

MRI and MRA/MRV Protocols for: Brain/Sella/Orbit

Protocol	Use	Note	Sequences
AVM No gad 30 minutes	- used for follow-up of AVM	- Brain (fast) protocol with an added coronal T2 sequence (allows detection of abnormal flow voids on T2 in both axial and coronal planes)	Sag T1 Ax Flair Ax T2 Ax DWI Ax GRE/SWI Cor T2
Brain pre + post gad (baseline primary tumour or f/u mets) Gad 30 minutes	- this should be used for most indications of contrast enhanced MRI - should ALWAYS be used for metastatic work-up or follow-up	- If done without gad, document the reason in the report	Sag T1 Injection Ax T2 Flair Ax DWI Ax GRE/SWI Sag T1 3D MPRAGE (Recon to Ax and Cor) Ax SE T1
Brain post gad only (f/u primary tumour not for mets) Gad 30 minutes	- For follow-up primary brain tumours only if patient has had previous baseline at MSH/UHN/WCH - Use for follow-up of meningioma, GBM, astrocytoma, glioma, medulloblastoma, etc.	- This protocol does not include any pre-contrast sequence. Gad injection is done prior to initiating scan.	Injection Sag T1 3D MPRAGE (Recon to Ax and Cor) Ax T2 Flair Ax DWI Ax GRE/SWI
Brain (Cavernoma) No gad 30 minutes	- this protocol is only useful to assess cavernoma of the posterior fossa/brainstem or thalami (since there is high resolution imaging covering these areas ONLY) - If cavernoma is elsewhere or location is uncertain, use Brain (fast) protocol		Sag T1 Ax T2 Flair Ax DWI Ax GRE/SWI Cor T2 (3mm) (4 th ventricle to mid orbit) Ax T2 (3mm) (foramen magnum to AC/PC line) Ax T1 (3mm)

<p>Brain (Dementia)</p> <p>No gad 30 minutes</p>	<p>- use instead of fast brain when “cognitive decline” or “dementia” is indicated in the history</p>	<p>- This protocol is the fast brain with added coronal oblique T1 angled through the temporal lobes to assess hippocampal volumes</p>	<p>Sag T1 FMPRAGE (Recon Ax and Cor Obl) Ax T2 Flair Ax T2 Ax DWI Ax GRE/SWI</p>
<p>Brain (Express)</p> <p>No gad 30 minutes or 3 per hour</p>	<p>- <u>Inclusion criteria</u>: headache, dementia or memory loss or cognitive decline, tinnitus, tremor, psychiatric symptoms, syncope - <u>Exclusion criteria</u>: seizure, tumors, cancer, metastasis, trauma, focal neurological deficit, aneurysm, AVM, hydrocephalus</p>	<p>- Shortened version of fast brain, no Ax T2</p>	<p>Sag T1 Ax T2 Flair AX DWI Ax GRE/SWI</p>
<p>Brain (fast)</p> <p>No gad 30 minutes</p>	<p>- “routine” all-purpose brain protocol</p>		<p>Sag T1 Ax T2 Flair Ax T2 Ax DWI Ax GRE/SWI</p>
<p>Brain (IAC)</p> <p>Optional gad 30 minutes / 45 minutes with gad</p>	<p>- use this for history of hearing loss (refer to IAC express to know when you can use that one instead) - use for any history suggestive of neurovascular compromise (trigeminal neuralgia, hemifacial spasm) - give Gad RARELY: query very small schwannoma not well seen on high-res T2, Bell's palsy imaging, other suspicion of cranial nerve enhancement</p>		<p>Sag T1 Ax T2 Flair Cor T1 Loc (for IAC) Ax T2 Space (IAC) AX DWI Ax GRE/SWI --Optional Contrast--- Ax T1 post gad (IAC) --Optional for cholesteatoma Ax Haste DWI (1.5T Siemens only)</p>

<p>Brain (IAC express)</p> <p>No gad 30 minutes or 3 per hour</p>	<p>- <u>Inclusion criteria</u>: hearing loss of any variant thereof such as sensorineural “hearing loss”. If an order has both, hearing loss and any of the above inclusion criteria for express brain, it should be considered IAC provided they do not have any exclusion criteria</p>	<p>- this is the shortened version of the IAC protocol</p>	<p>Sag T1 Ax T2 Flair AX DWI Ax GRE/SWI Cor T1 Loc (for IAC) Ax T2 Space (IAC)</p>
<p>Brain (MS)</p> <p>No gad 30 minutes</p>	<p>- For follow-up of known multiple sclerosis (fast brain protocol should be used for “query multiple sclerosis”)</p>	<p>- This substitutes the sagittal T1 in the fast brain protocol with sagittal FLAIR</p>	<p>Sag 3D T2 Space IR Dark Fluid Ax T2 Flair Ax T2 Ax DWI Ax GRE/SWI</p>
<p>Brain (Pulsatile Tinnitus 3T)</p> <p>No gad 30 minutes</p>	<p>- request should specifically indicate “pulsatile” tinnitus</p>		<p>Sag T1 Ax T2 Flair Ax T2 Ax GRE/SWI Ax DWI Ax 3D TOF COW Ax 3D T2 Space (IAC)</p>
<p>Brain (Tumour w Perfusion pre + post gad) Discuss w Staff</p> <p>PM only – 1.5T or 3T Post processing to be done through SyngoVia – still being sorted out</p>	<ul style="list-style-type: none"> • Not intended to be a routine protocol – rather on a select group of patients to differentiate between tumour and radiation necrosis • Do not use unless approved by staff (check with officer of the day) 		<p>Sag T1 Injection Perfusion Ax T2 Flair Ax DWI Ax GRE/SWI Sag T1 3D MPRAGE (Recon to Ax and Cor) Ax SE T1</p>
<p>Seizure temporal lobes</p>	<p>- for epilepsy - use when referral is from an epileptologist (Drs. Andrade, Carlen, Wenneberg, Tai, Bui, Del Campo)</p>	<p>- This is done at 3T, unless there are contraindications</p>	<p>Sag 3D T2 Space IR Dark Fluid Ax T2 Flair Cor Obl T2 Flair Cor Obl T1 Flair Sag T1 3D MPRAGE</p>

	<p>Usually No Gad – Gad for:</p> <ul style="list-style-type: none"> - rarely, can give gad to follow-up known tumor or inflammatory process (if known history of seizures + other disease) 		<p>(Recon to Ax - 1mm) Ax DWI Ax GRE/SWI --Optional Contrast-- Sag T1 3D MPRAGE (Recon to Ax and Cor Obl) Ax SE T1</p>
<p>Skull Base with gad</p> <p>(includes contrast) 45 minutes</p>	<ul style="list-style-type: none"> - for skull base tumours - includes fat sat pre/post gad T1 imaging which makes it particularly useful at the skull base 		<p>Sag T1 Ax T2 Flair Ax DWI Ax GRE/SWI Ax T1 (bottom of pons to 3rd vetn.) Cpr T2 FS (4th ventricle to mid orbit) Injection Ax T1 FS post gad Cor T1 FS post gad</p>
<p>Trigeminal Nerve</p> <p>Contrast optional 30 minutes / 45 minutes with contrast</p>	<ul style="list-style-type: none"> - this is a longer protocol for detailed assessment of the entire course of the trigeminal nerve - IAC protocol usually suffices for trigeminal neuralgia assessment, unless high suspicion for secondary etiology - very rarely needed - give contrast (add "Gad") if concern for inflammatory or neoplastic process 		<p>Sag T1 (includes all of mandible) Ax T2 Flair Ax T2 3D Space (foramen magnum to tentorium) Cor T2 FS (posterior pons to symphysis of mandible) Ax T2 3mm --Optional Contrast-- Ax T1 FS post gad (match) Cor T1 FS post gad (match)</p>

Brain (Parkinson-Degenerative; Lang) 3T No gad	- use instead of fast brain when history of “movement disorder” or history of related symptoms (parkinsonism, dystonia, cerebellar ataxia, tremor, etc.) is provided	- This protocol is like the fast brain, but done on 3T, with added Ax 3D FSPGR	
WAND TWH (gad) Gad 30 minutes	- Like Brain (pre + post gad) but performed pre-operatively for stereotactic intra-operative guidance	- compared to the Brain pre + post gad protocol, WAND has axial T2 instead of FLAIR, and omits the axial SE T1 post gad sequence and have AX 3D FSPGR seq	

Brain with MRA/MRV

Protocol	Use	Note	Sequences
Carotid MRA + Brain Gad (45 minutes)	<ul style="list-style-type: none"> - commonly used for stroke workup - may not need this protocol if the patient has had a recent CTA carotids (please check recent imaging and check with treating team if inpatient) - if recent CTA carotids, and ok with treating team, can use “Brain (fast)” protocol instead to simply r/o infarct 	<ul style="list-style-type: none"> - aka “ATECO carotid MRA” - includes both arterial and venous phases 	Sag T1 Ax T2 Flair Ax DWI Ax GRE/SWI Ax T2 Ax 2D TOF (Carotids) --inject test bolus-- TWIST Sag/Cor Cor 3D T1 PRE --Injection Cor T1 3D Arterial / Venous Ax SE T1 post gad

<p>Dissection</p>	<p>- to assess for arterial dissection (cervical/extracranial vessels)</p>	<p>- this is the “Carotid MRA + Brain” protocol with added axial T1 and T2 fast-sat through the neck</p>	<p>Sag T1 Ax T2 Flair Ax DWI Ax GRE/SWI Ax T2 Ax 2D TOF (Carotids) Ax T1 FS (neck) Ax T2 FS (neck) --inject test bolus-- TWIST Sag/Cor Cor 3D T1 PRE --Injection Cor T1 3D Arterial / Venous Ax SE T1 post gad</p>
<p>MRA COW with gad 1.5T</p> <p>Gad 45 minutes</p>	<p>- For follow-up of aneurysm with coils + stents</p> <p>- For assessment of vasculitis (bonus is that there is post-gad imaging of the brain included)</p>	<p>- aka “ATECO COW MRA”</p> <p>- includes both arterial and venous phases</p>	<p>Sag T1 Ax T2 Flair Ax T2 Ax DWI Ax GRE/SWI --inject test bolus-- TWIST Sag/Cor Ax 3D TOF COW Cor 3D T1 PRE --Injection Cor T1 3D Arterial / Venous Cor T1 3D delay Ax SE T1 post gad</p>
<p>MRA TOF COW 3T</p> <p>No gad – if gad required do “MRA COW with gad 1.5T”</p> <p>30 minutes</p>	<p>- for aneurysm screening and follow-up</p> <p>- for follow-up of coiled aneurysm (if coils safe for 3T and no stents)</p> <p>- if stents have been used, use MRA with Gad at 1.5T instead</p> <p>- for follow-up of sickle cell vasculopathy / moyamoya</p>		<p>Sag T1 Ax T2 Ax 3D TOF COW Ax T2 Flair Ax DWI Ax GRE/SWI</p>

<p>MRV</p> <p>Gad (30 minutes)</p>	<ul style="list-style-type: none"> - done for cortical venous thrombosis or sinus thrombosis - done for intracranial hypotension or hypertension 		<p>Sag T1 Injection Venogram Ax T2 Flair Ax DWI Ax GRE/SWI Sag T1 3D MPRAGE (Recon to Ax and Cor) Ax SE T1</p>
<p>NeuroVascular Package – 3T Siemens</p> <p>Gad (60 minutes)</p>	<ul style="list-style-type: none"> - this is a “rule out everything” protocol (includes the routine brain sequences, 3D TOF MRA COW, Ax 2D TOF MRA neck, CE dynamic MRA, MRV, and post gad brain) - VERY rarely needed 	<ul style="list-style-type: none"> - only available on Siemens scanners (MSH, PMH, TGH) - if patient not compatible – protocol will be done on 1.5T 	<p><i>Full Package including TOF COW and Venogram</i></p> <p>Sag T1 Ax T2 Flair Ax DWI Ax GRE/SWI Ax T2 Ax 2D TOF (Carotids) --inject test bolus-- TWIST Sag/Cor Ax 3D TOF COW Cor 3D T1 PRE --Injection Cor T1 3D Arterial / Venous Venogram Ax SE T1 post gad</p>
<p>Brain (TRICKS TWH 3T)</p>	<ul style="list-style-type: none"> - dynamic MRA - performed to assess for AV shunting, primarily for dural AV fistula 	<ul style="list-style-type: none"> - includes basic brain sequences and time-resolved MRA 	<p>Sag T1 Injection Sag TRICKS / TWIST Ax T2 Flair Ax DWI Ax GRE/SWI Sag T1 3D MPRAGE (Recon to Ax and Cor) Ax SE T1</p>

Carotid Cave Aneurysm 3T TWH	<ul style="list-style-type: none"> - very short protocol (3 sequences) - used only for determination of whether a cavernous carotid aneurysm is intradural or extradural 	<ul style="list-style-type: none"> - includes high-res images of the cavernous sinus region (similar to a sella MRI) - 3T preferred, can be done on 1.5T if unsafe for 3T. 	Cor T2 (sella) Sag T2 (sella) Ax 3D TOF COW
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Brain – Special surgical planning and follow-up

***The protocol required will usually be either indicated in the requisition, or easy to figure out from the patient's imaging history. **Please read the referring doctor's comments carefully.**

Protocol
DBS Post Insertion TWH
DBS Pre planning TWH 1.5T (frame)
DBS Pre planning TWH 3T (frameless)
sEEG planning – enhanced (3T)
DTI sequence (Dr. Hodaie)
GK AVM planning TWH
GK Pituitary Planning TWH
GK Tic F/U 3T TWH
GK Tic Planning TWH
GK Tic Pre-Screening 3T TWH
GK Tremor F/U 3T TWH
GK Tremor Planning TWH
GK Tremor Screen
GK Tumour Planning TWH
Post Thalamotomy-Pallidotomy TWH

Brain – Special protocols

Protocol	Use	Note	Sequences
Brain (nICU 1.5T MSH IP)	<ul style="list-style-type: none"> - Do not use this protocol - Meant for neonatal ICU babies (protocolled by Sick Kids neurorad) 		
Spectroscopy	<ul style="list-style-type: none"> - only use if specifically requested by the referring physician - use as add on to Brian (fast) protocol or Brain (pre + post gad) protocol 		
Brain (Acute Stroke + Gad)	<ul style="list-style-type: none"> - not used - use Brain (fast) if just need brain imaging to r/o infarct - used Carotid MRA + Brain if also need vascular imaging 		
Brain (CSF Flow 1.5T – TWH)	<ul style="list-style-type: none"> - only use if specifically indicated on the requisition 		
Brain (FMRI 3T TWH)	<ul style="list-style-type: none"> - only use if specifically indicated on the requisition 		
CVR TWH 3T	<ul style="list-style-type: none"> - only use if specifically indicated on the requisition 		
Post Thrombectomy 3T (TWH)	<ul style="list-style-type: none"> - only use if specifically indicated on the requisition 		
Vessel Wall Imaging TWH 3T	<ul style="list-style-type: none"> - only use if specifically indicated on the requisition 		

Sella

Protocol	Use	Note	Sequences
Sella Contrast optional (if need contrast – use Sella with Gad) 30 minutes / 45 minutes with contrast	<ul style="list-style-type: none"> - most screening sella MRIs don't need gad, unless ACTH or GH-secreting pituitary adenoma is suspected - follow up pituitary microadenoma or macroadenoma studies do not need gad - most post-op sella studies don't need gad 		Sag T1 (sella) Cor T1 (sella) Cor T2 (sella)
Sella with gad	<ul style="list-style-type: none"> - use for craniopharyngioma, hypophysitis, etc. (non-adenoma pathology) 		Sag T1 (sella) Cor T1 (sella) Cor T2 (sella) -- Contrast--- Cor T1 (sella) Sag T1 (sella)
Sella-Dynamic (includes contrast) 45 minutes	<ul style="list-style-type: none"> - for suspected ACTH or GH-secreting pituitary adenoma (that are not seen on non-contrast sella study) 		Sag T1 (sella) Cor T1 (sella) Cor T2 (sella) Injection Cor T1 3D Vibe Dynamic Cor T1 (sella) post gad Sag T1 (sella) post gad

Orbits – June 2018 – protocols in process of being updated

Protocol	Use	Note	Sequences
Orbit (mass) Contrast optional 30 minutes / 45 minutes with contrast	--no gad <ul style="list-style-type: none"> • Bilateral optic neuropathy • Glaucoma • Thyroid – eye --gad <ul style="list-style-type: none"> • Unilateral neuropathy • Mass 		Sag T1 Ax T1 (orbits) Cor T1 (orbits) Ax T2 (orbits) Cor T2 FS (orbits) --Optional Contrast--- Ax T1 FS (orbits) Cor T1 FS (orbits)
Orbits + Screening Brain	--no gad <ul style="list-style-type: none"> • MS • Visual loss • Field deficit 	- has mostly orbit sequences with an added Ax FLAIR of the brain (no DWI, GRE) - This protocol is almost identical to orbit (mass) protocol , but fat sat is removed from coronal T2 of the orbits and axial FLAIR of whole brain added	Sag T1 Ax T1 (orbits) Cor T1 (orbits) Ax T2 (orbits) Cor T2 (orbits) Ax T2 Flair Brain