Revised Nov 20 2019

Neuroradiology CT Protocols

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Sp 1: Cervical spine CT without contrast
Sp 1M: Cervical spine CT myelogram
Sp 2: Thoracic spine CT without contrast
Sp 2M: Thoracic spine CT myelogram
Sp 3: Lumbar spine CT without contrast
Sp 3M: Lumbar spine CT myelogram
Sp 4: Sacrum CT without contrast
Sp 5: Cervical *or* thoracic *or* lumbar spine CT with contrast (infection and mass protocol)

N 1: Head CT without contrast

Indications: bleeds, stroke, dementia, headaches.

Contrast parameters	None
Region of scan	Foramen magnum to vertex, *angled to exclude orbits*.
Scan delay	NA
Detector collimation	Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice)
Slice thickness	4.5 mm OR (helical) 5 mm thick axial and coronal reformats.
Filming	H30s, H70s kernels.

Comments:

- Use mAs of 375.

N 1C: Pre- and post-contrast head CT

Indications: mass, metastases, AVM.

Contrast parameters	1) None 2) 100 mL at 2.5 mL/sec
Region of scan	Foramen magnum to vertex, angled to exclude orbits.
Scan delay	1) NA 2) 60 sec
Detector collimation	Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice)
Slice thickness	4.5 mm OR (helical) 5 mm thick axial reformats, and post-contrast coronal reformats
Filming	1) H30s kernel (axials) 2) H30s and H70s kernels (axials)

Comments:

- Use mAs of 375.
- 16 slice CT scanners: non-helical axial slices only, no coronal or sagittal reformats recommended.

N 2: Head CT angiography

Indications: aneurysm, subarachnoid hemorrhage, AVM.

Contrast parameters	1) None 2) 100 mL at 4 mL/sec
Region of scan	Foramen magnum to vertex, angled to exclude orbits.
Scan delay	1) NA 2) Care Bolus at C1; peak + 5 sec 3) To follow CTA
Detector collimation	1) Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice) 2) 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm (CTA) 3) Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice)
Slice thickness	4.5 or 5 mm axials for pre- and post-contrast brain. 1 mm axials for CTA. 1 mm 3-D MIP (sagittal & coronal), and/or VRT reformats
Filming	1) H30s kernel 2) H30s kernel 3) H30s, H70s kernels

Comments:

- Siemens HeadAngioVol package
- If a head angiogram is done in conjunction with a neck angiogram, please separate the head images and send to PACS a smaller field of view.

N 2V: Head CT angiography (venogram)

Indications: suspected sinus thrombosis.

Contrast parameters	1) None 2) 100 mL at 4 mL/sec
Region of scan	Foramen magnum to vertex, angled to exclude orbits.
Scan delay	1) NA 2) 40 seconds 3) To follow CT venogram
Detector collimation	1) Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice) 2) 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm (CTV) 3) Non-helical 16 x 1.5 mm OR helical 64 x 1.2 mm, 32 x 1.2 mm (128 slice)
Slice thickness	4.5 or 5 mm axials for pre- and post-contrast brain. 1 mm axials for CT venogram. 1 mm 3-D MIP (sagittal & coronal), and/or VRT reformats
Filming	1) H30s kernel 2) H20s kernel 3) H30s, H70s kernels

Comments:

- Siemens HeadAngioVol package

N 3: Maxillofacial CT without contrast (trauma protocol)

Indications: orbital floor fractures, other facial trauma.

Contrast parameters	None
Region of scan	Mandible to frontal sinuses
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	1.5 mm axials; 1.5 mm coronal and sagittal reformats
Filming	H32f, B70f kernels

Comments:

Revised Nov 20 2019

N 3C: Maxillofacial CT with contrast

Indications: facial cellulitis or abscess.

Contrast parameters	100mL @ 2.5 mL/sec.
Region of scan	C5 to frontal sinuses
Scan delay	40 sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials; 3.0 mm coronal reformats
Filming	H31s, B70f kernels

Comments:

Revised Nov 20 2019

N 3D: Maxillofacial CT without contrast (dental implant protocol)

Indications: evaluate condition of bone prior to dental implant placement.

Contrast parameters	None
Region of scan	Maxilla only: bottom of orbits to maxillary teeth. Mandible only: mandibular teeth through bottom of mandible. Maxilla and mandible: bottom of orbits through bottom of mandible.
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	1.0 mm axials
Filming	B70f kernels; burn CD without viewing tools.

Comments:

- Have patients bite down on disposable bite blocks to minimize motion.
- Line up scans parallel to maxillary or mandibular teeth surface when scanning. When scanning both regions, split the difference between the two teeth surfaces.

N 4: Sinus CT without contrast

Indications: sinusitis.

Contrast parameters	None
Region of scan	Frontal sinus to floor of maxillary sinus; patient supine.
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm direct axials
Slice thickness	3.0 axials, 3.0 mm coronal and sagittal reformats.
Filming	H70f kernel

Comments:

- Suggested scan parameters: 120 kV, 100 mAs.
- Use radiation shields for the eyes.

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N 4C: Sinus CT with contrast

Indications: sinus tumor evaluation.

Contrast parameters	100 mL @ 2.5 mL/sec
Region of scan	Frontal sinus to floor of maxillary sinus; patient supine.
Scan delay	60 seconds
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm direct axials
Slice thickness	3.0 axials, 3.0 mm coronal and sagittal reformats.
Filming	H32f, H70f kernels

Comments:

N 5: Orbit CT without contrast

Indications: screening for orbital foreign bodies prior to MR.

Contrast parameters	NA
Region of scan	Orbital floor to roof
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm coronal reformats.
Filming	H30f, B70f kernels

Comments:

- Siemens Orbit package

N 5C: Orbit CT with contrast

Indications: intra-orbital masses, thyroid ophthalmopathy.

Contrast parameters	100 mL @ 2.5 mL/sec
Region of scan	Orbital floor to roof
Scan delay	60 seconds
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials; 3.0 mm coronal reformats
Filming	H30f, H70s kernels

Comments:

- Siemens Orbit package

N 6: Mastoid CT without contrast

Indications: mastoiditis, cholesteatomas, otitis media, fractures, otosclerosis.

Contrast parameters	None
Region of scan	EAC through top of petrous bones
Scan delay	NA
Detector collimation	0.6 mm non-helical direct axials and direct coronals.
Slice thickness	1.0 mm axials, 1.0 mm coronals.
Filming	U90u kernel

Comments:

- Siemens InnerEarSeqUHR package.
- Acquire each side separately.

N 6C: Mastoid CT with contrast

Indications: middle ear vascular tumors.

Contrast parameters	150 mL @ 2.5 mL/sec, OR 100 mL @ 2.5 mL/sec with 30 mL saline chaser
Region of scan	EAC through top of petrous bones
Scan delay	60 sec
Detector collimation	0.6 mm non-helical direct axials and direct coronals.
Slice thickness	1.0 mm axials, 1.0 mm coronals.
Filming	H30f, U90u kernels

Comments:

- Siemens InnerEarSeqUHR package.
- Acquire through symptomatic side only; divide contrast dose between axial and coronal acquisitions.

N 7: Soft tissue neck CT with contrast

Indications: neck masses, tumor staging, abscesses.

Contrast parameters	125 mL @ 2.5 mL/sec; OR 100 mL @ 2.5 mL/sec, with 30 mL saline flush
Region of scan	1) Sella to aortic arch 2) Pharynx (angled axials)
Scan delay	40 sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials and oblique axials; 3.0 mm thick coronal reformats
Filming	B31s kernel

Comments:

- Siemens NeckVol package.
- If concomitant trauma C-spine evaluation needed, perform additional 3 mm axials, 2mm sagittal and coronal MPR as specified in protocol Sp1, and merge with current study.

N 8: Neck CT angiography

Indications: stroke, carotid dissection.

Contrast parameters	100mL @ 4 mL/sec
Region of scan	Aortic arch to Circle of Willis
Scan delay	Care Bolus at C6; peak + 3sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	1.5 mm axials, 1 mm3-D coronal MIP (coronal and sagittal), and/or VRT reformats
Filming	B30f kernel

Comments:

- Siemens CarotidAngioVol package.
- If concomitant trauma C-spine evaluation needed, perform additional 3 mm axials, 2mm sagittal and coronal MPR as specified in protocol Sp1, and merge with current study.

N 9: Soft tissue neck CT with contrast (larynx protocol)

Indications: tumors, vocal cord paralysis, trauma.

Contrast parameters	125mL @ 2.5 mL/sec; OR 100 mL @ 2.5 mL/sec, with 30 mL saline flush. No contrast for trauma evaluation
Region of scan	1) Tumors: hard palate to sternal notch 2) Cord paralysis: sella to carina 3) Trauma: hyoid to sternal notch
Scan delay	40 sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, with additional 1.5 mm axials through true vocal cords. 1.0 mm thick coronal reformats.
Filming	B31s kernel; add B70f for trauma cases

Comments:

- Siemens NeckThinSlice package.
- CPGH-using Care dose and Care KV
- Radiologist to select level of thin slices through true vocal cords.
- Optional breathing instructions:
    - Straw-blowing: adducts vocal cords
    - 'Eee' phonation: assesses cord paralysis
    - Quiet breathing: abducts vocal cords

N 10: Pre- and post-contrast sella CT

Indications: pituitary pathology and contraindication to MRI scan.

Contrast parameters	1) None 2) 100 mL at 2.5 mL/sec
Region of scan	Foramen magnum to vertex, angled to avoid orbits.
Scan delay	1) NA 2) 60 sec
Detector collimation	1) Non-helical 16 x 1.5 mm, OR helical 64 x 0.6 mm, 128 x .6 mm (128 slice) 2) 16 x 0.75 mm OR helical 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	1) 4.5 mm or 5.0 mm axials through entire head. 2) 1 mm coronal and sagittal reformats through pituitary fossa. 4.5 mm or 5.0 mm axials from foramen magnum to vertex.
Filming	1) H30s and H70s kernels 2) H30s kernel

Comments:

N 11: Soft tissue neck CT with and without contrast (parathyroid protocol)

Indications: locate parathyroid adenomas prior to surgery.

Contrast parameters	75 mL @ 4.0 mL/sec, with 25mL saline flush (preferred), or 100 mL @ 4.0 mL/sec.
Region of scan	1) Non-contrast: mandible angle to carina 2) Arterial phase: mandible angle to carina 3) Venous phase: mandible angle to carina
Scan delay	1) NA 2) 25 sec (use bolus tracking for pts with significant heart disease) 3) 80 sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	2.0 mm axials in all 3 phases, with additional 2.0 mm coronals and sagittals in arterial and delayed phases.
Filming	B31s kernel

Comments:

- To reduce beam hardening artifact & noise at base of neck: place rolled towel b/w shoulder blades, ask patients to pull shoulders down.
- Instruct patients not to swallow, speak, or cough during scan.

Sp 1: Cervical spine CT without contrast

Indications: trauma.

Contrast parameters	None
Region of scan	Foramen magnum to bottom of T4
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 2.0 mm sagittal and coronal MPR
Filming	B20s, B70s kernels

Comments:

- Siemens C-SpineVol package.
- CPGH- using Care dose and Care KV
- Field of view: 12-13 cm; increase AP dimensions as needed for patients with C-spine kyphosis.
- Trauma criteria: *AJR* 2000; 174:713-717
    - Injury mechanism: high-speed (>35 mph combined) MVA, MVA with death at scene, fall >10 feet.
    - Clinical evaluation: known closed head injury, pelvic or multiple extremity fx, neurologic Sx or C-spine radiculopathy.

Sp 1M: Cervical spine CT myelogram

Indications: degeneration, disc herniations, canal or foraminal stenosis.

Contrast parameters	Intrathecal Isovue-M300
Region of scan	Foramen magnum to T1
Scan delay	Within 30 minutes of intrathecal contrast admin
Detector collimation	16 x 0.75 mm. 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 2.0 mm sagittal and coronal MPR
Filming	B20s, B70s kernels

Comments:

- Siemens C-SpineVol package.

Revised 9.2019 PC meeting
Myelogram preprocedural medication check no longer recommended (Approved Change).

Revised Nov 20 2019

It Is Not Necessary to Discontinue Seizure Threshold–Lowering Medications Prior to Myelography

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ABSTRACT

BACKGROUND AND PURPOSE: There is no consensus on whether patients undergoing myelography should discontinue medications that could lower their seizure threshold. The purpose of this study was to document the most commonly prescribed seizure threshold–lowering medications in patients undergoing myelography and determine whether withholding such medications decreases the incidence of seizures.

MATERIALS AND METHODS: We performed a retrospective observational study of all the myelograms obtained in 2016 at 2 affiliated hospitals. At hospital A, seizure threshold–lowering medications are discontinued before myelography, and prophylactic diazepam is given for all cervical myelograms. At hospital B, seizure threshold–lowering medications are not withheld before the procedure, and medical seizure prophylaxis is not implemented. The seizure threshold–lowering medications the patients were taking at the time of the procedure and postmyelographic seizure incidence were documented.

RESULTS: A total of 311 patients underwent myelography during 2016. One hundred eleven patients (36%) were on at least 1 seizure threshold–lowering medication, and 30 (10%) were on at least 2. The most common medications were duloxetine, sertraline, venlafaxine, bupropion, and trazodone. The most common tricyclic antidepressant was amitriptyline. Three patients across both sites had a controlled seizure disorder and were on antiepileptics. None of the patients at either hospital had seizures during or within 2 hours following any of the myelograms during the study period.

CONCLUSIONS: Continuing seizure threshold–lowering medications during myelography does not increase the risk of seizures. Screening for and withholding seizure threshold–lowering medications are not indicated for routine myelography.

ABBREVIATIONS: STLM = seizure threshold–lowering medication; TCA = tricyclic antidepressant

Myelography remains a useful diagnostic procedure to evaluate spinal disease, especially in patients with contraindications to MR imaging.[1] The risks of myelography are related to the lumbar puncture itself and the intrathecal administration of contrast.[2] Iodinated contrast agents used for myelography have been in use for >90 years. The earliest agents such as iodophendylate were oil-based and not readily resorbed from the CSF, and the oil residue caused arachnoid adhesions in 3 of 4 patients who received the agent.[3] The first water-soluble myelographic contrast agents were introduced in the early 1970s, and of these, metrizamide gained mainstream adaptation. Metrizamide compared favorably with iodophendylate because it resorbed with the CSF, but it was well-known to carry a non-negligible risk of neurologic symptoms, including seizure, with intrathecal administration.[4] Since the advent of second-generation, nonionic water-soluble contrast agents such as iohexol, myelography-related seizure activity has become a very rare event. There have been only scattered individual case reports of seizures occurring in patients undergoing myelography with these agents, and most of these case reports had extenuating circumstances such as a history of epilepsy or an overdosage of the intrathecal contrast agent.[5-8] Nonetheless, the published guidelines for clinical practice surrounding myelography have changed little since the transition from metrizamide to second-generation, nonionic water-soluble contrast agents.

The American College of Radiology–American Society of Neuroradiology–Society of Pediatric Radiology clinical practice guidelines recommend screening patients' medications and dis-

Received January 10, 2019; accepted after revision March 31.

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Paper previously presented, in part, at: Annual Meeting of the American Society of Neuroradiology and the Foundation of the ASNR Symposium, June 4–7, 2018; Vancouver, British Columbia, Canada.

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http://dx.doi.org/10.3174/ajnr.A6057

Sp 2: Thoracic spine CT without contrast

Indications: degeneration, trauma.

Contrast parameters	None
Region of scan	C7 to L1, or as specified by radiologist
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm sagittal and coronal MPR
Filming	B70s kernel; optional B20s for non-trauma cases

Comments:

- Siemens SpineVol package.
- In all cases, specific levels of concern should be obtained from referring physician if possible.

Revised Nov 20 2019

Sp 2M: Thoracic spine CT myelogram

Indications: degeneration, disc herniation, cord compression.

Contrast parameters	Intrathecal Isovue M300
Region of scan	To be specified by radiologist
Scan delay	30-60 minutes after intrathecal contrast admin
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm sagittal and coronal MPR
Filming	B20s, B70s kernels

Comments:

- Siemens SpineVol package.
- Roll patient 3 times on stretcher before transferring to gantry, to mix the contrast material.

Revised 9.2019 PC meeting
Myelogram preprocedural medication check no longer recommended (Approved Change).

Sp 3: Lumbar spine CT without contrast

Indications: degeneration, surgical fusion status, trauma, hemangiomas.

Contrast parameters	None
Region of scan	T12 to S1
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm sagittal and coronal MPR
Filming	B20s, B70s kernels

Comments:

- Siemens SpineVol package.
- Oblique axial scan plane, to best parallel the discs as a whole.

Revised Nov 20 2019

Sp 3M: Lumbar spine CT myelogram

Indications: degeneration, canal or foraminal stenosis.

Contrast parameters	Intrathecal Isovue M200
Region of scan	T12 to S1
Scan delay	30 to 60 minutes after intrathecal contrast admin
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm sagittal and coronal MPR, and oblique-axial MPR parallel to individual T12-L1 to L5-S1 discs.
Filming	B20s, B70s kernels

Comments:

- Siemens SpineVol package.
- Roll patient 3 times before transferring to gantry, to mix contrast.

Revised 9.2019 PC meeting
Myelogram preprocedural medication check no longer recommended (Approved Change).

Sp 4: Sacrum CT without contrast

Indications: sciatic radiculopathy, sacral masses.

Contrast parameters	None
Region of scan	L5 to inferior coccyx; supine with bent knees.
Scan delay	NA
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3.0 mm sagittal and oblique coronal MPR
Filming	B20s, B70s kernels

Comments:

- Siemens SpineVol package.

Sp 5: Cervical/thoracic/lumbar CT with contrast (infection and mass protocol)

Indications: osteomyelitis, diskitis, epidural abscess, masses.

Contrast parameters	125 mL at 2.5cc/sec, OR 100 mL at 2.5 cc/sec, with 30 mL saline chaser
Region of scan	As specified by radiologist or referring physician
Scan delay	60 sec
Detector collimation	16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm
Slice thickness	3.0 mm axials, 3 mm sagittal and coronal MPR (T- and L-spine) or 2 mm reformats (C-spine).
Filming	B20s, B70s kernels

Comments:

- Siemens SpineVol package.
- In all cases, specific levels of concern should be obtained from referring physician if possible.