NASAL OBSTRUCTION

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INTRODUCTION

- sinonasal imaging focuses on structural abnormalities of the **POSTERIOR (BONY 3/4)** of the nose :
  septal deviation (SD), turbinate morphology + size, spurs, variants
  SD is associated with an risk of CRS but is a normal finding - 90% adults, M>>F

- **NASAL OBSTRUCTION (NO)** is a common symptom and a **FREQUENT** indication for imaging

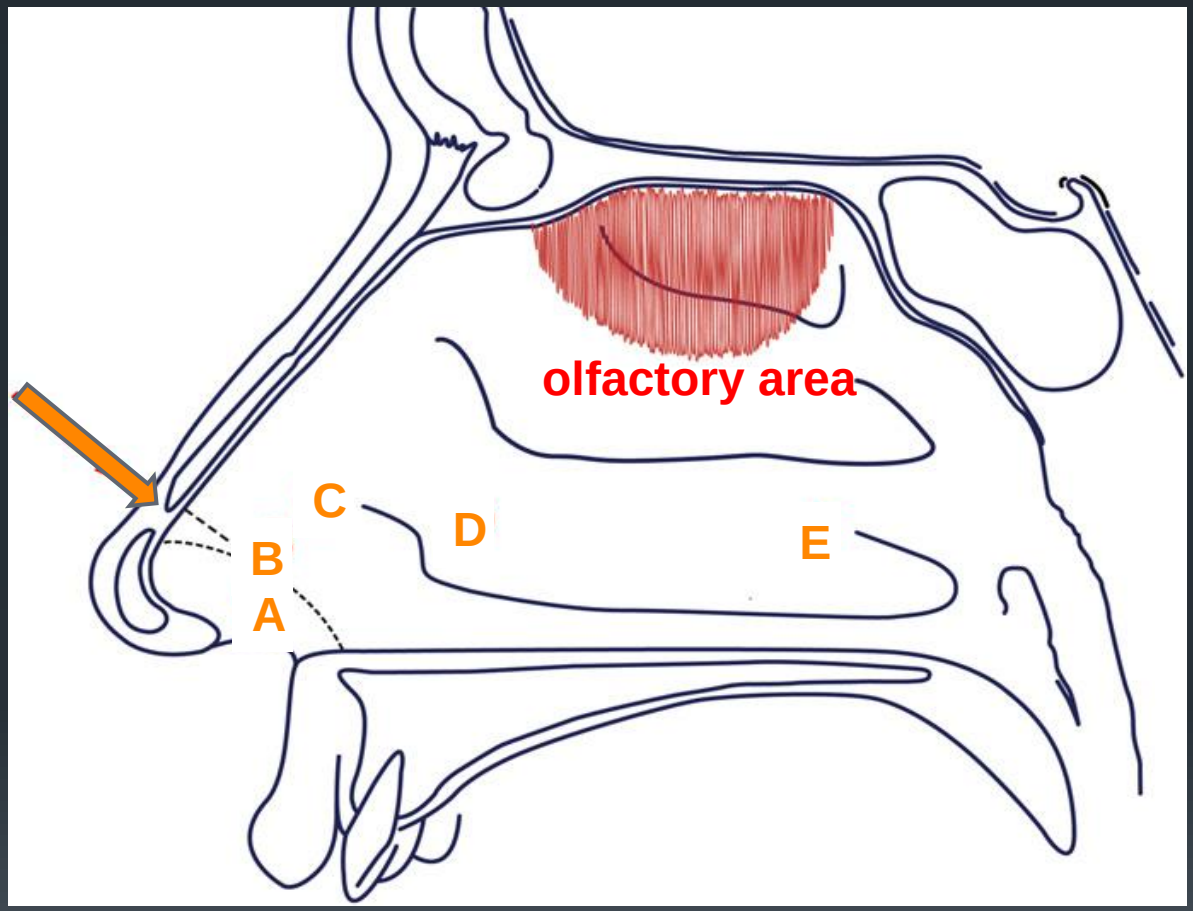
- the **ANTERIOR NOSE (SOFT TISSUE 1/4)** is of critical importance in nasal physiology including **REGULATION** of airflow

- **ANTERIOR NASAL PATHOLOGY** is the **MAJOR** cause of nasal obstruction:
  a small deviation of the anterior nasal septum can lead to significant **NO**
  whereas
  a large deviation of the posterior septum has **no** effect on airflow resistance

FUNCTIONS OF THE NASAL CAVITY

- **HEAT EXCHANGE – HUMIDIFY – FILTER inspired air**
- **OLFACTORY sensation**
- **REGULATE air flow and respiration**
- **MUCOCILIARY CLEARANCE**
- **IMMUNOLOGICAL DEFENSE with remainder of the upper and lower respiratory tract: UNIFIED AIRWAY**
- **PLEASURE**

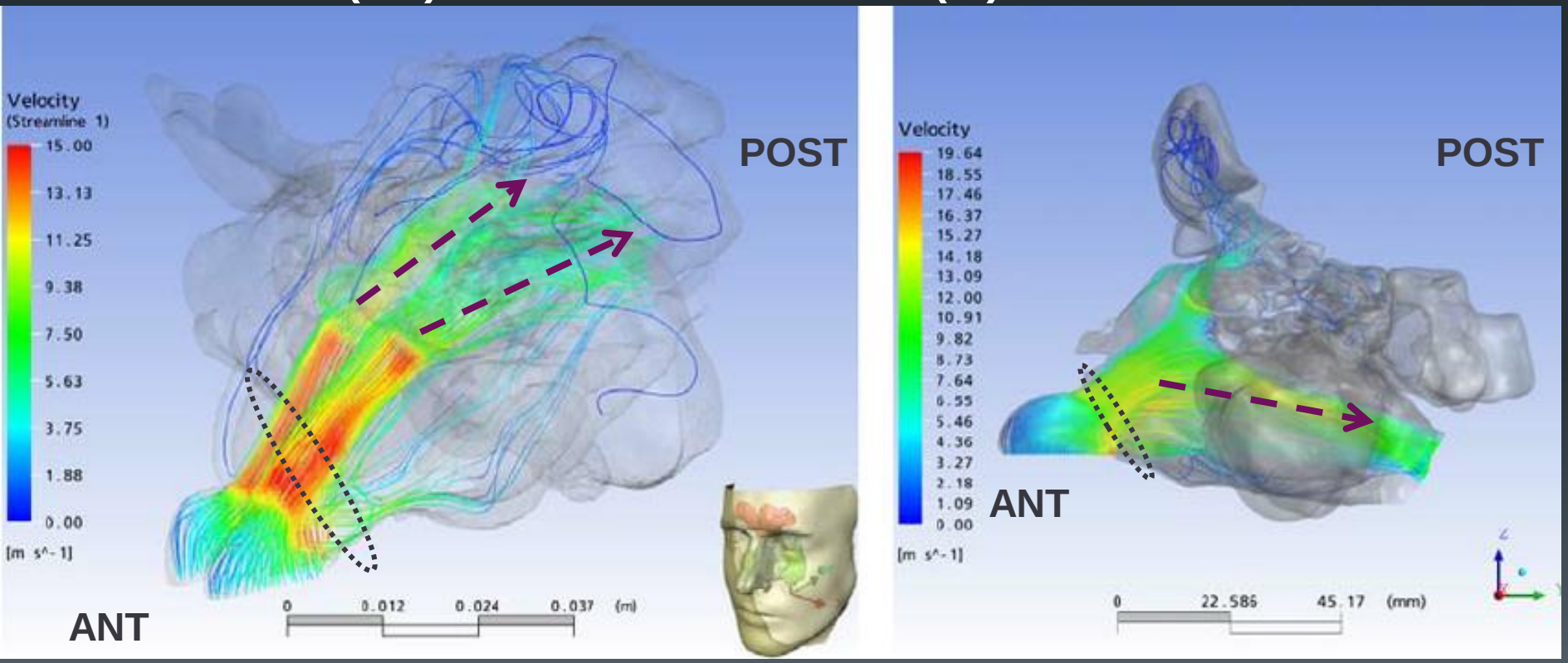
FUNCTION AND TYPE OF EPITHELIUM



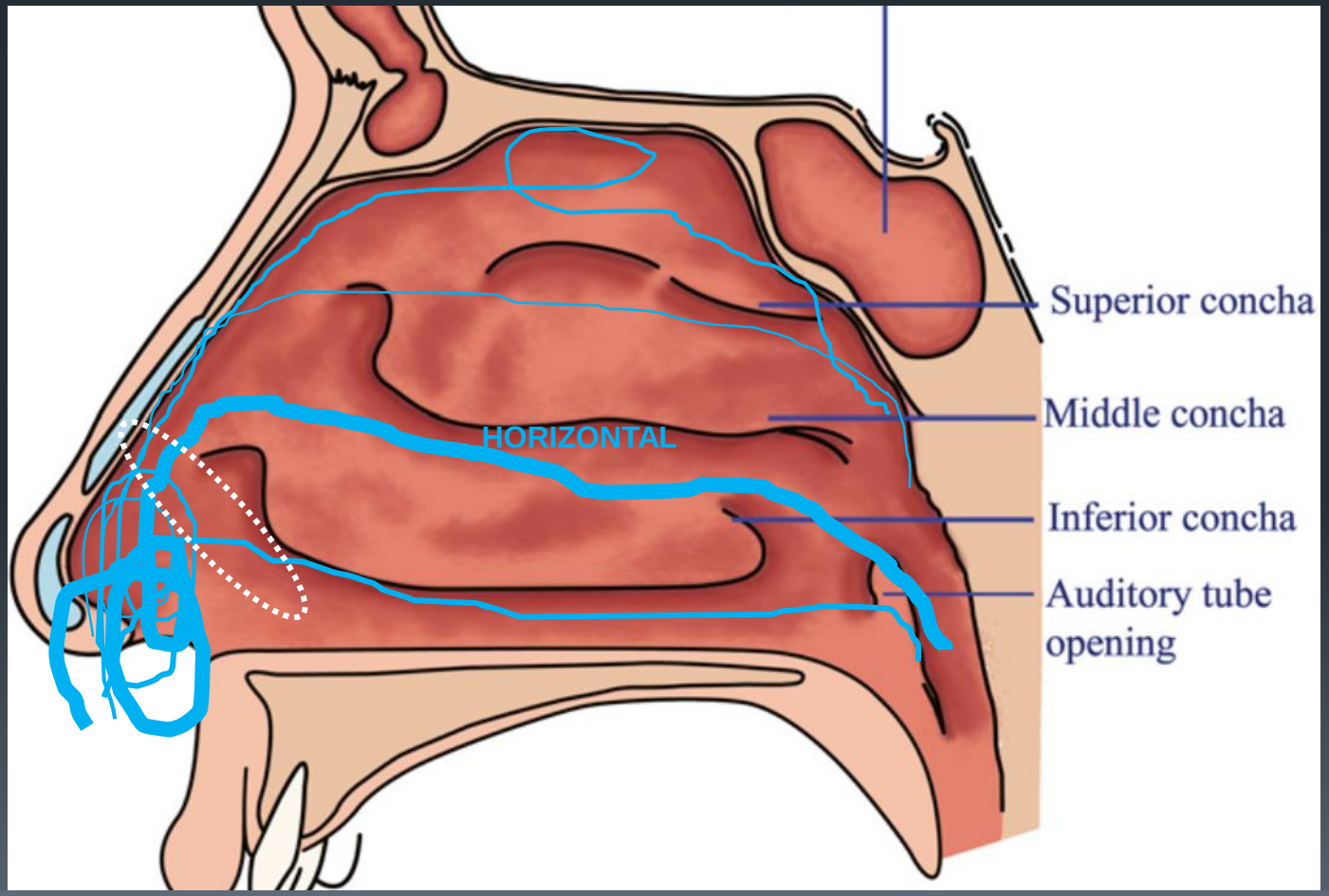
A: skin B : modified skin
C: transitional epithelium
} thermoreceptors
D: pseudostratified columnar with few cilia
E: pseudostratified columnar with many cilia

NASAL AIRFLOW

- **Within the INTERNAL NASAL VALVE (INV), turbulent inspired air is converted to a high velocity jet of LAMINAR flow**
- **70% of air Passes POSTERIORLY and HORIZONTALLY between the middle (MT) and inferior turbinates (IT).**



NASAL AIRFLOW

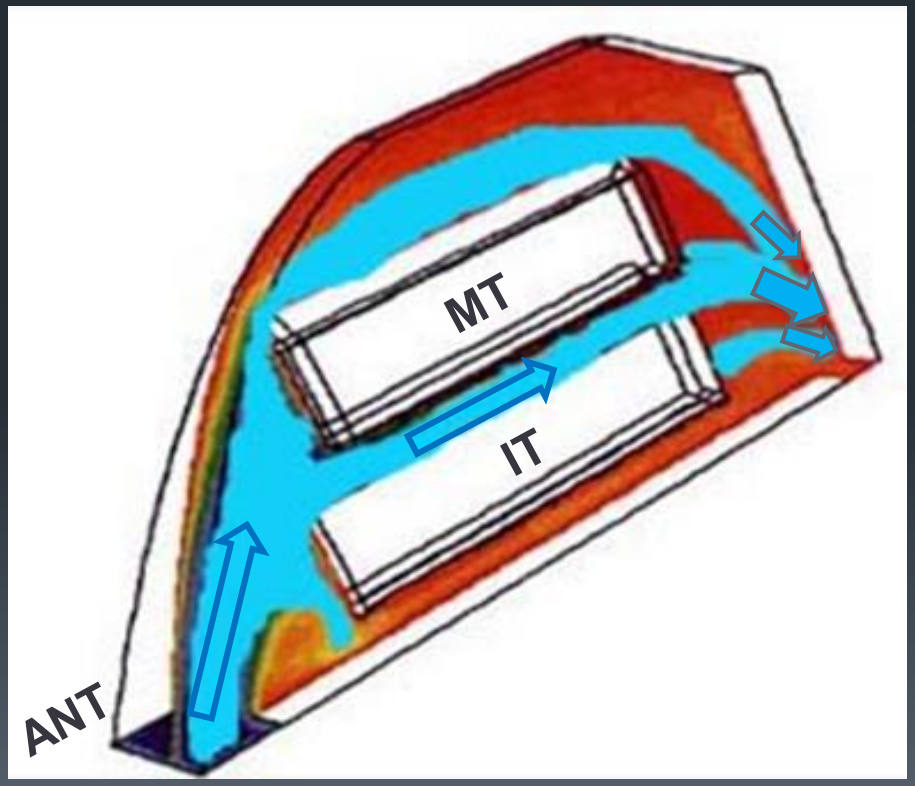


70% airflow **passes between the middle and inferior turbinates**

NASAL BREATHING

NASAL BREATHING occurs in the inferior half of the nose

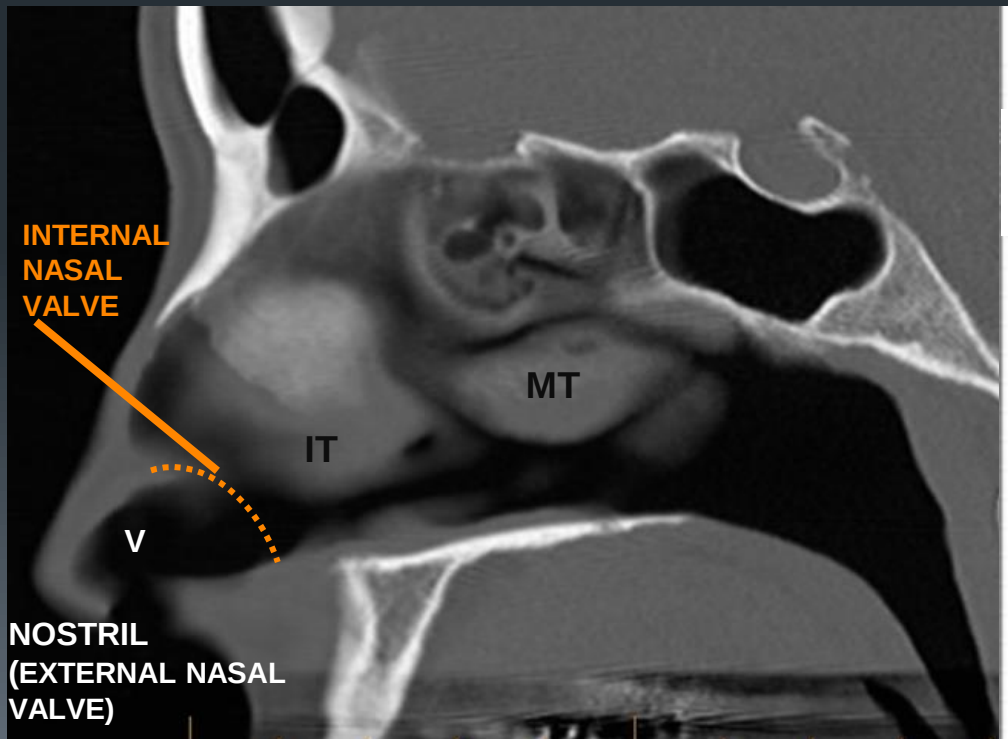
IT and MT act like shutters deflecting airflow in a stable + orderly pattern: LAMINAR flow

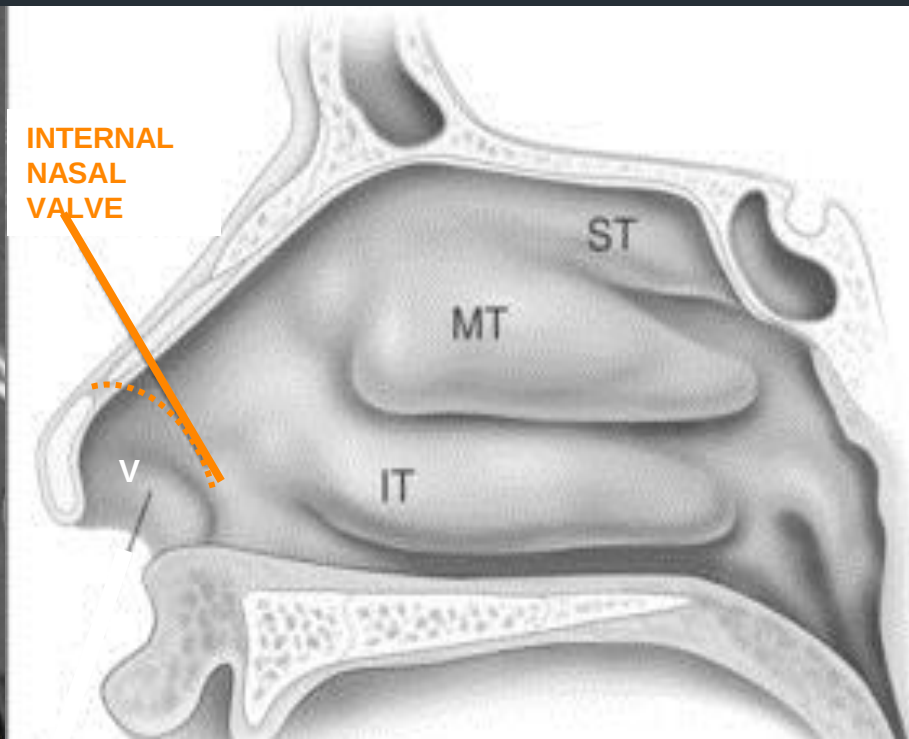


NASAL AIRFLOW - VALVES

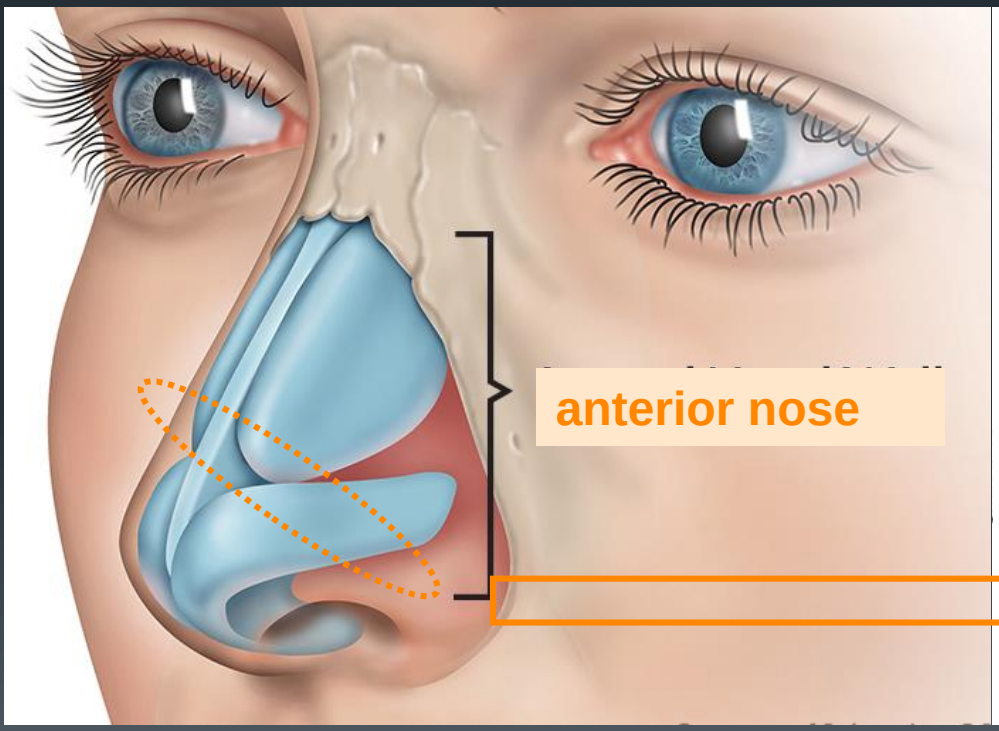
50-70% of resistance to airflow in the upper airway is ANTERIOR:

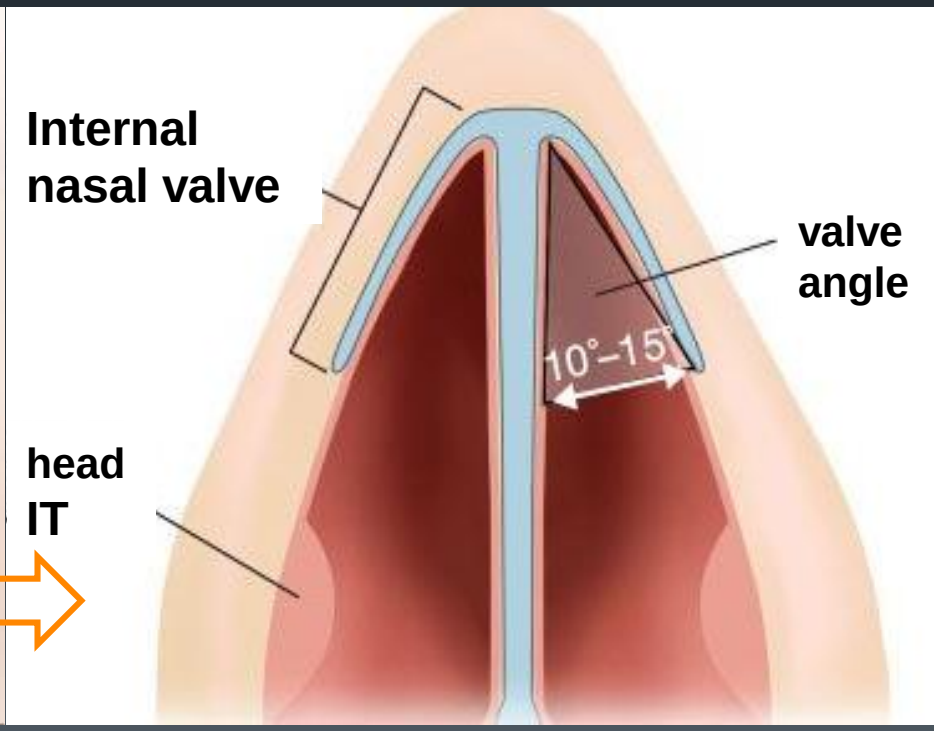
- **NOSTRIL (EXTERNAL NASAL VALVE)**
- **VESTIBULE**
- **INTERNAL NASAL VALVE: KEY**





NASAL AIRFLOW – IN VALVE

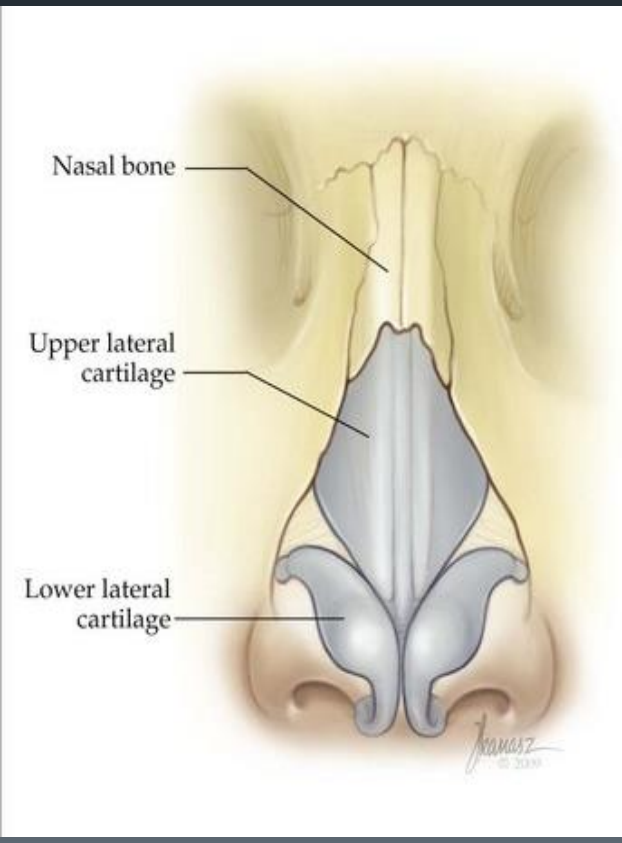


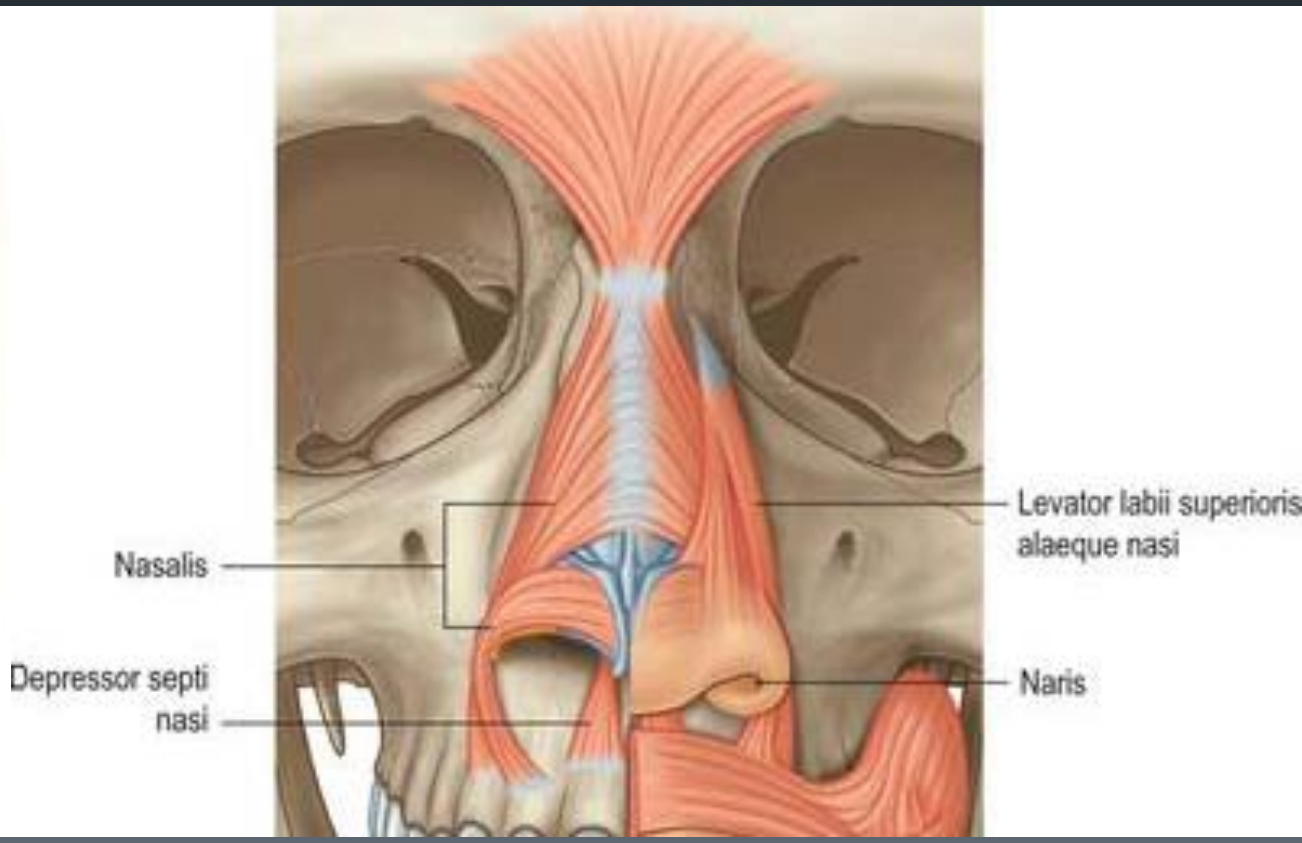


NASAL AIRFLOW - VALVES

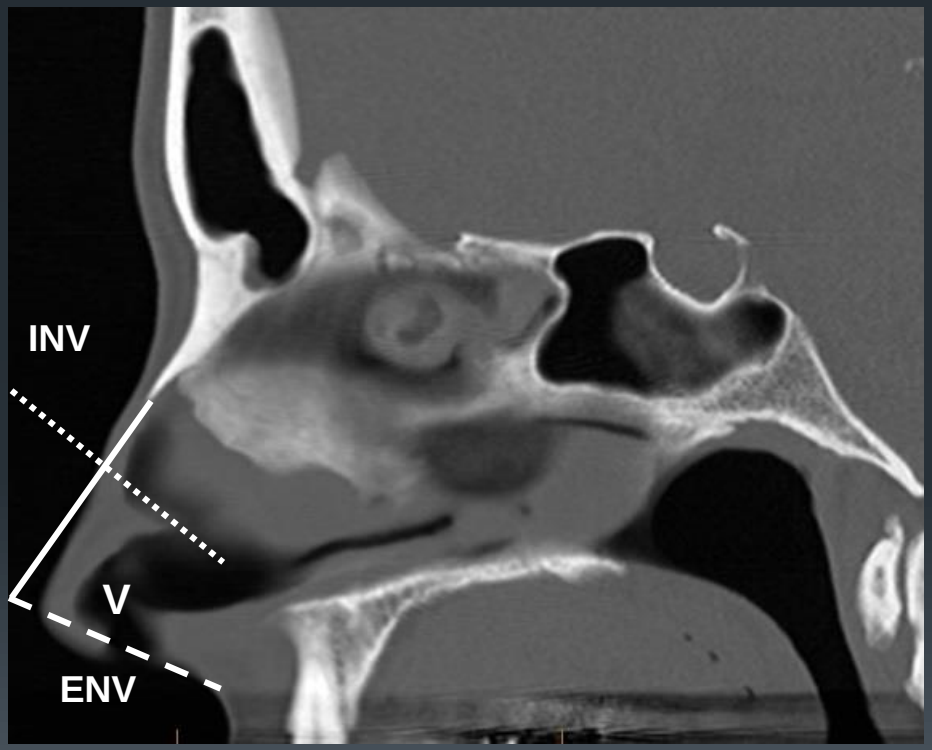
resistance to airflow in the anterior (external) nose is regulated by:

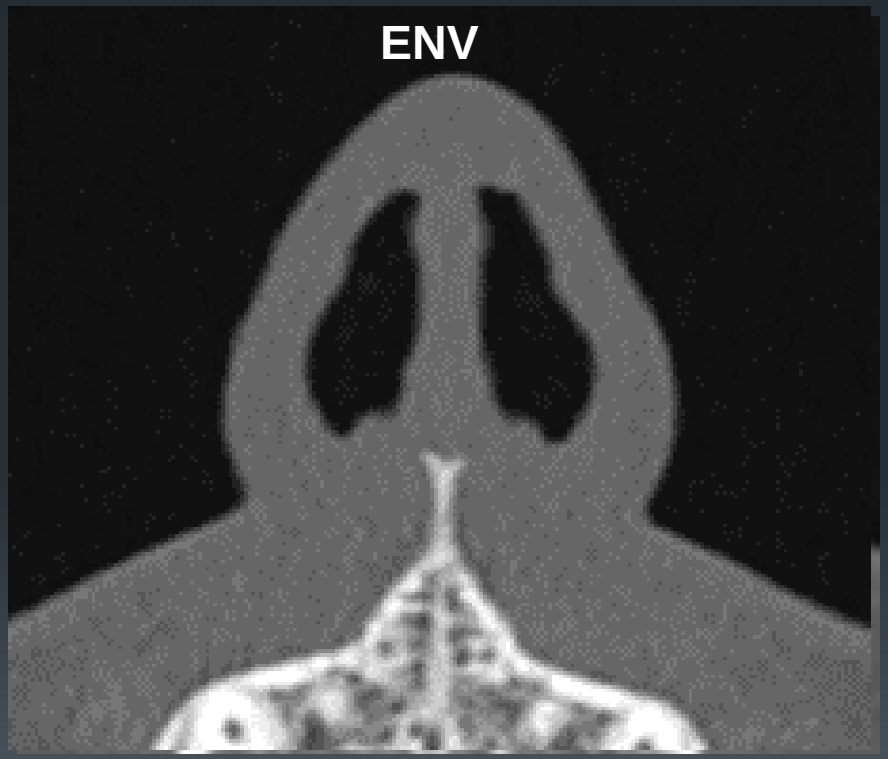
- **thermoreceptors in the vestibule monitor air temperature**
- **reflex contraction or relaxation of the dilator muscles**





CT OF THE NASAL VALVES

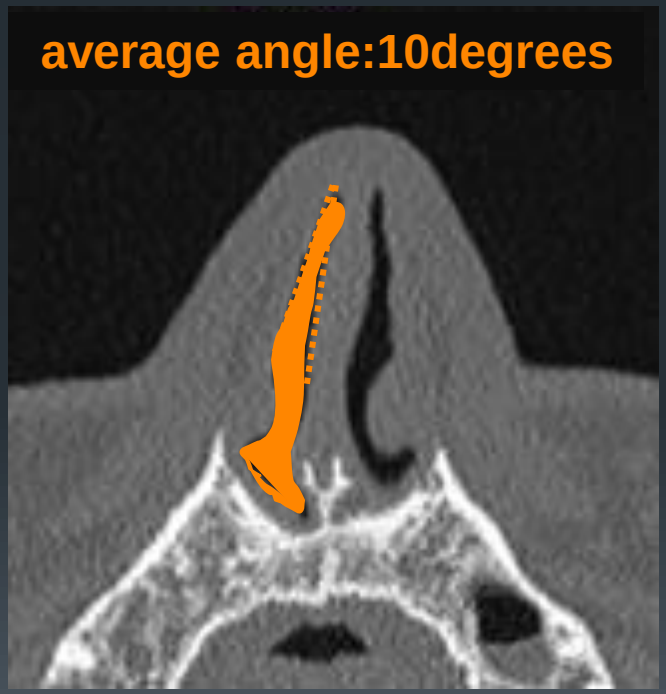




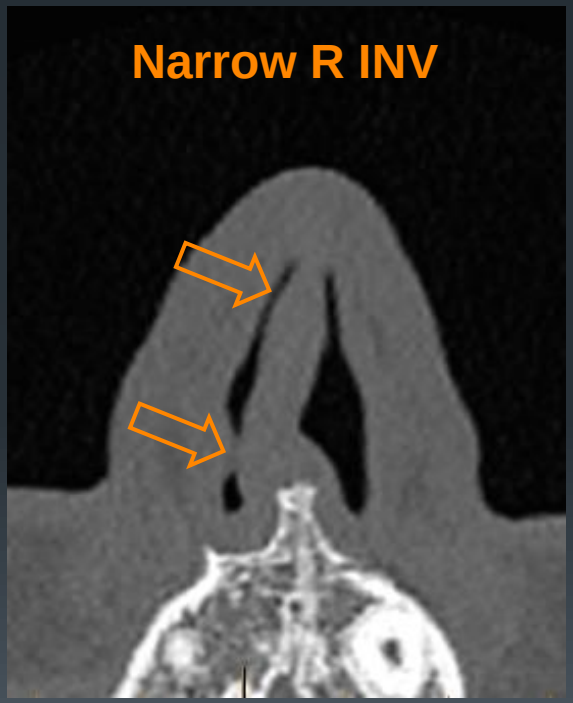
- **INV, VESTIBULE and ENV are assessed by a dynamic (stress) manoeuvre: modified Cottle procedure performed in inspiration**
- **CT can be used for the same purpose but provides static assessment only**

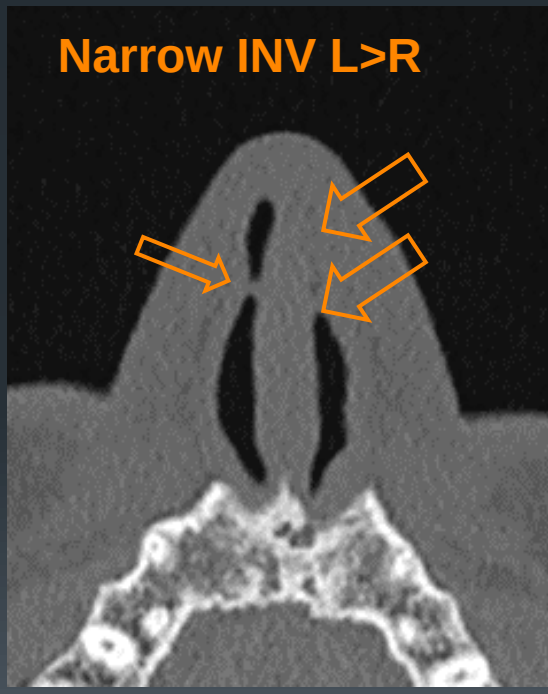
CT OF THE INTERNAL NASAL VALVE

- grade as normal OR mild - moderate - severe narrowing
- or measure the valve angle + area (see refs)



average area = 84mm2

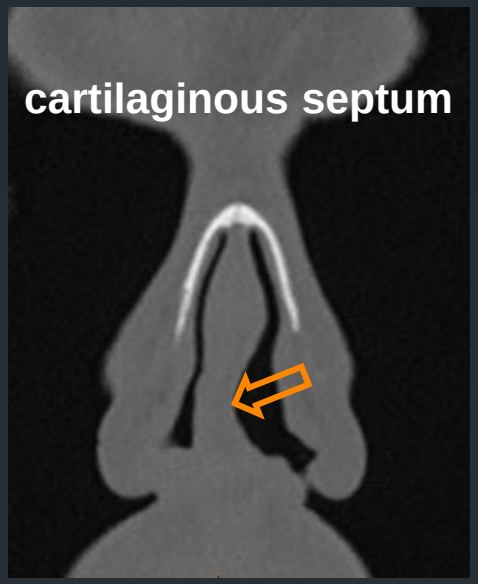


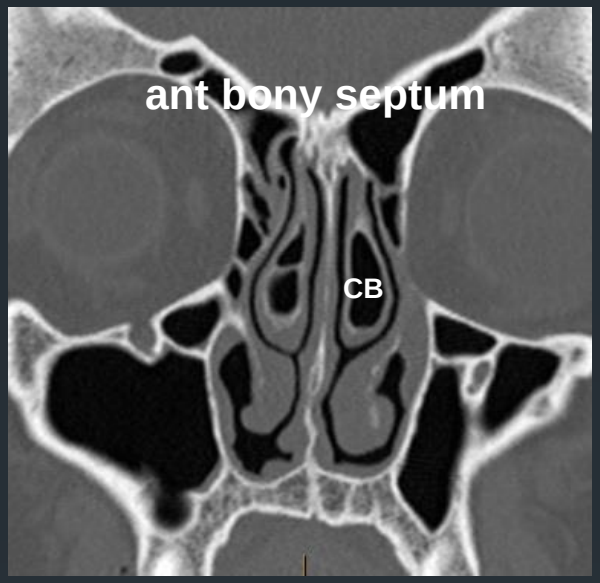


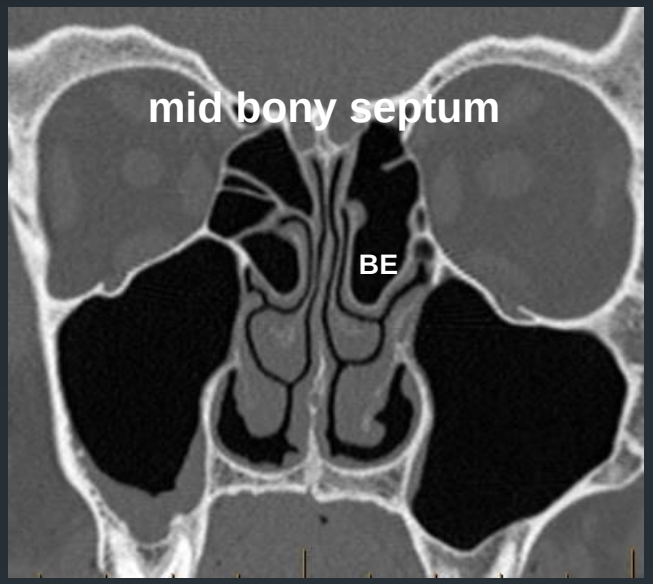
CASE 1: 45M

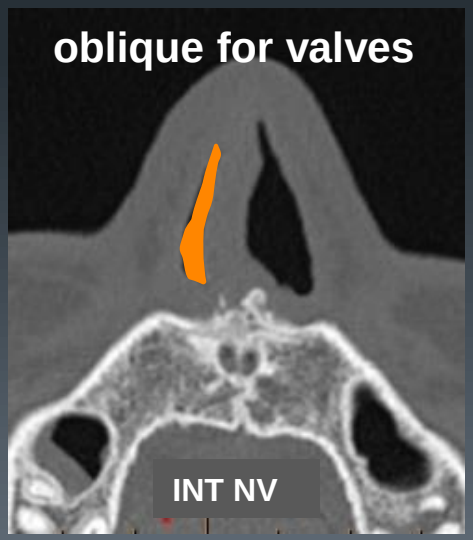
post septoplasty + partial inferior turbinectomies

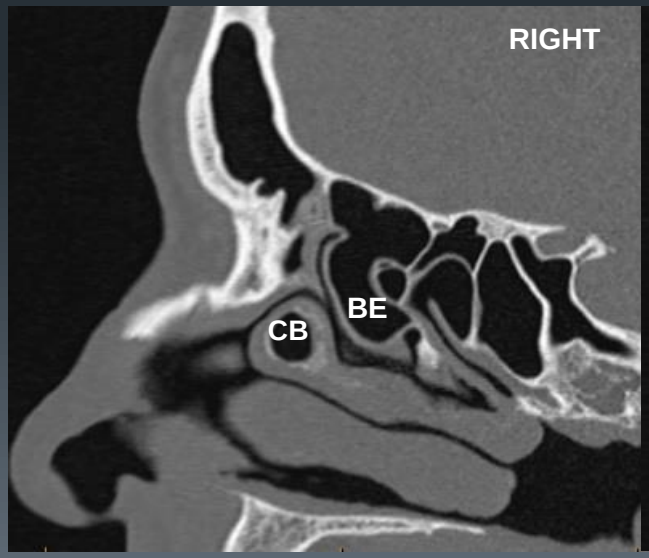
c/o snoring/ R nasal obstruction

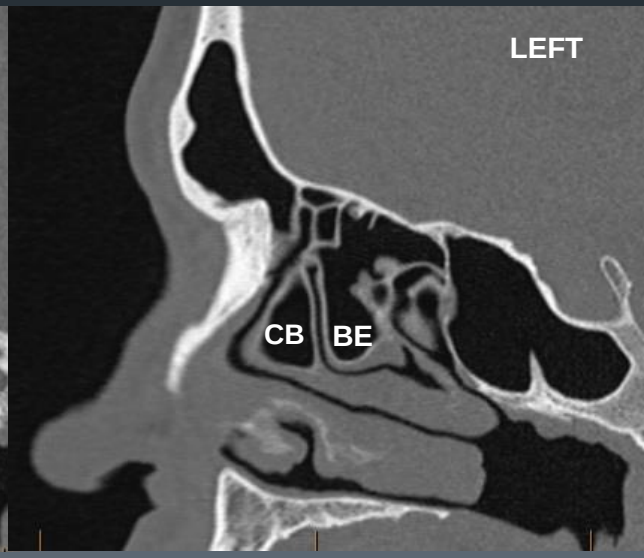








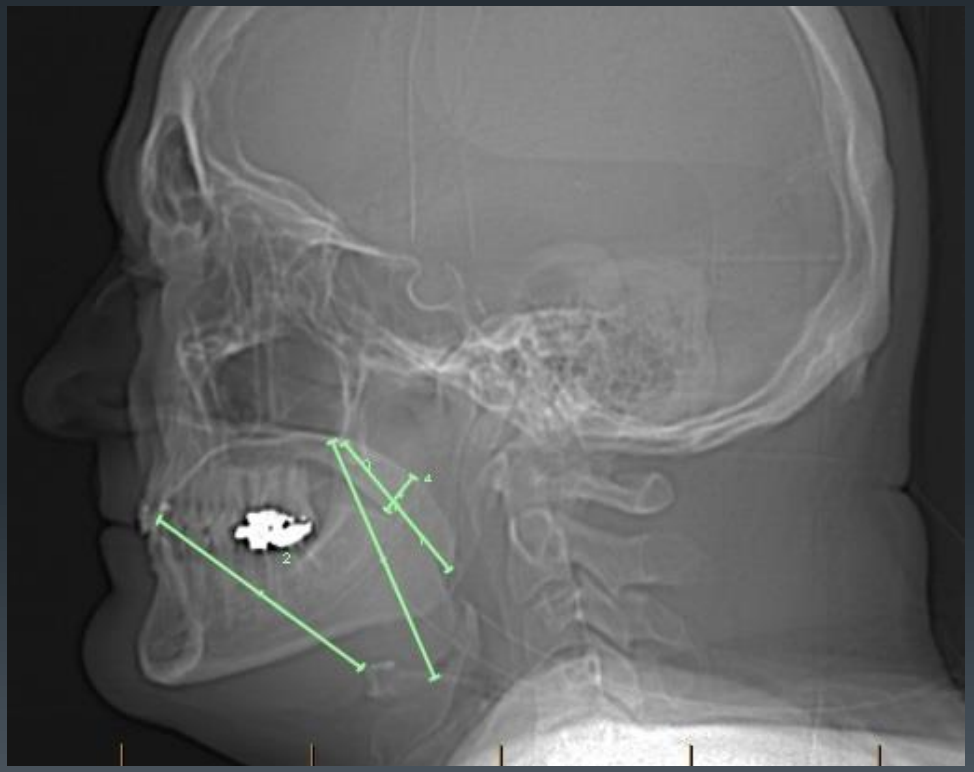


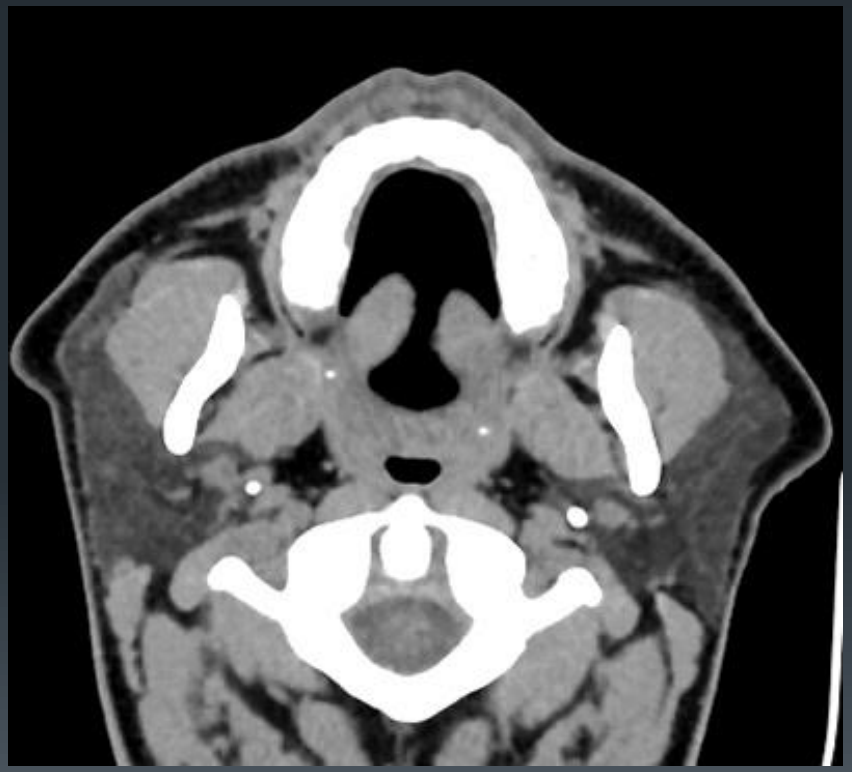


CASE 1: 45M

nose , age, sex, habitus + narrowed retropalatal OP

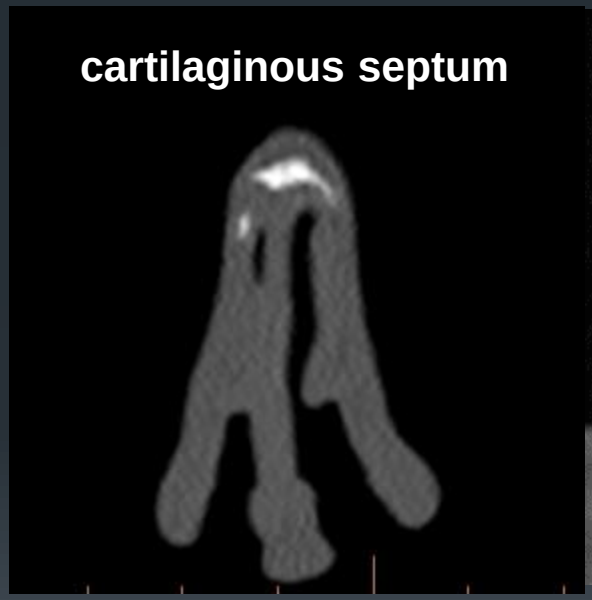
hyoid and OP length normal

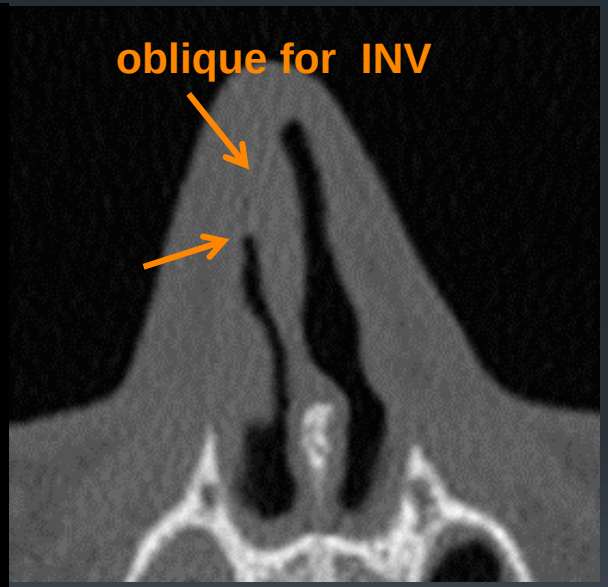




CASE 2: 42M

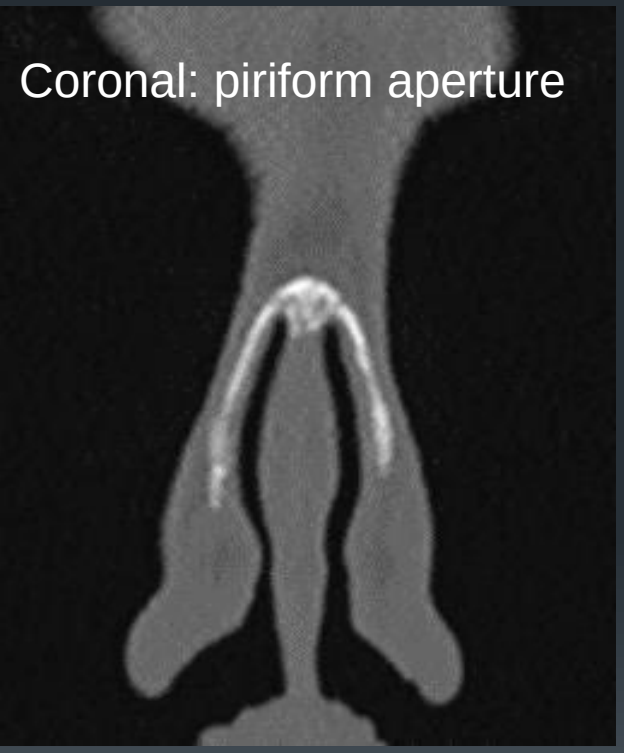
previous septoplasty, RIGHT nasal obstruction

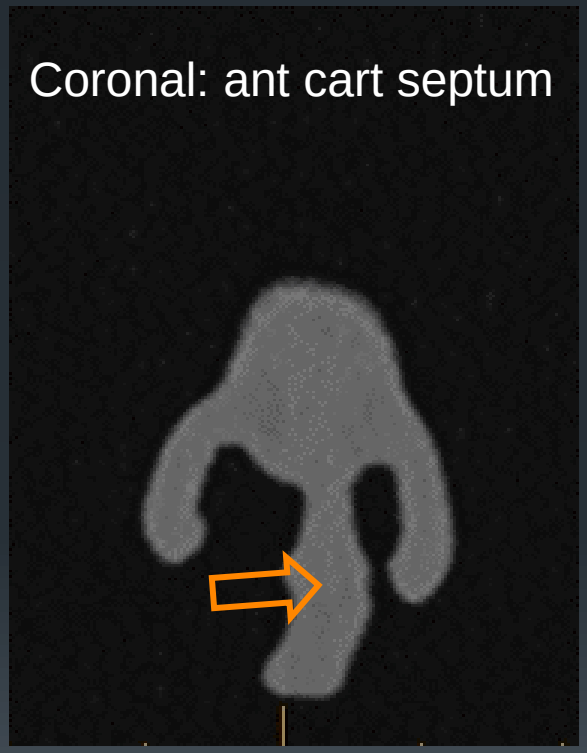


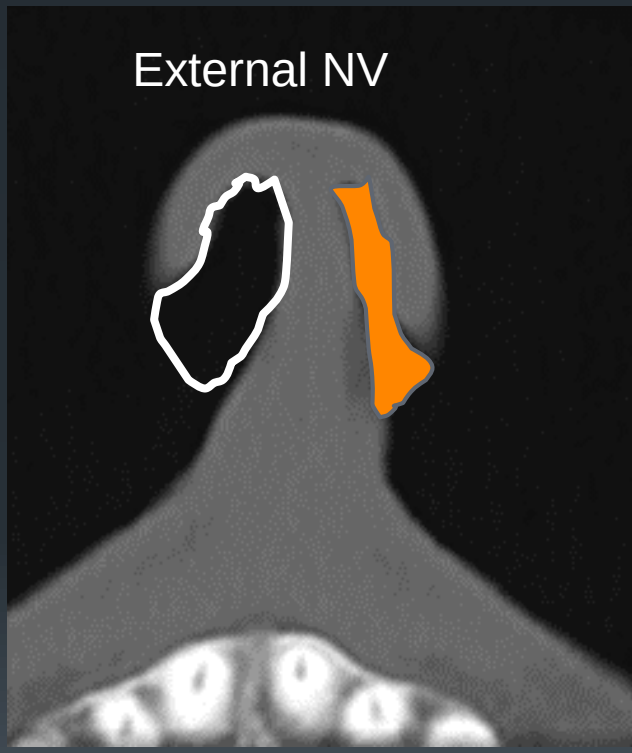


CASE 3 : 37F

LEFT nasal obstruction
normal INVs and constricted L ENV

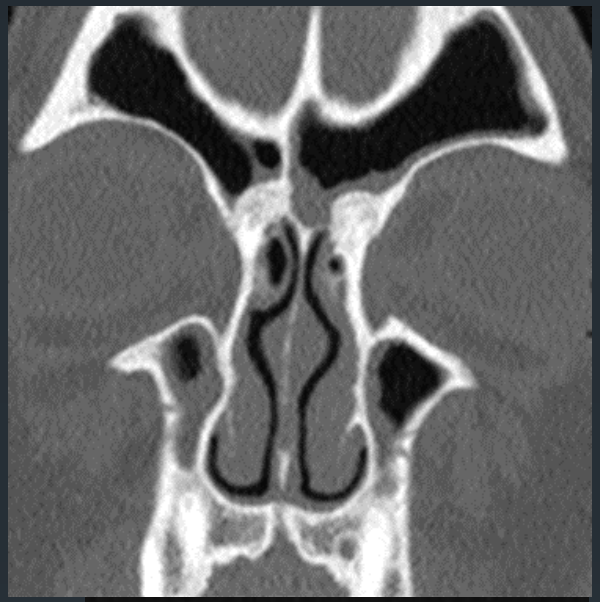


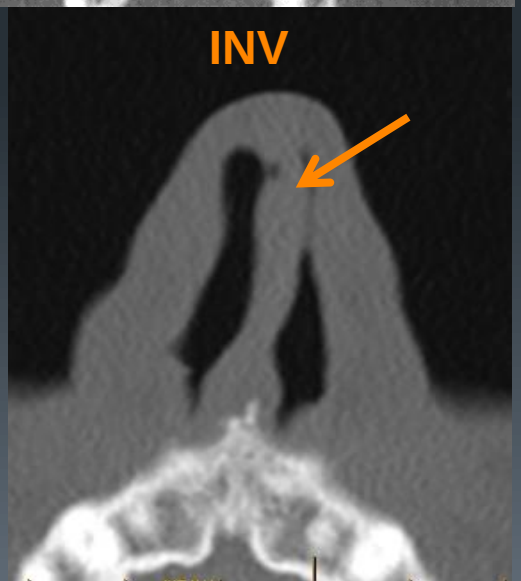


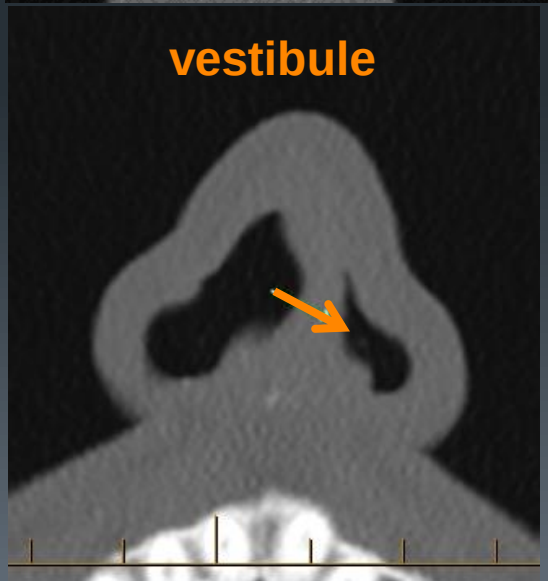


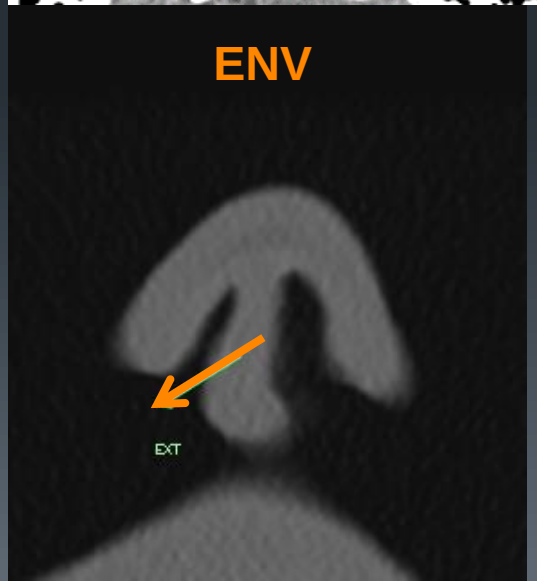
CASE 4: 44M

bilateral NO – no deviation of the bony septum





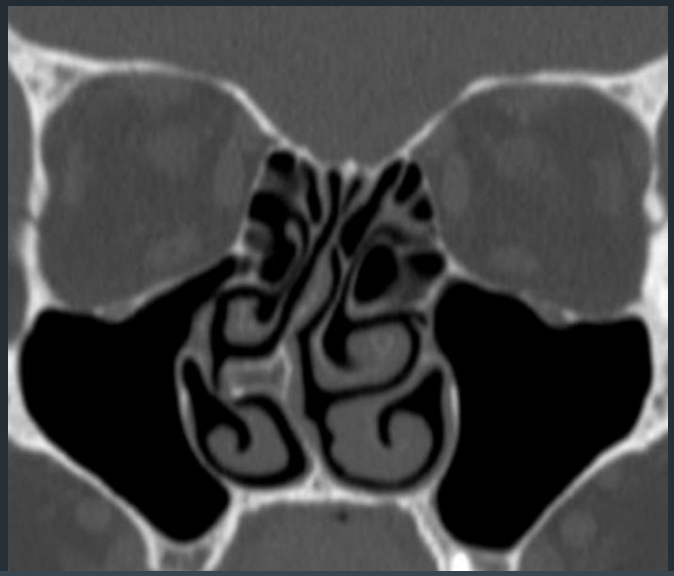


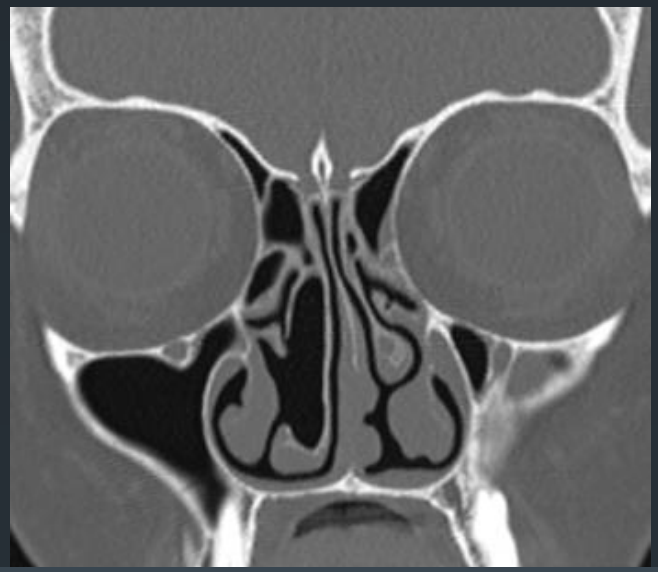


NASAL OBSTRUCTION: NO – KEY FACTS

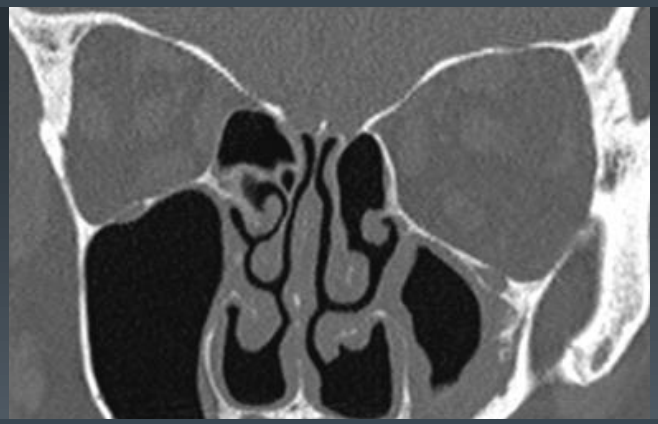
- during sleep, upper airway (UA) resistance is **2.5 x lower** with nasal rather than oral breathing. Normally, **less than 5%** of breathing is oral in type
- with **NO**, there is a switch to inefficient oral breathing and **reduction** in airway dimensions exacerbated by the **supine** position
- the **nasal-ventilatory reflex** is absent during oral breathing; airflow through the anterior nose stimulates breathing and this protects against apnoeas
- **reversible NO,** most commonly due to **allergic rhinitis** and non-allergic rhinitis (NAR) closely correlates (83%) with SDB **rather** than structural abnormalities: septal deviation, spurs, CB that we carefully report on CT.
- NO is **not** a major factor in the aetiology of OSA but it can exacerbate this condition ; it is a **major** factor causing habitual snoring (SDB)
- following a septoplasty, **narrowing of the INV** is the major cause of failure to improve NO

NASAL OBSTRUCTION: posterior 3/4
structural abnormalities ? importance





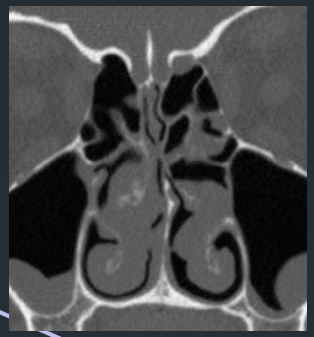
surgery is NOT benign: resection of IT + septal perforations disrupt laminar flow



most severe manifestation of radical surgery is the paradoxical sensation of NO: “empty nose syndrome” – now grudgingly accepted as a significant reality!

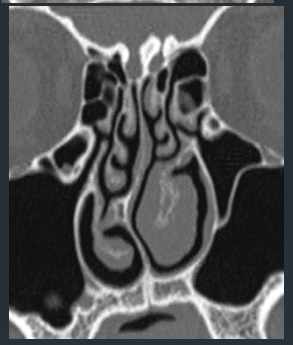
NASAL OBSTRUCTION - SUMMARY

treatment of NO improves OSA + can cure snoring

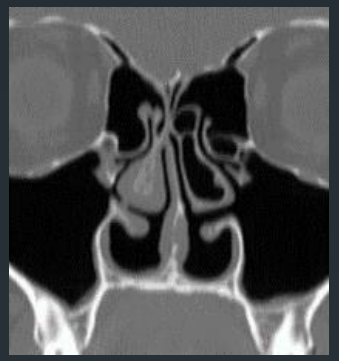


SOFT TISSUE
rhinitis
polyps

ANT NOSE
cart. septal deviation
narrowed INV



POST NOSE
bony septal deviation
spur + CB



"NIL"
empty nose S

INCIDENCE

SPECTRUM OF BENIGN NASAL OBSTRUCTION

REFERENCES

- Computed Tomography Technique for Evaluation of the Nasal Valve. Arch Facial Plast Surg. 2004;6: 240-243
- The role of the nose in snoring and obstructive sleep apnoea: an update. Eur Arch Otorhinolaryngol 2011; 268(8): 1365–1373
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- The role of 3 dimensional CT in the evaluation of nasal structures and anomalies. Eur Arch Otorhinolaryngol 2011;268(8):1163-1167
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