Guideline for Anesthetic Management of Endovascular Therapy for Acute Ischemic Stroke

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This guidance is directed at care of patients during Emergent Endovascular Thrombectomy performed by Neurosurgeons and NeuroInterventional Radiologists at Baylor Scott and White Healthcare, Temple Memorial Hospital, Temple Texas, specifically Ethan Benardete, M.D. and Walter Lesley, M.D. The recommendations are largely derived from recent experience and the following article:

Society for Neuroscience and Critical Care (SNACC) Consensus Statement: Anesthetic Management of Endovascular Treatment for Acute Ischemic Stroke Endorsed by the Society of NeuroInterventional Surgery and the Neurocritical Care Society, published in Journal of Neurosurgical Anesthesiology: April 2014, Volume 26, Issue 2, page 95-108.

The following priorities should be kept in mind at all times:

These cases are true Emergencies! Time from onset of stroke to removal of thrombus and restoration of flow to the ischemic brain is very critical. Even a few minutes can affect outcome. Try to avoid any unnecessary delay. While redundant IV access and direct arterial pressure monitoring are desirable, the benefit may not be worthwhile if they cause delay in intervention, and should usually be deferred unless they can be done without impeding progress to incision. The entire team should make a concerted effort to be both safe and efficient during patient movement into OR, preparation for Anesthesia, and readiness for the surgical incision.

The choice of management with sedation and local anesthesia or General Endotracheal Anesthesia is complex with many considerations such as the baseline state of the patient, preference of the surgeon, and judgement of anesthesia providers. The latest data indicate that either option, if appropriately managed, has comparable outcomes. Local surgeon preference: Dr Lesley will usually prefer General Anesthesia unless some patient concern would make it excessively difficult or cause a delay. Dr Benardete would

consider and slightly encourage sedation and local in appropriate patients.

If sedation is chosen, it should be understood by all that the level of sedation is limited to light or moderate sedation only, as the patients likely have full stomach and are at risk of aspiration, and may deteriorate neurologically at any time. My recommendation is that the patient should remain arousable to voice or light stimulation at all times! With appropriate local anesthesia, the procedure is not very painful, and deeper levels of sedation are usually not needed and should be avoided. If the patient is not cooperative with this level of sedation then general anesthesia may be preferred, and the anesthesia team should always be prepared to proceed to general anesthesia quickly. (See more specific recommendations below).

Management of arterial blood pressure seems to be a critical factor. Current recommendations are to maintain a systolic blood pressure range of 140-180 systolic, with a target of 160 systolic, at all times, including the immediate post-induction period and throughout the prep and drape and procedure time. Often, patients will present with hypertension. Systolic pressures up to 200 mmhg may be tolerated, unless patient has received Tissue Plasminogen Activator (TPA), in which case systolic pressure should be kept below 180 to reduce risk of intracranial bleeding. After successful thrombectomy and restoration of cerebral blood flow, blood pressure may be allowed to be reduced but this should be in consultation with the surgeon.

See attached for specific details:

Stroke Alert Quick Guide

Preparation: True Emergency – Do not delay for lines, pre-eval, consent, etc. Emergency consent is implied. Formal Pre-eval and consent should not delay progress of patient to OR, but can be done if someone is available to do so without delay. Try to be sure the EPIC record opened in the OR is the correct event (best to open from "snapboard"). If a pre-eval was done before case encounter posted on Snapboard, it may be under another case event and may need to be linked or copied to the correct case. DO your best to get Epic record, but do not delay case for EPIC issues! (use paper record if necessary).

Basic GA setup (airways, suction, propofol, fentanyl, sux, Rocuronium, phenylephrine bolus, ephedrine, etc) plus phenylephrine infusion ready.

IF time permits, recommend having Cleviprex in the room, arterial line set-up, extra basic IV set-up (patients often arrive

from outside hospital with non-standard IV lines and having one of our standard sets ready to go may save time). Heparin will likely be requested – be sure it is available. Consider setting up Propofol/Remifentanil infusions (but not mandatory if time is limited). If sedation planned, consider Dexmetetomidine (also versed, fentanyl, propofol).
Patient will likely be transported to OR by Emergency Department nurses, which should allow a brief face to face turnover. Brief Neuro assessment and report on hemodynamic range during last hour is recommended.
Patient In the Room: IF GETA, can either induce anesthesia on stretcher then move patient to X ray table, or move patient into position on X ray table and then induce GETA. I think it may be a little faster to move patient to table first so that other preparations such as foley catheter and prep can be done concurrently or immediately after induction, but some patients may be easier to move after placement of a secure airway, and the stretcher may be easier to get into a favorable position relative to the anesthetic machine to facilitate airway management at induction.
If not done prior to OR, attempts at arterial line can proceed <u>IF it doesn't impede or delay induction of anesthesia, positioning, prep and drape.</u> There is a smaller, white armboard that can be used on the X-ray table to position the left arm at an angle for line insertion attempts while out of the way of the surgical field, so that attempts at line placement can continue while other work is in progress, but it can be difficult due to the necessary movements of patient and equipment. If unable to place arterial line, the surgeon may be able to provide a connection to the femoral arterial line for monitoring. It is perfectly acceptable to manage the whole case with non-invasive BP and a single IV.
Pay attention to IV lines! Lines in left arm will be accessible, but an IV or arterial line in the right arm will be covered and inaccessible during the case. Ensure patency and function of lines before they get tucked, and consider adding an extension or "push line" to an IV in the right side.

<u>IF GETA Planned</u>
Induction of GA: Likely to be Rapid Sequence Induction due to full stomach. Ensure that <u>suction reaches the airway at induction position and is accessible during intubation</u>! (if patient on X ray table, consider rotating table toward anesthesia machine at

induction). Remember to try to prevent fall in BP or treat promptly. Even a short period of reduced BP is thought to be detrimental. Systolic arterial pressure temporarily at 180-200 would generally be preferable to systolic 120 (unless TPA has been given), even for 5 minutes, so treat any BP less than 140 promptly.

They usually want ETT to the left side of the mouth. ETT breathing circuit, lines and cables will need to be secured by the left side leaving the area around and under the head and shoulders clear for C- arm rotation. Be aware that the table slides back and forth a considerable distance, so lines need to be watched carefully. I usually secure breathing circuit and IV lines and arterial transducer to the left side arm board to keep them out of the way.

Maintenance of Anesthesia: Either volatile or intravenous agents are acceptable provided BP is maintained.

Propofol/Remifentanil is popular in study protocols and seems to be favored at experienced centers and is currently my favored regimen due to stability, rapid emergence, and rapid return of cognition for neuro evaluation. Propofol at 75-100 ug/kg/min and Remifentanil at 0.1 to 0.2 ug/kg/min is the average dose, but this will be variable. Desflurane, Sevoflurane, and Fentanyl are also appropriate. Neuromuscular blockade can be used if desired but should be completely reversed before emergence (consider Suggamadex). Phenylephrine is usually needed to **keep BP in target Range (160 mmhg Systolic).** Rarely, the addition of norepinephrine or vasopressin may be needed. After sheath insertion, there is very little surgical stimulation so anesthetic requirements are usually low and only need to be sufficient to keep patient still.

Respiratory pauses will often be requested for a few seconds at a time, so keeping ET CO2 at a low-normal range (~ 35) may facilitate apnea, but excessive hyperventilation with hypocarbia should be avoided as it could reduce cerebral blood flow, and hypercarbia may elevate Intracranial pressure.

Heparin is usually requested. Note patients may have already received TPA.

After clot is removed, discuss BP target with surgeon (generally, a slightly reduced level is acceptable).

Occasionally additional drugs such as Integrelin will be requested by surgeon. If the drug is unfamiliar, be sure to verify dosage, administration rate and precautions before giving.

Hyperglycemia may be detrimental – suggest check glucose

and treat if over 180, and treat hypoglycemia if under 60. Arterial blood gases, hgb, and electrolytes should be checked when time allows.

Emergence: Goal is for smooth emergence with minimal coughing, but deep extubation is not usually recommended due to full stomach considerations. Suctioning of gastric contents with OG tube should be considered. Be aware that they may need to hold femoral pressure for up to 10 minutes or longer after removal of sheath, and this can be painful, so timing of emergence should take this into consideration. Depending on patient's neurologic status, extubation should be considered with caution, recognizing the possibility that re-intubation could be required due to neurologic decline. In general, if patient was alert and was maintaining airway prior to induction, extubation is desirable to facilitate neurologic evaluation.

If patient was obtunded and intubated or on the verge of needing ventilation prior to arrival in OR, they will likely remain intubated post-op. Consider titration of propofol or dexmetetomidine if needed to help patient tolerate intubation, but at a level that would allow neurologic assessment.

Per the Stroke management guidelines, if there is no evidence of hemorrhage, **hypertension is permissible up to about 200 systolic** (some protocols allow up to 220 systolic), unless TPA has been given (recommended maximum systolic BP of 180). Discuss post op BP parameters with surgeon. If needed, Labetalol, Nicardipine or Clevidipine are favored for hypertension above these levels. If BP is below target range, consider vasopressors such as phenylephrine.

These patients routinely are transferred to the Neuro section of MICU post-op. Communication to the ICU team regarding neurologic conditions and blood pressure parameters is important!

EPIC documentation has frequently been a problem. Note the following:

Sometimes the record is begun under the wrong case encounter. Try to verify that the case title is correct and it is the encounter that shows on Snapboard. If not, the case must be "linked" to the correct encounter.

Some information is required to be entered into the Pre-eval section before case can be closed –even if little information was available and no pre-eval done prior to case, note that it was an emergent case, explain what information was available, whether consent was obtained or waived, and sign Pre-eval and Mark

"Ready for Procedure" even if this has to be done after case has ended.
The usual attestations and procedure notes for arterial line etc. need to be entered, and a Handoff and Post-Eval note need to be entered, as well as the usual entries for Anesthesia Stop, extubation notes, Train of Four, etc. Checking the "requirements" tab in the "Post" section will detail missing elements.

If Local Anesthesia with light sedation Planned:

This should be a decision involving both the surgeon and Anesthesia staff! My recommendation is that it could be considered if the patient is arousable, able to follow directions, is maintaining ventilation well and has no major airway risk factors (such as morbid obesity, obstructive sleep apnea, limited cervical motion, thick beard, etc.), and the surgeon is in agreement. Surprisingly, many patients with Middle Cerebral Artery occlusion will have a paraplegia or other focal deficit but remain alert and cooperative, and be consistent with the above limitations. Since the procedure involves very little pain, it can be performed on a fully awake patient if cooperative. The patient is positioned on the X ray table awake, the head is secured in the cradle, nasal cannula oxygen (with ET CO2 sample line) is placed. Small doses of anxiolytic (i.e. versed), analgesic (fentanyl), or sedative (propofol or dexmetetomidine) medications are administered while ensuring the patient remains responsive to voice or light stimulus (i.e. tap on forehead or light shake). If the level of sedation goes beyond this, to the point that a patient is unresponsive to jaw thrust, there is a significant risk of suppression of airway reflexes and possible aspiration, so it is strongly recommended that this be avoided!
While there is no clear evidence favoring one sedation regimen over another, dexmetetomidine seems to be common and preferred in many centers. Light propofol with low dose remifentanil has also been used successfully in some trials. I currently recommend low dose dexmetetomidine, possibly supplemented with small doses of fentanyl or very small doses (10-30 mg increments) of propofol. The level of sedation is more important than which drug is used. As the surgeon prepares to inject local anesthetic, warn the patient and ask them to be still. A small dose of propofol may be appropriate, but be aware that there is no access to the patient's head to assist ventilation, so this must be done very carefully. The local injection and femoral puncture and sheath placement is usually

only mildly painful, and once completed there is nearly no other painful stimulation, so the level of sedation can be lightened after this is completed. (Dr Lesley advised me that some patients may experience pain with some guidewire maneuvers or during clot retraction, so be alert for this). Deeper sedation with snoring or disorientation is probably worse than wide awake. If emesis occurs, an awake patient will easily clear it with assistance and suction, but a deeply sedated patient may aspirate. An extra level of vigilance is required!

If the patient cannot remain still, or is too anxious, or has ventilation issues, or emesis, it may be necessary to convert to general anesthesia at any time. The C –arm will need to be retracted in order to access the airway, and intubation may be difficult due to the position of the head. Remember that the patient likely has a full stomach so RSI may be recommended, and ensure suction is immediately accessible. In a situation of immediate need for airway rescue, an LMA may provide a temporary solution as it can be placed quickly with limited access to the head, but it should probably be considered as only a temporary solution until an ETT can be placed due to concerns of full stomach.

If the patient tolerates local and sedation, blood pressure recommendations are similar, and it is possible that phenylephrine may be needed. After clot removal, discuss BP parameters with surgeon.

At the end of the case, they may need to hold firm pressure on the femoral catheter site after removal, and this can be painful, so additional analgesic or sedation may be required for a few minutes.