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FOREWORD

“Vascular and Interventional Radiology handbooks have been around since I was fortunate to discover this field four decades ago. But the information contained in this current volume bears little resemblance to the copy I first carried around with me. Each edition is invaluable to the student, however. In the early days handbooks contained a plethora of information on how to make a good film, full of diagnostic information. MA and KVP techniques for different body parts, filming rates to keep down the cost of silver based film, and contrast injection rates and volumes were paramount. Advances in imaging technology greatly simplified this process (still important) and allowed later handbooks to concentrate on technical aspects of procedures such as balloon inflation times, tips and tricks for the newest procedures, and small but important differences in materials used to construct the latest devices.

The current handbook takes us to the next stage, long imagined and sought after by all those in the field: true incorporation of total clinical involvement. This volume will direct the student of Interventional Radiology in the art of providing full patient care, not just being a highly skilled operator. Although this handbook is specific to the Medical University of South Carolina, the majority of information it imparts can be used anywhere in the world to establish a better VIR practice. Other organizations looking to develop similar materials would do well to use this as a guide. Dr. Guimaraes and his team have done an excellent job of preparing a VIR handbook for the 21st century.”

J. Bayne Selby Jr., MD FSIR
Professor, Former Director
Vascular & Interventional Radiology, MUSC
“Vascular and Interventional radiology is intimately involved in patient care throughout all medical specialties. Minimally invasive therapies are evolving so quickly that traditional textbooks soon become outdated. This up to date introductory handbook to VIR emphasizes a team approach to safe patient centered care. The authors are to be commended in their efforts to enhance patient safety and outcomes through these remarkable medical advances. Congratulations.”

Phil Costello, MD FACR
Chairman
Department of Radiology and Radiological Sciences

“As the Diagnostic Radiology Residency Program Director, I often hear it is difficult and confusing for residents to understand the intricacies of a subspecialty rotation, especially one as complex as interventional radiology. This handbook is designed to guide residents efficiently into accessing knowledge about Vascular Interventional Radiology practices and procedures and serve as a concise and useful introduction and tool. I am sure it will be a manageable resource to assist residents as they master the specialty. Hopefully over time, they will become very familiar with commonly encountered procedures and the way they are managed by the MUSC Vascular Interventional Radiology Division. When they graduate from this program, this handbook will continue to be a valuable resource.”

Madelene Lewis, MD
Program Director Diagnostic Radiology Residency Program
Assistant Program Director IR/DR Residency Program
Associate Professor
INTRODUCTION

The goal of this handbook is to provide medical students, residents, fellows, nurses, CT technologists, angiography specialists, and advanced practice providers with some basic information about the most frequently performed Vascular & Interventional Radiology (VIR) procedures. Also, information is presented on how to obtain an adequate informed consent, to deal with the most common procedure complications, to perform appropriate pre-procedure evaluation and preparation, to manage post-procedure care, to perform airway evaluation (Mallampati score), amongst other things.

VIR is a dynamic and modern specialty. It is in a constant state of change, which requires reinvention and frequent updates in imaging, clinical, and surgical knowledge. In the last decade, VIR has refocused in “best patient care value” and in “patient centered operations”, which has resulted in the creation and expansion of clinical activities such as the admission of post procedure patients, the evaluation and management of patients in outpatient clinics, and the consultation service for inpatients.

The American Medical Association has recognized VIR as a medical specialty. Specific VIR board certification is now offered in conjunction with Diagnostic Radiology certification (dual certification). The new IR/DR residency program will start at MUSC in July 2018.

There will be several challenges in the future, but VIR never has been in a stronger situation to position itself as a medical specialty capable of providing the best minimally invasive procedures, under safe and cost-effective conditions.
• The 5th edition has new information about navigating the EPIC chart and maintaining the consult service. We have also included a “Resident Check List” to better delineate resident duties when on service and the following changes:

• Ancef changed to 2 grams
• Total bilirubin within 48 hours of Y90 treatment
• Edited lysis parameters for overnight treatment
• CPAP patients to be seen by anesthesia
• Changed “Endovenous Laser Therapy” to “Percutaneous Venous Closure”
• Added Chest tube management
• Clarified GA after-hours cases
• DDAVP protocol in patients with acute kidney dysfunction

Special thanks to Dr. Jonathan Botstein who has done excellent work editing the 5th edition and to the outstanding contributions of several VIR staff members, especially Meghan Fashjian and Heather Hartung for her work on this updated version. Without the constant feedback from the VIR staff, it would be simply impossible keep on improving the content of the VIR Handbook.

Hopefully, this handbook will provide general guidelines and basic knowledge to enhance the learning experience,
facilitate exceptional patient care and consequently increasing patients’ safety and satisfaction.

Marcelo Guimaraes, MD FSIR
Director
Vascular & Interventional Radiology
June 2018
RESIDENT GOALS AND OBJECTIVES IN VASCULAR AND INTERVENTIONAL RADIOLOGY ROTATION

If at the main hospital, you should report to the Vascular and Interventional Radiology Division located on the 5th floor of the Children’s hospital. Take the Children’s hospital elevators (F) to the 5th floor. The Division VIR is behind the security protected double doors (use your ID to enter).

If at ART, the VIR Division is on the 3rd floor through the security doors, take a left all the way down the hall, then a right will get you to the VIR suites.

**Rotation 1**

**Patient Care**

- Learn layout of the department, including patient flow. Learn the layout of the hospital to aid efficiency seeing consults.
- Learn how to evaluate a patient EMR, with particular attention to the indications and contraindications for the particular procedure requested.
- Learn how to order appropriate labs and imaging studies in the pre-procedural, procedural, and post-procedural care of a patient.
- Learn how to obtain a medically legal and ethical informed consent from a patient or a patient's power
of attorney for the common procedures done in VIR. This applies to both scheduled outpatients and inpatient consults.

- Learn how to properly document the informed consent in the EMR (pre-procedure note).
- Learn how to do a directed physical exam tailored to the specific procedure, including assessing risk for moderate sedation.
- All new cases should be discussed with the VIR attending of the day. Approval, adding or cancellation of cases should be at the VIR Attendings’ discretion.

**Medical Knowledge**

- Learn the techniques, indications, and contraindications to the common VIR procedures.
- Read a basic textbook (Requisites) on VIR.
- Learn sterile technique, including pre-procedure scrub and patient preparation and dressing.
- Learn radiation protection of self, co-workers, and patients.
- Learn how to operate the basic functions of the equipment.
- Learn basic techniques of guidewire and catheter handling, including anti-clot measures such as wire-wiping and catheter flushing.
- Participate as first assistant for a variety of the more basic interventions.
Learn arterial access techniques and hemostasis with manual compression and the use of arterial closure devices.

Learn technique of ultrasound guidance.

Learn how to place a PICC line.

Learn how to place a venous central line.

Learn how to perform CT guided procedures as the primary operator.

Learn how to dictate VIR procedures on Talk system.

Begin reviewing non-invasive vascular studies (CTA/V, MRA/V) with attending VIR.

Practice Based Learning and Improvement

Learn how to evaluate the patient’s previous imaging studies, including mastery of the PACS system, as well as loading and viewing images from outside sources (MIES).

Review any complications or poor outcomes that occurred in VIR during the rotation to learn the root cause of the problem and develop and implement mechanisms to avoid the complications or poor outcomes in the future.

Interpersonal and Communication

Learn how to properly document the results of a study, both in the EMR (procedure note) and verbally (to referring physician).
• Begin role as teacher by inviting medical students on the rotation to observe and teach them anatomy.

**Professionalism**

☐ Introduce yourself (or be introduced) to the VIR team (MDs, RNs, RTs, scheduler).

**Systems Based Practice**

☐ Maintain procedure log of all procedures in which you participated in the performance, interpretation, and reporting of the procedure for accreditation, credentialing, evaluation and possible program improvement. Record the medical record number, date, type of procedure, supervising radiology attending, and any complications.

**Rotation 2**

**Medical Knowledge**

☐ Learn the shapes, properties and indications for use of the most common vascular catheters.

☐ Learn the properties and indications for use of the most common guidewires.

☐ Learn proper guidewire and catheter manipulation techniques during cases.
☐ Read selected chapters from comprehensive VIR textbook (e.g. Castaneda-Zuniga) pertinent to next day procedures of interest.
☐ Scrub in as primary operator on more basic cases, and scrub in as first assistant on complex cases.
☐ On all cases, the resident is to learn the indications, contraindications and techniques involved in the performance of the procedure.
☐ Learn the basics of CT guidance in the performance of complex procedures.
☐ Performing supervised CT guided procedures such as biopsies and drainages.
☐ Perform initial evaluation of non-invasive vascular cases (US Doppler, CTA/V, MRA/V) with subsequent review with VIR attending followed by dictation of the cases. (See important information on reading CTA/MRA on call in the section “VIR CT protocols”).

**Interpersonal and Communication**

☐ Dictate all cases that the resident scrubbed.
☐ Take initiative to see both CT and straightforward angio consults (catheter placement, IVC filter)
☐ Discuss more complex consults with VIR Fellow or VIR attending
☐ All new cases should be discussed with the VIR attending of the day. Approval, adding or cancellation of cases should be at the VIR Attendings’ discretion.
Practice Based Learning and Improvement
- Continue role as teacher by discussing cases with medical students, RNs and RTs, to increase their fund of knowledge.

Systems Based Practice
- Review and continue to improve upon the goals and objectives for the first rotation.
Rotation 3

Medical Knowledge

☐ Scrub in as primary operator on all types of cases, including vascular, non-vascular, US, and CT-guided.
☐ Attain a deeper knowledge regarding the clinical and pathophysiologic understanding of the diseases that are being treated.
☐ Review all major cases with an attending physician (even those not performed by resident) and dictate these cases after review.
☐ Continue reading selected chapters from comprehensive VIR textbook, as well as relevant articles found in radiology journals (Radiology, AJR) and subspecialty journals (JVIR).
☐ Learn about catheter maintenance and follow-up care (including dressing care, flushing, input and output).

Interpersonal and Communication

☐ Take an active role in triaging patients for procedures, working with the VIR nursing staff.
☐ Continue role of teacher by instructing more junior residents, as well as continuing to teach medical students, nurses and techs
☐ All new cases should be discussed with the VIR attending of the day. Approval, adding or cancellation of cases should be at the VIR Attendings’ discretion.
Practice Based Learning and Improvement

Review and continue to improve upon the goals and objectives of the first two rotations.

FELLOW & RESIDENTS GOALS AND OBJECTIVES IN VASCULAR AND INTERVENTIONAL RADIOLOGY (4th and 5th YEARS)

FIRST HALF 4th Year:

The fellow should gain:

- Theoretical information about vascular diseases GI, Urologic and thoracic diseases, treatable by VIR.
- Knowledge of patient preparation, pre and post procedure care.
- Knowledge about informed consent specific for VIR procedures.
- Knowledge of specific interpretation and dictation of interventional procedures.
- Familiarity with correct indications, contraindications, risks and complications of VIR procedures.
- Familiarity with the on call cases, assisted by the attending.
- Familiarity with the relevant VIR literature.

SECOND HALF 4TH YEAR:

The fellow or resident should gain:

- Familiarity with access techniques.
Techniques of selective catheterization.
Primary operator skills in diagnostic and therapeutic procedures.
Knowledge of pharmacology applied to VIR procedures.
Skills to be on call as primary operator, under supervision.

FIRST HALF 5TH YEAR:

The fellow or resident should:

- Participate in all diagnostic and therapeutic procedures as primary operator, assisted by an attending
- Be active in the admission, pre, trans and post procedure care of the patients under supervision of the attending
- Be on call as primary operator, under supervision of the attending

SECOND HALF 5TH YEAR:

The fellow or resident should:

- Be competent as primary operator in the majority of the VIR procedures.
- Be competent in independent decision making.
- Develop the curiosity about new techniques, procedures, devices and modalities.
RESIDENT CHECK LIST

FIRST THING IN THE MORNING, CHECK:

☐ Imaging Protocol list and assure it is up to date.
☐ PACS for diagnostic imaging from overnight/weekend.
☐ Consult list for outstanding consults.
☐ Confer with fellows/Advanced Practice Provider (APP) about responsibilities for seeing consults.
☐ Review info and imaging on the day’s scheduled cases, especially for CT cases which are a primary responsibility of the residents rotating in VIR.

THROUGHOUT THE DAY

☐ Work up outpatients including placing H&P on EPIC and obtaining Informed Consent at bedside.
☐ Monitor Consult list and keep communication with the VIR APPs and fellows.
☐ Review and work up new inpatients including placing Consult note and Orders in EPIC and obtaining Consent.
☐ Scrub into as many cases as you can.
☐ Review and make necessary changes (if any) to the post-procedure orders in EPIC with the procedure RN just before leaving the case.
Monitor PACS for VIR diagnostic studies to be dictated (MRAs, CTAs, Oncology follow-up CTs such as 4-phase liver CTs from VIR clinic).

**BEFORE LEAVING FOR THE DAY**

- All dictations including diagnostic studies and procedures **must** be complete in the same day. One of the VIR quality metrics is the turnaround time.
- Review cases for next day including clinical info/imaging.
- Place orders in EPIC for the next day’s outpatients if necessary.
PATIENT WORKUP

- Consults/History & Physical exam (EPIC)
- Airway evaluation (EPIC)
- Informed Consent (paper for now, electronic informed consent is under implementation)
- Pre-procedure labs (EPIC)
- Medications (EPIC)
- Post-procedure bed rest (EPIC)

Please see the dedicated EPIC help section (pg 185) for more help with entering the data from your patient encounters, particularly placing H&P/Consult notes and Orders.

CONSULTS/HISTORY & PHYSICAL EXAM

General Information

Communication between fellows/residents and the APPs on the service is key to avoid duplication of work (e.g. two people working on the same consult) and doing unnecessary work (e.g. working up a consult for a non-indicated procedure).

All patients require an H&P/Consult note, a procedure order placed in EPIC, and an Informed Consent before a procedure can be scheduled. The referring physician can no longer put an order for a procedure to be done by VIR in EPIC, but only a VIR consultation. Assuring
each patient has these three documents will minimize delays in posting the case. Templates for the consults are available.

If a fellow or resident plans to participate in a case, he/she should know the pertinent clinical information/imaging and have a plan in mind for the case. This includes access, the devices, potential complications, what outcomes to expect, endpoint of the case previously discussed with the VIR Attending. Use common sense.

The VIR fellows and residents should be aware of the following information ideally before meeting any patient prior to a procedure: name/type of requested intervention, the indication of the procedure, list of current medications, check the patient’s symptoms if any and review the history of drug allergies. If any of this essential information is not available in the online chart or procedure request, the information should be obtained directly from the patient or from the referring physician before the patient encounter.

The procedure indication should match clinical needs. If there is unclear indication or any concern, it should be discussed with the VIR fellow or Attending.

The list of current medications must be reviewed in order to detect if a medication that should have been stopped was really stopped and when (e.g. Coumadin). Also, check for chronic use of medications such as opioids for pain control, which may lead to difficult analgesia during the moderate sedation with Versed and Fentanyl due to opioid tolerance. Alternative analgesics such as
non-steroid anti-inflammatory drugs (e.g. Toradol) or even general anesthesia should be discussed (especially for procedures in which moderate to severe pain is anticipated, e.g. fresh gastrostomy placement, percutaneous biliary/ nephrostomy tube placement, and TIPS procedures). For additional information, please see the moderate sedation pharmacology section in the appendix.

The history of drug allergies should be reviewed and, if positive, what happened during the “patient’s allergic reaction” should be investigated. It is not unusual for some patients to misinterpret adverse drug reactions (e.g. nausea, vomiting, bad taste in the mouth) to allergic reaction (itching, hives, shortness of breath).

A targeted physical exam should be performed. Lungs and heart auscultation, airway assessment (Mallampati) and evaluation of the procedure access site are minimal requirements during the physical exam. Evaluate the patient for relevant issues regarding the planned procedure (e.g. shortness of breath when flat, pulmonary hypertension, poor respiratory reserve, prior adverse reaction to sedation or access issues).

Again, all new cases should be discussed with the VIR attending of the day. Approval, adding or cancellation of cases should be at the VIR Attendings’ discretion.
INPATIENT CONSULT WORKFLOW:

The VIR Advanced Practice Providers (Nurse Practitioner or Physician Assistant) will be the primary responders to the VIR inpatient consults during work hours M-F 0700-1700 (based on location). The expectation is that the APPs and the fellows will communicate first thing every morning and the APP will coordinate the distribution of consultation workload among the APPs, VIR fellows and the residents rotating in VIR.

The APPs should be the primary person managing the consultation service until 1500 at MH and 1700 at ART. After that, the VIR fellows need to make sure that the same level of service is provided smoothly until the end of the day.

Consults should be discussed with the attending responsible for the modality (CT or fluoro cases) to assure appropriate indication, workup and preparation.

An APP is expected to have a collaborative attitude and a patient-centric mindset. After the first batch of consultations gets managed adequately, additional consultation posted during the day should be responded to within 90 minutes (consult note in Epic within this time-frame).

PROCESS:

1. Patient is seen and assessed including review of history, systems, imaging, and labs to determine if
patient is appropriate for requested procedure. Consent should be obtained at this time. The electronic informed consent project is under implementation and there will be tablets available to obtain informed consent on the floor and in the PR areas at the CH and ART.

2. A consult note should be completed in EPIC. The VIR fellows can share notes templates.

3. Pre-procedure orders are placed in EPIC; including any necessary laboratory exams and NPO status.

4. An order for the appropriate procedure must be placed in EPIC before it can be scheduled. Please, communicate with the VIR board runner about new cases (add-ons) that must be included on the electronic board.

5. Referring team and patient are notified once patient has been scheduled for procedure.

OUTPATIENT PROCEDURE WORKFLOW:
Patients are scheduled for procedure by calling the VIR scheduling line at 792-9271.

1. Pre and post procedure orders should be placed in the afternoon for the next day’s outpatient procedures to avoid delays upon arrival. VIR order
sets are available in EPIC for use. (The patient will already have an order for the procedure.)

2. On the day of the procedure, the patient should be consented and have an H&P placed in EPIC. Any possible problems with the patient should be discussed with either an attending of fellow prior to rolling back. Make sure to update the medications reconciliation in Epic.

VIR OUTPATIENTS PRE-PROCEDURE ORDER

The review of the patient’s procedure, indication, and H&P will provide enough information to fill out the pre-procedure form regarding of the need for access preparation (e.g. femoral versus radial), I.V. hydration, Foley catheter, pre-procedure medications (analgesic, anxiolytic, antibiotic), ordering chemotherapeutic agent from the pharmacy (typically for liver chemoembolization), and in case of allergic reaction to iodine, the prescription of prophylactic medications. Specific discussion on protocols for I.V. hydration, allergic reaction prevention, pre-procedure blood tests and antibiotic prophylaxis are available in subsequent sections of this handbook. Consult the appendix for possible antibiotic prophylaxis, depending on procedure.

Residents are not responsible for cases done at East Cooper. In some cases, if a patient has been seen in clinic by an attending at East Cooper, they may have been already appropriately worked up and informed consent.
Please, check the VIR consultation note. In this case, and H&P update and medication reconciliation are all that is necessary to document if there has been any change since the last encounter.
AIRWAY EVALUATION AND ASA CLASSIFICATIONS

Anesthesia Guidelines with ASA and Mallampati Classification.

Please note that all Mallampati scores of IV should require evaluation by anesthesiology. This is often a rate-limiting step, so mention it to the VIR attending and consult anesthesia promptly.
Notes regarding anesthesia

1. **All** pediatric cases require consultation with the anesthesia department, and cannot be guaranteed to be performed the same day. Discuss the case with the VIR attending. Some older pediatric cases may not need GA depending on the procedure.

2. Majority of left ventricular assist device (LVAD) cases require GA. Discuss this with the VIR attending.

3. Fresh G tubes often require GA. Discuss this with the VIR attending.

4. Fresh biliary drains (Percutaneous Transhepatic Cholangiogram = PTC) often require GA. Discuss this with the VIR attending.

5. Liver, kidney, bone and lung ablations often require GA. Discuss this with the VIR attending.

6. **All** RF wire central venous recanalization cases require GA.

7. Mallampati IV requires anesthesia consult (they will not necessarily need GA for the case, but must be evaluated prior to proceeding).

8. All patients who have a history of CPAP will need to be evaluated by the respiratory therapy team, who may suggest the patient to have GA. We've
included this item on the VIR pre-procedure standing orders, so the PR area RN can call for the respiratory therapist consultation STAT. As usual, it is the VIR APPs, Fellows and Residents' responsibility to evaluate the airway and order an Anesthesia consultation in any patient who is Mallampati IV or has any airway issues.

9. All cases should be reviewed on individual bases. If the VIR RN feels like there is any missed information, the issue should be brought to the VIR attending’s attention and the decision made collectively thinking in what is the safest approach that particular patient.

It is well known that inpatients with history of CPAP are under higher risk of respiratory adverse events because they are typically sicker overall and more thorough assessment is needed on these patients.

If the patient is to undergo General Anesthesia, it should be arranged and scheduled by the board runner. A separate informed consent must be obtained from the Anesthesiology team.
On Call Anesthesia Cases:
MH - there is a GA team in house to support us in on call cases.

ART - there is NO GA team in house to support us in on call cases (only a resident).

Please, contact directly the attending on call, who can be reached through simonweb.musc.edu. If you hit the “on call” tab (left upper corner), then select “anesthesia” and then open the “attending by service” drop down list.

For the MH, page “IN-HOUSE CALL M-F” if the case is from Mon-Fri. If it is during the weekend, page the “WEEKEND IN-HOUSE CALL”.

For ART, page “ART- GENERAL CALL” at any day of the week.

Consider Foley catheter placement for the following:
1. The case will be of a long duration (>2 hs).
2. The pelvic vasculature is the focus of the exam (e.g. Uterine Fibroid Embolization). Discuss this with the VIR attending.
3. Initiating lytic therapy. The patient will be on strict bedrest while TPA is being administered in an ICU. Catheter placement after initiating TPA could result in GU hemorrhage.

Make sure to discontinue the catheter as soon as possible following the procedure.
INFORMED CONSENT

General Information

Informed consent must be obtained for all VIR procedures. The steps of the procedure should be explained to the patient using colloquial terms as well as special considerations for the procedure when appropriate. Indication/benefits, risks, potential complications and alternatives for the procedure should be discussed.

In case the patient cannot provide informed consent and it will be provided by a family member, make sure to ask what is the relationship between the patient and the person who will sign the informed consent and make sure to document it on the informed consent form (below the signature).

All consents require a witness and should ideally be obtained from a person that witnessed the consent and conversation about the procedure.

In general, all VIR procedures carry risk of bleeding, infection, and pain. Damage to surrounding structures is also a risk, depending on where the target lesion is located. There is also always a possibility that the procedure will fail to yield the diagnostic or therapeutic benefits expected. Please refer to the subsequent section for specific risks associated with each procedure.

Contrast-induced nephropathy (CIN) and contrast allergic reaction should be discussed if iodinated contrast will be used. Alternatively, negative contrast such as CO2
(carbon dioxide) could be considered and discussed with the VIR attending. It is especially important to prevent CIN in patients with Diabetes Mellitus, Multiple Myeloma and borderline kidney function (Creatinine > 1.5). Hydration and reduction in the amount of iodine contrast should be discussed with the VIR Fellow/Attending. Special attention should be paid to patients with history of cardiac failure. End-stage renal disease (ESRD) patients with chronically elevated creatinine do not need hydration protocol.

For complex cases that may require extended fluoroscopy, the patient should be made aware of the small possibility of radiation exposure complications (see appendix for cutaneous injury threshold doses).

Patients who are Spanish speakers must sign an Informed Consent in Spanish. The consent may be obtained by an authorized Spanish speaking M.D. (from VIR Dr. Schonholz or Dr. Guimaraes) or by an official interpreter.

On a practical note, this can be printed out from the URL https://www.musc.edu/cce/ORDFRMS/. Search for surgical consent, and a blank form may be filled in and printed off. Alternatively, whoever is running the desk at either hospital can print off a specific, pre-filled consent form. Lastly, make sure to get the consent witnessed by the patient’s nurse if obtained before the patient gets to the VIR unit.

The patient's signature on the appropriate informed consent form must be witnessed by an individual 18 years of age or older; a hospital employee may witness
the signature. If the witness is not present for signature when Informed Consent is obtained, the witness must verify the signature by having the person granting consent initial, date, and record the time of verification beside their signature. Consent forms shall be filed in the patient's medical record.

The Health Care Professional(s) that is responsible for carrying out and/or personally performing the procedure is required to ensure that informed consent is obtained and documented. This is a non-delegable duty under State law. However, another Health Care Professional (NP, PA) who possesses sufficient knowledge to provide the necessary information for the patient to make an informed decision about their health care may facilitate this discussion. Facilitation duties include providing information to the patient and assisting with form completion. However, the responsible Health Care Professional remains responsible for the consent and for ensuring the adequacy of the information conveyed in the informed consent discussions and appropriate documentation of same. In case the informed consent is obtained by a PA or NP, she or he will have to sign on the witness space of the informed consent and a VIR attending or VIR fellow will have to sign at the bottom of the document.

It is encouraged to obtain the informed consent when they are evaluated in the VIR clinics. The informed consent form should be uploaded in Epic under “Media” tab.
The consent form should be signed as close to the performance of treatment as possible, however, consents are valid as follows:

1. The general consent form for ambulatory care in the outpatient clinics is valid for one year.
2. The general hospital consent form is valid for the duration of the hospital stay.
3. The Consent for Authorization for Administration of Anesthesia and for the Performance of Operations and Other Procedure form is valid unless the patient revokes it at any time prior to the treatment being performed or if the procedure has changed.
4. The non-surgical blood consent form is valid for the duration of treatment for a medical condition up to a maximum of one year. Copies of the original blood consent form will be accepted, and must be on the chart prior to the administration of blood or blood products.

MINORS

Any minor who has reached the age of sixteen (16) years may give his or her own consent for medical services or procedures unless such involves an operation.
Patients Unable to Provide Consent:

Prior to rendering health care to patients who are unable to consent, two licensed physicians who have examined the patient must certify that the patient is unable to consent. Each physician must document an opinion in the medical record regarding the cause and nature of the inability to consent, its extent, and its probable duration.

In the absence of a healthcare power of attorney, prior to rendering medical care to a patient who is unable to consent, reasonable efforts should be made to obtain consent in accordance with the South Carolina Adult Healthcare Consent Act, SC Code Ann.

Emergency Situations:

Medical or surgical procedures may be undertaken without Informed Consent when the patient is unable to consent, no surrogate is available immediately, and the delay caused by attempting to locate a surrogate will create a substantial risk of death, serious disfigurement, or loss or impairment of the functions of a bodily member or organ or other serious threat to the health of the patient. Healthcare for relief of suffering may be provided without consent anytime an authorized person is unavailable. In emergencies, the patient's inability to consent may be certified by a single health care professional responsible
for the care of the patient if the delay resulting from obtaining a second physician’s certification would be detrimental to the patient’s health. A notation shall be made in the medical record explaining why a second physician’s certification was not obtained and that the delay would be detrimental to the patient's health.

When the patient is unable to consent and reasonable efforts fail to locate an authorized surrogate to act on behalf of the patient, the physician may proceed with emergency treatment. A notation must be included in the medical record explaining the medical emergency; the note should also state that a consultation with at least one other physician has been held.

**Phone consent - conference calls:**

When appropriate, a telephone call to a surrogate decision-maker may be used to obtain informed consent for treatment. The requirements above related to verbal consents must be met. The Responsible Practitioner must disclose all relevant information regarding the proposed procedure or treatment. This information must be disclosed to the surrogate and the surrogate's understanding must be confirmed before accepting permission for treatment. The patient and the consenting surrogate must be identified in writing by name and relationship on the informed consent. The Responsible
Practitioner accepting consent and two licensed staff persons who also heard the information given and the subsequent response will both sign the informed consent form.

Efforts are being made to convert Informed Consent to an electronic process, however, at present, we are still using the paper consents.

E-Consent:
The E-Consent project is getting implemented and hopefully it will expedite patient care, increase safety and efficiency during the consent process. The goals are to facilitate the VIR team work and to have paperless operations.

**PRE-PROCEDURE LABS**
All blood work must be from within 2 weeks of procedure. VIR attending may waive labs depending on the clinical situation and procedure. Labs may be ordered depending on the clinical scenario even if recent labs are present. However, consistency and common sense should prevail****.

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* Recent TBili and Cr levels should be documented prior to biliary drain and nephrostomy tube removals, respectfully.
** Pregnancy test must be ordered and checked for all UFE cases and on all women of child bearing age for any CT or fluoroscopic-guided cases.
*** Y90 cases MUST have CMP drawn up to 48 hrs of treatment.
****Urine Pregnancy test on all female patients unless hysterectomy, if menstruating or between ages of 10 and 50, inpatient and outpatient. Dialysis female patients will require blood pregnancy test.
*****Fresh TIPS and RF Wire cases must all have Type and Screen ordered within 48 hours of procedure.

NOTES:
For PICC lines, non-tunneled central lines, some tunneled lines, and tube exchanges, labs are not necessary upon review of patient history.

Notify the VIR attending if platelets <50, INR<1.5. In some cases we still may proceed with interventions, especially in a case in which the intervention is performed via radial access.

Other abnormal lab values should be noted, especially elevated creatinine in a case that will require contrast, and elevated bilirubin in liver directed therapies.

DDAVP is to be administered 30 minutes prior to all kidney biopsies unless otherwise specified by the ordering team. 0.3 mcg/kg over 15 minutes. Use “order specific” if ordering ahead of time.

POST-PROCEDURE CARE

POST PROCEDURE BED REST PROTOCOLS

ARTERIAL ACCESS

- Femoral access with closure device: 2 hours of bed rest with punctured leg immobile if a closure device is used without complication.

- Femoral access without closure device: 6 hours of bedrest (flat with access leg immobile for 4 hours and HOB 30 degrees for 2 hours).
- Radial access with TR band: 2 hours of bed rest after radial cases with bathroom privileges (mostly due to sedation) with a reminder to keep access wrist straight.

**VENOUS ACCESS**

Femoral: 2 hours of bed rest with punctured leg immobile

Jugular: 1 hour of bed rest after jugular puncture with HOB elevated to 30 degrees

**Post-Procedural Catheterization Care using the TR Band:**

1. The TR Band is placed and inflated with 15ml of air.
2. The sheath is removed, and then air is removed until a flash of blood is seen and 2ml of air is replaced in the TR Band.
3. May make small adjustments in inflation/deflation based on the waveform.
4. Patent hemostasis is the goal.

**Care of the patient after the TR Band is removed:**

1. Following radial access, the TR Band is removed after 2 hours (first hour of observation, band deflation during the 2\textsuperscript{nd} hour).
2. Attach pulse oximetry on left index finger to help assess perfusion of the hand.
3. After the first hour of observation, deflate the balloon of the TR band as follows: Remove 1/4 volume of air
every 15 minutes until fully deflated, assessing pulse, bleeding and access site closely. Inflate band by amount just removed if bleeding occurs, wait 30 minutes and resume deflation.

4. Leave band on for additional 15 min once fully deflated and then remove it.

5. Cover with Tegaderm dressing.

6. Give patient “Radial Artery Discharge Instruction Sheet”.

We are currently working to decrease the time of the TR band removal protocol, and the above procedure may change in the future. More radial access info is located in the appendix.

**LUNG BIOPSY**

- CXRs obtained at 1 and 3 hours post procedure.

- These patients should be recovered in the prep and recovery area, even if they are inpatient. Oxygen by nasal cannula during entire recovery time.

- Typically, the patient has the NPO released if the 1 h chest X-ray is normal. Patient may be discharged if there is no pneumothorax at the 3 h CXR.

**MOST OTHER PROCEDURES**
- 2 hours post-procedure monitoring is usually sufficient to watch for possible complications and to allow sedation to wear off. Fellows and residents should round on their patients (briefly) to check immediate post procedure complications - make sure that access site and the vital signs are OK before the patient is discharged.
POST PROCEDURE ORDERS

Following a procedure, all outpatients and inpatients will need post procedure orders that should be in EPIC before the case starts. The VIR order sets should be used pre and post interventions. There is one standing orders set, one generic pre-procedure orders set, and 8 procedure specific post-procedure orders sets. Outpatients should be monitored in the recovery area until their sedation has subsided. As a new policy, inpatients are also to be monitored in the prep and recovery area following any procedure that requires sedation.

Orders are necessary to remove the peripheral IV, monitor vital signs, resume regular/special diet, and to be discharged. Most patients need some pain control depending on the procedure. Bed rest per protocol should be followed. Any special instructions regarding post procedure care should also be communicated to the patient and to the referring clinician.

At the end of every intervention, before the fellow/resident leaves the room, the post procedure orders should be reviewed with the procedure RN in order tailor/adjust the orders. This is a key step to make sure that there are correct orders for the correct patient. After reviewing the orders, the procedure RN will release them and the patient can leave the room.
ADMITS

Generally, the fellows (or resident if managing the case) will be responsible for either directly admitting or coordinating admits to another service. Communication with the admitting team (if not VIR) is necessary to relay important clinical and procedural information.

If directly admitting to VIR:

- admit orders (Adult Admission orders in Epic)
- home medications
- vital checks
- appropriate diet
- PRN medications (e.g. for pain, nausea, hypertension, itching, sliding scale insulin for diabetics) are advised for patient comfort and to avoid numerous phone calls on admits.

Next morning, all admitted patients (regardless the admitting team) should be rounded on before starting to perform VIR cases, by the APP, resident, or fellow. Make sure to communicate with the VIR attending the patient status and discuss an action plan e.g. discharge, transfer to Hospitalists, order images or laboratory exams, etc. Make
sure to document the visit either in the Epic progress note or in the discharge summary.

These cases requiring an inpatient stay should be discussed with the fellow on call, as he/she will be handling calls overnight on admits. IMPORTANT: All TIPS and carotid angioplasty procedures must have admission orders done before the intervention gets started, and the patient must be under “inpatient bed status”.

If admitting to medicine, communicate with P&R nurse to put in bed request under IR attending name to be admitted to medicine. ATC (admit transfer center) will facilitate phone call between fellow and admitting physician.

For discharges, go to “inpatient” tab in EPIC. Go to Med reconciliation under discharge orders and check appropriate meds to continue or dc. Click “next” and follow prompts until sign for discharge. Helpful to ask any intern in the hospital.
RESIDENT DUTIES ON CALL

When on call, the radiology resident will often be asked questions regarding VIR procedures and how to get an emergent procedure performed after hours. Often, the consulting physician will directly contact the VIR fellow personally; however, it is important to know what information regarding the case is available, and what may be needed in order for the case to be performed.

Also, there are often CTA studies that will be read by the overnight resident that will need the attention of the VIR fellow and attending.

RESIDENT DUTIES FOR “ON CALL” VIR CASES

The consulting service should contact the VIR fellow on call directly regarding a possible emergent case overnight or on the weekend. However, if the on call resident fields a call related to a VIR consult, it is helpful to obtain the following information, which should be passed on to the on call VIR fellow: (This information should be obtained on all inpatient consults seen by VIR prior to posting a procedure.)

1. Patient name and MRN
2. Referring physician and service
3. Determine procedure to be performed
   a. Have requesting MD write an order for VIR consult in EPIC
   b. Gather basic relevant clinical information
   c. Are there other imaging studies available for review from MUSC or elsewhere (for example, in MIES)?
4. Patient location
5. Patient weight (weight limit is **440 lbs** for Angio tables)
6. Laboratory (abnormal results do not preclude the case from happening, but they must be discussed with the VIR attending).
   a. Platelet (ideally >50K)
   b. Creatinine (ideally <1.5)
   c. INR (ideally <1.5)
7. History of allergies: medications, iodine contrast?
8. Consent
   a. Is the patient consentable? If not, who will give consent? (Acquire telephone # if phone consent needs to be obtained from a family member)
   b. If patient cannot give consent and there is not a family member to contact, have requesting service write emergent note in chart with 2 different MD’s signature
9. Is patient on ventilator? Hemodynamically stable?
10. NPO status?
POLICY FOR RADIOLOGY RESIDENTS ABOUT READING CTAs OVER THE WEEKEND

On call, there will be studies that VIR is responsible for- CTA’s of the extremities, abdomen, pelvis, chest, including trauma (please see below for list of studies and protocol information). As with all call studies, results should be communicated with the referring physician as soon as possible and the impression should be placed in the ibox.

If an overnight study is completely negative and the resident is comfortable calling the study negative, the VIR attending on call should be notified via page in the morning before the call resident leaves. If the CTA is read during the day (on the weekend), page the VIR attending soon after the case is pre-dictated.

If there are positive findings at night, a call should be made to the referring physician right away. If these findings would require VIR intervention, page the on call fellow as well. If you are uncertain, page the VIR fellow at any time. Document that the VIR fellow has been paged in the ibox. If the VIR fellow does not respond STAT, it may be because he/she is scrubbed in an on call case. The radiology resident should review and discuss all the positive studies with the VIR fellow immediately or soon after the VIR fellow is available.

If there are positive findings during the day, the radiology resident should page the VIR attending directly soon after
the case is pre-dictated, so both can discuss the findings and the report can be signed off by the VIR attending in a timely fashion.

If there are emergent findings during the day or at the night that would require immediate intervention, call the referring clinician and page the VIR fellow on call STAT. As always, the VIR fellow should return the page to discuss the case ASAP. If the fellow does not return the page within 5 minutes, page the VIR attending on call.

This workflow will allow the overnight/weekend CTAs being reviewed and signed off by the VIR attending in a timely fashion. All these reports can be signed off the same day or the next day in the morning.

There will be CTA’s without clear indication on who should read it (VIR, Body, Cardiac, Thoracic), use the best judgment about whether VIR would be reading the study. If there is any doubt, err on the side of notifying the VIR fellow. The VIR fellows are aware they will be contacted about these studies.

NOTES:
DIAGNOSTIC IMAGING

There will be an assigned VIR attending responsible for checking out diagnostic studies each day. These studies should be dictated and signed out with that attending. The VIR attending schedule can be found here: http://academicdepartments.musc.edu/radiology/divisions/pdf/intrad-call-schedule.pdf

The senior resident is ultimately responsible for interpretation of the CTAs, MRAs, and interventional oncology patient abdominal studies. The junior resident should help with reading diagnostic studies. The senior resident should set clear expectations with junior resident(s) in regards to sharing the diagnostic workload.

During the regular work hours, the diagnostic studies should be signed off by a VIR attending before the end of the day. The resident should contact the VIR attending responsible for the diagnostic studies to check them out as soon as time permits, particularly if the attending is at a different site. Checkout will vary based on the attending. Do not leave the VIR diagnostic studies to be read late in the afternoon or at the end of the day.

If there are no senior residents on rotation, the residents should decide amongst themselves who will be responsible for the studies and let the VIR attending know.
COMPUTED TOMOGRAPHY VIR PROTOCOLS

The senior resident is responsible for protocolling diagnostic imaging. This should be done a month out and monitored first thing daily for new studies.

- **Pre/Post Endovascular Abdominal Aorta Aneurysm Repair (EVAR)**
  
  **Pre EVAR**: Low dose non-contrast and arterial phases from diaphragm to femoral neck.
  
  **Post EVAR**: Low dose non-contrast, arterial, and delayed phases from diaphragm to femoral neck.
  
  All 1.5 mm slices, with MPR and 3D reconstructions

- **Pre/Post Thoracic Endovascular Aorta Aneurysm/Dissection/Intimal tear Repair (TEVAR)**

  **Pre TEVAR**: Low dose non-contrast and arterial phases. Scan from the base of the neck to the femoral heads.
  
  **Post TEVAR**: Low dose non-contrast, arterial and delayed phases.
  
  Scan the Chest: from the base of the neck to the diaphragm.
  
  All 1.5 mm slices, with MPR and 3D reconstructions

- **Pre/Post Central Venous Recanalization/ RF wire technique**
  
  Phases: Low dose non-contrast, Arterial, Venous – all 3 mm slices
  
  Scan Chest: from the base of the neck to the diaphragm
  
  MPR reconstructions

- **Abdominal CTA for flap construction DIEP (Deep Inferior Epigastric Perforators)**
Phases: Arterial
Scan Abdomen and Pelvis: from the diaphragm to the femoral neck
1.5 mm slices, with MPR / MIP reconstructions

- **Lower extremity Run-off**

Phases: Low dose non-contrast and Arterial
Scan Pelvis and lower extremities:
- **Peripheral arterial disease**: scan from the diaphragm to toes
- **Pre-op for fibular flaps**: scan from the crest to the toes
All 1.5 mm slices with MPR and 3D reconstructions

- **Mesenteric CTA (Unless ordered by ED for mesenteric ischemia)**

Phases: Low dose, 5 mm non-contrast and 1.5mm Arterial. Abdomen and Pelvis: scan from the diaphragm to the pubic symphysis, Delay often necessary if concern for GI bleed
Provide MPR reconstructions

- **Renal CTA (Unless living renal donor protocol)**

Phases: Low dose non-contrast and Arterial, Excretory may be necessary if planning for ablation to define the collecting system
Abdomen: scan from the diaphragm to crest
All 1.5 mm slices MPR reconstructions

- **Liver CT (pre/4 weeks post TACE and RFA procedures, VIR clinic patients)**

4 Phases: Low dose non-contrast, Arterial, Venous, Delayed
Abdomen: scan from the diaphragm to crest
All 3 mm slices with MPR reconstructions
Delayed imaging will be obtained in certain cases

**General comments on CTAs:**

- All contrast volumes and flow rates determined by patient weight and scan duration.
- Best scanned with Dual Energy. If single source scanner, use 100 kV for any arterial work.
- Omnipaque 350 is used for all CTAs.
- 20-gauge peripheral I.V. access in the upper extremities, unless evaluating the aortic arch vessels in which case, lower extremity injection may be preferable.
- In case of known central venous occlusion, access should be obtained preferably on the contra-lateral side of the occlusion.
- VIR should read any complex CTA that may fall into a “gray area” or that is not read by other Divisions.
- Please confirm that the listed indication on the study is factual and appropriate for the exam. Double check reports to minimize errors and typos.

**ALL DIAGNOSTIC IMAGING EXAMS (CTAs, MRAs, 4-phase LIVER CTs) MUST BE READ ASAP BETWEEN**
CONSULTATIONS AND PROCEDURES. AVOID LEAVING STUDIES TO BE READ AT THE END OF THE DAY.

ALL DIAGNOSTIC IMAGING EXAMS MUST BE READ BEFORE LEAVING GOING HOME. REPORTS TURN AROUND TIMES IS AN IMPORTANT DIVISIONAL QUALITY METRIC.

ASEPTIC TECHNIQUE GUIDELINES FOR VIR

All VIR staff and any visitors entering the suites should follow these recommendations. These guidelines have been derived from the Aseptic Technique guidelines from MUSC, and adapted to fit the VIR working area. These guidelines will be amended as indicated by current practice trends.

☐ All VIR staff should wear head covers, mask, gown and gloves when setting up a sterile field.

☐ All medical staff and visitors should wear head covers and mask when entering a procedure room that has an open sterile field. Protective gear should be worn until the procedure is completed or a dressing is in place.

☐ All procedure trays should be set up as close as reasonably possible to the beginning of the case and/or covered to minimize the risk of contamination.
An inspection of all pre-packaged sterile trays should take place prior to setting up each case. Integrity of the sterile procedure tray is to be confirmed and maintained by the Angio Specialist (Radiology Technologist) setting up the tray.

VIR staff and visitors are required to dress in scrub attire when in the procedure rooms. Scrub attire is defined as clothing that is non-shedding and made of cotton fabric. Loose fitting coats and shirts are discouraged.

IV fluid lines should be set up on every patient in the procedure suite. IV solution order per protocol (see appendix). Nurses should utilize the side arm port of the fluid line to administer medications. Manipulation of the sterile drape should be avoided at all times.

VIR staff that is going to scrub into a case should perform surgical hand scrub. All other staff should follow hospital guidelines for handwashing after each contact with a patient. Scrubbed staff should not travel from procedure room to procedure room. Scrub attire must be changed if a staff member enters another procedure room to assist with a case. Avagard may be used between cases if a surgical scrub has been previously performed.

Every VIR staff member practicing in the VIR working area is responsible for following these guidelines
and providing their team members with constructive feedback when they observe breaks in aseptic techniques. Breaks in the guidelines should be corrected at the time of the incident.
CT GUIDED PROCEDURES

The radiology resident is primarily responsible for the CT-guided procedures. The majority of these are biopsies, but there will be also drain placements/checks and solid organ (liver, kidney, lung, etc.) ablations using microwave, radiofrequency, alcohol or cryoablation. It is important to preview prior imaging if available to plan the approach for the percutaneous CT guided intervention and how to position patient for best approach. Consideration should be given to critical surrounding structures (thermal protective techniques are needed?) and respiratory motion (especially lung and liver).

The expectation is that the resident should proactively review the requested case, discuss the indication, patient’s position, site for access and devices. Need of general anesthesia (GA) should be considered. As a general rule, all the pediatric patients will require GA. Coagulation status of the patient should be discussed with the VIR attending and corrected as needed.

Regarding percutaneous biopsies and drainages procedures, keep in mind that, depending on the clinical question, samples of the target area may need to be sent not only to pathology, but also to microbiology and biochemistry.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>CT Guided Biopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>To obtain tissue for pathologic/microbiologic diagnosis</td>
</tr>
<tr>
<td>Consent/ Complications</td>
<td>Bleeding (Category 1-superficial; Category 2- abdominal, lung, retroperitoneal, liver; Category 3- renal), infection, bruising, damage to adjacent organs, tumor cell seeding in the needle tract.</td>
</tr>
<tr>
<td></td>
<td>Lung biopsy – hemoptysis and pneumothorax (which may require a chest drain and overnight admission). If hemoptysis occurs, use oral aspirative cannula to help drainage of blood, check O2 levels, BP and keep the bleeding side down (lateral decubitus)</td>
</tr>
<tr>
<td>Contraindications</td>
<td>INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>No biopsy, Surgical biopsy Treatment without diagnosis</td>
</tr>
<tr>
<td>Medication</td>
<td>1% Lidocaine Moderate sedation (Versed/Fentanyl)</td>
</tr>
<tr>
<td>Equipment</td>
<td>CORE: Biopsy Temno kit (general rule: lung and lymph nodes 20G. Liver and kidney mass 18G. Kidney cortex 16G) FNA: Franseen needle, 20 or 22G. 22G is the most commonly used.</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| How to perform | 1. Position grid on skin, perpendicular to the CT scan slice. Scan an mark the entry site  
2. Prep and drape overlying skin  
3. Local anesthesia with Lidocaine.  
4. Scan through region with the numbing needle through the skin to confirm safe approach  
5. Skin nick with blade #11.  
6. Advance the guide needle into lesion, reimage to assure appropriate needle position  
7. FNA usually obtained first for pathology to check tissue origin  
8. 2-3 core Temno needle biopsies are obtained and the specimens kept in formalin and sent to pathology. Consider additional core for “flow study” if Lymphoma is suspected. In infection is in the differential, consider getting a sample for culture and cytology.  
9. Gelfoam “torpedoes” may be used in certain cases (renal, liver) for hemostasis at the end of the case through the guide needle. |
| Follow up | Bed rest:  
Most solid organ 2 hours  
Kidney biopsy 3 hours  
Lung biopsy 3 hours  

Lung biopsy requires Chest x-ray (CXR) at 1h and 3h post procedure that should be checked by the rad resident or VIR fellow. If the control 1h CXR is normal, the patient may eat. If the 3h CXR is unchanged, then the patient may be discharged home. **Lung biopsy patients must wear O2 by Nasal Cannula during entire recovery period.**  

Keep bandaged and dry for 24 hours.  
No strenuous activity for 24 hours  
If there is chest pain and/or shortness of breath after being discharged, the patient should be sent to the closest ED in order to rule-out late pneumothorax; tension pneumothorax must be managed STAT. |

**NOTES:**  
Please note that the post procedure chest x-rays for lung biopsies are included in the initial exam and do not have to be ordered separately in EPIC (otherwise the patient will be charged twice).
Occasionally, a blood patch will be used in lung biopsy, which will require approximately 5 cc of autologous blood drawn from the patient’s peripheral IV.

Pathology- Required to be present for all targeted biopsies. FNA will be reviewed prior to obtaining core samples. Most specimens are placed in formalin unless otherwise specified.

Cultures will be placed in sterile specimen cup, and the cultures should be ordered in Epic (aerobic, anaerobic cultures on all, fungal and mycobacterial cultures if indicated also).

Lung biopsies require cyto/surgical pathology/molecular testing paperwork.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>CT Guided Drain Placement (any fluid collection/ cholecystostomy tube/Chest Tube)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Placement of percutaneous drain in a fluid collection under CT guidance</td>
</tr>
<tr>
<td>Consent/ Complications</td>
<td>Bleeding, spread of infection/sepsis (rigors), damage to adjacent organs (e.g. bowel perforation)</td>
</tr>
<tr>
<td>Contraindications</td>
<td>Collection too small to leave a drain. Consider aspiration biopsy. Unsafe approach- bowel, vascular structures, etc. (hydro-dissection may be attempted to move bowel out of</td>
</tr>
</tbody>
</table>
the way), consider Hawkins needle. If INR >1.5, Platelets <50K, discuss with VIR attending about blood products.

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Do nothing, Surgical biopsy Medical treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meds</td>
<td>1% Lidocaine Moderate sedation(Versed/Fentanyl) Antibiotics- usually prescribed by requesting physician, if not see antibiotic prophylaxis section for recommendations</td>
</tr>
<tr>
<td>Equipment</td>
<td>Drain kit, 8-14Fr APDL drains</td>
</tr>
</tbody>
</table>
| How to perform | 1. Position grid on skin, perpendicular to the CT scan slices. Scan and mark the patient’s skin.  
2. Prep and Drape the overlaying skin.  
3. Local anesthesia with Lidocaine 1% and skin nick #11 blade  
4. Trocar 18-gauge needle is advanced into the fluid collection, reimaging to assure appropriate needle position  
5. Trocar needle is exchanged over the 0.035” stiff guide wire for a dilator.  
6. Thread an all-purpose (e.g. APDL)catheter over a 0.035” stiff guide wire into collection  
7. Drain immediately the max amount |
of fluid. If blood is seen, stop aspiration, avoid sepsis.

8. Send a sample for culture studies. Consider cytology and fungal culture in the appropriate clinical setting.

9. Final CT scan and then secure drain with stitch 2.0 Silk. Put a bandage appropriately, and connect the drain to bag. All patients with a new drain get admitted overnight.

10. **CHOLECYSTOSTOMY**: approach the gallbladder through the right hepatic lobe parenchyma

| Follow up | Bandage and keep dry for 24 hours.  
No strenuous activity for 24 hours.  
Drain care: keep clean and dry, monitor skin site, record output, and flush 10 cc on normal saline bid if fluid is viscous.  
Drain check: Limited non-contrasted CT scan to evaluate the fluid collection.  
Criteria to remove a drain:  
1. Less than 10cc output in 24h  
2. No fever or abdominal pain  
3. No or minimal fluid around the |
4. If WBC count is available, check if there is trend to infection resolution.
5. Cholecystostomy tube should not be removed until tract has had time to mature (at least 4 weeks)

| Chest tube Mgmt                                      | 1. Keep to wall suction overnight  
|                                                      | 2. Place to water seal and obtain CXR after 2 hours  
|                                                      | 3. If no PTX, clamp tube by turning off stopcock.  
|                                                      | 4. 2 hour CXR.  
|                                                      | 5. If no PTX can pull tube. Apply dressing and obtain 1 hour follow up CXR.  

**NOTES:**

Be sure to place flushing orders for drains if deemed appropriate by the attending for both inpatients and outpatients.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percutaneous Ablation (Radiofrequency, Cryoablation, Microwave, Alcohol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Tumor treatment</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Bleeding, infection, shoulder pain, thermal damage of adjacent organs or liver structures: gallbladder, bile ducts, bowel, stomach, diaphragm, pancreas, kidney (depends on the tumor location).</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>Post-ablation syndrome: “flu-like” symptoms (fatigue, lack of appetite), nausea/vomiting, abdominal distention, fever, increase in WBC count, abdominal pain. It does not mean that there is infection if they are present in the first 2-3 days and the patient improves clinically in the following days.</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Do nothing, Surgical excision Medical treatment</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine GA usually required Antibiotic Prophylaxis Pending type of ablation: 60-80mg of available steroid (Depomedrol 80mg for IM injection) + Bupivicaine 0.5% 100mg (20mL x500mg/100mL =100mg) to be ordered ahead of time</td>
</tr>
<tr>
<td>Equipment</td>
<td>RFA, Microwave and Cryoablation needles. Consider thermal protective techniques is some challenging cases</td>
</tr>
</tbody>
</table>
How to perform

1. Position grid on skin, perpendicular to the CT scan slices. Scan and mark the patient’s skin.
2. Prep/Drape
3. Local anesthesia, skin nick #11 blade
4. Numbing needle (s) in the skin toward the lesion, reimaging to assure safe approach
5. If needed, thermal protection may be considered to cool (e.g. gallbladder) or to move adjacent organs out of the way (bowel, kidney)
6. Insert 1-3 ablation needles into the lesion. Always consider a 1cm surgical margin around the lesion.
7. Activate RFA, Cryoablation, Microwave machine. If unipolar RFA is used, then 4 ground pads MUST BE placed, 2 on each thigh
8. Perform cauterization of the needle track after the ablation is terminated
9. Remove needle(s), re-scan.
10. Clean site and sterile bandage
11. Patient is discharged home after 2-3hs of observation

Follow up

Bandage and keep dry for 24 hours
No strenuous activity for 24 hours
Home with Rx for pain, nausea and antibiotic (usually Cipro 500 mg BID x 7 days)

THE RADIOLOGY RESIDENT WHO PERFORMS A CASE IS RESPONSIBLE FOR THE ENTIRE PATIENT CARE, WHICH INCLUDES PRE, INTRA AND POST PROCEDURE ORDERS AND POST PROCEDURE PATIENT EDUCATION.

Discharge Scripts for Percutaneous Ablation Patients

1) Cipro 500 PO BID for 1 week, may add Flagyl if higher concern for infection/abscess formation such as in patients with choledocojejunostomy or papillotomy.

2) 30 tabs of Zofran or Phenergan q8 h PRN

3) 40 tabs of Oxycodone 5 mg tabs, 1-2 tabs q6 h PRN

4) Senna or Colace over the counter daily for opiate constipation
FLUOROSCOPIC GUIDED / ANGIOGRAPHIC PROCEDURES

The fellows are primarily responsible for all angiographic procedures. Residents are encouraged to assist and sometimes perform these procedures along with the fellow. Residents can help by performing the informed consents, ensuring the appropriate labs are ordered and reviewing prior images with the VIR Fellow or Attending before the case.

As with CT guided cases, it is important to preview prior imaging if available to plan the approach for the intervention and how to position patient for best approach. Consideration should be given to critical surrounding structures and possible access difficulties or challenges to selective catheterization.

The expectation is that the resident should proactively review the requested case, discuss the indication, patient’s position, site for access and devices.

Need of general anesthesia (GA) should be considered. Coagulation status of the patient should be discussed with the VIR attending and corrected as needed.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>General Vascular Access (Seldinger Technique)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Vascular accesses for diagnostic or therapeutic interventions</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site - bleeding, hematoma, pseudoaneurysm, infection, distal embolization, direct vessel injury (dissection)</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Open surgical access or no action</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine</td>
</tr>
<tr>
<td>Equipment</td>
<td>Micropuncture kit</td>
</tr>
<tr>
<td>How to perform</td>
<td>1. Identify the target vessel - Direct palpation or US guidance.</td>
</tr>
<tr>
<td></td>
<td>2. Advance micropuncture needle (21 gauge) or regular access needle (18 gauge) into the vessel lumen until there is blood return. Ideally, arterial puncture site should have no calcifications. Preferably use micropuncture kits in coagulopathic patients</td>
</tr>
<tr>
<td></td>
<td>3. Thread small guidewire (.018” in micropuncture kit, others use .035” wire) through needle into the vessel lumen</td>
</tr>
<tr>
<td></td>
<td>4. Remove needle while pressure is held in the puncture site and the guidewire is kept in place</td>
</tr>
<tr>
<td></td>
<td>5. Insert the introducer sheath over the wire. The type of intervention and necessary devices should</td>
</tr>
</tbody>
</table>
dictate its size.

6. At the termination of the intervention, remove the sheath and consider holding manual compression (venous and brachial/femoral punctures), closure devices (femoral) and TR band (for radial)

Follow up

<table>
<thead>
<tr>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed rest per protocol</td>
</tr>
<tr>
<td>Bandage and keep dry for 24 hours</td>
</tr>
<tr>
<td>No strenuous activity for 48 hours</td>
</tr>
<tr>
<td>Keep clean and dry</td>
</tr>
</tbody>
</table>

**NOTES:**

**All access should be performed with US guidance.**

Micropuncture kit- 21-gauge micropuncture needle, 0.018” guidewire, and a sheath (usually 4-Fr). It may be converted to a 0.035” platform after the 4-Fr sheath is intra-vascular.

Regular access - 18-gauge Trocar needle, 0.035” guidewire, and a sheath (usually 5-Fr). Sheath sizes available: 4-18 Fr.

Precision access kit: 21-gauge micropuncture needle, 0.018” guidewire, 5 French tapered sheath (no need for transitional sheath), good for diagnostic venograms, arteriograms and interventions not requiring a larger sheath diameter
Femoral Artery Puncture- Aim for the disease-free anterior wall of the common femoral artery (CFA) at the level of the femoral head, below inguinal ligament and above femoral artery bifurcation. Femoral head should be visualized under fluoroscopy and a mark can be done at the skin level to prevent high punctures above the inguinal ligament that could lead to retroperitoneal hematoma or low punctures that could lead to access the SFA or DFA with the potential risk of pseudoaneurysm and/or AVF. It is important for the puncture to be at the level of the femoral head for effective manual compression and to minimize bleeding complications. The access level should be confirmed by US guidance to prevent puncture of the femoral artery in an area where calcifications are present.

Radial Artery Access (see also section in appendix) - Preoperative assessment is paramount for uncomplicated radial access. Workup includes Allen’s Test and Barbeau’s Test as well as sonographic evaluation of the artery. This should be done prior to patient arrival to the angio suite. A 1.8 mm (if the Slender sheath is used) or greater radial artery diameter must be documented with ultrasound. Please see appendix for further explanation of the Allen’s and Barbeau’s Tests. If an oximetry pulse monitoring system is available, then give preference to the Barbeau’s test, as it is more sensitive than the Allen’s test. Barbeau’s is obligatory in all patients. Allen’s may be used in clinic or when there is no oximetry pulse available.
During a radial access case, we will administer intra-arterial nitroglycerin via the sheath in the radial artery. It is important to assure that systolic blood pressure is greater than 100 mmHg prior to administration. A saline bolus may be initiated if the patient is running slightly hypotensive. Typically, we will administer 200mcg/1mL after securing access and again before removing the sheath.

Systemic heparin will be administered following secure access (usually 2000-3000 units, possibly re-dosed if the case runs longer than 30 minutes).

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Adrenal Vein Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>To localize aldosterone-secreting adenomas and for distinguishing adenomas from bilateral adrenal hyperplasia in patients with primary hyperaldosteronism</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, hematoma, pseudoaneurysm, infection, damage to vessel. Damage to the adrenal gland during venogram, especially of the right adrenal gland.</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Do nothing</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine</td>
</tr>
<tr>
<td></td>
<td>Moderate sedation</td>
</tr>
<tr>
<td></td>
<td>Cosyntropin 250mcg in 100mL 0.9% NaCl (to be ordered ahead of time)</td>
</tr>
<tr>
<td>Equipment</td>
<td>Regular needle for access, guidewires/catheters</td>
</tr>
<tr>
<td>How to perform</td>
<td>1. Review coronal abdominal CT with contrast in order to detect the level of the right adrenal vein(s).</td>
</tr>
<tr>
<td></td>
<td>2. Before starting, 9 vials correctly labeled must be ready for blood sample. At least 4 cc of blood is needed in each vial according to MUSC lab.</td>
</tr>
<tr>
<td></td>
<td>3. Create side holes (hole puncture device) at the tip of the Mikaelson/Cobra for the right and Simmons 2 or 3 for the left adrenal vein.</td>
</tr>
<tr>
<td></td>
<td>4. Prep/drape femoral vein. Lidocaine</td>
</tr>
<tr>
<td></td>
<td>5. Venograms of right and left adrenal glands are performed with gentle hand injection. The right adrenal gland vein(s) is typically more challenging to be identified. An accessory hepatic vein can be easily</td>
</tr>
</tbody>
</table>
misinterpreted as the right adrenal vein.
6. Draw baseline plasma cortisol and aldosterone from IVC
7. Start infusion of ACTH analogue (Cosyntropin) at 1ug/min (24 cc/hr)
8. At 15 min and 30 min into infusion draw samples from left, right adrenal veins and IVC for cortisol and aldosterone
9. Blood samples are required

| Follow up                  | Bed rest per protocol
|                           | Bandage and keep dry for 24 hours
|                           | No strenuous activity for 24 hours
|                           | Keep clean and dry

**NOTES:**

There is a binder with intraprocedure guidelines for the procedure RN. Please consult this prior to beginning case.

**Meds to be held prior to procedure (2 weeks minimum ideally 4-6 weeks):**
Amiloride, Triamterene, Spironolactone, Eplerenone, Cinacalcet, ACEi, ARBs, Loop diuretics, Steroids
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Arterial and Venous Angiography/Angioplasty/Thrombolysis/Lymphangiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Evaluation and treatment of acute, chronic, or acute on chronic arterial/venous occlusive disease that includes: balloon angioplasty, stent placement, mechanical thrombectomy, infusion of lytic therapy (thrombolysis), Evaluation for lymphatic leak as cause for chyloous effusion</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, infection, hematoma, pseudoaneurysm, pain or discomfort at puncture site, damage to adjacent vessels, abrupt vessel closure, bruising, distal embolization, failure to relieve stenosis/occlusion, re-thrombosis/re-stenosis necessitating further intervention, PE, stroke (hemorrhagic or ischemic), heart attack, possible death</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>CTA for diagnosis, but no intervention. Open surgical repair, medical therapy, no action</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine, Moderate sedation, Heparin if plan to lyse, angioplasty or stent</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Follow up</strong></td>
<td>Bed Rest per protocol. Evaluate puncture site. Evaluate for distal embolization, rethrombosis/ occlusion.</td>
</tr>
<tr>
<td>How to perform</td>
<td>1. Review CTA, MRA, prior angiographies, history of prior interventions, surgeries if available.</td>
</tr>
<tr>
<td></td>
<td>2. Prep and drape <strong>both</strong> groins</td>
</tr>
<tr>
<td></td>
<td>3. Vascular Access</td>
</tr>
<tr>
<td></td>
<td>4. Catheter advanced to the target vessel</td>
</tr>
<tr>
<td></td>
<td>5. Diagnostic angiogram. Consider pressure measuring across the anastomosis in case there is a questionable stenosis and pre and post PE MT</td>
</tr>
<tr>
<td></td>
<td>6. Balloon angioplasty, stent, MT, MIC</td>
</tr>
<tr>
<td></td>
<td>7. Completion angiogram</td>
</tr>
<tr>
<td></td>
<td>8. Sheath removal. Check ACT if heparin was given before removing the sheath</td>
</tr>
<tr>
<td></td>
<td>9. Closure device or hold pressure (depending on site of puncture, vessel disease, ACT)</td>
</tr>
<tr>
<td></td>
<td>10. Clean site and sterile bandage</td>
</tr>
<tr>
<td></td>
<td>11. In case of MT: Angiojet may cause significant bradycardia especially in MT of the Pulmonary arteries. Have atropine (0.5-1 mg I.V) available.</td>
</tr>
<tr>
<td></td>
<td>12. In case of thrombolysis: Label the infusions/catheters to avoid confusion. Suture the sheath in the groin. Cover the sheath and infusion catheter with Opsite dressing to prevent infection and catheter dislodgment. Follow</td>
</tr>
</tbody>
</table>
Follow Up

- Bed Rest per protocol
- Evaluate puncture site
- Evaluate for distal embolization, rethrombosis/occlusion

**NOTES ON ANGIOPLASTY AND STENTING:**

Heparin (weight based, 50 IU / kg) should be administered after access is secured, but prior to crossing a stenotic lesion.

It is important to measure vessel diameter and lesion length to insure appropriate balloon and stent selection.

Balloon expandable stents are desirable when precise deployment is necessary. Self-expandable stents are often better for tortuous anatomy and where the stent could easily be compressed by external force (Carotid and SFA).
Discuss with attending prior to case to ensure you have the appropriate devices available.

Larger diameter balloons require larger sheaths to accommodate them. This is important to think about the compatibility among different materials when planning the case.

NOTES ON LYSIS:

Alteplase (tPA) should be ordered prior to the procedure at the 10mg/500ml concentration for single lumen (catheter) infusion or 5mg/250ml for double lumen infusion. Confirm dosing with attending prior to procedure. tPA infusion requires ICU admission for close monitoring.

tPA infusion is typically initiated at 1 mg/hr through the infusion catheter, which has been previously positioned within the clot. Often, we may use 2 infusion catheters for bilateral DVT in the lower extremities and bilateral pulmonary arteries lysis; in this case, 0.5 mg/hr tPA infusion is performed through each catheter (this makes a total of 1 mg/hr). 500 IU/hr heparin is infused through the sheath.

When using EKOS system, additional saline infusion at 35 cc/hr is necessary to keep the US unit from overheating.
Fibrinogen should be monitored q 6 hours- If the level is <200, tPA infusion is halved; if the level is <100, infusion should be discontinued.

**Normal PTT test results** are measured in seconds. **Normal results** are typically 25 to 35 seconds. This means that it took the blood sample 25 to 35 seconds to clot after adding the chemicals.

**Heparin**— will prolong a PTT. **During the anticoagulation therapy**, the target PTT is often about 1.5 to 2.5 times longer than a person's pretreatment level. Patients with Heparin Induced Thrombocytopenia (HIT) can receive argatroban. Contact pharmacy for dosing.

**NOTES ON CONTRAST INJECTION:**

*Contrast administered e.g. “5 for 30”, means injection rate of 5 cc/sec of contrast for a total of 30 cc of contrast volume (this would be a 6 second injection).

Contrast injection rate will roughly correspond with the vessel diameter (e.g. a 5 mm celiac artery will often use a 5cc/sec rate; a 2 cm aorta may need up to a 20cc/sec rate.

Rates and pressures differ between catheters; it is important to specify if a power injection will be performed through a microcatheter to use appropriate pressures and rates during a power injection.

- Standard pressure limits range from 900-1000psi
- Microcatheter pressure limits from 700-800psi
• Microcatheters range from 3-4 cc per second

Siemens rooms have several options for administration of contrast with the power injector. Make sure the toggle switch is in the RED off position on the MEDRAD injector for the injection to work via the table hand switch/acquisition foot pedal. A hand switch is also available in the control room.

In the GE rooms, make sure that the auto inject button is on to deliver contrast through the injector.

**SUGGESTIONS FOR POWER INJECTION RATES**

<table>
<thead>
<tr>
<th>AREA</th>
<th>CC/SECOND</th>
<th>TOTAL CC</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>THORACIC ARCH</td>
<td>15</td>
<td>30</td>
<td>1000</td>
</tr>
<tr>
<td>ABDOMINAL AORTA</td>
<td>15</td>
<td>30</td>
<td>1000</td>
</tr>
<tr>
<td>PELVIS</td>
<td>10</td>
<td>20</td>
<td>700</td>
</tr>
<tr>
<td>CELIAC ARTERY</td>
<td>5</td>
<td>30</td>
<td>400</td>
</tr>
<tr>
<td>HEPATIC ARTERY</td>
<td>3</td>
<td>15</td>
<td>700</td>
</tr>
<tr>
<td>RENAL ARTERY</td>
<td>3</td>
<td>12</td>
<td>400</td>
</tr>
<tr>
<td>SMA</td>
<td>5</td>
<td>30</td>
<td>400</td>
</tr>
<tr>
<td>IMA</td>
<td>3</td>
<td>18</td>
<td>400</td>
</tr>
<tr>
<td>SFA</td>
<td>3</td>
<td>12</td>
<td>500</td>
</tr>
<tr>
<td>IVC GRAM</td>
<td>10</td>
<td>20</td>
<td>1000</td>
</tr>
<tr>
<td>Procedure</td>
<td>Central Venous Access (Nontunneled)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indication</td>
<td>Temporary dialysis catheter, medication administration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Bleeding, infection, damage to vessel, nerve, pneumothorax, abnormal heart rhythm, arterial puncture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternatives</td>
<td>Do nothing, Peripheral IVs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Take care with pulmonary artery injections in the setting of increased R heart pressures- large volumes may precipitate R heart failure and arrhythmia

Lymphangiogram: Slow injection of ethiodol/lipiodol into inguinal lymphnodes to opacify the lymphatics, imaging of pelvis→abdomen→chest to identify cysterna chyli and potential leak from thoracic duct causing chylous effusion. If seen can potentially access duct or cysterna chyli with chiba needle for embolization or masceration.
| Meds                      | 1% Lidocaine  
Moderate sedation if possible, but not always necessary |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>Central line kit</td>
</tr>
</tbody>
</table>
| How to perform           | 1. Check with US if the target vein is open (usually internal jugular)  
Check if there is any history of previous central venous occlusion  
2. Prep and drape  
3. Local anesthesia and skin nick  
4. Seldinger technique – guidewire, dilator and temp catheter are advanced under fluoroscopic guidance  
5. Check the catheter tip and if there is adequate flow.  
6. Suture into place  
7. Clean site and sterile bandage |
| Follow up                | 1. Bandage and keep dry for 24 hours  
2. No strenuous activity for 24 hours  
3. Keep clean and dry  
4. Patients with Temporary central line cannot be discharged home |
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>Central Venous Access (Tunneled) - (port, dialysis catheter, etc)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Long term access for medications or dialysis</td>
</tr>
<tr>
<td><strong>Consent/Complications</strong></td>
<td>Bleeding, infection, damage to vessel, damage to nerve, pneumothorax, arrhythmia, arterial puncture</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td>Do nothing, working fistula, surgical access?</td>
</tr>
<tr>
<td><strong>Meds</strong></td>
<td>1% Lidocaine Ancef 2 g if placing port of cuffed line.</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Tunneled port or dialysis catheter kit Port tray</td>
</tr>
</tbody>
</table>
| **How to perform** | **Tunneled Catheter Placement**  
1. Check with US if the target vein is open (usually internal jugular). Check if there is any history of previous central venous occlusion |
2. Prep and drape
3. Local anesthesia and skin nick in neck
4. Seldinger technique – guidewire advanced ideally to the IVC
5. Measure approximately 3 fingers width inferior to the ipsilateral clavicle (end point above the nipple) and administer local anesthesia, second nick in the chest (tunnel track)
6. Catheter introduced through the subcutaneous tunnel
7. Dilator and peel-away are advanced over the wire under fluoroscopic guidance
8. Check the tip of the catheter and if there is adequate flow.
9. Suture the catheter in place
10. Clean site and sterile bandage

**Chest Port placement**
1. Similar technique to the above including the 3 fingers distance from the clavicle where a 3 cm incision is performed for dissection of the subcutaneous tissues and pocket creation
2. Using the sharp tissue dissector with attached catheter, tunnel
towards the neck incision slowly
3. Place catheter through the peel-away sheath into appropriate position under fluoroscopic control
4. Connect the port to the catheter and sew the port down into the subcutaneous tissues within the pocket created. Check the flow.
5. Look for catheter kinks under fluoro. Fill up the lumen with heparin
6. Sew incision with 3.0 Vicryl
7. Dermabond the skin nick and the neck sites
8. Clean sites and sterile bandages

Arm port placement
1. Check with US if the target vein is open (usually basilic/brachial vein). Check if there is any history of previous central venous occlusion
2. Prep and drape
3. Local anesthesia w/ Lidocaine
4. Under US guidance and Seldinger technique – micropuncture kit is used to obtain venous access
<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Incision of ~ 2 cm is performed to include the puncture site. Dissection of a small subcutaneous pocket to accommodate the port. No tunneling in arm ports</td>
</tr>
<tr>
<td>6.</td>
<td>Port catheter introduced over a hydrophilic wire through a 7-Fr sheath under fluoroscopic control</td>
</tr>
<tr>
<td>7.</td>
<td>Check the tip of the catheter, connect it to the chamber, check if there is adequate flow. Heparinization of the catheter lumen.</td>
</tr>
<tr>
<td>8.</td>
<td>Sew the chamber in the pocket and the skin with 3.0 Vicryl Clean site and sterile bandage</td>
</tr>
</tbody>
</table>

**Follow up**

- Bandage and keep dry for 24 hours
- No strenuous activity for 24 hours
- Keep clean and dry

**NOTES:**

We are frequently asked to place tunneled, non-cuffed, central venous lines (tunneled PICCs) for patient with renal dysfunction and difficult access (to preserve arm veins for possible future dialysis). No antibiotics are required.

A Hawkins needle may be used to tunnel the PICC to the chest from the internal jugular vein. Also a single puncture
with a modified curved needle can be useful in these situations.

Ports and catheters should be loaded with the appropriate heparinized solution and labeled. Adult HD catheters should be loaded with 1,000 IU/mL heparinized saline (appropriate volume based on the catheter placed).

Ports should be loaded with heparin solution (5cc/lumen) - 10 IU/mL if leaving accessed, 100 IU/mL if not accessed.

Trifusion catheters are typically loaded with 10 IU/ml (5ml/lumen). If ordered for stem cell txp this usually requires the 100IU/ml heparin lock but this can be clarified with the stem cell coordinator.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Chemoembolization-Liver (TACE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Tumor control, alleviate pain, palliative</td>
</tr>
<tr>
<td>Consent/ Complications</td>
<td>Make sure the patient is not drinking alcohol. Complications: Puncture site- bleeding, hematoma, pseudoaneurysm, infection; damage to vessel or adjacent organs, non-target embolization-may result in gastric or duodenal necrosis/ulceration, contrast allergy/nephropathy, reaction to chemotherapy Mitomycin (bone marrow suppression is rare, no alopecia), liver injury, rigors, GI bleeding.</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>Post-TACE syndrome is expected in ~ 40% of patients: “flu-like” symptoms (fatigue, lack of appetite), nausea/vomiting, abdominal distention, fever, increase in WBC count, abdominal pain. It does not mean that there is infection if they are present in the first 2-3 days and the patient improves clinically in the following days.</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products. Also, discuss w/ Attending if TGO/TPG and total Bilirubin are elevated</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Do nothing (tendency for the lesion(s) to grow), Surgery, Transplant, Systemic chemotherapy</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Meds</td>
<td>Moderate sedation&lt;br&gt;Antibiotic prophylaxis&lt;br&gt;Nitro, Heparin for radial access</td>
</tr>
<tr>
<td>Equipment</td>
<td>Femoral or radial access kits&lt;br&gt;Mikaelson / Jackie catheters, microcatheter coaxially&lt;br&gt;PVA micro-particles, lipiodol chemotherapeutic agent</td>
</tr>
<tr>
<td>How to perform</td>
<td>1. Prep and drape&lt;br&gt;2. Femoral or radial access (femoral/radial) via Seldinger technique&lt;br&gt;3. Angiograms, check portal vein phase&lt;br&gt;4. Cannulate hepatic arteries, as super selective as possible&lt;br&gt;5. Infuse chemo agent and micro-particles&lt;br&gt;6. Completion angiogram&lt;br&gt;7. Remove catheters, closure device/TR Band, manual pressure&lt;br&gt;8. Clean site and sterile bandage&lt;br&gt;Patient gets admitted overnight for observation (may not need overnight admission if DEB-TACE)</td>
</tr>
</tbody>
</table>
Follow up

Bed Rest per protocol
Evaluate puncture site
Keep clean and dry

NOTES:

Embolization mixture: 10 cc saline, 10 cc contrast, 5 cc Lipiodol, 10 cc chemotherapy agent is placed in each of 2 cups. One of the mixtures will have a vial of 300 microns PVA to it.

DEB-TACE beads with Doxorubicin come pre-loaded from pharmacy.

In the case of bland embolization the above mixture will be the same, but without the chemotherapy.

Chemotherapy agent should be ordered in advance and will be picked up by the procedure nurse prior to case.

Consult the VIR attending for access preference- femoral v radial prior to case. Patients who are taller than 6’ 4” should have the 150 cm microcatheter for any liver directed therapy.

Patients will be admitted overnight for pain and nausea control. DEB-TACE may not need admission.
Discharge scripts for ALL chemoembolization patients:

1) Cipro 500 PO BID for 1 week, may add Flagyl if higher concern for infection/abscess formation such as in patients with choledocojejunostomy or papillotomy.

2) 30 tabs of Zofran or Phenergan q8 h PRN

3) 40 tabs of Oxycodone 5 mg tabs, 1-2 tabs q6 h PRN

4) Senna or Colace over the counter daily for opiate constipation

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Embolization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Internal bleeding – trauma, GI bleed, renal, etc.</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, hematoma, pseudoaneurysm, infection, non-target embolization – damage to healthy adjacent organs, ischemia- need for surgical procedure, contrast allergy/nephropathy. Failure to stop bleeding.</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>Post-embolization syndrome- fever, pain, leukocytosis, nausea, vomiting</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Open surgical repair, correction of coagulopathy if any</td>
</tr>
</tbody>
</table>
| Meds              | 1% Lidocaine Moderate sedation  
Antibiotics may be necessary (solid organ embolization)  
Alcohol Embo: (3% sotradecol 10-15mL to be ordered ahead from pharmacy) |
| Equipment         | Regular needle or micropuncture kits  
guidewires/ diagnostic and micro catheters- often vessel/procedure specific  
Embolization agent – gelfoam, coils, PVA, glue, Onyx, Vascular plug, etc. |
| How to perform | 1. Prep and drape  
| | 2. Local anesthesia and skin nick  
| | 3. Seldinger technique – guidewire, sheath, place catheter into appropriate vessel  
| | 4. Angiogram to visualize target vessel  
| | 5. Microcatheters may be used to access vessel of interest  
| | 6. Deploy appropriate embolization agent  
| | 7. Post embolization angiogram  
| | 8. Remove catheters, obtain hemostasis (femoral: closure device, hold pressure/radial: TR band)  
| | 9. Clean site and sterile bandage  
| Follow up | Bed Rest per protocol  
| | Evaluate puncture site  
| | Keep clean and dry  

**NOTES:**

There are multiple embolization agents that are used in VIR, and each case will have a preferred agent, given the scenario. These agents include Gelfoam, coils, glue/Onyx, and PVA. Discuss with attending the pros and cons of each agent for a given scenario.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Endovascular Aortic Repair (TEVAR, EVAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Aneurysm, aortic dissection or intimal tear</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, infection, hematoma, pseudoaneurysm, pain or discomfort at puncture site, damage to vessel and organs (bowel/renal ischemia), bruising, stroke, heart attack, possible death. Thoracic specific: paraplegia</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If creatinine abnormal or INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about contrast nephropathy prevention (hydration, CO2, IVUS) blood products.</td>
</tr>
</tbody>
</table>
| Alternatives    | Open surgical repair  
No action |
| Meds            | General Anesthesia  
Antibiotic prophylaxis.  
I.V. Heparin after access is obtained |
| Equipment       | Regular needles, 8-Fr sheath, regular/stiff guidewires/pigtail/Mikaelson catheters, 2 Perclose device, stent-graft (body + limb+ extension if needed), trilobe or Coda balloons, |
| How to perform | 1. Prep and drape both groins and the abdomen (in case of conversion)  
2. Bilateral Percutaneous vascular access  
3. Pre deployment in “X” fashion of the Perclose (closure device) in the percutaneous access (2 Perclose devices on the intervention access, 1 on the diagnostic access)  
4. 8 Fr sheath and pigtail catheter inserted on the diagnostic side  
5. Abdominal Angiogram  
6. 20-24 Fr sheath placed over Lunderquerquist wire on intervention side  
7. Main body and limb stent-graft placement  
8. Post stent-graft deployment balloon angioplasty  
9. Completion angiogram  
10. Sheaths removal, access hemostasis with Perclose. Clean site and sterile bandage |
| Follow up | Post-surgical procedures recovery area  
Before discharge: evaluate puncture site, kidney function  
Post: the same + Evaluate for stent-graft migration, occlusion, endoleaks (see appendix for types) |
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>Endovenous Thermal Ablation (EVTA) of the Greater Saphenous vein (GSV) w/ or without Phlebectomy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Varicose veins</td>
</tr>
<tr>
<td><strong>Consent/Complications</strong></td>
<td>Infection, hematoma, pain, post-op bruising/tenderness, thermal damage to adjacent structures (nerves), blood clot that could lead to PE</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td>GSV surgical phlebectomy, do nothing</td>
</tr>
<tr>
<td><strong>Meds</strong></td>
<td>1 % Lidocaine Moderate sedation</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Perc Venous Closure kit, RFA kit, crochet hooks for stripping</td>
</tr>
</tbody>
</table>
| **How to perform** | 1. In case of phlebectomy, make sure the borders of varicose veins were marked in the skin w/ a pen.  
2. EVTA +/- stripping: Prep and drape from the groin to the ankle. Administer Lidocaine and under US obtain access to the saphenous vein at the medial |
aspect of the knee with micropuncture kit.

3. GSV venogram, wire advanced proximally, ablation catheter introduced 2 cm away from the GSV-femoral vein confluence.

4. Under US guidance, lidocaine solution is injected 360 degrees around the GSV from the GSV-Fem vein junction until the skin entry site (tumescent anesthesia)

5. Use Laser safety glasses if applicable (patient and operators)

6. Activate catheter while retracting slowly (2mm/sec) until the skin entry site for laser or at marked increments per RFA instructions

7. PHLEBECTOMY (stripping):

8. After local lidocaine, make one/two skin nicks at the pre-procedure areas and use the venous hooks to remove the superficial varicose veins

9. Dermabond any skin nicks necessary, clean and bandage

10. ACE bandage from ankle to groin followed by compression hose

| Follow up | 20 minutes of ambulation after sedation has worn off prior to DC. No bed rest but wear compression hose per protocol |
NOTES:

Will need to get ACE wraps and TED hoses from prep and recovery for placement prior to the case. Wrap bandage starting at midfoot up to the proximal thigh, then place TED hose over the wrap. Important to educate the patient to maintain the compression hose all the way up to the groin at ALL TIMES. ACE bandage in place for 2 days then may shower. TED hose for one week until follow up appointment. OTC NSAIDS for pain relief.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Fistulagram/ Balloon Angioplasty/ Stent placement/ Mechanical thrombectomy, Possible temporary dialysis catheter placement if failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Evaluation of dysfunctional fistula Treatment of stenosis/ thrombosis</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, infection, hematoma, pseudoaneurysm, pain or discomfort at puncture site, damage to vessel, bruising, failure to relieve stenosis/occlusion, distal embolization, hand ischemia, PE, stroke, heart attack, possible death. Always consent for placement of a temporary dialysis catheter if the stenosis/occlusion cannot be treated.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Open surgical repair</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine Moderate sedation Heparin I.V. by weight.</td>
</tr>
<tr>
<td>Equipment</td>
<td>Micropuncture kit Guidewires/ catheters- often vessel/procedure specific Balloon angioplasty Bare and covered-stents Mechanical thrombectomy (Angiojet)</td>
</tr>
<tr>
<td>How to perform</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Exam the AVF/AVG. Pulse? Thrill?</strong></td>
<td></td>
</tr>
<tr>
<td>2. <strong>Prep and drape the entire fistula/graft (not just where you think you’ll access)</strong></td>
<td></td>
</tr>
<tr>
<td>3. <strong>Fistula Access w/ micropuncture kit, sometimes necessary to access clotted graft with 18G needle</strong></td>
<td></td>
</tr>
<tr>
<td>4. <strong>Heparinize after access secured</strong></td>
<td></td>
</tr>
<tr>
<td>5. <strong>Catheters advanced towards the central veins</strong></td>
<td></td>
</tr>
<tr>
<td>6. <strong>Arm venograms until the culprit lesion is identified (typically close to or at the venous anastomosis)</strong></td>
<td></td>
</tr>
<tr>
<td>7. <strong>Balloon angioplasty (preferential)/ stent placement (rarely used), +/- mechanical thrombectomy with Angiojet, Fogarty maneuver</strong></td>
<td></td>
</tr>
<tr>
<td>8. <strong>Completion angiogram. Turn the sheath to the arterial side, evaluate arterial inflow in a retrograde fashion by external compression or consider a second access</strong></td>
<td></td>
</tr>
<tr>
<td>9. <strong>Evaluate arterial limb stenosis</strong></td>
<td></td>
</tr>
<tr>
<td>10. <strong>Fogarty maneuver to clear plug from arterial side.</strong></td>
<td></td>
</tr>
<tr>
<td>11. <strong>Completion fistulagram</strong></td>
<td></td>
</tr>
<tr>
<td>12. <strong>Sheath removal, hold pressure or skin suture for hemostasis</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Clean site and sterile bandage</strong></td>
<td></td>
</tr>
</tbody>
</table>
Follow up | Bed Rest per protocol  
---|---
| Evaluate puncture site, thrill

**NOTES:**

Bradycardia may be seen during Angiojet thrombectomy—have atropine available.

If the patient has missed their last dialysis, K+ should be checked. **K+ greater than 6.5 constitutes a MET which must be called so team can assess pt for urgent intervention and management of possible cardiac arrhythmias. Hyperkalemia protocol must be initiated. If K can be controlled and patient is stable may proceed with fistulogram or potentially place a temporary dialysis catheter for the patient to receive dialysis prior to the procedure.**

Regardless the patient should always be consented (and prepped) for a possible dialysis catheter, as we never know if we will be able to open the access.
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>IVC Filter Placement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Proximal Floating clot, Iliac-Fem-Pop DVT and contra-indication to anticoagulation, PE despite anticoagulation, prophylaxis in trauma/paraplegia and pre surgical if patient will have to hold anticoagulant</td>
</tr>
</tbody>
</table>
| **Consent/Complications** | Bleeding, infection, damage to vessel, filter migration, fracture, tilting  
Discusses permanent vs temporary filters and importance of retrieving temporary filters |
| **Contraindications** | If INR >1.5, Platelets <50K, discuss with VIR attending about blood products.                                                                                                                                            |
| **Alternatives**   | Medical treatment only, no action                                                                                                                                                                                        |
| **Meds**             | 1% Lidocaine  
Moderate sedation                                                                                                                                                                                            |
| **Equipment**       | IVC filter kit                                                                                                                                                                                                          |
| **How to perform**  | 1. Review where the clot (s) is/are. Extension to the femoral/iliac/IVC?  
2. Consider IJ vs femoral venous access  
3. Prep and drape |
<p>| | |</p>
<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Local anesthesia and skin nick</td>
</tr>
<tr>
<td>5.</td>
<td>Under US guidance, venous puncture of femoral or IJ veins</td>
</tr>
<tr>
<td>6.</td>
<td>Seldinger technique – guidewire, sheath, place catheter</td>
</tr>
<tr>
<td>7.</td>
<td>Venogram to check: IVC diameter, duplication, patency and level of renal veins</td>
</tr>
<tr>
<td>8.</td>
<td>Deploy IVC filter with cranial tip just inferior to the renal vein ostia</td>
</tr>
<tr>
<td>9.</td>
<td>Completion IVC venogram</td>
</tr>
<tr>
<td>10.</td>
<td>Remove catheter</td>
</tr>
<tr>
<td>11.</td>
<td>Clean site and sterile bandage</td>
</tr>
</tbody>
</table>

**Complications**

- Puncture site- bleeding, hematoma, pseudoaneurysm, infection, damage to vessel, device migration- possible need for retrieval, IVC thrombosis

**Follow up**

- Bed Rest 1 hour
- Evaluate puncture site
- Per protocol, remove the filter if anticoagulation can be restarted, resolution of Iliac-fem-pop DVT, improved mobility.

**NOTES:**

Make sure the patient will receive the IVC filter brochure that contains very important information about the filter retrieval program.
Per retrieval protocol, the program includes a consultation 90 days after the IVC was placed in order to evaluate if it is safe to have the filter removed. Ambulatory order must be placed so PCC can set up appropriate follow up visits/imaging for pt.

Anticoagulation status, ambulation, US Doppler of the Lower extremities to check for residual DVT are among the most important factors to consider before filter removal.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>IVC Filter Retrieval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Indication is evaluated at the F/U clinic visit. IVC filter in place without continued need (e.g. no longer at high risk for DVT/PE, or no longer contraindicated for anticoagulation), filter migration/displacement</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Bleeding, infection, damage to vessel or surrounding structures, inability to remove</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Leave filter in place</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine Moderate sedation</td>
</tr>
<tr>
<td>Equipment</td>
<td>IVC filter retrieval kit-15mm snare, braded sheath &gt;9 mm Consider large sheaths and bronchial forceps in difficult cases</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| How to perform         | 1. Review filter location and surrounding anatomy; plan access-most commonly IJ  
2. Prep and drape  
3. Local anesthesia and skin nick  
4. Under US guidance, venous puncture of femoral or IJ veins  
5. Seldinger technique – guidewire, sheath, place catheter  
6. Venogram to check: IVC anatomy and filter position  
7. Snare proximal hook of filter and advance sheath over the snare and filter  
8. Remove sheath, snare, and filter as one unit  
9. Completion IVC venogram  
14. Remove venous access  
15. Clean site and sterile bandage |
| Complications          | Puncture site- bleeding, hematoma, pseudoaneurysm, infection, damage to vessel, |
| Follow up              | Bed Rest per protocol Evaluate puncture site |

**NOTES:**
1. It is essential to have a recent bilateral lower extremity US Doppler.

2. Need to know: upcoming surgery? Residual thrombus in lower extremity, pelvis or IVC? Able to be anticoagulated? Is patient ambulatory?

3. IS THE FILTER RETRIEVABLE? If don’t know, order abdominal CT to evaluate.

4. How long has the filter been in place? If over 1 year, less likely to be successfully removed.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Gastrostomy or gastrojejunostomy tube placement</th>
</tr>
</thead>
</table>
| Indication | Feeding – malnutrition; esophageal cancer; gastroparesis; failed swallow study  
Venting of stomach in palliative and postsurgical patients |
<p>| Consent/ Complications | Puncture site- bleeding, hematoma, infection; damage to adjacent organs – pancreas, liver, colon and large vessels; peritonitis |
| Contraindications | If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products. Interposed colon between stomach and abdominal wall. Consider CT guidance to obtain access to the stomach |</p>
<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Endoscopic or surgical placement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meds</td>
<td>1% Lidocaine</td>
</tr>
<tr>
<td></td>
<td>Moderate sedation v GA</td>
</tr>
<tr>
<td></td>
<td>Antibiotic prophylaxis</td>
</tr>
<tr>
<td>Equipment</td>
<td>T-fasteners</td>
</tr>
<tr>
<td></td>
<td>Dilators – serial or balloon</td>
</tr>
<tr>
<td></td>
<td>G or GJ tube</td>
</tr>
<tr>
<td></td>
<td>CT guidance used if placing in</td>
</tr>
<tr>
<td></td>
<td>excluded stomach</td>
</tr>
<tr>
<td>How to perform</td>
<td>1. Place NG tube</td>
</tr>
<tr>
<td></td>
<td>2. Prep and drape epigastric</td>
</tr>
<tr>
<td></td>
<td>region</td>
</tr>
<tr>
<td></td>
<td>Insufflate stomach through NG</td>
</tr>
<tr>
<td></td>
<td>tube</td>
</tr>
<tr>
<td></td>
<td>3. Puncture gastric lumen with</td>
</tr>
<tr>
<td></td>
<td>18 Ga needle</td>
</tr>
<tr>
<td></td>
<td>4. Place T-fastener(s) through</td>
</tr>
<tr>
<td></td>
<td>initial puncture or separate</td>
</tr>
<tr>
<td></td>
<td>punctures depending on VIR</td>
</tr>
<tr>
<td></td>
<td>attending</td>
</tr>
<tr>
<td></td>
<td>5. Insert .035” Amplatz guide</td>
</tr>
<tr>
<td></td>
<td>wire</td>
</tr>
<tr>
<td></td>
<td>6. Serially dilate</td>
</tr>
<tr>
<td></td>
<td>7. Place peel away sheath</td>
</tr>
<tr>
<td></td>
<td>8. Insert tube through sheath</td>
</tr>
<tr>
<td>Follow up</td>
<td>Bed Rest per protocol</td>
</tr>
<tr>
<td></td>
<td>Do not use for 24 hours</td>
</tr>
</tbody>
</table>

**NOTES:**
If placing a gastrostomy tube in a patient with prior gastric bypass, typically the access to the excluded stomach will
be obtained in CT, as the excluded stomach cannot be insufflated by enteric tube. Once access is confirmed the Amplatz wire and KMP catheter will be placed through the 18 Ga needle and taped to the sterile abdomen. The patient is then transported to the angio suite to finish the case under fluoro. Alternatively, the case may be performed in GE room 5 (at the CH) and in GE room 3 (at ART) and used the combination of rotational angiography and fluoro on the same procedure table.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Nephrostomy +/- Double J stent placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Obstructive hydronephrosis</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site- bleeding, hematoma, pseudoaneurysm, infection; damage to kidney/adjacent organs, hematuria, rigors, pain, need for surgery</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Open surgical decompression, do nothing, double J placement from below</td>
</tr>
</tbody>
</table>
| Meds | 1% Lidocaine  
Moderate sedation  
Antibiotic prophylaxis for new tube and replacement of obstructed tubes, non-obstructed routine exchange do not need antibiotics |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>Chiba needle/Accu-stick kit, guidewires, dilator, APDL (all-purpose drain catheter), Double J stent kit</td>
</tr>
</tbody>
</table>
| How to perform | 1. Prone position, review axial images if available.  
2. Prep and drape the patient the lumbar region and around the tip of the 12th rib (wide prep)  
3. Administer local anesthesia  
4. Consider using US for puncture guidance  
5. From a posterior approach advance the Chiba needle into the renal pelvis – ideally a lower pole calyx  
6. Inject contrast until confirmation of renal pelvis access and perform a nephrostogram to identify the obstruction  
7. Place a stiff guidewire into the renal pelvis and remove needle.  
8. Dilate the track, place an all-purpose drain catheter and |
| Follow up | Patient is admitted over night  
Bed Rest per protocol  
Evaluate puncture site  
Keep clean and dry  
Ensure adequate drainage of urine and connect to a drainage bag. |

**NOTES:**

Minimize manipulation of the collecting system in acute obstruction, as sepsis can occur, and can come on very quickly. Be prepared for this scenario. Patients should
have a PRN order for Demerol (25 mg q15 minutes up to 4 doses).

Once the acute process has subsided (usually 1-2 weeks), we can then more safely attempt to place a nephroureterostomy or ureteral stent.

Follow up nephrostogram and tube exchanges should be ordered in Epic prior to procedure, for a fresh tube or routine exchange. Until a more efficient way to ensure that these follow ups are scheduled, it will be the responsibility of the resident or fellow performing the case to place these orders upon completion of the procedure. Close communication with the RN navigators is essential.

Routine exchanges should be performed every 4-6 weeks to avoid infection. After each procedure PR RN should call and have this scheduled prior to DC.

You may not want to wait the routine 4-6 weeks to schedule follow up; for example, in many cases of acute obstruction, we will see the patient in 1-2 weeks from the initial placement to attempt to place a nephroureterostomy and work towards placing a ureteral stent to then remove the tube. It is often useful to speak with urology or the referring service about the patient.

Although it is easy to mindlessly change tubes over and over, we should try to work towards getting a patient tube free.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percutaneous trans-hepatic cholangiogram (PTC)/Percutaneous Biliary Drainage/ Biliary stent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Biliary obstruction</td>
</tr>
<tr>
<td>Consent/ Complications</td>
<td>Puncture site- bleeding, hematoma, pseudoaneurysm, infection; damage to liver/adjacent organs, bile duct inflammation, rigors, need for surgery</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Open surgical repair, do nothing</td>
</tr>
</tbody>
</table>
| Meds       | 1% Lidocaine  
Moderate sedation  
Antibiotic prophylaxis for fresh sticks and new manipulation (crossing an occlusion, stent placement), no prophylaxis needed for routine exchange unless concern for obstructed tube |
| Equipment  | Chiba needle, KMP catheter, hydrophilic and stiff wires, APDL drain                       |
| How to perform | 1. Prep and drape the right upper quadrant and epigastric region  
2. For PTC – from a lateral (right lobe) or anterior (left lobe) approach advance the Chiba needle under fluoroscopic guidance into the liver while intermittently injecting contrast until confirmation of intrahepatic biliary access is made. Perform cholangiogram.  
3. For biliary drainage – through a peripheral bile duct, place a wire through the Chiba needle and advance into the duodenum. Remove needle, dilate and place biliary drainage internal-external catheter with the tip in the duodenum. Sometimes a KMP catheter and a hydrophilic/Wholey wire may help crossing an occlusion. Confirm location with contrast. Ensure adequate drainage of bile and connect to a drainage bag. Suture to skin.  
4. In case the occlusion can’t be crossed, use similar technique leaving an external drain only and consider re-attempt in 5-10 days. Keep in mind: Internal-external drain is more |
physiological.

5. BILIARY STENT: typically used for malignancy, once the access to the duodenum is established, place the stent (s) (single in the CBD or two in Y shape configuration to treat occlusion at the confluence), post dilate the stent with balloon(s), and leave a biliary drain in place

| Follow up | Evaluate puncture site  
Keep clean and dry  
In stent placement, bring the patient back between 5-7 days to check stent patency and possible pull |

**NOTES:**

GA should be considered as these can be potentially long and painful procedures.

Minimize manipulation of the biliary system in acute obstruction, as sepsis can occur, and can come on very quickly. Be prepared for this scenario. We may place only an external drain in this setting. Demerol PRN 25 mg q15 minutes up to 4 doses for potential rigors.
Once the acute process has subsided (usually 1-2 weeks), we can then more safely attempt to place an internal-external drain.

Follow up cholangiograms and tube exchanges should be ordered in Epic following the procedure, for a fresh tube or routine exchange. Until a more efficient way to ensure that these follow ups are scheduled, it will be the responsibility of the resident or fellow performing the case to place these orders upon completion of the procedure.

Routine exchanges should be performed every 4-6 weeks to avoid infection. This should be ordered at time of procedure and pt will be given date/time prior to DC.
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>PICC line</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Long term, but temporary IV access, antibiotic, TPN, etc.</td>
</tr>
<tr>
<td><strong>Consent/Complications</strong></td>
<td>Bleeding, infection, damage to vessel, damage to nerve, abnormal heart rhythm, arterial puncture</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>If there is coagulopathy, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td>peripheral IVs (butterfly, jelco needles)</td>
</tr>
<tr>
<td><strong>Meds</strong></td>
<td>1% Lidocaine</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>PICC line kit</td>
</tr>
</tbody>
</table>
| How to perform | 1. Check vein patency with US  
| | 2. Prep and drape the upper part of the non-dominant arm  
| | 3. Place a tourniquet around the upper arm to distend vein  
| | 4. Local anesthesia and skin nick  
| | 5. US guided venous puncture w/ 21g needle and 0.018” wire  
| | 6. Introduce the peel-away over the wire  
| | 7. Tourniquet down  
| | 8. Use guidewire to measure length of PICC line  
| | 9. Trim PICC and thread into the right atrium. Fluoro to confirm tip location. In central venous occlusions, either attempt to recanalize it with balloon angioplasty or leave a short PICC.  
| | 10. Sew the PICC to the skin or use the stat lock.  
| | 11. Clean site and sterile bandage  

| Follow up | No strenuous activity for 24 hours  
| | Keep clean and dry  

**NOTES:**

Labs are (almost always) unnecessary for PICC placement.
Sedation is also often unnecessary, unless a patient is known to have existing central venous occlusion.

All PICC consults should go through the VAIN team prior to being seen by VIR.

VAIN pager number: 18301 (Main); 17092 (ART)

All Pediatric patients should have any PICC line placement attempted in the arm first. In case the vein is too small, tunneled IJ PICC may be considered. Consult with referring service. Pediatric patients also need general anesthesia on board.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Port Removal/Venous access explant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Termination of therapy; line infection</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Bleeding, infection, sepsis, damage to vessels, foreign body</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Do nothing</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine Moderate sedation (not always needed)</td>
</tr>
<tr>
<td>Equipment</td>
<td>Scalpel, hemostat, scissors, suture</td>
</tr>
<tr>
<td>How to perform</td>
<td><strong>PORT:</strong> Examine previous incision 1. Prep and drape 2. Local anesthesia 3. With scalpel make incision along existing scar 4. With hemostat and/or scissors dissect around port 5. Cut the suture anchoring the port in the subcutaneous tissues 6. Remove port and the catheter. In case of chest port apply pressure for hemostasis at the</td>
</tr>
</tbody>
</table>
venipuncture site.
7. Flush the pocket with saline and, if no infection, consider closing the pocket with Vicryl in different planes.
8. Final subcuticular suture if necessary for cosmesis, dressing
9. Clean site and sterile bandage
10. If infection, send the port and the catheter tip for culture

**TUNNELED CATHETERS:**
1. Prep and drape
2. Identify how deep the cuff is in the subcutaneous tunnel. It will guide dissection depth.
3. Local anesthesia around the entry site and the cuff.
4. Release the suture from skin
5. With a hemostat, dissect around the cuff. Gentle pull may help visualization of the cuff
6. Remove the catheter and apply pressure for hemostasis in the ipsilateral IJ area.
7. Clean site and sterile bandage
   Avoid closing the chest wound due to skin bacterial colonization.
   Increases the chance of abscess in the subcutaneous track. Leave if open, but covered with dressing
| Follow up          | Bandage, keep clean and dry  
|                   | No strenuous activity for 24 hours |

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Radioembolization (SIRS)– work up and infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Curative, Palliative therapy</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Puncture site (bleeding, hematoma, pseudoaneurysm, infection) non target embolization- may result in gastritis and duodenitis, ulceration and perforation; post-embolization syndrome- fever, pain, leukocytosis; non curative therapy, contrast allergy/nephropathy</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>Post-radioembolization syndrome: more important are “flu-like” symptoms (lack of appetite, fatigue) and nausea/vomiting. It may also have fever, and abdominal pain.</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Surgery, systemic chemotherapy</td>
</tr>
<tr>
<td>Meds</td>
<td>Moderate sedation, Antibiotic prophylaxis (for therapy) 2 vials MAA (for workup)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Equipment</td>
<td>Similar to TACE, except for the Y-90 beads prepared by Rad Oncology</td>
</tr>
</tbody>
</table>
| How to perform                | **WORK UP PROCEDURE:**  
1. Review the abdominal axial images available  
2. Prep and drape  
3. Arterial Access (femoral/radial) via Seldinger technique  
1. Visceral angiogram (Celiac trunk, +/- SMA and selective hepatic angiograms. )  
4. Depending on the tumor location and anatomy of the hepatic arteries, coil embolization with microcatheter of the gastro-duodenal; embolization of the right/left gastric, supra-duodenal arteries may be needed.  
5. Hepatic arteriogram with the microcatheter tip in the same spot that will be used for the infusion of Y-90 in the following week. Infusion of Technetium 99mTc albumin aggregated (99mTc-MAA) in the right and/or left hepatic arteries. Injectable radiopharmaceutical used for a |
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECT of the thorax and abdomen right after the case. Remember to prime the MAA syringe to avoid dose being stuck in needle.</td>
<td>6. Before the patient is discharged, review the SPECT findings (radioactivity distribution and hepato-pulmonary shunt)</td>
</tr>
<tr>
<td>Y-90 INFUSION:</td>
<td></td>
</tr>
<tr>
<td>2. Double check the total Bilirubin level within 48 hours of the case. (2.0 limit for Sirtex, and 3.0 limit for Theraspheres)</td>
<td></td>
</tr>
<tr>
<td>3. Prep and drape</td>
<td></td>
</tr>
<tr>
<td>4. Arterial access (femoral/radial) via Seldinger technique</td>
<td></td>
</tr>
<tr>
<td>5. Celiac trunk and selective hepatic angiograms.</td>
<td></td>
</tr>
<tr>
<td>6. Microcatheter tip in the same spot where the TC-99 MAA was injected</td>
<td></td>
</tr>
<tr>
<td>7. Selective angiogram, follow by Y-90 infusion in collaboration with the Rad Oncologist.</td>
<td></td>
</tr>
<tr>
<td>8. Completion angiogram</td>
<td></td>
</tr>
<tr>
<td>9. Remove catheters that should be kept in special container</td>
<td></td>
</tr>
<tr>
<td>10. Hemostasis with closure device or manual pressure</td>
<td></td>
</tr>
<tr>
<td>11. Clean site and sterile bandage</td>
<td></td>
</tr>
<tr>
<td>Patient is discharged home after having clearance from radiation safety</td>
<td></td>
</tr>
</tbody>
</table>
NOTES:

Y-90 workup typically occurs one week before the Y-90 radioembolization infusion.

Nexium 40 mg QD for 14 days post infusion; Medrol dose pack for non-diabetics, pain and nausea Rx as well, antibiotics not necessary for y-90

Mandatory to check total bilirubin in the day of infusion

MAA with SPECT CT obtained from Nuclear Medicine: 4 mCi of Tc-99 MAA is typically injected into the hepatic artery (2 mCi in each hepatic artery in case of bilateral disease).

All Y-90 patients must have total bili within 48h from the procedures (work up and infusion). That’s what we have agreed with Rad Onc. Preferably to be done the day before so there is no delay the day of the procedure. However, we must make sure the result is available by the time the patient comes to the PR area.
Discharge Scripts

1. Nexium 40 mg daily x 14 days.
2. Medrol dose pack non diabetic
3. 30 tabs Zofran or Phenergan
4. 40 tabs Oxycodone 5mg 1-2 Q6H PRN
5. Senna or Colace daily for opiate constipation
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Radiofrequency wire technique for the recanalization of chronically occluded central veins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Facial, arm, breast swelling, malfunctioning AV fistula/graft</td>
</tr>
<tr>
<td>Consent/Complications</td>
<td>Infection, hematoma, pain, post-op bruising/tenderness, pericardial effusion, hemothorax (both will require drain placement), arteriovenous fistula (that will require covered stent placement), stroke</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Conventional endovascular recanalization, surgical venous bypass, do nothing</td>
</tr>
</tbody>
</table>
| Meds | 1% Lidocaine  
General anesthesia  
Heparin (wt based) |
<p>| Equipment | Conventional guidewires/catheters, RF wire and generator. If there is pacemaker/defibrillator, it will require a magnet to turn it off. Have a pericardial drainage tray available |</p>
<table>
<thead>
<tr>
<th>How to perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check if there is defibrillator/pacemaker</td>
</tr>
<tr>
<td>2. Under US guidance, mark the pericardial window in the skin. Leave this area prep and draped.</td>
</tr>
<tr>
<td>3. Prep and drape the upper arm ipsilateral to the occlusion and the right groin for dual access (often both arms are prepped)</td>
</tr>
<tr>
<td>4. Access vessel intended to treat via the Seldinger technique and US guidance</td>
</tr>
<tr>
<td>5. Simultaneous hand injections are done through both accesses for central venograms in PA, RAO and LAO.</td>
</tr>
<tr>
<td>6. Semi-curved catheter in one side with the RF wire coaxially</td>
</tr>
<tr>
<td>7. 10 mm snare in the other side that will be used as a target</td>
</tr>
<tr>
<td>8. Activate the generator crossing the occluded segment</td>
</tr>
<tr>
<td>9. 4 mm balloon angioplasty</td>
</tr>
<tr>
<td>10. Stent placement and post stent PTA</td>
</tr>
<tr>
<td>11. Completion central venogram</td>
</tr>
<tr>
<td>12. Remove catheters/sheaths</td>
</tr>
<tr>
<td>13. Pressure held to obtain hemostasis</td>
</tr>
<tr>
<td>14. Clean site and bandage</td>
</tr>
<tr>
<td>15. Patient is discharged home</td>
</tr>
</tbody>
</table>
unless if there was a complication or need to go for dialysis

| Follow up | Bed rest per protocol  
|           | Bandage and keep dry for 24 hours  
|           | No strenuous activity for 24 hours |

**NOTES:** It is essential to have a chest CT with coronal recons in order to evaluate the occluded segment and surrounding tissues.  
All cases should be performed under GA and at the ART building.  
All cases must have type and screen within 48 hours.
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>TIPS (Transjugular Intrahepatic Portosystemic Shunt)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>GI bleeding due to portal hypertension, refractory ascites/hydrothorax</td>
</tr>
<tr>
<td><strong>Consent/Complications</strong></td>
<td>Puncture site - bleeding, hematoma, infection; damage to vessel, temporary encephalopathy, anemia, worsening liver function, GI and intra-abdominal bleeding, worsening heart failure, death</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>INR &gt;1.5, Platelets &lt;50K; heart failure, severe tricuspid regurgitation, severe pulmonary hypertension, multiple hepatic cysts, sepsis, unrelieved biliary obstruction, malignancy in the tract of the TIPS</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td>Medical, endoscopic management</td>
</tr>
<tr>
<td><strong>Meds</strong></td>
<td>1% Lidocaine Moderate sedation. If the patient is actively bleeding, protect the airway w/ ETT and GA. Antibiotic prophylaxis</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>TIPS kit (Rosh-Ushida or Ring set)</td>
</tr>
</tbody>
</table>
| How to perform | 1. Review abdominal axial images to check the liver size and the anatomy/patency of the right hepatic and right portal veins  
2. Prep and drape the right neck  
3. Access right internal jugular vein via Seldinger technique and US guidance  
4. Record right atrial pressure  
5. MPA catheter is placed into the right hepatic vein for venogram and pressure  
6. Occlusion balloon catheter is wedged and used for indirect portal vein pressure (corrected sinusoidal pressure) and for CO2 venogram under balloon insufflation  
7. Under stiff wire, 10 Fr long sheath is advanced to the right hepatic vein. TIPS kit needle is then advanced through the wall of the right hepatic vein and directed typically in an anterior direction to access the right portal vein. IV contrast is then used to confirm access into the portal vein  
8. Advance the Bentzon wire through the needle  
9. Pigtail catheter is advanced through a stiff wire to the main |
| Follow up | Bed Rest per protocol  
Evaluate puncture site |
|-----------|------------------------|

**NOTES:**

All cases must have type and screen within 48 hours.

Pressure measurements required: Main difference from TJ liver bx is to obtain a right atrial pressure early!

Pressures:

Right Atrium, Free Hepatic, Wedged Hepatic, Direct Portal (pre-TIPS), Direct Portal (post-TIPS), Right Atrium (post-TIPS)
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Transjugular liver biopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>Percutaneous biopsy is contraindicated – bleeding risk; massive ascites</td>
</tr>
<tr>
<td>Consent/ Complications</td>
<td>Puncture site- bleeding, hematoma, infection; damage to vessel and to the liver, arrhythmia</td>
</tr>
<tr>
<td>Contraindications</td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td>Alternatives</td>
<td>percutaneous biopsy, do nothing</td>
</tr>
<tr>
<td>Meds</td>
<td>1% Lidocaine</td>
</tr>
<tr>
<td></td>
<td>Moderate sedation</td>
</tr>
<tr>
<td>Equipment</td>
<td>Transjugular liver biopsy kit</td>
</tr>
</tbody>
</table>
| How to perform | 1. Review abdominal axial images to check the liver size and the anatomy/patency of the right hepatic  
2. Prep and drape the right or left neck  
3. Access internal jugular vein via Seldinger technique and US guidance  
4. MPA catheter is placed into the right hepatic vein for venogram  
5. Exchange for occlusion balloon catheter  
6. Measure free hepatic pressure and wedged pressure for indirect portal vein pressure (corrected sinusoidal pressure)  
7. CO2 venogram under balloon insufflation  
8. Exchange occlusion balloon for stiff cannula  
9. Obtain at least 3 quality core biopsies that will be sent in formalin to pathology  
10. Perform completion venography and measure right atrial pressure  
11. Remove catheters, hemostasis with manual pressure.  
12. Clean site and sterile bandage |
|---|---|
| Follow up | Bed Rest per protocol  
Evaluate puncture site |
NOTES:

Pressure measurement set up: Draw 60cc out of NS bag and connect syringe to pressure transducer (hung on the IV pole). Cap the distal end of syringe with needle. Connect pressure cable and right heart cable together. Make sure syringe is closed to patient. Zero the P wave BEFORE hooking up to patient.

Three pressures would be measured: 1\textsuperscript{st} Free Hepatic, 2\textsuperscript{nd} Wedged, and 3\textsuperscript{rd} Right Atrium. Document pressures in Nurses Notes.

There are several clinical studies that require extensive pressure measurements. We have handouts that specify which protocol should be followed. Coordinate this with the procedure nurse prior to beginning the case.
<table>
<thead>
<tr>
<th><strong>Procedure</strong></th>
<th><strong>Uterine artery embolization</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Uncontrollable post-partum hemorrhage; uterine fibroids</td>
</tr>
<tr>
<td><strong>Consent/Complications</strong></td>
<td>Infection, hematoma, pain, post-op bruising/tenderness, damage to vessel, need for surgery, infertility</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>If INR &gt;1.5, Platelets &lt;50K, discuss with VIR attending about blood products.</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td>Surgery (hysterectomy/myomectomy) Hormone therapy, do nothing</td>
</tr>
<tr>
<td><strong>Meds</strong></td>
<td>1% Lidocaine Moderate sedation Antibiotic Prophylaxis</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Guidewires/(micro) catheters, particulated (irregular PVA/spherical beads) embolic agents (depends on access site femoral/radial)</td>
</tr>
<tr>
<td><strong>How to perform</strong></td>
<td>1. Review the Pelvic US or MRI 2. Prep and drape both groins or left wrist 3. Access artery via the Seldinger technique 4. Place sheath, perform a Pelvic angiogram, followed by</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>142</td>
<td>selective right and left uterine arteriograms</td>
</tr>
<tr>
<td>5.</td>
<td>RUC or microcatheter is advanced to the horizontal segment of the both uterine arteries</td>
</tr>
<tr>
<td>6.</td>
<td>Embolization until stasis is obtained</td>
</tr>
<tr>
<td>7.</td>
<td>Completion angiogram with gentle hand injection</td>
</tr>
<tr>
<td>8.</td>
<td>Remove catheters, use closure device or pressure is held to obtain hemostasis.</td>
</tr>
<tr>
<td>9.</td>
<td>Clean site and bandage</td>
</tr>
</tbody>
</table>

**Follow up**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bed rest per protocol</td>
</tr>
<tr>
<td></td>
<td>No strenuous activity for 24 hours</td>
</tr>
<tr>
<td></td>
<td>Overnight admission for pain control</td>
</tr>
</tbody>
</table>

**NOTES:**

Patient will be admitted overnight for pain and nausea control, and these patient often have significant pain associated with fibroid degeneration.

PCA pump may be necessary. There is an order set for this an the pharmacy staff are wonderful with helping you decide what doses to use.
Discharge Scripts for UFE Patients

1) Cipro 500 PO BID for 1 week, may add Flagyl if higher concern for infection/abscess formation

2) 30 tabs of Zofran or Phenergan q8 h PRN

3) 40 tabs of Oxycodone 5 mg tabs, 1-2 tabs q6 h PRN

4) Senna or Colace over the counter daily for opiate constipation

5) Ibuprofen 800mg TID x 1 week
## APPENDIX

### ACUTE LIMB ISCHEMIA

**SVS/ISCVS CLINICAL CATEGORIES**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Sensory Loss</th>
<th>Weakness</th>
<th>Arterial Doppler</th>
<th>Venous Doppler</th>
</tr>
</thead>
<tbody>
<tr>
<td>I- Viable</td>
<td>Not immediately threatened</td>
<td>None</td>
<td>None</td>
<td>Audible</td>
<td>Audible</td>
</tr>
<tr>
<td>IIA- Marginally</td>
<td>Salvageable w/ prompt treatment</td>
<td>Min, toes, none</td>
<td>None</td>
<td>Often in-audible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>threatened</td>
<td></td>
<td></td>
<td></td>
<td>Audible</td>
</tr>
<tr>
<td>IIB- Immediate</td>
<td>Salvageable w/immediate revascularization</td>
<td>Mod, rest pain</td>
<td>Mild-mod</td>
<td>Usually in-audible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>threat</td>
<td></td>
<td></td>
<td></td>
<td>Audible</td>
</tr>
<tr>
<td>III- Irreversible</td>
<td>Major tissue loss/ nerve damage</td>
<td>Severe</td>
<td>Severe</td>
<td>In-audible</td>
<td>In-audible</td>
</tr>
</tbody>
</table>
## ANTIBIOTIC PROPHYLAXIS
### Practice Guidelines for VIR Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Potential Organisms</th>
<th>Routine PPY</th>
<th>1st Choice Abx</th>
</tr>
</thead>
</table>
| Angiography, angioplasty, thrombolysis, arterial closure device placement, stent placement | *S. aureus*  
*S. epidermidis*                                          | No          | None                                 |
| Endograft Placement                                   | *S. aureus*  
*S. epidermidis*                                          | Yes         | Cefazolin                             |
| Endovascular thermal ablation                        | *S. aureus*  
*S. epidermidis*                                          | No unless doing phlebectomy                  | Cefazolin  
Clindamycin  
Vancomycin |
| IVC Filter                                           | *S. aureus*  
*S. epidermidis*                                          | No          | None                                 |
| Tunneled Catheter                                    | *S. aureus*  
*S. epidermidis*                                          | No consensus | Cefazolin,  
Clindamycin  
Vancomycin |
| Embolization and chemo-embolization (if intent to create / or high likelihood of infarction) | *S. aureus*  
*S. epidermidis*  
*S. epidermidis*  
*Streptococcus spp*  
*Corynebacterium spp, and/or enteric flora* (if prior sphincter of Oddi manipulation or bilioenteric surgery) | Yes | No consensus  
Ciprofloxacin  
Unasyn  
Cefazolin and Flagyl  
Vancomycin |
<p>| SIR work-up                                          |                                                        | No          | No                                   |</p>
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Potential Organisms</th>
<th>Routine PPY</th>
<th>1st Choice Abx</th>
</tr>
</thead>
</table>
| SIR (Y-90)        | *S. aureus*  
*S. epidermidis*  
*Streptococcus* spp  
*Corynebacterium* spp, and/or enteric flora (if prior sphincter of Oddi manipulation or bilioenteric surgery) | No          | No consensus  
Ciprofloxacin  
Cefazolin and Flagyl                                      |
| UAE               | *S. aureus*  
*S. epidermidis*  
*Streptococcus* spp  
*E. coli* | Yes         | No consensus  
Cefazolin  
Ciprofloxacin  
Clindamycin and Gentamicin  
Unasyn  
Vancomycin |
| TIPS creation     | *S. aureus*  
*S. epidermidis*  
*Corynebacterium* spp  
Biliary pathogens  
Enteric gram neg rods  
*Anaerobes*  
*Enterococcus* spp | Yes         | No consensus  
Ciprofloxacin  
Ceftriaxone  
Unasyn  
Clindamycin and Gentamycin  
Vancomycin |
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Potential Organisms</th>
<th>Routine PPY</th>
<th>1st Choice Abx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroscopic guided gastrostomy and gastro-jejunostomy tube placement</td>
<td><em>S. aureus</em> &lt;br&gt;<em>S. epidermidis</em> &lt;br&gt;<em>Corynebacterium</em> spp</td>
<td>No consensus</td>
<td>Cefazolin - Gastrostomy Tube pull – none</td>
</tr>
<tr>
<td>Liver and biliary interventions</td>
<td><em>Enterococcus</em> spp &lt;br&gt;<em>Streptococcus</em> spp &lt;br&gt;Aerobic gram-negative organisms (&lt;i&gt;E. coli&lt;/i&gt;, &lt;i&gt;Klebsiella&lt;/i&gt; spp, etc) &lt;br&gt;<em>Clostridium</em> spp &lt;br&gt;<em>Candida</em> spp &lt;br&gt;Anaerobes</td>
<td>Yes</td>
<td>No consensus &lt;br&gt;Ciprofloxacin &lt;br&gt;Ceftriaxone &lt;br&gt;Unasyn &lt;br&gt;Unasyn &lt;br&gt;Ceftriaxone &lt;br&gt;Gentamicin &lt;br&gt;Vancomycin</td>
</tr>
<tr>
<td>GU procedures Percutaneous Nephrostomy Tube Placement/Exchange Ureteral Stents</td>
<td><em>E. coli</em> &lt;br&gt;<em>Proteus</em> &lt;br&gt;<em>Klebsiella</em> &lt;br&gt;<em>Enterococcus</em></td>
<td>Yes</td>
<td>No consensus &lt;br&gt;Ceftriaxone &lt;br&gt;Unasyn &lt;br&gt;Ciprofloxacin &lt;br&gt;Gentamicin &lt;br&gt;Vancomycin</td>
</tr>
<tr>
<td>Procedure</td>
<td>Potential Organisms</td>
<td>Routine PPY</td>
<td>1st Choice Abx</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tumor ablation</td>
<td><em>S. aureus</em>&lt;br&gt;<em>S. epidermidis</em>&lt;br&gt;<em>Streptococcus</em> spp&lt;br&gt;<em>E. coli</em></td>
<td>No consensus</td>
<td>No consensus&lt;br&gt;Liver: Unasyn Ciprofloxacin&lt;br&gt;Renal: Ceftriaxone Ciprofloxacin</td>
</tr>
<tr>
<td>Percutaneous abscess drainage</td>
<td><em>S. aureus</em>&lt;br&gt;<em>S. epidermidis</em>&lt;br&gt;<em>Corynebacterium</em> spp&lt;br&gt;Aerobic gram-neg Anaerobes</td>
<td>Yes</td>
<td>No consensus&lt;br&gt;Patients are typically under ATB but if not that should be discussed with referring doc</td>
</tr>
<tr>
<td>Percutaneous biopsy</td>
<td>Transrectal: bowel flora, mostly Anaerobes and Aerobic gram negative <em>Streptococcus</em> spp</td>
<td>Only required for Transrectal biopsy</td>
<td>Non-transrectal, none Transrectal, Gentamicin 80 mg IV plus 250 mg Ciprofloxacin BID PO x 5d</td>
</tr>
<tr>
<td>Percutaneous Vertebroplasty</td>
<td><em>S. aureus</em>&lt;br&gt;<em>S. epidermidis</em>&lt;br&gt;<em>Corynebacterium</em> spp</td>
<td>Yes</td>
<td>Cefazolin 1 g IV</td>
</tr>
</tbody>
</table>
NOTES:
Ciprofloxacin: 400 mg IV
Cefazolin 2 g IV
Clindamycin 600-900 mg IV
Unasyn 1.5-3 mg IV
Metronidazole (Flagyl) 500 mg IV
Ceftriaxone 1 g IV
Pregnancy Antibiotics;
Okay to use Rocephin, Flagyl, Nitrofurantoin. All others, call OB.
ANTICOAGULATION NOTES:

Even in a patient with low platelets (<50,000), it is sometimes possible to proceed with a procedure, usually after giving infusion of platelets prior to and during the procedure. This should be discussed with the attending.

Note should be made of any anticoagulation that the patient is currently receiving, and it should be discussed with the attending prior to the case. Often, it will still be safe to proceed with the procedure.

It is extremely important to find out why the patient is on anticoagulation before they are told to stop it. Patients on anticoagulation or antiplatelet therapy for mechanical
heart valves or cardiac stents (especially newly placed stents) typically cannot safely stop their anticoagulation safely for the length of time required. They may need bridge therapy to Lovenox, which can be held for a shorter period of time and restarted quickly after the procedure. Please discuss anticoagulation with the fellows, APPs or attendings.

If the patient is on a heparin drip, it is usually sufficient to stop the drip 2 hours prior to and following the procedure. Again, discuss this with an attending.

Coumadin should usually be held for 4 days. INR should be drawn prior to the procedure.

Plavix should be held for 5 days. Aspirin to be held for 5 days for category 3 patients.

New oral anticoagulants (Eliquis, Xarelto) generally only need to be held for 2 days.

Anticoagulated patient should be discussed with the attending, as there may be a reason to proceed with the case despite anticoagulation.

**BLEEDING RISK GUIDELINES**

**Category 1 Procedures:**
Vascular
• Dialysis access interventions
• Venography
• Central line removal
• IVC filter placement
• PICC placement

Nonvascular
• Drainage catheter exchange (biliary, nephrostomy, abscess catheter)
• Thoracentesis
• Paracentesis
• Superficial aspiration and biopsy (excludes intrathoracic or intra-abdominal sites): thyroid, superficial lymph node
• Superficial abscess drainage

Management
• INR <2.0: threshold for treatment (i.e., FFP, vitamin K)
• PTT: no consensus
• Platelets: transfusion recommended for counts <50,000/L
• Clopidogrel: withhold for 5 d before procedure
• Aspirin: do not withhold
• LMWH (therapeutic dose): withhold one dose before procedure

Category 2: Procedures with Moderate Risk of Bleeding
Vascular
• Angiography, arterial intervention with access size up to 7 F
• Venous interventions
• Chemoembolization
• Uterine fibroid embolization
• Transjugular liver biopsy
• Tunneled catheters/ports

Nonvascular
• Intra-abdominal, chest wall, or retroperitoneal abscess drainage or biopsy
• Lung biopsy
• Trans-abdominal liver biopsy (core needle)
• Percutaneous cholecystostomy
• Gastrostomy tube: initial placement
• Radiofrequency ablation: straightforward
• Spine procedures (vertebroplasty, kyphoplasty, lumbar puncture, epidural injection, facet block)

Management
• INR: correct to < 1.5
• PTT: no consensus (trend toward correcting for values < 1.5 control)
• Platelets: discuss transfusion for count < 50,000/L
• Hematocrit: no consensus threshold for transfusion
• Clopidogrel: withhold for 5 d before procedure
• Aspirin: do not withhold
• LMWH (therapeutic dose): withhold one dose before procedure

Category 3: Procedures with Significant Risk of Bleeding
Vascular
• TIPS

Nonvascular
• Renal biopsy
• Biliary interventions (new tract)
• Nephrostomy tube placement
• Radiofrequency ablation: complex

Management
• INR: correct to > 1.5
• PTT: stop or reverse heparin for values > 1.5 control
• Platelets < 50,000: transfuse
• Hematocrit: no recommended threshold for transfusion
• Clopidogrel: withhold for 5 d before procedure
• Aspirin: withhold for 5 days
• LMWH: withhold for 24 h or up to two doses
COMPLICATION MANAGEMENT

Bleeding at the arterial/venous access site
• Direct pressure
• Maintain bed rest
• Interrupt anticoagulation if necessary
• Hydration
• Serial CBC’s, transfusion if indicated
• Re-image as necessary
• Suture may control persistent superficial bleeding

Bleeding around venous access site
• Direct pressure, Lido with Epi injection
• Suture if superficial bleeding
• Interrupt anticoagulation if necessary
• Hydration,
• Serial CBC’s, transfusion if indicated

Venous access infection
• Remove access, culture tip
• Antibiotics- broad, then focus based on micro

Infection post PTC/ nephrostomy tube placement with or without rigors
• Antibiotics- broad, then focus based on micro
• Supportive

Post-TACE / RFA syndrome
• Important to work up for infection/sepsis as the symptoms overlap
• Mild- supportive; hydration, pain control, antipyretics
• Severe- also supportive; Blood cultures and broad spectrum antibiotics if infection suspected

Post Y-90 syndrome
• Important to work up for infection/sepsis as the symptoms overlap
• Mild- supportive; hydration, pain control, antipyretics
• Severe- also supportive; Blood cultures and broad spectrum antibiotics if infection suspected

Rigors
• Demerol- 25 mg IV. May give q15 minutes up to 100 mg
• Warm blankets, fluids
• Broader spectrum antibiotics if necessary

Nausea/vomiting
• IV hydration, Zofran, Phenergan, NG tube

Seizures
• Supportive
• Benzodiazepines I.V.

Contrast induced nephropathy prevention
• Hydration, hydration, hydration
Drains / venous access / PTC or nephrostomy catheters partially or totally pulled out
  • Remove and replace if necessary

Cold foot
  • CTA runoff
  • Intervention based on CTA findings

“Bloody urine” post mechanical thrombectomy
  • Follow labs (Creatinine, H/H)
  • Hydration
  • NOT a urology consult

**CONTRAST ALLERGY PREPARATION**

**Elective cases**
13-hour premedication schedule:
Prednisone 50 mg PO x3 doses at 13, 7, and 1 hour prior to procedure
Benadryl 50 mg PO x1 at 1 hour prior to procedure

**Emergency cases/Last minute preparation**
Only if emergent procedure:
Solu-medrol 125 mg IV x1 dose
Benadryl 50 mg IV x1 dose
Pepcid 20 mg IV x1 dose
CONTRAST REACTION MANAGEMENT IN ADULTS

Urticaria
1. Discontinue injection if not completed
2. No treatment needed in most cases

If severe or widely disseminated: give alpha-agonist (arteriolar and venous constriction): epinephrine SC (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg) (if no cardiac contraindications).

Facial or Laryngeal Edema
2. Give alpha agonist (arteriolar and venous constriction): epinephrine SC or IM (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg) or, especially if hypotension evident, epinephrine (1:10,000) slowly IV –3 ml (= 0.1–0.3 mg).

Repeat as needed up to a maximum of 1 mg.

If not responsive to therapy or if there is obvious acute laryngeal edema, seek appropriate assistance (e.g., cardiopulmonary arrest response team).

Bronchospasm

Monitor: electrocardiogram, O2 saturation (pulse oximeter), and blood pressure.
2. Give beta-agonist inhalers (bronchiolar dilators, such as metaproterenol [Alupent], terbutaline [Brethaire], or albuterol [Proventil or Ventolin]) 2 to 3 puffs; repeat as necessary. If unresponsive to inhalers, use SC, IM, or IV epinephrine.

3. Give epinephrine SC or IM (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg) or, especially if hypotension evident, epinephrine (1:10,000) slowly IV 1–3 ml (= 0.1–0.3 mg).

Repeat as needed up to a maximum of 1 mg.

Call for assistance (e.g., cardiopulmonary arrest response team) for severe bronchospasm or if O2 saturation <88% persists.

**Hypotension with Tachycardia**

1. Legs elevated 60 degrees or more (preferred) or Trendelenburg position.


4. Rapid intravenous administration of large volumes of Ringer’s lactate or normal saline.

If poorly responsive: epinephrine (1:10,000) slowly IV 1 ml (= 0.1 mg)

Repeat as needed up to a maximum of 1 mg

If still poorly responsive seek appropriate assistance (e.g., cardiopulmonary arrest response team).
Hypotension with Bradycardia (Vagal Reaction)

2. Monitor vital signs.
3. Legs elevated 60° or more (preferred) or Trendelenburg position.
4. Secure IV access: rapid administration of Ringer’s lactate or normal saline.
5. Give atropine 0.6–1 mg IV slowly if patient does not respond quickly to steps 2–4.
6. Repeat atropine up to a total dose of 0.04 mg/kg (2–3 mg) in adult.
7. Ensure complete resolution of hypotension and bradycardia prior to discharge.

Hypertension, Severe

2. Monitor electrocardiogram, pulse oximeter, blood pressure.
3. Give nitroglycerine 0.4-mg tablet, sublingual (may repeat × 3); or, topical 2% ointment, apply 1-inch strip.
4. If no response, consider labetalol 20 mg IV, then 20 to 80 mg IV every 10 minutes up to 300 mg.
5. Transfer to intensive care unit or emergency department.
6. For pheochromocytoma: phentolamine 5 mg IV (may use labetalol if phentolamine is not available).

Seizures or Convulsions
2. Consider diazepam (Valium) 5 mg IV (or more, as appropriate) or midazolam (Versed) 0.5 to 1 mg IV.
3. If longer effect needed, obtain consultation; consider phenytoin (Dilantin) infusion — 15–18 mg/kg at 50 mg/min.
4. Careful monitoring of vital signs required, particularly of pO2 because of risk to respiratory depression with benzodiazepine administration.
5. Consider using cardiopulmonary arrest response team for intubation if needed.

**Pulmonary Edema**

2. Elevate torso.
3. Give diuretics: furosemide (Lasix) 20–40 mg IV, slow push.
4. Consider giving morphine (1–3 mg IV).
5. Transfer to intensive care unit or emergency department.

Reference: ACR Manual on Contrast Media

**CUTANEOUS INJURY GRADING POST RADIATION EXPOSURE**

Grade I: > 2 Gy- (2-5 week post exposure) Redness, edema. (6-7 week post exposure) Dry desquamation. Expect complete healing 4-6 weeks following desquamation. Possible permanent skin atrophy
Grade II: > 15 Gy- (1-3 week post exposure) Erythema, edema, skin turns brown. (5-6 week post exposure) subcutaneous edema and blistering, moist desquamation. Healing depends on size of injury. Permanent skin atrophy, possible telangiectasia.

Grade III: > 40 Gy- (1-2 week post exposure) Erythema, blistering, edema, erosions/ ulceration. Ulcerations may take months-years to fully heal. Permanent skin atrophy, depigmentation, telangiectasia formation, lymphatic/ small vessel destruction

Grade IV: > 550 Gy (1-4 day post exposure) Blistering, early ischemia, tissue necrosis by 2 weeks. Treatment via skin graft or amputation if severe. May take many months-years of procedures to correct.

All grades may increase skin cancer risk in the future

DEVICES

It is expected that the Fellow assigned for a case will be the one responsible to select the key materials/devices that will potentially be needed to perform a particular procedure (balloon, sheaths, stents, etc). These materials are stocked in the supply room in each building. The Fellow and the RT should discuss about the devices and have them in the procedure room BEFORE starting the case. The goal is avoid unnecessary waiting or
delay during the procedure. Plan the strategy and anticipate issues ahead of the game.

**Biopsy Equipment:**
- Coaxial systems- Guide introducer needle into lesion and advance biopsy needle through the introducer into lesion.
- Core biopsies typically 18 or 20 gauge. Introducer needle is slightly larger. Systems have multiple lengths to choose from based on lesion depth.

**Guidewires**
- Diameter measured in inches, generally 0.018” or 0.035” diameter.
- Length also important when considering catheter exchanges and device usage
- Different guidewires have different properties, including hydrophilic and hydrophobic types. Wires also vary in stiffness.

**Common Wires**
- Straight Wire- All-purpose 0.035” wire
- J Wire- Similar to straight wire, but J tip
- Wholey Wire- Very useful 0.035” wire with a floppy, atraumatic tip, and slightly stiff back end; lock extension useful for crossing lesions and exchanges
- Glidewire- Hydrophilic wire, available in regular or stiff formats, also in 0.035” or 0.018” sizes; very
useful for crossing lesions, but take care to avoid dissection

- Advantage Wire- Hydrophilic, floppy tip like a glidewire with a braided back end, useful for crossing and exchanges
- Amplatz Wire- Super stiff wire with slightly floppy tip, very useful for catheter exchanges
- Rosen Wire- Almost as stiff as Amplatz with a J tip, also a very useful exchange wire
- Nitrex Wire- 0.018” wire with a floppy tip, nitinol back end
- Fathom Wire- 0.018” wire, floppy, shapeable, hydrophilic tip
- Progreat Wire- 0.018” wire, floppy, shapeable, hydrophilic tip

Catheters and Sheaths:

- Diameter measured in French scale (1 FR = 1/3 mm).
- For sheaths, the measurement is the inner diameter, so the outer diameter is slightly larger than the measurement. For example, a 5 Fr sheath will accommodate a 5 Fr catheter inside of it, but the outer diameter of the sheath will actually be slightly larger than 5 Fr to account for the wall thickness.
- Generally use 5 or 6 Fr sheath for routine femoral access angiograms (may use up to 24 Fr for procedures such as TAVRs)
For catheters, the measurement is the outer diameter, which includes the wall of the catheter.
Different catheters have different properties—stiffness, hydrophilic coating, tip shape, etc.
Catheter length is important to consider when planning case to prevent unnecessary exchanges.
Shuttle sheaths are useful to lend support during interventions.
Standard sheaths come in multiple diameters and are 10 cm. Lengths can be longer or shorter.
Slender sheaths accommodate catheters with a decreased outer diameter.
Ansel or Balkin shuttle sheaths very good for up and over access as well as support for mesenteric work.
Mikaelson Catheter—Workhorse reverse curve catheter; useful for selecting mesenteric vessels and up and over access.
Cobra Catheter—Workhorse forward facing catheter, not used as much at MUSC due to affinity for the Mikaelson.
Pigtail Catheter—Multiple side holes for large vessel power injections.
KMP/Kumpe, Tegtmeyer, Vert, MPA Catheters—Angled tip catheters; these common in multiple lengths and French sizes.
• Omniflush Catheter- multiple side holes for large vessel power injections; good for up and over access
• Jacky/Sarah Catheter- Radial access catheters; ideal for navigating aortic arch and selecting mesenteric vessels
• Simmons Catheters- Reverse curve catheter with a long leg; can be useful to select vessels with difficult angles.

Closure Devices:
- Perclose (suture)- 6 Fr sheath advanced over 0.035” guidewire
- Angioseal (bioabsorbable plug)- 6 and 8-Fr sheath
  Recommended no repuncture in 30 days. Consider puncturing above the previous puncture if really needed.
ENDOLEAK CLASSIFICATION

Type I- flow originates from ineffective endograft seal at fixation zones
   IA- proximal leak
   IB- distal leak
   IC- iliac occlusion site

Type II- branch vessel retrograde flow (Lumbar, IMA, accessory renal arteries cover by endograft)
   IIA- Simple (single vessel)
   IIB- Complex (two or more vessels creating a Circuit)
Type III- Structural failure of endograft
   IIIA- Junctional failure
   IIIIB- Endograft fracture/ hole (major>2mm, minor <2mm)

Type IV- Endograft porosity

Type V- Endotension

HYDRATION PROTOCOL

For Patients Receiving IV or IA Contrast

All Interventional Radiology patients receiving IV or IA iodine-based contrast will be placed on the following hydration protocol unless the patient on dialysis/ESRD or otherwise notified by a physician.

Pre-Procedure Orders

1. Place a 20-gauge (or smaller if necessary) peripheral IV

2. A baseline creatinine should be obtained if no recent value is available.

3. Initiate an infusion of 0.9% normal saline IV at 100cc per hour. End stage renal disease on hemodialysis should have no hydration. Decrease infusion rate in patients with congestive heart failure.
**Intra-Procedure Orders**

1. 150cc iodinated Omni-300 contrast loaded on the table at the beginning of the procedure. If the patient has creatinine >1.5, Visipaque should be used instead of Omnipaque. Consider using CO2 as a contrast agent in patients with elevated creatinine.

2. Additional contrast to be added in 50cc increments throughout the procedure.

3. Contrast count to be called out by the RT at 150cc and with each additional 50cc of contrast given.

4. Document contrast counts throughout the procedure as they are called out.

5. IV normal saline to continue throughout the procedure at 100 cc per hour.

**Post-Procedure Orders**

10. Post procedure hydration of 250cc normal saline for 2-6 hours unless patient has ESRD or congestive heart failure. In case of congestive heart failure, consult with VIR attending as to how to proceed.

**MODERATE SEDATION PHARMACOLOGY**

All moderate sedation must be monitored by qualified nursing staff

Anxiolytic - Benzodiazepine
• Versed (Midazolam) - 0.5-2.0 mg IV initially (duration 1-2 hours)
  o May repeat doses in 0.5 mg IV increments prn during the procedure for discomfort

Pain control - Local Anesthesia
• 1% Lidocaine - May use ester type anesthetic like Bupivicaine/ Procaine if allergic to Lidocaine (true allergies very rare)

Pain control- Narcotics
• Fentanyl- 25-100 ug IV initially (duration 0.5-1 hour)
  o May repeat doses in 25-50 ug IV increments prn during the procedure for discomfort

MUSCs opioid analgesic comparison chart: [http://academicdepartments.musc.edu/pharmacy_services/medusepol/pdf/OpioidAnalgesicConversionChart.pdf](http://academicdepartments.musc.edu/pharmacy_services/medusepol/pdf/OpioidAnalgesicConversionChart.pdf)

Pain control- Non-steroid anti-inflammatory
• Toradol (Ketoralac)
  o Single dose administration:
    IM: Patients less than 65 years of age: one dose of 60 mg. Patients who are renally impaired, and/or less than 50 kg (110 pounds): one dose of 30 mg.
    IV: Patients less than 65 years of age: one dose of 30 mg. Patients who are renally impaired, and/or less than 50 kg (110 pounds): one dose of 30 mg.
impaired, and/or less than 50 kg (110 pounds): One dose of 15 mg.

- Multiple dose administration:
  Patients less than 65 years of age: 30 mg IM or IV every 6 hours as needed. The max daily dose should not exceed 120 mg.

Patients who are renally impaired, and/or less than 50 kg (110 pounds): 15 mg IM or IV every 6 hours as needed. The maximum dose should not exceed 60 mg.

**OVERDOSE REVERSAL:**

- **FOR FENTANYL: Use Naloxane (Narcan)**
  - Administer naloxone for significant CNS and/or respiratory depression.
  - Proper airway management is important. This may involve:
    - Breathing support to help maintain proper oxygen levels. It includes assisted bag-valve mask breathing that can be provided until the patient is ventilating adequately.
    - Consider endotracheal intubation
  - The usual dose of administered is between 0.4 and 2 mg in the adult and 0.1 mg/kg in
the child or infant. In suspected habituated opiate users, if the situation allows, slowly administer 0.1-0.4 mg of IV aliquots every 1-2 minutes for a more controlled and partial reversal of opiate effect.

- The onset of effect following IV naloxone administration is 1-3 minutes; maximal effect is observed within 5-10 minutes. A repeat dose is indicated for partial response and can be repeated as often as needed.

- FOR VERSED: Use Flumazenil
  - The cornerstone of treatment in benzodiazepine overdose is good supportive care and monitoring.
    - Cardiac monitoring
    - Supplemental oxygen and airway support
    - Intravenous (IV) access
    - Rapid glucose determination (finger stick) and administration of D50 if necessary
    - Flumazenil is a competitive BZD receptor antagonist and is the only available specific antidote for BZDs though its use in acute BZD is
controversial and its risks usually outweigh any benefit.

- 0.2 mg IV injection over 15-30 sec
- If no response: then 0.3 mg over 15-30 sec 1 min later, if no response then again 0.5 mg IV over 15-30 sec to max cumulative dose of 3 mg/hr
- Rarely patient may require titration up to total dose 5 mg; if no response after 5 min, sedation unlikely to be secondary to benzodiazepines
- Slow infusion of lowest dose required to decrease adverse events
- Indicated for reversal of benzodiazepine use during procedure, OR known isolated benzodiazepine overdose in patients not taking benzodiazepines chronically.

 ➢ FOR HEPARIN: Use Protamine
  - 1mg every 10 Unit of Heparin, or 10 mg of Protamine for every 1,000 Units of Heparin.
  - Slow I.V. infusion (over 5-10 min)

RADIAL ACCESS WORKUP

Allen’s Test

1. The hand is elevated and the patient/person is asked to make a fist.
2. Pressure is applied over the ulnar and the radial arteries so as to occlude both of them.

3. Still elevated, the hand is then opened. It should appear blanched (pallor can be observed at the finger nails).

4. Ulnar pressure is released and the color should return in 7 seconds. This indicates that the patient has complete palmar arch and is safe to have transradial intervention.

**Barbeau’s Test**

Similar to Allen’s Test. A pulse oximetry is placed on either the thumb or index finger (areas perfused by the radial artery). After occlusion of the radial and ulnar arteries, the pulse oximetry waveform should flat-line. Release the ulnar occlusion and if the palmar arch is complete, you should observe a “normal” waveform (normal variants are A, B and C). Type D waveform is a contraindication to radial access.
Both tests are designed to assure collateral blood flow to the whole hand via the ulnar artery / complete palmar arch. Inadequate perfusion of the 1st and 2nd fingers during radial compression is a contra-indication to transradial interventions.

**US EVALUATION**

The left radial artery should be scanned 1 cm above the styloid process with B-mode US in order to check the AP diameter, measured inner-to-inner wall. Avoid excessive compression of the wrist which would underestimate the radial artery diameter. Minimum 1.8 mm diameter

If there has been prior radial intervention, radial artery should be scanned up to the brachial artery bifurcation.

Make sure there is a printed copy of the radial artery diameter with a patient sticker. Alternatively, make sure the US images are sent to PACS.

**RESIDENCY FOR IR/DR (from SIR website)**

The total period of training is designed to comply with the normal six-year (combined) requirement for a Diagnostic Radiology residency and IR fellowship training program.

As for the traditional training pathway, a minimum of 12 months of direct patient care in the PGY-1 year is required in an ACGME-approved program in Internal Medicine or its
subspecialty areas (i.e. cardiology, nephrology, pulmonary, critical care, gastroenterology, or hematology/oncology); Pediatrics; Surgery (General, Cardiovascular, Pediatric, Thoracic, or Urological); Family Practice; Emergency Medicine; OB-GYN; or a combination of these specialties.

In addition, seven months during PGY-2 to PGY-6 will be dedicated to research and clinical training in areas relevant to the practice of VIR (i.e. consult service for cardiology, nephrology, vascular surgery, oncology, hepatology, gastroenterology or other non-radiology clinical rotations).

Programs may also provide a resident IR clinic to provide the trainees opportunity for managing outpatients and to provide enhanced continuity of care.

**DIAGNOSTIC RADIOLOGY TRAINING:**

Thirty-two months of full-time radiology is required including 3 months of IR during the PGY-2, PGY-3 and PGY-4 years. Because of the attenuation of the traditional clinical radiology training, it will be imperative that the Radiology residency and IR Fellowship program directors make annual evaluations regarding the residents’ progress in radiology. This diagnostic radiology training will be obtained during the PGY-2, 3, 4, and 5 years.

**ADDED INTERVENTIONAL RADIOLOGY TRAINING:**

Nine months of subspecialty training in IR will be scheduled during the PGY-5 ("mini-fellowship") year.
These nine months could include training in the noninvasive peripheral vascular lab, MRA, CTA, neuroangiography, neurointerventions, cardiac MRI or IR. This is IR fellow-level training that is in addition to the required PGY-6 fellowship year in an ACGME-approved IR fellowship training program.

**RESEARCH/VIR CLINICAL TRAINING:**

Seven months will be dedicated to research and clinical training in areas relevant to the practice of VIR. Of these seven months, the trainee should have a minimum of 3 months dedicated to basic or clinical research activities.

**CALL SERVICE:**

During the IR rotations in the PGY-5 year and non-radiology clinical training rotations during the PGY-2-5 years, call responsibility for the trainee will be determined by the Residency and Fellowship Program Directors.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Description</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGY 1</td>
<td>Transitional-clinical year</td>
<td>12 months</td>
</tr>
<tr>
<td>PGY 2-5</td>
<td>Diagnostic Radiology (includes 3 months IR during PGY-2, 3 or 4)</td>
<td>32 months</td>
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<tr>
<td>PGY 2-5</td>
<td>Clinical Training and Research</td>
<td>7 months</td>
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<tr>
<td>PGY 5</td>
<td>Interventional Radiology “mini-fellowship”</td>
<td>9 months</td>
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<tr>
<td>-----------------</td>
<td>------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>PGY 6</td>
<td>Interventional Radiology Fellowship</td>
<td>12 months</td>
</tr>
<tr>
<td>Total Training</td>
<td></td>
<td>72 months</td>
</tr>
</tbody>
</table>

**VASCULAR & INTERVENTIONAL RADIOLOGY PHONE LIST**

Main phone at Children’s Hospital MH VIR 2-7456 (FAX 2-5551)
Main phone at ART VIR 6-5542 (FAX 6-5577)
MH & ART scheduling (Adrian Stewart): 2-9271 (FAX 2-2672)
East Cooper Scheduling: 6-8282 (FAX 6-8181)
VIR Admin Assistant Sandra Stringer: 6-5556 (FAX 6-4976)

**ATTENDINGS**

Dr. Marcelo Guimaraes  
Office 6-5543  Pager 14179  Cell 843-327-9969
Dr. Bayne Selby  
Office 6-5561  Pager 14135  Cell 843-276-8733
Dr. Claudio Schönholz  
Office 6-5562  Pager 14147  Cell 843-693-2077
Dr. Chris Hannegan  
Office 6-5560  Pager 14464  Cell 843-670-1627
Dr. M. Bret Anderson  
Office 6-5557  Pager 14733  Cell 843-437-4437
Dr. Ricardo Yamada  
Office 6-0079  Pager 14865  Cell 843-814-3721
Managers/Directors/Supervisors
Mike Ricciardone, Director of Radiology
Office 2-4030   Cell 843.834.6960   Pager 13003
Rob Finch, Interventional Radiology Manager
Office 2-0559   Cell 843.442.1750   Pager 11975
Paula Dixon, RN Supervisor
Office: 6-5536   Pager 12160   Cell 843-613-4038

Nurse Patient Care Navigators
Shannon Shuler       Office: 2-8406 (FAX 2-9068)
Pager 13589   Cell: 843-425-4739
Heather Hartung     Office: 6-5558 (FAX 6-4921)
Pager 12639   Cell: 765-265-5338
Nicole Wrazin       Office: 2-8996 (FAX 2-9068)
Pager 13232   Cell: 843-343-2519

Nurse Practitioners and Physician Assistants
Brandi Aquino PA Office: 2-3011 WiFi Phone: 6-3331
(FAX 2-9068)   Pager 12558   Cell: 843-323-7313
Meghan Fashjian NP Office: 6-1238 WiFi Phone: 6-8874
(FAX 6-4921) Pager 11821

Holding Areas:
Main Hospital (5th floor CH) Prep & Recovery 2-8955   Fax: 2-8955
ART Prep & Recovery 6-5566

Check-In / Waiting:
Guest Relations: 2-2083   Fax: 2-3736
Main Hospital (CH) Reception: 2-2083
Ashley River Tower Reception: 6-5709

ANGIO NUMBERS at Children’s Hospital
Room 1   6-0315 Control Desk: 2-9153
Reading Room:  Room 510D  2-7456  
Room 2         6-0316  
Control Desk:  2-3793  
**Main Phone:  2-7456, 2-7455 & 2-0689**  
Room 3(CT)     6-0317  
Control Desk:  2-3683  Fax:  2-5551  
Room 4         6-0306  
Control Desk:  2-6037  Dictaphone:  2-7451  
Room 5         6-0307  Control Desk:  2-3706  

**ANGIO NUMBERS at Ashley River Tower**  
Room 1  (CT)  6-5537  Main Phone:  6-5542  
Room 2  (Control Desk) 6-5540  Fax: 6-5577  Tube 64  
Room 3  (Control Desk) 6-5538, 6-5539  
Reading Room: 6-5531, 6-5532, 6-5534  

**ANGIO NUMBERS at North Charleston & East Cooper**  
North Charleston  6-2767/2742  
Radiology Supervisor  6-2719  
East Cooper  6-8133
VIR REQUIRED PROCEDURES LOG - THESE PROCEDURES SHOULD ALSO BE LOGGED INTO E-VALUE.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Min</th>
<th>Max</th>
<th>CPT Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess Drainage/ Fluid Aspiration (CT guided)</td>
<td>3</td>
<td>15</td>
<td>75989</td>
</tr>
<tr>
<td>Biopsy (CT guided)</td>
<td>3</td>
<td>15</td>
<td>76360</td>
</tr>
<tr>
<td>Biopsy (Fluoro guided)</td>
<td>3</td>
<td>15</td>
<td>76003</td>
</tr>
<tr>
<td>G tube/ GJ tube placement</td>
<td>3</td>
<td>15</td>
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<tr>
<td>Procedure</td>
<td>Code 1</td>
<td>Code 2</td>
<td>Code 3</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Nephrostomy placement</td>
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<td>15</td>
<td>74485</td>
</tr>
<tr>
<td>Thoracentesis (CT guided)</td>
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<td>15</td>
<td>76360</td>
</tr>
<tr>
<td>Venous Access</td>
<td>3</td>
<td>15</td>
<td>76942</td>
</tr>
</tbody>
</table>

**WEBSITES:**

**HELPFUL LINKS TO MUSC INTERVENTIONAL RADIOLOGY**

http://clinicaldepartments.musc.edu/radiology/interventional

An electronic copy of this document is available on Moodle (password protected) moodle.musc.edu
Electronic copies of many helpful documents can be found here:
https://www.musc.edu/cce/ORDFRMS/Interventradiol/index.htm

General Consent
https://www.musc.edu/cce/ORDFRMS/pdf/all_all_consentsurgicalconsent.pdf

CT Guided Post-procedure Orders

Venous Access Device Post-procedure Orders

Cholangiogram /Nephrostogram Post-procedure Orders

Arteriogram Post-procedure Orders

Venogram Post-procedure Orders
CT Guided Procedure Patient Instructions

Drain Placement Patient Instructions

Nephrostogram Patient Instructions
https://www.musc.edu/cce/ORDFRMS/pdf/ah_hvc_intrad_dc_pated_nephdcinstruct.pdf

Cholangiogram/ Biliary Tube Patient Instructions

Fistula Thrombectomy Patient Instructions

Angiography Patient Instructions

Percutaneous Venous Closure Patient Instructions

OTHER VIR WEBSITES

Society of Interventional Radiology (SIR)
http://www.sirweb.org/
EPIC NOTES

LOGIN

When logging in for the first time, select a VIR attending. Do not change this for the rest of the rotation as it doesn’t matter if the appropriate attending for that day is selected in any further activities in EPIC.

CHANGING CONTEXT

The first thing that must be done before starting the rotation is changing the context of EPIC. This is performed by clicking the EPIC button in the top left corner of the screen and selecting “Change Context” near the bottom of the menu. Enter one of the VIR attendings under Provider and change the department to RAD VASC MH. This will stay in place for the rest of the month. After your rotation ends, you need to change your context back to your prior setting.
CREATING CONSULT LISTS

You need to create two consult lists to function on service, pending and completed consults. After a consult note is signed, the patient drops off the pending list and joins the completed consults list.

To create these lists, click on the “Patient List Tab”, then click Edit List, then choose Create My List.
1. Name your first list “Pending IR Consults”.

2. Add the following columns from the “Available columns” on the left to your selected columns on the right (you can add more columns if you prefer):
   a. Patient Name/Age/Sex
   b. Unit/Rm/Bed
   c. MRN
   d. Problem
   e. Diagnosis

3. To rearrange the order in which the columns appear within your My List, click the column you want to move and click the Up or Down arrow.

Repeat this step to create a “Completed IR Consults” list.

Next, expand the “System Lists” folder, then expand “Consults (Pending) – Physician”, and find “Interventional Radiology” which can then be dragged & dropped into your “Pending IR Consults” list you just created.
Repeat this step under the “Consults (Pending & Completed)” system list by dragging that into your “Completed IR Consults” list you just created.

**HOW COPY NOTE TEMPLATES**

Click on the EPIC button in the top left, go to the “Tools” Menu, then “SmartTool Editors”, then “SmartPhrase Manager”

![SmartTool Editors](image)

Enter the name of the person you will be copying a note template from in the User field (probably an IR Fellow) and click “Go”. You should see a list of their notes.
Select a note you want to copy, then click the “Share” button. Remember the name of each note you are copying.

Enter your name in the Users field and then click Accept.

You can repeat these steps for all the notes you want to copy.

**HOW TO WRITE A NOTE**

Double click a patient, either in the consult or scheduled patients list.

Patient tab will open. Click the notes button on the left.

Then click “New Note”.

The new pop up box will ask for a note type.
For scheduled outpatients, enter “4” (H&P)

For inpatient consults, enter “2” (Consult)

For service, enter 266 (or “RAD-VASCULAR”)

Make sure the “Cosign Required” box is checked.

Enter the name of your attending for the procedure under “Cosigner. See example below.

To insert a note template, click on the body of the note editor, type a period “.” then the name of a note template you have either created or copied. (eg: .IRCONSULTS)

When typing in a consult note template, the F2 button is used to automatically select the next text area that must be filled out and is denoted with “***” or selects the next pull down menu. Please note from the pull down portions of the physical exam, left click is used to highlight and unhighlight different choices such as “regular rate and
rhythm” and using right click enters the highlighted choices into the text of the note.

CREATE IR OUTPATIENT SCHEDULES

First, click on the Schedule tab, then click the Create button.
You will need to create 2 lists which will appear under the “My Schedule” Folder. Create a “Rad Vasc Main” and a “Rad Vasc ART” list

Each time you create a list, a list properties box will appear.

You can change your Selected Columns as below.

Then click on the Configuration Tab and select Search by Provider [All Depts]

Search and add the following providers:

- Main: IN1, IN2, IN3, IN4, IN5
- ART: ANG1, ANG2, ANG3
Now daily schedules can be viewed under the Schedule or Status Board tab just under the big EPIC button.

INPATIENT WORK FLOW

Inpatient workflow can be divided into 3 steps

1. Seeing the consult on your “Pending IR Consults” patient list and approving the case.

2. Visit the patients room and obtain consent

3. Complete a CONSULT note, making sure to document Mallampati and ASA scores.

4. Placing an order for the procedure as well as making other associated orders (Labs, NPO status).

When you type a consult note, you can check a box that appears that will associate your note with the consult order from the referring physician. This will ensure that the consult drops off the “Pending IR consults” list and moves to the “Completed IR Consults”.

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Selecting the Manage Orders Button on the right allows you to place the correct procedure order.

Individual orders can be placed under the Manage Orders Button. Common orders such as NPO status, PT/INR, CBC, and antibiotics are placed here.
Angiographic procedures often begin with “IR”, such as “IR Cholangiogram”.

CT Procedures often begin with “CT”, such as “CT abdomen Drain Placement”.

If you’re not sure, just search for a few key words, such as “IR Biliary” or “CT Drain” and a few relevant options will pop up.

OUTPATIENT WORK FLOW

Scheduled outpatients are seen on the schedule tab explained earlier in this chapter.

Outpatient workflow can be divided in 3 steps.

1. Open the patients chart from the schedule
2. Talk with the patient in the pre-procedure bay and obtain consent

After the procedure is order, you will often have to enter post-procedure orders for outpatients.
This is completed by clicking the Manage Order button and clicking “Go To Order Sets”

Under the Order Sets menu, you can search for pre-made IR order sets by searching for “MUSC VIR POST”. Many IR post-procedure options should appear – choose the one appropriate for the procedure just performed.

Certain things should be selected after every procedure to limit phone calls from Prep & Recovery.

1. VTE prophylaxis – If you don’t need VTE prophylaxis, check the VTE Prophylaxis Contraindicated box and click the Contraindicated Qualifier Value button for both Pharmacological and Mechanical Prophylaxis.

2. Vital Signs

3. Activities
4. Diet – NPO or advance as tolerated

5. Notify physician orders

Other orders such as PRN pain medication and discharge orders can also be entered post-procedure.

OUTPATIENT FOLLOW UP

Nurse coordinators can be reached at extension 2-9271 and are very helpful.

Outpatient prescriptions should be printed from Epic and given to patient (e.g., chemoembolization patients).

Follow up procedures for nephrostomy and biliary drain changes should be placed in Epic.

These tasks can be accomplished by selecting the Orders Only tab from the Epic dropdown menu. Next, select Meds & Orders from the left hand side menu. You can then enter the appropriate order, whether it is a follow up procedure or a prescription to send home with the patient.

EPIC is a great tool, but can be challenging to navigate in some situations. Some problems may be solved by talking with the current fellows. Others may be solved by calling the EPIC helpline at 2-9700.