Introduction

Welcome to the cardiothoracic division at UCSD. This guide will serve as an introduction to the cardiothoracic anesthesia service and procedure guide at UCSD Department of Anesthesia. The UCSD CT Anesthesia service covers the elective cardiac and thoracic cases occurring at Thornton Hospital in La Jolla for UCSD and at the VA Hospital for the VAMC as well as emergent cases occurring at the Hillcrest UCSD Hospital. This guide will be further modified in the future when the Sulpizio Cardiovascular Center opens in the spring of 2011.

The Cardiac rotation is a two month block comprising the first month at Thornton and the second month at the VA.

Goals and Objectives for The Thornton Rotation

I. Patient Care

The residents will develop their skills in the compassionate, appropriate and effective care of patients presenting for cardiac surgery. Please refer in detail to the CA-1 goals and objectives handout as published. The skills to be developed will include:

1. Peripheral venous cannulation
2. Peripheral arterial cannulation
3. Femoral arterial cannulation
4. Central venous cannulation (internal jugular, external jugular)
5. Cardiac-stable anesthetic induction and maintenance of patients with a variety of cardio-vascular illnesses, including
   a) ischemic heart disease
   b) pulmonary hypertension (thromboembolic and primary)
   c) aortic valvular stenosis
   d) mitral valvular disease
   e) aortic disease
8. Management of separation from cardiopulmonary bypass, including providing inotrope support, vasodilator therapy and heparin reversal.
10. Performing a safe, neat transport of the patient to the ICU for postoperative care.
II. Medical Knowledge
The residents will expand their knowledge of cardiac physiology and the treatment of cardiovascular illness. They will also develop an understanding of the surgical anesthetic care of patients with cardiovascular disease. The suggested text is Kaplan book, which should be sufficient for a resident level. There are however additional texts (Miller and Barash) and resources in the cardiac office at Thornton hospital. They will learn indications for and basic interpretation of intraoperative transophageal echocardiography (ventricular function, valvular function).

III. Practice-based Learning and Improvement
During the rotation the residents will evaluate their own practice, with the goal of improvement, as well as the medical literature. They will become familiar with outcome studies regarding cardiac surgical care, including those involving “fast tracking”, perioptive beta blockade and “off-pump CABG”. They will learn to apply their findings to their own scientific, “evidenced-based” practice. During the cardiac rotation residents are expected to attend the monthly cardiac educational meeting where discussion of latest articles and controversial topics discussed between the CT surgery team and CT anesthesia team.

IV. Interpersonal Communication Skills
The residents will develop their communication skills, both with surgical colleagues (in no type of surgery is close communication with surgeons more important than in cardiac anesthesia) and patients. Cardiac surgical patients, in the preoperative period, are extremely vulnerable. Residents will develop sensitivity to the fact that the patients suffer from a life-threatening illness and are about to undergo life-threatening surgery. They will also develop their skills in interacting with the patient’s family, nurses, and anesthesia technicians.

V. Professionalism
Residents will further develop their professionalism and, in particular, be indoctrinated to the “etiquette of the heart room”. This will include sensitivity to the high pressure environment of the heart room and the social and emotional needs of the surgical team at various times of the surgery.
In addition residents will be asked to give a lecture during the cardiac educational meeting where they will be evaluated on the presentation and their professionalism.

VI. Systems Based Practice
The residents will develop understanding of cardiac anesthesia in the larger context of cardiac care in the hospital, community and nation. Principles of cost containment (drugs, ICU length of stay, for example) will be studied. Also, the changing population of cardiac surgical patients resulting from the increased use of less invasive procedures by cardiology will be appreciated. The potential contributions of the cardiac anesthesiologist to the entire perioperative experience will be appreciated. These include preoperative preparation, intraoperative management and postoperative hemodynamic, respiratory and pain management.
By the conclusion of your Thornton cardiac block, you should have a basic understanding of the following:

A. Preoperative evaluation of a patient undergoing cardiac surgery
B. The basic principles in providing a cardiac anesthetic
C. The mechanics of the cardiopulmonary bypass pump, including pump oxygenation, CO2 clearance, PH management, hypothermia, cardioplegia, complete and partial bypass, hormonal response to bypass, and hematologic response to bypass.
D. The process of separation from cardiopulmonary bypass.
E. Management of patients with ischemic heart disease.
F. Management of patients with valvular heart disease.
G. Management of patients with aortic injury
H. The most commonly used drugs for cardiovascular support, vasodilatation, and dysrhythmia managing.
I. Becoming efficient with all types of line placement.

**Evaluation Methods**: Evaluations are a requirement of all training programs. During the cardiac rotation, residents will be evaluated on a monthly basis and given appropriate feedback to help them grow professionally, they will also be evaluated by performances during Cardiac educational meeting presentations, journal reviews. They are encouraged to bring any suggestions, criticisms, or problems to the attention of the Program Director so they can be addressed in a timely fashion.

In addition, there is an examination at the end of the block, which consists of a written exam and oral exam questions just to follow each resident's progress.

**Other Expectations**

A. Residents are expected to see each patient and every cardiac or thoracic patient themselves preoperatively except under extraordinary circumstances.
B. Residents are expected to contact their attending the night before to discuss the cases.
C. Attending should be called for:
   1. Patient in the room
   2. Cannulation
   3. Coming off
   4. Transport to ICU

*If in doubt, call. Your attending is there to protect you.*

**CALL DUTIES**

*During your rotation on the CV service you will often be requested to take pager call for the majority of the month. It is also often requested that you will stay past 5pm in the interest of patient care despite not being on call for a given day. The division will carefully track your work hours on a day to*
day basis and make sure that you receive the necessary and required off duty hours between work days. Please contact your attending or the clinical directors if you feel that sufficient off duty hours are not being granted. This is a very important detail of the rotation.

Your duties during pager call are for the most part identical to your preparation for an elective or scheduled case. It is expected that you completely prepare the heart room including all infusions prior to starting a case. You are expected to conduct an interview and obtain a full history and physical examination prior to starting. This is followed by the necessary line placement as required for each case.

**POLICIES AND PROCEDURES**

**Specific Rotations**

**Thornton Hospital**
This location is a seven operating room facility that runs one dedicated cardiac room daily (two dedicated rooms on Tuesdays). Cases at Thornton typically include the Pulmonary Thromboendarterectomy (PTE), CABG both on and off pump, and valvular repair or replacement. Urgent solid organ transplantation of the lung and heart will also be scheduled as necessary. Mechanical assist device insertion in the patient with a end stage cardiomyopathy will also be scheduled as necessary. Elective thoracic surgery cases are also typically scheduled at Thornton. Less commonly aortic repairs and adult ASD repairs occur. The new Sulpizio Cardiovascular Center will change the logistics of daily operating room conduct. The procedure and policies for the new center will be published shortly after opening.

**Day to Day Experience:**
You can learn of the next day cases in two ways. You are able to contact the OR Front Desk at 858-657-6500 or simply look at the OR Schedule on PCIS (Home access via [http://cwp.ucsd.edu/](http://cwp.ucsd.edu/)). Epic will also give you all the necessary patient information, including history, labs, radiology reports, and patient location. You should see the patient if in-house. If the patient was seen in pre-op clinic, you will find their completed pre-op sheet in the blue folders in the Thornton PreOp Holding Area roughly after 4pm.
the day prior to surgery. Again you should contact the attending the day prior to discuss all details.

Each attending anesthesiologist may have specifics for how they like the room setup (this can be discussed the evening before during the nightly phone call), however a typical setup follows (please refer to publication entitled "heart room setup.") Typical drugs to be prepared ahead of time include a syringe each of versed, fentanyl, propofol, lidocaine, etomidate, sux, rocuronium, phenylephrine, ephedrine, dilute epinephrine (10mcg/ml), dilute nipride (20mcg/ml), and esmolol. Typical drips include dopamine, phenylephrine and either nitroprusside (PTE) or nitroglycerin (CABG). Please prepare 500mg of Propofol and give to the perfusionist before initiating deep hypothermic circulatory arrest. The majority of drugs will be found in the anesthesia cart (Code 1212), you may obtain a key for the year from the anesthesia techs to unlock the top drawer. Narcotics keys are obtained from the satellite pharmacy on the second floor near the elevators (with the narcotics cabinet outside of OR4). Airway supplies, IV catheters, tubing, fluids are also found in the regular anesthesia cart. Drips, extra IVAC tubing, fluids can be found in the heart cart of rooms 6 & 7. The code and key are the same as the regular carts.

**Typical Day:**
The typical day involves arriving around 5am-5:30 am to setup your room, place peripheral IV and radial arterial line with an in-room time of 0630. These lines are typically an 18g or preferably larger PIV and a 20g radial line (either Angiocath or Arrow kits are available).

*If you are not able to place the A-line in time please head back to the room at 6:30 and place your lines in the room. Also, please check with all OR staff before bringing patient back to make sure every member is ready.*

Induction and line placement ensue once cardiac surgeons are noted to be present. The majority of attendings prefer Right IJ Cordis and PAC placement with ultrasound guidance and a shoulder roll placed. Antibiotics are given during prepping except for Vancomycin. You need to chart all your antibiotics within one hour of incision...

*After each arrest please reside these 5 items for the surgeons:*
  1. The patient is cold (the head is cooled)
  2. The EEG is flat
  3. Stopcocks are off to the patient
  4. I am ventilating nicely with unwarmed room air
  5. The TEE is off

Please remain near the ether screen during arrest periods to aid in bed movement (which is frequent during the PTE).

Always page the attending anesthesiologist when coming off pump. Although it’s not obligatory, dopamine is often the drug of choice when separating from bypass. Alternative drugs used include milrinone and epinephrine. Rarely vasopressin, levophed or others are utilized.

When transporting, an anesthesia tech will help you hook up the portable monitor and transport. However it is helpful to disconnect extra PIVs, remove fluid warmers, and
place an orogastric tube in anticipation of transport. Prior to transport, please place
tegaderms over any invasive line placement sites. Lastly PTEs are transported with the
assistance of respiratory therapy and a portable vent (avoid hypercarbia and hypoxia with
mild hyperventilation and 5 cm of PEEP), whereas other cardiac cases are transported
with our oxygen tank and bag-valve ventilation.

*Please call your attending AND Fellow before transport to ICU.*

**VA Hospital**
Typical cases include CABGs both on and off pump as well as valvular cases. Aortic
repairs and thoracic cases are less common. However the patient population tends to be
older and sicker with more extensive comorbidities.

**Day to Day Experience:**
You can learn of the next day cases in two ways. In the main Anesthesia office there is a
drawer that contains a book with the following day’s preops. If you need assistance
Craig Dionne (extension 3292) will be able to show the preops as well as to help set you
up with CPRS (computer patient records system) access. However if you are not in
house at the VA, you can always page the resident on call to read you the preop (858-
347-1418). Unlike Thornton Hospital, all preops are completed by the preop clinic or the
on-call resident. However as at Thornton, the rotating cardiac resident or fellow should
call the attending the evening prior.

Each attending anesthesiologist may have specifics for how they like the room setup (this
can be discussed the evening before during the nightly phone call), however the setup is
essentially identical to a Thornton cardiac case. The majority of drugs will be found in
the anesthesia cart (Code 3292). Narcotics are obtained from the satellite pharmacists in
the PACU. Airway supplies, IV catheters, tubing, fluids, and drips are also found in the
regular anesthesia cart.

**Typical Day:**
The typical day also involves arriving at 5:30-6:00 am to setup your room and line
placement with an in room time of 0730. Attendance at morning conferences at the VA is
mandatory Intraoperative line placement is similar to Thornton except femoral lines and
DHCA are rarely used. Case management will be overall similar to cases at Thornton.
Transport also is assisted by the anesthesia technicians.
Heart Room Set-up

*Mandatory Drugs:*
2 x 20cc Fentanyl
2 x 10cc Midazolam
1 x 20cc Pentathol(500mg)- only for Circ arrest(PTE)
Propofol(2.5mg/kg) for Circulatory Arrest

1 x 20cc propofol
1 x 10cc etomidate
1 x 10cc rocuronium
1 x 10cc Sux

1 x 10cc ephedrine
1 x 10cc phenylephrine
1 x 20cc Vasopressin(1 unit/mL)
1 x 10cc Epi (5-10mcg/mL)

*Extra Drugs*(depending on case):
1 x10cc esmolol
1 x 10cc CaCl
1 x 5 cc glycopyrolate
1 x 5 cc lidocaine

2 x 10cc Amicar(250mg/mL)- give one 10cc to perfusionist- **NOT for PTE, but for other PUMP cases**
ABX- usually Cefuroxime 1.5g(no need to re-dose throughout case)

*Drips: carrier on Pump(1L Bag LR, 50cc/hr) connected to 5 stopcocks*
Phenylephrine 2mg/250mL(10-200mcg/min)- α-agonist
Dopamine 400mg/250mL- premade- (2-10mcg/kg/min)- δ predominates 0.5-3, β 3-7 α predominate at >10, but more prominent at 7
Nipride 50mg/250mL(0.1-5mcg/kg/min)- PTE, valves, aortic cases
Nitroglycerin 50mg/250mL(10-50mcg/min)- CABG
Amicar 5g/250mL(50ml/hr)- run for the entirety of Pump Cases except PTE
Epi 4mg/250mL(0.01-0.15 mcg/kg/min)- rarely used

*Room Setup-*
NS on warmer(R pole- for Cordis)--Dr Roth likes 2nd bag of LR on warmer with second bag on it’s own IV pole(NOT the drip pole)- start IV with extension and stopcock in the pre-op and then use this bag in OR.
Gown and 2 sets of gloves(always double glove and remove 2nd set prior to Swan)
All PTE’s check in the night before- must do your own pre-op; Some CABG and valves will go to pre-op clinic- check pre-op clinic for their pre-ops
Pt in Pre-op Holding 6-6:10- start PIV and A-line(most important to get pt into room by 6:30 so can place A-line in room), Dr. Roth is the exception for this. He prefers A-line in holding area. If this is not possible (i.e. pt is late). Please ask Dr. Roth for his plan of action.

Cases:
RM, PIV and Radial A-line placed
Induce pt and Intubate
Fellow or person on TEE rotation will place TEE
RIJ Cordis followed by Swan placement
If PTE- L Femoral A-line- surgeons like an extra stitch to hold tubing straight
Connect all IVs
Go through 4 A’s- Antibiotics( usually give when surgeons prepping)
Amicar(NOT for PTE)= 2.5 gram load over 10minutes then 1 gram/hr infusion
ABG- for baseline
ACT- give to perfusionist to run
Insure adequate anesthesia during skin incision, chest opening(will be asked to hold ventilation) and on opening of pericardium and aortic manipulation
When asked give the Heparin- the perfusionist will tell you how much(400units/kg)- announce you are giving
Surgeon will ask to lower pressure to SBP 90’s for aortic cannulation- can also put head up

Coming off Pump-
- Check perfusionists last gas, make corrections as needed, hematocrit check
- ABC’s- 1) Airway- ensure airway patent, no mucus plugs, right mainstem migration of ET tube
  o 2) Breathing- recruitment maneuvers, inspect lung inflation, check compliance by hand and place back on vent and inhalational after adequate bilateral ventilation confirmed
  o 3) Circulation- evaluate- note often targeting MAP 60-70 due to aortic cannula in place, in preparation for decannulation and aortic closure with suture
    ▪ HR and Rhythm(usually taken care of by surgeons if problematic with pacing wires); often sinus bradycardia, junctional, or tachy, due to inadequate myocardial protection, air in the coronaries, ischemia, inadequate rewarming, too much inotropy or not enough etc.
    ▪ Pre-load (as coming off pump perfusionist will transfuse back in small increments);
    ▪ Afterload(can shoot CO and numbers to eval);
- Inotropes (will almost always be asked to start Dopamine 3-5mcg/kg/min and then add others as needed).

When asked give the protamine- perfusionist will calculate how much to give- ACT and ABG 3 minutes after- always announce that you are giving (give slowly- Dalia likes it diluted into 100cc and hung on a dripper- all other attendings just give over 5-10 min). Note can get Anaphylaxis and Pulmonary HTN (TXA2 mediated).