FESS: The Required Imaging Anatomy

Vincent Chong, MD MBA FRCR
Professor
Department of Diagnostic Imaging
National University Health System
Singapore

Overview

- Normal anatomy
  - General concepts
  - Specific anatomic structures
  - Variants
- Pathological anatomy
  - Stress normal anatomy
  - Appropriate imaging modality

Basal Lamella & Drainage System

- Basal lamella
- Middle turbinate
Basal Lamella & Drainage System

- Anterior system
  - Ostiomeatal unit
  - Ethmoid infundibulum
  - Middle meatus

Basal Lamella & Drainage System

- Posterior system
  - Posterior ethmoid cells & sphenoid sinus
  - Sphenoethmoidal recess
  - Superior meatus
Anterior Drainage System: Ostiomeatal Complex

Posterior Drainage System: Spheno-ethmoidal Recess
Spheno-ethmoidal Recess

Identifying the spheno-ethmoidal recess

Frontal Recess

Relationships
- Anterior
  - Agger nasi cell
- Posterior
  - Anterior wall of ethmoid bulla
Frontal Recess

Relationships
- Medial
  - Middle turbinate
- Lateral
  - Lamina papyracea

Frontal Recess

Ethmoid bulla

Lamina papyracea

MT

A
Frontal Bulla Cells
Fronto-ethmoid Cells

Kuhn Type 1: single cell above agger nasi

Fronto-ethmoid Cells

Kuhn Type 2: Two or more cells above agger nasi
Fronto-ethmoid Cells

Kuhn Type 2: Two or more cells above agger nasi
Fronto-ethmoid Cells

Kuhn Type 3: Two or more cells above agger nasi

Fronto-ethmoid Cells
Frontal Bulla

Difficult to differentiate frontal-ethmoidal cells from frontal bulla cells on coronal sections alone

Frontal Bulla versus K3 Cells

Leunig A et al. Surgical anatomy of the frontal recess – is there a benefit in multiplanar CT-reconstruction? Rhinology, 46, 188-194, 2008
Middle Turbinate

- Insertion
- Anterior ethmoidal artery
- Concha bullosa
- Orientation

Insertion of MT
Attached to lamina papyracea

A
Attached to medial wall of maxillary sinus

Skull Base Insertion of MT: Critical Anatomy

Cribriform plate “sieve-like”
Skull Base Insertion of MT: Critical Anatomy

Keros (1962): Type I, II, III

Skull Base Insertion of MT: Critical Anatomy

Keros (1962): Type I, II, III
Skull Base Insertion of MT: Critical Anatomy

Anterior Ethmoidal Artery
Anterior Ethmoidal Artery
MT Variant: Concha Bullosa

MT Variant: Concha Bullosa
MT Variant: Concha Bullosa

Endoscopic Diagnosis Versus CT Diagnosis

MT Variant: Concha Bullosa

How should we treated the inflammation?
MT Variant: Concha Bullosa

My Journey (through time....)
Uncinate Process

- Insertion
  - Anteriorly nasolacrimal apparatus
  - Inferiorly inferior turbinate
Uncinate Process
Hiatus semilunaris

Uncinate Process

- Insertion
  - Anteriorly nasolacrimal apparatus
  - Inferiorly inferior turbinate
Uncinate Process

- Ethmoid infundibulum
  - Lamina papyracea
  - Ethmoid bulla

- Insertion in lamina papyracea
- Recessus terminalis
- Ethmoid infundibulum sealed off from frontal recess
Uncinate Process

- Insertion in skull base
Uncinate Process

[Images of medical diagrams and scans related to the uncinate process]
Uncinate Process: Variants

Maxillary Sinus Ostia
Accessory Ostia & Nasal Fontanelle
Ethmoid Cell Anatomy

- Ethmoid
  - Absent - torus ethmoidalis
  - Small
  - Giant
- Infraorbital ethmoid (Haller Cell)
- Sphenoethmoid (Onodi Cell)

Haller Cell

- Albrecht von Haller (19th century Swiss anatomist)
- Location
  - Below ethmoid bulla, along orbital floor
- Significance
  - Infection
  - Imaging (not surgical) diagnosis
Haller Cell

Haller Cell
Haller Cell Infection

Sphenoethmoid (Onodi) Cell

- What is a Onodi (1908) cell?
  - Post ethmoid cell
  - Superior to & lateral to sphenoid sinus
  - Optic nerve contact
Posterior Ethmoid: Critical Anatomy

- Optic nerve relations
  - Posterior ethmoid cell
  - Sphenoid sinus
  - Onodi cell
Posterior Ethmoid: Critical Anatomy

Sphenoid Sinus: Critical Anatomy

- Optic nerve
- Maxillary nerve
- Carotid artery
Man with headache, post-endoscopy, sudden blindness

Man with headache, post-endoscopy, sudden blindness
Man with headache, post-endoscopy, sudden blindness

Trigeminal Nerve (V2) Neuralgia
Trigeminal Nerve (V2) Neuralgia

Trigeminal Nerve (V2) Neuralgia
Carotid Artery

More “dangerous”? Less “dangerous”?

This is dangerous!
Mucosal Variant: Nasal Cycle (Lillie, 1923)

- Normal
- Affects
  - Turbinates
  - Nasal septum
  - Ethmoid cells
- Suprachiasmatic nucleus of hypothalamus
- Age
Reminders

- Meningocoeles
- Meningomyeloceles
- Tumours
  - Pituitary
  - Macroadenoma

Nasal Meningocoeles
Nasal Meningocoeles

Nasal Meningocoele
Pituitary Macroadenoma

Macroadenoma
Conclusion: Drainage System

- Basal lamella
- Middle turbinate

Conclusion:

- Anterior
  - Ostiomeatal complex
  - Middle meatus
- Posterior
  - Sphenoethmoidal
  - Superior meatus
Conclusion: Frontal Recess

Leunig A et al. Surgical anatomy of the frontal recess – is there a benefit in multiplanar CT-reconstruction? Rhinology, 46, 188-194, 2008
Conclusion: AEA

Conclusion: Ethmoid Cell

- Infraorbital ethmoid (Haller Cell)
- Sphenoethmoid (Onodi Cell)
Conclusion: Posterior Ethmoid Critical Anatomy

Conclusion: Critical Sphenoid Sinus Anatomy
Conclusion: Reminders

Encephalocele

Pituitary macroadenoma

Conclusion: Reminders

Carotid Aneurysm