IR Procedures for Anesthesiology

Common IR Procedures

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1. Central venous access
    - Includes placement of mediports, permcath (tunneled hemodialysis catheter), Hickman/Powerline/Groshong (other tunneled central venous catheters)
    - Positioning: supine
    - Access: preferentially right internal jugular, but based on anatomy/venous occlusions can be performed in the left IJ, either subclavian, femoral or as last resource translumbar/trans-hepatic
    - Duration: 0.5-1 hour
    - Anesthesia: usually sedation/MAC
    - Typical length of stay (if outpatient): same day discharge

2. Visceral angiogram
    - Usually for diagnostic and/or embolization of bleeding, such as for hepatic/splenic/renal trauma, gastrointestinal bleeding, postoperative bleeding
    - Positioning: supine
    - Access: femoral, rarely left radial
    - Set-up: frequent need for cone-beam CTs, where the C-arm spin arounds the patient to acquire a CT during the procedure; requires clearance of cables/lines and machines around the patient and arms up
    - Anesthesia: usually either lighter sedation as breath holds are very important, might benefit from GA for paralysis if not able
    - Duration: 2-3 hours
    - Typical length of stay (if outpatient): same day discharge

3. Biopsies/collection drainages
    - sampling/aspirating/putting percutaneous drain in target lesions
    - Set up/positioning depends on target lesion location and plan
    - Duration: 1 hour
    - Anesthesia: usually sedation/MAC
    - Typical length of stay: same day discharge

4. IVC filter placement
    - Placement of filter in the inferior vena cava to trap potential clots migrating to lungs, preventing pulmonary embolism
    - Access: right internal jugular or femoral depending on operator preference/anatomy
    - Duration: 30 minutes
    - Anesthesia: usually sedation/MAC, sometimes just local anesthesia
    - Typical length of stay (if outpatient): same day discharge

5. IVC filter retrieval
    - Removal of IVC filter by capturing it and sheathing it
    - Access: right internal jugular, rarely femoral
    - Duration: 30 minutes to 2 hours depending on complexity
    - Anesthesia: usually sedation/MAC, LMA/GA if retrieval expected to be more difficult such as filters in place for long time, and require significant manipulation from the RIJ which can cause pain (subjective, operator's preference)
    - Typical length of stay (if outpatient): same day discharge

6. Gastrostomy/gastrojejunostomy/jejunostomy placement
    - Placement of catheter into stomach or small bowel for feeding or drainage/venting; usually requires placement of NG/NJ tube (on the floor or in the procedure room) and insufflation of the stomach with air prior to puncture. Usually tube is placed from outside into abdomen and stomach ("push-type"), as opposed to what is usually done by GI/surgery when tube is swallowed and pulled from the stomach to the outside ("pull-type / PEG)
    - Set-up/positioning: supine, usually operators on left side
    - Anesthesia: usually sedation/MAC, GA most commonly if concerns for airway/aspiration. Commonly requires glucagon 1 mg IV when procedure is about to start (after asked by IR)
    - Duration: 30 minutes
    - Typical length of stay (if outpatient): overnight observation

7. Tube exchanges (nephrostomy/biliary/gastrostomy/gastrojejunostomy/abscess)
    - Positioning depends on drain
    - Duration 0.5-1 hour
    - Anesthesia: usually sedation/MAC, GA/LMA more commonly particularly in biliary drains
    - Typical length of stay (if outpatient): same day discharge

8. TIPS (transjugular intra-hepatic portosystemic shunt) creation
    - Establishing a shunt between the portal vein and hepatic vein for managing variceal bleeding, ascites or hydrothorax; can be done electively or urgently
    - Might be combined with BRTO/BATO (see below) and paracentesis/thoracentesis
    - Positioning: supine
    - Operators: usually work from right neck, right groin, sometimes right and/or left abdomen as patients often require a simultaneous paracentesis/thoracentesis
    - Prep: patients usually typed and crossed, may require PRBCs, FFP, and PLTs during the case. Patients might need albumin if paracentesis or thoracentesis
    - Anesthesia: GA
    - Duration: 2-4 hours
    - Post: TIPS increases cardiac preload, might require furosemide to minimize the acute effects of right heart strain
    - Typical length of stay (if outpatient): overnight observation, sometimes longer

9. TIPS venogram/revision
    - Venogram and dilatation /re-stenting / narrowing of an existing TIPS to manage a dysfunctional TIPS or a TIPS that is causing too much shunting (and hepatic encephalopathy); sometimes associated with variceal embolization
    - Might be combined with paracentesis/thoracentesis
    - Positioning: supine
    - Operators: usually work from right neck, possible right groin
    - Duration: 1-3 hours
    - Anesthesia: GA or sedation/MAC
    - Typical length of stay (if outpatient): same day discharge

10. BRTO (Balloon retrograde transvenous obliteration) / BATO (balloon antegrade transvenous obliteration) - **Sometimes done concurrently with a TIPS placement**
    - obliteration/sclerosis/embolization of varices and collaterals between the portal system and the systemic venous circulation (portosystemic shunts), such as splenorenal shunt / gastroesophageal varices, to control bleeding, decrease hepatic encephalopathy, and/or improve hepatic perfusion. If done without a concurrent TIPS, cause increase in portal hypertension
    - Positioning: supine
    - Operators: usually work from right neck (at the head), right groin, sometimes right and/or left abdomen
    - Prep: patients usually typed and crossed, might need albumin if paracentesis or thoracentesis
    - Duration: 2-4 hours
    - Anesthesia: GA, most commonly, sometimes sedation/MAC
    - Typical length of stay (if outpatient): overnight observation, sometimes longer

11. TACE (transarterial chemoembolization)
    - Hepatic arteriogram with delivery of particles and chemotherapy into liver tumors (HCC or metastases)
    - Positioning: supine
    - Access: femoral, with operators on the right side, or left radial (very rare at Georgetown University Hospital)
    - Set-up: frequent need for cone-beam CTs, where the C-arm spin arounds the patient to acquire a CT during the procedure; requires clearance of cables/lines and machines around the patient and arms up
    - Anesthesia: sedation should either be light so patient can comply with breath holding, or GA and paralysis
    - Duration: 2-3 hours
    - Post: some patients can have a fair amount of pain at the end of the procedure and during recovery and sometimes require PCA
    - Typical length of stay: overnight observation or same day discharge depending on patient/extension of treatment

12. Y90 mapping and radioembolization
    - Hepatic arteriogram with delivery of radioactive particles into liver tumors (HCC or metastases); low collateral dose to operators / anesthesiology staff so no need for additional radiation protection
    - Positioning: supine
    - Access: femoral, with operators on the right side, or left radial (very rare at Georgetown University Hospital)
    - Set-up: frequent need for cone-beam CTs, where the C-arm spin arounds the patient to acquire a CT during the procedure; requires clearance of cables/lines and machines around the patient and arms up
    - Anesthesia: usually sedation/MAC; breath holds are very important, might benefit from GA if not able
    - Duration: Mapping 1-3 hours; Radioembolization 1-2 hours
    - Post: not usually painful; patients go to Nuclear Medicine for scanning prior to recovery
    - Typical length of stay: same day discharge

13. Hepatic Angioablation
    - Hepatic arteriogram is used to localize the target tumor in the liver and to target it with the microwave ablation probe
    - Positioning: supine
    - Access: femoral for angiography and transabdominal with operators on the right side
    - Set-up: always needs cone-beam CTs, where the C-arm spin arounds the patient to acquire a CT during the procedure; requires clearance of cables/lines and machines around the patient and arms up
    - Anesthesia: GA with complete paralysis and multiple apneas; very important that the patient does not move during the procedure
    - Duration: 1-3 hours
    - Post: patients can have some pain post procedure, particularly if lesions are more peripheral / adjacent to the diaphragm
    - Typical length of stay: overnight observation or same day discharge depending on patient/extension of treatment

14. Hepatic Microwave ablation
    - Use of percutaneous probes that cause heating to treat tumors; more frequently done for liver or lung lesions
    - Set-up/positioning depends on the tumor target; most commonly done on CT, but can be done with ultrasound/fluoroscopy/cone-beam CT
    - Anesthesia: GA > sedation/MAC (more complex procedures and/or need for cone-beam CTs benefit from GA)
    - Duration: 1-2 hours
    - Lung ablations: risk for hemoptysis, risk for pneumothorax
    - Typical length of stay: overnight observation or same day discharge depending on patient/extension of treatment

15. Biliary drain placement
    - Drain placement into hepatic biliary system; might be associated with biliary stone removal, biliary dilatation, stenting
    - Set up/positioning: supine (sometimes right side tilted up), ideally right arm up above head; operators can work from right or left side depending on site of obstruction
    - Duration: 1-2 hours
    - Anesthesia: GA/LMA > sedation/MAC (can be painful and lengthy particularly if not dilated)
    - Typical length of stay (if outpatient): overnight observation or same day discharge depending on patient/time of day

16. Uterine artery embolization
    - Embolization of uterine arteries most commonly for treatment of fibroids/adenomyosis (sometimes for pre / post-partum hemorrhage, or other bleeding tumors)
    - Positioning: supine
    - Access: right femoral, bilateral femoral, and sometimes left radial artery
    - Set up: usually requires urethral Foley during the procedure, placed when patient is in the room prior to prep
    - Anesthesia: usually sedation/MAC vs LMA
    - Duration: 1-2 hours
    - Post: Very painful, PCA prescribed and overnight admission most of the time at MGUH. Typically, also prescribe scheduled 30mg IV Toradol Q6H day/night of the procedure, then transition to PO ibuprofen.
    - Typical length of stay): overnight observation

17. Prostate artery embolization
    - Embolization of prostatic arteries for BPH symptoms, gross hematuria, and urethrorrhagia
    - Access: right femoral, sometimes left radial
    - Positioning: supine
    - Set-up: frequent need for cone-beam CTs, where the C-arm spin arounds the patient to acquire a CT during the procedure; requires clearance of cables/lines and machines around the patient and arms up; often require urethral Foley during the procedure
    - Anesthesia: GA/LMA > MAC/sedation (potentially long case)
    - Duration: 2-4 hours
    - Post: not as painful as UAE
    - Typical length of stay (if outpatient): same day discharge

18. Cryoablation
    - Use of percutaneous probes that freeze/thaw/freeze/thaw to treat tumors; more frequently done for kidney, lung and bone/soft tissue lesions
    - Set-up/positioning depends on the tumor target; most commonly done on CT, but can be done with ultrasound/fluoroscopy/cone-beam CT
    - Anesthesia: sedation/MAC or GA (more complex procedures and/or need for cone-beam CTs benefit from GA)
    - Duration: 1-2 hours
    - Post: does not tend to cause as much pain as other ablation methods
    - Lung ablations: risk for hemoptysis, risk for pneumothorax
    - Typical length of stay: overnight observation or same day discharge depending on patient/extension of treatment

19. IRE (Irreversible electroporation)
    - Use of usually multiple (2-6) percutaneous probes that cause pore formation in cell membranes and apoptosis to treat tumors (usually in locations where other ablation techniques are not deemed safe); more frequently done for liver lesions
    - Set-up/positioning depends on the tumor target; most commonly done on CT, but can be done with ultrasound/fluoroscopy/cone-beam CT
    - Duration: 1-3 hours
    - Anesthesia: GA with paralysis
    - Typical length of stay: overnight observation or same day discharge depending on patient/extension of treatment

20. Venogram, thrombectomy/thrombolysis/stenting
    - Venous access followed by management of obstruction/clot depending on the case
    - If AngioJet is used for thrombolysis/thrombectomy, risk for bradycardia (reportedly due to adenosine release), usually resolves quickly after interruption
    - Set up/positioning: depends on target, often jugular, femoral, sometimes popliteal, posterior tibial vein; might require prone positioning particularly if popliteal access
    - Anesthesia: procedure not usually very painful (except for stenting of chronic venous stenoses), but often long; GA or MAC/sedation depending on expected complexity/patient, often the case for stenting for May-Thurner syndrome, SVC syndrome, or complex venous recanalizations.
    - Duration: 2-3 hours
    - Post: if thrombolysis is initiated, patient might require ICU bed afterwards to monitor labs/bleeding during tPA infusion
    - Typical length of stay (if outpatient): overnight observation or same day discharge depending on patient/procedure

21. Bronchial artery embolization
    - Arteriogram for embolization of thoracic aorta branches for hemoptysis
    - Positioning: supine
    - Access: right femoral, rarely radial
    - Duration: 2-3 hours
    - Anesthesia: usually sedation/MAC; breath holds are very important, might benefit from GA if not able; also need to consider airway protection, including discussing selective intubation of the nonbleeding bronchus
    - Typical length of stay (if outpatient): same day discharge or overnight observation

22. Pulmonary arteriogram and thrombectomy/thrombolysis
    - Pulmonary arteriogram for thrombectomy (suction/maceration) and/or lysis of pulmonary embolism
    - If prior left bundle branch block, might require temporary pacing pre-procedure due to risk for triggering added right bundle branch block
    - Positioning: supine
    - Access: right femoral, rarely internal jugular
    - Anesthesia: usually local or very light sedation; risk for decompensation with GA/propofol in the setting of acute right heart strain
    - Duration: 1-2 hours
    - Post: if thrombolysis, lysis catheters for dripping tPA and ICU admission

23. Pulmonary arteriogram and embolization of PAVM (pulmonary arteriovenous malformation)
    - Pulmonary arteriogram for occlusion of pulmonary arteriovenous malformation
    - If prior left bundle branch block, might require temporary pacing preprocedure due to risk for triggering added right bundle branch block
    - Positioning: supine
    - Access: right femoral, rarely internal jugular
    - Duration: 2-3 hours
    - Anesthesia: sedation/MAC (breath holds are very important), might benefit from GA if not able; monitor neurologic status, risk for right to left embolism and stroke intraprocedure
    - Typical length of stay (if outpatient): same day discharge

24. Lower extremity arteriogram
    - Angiogram for diagnosis and treatment arterial lesions usually from atherosclerosis, including ballooning and/or stenting more commonly
    - Positioning: supine
    - Access: variable, most commonly femoral but potentially popliteal, pedal; sometimes might require patient positioning "upside-down" so that C-arm can reach all the way to patient's foot
    - Duration: 2-3 hours
    - Anesthesia: sedation/MAC or GA/LMA, immobility of the treated lower extremity very important. Often requires intra-procedure heparin boluses, as well as intra-arterial nitroglycerin.
    - Typical length of stay (if outpatient): same day discharge

25. Lymphangiogram and embolization
    - For management of chylous/lymphatic leaks, often post-surgical
    - Lymphangiogram is obtained by administering contrast into groin lymph nodes and slowly observing it follow the lymphatic channels. Once the cysterna chyli in the retroperitoneum is identified, it is punctured trans-abdominally under fluoroscopy. Catheter and wire are placed and embolization then performed. Sometimes the lymphatic system can be accessed from its draining point in the left subclavian vein, directly with ultrasound percutaneously, or from and intravascular transvenous approach
    - Access/set-up: operators usually work from the right side, in both groins and abdomen; rarely also access from the left neck (percutaneous) or left arm (transvenous)
    - Duration: 3-4 hours
    - Anesthesia: GA/LMA > MAC/sedation since can be very long
    - Typical length of stay (if outpatient): same day discharge or overnight observation

26. Nephrostomy placement
    - Drain placement into renal collecting system; might be associated with ureteral catheter placement or stenting
    - Set up/positioning: PRONE; for patients with limited positioning can be done in lateral decubitus, target side up
    - Duration: 1-2 hours
    - Anesthesia: sedation/MAC or LMA/GA (GA beneficial in difficult cases such as non-dilated collecting kidneys)
    - Typical length of stay (if outpatient): overnight observation or same day discharge depending on patient/time of day

27. Cerebral Angiogram - Diagnostic
    - Angiogram of the carotid arteries and intracerebral circulation
    - Commonly for evaluation of cerebral aneurysm, arteriovenous malformation (AVM)/arteriovenous fistula (AVF), tumor or atherosclerotic disease/stroke
    - Positioning: Supine
    - Access: Commonly femoral artery; occasionally radial artery
    - Set-up: All monitors below the clavicles, tube down the middle off to left side toward anesthesia machine
    - Anesthesia: GA preferred for respiration hold during imaging; LMA can sometimes be performed
    - Monitoring Parameters: Normotensive
    - Duration: 1 hour
    - Post: 4 hours bed rest, leg straight, HOB elevated 30 degrees; rarely post procedure pain
    - Typical Length of stay (Outpatient): Same Day discharge from PACU/Recovery Room

28. Cerebral Angiogram – Embolization
    - Angiogram of carotid arteries and intracerebral circulation
    - Commonly for evaluation and endovascular treatment (through the blood vessel) of:
    - Ruptured or unruptured aneurysm, AVM or AVF
    - Pre-operative evaluation and treatment prior to surgical resection of tumors
    - Treatment of Subdural Hematomas
    - Treatment of Head & Neck Hemorrhages
    - Treatment of vascular injury from Trauma
    - Positioning: Supine
    - Access: Commonly femoral artery; occasionally radial artery
    - Set-up: All monitors below the clavicles, tube down the middle off to left side toward anesthesia machine
    - Anesthesia: GA for respiration hold during imaging and ABSOLUTE PARALYIS/NO TWITCHES! Patient cannot move during procedure.
    - Monitoring Parameters: Generally, SBP below 130-140 in bleeds. Many patients will have EVD that needs to be monitored, and all patients should have A-line, Foley. Be prepared for rupture with mannitol, hyperventilation, blood and pressors.
    - Duration: 2-4 hours
    - Post: Generally, don't have pain, sometime headache. CLOSE neurologic monitoring is mandatory to evaluate for post-procedure stroke/bleed!!!!!
    - Typical Length of stay: Outpatient, 24-48 hours. Inpatient/rupture- weeks

29. Cerebral Angiogram- Stroke Thrombectomy
    - Angiogram of carotid arteries and intracerebral circulation
    - For Evaluation and endovascular treatment of acute embolic stroke; TIME IS BRAIN! These cases move very quickly.
    - Positioning: Supine
    - Access: Commonly femoral artery; occasionally radial artery
    - Set-up: All monitors below the clavicles, tube down the middle off to left side toward anesthesia machine
    - Anesthesia: GA for respiration hold during imaging.

- Monitoring Parameters: SBP is initially kept high (160-180); if thrombectomy is successful, generally drop SBP goals to below 140 to prevent reperfusion hemorrhage. A-line is preferred but will not pause to get one during prep & access.
- Duration: 1-2 hours
- Post: All patients go to neuro ICU; if during the day, we may ask to extubate in room. Generally, no pain, but if they've had brain ischemia, may not follow commands
- Typical Length of stay: Days to weeks

30. Spine-Kyphoplasty (+/- Ablation)
    - Percutaneous treatment of vertebral compression fractures that have failed medical management by injection PMMA (Bone Cement) into the Broken bone. If pathologic fracture, can do RF ablation at same time.
    - Most Patients are typically elderly with osteoporosis and have co-morbidities including heart disease & lung disease
    - Anesthesia: GA
    - Position: Prone
    - Monitoring: Typically, do not need A-line or Foley but depends on comorbidities. Normotensive. Usually give Ancef.
    - Duration: Usually 1 hour
    - Post: Usually moderate post procedure pain that quickly improves; if ablation, pain can get severe.
    - Typical Length of Stay: Benign osteoporotic fracture patients typically go home in 4-6 hours. Rarely, may require 23-hour observation for pain control

31. Spine-Spine Biopsy
    - Percutaneous vertebral bone biopsy to evaluate for cancer or infection
    - Most have baseline pain
    - Anesthesia: GA
    - Position: Prone
    - Monitoring: Normotensive
    - Duration: Usually 20-30 minutes
    - Post: Usually have mild to moderate pain
    - Typical Length of Stay: 2-4 hours, same day discharge