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|  Skagit RADIOLOGY <small>INCORPORATED PROFESSIONAL SERVICES</small> | Neuro: CT Protocols | | |
| | Reviewed: | Date: 1/05/2023 | D. Chaudry |
| | Revised: | Date: | |

N 1: Head CT without contrast

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

N 2: Head CT angiography

N 2V: Head CT venography

N 3: Maxillofacial CT without contrast (trauma protocol)

N 3C: Maxillofacial CT with contrast

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

N 4: Sinus CT without contrast

N 4C: Sinus CT with contrast

N 5: Orbit CT without contrast

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N 6: Mastoid CT without contrast

N 6C: Mastoid CT with contrast

N 7: Soft tissue neck CT with contrast

N 8: Neck CT angiography

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

N 10: Pre- and post-contrast sella CT

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

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)

Sp 6: Epidural / Nerve Root / Facet Injection C and L spine

N 1: Head CT without contrast

Indications: bleeds, stroke, dementia, headaches.

| | |
|----------------------|---|
| Contrast parameters | None |
| Region of scan | Foramen magnum to vertex, <i>angled to exclude orbits.</i> |
| 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, <i>angled to exclude orbits.</i> |
| 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 and 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, <i>angled to exclude orbits.</i> |
| 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 Head Angio Vol 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, <i>angled to exclude orbits.</i> |
| 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 Head Angio Vol 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:

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:

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 |
| Slice thickness | 3.0 mm axials. 3.0 mm coronal and sagittal reformats |
| Filming | B70f kernels; burn CD without viewing tools. |

Comments:

N 4C: Sinus CT with contrast

Indications: sinus tumor evaluation

| | |
|----------------------|---|
| Contrast parameters | 100mL @ 2.5mL/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 |
| Slice thickness | 3.0 mm axials. 3.0 mm coronal and sagittal reformats |
| Filming | B70f kernels; burn CD without viewing tools. |

Comments:

N 5: Orbit CT without contrast

Indications: screening for orbital foreign bodies prior to MR

| | |
|----------------------|--|
| Contrast parameters | None |
| 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 | 2.0 mm axials. 2.0 mm coronal and sagittal reformats |
| Filming | B70f kernels; burn CD without viewing tools. |

Comments:

- Siemens Orbit package

N 5C: Orbit CT with contrast

Indications: intra-orbital masses, thyroid ophthalmopathy

| | |
|----------------------|--|
| Contrast parameters | 100mL @ 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 | 2.0 mm axials. 2.0 mm coronal and sagittal reformats |
| Filming | B70f kernels; burn CD without viewing tools. |

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 (Sequential Scan – If Patient cannot lay prone Scan Spiral) |
| Scan delay | none |
| Detector collimation | 2 x 0.6 mm, 16 x 0.6 mm, 128 x 0.6 mm Non-helical direct axial |
| Slice thickness | 0.6 mm direct axials. 0.6 mm coronal reformats |
| Filming | U90u kernels; burn CD without viewing tools. |

Comments:

- Siemens InnerEarSeqUHR package
- Acquire each side separately

N 6C: Mastoid CT with contrast

Indications: intra-orbital masses, thyroid ophthalmopathy

| | |
|----------------------|--|
| Contrast parameters | 100mL @ 2.5 mL/sec with 30 mL saline chaser |
| Region of scan | EAC through top of petrous bones (Sequential Scan – If Patient cannot lay prone Scan Spiral) |
| Scan delay | 60 seconds |
| Detector collimation | 2 x 0.6 mm, 16 x 0.6 mm, 128 x 0.6 mm Non-helical direct axial and direct coronals |
| Slice thickness | 1.0 mm axials. 1.0 mm coronals |
| Filming | U90u kernels; burn CD without viewing tools. |

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 | 125mL @ 2.5mL/sec or 100mL @ 2.5 mL/sec with 30 mL saline chaser |
| Region of scan | Sella to Aortic Arch |
| Scan delay | 40 seconds |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 3.0 mm axials, coronal, & sagittal reformats |
| Filming | H41f – medium+(3mm axial, coronal, & sagittal larynx); burn CD without viewing tools. |

Comments:

- Siemens NeckVol package
- If concomitant trauma C-spine evaluation needed, perform additional 3mm axials, 2mm sagittal and coronal MPR as specifies in protocol Sp1, and merge with current study
- Dose Notification: CTDI 28.00mGy

N 8: Neck CT angiography

Indications: stroke, carotid dissection

| | |
|----------------------|---|
| Contrast parameters | 100mL @ 4.0 mL/sec with 30 mL saline chaser |
| Region of scan | Aortic Arch to Circle of Willis |
| Scan delay | Care Bolus at C6; peak + 3 sec |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 1.5 mm axials, 10mm MIP at 5mm intervals (coronal & sagittal) |
| Filming | H24hs – medium smooth (1.5 mm axial, coronal, & sagittal-angio; 10 x 5 mm axial, coronal, and sagittal MIP); burn CD without viewing tools. |

Comments:

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

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

Indications: tumors, vocal chord paralysis, trauma

| | |
|----------------------|--|
| Contrast parameters | 125mL @ 2.5mL/sec or 100mL @ 2.5 mL/sec with 30 mL saline chaser. 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 seconds |
| 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 | H31s – medium smooth (3mm, 1.5mm axial, 3.0mm coronal, & sagittal larynx); add H70f – very sharp (3mm axial, coronal & sag – osteo for trauma cases); burn CD without viewing tools. |

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: assess vocal cord paralyzation
 - 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) 100mL @ 2.5 mL/sec with 30 mL saline chaser |
| Region of scan | Foramen Magnum to Vertex, angled to avoid orbits |
| Scan delay | 1) NA 2) 60 seconds |
| Detector collimation | 16 x 1.5 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 1) 5.0 mm axials through entire head 2) 1.0 mm coronal and sagittal reformats through pituitary fossa. 5.0 mm axials from foramen magnum to vertex |
| Filming | 1) H30s – medium smooth (5mm axial, coronal, & sagittal - cerebrum); H70f – very sharp (osteo kernels); burn CD without viewing tools. 2) H30s – medium smooth (5mm axial, 1mm coronal, & sagittal - cerebrum); |

Comments:

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

Indications: locate parathyroid adenomas prior to surgery

| | |
|----------------------|---|
| Contrast parameters | 75mL @ 4.0 mL / sec or 100mL @ 4 mL/sec with 30 mL saline chaser |
| Region of scan | 1) Non-contrast: mandible angle to carina 2) Arterial: mandible angle to carina 3) Venous: 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 | 1) H41s – medium smooth (3mm axial, coronal, & sagittal - larynx) 2) H41s – medium smooth (3mm axial, coronal, & sagittal - larynx) 3) H41s – medium smooth (3mm axial, coronal, & sagittal - larynx) |

Comments:

- To reduce beam hardening artifact & noise at base of neck; place a rolled towel b/w shoulder blades, ask patients to pull shoulders down.
- Instruct patients not to swallow, speak, or cough during scan
- Save the raw data if the patient has not had a Nuclear Medicine parathyroid yet

SP 1: Cervical Spine CT without contrast

Indications: bleeds, stroke, dementia, headaches.

| | |
|----------------------|---|
| 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 and 2.0 coronal and sagittal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

- Siemens C-SpineVol Package
- If high BMI increase kV to 140
- 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 administration |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 3.0 mm axials and 2.0 coronal and sagittal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

- Siemens C-SpineVol Package

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 and 3.0 coronal and sagittal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

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

SP 2M: Thoracic Spine CT myelogram

Indications: degeneration, disc herniation, cord compression

| | |
|----------------------|---|
| Contrast parameters | Intrathecal Isovue-M300 |
| Region of scan | To be specified by a Radiologist |
| Scan delay | 30 – 60 minutes after intrathecal contrast administration |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 3.0 mm axials and 3.0 coronal and sagittal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

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

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 and 3.0 coronal and sagittal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

- Siemens SpineVol Package
- Oblique axial scan plane, to best parallel the discs as a whole
- Dose Notification: CTDI 45.00 mGy

SP 3M: Lumbar Spine CT myelogram

Indications: degeneration, canal or foraminal stenosis

| | |
|----------------------|--|
| Contrast parameters | Intrathecal Isovue-M200 |
| Region of scan | T12 – S1 |
| Scan delay | 30 – 60 minutes after intrathecal contrast administration |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 3.0 mm axials and 3.0 coronal and sagittal MPR, and oblique axial MPR parallel to individual T12-L1 to L5-S1 discs. |
| Filming | H30s – medium smooth (3mm axial & 3mm axial disc space– mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

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

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 and 3.0mm sagittal and oblique coronal MPR. |
| Filming | H30s – medium smooth (3mm axial – mediastinum); H70s – very sharp (3mm axial, coronal & sag – osteo) |

Comments:

- Siemens SpineVol Package

SP 5: Cervical / Thoracic / Lumbar CT with contrast (infection and mass protocol)

Indications: osteomyelitis, diskitis, epidural abscess, masses

| | |
|----------------------|---|
| Contrast parameters | 100mL @ 2.5mL/sec or 100mL @ 2.5 mL/sec with 30 mL saline chaser. |
| Region of scan | As specified by radiologist or referring physician |
| 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 mm sagittal and coronal MPR (T and L – spine) or 2 mm reformats (C-spine) |
| Filming | H30s – medium smooth (3mm axial, coronal, & sagittal – mediastinum; 2 mm axial, coronal, & sagittal for C-SPINE); H70s – very sharp (3mm axial – osteo); burn CD without viewing tools. |

Comments:

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

SP 6: Epidural / Nerve Root / Facet Injection C and L Spine

Indications: osteomyelitis, diskitis, epidural abscess, masses

| | |
|----------------------|--|
| Contrast parameters | Isovue-200M |
| Region of scan | As specified by a Radiologist or referring physician |
| Scan delay | N/A |
| Detector collimation | 16 x 0.75 mm, 64 x 0.6 mm, 128 x 0.6 mm |
| Slice thickness | 1) Scout: 3.0 mm 2) Needle Positioning: 1.5 mm for L-spine; 0.75 mm for C-spine |
| Filming | H70s – very sharp-osteo (please see slice thickness section) |

Comments:

- Siemens SpineVol Package
- For needle position images only 7 images are needed.
- SFOV for all images
- Send TOPO and last series of exam to PACS only