Clinical Head & Neck MRI and Essential Protocols

Kristine Mosier DMD, Ph.D.
Chief, Head & Neck Imaging
Department of Radiology / Neuroradiology
Indiana University
Outline

- Background /Introduction
- Standard Protocols at 1.5T
- Special Protocols
- Issues in 3T imaging of the head and neck
Background & Introduction

- Head and Neck is very difficult to image!
  - 7 subsites with very different indications and protocols: orbits, IAC, paranasal sinus, TMJ, maxillofacial, salivary glands, neck
  - Large number of very small anatomical structures
  - Irregular geometry: field effects, coils
  - Artifacts: susceptibility, flow, motion, etc.
- Need high resolution
- Need speed
- Need high contrast in small volumes
Protocols at 1.5T: Orbit

Indications

- Optic nerve neuritis: brain and orbits
- Tumor orbit / optic chiasm, globe, anterior cranial fossa or paranasal sinuses.
- Inflammation / infection: Pseudotumor / Tolosa-Hunt, sarcoidosis, endopthalmitis, etc.
- CT for trauma, FB
Protocols at 1.5T: Orbit

Protocol

- Ax T1 (3 mm)
- Cor T2 FSE/ TSE (3-4mm covers to sella)
- + Contrast: Ax T1, Cor T1, +/- obl Sag T1, 3 mm, +Fat-Sat routine
- Brain (pre-Ax T2, Flair, post-gado Ax T1, DWI)
- Head coil / phased array vs dedicated (surface) coil
- Field strength
Orbits: Anatomy

- Optic nerve canal vs SOF: optic canal superior
- Image along long axis of optic nerve (in-plane)
Orbits: Anatomy
Protocols at 1.5T: IAC

Indications

- Rule out CN 7/8 pathology: vestibular schwannoma vs other tumor.
- Rule out central etiology: infarct.
- Intracranial extension from middle ear infection.
- Perineural spread along CN 7 from malignant tumor in parotid or other adjacent areas.
Internal Auditory Canal: Anatomy

CN 8-C
CN 8-Vi
CN 8-Vs
CN 7
30 y.o • w/ ? Schwannoma
43 y.o with Lt. SNHL
Intralabyrinthine Schwannoma: 3T, 8 Channel coil
Normal: 3T, SPACE, 32 Channel C oil
Protocols at 1.5T: Paranasal Sinus

Indications

- Intracranial / intraorbital extension by tumor involving nasal cavity or sinuses.
- Intracranial / intraorbital extension by infection (usually fungal) involving nasal cavity or sinuses.
- Post-surgical complications/ post CSF leak repair.
- Encephalocele.
Protocols at 1.5T: Paranasal Sinus

Protocol

- **Coverage**: Axial • ventricles to mandible; Coronal • tip of nose to sella.
- **Thin section (3 mm)**: Axial T1; Axial & coronal T2.
- **Axial, coronal and sagittal T1 post-gad with fat sat, 3mm.**
Paranasal Sinsues
Protocols at 1.5T: Maxillofacial

Indications

- Tumor involving the maxilla, mandible or adjacent spaces.
- Osteomyelitis / osteoradionecrosis / osteonecrosis of maxilla or mandible.
Protocols at 1.5T: Maxillofacial Protocol

- **Coverage:** Axial • orbits to hyoid; Coronal • nasal cavity to pons.
- **Thin section (3 mm):** Axial T1; Axial T2.
- **Axial STIR**
- **Coronal T1; +/- STIR**
- **Axial and coronal T1 post-gad with fat sat, 3mm.**
Maxillofacial Complex
Garré’s Sclerosing Osteomyelitis
Protocols at 1.5T: TMJ

Indications

- Arthritis involving TMJ: osteoarthritis, rheumatoid.
- Internal derangements.
- Neoplasm
Protocols at 1.5T: TMJ

Protocol

- TMJ coil
- All Sagittal images acquired along long axis of condylar head.
- Sagittal T1 closed and open.
  - Condyle cortex, marrow
  - Articular disk position
- Sagittal T2 closed:
  - Joint effusion
- Coronal T1 closed: condyle + medial-lateral displacement of articular disk
- Contrast only if evaluating neoplasm
Anatomy: Temporomandibular Joint
Normal TMJ : T1 weighted
Normal TMJ: T2 weighted
Normal TMJ: open
28 y.o w/ 1 yr. hx. Rt. preauricular pain s/p conservative tx
Indications

- Inflammatory disease: sialoadenitis, parotitis, abscess, sarcoidosis.
  - M R Sialography
- Autoimmune: Sjogrens.
- Neoplasms
Protocols at 1.5T: Salivary Glands

Protocol

- Use standard MR neck protocol + gado:
  - Always include Axial STIR
- Parotid: acquire axial parallel to the plane of the hard palate.
- Submandibular: acquire axial parallel to the inferior border of mandible.
- MR Sialography: evaluate ductal obstructions
  - MR neck protocol + Axial SPACE to cover parotid or submandibular gland.
  - MIP recon of parotid duct or submandibular duct.
Normal Anatomy: Parotid
Normal Anatomy: Submandibular & Sublingual
Salivary Gland Neoplasm Contrast Enhancement

Iopamidol

Gadolinium

Pleomorphic Adenomas have the longest delay in contrast enhancement

A adapted from Fig. 2; Yabuuchi et al. 2002
A adapted from Fig. 6; Choi et al. 2000

Pleomorphic Adenomas have the longest delay in contrast enhancement
Contrast Enhancement: Pleomorphic Adenoma
Protocols at 1.5T: Neck

Indications

- Evaluation of the extracranial head and neck – NOT C-Spine.
- Neoplasm
  - NP / base of skull
  - OP/OC/ HP/ larynx /salivary gland where involvement of specific anatomic subsites is important, i.e. staging not determined on CT.
- Perineural spread: + relevant CN protocol.
- Lymphadenopathy
- Infection
- Developmental lesion
Protocols at 1.5T: Neck

Protocol

- Exam at • 1.0T or open not very useful.
- Axial T1, T2 skull base to thoracic inlet; Cor T1 nose to cerebellum
  - 3 mm
  - Use BLADE (PROPELLER) when motion artifact a problem.
- Axial STIR, +/- Cor STIR
- + Gado: Ax, Cor, +/- Sag
  - 3mm, Fat Sat.
- Larynx: quiet respiration/inspiration
- Flow comp.
T4aN0Mx SCCA FOM mass
Lymphangioma
Protocols at 1.5T: Cranial Nerves

Indications

- Neuralgia: CN V, IX / X / XII.
- Bell’s Palsy: CN VII
- Other CN palsies: CN III, IV / VI
- Perineural spread
Protocols at 1.5T: Cranial Nerves

Protocol:

- Brain + IAC / Neck
- Hi-res axial and cor T2
- CISS / SPACE
- 3mm Axial and cor T1 + gado
Cavernous Sinus Anatomy
Cranial Nerves: Trigeminal Neuralgia
Cranial Nerves: Trigeminal Neuralgia
Imaging the H & N at 3T

**Advantages**
- SNR.
- +/- CNR.
- Speed.
- Multi-channel multi-coil

**Disadvantages**
- Susceptibility artifacts
- 0 / 1 in homogeneities
- T1
- Fat saturation
- Chemical shift
Imaging the H & N at 3T

Best for:
- Orbits
- IAC
- Cranial Nerves
- +/- Paranasal sinuses

Needs optimization
- Neck
- Maxillofacial / TMJ
- Salivary glands
Thank you!