nasal cavity was placed for a duration ranging from 24-72 hours.[5]

Rutherford Morrison first introduced BIPP in 1916, for dressing wounds of soldiers. But nowadays, BIPP is largely not used for the purposes of nasal packing due to the many side effects it causes. The side effects ranges from type IV hypersensitivity reactions to eye, skin or gastric irritations to renal and neurotoxicity.[10] Fig11 shows the image of a ribbon gauze soaked in BIPP. A normal ribbon gauze soaked in clobetasol ointment with antibiotic like gentamycin or soframycin ointment are used as alternatives.

Newer techniques and materials are used nowadays for nasal packing including Merocel and Kaltostat packs also known as calcium alginate pack (shown in Fig 12) which acts like a tampon and these packs are now preferred due to the longer duration for which these can be kept. Balloon catheters may also be used to tamponade the nasal bleeding or to provide structure, although it has no advantage more than the Merocel nasal pack. Balloon catheter is shown in Fig 13. Care must also be taken to prevent over inflation of the balloon, as that might lead to prolapse of balloon or may cause pressure necrosis at the ala. [5, 11]

Fig11: BIPP soaked ribbon gauze

Fig 12: Kaltostat nasal pack

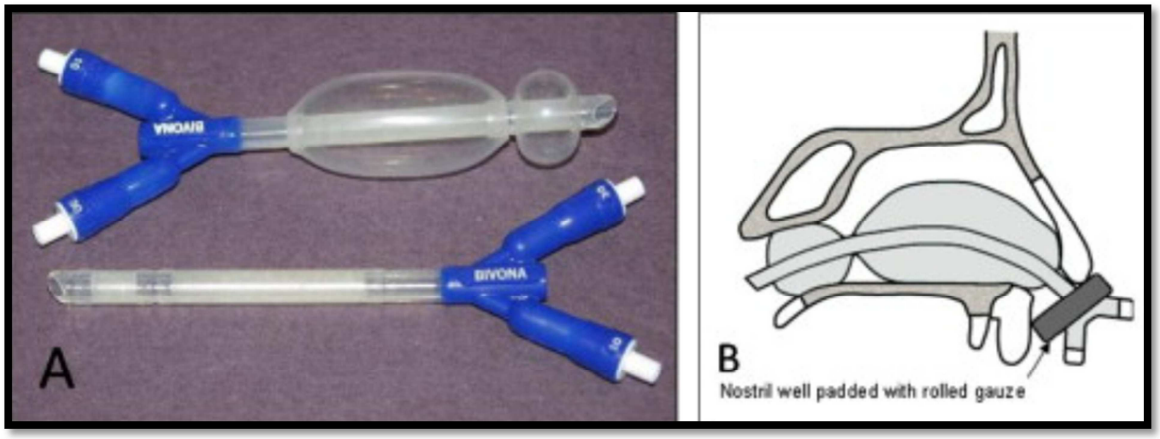


Fig 13: Image shows balloon nasal catheter used for nasal packing in epistaxis. Image A shows inflated and deflated balloon and image B shows the inflated balloon catheter in nasal cavity.[12]

Complications of anterior nasal packing include sinusitis due to inadequate ventilation of sinuses, pressure necrosis causing alar and septal perforations. Sometimes although, it may lead to hypoxia and myocardial infarction.[5]

IMPEDANCE AUDIOMETRY:

It is an objective screening test useful for measuring the function of middle ear. The other functions involves assessment of the mobility of the tympanic membrane done by brief pure tones.[3] The test is conducted by periodically increasing or decreasing the external acoustic meatus pressure and the tympanic cavity impedance is measured.

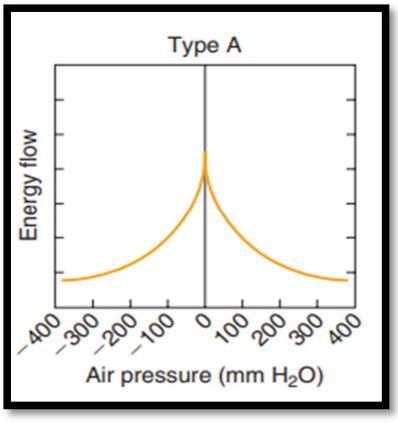


Fig 14- Normal A type curve of impedance audiogram.[4]

The tympanic membrane will change its resting position with respect to the rise or fall of pressure in the tympanic cavity and this is the basic understanding of impedance audiometry.[13] It is expressed graphically with the variables being measured are the static compliance- reciprocal of stiffness of the middle ear along the y- axis, peak pressure along the x- axis. The result was described by James Jerger in 1970 and is still widely accepted and used in clinical practice. The normal impedance audiogram is shown in Fig 14 and is a Type A graph where air pressure is measured along x- axis and energy flow is measured along y- axis.[14, 4]

Impedance audiogram machine measures the acoustic admittance of the tympanic cavity. The atmospheric pressure changes are compared to middle ear pressure changes that occur in various conditions by this objective, physiologic test. When the pressure varies from positive to negative, the tympanic membrane and the ossicles stiffen to cause graphical changes which indicate reduced admittance of the pressure into middle ear. [15]

This objective test is carried out by completely shutting close the patients' external acoustic meatus with a probe that fits the canal meatus snuggly, and the probe contains 3 tubes. Hence, a closed chamber is formed within the external acoustic meatus against the ear drum medially. [13] Impedance audiometry is carried out by applying air pressure equivalent to +200 daPa to the tympanic membrane, measuring its compliance, and then taking repeated compliance readings as the canal's pressure drops. Once the pressure drops to 0 daPa, the pump provides negative pressure, then further compliance measurements are made. Finding the tympanic membrane's position and magnitude of maximum compliance is the aim of impedance audiometry.[8]

History of tympanometry:

Scott-Nielson and Terkildson invented an electroacoustic device that measured the admittance of various sound pressures into a sealed ear canal.

1959- first commercially available acoustic immittance device that used 220 Hz pure tone probe by Terkildson and Thomsen, the Madsen ZO61.

1963- the Madsen ZO70 was widely accepted and used but did not have the phase adjustments and produced inferences based on compliance units.

1973- introduced otoadmittance meter, Grason Stadler Model, which was the first tympanometry machine that had multifrequency and multicomponent subcomponents. There was provision to test with frequencies ranging from 220 Hz to 1000 Hz.

1987- the first ANSI (American National Standards Institute) set of guidelines were accepted for tympanometry for easy reporting across clinics.

Manufacturers started adhering to the ANSI (1987) standard, which recommended that immittance devices give calibrated physical units of measurement as opposed to arbitrary units of compliance. Since then, virtually all immittance equipment have been calibrated admittance meters. Tympanograms are best analysed quantitatively, particularly when evaluating infants and children, for whom distinct age-based normative values are required. Impedance audiometry forms judgment giving a general idea, but three fundamental tympanometric measurements are needed to differentiate between normal and abnormal tympanometry.

(i) External ear canal volume (Vea),

(ii) Peak- compensated static acoustic admittance (Ytm),

(iii)Tympanogram peak pressure [15, 16]

Stapedial reflex is also measured by tympanometry- reflex contraction of stapedius muscles loud sounds.

Working of impedance machine:

Figure 15 explains the working mechanism of a day-to-day impedance machine. When the pressure on either sides of ear drum is equal, the tympanic membrane vibrates most effectively. This assertion is fundamental to impedance audiogram comprehension. When the tympanic membrane gets displaced from its resting position, the compliance decreases, meaning the efficiency with which the membrane vibrates decreases.[8]

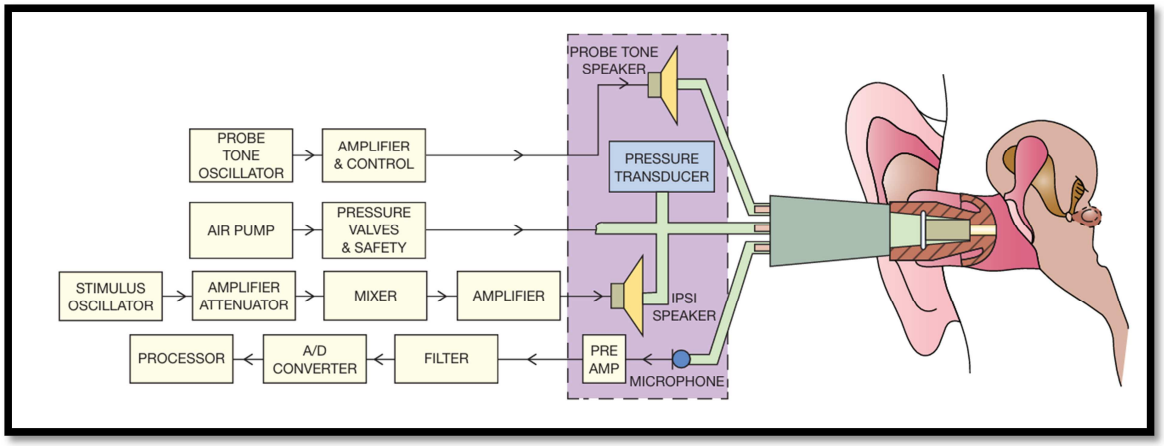


Fig 15: Diagram of impedance machine with its main components: a speaker, a microphone and an air-pressure pump[8]

Abnormal impedance audiograms and the conditions causing it:

The impedance audiometry, as mentioned earlier, in addition to being responsible for measuring the middle ear pressure, it also assesses the structure of tympanic membrane, the status of the ossicular chain (discontinuity or fixity). It also gives data regarding eustachian tube functioning, as the main function the auditory tube is to aerate the tympanic cavity. Reflected in the impedance audiometry graph as shown in Fig 14.

Type A_D is a variation of Type A graph, implying increased compliance. Increased compliance indicates a thinned out or an atrophic tympanic membrane which may be too sensitive to pressure changes or ossicular discontinuity which causes increased deflections of the tympanic membrane from its resting position even to mild changes in pressure.

Type A_S, also being a variation of Type A, is different from the A_D type, in which the peak pressure remains at 0 daPa, although the amplitude is low. This indicates a decreased compliance, or a resistance caused by fixation of ossicles, stapes footplate otosclerosis.

Type B graph shows no points of maximum compliance and is a flat graph, indicating that there is fluid collection in the middle ear as in otitis media with effusion.

Type B may also be seen in perforations of tympanic membrane and any mass in the middle ear cavity.[4]

A study was done by K Pragadeeswaran et al, in 2020, aimed to assess the safe duration of having anterior nasal pack following nasal surgeries, on 63 patients who underwent nasal surgeries and subsequent anterior nasal packing post operatively. From the impedance audiometry values obtained, it was inferred that middle ear dysfunction was caused by anterior nasal packing and it was mild and transient. They also concluded that 24 hours of nasal packing was safe. [9]

Similarly, in another study conducted by Per Bonding and Mirko Tos in 2009, to assess the middle ear pressure variations while transient and non-severe pathologies of nose and throat. Their study involving 75 patients with infectious mononucleosis, unilateral or bilateral anterior or posterior nasal packing and status post tonsillectomy

had serial assessments of impedance audiometry and in all cases, their tympanic cavity pressures returned to normal in 2 to 4 weeks' time and all patients changes were transient. [13]

In a study, the impact of anterior nasal packings on tympanic cavity pressures by Jorn Johannessen et al in 2009, was done in 27 patients who underwent septoplasty or rhinoplasty. Results showed significant difference between the middle ear pressures prior to surgery and with pack in situ but not much difference was noted after pack removal to the middle ear pressures before surgery. This showed temporary and mild tympanic cavity pressure variations caused by anterior bilateral packings of nasal cavity.[14]

Similar study conducted by Murat Sereflican et al, in 2015, in Turkey, "Is middle ear pressure effected by nasal packings after septoplasty", studied the different effects on middle ear pressure by different types of nasal packings (Merocel and nasal splint) in 60 with equal number in each group. The impedance audiometry values compared between both groups They concluded that silicone cannulated intranasal splints were better for eustachian tube function and patient comfort.[17]

63 patients were taken as sample for a study done by A C Thompson et al in Glasgow, in 1991, to assess the effects of nasal packing on auditory tube function. All patients underwent nasal septal surgeries (submucous resection or septoplasty) followed by bilateral anterior nasal packings. Impedance was measured for all patients pre- and postoperatively, to measure the effects on middle ear pressure. They concluded that middle ear pressure variations were produced by nasal packings but were mild and temporary, deeming 24 hours of nasal packing safe.[18]

MATERIALS AND METHODS

STUDY OBJECTIVE: To study the effects of anterior nasal packing on middle ear pressure and the safe time period to keep the anterior nasal pack in situ.

STUDY DESIGN: Observational prospective study.

SOURCE OF DATA: All patients who were admitted in the department of ENT and HNS in KLES Dr. Prabhakar Kore Charitable Hospital, Belgaum, planned for any nasal surgeries requiring bilateral anterior nasal packing post operatively.

STUDY PERIOD: 1 year (The study group was recorded from June 2023 to July 2024).

SAMPLE SIZE: A total number of 72 sample size was taken.

SAMPLING TECHNIQUE:

$$n = \frac{[Z_{1-\alpha/2}]^2 \times [SD]}{[23\% \text{ of } SD]^2}$$

$$= \frac{(1.90)^2 \times (SD)^2}{[23\% \text{ of } SD]^2}$$

$$= \frac{(1.90)^2 \times (SD)^2}{(23\%)^2}$$

Where $Z_{1-\alpha/2} = 1.96$ at 95% confidence interval

INCLUSION CRITERIA:

- Any patient that undergoes any nasal surgery resulting in anterior nasal packing post operatively with normal tympanic membrane with otoscopic examination and normal impedance audiogram bilaterally
- Age 18-60 years

EXCLUSION CRITERIA:

- Any patient with abnormal impedance audiogram, patients with middle ear or labyrinthine pathologies, any patients with systemic diseases, upper respiratory tract infections or active infections
- Patients below the age of 18 years and above 60 years

DATA COLLECTION PROCEDURE:

- The patients visiting the ENT and HNS OPD with complaints of bilateral nasal obstruction, external deformity of nose, active or inactive epistaxis were examined, and a detailed history and examination was done.
- After a clinical diagnosis is made, patients were explained in their own vernacular language about the condition and were counselled for respective surgical modality requiring bilateral nasal packing post operatively.
- They were also counselled in their own vernacular language about serial impedance audiometric assessment of their middle ear pressure during their hospital stay.
- Middle ear pressures were assessed using impedance audiometry preoperatively once, once with anterior nasal pack within postoperatively and once after pack removal done after 24 hours of surgery.
- Impedance audiometry was done 6 hours after packing and 6 hours after pack removal which was done 24 hours after surgery.

STATISTICAL ANALYSIS:

The preoperative and the postoperative impedance audiogram results were collected and recorded in a masterchart. The analysis was done using Mc Nemar test and Cochrane Q test comparing both left and right ears preoperatively,

postoperatively 6 hours following nasal packing and 6 hours following pack removal which is done 24 hours following surgery.

STUDY PROTOCOL:

All patients undergoing any nasal surgery requiring anterior nasal packing postoperatively in KLEs Dr. Prabhakar Kore Hospital & Medical Research Centre, Belagavi. After taking informed consent from the patient, their details and matching of the inclusion and exclusion criteria, selected for study.

Nasal packing:

Fig 16 shows an image of normal anterior nasal packing done in a patient with normal ribbon gauze soaked with clobetasol ointment and Fig 17 shows image of Merocel packs placed after surgery on table.

Fig 16: Normal ribbon gauze nasal pack

Fig 17: Merocel nasal packs in situ[18]

In this study, normal ribbon gauze soaked with clobetasol ointment were used for anterior nasal packing every patient and the results were collected by serial impedance audiograms.

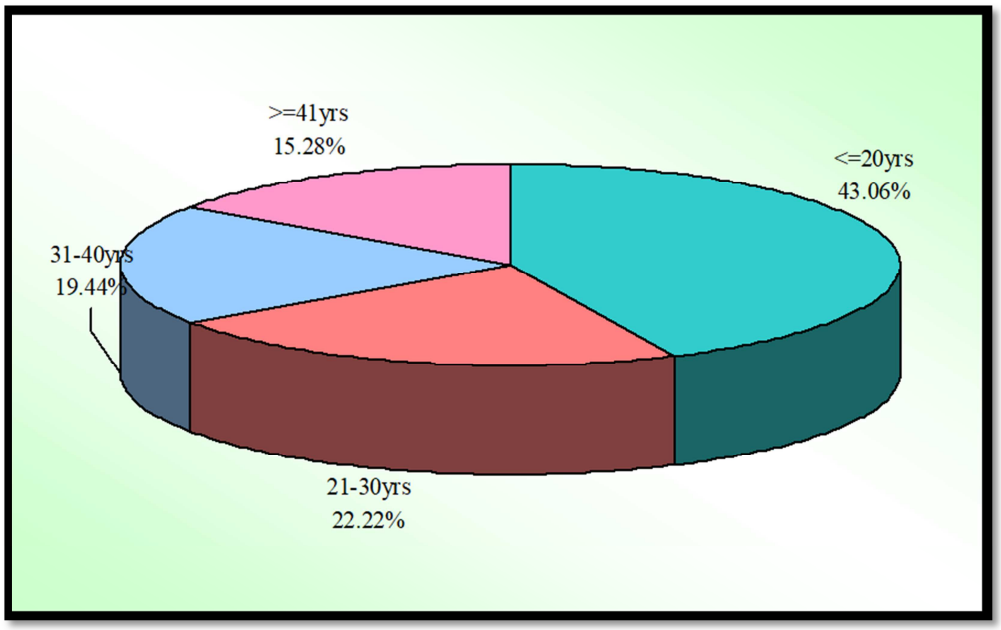
RESULTS

A total of 72 patients requiring nasal surgeries and postoperative anterior nasal packing were included in the study.

(I) DEMOGRAPHIC ANALYSIS:

1. Age wise distribution:

The age wise distribution of the collected samples is shown in the pie chart below in Graph 1 and in table 1 below.



Graph 1: Pie chart showing age demography among 72 samples

Table 1: Age demography of patients

Age groups	Number of patients	% of patients
<=20yrs	31	43.06
21-30yrs	16	22.22
31-40yrs	14	19.44
>=41yrs	11	15.28
Total	72	100.00
Mean	27.88	
SD	11.62	

The age distribution among patients showed that most of the patients fell into more than or equal to 20 years category having 31 patients (43.06 %). Only 11 patients were found to fall in the age group more than or equal to 41 years (15.28 %). Mean distribution was found to be 27.88.

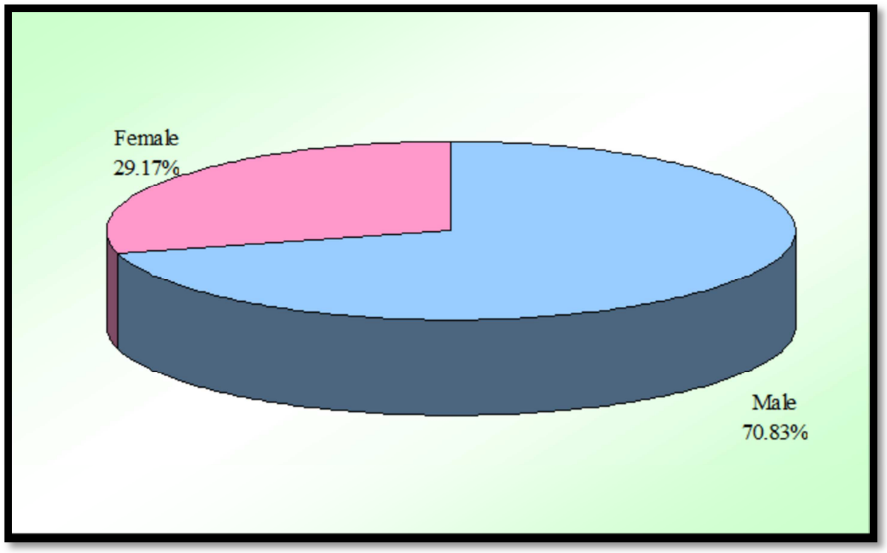
From the results obtained, it is inferred that, 43.06 % of patients were more than or equal to 20 years of age.

2. Gender wise distribution:

Table 2 and graph 2 shows the gender wise distribution among the sample size of 72 patients where in 70.83 % (51 patients) were males and 29.17 % (21 patients) were females.

Table 2: Table showing the gender wise distribution among samples

Gender	Number of patients	% of patients
Male	51	70.83
Female	21	29.17
Total	72	100.00



Graph 2: Pie chart showing gender wise distribution among samples

More male preponderance for nasal diseases is implied from the above obtained results.

3. Age and gender wise distribution:

Table 3 and graph 3A, graph 3B show the age and gender wise distribution in the collected sample.

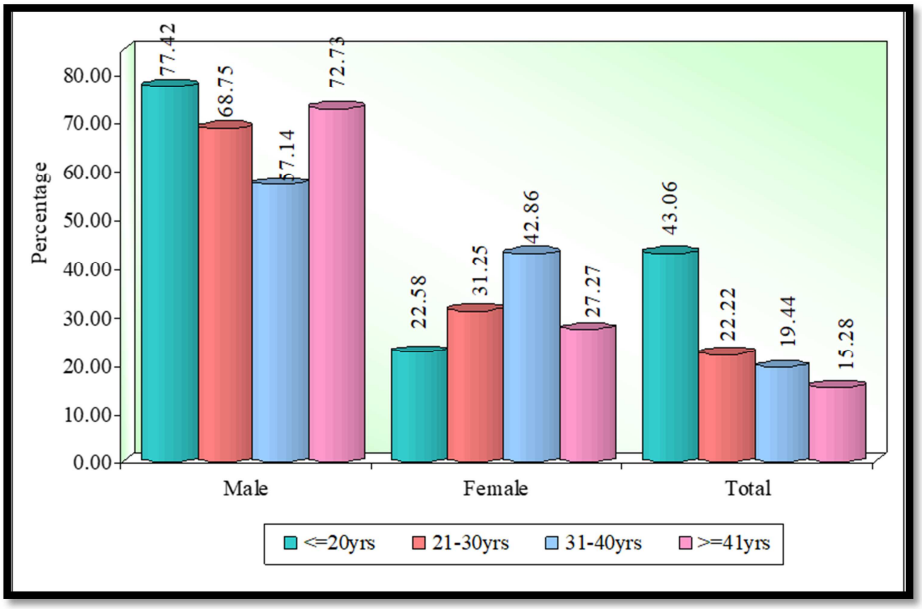
Among summative of 51 male patients, 77.42 % (24 patients) fall into the age group of less than or equal to 20 years, 68.75 % (11 patients) fall into the category of 21-30 years age group, 57.14 % (8 patients) fall into 31-40 years category and 72.73 % (8 patients) fall into more than or equal to 41 years age group.

Among 21 female patients, 22.58 % (7 patients) fall into less than or equal to 20 years age category, 31.25 % (5 patients) fall into 21-30 years of age category, 42.86 % (6 patients) fall into 31-40 years of age group and 27.27 % (3 patients) fall into more than or equal to 41 years age group.

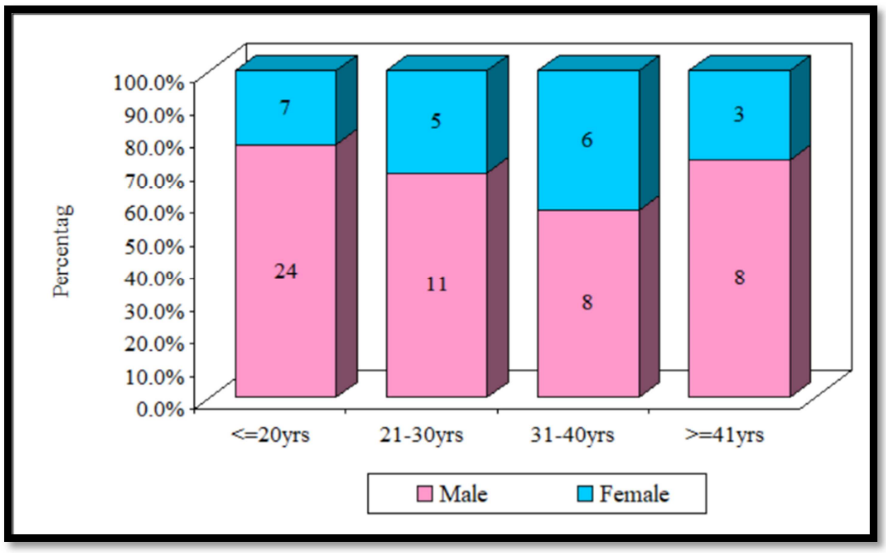
A total of 31 patients (43.06 %) fall into less than or equal to 20 years age group, 16 patients (22.22 %) in 21-30 years age group, 14 patients (19.44 %) in 31-40 years of age group and 11 patients (15.28 %) fall into more than or equal to 41 years category.

Table 3: Table showing the age and gender wise distribution among samples

Age groups	Male	%	Female	%	Total	%
<=20yrs	24	77.42	7	22.58	31	43.06
21-30yrs	11	68.75	5	31.25	16	22.22
31-40yrs	8	57.14	6	42.86	14	19.44
>=41yrs	8	72.73	3	27.27	11	15.28
Total	51	70.83	21	29.17	72	100.00
Mean	27.35		29.14		27.88	
SD	11.98		10.88		11.62	



Graph 3A: Histogram showing the gender of patients by age group



Graph 3B: Bar diagram showing the gender of patients by age group

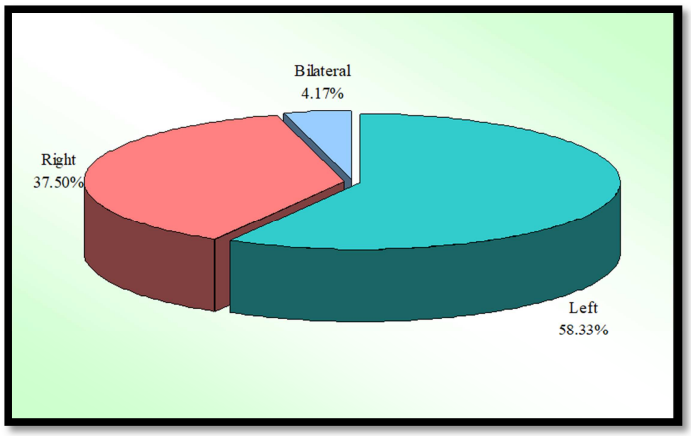
Most patients in more than or equal to 20 years category were males, and more females were found in 21-30 years age group. On comparison, both males and females showed opting for surgeries in the younger age groups in comparison to older age group categories.

(II) AFFECTED NASAL SIDE WISE DISTRIBUTION OF PATIENTS:

Table 4 and graph 4 shows the affected side wise distribution among the samples. 58.33 % of patients had left nasal cavity pathology and 37.50 % of patients had right nasal complaints. 4.17% of patients had bilateral nasal complaints.

Table 4: Table showing the affected side wise distribution of patients.

Affected side	Number of patients	% of patients
Left	42	58.33
Right	27	37.50
Bilateral	3	4.17
Total	72	100.00



Graph 4: Pie chart showing affected nasal side wise distribution

Most commonly left side was affected more than right side. Deviated nasal septum is more commonly affected on the left side.[5] This result is consistent with left side being more commonly affected side in study subjects.

(II) COMPARISON OF PREOPERATIVE AND POSTOPERATIVE IMPEDANCE AUDIOGRAM EFFECT OF ANTERIOR NASAL PACKING ON MIDDLE EAR PRESSURE:

1. RIGHT EAR:

Using Cochran Q test, comparison was made between the preoperative and postoperative impedance audiometry values of right ear, and it is shown in table 5.

The table shows all 72 patients (100 %) had preoperative type A impedance audiogram (and hence included for the study). Postoperatively, 2 values were taken, once with nasal pack within and once after the pack was removed after 24 hours.

With pack in situ, right ear impedance audN iogram showed Type C graph in 61 patients (84.72 %) and Type A graph in 11 patients (15.28%).

On pack removal, impedance audiometry was repeated and 6 patients (8.33 %) showed Type C and 66 patients (91.67 %) reverted to Type A. Graph 5 shows the right ear preoperative and post operative impedance audiogram comparisons.

Table 5: Table showing comparison of preoperative impedance audiogram and postoperative impedance audiometry values of right ear

Right ear	Type A	%	Type C	%
Preoperative impedance audiogram	72	100.00	0	0.00
Post operative impedance audiogram with pack within	11	15.28	61	84.72
Post operative impedance audiogram after pack removal	66	91.67	6	8.33
Cochran Q	111.1803			
P- value	0.0001*			

*p <0.05

Figure 18 A and 18 B shows the tympanometry graph of one of the subjects of the study with the anterior nasal pack within and after nasal pack removal in right ear respectively.

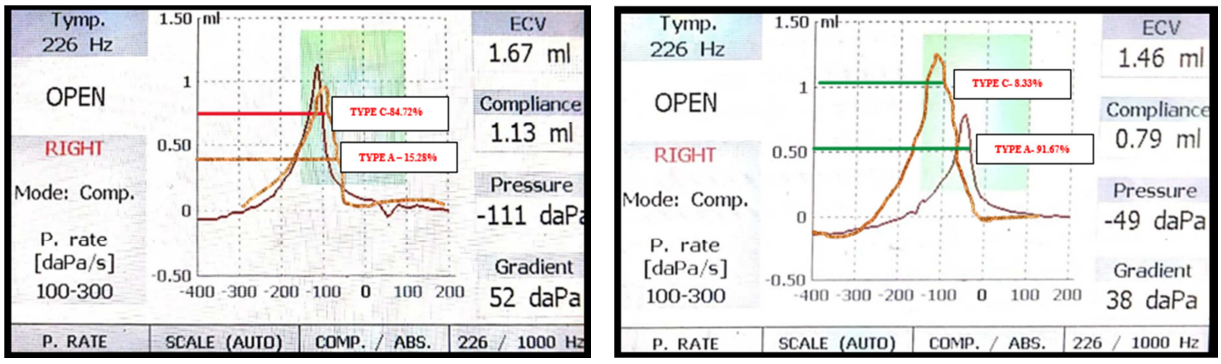


Fig 18A: Impedance audiogram of right ear postoperatively with nasal pack in situ showing Type C graph seen in 84.72 % patients. Fig 18B Impedance audiogram graph of the same ear 6 hours following nasal pack removal after pack removal for 24 hours of surgery showing normal Type A graph in 91.67%

Type C graph indicates middle ear dysfunction, and the graph has a distinctive peak with a left ward displacement of graph with a negative pressure of -111 daPa. The repeat tympanometry was done 6 hours after nasal pack removal (done 24 hours after surgery) and the same patient reported to have a reversal of Type C graph to Type A with peak pressure being -49 daPa.

A significant change was observed between preoperative and both post operative impedance audiograms with respect to the impact of anterior nasal packing on tympanic cavity pressure at right ear (Cochran Q= 111.1803, p=0.0001).

Further, the pair wise comparison was done by using Mc Nemar test. the results are shown in the following table 6.

Table 6: Pair wise comparison of preoperative impedance audiogram and postoperative impedance audiogram impact of anterior nasal packing on middle ear pressure at right ear by Mc Nemar test

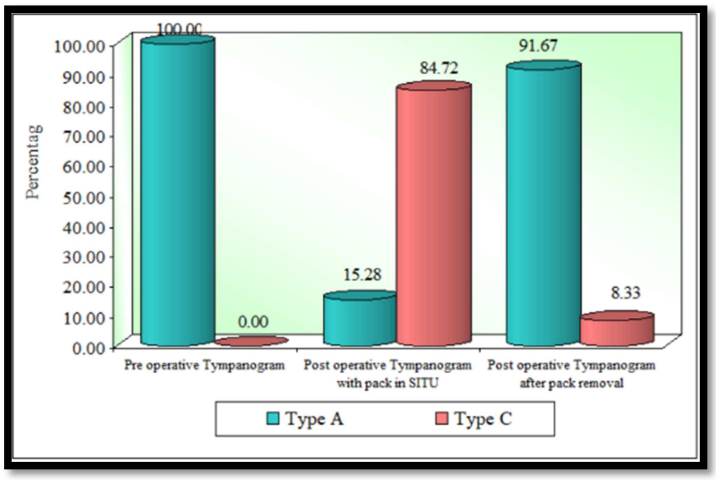
Right ear	p-value
Preoperative impedance audiogram vs post operative impedance audiogram with pack within	0.0001*
Preoperative impedance audiogram vs post operative impedance audiogram after pack removal	0.0310*
Post operative with pack within vs post operative impedance audiogram after pack removal	0.0001*

*p <0.05

- A significant change was seen between preoperative impedance audiogram vs post operative impedance audiogram with pack within for the impact of anterior nasal packing on tympanic cavity pressure at right ear (p=0.0001)

- A significant change was seen between preoperative vs post operative impedance audiogram after pack removal in impact of anterior nasal packing on tympanic cavity pressure at right ear (p=0.0310)

- A significant change was seen between post operative impedance audiogram with pack in situ vs post operative impedance audiogram after pack removal in impact of anterior nasal packing on tympanic cavity pressure at right ear (p=0.0001).



Graph 5: Comparison of preoperative and post operative Impedance audiogram effect of anterior nasal packing on middle ear pressure at right ear

2. LEFT EAR:

Using Cochran Q test, comparison was made between the preoperative and postoperative impedance audiometry values of left ear and it is shown in table 7.

The table shows all 72 patients (100 %) had preoperative type A impedance audiogram (and hence included for the study). Postoperatively, 2 values were taken, once with nasal pack in situ and once after the pack was removed after 24 hours.

With pack in situ, left ear impedance audiogram showed Type C graph in 63 patients (87.50 %) and Type A graph in 9 patients (12.50%).

On pack removal, impedance audiogram was repeated and 5 patients (6.94 %) showed Type C and 67 patients (93.06 %) reverted to Type A. Graph 6 shows the left ear preoperative and post operative impedance audiogram comparisons.

Table 7: Comparison of preoperative and postoperative impedance audiogram effect of anterior nasal packing on middle ear pressure at left ear by Cochran Q test

Left ear	Type A	%	Type C	%
Preoperative impedance audiogram	72	100.00	0	0.00
Post operative impedance audiogram with pack in situ	9	12.50	63	87.50
Post operative impedance audiogram after pack removal	67	93.06	5	6.94
Cochran Q	116.7936			
P- value	0.0001*			

*$p<0.05$

Figure 19 A and 19 B shows the tympanometry graph of one of the subjects of the study with the anterior nasal pack within and after nasal pack removal in left ear respectively.

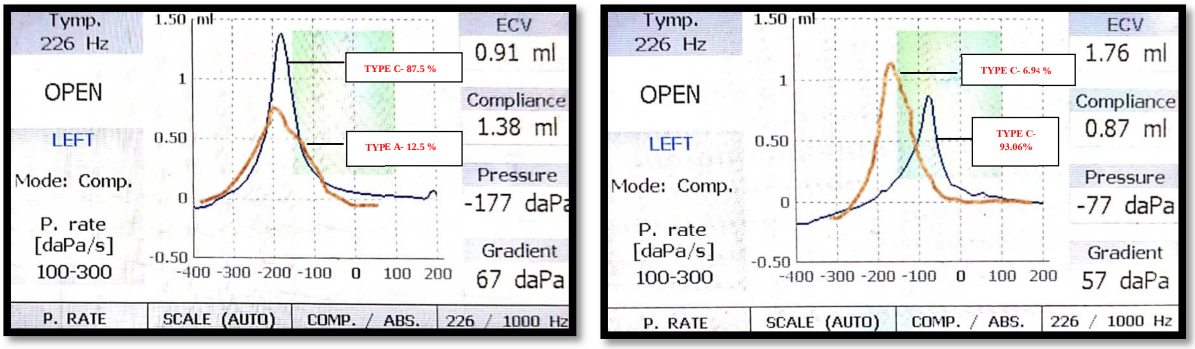


Fig 19A: Impedance audiogram of left ear postoperatively with nasal pack in situ showing Type C graph seen in 87.5 % patients. Fig `19 B Impedance audiogram graph of the same ear 6 hours following nasal pack removal after pack removal for 24 hours of surgery showing normal Type A graph in 93.06 %

As observed by the results and the figures shown above, the middle ear pressure changes had already occurred and resolved at six hours of nasal packing anteriorly and six hours after nasal pack removal, when both values of impedance audiogram were recorded, respectively.

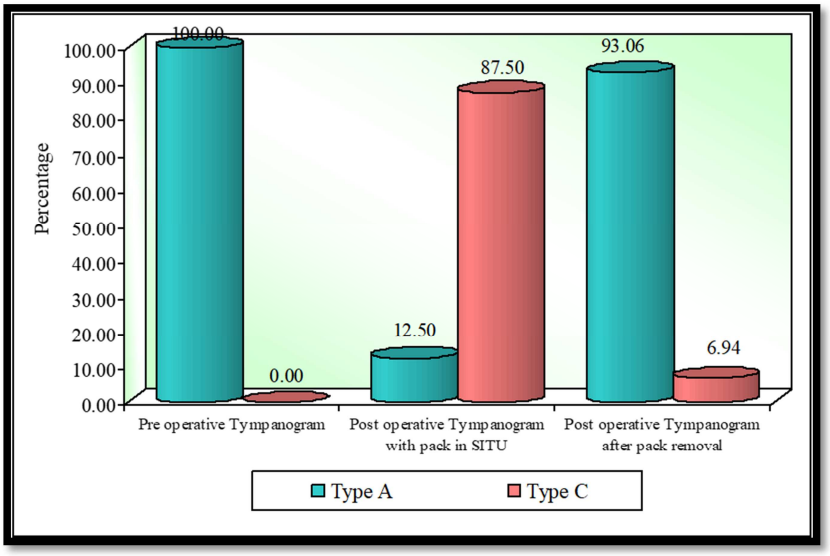
A significant change was observed in preoperative and postoperative impedance audiogram impact of anterior nasal packing on tympanic cavity pressure at left ear (Cochran Q= 116.7936, p=0.0001).

Further, the pair wise comparison was done by using Mc Nemar test. the results are shown in the following table 8.

Table 8: Pair wise comparison of preoperative and postoperative impedance audiogram effect of anterior nasal packing on middle ear pressure at left ear by Mc Nemar test

Left ear	p-value
Preoperative vs post operative impedance audiogram with pack within	0.0001*
Preoperative vs post operative impedance audiogram after pack removal	0.0630
Post operative impedance audiogram with pack within vs post operative impedance audiogram after pack removal	0.0001*

- A significant change was seen between preoperative vs post operative impedance audiogram with pack within for the impact of anterior nasal packing on tympanic cavity pressure at left ear (p=0.0001)
- No significant change was seen between preoperative vs post operative impedance audiogram after pack removal in impact of anterior nasal packing on tympanic cavity pressure at left ear (p=0.0630)
- A significant change was seen between post operative impedance audiogram with pack in situ vs post operative impedance audiogram after pack removal in impact of anterior nasal packing on tympanic cavity pressure at left ear (p=0.0001).



Graph 6: Comparison of preoperative and postoperative impedance audiogram effect of anterior nasal packing on middle ear pressure at left ear

From the results obtained, there was no difference significantly between the preoperative and postoperative impedance audiogram after pack removal except in 6 patients in the right ear, although left ear showed insignificant results. It can be inferred that the anterior nasal pack and the technique of nasal packing implemented in this study is safe and correct. The changes produced in the tympanic cavity pressure were mild, transient and easily reversible on removal of pack.

DISCUSSION

The study participants had multiple nasal complaints prior to undergoing their respective nasal surgeries including chronic unilateral or bilateral nasal obstruction, nasal discharge, headache. Most common among them is nasal obstruction secondary to deviated nasal septum followed by chronic rhinosinusitis with or without nasal polyposis. [9]

Most patients were more than or equal to 20 years of age, with complaints of bilateral or unilateral nasal obstruction being the most common complaint for which they were seeking help. Most patients also had left sided nasal complaints more than their right side alongside the observation that, most patients were males, in this study. All patients included in the study had normal anterior nasal packing for 24 hours following surgery and they were checked for the possibility of developing pressure abnormalities of tympanic cavity and otitis media to improve the safety of anterior nasal packing methods that are being followed at present. Dysfunction of eustachian tube can occur as a result of anterior nasal packing and if prolonged may result in otitis media with effusion. [20]

Peritubal inflammation that occurs as a result of anterior nasal packing can result in improper drainage of eustachian tube lymphatic system that may lead to stasis of fluid in middle ear following negative pressure build up. This inflammation further causes reduction in surfactants that normally facilitates the opening of eustachian tube and as a result, eustachian tube dysfunction occurs.

All patients in this study who underwent nasal surgery and had anterior nasal packing had postoperative pain and discomfort which lead them to mouth breathing and dryness of throat which further caused reduced swallowing movements in these patients. On comparison of our study with the study by Hussein Jasser, it can be

inferred that there was reduced swallowing movements in patients with anterior nasal packing which further led to poor opening of eustachian tube. The results showed that 14 out of 40 ears at the end of 48 hours of nasal packing, showed abnormal impedance, although the side of the affected ear wasn't specified. They also found that there was no significant difference in impedance audiometry in both ears following pack removal after 7 days. They also inferred that:

- Inflammation of the eustachian tube orifice due to irritation by the nasal pack would be the most probable cause for peritubal stasis
- The surfactants inactivated by the mucosal inflammation further delayed or reduced eustachian tube opening
- Dryness of mouth due to mouth breathing and reduced swallowing further impeded with eustachian tube opening.[21]

On comparison of our study with the study by Wake et al in 1990, the effect on middle ear pressure change following nasogastric tube insertion while keeping the contralateral ear as control, showed similar results. The impedance audiogram of the ipsilateral side of tube insertion was tested and compared to the contralateral side which was taken as control. Although the side of the affected ears was not specified in this study, it can be inferred that the changes in middle ear pressure was transient/ easily reversible by removing the irritant (nasogastric tube) causing mucosal oedema at the eustachian tubal orifice as with the case of anterior nasal packings.[22]

As in the observations made in our study, most patients developed type C due to the drop the middle ear pressure as compared to the barometric pressure. This negative pressure changes of the tympanic cavity caused by auditory tube dysfunction is what causes a type C graph. Even in earlier stages of otitis media effusion, a type C graph may be obtained due to the below zero pressure in the middle ear cavity.[4]

CONCLUSION

In this study, the middle ear pressure changes brought about by anterior nasal packing is temporary and mild and does not cause long term middle ear pressure abnormalities along with no development of complications due to nasal packing in any of the patients.

Also, the pack placed for 24 hours following surgery prior to removal, was found to be safe. This practice ensures safe and adequate nasal packing.

Another cause of eustachian tube dysfunction could arise from the irritation and mucosal oedema at the orifice of auditory tube influenced by the pack and the length of each patient's nasal cavity which should be taken into account while packing the nose in order to avoid the same.

SUMMARY

This study conducted at KLE Hospital and MRC, between the time period of June 2023 to July 2024.

The objective was to study the effects of anterior nasal packing on middle ear pressure and the safe time period to keep the anterior nasal pack in situ. This was done with help of serial measurements of impedance audiometry.

72 patients requiring nasal surgeries were selected for the study, if they met the inclusion criteria, including normal preoperative impedance audiogram and a normal otoscopic visualisation of impedance audiogram, with their full informed consent. Following surgery, they were subjected to impedance audiometric evaluation with anterior nasal pack and without it. The results were tabulated and analysed. None of the patients was not charged of this. The results were analysed with Mc Nemar test and Cochrane Q test. The results obtained give us a better understanding for the safe practices (while nasal packing and the duration to be kept) to be followed and showed that there were significant changes in the middle ear pressures that were noted following nasal packing that reverted to normal within 6 hours following pack removal. It is safe to conclude that the anterior nasal pack placed for 24- 48 hours was safe and any changes caused by it was temporary. None of the patients developed any complications following negative middle ear pressures developed due to anterior nasal pack.

LIMITATIONS AND SCOPE OF THE STUDY:

- Limitations of the study are that it is a single centre study with limited sample size.
- The impedance audiometric assessment was only conducted during the period of the patient's hospital stay and the same was not followed up during their weekly follow ups.
- There is also scope for further study with a larger sample size.

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ANNEXURE – I - INFORMED CONSENT FORM

"THE STUDY OF EFFECT OF ANTERIOR NASAL PACKING ON MIDDLE EAR PRESURE"

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Introduction: Bilateral nasal obstruction due to any cause often leads to middle ear pressure changes due to eustachian tube dysfunction. One of the main functions of the eustachian tube is to maintain the middle ear pressure by equalizing it with the atmospheric pressure. Due to nasal obstruction, this function of the eustachian tube is disrupted leading to negative pressure in the middle ear leading to various other middle ear pathologies including serous otitis media and retraction of tympanic membrane. For patients who are undergoing nasal surgeries (septoplasty, SMR, etc), bilateral anterior nasal packing is done post operatively for various reasons, some of which being to control the bleeding, to stabilize the nasal bones, to help the settlement of septal mucosal flaps and to prevent adhesions and septal hematoma. This study is conducted to gain more information regarding the same and how safe it is to practice anterior nasal packing and how it affects middle ear pressure as indicated by impedance audiometry values.

Explanation of procedure: If you agree to participate in this study, the relevant data will be collected as per the proforma and final diagnosis will be confirmed. After getting inducted in the study, you will be evaluated for hearing with Tympanometry.

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/ will not get any 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 done during the course of study will be paid by the **principal investigator / Participant.**

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: In case of any questions with regard to this study, you are free to contact: 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 waiving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study "**THE STUDY OF EFFECT OF ANTERIOR NASAL PACKING ON MIDDLE EAR PRESSURE"**. 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 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

Name and Signature of the student/principal investigator:

Signature of the guide: **Date:**

"STUDY OF EFFECT OF ANTERIOR NASAL PACKING ON MIDDLE EAR PRESSURE"

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

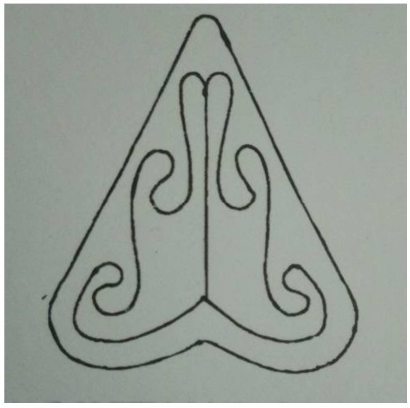
2. NOSE EXAMINATION:

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. TYMPANOMETRY:

Preoperative tympanogram	
Postoperative tympanogram (anterior nasal pack insitu)	
Postoperative tympanogram (after removal of pack)	

ANNEXURE – III - MASTERCHART

SL. NO.	PATIENT NAME	AGE	SEX	DIAGNOSIS	PRE OPERATIVE TYMPANOGRAM		POST OPERATIVE TYPMANOGRAM		POST OPERATIVE TYPMANOGRAM	
					RIGHT EAR	LEFT EAR	WITH PACK IN SITU		AFTER PACK REMOVAL	
							RIGHT EAR	LEFT EAR	RIGHT	LEFT
1	1011206	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE C	TYPE A
2	1011345	20	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE C	TYPE A
3	1011336	18	M	RIGHT AC POLYP	TYPE A	TYPE A	TYPE C	TYPE C	TYPE C	TYPE A
4	1011389	28	F	B/L ETHMOIDAL POLYP	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
5	1011551	41	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
6	1011628	22	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
7	1011700	32	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
8	1011428	33	M	B/L ETHMOIDAL POLYP	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
9	1011663	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
10	1011225	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
11	1011793	22	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
12	1012920	58	M	LEFT INVERTED PAPILLOMA	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
13	1011765	19	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
14	1011421	36	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
15	1011652	23	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
16	1012987	45	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
17	1012293	48	F	LEFT DACROCYSTORHINITIS	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
18	1012341	30	M	B/L ETHMOIDAL POLYP	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
19	1011590	35	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
20	1011832	22	M	LEFT DNS	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
21	1011376	33	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
22	1012521	18	M	CHRONIC RHINOSINUSITIS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
23	1012291	19	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
24	1012163	38	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE C
25	1012770	23	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
26	1012989	47	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
27	1012874	22	M	LEFT DNS	TYPE A	TYPE A	TYPE A	TYPE A	TYPE A	TYPE A
28	1012540	20	M	LEFT DNS	TYPE A	TYPE A	TYPE A	TYPE A	TYPE A	TYPE A
29	1011629	19	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
30	1012430	18	M	LEFT NASAL SYNECHIAE	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
31	1012441	22	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
32	1012308	23	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
33	1012381	29	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
34	1012678	41	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A

35	1012418	19	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE C
36	1012512	19	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
37	1012219	34	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
38	1012716	40	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
39	1012231	38	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
40	1012765	26	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
41	1012439	18	F	LEFT AC POLYP	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
42	1013371	18	M	LEFT DNS	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
43	1013354	53	M	RIGHT AC POLYP	TYPE A	TYPE A	TYPE C	TYPE C	TYPE C	TYPE A
44	1013885	35	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
45	1012551	20	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
46	1013362	50	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
47	1013356	18	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
48	1013369	29	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
49	1015727	19	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
50	1014322	52	F	RIGHT DACROCYSTITIS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
51	1012778	18	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
52	1012983	38	F	LEFT DACROCYSTORHINITIS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE C
53	1013588	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
54	1013686	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
55	1013352	22	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
56	1013602	18	M	SEPTAL HEMATOMA	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
57	1013377	23	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
58	1013391	39	M	LEFT AC POLYP	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
59	1014495	35	F	RIGHT DACROCYSTITIS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
60	1014731	18	M	LEFT DNS	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A
61	1014733	60	M	RIGHT DNS WITH RIGHT PAN SINUSITIS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
62	1013931	18	F	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE C	TYPE A
63	1018416	19	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
64	1015703	47	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
65	1014605	18	M	RIGHT DNS	TYPE A	TYPE A	TYPE A	TYPE C	TYPE A	TYPE C
66	1017730	18	F	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
67	1014409	18	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE A	TYPE A	TYPE A
68	1014578	18	M	RIGHT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE C	TYPE A
69	1014490	19	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
70	1015543	40	F	CHRONIC SINUSITIS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A
71	1013278	21	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE C
72	1013776	18	M	LEFT DNS	TYPE A	TYPE A	TYPE C	TYPE C	TYPE A	TYPE A