Image quality assessment in turbo-spin echo diffusion-weighted MR imaging and the correlation between the ADC value and the histological features of head and neck tumors

Poster Number: ADV-01

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Abstract Details
Purpose
Many studies have supported the utility of diffusion-weighted images (DWIs) in the differential diagnosis. However, Echo-planar imaging (EPI) DWIs are susceptible to inhomogeneity of the magnetic field, which limits their usefulness in the head and neck region. Thus, the first purpose of this study was to evaluate the image distortion of Turbo-spin echo (TSE)-DWIs in comparison to anatomical images. The second purpose was to demonstrate the apparent diffusion coefficient (ADC) values in various types of head and neck lesions.

Materials & Methods
In all cases, MRI was performed using a clinical 3T whole-body MRI system (Philips Healthcare, Best, Netherlands). A total of 99 cases were enrolled. In each case, MRI was performed and T2-weighted images (T2WIs) and TSE-DWIs (b-value, 0 and 1000 s/mm² [DWIb0 and DWIb1000]) were obtained. At first, the DWI was reoriented onto a T2WI to match the matrix size and slice thickness. Then, we carefully drew the lesion, the bilateral Masseter muscles (MMs) and the spinal cord and defined them as regions of interest (ROIs) on a DWIb0, a DWIb1000 and a T2WI. The centroids of the ROIs were obtained. The
differences along the X-axis (the direction of frequency encoding) and the Y-axis (the direction of phase encoding) were measured among these centroids. For the second purpose, an ADC map was obtained using DWIb0 and DWIb1000 images. All of the procedures were performed using the OsiriX Lite software program (Pixmeo SARL, Bernex, Switzerland) and the Image J software program (NIH, Maryland, USA).

Results
The 88 remaining cases (89%) (benign tumor, n=20; malignant tumor, n=52; inflammation, n=9; cyst, n=7) could be evaluated by TSE-DWI. Eleven cases were excluded because their lesions were too small (n=8), or due to the presence of a severe metal artifact (n=3).

Focusing on the comparison of DWIb1000 images to T2WIs, the deviations along X-axis were 0.87±0.62 mm, 0.74±0.61 mm, and 0.42±0.38 mm (lesion, MMs, and spinal cord, respectively). Meanwhile, the deviations along the Y-axis were 1.37±1.28 mm, 1.44±0.99 mm, and 0.67±0.57 mm (lesion, MMs, and spinal cord, respectively). The deviation along the Y-axis was significantly larger than that along the X-axis in MMs and the spinal cord (p-value < 0.05); however, the absolute amount was not so large. In addition, the deviation that was observed between DWIb0 images and T2WIs was almost identical to that observed between DWIb1000 and T2WI (mean difference, < 0.1 mm). Thus, the image distortion in the direction of phase encoding was not so severe.

Regarding the ADC values, cysts presented the highest values (1.91±0.59 x10-3 mm2/s) followed by benign tumors (1.46±0.44 x10-3 mm2/s), while malignant lymphoma showed the lowest values (0.86±0.12 x10-3 mm2/s). Thus, the ADC values obtained from TSE-DWIs were useful for evaluating these lesions.

Conclusions
TSE-DWIs were found to be immune to image distortion; thus, these images could be easily superimposed on anatomical images. Moreover, the ADC values that were obtained showed high diagnostic power in the assessment of head and neck lesions.
Clinical MRI Applications in Head Neck Imaging
Poster Number: ADV-02

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Abstract Details
PURPOSE: Computed tomography (CT) is the main imaging modality in head neck imaging. The purpose of this exhibit is to:

1. Review MR anatomy, protocols and relevant physics in head neck imaging.
2. Illustrate characteristic MR imaging features of common and uncommon diseases of each subsite with a compartmental approach.

Description: The subsites of head and neck regions include nasal cavity, paranasal sinus, skull base, temporal bone, orbits, nasopharynx, oropharynx, hypopharynx, oral cavity, larynx, salivary glands, and thyroid glands. The exhibit reviews MR of head and neck performed at a tertiary referral center over a 6-year period (2010-2016) with radiological and pathological correlation. Images of each entity will be presented with any distinguishing imaging features, diagnostic pearls and pitfalls. MRI artifacts are also discussed.


SUMMARY:
It is crucial for the otolaryngologists to know the clinical MRI applications in head and neck to order the studies appropriately. The radiologists must know characteristic MR findings to interpret the study correctly.
Amalgam Artifact

Metallic streak due to dental amalgam obscures the tongue squamous cell carcinoma on CT. The lesion is easily seen on MRI (yellow arrow).

Bone Marrow Involvement

Left mandibular osteomyelitis is appreciated only on MRI (blue arrow). CT was negative.

Tumor VS Polyp VS Fluid

Tumor in the nasal cavity and left maxillary sinus (blue arrow). Trapped fluid is seen in the right maxillary sinus and frontal air cells (green arrows).

Cartilage Involvement

The left thyroid cartilage is heterogeneously calcified (red arrow). MRI helps to exclude thyroid cartilage invasion by the tumor (blue arrow) when the cartilage is normal. However, MRI may yield false positivity due to inflammatory process.
In the city of lights, let us review things that light up - Role of DWI imaging in characterizing various head and neck pathology.

Poster Number: ADV-03

Abstract Details

Purpose:

To describe the role of diffusion weighted imaging (DWI) and the apparent diffusion coefficient (ADC) in head and neck imaging.

To illustrate use of DWI imaging features to differentiate various head and neck pathologies.
Discussion:

The standard imaging modalities for evaluating head and neck disease are MRI and CT. The diagnostic accuracy of conventional MRI is limited by similar imaging features for several head and neck lesions. By depicting the microscopic random motion of water molecules within biological tissues, DWI/ADC can provide information regarding tissue microstructure and thus facilitate further characterization of these disease processes.

Cellular packing, intracellular organelles, cell membranes and other macromolecules within the tissue, all restrict the random motion of water molecules. It is this variation in motion and redistribution of water molecules between tissue compartments that is reflected in DWI/ADC values which, in turn helps to differentiate disease processes.

We will discuss the role of DWI in following clinical situations with pictorial review:
1. Benign vs. malignant
2. Low grade vs. high Grade malignancy
3. Lymphoma vs. squamous cell carcinoma
4. Benign vs. malignant lymph nodes
5. Prediction of response to chemo-radiotherapy
6. Recurrent/residual tumor vs. post treatment changes
7. Pediatric benign and malignant tumors

Summary:

Proper utilization of DWI and corresponding ADC imaging enables the radiologist in characterizing head and neck lesions.

DWI can be helpful in differentiating aggressive vs benign lesions, low grade vs high grade tumors, as well as in cancer follow up imaging.
Rhabdomyosarcoma with restricted diffusion
Purpose:
This educational exhibit demonstrates the specific imaging findings in patients under active immunotherapy. It has been widely accepted that the immune system plays a crucial role in cancer development, as tumor cells evade immnosurveillance by exploiting inhibitory checkpoint pathways that suppress antitumor T-cell responses. Head and neck squamous cell carcinoma (HNSCC) has been intensely studied as an immunosuppressive disease. Following the increasing understanding of the underlying mechanisms behind control of malignancies by the immune system, the establishment of immunomodulatory monoclonal antibody (mAb) therapy has emerged as a promising approach for the treatment of cancer. Ipilimumab and pembrolizumab: both monoclonal antibodies, are currently being evaluated in clinical trials in patients with advanced HNSCC. As a result, it is crucial that radiologists recognize the unique adverse events associated with immunotherapy to guide appropriate treatment and avoid potential imaging pitfalls that could be mistaken
for metastatic progression of disease.

Description:
The potential treatment-related complications associated with monoclonal antibody therapy have been termed immune-related adverse events. Adverse effects of immunotherapy are either a result of the induction of autoimmunity or of a proinflammatory state. Through this overview of immune related adverse events, we will highlight the important imaging findings in these patients treated with monoclonal antibodies. This presentation includes reports of colitis, an important complication that requires prompt diagnosis and treatment. The highest mortality associated with immune-related adverse events occurred as a result of severe colitis, with the worst outcomes resulting from prolonged time between diagnosis and appropriate treatment of immune-related colitis.

Imaging findings in auto-immune hepatitis are not specific, but the imager should recognize the possibility of autoimmune hepatitis in the setting of cancer immunotherapy.

Endocrinopathies that are reported with use of monoclonal antibodies include autoimmune hypophysitis, thyroiditis and pancreatitis.

Other, less common immune-related adverse events that can be diagnosed at imaging include myositis, arthritis, sarcoid-like reaction, lymphocytic vasculitis, organizing pneumonia, and fasciitis. Sarcoid-like adenopathy and pancreatitis are important immune-related adverse events that should be recognized and differentiated from metastatic disease.

Organising pneumonia, characterised by peripheral bilateral patchy opacities, more frequently in the periphery and in the lower lung zone, air bronchogram, and reverse halo sign is a rare adverse events that can also be diagnosed at imaging.

Conclusion:
To date, conventional treatment has mediocre results and prognosis in patients with advanced HNSCC is dismal. Immunomodulatory monoclonal antibody (mAb) therapy is emerging as a promising approach for the treatment of HNSCC. Advancements in cancer immunotherapy challenge the current imaging approach to evaluation of treatment-related complications. Radiologists must recognize the wide range of autoimmune-related toxic effects that should not be mistaken for disease progression. In addition, early recognition of potential immune-related adverse events and recommendations for appropriate clinical management by the cognizant radiologist may be critical to successful management of immune-related toxic effects.
Head and Neck Lesions: Correlating Imaging Findings with Histopathology
Poster Number: ADV-05

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Head and Neck Lesions: Correlating Imaging Findings with Histopathology

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Purpose
Most of the imaging findings seen with head and neck lesions can be related directly to the histopathology of the abnormality. In many cases, these findings can be predicted by the underlying abnormalities at a cellular level. The purpose of this exhibit is to familiarize the reader with the microscopic appearance of a variety of head and neck lesions, and how they relate to the corresponding MR imaging findings, with supporting CT imaging examples.

Description
This educational exhibit will illustrate how imaging findings of head and neck lesions often correlate with the microscopic findings. Specific examples to be discussed include but are not limited to the following, listed by subsite: Skull base – meningioma (varying restricted diffusion), chordoma (T2 bright), chondrosarcoma (T2 bright, calcifications), craniopharyngioma – juvenile type (T1 bright protein) vs. adult type (more solid, enhancing); Sinonasal – esthesioneuroblastoma (peripheral cysts), melanoma (T1 bright blood versus melanin), lymphoma/sinonasal undifferentiated carcinoma/squamous cell carcinoma (T2 dark, restricted diffusion due to high cellularity), adenocarcinoma (T2 bright), inverted papilloma/inverted papilloma degenerated to squamous cell carcinoma (darker T2 than IP); Pharynx – adenoid cystic carcinoma (poor encapsulation, tends to undergo perineural tumor spread), adenocarcinoma (T2 bright), lymphoma, squamous cell carcinoma; Larynx – chondrosarcoma; Oral Cavity – epidermoid (restricted diffusion); Soft tissues – glomus tumor (salt and pepper vascularity), nerve sheath tumors (T2 bright/cystic change in Antoni B), parotid pleomorphic adenoma (T2 bright/carcinoma ex pleomorphic adenoma (T2 dark); Nodes – nodal metastases with HPV (cystic) and without HPV infection (solid); Orbits – lymphoma versus orbital pseudotumor (lower ADC in lymphoma); Facial Bones – fibrous dysplasia (ground glass matrix), Paget’s disease (cotton wool appearance).

Summary
A basic knowledge of head and neck pathology is most helpful in understanding why certain lesions have characteristic MRI signal changes. We find this to be a more meaningful learning tool than rote memorization.

References:
Comparative evaluation of the white matter fiber integrity in subjects with pre and postlingual deafness
Poster Number: ADV-06

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Abstract Details
Purpose: To perform a comparative investigation of white matter integrity in subjects with pre- and postlingual deafness.
Materials and Methods: We performed a tract-based statistical analysis of diffusion tensor anisotropy in eight and ten adults with pre and postlingual deafness, respectively.

Results: Subjects with deafness exhibited significant decreases in diffusion anisotropy at the right internal capsule, right thalamus, and splenium of the corpus callosum as well as within the bilateral superior temporal gyrus (including Heschl gyrus) and right temporal white matter. Furthermore, relative to subjects with postlingual deafness, those with prelingual deafness exhibited lower anisotropy in the right superior temporal gyrus, bilateral temporal white matter, and the genu and anterior body of the corpus callosum.

Conclusion: We believe that, in subjects with deafness, reception of early auditory stimuli before language acquisition might be more critical to white matter maturation and brain reorganization than the nature of auditory stimuli itself or the duration of disuse. These findings provide the theoretical background for early auditory rehabilitation.
Launching a Head and Neck PET/MRI Program: Lessons Learned.
Poster Number: ADV-07

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Purpose:
The development of MRI compatible PET detectors has enabled the new imaging modality of simultaneous PET/MRI. This technology, which couples the high soft tissue contrast of MRI with the molecular specificity available from PET, has a growing installation base within the United States. Head and neck oncology is one of the best described applications of this budding technology. However, this support from the literature is insufficient on its own to construct a successful clinical PET/MRI program. Successful implementation of a head and neck PET/MRI program requires solving both technical and workflow related challenges.

Description:
This module describes elements which will enable the viewer to more rapidly and successfully develop a head and neck PET/MRI program. The module is divided into scanner and room related elements (inpatient / outpatient setting, research and human subject compatible sedation), patient selection, protocol elements (PET compatible coils, sequences compatible with simultaneous PET acquisition, expected changes in SUV between sequential PET/CT and PET/MRI exams), and interpretative elements (efficient fusion of morphologic and PET data, interpretation, and presentation to referring clinicians).

Summary:
PET/MRI is a promising modality with a growing installation base. This new modality presents intriguing possibilities for furthering both clinical care and research in head and neck oncology. Successfully starting a new head and neck PET/MRI program requires attention to both workflow and technical issues.
Approaches for Biobank Specimen – Preoperative Imaging Correlation for Radiogenomic Studies of Head and Neck Cancer
Poster Number: ADV-08

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Abstract Details
Purpose: There is increasing interest in the use of texture or radiomic approaches with machine learning for prediction of tumor molecular features. For radiogenomic investigations, the best achievable correlation of site of tumor specimen collection with the pre-operative images is desired. In this study, we review our experience using different approaches for image-pathology specimen sample correlation and discuss the advantages and pitfalls of the different approaches.

Materials & Methods: This technical exhibit is based on a single institution experience from an ongoing prospective study of head and neck squamous cell carcinoma with informed consent. During operative resection, surgical sutures were used for proper orientation of the resected tumor specimen in the pathology suite. For biobank specimen – image correlation, 3D printing and video-recordings were used. 3D printing was performed pre-operatively with creation of “positive” tumor molds (based on segmented tumor contour) and “negative” molds (based on estimated resection margin). Video recordings were performed in the pathology suite at the time of biobank specimen harvesting for live replay during post-operative tumor segmentation for future radiomic analysis.

Results: Live video recording in the pathology suite replayed during segmentation was most helpful for biobank specimen – image correlation and targeting of a subarea within the tumor on pre-operative imaging. Positive 3D molds provided good visual representation of the tumor but were not helpful for biobank specimen – image correlation. Negative molds with slots, previously used for other organs such as prostate, did not work well for HNSCC because of complex shape of tumors and need for preservation of tumor margins for appropriate clinical-pathologic evaluation of the tumor margins.
Conclusions: Video recordings performed during biobank specimen harvesting are most useful for guiding tumor segmentation for future radiomic analysis.
Abstract Details
Purpose: There is increasing use of dual energy CT (DECT) for the evaluation of head and neck pathology. Optimal application and use of DECT requires familiarity with the appearance of normal tissues, incidental findings, or pathology on different reconstructions. The purpose of this exhibit is to provide a practical, pictorial review of the normal anatomy, benign lesions, and various head and neck pathology on commonly used DECT reconstructions.

Description: The presentation will begin with a brief overview of fundamentals of virtual monochromatic images (VMIs) and material decomposition maps using a fast kVp switching DECT scanner. Thereafter, a pictorial review of normal anatomy and pathology will be provided using low energy and high energy VMIs,
iodine material decomposition maps, and virtual unenhanced images. The major anatomical structures of the neck will be reviewed on different reconstructions followed by a review of benign and various pathology including (1) malignant and benign tumors (e.g., head and neck squamous cell carcinoma, thyroid cancer, lymphoma, salivary gland tumors, parathyroid adenomas), (2) infectious and inflammatory disorders (e.g., soft tissues infections and abscesses, sialolithiasis), (3) malignant and inflammatory lymphadenopathy, and (4) miscellaneous pathology (e.g. perineural spread of tumor, thyroglossal duct cyst, skull base lesions). In addition to reviewing the appearance of the lesions on different reconstructions, the exhibit will also highlight reconstructions that may enhance diagnostic evaluation and review the advantages and disadvantages/pitfalls of different reconstructions based on the pathology and location in the neck, when appropriate.

Summary: DECT is a useful tool for evaluation of head and neck pathology and is increasingly used in the clinical setting. The exhibit will provide an overview of the appearance of major anatomical structures and diverse neck pathology on commonly used DECT reconstructions and discuss potential advantages and pitfalls of different reconstructions for lesion evaluation.
Workflow Implications of Routine Dual Energy CT Scanning of the Neck in Clinical Practice
Poster Number: ADV-10

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Abstract Details
Purpose: The increasing use of dual energy CT (DECT) with multiple emerging clinical applications in head and neck imaging. In the long-run, widespread adoption of DECT in clinical practice will likely depend not only on demonstration of added diagnostic value but also seamless workflow integration. The purpose of this exhibit is to review the practical workflow implications of routine DECT scanning based on the experience at a single institution where a majority of elective neck CTs are acquired in DECT mode using a fast kVp switching scanner.

Description: The exhibit will begin with a brief overview of DECT systems and then focus on the workflow using a fast kVp switching DECT scanner. Different modes of acquisition and the need for prospective (or pre-planned) DECT acquisition will be discussed with exceptions such as scanners based on sandwich or layered
detectors that always acquire in DECT mode. Thereafter, the entire workflow will be reviewed, with special emphasis on factors that impact workflow on the (1) technologist side (e.g. preset protocols with generation of special DECT reconstructions; scan acquisition and processing times and their impact on patient scheduling) and (2) interpretation or radiologist side (use of preset reconstructions, audit evaluating frequency of use of specialized reconstructions by radiologists if sent to PACS, etc.). The exhibit will conclude with a discussion of remaining challenges and potential solutions for seamless workflow integration.

Summary: Widespread adoption of DECT in routine clinical practice will likely in part depend on seamless workflow integration. A number of steps can be taken that improve workflow with current systems, and these are reviewed in this exhibit. Although some challenges remain, these can likely be resolved with future technical innovations.
Neurotropic malignant neoplasms of the head and neck: common and unusual etiologies.
Poster Number: CN-01

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Abstract Details
Background: Perineural spread (PNS) represents the extension of malignant cells on the layers of the nerve sheath beyond the margins of the primary tumor. When PNS is present, the prognosis is poorer and it is related to increased local recurrence rates. PNS is more frequently seen in squamous cell carcinoma and in salivary gland cancer, but it may occur in other malignancies.

Purpose: To demonstrate the different etiologies (common and unusual) and patterns of PNS in head and neck cancer.

Material and Methods: Case-based discussion on pathological and imaging findings, using Computed Tomography (CT) and Magnetic Resonance (MR) images of patients with different types of head and neck malignancies (squamous cell carcinoma, adenoid cystic carcinoma, basal cell carcinoma, mucoepidermoid carcinoma, lymphoma, melanoma and germ cell tumor), with PNS.
Summary: Different etiologies can be associated with PNS in head and neck malignancies and the radiologist must be aware and actively look for imaging findings that may correspond to PNS, which are thickening of the nerve, post contrast enhancement in the path of the nerve and enlargement of the neural foramen.
More Than a Pain in the Neck! Imaging Findings of Neurovascular Compression Syndromes around the Cervical Spine
Poster Number: CN-04

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Abstract Details
Background:
Neurovascular compression (NVC) is the term used to describe the process when vascular structures, particularly arteries, come into direct conflict with adjacent nerves resulting in cranial nerve displacement and/or indentation. Trigeminal neuralgia secondary to NVC is most commonly implicated. While less well known, there are a variety of intra- and extra-neuraxial cervical spine related causes of NVC that exist, including spasmodic torticollis and occipital neuralgia. The purpose of this exhibit is to use a case-based approach to illustrate the spectrum of cervical spine related neurovascular compression and to identify important anatomical characteristics of cervical spine NVC.

Materials and Methods:
A variety of cervical spine related NVC cases are presented using high-resolution cross-sectional imaging. Relevant anatomy is reviewed. Additionally, a detailed literature review on cervical spine related NVC syndromes was completed.
Results/Discussion:

Conclusion:
Cervical spine related NVC is relatively uncommon and thus it can easily be overlooked. Radiologists play a critical role in the diagnosis of cervical spine related NVC and a detailed knowledge of these entities is critical in providing comprehensive care for our patients.

Case 2. 48-year-old with history of recurrent syncope and transient vertigo.

(a, b) Coronal large and small FOV enhanced T1 high resolution isotropic volume excitation (eTHRIVE) images demonstrate a tortuous left vertebral artery (→) which is compressing the CMJ resulting rightward mass effect at that level. Additionally, the left half of the medulla is uplifted and overhanging the offending vessel. (b-c) Volumetric sagittal T1WI post contrast large and small FOV demonstrate similar compressive findings with an overhanging medulla at the level of the offending vessel (→); however, posterior mass effect is also apparent on this sequence. (c-e) Axial large and small FOV MRA, T2 with fat sat, and T1 demonstrate a tortuous left vertebral artery (→) resulting in left anterolateral surface compression with posterior and rightward mass effect. Suggested signal abnormality in the medulla represents flow artifact.
Rare isolated Medial Longitudinal Fasciculus syndrome. Where do I need to look?
Poster Number: CN-05

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Abstract Details

Purpose:
The purpose of the exhibit is to discuss the imaging characteristics, pathophysiology and relevant anatomy of isolated Medial Longitudinal Fasciculus (MLF) syndrome, in an attempt to acquaint the Neuroradiologists with this condition so as to look carefully at the midbrain in those cases who present with symptoms of isolated MLF syndrome.

Methods:
Isolated MLF syndrome due to infarction in the midbrain only is rare. Infarcts in the pons is not uncommon. Such small infarcts can easily be missed by young Radiologists and the trainees. In this review, we discuss the clinical and imaging characteristics of this clinical entity followed by comprehensive review of the anatomy and pathophysiology.

Discussion:
Isolated MLF syndrome is an important cause of impairment of adduction of ipsilateral eye during horizontal gaze and has to be differentiated from partial oculomotor nerve palsy. Ipsilateral adduction abnormality during horizontal gaze with preservation of convergence is suggestive of isolated MLF syndrome rather than partial oculomotor nerve palsy. Careful scrutiny of the brain stem is crucial to recognize such small infarcts, explain the clinical symptomatology and help the clinician to determine the etiology of patient’s symptoms.

Conclusion:
Isolated MLF syndrome secondary to acute lacunar midbrain infarct is rare. Visualization of such small infarcts is difficult and challenging especially for young radiologists and the trainees. This exhibit will help the Radiologist to understand this condition, its pathophysiology and anatomy and to identify such small infarcts in the relevant clinical setting.

References:
Tic Douloureux: Imaging Following Non-medical Treatment.

Poster Number: CN-06

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Abstract Details
Purpose: The purpose of this exhibit is to review expected imaging findings and complications following various non-medical treatments for trigeminal neuralgia.

Description/Summary: Trigeminal neuralgia is a well-recognized incapacitating syndrome characterized by severe paroxysmal pain in the distribution of the trigeminal nerve. The most common etiology, extrinsic vascular compression of the cisternal segment of the trigeminal nerve, is found in 80-90% of cases, and the most commonly implicated vessel is the superior cerebellar artery. Less frequently, trigeminal neuralgia can be caused by other etiologies, such as demyelination (i.e. multiple sclerosis) or extrinsic mass compression of the trigeminal nerve. The utilization of MRI allows for detailed evaluation of the trigeminal nerves, including evaluation for neurovascular compression.

While medical management remains the primary treatment for trigeminal neuralgia, nearly half of patients will ultimately require surgical or alternative non-invasive treatment techniques, mostly due to refractory symptoms and/or medication side effects. These alternative nonmedical treatment options include: trigeminal rhizotomy, microvascular decompression surgery, and stereotactic radiosurgery.

The interpreting radiologist should be familiar with the expected posttreatment imaging appearance following these procedures, as well as potential complications. We will review several entities, including: post-rhizotomy changes and complications, expected imaging findings following microvascular decompression, Teflon granuloma formation after microvascular decompression, nerve enhancement following stereotactic radiosurgery, and trigeminal trophic syndrome. Case examples will be provided.
Beyond the taste buds: Comprehensive review of pathway, cortical and subcortical substrate of taste sensation
Poster Number: CN-07

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Abstract Details
Purpose:
The taste sensation is one of the most important special sensory phenomena. It is especially true for people who love tasting all kinds of cuisines. This can truly be understood when one is struggling with upper airway illness with dulling of taste sensations. What makes us like or dislike the taste of food? The aim of this exhibit is to explore the taste sensation pathway and its higher center neural control. The exhibit will enable clinicians, trainee radiologists and head and neck radiologists to understand anatomy and neural pathways of taste sensation, one of the special sensory pathways in humans.
Description:
The taste sensation is one of the most important special sensory phenomena. The only thing we understand is
that the tongue contains taste buds which make us taste food good or bad. However, very few know the
neural pathways and higher center neural control. In this review, we comprehensively discuss neural
pathways and cortical & subcortical substate of cranial nerves involved in taste sensation superimposed on
diagrammatic / CT or MRI imaging. This will help the audience to better understand the anatomy and location
of the structures inside the body.

Discussion:
The gustatory pathway begins from the tongue. Anterior 2/3rd of the tongue is innervated by facial nerve and
posterior 1/3rd by glossophyryngeal nerve. The pharynx and epiglottis are innervated by the glossophyryngeal
and vagus nerves. The axon of sensory nerves in these 3 cranial nerves terminate in rostral part of the
nucleus of tractus solitarius in the medulla. Second order neurons then travel through the ipsilateral central
tegmentum to the ventroposteromedial (VPM) nucleus of thalamus. The VPM nucleus than projects to
ipsilateral gustatory cortex near the postcentral gyrus or insular cortex (Broadmann area 43 ; insulo-opercular
cortex; primary gustatory cortex). The orbitofrontal and anterior insular cortex are the secondary gustatory
cortex. The OFC is an area of multisensory integration. It receives inputs from primary gustatory, olfactory,
somatosensory, auditory and visual areas and modulates awareness of flavor, taste recognition and
discrimination. Thalamus processes taste sensation along with pain, touch and temperature sensations from
intraoral structures.

Most of the studies favor left hemispheric dominance for the taste. However, studies have shown ipsilateral,
contralateral and bilateral dysgeusia after involvement on unilateral gustatory cortex.

Conclusion:
Taste sensation begins at the tongue and ultimately end in cerebral cortex though relay mechanism by several
order neurons. In depth understanding of these pathways are easier if superimposed on diagrams and
Neuroimaging. We need to be aware of anatomical and functional relationship beyond our classical teaching
and knowledge base. This will not only enhance our readings but also better management of our patients.
Advanced Cutaneous Malignancy of the Head and Neck with Perineural Tumor Spread Along Cervical Nerves: A Plexus of Cancer
Poster Number: CN-08

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Abstract Details
Purpose
The cutaneous branches of the cervical plexus and cervical spinal nerves are not well known by radiologists because the nerves are not typically seen. The purpose of this exhibit is to review the anatomy of the cutaneous branches of the cervical plexus and imaging findings of perineural tumor spread of cutaneous malignancy along the superficial cervical plexus.

Materials/Methods
We present cases of recurrent skin cancers of the head and neck involving cutaneous branches of the cervical plexus and spinal nerves. Cases include: a 67-year-old man with a remote history of a cutaneous malignancy resected over his left shoulder with 6 month history of neck pain found to have palpable nodule at Erb’s point and on imaging showed isolated recurrence along the left cervical plexus; a 57-year-old man with multiply recurrent scalp squamous cell carcinoma that presented with recurrence along the right cervical plexus extending into the spinal roots; a 58-year-old man with multiple squamous cell carcinoma treated with surgery and developed a recurrent nodule in the right suboccipital scalp and with perineural tumor along the greater occipital nerve. Additionally, a 72-year-old man with history of prior left supraorbital squamous cell carcinoma with intracranial perineural tumor spread involving multiple cranial nerves and successfully treated with chemotherapy and radiation, presented with neck recurrence and extensive tumor along the great auricular nerve which could be followed into the C2-C3 and C3-C4 foramina.
Results
The cutaneous branches of the cervical plexus include the great auricular nerve, lesser occipital nerve, transverse cutaneous nerve and supraclavicular nerve. Cutaneous branches originating from the dorsal ramus of the cervical spinal nerves in the posterior scalp include the greater occipital nerve and 3rd occipital nerve. CT and PET imaging findings from these cases help to define the anatomic location of these nerves including their origin from the spine.

Conclusions
Perineural tumor spread can occur distant from a primary tumor or can be the only manifestation of recurrent skin cancer. Perineural involvement changes staging and will alter the treatment of patients. Radiologists must be aware of potential routes of perineural spread and tumor recurrence based on the anatomic location of cutaneous nerves of the cervical plexus and cervical spinal nerves, particularly if a patient with history of head and neck cutaneous malignancy presents with neck pain.

Figure 1: A 67-year-old man with history of multiply resected squamous cell carcinoma of the right temple and occipital scalp presented with increasing neck pain. Contrast enhanced CT revealed (a) cordlike enhancement of multiple branches of the cervical plexus, including the great auricular nerve, transverse cutaneous nerve and lesser occipital nerve, originating at Erb’s point (circle). Extension of tumor along the thickened lesser occipital nerve (arrows) is also seen (b). This patient had isolated perineural recurrence along the cervical plexus.

Figure 2: A 72-year-old man with history of prior left supraorbital squamous cell carcinoma and perineural tumor spread was successfully treated with chemotherapy and radiation. He presented 4 years later with recurrence in the left neck with perineural tumor spread along the great auricular nerve. The PET/CT (a) showed FDG avidity along the left great auricular nerve (dotted arrow) which could be traced to the left C2-C3 foramen (circle). The contrast-enhanced CT demonstrated the neck nodule (short arrow) and a thickened great auricular nerve (solid arrow) superficial to the sternocleidomastoid muscle.
The pteryopalatine fossa as a crossroad for perineural spread.
Poster Number: CN-10

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Abstract Details
Purpose
This educational exhibit helps its readers to get familiar with the anatomy of the pterygopalatine fossa (PPF), its neurovascular content and its different communications. The second objective is to understand and diagnose the presence of perineural spread (PNS). Finally, you’ll be able to predict nerves at risk for PNS using an illustrative diagram provided in the exhibit.

Description
The PPF is a fat-containing inverted pyramid shaped space, which can be considered a major crossroad of multiple neurovascular structures. As a general, obliteration of this normal fat should alert the radiologist to search for pathology. This paper will give a detailed review on the anatomy of the PPF, which is of great importance in disease spreading along the nerves connected to the PPF. We'll highlight the importance of knowledge of the detailed neurovascular anatomy through several cases of pathology (eg. adenoid cystic carcinoma, locally aggressive sphenoidal meningioma, squamous cell carcinoma). By using a diagram of nerves and foramina linked to the PPF, we illustrate the importance of perineural spread and existence of true PNS loops. Any process involving the PPF may spread via several nerves and in an antegrade as well as a retrograde way. For instance, we present a case of an adenoid cystic carcinoma directly invading the PPF, with PNS along the maxillary nerve tracking back to the ipsilateral Gasser’s ganglion and from there on antegrade PNS to the mandibular nerve. Also, antegrade PNS to the infraorbital nerve as well as retrograde tracking to the Vidian nerve is seen in this case. The direct and indirect radiological signs of perineural spread will be discussed in this exhibition.

Summary
The pterygopalatine fossa is a challenging anatomical space, involved in a wide range of pathologies. This overview on PPF and PNS will provide the practicing neuroradiologist with a working knowledge on the perineural spreading pattern around the PPF, thereby facilitating early detection. Potentially missing PNS around the PPF may have major consequences on treatment and subsequently on the life expectancy and patient’s quality of life.
Perineural tumor spread- Highway to the central nervous system
Poster Number: CN-11

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Abstract Details
Perineural spread is one of the more insidious forms of tumor growth that is well-recognized in head and neck cancers. Squamous cell carcinomas and adenoid cystic carcinomas are the most frequent malignancies to display this behavior, however perineural spread of tumor can also be seen in lymphoma, rhabdomyosarcoma, or melanoma. Because of the extensive neural system in the head and neck, malignant tumors can invade cranial nerves which then serve as conduits for intracranial extension. Knowledge of the pertinent cranial nerve anatomy allows radiologist to predict the pathways of perineural tumor spread.

Perineural spread of tumors most commonly occurs along branches of the trigeminal and facial nerves. The pterygopalatine fossa is a crossroad communicating with the infratemporal fossa, palate, sinus, nasal cavity and nasopharynx, face, orbit, and middle cranial fossa. These connections are important because they serve as channels for perineural tumor spread. Knowledge of these pathways allows the radiologist to predict where the tumor may eventually spread.

The goals of this exhibit are to review the anatomy of the cranial nerves and pterygopalatine fossa and illustrate the common pathways of perineural tumor spread between the trigeminal and facial nerves. Additionally, this exhibit will present the imaging appearance of perineural spread and highlight the complimentary roles of CT and MRI in assessment of perineural tumor spread. Finally, the clinical significance of perineural spread on extension of head and neck tumor will be discussed.

Perineural spread of tumor is a form of metastatic disease in which tumor disseminates along cranial nerves. The presence of perineural spread is associated with poor prognosis because of the increased risk of local recurrence, increased risk of metastasis, and decreased rates of survival. In many cases, patients with perineural spread are asymptomatic or initially misdiagnosed resulting in delay in treatment. Therefore, it is imperative that the radiologist be familiar with both normal cranial nerve anatomy and the radiologic appearance and assessment of perineural tumor extension.
Familiar faces in unfamiliar places: Non-vestibulocochlear sporadic schwannomas of the head and neck
Poster Number: CN-12

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Abstract Details
Purpose: The purpose of this exhibit is to provide examples of sporadic Schwannomas involving cranial nerves other than the vestibulocochlear nerve in order to increase familiarity with uncommon presentations of this tumor.

Description: Schwannomas represent 7% of all primary intracranial tumors. The most common distribution of intracranial schwannomas involves the vestibular portion of the vestibulocochlear nerve. Much less common is involvement of the trigeminal nerve and facial nerve, followed by the remaining cranial nerves with the exception of the olfactory and optic nerves which lack sheaths made of Schwann cells. Involvement of cranial nerves other than VIII and V accounts for less than 2% of intracranial schwannomas. In descending frequency, these are comprised of schwannomas involving the jugular foramen (CN IX, X, XI), facial nerve, and hypoglossal nerve. Even more rare is intracerebral, or non-cranial nerve associated, schwannoma. Representative tumors involving each of these groups are presented in this short series. Furthermore, brief comment is made that imaging characteristics of extracranial nerve schwannomas mirrors those tumors in intracranial locations. To illustrate this point, an extracranial sympathetic chain schwannoma is also presented. As a disclaimer, syndromic or multiple Schwannomas such as in Neurofibromatosis 2 are not presented as multiplicity and clinical history facilitate diagnosis in such instances.

Summary: A short series of non-vestibulocochlear Schwannomas is presented to increase familiarity with atypical locations of a less common tumor.
The challenge: Uncommon perineural tumor spread manifestations
Poster Number: CN-13

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Abstract Details
Perineural tumor spread is a well-known phenomenon in head and neck malignancies describing local macroscopic tumor growth or invasion along nerve sheaths. The most common tumors that disseminate via perineural spread are squamous cell, adenoid cystic, and mucoepidermoid carcinomas that arise from squamous epithelial lining or salivary glands. Cranial nerve (CN) V and VII as well as their connections are most commonly affected, however, the radiologist needs to be aware that any nerve may be affected by perineural tumor spread.

This educational exhibit examines the imaging manifestations of perineural tumor spread along other cranial and non-cranial nerves that can be easily overlooked by the radiologist. Examples of perineural tumor spread along CN III, X and XII, as well as along occipital nerves(s) and the sympathetic plexus will be given to familiarize the radiologist with the imaging features of these uncommon manifestations of perineural tumor spread outside of CN V and VII. Clinical and / or imaging hints raising the possibility of perineural tumor spread will be highlighted that should serve as triggers for more careful evaluation / imaging of certain nerve(s).
Three different patients with perineural tumor spread affecting different nerves

A & B – Follow up CT shows thickened left occipital nerve (red arrowheads) compared to right (green arrowheads) and soft tissue fullness along C3 (blue arrows) consistent with perineural tumor spread that is confirmed by FDG uptake (*) and more obvious spinal canal tumor extension (●); C – Infrahyoid epiglottic cancer (green arrows) with extension along the superior laryngeal neurovascular bundle (orange arrows) and signs of extralaryngeal perineural tumor spread manifesting as obliteration of fat planes (red arrows) around the EAC branches; D-F – Follow up CT reveals a small posterior tongue recurrence (yellow arrow) which does not explain the new tongue atrophy. Notice the fullness of the carotid sheath (pink arrows) that extends almost to the skull base consistent with perineural tumor spread along CN XII explaining the new tongue atrophy.
Utilizing Structured Reporting to Improve Oropharyngeal Cancer Initial Staging
Poster Number: EDU-01

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Abstract Details
Contrast enhanced computed tomography plays a critical role in the initial staging of oropharyngeal malignancy. However, the radiology report can vary between institutions as well as within a single institution, which can compromise accurate staging of malignancy. We propose that utilizing a structured reporting template will improve the accuracy of staging oropharyngeal malignancy. Prior to our study, a pre-test was administered to referring otolaryngologists which identified a perception by the otolaryngologists that the radiology reports only sometimes included the accurate information for stating of oropharyngeal cancer. Our single institution study retrospectively reviewed all cases of oropharyngeal malignancy over a span of 10 years (n=42). Two board certified neuroradiologists blinded to the original report reviewed the examinations utilizing a template based on 7th edition of The American Joint Committee on Cancer Staging Manual. The results of this review were then compared to the original report by a third investigator. Our results show that only 29% (n = 12) of the original reports were adequate for accurate radiologic staging of oropharyngeal malignancy. These results suggest that the use of a standardized template has the potential to greatly improve not only oropharyngeal malignancy staging, but staging of other head and neck malignancy as well. In the next step of our study, we plan to implement the use of structured reporting for oropharyngeal malignancy staging, with feedback from referring otolaryngologists in the form of a post-test. In addition, we plan on expanding the use of structured reporting to include staging of malignancy of the lip and oral cavity, remaining pharynx, and larynx. Gathering feedback on the perceived completeness of current reporting practices from referring clinicians may be a useful way to identify potential quality improvement initiatives within oncologic care. Our study suggests that standardized reports offer a potential method for improvement.
Comparison of Incidence of Xerostomia between Three-dimensional Conformal Radiation Therapy and Contralateral Superficial Lobe Parotid-sparing Intensity-modulated Radiotherapy for Oropharyngeal and Hypopharyngeal Cancer

Poster Number: HPE-01

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Abstract Details
Purpose/Objective(s): In the treatment of head-neck squamous cell carcinoma, contralateral whole lobe parotid-gland sparing intensity modulated radiotherapy (IMRT) and bilateral superficial lobe parotid-gland sparing IMRT could reduce incidence of xerostomia in clinical trials. When we experienced the case that was difficult to spare parotid gland enough, we used contralateral superficial lobe parotid-sparing IMRT to reduce marginal recurrence. However, the results of contralateral superficial lobe parotid-sparing IMRT remains unclear.

The purpose of this study was to compare incidence of xerostomia between three-dimensional conformal radiotherapy (3D-CRT) and contralateral superficial lobe parotid-gland sparing IMRT for oropharyngeal and hypopharyngeal cancer in our institution. We secondarily evaluated efficacy.

Materials/Methods: We retrospectively reviewed the medical records of locally advanced oropharyngeal and hypopharyngeal cancer patients who were treated with definitive concurrent chemoradiotherapy between June 2007 and April 2014. We estimated the average mean dose to the parotid glands, incidence of Grade 2 or worse xerostomia, patterns of failure and survivals. Acute and late xerostomia were scored according to the CTCAE v4.0 and the LENTSOMA, respectively. We used Fisher’s exact test to compare the proportions of categorical variables and Student’s t-test to compare the averages of continuous variables. Survivals were estimated with the Kaplan–Meier method, and survival estimates were compared by using the log-rank test.

Results: Seventeen patients received 3D-CRT and 21 received IMRT. The average mean dose to the
superficial lobe of the contralateral parotid gland was 45.3/26.6 Gy (p < 0.001) in the 3D-CRT group/IMRT group. The incidence of Grade 2 or worse acute xerostomia was 94/81% (p = 0.48) in the 3D-CRT group/IMRT group. The incidence of late Grade 2 or worse xerostomia at 12 and 24 months after the treatment were 75/26% (p = 0.012) and 67/18% (p = 0.018) in the 3D-CRT group/IMRT group, respectively. The patterns of failure did not differ between two groups and no patients had marginal recurrence in both groups. The 2-year progression-free survival rate was 59/62% (p = 0.73) and the 2-year overall survival rate was 71/71% (p = 0.76) in the 3D-CRT group/IMRT group, respectively.

Conclusion: The incidence of late xerostomia was significantly lower in contralateral superficial lobe parotid-sparing IMRT group compared with 3D-CRT group, while the efficacy did not differ between two groups.

Proportion of patients with Grade 2 or worse late xerostomia

<table>
<thead>
<tr>
<th>Time in months</th>
<th>3D-CRT</th>
<th>IMRT</th>
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<tbody>
<tr>
<td>3 months</td>
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<tr>
<td>6 months</td>
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<td>18 months</td>
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<tr>
<td>24 months</td>
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p = 0.46  

p = 0.019

p = 0.012

p = 0.022

p = 0.018
Don’t Get Choked Up!: An Imaging Review of Dysphagia
Poster Number: HPE-03

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Purpose:

Dysphagia is traditionally evaluated primarily with endoscopic visualization, manometry, and fluoroscopic evaluation. However, patients are increasingly evaluated with cross-sectional imaging of the neck, often on a screening basis. The purpose of this exhibit is to review the most common imaging findings associated with dysphagia, particularly those findings most likely to be encountered by the head and neck imager.

Description:

Dysphagia refers to a general difficulty in swallowing and affects more than one in five adults in the United States, with nearly two-thirds of those affected above the age of 65. In addition to potentially devastating complications such as aspiration, dysphagia can result in malnutrition and generalized increase in morbidity and mortality. In terms of imaging, fluoroscopic examination is commonly the first-line modality of choice for evaluating dysphagia, as it can provide both structural and functional information. However, it is limited in its scope of identifying specific etiologies of dysphagia. In this regard, cross-sectional imaging of the neck may be complimentary to endoscopy or fluoroscopy, providing further assessment for identifying etiologies of dysphagia.

In accordance with the policies of the institutional review board, a HIPAA-compliant retrospective search was performed using a database of all radiologic exams performed at our institution. Illustrative cases of common and uncommon etiologies of dysphagia are presented with multimodality imaging correlates. We highlight important congenital, neoplastic, structural, infectious, inflammatory, and iatrogenic etiologies of dysphagia that are of critical importance to head and neck imagers.

Summary:

Dysphagia is a common condition primarily affecting the elderly that is associated with increased morbidity and mortality as well as lower quality of life. While fluoroscopy is the radiologic imaging modality of choice for initial evaluation, cross-sectional imaging of the neck is often complimentary and may help identify sundry etiologies of dysphagia. Knowledge of the most common etiologies of dysphagia that may be seen on head and neck imaging will help the imager come to the correct diagnosis and add value to the patient’s care.
Diffusion-Weighted Imaging for the Evaluation of the Neck: New Qualitative Assessment Metric
Poster Number: ITP-01

Abstract Details
Purpose: Current DWI sequences of the head and neck have significant issues with fat saturation, distortion, aliasing/ghosting and resolution that limit their utility, even though the Quantitative Imaging Biomarkers Alliance [QIBA, 2015] has attempted to address these shortcomings through optimized image parameters. We propose to create a standardized method to evaluate neck DWI sequence artifacts that includes qualitative measurements.

Materials and Methods: A total of 27/37 consecutive suprahyoid or full neck MRI studies performed in October 2016 were evaluated for artifacts using our proposed qualitative artifact scale, which rated them from 1 (no artifact) to 4 (severe artifact) for aliasing/ghosting, geometric distortion, fat saturation quality, and motion. 10 were excluded due to lack of DWI images. The grading scales and imaging examples are seen on Figure 1.

Results: 10 out of 37 patients (27%) had no DWI available for interpretation. Of the remaining 27, only 3/27 (11%) had DWI sequences with no artifacts for a score of 1 on all four artifact parameters. Three out of 27 (11%) were completely non-diagnostic per our scale, with a score of 3 or 4 on most or all artifact parameters; they demonstrated severe ghosting/aliasing, geometric distortion, motion, and/or failure of fat saturation. The remaining 21 out of 27 (77%) demonstrated mild to moderate artifacts and had scores of 2 or 3 on some or most parameters, which limited ADC evaluation at the region of interest.

Conclusion: This preliminary study demonstrates the capability of a new qualitative method to assess artifacts in MRI neck diffusion imaging. Although our preliminary data suggests this scale is a promising technique to accurately measure artifacts, larger studies with quantitative parameters of geometric distortion, ghosting, and residual fat signal are needed to validate our qualitative parameters.
**Figure 1:** DWI images from three different patients with clinical suspicion of malignancy. A (left), Severe aliasing/ghosting artifact in large portions of the neck, Grade 4. B (center), Severe geometric distortion in 3 or 4 quadrants, Grade 4. C (right), Severe failure of fat saturation in the ventral and dorsal aspect of the neck, Grade 4.
Detection of Occult Primary Tumors in Patients with Cervical Metastases of Unknown Primary Tumors: Comparison of Three-Dimensional THRIVE MR Techniques with Two-Dimensional Spin-Echo MR or Contrast-Enhanced CT Imaging
Poster Number: ITP-02

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Abstract Details

Purpose: To evaluate and compare the diagnostic potential of postcontrast 3D T1-weighted high resolution isotropic volume examination (THRIVE) sequence to spin-echo (SE) T1-weighted sequence or CT imaging in the detection of occult primary tumors in patients with cervical metastasis of an unknown primary tumors (CUP).

Materials and Methods: A total of 73 patients with initially undetected tumors after endoscopic or physical examination underwent preoperative contrast-enhanced CT and MR imaging using both SE and 3D THRIVE sequences. Results of guided biopsy with general anesthesia or surgery served as the reference standard. Diagnostic values of 3D THRIVE and SE T1-weighted MR, and contrast-enhanced CT imaging were compared with the McNemar test and pairwise comparison with DeLong method.

Results: Primary tumors were detected in 59 (80.8%) of 73 patients. There were 36 tumors in the palatine tonsil, eleven in the base of the tongue, five in pyriform sinus and seven in the nasopharynx. 3D THRIVE MR technique depicted 43 (72.9%) of 59 primary tumors, but it failed to depict primary tumors in 16 (27.1%) cases. Overall, sensitivity (72.9%) and accuracy (71.2%) of 3D THRIVE MR in detection of primary tumors was higher than that of SE T1-weighted MR (49.2%, 53.4%) (P < 0.05) or contrast-enhanced CT (36.4%, 46.4%) (P < .05), while specificity did not differ (P > 0.25). Diagnostic performance (AUC) of 3D THRIVE MR in tumor detection was not different from that of SE T1-weighted MR or contrast-enhanced CT imaging (P > .282).

Conclusion: 3D THRIVE MR sequence is more sensitive in detection of primary tumors than SE T1-weighted MR or contrast-enhanced CT in patients with CUP; therefore, it may lead to improved targeted biopsy and therapeutic planning in these patients.
Optimal Anatomic Imaging in Head and Neck Squamous Cell Carcinoma Patients Undergoing Screening PET for Distant Metastasis
Poster Number: ITP-03

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Purpose:
Distant metastasis is an infrequent finding in head and neck squamous cell cancer (HNSCC), with the lungs being the predominant site of metastatic disease. The site and frequency of distant metastases is of interest as time spent imaging for distant metastasis could be utilized for improved local tumor characterization and reduce unnecessary radiation exposure. The purpose of this retrospective cross-sectional study is to identify the optimal anatomic coverage for PET exams in a modern cohort of HNSCC patients.

Materials & Methods:
This single institution retrospective review identified a cohort of PET/CT examinations, consisting of patients with squamous cell carcinoma of the oral cavity, oropharynx, hypopharynx, or larynx. This cohort underwent PET/CT between 6/1/2014 and 5/30/2015. The PET/CT report, along with associated pathology reports and subsequent imaging follow-up, served as the gold standard for determination of distant metastatic disease.
Results:
A total of 215 examinations met inclusion criteria. The oropharynx was the predominant primary site, representing 108 exams (50%). There were 70 exams (33%) in which the patient presented with T4a disease. Nodal disease was advanced in this cohort, with 135 exams with patients staged with either N2 or N3 nodal disease. There were 71 exams (33%) in which a pulmonary nodule was described in the PET/CT report, with 35 (16%) describing FDG avid nodules. There were 14 exams (7%) with distant metastatic disease. Five exams (2%) demonstrated abdominal metastasis. No exams demonstrated pelvic metastasis or isolated subdiaphragmatic metastasis.

Conclusion:
Distant metastasis of HNSCC is uncommon, most frequently occurring in the thorax. Subdiaphragmatic metastasis is rare, with no exams in this study demonstrating pelvic metastasis or isolated subdiaphragmatic metastasis. These results support routine anatomic imaging of the chest. However, imaging of abdomen and especially the pelvis in the absence of thoracic metastasis is not warranted and results in unnecessary radiation exposure.
Normal Patterns and Pitfalls of FDG Uptake in the Head and Neck
Poster Number: ITP-04

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Purpose:
The purpose of this educational exhibit is to provide a comprehensive review of the normal patterns of FDG uptake in the head and neck, as well as imaging findings of common diagnostic pitfalls related to incidentally found FDG-avid foci in the head and neck on PET/CT.

Description:
This study was performed in compliance with policies of the institutional review board at the authors' institutions and was HIPAA compliant. We performed a literature review and retrospective review of the electronic medical records and PACS at the authors' affiliated institutions (academic medical centers with tertiary neuroradiology and head and neck surgical referral). While the increased utilization of PET/CT imaging has significantly improved the characterization of primary head and neck malignancies and the identification of locoregional and metastatic disease, the imaging modality also presents many diagnostic challenges, including incidentally identified FDG-avid foci found within the neck. The underlying pathophysiology contributing to incidental increased FDG uptake within the head and neck includes normal anatomic patterns, as well as benign and malignant etiologies. In an image-rich format, we present a selection of illustrative cases of incidental increased FDG activity within the neck, including normal physiologic uptake (such as muscular, glandular, lymphatic, and brown adipose tissue), incidental neck lesions (such as thyroid nodules or neoplasia), and infectious and inflammatory conditions.

Summary:
Incidental foci of increased FDG activity within the head and neck often pose a significant diagnostic challenge. In order to avoid misdiagnosis, imagers should be familiar with the normal patterns of FDG activity within the head and neck and the pathophysiology and imaging-findings of the common diagnostic pitfalls related to incidental FDG-avid lesions.

References:
The Added Value of Contrast Enhanced MRA in the Assessment of Head and Neck Paragangliomas
Poster Number: ITP-05

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Abstract Details
Purpose: To demonstrate the utility of contrast-enhanced magnetic resonance angiography (CE-MRA) as a complement to conventional MR imaging in the assessment of head and neck paragangliomas.

Approach: A series of illustrative cases is provided.

Discussion: Paragangliomas are hypervascular neuroendocrine tumors that occur in characteristic locations in the head and neck. CE-MRA technique greatly aids in the diagnosis and assessment of these tumors as an adjunct to conventional MR imaging. Prior to treatment, CE-MRA technique helps to fully delineate the extent of primary tumors. This technique is also useful for screening patients with familial paragangliomas who may have multifocal disease. CE-MRA also helps to refine a location-based differential diagnosis of head and neck masses.

Conclusion: As a complement to conventional MR Neck and MR Temporal Bone imaging, CE-MRA Neck technique increases both sensitivity and specificity in the diagnosis of head and neck paragangliomas.
Diffusion of Good Ideas: Using Diffusion Weighted Imaging for Problem Solving in Head and Neck Radiology
Poster Number: ITP-06

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Abstract Details
Teaching Points:

1. Principles of diffusion weighted imaging

2. Practice of diffusion weighted imaging in head and neck radiology
   a. Selection of b values
   b. Techniques to minimize artifact
   c. Qualitative and quantitative analysis

3. Review the imaging appearance of various head and neck pathologies in which diffusion weighted imaging can help improves or confirms the diagnosis
Table of Contents/Outline:

1. Principles of diffusion weighted imaging
   a. Physics of molecular motion

2. Practice of diffusion weighted imaging in head and neck radiology
   a. Selection of b values
   b. Echo planar versus non-echo planar technique
   c. Techniques to minimize artifact
   d. Qualitative and quantitative analysis

3. Review the imaging appearance of various head and neck pathologies in which diffusion weighted imaging can help improves or confirms the diagnosis
   a. Cholesteatoma
   b. Salivary gland tumors
   c. Lymphadenopathy
   d. Osseous metastases
   e. Head and neck lymphoma
   f. Head and neck tumor recurrence

**Using DWI to confirm the diagnosis**

*Head and Neck Lymphoma*

- Parotid Space

- Pharyngeal lymphatic ring
  - Adenoids
Strategies to Optimize CT Imaging and CT guided biopsies for Head and Neck Pathology
Poster Number: ITP-07

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Abstract Details
Purpose:
CT remains the modality of choice for initial imaging of majority of head and neck pathology, staging (especially in combination with PET), as well as for subsequent surveillance. It is also the most viable option for biopsy of lesions involving deep spaces of neck and skull base, which are not readily accessible by
Tailoring protocols to specific head and neck pathology and patient anatomy (both in the pre and post operative setting) is crucial for accurate characterization of disease, image guided biopsies as well as subsequent treatment planning for the referring surgeon / radiation oncologist.

Description:
We review commonly encountered pitfalls and strategies to optimize and standardize imaging parameters for head and neck pathology in both the pre and post operative setting with specific case examples, including:

- Methods to troubleshoot and consistently acquire optimal bolus timing to ensure adequate mucosal phase of enhancement for characterization of head and neck pathology.

- Routine acquisition of multiplanar reconstructions with bone and soft tissue algorithms as well as additional reconstructions specific to anatomy involved, pathology of interest and tailored to assist in surgical planning.

- Examples of advanced techniques such as CT Dacrocystogram using passive intraocular contrast on DE scanner, with iodine overlay maps.

- Examples of Dual Energy CT to improve delineation of primary and regional disease.

- Dual energy CT with 4D CT protocol for delineation of parathyroid adenoma from ectopic thyroid.

- Methods to improve detection of pathology in the post treatment neck. For example: ventilation via stoma in the post operative neck during imaging/biopsy planning to better assess the walls of neopharynx. This is similar in principle to puffed cheek acquisition for lesions involving buccal space.

- Methods to minimize commonly encountered artifacts. For instance angled images to minimize artifact both for diagnostic imaging and for biopsy planning. If this is not possible by tilting gantry, we show examples of controlled patient head tilt with review of scout to ensure artifact will be out of plane of interest.

- Other commonly encountered challenges during CT guided biopsies of small deep space lesions and strategies to work around them. For example- in plane beam hardening artifact from biopsy device, which can obscure lesion of interest.

Summary:
Growing volumes in imaging head and neck pathology as well as increasing demands for image guided biopsies mandate that the neuroradiologist remains up to date with optimizing CT protocols, which should be tailored to pathology of interest and altered anatomy in the post treatment setting, and familiar with strategies to maximize yield from CT guided intervention.
Vocal Cord Paralysis: A pictorial review of various lesions associated with unilateral vocal paralysis and a review of the relevant anatomy on cross sectional imaging.

Poster Number: LAR-02

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Abstract Details
Electronic Educational Exhibit – ASHNR 2017
Title: Vocal Cord Paralysis: A pictorial review of various lesions associated with unilateral vocal paralysis and a review of the relevant anatomy on cross sectional imaging.
Authors: Mitchell, Patel, Griffith, Lai

Purpose:
The primary innervation of the vocal cord is by the ipsilateral recurrent laryngeal nerve after branching from the vagus nerve. A lesion anywhere along the nervous pathway may result in a vocal cord paralysis. With a clinical suspicion of vocal cord paralysis, or imaging findings of such, a search should be carried out from the skull base to the aortopulmonary window; to detect a lesion involving the vagus nerve as it exits the medulla or, for example, the left recurrent laryngeal nerve as it loops under the arch of aorta. The pathology associated with vocal cord paralysis is thus broad, and varies by location. Etiologies include, but are not limited to, malignant, traumatic, cardiovascular and iatrogenic. We aim to review the anatomy of the vocal apparatus and its innervation, and to show cases that illustrate various pathologies that may result in a vocal cord paralysis.
Description:
• A pictorial review and discussion of the relevant anatomy of the vocal cords and their innervation.

• Case files obtained from our institution’s database will be used to illustrate the imaging findings of vocal cord paralysis on CT and MRI and PET.

• Various etiologies of vocal cord paralysis and their imaging characteristics will be discussed, including brainstem meningioma, glomus jugulare, invasive esophageal cancer, metastatic lung malignancy and cardiovascular pathologies.

• Imaging techniques and pitfalls for missed diagnosis will be discussed.

Summary:
Vocal cord paralysis is a common clinical entity, due to a wide array of common and rare pathologies. The diagnosis is confirmed by direct visualization, however it is often suggested on imaging prior to clinical detection. Radiologists are integral in the discovery of the cause, which may due to unknown malignancy or silent cardiovascular disease. As such it is important that diagnosticians are aware of the anatomy of the innervation of the vocal cords, and the broad etiologies and potential locations for insult. This article hopes to review of the appearance of a vocal cord paralysis, and the important pathological findings on imaging studies for both the radiologist’s and clinician’s benefit.

Case 1:
70 y/o female presented with chest pain and cough with progressive hoarseness. A left upper lobe mass, with mediastinal metastasis was seen on CT. Pathology of the mass revealed poorly differentiated non small cell carcinoma. Of note, the patient had a previous total thyroidectomy, with no postoperative symptoms of dysphagia or dysphonia.

Figure 1a: Contrast enhanced, axial CT of the chest showing left upper lobe mass.

Figure 2a: Contrast enhanced axial CT at the level of the aortopulmonary window. Large mediastinal soft tissue is noted.

Figure 2b: PET/CT of the neck. Relative hypometabolism of the left vocal cord.
Multimodality Imaging Approach in the Preoperative Evaluation of Laryngeal Cancer
Poster Number: LAR-04

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Purpose: The purpose of this presentation is to provide a comprehensive overview of the cross sectional imaging anatomy of the larynx and to describe multi-modality approach in preoperative staging of laryngeal carcinoma.

Methods: We performed a HIPAA-compliant retrospective review of our institution's electronic medical record, including radiology and pathology databases, for illustrative cases of pathologically proven laryngeal carcinoma. A case based cross sectional imaging review of variety of cases will be presented and discussed in order to determine a correct TNM staging for laryngeal carcinoma. Where possible, FDG-PET imaging will be supplemented along with cross-sectional CT/MR imaging.

Discussion: While laryngoscopy is the gold standard to evaluate the mucosal tumor burden and cord mobility in the setting of laryngeal cancer, cross-sectional imaging is necessary to delineate the submucosal extent of the tumor, infiltration of surrounding structures and nodal metastasis. This combined information allows the tumor to be classified according to the relevant T and N staging, which guides treatment. Treatment options for laryngeal carcinoma involve singly or combination of surgery, radiotherapy and chemotherapy. The choice of treatment, response to treatment and patient outcomes depend on the multiple factors as follows: (a) Tumor volume (b) Relationship to the glottis (c) Submucosal space involvement (d) Laryngeal cartilage involvement (e) Surrounding structures infiltration such as posterior extension and involvement of post-cricoid pharynx (f) Nodal metastasis (most commonly level 2-4) as well as distant systemic metastasis (most commonly lungs).

Conclusion: As demonstrated in this exhibit, Cross-sectional imaging plays a crucial role in the pre-operative staging of laryngeal cancer and familiarity as well as careful assessment of specific imaging findings are necessary for appropriate staging to optimize the therapeutic planning.
Advanced Ultrasound Techniques for Benign and Malignant Cervical Lymph Nodes: Microvascular Ultrasonography, Shear Wave Elastography and MicroPure Imaging
Poster Number: LN-01

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Purpose
To analyze image findings of benign and malignant cervical lymph nodes with ultrasonography, focused on advanced techniques: microvascular ultrasonography, shear wave elastography and MicroPure imaging.

Description
Recent advances in ultrasound technology, such as microvascular ultrasonography, shear wave elastography and MicroPure imaging, have potential to improve the accuracy for differential diagnosis of cervical lymph nodes when integrated with conventional sonographic findings by its better ability to characterize lymph nodes. Microvascular ultrasonography with Superb Micro-vascular Imaging can reveal low velocity blood flow
that cannot be easily depicted in conventional power Doppler ultrasonography. Shear wave elastography can quantify velocity and indirectly measure tissue stiffness. MicroPure imaging is a technique designed to better detection of microcalcification that can overcome the limitation of conventional gray scale ultrasonography. We prospectively assessed comprehensive sonographic findings of lymph nodes with a high frequency linear transducer during ultrasonography-guided core needle biopsies for cervical lymph nodes. The findings of cervical lymph nodes on conventional gray scale ultrasonography, power Doppler ultrasonography and advanced ultrasound techniques (microvascular ultrasonography, shear wave elastography and MicroPure imaging) were evaluated. From November 2014 to April 2017, total 481 patents underwent ultrasonography-guided core needle biopsies of cervical lymph nodes at our institution. Among them, we retrospectively reviewed sonographic findings of benign and malignant cervical lymph nodes that are pathologically confirmed as reactive hyperplasia, subacute necrotizing lymphadenitis (Kikuchi disease), tuberculous lymphadenitis, metastatic lymphadenopathy and lymphoma. Microvascular ultrasonography could visualize detailed internal vascular distributions. With this technique, prominent branching hilar vessels in reactive lymph nodes were depicted more clearly than that with power Doppler sonography. Microabscesses in subacute necrotizing lymphadenitis caused displacement of internal vascular structures of lymph nodes. Furthermore, it was useful in differentiating tuberculous and metastatic lymphadenopathy by analyzing vascular patterns. Shear wave elastography revealed stiffer tissue of malignant lymph nodes than that of benign lymph nodes. However, tuberculous lymphadenitis showed variable stiffness. Microcalcifications of metastatic lymph nodes from papillary thyroid carcinoma were depicted with MicroPure imaging.

Summary
We illustrated sonographic features of various pathologic lymph nodes in neck focused on advanced ultrasound techniques. Combination of conventional and advanced sonographic findings may be helpful to improve the differential diagnosis of cervical lymph nodes and further studies will be needed to evaluate the added diagnostic value of advanced ultrasound techniques.
Between a Rock and a Neck Space: Spectrum of Pathologic Calcifications of the Soft Tissue Neck
Poster Number: LN-02

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Purpose:
A wide range of calcifications can be visualized within the superficial and deep spaces of the neck. Cross-sectional imaging has a key role in the evaluation of these calcifications, as the associated pathologies are often first detected on imaging. The severity and potential therapy of pathologies that display calcifications vastly varies, thus understanding the typical patterns and locations in which they present can be incredibly helpful to the radiologist. The purpose of this exhibit is to display and discuss a multitude of cases, which can contain calcifications within the soft tissues of the neck.

Description:
Utilizing cross-sectional images, in addition to 3D reconstructions a variety of pathologies will be presented. Adjunct to a thorough review of each entity’s typical imaging findings, a few original illustrations will be employed for further characterization in select cases. The pathologies to be shown include, but are not limited to: papillary thyroid cancer metastasis, longus colli calcific tendinitis, eagle syndrome, venous developmental anomaly (hemangioma), amyloidosis, thyroglossal duct cyst, sialolith, tonsillar calcifications, vascular aneurysm and opacification of the posterior longitudinal ligament. In supplement, some of the common, often expected calcifications will be shown, such as laryngeal, tracheal and thyroidal calcifications.

Summary:
Calcifications are a common finding throughout the spectrum of radiology. When calcifications within the head and neck are encountered, a thorough review and understanding of the typical imaging findings of the entities that can demonstrate calcifications can aid in the development of an appropriate differential. Accurate interpretations in many of these cases have significant clinical implications, with the potential to avoid additional testing and unnecessary procedures.
Systemic Malignancy: A Review of Head and Neck Imaging Manifestations
Poster Number: LN-04

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Purpose:
The purpose of this educational exhibit is to provide a comprehensive review of the common and uncommon imaging manifestations of systemic malignancy of non-head and neck primary tumor origin involving the head and neck region, including multimodality imaging findings, typical locations, differential diagnosis, and diagnostic pitfalls.

Description:
Systemic malignancies with manifestations in the head and neck are relatively common and it is important to recognize these findings on cross sectional imaging. Adequate knowledge of these manifestations may result in early detection of disease, a cue to look elsewhere for additional areas of involvement, and more appropriate triaging of patients for clinical management. In this IRB-approved, HIPAA-compliant study, we reviewed our institution’s electronic medical record, imaging database, and pathology database for illustrative cases of systemic metastatic disease of non-head and neck primary malignancy involving head and neck sites. These include osseous metastases; cervical, parotid, and facial nodal (including “signal” or “Virchow” node involvement) and non-nodal (pharyngeal or “Waldeyer” ring) lymphatic disease; orbital metastases; intracranial metastases; perineural tumor spread (including brachial plexus involvement); and non-osseous spinal metastatic disease (including epidural, leptomeningeal, and intramedullary disease). We present an image-rich collection of cases highlighting multi-modality imaging findings, as well as a review of the current medical literature.

Summary:
Systemic metastatic disease from a non-head and neck primary malignancy involving the head and neck is a relatively common entity. Head and neck imagers should be familiar with the imaging characteristics, commonly involved sites, differential diagnosis, and potential pitfalls.
Role and value of CT in the diagnosis of tuberculous cervical lymphadenitis
Poster Number: LN-05

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Abstract Details
Purpose:
Tuberculosis involvement of the neck typically manifests as diffuse cervical lymphadenitis with variable imaging findings including intranodal necrosis. Timely diagnosis of tuberculosis may be often difficult due to its nonspecific imaging findings, and other important pathologies such as papillary thyroid cancer, squamous cell carcinoma, bacterial abscess, or lymphoma sharing similar imaging findings. Pathology and laboratory correlates are not perfect, with equivocal results often failing to advance the diagnosis. The purpose of this study was to evaluate the role of CT in the diagnosis of tuberculous cervical lymphadenitis and to determine the utility of a follow-up CT as a tool to aid in timely and correct diagnosis of tuberculosis in the neck.
Materials and Methods:
This HIPAA compliant retrospective study was approved by our IRB and the requirement for the informed consent was waived. Using the RIS keyword search function, patients who had contrast-enhanced neck CT from January 2001 to December 2016 that included word “tuberculosis” in the impression section of the radiological report were identified (n=94). Their electronic charts were reviewed for pathology, laboratory results and treatment. Follow up images, if available, were also reviewed. Those with pathologically proven tuberculosis in the neck or positive sputum cultures were grouped as definitive tuberculosis patients (Group A). Those with no definitive pathology, but who were treated for tuberculosis based on strong clinical suspicion were labeled as clinically diagnosed tuberculosis patients (Group B).

Results:
All 94 patients presented with lymphadenopathy. 24% (23/94) fell into one of the above groups. Sixteen belonged to Group A and 7 to Group B. 88% (14/16) in Group A had cystic or necrotic lymphadenopathy ranging 1.6-7.0 cm. 85% (6/7) of patients in Group B demonstrated necrotic lymphadenopathy. Nine patients (56%) in Group A and 5 patients (71%) in Group B had follow-up CT. Ten of these 14 follow-up CTs (71%) demonstrated significant improvement of neck lymphadenopathy within 5-9 months of initiation of therapy. Two of the Group B patients did not demonstrate significant improvement on the follow-up CT, and were later diagnosed with lymphoma.

Conclusions:
Response to anti-tuberculosis medication treatment was seen within 5-9 months following initiation of treatment. Close follow-up CT is useful to evaluate the treatment response and confirm the diagnosis. More importantly, in situations where the initial diagnosis is equivocal, follow-up CT is helpful in identifying patients who need further investigation. We recommend the first follow up CT imaging within 5 months of initiation of therapy. If no significant improvement is seen in the follow up, this should warrant further workup.
What Deintensification of Head and Neck Radiation Therapy Looks Like
Poster Number: NAS-01

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Abstract Details
At least 70% of oropharyngeal squamous cell carcinomas (OPSCC) in the U.S. are HPV-associated and half of these patients will be at low risk of death from their index cancer. Because HPV+ OPSCC patients tend to be younger and healthier, they can have long survivorship and interest has grown in deintensification of radiation therapy. In this talk, I will describe the current experimental landscape of radiation dose and field deintensification, show some data related to our study of the overall dosimetric effects of deintensification, and show illustrative imaging series of patients treated definitively with higher vs lower doses of radiation and larger vs smaller fields of radiation. Of note, if this is not really appropriate for the purposes of a scientific abstract submission, I'd be happy to give an educationally oriented talk on this topic at an ASHNR conference in the future.
An institutional and literature review of findings differentiating post-treatment changes from recurrent head and neck tumors
Poster Number: NAS-03

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Abstract Details
Purpose: To illustrate using our institutional experience and literature review, the findings differentiating post-treatment changes from recurrent head and neck tumors.

Description/Summary: Treatment for head and neck malignancies may include chemotherapy, radiation, and/or surgery as well as a variety of flaps. Post-treatment changes and complications may have a variety of presentations and differentiating them from disease recurrence is often complicated by altered anatomy, postsurgical changes, edema, and inflammatory changes among other complicating factors. We will be reviewing distinct and differentiating imaging findings from our institutional experience and a literature review illustrating expected post-treatment changes and alterations and comparing them to findings seen with disease recurrence.
HPV-associated Oropharyngeal Squamous Cell Carcinoma: Imaging Review and Update on Staging.
Poster Number: NAS-04

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Abstract Details
Purpose: The incidence of HPV-associated (HPV+) oropharyngeal (OP) squamous cell carcinoma (SCCa) is increasing and is projected to surpass that of HPV+ cervical cancer by 2020. In this exhibit, we will 1) Review the imaging features of HPV+ OP SCCa compared to HPV- cancers; 2) Describe lesions that can mimic cystic adenopathy seen with HPV+ malignancies; and 3) Discuss the revised staging of HPV+ OP SCCa in the American Joint Committee on Cancer (AJCC) 8th Edition (published December 2016).

Description: HPV+ OP SCCa differs from HPV- head and neck (H&N) SCCa in several ways. HPV+ tumors affect a younger population often with minimal exposure to tobacco and alcohol. An increased incidence is seen in males who engage in oral sexual activity with multiple partners. Advanced nodal disease with relatively small and sometimes occult primary sites are characteristic. The most common site of the primary lesion is the palatine tonsil followed by the base of tongue. Associated lymphadenopathy is frequently cystic and can be confused with non-neoplastic entities such as second branchial cleft anomaly, suppurative lymph node, or abscess. On pathology, these tumors are poorly differentiated and overexpress p16 on immunohistochemistry. HPV positivity has prognostic implications as the response to therapy is significantly better compared to HPV- tumors, even in an advanced stage. In the most recent, 8th edition of H&N cancer staging, the AJCC has separated HPV+ OP SCCa from HPV- lesions, and has revised the staging system for these malignancies. Multiple enlarged lymph nodes in HPV+ tumors are now categorized as N1 provided the nodal disease is ipsilateral and the nodes measure less than 6cm. Therefore, this change downgrades potential stage IV cancers to stage I.

Summary: HPV+ OP SCCa differs from HPV- tumors in several ways. Compared to HPV- H&N SCCa, HPV+ cancers tend to occur in younger patients without typical H&N cancer risk factors, patients often present with advanced nodal disease, and HPV+ malignancies have a more favorable prognosis. A review of this malignancy is timely given the recent change in staging.
Abstract Details

Purpose:
We will discuss the biology of the human papilloma virus (HPV), review the HPV viruses and their associations with head and neck squamous cell cancers (HNSCC), illustrate the imaging findings of HPV positive HNSCC, and describe how clinicians use information about HPV to manage their patients.

Description:
HPV is an encapsulated, non-enveloped, double-stranded DNA virus of the family Papillomaviridae. Approximately 85% of humans will be infected by HPV infection during their lifetime. There are more than 150 HPV related viruses, of which 15 HPV types are considered carcinogenic. Types 16 and 18 are most
commonly associated with HNSCC, and high risk HPV16 accounts for more than 90% of HPV associated HNSCC. HPV has a specific tropism for oropharyngeal epithelium, and the association of HPV with cancer of the oropharynx is stronger than for any other head and neck site of disease.

HPV positive (HPV+) oropharyngeal squamous cell carcinomas (OPSCC) represent a different disease from HPV negative (HPV-) head and neck squamous cell carcinomas with regard to epidemiology, molecular pathogenesis, and survival. Patients with HPV+ HNSCC tend to be younger and lack the extensive smoking and/or alcohol abuse history common in many patients diagnosed with HNSCC. Direct testing for HPV DNA by in situ hybridization (ISH) is not routinely performed, however. Instead, testing for increased expression of the surrogate marker p16 is performed via immunohistochemistry (IHC). p16 IHC is performed of the primary lesion on all new cases of OPSCC and of cervical lymph nodes on all metastatic HNSCC (of unknown primary). If the result does not seem to reflect the clinical scenario, then direct testing for HPV itself can be performed. Patients with HPV-associated OPSCC have improved survival. This can potentially be leveraged to de-intensify adjuvant or primary antineoplastic therapy in these patients, thereby reducing the acute and long term treatment side-effects, and this is an area of active investigation.

HPV+ OPSCCs more commonly present with a neck mass, while HPV- OPSCC more likely present with symptoms referable to primary site of the lesion, such as sore throat, dysphagia, or odynophagia. On imaging, p16 positive OPSCC is more likely to have a smaller primary lesion that may be occult, is more likely exophytic, and more likely to be associated with cystic lymph nodes. p16 negative OPSCC is more likely to have a larger primary lesion that is more heterogeneous, infiltrative, and has less distinct margins. The staging of these two entities is also different, and the updated AJCC 8th edition staging for HPV+ and HPV- OPSCC will be reviewed.

Summary:

The differences between HPV-associated OPSCC and traditional HNSCC with regards to risk factors, molecular pathogenesis, imaging findings, response to therapy, and prognosis will be reviewed.
Case 1. 70 year old male who noted a painless neck masses while shaving. No history of tobacco or alcohol use. Sagittal (A) and axial (B) post-contrast CT images show a base of tongue lesion (red arrow) with associated bilateral cystic lymph nodes (yellow arrows). Pathology revealed p16+ squamous cell carcinoma.

Case 2. Older veteran male with dysphagia and otalgia. Positive history of tobacco and alcohol use. Sagittal T1w post-contrast (A) and axial T2w (B) images show a deeply infiltrative base of tongue lesion (green arrows) with irregular margins (pink arrow) and associated small solid pathologic lymph node (yellow arrow). Pathology revealed p16- and HPV- squamous cell carcinoma. There is an incidental Warthin tumor (blue arrow) in the right parotid.
Poster Number: NAS-08

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Abstract Details

Purpose
2017 marks the publication of a substantially updated 4th edition of the World Health Organization Classification of Head and Neck Tumors, a significant update to the 2005 edition. Practicing radiologists should understand how these updates are driving changes in understanding of these conditions and significantly altering the care of patients with head and neck neoplasms.

Description
Updates to the classification will be presented in a easily understood format that can be applied immediately to a radiologist’s practice. The exhibit will focus on updates to tumor classification and impacts on patient management. Molecular and genetic advances will be addressed where they have substantial implications on patient care.
Topics covered will include:
• Reasons behind defining the oral cavity and oropharynx as separate sites of disease
• Different risk factors, management steps, and prognosis of HPV versus non-HPV associated oropharynx squamous cell carcinomas (SCCs). Also, differences in diagnosis and prognosis of HPV associated SCCs in the oropharynx versus other sites.
• Increasing use of molecular diagnostics (e.g. HPV and EBV in situ hybridization) to identify the likely source of previously occult SCC primaries presenting with lymph node metastases
• Prognostic and management implications of newly identified paraganglioma associated syndromes
• Deepening understanding of genetic abnormalities associated with mucosal melanomas
• Deepening understanding and changing clinical profile of multifocal epithelial hyperplasia (papillomatosis)
• Enhanced coverage of metastatic Merkel cell carcinomas involving cervical lymph nodes
• Newly defined or reorganized oral cavity tumors such as myofibroblastic sarcoma and rhabdomyoma
• Newly defined oropharynx entity small cell cancer of the oropharynx
• Updated understanding of genetic alterations in the MAPK pathway leading to ameloblastoma
• Newly defined salivary gland tumor “secretory carcinoma”

Summary
This educational exhibit will provide practicing radiologists with a summary of the most clinically relevant changes present in the 2017 updated WHO Classification of Head and Neck Tumors. This knowledge can be applied in daily practice to improve diagnostic interpretation of imaging, aid in better understanding of pathology reports, provide guidance to referring physicians, and to increase the value offered by radiologists participating in multidisciplinary conferences.
Purpose: To present the major changes in the 8th edition of the American Joint Committee on Cancer (AJCC) Staging Manual in head and neck cancer with the detailed explanations and images from the corresponding cases.
Head and neck oncology encompasses a group of malignancies that arise in the mucosal surfaces of the upper aerodigestive tract, including the oral cavity, pharynx, larynx, and paranasal sinuses, as well as cancers of the major and minor salivary glands. The AJCC Cancer Staging Manual, 8th Edition, introduces a number of significant changes, and is recommended to be applied in the clinical field starting Jan, 2018. Therefore, radiologists should be familiar with the major changes in the AJCC 8th Edition to precisely stage head and neck cancer and to communicate well with the clinicians and the pathologists. The major changes includes the followings: a> separate staging for high-risk human papilloma virus (HPV)-associated oropharyngeal cancer, b> changes in the primary tumor (T) category for oral cavity cancer, c> new stage for nasopharyngeal cancer, and d> changes in the node (N) category. HPV-associated oropharyngeal cancer has been recognized as an entity with high responsiveness to treatment and excellent prognosis, generally occurs in younger, healthier patients with little or no tobacco exposure. T categories for HPV-associated cancer are equally valid with non-HPV associated cancer except for Tis and T4b. Its N categories are based on the size and the laterality of the nodes. T category for oral cavity cancer is significantly changed with new predictive parameter of depth of invasion. Nasopharyngeal cancer has adopted new T and N stages with newly defined anatomical landmarks. Lastly, the modification of N stage includes the addition of extranodal tumor extension (Supporting Figures), different clinical and pathological classifications, and new chapter for cervical lymph nodes with unknown primary tumors.

Summary: The 8th Edition of AJCC Cancer Staging Manual encompasses many significant changes. Radiologists should be familiar with these changes and capable of precise staging based on the new paradigms on the imaging studies.
Looking for the good amongst the bad: How viral associated neoplasms of the head and neck are different from the non-viral induced tumors
Poster Number: NAS-11

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Abstract Details

Purpose/Objective:
The objective of this exhibit is to review imaging findings, prognostic information, and treatment implications associated with viral-induced neoplasms of the head and neck, including those induced by human papillomavirus (HPV), Epstein-Barr virus (EBV), human immunodeficiency virus (HIV), and Merkel cell polyomavirus (MCPyV).

Content/Organization:
This electronic exhibit will delineate the known viruses associated with head and neck tumors, and the specific tumors associated with each virus, including HPV, EBV, HIV, and MCPyV. Information will include epidemiological data, typical imaging findings, differences in prognosis compared to non-viral associated head and neck tumors of the same/similar type, and the impact of viral status on staging and treatment options. Our presentation will include amongst other tumors a more detailed discussion of nasopharyngeal cancer, oropharyngeal cancer, non-Hodgkin’s lymphoma and Kaposi sarcoma.

Viral-induced tumor association is an important differentiator; for example, p16 positivity, indicating an HPV-positive squamous cell carcinoma, not only affects prognosis and treatment options, but there are also upcoming changes to staging criteria establishing a completely separate TNM classification from HPV-negative tumors. Our discussion will include how the 8th edition of the AJCC criteria has been updated with separate criteria proposed for HPV-positive cancers.
Summary statement:
Viral-induced neoplasms of the head and neck are important to recognize as separate entities amongst all head and neck malignancies as there are significant differences in staging, prognosis, and treatment; demographic information, patient history and specific imaging appearances can help the radiologist suggest the possibility of a virally induced tumor.
Growth of the upper airway during the first five years of life assessed by three-dimensional volumetric analysis.

Poster Number: NAS-12

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Abstract Details
Purpose: We seek to establish an upper airway volume growth curve for infants and young children from ages 0 through 4 years. To our knowledge, no such report exists in the literature specifically investigating the normative values for airway volume and rate of growth during the first several years of life.

Materials and Methods: Following institutional IRB approval, we conducted a retrospective search of the radiologic databases of our institution to identify high resolution CT scans covering the oropharyngeal and hypopharyngeal airway in children aged 0 through 4 years. Exams were excluded from analysis for the following reasons: lack of thin section images (1 mm slices or less); excessive motion artifact; presence of airway appliances or tubes; presence of maxillofacial dysmorphism or any active process likely to alter the airway anatomy; any indication in the medical record of a maxillofacial syndromic condition. 220 cases met the criteria for inclusion, and these were subjected to semi-automatic 3D airway volume calculation using a commercially available image processing suite (Vitrea, Vital Images).

Results: Airway volumes range from less than 1 cc in newborns to almost 9 cc in older children. Mean airway volumes increase steadily with age as expected, but the range of observed volumes also increases notably with age.
Conclusions: We present what we believe to be the first normative airway volume growth curve specifically focusing on the first 5 years of life. Patients with congenital or syndromic maxillofacial anomalies, and in particular those suffering from obstructive airway symptoms, often present during this age window for surgical evaluation. We expect that our data will be useful in stratifying these patients for surgical correction of chronic airway obstruction.
Overcoming “Stage” Fright: - AJCC 8th Edition Head and Neck Cancer Update
Poster Number: NAS-13

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Purpose:
The American Joint Committee on Cancer recently released the 8th Edition Cancer Staging Manual which is scheduled for implementation on January 1, 2018. Within the 8th edition are significant changes to head and neck cancer staging, particularly with regards to oropharyngeal and nasopharyngeal cancers. The purpose of this educational exhibit is to illustrate the relevant head and neck cancer staging changes with an emphasis on oropharyngeal and nasopharyngeal cancers using a case-based approach.

Description:
Case-based approach to illustrate relevant head and neck cancer staging changes as per the 8th Edition Cancer Staging Manual with an emphasis on staging updates related to oropharyngeal and nasopharyngeal cancers.

Summary:
Squamous cell carcinoma, particularly of the oropharynx and nasopharynx, is commonly encountered in daily clinical practice by head and neck radiologists. There are significant changes to the staging system for these cancers within the AJCC 8th Edition Cancer Staging Manual. In some cases, this actually results in “down-staging” the disease relative to current standards. This update reflects current prognosis and treatment options for these cancers and has the potential to offer added psychological benefit to afflicted patients at the time of initial diagnosis. The head and neck radiologist plays a critical role in the diagnosis and staging of head and neck cancer and a detailed knowledge of these staging updates is crucial to provide relevant and comprehensive care for our patients.
Fever and Neck lump – Imaging Spectrum of Acute Head and Neck Infections, Complications and Mimics
Poster Number: NAS-14

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Abstract Details
Background:
Neck lump with fever in adults is a common presentation of acute head and neck infection in the emergency department. Imaging is often requested to confirm the diagnosis, identify the source and extent of infection and search for complications. Complications such as severe airway compromise, osteomyelitis, abscess formation and descending mediastinitis often require urgent medical or surgical intervention. Hence, prompt detection is vital in reducing morbidity and mortality. Inflammatory and neoplastic conditions may masquerade as an infection on presentation, of which differentiating imaging features may not be apparent and delay in diagnosis can have devastating consequences.

Educational Objectives:
At the end of reviewing the exhibit, the reader should be able to:
1) Identify the cross sectional imaging features of acute head and neck infections and complications,
2) Identify the differentiating imaging features of phlegmon and abscess,
3) Be aware of non-infective mimics of head and neck infections,
4) Identify the differentiating imaging features of malignancy and abscess.
Imaging Findings:
1) Illustrate the imaging spectrum of acute head and neck infections and complications through the following case examples: peritonsillar abscess complicated with Lemierre's syndrome and septic emboli, Ludwig angina secondary to odontogenic infection, Ludwig angina complicated with descending mediastinitis, masticator space abscess and mandibular osteomyelitis post tooth extraction, acute necrotising descending mediastinitis, disseminated tuberculosis with cervical TB adenitis, acute suppurative mastoiditis with Bezold's abscess, submandibular sialoadenitis secondary to sialolithiasis and complicated with pyocele, sinonasal mucocoele complicated with intracranial empyema, sphenoid sinusitis complicated with cavernous sinus thrombosis.
2) Illustrate the differentiating features of phlegmon and abscess through the cases.
3) Illustrate the inflammatory and neoplastic mimics of infection through the following cases: Diffuse large B-cell lymphoma that initially presented as a neck lump with fever, Warthin’s tumour with superimposed inflammation/infection mimicking a parotid abscess, parathyroid cystic adenoma mimicking an abscess, infected lymphoepithelial cyst mimicking an abscess, left parotid space mucoepidermoid carcinoma mimicking an abscess, Kimura’s disease mimicking infective lymphadenitis, acute longus colli tendonitis mimicking retropharyngeal infection.
4) Illustrate the differentiating features of malignancy and abscess through the cases.

Conclusion:
Acute head and neck infections in adults can result in severe complications and mortality. Knowledge of potential complications allows prompt detection and early intervention. Meticulous evaluation is necessary to differentiate infection from other mimics, especially malignancy.
Styloid Muscles May Help in Characterizing Parapharyngeal Space Masses
Poster Number: NAS-15

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Abstract Details
Purpose:
Localization of a parapharyngeal space mass in to prestyloid or retrostyloid compartments of the parapharyngeal space increases diagnostic specificity and may alter surgical approach. Tensor vascular styloid fascia separates the prestyloid and retrostyloid compartments of the parapharyngeal space. Although the fascia is not readily imaged, one of its attachments - the styloid muscles - can be identified on current cross-sectional imaging studies. The purpose of this study is to investigate whether styloid muscles may help differentiate prestyloid and retrostyloid parapharyngeal space masses.

Methods:
Thirty-two MRI and CT imaging studies of twenty-three patients with parapharyngeal space masses were reviewed retrospectively after IRB approval. The studies were performed between 3/2005 and 5/2015. Displacement of internal carotid artery, internal jugular vein, and styloid muscles was recorded. Correlation was made with pathology or presumed diagnosis.

Results:
Twenty-two (69%) MRI and ten (31%) CT studies were reviewed. The styloid muscles were anterior to the mass or anteriorly displaced in 16 cases and posterior to the mass or posteriorly displaced in 16 cases. When the styloid muscles were anterior to the mass or anteriorly displaced, the pathology or presumed diagnosis included paraganglioma, schwannoma, or metastatic thyroid cancer. When the styloid muscles were posterior to the mass or posteriorly displaced, the pathology or presumed diagnosis was pleomorphic adenoma, carcinoma ex pleomorphic adenoma, acinic cell carcinoma, or oncocytic neoplasm. In one case the presumed diagnosis was either a schwannoma or pleomorphic adenoma. The styloid muscles were displaced in 23 (72%) cases. Tumor size of greater than 3-cm resulted in displacement of the styloid muscles in 22/23 (95%)
cases. The internal carotid artery was displaced in 21 (66%) cases. The internal jugular vein was displaced in 19 (59%) cases.

Conclusion:
Styloid muscles may help differentiate prestyloid and retrostyloid parapharyngeal space masses. If the styloid muscles are posterior to the mass or are posteriorly displaced, the mass may be a prestyloid parapharyngeal space mass. If the styloid muscles are anterior to the mass or are anteriorly displaced, the mass may be a retrostyloid parapharyngeal space mass.
The detection of recurrence of oral cancer using turbo spin echo-diffusion-weighted imaging
Poster Number: OC-01

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Objective
Many studies have supported the utility of diffusion-weighted image (DWI) for detecting recurrence. However, Echo-planar imaging DWIs are susceptible to inhomogeneity of the magnetic field, which limits its usefulness in the head and neck region. The first objective was to evaluate the utility of turbo spin echo (TSE)-DWI for detecting recurrence of oral cancer. The second objective was to compare the observer performance between TSE-DWI and gadolinium-enhanced T1-weighted imaging (Gd-T1WI).
Materials and Methods
Forty-two patients underwent surgery for oral squamous cell carcinoma and postoperative MRI, including axial T2-weighted imaging (T2WI), TSE-DWI and Gd-T1WI. All MRI procedures were performed using a 3T MRI system (Philips Healthcare, Best, the Netherlands). Twenty-two patients were classified as the recurrence group, and 20 were classified as the non-recurrence group. First, the DWI images were automatically adjusted for the translational and rotational motion to achieve superimposition with the Gd-T1WI images. We then assumed the high-signal-intensity area on DWI_b1000 images or the enhanced area on Gd-T1WI images to indicate signs of recurrence and calculated the sensitivity and specificity. Once the enhanced area was identified, we outlined this area as a region of interest, copied it onto the adjusted ADC map, and measured the ADC value. These procedures were performed using the PACS system (Volume Analyzer Synapse Vincent; FUJIFILM, Tokyo, Japan). Next, two observers (observer 1: 22 years experience, observer 2: 3 years experience) interpreted the presence of recurrence using a five-point scale. The first session included the T1WI, T2WI and Gd-T1WI images, and the second included the axial T1WI, T2WI, DWI_b1000, ADC map and combined T2WI and DWI_b1000 fusion images. We estimated the area under the curve (AUC) using a receiver operating characteristic analysis. The image interpretation was performed on a personal computer using the OsiriX Lite software (Pixmeo SARL, Bernex, Switzerland).

Results
The sensitivity was 81.8% on both DWI_b1000 and Gd-T1WI, and the specificity was 75% on DWI_b1000 and 55% on Gd-T1WI. Although the specificity of DWI_b1000 was quite high, the T2 shine-through might have reduced it to some degree. Of the 27 cases with enhanced areas on Gd-T1WI, the ADC of non-recurrence (1.82±0.51×10^-3 mm^2/s) was significantly higher than that of recurrence (1.14±0.113×10^-3 mm^2/s) (P < 0.0001, Wilcoxon’s test). The AUCs in the first session including Gd-T1WI were 0.74±0.08 and 0.66±0.08 for observers 1 and 2, respectively. The AUCs in the second session including DWI were 0.79±0.07 and 0.82±0.06 for observers 1 and 2, respectively. There was a significant difference in the findings of observer 2 between the two methods (P=0.02). Therefore, DWI yielded a higher AUC, even if they did not use the enhanced MR images. In addition, a low ADC value was found to be characteristic of recurrence, and a good fusion image on DWI along with anatomical images were believed to help observers interpret the imaging findings.

Conclusions
TSE-DWI was found to be immune to image distortion and proved useful for differentiating between recurrence and a postoperative state. Adding the TSE-DWI sequence improved the observer performance regarding the interpretation of recurrence.
A Mouthful of Lesions: Imaging of the Root of the Tongue and Adjacent Spaces
Poster Number: OC-02

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Abstract Details
Purpose: The oral cavity is a challenging space in head and neck imaging due to its multiple contents. In particular, the root of the tongue and the adjacent spaces can be difficult to navigate. In this exhibit, the regional anatomy will be reviewed with relevant embryological relationships highlighted. Additionally, the numerous entities that occur within this region and adjacent spaces will be reviewed based on etiology and location; diagnostic pearls will be discussed for accurate diagnosis of a particular lesion.

Description: The tongue is conventionally divided along the circumvallate papillae into the mobile tongue and base of the tongue. However, the root of the tongue is situated in between and principally consists of the bilateral genioglossus and geniohyoid muscle complex and the midline lingual septum. Serving as the center of the floor of the mouth, the root of the tongue can be used as an anatomic frame of reference in navigating this region and in evaluating pathology. Specifically, congenital lesions are the most frequently encountered in the root of the tongue. Lesions affecting the surrounding spaces can be broadly categorized into congenital, vascular, infectious and neoplastic etiologies. This educational exhibit will review these lesions (examples include lingual thyroid, dermoid, ranula, abscess, and squamous cell carcinoma) using both CT and MR.

Summary: The root of the tongue is the center of an anatomically complex component of the oral cavity, a region which serves host to a variety of lesions. Placing a lesion within a particular space followed by attention to characteristic imaging features allows for accurate diagnosis.
32 year old male with history of gradually increasing mouth fullness.

Axial (A) and sagittal (B) contrast-enhanced CT images demonstrate a midline expansile cystic lesion which splays the genioglossus muscles laterally (→), containing multiple globules of fat (←).

**DIAGNOSIS: DERMOID CYST**

- Majority are congenital: encapsulated lesions entrapped during the fusion of first and second branchial arches, lined with ectoderm derived squamous mucosa containing skin appendages
- Common in males in the second to third decade
- Overall rare lesions in the oral cavity (less than 1%), however more frequent than epidermoid cysts
- Most commonly arise from floor of the mouth, in particular the submandibular or sublingual space
- 5% undergo malignant degeneration into squamous cell carcinoma
Poster Number: OC-03

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Abstract Details
Purpose:
Accurately staging squamous cell carcinoma (SCC) of the head and neck (HN) is vital in the management of these patients. The aim of this exhibit is to familiarize the reader with changes between AJCC 7th and AJCC 8th editions in staging of HN SCC and to review the "game changer" imaging findings which have the potential to impact decisions about radiation, surgery, and chemotherapy. We present an image-based review of the critical findings and changes on staging CT, PET-CT and MR scans.

Approach/Methods:
Electronic educational review.
Findings/Discussion:
This educational exhibit will provide a practical review of the recent updates to the 8th edition of the American Joint Committee on Cancer (AJCC) staging for SCC of the HN and will focus on key cross-sectional imaging findings that directly impact patient management and prognosis. This exhibit will focus on the primary changes which affect radiologic staging including:

- Elimination of extrinsic tongue muscle invasion ETMI for T4a oral cavity.
- Depth of invasion (DOI) added for oral cavity.
- Separate HPV + and – for oropharyngeal cancer.
- Elimination of radiographic ECS for HPV + disease.

After exploring this exhibit, participants will be more comfortable providing a summary imaging stage assessment due to a better understanding of staging principles.

Clinical vignettes will be used to illustrate the utility of different imaging modalities and the specific imaging findings critical to tumor staging and patient management. In particular, the exhibit will focus on which findings upstage the tumor, followed by a description of how the stage change results in a management change.

Summary/Conclusion:
As critical members of a multidisciplinary cancer team, radiologists must be familiar with key staging and treatment principles, adding greater value to patient care. After the reader has reviewed the presentation, they will be familiar with T and N staging changes in the AJCC 8th edition and with key imaging findings having the potential to alter patient management.
Oral Tongue SCCa: AJCC 8th T-Staging: T2

<table>
<thead>
<tr>
<th>7th edition</th>
<th>8th edition</th>
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<tbody>
<tr>
<td>T4a: Extrinsic tongue muscle invasion</td>
<td>T2: Tumor &gt;2 cm but ≤4 cm and DOI ≤10 mm</td>
</tr>
<tr>
<td></td>
<td>T4a: Extrinsic tongue muscle infiltration now deleted</td>
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</tbody>
</table>

**Depth of Invasion (DOI)**
- DOI ≠ tumor thickness.
- DOI is measured from the level of the basement membrane of the closest adjacent normal mucosa by drawing a plum line to the deepest point of invasive tumor on pathological specimens.
- Tumor thickness alone underestimates tumor aggressiveness.
- *Extrinsic tongue muscle infiltration now deleted as DOI supersedes it.*
Clinical Characteristics can Differentiate Peritonsillar from Intratonsillar Abscesses: A Retrospective Imaging Study
Poster Number: OC-04

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Abstract Details
PURPOSE: Intratonsillar abscesses are typically treated conservatively whereas peritonsillar abscesses often require incision and drainage. The purpose of this study is to determine the clinical signs and symptoms that can differentiate a peritonsillar from an intratonsillar abscess as validated by contrast-enhanced computed tomography.

MATERIALS & METHODS: This retrospective HIPPA compliant study has been approved by our Institutional Review Board. A 10-year retrospective chart review was performed from 2006 through 2016 to identify patients who (1) presented to our hospital with either a peritonsillar (PTA) or intratonsillar (ITA) abscess and who (2) received imaging at the time of initial presentation; 91 abscesses were identified. Individual patient
medical records were then reviewed for the following clinical signs and symptoms: muffled voice, drooling, trismus, tonsillar abnormality, uvular deviation, uvular edema, peritonsillar or soft palate fullness, tonsillar erythema or exudate, and soft palate erythema. The patient’s imaging by CT at their initial encounter was then reviewed by three experienced board-certified neuroradiologists to establish an imaging diagnosis of either a PTA or ITA; abscesses with imaging findings suggestive of a combined PTA and ITA were excluded from our study. Logistic regression analysis determined statistically significant associations between clinical characteristics and an imaging diagnosis of a PTA or ITA.

RESULTS: Contrast-enhanced imaging of the neck identified 51 PTAs and 26 ITAs; 14 abscesses possessed imaging characteristics of both PTA and ITA and were excluded from our study. The odds of a PTA versus an ITA is 15.60 times greater with soft palate or peritonsillar fullness (95% CI [2.25, 108.11]), 7.12 times greater with uvular deviation (95% CI [1.39, 36.50]) and 4.57 times greater when a muffled voice is clinically present (95% CI [1.18, 17.68]).

CONCLUSION: Peritonsillar abscess is associated with muffled voice, soft palate or peritonsillar fullness, and uvular deviation. These clinical signs can be used to guide clinicians in differentiating between peritonsillar and intratonsillar abscess and to prospectively identify those patients that may substantially benefit from additional imaging.
The Resident’s Guide to Identification of Imaging Findings in Squamous Cell Carcinoma of the Tongue and their Therapeutic Implications
Poster Number: OC-07

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Abstract Details

PURPOSE:
1. To review the normal MR anatomy of the oral cavity and the sublingual space.
2. To discuss MR protocols and parameters essential to achieve adequate diagnostic images of the oral cavity.
3. To discuss the MR appearance of squamous cell carcinoma of the tongue and to highlight potential routes of its spread.
4. To understand the role of imaging in pre-operative staging of SCC of the tongue and its therapeutic implications.
5. To identify recurrent lesions in patients post chemo-radiotherapy and/or surgery.
6. To provide a structured approach in interpreting malignant lesions of the tongue.

MATERIALS AND METHODS:
Patients with a clinical suspicion of malignancy of the tongue were subjected to contrast enhanced, multiplanar multiecho MR imaging of the oral cavity. Post therapy patients are also included in this study in order to help the reader understand the post-operative appearance of the oral cavity and identify recurrent lesions. All scans were performed on a 3T scanner and were reviewed by 2 senior radiologists. Artistic renditions of the normal anatomy and therapeutic planning will also be included to consolidate understanding.

RESULTS:
MRI findings in SCC of the tongue include ulceroproliferative and/or infiltrative lesions. Some of the findings commonly encountered in our study include spread of the lesion across the midline of the tongue, into the root of the tongue, extensions into the floor of the mouth and the sublingual space. Other findings include mandibular invasion, perineural spread, extension along the oropharyngeal mucosa, into the pterygomandibular raphe and the retromolar trigone. Metastatic cervical lymphadenopathy was another finding common to most patients.
Surgical and chemoradiotherapeutic principles and rationale pertinent to each finding will be highlighted in this exhibit. Local and distant recurrence of lesions will also be elaborated in order to ensure a holistic understanding and approach to this topic.
CONCLUSIONS:
MRI has revolutionized the field of clinical oncology due to its accuracy in detecting the presence and spread of malignancies of the tongue especially in those presenting with trismus. SCC of the tongue is a disease notorious for locoregional spread and lymph nodal metastasis, thus posing a serious burden on the healthcare system predominantly in countries with high tobacco consumption. Owing to the vital role of the tongue in taste, deglutition and phonation, this disease also threatens quality of life post resection.

The focus of this structured exhibit is to aid the radiology trainee in understanding and identifying malignancies of the tongue. The exhibit will also help in providing a detailed pre-operative roadmap for complete surgical resection, identification of unresectable and recurrent lesions and guiding coverage for radiotherapy thus expanding the scope of reporting.

A. T2W
B. T1 POST CONTRAST

A PERIPHERALLY ENHANCING LYMPH NODE IS SEEN IN THE LEFT LEVEL IB LOCATION. ALSO NOTE THE ENHANCING LESION IN THE LEFT SUBLINGUAL SPACE (DOTTED ARROW). HISTOPATHOLOGY REVEALED LOCAL EXTENSION OF A SQUAMOUS CELL CARCINOMA OF THE TONGUE WITH CERVICAL NODAL METASTASIS.
Purpose The human papilloma virus (HPV) status is an important prognostic factor in patients with oropharyngeal squamous cell carcinoma (OPSCC). The purpose of this study was to evaluate the use of texture analysis for distinguishing HPV-positive and HPV-negative oropharyngeal squamous cell carcinoma in primary tumor and metastatic lymph nodes.

Materials & Methods This retrospective study comprised 100 patients with primary OPSCC and 63 patients with metastatic lymph nodes who have known HPV status and underwent pretreatment contrast-enhanced CT between August 2011 and April 2017. The tumor heterogeneity on CT was assessed using TexRAD software and imaging features of primary and metastatic lymph node were also evaluated. Differences between HPV-positive and HPV-negative groups were analyzed using χ² test for categorical variables and Mann–Whitney U test for continuous variables. For heterogeneity parameters, ROC curve analysis was performed for discrimination of HPV status.

Results The HPV-positivity was 37.0% for the primary tumors and 50.8% for metastatic lymph nodes. Patients who had HPV-positive OPSCC were more likely to present with N-positive disease (p=0.005). HPV-positive
groups demonstrated more frequently well-defined border of primary tumor (p < 0.001) and cystic nodal metastasis (p=0.011) than HPV-negative groups. Significant differences were seen in all CT texture analysis parameters with fine and medium spatial scaling filter (mean, p=0.029; SD, p < 0.001; entropy, p < 0.001; MPP, p=0.006; skewness p=0.004; kurtosis, p < 0.001 for fine filter, mean, p=0.003; SD, p < 0.001; entropy, p < 0.001; MPP, p=0.002; skewness p=0.005; kurtosis, p=0.027 for medium filter) at primary tumor site and in standard deviation (SD, p=0.042), entropy (p=0.028), mean positive pixels (MPP, p=0.005), kurtosis (p=0.027) with fine filter at metastatic lymph nodes according to HPV status. Entropy with medium filter was the best discriminator between HPV-positive and HPV-negative OPSCC (AUC 0.811) in primary tumor and mean positive pixels with fine filter (AUC 0.661) in metastatic lymph nodes.

Conclusions We found significant differences in heterogeneity parameters from texture analysis performed on pretreatment contrast-enhanced CT, according to HPV status in OPSCC. CT texture analysis can be additional tool for evaluation of HPV status in patients with OPSCC.
Imaging Evaluation of Optic Pathologies
Poster Number: ORB-03

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Abstract Details
Purpose
Imaging evaluation of the orbital pathologies is an important step in the diagnostic algorithm. It requires
intimate knowledge of the complex orbital anatomy and radiographic appearance of the various
ophthalmological lesions. Here we present 11 cases of traumatic and nontraumatic orbital pathology and
discuss relevant observations.

Materials
Imaging evaluations of the orbit was performed using CT and MRI. Patients ranged from the 3rd to 8th decade
in age.

Results
(1) CT of the head performed on a 77 year old patient with expressive aphasia incidentally revealed a
dislocated right ocular lens. (2) MRI of the orbits performed on a patient with a history of malignant melanoma
presenting with scleritis demonstrated a mildly T1 hyperintense and T2 hypointense mass along the superior
right globe as well as an extraconal enhancing soft tissue mass in the right orbit consistent with scleral
melanoma. (3) CT of the head performed on a 73 year old with headaches revealed a foreign body in the right
middle chamber of the eye consistent with a spacer graft. (4) CT of the head performed on an 81 year old with
syncope revealed a chronic left sided retinal detachment. (5) CT of the head performed on an 82 year old with
trauma revealed left orbital fracture with globe rupture. (6) MRI of the brain performed on a 51 year old with a
history of optic neuritis revealed left optic nerve atrophy consistent with sequelae of optic neuritis. (7) CT of
the maxillofacial structures performed on a 50 year old with facial trauma incidentally revealed fatty infiltration
of the retro-orbital fat suggestive of malnutrition. (8) MRI of the orbits performed on a 51 year old with a history
of lung cancer revealed an enhancing T1 and T2 hypointense lesion centered in the macula of the right eye and another similar lesion within the right globe consistent with metastases to the eye. (9) CT of the head performed on a 36 year old with trauma revealed right globe rupture. (10) CT of the orbits performed on a 46 year old revealed an extraconal partially calcified soft tissue mass in the left lateral orbit and lacrimal fossa. This nonspecific finding has a wide differential. (11) MRI of the orbits performed on a patient with a history of B cell lymphoma presenting with gradual vision loss revealed a T1 and T2 hypointense lesion centered in the left posterior extrabulbar and extraconal space. This finding is consistent with choroidal lymphoma.

Conclusion
Radiologic imaging can play a key role in detecting abnormalities of the eye and can be utilized as the first step of an ophthalmologic or neurologic workup. This presentation showcases a wide variety of optic pathology, including neoplastic, inflammatory, idiopathic and post traumatic lesions. A patient’s visual exam findings and case history can also be a helpful component of diagnosis.
Orbital DDX and the Fantastic Four: 4 diagnoses to include in virtually ALL orbital differentials
Poster Number: ORB-06

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Abstract Details
Teaching Points

1. Orbital pathology produces a limited number of imaging patterns, all of which may be caused by many diseases. Conversely, there are several diseases that can produce multiple imaging patterns.

2. In this exhibit, we will illustrate the most common orbital disease imaging patterns, emphasizing 4 diagnoses that should be included in virtually all orbital imaging differentials (pseudotumor, lymphoma, sarcoidosis, metastatic disease).

Outline

I. Introduction to pattern-based orbital differential diagnosis

II. Four entities to include in orbital differential diagnoses
a. Pseudotumor
b. Lymphoma
c. Sarcoidosis
d. Metastatic disease

III. Patterns of orbital disease, with differential diagnoses and examples
A. Extraocular Muscle Enlargement
B. Retrobulbar Infiltrate
C. Discrete Orbital Mass
D. Optic Nerve/Sheath Complex Enlargement
E. Bony Orbital Lesion
F. Lacrimal gland enlargement

IV. Conclusion
Retrobulbar Infiltrate Pattern as illustrated by the Fantastic Four: All diseases demonstrate diffuse, ill-defined enhancement in the retrobulbar space without evidence of a discrete mass.
Endoscopic endonasal surgery of orbital tumors: What the surgeon wants to know
Poster Number: ORB-07

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Abstract Details

Purpose:
The endoscopic endonasal approach to orbital masses is a novel surgical technique that has many advantages including:
a) less invasive approach to the medial orbit and orbital apex not requiring an external approach or craniotomy,
b) decreased morbidity, and
c) improved cosmesis with quicker healing.

The purpose of this educational exhibit will be to explore this novel surgical technique and provide the radiologist insight into pre-operative planning and potential pitfalls.

Description:

This electronic exhibit will use CT and MR to briefly review relevant orbital anatomy. Imaging features of common orbital tumors considered for this surgical approach will be reviewed. Important compartmental
anatomy used by surgeons, as well as important surgical decision points and its relevance to the radiologist will be highlighted. Finally, examples of cases performed at our institution will emphasize pearls and pitfalls for imaging and surgery.

Summary:

The endoscopic endonasal approach to orbital masses is a novel minimally invasive surgical technique that has helped to minimize morbidity of orbital apex lesions. Pre-operative imaging is crucial in helping the surgeon determine appropriate candidates and potential pitfalls. The radiologist can play a helpful role in this collaborative multi-disciplinary team.
Ouch, my eye hurts! An imaging approach to evaluating the painful eye
Poster Number: ORB-09

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Abstract Details
Purpose: To review different etiologies resulting in the painful eye with emphasis on developing an appropriate search pattern on imaging.

Content organization: In the first part of the abstract, we will describe the pathways for pain arising in the orbit including the different divisions of the trigeminal nerve and the structures that they supply. We will follow up with different orbital pathologies that result in the painful eye based on correlating the pain with other relevant clinical symptoms that include the following criteria:- unilateral versus bilateral, status of visual acuity, extraocular muscle movement abnormalities etc. that can help determine the potential locations of the lesions.

The spectrum of orbital pathologies discussed will include infectious, inflammatory, vascular, neoplastic and idiopathic processes. Some of the examples include cavernous sinus thrombosis, IgG4 related disease, perineural spread of tumor and optic neuritis. Familiarity with the imaging features and clinical presentation allows the radiologist to develop a search pattern and make the correct diagnosis.

Summary: This presentation will allow the reader to understand the common causes of a painful eye and develop a search pattern for evaluating imaging abnormalities responsible for the symptoms.
Orbital Pseudotumor
Retinal Detachment
Sarcoid Orbitopathy
Globe Hemorrhage
Direct CC Fistula
Tumor Invasion
Diffusion Tensor Abnormalities in Primary Open Angle Glaucoma
Poster Number: ORB-10

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Abstract Details
Introduction: Glaucoma is considered the third leading cause of blindness with over 8 million new cases each year. It is a disease that is characterized by retinal ganglionic cell death associated with reduction in the total number of axonal fibers that make up the optic nerve. High intraocular pressure (IOP) is one of the most consistent risk factors associated with primary open angle glaucoma (POAG) however, the concept that high IOP is a defining characteristic of POAG has almost universally discarded as it has been demonstrated that retinal ganglionic cell degeneration continues after the intraocular pressure is normalized. Objective: we aim to evaluate Diffusion Tensor Imaging (DTI) findings at 7 different segments of the visual pathway (from the intraorbital optic nerve to the visual cortex) to detect spread of glaucomatous damage within the nervous system in POAG patients and to correlate fractional anisotropy (FA) values of the visual pathway with clinical and quantitative ophthalmologic parameters including the severity and duration of disease, intraocular pressure and thickness of the retinal nerve fiber layer (RNFL). Methods: Thirty individuals (15 patients and 15 age/gender-matched controls) were included in the study. Patients (9 males and 6 females with an age range from 31 to 59 years, mean age: 47.6 +/- 8.84) were referred by our ophthalmology outpatient clinic during the time period from December 2015 to April 2016 with an established diagnosis of POAG. All patients were subjected to extensive ophthalmologic evaluation that included: 1) Visual field examination, 2) Goldmann applanation tonometry to measure IOP, and 3) Optic Coherence Tomography (OCT) to measure the thickness of retinal nerve fiber layer. Results: FA values were significantly lower at bilateral 7 different segments of the visual pathway in POAG patients compared to normal controls with the average FA of all seven segments = Right side: 0.52 (patients) versus 0.63 (controls), p = 0.001 – Left side: 0.58 (patients) versus 0.63 (controls), p = 0.009. At the intracranial segment of the optic nerve, there was a significant correlation between FA values and both the total RNFL thickness (r = 0.7, p = 0.004) and the duration of disease (r = -0.6, p = 0.03). Conclusion: DTI demonstrated a statistically-significant correlation with glaucomatous changes of the visual pathway and might be used as an imaging biomarker of disease progression in POAG patients.
Abstract Details

Purpose: To review and describe various diseases of the orbit that result in exophthalmos, extra ocular muscle enlargement, and/or enlarged lacrimal glands, with an imaging review of the various etiologies, listing the differential diagnosis for each and clues to a likely diagnosis.

Methods: To describe in a review type fashion the various conditions that cause 1.) exophthalmos, 2.) enlarged extraocular muscles, and 3.) enlarged lacrimal glands. Each of the leading differential considerations, as well as more rare conditions, will be reviewed in detail and imaging examples, using CT and MR, will be presented.
For exophthalmos, etiologies of vascular, endocrine, infection/inflammation, and neoplasm will be discussed. For enlarged extraocular muscles, etiologies of thyroid orbitopathy, IgG4, lymphoma, amyloidosis, metastatic disease, pseudotumor/myositis, and Erdheim Chester will be presented. For enlarged lacrimal glands, etiologies of neoplasm and inflammation will be discussed. For each category, imaging examples will be provided, with clues to the differential and diagnosis presented.

Conclusion: From the review, the reader should then be able to recognize and list differential considerations for exophthalmos, enlarged extraocular muscles, and enlarged lacrimal glands, and narrow to a likely diagnosis.
Preseptal versus postseptal cellulitis: cased based review of clinical and imaging features
Poster Number: ORB-12

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Abstract Details
Purpose: To review the pathophysiology, clinical presentation and imaging features of both preseptal and postseptal orbital cellulitis including associated complications such as subperiosteal abscess.

Description: Understanding the imaging differences between preseptal and postseptal cellulitis first comes from a basic knowledge of their pathophysiology and clinical presentation. Some information gained from the above should make you interrogate the postseptal fat much more closely. Preseptal cellulitis is usually a superficial infection involving the eyelids and periorbital region. While the affected areas can be painful, usually the pain is not associated with eye movements. Postseptal cellulitis is thought to occur one of two ways, either from progression/spread from a preseptal infection or more often from contiguous spread from sinus mucosal disease, usually involving the ethmoid sinuses. The latter method increases the risk of developing a subperiosteal abscess which is an important complication not to miss on imaging because depending on the size can require more urgent intervention.

Given the major difference in treatment between these related entities, it is especially important to be able to help the clinicians distinguish the two. By going over a multitude of cases here we will demonstrate the best approach to making certain the novice radiology resident will be able to pick up on these differences. We will also show cases where the abnormality is only picked up on certain planes of imaging, further emphasizing the need to review all the reformats is reaching an accurate diagnosis.

Summary: It is not an uncommon scenario that the on-call radiology resident is asked to distinguish between preseptal and postseptal orbital cellulitis. This important call usually makes the difference between sending the patient home on oral antibiotics versus admitting the patient for intravenous antibiotics and further evaluation. Since distinguishing these two entities based on imaging can sometimes be subtle, we hope to give you a better understanding of the different imaging characteristics through a case based review.
Vaso-occlusion is the Conclusion: Orbital Inflammation due to Sickle Cell Disease in Pediatric Patients
Poster Number: ORB-13

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Abstract Details
Purpose:
Orbital and periorbital inflammation resulting from bone infarction in pediatric patients with sickle cell disease (HgbSS) is unusual. Imaging findings differ from those in more common entities such as infectious periorbital/orbital cellulitis and idiopathic orbital inflammatory disease (IOID). Distinguishing osteomyelitis from bone infarction may be difficult in patients with sickle cell disease who are predisposed to both, particularly because of overlapping clinical and imaging features. The purpose of this study is to evaluate cases of vaso-occlusive disease-associated facial bone infarcts and periorbital and orbital inflammation in pediatric patients with sickle cell disease.

Materials and Methods:
A retrospective review of cases from a single institution was performed. Cases of patients under 21 years of age with sickle cell disease and orbital and periorbital inflammation on imaging were obtained by querying an intra-institutional search engine for radiology reports generated between January 2009 and May 2017. Using these reports and the electronic medical record, demographic data, clinical histories, imaging results, and information about management and outcomes were obtained.
Results
Six cases of orbital bone infarction in pediatric patients with sickle cell disease were identified. Of affected patients, 4 were male and 2 were female. Patients ranged in age from 4 to 15 years. Fevers featured in the clinical presentation in 5 of 6 patients. Two patients underwent aspiration of subperiosteal collections, yielding sterile material. Five of 6 patients received antibiotics. Four patients experienced recurrent episodes of orbital or periorbital inflammation. Analysis of the included cases highlights common CT and MR imaging features including proptosis, preseptal edema, subperiosteal collections in the infratemporal fossa and extraconal space, osseous sclerosis, and abnormal marrow signal. Companion cases are provided to emphasize imaging features that may be helpful in discerning sickle cell disease-related orbital bone infarction from other pathologies.

Conclusion:
Orbital inflammation related to bone infarction in sickle cell disease is an infrequently encountered entity in pediatric patients. Key imaging features allow the radiologist to differentiate bone infarction from other commonly encountered entities (periorbital/orbital cellulitis and IOID) in the correct clinical context of sickle cell disease. Though osteomyelitis and bone infarction may be indistinguishable by imaging alone, a detailed understanding of these disease processes and their associated imaging findings will allow radiologists to provide clinically helpful information to clinicians directly caring for affected patients.
Purpose: To describe the post-treatment imaging appearance of retinoblastoma and describe imaging features of retinoblastoma treatment related complications

Material & Methods: We retrospectively reviewed the post-treatment imaging of retinoblastoma performed at our institution from 2011 to 2016, primarily on MR imaging. All studies were performed on either a 3 Tesla or 1.5 Tesla Siemens MRI scanner utilizing a brain and orbit protocol MRI without and with gadolinium contrast. Additional imaging such as CT orbit, MRI spine, bone scans were reviewed when relevant.

Results: Treatment of retinoblastoma has evolved in the past few years from prior methods of surgical enucleation and/or external radiation to using novel therapies intended for eye salvage such as systemic chemotherapy and local intra-arterial or intravitreal chemotherapy which may be combined with focal radiotherapy, laser photocoagulation and cryotherapy, especially when tumors are small. Each type of treatment has its own advantages and shortcomings and despite dramatic response may cause toxic effects. The treatment related complications were grouped into two broad categories: orbital complications (cataracts, scarring), and cerebral complications (dystrophic mineralization, ischemia, vasculopathy and secondary tumor). The overall incidence and imaging manifestations of treatment-related complications will be illustrated on imaging.

Conclusion: Imaging plays a very important role in the evaluation of residual or recurrent retinoblastoma and in monitoring treatment related complications.
Abstract Details

Purpose: The differential diagnosis of parotid region lesions in children overlaps with that of adults, but also contains a number of entities that are far more common in the pediatric population.

Description: Pediatric parotid lesions can largely be subdivided into inflammatory/infectious, neoplastic, and congenital/developmental categories, as well as benign mimics of disease. Infectious/inflammatory processes are common in children, and we will review the appearance of typical and atypical infections, as well as uncommon inflammatory conditions such as Rosai-Dorfman and nodular fasciitis. Though salivary gland tumors are relatively uncommon in children, a variety of other tumor types can arise in the parotid region or involve it by either hematogenous metastasis or direct extension. Illustrated benign neoplasms will include infantile hemangioma pleomorphic adenoma, and cystic hygroma, while malignant lesions will include the various sarcomas and carcinomas encountered in the parotid region including rhabdomyosarcoma, osteosarcoma, actinic cell carcinoma. Congenital/developmental conditions to be reviewed in this exhibit include branchial cleft cysts, lymphatic malformations, and various vascular malformations. A number of mimics of disease, including hematoma and benign adenopathy will also be reviewed.

Summary: We review a number of common and uncommon childhood parotid region lesions to illustrate the range of pathology encountered in this setting.
Example Slide: Pediatric Parotid Region Lesions: A Pictorial Review

CT with contrast  
T1w MR with contrast  
T2w MR

Lymphatic Malformation
(a.k.a. lymphangioma, cystic hygroma)
- Typically congenital
- Multiloculated lesion containing lymphatic fluid
- Insinuates between normal structures
- Benign, but can be cosmetically significant
- Usually sporadic, but associated with Turner’s syndrome
- Treated with surgery or sclerosing agents
Pediatric Sensorineural Hearing Loss
Poster Number: PED-05

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Abstract Details
Pediatric Sensorineural Hearing Loss

Purpose: To discuss the variety of causes of pediatric sensorineural hearing loss (SNHL), the classification of these disorders, and the important imaging characteristics.

Description:

Pediatric SNHL is a major cause of childhood disability. Early diagnosis and treatment is critical for language progress and social development. There are a wide variety of causes for SNHL, including genetic syndromes with inner ear manifestations, cochleovestibular malformations, and acquired causes. CT and MRI play complimentary roles in the identification of the source of hearing loss and treatment guidance, and can give prognostic implications.

In over 50% of patients with congenital SNHL, a genetic cause can be found. Many of these patients have a syndromic cause for SNHL with other additional clinical features demonstrated. Some of these patients have cellular or microscopic causes for hearing loss that are not detectable by imaging. Several of the numerous syndromic causes of SNHL that have characteristic imaging findings include Branchio-oto-renal syndrome, Waardenburg syndrome, and X-linked Deafness with Stapes Gusher. Congenital SNHL can also be secondary to cochlear nerve deficiency, best demonstrated on MRI which exhibits absence or decreased caliber of the cochlear nerve.
Causes of congenital SNHL not linked to a genetic syndrome include intrauterine exposure to toxins such as alcohol or drugs, in-utero infection, and prematurity. These typically do not exhibit inner ear abnormalities detectable by imaging.

Cochleovestibular malformations are also a cause of SNHL and range in severity, depending on timing of interruptions to inner ear development. This spectrum, from most to least severe, includes labyrinthine aplasia, cochlear aplasia, common cavity, cystic cochleovestibular anomaly, cochlear hypoplasia, and incomplete partition type II. Cross sectional imaging with CT or MRI is a critical component of the evaluation of cochleovestibular malformations.

Acquired SNHL presents later in childhood. Some of the more common causes include infectious or autoimmune labyrinthitis, trauma, and tumors.

Summary:

There is a wide variety of causes for pediatric SNHL, many of which rely heavily on imaging for early diagnosis and treatment guidance. MRI and CT play critical and complementary roles in identifying abnormalities of the inner ear and can give prognostic implications. It is important for neuroradiologists to have a comprehensive understanding of the spectrum of causes of SNHL and their characteristic imaging findings.
Purpose:
The mandible and maxilla are affected by a wide spectrum of abnormalities arising from non-odontogenic origin which differ substantially from adult jaw lesions. The aim of our exhibit is to review imaging features of various non-odontogenic developmental and acquired conditions that involve the mandible and maxilla in children using a multimodality approach. Different imaging features will be highlighted in an effort to aid in the diagnosis of these lesions, with an emphasis on CT and MRI.

Description:
Different case examples encompassing a multitude of congenital, malformations, inflammatory, infectious, and neoplastic (benign, primary malignant, and metastatic) lesions involving the mandible and maxilla which do not arise from teeth structures will be presented. The cases will be collected from two teaching children’s hospitals.
This will be an image-rich exhibit focusing on CT, MRI, and scintigraphic imaging features which aid in formulating a relevant differential diagnosis in mandibular and maxillary lesions in children. Additionally, we will describe clinical findings that would narrow down the diagnostic possibilities. The case examples will include but will not be limited to developmental abnormalities such as fibrous dysplasia and cherubism (Figure 1), inflammatory and infectious conditions with emphasis on chronic recurrent multifocal osteomyelitis (CRMO) as well as acute and chronic bacterial and fungal osteomyelitis (Figure 2). Additionally, a myriad of neoplasms unique to the pediatric population ranging from the more well-known neuroblastoma metastases and Ewing’s sarcoma to rarer lesions such as desmoplastic fibroma and melanotic neuroectodermal tumor of infancy.
Summary:
Non-odontogenic jaw lesions are rare in children. Imaging plays a crucial role in narrowing down the differential diagnosis when a child presents with clinical signs and symptoms referable to the mandible or maxilla. This review aims at familiarizing radiologists with the diagnostic possibilities in the pediatric population and raises awareness of the salient radiologic features.

Figure 1. 8 year old boy with progressive painless symmetric facial swelling. Coronal bone CT image (A) shows bilateral bubbly expansile lucent lesions confined to the mandible and maxilla without aggressive bone destruction or periosteal reaction. Lateral 3D reconstruction image (B) shows the diffuse cystic expansion and deformity of the mandible and maxilla due to cherubism.

Figure 2. 9 year old boy presenting with left jaw pain. Bone window coronal CT (A) shows erosive changes of the left mandibular condyle with periosteal reaction and adjacent hypodense fluid collection. Coronal post-contrast T1w image (B) demonstrates left masseter muscle collection with thick peripheral enhancement. Axial T2w image (C) shows the fluid collection within the mandibular ramus. ADC image (D) show diffusion restriction of the fluid characteristic of an abscess. Sampling revealed coccidioidomycosis infection.
Abstract Details
The purpose of this exhibit is:
- To review neuroimaging of nonvascular congenital skin lesions, not related to neurocutaneous syndromes
- To correlate neuroimaging with pathology and neurosurgical clinical imaging
- To understand the key radiologic features of clinical significance
- To learn the clinical management, treatment and follow-up of these lesions

Outline:
1) Overview
2) Clinicopathological findings
3) Review of imaging findings, correlated with pathology and neurosurgical images
   - Aplasia cutis congenita
   - Branchial apparatus anomalies
   - Craniofacial dermal sinuses and inclusion cysts
   - Encephaloceles
   - Spectrum of spinal dysraphisms and related anomalies
4) Sample cases, emphasizing imaging findings of clinical importance
5) Summary
Branchial apparatus anomaly

Clinical photograph demonstrates an opening into a sinus tract in the left lateral neck (arrow).

Hematoxylin and eosin stained photomicrograph shows stratified squamous epithelium, subepithelial inflammatory cells, and cartilage (arrow).

Branchial fistula. Direct injection of contrast via a cutaneous opening in the lower anterior neck demonstrates fistula tract (arrows) extending to the apex of the piriform sinus.
Multi-Modality Imaging Approach to Branchial Cleft Cysts and Common Complications
Poster Number: PED-09

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Abstract Details
Purpose: The purpose of this exhibit is to:
--Review the embryologic origin of all four branchial cleft cysts
--Demonstrate the radiographic appearance and location of all four branchial cleft cysts
--Discuss common presentations and complications of branchial cleft cysts

Description: Branchial cleft cysts are congenital abnormalities which arise within the lateral part of the neck secondary to failure of obliteration of the branchial clefts during embryonic development. There are four different types of branchial cleft cysts corresponding to the embryonic branchial clefts. Second branchial cleft cysts are the most common variety seen in patients. Most commonly, branchial cleft cysts are asymptomatic and may only be noted incidentally on exams; however, there may be complications.

Branchial cleft cysts are the most common cause of congenital neck mass. If the cysts become too large, they may cause aesthetic deformity of the neck or peri-auricular region. Additionally, they may become infected, especially when a patient develops an upper respiratory tract infection. Severity of infection of these cysts may vary to mild inflammation that resolves with time and antibiotics to large abscesses that require excision and debridement. If surgical resection of the cyst is deemed necessary, recurrence is rare.

Multiple imaging modalities can be used to examine branchial cleft cysts and their complications. Often, CT with or without IV contrast is used to characterize the anatomic location of the cysts within the neck. Since these most commonly present initially in children, ultrasound is a good modality for monitoring of the cysts as there is no radiation exposure to the growing child. Additionally, MRI imaging of the neck can also be used, particularly fluid sensitive sequences.

The differential diagnosis for branchial cleft cysts is similar to other causes of neck swelling or masses. Thyroglossal duct cysts, cystic appearing lymph nodes secondary to necrotic metastasis, tuberculous adenitis, jugular venous thrombosis, neurogenic tumors, dermoid cysts, cavernous lymphangioma, and thyroid pathology may appear similar to branchial cleft cysts.

Summary: Branchial cleft cysts are a common congenital malformation responsible for neck swelling or mass. CT, MR, and ultrasound imaging all provide different approaches to evaluating these structures. While normally asymptomatic, increased size or super-infection of the cysts may result in significant symptoms for the patient requiring medical treatment or surgical excision. Being able to identify these structures clearly is important for any head and neck radiologist.
Figure 1: This patient is a 35 year old female who presents with right ear deformity. Patient was found to have a small cystic structure in the right parotid region (arrow), consistent with a first branchial cleft cyst. The first branchial cleft normally develops into the external auditory canal, so first branchial cysts are found within this area.

Figure 2: Coronal CT images of two different patients with second branchial cleft cysts. The second branchial cleft cysts are the most common type and are found along the sternocleidomastoid muscle. They are the result of failed obliteration of the second branchial cleft.

Figure 3: Axial and coronal CT images of a 13 year old male who presented with left neck swelling. A cystic structure (arrow) was noted within the left neck, consistent with a third branchial cleft cyst based on its location. Normally branchial cleft cysts are asymptomatic; however, a common complication is super-infection, as is demonstrated in this patient.

Figure 4: The top row shows ultrasound images of a 12 year old female with left neck swelling and fever. A complex hypoechoic round structure (solid arrow) with peripheral vascularity is seen lateral to the left lobe of the thyroid gland. The bottom row demonstrates CT images of the same patient showing a multicellular abscess (dashed arrow) within the lower portion of the left neck, consistent with a superinfection of the third branchial cleft cyst. This patient required excision and debridement of the cyst and abscess.
Imaging of Common Pediatric Cystic Neck Masses: A Practical Approach
Poster Number: PED-10

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Abstract Details
Purpose: This review aims to familiarize radiologists with classic imaging features of common and uncommon cystic neck masses in children. After review of basic embryology of the neck, original cases collected over the last 20 years from a large tertiary medical center will be showcased and followed by a discussion of their typical clinical presentation and imaging findings. Original drawings will be utilized to help understand the various anomalies.

Description: When evaluating a pediatric patient with a neck mass the primary imaging questions to be answered are the location and the extent of the lesion and whether the mass is cystic or solid. Ultrasound has the advantage of being able to be performed without sedation or radiation exposure and is helpful in determining whether a lesion is cystic or solid in nature. Cystic neck lesions in the pediatric population are usually of a benign etiology and most are congenital or developmental in origin. Based on the location and extent of the mass, its relationship with muscles or vessels and its vascular pattern, a reasonable differential diagnosis can be achieved. This differential can then be further narrowed by clinical history and age groups (newborn/infant, older child, young adult). Often an advanced cross-sectional modality (CT or MRI) is necessary to make a more definitive diagnosis and for surgical planning.

The authors will present a variety of common and uncommon cystic lesions which will include but not be limited to: anomalies of the branchial apparatus (I-IV), thymopharyngeal duct anomalies, venolymphatic vascular malformations, dermoid, epidermoid, ranula, abscess and foregut duplication. Examples of each listed lesion along with their imaging characteristics will be presented, followed by a differential diagnosis, and further imaging recommendations. Narrowing the differential is essential, as appropriate diagnosis is crucial in treatment decisions.

Summary: Cystic neck masses are frequently encountered in the pediatric population. Imaging plays an important role in their diagnosis and in determining subsequent management. Familiarity with the numerous common cystic neck masses, their varying radiologic and clinical presentations, lesion location and their most common age of presentation will help the radiologist guide the referring clinician to a narrow differential, and often to a final diagnosis, for effective and adequate treatment.

Thymopharyngeal Duct Drawing Example.TIF
Beyond Venolymphatic Malformations and Hemangiomas: Image-guided Diagnosis and Management of Infantile Neck Masses
Poster Number: PED-11

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Purpose
To illustrate the spectrum of neonatal and infantile head and neck tumors and the role of image guided diagnosis and interventions in the management of these patients

Methods
Review of clinical cases and teaching file examples of rare head and neck neoplasms presenting during infancy was performed with clinical pathological correlation. Imaging features were analyzed for features to distinguish benign from more aggressive lesions. Prenatal imaging was included where available. Specific attention was paid to the role of multimodality imaging in patient management.

Description
Infantile hemangiomas are benign and most common vascular head and neck tumors during infancy. Highly vascularized more aggressive tumors or malignancy may resemble hemangiomas clinically. Multimodality imaging, including ultrasound, MRI, and CT, characterizes these lesions with respect to location and or site of origin, presence of cysts, hemorrhage or necrosis, assessment of vascularity (arterial or venous channels), and presence of phleboliths or thrombosis. Image guided interventions including biopsy, sclerotherapy and endovascular embolization can be critical to management in some cases. A series of neonatal and infantile head and neck neoplasms are presented and the features distinguishing them from hemangiomas, lymphatic and venous/venolymphatic malformations are highlighted. Heterogeneity with intralesional necrosis and hemorrhage should raise suspicion for more aggressive tumors. The roles of each imaging modality and the contributions of image guided interventions are described with each case. Correlative pathologic images are included to compare with the imaging features. Lesions illustrated include congenital and infantile hemangiomas, venolymphatic, venous and lymphatic malformations, infantile fibrosarcoma, and kaposiform hemangioendothelioma.

Conclusion
Not all vascular head and neck masses during infancy are venolymphatic malformations or infantile hemangiomas.
Multi-modality imaging helps to characterize the tumors, enables safe percutaneous biopsy, provides angiographic assessment and preoperative embolization where needed.
Infantile fibrosarcoma in a neonate with left submandibular mass. (a) Color Doppler ultrasound shows a heterogeneous and highly vascular mass with blood vessel enlargement. (b) Coronal T1-weighted fat-suppressed contrast-enhanced MR image shows heterogeneous enhancement with areas of necrosis. (c) Left external carotid angiogram shows hypervascular tumor with feeding arteries from the facial and internal maxillary artery branches. (d) Resected specimen shows vascular tumor with large vessels.
Non-Traumatic Emergencies of the Head and Neck in the Pediatric Population—an Imaging Potpourri
Poster Number: PED-12

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Abstract Details
Purpose:
Familiarity with non-traumatic head and neck emergencies in the pediatric population is important for all radiologists who read pediatric imaging. In this exhibit, we use examples to illustrate the clinical presentations, imaging findings, and complications of these emergencies.

Approach/Methods:
We retrospectively reviewed CT, MR and US images of the head and neck from 2012-2017 to identify cases of non-traumatic pediatric head and neck emergencies.

Findings/Discussion:
Diagnosis of head and neck emergencies in pediatric patients relies heavily on imaging given the barriers to obtaining a history and physical exam in pediatric patients, and given the nonspecific clinical presentation of many patients who present with head and neck emergencies. Many non-traumatic emergencies relate to infection, but can also result from tumor, congenital abnormalities, or foreign bodies. Infections may involve the orbit (periorbital or orbital cellulitis), the sinuses (Pott's Puffy Tumor), the temporal bone (otomastoiditis,
Bezold's abscess, petrous apicitis), the airway (peritonsillar abscess, epiglottitis, laryngotracheobronchitis), and the neck (retropharyngeal abscess). Tumors (juvenile angiofibroma) can cause airway obstruction either by mass effect or by hemorrhage. Vascular pathology (cavernous sinus thrombosis) can cause infarction. Congenital abnormalities (thyroglossal duct cysts, branchial cleft cysts) may become secondarily infected. Foreign bodies may be aspirated or ingested, and risk causing airway obstruction or esophageal perforation and mediastinitis.

Summary/Conclusion:
Recognizing the imaging findings, as well as the complications, of various non-traumatic head and neck emergencies in the pediatric population is important given that diagnosis of these cases relies heavily on imaging.
My child's forehead is swollen. It's not just frontal sinusitis: A Review of Conditions That Cause Swelling or Masses in the Frontal Region.
Poster Number: PED-13

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Abstract Details
Purpose:
A mass or swelling in the forehead can be a clinical as well as radiological diagnostic dilemma and can be caused by a number of conditions, ranging from congenital conditions, to infections of the skin, subperiosteal abscesses, to neoplastic processes, both benign and malignant. We aim to present select conditions, particularly in children, that can present as swelling or masses in this region, especially those that simultaneously affect the frontal sinuses. We aim to highlight their distinctive features through a combination of imaging and clinical evaluation.

Materials:
Imaging studies of patients with abnormalities near the forehead and frontonasal region from our institution were collected and classified. Correlative clinical information and pathology was also collected.

Description:
A number of conditions can present with swelling in the forehead. In children, ‘Pott puffy tumor’, or subperiosteal abscess extending from frontal sinusitis, is a well-known cause for forehead swelling with associated frontal sinus disease. We have come across Langerhans Cell histiocytosis of the frontal sinus region that can look remarkably similar. This can lead to potential misdiagnosis and affect care. We shall also present other conditions in this region such as congenital conditions, neoplasms both benign and malignant. Select adult forehead causes for swelling will also be presented to round up the discussion.

Summary:
We review and discuss the imaging features, which in concert with clinical history and examination, can help sort out the different causes for swelling or masses in the forehead.
Emergent Imaging of Pediatric Head and Neck Pathologies: What On Call Radiologists Should Know.
Poster Number: PED-14

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Abstract Details
Purpose:
The aim of this educational exhibit is to review several common and uncommon emergent pathologies affecting the head and neck in the pediatric population and their key imaging features that will aid both clinicians and radiologists to appropriate and efficiently make diagnoses.

Approach:
Noteworthy cases will be provided with discussion focusing on presenting clinical signs and symptoms, diagnostic planning, and initial imaging. Final diagnosis and key imaging characteristics for each associated pathology will be provided with follow-up discussions focused on the explanation for the use of each imaging modality and the consequences of missed diagnoses. Example cases will include but are not limited to trauma, retropharyngeal abscess, epiglottitis, mastoiditis, and intracranial hemorrhage.
Discussion:

1. Discuss presenting clinical signs and symptoms for each case and initial imaging findings if available.

2. Discuss diagnostic planning and reasoning for use of specific imaging modality for suspected pathologies of the head and neck.

3. Discuss focused characteristic imaging findings for each provided final diagnosis.

4. Discuss differential diagnoses for the imaging characteristics and the consequences of either misinterpretation or failure to use specific imaging modalities.

Summary:

The aim of this educational exhibit is to review several common and uncommon emergent pathologies affecting the head and neck in the pediatric population and their key imaging features that will aid both clinicians and radiologists.
Imaging findings in the orbits of extra orbital oncologic processes in pediatric population
Poster Number: PED-15

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Abstract Details

Purpose: To describe the imaging findings of orbital involvement in extra orbital oncological processes in the pediatric population

Description: Following IRB approval we retrospectively reviewed imaging features of orbital involvement in pediatric patients affected by extra-orbital oncologic processes primarily on MR imaging. All studies were performed on either a 3 Tesla or 1.5 Tesla Siemens MRI scanner utilizing a brain and orbit protocol MRI without and with gadolinium contrast. Some of the cases were evaluated with CT study of the orbits mainly with contrast.

Results: Based on our review we found involvement of the orbit in oncological processes which included but were not limited to mainly neuroblastoma, rhabdomyosarcoma, Ewing's sarcoma, lymphoma, leukemia and Langerhans cell histiocytosis. We will describe the spectrum of MR imaging findings in each of these malignancies. CT orbit findings will be reviewed in some cases.

Conclusion: It is important for head and neck radiologists to be familiar with imaging manifestations of common pediatric malignancies which can involve the orbit. Oftentimes the orbital manifestation may be the presenting feature of some of these malignancies.
The Developing Mouth, Pediatric Dentition and Dental Lesions
Poster Number: PED-16

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Abstract Details
Purpose:
The purpose of this exhibit is to describe normal anatomy and development of the teeth and supporting tissues and describe pathologic dental processes and their differential diagnoses from an imaging perspective. Dental treatments and their imaging appearance will also be discussed.

Description:
With teeth at various stages of development, eruption, and exfoliation, the pediatric mouth can have a complex imaging appearance. Normal processes of development may be confused with pathology and pathology may be overlooked. This exhibit will review normal dental anatomy and dental development through childhood and discuss pediatric dental ailments. Odontogenic tumors, tooth decay/restorations, and inflammatory processes will be discussed with appropriate terminology to describe and communicate these findings to referring physicians.

Summary:
Pediatric odontogenesis and exfoliation is complex and can both be confused with and disguise pathology. An understanding of normal development and common dental disease entities can help a radiologist navigate the pediatric mouth.
How to spit out the diagnosis. A multimodality review of pertinent anatomy and pathology of the major and minor salivary glands

Poster Number: SAL-03

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Abstract Details

Purpose:
The major and minor salivary glands of the head and neck are routinely included within the field of view of standard neuroimaging. Although the major salivary glands are easily identifiable, salivary pathology is relatively rare and many radiologists devote little time evaluating them as part of their routine search pattern. It is therefore of paramount importance that radiologists do not overlook subtle abnormalities in the salivary glands and instead be aware of which common and uncommon disease processes can be confidently identified on routine imaging. The purpose of this exhibit is to provide a multimodality review of relevant anatomy and pathology of the major and minor salivary glands of the head and neck.

Description:
Topics to be discussed include: Normal anatomy of the major salivary glands, including important anatomic landmarks that pertain to management and surgical approach; Common distribution of minor salivary gland tissue; Imaging features of benign and malignant salivary neoplasms (Benign mixed tumor, Warthin tumor, Oncocytoma, Hemangioma, Lipoma, Dermoid/Epidermoid cyst, Branchial cleft cyst, Mucoepidermoid carcinoma, Adenoid cystic carcinoma, Adenocarcinoma, Squamous Cell Carcinoma, Lymphoma, Metastasis); Imaging features of infectious/Inflammatory processes of the salivary glands (Sialolithiasis, Sialadenitis, Ranula, Sjogrens, Sarcoidosis)

Summary:
A variety of disease processes can occur within salivary gland tissue and it is important to be familiar with their imaging findings. However, the rarity in which salivary pathology is encountered often leads to improper characterization or misidentification. An appropriate understanding of the relevant anatomy and common pathology within the major and minor salivary glands of the head and neck will expand the learner’s search pattern and comfort level, leading to more accurate diagnoses and improved patient management.
Sjogren Syndrome

Demographics:
- Female predominance (>90%), Postmenopausal 50-70 years old
- Juvenile subtype in men < 20 years old, resolves at puberty
- Commonly seen with other autoimmune diseases (RA > SLE > Scleroderma)

Imaging Findings:
- Sialography: Alternating ductal stenosis and dilatation within the parotid gland ("String of beads" sign)
- CT/MRI:
  - Early: Enlarged parotid glands + Diffuse small cysts + Early fatty replacement
  - Late: Parotid atrophy + Larger areas of cystic destruction + Solid masses (lymph node aggregates) + Calcifications

*Key Teaching Point:*
- Increased risk of lymphomatous transformation (14x increased risk of NHL)

![Image A](image1.png)  ![Image B](image2.png)  ![Image C](image3.png)

**Early Sjogren Syndrome.** Axial noncontrast CT (A) and Axial T2WI (B) demonstrate enlarged parotid glands with areas of fatty replacement (yellow arrow) and cystic changes (red arrow).

**Late Sjogren Syndrome.** Axial CT shows multiple calcifications in the bilateral atrophic parotid glands.

**Sjogren Syndrome + NHL.** Axial CT demonstrates multiple mildly enlarged Level I and II lymph nodes in a patient with Sjogren Syndrome. Biopsy proven NHL.
Spitting it out! - Review of Benign and Malignant Salivary Gland Neoplasms
Poster Number: SAL-06

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Abstract Details
Purpose:
Salivary gland tumors encompass a wide spectrum of benign and malignant pathologies. They most often present as painless palpable masses but may occasionally present with additional symptoms such as facial nerve palsy and cervical lymphadenopathy. Most parotid gland tumors are benign, however, approximately half of submandibular and the majority of sublingual and minor salivary gland tumors are malignant. It is often difficult to distinguish benign from malignant based on imaging alone. Ultrasound may be used as the first line imaging modality for suspected lesions in the superficial lobe of the parotid gland and for guidance during FNA biopsy but it does a poor job at evaluating deep lobe lesions and determining extent of disease. For most salivary gland tumors, CT and MR are the mainstays of imaging. Comparing the two modalities, MR is superior to CT in identifying small tumors and predicting malignancy. MR is also better at detecting deep lobe extension, marrow infiltration, and perineural spread. Certain imaging features may be suggestive of a particular diagnosis but further evaluation with fine needle aspiration cytology and/or surgical excision is typically warranted. The purpose of this exhibit is to review the imaging features of the common and some not so common benign and malignant salivary gland tumors in an effort to help radiologists provide a narrow and accurate differential diagnosis when faced with these lesions.

Description:
This educational exhibit will provide an overview on the anatomy of the salivary glands, epidemiology of salivary gland tumors, and different imaging modalities applied in the workup of salivary gland masses. Several original pathologically proven case examples of salivary gland neoplasms will be illustrated. The imaging features of each lesion and their differential diagnoses will be discussed in detail. Important clinical and imaging pearls which may help the radiologist include or exclude specific entities from the differential diagnosis will also be provided. Finally, staging classification and treatment options will be presented.

Summary:
Definitive imaging diagnosis of salivary gland tumors remains a major challenge for radiologists. MR is the imaging method of choice in patients with palpable salivary gland masses to assess the extent of tumor, invasion of neighboring structures, perineural spread, and lymph node staging. The differentiation of benign
and malignant masses is often difficult, however certain imaging features can be suggestive of a particular diagnosis. Ultimately, biopsy is often warranted to determine the exact diagnosis and guide management.
Submandibular gland transfer prior to radiation therapy for head and neck cancer
Poster Number: SAL-07

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Abstract Details

Patients with locally advanced head and neck cancer can experience toxicity to the major salivary glands due to their proximity to treatment targets. Consequently, up to 80% (1) of head and neck cancer patients experience post-radiation xerostomia, which can severely impact quality of life.

The submandibular gland contralateral to the site of primary disease can be surgically transferred into the submental space prior to radiotherapy. This has been shown to prevent post-radiation xerostomia in 80-90% of head and neck cancer patients, without increased risk of disease recurrence or significant post-surgical complications (2). However, the post-surgical appearance of a submandibular gland transfer can present a diagnostic challenge to the radiologist unfamiliar with this surgical technique for evaluating complications and disease recurrence.

An IRB approved review of the radiology and medical record databases at a NCI cancer center was performed to identify illustrative cases of pre and post-operative CT, MRI and PET imaging, intra-operative pictures and radiation oncology treatment plans of patients who underwent submandibular gland transfer. These cases will be used to:
1. Review staging of squamous cell and salivary head and neck cancer, indications for radiation therapy and illustrative cases of standard radiation plans and dosimetry.

2. Detail regional anatomy for surgical planning.

3. Highlight the post-transfer appearance of the submandibular gland on imaging, expected sequelae of radiotherapy, and

Lastly, a self-assessment quiz will be presented for knowledge consolidation.

Attached figure caption:
Post-operative seroma in the setting of submandibular gland transfer. Pre-operative axial CT with contrast (left) for a 49 year old male patient with a right peritonsillar/base of tongue squamous cell carcinoma. Follow-up CT 4 days after submandibular gland transfer (middle) demonstrates a mixed gas and fluid collection within the surgical resection bed with interval resolution on serial imaging one month later (right). Note the transferred left submandibular gland is now present within the left submental space.


Abstract Details
Purpose: To provide a diagnostic toolbox to the radiologist and radiology resident as a guide to appropriate imaging and interpretation of salivary glands pathology.

Description: Interpretation and proper imaging of the salivary glands can be initially challenging due to the complex anatomy, associated structures, varied pathology of the salivary glands, and multiple techniques currently available. Anatomy of the major and minor salivary glands will be reviewed using the different imaging modalities including CT, MRI, sialography, and ultrasound. Imaging protocols and appropriate imaging will also be discussed. Benign, neoplastic, and systemic disorders of the salivary glands will be reviewed separately using a case-based format.
Summary: This exhibit will review anatomy and pathology of the salivary glands as well as appropriate imaging techniques using a case-based format. At the end of the presentation, the viewer will be proficient in diagnosing and describing both common and uncommon benign and neoplastic disorders of the salivary glands.
Risk assessment of the mandibular fracture by classification of the mandibular inferior cortical shape using pantomography
Poster Number: SIN-02

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Purpose
Low bone mass and microarchitectural deterioration of bone tissue leads to enhanced bone fragility and consequent increase in fracture risk. Decrease in bone mineral density is known to alter the mandibular inferior cortical shape on pantomography. The purpose of this study was to assess the risk of the mandibular fracture by classification of the mandibular inferior cortical shape using pantomography.

Patients and Methods
This prospective study was approved by the Institutional Review Board (EC15-12-009-1). 450 patients (236 males, 214 females; age 20–90 years, mean age 49.8 years) suspected for mandibular fractures who underwent both pantomography and multi-detector-row CT (MDCT) from April 2006 to December 2016 were included in this study. All patients read and signed an informed consent form.

The mandibular inferior cortical shape was evaluated on both sides of the mandible, distal to the mental foramen on pantomography by two oral and maxillofacial radiologists, and classified into three types; Type I: the endosteal margin of the cortex was even and sharp on both sides; Type 2: the endosteal margin showed semilunar defects or seemed to form endosteal cortical residues on one or both sides; and Type 3: the cortical layer formed heavy endosteal cortical residues and was clearly porous. Then, the patients were grouped into two groups; Group I: normal bone mineral density (Type 1), and Group II: low bone mineral density (Type 2 and 3). Presence of mandibular fractures was independently evaluated by two oral and maxillofacial radiologists on MDCT. Any differences were resolved by forced consensus. Statistical analysis was performed using χ2 test with Fisher’s exact test.

Results
Of the 450 patients, fractures were seen in 287 patients (63.8%). Of the 287 patients with mandibular fractures, 59 (20.6%) were in Group I and 228 were in Group II (79.4%). Of the 163 patients without mandibular fracture, 102 (62.6%) were in Group I and 61 were in group II (37.4%). There was a statistically significant difference between Group I and Group II in the prevalence of mandibular fractures (p < 0.05).
Conclusion
Group II (low bone mineral density) patients had a higher prevalence of mandibular fractures compared to Group I (normal bone mineral density) patients. Our results suggested the classification of the mandibular inferior cortical shape on pantomography is able to use risk assessment of mandibular fractures.
Primer of Dental Nomenclature for the Practicing Radiologist
Poster Number: SIN-04

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Abstract Details
Purpose: To Provide a Primer of Dental Nomenclature for the Practicing Radiologist

Materials and Methods: Retrospective review of 153 dental planning CT scans between June 1 2016 and April 1 2017. All studies performed to determine course of inferior alveolar nerve in relation to teeth prior to dental extraction. Studies performed on 64 slice GE scanner with orthogonal and oblique reconstructions. Images were reviewed on GE AW work station

Results: Examples of dental anatomical descriptors and tooth numbering in relation to the inferior alveolar nerve will be provided

Conclusion: Using accurate dental nomenclature is vital in communicating findings to dental surgeons for accurate surgical planning and good surgical outcomes.
Surgically relevant anatomical variants on sinonasal CT.
Poster Number: SIN-05

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Abstract Details
Purpose: The purpose of this study was to determine the incidence of surgically relevant variants in sinonasal anatomy in CT.

Material and Methods: A retrospective evaluation of 140 consecutive sinus CT examinations of patients with clinical history of sinusitis was conducted. CT scans were evaluated for presence of several anatomic variants including infraorbital foramen dehiscence, optic nerve dehiscence, pneumatized clinoid processes, protrusion of molar tooth root into the maxillary sinus, and transit of the vidian canal or foramen rotundum across the sphenoid sinus. The prevalence of each variant was calculated. The prevalence of lamina papyracea dehiscence, an acquired defect was also calculated.

Findings: The study included 76 male and 64 female patients, ages ranging from 25-90 years. The most common anatomic variant identified was the presence of the vidian canal within the sphenoid sinus (39%), followed by protrusion of molar tooth root into the maxillary sinus (23%) and pneumatized anterior clinoid process (23%). 31/140 patients (22%) had more than one measured variant with a combination of transit of vidian canal and foramen rotundum through the sphenoid sinus being the most common (21/31 patients 68%)

Conclusion: Our study found that potentially relevant anatomic variants are commonly encountered in a cohort of patients with a history of sinusitis. Knowledge of variant anatomy prior to FESS is critical in order to avoid operative complications.
MR imaging of Temporomandibular Joint disorders: Normal and abnormal findings
Poster Number: SIN-06

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Abstract Details
Temporomandibular joint disorder is a general term that refers to disorders associated with the temporomandibular joint and the masticatory muscles. Types of the temporomandibular joint disorders are known as myalgia, arthralgia, articular disk displacement and degenerative joint disorder. The prevalence of temporomandibular joint disorder symptoms among the general population is between 5-40%, commonly in 20s to 40s, and the male to female ratio is 1:2.

The most frequent cause of the temporomandibular joint disorder is internal derangement, which is defined as an abnormal relationship of the disk to the mandibular condyle. MR imaging of the temporomandibular joint is essential to evaluate the location of the articular disk and its morphologic changes and its location relative to the mandibular condyle in open and closed mouth position. The disk location is of prime importance because presence of the displaced disk is a critical finding of temporomandibular joint disorders.

In the past reports, the disk location has been discussed mainly anterior or posterior. However, the disk displaces medially or laterally. Medial or lateral disk displacement can also be the cause of temporomandibular joint pain or joint effusion.

The purpose of this exhibit is to illustrate 1) normal anatomy of the temporomandibular joint and 2) how to read MRI of temporomandibular joint disorders.
The Emerging Molecular Phenotypes of Aggressive Sinonasal Carcinomas
Poster Number: SIN-07

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Abstract Details

Purpose:
To discuss the emerging molecular phenotypes and demonstrate the clinical, histologic and imaging features of SMARCB1-deficient sinonasal carcinomas and NUT midline carcinomas (NMC).

Description:
In this IRB-approved, HIPAA-compliant study, a retrospective search of our institution’s radiology and pathology databases identified SMARCB1-deficient sinonasal carcinomas and NMC. Clinical, histologic and imaging features of these molecular phenotypes of sinonasal carcinomas are presented, highlighting multimodality imaging findings on MRI, CT, and PET/CT.
Squamous cell carcinoma is the most common of the sinonasal carcinomas. However, there is a growing recognition of the histological types of rare and aggressive sinonasal carcinomas, including the SMARCB1-deficient sinonasal carcinomas and NMC. Many of these histologies as well as their imaging characteristics overlap. Advancement of the knowledge of these tumors, especially on a molecular level, will facilitate a more comprehensive understanding of the imaging characteristics, clinical behavior, and response to targeted therapies.

SMARCB1 is a tumor suppressor gene located on chromosome 22q11.2 which is ubiquitously expressed in the nuclei of all normal tissues. On cytopathological examination, these sinonasal malignancies are characterized by the presence of varying proportions of basaloid and rhabdoid components without histologic evidence of specific differentiation, including squamous or glandular components. These tumors are generally very aggressive with advanced stage at presentation due to intracranial and/or orbital invasion. In the sinonasal cavity, a central distribution is most common with the nasoethmoidal region most frequent, followed by the sphenoethmoidal and frontoethmoidal regions. Clinical, histological, and radiological features of SMARCB1 sinonasal carcinomas will be demonstrated in this presentation.

NMC is an aggressive cancer that does not arise from a specific tissue or organ. Instead, the NMC presents as a poorly differentiated carcinoma originating from midline locations including the sinonasal cavity. In the majority of NMC, most of the coding sequence of the gene NUT on chromosome 15q14 is fused to the BRD4 gene on chromosome 19q13.1, referred to as the BRD4-NUT fusion gene. This fusion gene functions to block cellular differentiation and promote uncontrolled growth of carcinoma cells. Given that this is a relatively new tumor, it is often misdiagnosed or undiagnosed, especially since the histologic features of NMC widely overlap and may only be subtly distinct from other undifferentiated sinonasal carcinomas. Historically, the preferred confirmatory method of diagnosis of NMCs is made by confirming the NUT rearrangement by dual color, split-apart FISH using probes flanking NUT. There is no effective treatment to date of this extremely aggressive sinonasal cancer. Clinical, histological, and radiological features of NMC will be demonstrated in this presentation.

Summary:

SMARCB1-deficient sinonasal carcinomas and NMC are both aggressive and rare sinonasal carcinomas that have been more recently recognized. An awareness of these sinonasal carcinomas is imperative for neuroradiologists when reviewing aggressive sinonasal cancers in order to guide appropriate management.

References:


Pictorial Review of Complications from Inflammatory Sinus Disease
Poster Number: SIN-08

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Abstract Details

Purpose
1. Review the basic anatomy of the paranasal sinuses.
2. Illustrate the key imaging features of inflammatory sinus disease in computed tomography (CT) and magnetic resonance imaging (MRI).
3. Provide a spectrum of the progression of acute and chronic inflammatory changes of the paranasal sinuses.
4. Discuss complications arising from inflammatory sinus disease.
Description
This pictorial review will use CT and MRI to discuss basic anatomical features of the paranasal sinuses, commonly encountered inflammatory/infectious processes and various regional and intracranial complications (some of which include Pott Puffy ‘tumor’, orbital cellulitis, cavernous sinus thrombosis, meningoencephalitis, intracranial empyemas and parenchymal abscesses). Several anatomical variants will be reviewed which may serve as predisposing factors regarding complications of paranasal sinus disease.

Summary
It is important to have basic understanding of the normal anatomy and variants of the paranasal sinuses in order to adequately assess inflammatory sinus disease. Evaluation of the paranasal sinuses with CT and MRI plays an essential role in prompt diagnosis and appropriate management of inflammatory sinus disease in an attempt to avoid potential complications.
**Paranasal Sinuses Normal Anatomy**

- Ethmoid Air Cells
- Ethmoid Roof
- Maxillary Sinus
- Canal
- Medial Wall
- Anterior Wall
- Nasal Septum
- Nasal Cavity
- Cribiform Region
- Zygomatic Bone
- Temporalis Muscle
- Pterygoid Muscles: Lateral, Medial
- Mastoid Air Cells
- Rosenmüller Fossa
- Maxillary Sinus; Anterior Wall
- Medial Wall
- Posterior Wall
- Masseter Muscle
- Ramus of the Mandible
- Pterygoid Plates: Lateral, Medial
- Occipital Bone

**Acute Sinonasal Disease**

Mild Mucosal Thickening (*) of Right Maxillary Sinus (A) and Right Ethmoidal Sinus (B).

**Chronic Sinonasal Disease**

Mucoperiosteal Thickening (+) of the Right Ethmoidal Sinus (C and D).

**A Complication from Inflammatory Sinus Disease:**

Pott Puffy “tumor”

Erosion of the anterior wall of the right frontal bone with subcutaneous abscess formation (arrow) in CT axial (A) and sagittal (B) views.

Frontal mucosal thickening (arrowhead) in CT axial (C) and coronal (D) views.

Maxillary sinus mucosal thickening (*) with sclerosis in CT sagittal view (E).
Beyond FEGNOMASHIC: Lytic Lesions of the Face
Poster Number: SIN-09

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Abstract Details

Purpose
Lytic lesions of the maxillofacial region encompass a wide variety of pathologies and differ in clinical significance, as they have varying degrees of aggressive/malignant potential. Computed tomography (CT) is commonly used for imaging of the face. Many lesions are found incidentally on imaging, and sorting out which are more suspicious or require prompt attention can be a challenge. Therefore, familiarity with the characteristic imaging appearances of benign and aggressive/malignant lytic lesions of the maxillofacial region, as well as knowledge of their clinical significances and possible complications, is important for a radiologist.

Description
We will present a spectrum of lytic lesions of the maxillofacial region, ranging from incidental findings to life threatening conditions, with a focus on characteristic imaging findings that will help narrow the differential. Though we will include many entities from the popular “FEGNOMASHIC” differential diagnosis, we will extend this to include a broader range of entities, some of which are unique to the head and neck.

The cases include common and uncommon benign entities such as fibrous dysplasia, cherubism, enchondroma, eosinophilic granuloma, giant cell tumor, non-ossifying fibroma, osteoblastoma, aneurysmal bone cyst, simple bone cyst, brown tumor, osteomyelitis, chondroblastoma, chondromyxoid fibroma, intraosseous lipoma, ameloblastoma, radicular cyst, residual cyst, dentigerous cyst, keratocyst, and osteonecrosis in the setting of radiation and steroids as well as malignant tumors such as lymphoma, plasmacytoma, osteosarcoma, chondrosarcoma, squamous cell carcinoma with osseous invasion, and metastasis. We will discuss key imaging features to help differentiate a benign from malignant lytic tumor and to help narrow the differential, including margins, tumor matrix, and bony destruction pattern, presence or absence of cortical breakthrough, and associated soft-tissue masses. Underlying clinical implications and potential complications will also be included.
At the end of this activity, the radiologist will be able to accurately describe benign and malignant imaging features of a lytic facial lesion, provide a focused differential diagnosis when encountering a lesion on imaging, and discuss possible underlying clinical implications and complications.

Summary
Lytic lesions of the face encompass a broad spectrum of pathologies and range from incidental to life threatening. This exhibit will review characteristic imaging features of benign and malignant lytic lesions of this region, encouraging the radiologist to play a leading role in diagnosis and management.
Sinonasal radiology: A systematic review
Poster Number: SIN-10

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Abstract Details
Purpose: The purpose of this educational exhibit is to review sinonasal development, normal anatomy, anatomical variants, and pathology utilizing diagrams, CT, and MRI. The objective is to improve the viewer’s ability to identify anatomical variants and pathology.

Description: The educational exhibit will start with a brief overview of the timing of sinonasal development and pneumatization. Normal anatomy will be introduced initially with diagrams and then with cross-sectional imaging. Anatomical variants will then be covered including their clinical/surgical significance. Examples of sinonasal pathology will be discussed. Throughout the exhibit there will be quiz questions that will test the viewer’s comprehension of each area of the exhibit.

Summary:
After reviewing the educational exhibit, the viewer is expected to become more comfortable with sinonasal anatomy and pathology. The viewer is expected to better be able to identify anatomic variants and better discuss their clinical implications with the ordering physician.
Anatomical variants
Arrested pneumatization sphenoid sinus
Can be mistaken for skull base tumor or chronic sinusitis
The well-defined sclerotic borders, curvilinear internal calcifications, soft tissue density zones, and absence of any evidence of expansion suggest the diagnosis

Sinosnasal pathology
Esthesioneuroblastoma
- Laterally oriented soft tissue lesions often involving the nasal cavity extending inferomedially and into the nasal cavity
- Causes bone remodeling or destruction

Quiz Question
Which anatomical variant relevant for endoscopic sinus surgery is depicted on these CT images?
A. Hilar cell
B. Papillary tumor
C. Auger nasal cell
D. Aneurysm of the skull

Anatomical variants
Otic cell
These are posterior ethmoid cells extending into the sphenoid bone, either adjacent to or involving the optic nerve. When these Otic cells extend or involve the optic nerve, the nerve is at risk when surgical excision of these cells is performed.

Sinosnasal pathology
Tumors - Inverted papilloma
Called "inverted" because the cells invaginate the stroma resulting in endophytic rather than exophytic growth. Usually arise in middle meatus nasal cavity and obstruct or grow into the paranasal sinuses. Classic cerebellar or lamellar enhancement pattern
Purpose:
This pictorial review aims to illustrate the relevant imaging anatomy of paranasal sinus and imaging characteristics of neoplasms and mimickers that neuroradiologists should know. Radiologic, pathologic and clinical correlation is emphasized.

Description:
Patients with sinonasal neoplasms often present with nonspecific symptoms, including pain, nasal obstruction, epistaxis, hyposmia, etc. Endoscopic examinations may reveal nonspecific mass lesions. Imaging plays critical roles in localizing and characterization. Some neoplasms have pathognomonic appearances on imaging. This retrospective review of sinonasal neoplasms at a tertiary referral center over a 6-year period (2010-2016) was performed with radiological and pathological correlation. Images of each entity will be presented with any distinguishing imaging features, diagnostic pearls, pitfalls, treatment and prognosis discussed. Approximately 40 cases of sinonasal neoplasms are found in our tumor board registry and classified into benign and malignant neoplasms per tissue of origins utilizing WHO classification. This includes neoplasms of epithelial, soft tissue, bone, cartilage, hematolymphoid, neuroectodermal, germ cells and metastatic in origin. American Joint Committee of Cancers (AJCC) 6th edition is used for tumor staging. Post treatment imaging findings are reviewed. Some tumor-like lesions are discussed including polyps, fungal infection (fungal balls, invasive fungal sinusitis, allergic fungal sinusitis), mucocele, rhinophyma and pseudotumor of hemophilia.

Summary/Conclusion
Familiarity with anatomy and characteristic neuroimaging findings of sinonasal neoplasms is invaluable for neuroradiologists in providing accurate diagnoses and management guidance.

Key Words: paranasal sinus, neoplasm, CT, MRI
References:


Incidental Paranasal Sinusitis on routine Brain Magnetic Resonance Scans - Analyzing maxillofacial
disease patterns for clues to predominant underlying causes.
Poster Number: SIN-12

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Abstract Details
Background: We recently reported a strong association of significant Incidental Paranasal Sinusitis (IPS),
measured on Routine Brain MRs, with clinical history of Cerebrovascular Disease. This study replicated
effects noted in a few prior studies correlating chronic Periodontitis (PD) with multiple atherosclerosis
endpoints, in single or equivalent populations. While IPS causation may be multifactorial, the results
suggested predominant IPS derivation from PD. Purpose: This descriptive analysis of maxillofacial findings on
MR (same cohort), analyzes features of IPS for clues to underlying causes, e.g. ostiomeatal obstruction vs
others. Secondarily, we tested if residual posterior maxillary dentition might correlate with IPS. Materials and
methods: The cohort was random, the first 15 brain MRs per month for 2009, without duplication of
subjects/exams. On sagittal T2 Brain MR scans, primarily, a new sinus volume scoring system and formal IPS
pattern scheme, nasal passage status and residual dentition were recorded. A second experienced MR reader
scored IPS volume / patterns, in 115/85 post-contrast MR scans respectively, to validate the scoring methods. Various analyses of IPS were performed, including volume of inflammation of the whole sinus system in each subject, and by sinus type across subjects. Prevalence of fully filled maxillary sinuses, maxillary sinus fluid levels, cysts, polyps, nasal passage obstruction and dentition were analyzed. Results: Of 180 subjects, 7 were excluded, leaving 173; 156 males, 17 females (M 90.2% : F 9.8%); mean age 62.4 years, (M 64.1 yrs: F 46.3 yrs) range 23.3 – 97.7 years; 104 Whites (60.1%), 66 Blacks (38.2%), and 3 other minorities. The vast majority of sinus mucosal inflammation was T2 fluid-bright. The mean of summed IPS volume scores out of 30, from all subjects, was 2.20/30 (SD 3.24) (0 – 22/30). Most sinuses were clear and most abnormalities minimal or mild. A fully inflamed maxillary sinus was present in 3 (1.7%); sizeable cysts in the maxillary sinus without other inflammation (2.9%); maxillary sinus fluid levels (2.3%); partial nasal passage obstruction (2.3%). Nasal passage obstruction, alone and cumulative with other potentially obstructive features (full maxillary sinuses and fluid levels), was a non-dominant feature of IPS, for all and for significant IPS. A stratified analysis of IPS scores by sinus types, sides and grades of IPS severity showed consistently declining gradients of inflammatory volume with increasing distances of the sinuses from the maxillary floors. Posterior maxillary tooth counts by side were - none (41.6%), few (18.2%), several (31.2%) and full 31 (9.0%). By subjects, 64/173 (37.0%) had bilateral absence of posterior maxillary teeth. There were no significant correlations of IPS severity to the grades of tooth loss.

Conclusions: IPS affects the maxillary sinuses more than the other sinuses combined. Polyps are rare in IPS. Cysts, and features suggesting ostiomeatal obstruction – nasal passage obstruction, fully filled maxillary sinuses and maxillary fluid levels – are infrequent. Hence, ostiomeatal obstruction is a non-dominant cause of IPS. The consistent declining gradients of sinus inflammation ascending the sinuses favors cause/s at the base of the maxilla, effectively favoring periodontitis as the predominant derivation of IPS.
Schematic representation of sinus volume scores by sinus type:
Gradients declining consistently with distance from Maxillary Sinus floors (↑)
(All subjects’ total severity scores shown from A – G: whole cohort scores H.)

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<td>32.5</td>
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<td>30.5</td>
<td>16</td>
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A: Sinuses clear except for tiny T2 bright mural foci.
N = 44

B: Sum scores: 1 - 2.5 (excluding A)
N = 38

C: Sum scores: 3 - 5.5
N = 23

D: Sum scores: 6 - 9
N = 12

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<td>Ethmoids</td>
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<td>130</td>
<td>86.5</td>
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E: Sum score range: 9.5 - 12.0
N = 5

F: Sum scores: 12.5 - 15
N = 2

G: Sum score: 22
N = 1

H: Whole cohort sum
N = 173
Surgical lesions of the sinonasal region - from the perspective of the radiologist and otolaryngologist.
Poster Number: SIN-15

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Abstract Details
Purpose: Provide a detailed review of the more commonly encountered malignant tumors and benign "tumor-like" lesions in the sinonasal region highlighting typical features that might suggest a specific etiology. Additionally, provide a checklist of key findings to include in the radiology report that will benefit treatment planning from a surgical approach.

Description: Sinonasal tumors are relatively rare tumors (comprising only 3% of all head and neck cancers) that frequently present in an advanced stage with extensive sinonasal involvement. Therefore, these tumors can be a cause for substantial consternation for both inexperienced and experienced imagers alike. In addition, there are many benign sinonasal lesions which may mimic tumors and therefore are important to recognize. As such, this educational exhibit will provide an image-rich review of the more typical sinonasal tumors and "tumor-like" lesions and highlight features that may suggest a specific etiology. Important anatomic relationships with regional structures will be illustrated as to aid the surgeon in treatment. When possible, we will also provide a clinical-imaging correlation from the operating room. Finally, we will provide a checklist of items that the radiologist needs to include in their reports including discussion of orbital and intracranial involvement.
Summary: Benign and malignant sinonasal lesions can be challenging for both experienced and novice head and neck imagers. However, following completion of this educational exhibit, the viewer will be able to develop a practical differential diagnosis, recognize some of the classic findings which may suggest a specific diagnosis, and detail key findings radiologists should include in their report to better assist the referring clinicians.
Imaging Features of Parapharyngeal Space Cavernous Hemangiomas
Poster Number: SIN-17

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Abstract Details
PURPOSE: Cavernous hemangiomas in the parapharyngeal space are rare and can be challenging to diagnose prior to surgical resection or biopsy. Descriptions in the literature consist largely of case reports. The primary aim of this study was to review the CT and MR appearance of parapharyngeal cavernous hemangiomas through a retrospective case series.
MATERIALS & METHODS: The pathology database at the authors’ institution was electronically queried over 17 years using a keyword search. Patients with pathologically confirmed parapharyngeal space cavernous hemangiomas were identified, and those with pre-treatment CT and/or MR were included. Demographic and clinical data were obtained from the electronic medical record. The imaging appearance of these lesions was characterized through a detailed review by a board-certified neuroradiologist (i.e. CT density, MR signal characteristics, enhancement pattern, presence/absence of calcification, relationship to adjacent structures, size/growth).

RESULTS: A total of six patients met inclusion criteria, five female and one male, ranging in age from 34 to 76 years (mean 59 years). Diagnosis was established with CT-guided core biopsy and surgical resection in four and two patients respectively. The cavernous hemangiomas were all located in the pre-styloid parapharyngeal space (four right, two left), and only one contacted the deep lobe of the parotid gland. Volume ranged from 0.8 mL to 5.5 mL. On MR, all of the cavernous hemangiomas were well defined, demonstrated markedly increased T2 signal relative to adjacent skeletal muscle and were isointense relative to skeletal muscle on pre-contrast T1 weighted sequences. Post gadolinium sequences were obtained in 5 out of 6 patients. MR contrast enhancement features were highly variable ranging from mild enhancement of a portion of the hemangioma to moderate diffuse enhancement. Two cavernous hemangiomas demonstrated increased lesion enhancement on the more delayed of the two post gadolinium sequences. On non-contrast CT, all of the cavernous hemangiomas were isodense to skeletal muscle. Only one patient had post contrast CT images which demonstrated enhancement of the central portion of the hemangioma. None of the cavernous hemangiomas contained phleboliths or other calcifications. Most patients had no follow-up imaging after diagnostic biopsy or surgical resection. In one patient, the cavernous hemangioma was stable at 8 months following biopsy. In a second patient, the hemangioma was smaller 5 years after core biopsy. All of the cavernous hemangiomas were found incidentally on imaging studies obtained for an unrelated clinical problem. All of the MR and CT studies were initially interpreted by a board-certified neuroradiologist, and the possibility of a cavernous hemangioma was not suggested in the radiology report prior to tissue diagnosis in any of the six cases. The most commonly suggested diagnosis prior to tissue sampling was salivary gland tumor.

CONCLUSIONS: Parapharyngeal cavernous hemangiomas are rare, difficult to diagnose prospectively on MR and CT, and are typically found incidentally on imaging studies obtained for other reasons. With heightened awareness of cavernous hemangiomas occurring in the parapharyngeal space and their typical imaging features, the radiologist may appropriately include cavernous hemangioma in the differential diagnosis of a parapharyngeal mass.
Malocclusion: a review and the role of imaging in malocclusion orthognathic surgery
Poster Number: SIN-18

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Abstract Details
Purpose: To give an overview of malocclusion and the use of imaging in malocclusion surgery. We will highlight the classification, causes, and corrective surgical procedures for malocclusion along with imaging illustration. We also discuss the use of panoramic dental x-rays and CT imaging in preoperative planning for malocclusion corrective surgery.

Description:
Malocclusion encompasses a wide range of disorders of misalignment of the teeth. The causes are diverse and multifactorial, including environmental and genetic factors [1]. Only 35% of adults have well-aligned mandibular incisors and 15% of the general population have irregularities that can affect aesthetics and functionality [2]. Therefore, having a good understanding of our role as radiologists in the preoperative and postoperative assessment of these patients is invaluable.

We have a very active oral and maxillofacial surgery service at our institution and as such see a large volume of preoperative and postoperative malocclusion cases. We will highlight variations of some of the more common causes of malocclusion, such as hypoplasia and/or hyperplasia of the maxilla or mandible [1], as well as review the most popular classification method of malocclusion, Angle’s classification. In addition, we will review how the panoramic dental x-rays and CT 3D facial bone reconstructed images play a role in
assessment of facial symmetry and surgical planning. This includes a discussion of how the acquired CT dataset is used to generate preoperative 3D models and guides that aid in intraoperative guidance. Moreover, we will also discuss the treatment options ranging from extraoral appliances to orthognathic surgery, with emphasis on the types of orthognathic surgical procedures. We hope that at the end of presentation, there is a clear understanding of malocclusion and a clear understanding of our role as radiologist in the preoperative and postoperative assessment of these patients.

Summary:
This educational exhibit will give an overview of malocclusion, including classification, causes, and corrective surgical procedures. Moreover, we will review how dental x-rays and CT images are utilized preoperatively, intraoperatively, and postoperatively.

References:
Quantitative assessment of myalgia of the masticatory muscle in temporomandibular disorders using apparent diffusion coefficient
Poster Number: SIN-19

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Abstract Details

Purpose
Temporomandibular disorders (TMDs) are the second most common musculoskeletal condition resulting in pain and disability. TMDs are divided into the four types such as myalgia of the masticatory muscle, arthralgia of the temporomandibular joint, temporomandibular joint disc derangement and osteoarthrosis. However, myalgia of the masticatory muscle cannot be evaluated by conventional imaging modalities. The purpose of this study was to examine the quantitative assessment of myalgia of the masticatory muscle in patients with TMDs using ADC.
Patients and methods
This prospective study was approved by the Institutional Review Board (EC15-12-009-1). 106 TMD patients with unilateral symptoms (18 males, 90 females; age 15-80 years, mean age 48.7 years) who underwent MR imaging from March 2015 to January 2017 were included in this study. Exclusion criteria were patients younger than 15 years old, patients with tumors around the temporomandibular joint (TMJ), and imaging studies with severe artifacts. Visual Analogue Scale (VAS) was used to evaluate the patient’s TMD pain.

MR imaging was performed with a 1.5-Tesla unit (Intera Achieva 1.5T; Philips Medical Systems, Netherlands) with a 5ch phased array coil. The imaging techniques used included axial diffusion-weighted imaging (b = 0, 1000 s/mm²) and STIR imaging through the neck to skull base. Regions-of-interest (ROIs) were drawn to completely include the right and left lateral pterygoid muscle, medial pterygoid muscle and masseter muscle on a slice demonstrating the largest area of each muscle on ADC map. All images were independently evaluated by two oral and maxillofacial radiologists and any differences were resolved by forced consensus. Statistical analysis was performed using a Mann–Whitney U test with the statistical package SPSS version 21.0 (SPSS Japan, Tokyo, Japan). P-values < 0.05 were considered statistically significant.

Result
Of the 106 patients, 48 patients had a TMJ pain on the right, and 58 patients had on the left using VAS response.

ADC values of the pain side were 1.34±0.15x10⁻³mm²/s (lateral pterygoid muscle), 1.28±0.10x10⁻³mm²/s (medial pterygoid muscle), and 1.33±0.18x10⁻³mm²/s (masseter muscle). ADC values without pain side were 1.12±0.15x10⁻³mm²/s (lateral pterygoid muscle), 1.04±0.18x10⁻³mm²/s (medial pterygoid muscle), and 1.09±0.12x10⁻³mm²/s (masseter muscle).

ADC values of the masticatory muscle of the pain side were significantly higher than those of without pain sides (P < 0.01).

Conclusion
ADC values of the masticatory muscle on the pain side were significantly higher than those of without pain side. Our results suggest quantitative assessment of myalgia of the masticatory muscle in TMDs may be feasible using ADC.
Marginal periodontitis causing maxillary sinusitis: Study of 500 maxillary sinuses
Poster Number: SIN-20

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Purpose
Odontogenic maxillary sinusitis primarily results from multiplication of bacteria secondary to dental infection. Since the maxillary premolar and molar roots have the closest proximity to the antral floor, periapical abscess of these teeth is the most common cause of odontogenic maxillary sinusitis. There have been many reports revealed association between periapical abscess and maxillary sinusitis. However, there have been few reports that evaluated marginal periodontitis as a cause of maxillary sinusitis. The purpose of this study was to evaluate association between marginal periodontitis of maxillary molars and mucosal thickening of the maxillary sinus using MDCT.

Patients and Methods
This retrospective study was approved by our IRB (EC 15-12-009-1). We reviewed 500 maxillary sinuses in 250 CT studies (149 women and 101 men, mean age: 49.4 years [range 15-85]) performed for dental implant surgery planning and suspicion for maxillary sinusitis in our department from April 2015 to December 2016. Patients with maxillary tumors were excluded. Patients were classified into four groups based on periodontal tissue conditions; Group I: normal periodontal tissue (without periodontitis), Group II: marginal periodontitis without periapical abscess, Group III: marginal periodontitis and periapical abscess, and Group IV: periapical abscess without marginal periodontitis. CT images were evaluated for mucosal thickening (>2 mm) of maxillary sinus floor.

Relationship between periodontal conditions and CT imaging findings were evaluated using χ2 test with Fisher's exact test.

Results
340 maxillary sinuses demonstrated mucosal thickening (68.0%). Of the 340 sinuses with mucosal thickening, 42 (12.3%) were Group I, 161 (47.4%) were Group II, 113 (33.2%) were Group III, and 24 (7.1%) were Group IV. Of the 160 sinuses without mucosal thickening, 105 (65.6%) were Group I, 44 (27.5%) were Group II, 5 (3.1%) were Group III, and 6 (3.8%) were Group IV. 161 sinuses out of 205 (78.5%) in Group II presented mucosal thickening in the maxillary sinus which was statistically significant when compared with Group I which showed mucosal thickening in 42 sinuses (28.2%) (P < 0.05). 113 sinuses out of 118 (95.8%) in Group III
presented mucosal thickening in maxillary sinus which was statistically significant when compared with Group I which showed mucosal thickening in 42 sinuses (28.2%) \((P < 0.05)\). 24 sinuses out of 30 (80.0%) in Group IV presented mucosal thickening in maxillary sinuses which was statistically significant when compared with Group I which showed mucosal thickening in 42 sinuses (28.2%) \((P < 0.05)\).

Conclusion
Patients with marginal periodontitis showed significantly higher prevalence of maxillary sinus mucosal thickening than patients without marginal periodontitis. Patients who had both marginal periodontitis and periapical abscess showed significantly higher prevalence of maxillary sinus mucosal thickening than patients with marginal periodontitis without periapical abscess. Our results suggested that marginal periodontitis of maxillary molars can cause maxillary sinus mucosal thickening and may be a cause of maxillary sinusitis.
Inside-Out: What clinical observations and published studies of Incidental Paranasal Sinusitis may reveal about the origins of inflammatory ostiomeatal obstruction and maxillary sinus pseudocysts
Poster Number: SIN-21

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Abstract Details
Background: Chronic Rhinosinusitis (CRS) is a polygenic disorder with puzzling aspects – the unresolved origins of - a) Inflammatory Ostiomeatal Obstruction, b) Incidental Paranasal Sinusitis (IPS) and c) Maxillary Sinus Pseudocysts.

Purpose: A review of clinical imaging observations of IPS and CRS against the backdrop of pivotal findings from well-conducted studies of IPS. The review is aimed at suggesting explanations for the above entities.

Summary of content: a) Sinonasal pathophysiology: The sinonasal passages are lined by respiratory epithelium which is mainly secretory in function, producing 1.5 L of fluid in 24 hours, and hypersecreting when exposed to inflammogens. The mucosal ciliary system sweeps the fluid out of the sinuses and backwards in the nasal passages to be swallowed and managed by defenses in the intestinal tract. b) Role of MR in imaging sinusitis and our observations of IPS: Modern MR provides high resolution of T2 bright findings and subtle T1 mucosal enhancements, permitting discrimination between mural vs luminal features in the Maxillary Antra (MA). In our experience, most of IPS involves some stripping of the mucosa off the osseous wall/s by non-enhancing fluid. c) MR Sinus Membrane Signs: We demonstrate three variants of membrane signs that support the above principles. A membrane sign may also be seen with isolated large MA cysts, many of which are likely pseudocysts. d) Parallel causation of MA Pseudocysts and IPS: Some pathologists have suggested these cysts are filled with exudates, the latter most likely derived from dental-related infections. This causal axis is congruent with recent dental science research using coned beam CT, showing strong associations of measures of chronic Periodontitis (PD) with MA inflammation. Others have shown that regular periodontal scaling treatments may reverse mild MA thickening without other therapies such as antibiotics. The transit of microorganisms and inflammogens is thought to be through small veins and lymphatics. The breaching of the gums is probably similar to the origins of Bacterial Endocarditis, where bacteremia follows chewing, tooth brushing and dental procedures. e) PD-derived Pansinus IPS: Our recent study linking significant IPS with Cerebrovascular Disease replicates prior similar reports related to PD. This suggests that PD may cause pansinus inflammation, not just MA inflammation. Our concurrent abstract (ID 334987) shows IPS to occur more in the MAs than the other sinuses combined and with a decreasing gradient of sinus inflammatory volume the further the affected sinus is sited from the maxillary sinus floor.

Conclusions: We suggest that incursions of agents through the gums percolate up small vessels to reach the sinuses and extend further upwards in the vessels of the mucosa. Inflammation is initiated where the agents settle in or under the mucosa. We propose that most IPS results from multiple such incursions, while Pseudocysts arise from potent single incursions or serial incursions along a single small-vessel pathway.
Finally, ostiomeatal obstruction arises when the rising agents, or the mucosal stripping, reach the ostium via the maxillary sinus walls. From here, the mucosal inflammation extends out into the middle meatus and further up the sinonasal system.

Three Tier Odontogenic Sinusitis - note sparing of posterior ethmoids 2.tif
Multimodality Imaging Overview of the Common and Uncommon Sinonasal Cavity Mass Lesions
Poster Number: SIN-23

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Abstract Details

Purpose:
2. To identify and to formulate the appropriate differential diagnosis for common and uncommon sinonasal cavity masses based on clinical presentations and imaging features.

Methods:
Common and uncommon cases of sinonasal cavity masses, correlated with histopathology when available, were identified through retrospective chart review. Relevant neuroimaging studies, including but not limited to CT, MRI and PET, were presented for discussion.

Discussion:
Sinonasal cavity mass lesions are common, and can be congenital or acquired. Congenital lesions include rare developmental mid-line nasal masses and also included normal anatomical variants. Acquired sinonasal cavity mass lesions may be due to underlying infectious, inflammatory or neoplastic processes.

Summary/Conclusion:
Sinonasal cavity masses are a commonly encountered entity. Congenital mass lesions are rare but often easy to identify the correct diagnosis when considering the developmental anatomy. Acquired mass lesions often have nonspecific imaging features, and when forming a differential diagnosis one must take into account of the patient's clinical presentations, risk factors, and imaging features. Neuroradiologist plays an important role in the mapping of the disease location and extent of mass for better treatment planning.
Respect My Space: A Review of Premaxillary Space Anatomy and Pathology
Poster Number: SIN-24

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Abstract Details

PURPOSE:
The premaxillary space has recently been described as a discrete anatomic entity in the surgical literature, however there is a paucity of radiology literature describing this space and the pathology in this location. We present an image based review of the anatomy and pathology that occurs within this lesser known space.

APPROACH/METHODS: Representative CT and MRI images were selected to depict anatomy and pathology which can occur in the premaxillary space.

FINDINGS/DISCUSSION:
This exhibit will initially define the boundaries and contents of the premaxillary space, as recently described in the surgical literature. A host of pathologies that involve the premaxillary space will then be reviewed, including those that extend into the premaxillary space from nearby regions and those isolated to the space itself. Extrinsic processes that will be covered include odontogenic infection, complicated or invasive sinusitis, maxillary alveolar ridge or palatine tumors, and sinonasal tumors. The isolated premaxillary mass differential will then be discussed, which predominantly includes lymphoma and perineural tumor. Lymphoma will be emphasized, as it is a common cause of an isolated premaxillary space lesion, and consideration of this diagnosis may aid in tissue sampling, since core biopsy may be required as opposed to FNA alone. Finally, the exhibit will touch upon iatrogenic causes of premaxillary soft tissue abnormalities commonly seen after plastic surgery interventions, including implant or filler placement, as well as their complications. Imaging pearls to help differentiate between the different premaxillary entities and pitfalls in diagnosis will be highlighted.

SUMMARY/CONCLUSION:
It is important for interpreting radiologists to include the premaxillary space in their imaging checklist and to be familiar with the pathology that can occur in this location. These include extrinsic processes as well as lesions confined to the premaxillary space on imaging. Importantly, lymphoma should be considered in the differential diagnosis for an isolated premaxillary space lesion.
IMAGES:
Three sample images from the exhibit are provided as a part of the abstract. (Images are uploaded as one
JPEG, as the system is not currently allowing multiple JPEGs to be uploaded. If only one slide is allowed in
the abstract submission, please consider only the middle slide).
Premaxillary space: Spectrum of pathology

- Most common processes to secondarily involve the premaxillary space
  - Osseodentogenic infection
  - Complicated or invasive sinusitis
  - Maxillary alveolar ridge or palate tumors
  - Sinonasal tumors

- Most common processes that can be isolated on imaging to the premaxillary space
  - Lymphoma
  - Perineural tumor (occult primary site; recurrence at V2)
  - Intranasal implants or fillers

Isolated Premaxillary Space Lesion: Lymphoma

- Consider lymphoma in a mass confined to the premaxillary space
- Likely extranodal tumor, although could skin represent perineural tumor, less likely facial lymph node involvement, given the location deep to the muscle
- Look for pathologic lymph nodes and for other sites of extranodal involvement, including soft tissue in the nasal cavity, orbit, etc

Premaxillary Space Lesion: Perineural Tumor

- Maxillary division of the trigeminal nerve V2 courses through the premaxillary space
- For a lesion in the premaxillary space, it is important to correlate with a history of skin cancer and scrutinize the course of V2, including the infraorbital nerve canal and the inferior orbital fissure, to evaluate for possibility of perineural tumor spread
Imaging of the New Hat Wearer: Pearls and Pitfalls in the Workup of Scalp Malignancy
Poster Number: SIN-25

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Abstract Details
Purpose: The purpose of this educational exhibit is to provide a systematic approach to imaging staging of advanced scalp malignancies. This exhibit will illustrate the common patterns of lymphatic and perineural spread as well as describe the features of the primary tumor that can change clinical management.

Description: Solar radiation exposure is a risk factor for the development of skin malignancy, particularly in fair skinned individuals living and working outdoors at high elevation and sun drenched environments such as the mountain west. Unfortunately, some patients with scalp malignancy remain untreated for long periods of time due to fear and denial. These are patients who present for clinical evaluation as “a new full time hat wearer” often brought in by concerned family members. The purpose of this educational exhibit is to provide a systematic approach to imaging staging these very complicated patients. This exhibit will illustrate the common patterns of lymphatic and perineural spread as well as describe the features of the primary malignancy that can change clinical management.

Summary: Scalp malignancy is an unusual indication for imaging and many patients present with surprisingly advanced disease. We review interesting cases with a focus on patterns of spread and local invasion.
Syndromic and non-syndromic keratocystic odontogenic tumors: Imaging findings.
Poster Number: SIN-26

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Abstract Details

Background/Purpose:
Keratocystic odontogenic tumors (KCOTs) are unilocular or multilocular expansile cystic lesions with sclerotic rim that originate from the stratified squamous keratinizing epithelium along the dental lamina and periodontal margin of the mandibular/maxillary alveolus. Although size or location does not have influence on recurrence rate, this is more frequently seen in multilocular than unilocular cysts.

They are commonly discovered incidentally, but sometimes are associated with Gorlin-Goltz syndrome, or other syndromes such as Marfan or Noonan syndromes.

Gorlin-Goltz syndrome (also known as basal cell nevus syndrome) is attributed to 9p22.3 abnormality that affects gene PTCH1, characterized by multiple KCOTs, multiple basal cell carcinomas and other abnormalities. KCOTs occurring in Gorlin-Goltz syndrome have a higher recurrence rate when compared to non-syndromic solitary KCOT. This aggressive behavior may be caused to the presence of satellite and daughter cysts in the context of a syndrome.

The purpose of the exhibit is to 1) illustrate the imaging findings of the KCOTs, 2) analyze the imaging differences between the isolated KCOTs and those seen in a syndromic context.

Description/Table of contents:
This is a retrospective teaching exhibit with cases identified from the database of a tertiary university hospital to illustrate isolated KCOTs and those related to Gorlin- Goltz, Marfan or Noonan syndromes.

-We review and discuss the imaging findings of KCOTs of the jaw using diagrams, radiographs, CT and MR images from our database.
-We discuss the CT and MR imaging techniques and protocols to analyze KCOTs of the jaws.
-We describe the imaging findings of non-syndromic and syndromic KCOTs.

Summary:
Keratocystic odontogenic tumors are unilocular or multilocular benign cystic neoplasms of the jaw with aggressive behavior and high recurrence rate seen isolated or associated to syndromes (such as Gorlin-Goltz, Marfan or Noonan). Radiologist may be aware of certain KCOT imaging findings that could raise the suspicion of an underlying syndrome.
Purpose:
Skull base tumors are notoriously difficult to treat due to the inherent high risk of complications from a large number of neurovascular structures within an anatomically dense area. In the management of skull base lesions, craniofacial and endonasal approaches have become viable options either in conjunction or in isolation. However, accurate postoperative imaging remains an issue due to changes in anatomy from surgical defects, reconstructions, or any grafts. Hence a solid fundamental understanding of anticipated postoperative imaging features and expected deviations become crucial for subsequent imaging surveillance.
Materials & Methods:
We present a review of the imaging features involved in diagnosis and treatment surveillance for skull base tumors. The expected appearance as well as possible acute and delayed complications following surgical intervention and radiotherapy are discussed. Insight into the frequent locations of disease recurrence are also presented.

Results:
Each imaging modality has a unique range of practical applications. CT is often utilized for good soft tissue resolution, excellent assessment of bone, detection of cervical adenopathy, and rapid image acquisition for patients who are medically unstable or unable to maintain a still supine position. Similarly, magnetic resonance imaging (MRI) provides greater soft tissue resolution and is the modality of choice when investigating dural invasion or perineural spread. Diffusion weighted imaging (DWI) MRI is an adjunct to CT and/or MRI in the early post-treatment period to elucidate tumor recurrence from normal expected changes. FDG PET/CT has limited utility in the immediate 12 week post-treatment phase due to the higher likelihood of false positive and negatives from inflammation and vascular compromise respectively.

Following skull base reconstruction, the majority of postoperative complications occur acutely in the immediate period, including seroma/fluid retention, fistula formation, infection/abscess and flap necrosis. For fluid collections CSF leaks and chylous fistulas are the primary concern. On CT and MR imaging, particularly in the inferior lower left neck, a peripherally enhancing fluid collection may represent a chylous leak, a hematoma, an abscess or a seroma. MR is indicated in situations where fluid or soft tissue is subjacent to a bony defect it cannot be reliably distinguished or identified on CT, thus T2 weighted imaging complimented by fast imaging employing steady-state acquisition (FIESTA) sequence allows differentiation of herniation contents. When investigating for reconstruction ischemia or necrosis, a highly reliable sign is venous thrombosis, commonly occurring within 1-5 days following surgery. At this point dedicated vascular studies to exclude both arterial and venous thrombosis are warranted. Long term complications detected on skull base imaging include osteoradionecrosis, radiation vasculopathy, cerebral necrosis, spinal and cranial neuropathy, and neoplasm induction.

Conclusion:
Knowledge of the expected appearance following open and endoscopic surgical reconstruction, as well as radiation therapy, is necessary to successfully delineate complications and recurrences. An understanding of latencies involving tumor recurrence and early versus late complications can be aligned with the clinical context to formulate a logical approach to equivocal findings. Lastly, an appreciation of the utility and limitation of various imaging modalities will allow for troubleshooting of challenging cases and avoid unnecessary over-investigation.
Remembered and unremembered paths and passages at the skull base: What a radiology resident needs to know.
Poster Number: SKB-02

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Abstract Details

Purpose:
There are multiple foramina and canals at the skull base that are important for the transmission of the 12 cranial nerves and the major vessels that supply the brain.

These structures generally are well described in the literature and are commonly discussed in our radiology reading rooms. However, there are many other foramina and canals of the anterior, middle, and posterior cranial fossa base that are not discussed frequently in radiology. These structures are commonly confused and misinterpreted as fractures, especially by trainee radiologists. The knowledge of these unremembered structures will be of tremendous help when evaluating images for intracranial spread of head and neck pathologies.

Description:
The radiology, anatomy as well as surgical literature is reviewed for foramina, canals, and recesses of the skull base. Very little has been discussed in our radiology literature. High resolution CT and MR images have been reviewed to identify the radiologic features of these unremembered paths and passages. Special attention has been paid for their location and structures passing through them. Pathology arising from these structures or their secondary involvements will also be evaluated.

Discussion:
Multiple foramina, recesses and canals of the cranial base are identified on CT and MR imaging. Out of these, we discuss few anatomical structures rarely been discussed or mentioned in Radiology literature and even rarely discussed during routine readings. Few of the notable structures include (not limited to) foramen cecum, the anterior and posterior ethmoidal canals, foramen of Vesalius, glossopharyngeal meatus, the petromastoid canal, mastoid canaliculus, inferior tympanic canaliculus and posterior condylar canal. Prior knowledge and careful scrutiny of these structures is crucial to recognize them and evaluate for their possible pathologies.

Conclusion:
Understanding of the anatomy of the skull base foramina and recesses is important when evaluating pathologies like tumors and infections of the head and neck that have a tendency to spread intracranially. Additionally, differentiation of anatomical canals from skull base fractures is difficult without prior knowledge of their existence. These less commonly studied structures that are not described frequently in the radiology literature are however important in the radiologic evaluation of skull base pathology. This exhibit will acquaint the radiology residents and young head and neck radiologist to these unremembered paths and passages at the skull base and reinforce to look for them while evaluating studies in a real world inside our reading rooms.
A. Foramen of Vesalius: Transmits an emissary vein from the cavernous sinus to the pterygoid plexus. B. Posterior ethamoidal canal: Transmits posterior ethmoidal Artery, Vein and nerve. C. Palatovaginal canal: Transmits the pterygovaginal artery which is a branch of the maxillary artery. D. Posterior condylar canal: transmits an emissary vein anastamosing the jugular bulb or sigmoid sinus to the suboccipital venous plexus.
Pathogenesis of CAPNON: Collision or Collusion?
Poster Number: SKB-03

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Abstract Details
PURPOSE:
To perform radiologic-pathologic correlation of calcifying pseudoneoplasms of the neuraxis (CAPNON) in the head and neck (H&N) based on retrospective review of cases at our institution.

MATERIALS & METHODS:
Following institutional review board approval, we searched the hospital information system for pathology-proven cases of H&N CAPNON diagnosed between 1997-2017. Radiologic-pathologic correlation was performed with retrospective review of CT and MR images from the radiology database, as well as tissue slides and immunohistochemistry from the pathology database.

RESULTS:
A total of 47 patients were identified with CAPNON, of which 11 lesions (23%) localized to H&N and 36 lesions (77%) to spine. For H&N lesions, mean age at diagnosis was 38 years (range 7-86), with 7 (64%) female and 4 (36%) male. A history of inciting trauma was elicited in 2 (18%) patients and presenting symptoms included seizure (36%), pain (36%), weakness (27%), and swelling (18%). At imaging, all lesions were parameningeal in location with dense calcifications, variable enhancement, and mass effect/vasogenic edema related to size. Osseous remodeling was negligible in the majority (73%) of cases, with isolated examples of hyperostosis, smooth bone erosion, and irregular bone destruction. Recurrence at follow-up was noted in 2 (18%) cases, both treated by subtotal resection. Pathologic features included variably fibro-osseous stroma with coarse calcifications, occasionally associated with reactive meningothelial cells and fibrosis. “Dual” or concurrent pathology was noted in 5 H&N cases (45%) and included atypical meningioma with parenchymal brain invasion (see Image), dysembryoplastic neuroepithelial tumor, pleomorphic xanthoastrocytoma, meningioangiomatosis, and synovial chondromatosis.
DISCUSSION/CONCLUSIONS:
CAPNON—also known as CRUDoma or fibro-osseous lesion—is an unusual CNS lesion reported in various extra- and intraaxial locations including cerebrum, corpus callosum, posterior fossa, skull base, craniovertebral junction, spine, and nerve roots. Clinical presentation depends on lesion location and size, with resultant mass effect on brain, spinal cord, and/or nerves. These are benign and slowly growing lesions with no metastatic potential, though wide resection is preferred due to the locally aggressive behavior, with tendency for recurrence.

Radiologically, the diagnosis of CAPNON should be considered whenever a densely calcified lesion is identified along the neuraxis, particularly when dural-based and atypical for tumor. On CT, there is a dense nodular calcification pattern with variable bone reaction. At MR, there is corresponding susceptibility with low T1/T2 signal and variable peripheral enhancement, dural thickening, parenchymal edema, and marrow involvement. Histologically, CAPNON is characterized by nodular chondromyxoid matrix with varying proportions of dense metaplastic calcification/ossification, inflammatory infiltrates, and fibrovascular stroma.

The pathophysiology of CAPNON is as yet undetermined and has occasionally been reported in conjunction with other brain abnormalities including neoplastic, infectious, and congenital. In our series, radiologic-pathologic correlation and association of a proportion of our cases with a variety of other CNS lesions supports a likely reactive/dysplastic etiology.
The Devil is in Missing the Details: Beware of intracranial complications of skull base infections
Poster Number: SKB-05

Abstract Details
Purpose: Skull base infections (SBI) carry significant morbidity and mortality, requiring prompt and aggressive antimicrobial management combined with surgical debridement and drainage when necessary. Unfortunately, the nonspecific nature of initial clinical manifestations and radiological findings may result in diagnosis delay until patient symptomatology reflects complications related to intracranial extension and/or cranial nerve involvement. After summarizing the early imaging findings of SBI and an algorithmic approach its diagnosis, this pictorial review focuses on complications associated with SBI including cranial neuritis, meningitis, sinus thrombosis, epidural/subdural empyema, cerebritis and brain abscess, aneurysm and infarction. The role of imaging in distinguishing SBI from post radiation osteonecrosis and skull base involvement from nasopharyngeal malignancy is also briefly discussed.

Abstract: The most common source of the SBI is direct extension from sphenoid sinus and petromastoid complex infections. Less frequently SBI may be to postoperative infection, penetrating trauma, and very rarely from hematogenous seeding or temporomandibular joint sepsis. Whereas acute pyogenic (bacterial) infections are the most common underlying pathogen in immunocompetent subjects, invasive fungal disease typically affects immunocompromised individuals. CT examination of the paranasal sinuses and temporal bone is usually the initial imaging modality, and is superior to MRI for detection of bone erosion or destruction.
However, in absence of cortical bone destruction subtle soft tissue abnormalities such as dural thickening and small adjacent fluid collections may be easy overlooked on CT even by an experienced observer. Due to superior sensitivity for marrow edema, delineation of soft tissue inflammatory changes and detection of early intracranial complications, contrast enhanced MRI should readily be performed in the setting of a negative CT exam if SBI is clinically suspected. This is particularly important is immunocompromised patients suspected to have invasive fungal sinusitis.
Illustrative cases:

Figure 1: Left cavernous carotid artery pseudoaneurysm (arrow) complicating invasive fungal sphenoid sinusitis.

Figure 2: Diffuse central skull base osteomyelitis complicating bacterial sinusitis. Note extensive dural enhancement (arrows).
Diffusion Weighted Imaging in Skull Base Lesions: What a Radiologist should know?

Poster Number: SKB-09

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Abstract Details

Purpose
1. To outline the imaging techniques and normal findings of diffusion-weighted MRI (DWI) in the skull base lesions.
2. To describe the advantages and potential pitfalls of DWI in the head and neck compared with conventional MRI.
3. To illustrate use of DWI imaging features to differentiate various skull base pathologies.

Description

Skull base lesions can be related to wide number of pathologies including infections, benign and malignant tumors. Accurate diagnosis and differentiation between these entities is important for prompt and appropriate institution of treatment. However, CT and routine MRI techniques only provide information on the extent of the lesions with limited ability to differentiate between benign and malignant lesions. Diffusion-weighted imaging (DWI) can help in many such situations by providing additional information, and help in differentiating benign from malignant lesions, so that appropriate treatment can be initiated. In this electronic exhibit, we illustrate the imaging findings of the spectrum of skull base lesions, emphasizing the role of DWI in this domain.

Following clinical situations will be discussed:

Benign lesions:

Skull osteomyelitis, Cholesteatoma, Fibrous dysplasia, Juvenile nasopharyngeal angiofibroma, Aspergillus infection, Craniopharyngioma, Ecchordosis physaliphora, Posterior fossa epidermoid, Meningioma
Malignant lesions:

Chondrosarcoma, Chordoma, Nasopharyngeal carcinoma, Lymphoma, Skull metastases, Rhabdomyosarcoma, Malignant schwannoma

Summary

1. Although CT and routine MR pulse sequences are very good in defining the extent of skull base lesions and associated bone destruction, they are not reliable in the differentiation of benign from malignant pathologies.
2. DWI is a promising, noninvasive approach that can be used in the characterization of skull base lesions, differentiate malignant tumors from benign lesions and evaluate the pathological grading of malignant tumors.
Imaging of Skull Base Schwannomas
Poster Number: SKB-10

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Abstract Details
Purpose:
To review the imaging findings of skull base schwannomas by using illustrative examples to review anatomy, discuss the differential diagnosis and the role of imaging in treatment planning.

Description:
Schwannomas are benign nerve sheath tumors that may arise along the complex course of the cranial nerves (CNs), not infrequently presenting as skull base lesions. Sound knowledge of the CN anatomy and imaging features of schwannomas is paramount for making the correct diagnosis. In this review, approaches to diagnosing CN schwannomas by describing their imaging characteristics and the associated clinical presentations will be discussed. Relevant anatomic considerations are highlighted by using illustrative examples and key differential diagnoses categorized according to regions in the skull base involved. Individuals with the inherited disorder neurofibromatosis type 2 are predisposed to multiple schwannomas. The radiologist's role is to confirm the imaging features of schwannomas and exclude appropriate differential considerations. The characteristic imaging features of CN schwannomas reflect their slow growth as benign neoplasms and include circumscribed margins, displacement of local structures, and smooth expansion of osseous foramina.

Summary:
With a detailed understanding of the course of the CNs and imaging findings of skull based schwannomas, the radiologist can have a key role in the diagnosis and treatment planning of these skull base lesions. This exhibit will highlight the key features and improve their understanding.
Imaging of Meckel's cave – anatomy and pathology
Poster Number: SKB-11

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Abstract Details
Purpose:
To review the anatomy of Meckel's cave and imaging findings of different pathologies involving Meckel's cave.

Description:
Meckel's cave is a natural mouth-shaped dural-lined structure connecting the medial portion of the middle cranial fossa with the posterior fossa. The cave extends forward similar to an open-ended three-fingered glove and provides a channel for the rootlets of the trigeminal nerve; the trigeminal ganglion; and the ophthalmic (cranial nerve V1), maxillary (cranial nerve V2), and mandibular (cranial nerve V3) divisions until they reach their respective foramina.

Schwannomas of the trigeminal nerve and meningiomas are benign tumors that are the more frequent pathologies involving the Meckel's cave. Less commonly lymphoma and dural-based metastasis can involve this region. Perineural spread of head and neck cancers frequently involves the trigeminal nerve and can be associated with skip lesions. Infections such as VZV, listeria and tuberculomas may present with imaging findings in Meckel's cave and involve the trigeminal nerve. Neurosarcoidosis can also frequently involve this region. Petrous apex cephaloceles can present with a variety of neurologic symptoms and have unique imaging appearance. Rare lesions presenting in the Meckel's cave region are epidermoid and amyloidoma of the trigeminal nerve.

Summary:
This review will comprehensively review the complex anatomy of Meckel's cave and surrounding structures, and discuss the imaging findings of pathologies involving this region. This will provide the knowledge needed to devise a more complete imaging strategy for accurate diagnosis and treatment planning.
Do not touch lesions of the central skull base and middle cranial fossa
Poster Number: SKB-12

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Abstract Details

Background/Purpose:
The skull base represents the floor of the cranial cavity and connects the central nervous system with the neck and facial structures. The body of the sphenoid bone forms the central portion of the central skull base and the petrous portion of the temporal bone represents its posteromedial boundary, with several foramina for cranial nerves and vessels traversing this region.

Multiple diseases involve this complex anatomic region, some of them benign or non-aggressive that do not need to be treated. Radiologist and ENT surgeons should be familiarized with these entities in order not to cause useless harmful treatments.
Some of these entities are: dysplasias and endocrinologic disorders; cephalocele; congenital/developmental
cystic lesions (dermoid /epidermoid cyst or arachnoid cyst); benign tumors (meningiomas, neurofibromas,
shwannomas); petrous apex pseudolesions; vascular pathologies

The purpose of the exhibit is to 1) illustrate the anatomy of the central skull base and middle cranial fossa with
its openings and contents, 2) analyze the imaging approach and discuss optimized advanced imaging
techniques, and 3) illustrate the “do not touch” lesions that can involve the central skull base and middle
cranial fossa.

Description/Table of contents:
This is a teaching exhibit with cases identified from the database of a tertiary university hospital to review the
central skull base and middle cranial fossa anatomy and the benign and non aggressive lesions that may be
involved in this region.

-We review and discuss the anatomy of the central skull base and middle cranial fossa using diagrams, CT
and MR images from our database.
-We discuss the CT and MR imaging techniques and protocols to better identify normal structures and
pathological findings.
-We describe the imaging findings of non-aggressive or benign pathologies and pseudo lesions that affect the
central skull base and middle cranial fossa.

Summary:
This pictorial review aims to help the reader better understand the anatomy of the central skull base and
middle cranial fossa , and its important passageways and communications. Many lesion in this region are
benign or non-aggressive in their behavior, and therefore should not be treated since any action over them
could be harmful.
Acute Otomastoiditis: Coalescing the Complications
Poster Number: TB-01

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Abstract Details
TITLE:
Acute Otomastoiditis: Coalescing the Complications

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INSTITUTE:

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PURPOSE:

1) Discuss relevant temporal bone anatomy and pathophysiology of acute otomastoiditis (AOM) using illustrative diagrams and radiographic images.
2) Review the spectrum of imaging findings of AOM and its complications

BACKGROUND:

Acute otomastoiditis refers to an acute pyogenic infection of the middle ear and mastoid air cells, most commonly caused by Streptococcus pneumoniae and Haemophilus influenzae. Significant intra- and/or extracranial complications may occur with AOM via retrograde thrombophlebitis, direct extension, congenital bony dehiscence or hematogenous dissemination. These can have devastating sequelae, given the proximity of the inflammation to the brain, major vessels, and skull base and may even require emergent surgical intervention. CT is frequently the first imaging modality to evaluate for complications, although many patients require MR imaging to better define soft tissue, intracranial and skull base involvement.

IMAGING FINDINGS:

- Subperiostial abscess
- Bezold abscess
- Epidural abscess
- Subdural empyema
- Meningitis
- Brain abscess
- Internal jugular vein thrombosis
- Dural venous thrombosis
- Petrous apicitis/Gradenigo’s syndrome
- Labyrinthitis
- Skull base osteomyelitis

CONCLUSION

Acute otomastoiditis can have significant neurological complications, given the location of the mastoids and their proximity to vital structures. This exhibit includes a concise review of the pathophysiology of otomastoiditis along with a comprehensive review of the spectrum of associated complications.
The Spectrum of Middle Ear Pathology
Poster Number: TB-02

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Abstract Details
PURPOSE:
1. Review key MR and CT findings of commonly encountered pathology involving the middle ear.
2. Discuss the clinical implications of these findings.

DESCRIPTION:
MRI and CT play an important role in the evaluation of multiple entities involving the middle ear, including neoplastic and non-neoplastic masses, anatomic abnormalities, vascular anomalies, infectious/inflammatory diseases, pre- and post-operative evaluation, and post-traumatic sequelae. The imaging findings are often sufficient to make the definitive diagnosis. It is imperative that the interpreting radiologist understand the differentiating imaging features of each disease in order to help guide the patient’s clinical management.

SUMMARY:
Pathology of the middle ear to be presented in this educational exhibit includes, but is not limited to: glomus tumors, including key imaging differences between the different types (glomus tympanicum, glomus jugulare, glomus jugulotympanicum); cholesteatoma (pars flaccida and pars tensa); dehiscence of the jugular bulb; dehiscence of the internal carotid artery; temporal bone fractures; tympanosclerosis; otomastoiditis; and evaluation of ossicular prostheses. The masses presented demonstrate imaging features sufficient for accurate diagnosis, although they have also been confirmed on pathology following surgical excision. Representative images submitted for this abstract include glomus tympanicum (CT and MR), jugular bulb dehiscence (CT), and cholesteatoma (DWI and ADC).
Imaging the complications of cholesteatomas, a pictorial review
Poster Number: TB-03

Abstract Details

Purpose:
To demonstrate the imaging appearance of a variety of complications of middle ear and mastoid cholesteatomas.

Discussion:
Cholesteatomas are nonneoplastic collections of keratin lined by stratified squamous epithelium in the temporal bone, most commonly situated in the middle ear cavity. These lesions have an annual incidence of 3/100,000 in children and 9.2/100,000 in the adult population. Cholesteatomas can be congenital or acquired. On visual inspection, cholesteatomas appear pearly, white, and waxy. Characteristically, they restrict diffusion on MRI, and may be locally aggressive. Multiple theories regarding the pathogenesis of cholesteatomas have been proposed. As a cholesteatoma enlarges it can erode and destroy adjacent structures, including ossicles and bony confines of the middle ear cavity, as well as dehiscence and fistula of labyrinthine components and the facial nerve canal.
Imaging is crucial to delineate lesion extent and evaluate for potential complications of cholesteatomas, as well as distinguish recurrent or residual lesions from other postoperative changes. Cholesteatomas are invasive aggressive lesions that if not treated can lead to serious and disabling complications. Accurate preoperative delineation of the extent of cholesteatoma involvement and complications is crucial to successful operative planning and avoidance of operative complications. Involvement of the sinus tympani is associated with a higher postoperative recurrence rate.

We will illustrate potential complications of cholesteatomas, which include: semicircular canal dehiscence and labyrinthine fistula (blue arrow and arrowhead on accompanying image), hearing loss from ossicular destruction and/or cochlear erosion, oval window fistula, facial nerve canal dehiscence and facial palsy due to compression, inflammation or perineural extension of disease, erosion of the sigmoid sinus plate and secondary sigmoid sinus or internal jugular vein thrombosis, and tegmen tympani erosion with intracranial extension, abscess formation, and/or encephalocele.

Summary:
In addition to confirming the diagnosis of primary or recurrent/ residual cholesteatomas, imaging is crucial to evaluate for associated complications. Awareness of these complications and their imaging appearance is critical for planning successful operative management.
The Didgeridoo Eustachian tube
Poster Number: TB-04

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Abstract Details

Purpose: To characterize a Eustachian tube (ET) anomaly with abnormal course found in eight CT examinations.

Materials and methods: Incidentally, we have discovered a particular ET developmental anomaly in eight patients (4 female, 4 male). All patients had a CT examination which included the temporal bone, although the background for referral varied. Age at CT imaging ranged from 11 months to 31 years. Clinical information on ET related disease was not given, nor denied in any of the referrals. Six patients had been diagnosed with oculo-auriculo-vertabral spectrum (OAV) by expert clinicians on “the Norwegian National Team for treatment of rare craniofacial disorders”.

Results: The common findings were a long, wide, pneumatized bony portion of the Eustachian tube with a horizontal progression from the hypotympanon to the sphenoid bone. The ET entered the sphenoid bone dorsal or lateral to the sphenoid sinus, but there was no visual communication between the ET and the sinus. There was a widening at the sphenoid end, giving the tube a visual resemblance to a Didgeridoo (native Australian musical instrument). The narrowest point measured in the axial plane varied from 1 to 7 mm, with an average of 2.5 mm. The widest diameter varied between 3 and 12 mm, with an average of 5.1 mm. One patient had yet to develop the sphenoid sinus, indicating that the anomaly is not dependent on the pneumatization of the sphenoid sinus. In all but one patient there was a short, air filled, almost vertical soft tissue tube from the sphenoid bone to the roof of the epipharynx, resembling the cartilaginous portion. One patient was bilaterally affected.

Coinciding findings were middle ear anomalies including the ossicles (all), semicircular canal anomalies (5), semicircular canal and cochlear anomalies (1), outer ear and external acoustic canal anomalies (6). Conclusion: We refer eight patients with a Eustachian tube anomaly which previously is scarcely documented. The Eustachian tube can enter and run through the sphenoid bone in which it widens into a funnel shape. These tubes are wider and longer than normal, and have a more horizontal course. This particular anomaly seems to coincide with other developmental anomalies in the middle ear. Pneumatization of these tubes is not dependent on a pneumatized sphenoid sinus.
Abstract Details
The purpose of this exhibit is:
- To expose radiologists to a series of common and not-so-common temporal bone anomalies associated with syndromes
- To discuss mimics and differential diagnoses, as well as other associated imaging findings, which will help improve the radiologist's diagnostic accuracy with cases of temporal bone anomalies

Outline:
The exhibit will review the temporal bone anatomy and clinical implications. Next, cases will be presented in a quiz format. Key mimics, differential diagnoses and associated imaging findings will be highlighted in the discussion of each case. The list of cases includes:

Charge syndrome
Goldenhar syndrome
Down syndrome
Turner syndrome
Branchio-oto-renal syndrome
Klippel feil
Cornelia de Lange
Crouzon syndrome
Trisomy 18
Pierre Robin sequence
Waardenburg syndrome
Alagille syndrome
Osteogenesis imperfecta
Osteopetrosis
Neurofibromatosis 2
Underdeveloped left middle ear cavity associated with external auditory canal atresia.

Case 1 Additional Findings

Left hemifacial microsomia with atrophy of the muscles of mastication and microtia

Diagnosis: Goldenhar syndrome
Purpose
To provide a streamlined review of congenital malformations in the temporal bone with an emphasis on embryogenic development.

Description
This presentation reviews congenital malformations in the temporal bone beginning with an embryologic overview of the development of the temporal bone and associated radiological anatomy. Congenital pathology of the temporal bone involving the middle ear and inner ear will be reviewed including ossicular anomalies, cochlear dysplasia, enlarged vestibular aqueduct syndrome and otodystrophies, among others. Finally, a summary of syndromic associations will be presented including Klippel-Feil syndrome, Treacher Collins syndrome and Crouzon disease.

Summary
A review of congenital malformations in the temporal bone is provided with a focus on embryological development and also presents a review of associated syndromes.
Navigating the petrous apex- A pictorial review of classic lesions of the petrous apex and their mimics
Poster Number: TB-09

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Abstract Details
The petrous apex is a small anatomical structure but becomes clinically relevant secondary to its unique anatomical location, proximity to critical neurovascular structures and propensity for secondary involvement. The purpose of this review is to highlight
1. The anatomy of the petrous apex.
2. Illustrate the anatomical variants and developmental disorders mimicking pathology such as asymmetric fatty marrow, asymmetric pneumatization, cephaloceles, fibrous dysplasia and pseudofractures.
3. Expand on the spectrum of common inflammatory and infectious conditions ranging from innocuous effusions, mucoceles and cholesteatomas to the acute apical petrositis and osteomyelitis.
4. Describe the common and uncommon appearances of petrous apex neoplasms. These will include lesions intrinsic to the petrous bone (such as chondrosarcoma, chordoma, endolymphatic sac tumors), tumors or lesions invading from adjacent structures (such as meningiomas, schwannomas, aneurysms, paragangliomas, nasopharyngeal carcinoma and sinonasal tumors) and lesions causing secondary involvement from distant sites (such as Langerhans cell histiocytosis, myeloma, metastasis and leukemia).

After reviewing the exhibit the reader will be confident in differentiating pathology from variant anatomy and be able to provide a list of relevant differential diagnosis for lesions affecting the petrous apex.
Fibrous dysplasia mimicking a mass in the petrous apex

T2 hyperintense, heterogeneously enhancing lesion in the right petrous apex, mimicking a lesion. CT demonstrates the ground appearance of the sphenoid wing extending into the petrous apex in this young patient suggesting underlying FD. Appearance was stable over 2 years.
MRI replacing second look surgeries for cholesteatomas: A review of current imaging technique, expected postop findings, and imaging pitfalls

Poster Number: TB-10

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Introduction/ Purpose:
Canal-wall up mastoidectomy surgeries for cholesteatoma resection have traditionally required a second look surgery within the first year following the initial operation. Advances in MRI, with improved quality of non-echo-planar diffusion weighted imaging (DWI) techniques reliably detect even tiny foci of recurrent disease and allow distinction from post treatment and inflammatory changes. At our institution, MRI has replaced obligatory second look surgeries in detection and management of recurrent cholesteatoma. This exhibit will demonstrate the spectrum of imaging findings of recurrent/residual cholesteatoma as compared to posttreatment and inflammatory changes and highlight imaging pitfalls.

Discussion:
Cholesteatoma is a nonneoplastic collection of exfoliated keratin within stratified squamous epithelium in the temporal bone. The initial diagnosis of cholesteatoma is typically straightforward, especially for larger lesions. The presence of bony erosions associated with a soft tissue attenuation mass in a typical location is characteristic, particularly in association with otologic findings. MRI demonstrates a mass with restricted diffusion and no central enhancement.

Depending on the location and extent of the cholesteatoma, as well as other relevant clinical factors, surgical options include a more extensive canal wall down procedure which is associated with a lower recurrence rate, or a canal wall up approach, which is generally preferred if possible, particularly in the pediatric population, but historically associated with a higher recurrence rate. Traditionally, canal wall up procedures have necessitated a second look surgery within the first year to detect residual or recurrent disease.
CT is not reliable in postoperative cases for distinguishing recurrent or residual cholesteatoma from other etiologies with soft tissue attenuation such as granulation, scar, effusion, and inflammation. Cholesteatoma does not enhance on MRI but postsurgical changes can make interpretation of post contrast MRI problematic. Early experience with echo-planar DWI was shown not to be sufficiently reliable to replace second look surgery in detection of recurrent cholesteatoma. Experience with various non-echo-planar techniques over the last decade has demonstrated remarkable sensitivity and specificity in detecting even small residual or recurrent lesions, and is now being used instead of a second look surgery in many cases.

In this exhibit, we will review the spectrum of expected post operative imaging findings following different types of mastoidectomy procedures for cholesteatoma, signs of recurrent disease and distinguishing from other post-treatment or inflammatory changes, and will also review imaging pitfalls, such as false positive DWI findings. The attached figure is one example of a pitfall encountered, where a focus of restricted diffusion in the anterior epitympanic recess was concerning for recurrent disease in a patient with prior mastoidectomy for cholesteatoma, but the focus of signal abnormality corresponded to the tensor tympani muscle, not recurrent cholesteatoma.

Conclusion:
Awareness of the normal imaging appearance of the postsurgical temporal bone, as well as expected findings and potential imaging pitfalls in evaluation for residual or recurrent cholesteatoma, increases the accuracy of radiologic interpretations, allowing MRI to reliably replace second look surgeries in most instances.
Navigating the Imaging Appearances of Labyrinthitis
Poster Number: TB-11

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Abstract Details
Purpose
The goal of this presentation is to review the pathophysiology and imaging characteristics of common as well as uncommon forms of labyrinthitis. This review includes cases from our institution that demonstrate both usual and unusual imaging findings of labyrinthitis as well as potential imaging mimics. Relevant anatomy of the inner ear, to include the bony and membranous labyrinth, will be reviewed. The clinical presentation of labyrinthitis, its etiologies, outcomes and treatment will also be discussed in brief.

Description
Labyrinthitis is an uncommon cause of hearing loss, vertigo and tinnitus. In its classic presentation, labyrinthitis leads to sudden, unilateral sensorineural hearing loss (SNHL), affecting patients of any age group. In general terms it is defined as inflammation of the membranous labyrinth. Mild inflammatory reactions will often appear normal on imaging. More fulminant cases will be characterized by hyperintense labyrinthine fluid on FLAIR sequences and post-gadolinium enhancement of the affected portions of the cochlea, vestibule and semicircular canals during the acute phase. The end-stage of the disease will often result in calcification of the inner ear (labyrinthitis ossificans), detectible on CT and MR. The most common etiology is infection, with viral being much more common than bacterial, however alternative causes such as autoimmune disease or trauma...
are also encountered. The vast majority of patients diagnosed with labyrinthitis fully recover, however outcomes vary based on the etiology. Treatment is also highly dependent on the underlying cause. Differential diagnostic pitfalls would include intralabyrinthine masses and post-surgical changes following vestibular schwannoma resection. Distinguishing features will be discussed.

Summary
Labyrinthitis is an uncommon but important cause of SNHL, vertigo and tinnitus. A detailed understanding of the anatomy of the inner ear, the imaging appearance of labyrinthitis and its potential imaging mimics can aid the radiologist in providing an accurate diagnosis that will potentially effect patient management and improve clinical outcomes.
Purpose:
The aim of this exhibit is to review infectious pathologies and their associated findings affecting the temporal bone and how the various steps leading to their proper diagnosis can dramatically affect clinical outcome.
Approach:
Related cases will be provided with initial presenting clinical signs and symptoms. Discussion will include but is not limited diseases such as otitis media, osteomyelitis, petrous apicitis, chronic otomastoiditis with acquired cholestatoma, and labyrinthitis. Associated secondary conditions will be identified. Different imaging modalities from initial workup to advanced techniques will be illustrated for each case. Additionally included will be pertinent examples of peri-operative findings and post-treatment clinical courses.

Discussion:

1. Discuss the causes of infectious pathologies of the temporal bone and their clinical presentations. Pictorial examples will be provided.

2. Case-based demonstration of characteristic imaging findings for diagnosis.

3. Discuss related complications including but not limited to meningitis, intracranial abscess, cranial nerve neuropathy, conductive hearing loss, and granuloma formation.

4. Discuss characteristic imaging findings for each provided pathology.

4. Discuss differential diagnoses and the consequences of misinterpretation.

Conclusion:
Infectious pathologies affecting the temporal bone can be complex and complications of these infections often carry the potential for extensive morbidity and mortality. At the end of the presentation, the viewer will become familiar with causes, clinical presentations, diagnostic imaging features, and differential diagnoses.
Optimization techniques for needle visualization in US guided thyroid FNA biopsies
Poster Number: THY-01

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Abstract Details
Fine needle aspiration biopsy (FNAB) of thyroid nodules is a procedure frequently requested of radiologists. Image guidance is the mainstay for thyroid nodule FNAB given the accuracy and safety compared to palpation based procedures. Ultrasound (US) is preferred over other imaging modalities given its availability, cost, and other inherent benefits (real-time imaging, radiation safety, etc.). With advances in ultrasound artifact-reduction technology employed on most modern ultrasound units, it is our experience that needle localization during FNAB has become more challenging. The acoustic impedance of the metal biopsy needle creates artifacts used to aid needle detection. Knowledge and manipulation of certain sonographic parameters can minimize artifact reduction improving visualization of the needle and thereby the safety of the procedure. With the aid of a phantom thyroid model, we present the ultrasound parameters that can be adjusted to improve needle localization in a step-by-step fashion. An example and explanation of each imaging parameter will be provided along with the overall final result (demonstrated on the provided Figures 1 and 2).
Purpose:
Using an online calculator (www.TIRADSCalculator.com) for Thyroid Imaging, Reporting and Data System (TI-RADS) with images and descriptions of each of the ultrasound features as a clinical and educational tool to guide management of incidental thyroid nodules.
Thyroid nodules are common, with a prevalence of up to 68% of adults on ultrasound (1). Fine needle aspiration (FNA) is the most effective test in determining if a thyroid nodule is malignant and occasionally surgery is required to achieve a definitive diagnosis. But most thyroid nodules are benign and not all nodules require FNA or surgery. Over diagnosis of thyroid cancer results in many detected thyroid cancers without affecting mortality between 45 to 80% of cases. Recent attention has been focused on developing a non-invasive system, called Thyroid Imaging, Reporting and Data System (TI-RADS), with the use of ultrasound for risk stratification of thyroid nodules to identify clinically significant malignancies while reducing the number of biopsies performed on benign nodules.

The American College of Radiology (ACR) released a white paper in 2017 on the use of the TI-RADS. TI-RADS is based on ACR recommended standardized terms for ultrasound reporting of thyroid nodules (2). Selected ultrasound features of thyroid nodules are combined into a score to identify nodules that warrant biopsy or sonographic follow-up. The use of TI-RADS to risk stratify incidental nodules may result in fewer unnecessary biopsies (3). In order to facilitate the use of TI-RADS, an online calculator was developed. To serve as an educational and clinical tool, images demonstrating each of the ultrasound features are included in the online calculator.

Summary:
An online calculator was developed for TI-RADS based on the ACR white paper in 2017 to facilitate the application of TI-RADS in clinical practice. Images and description of each of the ultrasound features of thyroid nodules are included to serve as an educational and clinical tool on the use of TI-RADS. Using TI-RADS in ultrasound based risk stratification of incidental thyroid nodules will guide management and potentially reduce unnecessary thyroid biopsies and interventions.

References:
TI-RADS Calculator

Online calculator for Thyroid Imaging Reporting and Data System (TI-RADS) based on 2017 ACR white paper with guidance on fine needle aspiration (FNA) and follow-up.

Click here for images and description for each of the ultrasound features

Composition (Choose 1):
- Cystic: almost completely cystic 0 points
  - Spongiform 6 points
  - Mixed cystic and solid 1 point
  - Solid or almost completely solid 2 points

Echogenicity (Choose 1):
- Areal: 0 points
  - Hypoechoic 1 point
  - Hyperechoic 2 points
  - Very hypoechoic 3 points

Shape (Choose 1):
- Wider-than-tall 0 points
- Taller-than-wide 3 points

Margin (Choose 1):
- Smooth: 0 points
  - Ill-defined: 3 points
  - Lobulated or irregular 2 points
  - Extra-thyroidal extension 3 points

Echogenic Foci (Choose All That Apply):
- Noise or large vascular artifacts 0 points
- Microcalcifications 1 point
- Parathyroid (not included): 2 points
- Focal hypoechoic nodule 3 points

Total Points: 0

TI-RADS Level: TRI

Recommendations: Biopsy: No FNA

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Reference:

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ACR Thyroid Ultrasound Reporting Lexicon PDF

Reference:
Ectopic Thyroid: A Review of Embryology, Etiology and Diseases
Poster Number: THY-04

Abstract Details
Purpose:
1. To review the embryology and etiology of ectopic thyroid tissue.
2. To review diseases that may arise in ectopic thyroid.
3. To review imaging clues of identification of ectopic thyroid and diagnosis of thyroid diseases.

Description:
Ectopic thyroid is a well-known entity in the head and neck. In most patients, this is found near midline along the thyroglossal duct. Rarely, ectopic thyroid can be found outside this predictable location. Atypical locations of ectopic thyroid may include submandibular and sublingual region, larynx, trachea, lateral neck, mediastinum and heart. Ectopic thyroid at these locations most likely arises from embryological dysgenesis, but other possible mechanisms have also been proposed, including mechanical implantation secondary to surgical intervention or trauma, development of normal follicles within cervical lymph nodes and metastasis from occult thyroid cancer. Atypical location of ectopic thyroid can be confusing for clinicians who are not aware of this possibility. Ectopic thyroid is at same risk of development of diseases seen in normal thyroid gland, including thyroid adenoma, goitre, inflammation and malignancy.
Imaging clues that help to identify ectopic thyroid include its parenchymal signal similar to that of normal thyroid gland, such as hyperdensity on CT. In some cases, the ectopic thyroid shares the same vascular supply or venous drainage with normal thyroid gland. Nuclear iodine imaging may help to confirm ectopic thyroid tissue.

Summary:
This educational exhibit will review the embryology and etiology of ectopic thyroid tissue, including lateral ectopic thyroid. Diseases that may arise in ectopic thyroid will be discussed and illustrated with case collection from our institutions.

Axial CT image (A) of neck showing a mass in right lateral neck (indicated by *) immediately posterolateral of the greater cornua of hyoid bone. The mass is heterogeneous but remains well circumscribed, suggesting non-aggressive mass.

Duplex ultrasonography (B) showing significant vascularity in the periphery of the mass.

Key imaging clues include:

1. Partial embedment in right infrahyoid muscle.
2. CT density and enhancement of parenchyma similar to normal thyroid gland seen at normal location on a different image (not shown).
3. Venous drainage through inferior thyroid vein.

The imaging appearance is very similar to thyroid goiter, but at the wrong location.

Goiter of ectopic thyroid is suspected, further supported by positive radiopharmaceutical uptake on nuclear iodine imaging. Diagnosis is confirmed by surgical excision.
Thyroid Malignancy. Staging and Restaging
Poster Number: THY-05

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Abstract Details
Determining the extent of disease is necessary for guiding the management of thyroid carcinomas. Diagnostic imaging, including ultrasound, CT, MRI, and nuclear medicine scans, plays an essential role in staging and restaging of thyroid carcinomas. This article reviews the approaches and imaging findings for evaluating the primary tumor, regional lymph node metastases, and distant metastases. In addition, potential pitfalls are discussed and depicted in this exhibit.
Neuroendovascular Procedures for Skull Base Neoplasia
Poster Number: VAS-01

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Abstract Details
Purpose
Neuroendovascular procedures are performed in skull base neoplasias with the objective of achieving preoperative embolization to increase the safety of surgical procedures by limiting intraoperative hemorrhage, reduce the need for blood transfusion, increase visibility in the surgical field, and shortening hospitalization length. While the benefits are significant, this procedure within itself carries a substantial range of repercussions including tissue ischemia, stroke, and death, thus a risk-benefit profile should be considered in each case. Hence embolization should be reserved for lesions with numerous, deep, surgically inaccessible tributaries, where a significant bleed is anticipated, or the tumor is surrounded by critical neurovascular structures.

Materials & Methods
We present an evidence-based review of the perioperative process involved in endoscopic embolization of skull base tumors. This summary will outline the risk-benefit profile as well as indications and contraindications taken into consideration when determining suitability of radiologic intervention, and resultant scope of outcomes. Additional parameters including circumstances in which temporary or liquid embolic agents are more amendable, preoperative imaging features, procedural details of angioembolization, and subsequent follow up monitoring are also discussed.
Results
Angiography often precedes embolization to establish tumor supply and collateralization as well as occluding anastomoses with coils. Additionally, it provides the interventionalist with the opportunity to become familiarized with the vasa nervorum and arteries supplying cranial nerves, as well as the tributaries supplying the tumor, thereby informing selection of an appropriate embolic agent. With encasement of large arteries like the ICA or vertebral, where inadvertent or deliberate sacrifice may be anticipated, preoperative balloon test occlusions may be utilized. Surgery often occurs within 72 hours of angioembolization to maximize benefits, while simultaneously occurring at increased risk of tissue necrosis, migration into collateral channels, and injury to the vasa nervorum in certain pedicles. The primary skull base tumors that most commonly benefit include meningioma, juvenile angiofibroma, and paraganglioma.

Conclusion
Neurointerventional procedures play a pivotal role in the management of skull base neoplasms. Pre-operative embolization must performed judiciously in the context of the potential harms and benefits imposed on the patient. While effective intervention can yield improved perioperative visualization with reduced tumor size and resultant blood loss, important risks for consideration include cranial nerve injury, tissue necrosis, access vessel injury, and death from inadvertent non-target embolization.
An institutional and literature review of the varying approaches for the biopsy of head and neck lesions
Poster Number: VAS-03

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Abstract Details
Purpose/Description: To compare and assess the varying approaches for percutaneous biopsies of head and neck lesions using institutional experience and a review of the literature.

Summary: There are multiple approaches to obtaining image guided percutaneous biopsies of lesions located within the complex anatomy of the head and neck region. Each has its own technical and anatomical considerations and limitations providing the radiologist with numerous options when considering obtaining a biopsy. We will review the indications as well as technical and anatomical considerations of varying approaches using our institutional experience with a review of the literature.
Carotid Blowout Syndrome - A Review of Imaging Findings, Interventional Management, and Treatment Complications
Poster Number: VAS-04

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Abstract Details
Purpose: The purpose of this exhibit is to provide a detailed review of imaging findings in the setting of carotid blowout syndrome (CBS) and provide the Neuroradiologist with a review of carotid blowout syndrome pathophysiology, current interventional treatment options, and complications.

Description: Carotid blowout syndrome is seen in patients with head and neck cancer who have undergone treatment using radiation or surgical resection. Head and neck cancer patients treated with radiation have an increased incidence of Carotid Blowout Syndrome (CBS). Predisposing factors of arterial wall weakening include radiation therapy, wound breakdown, surgical removal of tissue with resultant desiccation, or tumor recurrence. Rupture of the carotid artery can result in active hemorrhage into the airway, pseudoaneurysm formation, or arteriovenous fistula formation. Morbidity and mortality following CBS has been reported as high as 60% and 40% respectively. The treatment options for a patient presenting with a bleeding event include open surgical ligation of the artery or endovascular occlusion. Since subsequent wound healing is a major issue, endovascular occlusion is preferred. While the affected arteries vary, the majority of cases described in the literature involve the internal carotid artery.

The increasing number of CBS involving the external carotid artery is thought to be due to advances in microcatheter technology which allow superselective angiography. A pseudoaneurysm of the external carotid artery is thought to be more difficult to detect due to the complex anatomy and the multiple small overlying branches. Endovascular treatment techniques include coil embolization. Due to the weakened surrounding tissues there is a rare risk of coil migration or recurrent bleeding following embolization. While rare, Neuroradiologists and Neurointerventionalists should be aware of delayed complications following pseudoaneurysm embolization. Imaging surveillance should be considered to detect and preemptively treat coil erosion.

Summary: As aggressive treatment regimens for head and neck malignancies rise in incidence so too have the number of cases of carotid blowout syndrome. Systematic evaluation of head and neck imaging is important for the Neuroradiologist as CBS has a high morbidity and mortality.
Acute vascular emergencies of neck
Poster Number: VAS-05

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Abstract Details
LEARNING OBJECTIVES/AIMS
Acute vascular emergencies of neck are serious and potentially life threatening conditions. The purpose of this exhibit is to discuss findings to recognize, comprehend, and understand the imaging of these vascular abnormalities and potential pitfalls.

METHODS/BACKGROUND
Acute vascular abnormalities of the neck are associated with significant patient morbidity and mortality. Accurate and swift diagnosis of these vascular injuries are essential in early management to improve outcome in terms of salvaging the brain, and other vital structures, reducing mortality from blood loss and preventing tissue ischemia.

Unfortunately, some of the most significant vascular abnormalities can present a diagnostic challenge unless one is familiar with the abnormality (e.g. streak artifact from dental amalgam vs. acute vascular injury). In addition, clinicians may be unfamiliar with some of the vascular abnormalities reported. Therefore, knowledge of the mechanism, imaging appearance and treatment of vascular abnormalities is also important.

SUMMARY
Radiologists play an important role in the management of vascular emergencies of the neck. Recognizing and understanding acute vascular abnormalities, such as those presented in this case series, is very important as some findings can be subtle and confusing to someone not familiar with the entities. Quick recognition and reporting of these findings is necessary to prevent the high morbidity and mortality associated with vascular injuries.
A 24-year-old patient presented after a stab wound to the left neck. Post-contrast CT neck images demonstrate a pseudoaneurysm from one of the left external carotid artery branches with surrounding hematoma and emphysema.
Ultrasound Guided-Fine Needle Aspiration of Base of Tongue Tumors
Poster Number: VAS-08

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Abstract Details
Purpose
To describe the technical feasibility of ultrasound guided-fine needle aspiration (US-FNA) for base of tongue tumors (BOT), with our experience and results in 8 patients.

Materials and Methods
We retrospectively searched in our institution PACS from 2013 to May 2017 patients with percutaneous US-FNA of suspected base of tongue tumors. We report clinical data, technical points, imaging and pathology findings.

Technical aspects
During the procedure, the patient is in supine position, with the neck extended. After US evaluation of the lesion with a 12 MHz transducer, sterile draping is applied and local anesthesia is performed using lidocaine. FNA is performed using either 22- or 25-gauge needles, under US supervision, by lateral submental approach, through the muscles of the floor of mouth.

Results
We included 8 patients (3 women, 5 men) with median age of 66 years (range 55-74). Six cases were of suspected BOT squamous cell carcinoma, one case presented with a suspicion of persistent tumor versus radiotherapy-induced changes, and one case presented for suspicion of cancer recurrence 1.5 years after treatment. All patients had a CT-scan and/or MRI and/or PET-CT that showed the lesion before procedure. The indications of US-FNA were: risk factors for laryngoscopy under general anesthesia due to poor health (n=5), no evidence of lesion at physical examination and endoscopy (n=2), negative transoral biopsies
performed during laryngoscopy (n=2). The mean longest diameter of the lesions was 31 mm (range 13-60). All US-FNA procedures were technically successful, with no major complication. In 6 out of 8 cases, the samples were conclusive; in two cases they were hypocellular. Five patients went on to have histological confirmation of squamous cell carcinoma (including 2 cases of hypocellular US-FNA) by transoral biopsy (n=2), US guided adenopathy biopsies (n=3), surgery (n=1).

Conclusion
Our experience suggests that US-FNA is a safe technique which can be a simple alternative for patients with contraindications or technical limitations to laryngoscopy under general anesthesia, or with negative prior biopsies.
Abstract Details
Purpose:
Regardless of patient age, vascular lesions can result in variable clinical and psychological impact depending on their pathologic type and anatomical location. The aim of this exhibit is to provide a comprehensive review of several common and uncommon vascular malformations and vascular neoplasms of the head and neck including characteristic diagnostic imaging findings as well as treatment specifics.

Approach:
Related cases will be provided with presenting clinical signs and symptoms. Associated secondary conditions will be identified. Different imaging modalities from initial workup to advanced techniques including US, CT, CTA, MR, and angiography will be illustrated for each case. Post-treatment clinical course and imaging will also be included.
Discussion:

1. Discuss causes of both congenital and acquired vascular lesions, including pertinent embryology. Pictorial examples will be provided. Example pathology types include but are not limited to congenital hemangioma, venous and lymphatic malformations, arteriovenous fistula, sinus pericranii, cavernous-carotid fistula, intracranial arteriovenous malformations, and juvenile nasopharyngeal angiofibroma.

2. Case based demonstration of characteristic imaging findings for diagnosis. Emphasis will be on advantages and disadvantages of various imaging modalities/techniques, which may include US, CT, or MRI, as well as differential diagnoses.

3. Discuss both short term and long term clinically relevant complications of untreated vascular lesions.

4. Discuss importance of treatment, plans of intervention, and expected imaging findings during post-treatment phase.

Conclusion:

Given the large spectrum of various types of vascular malformations and neoplasms of the head and neck, accurate diagnosis can be of great benefit for overall clinical outcome and patient quality of life. At the end of the review, the radiologist should have proficient understanding of the imaging characteristics of these unique lesions, associated correlating conditions, and expected treatment course.
The IMAX (internal maxillary artery): Angiographic Anatomy & Implications in Craniofacial Pathology
Poster Number: VAS-12

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Abstract Details
Purpose:
The IMAX is a complex arterial system that traverses, delineates, and supplies deep facial structures. We review the angiographic anatomy of this arterial network, and its implications in craniofacial pathology and treatment.

Objectives:
1. Review the angiographic anatomy of the 3 major segments of the IMAX including its terminal branches
2. Describe the concept of functional angiographic anatomy
3. Identify important IMAX anastomoses and potentially dangerous collaterals
4. Illustrate clinical scenarios where the IMAX arterial network plays an important role in pathology and treatment strategies

Discussion:
The IMAX is divided into three segments namely: proximal (mandibular), middle (pterygoid), and distal (pterygopalatine). Examples of important branches of the IMAX involved in pathology include the middle meningeal artery (MMA) and sphenopalatine artery (SPA). The MMA may supply a dural AV fistula, for which it may be embolized for treatment of such lesion. The SPA has been colloquially known as the "artery of epistaxis", being the culprit for intractable posterior nose bleeds. Branches of the SPA also typically feed hypervascular tumors such as juvenile angiofibroma. In occlusive disease, the internal carotid artery may be reconstituted via the foramen rotundum branch of the IMAX.

Thorough knowledge of vascular anatomy including potentially dangerous anastomoses with the intracranial circulation is crucial in treatment planning in the setting of refractory epistaxis, tumors, shunts, and occlusive vascular disease. Knowing important collaterals is required in the safe performance of endovascular treatment of these lesions.
Summary/Conclusion:
The IMAX plays a major role in certain craniofacial pathologies. Thorough knowledge of angiographic anatomy and dangerous collaterals is crucial in carrying out safe treatment of vascular conditions.

**Juvenile angiofibroma**

Catheter angiogram with selective injection of the external carotid artery demonstrating tumor blush (circle). The mass is fed by multiple branches of the internal maxillary artery.

- ECA – external carotid artery
- STA – superficial temporal artery
- IMAX – internal maxillary artery
- SPA – sphenopalatine arteries
- MMA – middle meningeal artery
- GPA – greater palatine artery
- IOA – infraorbital artery

Red arrow – abrupt angulation of the MMA as it enters the foramen spinosum

Postcontrast MRI depicting a hypervascular mass (circle) expanding the right pterygopalatine fossa.
Classification and Imaging of Head and Neck Vascular Malformations
Poster Number: VAS-14

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Abstract Details
Purpose: To describe the classification of head and neck vascular malformations and provide a case based presentation of commonly encountered head and neck vascular malformations.

Description: The International Society for the Study of Vascular Anomalies (ISSVA) classification is widely used by subspecialists who encounter patients with these anomalies. Understanding of a universal classification system is important to assist clinicians in diagnosis and treatment and potentially decrease mismanagement of these conditions. This classification system will be explained in simple terms. Using a case-based presentation, a systematic approach to imaging of these lesions will be discussed, focusing primarily on MRI, CT, and ultrasound. This will be supplemented with clinical photographs and pathologic specimens where applicable.
Summary:
This exhibit will discuss the ISSVA classification system and review imaging of head and neck vascular malformations using a case-based format. At the end of this exhibit, the viewer will be able to accurately identify and describe these vascular anomalies.