Within this syllabus you will be given a concise description of the goals and objectives for this rotation, introductory information about Neonatal Anesthesia at UCSD, General Anesthesia at Rady Children’s Hospital, Anesthesia for Pediatric Radiation Oncology at the UCSD Moores Cancer Center, and a handful of journal articles to stimulate thought and discussion.

We hope that you will find the practice of pediatric anesthesia challenging and rewarding in ways that you have not experienced before as an anesthesiologist and that you will gain an appreciation of your unique role in a moment of a child’s life.

Revised July 2013 by Alyssa Brzenski MD and Karim Rafaat MD
(previous versions: Patrick D. DeMars MD, Josh Gordon MD, Mark Greenberg MD, Sidney Merritt MD, Christine Nieman MD and Daniel Lee MD PhD)
PEDIATRIC ANESTHESIOLOGY SYLLABUS

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A. LEARNING OBJECTIVES

LEARNING OBJECTIVES FOR RCHSD PEDIATRIC ANESTHESIA CA-2 ROTATION

I. PATIENT CARE

1. Pediatric Airway
   a. Know the appropriate size and type of equipment for bag-mask ventilation, oral and nasal airway, endotracheal intubation, and laryngeal mask airway for newborns, infants, and children.
   b. Know options in managing a difficult airway.

2. Vascular Access
   a. Placement of IV catheter in infants and children—awake and asleep.
   b. Placement of arterial line in infants and children.

3. Pharmacology
   a. Know appropriate dosages of the following medications and how to prepare them in appropriate syringes—atropine, glycopyrrolate, epinephrine, succinylcholine, vecuronium, rocuronium, calcium chloride, sodium bicarbonate, propofol, ketamine, cefazolin, clindamycin, morphine, meperidine, fentanyl, lidocaine, and bupivacaine.
   b. Know the interaction between physiology and inhalational anesthetics and the characteristics of each inhalational anesthetic so that the appropriate agent is used for induction.

4. Administering Anesthesia
   a. To conduct a thorough preoperative history and exam in a manner that is sensitive to the child and allays the fears of the parents and child.
   b. Be able to explain the risk and benefits of anesthesia to parents.
   c. Be able to explain NPO guidelines.
   d. Know when a premedicant is appropriate. Prepare and deliver a premedicant to a pediatric patient.
   e. Be able to conduct an inhalational induction in a safe and age appropriate manner.
   f. Be able to conduct a parental induction in a safe manner and reassuring.
   g. Be able to perform a rapid sequence induction in a safe manner.
   h. Be able to set up appropriate IV solution and fluid.
   i. Be able to set the ventilator for pediatric patient.
   j. Be able to maintain anesthesia and maintain the pediatric patient in a safe thermal, hemodynamic, and surgical milieu.
   k. Be able to extubate an infant or child in a safe manner.
I. Be able to manage and “break” laryngospasm.

5. Pain Management and Regional Anesthesia
   a. Be able to administer pain medication intraoperatively so that the patient wakes up comfortably.
   b. Perform a caudal block.
   c. Write appropriate PACU pain orders, IV PCA, and epidural orders.

II. MEDICAL KNOWLEDGE
Residents at the end of the rotation will be able to discuss the following topics in pediatric anesthesia:

1. Apparatus: Breathing Circuits, Humidity, Thermal Control

2. Premedication: Drugs; Dosage; Routes; Vehicles, Including Eutectic Mixture of Local Anesthetics (EMLA) Cream; Parental Presence

3. Agents and Techniques
   a. Induction Techniques
   b. Anesthetics: Actions Different From Adults
   c. Neuromuscular Blockers (Sensitivity, Congenital Diseases, Complications of Succinylcholine)
   d. Regional Anesthesia

4. Fluid Therapy and Blood Replacement, Physiologic Anemia, Glucose Requirements

5. Problems in Intubation (Full Stomach, Diaphragmatic Hernia, Tracheo-esophageal (T-E) Fistula, Pierre-Robin Syndrome, Awake/Fiberoptic Intubation, Dentition)

6. Neonatal Physiology
   a. Respiratory
      i. development, anatomy, surfactant
      ii. pulmonary oxygen toxicity
      iii. pulmonary function
      iv. lung volumes vs. adult
      v. airway differences, infant vs. adult
   b. Cardiovascular
      i. transition, fetal to adult
      ii. persistent fetal circulation
   c. Retinopathy of Prematurity: Anesthetic Implications
   d. Metabolism, Fluid Distribution and Renal Function
   e. Thermal Regulation (Neutral Temperature, Nonshivering Thermogenesis)
   f. Fetal Hemoglobin
   g. Prematurity, Apnea of Prematurity
   h. Bronchopulmonary Dysplasia
7. Congenital Heart Disease
   a. Cyanotic Defects
   b. Acyanotic Defects
   c. Primary Pulmonary Hypertension
   d. Altered Uptake/Distribution of IV and Inhalation Anesthetics
   e. Anesthetic Considerations
      i. cardiac surgery; corrective and palliative
      ii. noncardiac surgery

8. Emergencies in the Newborn
   a. Diaphragmatic Hernia
   b. Tracheoesophageal Fistula
   c. Neonatal Lobar Emphysema
   d. Pyloric Stenosis
   e. Necrotizing Enterocolitis
   f. Omphalocele/Gastroschisis
   g. Respiratory Distress Syndrome (RDS): Etiology, Management, Ventilation Techniques
   h. Myelomeningocele

9. Common Pediatric Medical Problems With Anesthetic Implications
   a. Upper Respiratory Infections
   b. Muscular Dystrophies
   c. Developmental Delay
   d. Airway Foreign Bodies

10. Postoperative Analgesia
   a. Systemic Medications and Routes of Administration, Multimodal Therapy
   b. Regional Techniques: Caudal, Epidural, Nerve Blocks
   c. Postoperative Nausea and Vomiting: Risk Factors, Prophylaxis, Treatment

III. PRACTICE BASED LEARNING AND IMPROVEMENT
1. Residents in the first week of the rotation should start with ambulatory cases (e.g. ENT, Optho, Dental), taking care of healthy patients for simple procedures. As the residents progress toward the 2nd week of the rotation they should shift their emphasis onto sicker patients or more complicated procedures. During the last part of the rotation, they should target complicated anesthetic cases in sick patients. They should never forgo an opportunity to take care of an infant, especially those who are premature.

2. Residents will be provided with a list of recommended text and a syllabus with recommended readings containing information not normally found in the textbooks.
IV. INTERPERSONAL AND COMMUNICATION SKILLS

1. Be able to appreciate the anatomical, physiological, and cognitive development of an infant or child and how it applies to the practice of anesthesiology. Be able to explain and guide a child through a complete anesthetic—preoperative history and exam, induction, maintenance of anesthesia, postoperative care, and pain control—for a child in a competent and compassionate manner.

2. To be able to explain the risks and benefits of anesthesia to a parent that is informative, thorough, and reassuring. Be able to understand a parent’s frame of mind when his/her child is about to undergo surgery and the stresses it can place on the family unit.

V. PROFESSIONALISM

1. Residents will adhere to the highest standard when taking care of pediatric patients who often cannot speak for themselves and almost always not responsible for their disease states and often unable to comprehend their medical care.

2. Residents will demonstrate respect and courtesy to other members of the operating room team.

VI. SYSTEMS BASED PRACTICE

1. Residents should learn which cases to perform in ambulatory surgery and how to deliver anesthesia in that setting including techniques that improve recovery times and stays.

2. Residents will also learn about pediatric anesthesia in the different settings - within a children’s hospital and within a mixed population hospital, and the advantages and limitations of both.

3. Residents will also have the opportunity to practice pediatric anesthesia safely in international locales in which resources are extremely limited.
LEARNING OBJECTIVES FOR RCHSD PEDIATRIC ANESTHESIA CA-3 ROTATION

I. PATIENT CARE

1. Pediatric Airway
   a. Be able to recognize medical conditions and syndromes that are associated with a difficult airway.
   b. Be familiar with difficult airway techniques.
   c. Be able to recognize and “break” laryngospasm

2. Vascular Access
   a. Placement of IV catheter in patients with difficult access—by using saphenous vein or central vein. Be familiar with the use of ultrasound to guide placement of these catheters.
   b. Placement of arterial line in infants and children.

3. Pharmacology
   a. Know the appropriate concentrations and starting rates for common infusions used in pediatric anesthesia such as dopamine, epinephrine, and calcium.
   b. Be familiar with drug algorithms used in PALS

4. Administering Anesthesia— to be able to conduct a safe anesthetic for a child or neonate with complicated medical problems or complicated surgery with a focus on the following:
   a. To conduct a thorough and reassuring preoperative history and exam for especially anxious child or parent.
   b. Be able to explain NPO guidelines.
   c. Be able to use an IM medication for premedication.
   d. Be able to set the ventilator for a sick neonate by using PCV or HFOV.
   e. Be able to transport a sick child to and from the operating rooms.
   f. Provide safe anesthesia in an off-site area: MRI, interventional radiology, GI endoscopy.
   g. Be able to resuscitate a child with traumatic injuries including traumatic brain injury and increased intracranial pressure.

5. Pain Management and Regional Anesthesia
   a. Be able to assess the situations when an asleep epidural catheter/ regional block might be placed by some practitioners.
   b. Be able to troubleshoot and correct problems with epidural catheters.
   c. Be able to control and assess a child’s postoperative pain from IV PCA to oral medications to discharge home.

II. MEDICAL KNOWLEDGE
Residents at the end of the rotation will be able to discuss the following topics in pediatric anesthesia:
1. Apparatus: Breathing Circuits, Humidity, Thermal Control

2. Premedication: Drugs; Dosage; Routes; Vehicles, Including Eutectic Mixture of Local Anesthetics (EMLA) Cream; Parental Presence

3. Agents and Techniques
   a. Induction Techniques
   b. Anesthetics: Actions Different From Adults
   c. Neuromuscular Blockers (Sensitivity, Congenital Diseases, Complications of Succinylcholine)
   d. Regional Anesthesia

4. Fluid Therapy and Blood Replacement, Physiologic Anemia, Glucose Requirements

5. Problems in Intubation (Full Stomach, Diaphragmatic Hernia, Tracheoesophageal (T-E) Fistula, Pierre-Robin Syndrome, Awake/Fiberoptic Intubation, Dentition)

6. Neonatal Physiology
   a. Respiratory
      i. development, anatomy, surfactant
      ii. pulmonary oxygen toxicity
      iii. pulmonary function
      iv. lung volumes vs. adult
      v. airway differences, infant vs. adult
   b. Cardiovascular
      i. transition, fetal to adult
      ii. persistent fetal circulation
   c. Retinopathy of Prematurity: Anesthetic Implications
   d. Metabolism, Fluid Distribution and Renal Function
   e. Thermal Regulation (Neutral Temperature, Nonshivering Thermogenesis)
   f. Fetal Hemoglobin
   g. Prematurity, Apnea of Prematurity
   h. Bronchopulmonary Dysplasia

7. Congenital Heart Disease
   a. Cyanotic Defects
   b. Acyanotic Defects
   c. Primary Pulmonary Hypertension
   d. Altered Uptake/Distribution of IV and Inhalation Anesthetics
   e. Anesthetic Considerations
      i. cardiac surgery; corrective and palliative
      ii. noncardiac surgery
8. Emergencies in the Newborn
   a. Diaphragmatic Hernia
   b. Tracheoesophageal Fistula
   c. Neonatal Lobar Emphysema
   d. Pyloric Stenosis
   e. Necrotizing Enterocolitis
   f. Omphalocele/Gastroschisis
   g. Respiratory Distress Syndrome (RDS): Etiology, Management, Ventilation Techniques
   h. Myelomeningocele
   i. ECMO

9. Common Pediatric Medical Problems With Anesthetic Implications
   a. Upper Respiratory Infections
   b. Muscular Dystrophies
   c. Developmental Delay
   d. Airway Foreign Bodies

10. Postoperative Analgesia
    a. Systemic Medications and Routes of Administration, Multimodal Therapy
    b. Regional Techniques: Caudal, Epidural, Nerve Blocks

11. Postoperative Nausea and Vomiting: Risk Factors, Prophylaxis, Treatment

III. PRACTICE BASED LEARNING AND IMPROVEMENT

1. Residents in the first week of the rotation should start with a healthy child in a difficult procedure such as scoliosis surgery or a large tumor excision. The next few weeks should then be focused on sick children for difficult procedures such as a child s/p chemotherapy or BMT for re-excision of tumor. The last week, some time should be spent in the heart room or cardiac catheterization lab. Every effort should be made to attend cases where a neonate is involved especially those with congenital heart disease, severe pulmonary problems, or sepsis. Several days during the month may be spent doing ambulatory surgeries (e.g. ENT, Optho, Dental) to review the care of healthy pediatric patients in a high volume, out patient setting.

2. Residents will be provided with a list of recommended textbooks and a syllabus with recommended readings containing information not normally found in the textbooks. The senior resident should be consistently consulting the pediatric anesthesiology textbooks or literature.

IV. INTERPERSONAL AND COMMUNICATION SKILLS

1. Be able to assist and teach junior residents about the elementary aspects of pediatric anesthesiology.

2. Be able to communicate to the attending all the vital aspects of a complicated case or patient.
3. Be able to confidently and completely communicate to the parents of the patients so that they can place their trust in the resident to take care of their child.

4. Know when consults from other pediatric specialties such as radiology, critical care, oncology are needed prior to administering an anesthetic.

V. PROFESSIONALISM

1. Residents should adhere themselves to the highest standard when taking care of pediatric patients who often cannot speak for themselves and almost always are not responsible for their disease states and often unable to comprehend their medical care.

2. Residents should demonstrate respect and courtesy to other members of the operating room team.

VI. SYSTEMS BASED PRACTICE

1. Residents should learn which pediatric cases can be practiced in the community hospital and which cases should be transferred to a pediatric center.

2. Be able to perform efficient (economically and time) anesthetics in a setting where turnover between cases are very quick such as the ambulatory surgery center.

3. Residents will also have to the opportunity to practice pediatric anesthesia safely in international locales in which resources are extremely limited.
B. COMMON PEDIATRIC DRUG DOSAGES
C. **UCSD SETUP FOR NEONATAL SURGERY**  
**NOT BURN KIDS**

1. **Warm Environment.**
   a. OR room temperature 85 degrees
   b. Water blanket on to 40 degrees and make sure the top of the blanket is aligned to top of the bed.
   c. Infant Bair hugger on bed.
   d. “French Fry light”

2. Get an MRI/PEDS cart from the hallway next to the anesthesia workroom (the one with drugs, peds ETTs, peds suction catheters, etc.) and make sure it has a #1 LMA in the bottom drawer.

3. **Monitors**
   a. Set the monitor to Neonate, under the Monitor Setup menu.
   b. Take the adult EKG electrodes out of the cable. The babies come from the NICU with their own smaller electrodes that you can plug into the cable.
   c. Take an infant SpO2 out. The child will have a SpO2 already, but place a 2nd one in case the first one fails.
   d. Change the BP monitoring cord. Use the white BP monitoring cord from the bottom of the MRI cart. These cords plug into the white neonatal BP cuff.

4. **Suction**
   a. Make sure you have appropriate size ETT suction catheters in your cart. 6FR for 3.0 ETT, 8FR for 3.5 ETT
   b. When suctioning out baby OGT/NG don’t place on full suction, this may cause trauma to the neonatal mucosa. Low suction at 30 is usually adequate.

5. **Machine**
   a. Replace the 2-liter ventilation bag with 1-liter bag.
   b. Discuss with your attending whether an active heated circuit is necessary for your case. (NB: do not turn the warmer on until the circuit is hooked up to the patient and ventilator is running. If warmer is on with no gas flow, it can superheat and scald the lungs.)
   c. **DO NOT** leave the vent on Volume Control settings with adult tidal volumes. Set the ventilator to Pressure Control Ventilation. Inspiratory pressure of 16 and a rate of 25 with PEEP of 4 is a good place to start. You will fine-tune the settings once you hook up the child to the vent.

6. **Airway**
   a. Blades: Miller 0 for most newborns. Miller 1 for infants over 3 months. Make sure a Miller 00 is in cart as well for extremely premature infants.
   b. 2.5 ETT for the smaller preemies. 3.0 ETT for term newborns – may have a leak but better to start small and upsize if needed. 3.5 ETT may be needed if the infants are big and have large leak around the 3.0 ETT. Have this range of uncuffed tubes and a stylette ready.
c. Infant size mask
d. Oral airway, variety of sizes
e. Make sure you have an LMA: LMA #1 if for 0-5 kg children, LMA #1.5 for 5-10kg children.
f. Smallest temperature probe.

7. Drugs (see table above for doses)
   a. Succinylcholine 1 cc syringe with 22g needle in case you need to give IM.
   b. Atropine 1 cc syringe with 22g needle. Dose is 0.02mg/kg (though some pediatric anesthesiologist insist on giving a minimum dose of 0.1mg to avoid a theoretical paradoxical slowing of the heart rate).
   c. Propofol in 3 cc syringe
   d. Cisatracurium or Rocuronium in a 1 cc syringe
   e. NS in 10 cc syringe x 2. For testing IV and flushing meds.
   f. Narcotics: check with your attending, case dependent
   g. Cefazolin dose 25 mg/kg
   h. Epinephrine: check with your attending. Resuscitation dose is 10 mcg/kg for full cardiac arrest. It is prudent to keep a syringe of Epinephrine diluted to 1 mcg/cc for high-risk cases (Dilute to 4 mcg/mL by mixing 1mg into a 250mL NS bag. Dilute further for 1mcg/cc).
   i. Local anesthestic- check with your attending if performing a caudal, case dependent.

8. IV fluids
   a. Continue the Dextrose infusion the NICU started. If the infant does not have a source of glucose, start one. Maintenance fluids generally are 4cc/kg/hr for the first 10 kg though you may notice some neonates receiving more than that from the NICU.
   b. If you need to start an IV, have 24G and 22G IV’s, a primed long “T-connector”, and a small tourniquet (cut the adult tourniquet in half twice, length and widthwise).
   c. NO BUBBLES! Need to be careful when setting up and before your start as air bubbles can develop with the warming room.
   d. Talk to your attending about how to set up the IV infusion. Some attendings do not hook fluids directly to patient for bolusing, instead bolusing with a syringe via stopcock as needed. Plasmalyte is the preferred crystalloid and can be found in the pyxis in the anesthesia workroom at UCSD.
Welcome

Welcome to Rady Children’s Hospital, San Diego (RCHSD). This information package is designed as an introduction to your rotation.

Overview

At Rady Children’s Hospital, residents complete training in all aspects of pediatric anesthesia. Rady Children’s is the only major pediatric regional referral center in a two county area. There are approximately 1100 trauma activations yearly, 600 cardiac catheterizations, 400-500 complex open- and closed- heart surgeries, 400-500 neurosurgical cases and more than 20,000 total surgeries/year. This is a high-volume, high acuity experience where residents work one on one with pediatric anesthesia attendings in the operating room and outlying areas. Residents may also gain experience rounding with the pediatric acute pain service during their rotations.

Rady Children’s Hospital is unlike any other institution you have rotated to. Most of the hands-on medicine is practiced either by the attending medical staff directly or in immediate attendance, rather than by the resident trainees (there are 17 sites running each day with only 3-4 residents rotating at a time). This should not be misconstrued as meaning that you will not be allowed close contact with the patients, but rather that your contact may at times be more closely guided and supervised than in your individual training programs. This is to your benefit, as it allows you to be led through difficult cases by individuals who have been through similar cases many times before, rather than having to “sweat it out on your own”. As you become more comfortable with the rotation and get to know the attendings, your level of independence will increase appropriately. Any problems with too little or too much independence should be addressed with Alyssa Brzenski or Karim Rafaat (UCSD Residents) or Josh Gordon (Navy Residents).

Preoperative anesthesia evaluation is generally done immediately before each procedure in the pre-op area (bays labeled ‘P’). Once you have observed your attending’s preoperative evaluation style, you may then perform preoperative evaluations on your own or with the attending present depending on their preference and your experience – ask your attendings about this. You will have the opportunity to observe many different styles of interaction with both parents and children and then to develop your own style as your rotation progresses.
**Teaching Program Overview**

Because the time allocated to pediatric anesthesia during your residency training is limited, for many of you the majority of your pediatric experience will be obtained during your rotation at Rady Children’s. The UCSD and Navy resident lecture series covers fundamentals of pediatric anesthesia, which will then be reinforced at RCHSD on a daily basis.

1. **Conference Attendance**: UCSD and Naval Hospital residents are excused to attend their departmental M&M conferences on Wednesday and Friday mornings respectively. UCSD residents are also excused from Children’s to attend all UCSD educational conferences, including days they are the diamond/call resident (see below). Additionally, each week there will be 3-4 morning conferences that will occur before the first case start on Mondays, Tuesdays, Thursdays and Fridays. The conference format is interactive with residents responding to an oral board exam type question covering a classic peds topic. At the end of each conference a brief PowerPoint presentation will reinforce epidemiologic and management details of the conference’s case. The morning conference schedule will be given to residents on a weekly basis.

2. **In-Room Didactics**: It is impossible to cover all of the areas pertinent to the practice of pediatric anesthesia in a limited didactic series or in morning case conferences. As such, we strongly recommend that you seek out your daily attendings for mini-lectures as they relate to interesting cases encountered during your rotation. Days that you are caring for ‘adult-sized’ healthy children, which should be rare, ask your attending for oral board exam question/answer sessions on classic pediatric anesthesia topics or ask them questions you have had from other pediatric cases.

3. **Journal Club**: Pediatric anesthesia journal clubs are held quarterly throughout the year. Attendance at these during your rotation will be required and you may have presentation responsibilities as well. If you are presenting, a faculty member will assist you with your preparation.

4. **Required Reading**: Prior to your first day at RCHSD, read this syllabus and also the pediatric anesthesiology chapter in either the Miller or Barash textbooks. During your rotation, use the pediatric anesthesia texts available in the anesthesia office to read in more depth about specific cases or topics as you encounter them (see partial textbook list below). During the two months of your RCHSD pediatric anesthesia training, budget yourself enough time to read an entire pediatric anesthesia handbook at a minimum. There are also journal articles included in this syllabus to balance your reading. The following is a list of recommended manuals and textbooks:
**HANDBOOKS:**


**TEXTBOOKS (found in RCHSD in anesthesia office, do not remove):**

*Practice of Anesthesia for Infants and Children*. By Cote, Lerman, Todres

*Pediatric Anesthesia*. By Gregory

*Smith’s Anesthesia for Infants and Children*. By Motoyama

*Pediatric Cardiac Anesthesia*. By Lake

*Smith’s Recognizable Patterns of Human Malformation*. By Jones

3. **Clinical Experience:** As previously mentioned, you will provide anesthesia services for a full range of pediatric cases at RCHSD. There are a number of anesthetizing locations in which you should gain exposure, including ‘day surgery’ cases (e.g. tonsils, ear tubes, eyes, dental), more complicated cases in the main operating rooms, general anesthetic and sedation services for satellite anesthetic care, including CT scans, MRI scans, invasive and non-invasive radiologic procedures, hematology/oncology procedures and cardiac catheterizations.

The day surgery cases (e.g. tonsils, ear tubes, eyes, dental) provide an excellent opportunity to obtain technical skills, such as mask inductions, intubation and laryngeal mask airway skills, and IV placement. In the rest of the operating rooms, cases are generally more complex and of longer duration. In addition, the patients frequently have medical conditions necessitating a higher acuity of care and/or inpatient management. There is a greater opportunity for more advanced skills training in the main operating suites, including regional anesthetic techniques, nasal intubations, single lung ventilation and invasive line placement. Because these cases may be of longer duration, this is an excellent opportunity to work with the attending anesthesiologist for case discussions and in-room mini-didactics as they pertain to the cases encountered.

Each month, Josh Gordon assigns the residents a call schedule. Days you are on call, you should still be involved in educational pediatric anesthesia cases and have quality teaching in the operating room, let us know if that is ever a problem. We strongly recommend that on non-call days you divide your time equitably between day surgery cases, inpatient and main operating room cases, and satellite anesthetics, in order to gain a broad
exposure to the practice of pediatric anesthesia. If the end of your month is nearing and you feel you have missed certain types of cases, contact Alyssa Brzenski, Karim Rafaat or Josh Gordon to help you get the experience you need.

Finally, one of the more challenging aspects of pediatric anesthesia is the management of infants under one year of age, especially airway procedures and those requiring surgery for neonatal surgical emergencies. We strongly encourage you to be involved in as many of these specific types of cases as possible during your rotation at RCHSD.

After the first month of your rotation you may participate in the heart room cases, but you should discuss your participation in the heart room with the cardiac anesthesiologist in advance. If you would like help with this, please contact Drs. Brzenski, Rafaat, or Gordon.

We also run an active acute pain service managing components of pain therapy such as epidural catheters, patient controlled analgesia, and opioid weaning. Rounds are made daily by the pain nurse practitioner and an anesthesia attending. The pain attending for the day is listed at the top of the daily OR schedule. If you are interested in learning about pediatric pain management, please contact the attending the day before you plan on joining them for rounds. You should do this at least two days during your first month at RCHSD.

4. Morbidity and Mortality Conference: The department holds an M&M meeting once a month on a Friday morning at 0700 at room 403 in the 3030 Medical Office Building. The announcement is usually made the Thursday before. It is a lively, educational, and fun experience as interesting cases are discussed.

5. Learning Objectives: Learning objectives are listed elsewhere in this syllabus. The goals for clinical skills/patient care are different for CA-2 and CA-3 residents.

Physical Plant – Where to Find Us

Children’s Hospital is located between Highways 163 and 805, and is reached by exiting 163 at Genesee Avenue heading east and following the signs to Children’s Hospital. Park in the employee parking (#3 on the map below) lot across from the ‘New Pavilion’ on the east side of Children’s Way. Parking is free but you need to use a proximity card to enter and exit the parking structure. The proximity card is also used to open various doors in the hospital and you should arrange to receive it from the previous month’s resident.
Acute Care Pavilion (ACP): #4 on Map is where all of the Operating Rooms are now located on the first floor. See more detailed map on next page. Entrance is across the street from the Employee Parking (#3) and next to the Rose Pavilion.

Outpatient Procedures Center (OPC): 3rd floor of Hahn Pavilion above the cafeteria.

Cafeteria: 2nd floor of Hahn Pavilion (Orange on map) in the Northeast corner near the walkway from the Medical Office Building (walkway is Yellow on map).

Cardiac Cath Lab: 3rd floor of Nelson Pavilion (brown area labeled 3).

Sharp MRI: access from basement walkway between RCHSD and Sharp Memorial.

ACP MRI: in basement of Acute Care Pavilion (i.e. under operating rooms).

PICU: 3rd floor of Rose Pavilion near walkway from ACP.

NICU: in both ACP and 3rd floor of Nelson Pavilion.
First Day

We strongly suggest that everyone check with their fellow anesthesia residents who have rotated at RCHSD to get a general lay of the land prior to coming. The operating rooms generally start at 7:30 AM. Certain cases may start earlier, such as complicated spine cases and cardiac cases, which may start at 7:00 AM.

On your first day, arrive in time to find the operating rooms and make it to morning conference (you will be given a schedule and location prior). You should already have received a proximity card from the previous resident to enter the locker rooms. If you have not already done so, arrange to meet one of the other residents to show you where to go and what to do. Subsequently, you may check in with one of the anesthesiologists in front of the OR board, so that you can locate the attending to whom you have been assigned.

**ID Badge:** On your first day, go to the Occupational Health Trailer between 7AM and 4PM (Building #17 West of Rose pavilion – labeled on campus map above). Your ID should be waiting for you. It is without a picture so you will wear it along with your home institution’s picture ID.

**Assignments and Responsibilities**

As mentioned previously, in general we leave the selection of cases to the residents with a few exceptions. Residents should arrive no later than 07:10. If you have planned to participate in one of the cardiac or major spine cases, it is expected that you would arrive at least 20 minutes prior to the scheduled start of that case to meet with the attending or for room preparation. As mentioned above, the UCSD and Navy programs have morning departmental M&Ms (Wed UCSD/Fri Navy), and it is anticipated that you will participate in those sessions at your home institution and, following those sessions, will come to Children’s to start your day. You are expected to arrive by 08:30 in the morning on those days. On Wednesday afternoons the University program also has teaching conferences at 3PM and sometimes there are visiting professor conferences. It is expected that you will participate in all UCSD educational conferences even if you are the diamond (i.e. call) resident for that day; though after conference you should call the attending running the floor (858-576-1700 ext 5569) to ask if the attending needs you to return. Exceptions to attending the UCSD educational conferences should be on the order of an active OR resuscitation where you are critically needed or some other unusually educational case that you are actively participating in. If you do miss a UCSD educational conference, you are requested to call or send an e-mail explanation to Drs. Brzenski and Rafaat. When not on call, it is expected that the anesthesia residents will stay until 4:00 to 5:00 in the evening.
Call - If you are on call, aka the “Diamond” resident, check in with the anesthesia floor person/board runner (858-576-1700, ext 5569) for which cases would be most appropriate for you. If no one is yet running the board, pick a room you want to be in and bring them the 5569 phone from the OR front desk. When there are 3 or more residents rotating, the diamond resident usually stays until 7pm and should then be available by pager overnight. If there are 2 or fewer residents, the diamond resident stays until 5pm, and should be available by pager overnight. If you are called in or if you work past 9pm you get the following day off. However, before you leave that night, please make a note on the board so the anesthesiologist running the floor the following day knows why you are absent. On weekends and holidays, the Diamond resident should arrive for work at 0740 and stay until the cases are done or 8pm. The resident will then be available by pager. Prior to coming in on weekends/holidays, call 858-966-5856 to make sure there are cases scheduled (i.e. to make sure you have to actually come in to the hospital).

Days Off or Leaving Early - We understand that sometimes you need to leave early for various reasons—medical appointment, childcare issues, illnesses. We try to be flexible. We do ask that you let Drs. Brzenski, Rafaat, and Gordon know as soon as possible of your scheduling requests (joshgordon2@mac.com, krafaat@ucsd.edu and abrzenski@ucsd.edu). On the day you need to leave early, please talk to the floor runner (858-576-1700 ext 5569). The same is true if you are arriving late.

Conclusion
We hope that your experience at Rady Children’s Hospital is enjoyable. Please let us know if you have any feedback or concerns during your time here.
Pediatric Radiation Oncology at Moores Cancer Center
By Sidney Merritt MD

Introduction: You’ve learned all of the steps for how to deliver a safe, effective anesthetic to adults having surgeries. Taking care of the children receiving radiation therapy will be a different experience, a type of anesthetic that you probably haven’t done before. Read on.

Time: The radiation therapy cases generally start at 0800, but check the daily schedule; sometimes there will be a different start time. You should arrive at the Moores Cancer Center early enough to complete your set-up and pre-op charting by that time.

Location: 3855 Health Sciences Drive, right next to the Shiley Eye Center. Parking (by A or B permit) is either just east of the cancer center on heath sciences drive, at Thornton, or at the Shiley.

Arrival & Setup: The children are anesthetized in the La Jolla room. When you enter the building, go to your left and through the patient waiting area. After you go through the door next to the receptionist make a right then a left and the treatment room is right there. The radiation therapists are very helpful and will answer any questions or point you in the right direction.

Monitors/Machine: There is a machine in the corner of the room, often covered by a white sheet. Most days we leave it where it is, although you should check the machine out at least once during your rotation, to be sure it is in good working order.

The monitor is in the pre-op area. Bring it to the treatment room, place it on the treatment bed, facing the patient, and go to “Profiles” at the top and choose “peds.” You will have to hit a “confirm” button for it to register. Lay the monitors out for easy application. The EKG leads (disposable,) are in the cart. Make sure the proper BP cuff is on the monitor.

If a mask induction is planned for the day, bring the machine to the opposite side of the treatment bed and plug it in. Unwind the oxygen and suction lines and connect them to the wall ports (you’ll have to remove the existing oxygen and suction implements first.) Turn on the machine and check the circuit. Be sure to check the oxygen machine on the back--there has been a loss of central oxygen pressure at least once at Moore’s during a case. Be sure to have a ventilation mask that is of appropriate size for the patient.

MRI cart: Is located in a treatment room on the right as you head into the recovery area (if you’ve reached the CT scanner you’ve gone too far.) Take the cart to the La Jolla room and put it next to the wall to the left of the treatment table. The nurses can give you alcohol pads, flush syringes, regular syringes and the other supplies found on the cart if it needs to be stocked.
Medications: Make sure there is unexpired succinylcholine, rocuronium, atropine, and epinephrine in the drawer, but DO NOT OPEN THEM.

Draw up propofol in 10 mL syringes, normally one syringe for each patient of the day. Label everything you draw up with a date/time.

Most patients do not need Zofran, but if they are currently nauseous, on chemo, or getting radiation to the abdomen then prophylactic Zofran is indicated (0.1 mg/kg.) Make sure to check if the parent gave PO Zofran pre-op if the kid is already on it. If a parent requests Zofran, give it.

Put out one normal saline flush syringe and one heparin flush syringe (100 u/mL) for each patient (they are in the cart, pre-drawn.) Remove any bubbles from your syringes. If your medication supplies are running low, inform the Moore’s pharmacy tech (the RN will have the number.)

If a patient needs a narcotic or benzodiazepine, the Moore’s nurse can get those medications from the Pyxis. Draw up your dose and give her the remainder so she can waste it.

Airway: Make sure you have a working blade in the airway drawer (Miller 2 can be used for almost any patient and a Mac 2 is usually a good blade for most kids.) Be sure there are appropriate ETT available in the ETT drawer, but DO NOT OPEN ANY ETT TUBES unless you are about to intubate a patient. A 4, 4.5 and 5 cuffed tubes will work for the majority of our patients. If you open the ETTs, they get thrown out and then we don’t have them. (Same thing goes for stylettes and any medication that you are not actually planning to give to the patient. Don’t open anything unless you know you are going to use it.)

Look on the back of the anesthesia machine for a large clear plastic bag with the patient’s name on it. Inside will be her/his green facemask (also labeled with name) and CO2 line. Attach the mask line to the oxygen line and be sure that the oxygen is on at 2-4 liters/min. Connect the CO2 line to the monitor. Lay the oxygen facemask next to the head of the bed, ready to be used before or immediately after induction.

Be sure that you have a Mapleson circuit that you have checked (connect it to an O2 supply and be sure you can provide positive pressure with it, no leaks) with a properly sized mask. Attach it to an oxygen tank and put it somewhere near the head of the treatment bed. This will be your ventilation, should you need it. Remember, you need to have a way to quickly ventilate the patient if necessary.

Suction: Check the wall suction next to the oxygen outlet; be sure there is enough tubing to reach your patient and a Yankauer tip.

Pre-Ops: These patients have daily anesthetics for weeks, so there are plenty of old records to copy. On your first day, be sure to browse the chart and familiarize yourself with the patient. Under meds, do not write “see chart.” List the meds and ask the parent if any were taken pre-op (then check the boxes if so.) Do a brief physical exam,
listen to the heart and lungs and look for signs of a URI. Ask about loose teeth if the child is 5 or more years old. Offer to help the pre-op RN access the CVL (most children with ports will get accessed on Mondays and we pull the access on Fridays.) Ask the parent about NPO status, if there have been any problems with the anesthetics or radiation side effects, and if the child has been nauseous. If it is a Friday or the patient’s last treatment day, ask the parents if the child is scheduled for any labs or clinic visits that day. If so, don’t pull the port access at the end of the case. If the child is an inpatient at Children’s, they are supposed to come with the previous day’s progress note, recent labs, their med sheet and some kind of report of overnight problems and NPO status. This packet is called the “ticket to ride.” Please be sure that these records have arrived with the patient and review them. If the paperwork is not complete, please inform your attending ASAP so he/she can access the CH EPIC and get the proper records.

**Inductions:** Parents often carry the child to the treatment room. Once everyone is in the room, do a brief with the radiation therapist, put on gloves and wash the CVL or PICC line at least three times with alcohol swabs. Line sterility is very important for these children. They are often immune-suppressed; a line infection could mean an operation to replace their line or perhaps sepsis and death. (If the patient is small and has a large 2-lumen line, some attendings prefer to draw the heparin out with a 3 mL syringe before giving the propofol.)

Once the line is clean attach your propofol syringe, draw back to see if blood flows back, and give 2-3 mg/kg. If the line does not draw back at all then it is best to inject the propofol slowly and only give 2-3 mg/kg to be sure the line is in before giving more; we have had a couple of incidents where the port was no longer in place and we injected subcutaneous propofol (not ideal.) **Leave the propofol attached:** you will give more intermittently. Be sure to control the patient’s head as they are laid on the bed. Often patients go to sleep in their parent’s arms, but if you have a parent who hasn’t done this before then either put the child on the treatment table with the parent standing next to him/her (this is best for larger children anyway) or have the parent sit in a chair while holding the child. After several treatments, most kids become very comfortable with us and hop right onto the table with little fuss. We goof around, tell jokes, and blow bubbles to reduce stress for the patients. Feel free to be a little silly.

As soon as the child is laid down, step to the head of the bed and put oxygen on. Just hold it on the face, don’t put the strap around the head immediately. Position the patient in sniffing position if there isn’t immediate evidence of a good airway. **Remember: we don’t generally pre-oxygenate, so you must give oxygen ASAP.** Check your CO2 tracing—this is usually your most important and first available monitor. While you are doing this, your attending or the RN will put on the other monitors (sat, ECG, BP.) Once you have a confirmed good airway and proof of spontaneous ventilation you can push more propofol while the radiation therapists are positioning the patient for the treatment. Many of the patients have brain tumors and so wear tight plastic masks over their faces for the therapy. These hold the head in the exact same position for each day’s treatment. Tape the eyes and watch the airway while the radiation therapists put the mask on. You’ll have to move your O2
briefly but then you can put it on top of the treatment mask once they have finished. If you have a problem with the airway, have them remove their treatment mask. The radiation therapists will put a seatbelt over the patient, but it is **your responsibility** to be sure that this gets done. The table will be high in the air and you will be far away from the patient, so you don’t want to forget this step. If you have a sick patient or one with low sats pre-op, be more judicious with propofol dosing, make every effort to pre-oxygenate and put the monitors on before starting the induction. If you have reduced sat after induction but good spontaneous ventilation, double check the oxygen flow. Several times when this has happened the oxygen has been off or the tubing has been detached.

**Maintenance:** Once the radiation therapists are done with their set-up and the seatbelt is on, turn the monitor toward the camera so you can see it when you are outside. You may wish to give a 0.5-1 mg/kg propofol top-up dose before you leave the patient. Most patients get around 4-10 mg/kg total during a typical 20-minute radiation therapy case, but doses can vary even day to day on the same patient. Use your best clinical judgment. During the treatment, the radiation therapists will go into the room several times, to adjust things or move the treatment table (these are called “couch kicks.”) Whenever anyone goes into the room, you go with them. Whenever the radiation therapists are doing stuff to the patient, you should be ready to give more propofol, move the monitors as they turn the table, whatever. Whenever you are able to be with the patient, be there. If you are out of the room, keep a constant eye on the child through the TV monitor.

**Post-treatment:** When the therapy is finished, push the gurney into the treatment room. Give the zofran if appropriate, wash the outside of the line again to remove any propofol and then flush the line with 10 mL of normal saline flush to clear any residual propofol on the inside of the line (this can be a nidus for infection.) After this step, attach the heparin flush syringe (100 units/mL) push 2.5 mL, then clamp your line. If it’s Friday and the patient has a port, you can remove it at this time (as long as the child has had no complications, is perfectly stable, and isn’t going to clinic later.)

If the child has a double-lumen CVL you can do the same procedure (wash three times, flush) to the other line so the parents won’t have to do it at home (make sure you tell them that you did it.) If the patient has a large double-lumen line (Broviac or Hickman) and is small (<15 kg) then I prefer to draw back the heparin with a 3 mL syringe before induction (just draw back until you see frank blood.) Be sure to wear gloves whenever you handle a line.

When the line care is done, take the tape off the eyes and transfer the patient and the entire monitor to the gurney (the lateral decubitus position is a great position for transport.) Leave the O2 mask on so that you have CO2 monitoring and you can readily give O2 if the sats are < 95% on RA. Take him/her to recovery area and stand by until wake-up. Check your charting and make sure you have written in all medications and flushes given, all line care, vital signs for the entire anesthesia time, and any other relevant info. Don’t separate the record until the attending has signed.
Once the patient is responsive, go and set up for the next case. Return the previous patient’s mask to his/her bag behind the anesthesia machine and get the next mask out. Be sure the set up is still good and that the next meds are ready. If there is a second monitor available you can set it up, but we often use the same one as the previous patient. If you take the monitor off the previous patient, you can wash down the cords/cuff with the wipes provided. The RN usually does this, but you can be helpful by doing this task if she is busy.

**Radiation Oncology Simulations:** These are basically CT scans that are done for planning new patients’ radiation courses. The scanner is off of the recovery area.

If the patient doesn’t have a line yet and needs a mask induction, you’ll need to bring the anesthesia machine down the hall to the CT. You’ll need to put the machine on the opposite side of the CT bed; the oxygen and suction ports are back there. Make sure the radiation therapist has raised the CT bed and moved it as far as possible into the scanner so you don’t ding it with your machine. IV supplies are in the drawer of the MRI cart; just put out a short IV connector with a flush attached along with your IV supplies. We generally use the 24 and 22 size IVs.

If the patient has a central line, just set up as usual, with the monitor, MRI cart, mapleson circuit available, and a new green oxygen mask (you can write the new patient’s name on it with a Sharpie and get a plastic patient bag from the nurses to keep it in.) Be sure to put a CO2 line on the new mask.

Simulations take about 30-45 minutes, and we generally just do propofol boluses for those as well. Setting up a propofol infusion uses a lot more stuff that we then have to throw away and also keep stocked (big syringes, stopcocks, tubing, pump, batteries) plus boluses work very well. We use bolus doses except during long total-body irradiation cases where infusions are necessary because we’re out of the room for long stretches.

**Final Thoughts**

**Parents:** These are people who are in probably the most stressful situations of their lives. Please be empathetic and unfailingly polite and kind. Anything they request within reason please try to do. Don’t take abuse or allow unsafe behavior of course, but otherwise try to be flexible and unflappable when dealing with these families.

**Children:** You will likely spend about two weeks with these children. Some of them are terminally ill and they are delightful, wonderful children. This can be a difficult assignment emotionally. Try to take comfort in the fact that you are providing the best possible care in the worst of situations. We try to enjoy our time with these children and make them laugh. We play the Chipmunks during inductions, tickle, play peek-a-boo, admire light-up tennis shoes and so on. If you are talented in this area, here is your chance to shine. Families have given us feedback that they feel supported when they come to Moores and that the fun, loving atmosphere makes the treatments easier for their children. Please talk to your attending if you are feeling overwhelmed in caring for these children.
If you have any questions or concerns about the cases or the process, please call your attending or the resident who just completed the rotation for specific information.

**Radiation Therapy daily checklist:**

- MRI CART IN TREATMENT ROOM
- DRAW UP 10 ML OF PROPOFOL, CHECK OTHERS MEDS
- MONITOR ON BED, SET TO Peds
- O2 MASK AND CO2 LINE SET UP
- MAPLESON/O2 TANK SET UP
- AIRWAY SUPPLIES AVAILABLE
- SUCTION AVAILABLE WITH LONG ENOUGH REACH
- PRE-OP FILLED OUT
- NPO CONFIRMED, PATIENT STATUS ASSESSED, PROBLEMS ADDRESSED
F. **JOURNAL ARTICLES (PDFs provided separately) -**
(https://www.dropbox.com/sh/tbb2lj11up2azj0/TkLGmARt4o)

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