Protocol for the Insertion of Emergent External Ventricular Drains (EVDs) in the Emergency Department at Mount Sinai Hospital

Author: Cappi Lay, MD – Co-Director Neurosciences Intensive Care Unit, Mount Sinai Hospital

Rationale:

Acute hydrocephalus and intraventricular hemorrhage (IVH) are life-threatening emergencies that occur in patients with a variety of neurological illnesses. Aneurysmal Subarachnoid Hemorrhage (aSAH), intracerebral hemorrhage (ICH), and acute ischemic stroke affecting the posterior fossa, are examples of rapidly progressive processes that may precipitate hydrocephalus, leading to intracranial hypertension and cerebral herniation. In these cases, placement of an external ventricular drain (EVD) is a life-saving neurosurgical procedure that allows the diversion of cerebrospinal fluid outside of the cranium and results in a rapid lowering of elevated ICP.

The Mount Sinai Health System now oversees over 1,000 transfers per year involving acute neurologic illnesses, providing a tremendous service to the citizens of New York City. Mount Sinai Hospital offers advanced neurosurgical and stroke treatment that most of our affiliates and few other New York City hospitals can provide to patients. While the majority of MSH transfers requiring emergent EVDs are brought directly to the NSICU, on occasion it is necessary to bring the patient to the ED for this procedure when an ICU bed is not immediately available.

This protocol was written to create a standard way of approaching this procedure and assign roles and responsibilities to the physicians and nurses working in the ED who will be called on to assist.

The physician performing the EVD procedure will most often be a resident physician from the department of neurosurgery. The residents that have been approved to place EVDs independently have been proctored and observed in performing a minimum number of procedures by faculty in the department of neurosurgery. Under no circumstance should a medical student or resident who has not completed the required number of proctored EVDs be allowed to insert an EVD in a patient located in the resuscitation area.

The role of the ED physicians and nurses during the EVD procedure are to a.) control the patient's airway, b.) maintain a safe and sterile environment around the proceduralist, c.) provide sedation and analgesia as needed during the procedure, and d.) monitor for hemodynamic or respiratory instability during the procedure.

Nurses assisting in EVD placement should have undergone training in the management of the EVD drainage apparatus provided by the MSH-NSICU Nursing Supervisor. For more information on building familiarity with EVDs, please contact Ms Elka Riley – Nursing Supervisor

(elka.riley@mountsinai.org). If a patient requires an emergent EVD to be placed in the ED prior to transfer up to the NSICU, a NSICU-nurse may be called to assist the ED nurses in management of the EVD drainage apparatus or to provide just-in-time training to the ED nurses involved. Due to the busy nature of the NSICU and its own personnel needs, we cannot guarantee that a NSICU nurse will be available to assist in the ED under all circumstances. We understand that this is an unfamiliar procedure for many nurses however, and will make every attempt to assist as much as possible.

PRIOR to PROCEDURE:

1.)EVDs should only be placed with the patient located in the RESUS AREA of the ED.

2.) The Neurosurgery Resident will make an attempt to obtain informed consent from the patient's next of kin or surrogate. If unable to quickly obtain consent in the setting of an emergency, a two physician consent will be used.

3.) TWO IVs should be in place prior to the start of the procedure

3.) **HUDDLE:** Prior to the procedure, there are at least three team members that need to huddle: The patient's bedside nurse (RN), the neurosurgical resident performing the procedure, and the ED attending. An ED resident may also be part of the care team. In the huddle, the team will go over a plan for the following elements of the procedure:

- AIRWAY CONTROL:

In many cases, intubation should be performed prior to placement of an EVD but there may be cases in which EVD placement can proceed safely without intubation. Each case should be discussed between the providers. **The ED attending** will make the final decision on whether the patient needs intubation prior to EVD placement.

- SEDATION: All physicians and nurses should understand the sedation plan and the drug dosing expected prior to, during, and after the procedure. With few exceptions, all patients undergoing EVD placement should receive at least some sedative medication (Versed, Ativan, Propofol, Precedex), ***even if*** this requires the concomitant administration of vasopressors to maintain goal blood pressures.

-ANALGESIA: All physicians and nurses should understand the plan for pain control and the drug dosing expected. Fentanyl or morphine, when used, should generally be in addition to sedative use and not substituted as a sedative.

- POSITIONING & ROOM SETUP: The operator should discuss the proper setup of the patient's bed, the need for restraints, monitors, and tables that will be used for equipment. The patient requires heart rate, BP, and pulse oximetry monitoring throughout the procedure, as well as End-Tidal CO2 monitoring if the patient is not already intubated. We recommend that the patient be detached from

the wall monitor and placed on a portable monitor during the procedure to minimize wires at the head of the bed which have the potential to contaminate the procedure area.

- INTRACRANIAL PRESSURE CONTROL: Most of these patients will have elevated intracranial pressure. In addition to adequate sedation and pain control, team members should discuss the use of mannitol, and temporary hyperventilation PRIOR to the EVD procedure.

- HEMODYNAMIC MANAGEMENT: PRIOR to the start of the procedure, the team should discuss a blood pressure goal for the patient and how that goal is to be maintained if there is an unexpected drop or elevation in the middle of the procedure. Drugs for raising BP (phenylephrine) or lowering BP (Nicardipine, Clevidipine) should be immediately available PRIOR to the start of the procedure. While not required, the placement of an **arterial line** for close blood pressure monitoring is strongly recommended prior to beginning the procedure. Typical BP goals immediately after subarachnoid hemorrhage prioritize maintaining SBP < 140mmHg to reduce the potential for aneurysm re-rupture, while keeping MAP > 65 for global perfusion.

4.) All staff in the curtained RESUS bay in which the procedure is taking place must be wearing a mask and hat.

5.) A Time-Out should be performed prior to the start of the procedure.

6.) Pre-procedural antibiotics should be given as per Neurosurgery order

DURING the PROCEDURE

1.) The ED Nurse is responsible for making sure vitals are being checked with regularity. (BP at least q3 minutes if no arterial line in place), Heart Rate, SpO2, ETCO2 – continuously. The ED nurse is also responsible for administration of medications ordered by the ED attending or ED resident physician.

2.) The ED physician is responsible for ensuring stability of the airway, managing ventilation status, keeping hemodynamic variables within established parameters, and ordering sedative, analgesic, and hemodynamically active meds. Either the ED Resus area attending, or the ED resident, should be present for the *entirety* of the EVD procedure.

POST PROCEDURE

1.) At the end of the procedure, the EVD catheter should be attached to the Drain Apparatus.
2.) In most cases, the EVD will be set at 20cmH2O above the tragus of the ear.
3.) The drain should always be clamped during patient transport or turning.
4.) A post-procedure CT should always be ordered.

5.) A POST-PROCEDURE HUDDLE should take place between the Neurosurgery resident, ED physician, and ED nurse to quickly discuss the following:
    - Ongoing BP goals
    - EVD level and drainage plan
    - Necessity of additional treatment for elevated intracranial pressure
    - Need for specialized neuro-imaging (CTA, MRI, etc)
    - Surgical or interventional treatment plan for primary cause of hemorrhage (angiography vs Operating room vs NSICU admission)

For any questions about this protocol, please don't hesitate to contact:

Cappi Lay, MD

Co-Director Neurosciences Intensive Care Unit

Assistant Professor, Emergency Medicine and Neurocritical Care

Cappi.lay@mountsinai.org