You are reading PET-CT and see this...
Or this...
Is it abnormal?

And what is it?
First review:

Slice by Slice
Correlative Anatomy
Nasolacrimal duct

Carotid canal
**Zygomatic arch**

- Pterygopalatine fossa

- Foramen Rotundum, Ovale, Spinosum

**Rotundum**: Maxillary nerve (V2) exits

**Ovale**: Mandibular nerve (V3) exits

**Spinosum**: Middle meningeal artery and vein; nervus spinosus from mandibular nerve
Maxillary sinus

Inferior turbinate

Pterygoid plate (lateral and medial)
Foramen magnum
Fossa of Rosenmuller

Lateral pterygoid
Nasopharynx

Tensor and levator velli palatini m.

Adenoidal tissue

Torus tubarius (eustachian tube opening in front)

Temporalis m.
Medial pterygoid
Retroantral fat
Oropharynx
Tonsillar pillar
Styloid process
Medial pterygoid

Prestyloid parapharyngeal space
Level 2: from skull base to lower hyoid, posterior to back of submandibular gland, anterior to back of sternocleidomastoid

2A: anterior, lateral, medial or touching posterior to internal jugular vein

2B: posterior to internal jugular with fat plane separating
2A lymph node
Mylohyoid

Genioglossus

Palatine tonsil

Mylohyoid

Pharyngeal constrictors
Sternocleidomastoid

Stone in submandibular gland
Level 1: above hyoid bone, below mylohyoid

anterior to back of submandibular gland

1A: between medial anterior belly of digastrics (submental)

1B: lateral to 1A (submandibular)
Epiglottis
Geniohyoid
Levator scapulae
Semispinalis cervicis
Anterior belly of digastric
Hypopharynx (from hyoid to cricopharyngeus)
Pyriform sinus

Pre-epiglottic space

Sternohyoid and thyroid muscles

Pyriform sinus
Level 3: below hyoid bone, above lower cricoid arch, anterior to back of sternocleidomastoid.

Level 5A: posterior to back of sternocleidomastoid from skull base to lower cricoid arch.
Aryepiglottic fold
False cord level
Thyroid cartilage
Laryngeal vestibule
Cricoarytenoid joint (arytenoid anteriorly, cricoid posteriorly)

Above true cords to epiglottis is supraglottic,
Below to cricoid is subglottic
Anterior commissure
Inferior cornu of thyroid cartilage

Longus colli
Cricoid cartilage
Level 4: below lower cricoid to level of clavicle, lateral to carotid arteries, anterior to line connecting back of sternocleidomastoid and posterolateral margin of anterior scalene.
Level 5B: from lower cricoid to level of clavicle, posterior to line connecting back of sternocleidomastoid and posterolateral margin of anterior scalene.
Level 6: between carotid arteries from lower body of hyoid to top of manubrium
Thyroid at level of isthmus

Serratus anterior
Lung apices
Normal Uptake and Variants

Combined PET-CT in the Head and Neck

Part 1. Physiologic, Altered Physiologic, and Artifactual FDG Uptake

Todd M. Blodgett, MD • Melanie B. Fukui, MD • Carl H. Snyderman, MD • Barton F. Branstetter IV, MD • Barry M. McCook, MD • Dave W. Townsend, PhD • Carolyn C. Meltzer, MD

Dental Artifacts

- Dental artifacts
  - Due to metal
  - Very high density will cause over-correction
  - Appears as increased activity
  - Review non-AC corrected also
    - Can be seen with CT or Ge AC corrected
Dental Implants

with CT-AC

without AC
Dental Inflammation

- Head and neck cancer patients often have dental disease
- Teeth may be removed before radiation therapy started
- Can cause increased FDG uptake in jaw, adjacent soft tissues, and lymph nodes
58 year old female squamous cell right tonsil treated with surgery and radiation therapy
Recent tooth extraction
Different patient:

Unerupted right maxillary tooth
Mastication

- Mastication
  - Gum chewing, tongue smacking
- Altered muscle imbalance from surgery
  - Asymmetric or isolated pterygoid uptake
Asymmetric Pterygoid Uptake with Remote Laryngeal Disease
Tongue

- Variable, usually low
  - May be focal and intense
  - Especially at insertion of genioglossus
- Prevents tongue from falling back in supine patient
Mild uptake at insertion of genioglossus
Tongue

Intense uptake at insertion of genioglossus
Actual Lesion Near Insertion

Thanks to Dr. Peter Possert!
Salivary Glands

- Variable but usually low uptake in parotid and submandibular glands
- Our experience: more intense sublingual uptake
Salivary Glands

Two patients with normal sublingual uptake
Salivary Glands

Submandibular and sublingual uptake
Lymphoid Tissue

- Lymphoid Tissue
  - Palatine tonsils
  - Lingual tonsils
  - Waldeyer’s ring

- Connects nasopharyngeal adenoids, palatine tonsils, and lingual tonsils
Lymphoid Tissue

- Lymphoid Tissue
  - Usually low to moderate uptake but can be intense
  - More intense in children
  - May be asymmetric
  - Activated by respiratory illness
Lymphoid Tissue

Lingual tonsil
Lymphoid Tissue

Palatine tonsil

Palatine tonsil
Lymphoid Tissue

Portion of Waldeyer’s Ring
May be Asymmetric…

60 year old male, squamous cell cancer left cheek, post-excision.

PET for restaging
Asymmetric left tonsillar uptake with soft tissue fullness
Hypertrophic lymphoid tissue on flexible scope
Children...

3 year old with neuroblastoma
Mild bilateral uptake in cervical lymph nodes stable for 2 years
Normal intense tonsillar uptake
Beware the common cold...

55 year-old female; PET for breast cancer restaging shows no recurrence

Bilateral intense tonsillar and mild bilateral uptake in sub-cm level 2 nodes

Patient reports URI
But a stuffy nose should not look like this...
Differential

- Nasal Vault Masses
  - Malignant
    - Lymphoma
    - Melanoma
    - Vascular metastases
  - Benign:
    - Wegener Granulomatosis
    - sinonasal polyp, inverted papilloma, hemangioma (also occurs with pregnancy), pyogenic granuloma, hemangiopericytoma, juvenile nasopharyngeal angiofibroma
Differential

• Nasal Vault Masses
  – Malignant
    • Lymphoma
    • Melanoma
    • Vascular metastases
  – Benign:
    • Wegener Granulomatosis
    • Sinonasal polyp, inverted papilloma, hemangioma (also occurs with pregnancy), pyogenic granuloma, hemangiopericytoma, juvenile nasopharyngeal angiofibroma
Radiation and Chemotherapy

• Pseudo-lesion
  – Prior surgery or radiation therapy can make normal area appear abnormal

• May get radiation pharyngitis, mucositis, thyroiditis, pneumonia, and/or esophagitis
Radiation Therapy

Before – left base of tongue lesion

After — radiation therapy, now pseudolesion on right at normal tonsil uptake
Vocal Cords

- Laryngeal/Vocal Cord
  - Usually symmetric
    - Cricothyroid and cricoarytenoid muscles
  - Can be focal especially if surgery
    - Intense if talking during uptake phase
      - So sit quietly, no talking
Vocal Cords

- Laryngeal/Vocal Cord
  - Unilateral uptake
    - Contralateral vocal cord paralysis (benign or malignant)
      - Look for tumor in mediastinum
    - Ipsilateral lesion
    - Ipsilateral Teflon injection
Vocal Cords

Normal vocal cords
39 year-old female with melanoma metastases (not shown) and stable right vocal cord uptake
Patient has silastic implant on left due to benign paralysis
Unilateral Uptake in Right Vocal Cord from Tumor Effect on Recurrent Left Laryngeal Nerve
Unilateral Uptake in Left Vocal Cord from Tumor Effect on Recurrent Right Laryngeal Nerve
Unilateral Uptake in Left Vocal Cord from Actual Vocal Cord Tumor
Thyroid

• Thyroid
  – Euthyroid patients can have mild, moderate or intense uptake
    • Up to 1/3 of normals
  – More intense diffuse thyroid uptake likely abnormal
    • Associated with subclinical thyroiditis
Thyroid

• Thyroid cancer can have high uptake
  – Unlikely to have mild uptake (SUV < 2)
• Goiter and benign nodules can also have high uptake
• Malignant nodules will have higher uptake
• Bottom line: nonspecific but if focal—evaluate
Goiter Narrowing Airway
Be familiar with ultrasound anatomy too for ultimate correlation.
Thyroglossal Duct Uptake
Knowing CT anatomy will help with parathyroid imaging to find what does not belong...
Knowing CT anatomy will help with parathyroid imaging to find what does not belong…
Face and Neck Muscles

- Can use muscle relaxants
  - Most do not
- Longus capitis and scalene
  - May be focal and mimic lymph nodes
- Face and neck
  - Patients who are nervous
- Eye and eyelid
  - If eyes not closed or relaxed during uptake
Neck Muscles
Neck Muscles
Neck Muscles

Asymmetric longus colli/capitis muscle uptake
Post-surgical

Often seen around stoma for laryngectomy
Sino-nasal Disease

- Sinus inflammation can have increased uptake, usually low level

Mild sinus uptake

Normal intense adenoid uptake
and Can Simulate Disease…

64 year-old female adenoid cystic carcinoma soft palate, resection 4 years prior

Last PET negative; new uptake in soft tissue nodule at maxillectomy site

On exam, dried secretions no tumor, also looked good on 2 month follow-up visit
Sino-nasal Disease

67 year old male with newly diagnosed colorectal cancer
Intense uptake on PET at colorectal region

No loco-regional spread or metastases

Solitary left nasal uptake
Sino-nasal Disease

Answer: unerupted maxillary tooth
Brown Fat

- **Cohade C, et al. JNM 2003;44:170**
  - Ability to increase blood flow with norepinephrine stimulation
  - Extensive β-adrenergic innervation, and high content of mitochondria
  - Increased glucose utilization to generate heat
  - 6:1 female to male

  - Great review
Brown Fat

- Benign finding
  - Can be asymmetric
- Increased post-chemotherapy and/or with cold weather
  - Dress warmly
- More common if patient cold during uptake phase
  - Keep room warm, blankets
Brown Fat

- May be reduced with propanolol or reserpine, or just keeping patient warm

- **Williams, et al. AJR 2008;190:1406**
  - High fat - very low carbohydrate preparation diet night before and morning of PET decreased brown fat in winter and blood glucose levels
Brown Fat

18 year old female carotid space sarcoma, no chemo
You may also come across other emergencies. Great to be familiar with what they look like…
Intratonsillar Abscesses

I & D revealed 10 cc pus from both tonsils
Peritonsillar Abscess

I & D: lots of green pus, *Strep. pneumoniae*
Retropharyngeal Abscess, Adult

- Adult male
- Sore throat, fevers
- ER – “Bilateral peritonsillar abscess”
- Lesions are too posterior to be tonsillar
- **Tonsillar abscess cannot** be behind ICA/IJV
Neck Abscess

- Describe extent
- Effect on airway (is there airway compromise?)
- Proximity to ICA and IJV (involve carotid space, is IJV still patent?)
Odontogenic Infection
Small, acute, no imaging needed
Sinusitis with Intracranial Abscess
Acute Invasive Fungal Infection

**CT – early**
- Mucosal disease
- Septal or turbinate necrosis
- Erosions nasal cavity

**CT – late**
- Local invasion
  - Retroantral fat, cheek
- Intracranial/orbital spread
- Bone destruction
Acute Invasive Fungal Sinusitis
Airway Disease

- If there is lots of air, think perforation
- “Gas-producing organisms” don’t cause massive emphysema
The End…

Stay tuned for Chest…