

ANESTHESIA FOR RADIOLOGY

Most of the cases for the anesthesia team for radiology are in neuroradiology, but some are in body interventional, MRI, or CT scan. The radiology department in HUP is on the ground floor. The schedule can be seen in PennChart by clicking on Anesthesia Ad-Hocs on the status board and selecting HUP Rad Appointments or obtained by calling the neuroradiology suite (662 3064 or 662 3065). Some cases in radiology are done with local anesthesia or conscious sedation and anesthesiology involvement is not required. For elective procedures scheduled with anesthesia, the patients can be contacted on the day before, as is routinely done for the OR. Charts for neuroradiology patients can be found in a folder in the neuroradiology control room. For add-ons, which occur frequently, pre-operative assessment and anesthesia consent should be accomplished as soon as possible, with the assistance of the attending anesthesiologist and/or anesthesia pre-op residents. Write your name and phone number on the white board in the control room between neuroradiology rooms 1 and 2, so the radiology technicians can call you when needed. The first patient of the day should enter the procedure room around 7:30 a.m. (8:30 a.m. on Thursdays).

In each **neuroradiology** room, there is an anesthesia machine and a monitor, with PennChart, just like in each operating room. Radiology anesthesia patient records in PennChart should be opened via Patient Lists if they are not yet listed on the Status Board under Ad-Hocs. There is also a Pyxis machine, which should have just about every medication you might need (make sure that succinylcholine, atropine, lidocaine, and glycopyrrolate are not missing), except for nicardipine bolus, which may be obtained from the OR pharmacy. The airway equipment is usually on a Mayo stand. Make sure LMA's of correct sizes are there. There is also a Glidescope in neuroradiology; make sure it is there, it is charged, and it has clean blades of both sizes. The anesthesia technician usually comes once a day to stock supplies. Call him or her at other times when needed, for example at the end of a case where you used the anesthesia machine. If you are not sure who is the anesthesia technician for radiology, call the technician in charge (215-738-1320). Note that the anesthesia machine often must be moved during the procedure to accommodate the X-ray machines. Wear a lead apron during the procedure; during periods of intense radiation, you may step into the control room, where you can still see the patient and a slave monitor.

Procedures performed in neuroradiology with anesthesia include angiograms, vasospasm treatments, thrombolysis, embolizations, and vertebroplasties. Most elective cerebral **angiograms** can be done without involvement of anesthesiology personnel, with conscious sedation provided by the radiology nurse. However, occasionally the patient requires more sedation or general anesthesia in order to perform the procedure, so anesthesiology involvement may be requested. The risk of unsecured aneurysmal rupture in a patient with a subarachnoid hemorrhage often also results in a request for anesthesiology involvement for cerebral angiography. Deep sedation is not usually required for angiograms, and in fact could be risky because the patient's airway is not easily accessible during these procedures. For patients who are not intubated, end-tidal CO₂ can be monitored using a nasal cannula set-up, which can be shown to you by the attending anesthesiologist. For elective cerebral angiograms, routine monitors usually suffice. If the neuroradiologist decides to proceed with an intervention right after the angiogram, often the anesthesiology team should place a peripheral arterial line to help with blood pressure control and/or sampling during and after the intervention.

Vasospasm cases will start with angiography and, if spasm is confirmed, are followed by cerebral angioplasty and/or intraarterial infusion of nicardipine or papaverine. For these cases, patient immobility is required by the neuroradiologist, so general anesthesia (typically a propofol infusion with added volatile anesthesia as indicated) with neuromuscular blockade is typically employed. There are important blood pressure issues for each case, and intra-arterial monitoring is needed. The patients may arrive with pressors infusing to maintain induced hypertension. The infusion of nicardipine or papaverine may decrease the systemic blood pressure. After the vasospasm has been treated, hypertension may be undesirable. Thus, it is helpful to discuss blood pressure management with the neurosurgical ICU and radiology teams in advance. If there are intracranial pressure issues in these patients, their management must continue in neuroradiology. Since patients must be supine in neuroradiology, a previously well-controlled ICP may no longer be well-controlled, and more aggressive therapy may be required; specific therapies should be discussed with the neurosurgery ICU team and with your attending. These patients typically have ventriculostomies. Discuss with the neurosurgical ICU team whether CSF should be drained with the drain at a certain level above the tragus. Remember to clamp the drain during transport if you are involved in that and not to occlude the drainage chamber air inlet filter. In these patients with brain ischemia issues, it is critical to avoid and treat any fever and hyperglycemia.

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Patients sometimes present for **thrombolysis** within six hours of onset of focal cerebral ischemia. An urgent approach is needed: "Time is brain!" Thus, the history and physical have to be done as you are getting the patient into the radiology suite. An arterial line is helpful, but the case should not be delayed for this.

Embolizations of cerebral **arteriovenous malformations** are typically scheduled electively. General anesthesia is usually employed, to ensure absolute immobility during the procedure. Monitoring typically includes intraarterial pressure.

The primary anesthetic challenge for **vertebroplasties** is that they are done in the prone position and have a period of pain with the injection of cement into the vertebra. It is up to the attending anesthesiologist, the neuroradiology team, and you to decide whether endotracheal intubation will be needed to provide safe airway management.

In **other radiology** locations, such as **body IR** and **CT** (Dulles Building) there are not Pyxis medication dispensing machines in the rooms where procedures are performed. A drug cassette can be obtained from the Pyxis machine in the CT scan holding area. Some medications could also be obtained from the Pyxis machine in the body interventional radiology nursing station or from the nurse in MRI. There is an anesthesia machine and monitor with PennChart for body IR and CT scan that the anesthesia technician can set up in the procedure room when needed. Also, there are anesthesia supply carts with airway and IV supplies, syringes, needles, etc., which he or she can set up.

Most patients do not need anesthesia for **Magnetic Resonance Imaging**, but patients with severe mental disturbance or claustrophobia may. Special considerations are needed in this environment. Patient or provider injury in the MRI suite can occur from ferromagnetic materials becoming projectiles. Do not get credit cards near the scanner, or they could get erased. MRI-compatible monitors (including end-tidal CO₂) are available, though electrocardiography gets a lot of interference. Long intravenous infusion tubing is available to go from pumps outside the scanner room to the patient. The combination to open the MRI anesthesia supply cart is 0531. The cart must be charged for this to work, so try to keep it plugged in as much as possible. The cart drawers will automatically lock after an hour unless they are left pulled open at least a bit. In MRI, we have been using paper records rather than PennChart; for those, use the assessment form with the attending attestations and signature blanks (has a blue stripe along the right margin and a carbon copy). On the anesthesia record, please circle "RAD" for location. Do not forget to turn in the yellow billing copy (in the box in the neuroradiology control room or outside Sandy Boyer's office or in the PACU on the 4th floor). Please be sure that the start time and end time, diagnosis, procedure, physical status, attending signature, and concurrency are filled out.

Patients are usually recovered by the radiology nurses. Required Anesthesia Billing Information about the procedure (who did what where why) must be completed in the PostOp section of PennChart, but Beta Blocker information need not be completed for these non-surgical procedures. Please discard used syringes and medications left over after each case rather than leaving them unattended. Call the anesthesia technician when the case is done to take care of the anesthesia machine and supplies.

Relevant articles are posted in <http://pennpoint.uphs.upenn.edu>. I thank Dr. Andy Kofke for providing me with the introduction he wrote to neuroradiology for anesthesia residents; much of the above is taken from that. If you have any questions or comments about your experience in radiology, please let us know.

Sincerely,

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