ASSOCIATION OF CONCHA BULLOSA AND CHRONIC RHINOSINUSITIS PATIENTS-A COMPUTERIZED TOMOGRAPHY ASSISTED ONE YEAR CROSS SECTIONAL STUDY

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LIST OF ABBREVIATIONS

CRS	Chronic Rhinosinusitis
C.B	Concha Bullosa
CRSwNP	Chronic Rhinosinusitis with Nasal Polyposis
CRSsNP	Chronic Rhinosinusitis without Nasal Polyposis
DNE	Diagnostic Nasal Endoscopy
PNS	Paranasal Sinus
FESS	Functional Endoscopic Sinus Surgery
EPOS	European Paper Of Rhinoinusitis
TH-2	T-Helper 2 Cells
OMC	Osteomeatal Complex
Rt.	Right
Lt.	Left
Stg.	Stage
Gp.	Group
Pts.	Patients

ABSTRACT

BACKGROUND

Chronic Rhinosinusitis is a common disease among the population. It is a significant burden worldwide.

Currently CT is a method of choice for assessment of anatomical variants, para-nasal sinus and nasal cavity.

Some variations in lateral wall of the nose such as -Nasal Septal Deviation, Paradoxical Middle Turbinate, Concha Bullosa, Agger Nasi, bulla- oversize ,Haller cells etc.

Gold Standard for diagnosis of chronic rhinosinusitis- acomputerized tomography scan of Paranasal sinuses

Concha bullosa is one of the most common anatomical variant found in the patients of chronic rhinosinusitis.

C.B by itself does not represent a disease state, but it may be the etiology for the patient to develop Chronic sinusitis more readily & frequently. Computed Tomography (coronal view) is the best way for imaging concha bullosa.

It presents as enlarged body of the middle turbinate that is in contact with the septum of the nose and laterally bulging into the lateral wall of nose.

In our study we used Computed Tomography by enlarge to eavaluate the presence of concha bullosa along with diagnostic nasal endoscopy in patients of chronic rhinosinusitis

OBJECTIVE:

To find the association of concha bullosa in patients of Chronic Rhinosinusitis

MATERIALS AND METHODS

Our study is a Cross-Sectional Study that included 60 samples with Chronic Rhinosinusitis. CT-scan imaging of the nose and PNS and further endoscopy was being done to evaluate the patient to find the prevalence of concha bullosa.

RESULT

There was no association found in concha bullosa and patients of Chronic rhinosinusitis. In our study, out of 60 patients studied, in 33 patients concha bullosa was found to be prevalent either unilaterally or bilaterally. In 27 patients concha bullosa was absent. Bulbous Type is been found to be maximum in number.

CONCLUSION

Concha Bullosa being found in 55% of cases of CRS is a significant number and therefore in all patients of nasal obstruction it should be considered as important differential diagnosis.

KEYWORDS

Concha bullosa, Chronic rhinosinusitis, CT scan

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INTRODUCTION

Chronic Rhinosinusitis (CRS) carries a significant worldwide burden, 15% of the population is affected consequently representing with it a considerable economic load to system of healthcare, to patients and to the eco-nomy from loss of efficiency in the workfront.[1]

National Institute of infectious and allergy disease estimate that 1in 8 Indians bear CRS.[2]

Chronic Rhinosinusitis is an ordinary disease and a major cause of mor-bidity among patients. Its diagnosed clinically and the judgement depend on often vague physical complaints and with the aid of rhinoscopic examination done anteriorly. Currently CT is the method of choice for assessment of anatomical variants, para-nasal sinus and nasal fossa.[3]

There are some variations in anatomy of lateral wall of nose like septal deviation, concha bullosa and bulla- oversized are imp. As they are responsible in blockage of osteo-meatal complex, paranasal sinuses-drainage and its ventilation. Evaluation done pre-operatively of the variants is imp. To as a concern of surgical safety.

Gold standard radiologoical tool for diagnosis of chronic rhinosinusitis is computed tomo-graphy (CT) scan of the para-nasal sinuses. In poor resource countries since availability of CT scan is not widely in, most likely indication is after medical treatment which has been failed, there is complication when surgical treatment is been thought of and if CT scan has been shown to have the edge of concurrent assessment of the nasal cavities, paranasal sinuses and osteo-meatal complex.[4]

There is presence of different types of anatomical variants in percentage. The usual anatomical variation with an association with sinus disease to be found is deviated nasal septum, uncinate process then agger nasi cells, followed by enlarged ethmoidal bulla and Haller's cells. Concha bullosa is found to be least encountered variation in some studies.

Different types of anatomical variants are associated with different sino-nasal disease.

Chronic Rhino-sinusitis is the most frequent otolaryngologic disease. Sinusitis is not only cause from infection of bacterial origin but a number of other cause can cause sinus inflammation.

The Euro-pean position paper on rhino-sinusitis and nasal polyps (EPOS) has defined rhinosinusitis as on clinical grounds -the diagnosis made on the presence of symptoms which is characteristic, in combination with evidence of objective mucosal inflammation.[5]

The most recent international guidelines have supported the EPOS definition, confirming the need for objective evidence to confirm the symptom profile (ICORS).3 The defining symptoms and signs listed in the EPOS 2012 document apply to both adults and children and can be further qualified in terms of severity by use of a visual analogue score.

At the present time CRS is largely subcategorized into cases with polyps (CRSwNPs) and cases without polyps (CRSsNPs). The clinical definition has been outlined above but relates to a heterogeneous group of patients that fall loosely within one of these two subgroups.

CRSwNPs has a characteristic intense oedematous stroma in the epithelium of sinus and the nose with albumin deposition, formation of pseudocyst and subepithelial/ perivascular infiltration of inflammatory cell. It is association is in concern to typical T-helper-2 cell (TH2) eosinophilic inflammation, with increased amount of inter-leukin (IL-5) and eosinophil cationic protein (ECP) accumulation in the polyps.

The three important factors in the pathophysiology of the sinus disease are: the ostia- patency, the function of the cilia and the nasal secretions quality.

Alteration in any of these can lead to sinusitis by altering the physiology. Of these, the patency of the ostia is the most important as the osteo-meatal complex is the key area for pathogenesis of CRS.[6,7]

Knowledge and understanding the concept of mucociliary drainage pattern and pathophysiology of paranasal sinus (PNS) are important for functional endo-scopic sinus surgery (FESS).

FESS has also emphasized the importance of nasal endoscopy and computed tomography (CT) both of which are performed before to surgery to determine the extent of the disease and anatomical abnormalities.[8]

Knowledge of the anatomical variations is very important for radiologists and surgeons doing endoscopies as well as for the involved in preop evaluation so that therapeutic failure can be avoided and complications that arise iatrogenically.

Traditionally, X-rays were used to examine the paranasal sinuses. The standard radiographic series consist of four views: waters view, lateral view, Cald well view and submento-vertex view. Superimposition, inability to study all borders

clearly, absence of radiographic evidence of soft tissue involvement etc, are drawbacks of these views.[9]

In mid 1970's CT scans were introduced. They provide abundant information as compared to X-rays.

CT over the past decade has played a larger role in FESS, it gives a large idea of disease extension and determines the treatment course and success or complications related to failure.[10]

CT Scan imaging has certain limitations: over diagnosing asymptomatic individuals, the cost factor and a potential radiation hazard for the patient. However for evaluation of nose and PNS, CT is the investigation of choice.

Concha Bullosa is defined as middle turbinate pneumatization that can be present one side or both the sides. Aeration of the superior and inferior turbinates is less frequent. If large, C.B in the middle concha might obstruct the infundibulum or the meatus opening in middle concha.

The epithelium in the air cavity inside concha bullosa is lined with the similar as the other part of the nose, which can lead to involvement of these cells with the similar inflammatory diseases present in the paranasal sinuses. The obstruction of drainage of a concha can result into formation of mucocele.

The decision to investigate the patient further with CT scan is usually based on a combination of the history and endoscopic findings. Revised guidelines stated that symptoms alone cannot be used to form CRS diagnosis and physical findings (purulence , polyps, or polypoidal alterations) should be added to aid the diagnosis. Endoscopy of nose is adviced for patients who don't have marked inflammatory

disease on rhino-scopy seen anteriorly. CT scan is adviced if the clinical features suggest CRS but accessible parts to nasalendoscopy don't represent inflammatory signs.

The study has been undertaken to discover the association of Concha Bullosa in patients suffering from Chronic Rhinosinusitis

OBJECTIVE

To find the association of concha bullosa in patients of Chronic Rhinosinusitis

REVIEW OF LITERATURE

Historical Aspects [10,11]

Ancient Egyptians first identified Paranasal sinuses found inside the bones of the skull.

The paranasal sinuses history, definitely, starts from the history of the words "sinus" and "antrum." The word in latin"sinus" stands for a curve, land hollow; gulf or bay.

After Egyptians had gone, physicians of old greek, like Hippocrates, Celsus and Galen, have also discovered the paranasal sinuses as part of the structure of the skull.

Philip Bozzini in 1806 showed that one could see around the corners and inside the cavities in human body via his article.

Wertheim in 1869 made a conchoscope which consisted of a channel for introduction of a sound or any other instrument to examine anterior and middle third of nasal cavity.

In 1879 Nitze-Leiter developed cystoscope.

As mentioned by Draf, Hirschmann and Valentin first performed endoscopy with modified Nitze cystoscope.

In 1925; Maltz introduced the sinuscopy term and mentioned the methods for examining the sinus of maxilla using the endoscope via inferior meatal and routes of canine fossa.

Professor H.H Hopkins in 1951-1956 invented the rod optic telescope. Major advancements were made in endoscopy of the upper airway after this achievement.

Messerklinger was the first to establish a systemic diagnostic endoscopic approach to the nose and its lateral wall.

The Fibre optic light delivery system via the endoscopes have markedly improved illumination and optical clarity thus making routine examination of nasal cavity and sinuses very convenient.

Anatomical Considerations- Lateral Wall Of Nose

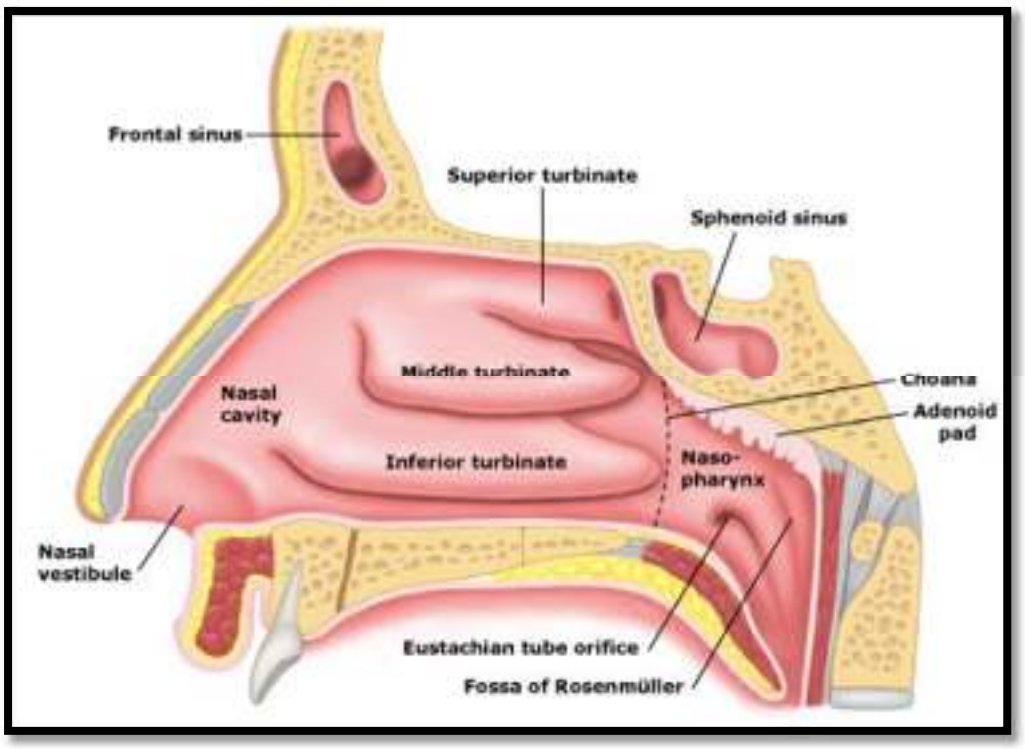


Fig 1: Lateral wall of Nose

There are many elevations and depressions seen on the lateral wall of now. The anterior limit is the vestibule lined by the skin. The atrium lies behind the vestibule where underlying agar nassi cell produces a bulge anterior to the middle turbinate.

Overlying the nasolacrimalduct, a ridge is present extending from agger nasi cell to the apex of superior border of inferior concha. Three scrolls of the inferior, middle and superior concha, overlying the particular meatii are present behind the atrium. A supreme turbinate may be presentat times.

Uncinate Process [12,13]

Uncinate Process is 3-4 milimetre wide and 1.5-2 centimetre in length.

The uncinate process is a thin hook like bone sagitally at 140* orientation to the nasal wall laterally and is attached to the following structures:-

The ethmoid process of inferior turbinate-inferiorly and far posteriorly.

The lamina papyracea skull base or middle turbinates-Anteriorly and far superiorly.

Lamina papyracea and fontanelle area-Laterally

Ethmoid Bulla [12,13]

The largest and most constantly pneumatized anterior ethmoidal cell is called the ethmoidal bulla.It can be extensively pneumatised to abut against the uncinate process or middle turbinate anteriorly, thus compromising the infundibulum or middle meatus respectively.

Retrobulbar recess is the region between the bulla and the ground lamella. Suprabulbar recess is present at the anterior and superior portion of lateral sinus and it separates the bulla from fovea ethmoidalis.

Supraorbital ethmoid cell is formed when sinus lateralis extends laterally to pneumatize the root of orbit. On Coronal section of CT scan this cell is seen behind

the frontal sinus at the level of bulla. The conchal sinus is the lumen between bulla ethmoidalis and middle turbinate.

Ground Lamella of the Middle Turbinate

The anterior and posterior ethmoids separates the ground lamella and may bulge into the anterior ethmoids with the convexity anteriorly or into the posterior ethmoids with the concavity anteriorly. It can be dehiscent leading to passage of infection from anterior to postrerior ethmoids. [12]

There could be extensive pneumatisation and multiple septa in the ground lamella. Rarely it may turn inferiorly to 'miss' its normal attachment to lamina papy-racea and instead attach to the lateral wall of the maxillary sinus,thus dividing the maxillary sinus into two parts.The anterior of which drains like the maxillary sinus while the posterior part drains like the posterior ethmoid cell.[12]

The ground lamella can be seen by passing the endoscope between the middle turbinate and ethmoidal bulla.[13]

Clefts and Spaces of the Lateral Nasal wall

Hiatus Semilunaris (The Inferior Hiatus Semilunaris of Grunwald) [10]

Zuckerandl coined the term Hiatus Semilunaris in 1860. It is two dimensional cleft bordered anteriorly by the posterior free border of uncinate and posteriorly by the anteriorly face of bulla ethmoidalis

Ethmoidal Infundibulum [10,13]

Ethmoidal Infundibulum is around 4cm in length ,5-6 mm width (uncinate process - free margin to the lamina papyracea) and is 12mm deep (measured vertically

against the uncinate posterior margin which is free) However, the ethmoidal Infundibulum is shallow as the uncinate process when it is not more than 1-1.5mm from the lamina papyracea.

The boundaries of ethmoidal Infundi-bulum are as follows:

- Anteriorly-The Uncinate Process
- Posteriorly- Anterior wall of ethmoidal bulla
- Laterally-Lamina papyracea anteriorly and fontanella area posteriorly.
- Medially-Hiatus Semilunaris inferioris and uncinate process
- Anteriorsuperiorly-Frontal recess area and frontal sinus osteum.
- Posteroinferiorly-Maxillary sinus osteum.

Frontal Recess[12]

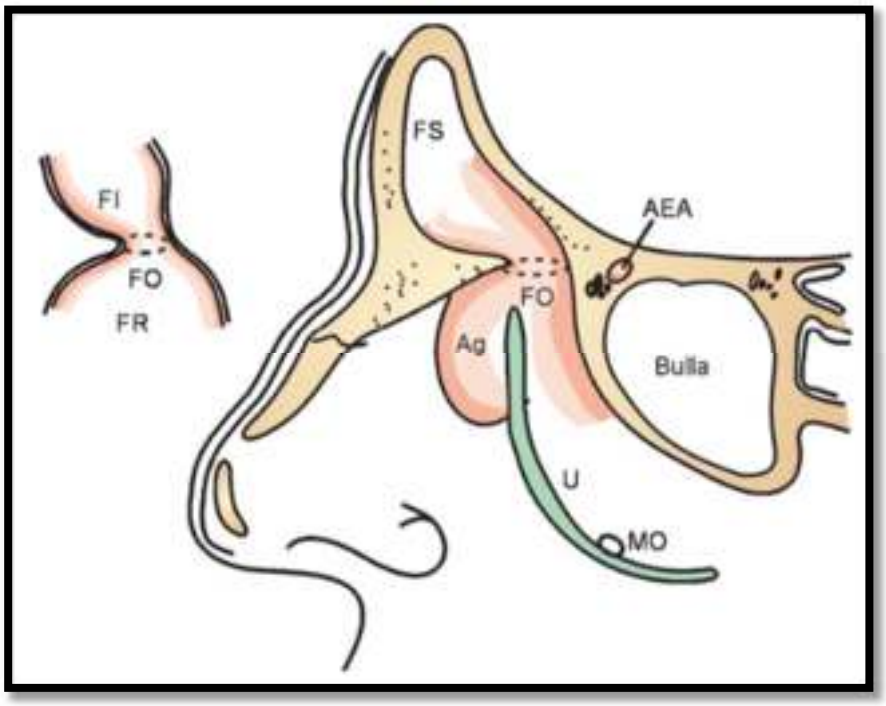


Fig 2 : Diagram representing Frontal Recess

It is present in the extreme antero -superior part of the middle meatus. The frontal sinus- natural ostium is an hour glass shape narrowing which opens into the frontal recess directly. The agar nasi cell forms the anterior limit while the ethmoidalis bulla forms the posterior border, laterally by lamina papyracea and the middle turbinate medially. Frontal ostium superiorly, it opens into the frontal sinus. Inferiorly the drainage of frontal recess depending upon the uncinate process attachment.

Sinus Lateralis

Sinus Lateralis is not constant however it can extend above the ethmoidal bulla when extensively pneumatized. [10]

It is divided into suprabullar and retrobullar recess. Inferiorly ethmoidal bulla and superiorly ethmoid fovea border the suprabullar recess in its anterior superior location. Anteriorly ethmoid bulla and posteriorly basal lamella border the retrobullar recess in posterior and inferior location. Suprabullar recess is absent if ethmoidal bulla adheres to ethmoidal fovea whereas no retrobullar recess is formed if ethmoidal bulla adheres to basal lamella.[13]

Physiology of Secretion Transportation[10]

The secretion and transport mechanisms of normal drainage of paranasal sinuses is complex.

It depends upon the amount of mucus production ,its effectiveness of ciliary beat, composition ,mucosal resorption; ostia condition and the ethmoidal clefts into which the ostia opens respectively.

The mucus film is made up of 2 layers-inner serous layer 'the sol phase' where the cilia beat and outer viscous layer 'the gel phase' that is transported by the ciliary beat. Normally an equilibrium is maintaining between sol and gel phase and at 7.5-7.6 pH

Principles

The two important factors necessary to maintain normal physiology of the para nasal sinuses and its mucosa is drainage and ventilation. The cilia beat in synchronized (transversally) and metachronized (longitudinally) manner but the precise mechanism of this synchronization is not fully known. Ciliary beat frequency normally is 8-15 Hz. The mucous glands mainly regulate by parasynthetic nerve fibres. Humidity, pollution or other external air borne irritants affect nasal mucous production. [10]

Pathways

After animal studies being done by Hilding Sr and studies by Messerklinger using cadaveric heads,he observed that the secretion of various sinuses reach their respective ostia by a definitive pathway which seems to be determined genetically.

Secretion transport in maxillary sinus[10]

The secretion transport begins from the floor of the sinus and is transported towards the roof, anterior; medial; lateral and posterior walls. All these secretions routes cover at the natural ostium of maxillary sinus. The ostium of natural maxillary sinus opens into the floor of the posterior third of infundibulum of ethmoid. It is bordered medially with the uncinate process and laterally by the orbital lamina papyracea.

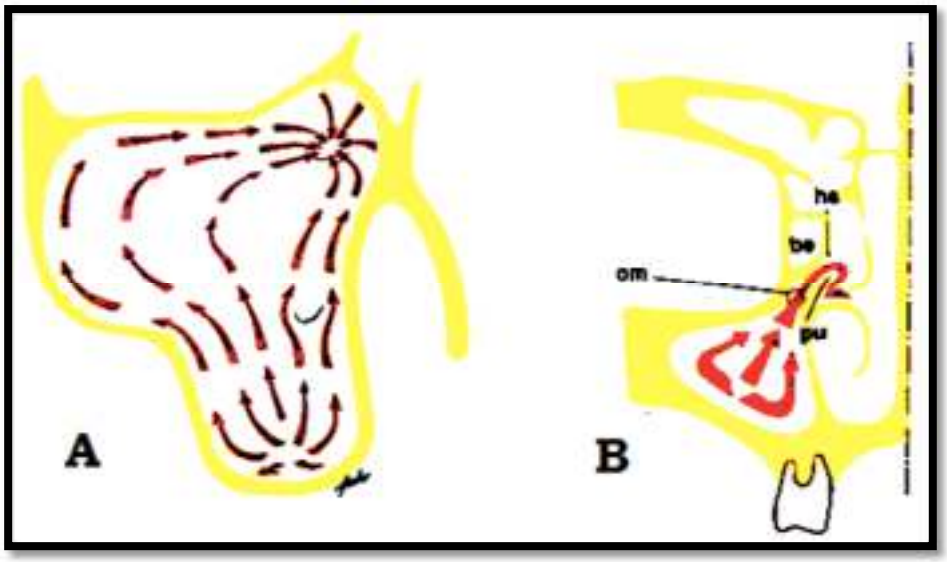


Fig 3: The pathway of mucus inside (A) and moving out (B) of the maxillary sinus.

The ethmoidal infundi-bulum inturn opens into the middle meatus through hiatus semilunaris. The secretions are then transported through the hiatus semilunaris into the nasopharynx over the inferior turbinate posteriorly.

Even when in the area of fontanelles there are accessory ostium, secretions are always transported via the natural ostium.

CHRONIC RHINOSINUSITIS

One of the most frequent otolaryngologic disease is Chronic Rhinosinusitis.[14] Not only bacterial origin infection but also a number of other etiologies are there apart from inflammation of sinuses.

Rhinosinusitis has now been defined by the European position paper on Rhino-sinusitis and nasal polyposis (EPOS) as a diagnosis made on clinical basis laying significance to the symptoms present, along with objective evidence of mucosa inflammation characteristically.[5]

Diagnostic criteria for rhinosinusitis

1. Primarily; symptoms (needs at least 1 to be there, but if both there it is enough to make diagnosis on the basis of presenting complain)
2. Symptoms additionally (might also have presence and at least 1 is required if only one of the primary symptoms is there)
3. Time
4. Endoscopic findings (either of these)
5. CT scan findings (either or instead of endoscopy findings)

Endoscopic and/or radiological findings should be correlated with symptoms

1. Nose obstruction/ block /congestion and Nose discharge (anteriorly/ posteriorly)
2. Face pain,face pressure Smell dysfunction Hyposmia ; anosmia
3. >10 days, acute :<3 months ; chronic : >3 months
4. Nasal polyposis Mucopurulent secretions (middle meatus) Oedema/mucosa blockage in middle meatus
5. Changes in mucosa within the ostio-meatal complex or sinuses.

The EPOS definition has been supported by the most recent international guidelines, confirming the need for objective evidence to prove the symptom profile (ICORS). The EPOS 2012 defines symptoms and signs that apply to both children and adults and visual analogue score can be used to further qualify in terms of severity.

CRS is largely subcategorized at the present time into cases without polyps (CRSsNPs) and cases with polyps (CRSwNPs).The definition has been mentioned

above but heterogeneous group of patients is related to it that fall loosely within one of these two subgroups.

The sinonasal epithelium with an intense oedematous stroma is characteristic of CRSwNP, with deposition of albumin, formation of pseudocyst and subepithelial/ peri-vascular inflammed cell infiltration. T-helper 2 cell (TH2) which are typical is associated along with high Interleukin-5 and concentrations of eosino-phil cationic protein in polyp.

CRSwNPs is characteristic of an intense oedematous stroma in the epithelium of nose and sinus, with albumin deposition, formation of pseudocyst and subepithelial/peri-vascular inflammed cell infiltration. There appears to have an association with a T-helper 2 cell (TH2) skewed inflammation of eosinophilia, with high interleukin-5 and eosinophil cationic protein (ECP) concentrations in the polyp.[5]

Pathogenesis

Many theories have come up over the last 15 years in an attempt to explain the etiology and pathogenesis of CRS. The first of these was hypothesis with fungal etiology where Alternaria fungi was the cause of excessive host response in all cases of CRS.

The hypothesis of staphylococcal superantigen says that staphylococcal bacteria that releases exo-toxins foster nasal polyp through effectivity on multiple types of cell.The hypothesis of immune barrier says that defective innate immune response and/or mechanical barrier.

Colonization of microbes when happen in large amount and accentuated barrier damage lead to more stimulation of the immune system with a compensation of immune response which is adaptive [5]

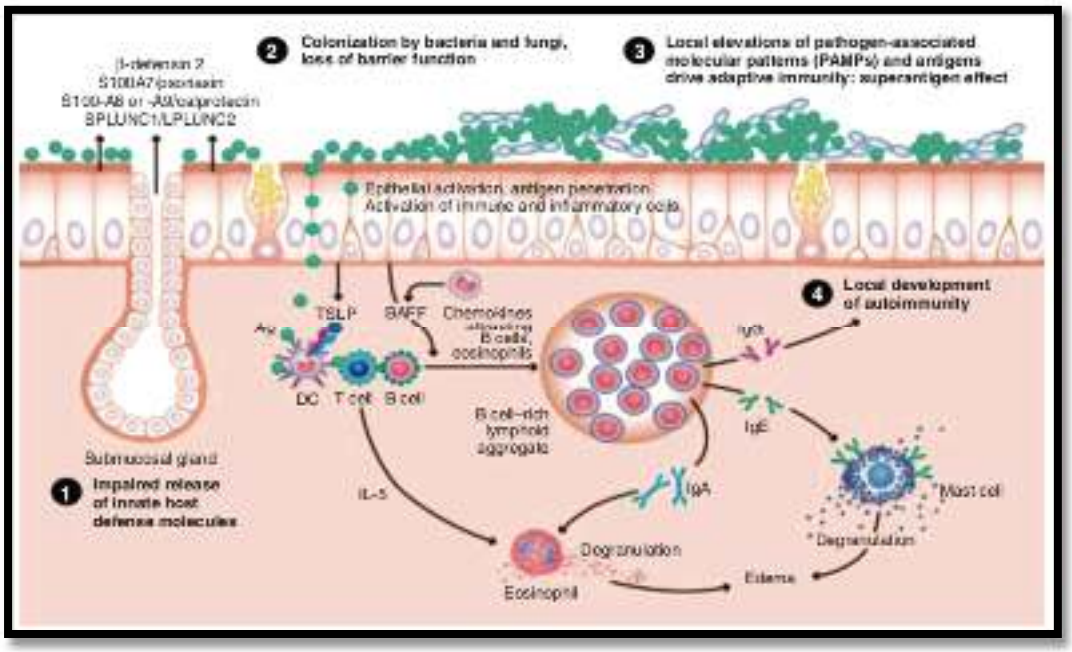


Fig 4: Illustration of the immune barrier hypothesis. Decreased secretion of innate immune molecules (1) results in increased microbial colonization (2). Coupled with a diminished mechanical barrier, (3). The epithelial cytokines thymic stromal lymphopoietin (TSLP) and B-cell activating factor (BAFF) (4). This hypothesis readily accommodates the superantigen hypothesis in that exotoxin effects can be superimposed on this pathway. Ag, antigen; DC, dendritic cell; Ig, immunoglobulin; IL, interleukin.

Diagnosis of Chronic rhinosinusitis

A wide variety of practitioners which includes physicians of primary care, chest physicians and otorhinolaryngologists make diagnosis of CRS. Threrefore an efficient, accurate, and easy way of making a diagnosis of CRS is needed.

1.**Nasal Endoscopy**

Fig 5: Diagnostic Nasal Endoscopy showing Left Concha bullosa

A careful and methodical diagnostic endoscopy is done to see for any anatomical variations and pathological processes. It is done to help the examiner recognize changes that may remain hidden from the naked eye. Provisional diagnosis may be made, confirmed, expanded or revised. The decision to investigate the patient further with CT scan is usually based on a combination of history and endoscopic findings.

2. Computed Tomography

The current imaging standard for the evaluation of rhino- sinusitis is CT Scan because of its unique ability to show and differentiate hypertrophied mucosa, bone;air.

- MRI is complementary for evaluation of tumors in many cases.
- It serves as a “road map” for the surgeon operating
- CT scans are preferred to be done after an antibiotics course, so that inflammation which is acute is not mistaken for chronic mucosal disease.

- It is also advisable to ask the patient to blow his nose to clear out loose secretions prior to the CT scan.
- CT data serve to guide planning and surgical navigation. Multichannel or multislice computed tomo-graphy scanners are easily present in most imaging centres and provide a quick and comprehensive evaluation of the head and neck anatomy.

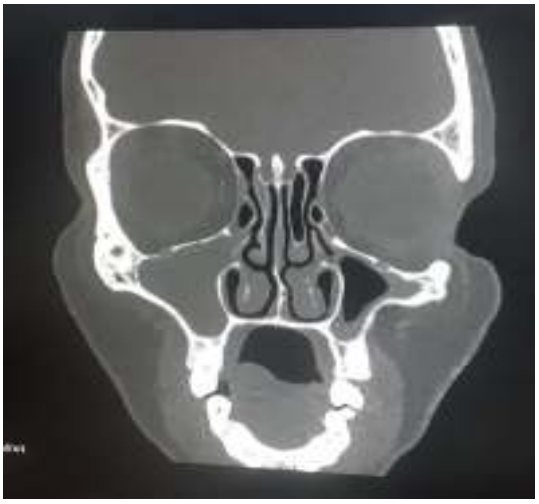


Fig 6 : Plain CT Scan-PNS coronal section showing Concha Bullosa of Lamellar type on the left side

Concha Bullosa

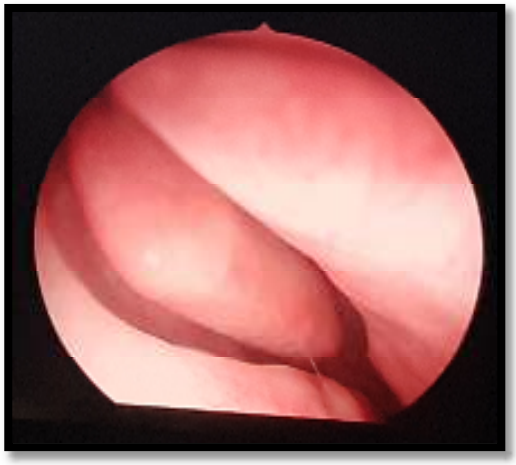


Fig 7: Endoscopic Appearence of Rt.Concha Bullosa

It is defined as air filled middle turbinate that can be unilateral or bilateral. Aeration of the superior and inferior turbinates is less frequent. If large, C.B in the middle turbinate may obstruct the middle meatus/ infundibulum. The air in a concha bullosa is lined with the same epithelium as the rest of the nose which can lead to involvement of these cells with the same infla-mmatory diseases seen in the paranasal sinuses. Drainage obstruction of concha can lead to formation of mucocele. [15] This is how Concha bullosa looks in CT scan of Paranasal sinuses in Coronal View:

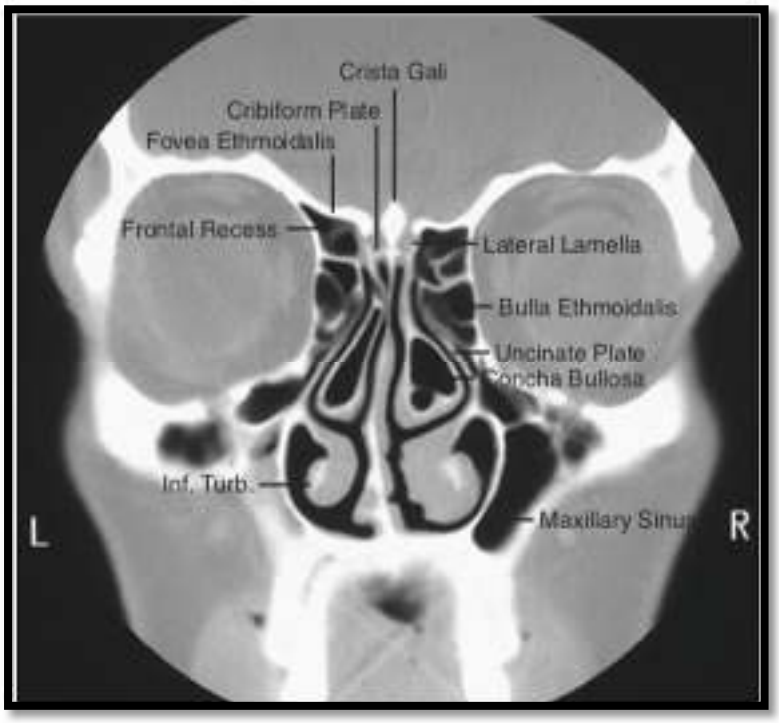


Fig 8 : Computerized Tomography of the Nose

Coronal SectionView of Osteomeatal Unit.

***Bilateral Concha Bullosa* is noted**

Lund and Mackay Grading[16,17]

In 1997,TFR mentioned about a modification of the Lund &Mackay system (the Lund System) most apt for use in study of CRS

Modified Lund System for CT Scoring

Sinus	Rt.	Lt.
Maxilla		
Ant. ethmoidal		
Post. ethmoidal		
Sphenoid		
Frontal		
Osteomeatal Complex		

Score: For all sinus systems, except the osteomeatal complex:

0 = Normal

1 = Partial opacified

2 = Totally opacified.

For the osteomeatal complex: 0 = not occluded, 2 = occluded.

Metson and Gliklich (System of Harvard) [17,18]

Stg. 0 Normal (< 2 cm mucosa thickening on any wall of sinus)

Stg. 1 All unilateral disease or anatomic abnormality

Stg. 2 Disease bilaterally limited to ethmoid or maxillary sinus

Stg.3 Disease bilaterally with inclusion of at least one sphenoida or frontal sinus

Stg. 4 Pan-sinusitis

Kennedy Staging System [17,19]

Stage 0 Normal

Stg.1 Anatomy and its abnormality

All unilateral disease of sinus

Disease bilateral limited to ethmoidal sinuses

Stg. 2 Ethmoidal disease bilaterally with inclusion of one dependent sinus

Stg. 3 Ethmoidal disease bilaterally with inclusion of >2 dependent sinuses on either of the side

Stg. 4 Diffuse sino-nasal polyposis.

Endoscopic Scoring System by Lund & Kennedy

Polyp	0 = absence of polyp 1 = polyps in middle meatus only 2 = beyond middle meatus
Oedema	0 = absent 1 = mild 2 = severe
Discharge	0 = no discharge 1 = clear, thin discharge 2 = thick, purulent discharge
Scarring	0 = absent 1 = mild 2 = severe
Crusting	0 = absent 1 = mild 2 = severe

Friedman and Associates [17,20]

Stg. 0 Normal

Stg. 1 Single-focus disease (including a single focus or single unit of sinus)

Stg. 2 Multi-focal disease (includeing bilaterally or multiple disease areas that are not confluent or diffuse through the ethmoidal labyrinth, as well as middle meatal polyps bilaterally)

Stg. 3 Diffuse disease (extreme bilateral inclusion of multiple sinuses) without any changes in the bone.

Stage 4 Diffuse disease associated with changes in the bone.

Levine and May[17,21]

Stg. 0 Normal

Stg.1 Disease restricted to ostio-meatal complex

Stg. 2 Incompletely opacificed- one or more major sinuses (frontal; maxillary; sphenoidal)

Stg. 3 Completely opacified- 1 or more major sinuses, but not all sinuses

Stg. 4 Total opacification of all sinuses

Newman and Associates [17,22]

Maxillary sinus

Frontal sinus

Sphenoid sinus

Ethmoid sinus

Osteo-meatal complex

Passages of Nose

Score: For thickening of mucosa in maxilla, sphenoidal and frontal sinuses: 0-normal to 1 mm, 1- 2 to 5 milimetre, 2 - 6 to 9 milimetre, 3- >9 milimetre.

For mucosal thickening in ethmoidal sinuses: 0-normal ,1-1 milimetre, 2- 2 to 3 milimetre, 3- >3 milimetre.

For obstruction degree : 0-normal, 1-mild, 2-partial, 3-total

Anatomic Variations

It is important to understand various anatomical variants as they are a predisposing cause for recurrent sinus disease and are useful in warning the surgeon of the the impending risk of the procedure.[23]

Nasal Septal Deviation

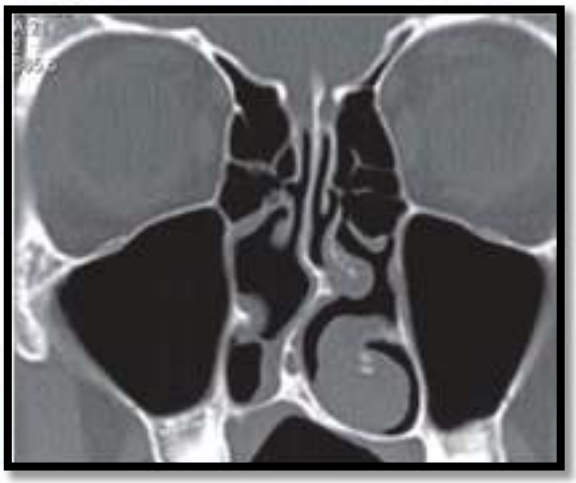


Fig 9 : Plain CT Scan-PNS coronal section showing Deviated Nasal Septum of the Left Side

True septal deviation forces the middle turbinate laterally and narrows the entrance into middle meatus. Thus, a marked deviation of a part or of the entire nose septum can cause not only hindered breathing but also disease within the lateral nose of wall and consequently within the para-nasal sinuses. Septal ridges and spur can cause headaches and other functional disturbances and cause the patient to have recurrent sinusitis.[24,25]

Concha Bullosa

Fig 10: Endoscopic Appearence of Concha Bullosa of the Left side.

It was first described by Santorini in 1739. Zuckerandl coined the word Concha Bullosa. [23]

Middle turbinate pneumatization might initiate from the agger nasi, the lateral sinus or the frontal recess (most frequent).Lothrop in his studies found middle turbinate pneumatization was caused by anterior ethmoidal cells in 55% of cases while in 45% of cases it was from posterior ethmoidal cells. [26,27]

Concha Bullosa may be lamellar, bulbous or extensive type.[12] Intralamellar cell of Grunwald occurs when superior meatus pneumatize the middle turbinates vertical lamella. [12]

Paradoxical middle turbinate

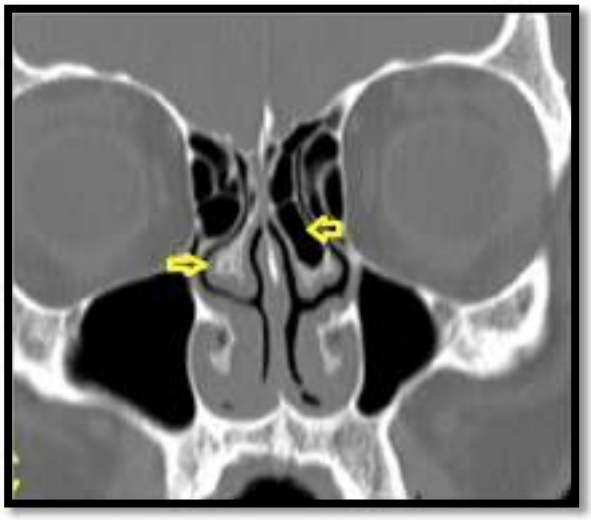


Fig 11 :Coronal section of CT Scan PNS showing Para-doxical middle turbinate on Rt. side and concha bullosa on the Lt. side

Here the concavity of the turbinate points at the septum and its convexity at the lateral nose wall causing significant narrowing and the mucosal contact site can predispose to polyp formation.[23]

Pneumatization of the superior turbinate (i.e a Supreme concha)

This is a rare condition in which the superior turbinate gets aerated via the posterior ethmoidal cells which may result in extension of inflammatory process to the pneumatized superior concha. [28]

Variation of Uncinate Process

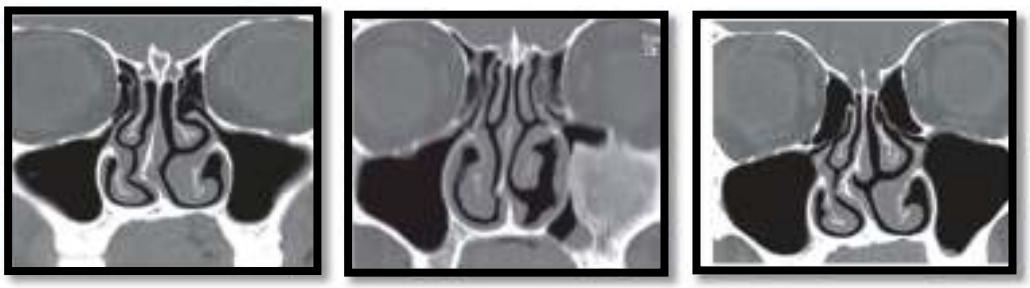


Fig 12 :Illustration showing Variation of Uncinate process-attaching laterally to lamina, cribriform plate and medially to middle turbinate respectively

Kauffman gave the term 'double middle turbinate' in which the uncinate process may be bent medially, folded anteriorly and protrude anteriorly and inferiorly giving the impression of two middle turbinates.[23]

Variations occur in attachment of upper end of uncinate process. Commonly it may attach to the lamina papy-racea ,in that case the sinus of frontal region drains to uncinate process on the medial side. [12]

Ethmoidal Bulla

The extent of pneumatization is very variable ranging from no pneumatization to extreme pneumatization where bulla extends far anteriorly under the middle turbinate where it may establish intimate contact with the posterior free margin of uncinate thereby blocking the hiatus semilunaris. In severe cases it produces an extensive area of contact between medial surface of the ethmoidal bulla and laterally over the surface of the middle concha and is the most common site for origin of polyps.[27]

Agger Nasi

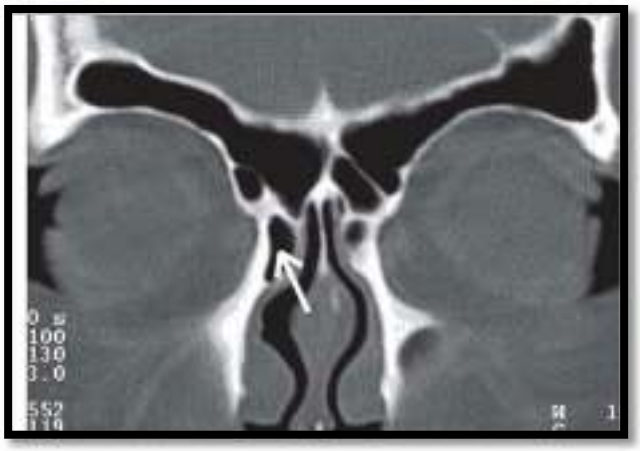


Fig 13 :Agger Nasi seen over the right side seen on coronal section in CT PNS scan

There is difference in prevalence of agger nasi pneumatization and incidence in different studies varies from 15% to 98.5%. [26,30]

Mosher [29] described it as cell near the extreme superior end of middle turbinate while Ritter described it as the anteriormost ethmoidal air cell. Zinreich et al called it as a chamber of air under the sinus of frontal region extending superiorly to the frontal recess, inferolaterally towards the lacrimal fossa and is anterolaterally enclosed by the nasal bones. [25,30]

MATERIALS AND METHODS

Source of Data: Patients with symptoms suggestive of chronic rhinosinusitis, attending the OPD /Inpatient Dept. of ENT ,'KLE'S Dr. Prabhakar Kore Hospital & Medical Research centre', Belgaum during the period Jan.2020 to Dec.2020

Study Design: Observational Study

Sample Size : 60

Duration: One year, from January 2020 to December 2020

Inclusion Criteria:

1. Patient in the age group of 18-60years
2. Patients diagnosed to have chronic rhinosinusitis.

Exclusion Criteria: The following pts. are excluded from the study:

1. With previous surgeries.
2. The one who refuse to give consent.
1. Patients over 60 years of age.
2. Patients diagnosed or suspected of disease like cystic fibrosis, primary ciliary dyskinesia, disorders of ciliary motility, immunodeficiency

Ethical Clearence: Ethical and research committee of KLE university, Belagavi approved the study by the (Letter No. MDC/DOME/300 dated 24th December 2019)

Methodology: Patients with symptoms of chronic rhinosinusitis,attending the out patient department/ In patient department of ENT at KLES Dr.Prabhakar Kore Hospital and MRC,Belagavi were evaluated as per EPOS 2012 international guidelines which consisted of:

- Nose Block/Nose congestion
- Nose discharge
- Face Pain /pressure
- Smell dysfunction

A thorough clinical examination was done and diagnosis of CRS was established.

The established cases of CRS were taken in the study. These patients were counselled regarding the CT-scan imaging of the nose and PNS and further about the need of endoscopic evaluation and surgery.

Informed consent was taken from all the cases and data regarding the patient was collected in a proforma as per the annexure.

Data collection included age, sex, preoperative CT scan, endoscopic findings.

Technique of CT scan performed

All patients were instructed to clean the nose by blowing before undergoing CT scan.

CT scan was done with Siemens Somatom sensation 64 slice CT machine.

Patient position: Prone with hypertension of head.In patients with cervical spondylosis as the head extensions is contraindicated, the gantry tilt is adjusted.

Angulation made: 90 degree to infra-orbitomeatal line.

Extent: Contiguous axial and coronal scans of slice thickness 3mm were obtained from frontal sinusntill posterioe extent of sphenoid sinus with thin sections in the regions of the osteomeatal complex.

Exposure: 125kV and 450mAs with a scan time of 5 to 7 sec, window width being 1500 to 2000 HU. Scans were evaluated preoperatively as per Lund-Mackay CT score.

For Diagnostic Nasal Endoscopy- Equipments used :

1. Nasal Endoscopes : 0 degree,30 degrees and 45 degrees
2. 'Cold light source'
3. Fibreoptic light cord
4. Karl-Storz camera with single chip
5. Sony 14 inch color monitor
6. Antifog solution-Savlon
7. Instruments

Statistical Analysis: Since the study is of observational type the analysis is planned in order to find the association between the outcome, clinical and demographic characteristics using Chi-square test. Suitable graphs and tables are used to depict the comparison.

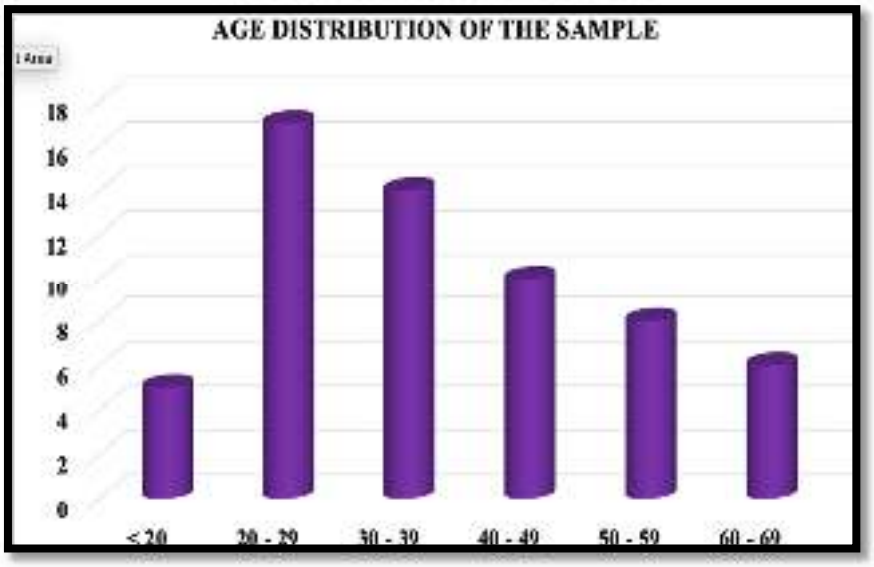
For all test the value of p less than 5%(0.05) will be significant.

RESULTS

TABLE 1: AGE DISTRIBUTION

AGE	NUMBER	%
< 20	5	8.33
20 - 29	17	28.33
30 - 39	14	23.33
40 - 49	10	16.67
50 - 59	8	13.33
60 - 69	6	10.00
TOTAL	60	100.00

Graph 1

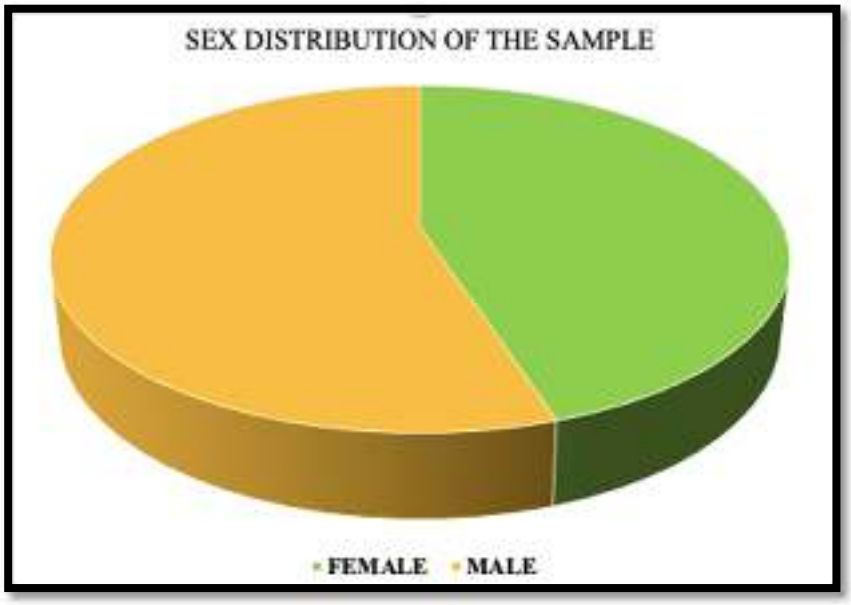


Common age group of presentation in our study was between 20-29 years, 17 patients (28.33%) followed by 14 patients (23.33%) in 30-39 years, with 10 patients (16.67%) in 40-49 years and 8 (13.33%) and 6 (10%) in 50-59 years & 60-69 years respectively. Only 5(8.33%) was present in age group below 20 years.

TABLE 2: SEX DISTRIBUTION

SEX	NUMBER	%
FEMALE	27	45.00
MALE	33	55.00
TOTAL	60	100.00

Graph 2

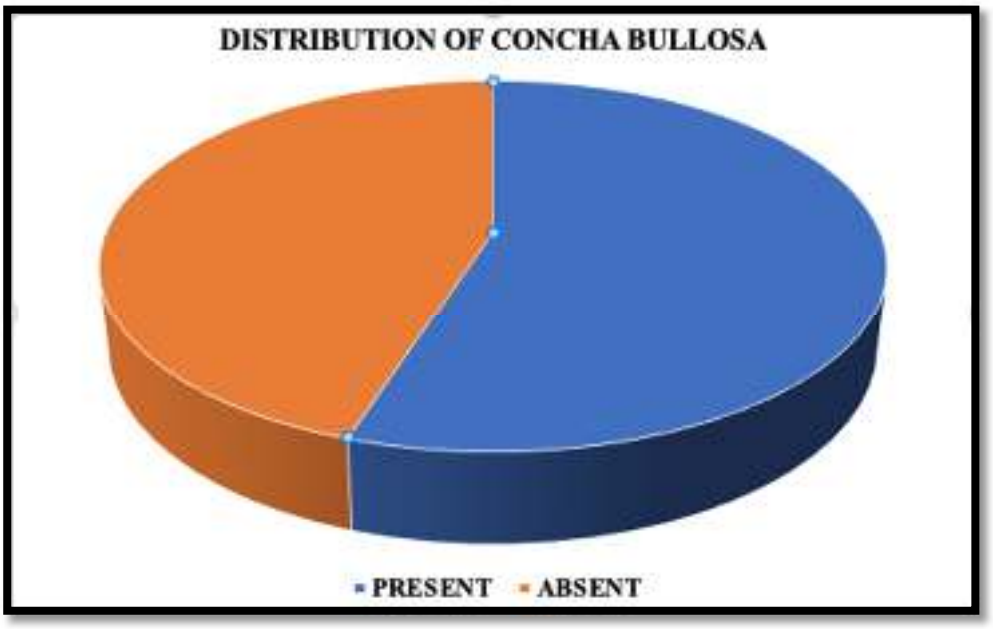


In Our study, sex distribution showed male preponderance with 33 (55%) males and 27(45%) females out of 60 patients studied.

TABLE 3 : PREVALENCE OF CONCHA BULLOSA

CONCHA BULLOSA	NUMBER	%
PRESENT	33	55.00
ABSENT	27	45.00
TOTAL	60	100.00

Graph 3

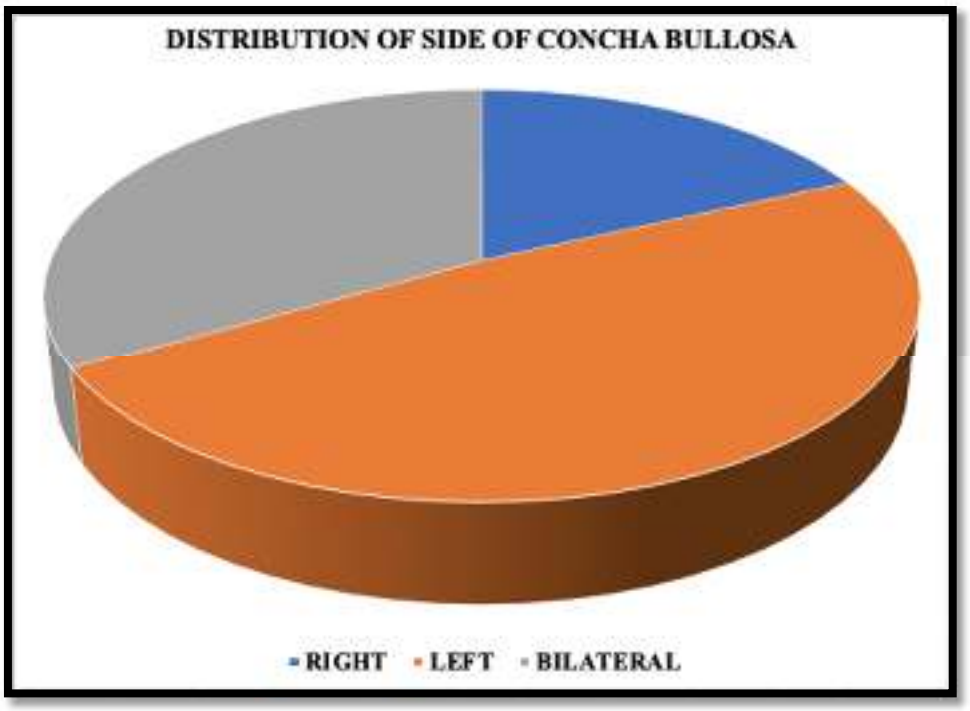


In our study, out of 60 patients studied , in 33 (55%) patients concha bullosa was found to be prevalent either unilateral or bilateral. In 27 (45%) patients concha bullosa was absent.

TABLE 4 : CONCHA BULLOSA-LATERALITY

SIDE OF CONCHA BULLOSA	NUMBER	%
RIGHT	6	18.18
LEFT	16	48.48
BILATERAL	11	33.33
TOTAL	33	100.00

Graph 4



In our study it was found unilaterally in 22 patients (66.66%) and bilaterally in 11 patients (33.33%).

C.B was found right side in 6 patients (18.18%)

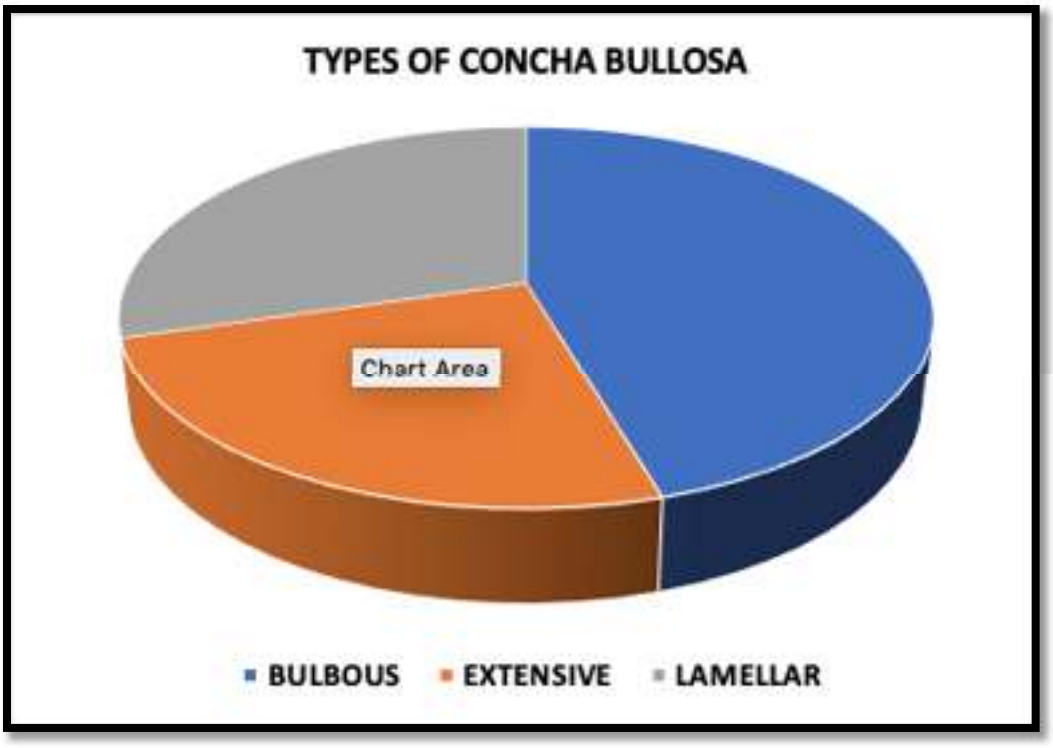
In 16 patients (48.8 %) it was found in left side

Predominance was found over left side.

TABLE 5 : TYPES OF CONCHA BULLOSA

TYPES OF CONCHA BULLOSA	NUMBER
BULBOUS	20
EXTENSIVE	11
LAMELLAR	13
TOTAL	44

Graph 5



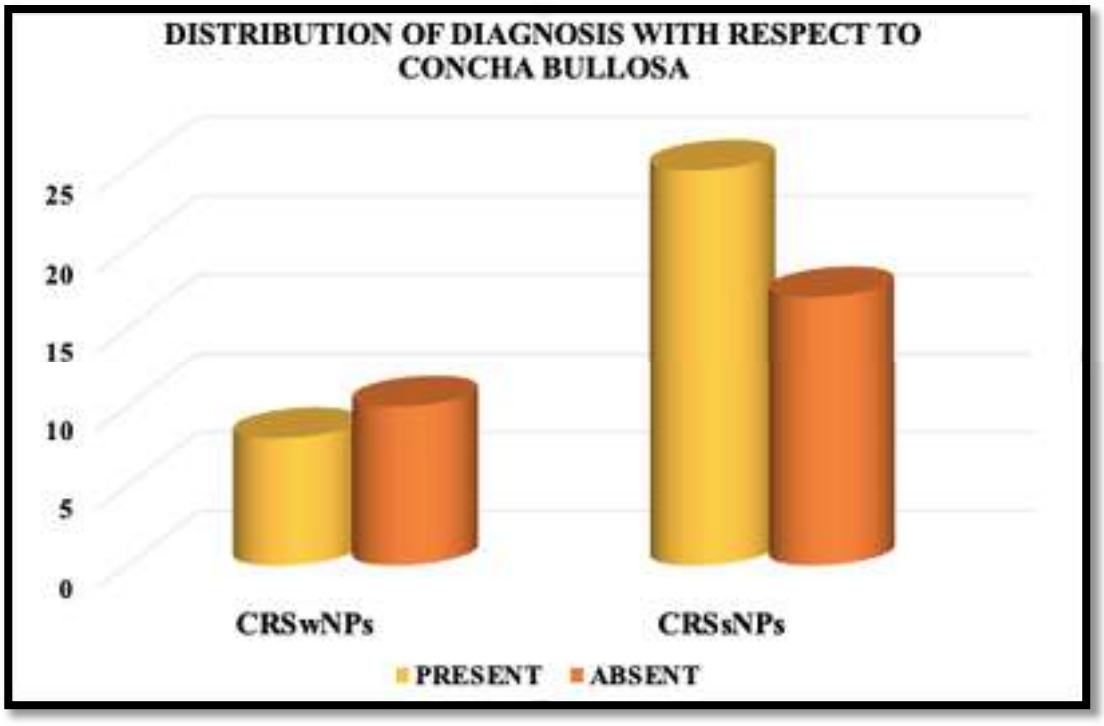
In the present study out of 44 Concha bullosa, Bulbous type were 20 (45.45%) , lamellar type were 13 (29.54 %) and extensive were 11 (25%).

Bulbous Type is been found to be maximum in number.

TABLE 6: ASSOCIATION OF CONCHA BULLOSA WITH CRS

	DIAGNOSIS				
CONCHA BULLOSA	**CRSwNPs**	**CRSsNPs**	**TOTAL**		
PRESENT	8	25	33	0.2820	NS
ABSENT	10	17	27		
TOTAL	18	42	60		

Graph 6



In our study out of total, C.B was found in 8 patients in chronic rhinosinusitis with nasal polyposis and in 25 patients of chronic rhino-sinusitis without nasal polyposis out of all the 33 patients possessing concha bullosa.

It was found to be statistically insignificant.

TABLE 7: ASSOCIATION OF CONCHA BULLOSA WITH MAXILLARY SINUS INVOLVEMENT

	MAXILLARY SINUS				
CONCHA BULLOSA	**PRESENT**	**ABSENT**	**TOTAL**		
PRESENT	32	1	33	<0.0001	HS
ABSENT	1	26	27		
TOTAL	33	27	60		

In our study the maxillary sinus changes were seen in 32 patients out of 33 cases with concha bullosa.

There is high association present between presence of concha bullosa and Maxillary sinus involvement.

TABLE 8: ASSOCIATION OF CONCHA BULLOSA WITH FRONTAL SINUS INVOLVEMENT

	FRONTAL SINUS				
CONCHA BULLOSA	**PRESENT**	**ABSENT**	**TOTAL**		
PRESENT	8	25	33	0.0131	S
ABSENT	15	12	27		
TOTAL	23	37	60		

In our study the Frontal sinus changes were seen in 8 cases out of 33 cases with CB while in 25 cases no sinus involvement was found.

There is Association found between concha bullosa and involvement of Frontal sinus. It is Statistically significant.

TABLE 9 : ASSOCIATION OF CONCHA BULLOSA WITH ANTERIOR ETHMOID INVOLVEMENT

	ANTERIOR ETHMOID				
CONCHA BULLOSA	**PRESENT**	**ABSENT**	**TOTAL**		
PRESENT	19	14	33	0.6717	NS
ABSENT	17	10	27		
TOTAL	36	24	60		

In our study the Anterior Ethmoid sinus changes were found in 19 cases out of 33 cases with concha bullosa while in 14 cases no sinus involvement was found.

There is No association found between presence of concha bullosa and Anterior ethmoid involvement.

TABLE 10: ASSOCIATION OF CONCHA BULLOSA WITH POSTERIOR ETHMOID INVOLVEMENT

	POSTERIOR ETHMOID				
CONCHA BULLOSA	**PRESENT**	**ABSENT**	**TOTAL**		
PRESENT	13	20	33	0.0693	NS
ABSENT	17	10	27		
TOTAL	30	30	60		

In our study the Posterior ethmoid changes were seen in 13 cases out of 33 cases with CB while in 20 cases no sinus involvement was found.

There is No association found between presence of concha bullosa and Posterior ethmoid involvement

TABLE 11 : ASSOCIATION OF CONCHA BULLOSA WITH SPHENOID SINUS INVOLVEMENT

	SINUS S				
CONCHA BULLOSA	**PRESENT**	**ABSENT**	**TOTAL**		
PRESENT	9	24	33	0.0124	S
ABSENT	16	11	27		
TOTAL	25	35	60		

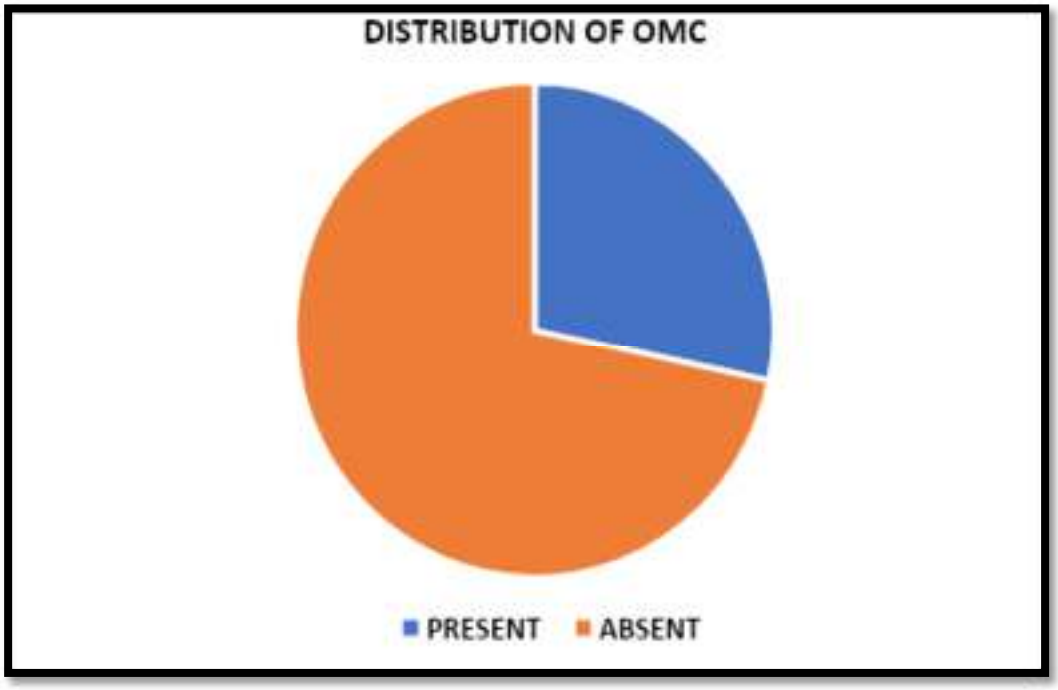
In our study, sphenoid sinus changes were seen in 9 cases out of 33 cases with CB whereas in 16 cases without C.B

There is association between presence of concha bullosa & sphenoid sinus involvement.

TABLE 12 : ASSOCIATION OF CONCHA BULLOSA WITH OSTEOMEATAL COMPLEX

OMC	NUMBER	%
PRESENT	17	28.33
ABSENT	43	71.67
TOTAL	60	100.00

Graph 7



In our study Osteomeatal complex occlusion was found in patients (28.33%) and absent in 43 patients (71.67%).

DISCUSSION

The present study Title 'Association of concha bullosa and chronic rhinosinusitis patients-a computerized tomography assisted one year 'cross sectional study' was conducted from Jan 2020 to Dec 2020 in the KLE University's Dept. of Otorhinolaryngology and Head and Neck Surgery, 'Jawaharlal Nehru Medical college' at KLES Dr.Prabhakar Kore Hospital and MRC, Belagavi.

The study includes 60 patients with Chronic Rhinosinusitis who underwent CT PNS scan, Diagnostic Nasal Endoscopy and association was made between concha bullosa and patients of Chronic Rhinosinusitis.

1.Age and Sex Distribution

Age: In our study maximum patients (28.33%) were there in the age gp. of 20-29 years, with minimum number of pts. in age group less than 20 yrs.

Sex: In the present study of 60 subjects, 33 males (55%) and 27 females (45%) were included. According to Ron G and Eric[30] J chronic rhinosinusitis was more among females (67.7%) as compared to males (33.3%) while in study by Zojaji[31]et al (2008) the prevalence was among males (69 %) as compared to females (31%).Jones[32] stated that there was no difference in the prevalence of Rhinosinusitis among both the sexes.

A study by Rafel et al (2007) [33] showed mean age group of 40years while Sheetal et al [06] in their study showed CRS was common in age group of 20-40 years.

2. Prevalence of Concha Bullosa and Laterality

In the present study, out of total 60 patients, C.B was found in 33 patients (55%). In study by Harugop et al [02] concha bullosa was seen in 50% of the patients. According to Shahizon et al [08] 45% had concha bullosa detected on CT scan.

In a study by Lloyd et al [06] concha bullosa was detected in 24% of patients while similar studies by Bolger(1991) [25], Jones[34] (1997), Kennedy and Zinreich (1988) [35] and Danse (1997) [36],showed CT evidence of concha bullosa in 53%, 20%, 36% and 31% of patients respectively.

Clark et al [100](1989) in their study noted, on CT scan C.B was witnessed in 33% of sinusitis patients & in 11% of asymptomatic patients.

A study by Jiannetto and Pratt[38] (1995) showed concurrent agreement of 85.71% while correlating preoperative CT and operative findings (p=0.00)

In this study it was found unilaterally in 22 patients (66.66%) and bilaterally in 11 patients (33.33%).

C.B was found right side in 6 patients (18.18%)

And left side in 16 patients (48.8 %).

Predominance is found over left side.

Saarthak Wadhwa et al [40] observed that about 54.28% had C.B on left side, 30% had C.B on right side and 15.71% had bilateral C.B

3.Type of Concha Bullosa

Bogler WE et al. [39] divided middle concha pneumatisation into 3 types, bulbous type: middle turbinate pneumatization of bulbous segm., lamellar type: Aeriation of middle turbinate's vertical lamella and extensive type: Both vertical and bulbous portion pneumatization.

In the present study out of 44 C.B, Bulbous type were 20 (45.45%) lamellar type were 13(29.54 %) and extensive were 11 (25%)

Study by Rashmi et al [03] percentage of bulbous, lamellar, extensive concha bullosa is 63% 13%, and 24%

In a study by Shyamakant et al[41], 48.27 %, constituted of lamellar type 31.03 % -bulbous type and 20.69 % cases were of extensive type out of 29 concha bullosa.

4.Nasal Septal Deviation

Septal deviation has been found to be there in 43 patients (71.66%) among the total patients studied out of which right side deviation is seen in 23(38.33%) , left DNS in 17 (28.33%) and B/L in 3 (5%) whereas 17 patients (28.33%) had no septal deviation

Among all the patients with C.B, 25 (56.81%) cases had Septal deviation whereas 8 (18%) cases had no septal deviation.

Mubarki M et al [42] showed that from all CB patients 15 cases (88%) have septal deviation that range from mild to severe type whereas 2 cases (12%) had no septal deviation.

5.Distribution with respect to disease

There is no statistical test present to find an association between Concha bullosa and Chronic Rhino-sinusitis individually so an association was made after categorizing chronic rhino-sinusitis into CRSwNP and CRSsNP.

In our study out of total, C.B was found in 8 patients in chronic rhinosinusitis with nose polyposis and in 25 patients chronic rhino-sinusitis without nasal polyposis. It was found to be statistically insignificant.

6.**Distribution according to Sinus involvement**

In our study the maxillary sinus changes were seen in 32 patients out of 33 cases with concha bullosa. There is an association found between C.B and sinus disease of the maxilla

Frontal sinus changes were seen in 8 cases out of 33 cases with C.B while in 25 cases no sinus involvement found.

Sphenoid sinus changes were seen in 9 cases out of 33 cases with C.B whereas in 16cases without C.B

In an article by Shyamakant Prasad et al[41], out of 240 sides, mucosa changes in maxillary sinus were visualized in 162 sides (67.5%). Among 87 sides with C.B, 72 (82.75%) had mucosal changes in sinus of maxilla while in 15sides (17.24%) no sinus involvement found. Among153 sides with no C.B, 58.8% had mucosal changes which comprised 90 sides and 41.2% had normal sinus which comprised 63 sides. A significant correlation was found between mucosal changes in maxillary sinus & concha bullosa.

In a subsequent study conducted by Raja Kalarasi[43], at the Dept. of ENT & HNS, Pondicherry, among 202 pts. studied, CB was seen among 31.7% patients. Among them 54.7% patients CB bilaterally and 45.3% patient CB unilaterally was found.

7. Osteomeatal Complex Occlusion

In our study OMC occlusion was seen in 17 patients (28.33%) out of 60.

In a study by Zinreich SJ et al [44] concha bullosa is found to have association with ostio-meatal complex disorder.

Limitations Of The Study- This study possess small sample size, there is a need of studies to be conducted at many centres ,with large sample size for sound results.

CONCLUSION

The present study Title 'Association of concha bullosa and chronic rhinosinusitis patients-a computerized tomography assisted one year cross sectional study' Aim was to find an Concha bullosa association between pts. of Chronic Rhino-sinusitis. Patients with signs and symptoms suggestive of CRS were subjected to CT scan and Diagnostic Nasal endoscopy.

- Chronic rhino-sinusitis is an ordinary condition in which the age gp. between 21 and 30 years gets affected most commonly.
- Male predominance was found (55%) among the patients getting affected with CRS.
- Out of 60 patients, concha bullosa was found in 33 patients (55%).
- C.B was found more in unilaterally (66.66%) and that too over the left side (48.8 %) as compared to right.
- Amongst all types Bulbous type were found to be the most seen in 20 cases (45.45%)
- In 43 patients (71.66%). DNS was found where right DNS 23(38.33%) was more predominant as compared to the left side.
- Concha bullosa was found in 25 patients of chronic rhinosinusitis without nasal polyposis.
- There is an association found between C.B and sinus disease of the maxilla, frontal sinus and Sphenoid sinus. In Statistical analysis for 'maxillary sinus' $p<0.0001$ which means there is high significance between maxillary sinus disease and presence of C.B whereas $p = 0.0131$ and $p = 0.0124$ for 'frontal

and sphenoid sinus' respectively. Therefore significant association is found in our study for all the above mentioned 3 sinus.

- OMC occlusion was seen in 17 patients (28.33%)

In the above study, concluding CB being found in 55% of cases of CRS is a significant number and therefore in all patients of nasal obstruction it should be considered as important differential diagnosis also one should consider regarding the chances of occurrence of Chronic Rhino-sinusitis or vice versa.

- Limitations of The Study- There is a limited sample size, hence further studies with larger sample size is required to confirm our study; it needs to be multicentric and to have sound results.

SUMMARY

In this study an attempt is being made to find an association between Concha Bullosa in Chronic Rhinosinusuitis patients.

In our study the patients got CT-PNS scan done and Diagnostic Nasal Endoscopy.

Significant number of patients are found to have Concha bullosa which proves it as a commonest anatomical variant of middle turbinate. CT Scan is of immense value to help diagnose CRS and pneumatization of middle turbinate.

Therefore line of management can be decided by the operating surgeon whether to remove Concha bullosa depending upon its size and level of nasal obstruction it is causing apart from occlusion of the osteomeatal complex.

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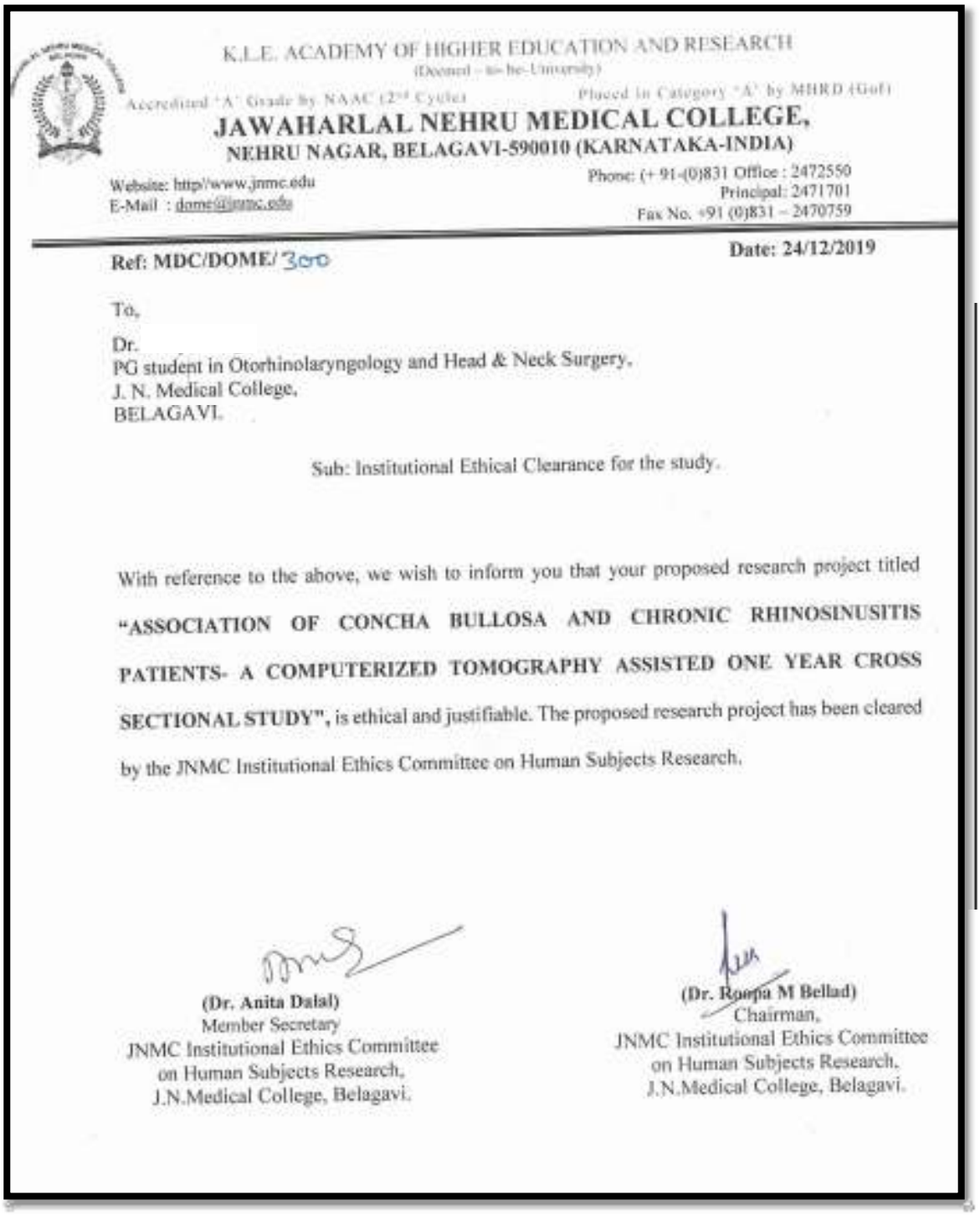
ANNEXURE - I – ETHICAL CLEARANCE LETTER



K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to-be-University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)

JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)

Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 300 **Date: 24/12/2019**

To,

Dr.
PG student in Otorhinolaryngology and Head & Neck Surgery,
J. N. Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"ASSOCIATION OF CONCHA BULLOSA AND CHRONIC RHINOSINUSITIS PATIENTS- A COMPUTERIZED TOMOGRAPHY ASSISTED ONE YEAR CROSS SECTIONAL STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Anita Dalal)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

ANNEXURE - II – CONSENT FORM

INFORMED CONSENT

Association of Concha Bullosa and Chronic Rhinosinusitis patients-A Computerized Tomography assisted One year Cross Sectional Study.

PRINCIPAL INVESTIGATOR: DR

Post Graduate student

Department of Otorhinolaryngology.

CO-INVESTIGATOR : DR MS, PhD

Head Of the Department and Professor, Department of Otorhinolaryngology

J.N. Medical College

INTRODUCTION AND PURPOSE:

The present study is conducted among patients with chronic rhinosinusitis in the department of ENT & HNS at KLE's Dr.Prabhakar Kore Charitable Hospital and Medical Research Centre, Belagavi. You are requested to participate in the study and your participation is completely voluntary.

The aim of the study is to find out the prevalence of Concha bullosa in patients of Chronic Rhinosinusitis.

PROCEDURE:

If you agree to participate in this study, the relevant data will be collected as per the proforma and the final diagnosis will be confirmed.

After getting inducted in the study, you will be screened for Concha Bullosa with help of Diagnostic Nasal Endoscopy and CT-Paranasal Sinus.

BENEFITS:

Patient will not be eligible for any kind of monetary benefits or free services by virtue of your participation in the study.

RISKS:

Methods applied to do the study are safe.

COST OF PARTICIPATION:

The cost of the Investigation will be borne by the Study Subject. The other indirect expenses will be borne by the Investigator.

PRIVACY AND CONFIDENTIALITY:

The results of the study may be published in journals for scientific purposes. However, your identity will not be revealed. All information collected will be coded so that no one other than the investigator will know your identity.

WITHDRAWAL FROM THE STUDY:

You can withdraw from the study at any time if you wish to do so.

Alternatives:

In case you opt out of the study, it will not affect your relationship with KLES Dr. Prabhakar Kore Hospital.

AUTHORIZATION TO PUBLISH THE RESULTS:

The researcher may use the information gathered from this study for presentation in scientific meetings. However, your identity will not be revealed.

INSTITUTIONAL /SPONSORS POLICY: In the event of any drug reaction or injury during endoscopy, related to this study, no reimbursement or compensation will be given by law. However, treatment will be made available at KLES Hospital & MRC, Belgaum. If you face any untoward event, you may contact– Dr. at Department of ENT and Head & Neck surgery, KLE's Hospital & MRC, Ph. No Dr. Professor at Department of ENT, Head & Neck Surgery, KLE's Hospital & MRC, Ph. No..

LEGAL RIGHTS: By signing this consent form, you are not waiving any of your legal rights.

QUERIES AND CONTACT:

If you have any queries regarding the study, you can contact Dr. ; without any hesitation on Mobile no: and the guide Dr. A.S Harugop Mobile No:

If you have any questions about rights as a research participant you can contact Dr Roopa M Bellad, Professor, department of Paediatrics, Jawaharlal Nehru Medical College Institutional Ethics Committee on human subjects' research.

CONSENT SUMMARY:

I have been explained all the contents of this consent form in my local language and having understood and clarified all my queries about the study to the best of my knowledge, I hereby give my voluntary consent for participation in the study. I do sign the informed consent form in front of an eyewitness whom I recognize.

Name and Signature/ left thumb impression of the participant:

Name and Signature of the interviewer:

Name and Signature/ left thumb impression of the eyewitness (Relative):

Signature of the guide: **Date:**

CONSENT STATEMENT TO PARTICIPATE IN A RESEARCH STUDY

I,Mr./Mrs./Miss._____voluntarily agree to take part in this study, by signing this consent form I am not giving up my legal rights. may withdraw at any time. I am signing after having read, or been read to me in the vernacula language including risks and the benefits and having all queries cleared.

Signature of the study patient _____

Name of Study patient _____

Name and Signature of Witness_____

_____

Name and signature of investigator_____

_____

DATE:_____ PLACE: _____

ANNEXURE - III – PROFORMA

PROFORMA FOR DATA COLLECTION

ASSOCIATION OF CONCHA BULLOSA AND CHRONIC RHINOSINUSITIS PATIENTS-A COMPUTERIZED TOMOGRAPHY ASSISTED ONE YEAR CROSS SECTIONAL STUDY .

S.No.:	Date:
NAME -	AGE -
OP/IP NO -	MOBILE -
ADDRESS -	CONSULTANT -
OCCUPATION-	
DOA -	DOD -

CHIEF COMPLAINTS

HISTORY OF PRESENTING ILLNESS

PAST HISTORY

FAMILY HISTORY

PERSONAL HISTORY

EXAMINATION

PHYSICAL EXAMINATION:

1) General physical examination

Vital signs:

Blood Pressure

Pulse

Respiratory Rate:

Pallor

Icterus

Cyanosis

Clubbing

Lymphadenopathy

Edema:

1.NOSE EXAMINATION:

External Appearance

- ROOT
- BRIDGE
- DORSUM
- ALA
- TIP
- COLUMELLA

MAXILLARY
FRONTAL
ANT. ETHMOID

ORAL CAVITY AND OROPHARYNX:

4.

DIAGNOSIS:

ROUTINE TESTS:

CBC

SERUM UREA:

SERUM CREATININE:

HIV: HBSAG:

BLEEDING TIME:

CLOTTING TIME:

ZERO DIGESTIC ENDOSCOPY FINDINGS:

ENDOSCOPIC APPEARANCES (0-2)

	RIGHT	LEFT
POLYP:		
DISCHARGE:		
OEDEMA:		
SCARS OR ADHESIONS:		
CRUSTING:		

CT-PNS SCAN EVALUATION:

RADIOLOGICAL GRADING

SINUS SYSTEMS (0-2)	RIGHT	LEFT
MAXILLARY:		
ANTERIOR ETHMOIDS:		
POSTERIOR ETHMOIDS:		
SPHENOID:		
FRONTAL:		
OSTEOMEATAL COMPLEX:		
TOTAL:		

ANNEXURE-IV - PHOTOGRAPHS

UNILATERAL CONCHA BULLOSA

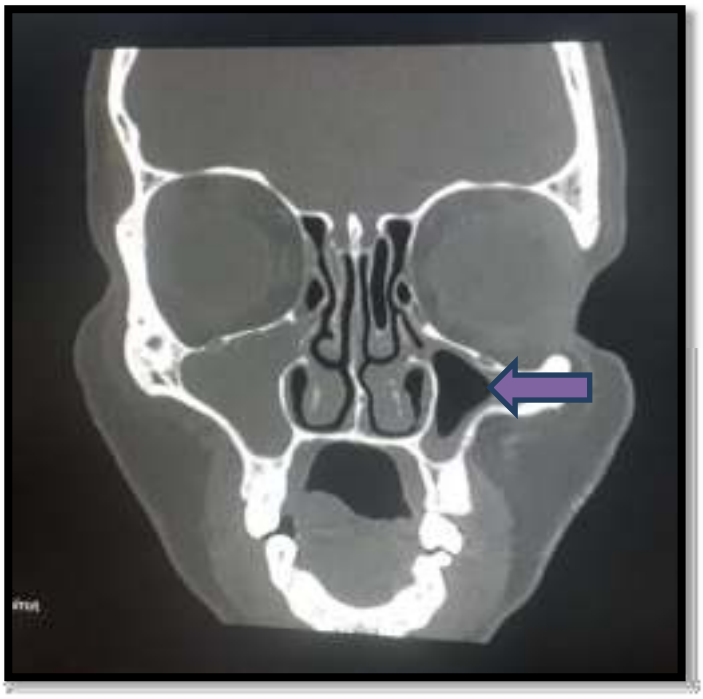


Photo 1. Plain CT Scan-PNS coronal section showing concha bullosa of lamellar type on the left si

Photo 2. Plain CT Scan-PNS coronal section showing concha bullosa of Bulbous type on the left side

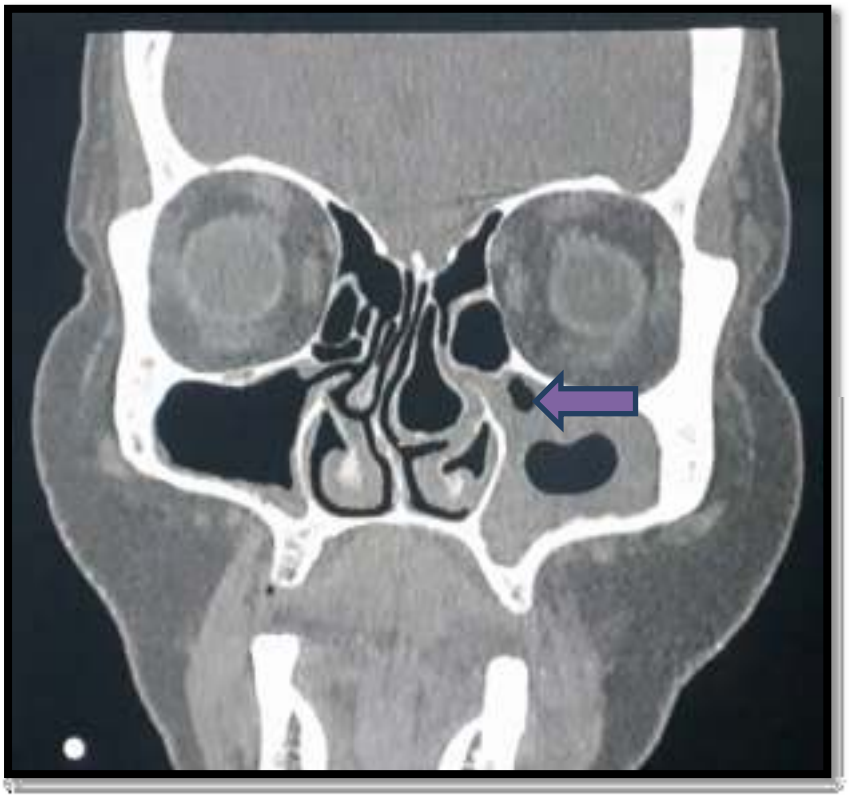


Photo 3. Plain CT Scan-PNS coronal section showing concha bullosa of Extensive type on the left side

BILATERAL CONCHA BULLOSA

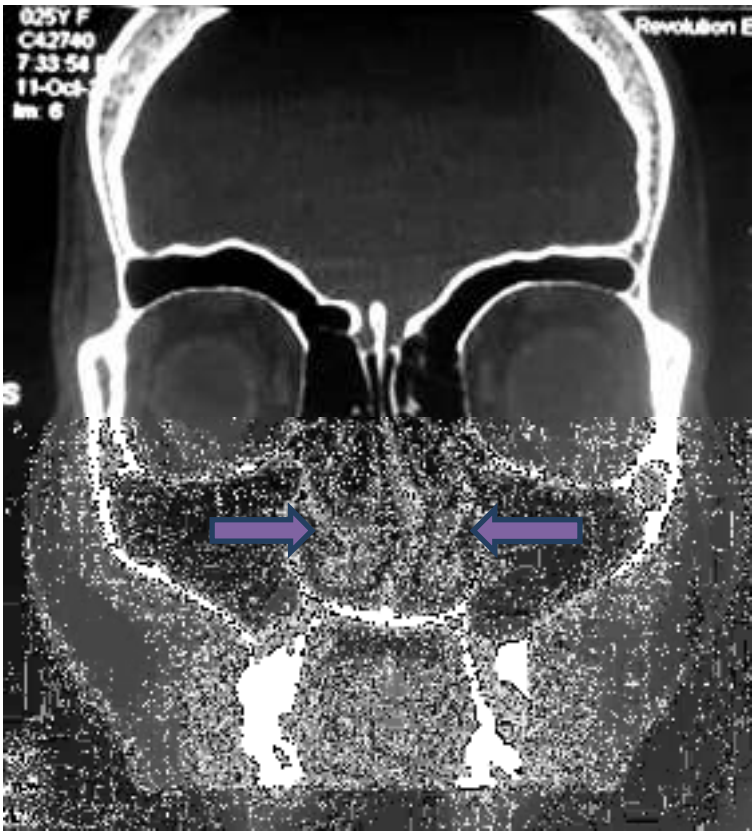


Photo 4. Plain CT Scan-PNS coronal section showing bilateral concha bullosa of lamellar type on the left side and extensive type on the right side.

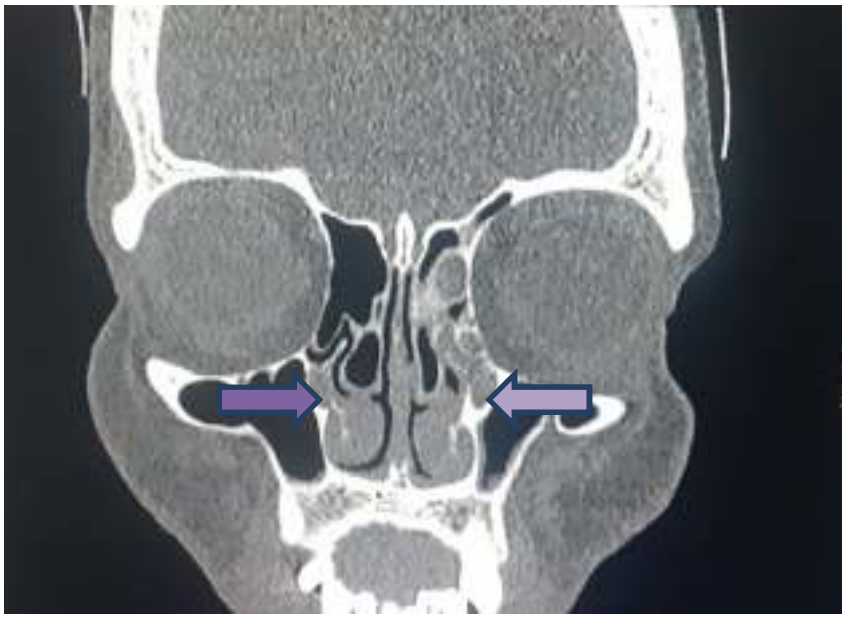


Photo 5. Plain CT Scan-PNS coronal section showing bilateral concha bullosa of lamellar type on the left side and bulbous type on the right side.

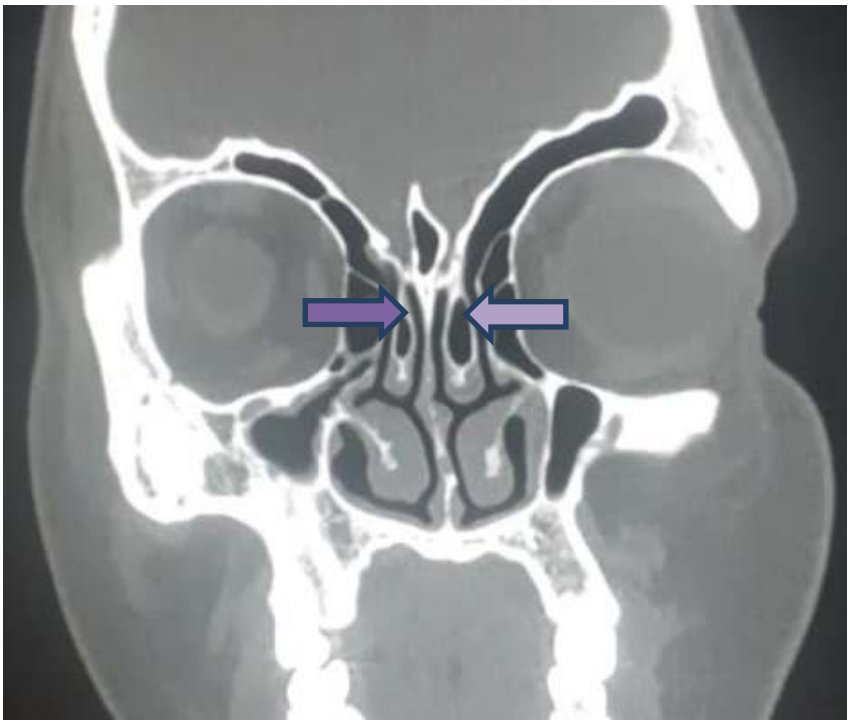


Photo 6. Plain CT Scan-PNS coronal section showing bilateral concha bullosa of bulbous type on both the sides

CONCHA BULLOSA-LAMELLAR TYPE

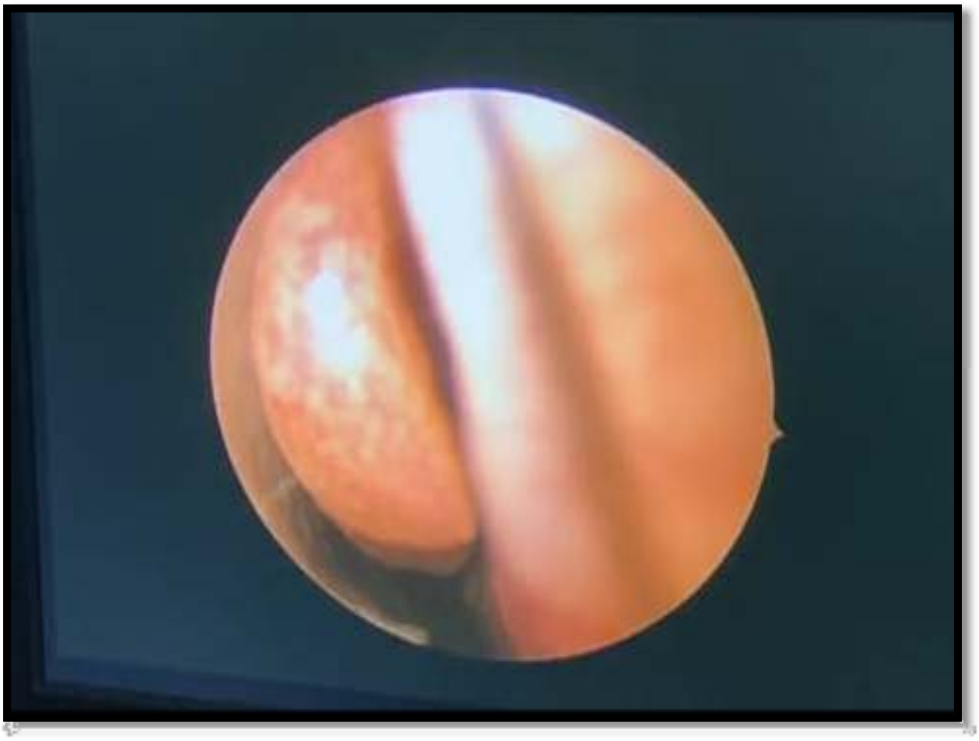


Photo 7:**Endoscopic Appearance Of Concha Bullosa of Lamellar type on the Left Side**

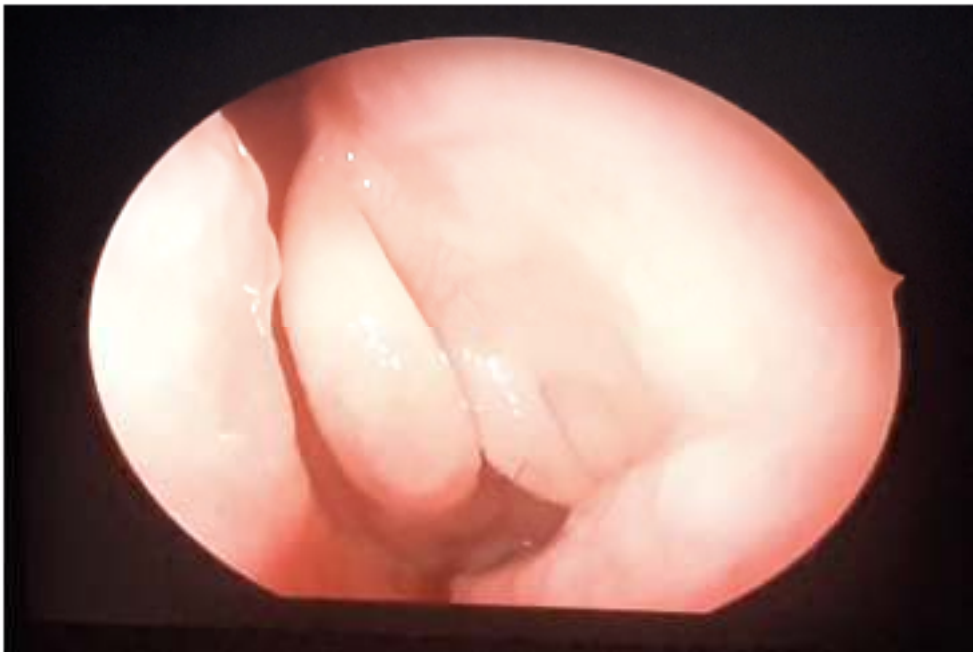


Photo 8. Endoscopic Appearance of Concha Bullosa of Lamellar type on the Left Side

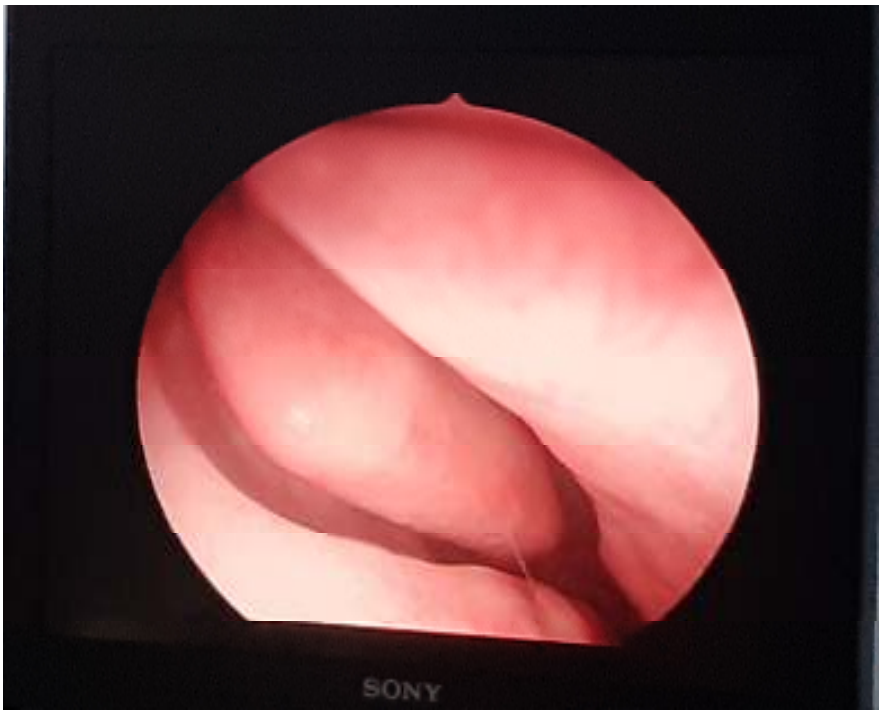


Photo 9.Endoscopic Appearance of Concha Bullosa of Lamellar type on the Right Side

CONCHA BULLOSA- BULBOUS TYPE

Photo 10. Endoscopic Appearance Of Concha Bullosa of Bulbous type on the Right Side.

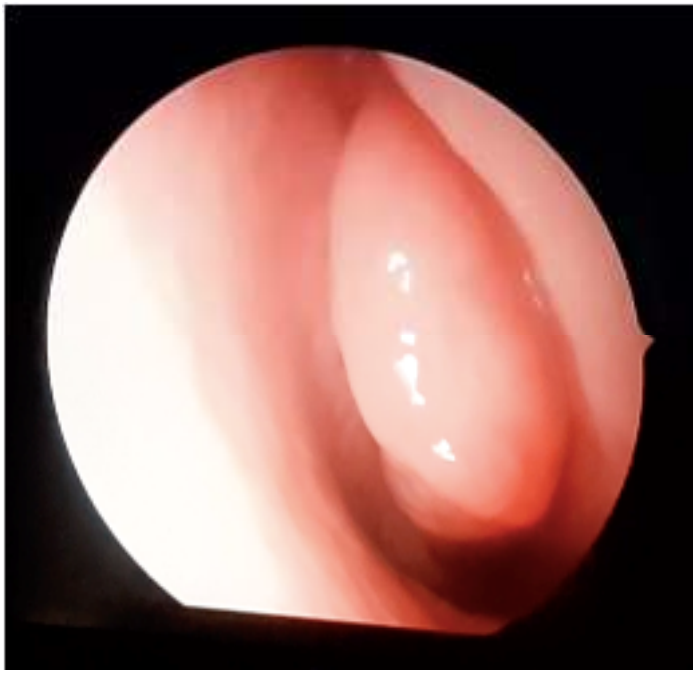


Photo11. Endoscopic Appearance of Concha Bullosa of Bulbous type on the Left Side.

Photo 12.Endoscopic Appearance of Concha Bullosa of Bulbous type on the Left Side

CONCHA BULLOSA- EXTENSIVE TYPE

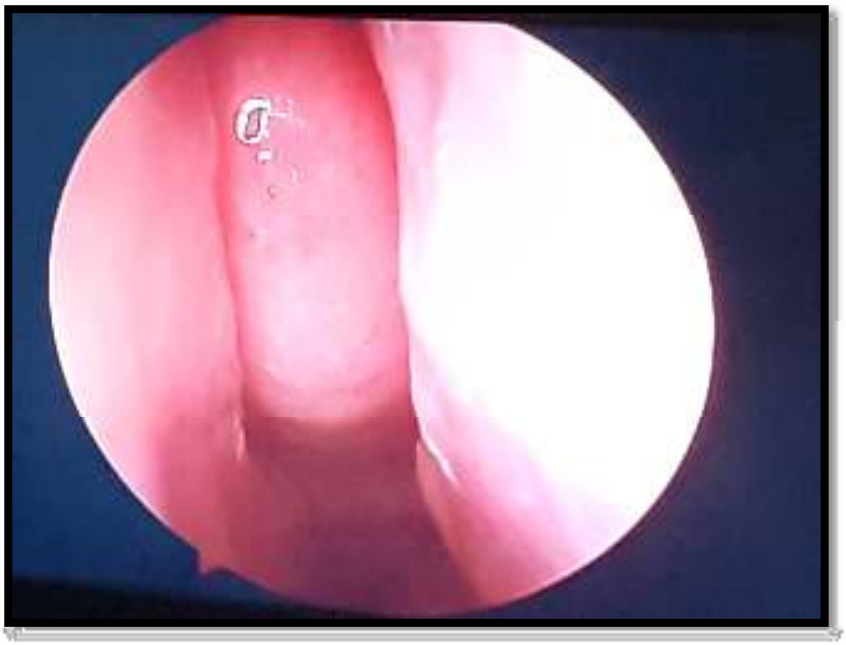


Photo 13. Endoscopic Appearance of Concha Bullosa of Extensive type on Right Side.

Photo 14. Endoscopic Appearance of Concha Bullosa of Extensive type on Right Side.

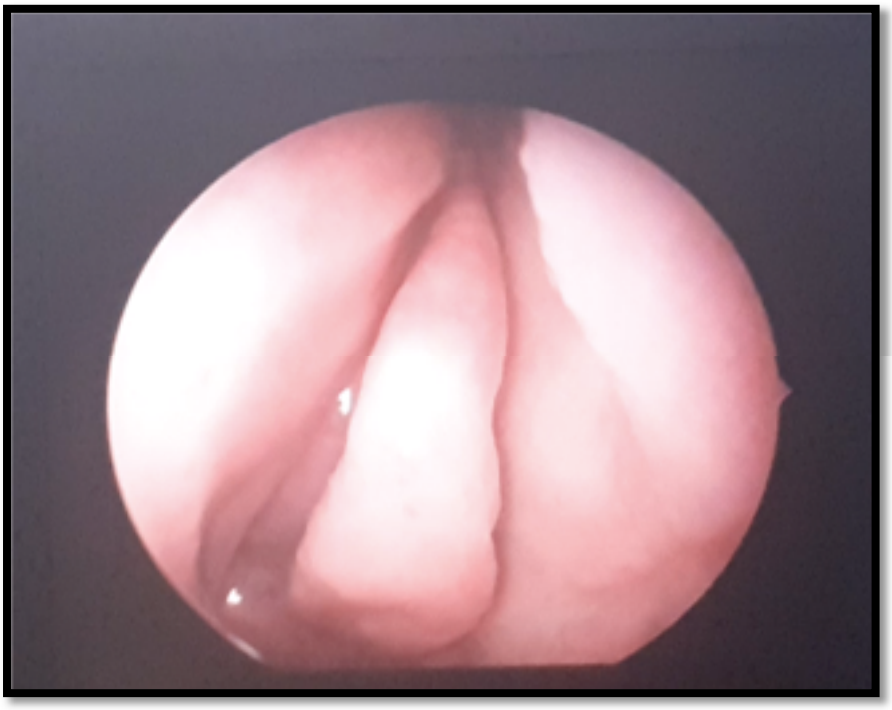


Photo 15. Endoscopic Appearance of Concha Bullosa of Extensive type on the Left Side.

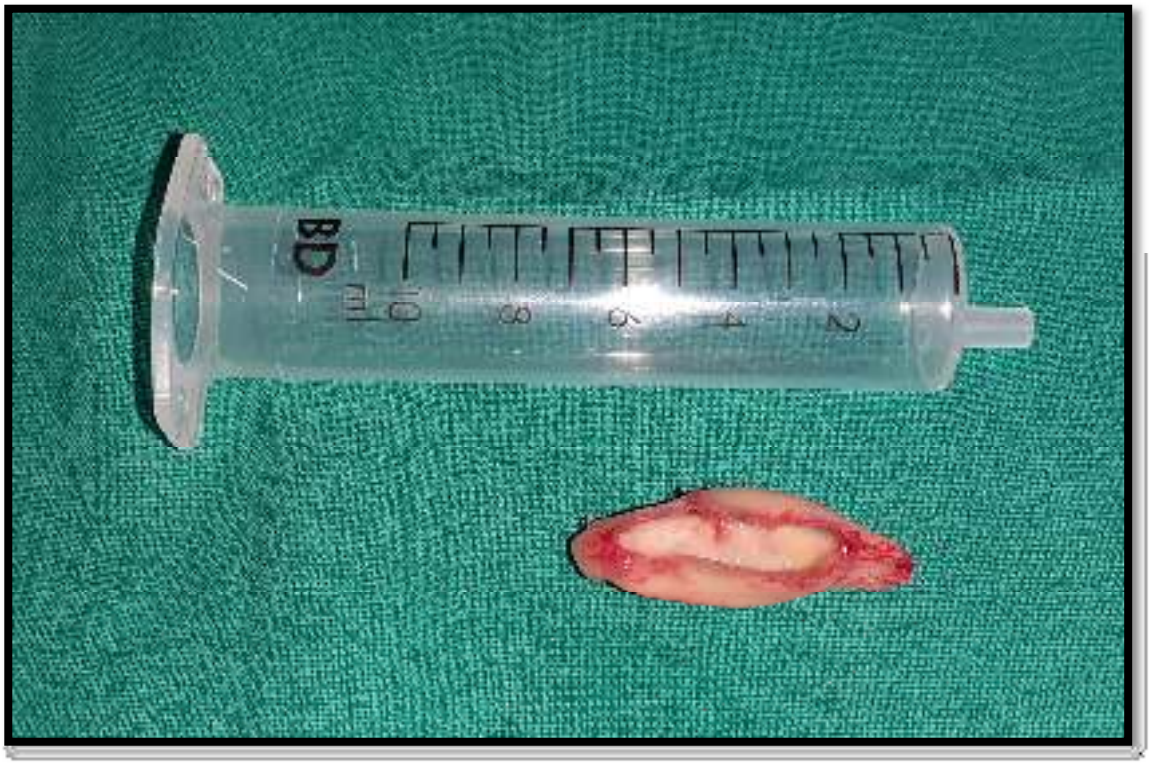


Photo 16. Specimen of Concha Bullosa measuring approx. 5.5 cm

Photo 17- Plain CT Scan-PNS coronal section showing concha bullosa of Bulbous type on the left side with its Endoscopic Appearance and the removed specimen of Concha Bullosa respectively

Photo 18 - Plain CT Scan-PNS coronal section showing concha bullosa of Lamellar type on the left side with its Endoscopic Appearance and the removed specimen of Concha Bullosa respectively

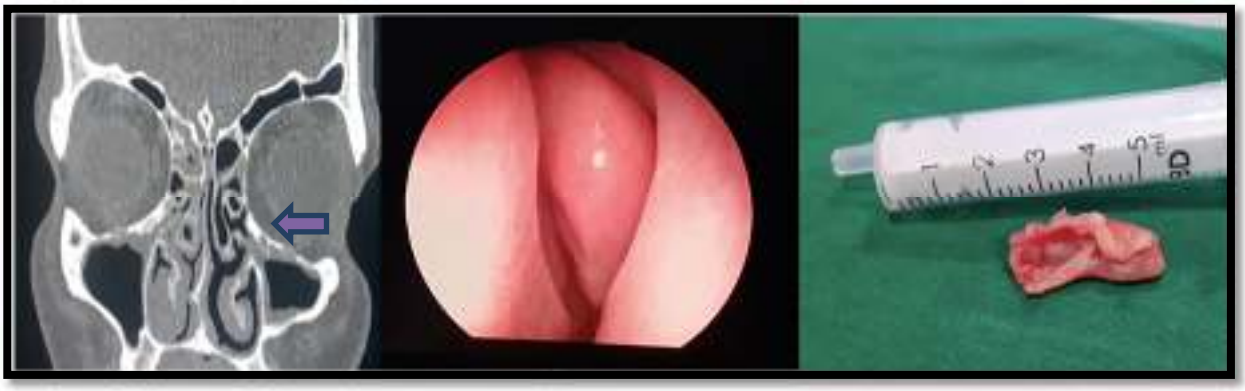


Photo 19. Plain CT Scan-PNS coronal section showing concha bullosa of Lamellar type on the left side with its Endoscopic Appearance and the removed specimen of Concha Bullosa respectively.

Photo 20. Removed Specimen Of Concha Bullosa (Closer View) showing clear air filled cavity.

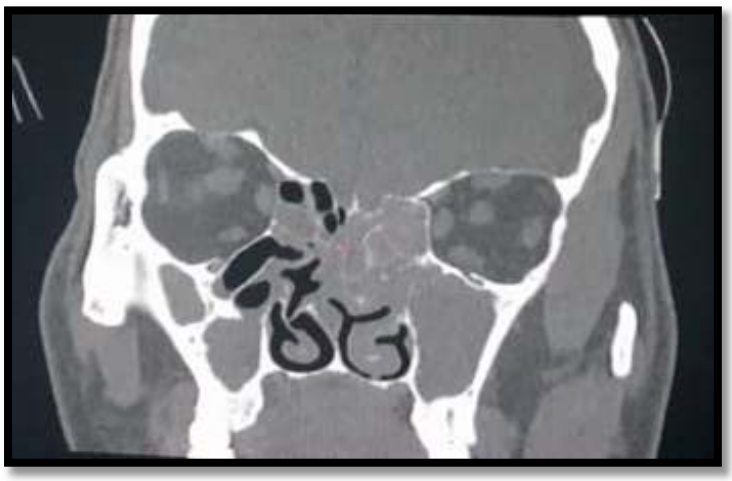


Photo 21. Plain CT Scan-PNS coronal section showing Chronic Rhinosinusitis with Nasal Polyposis (CRSwNP) with involvement of Left Maxillary Sinus, Anterior and Posterior Ethmoids

ANNEXURE - V - KEY TO MASTER CHART

- S.No – Serial Number
- Sex
  - M-Male
  - F- Female
- Diagnosis
  - CRSwNP- Chronic Rhinosinusitis with Nasal Polyposis
  - CRSsNP- Chronic Rhinosinusitis without Nasal Polyposis
- For CT Scan
  - PMT- Paradoxical middle Turbinate
  - Concha Bullosa
    - A-Absent
    - P-Present
    - If Present Then **Type** of Concha Bullosa :
      - (E) - Extensive
      - (L) - Lamellar
      - (B) - Bulbous
- Septum
  - L.DNS- Left Deviated Nasal septum
  - R.DNS- Right Deviated Nasal septum
  - B/L DNS- Bilateral Deviated Nasal septum
- MT-Mucosal Thickening
- PC-Polypoidal Changes
- OMC- Osteomeatal Complex

- Sinus Involvemnet:
    - M-Maxillary
    - F-Frontal
    - A.E-Anterior Ethmoid,
    - P.E-Posterior Ethmoid
    - S-Sphenoid
        - Rt.-Right
        - Lt.-Left

ANNEXURE - VI - KEY TO MASTER CHART

									Pre-Operative CT-Scan																		
S.No.	Name	Age/Sex	Diagnosis	MIDDLE TURBINATE									M.T		P.C		SINUS										
				PMT		**BULLOSA**		Septum	OMC								M		F		A.E		P.E		S		
				Rt.	Lt.	Rt. (Type)	Lt. (Type)	A	Rt.		Lt.		Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	
									N.O	O	N.O	O															
1	Sanjog Pujari	18yr/M	CRSsNPs	A	A	**P (B)**	**P (E)**	Central	A	A	A	A	P	P	A	A	P	P	A	A	P	P	A	A	A	A
2	Krishna Kumar	40yr/M	CRSsNPs	A	A	A	**P (B)**	B/L DNS	A	A	A	A	P	A	A	A	P	A	A	A	A	P	A	P	A	A
3	Shivanand Doddmani	52yr/M	CRSsNPs	A	A	A	A	L.DNS	A	P	A	P	P	P	A	A	P	P	A	A	P	P	P	P	P	P
4	Mahadevi Naduvinmani	25yr/F	CRSwNPs	A	A	A	A	L.DNS	A	A	A	A	P	A	P	A	P	P	A	A	P	P	P	P	P	A
5	Santosh Bintri	18YR/M	CRSwNPs	A	A	A	**P (B)**	L.DNS	A	A	A	A	A	A	P	P	P	P	A	A	A	A	A	A	A	A
6	Manjunath B.S	29yr/M	CRSsNPs	A	A	A	**P (E)**	R.DNS	A	P	A	P	P	P	A	A	P	P	A	A	P	P	P	A	A	A
7	Indrajeet	21yr/M	CRSsNPs	A	A	A	**P (B)**	L.DNS	A	A	A	A	A	A	A	A	P	P	A	A	P	P	A	A	A	A
8	Kousar Kalibhai	41yr/M	CRSwNPs	A	A	**P (B)**	A	L.DNS	A	A	A	A	P	P	A	A	P	P	A	A	A	A	A	A	P	P
9	Chanbasappa	60yr/M	CRSsNPs	A	A	A	**P (L)**	R.DNS	A	A	A	A	P	A	A	A	P	A	A	A	A	A	A	A	A	A
10	Leela Sanadi	30YR/F	CRSwNPs	A	A	A	A	R.DNS	A	P	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
11	Roopa Jadhav	32yr/F	CRSsNPs	A	A	**P (E)**	**P (L)**	Central	A	A	A	P	P	A	A	A	P	P	A	P	A	P	A	A	A	A
12	Aishwariya Paschapar	21 yr/F	CRSsNPs	A	A	A	**P (B)**	Central	A	A	P	A	P	A	A	A	P	A	P	A	P	P	P	P	P	P
13	Sunanda Mallanawa	57yr/F	CRSwNPs	A	A	A	**P (E)**	R.DNS	A	A	A	P	P	P	A	P	A	P	A	A	A	A	P	A	P	A
14	Sanjay Madilavar	29 yr/M	CRSwNPs	A	A	A	A	Central	A	P	A	A	P	P	A	A	P	P	P	A	P	P	P	P	A	A
15	Prajwal	34yr/M	CRSsNPs	A	A	A	**P (E)**	R.DNS	A	A	A	A	P	P	A	A	P	P	A	A	P	P	P	P	P	P
16	Imam Hussain Mulla	42yr/M	CRSwNPs	A	A	A	A	R.DNS	A	A	A	A	A	A	P	A	P	P	A	P	A	P	A	P	A	A
17	Channappa Holeyachi	31yr/M	CRSsNPs	A	A	A	A	R.DNS	A	A	A	P	A	P	A	P	A	P	A	A	P	P	A	A	A	A
18	Basvani Naik	38yr/M	CRSsNPs	A	A	**P (B)**	A	L.DNS	A	A	A	A	P	P	A	A	P	P	A	A	A	A	A	A	A	A
19	Madhu Sangmesh akki	27yr/F	CRSwNPs	A	A	A	A	Central	A	P	A	A	P	A	P	A	P	P	A	A	P	A	P	A	A	A
20	Dharani Goudar	18yr/F	CRSsNPs	A	A	A	A	Central	A	A	A	P	A	P	A	A	A	P	A	A	A	P	A	A	A	A
21	S.H Pujari	41yr/M	CRSsNPs	A	A	A	**P (B)**	Central	A	A	A	A	A	A	A	A	A	A	P	A	A	A	A	A	A	P
22	Laxmi	25yr/F	CRSsNPs	A	A	A	A	Central	A	A	A	A	A	A	A	A	A	P	A	A	A	A	A	A	A	A
23	Balasaheb Chougale	55yr/M	CRSsNPs	A	A	A	A	L.DNS	A	A	A	A	P	A	A	A	P	P	A	A	P	A	P	A	P	A
24	Kirthana Sanadi	18yr/F	CRSwNPs	A	A	**P (E)**	**P (E)**	R.DNS	A	A	A	A	A	A	P	A	P	A	A	A	A	A	A	A	A	A
25	Vijay Kurangi	44yr/M	CRSsNPs	A	A	A	A	R.DNS	A	A	A	A	P	A	A	A	A	A	P	A	P	A	P	A	P	A
26	Manisha Patil	31yr/F	CRSsNPs	A	A	A	A	R.DNS	A	P	A	P	P	P	A	A	P	P	A	A	P	P	P	P	A	P
27	Saraswati Patil	25yr/F	CRSsNPs	A	A	**P (E)**	**P (L)**	L.DNS	A	A	A	A	P	A	A	A	P	A	A	A	A	A	A	A	P	P
28	Rajiya Devodi	38yr/F	CRSsNPs	A	A	A	A	Central	A	P	A	P	P	P	A	A	P	P	P	A	P	P	P	P	P	P
29	Balagouda Patil	38yr/M	CRSsNPs	A	A	A	A	Central	A	P	A	P	P	P	A	A	P	P	P	P	A	A	A	A	A	A

30	Ritika Hawal	30YR/F	CRSsNPs	A	A	A	A	Central	A	P	A	P	P	P	A	A	P	P	P	P	P	P	P	P	P	P
31	Maruti Gundlur	50yr/M	CRSwNPs	A	A	A	A	Central	A	P	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P
32	Anubhav Shimpi	29 yr/M	CRSsNPs	A	A	**P (L)**	**P (L)**	B/L DNS	A	A	A	A	A	A	A	A	P	A	A	A	A	A	A	A	A	A
33	Gundu Gurav	49yr/M	CRSsNPs	A	A	A	A	Central	A	A	A	A	A	A	A	A	P	P	A	A	A	A	A	A	A	A
34	Mahadevi Madabhavi	45 yr/F	CRSsNPs	A	A	A	**P (L)**	Central	A	P	A	A	P	A	A	A	P	A	P	A	P	A	P	A	P	A
35	Ashish Chikumbhi	37yr/M	CRSwNPs	A	A	A	**P (L)**	R.DNS	A	A	A	A	P	A	A	P	P	P	A	A	P	A	P	A	A	A
36	Savita Lakare	30YR/F	CRSsNPs	A	A	A	**P (B)**	R.DNS	A	A	A	A	P	A	A	A	P	P	P	A	P	P	P	P	P	P
37	Bhimrao Irappa Madar	42yr/M	CRSsNPs	A	A	**P (B)**	A	R.DNS	A	A	A	A	A	P	A	A	A	P	A	A	A	A	A	A	A	A
38	Ramchandra Talwar	25yr/F	CRSwNPs	A	A	A	A	R.DNS	A	A	A	A	P	A	P	P	P	A	A	A	A	A	A	A	P	P
39	Shobha Madhugunki	28yr/F	CRSwNPs	A	A	A	**P (E)**	R.DNS	A	P	A	A	P	P	P	A	P	A	A	A	P	A	A	P	A	A
40	Santosh Chinappa	34yr/M	CRSsNPs	A	A	**P (L)**	A	B/L DNS	A	P	A	A	A	A	A	A	P	A	A	A	P	A	A	A	A	A
41	Lakshmi Ram	27yr/F	CRSsNPs	A	A	**P (E)**	**P (L)**	L.DNS	A	A	A	A	P	A	A	A	P	A	P	A	P	A	A	A	A	A
42	Raosao Hulloli	52 YR/M	CRSsNPs	A	A	A	A	L.DNS	A	A	A	A	P	P	A	A	P	P	P	P	P	P	A	A	P	P
43	Sheetal More	33yr/F	CRSwNPs	A	A	A	**P (B)**	R.DNS	A	A	A	A	A	P	A	P	A	P	A	A	A	A	A	A	A	A
44	Shivanav va	45 yr/F	CRSsNPs	A	A	**P (B)**	**P (B)**	L.DNS	A	P	A	A	P	A	A	A	P	A	A	A	P	P	P	P	A	A
45	Shankar	60 YR/M	CRSwNPs	A	A	A	A	Central	A	P	A	P	P	P	P	P	P	P	A	A	P	P	P	P	P	P
46	Ramappa Athani	60yr/M	CRSwNPs	A	A	A	A	L.DNS	A	P	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
47	Shrishail Kagoddi	60yr/M	CRSsNPs	A	A	A	A	R.DNS	A	A	A	P	A	P	A	A	A	P	A	P	A	P	A	P	P	P
48	Rakesh	26yr/M	CRSsNPs	A	A	A	A	L.DNS	A	A	A	A	A	P	A	A	A	P	A	P	A	A	A	A	A	A
49	Shobha	36yr/F	CRSsNPs	A	A	A	A	R.DNS	A	A	A	A	P	A	A	A	P	A	A	A	P	A	A	A	A	A
50	Prakash Gundlur	25yr/M	CRSsNPs	A	A	**P (L)**	**P (B)**	L.DNS	A	A	A	P	A	P	A	A	A	P	A	A	A	P	A	A	A	A
51	Durgappa Pujari	60yr/M	CRSsNPs	A	A	A	A	R.DNS	A	A	A	A	P	P	A	A	P	P	A	P	A	A	A	A	A	P
52	Savasuddi	18yr/M	CRSsNPs	A	A	A	A	R.DNS	A	A	A	A	P	P	A	A	P	P	P	P	P	P	P	P	A	A
53	Savitri Gireppa	27YR/F	CRSsNPs	A	A	A	**P (L)**	R.DNS	A	A	A	A	P	P	A	A	P	P	P	P	P	P	P	P	A	A
54	Annapurna Hadakar	57yr/F	CRSsNPs	A	A	**P (B)**	A	L.DNS	A	A	A	P	P	P	A	A	P	P	P	A	A	P	A	A	A	A
55	Shobha	45 yr/F	CRSsNPs	A	A	**P (B)**	**P (B)**	Central	A	A	A	A	A	A	A	A	P	A	A	A	A	A	A	A	A	A
56	Mayeppa Pujeri	57YR/F	CRSwNPs	A	A	A	A	R.DNS	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	A	P	P
57	Ramakrishna Yalashetti	60yr/M	CRSsNPs	A	A	**P (E)**	A	L.DNS	A	A	A	A	P	A	A	A	P	A	A	A	A	A	A	A	A	A
58	Nirmala Desai	45YR/F	CRSwNPs	A	A	**P (B)**	**P (B)**	Central	A	A	A	A	P	P	P	P	P	P	A	A	A	P	A	P	P	P
59	Appasaheb	26yr/M	CRSsNPs	A	A	**P (B)**	**P (L)**	L.DNS	A	A	A	A	P	A	A	A	P	A	A	A	A	A	A	A	A	A
60	Alka Gadkari	25yr/F	CRSsNPs	A	A	A	**P (L)**	R.DNS	A	P	A	A	P	P	A	A	P	P	A	A	P	P	P	P	A	A