

Table 1 Specialized Medical Services for Patients with Specific Stroke Subtypes

Stroke subtype	Stroke expertise	Surgery: vascular/neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
<i>Subarachnoid hemorrhage (SAH)</i>	<p>a) Guide use of neurointensive care strategies</p> <p>b) Treatment of neurologic complications</p>	<p>a) Aneurysm clipping</p> <p>b) Ventricular drainage for hydrocephalus, often ventriculo-peritoneal shunt for communicating hydrocephalus</p>	<p>To identify:</p> <p>a) aneurysm(s)</p> <p>b) vasospasm</p> <p>c) occlusive or stenotic complications of endovascular or surgical aneurysm treatment</p>	<p>a) Coiling of aneurysm</p> <p>b) Angioplasty and/or direct intra-arterial instillation of vasodilators for vasospasm</p>	<p>a) Intensive monitoring for neurologic change</p> <p>b) Ventilatory management of intubated patients</p> <p>c) Blood pressure control prior to aneurysm treatment</p> <p>d) "Triple H" therapy for treatment of symptomatic vasospasm</p> <p>e) Management of elevated intra-cranial pressure</p>	<p>a) Motor, cognitive, speech/swallowing therapy may be required depending upon degree and distribution of neurologic deficits</p> <p>b) Respiratory therapy may be required if tracheostomy</p>	<p>a) CTA to define anatomy for neurosurgeon and to detect aneurysms</p> <p>b) Serial CT required for detection of hydrocephalus, infarction</p> <p>c) TCD screening for evidence of vasospasm</p>
<i>Arteriovenous malformation (AVM) with intracerebral hemorrhage (ICH)</i>	<p>a) Neurologic assessments to guide use of neurointensive care</p>	<p>a) AVM removal</p> <p>b) Hematoma evacuation</p> <p>c) Ventriculostomy for secondary hydrocephalus</p>	<p>a) To identify AVM and its vascular anatomy</p>	<p>a) Endovascular embolization or coil occlusion of feeding vessels</p>	<p>a) Ventilatory management of intubated patients</p> <p>b) Intensive monitoring for neurologic change</p> <p>c) Blood pressure control</p> <p>d) Management of elevated intra-cranial pressure</p>	<p>a) Motor, cognitive, speech/swallowing therapy</p> <p>b) Respiratory therapy if tracheostomy</p>	<p>a) MRI often detects flow voids which leads to diagnosis of AVM in a patient presenting with ICH</p> <p>b) Serial CT required for follow-up of mass effect, cerebral edema, hydrocephalus, infarction related to treatment</p>

(continued)

24 Table 1 Specialized Medical Services for Patients with Specific Stroke Subtypes (continued)

Stroke subtype	Stroke expertise	Surgery: vascular/neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
<i>Basal ganglia or lobar hemorrhage</i>	<p>a) Patient management</p> <p>b) Guidance of intensive care</p> <p>c) Management of complications including seizure, brain edema</p> <p>d) Secondary prevention</p>	<p>a) Hematoma evacuation for progressive neurologic deterioration</p> <p>b) Ventriculostomy for secondary hydrocephalus</p>	<p>a) To rule out vascular malformation or vasculitis as cause of hemorrhage in select cases</p>	N/A	<p>a) Ventilatory management of intubated patients</p> <p>b) ICU level monitoring of vital signs</p> <p>c) Intensive monitoring for neurologic deterioration</p> <p>d) Management of elevated intracranial pressure</p>	<p>a) Motor, cognitive, speech/swallowing therapy</p> <p>b) Respiratory therapy if tracheostomy</p>	<p>a) MRI often used as screening tool to detect abnormal flow voids of an AVM</p> <p>b) MRA or CTA in some cases to rule out aneurysmal hemorrhage dissecting into brain</p>
<i>Cerebellar hemorrhage</i>	<p>a) Neurologic assessment to guide neurointensive care</p> <p>b) Secondary prevention</p>	<p>a) Hematoma evacuation for most bleeds greater than 3 cm. in diameter or if brainstem compression and/or</p> <p>b) Ventriculostomy for obstructive hydrocephalus</p>	<p>a) To rule out vascular malformation as cause in some cases</p>	N/A	<p>a) Intensive monitoring for signs of deterioration due to brainstem compression and/or hydrocephalus</p> <p>b) Management of cerebral edema</p> <p>c) Respiratory support in event of inability to protect airway or central respiratory failure</p>	<p>a) Motor therapy, speech/swallowing therapy</p> <p>b) Respiratory therapy if tracheostomy</p>	<p>a) MRI to screen for vascular malformation as the cause of hemorrhage</p> <p>b) DWI useful in distinguishing primary hemorrhage from bleed into infarct</p> <p>c) In posterior fossa MRI is superior to CT in defining brainstem compression</p> <p>d) Serial CT to follow for hydrocephalus</p>
<i>Brainstem and/or cerebellar infarction</i>	<p>Guide complicated decision-making regarding:</p> <p>a) cause of infarction</p> <p>b) advisability for intravenous or intra-arterial thrombolysis</p> <p>c) anti-coagulation for prevention of progressive basilar thrombosis or artery to artery embolus</p>	<p>a) Emergent decompressive craniectomy for brainstem compression due to cerebellar swelling and/or</p> <p>b) Ventriculostomy for obstructive hydrocephalus</p>	<p>a) To assess patency of vertebral and basilar arteries which are parent vessels of the cerebellar arteries (MRA and CTA often adequate)</p>	<p>a) Intra-arterial thrombolysis for patients with otherwise fatal basilar occlusion</p> <p>b) Angioplasty of vertebral or basilar stenosis in patients with concomitant severe vertebral-basilar flow impairment threatening basilar occlusion</p>	<p>a) Intensive monitoring for neurologic deterioration requiring neurosurgical, endovascular or medical intervention</p> <p>b) Ventilatory support often necessary due to pt's inability to protect airway or ischemia of primary respiratory centers</p>	<p>a) Motor, cognitive, speech/swallowing therapy</p> <p>b) Respiratory therapy if tracheostomy</p>	<p>a) MRI/DWI necessary to chart degree and distribution of infarction (CT performs poorly in the posterior fossa)</p> <p>b) CTA/MRA/TCD necessary to identify vascular stenoses/occlusion in vertebralbasilar arteries</p>

Stroke subtype	Stroke expertise	Surgery: vascular/neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
<i>Carotid territory infarction (internal carotid, middle cerebral, anterior cerebral artery occlusion or severe stenosis)</i>	<p>Patient management including:</p> <p>a) Decision-making regarding intra-venous and intra-arterial thrombolysis</p> <p>b) Planning secondary stroke prevention</p> <p>c) Preventing neuro or medical complications</p>	<p>a) Emergent carotid revascularization by experienced surgeon for progressive stroke due to carotid stenosis</p> <p>b) Brain biopsy for diagnosis of cerebral vasculitis</p> <p>c) Hemicraniectomy to prevent death due to malignant brain edema</p>	<p>a) To assess patency of carotid territory vessels (MRA/CTA and ultrasound are often adequate except for vasculitis)</p>	<p>a) Intra-arterial thrombolysis for major artery occlusion within 6 hours of symptom onset</p> <p>b) Stent/angioplasty for carotid stenosis</p> <p>c) Angioplasty for severe symptomatic intracerebral artery stenosis</p>	<p>a) Intensive monitoring for neurologic deterioration in patients with major artery stenosis or occlusion who are candidates for endovascular, surgical or medical intervention</p> <p>b) Blood pressure support for patients with fluctuating symptoms</p> <p>c) Post thrombolysis care</p> <p>d) Management of elevated intracranial pressure in patients with malignant brain edema</p>	<p>a) Motor, speech/swallowing therapy</p> <p>b) Respiratory therapy if tracheostomy</p>	<p>a) DWI and CT perfusion demonstrate regions of ischemic injury in the acute period</p> <p>b) CT, MR (SPECT) perfusion imaging may be useful in delineating degree and distribution of abnormal cerebral perfusion</p> <p>c) MRA and CTA identify intracranial vascular lesion</p> <p>d) MRA/CTA/CNI detect extracranial stenosis</p> <p>e) Serial CT needed to detect malignant brain edema, degree of infarction</p>
<i>Small vessel infarction</i>	<p>a) Patient management</p> <p>b) Secondary prevention</p>	N/A	N/A	N/A	<p>a) Post-thrombolysis care if decision made to treat with intravenous t-PA</p>	<p>a) Motor, speech/swallowing therapy</p>	<p>a) DWI often needed to demonstrate the small deep penetrator infarcts</p> <p>b) MRA /TCD/CTA needed to rule out underlying stenosis in Circle of Willis parent vessel</p>
<i>Venous sinus thrombosis</i>	<p>a) Patient management</p> <p>b) Seizure management</p> <p>c) Management of brain edema</p> <p>d) Secondary prevention</p>	<p>a) Rarely decompressive hemicraniectomy needed to prevent death due to brain edema</p>	<p>a) Identify sites of venous occlusion though MRV and CTIV often substitute</p>	<p>a) Cerebral arteriogram to make diagnosis</p> <p>b) Intra-sinus thrombolysis or direct thrombus removal</p>	<p>a) Intensive monitoring for neurologic deterioration</p> <p>b) Management of anticoagulation</p> <p>c) Management of raised intracranial pressure</p>	<p>a) Motor, speech/swallowing therapy</p> <p>b) DWI often needed to distinguish venous from arterial "infarct"</p>	<p>a) MR venogram or CT venogram to make diagnosis and follow state of the venous sinus</p> <p>b) DWI often needed to distinguish venous from arterial "infarct"</p>

DWI: diffusion weighted MR imaging.
 CNI: carotid duplex ultrasound.
 TCD: transcranial Doppler.
 CTA: X-ray computed tomographic angiogram using bolus of intravenous CT contrast.
 MRA: magnetic resonance angiography, improved sensitivity and specificity by using bolus of intravenous contrast.
 CTP: X-ray computed tomographic cerebral perfusion scan using bolus of intravenous CT contrast.
 Perfusion MR: magnetic resonance cerebral perfusion scan using bolus of intravenous gadolinium.
 SPECT: single photon emission computed tomography cerebral perfusion scan using radionuclide.