OHSU HEALTH CARE SYSTEM
PRACTICE GUIDELINES

Acute Stroke Practice Guidelines for Inpatient Management of Intracerebral Hemorrhage, PS 01.16

Last Reviewed Date: April 22, 2011

POLICY STATEMENT:

OHSU Hospitals and Clinics have adopted this practice guideline in order to delineate a consistent, evidenced-based approach to treating the patient who presents with signs and symptoms consistent with acute stroke due to intracerebral hemorrhage. Although this guideline assists in guiding care, responsibility to determine appropriate care for each individual remains with the provider themselves.

Outcomes/goals	• Create a multi-disciplinary, evidence-based, approach to the management of acute stroke patients secondary to intracerebral hemorrhage (ICH). • Patient plan of care to take into consideration the entire continuum of care from emergency department through rehabilitation.
Physician	1. Determine the appropriate unit for admission. **Recommended Admission Criteria for patient with ICH to Neurosciences ICU:** a. Acute symptom onset of < 24 hours. b. Patients in whom impending mental status decline and loss of protective airway reflexes is of concern. c. Patients requiring IV blood pressure or heart rate control. d. Patients requiring continuous cardiac monitoring. e. Patients requiring every 1-2 hour neurological evaluation due to ongoing or anticipated neurological deterioration. f. Patients post interventional neuroradiology procedure for minimum of 6 hours. g. Patients requiring external ventricular drainage (EVD) and/or intracranial pressure (ICP) monitoring. **Recommended Criteria for Admission to 10K:** a. S/p NSICU monitoring for at least 24 hours and not meeting above criteria.
Physician	2. Complete appropriate physician order set: a. NSG: NSICU Admission Orders. b. INR: ICU: Post Procedure Orders. c. NSICU: Daily Care Orders on Rounds. Admission orders must include CBC, CMP (complete metabolic set), PT/INR/PTT, lipid profile, urine toxicology, EKG, and CXR. Cardiac enzymes & transthoracic echocardiogram

	(TTE) are optional. Activity and diet orders, code status, GI and DVT prophylaxis must also be addressed.
Pharmacy and RN	3. Process physician orders according to OHSU policy.
RN	4. Complete admission database and initiate nursing plan of care according to the appropriate OHSU Adult Inpatient Standards of Care. 5. Adult Critical Care Standard of Care Adult Acute Care Inpatient Standard of Care
Physician	6. Evaluate for loss of airway protection and need for intubation.
Physician, RN, and RT	7. Maintain adequate oxygenation and ventilation. Avoid prophylactic or prolonged hyperventilation.
Neurosurgeon	8. Consider ICP monitoring and/or EVD for patients based on poor neurological status: Glasgow Coma Scale (GCS) score <8 or neurological deterioration with hydrocephalus or any concern for ICP elevation. If EVD placed, ICP goal < 20 with cerebrospinal fluid (CSF) surveillance sampling q 72h by Neurosurgery (more frequent if clinically indicated). Primary surgical intervention (at Attending Neurosurgeon's discretion) in: A) Cerebellar hemorrhage > 3 cm with 4th ventricle effacement and/or hydrocephalus with neurological deterioration. B) Lobar ICH (< 1 cm from surface) in younger patients (< 45) with GCS 9-12 or expanding lobar ICH associated with progressively worsening GCS. C) Select patient with Medically Refractory Intracranial Hypertension. D) Select patient for Early Hemicraniectomy.
Physician and RN	9. Keep Cerebral Perfusion Pressure (CPP) > 70 or Mean Arterial Pressure (MAP) > 70 in patients with no concern for elevated ICP. If concern for elevated ICP, prior to ICP monitor placement and estimation of CPP, consider MAP goal > 80. Consider continuous arterial pressure monitoring for continuous titration of blood pressure. 10. Measures to prevent increased ICP include: head of bed elevation > 30 degrees, avoiding excessive hip flexion, keeping head in midline position as much as possible, avoiding pressure on neck from endotracheal tube tape and suctioning only as needed and using short acting sedative or lidocaine prior to suctioning. 11. Measures to treat elevated ICP include controlled hyperventilation (Goal PaCO2 28-32; short term use only), osmotherapy with mannitol and/or hypertonic saline (central line for latter, 3% saline may be started using large bore PIV), analgesia and sedation, controlled external ventricular drainage, pharmacological coma, mild hypothermia (34-36 degrees centrigrade) and, in refractory cases, hemicraniectomy and/or clot evacuation as indicated by patient condition. Routine prophylactic hyperosmolar therapy NOT recommended. 12. Isotonic fluids recommended for volume resuscitation with goals of maintaining euvolemic state. 13. Initiate vasopressors, if necessary, to achieve MAP and CPP goals. Continuous arterial pressure monitoring is recommended in patients requiring close titration of vasoactive medications including vasopressors and continuous IV infusions for BP titration. Central line or peripherally inserted central venous catheter (PICC) recommended if patient receiving a vasoactive medication and/or hypertonic saline.

	14. Aggressively reverse coagulopathy with INR goal < 1.3 using Fresh Frozen Plasma (FFP). Vitamin K 10 mg every 12-24 hours times three doses (every 12 in large and expanding ICH), IV must be given as slow infusion. Administered IV upon admission, may be continued IV or transitioned to po. 15. For warfarin-associated ICH and INR > 1.45, follow the Warfarin Reversal Protocol for Intracranial Hemorrhage. 16. Factor VIIa (20 mcg/kg) restricted only to exceptional cases with *warfarin-associated ICH* with either a) failure to respond to FFP with neurological deterioration with associated hematoma expansion; or b) ongoing neurological deterioration with delayed FFP availability; or c) elective use of factor VIIa with evidence of spot sign on CTA or evidence of hematoma expansion on two serial CT. 17. Platelet transfusions (2-6 units, higher end of range if surgery planned) in patients on anti-platelet therapy. In Epic, 1 unit of platelet pheresis leukoreduced product equals 6 units of platelets. 18. Prepare for administration of 6-8 units of platelet transfusions and 6-8 units of cryoprecipitate & Factor VIII in patients with ICH related to prior use of tPA. In Epic, one unit of platelet pheresis leukoreduced product equals 6 units of platelets and one cryo pool equals 5 units of cryoprecipitate. 19. Protamine sulfate (dosing based on dose and time since administration of heparin) in heparin-induced ICH. 20. Consider seizure prophylaxis ONLY in high risk patients (Lobar hemorrhages). Consider continuous EEG x 24 hours in comatose patients (GCS < 8) including patients with deep supratentorial hemorrhages. Keppra IV >> IV Fosphenytoin for prophylaxis. All patients presenting post seizure should be treated with anti-epileptic medications. 21. Diagnostic Testing: If patient is a) > 45 years of age, b) h/o HTN with c) SBP > 160 on admission and d) ICH in basal ganglia or thalamus, CT and CT angiogram of head upon admission (latter if no history of or evidence of renal failure). If ***any*** of aforementioned criteria not met, *consider* conventional angiogram. MRI recommended if suspicion of underlying mass based on history (age, history of primary cancer), radiological appearance (multiple bleeds: r/o amyloid angiopathy, mets), or if etiology unclear.
Physician and RN	**Recommended Guidelines for Treating Elevated BP** a. SBP goal < 160 in patients with no clinical suspicion of elevated ICP. b. If clinical suspicion of elevated ICP exists, SBP goal < 180, with titration to SBP goal < 160 once ICP monitor placed and ICP better controlled. c. If evidence of hematoma expansion on serial CT or positive spot sign on CTA or if underlying coagulopathy, suspected or known lesion (aneurysm, AVM) consider aggressive titration of SBP goal to < 140 if no concern for significant elevation in ICP.
Physician and RN	**IV medications that may be considered for control of elevated BP** a. Labetalol, 5-20 mg IV bolus every 15 minutes or start at 2 mg/min continuous infusion (maximum 300 mg/day). b. Nicardipine, 5-15 mg/hour IV continuous infusion. c. Enalapril, 1.25 to 5 mg IV push every 6 hours. d. Hydralazine, 5-20 mg IV push every 30 minutes
Physician and RN	22. Monitor laboratory values as needed to monitor electrolytes, blood counts, coagulation status, and drug levels. 23. Maintain glucose levels with sliding scale insulin titrated to blood glucose 120-160

	mg/dL. Use Insulin infusion if blood glucose > 180 mg/dL for two consecutive checks. 24. Goal of normonatremia unless otherwise indicated. (If elevated ICP, or cerebral edema with worsening mass effect causing neurological deterioration: Administer hypertonic saline as needed.) 25. Maintain normothermia. Treat fever by trying to identify source; tailor interventions to possible source(s); provide antibiotics, if indicated; and use of antipyretics. Attempt to achieve goals with acetaminophen, cooling blankets, ice packs etc; if failure to achieve goal of 36-37 degrees centrigrade in 4 hours, transition to Arctic Sun and institute the Anti-shivering Protocol. as part of 'normothermia protocol measures', pan culture every 48 hours.
RN	26. Perform focused neurological assessments based on patient condition and physician orders, every 1-2 hour while in the ICU and every 2-4 hours in acute care. 27. Changes in patient condition to be reported immediately to the NSICU and Neurosurgery Team. 28. Maintain VAP (Ventilator associated Pneumonia) precautions *per protocol.*
RN and Rehabilitation Services	29. Keep head of bed > 30 degrees, if not contraindicated. 30. Bedrest for 24 hours from admission, then activity as tolerated, to promote active exercise, strength training, and gait training. 31. Initiate interventions as needed to reduce risk of formation of contractures and minimize edema formation, using bracing/orthotic devices as needed. 32. Provide aphasia treatment, cognitive rehabilitation, communication devices, movement therapy, spasticity treatment, and functional adaptation for visual/perceptual deficits and neglect.
RN, Rehabilitation Services, and Nutrition Services	33. Dysphagia screening to be completed and documented prior to anything by mouth using the Bedside Nurse Swallow Screen. Initiate Speech Language Therapist consult for formal swallow evaluation, as needed, and when patient able to participate. Place dobbhoff tube (DHT) within 24 hours of admission if patient unable to swallow to optimize nutrition needs. 34. Nutrition consult as needed to maximize nutritional support. 35. Initiate dietary interventions to lower LDL's, if greater than 100mg/dL.
Physician and RN	36. Initiate VTE prophylaxis upon admission with intermittent pneumatic compression (SCD's) in all ICH patients. Initiate pharmacological prophylaxis with Lovenox 40 mg subcutaneous every day if at least 24 hours of hematoma stability documented on serial CT scans in high risk (comatose or non-ambulatory) patients if ICH deemed to be of hypertensive etiology (Alternative: Heparin 5000 subcutaneous every 8-12 hours). Hold pharmacological prophylaxis in all patients with EVD and for 24 hours after either removal of EVD or shunt placement and for at least 1 week post surgery for clot evacuation or hemicraniectomy in spontaneous hypertensive ICH. Surveillance venous

	duplex of affected limb/ limbs every 3 days in all immobilized patients, and every 7 days in all other ICH patients. 37. Initiate peptic ulcer prophylaxis (PUD) as appropriate. 38. Review FAST HUG in daily rounds.
RN, Social Worker (MSW), Case Manager, and Physician	39. Provide social and psychological support for the patient and their significant others as needed. 40. Case management services to begin upon admission, providing ongoing utilization review. Works with multiple disciplines to determine patient's condition and needs/barriers for discharge. Coordinates discharge planning with patient and family (e.g., inpatient rehab, skilled nursing facility, home health, durable medical equipment).
Multi-disciplinary team	41. Identify patient and family education needs and provide appropriate information and resources found in the stroke education packet. This should include: personal risk factors, warning signs for stroke, activation of EMS, need for follow-up after discharge, medications prescribed, tobacco cessation counseling if smoked anytime in past 12 months, alcohol intake, nutrition, exercise, and blood pressure regulation. 42. Document education provided in the Patient Education section of the electronic medical record and or LIP documentation in progress notes.

Bibliography:

- Hemphill, JC., Anderson, C., Becker, K., et al. (2010). Guidelines for the Management of Spontaneuous Intracerebral Hemorrhage: A guideline for healthcare professionals from the AHA/ASA. Stroke, 41, pp. 2108-2129.
- Broderick, J., Connolly, S., Feldmann, E., et al. (2007). Guidelines for the Management of Spontaneous Intracerebral Hemorrhage in Adults: 2007 Update: A Guideline from the American Heart Association, American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. Stroke, 38(6), pp. 2001-23.
- A.D. Mendelow, B.A. Gregson, H.M. Fernandes, G.D. Murray, G.M. Teasdale and D.T. Hope *et al.*, STICH investigators. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomized trial, *Lancet* **365** (9457) (2005 (Jan. 29)), pp. 387–397.
- Frank JI. Large hemispheric infarction, clinical deterioration, and intracranial pressure. *Neurology .* 1995; 45: 1286–1290
- Misra UK, Kalita J, Ranjan P, Mandal SK. Mannitol in intracerebral haemorrhage – a randomized controlled study. *Journal of the Neurological Sciences* 2005; **234**: 41–45
- Mayer SA, Brun NC, Begtrup K, Broderick J, Davis SM, Diringer MN, Skolnick BE, Steiner T; FAST Trial Investigators. Efficacy and safety of recombinant activated factor VII for acute intracerebral hemorrhage. *N Engl J Med.* 2008; 358: 2127–2137
- Goldstein JN, Fazen LE, Snider R, Schwab K, Greenberg SM, Smith EE, Lev MH, Rosand J. Contrast extravasation on CT angiography predicts hematoma expansion in intracerebral hemorrhage. *Neurology.* 2007; 68: 889–894
- Wada R, Aviv RI, Fox AJ, Sahlas DJ, Gladstone DJ, Tomlinson G, Symons SP. CT angiography "spot sign" predicts hematoma expansion in acute intracerebral hemorrhage. Stroke. 2007 Apr;38(4):1257-62.
- Vespa PM, O'Phelan K, Shah M, Mirabelli J, Starkman S, Kidwell C, Saver J, Nuwer MR, Frazee JG, McArthur DA, Martin NA. Acute seizures after intracerebral hemorrhage: a factor in progressive midline shift and outcome. Neurology 2003;60(9):1441–6.
- Claassen J, Jette N, Chum F, Green R, Schmidt M, Choi H, Jirsch J, Frontera JA, Connolly ES, Mayer SA, Hirsch LJ. Electrographic seizures and periodic discharges after intracerebral hemorrhage. *Neurology.* 2007; 69: 1356–1365
- Naidech AM, Garg RK, Liebling S, Levasseur K, Macken MP, Schuele SU, Batjer HH. Anticonvulsant use and outcomes after intracerebral hemorrhage. Stroke. 2009 Dec;40(12):3810-5.
- Zhu XL, Chan MS, Poon WS. Spontaneous intracranial hemorrhage: which patients need diagnostic cerebral angiography? A prospective study of 206 cases and review of the literature. Stroke. 1997 Jul;28(7):1406-9.
- Anderson CS, Huang Y, Wang JG, et al, for the INTERACT Investigators. Intensive blood pressure reduction in acute cerebral haemorrhage trial (INTERACT): a randomized pilot trial. Lancet Neurol 2008;7:391–399.
- Oddo M, Schmidt JM, Carrera E, Badjatia N, Connolly ES, Presciutti M, Ostapkovich ND, Levine JM, Le Roux P, Mayer SA. Impact of tight glycemic control on cerebral glucose metabolism after severe brain injury: a microdialysis study. Crit Care Med. 2008 Dec;36(12):3233-8
- Vespa P, Boonyaputthikul R, McArthur DL, Miller C, Etchepare M, Bergsneider M, Glenn T, Martin N, Hovda D. Intensive insulin therapy reduces microdialysis glucose values without altering glucose utilization or improving the lactate/pyruvate ratio after traumatic brain injury. Crit Care Med. 2006 Mar;34(3):850-6
- Sherman DG, Albers GW, Bladin C, Fieschi C, Gabbai AA, Kase CS, O'Riordan W, Pineo GF; PREVAIL Investigators. The efficacy and safety of enoxaparin versus unfractionated heparin for the prevention of venous thromboembolism after acute ischemic stroke (PREVAIL Study): an open-label randomized comparison. Lancet. 2007 Apr 21;369(9570):1347-55.
- Kiphuth IC, Staykov D, Köhrmann M, Struffert T, Richter G, Bardutzky J, Kollmar R, Mäurer M, Schellinger PD, Hilz MJ, Doerfler A, Schwab S, Huttner HB. Early administration of low molecular weight heparin after spontaneous intracerebral hemorrhage. A safety analysis. Cerebrovasc Dis. 2009;27(2):146-50.

- CLOTS Trials Collaboration, Dennis M, Sandercock PA, Reid J, Graham C, Murray G, Venables G, Rudd A, Bowler G. Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke (CLOTS trial 1): a multicentre, randomized controlled trial. Lancet. 2009 Jun 6;373(9679):1958-65.

Related Forms and Procedures:

- Nursing Standard of Care: Adult Inpatient Critically Ill

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Originator/Author: OHSU Stroke Advisory Committee (2007)
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Revised by (2008): Jeremy Fields, MD, NSICU Neurointensivist; Neeraj Naval, MD, NSICU Neurointensivist; & Karen Ellmers, RN, MS, CCNS, Stroke Coordinator

Approved by:

OHSU Stroke Advisory Committee (2007, 2008)

Neurosciences Best Practices Committee (2010, 2011)

Reviewed by:

NSICU and 10K UBNPC (2007, 2008, 2010)

OHSU Nursing Practice Council (2007)

OHSU Stroke Center (2008, 2010, 2011)

NSICU Faculty & NSICU Protocols Committee (2008, 2010, 2011)

Dept. of Neurosurgery Faculty (2009)