MESSAGE FROM THE CHAIRMAN:

SCOTT T. REEVES, MD, MBA

I can’t believe that I’m writing the final opening statement for 2013. Where has the year gone? As the weather starts to get cooler, we find ourselves in the middle of interview season. This year we have an incredible group of resident and faculty applicants. I would encourage everyone to take a few minutes to get to know them. The future of our specialty is bright.

It is also a time of year when we stop and give thanks for all the blessings we have had over the past year. December for me is always hectic, but it also allows for a much needed period of rejuvenation as the operating rooms and clinics are a little slower. I enjoy the increased traffic in our house as my children are home from college.

I hope all of us make fond memories this holiday season, and look forward to all of us being together at our annual Christmas party on December 7th.
Academic clinical departments rest on three legs, and if each of the three legs are not equivalent or nearly equivalent then the platform is tilted or unstable. The three legs are, and always have been: education, clinical care and investigation. Our Department has a strategic plan that emphasizes the importance of research and more importantly how we plan to accomplish it.

The mission of our departmental research is to add new, important scientific knowledge to medicine through clinical, translational and basic science investigation.

**Strategy to accomplish the mission:**

- A departmental research center has been organized whose overall purpose is to improve faculty investigation by providing resources:
  - Biostatistician
  - Nursing and technical support
  - Coordination of faculty with mentors (in and outside the department)
  - Senior expertise in clinical research design, grant writing, manuscript writing
  - Hosting a vibrant interactive research conference monthly

- Capitalize focusing on existing areas of departmental and institutional strength:
  - Novel and improved approaches for perioperative pain management
  - Novel approaches to improve fluid and perioperative care with novel protocols
  - Human factors research, innovative operating room and intensive care unit design and management
  - Uses of medical simulation to improve patient safety and clinician education
  - Encourage research pods in areas of common interests

- Attempt to align with and leverage with COM’s Research Strategic Plan (Genetics/Genomic Medicine, Population Science, and Public Health)

The above center is operational and some faculty are availing themselves of the departmental resources and expertise. There is room for more to join this career stimulating area. To measure the effectiveness of departmental research, the following benchmarks have been agreed to accomplish.

**Benchmarks:**

- Increase number of departmental research projects and number of members participating
- Examine the functional success of the formal mentoring program and mentoring “pods”
- Increase peer-reviewed publications
- Increase extramural funding
- Increase job and personal satisfaction attributed to creation of and participation in research activities
THE RESEARCH STRATEGIC PLAN UPDATE CONTINUED...
BY: J.G. REVES, MD AND SIMONE CHINNIS, RN, MBA

Using the above benchmarks in key areas we have the following data:

<table>
<thead>
<tr>
<th></th>
<th>2011-2012</th>
<th>2012-2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRB Approved Projects</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>Pending IRB Projects</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Approved studies funded</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Active Investigators</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Number of extramural grants</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Amount of extramural S’s</td>
<td>$172,394.00</td>
<td>$404,957.00</td>
</tr>
</tbody>
</table>

The above shows some growth and about 15 faculty active in this arena. Research has never been one of the strongest areas in our department when compared with clinical care and education. To continue to improve we are working with the Chair of the department and others to facilitate this vital activity. The research work group understands that it is necessary that resources such as seed funding, investigator time, and personnel be available to accomplish the goals.

Readers are encouraged to go to the departmental website to learn about our research: (http://clinicaldepartments.musc.edu/anesthesia/research/)

Another website with tools for the investigator is: http://clinicaldepartments.musc.edu/anesthesia/research/preparingaproposal.htm

To help implement our plans, we have formed a departmental operations committee that consists of the following: Jerry Reves, MD (Interim Research Director), Jake Abernathy, MD, Jeff Borckardt, PhD, David Chandler, MBA, Simone Chinnis, RN, MBA, Larry Field, MD, Alan Finley, MD, Will Hand, MD, Latha Hebbar, MD, Julie McSwain, MD, Horst Rieke, MD, and Sylvia Wilson, MD.

An important new initiative of the work group is to incorporate a “kick this idea around” session at each monthly research department meeting where anyone is invited to get feedback on a new research idea. Please plan on attending our monthly meetings the first Thursday of each month.
October 1, 2013 marked the opening day for the new pediatric cardiac catheterization lab at MUSC. This lab has been two years in the planning and building. The pediatric cardiac anesthesia group has been integral in the planning of the unit. More than 90% of all pediatric cardiac cath procedures are performed under general anesthesia. In the new hybrid pediatric cath lab, the work area and equipment used by the anesthesia team is on par with or better than most pediatric operating rooms!

A hybrid cath lab fuses a pediatric cardiac operating room with a pediatric cath lab. Complex combined surgical and catheter based interventions can be performed in these procedural areas. The hybrid cath lab in the Children’s Hospital utilizes latest generation Toshiba fluoroscopy and angiography technology for high resolution cardiovascular imaging. Numerous large high resolution displays permit simultaneous viewing of physiologic data, fluoroscopic/angiographic imaging, and echocardiographic imaging.

The first combined surgical-endovascular intervention was performed in the new lab on November 14. At that time a neonate underwent pulmonary artery banding and ductus arteriosis stenting to palliate hypoplastic left heart syndrome. “Hybrid procedure” is the common vernacular for that intervention. The Children’s Hospital pediatric cardiac team performs the “hybrid procedure” for those neonates considered too high risk to undergo the conventional Norwood operation. At MUSC we perform approximately six “hybrid procedures” per year.

The new pediatric cath lab is used daily for diagnostic and interventional procedures. A second renovated and completely refurbished pediatric cath lab is due to be opened in February 2014. The second new pediatric cath lab will be designed primarily for electrophysiological studies and cardiac ablation. Diagnostic and interventional procedures can be performed in the second lab thereby doubling our capacity and operational flexibility.

These new, state-of-the-art facilities are definitely “changing what’s possible” for children with congenital heart disease.
MUSC’s new state-of-the-art Hybrid Operating Room gives our patients advanced treatment options and gives our surgeons increased flexibility by coupling traditional surgical capabilities with the latest imaging modalities.

By investing in the newest technology, MUSC continues to set an elite standard of care for our patients, changing what’s possible in heart and vascular care.

What is a Hybrid OR?

- Merges minimally invasive and traditional surgical sciences with advanced imaging technology.
- Cardiologists can perform traditional diagnostic functions of cardiac catheterization lab or interventional radiology suites with traditional surgical functions of the operating room.
- Provides real-time intra-operative image guidance to evaluate, intervene and assess the results of minimally invasive procedures, complex minimally invasive procedures and open surgical cases.
- Creates an environment where interventional approaches can be performed under even the most complex conditions, including patients who are considered high risk.
- No delays in converting interventional procedures to open surgery.

Benefits of a Hybrid OR

- Gives patients and their doctors a less invasive approach to treating cardiac problems, leading to improved outcomes and safer procedures.
- Patients who undergo procedures in the Hybrid Operating Room typically experience less trauma, less scarring, a shorter hospital stay and faster rehabilitation.
- Supports a multi-disciplinary approach to treat multiple medical issues in a single episode of care.
- Limits additional procedures with a goal to ultimately reduce hospital stays and possible complications or infections.

OR 10 opened in September, 2013 after years of planning. Thankfully, having experimented with several hybrid rooms both at University Hospital and Ashley River Tower, we were able to design and create a space that can be appreciated by all user groups. It is a space for collaboration amongst many teams. Large, well-placed monitors allow everyone in the room access to vitals signs and fluoroscopy images. Most importantly, the “anesthesia” space was greatly expanded – now one can actually maneuver around the c-arm.

Currently the room is utilized for endovascular surgery and the Transcatheter Aortic Valves. Soon we expect to be performing advanced procedures such as hybrid valve-coronary stenting. As the propaganda piece above states, OR10 provides MUSC with the equipment to push the envelope of advanced care for those adult patients with cardiac and vascular diseases.
Holiday Christmas Party, Carolina Yacht Club, December 7, 2013

Harbor lights will be brightly shining along the shore beckoning you to board ship and party all the more.

Department of Anesthesia and Perioperative Medicine
Medical University of South Carolina

Invite you and your guest
To celebrate the spirit of the season.

Carolina Yacht Club
50 East Bay Street
Charleston, South Carolina
Saturday, December 7, 2013
7:00 p.m.

CRNA Education Awards

Congratulations to Micki Ballister, RN for being selected by the MUSC Anesthesia Nurses class of 2013 as the overall clinical instructor of the year, in addition to being selected clinical instructor of the year for the main hospital Anesthesia Department.

Congratulations to Karin Bierling-Slowey for being selected by the AFN class of 2013 for the excellence in clinical instruction award at ART.
SUBSPECIALTY BOARD CERTIFICATION

It is with great pride that I announce that the following faculty have achieved subspecialty board certification by the American Board of Anesthesiology.

**Chronic Pain Medicine: Ryan Nobles, MD**

The pediatric certification examination was offered for the first time in September. I suspect we have the most board certified pediatric anesthesiologists in the state.

**Pediatric Anesthesiology:**
- 1- Cory Furse, MD
- 2- Marc Hassid, MD
- 3- Amanda Redding, MD
- 4- Scott Reeves, MD
- 5- Michelle Rovner, MD
- 6- Michael Sabbagh, MD
- 7- Gregg Schnepper, MD
- 8- Frank Stewart, MD
- 9- Ilka Theruvath, MD
- 10- Scott Walton, MD

MEET SYSTEMS ENGINEER, SPENCER CLARK WITH OCIO, WHO HAS JOINED JOHN FISHER’S TEAM TO SUPPORT THE DEPARTMENT

Spencer Clark is from Russellville, KY and attended Centre College in Danville, KY. He received two degrees, Mathematics and Computer Science, and graduated in June 2006.

After graduating from college, Spencer began his career at MUSC as a Field Engineer. Nine months after being employed, he was asked to join the Digestive Disease Center (DDC) to develop web based tools for collecting and reporting clinical data. During his stent with the DDC, he worked with vendors on beta products and analyzed process flow to improve efficiency. Spencer continued his career at MUSC as the lead developer for the eIRB application for the past two and a half years, and was responsible for all of the major upgrades and enhancements to production.

He is currently dedicated to being a part of the Enterprise Technology Architecture (ETA) team. Spencer will help to develop new enhancements and provide support to our OACIS and McKesson systems, as well as assisting in creating other tools.

The main focus of his work will be on the iPhone/iPad application for the Anesthesia Department and taking over for John Fisher in the development of the iVital application interface with Epic. Spencer Clark looks forward to meeting and working with all of the members of the Anesthesia and Perioperative Medicine Department.
The department has seen extensive growth in personnel over the past several years. We have attempted to improve communications through our departmental communication boards, *Sleepy Times*, and departmental meetings. Despite these efforts, it was felt by Wendy Ewing and me that the department could use a more robust process for discussing ways to improve group interactions and workflows at the University Hospital. As such, the faculty, residents and CRNAs were asked to nominate individuals within each group to serve on a new Anesthesiology Communication Committee. The following individuals were nominated and have agreed to participate:

**Faculty**
- Latha Hebar
- Tom Epperson
- Ryan Gunselman
- Ilka Theruvath

**Residents**
- Abdu Algendy
- Bryan Covert
- Ashley LaFevre
- Kam Wong

**CRNAs**
- Kim Saletan
- Mike Sloan
- Heather Highland
- Sam Tripp

The group will be meeting several times a month initially to discuss areas of excellence as well as areas where we as a department can improve on our modes of communication and workflows. It is expected that their efforts will result in improved patient care and work satisfaction. I want to thank you all for volunteering.

**CONGRATULATIONS TO KRISTIE DECOU, RN, WINNER OF THE ART OR SHARON BRINGEWATT AWARD**

Sharon Bringewatt was a former MUSC Main Operating Room Nurse Manager. After her death a Health Science Foundation fund was established in her memory. The Sharon Bringewatt Award for an outstanding Operating Room Nurse was established in 1989. This award was intended to be given annually to a deserving Operating Room RN for the purpose of funding personal educational growth. The OR RN recipient was to exemplify the best qualities of OR nursing leadership, teaching and mentoring, clinical expertise in surgical nursing and who serves as a role model for others.

Kristie Decou, RN and Tim Brendle, RN, Nurse Manager of Perioperative Services
PEDIATRIC PATIENT SAFETY CHECKLIST

Recently Michelle Rovner, MD has been working on making the Society of Pediatric Anesthesiology (SPA) patient safety checklists available in all pediatric anesthesia locations. The complete checklist is included in this edition of Sleepy Times and is attached as a PDF file. This document has been included as it is a powerful aid and would be excellent for faculty, CRNA, resident and SRNA education.

Cory Furse, MD has also sent out the following free phone application that deals with pediatric OR emergencies. I would encourage us all to download it to our smart phones and review its contents. It is a very powerful patient safety aid.

The app can be downloaded at:

For Apple devices:

For Microsoft devices (windows 8 only):

Note, the Microsoft version is a beta version. The full app will be developed in the future.
Air Embolism

Objective: Restore normal SaO2, hemodynamic stability, and stop source of air entry.

☐ Call for help. Notify surgeon.

☐ Increase oxygen to 100%.
☐ Stop nitrous oxide and volatile agents.
☐ Find air entry point, stop source, and limit further entry.
  ▪ Flood wound with irrigation
  ▪ Check for open venous lines or air in tubing
  ▪ Turn off all pressurized gas sources (laparoscope, endoscope)
  ▪ Lower surgical site below level of heart (if possible)
  ▪ Perform valsalva on patient using hand ventilation
  ▪ Compress jugular veins intermittently if head or cranial case
  ▪ Left-side down once source controlled

☐ Consider
  ▪ Vasopressors (epinephrine, norepinephrine)
  ▪ Chest compressions: 100/min; to force air through lock, even if not in cardiac arrest

☐ Call for transesophageal echocardiography (if available and/or diagnosis unclear).
PEDIATRIC PATIENT SAFETY CHECKLIST

Anaphylaxis

- Call for help.
- Increase oxygen to 100%
- Remove suspected trigger(s).
  - If latex is suspected, thoroughly wash area.
  - Ensure adequate ventilation/oxygenation.
  - Obtain IV access.
  - If hypotensive, turn off anesthetic agents.
- Rapidly infuse NS or LR (10-30 ml/kg IV) to restore intravascular volume.
- Epinephrine (1-10 mcg/kg IV as needed) to restore BP and ↓ mediator release.
  - Epinephrine infusion (0.02-0.2 mcg/kg/min) may be required to maintain BP.
- Adjuvants
  - Beta-agonists (albuterol 4-10 puffs as needed) for bronchoconstriction
  - Methylprednisolone (2 mg/kg IV, MAX 100 mg) to ↓ mediator release
  - Diphenhydramine (1 mg/kg IV, MAX 50 mg) to ↓ histamine-mediated effects
  - Famotidine (0.25 mg/kg IV) or ranitidine (1 mg/kg IV) to ↓ effects of histamine
- If anaphylactic reaction requires laboratory confirmation, send mast cell tryptase level within 2 hours of event.

Bradycardia: Unstable

- Call for help and transcutaneous pacer.
- Hypoxia is common cause of bradycardia.
  - Ensure pt is not hypoxic. Give 100% oxygen.
  - Go to “Hypoxia” card if hypoxia persists.
- Stop surgical stimulation. If laparoscopy, desufflate.
- Consider
  - Epinephrine 2-10 mcg/kg IV
  - Chest compression if ↓ pulses
  - Atropine (0.02mg/kg IV) if vagal etiology
- Assess for drug-induced causes
  - Beta-blocker overdose: Glucagon 0.05 mg/kg IV, then 0.07 mg/kg/h IV infusion
  - Calcium channel blocker overdose: Calcium chloride 10-20 mg/kg IV or calcium gluconate 50 mg/kg, then glucagon if calcium ineffective.
- If PEA develops, start chest compressions. Go to ‘Cardiac Arrest: Asystole, PEA’
PEDIATRIC PATIENT SAFETY CHECKLIST

Cardiac Arrest: Asystole, PEA

- Call for help.
- Designate team leader, assign roles.
- Give 100% oxygen. Turn off all anesthetic gases. Place pt on backboard.
- Start chest compressions (100 chest compressions/min + 8 breaths/min)
  - Maintain good hand position.
  - Maximize ETCO₂ > 10 mm Hg with force/depth of compressions.
  - Allow full recoil between compressions.
  - Switch with another provider every 2 minutes, if possible.
  - Use sudden increase in ETCO₂ for ROSC – do not stop compressions for pulse check.
- Epinephrine 10 mcg/kg IV q 3-5 min
- Check pulse & rhythm (q 2 min during compressor switch).
- No Pulse and Not Shockable: Resume CPR and checklist.

Read out H&Ts

<table>
<thead>
<tr>
<th>Hypovolemia</th>
<th>Tension Pneumothorax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxemia</td>
<td>Tamponade (Cardiac)</td>
</tr>
<tr>
<td>Hydrogen ion (acidosis)</td>
<td>Thrombosis</td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td>Toxin (anesthetic, β-blocker)</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>Trauma (bleeding outside surgical area)</td>
</tr>
<tr>
<td>Hypothermia</td>
<td></td>
</tr>
</tbody>
</table>

- Call for ECMO (if available) if no ROSC after 6 min of CPR.
- Notify parents/guardian that cardiac arrest occurred.

Cardiac Arrest: VF/VT

- Call for help and defibrillator.
- Designate team leader / assign roles.
- Give 100% oxygen. Turn off all anesthetic gases. Place pt on backboard.
- Start chest compressions (100 chest compressions/min + 8 breaths/min).
  - Maintain good hand position
  - Maximize ETCO₂ > 10 mm Hg with force/depth of compressions
  - Allow full recoil between compressions – lift hands off chest
- Shock 2-4 joules/kg
- Resume chest compressions x 2 min.
- Epinephrine 10 mcg/kg IV
- Check pulse & rhythm (q 2 min during compressor switch)

If shockable rhythm continues:
- Shock 4 joules/kg.
- Resume chest compressions x 2 min.
- Epinephrine 10 mcg/kg IV
- Check pulse & rhythm (q 2 min during compressor switch).
- Shock 4-10 joules/kg, continue chest compressions, and epinephrine 10 mcg/kg every 3-5 min.
- Amiodarone 5 mg/kg bolus; may repeat x 2
- Call for ECMO (if available) after 6 min of CPR
- Notify parents/guardian that cardiac arrest occurred.
PEDIATRIC PATIENT SAFETY CHECKLIST

Cardiac Arrest: Prone CPR

- Call for help.

Children/Adolescents
- No midline incision:
  Compress with heel of hand on spine and second hand on top

Infants
- Compress with encircling technique:
  - Thumbs midline if no incision
  - Thumbs lateral if incision

Midline incision:
- Compress with heel of each hand under scapula

Difficult Airway: After Induction

- Call for help.
- Increase oxygen to 100%.
- Get airway cart.
- Bag-mask ventilation
- Notify surgeon – may need to stop or cancel surgery. May awaken if surgery not started.
- If unable to mask ventilate, 2-hand if needed:
  - Add oral airway
  - Add nasal airway
  - Add LMA
- Regain spontaneous ventilation, if able; reverse neuromuscular blocker
- Alternative approaches for intubation:
  - Different blade
  - Different operator
  - Re-position head
  - Blind oral
  - Blind nasal
  - Video-laryngoscope
  - Intubating LMA
  - Fiberoptic scope
  - Light wand
  - Elastic bougie
  - Intubating styllet
  - Retrograde intubation

- If still unable to ventilate:
  - Consider possibility of invasive airway in early stage.
  - Emergency non-invasive airway (rigid bronchoscopy)
  - Emergency invasive/surgical airway
Pediatric Patient Safety Checklist

Fire: Airway

- Call for help.
- Stop all gas flow (O₂, N₂O)
- Disconnect breathing circuit.
- Pour saline into airway.
- Remove ETT.
- Remove sponges and other flammable materials from airway.
- Re-intubate and re-establish ventilation.
- If intubation difficult, don’t hesitate to obtain surgical airway.
- Consider bronchoscopy to assess for thermal injury, look for tracheal tube fragments, and remove residual material.
- Impound all equipment and supplies for later inspection.

OR Fire (non-airway)

- Call for help.
- Protect patient, contain fire.
- If drapes on fire, remove drapes from patient.
- Activate fire alarm.
- Stop medical gases.
- Declare team leader and define roles.
- Make one attempt to extinguish fire.
  - Use fire extinguisher or saline soaked gauze.
- If fire not extinguished on 1st attempt:
  - Remove patient from OR.
  - Confine fire by closing all OR doors.
  - Turn off O₂ gas supply to OR.
- Impound all equipment and supplies for later inspection.
PEDiatric Patient Safety Checklist

**Hyperkalemia**

**Serum K+ > 6 meq/L**

**Causes:**
- Excessive intake: massive or "old" blood transfusion, cardioplegia, "K+ runs"
- Shift of K+ from tissues to plasma: crush injury, burns, succinylcholine, malignant hyperthermia, acidosis
- Inadequate excretion: renal failure

**Manifestations:**
- Tall peaked T wave, heart block, sine wave, v fib or asystole

**Management:**
- **CALL FOR HELP!**
- Stop K+ containing fluids (LR/RBCs) ➔ Switch to NS/washed RBCs
- If hemodynamically unstable: initiate CPR/PALS
- Hyperventilate with 100% Oxygen
- Give: Calcium chloride IV 10 mg/kg; Insulin IV/SC 0.1 Unit/kg; Dextrose IV 0.25 -1 gram/kg; Sodium Bicarbonate IV 1-2 mEq/kg; Furosemide IV 0.1 mg/kg
- Dialysis if refractory to treatment
- Activate ECMO (if available) if cardiac arrest > 6 min

---

**Acute Hypertension**

**BP > 99 th %tile for age + 5 mmHg**

- Consider likely cause: Rule out medication error, light anesthesia, and other patient-specific factors.
- Ensure that correct BP cuff size is used with a cuff bladder width approximately 40% of limb circumference.
- 99 th %tile for BP is based on patient age and height.

<table>
<thead>
<tr>
<th>Action</th>
<th>Drug (IV Dosing)</th>
<th>99 th %tile systolic range (5 th – 95 th %tile height)</th>
<th>99 th %tile diastolic range (5 th – 95 th %tile height)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct smooth muscle relaxation</td>
<td><strong>Sodium nitroprusside</strong> 0.5-10 mcg/kg/min</td>
<td>1: 105-114</td>
<td>1: 61-66</td>
</tr>
<tr>
<td></td>
<td><strong>Hydralazine</strong> 0.1-0.2 mg/kg (adult dose 5-10 mg)</td>
<td>2: 109-117</td>
<td>2: 66-71</td>
</tr>
<tr>
<td>β-Adrenergic blockade</td>
<td><strong>Esmolol</strong> 100-500 mcg/kg over 5 min then 50-200 mcg/kg/min</td>
<td>3: 111-120</td>
<td>3: 71-75</td>
</tr>
<tr>
<td></td>
<td><strong>Labetalol</strong> (also α effect) 0.2-1 mg/kg q10 min or 0.4-3 mg/kg/h (adult dose)</td>
<td>4: 113-122</td>
<td>4: 74-79</td>
</tr>
<tr>
<td></td>
<td><strong>Propranolol</strong> 10-100 mcg/kg slow push (adult dose 1-5 mg)</td>
<td>5: 115-123</td>
<td>5: 77-82</td>
</tr>
<tr>
<td>α2-Agonist</td>
<td>Clonidine 0.5-2 μg/kg</td>
<td>6: 116-125</td>
<td>6: 80-84</td>
</tr>
<tr>
<td>Calcium channel blockade</td>
<td><strong>Nicardipine</strong> 0.5-5 mcg/kg/min</td>
<td>7: 117-126</td>
<td>7: 82-86</td>
</tr>
<tr>
<td></td>
<td><strong>Clevidipine</strong> 0.5-3.5 mcg/kg/min</td>
<td>8: 119-127</td>
<td>8: 83-88</td>
</tr>
<tr>
<td>D-1 agonist</td>
<td><strong>Fenoldopam</strong> 0.3-0.5 mcg/kg/min (max. 2.5 mcg/kg/min)</td>
<td>9: 120-129</td>
<td>9: 84-89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10: 122-130</td>
<td>10: 85-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11: 124-132</td>
<td>11: 86-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12: 126-135</td>
<td>12: 86-91</td>
</tr>
</tbody>
</table>
# Pediatric Patient Safety Checklist

## Hypotension

### Causes of Hypotension

<table>
<thead>
<tr>
<th>Preload</th>
<th>Contractility</th>
<th>Afterload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemia</td>
<td>Negative inotropic drugs</td>
<td>Drug-induced vasodilation</td>
</tr>
<tr>
<td>Vasodilation</td>
<td>(anesthetic agents)</td>
<td>Sepsis</td>
</tr>
<tr>
<td>Impaired venous return</td>
<td>Arrhythmias</td>
<td>Anaphylaxis</td>
</tr>
<tr>
<td>Tamponade</td>
<td>Hypoxemia</td>
<td>Endocrine crisis</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>Heart failure (ischemia)</td>
<td></td>
</tr>
</tbody>
</table>

### Treatment of Hypotension

- Inform surgeon and OR nurse
- Ensure oxygenation/ventilation
- Turn off anesthetic agents
- Verify patient is truly hypotensive, check cuff size and position
- Expand circulating blood volume (administer fluids rapidly)
- Trendelenberg position
- Place or replace IV; consider interosseous needle
- Start inotrope infusion (dopamine, epinephrine, milrinone) as needed
- Review ECG for rhythm disturbances or ischemia
- Send ABG, Hb, electrolytes
- Start vasopressor infusion: phenylephrine, norepinephrine
- Follow “Anaphylaxis” Card if appropriate.
- Administer steroids for endocrine crisis

## Hypoxia

### Hypoxia: All Patients

- Give 100% oxygen
- Check:
  - Oxygen flow
  - Airway patency
  - Breathing circuit connected and patent
  - Ventilation rate and depth adequate
  - Listen to breath sounds:
    - Wheezing
    - Crackles
    - Diminished or absent
  - Is pulse oximeter working correctly?
  - Presence of cardiac shunt
  - Possibility of embolus

### Hypoxia: Intubated Patients

- D islodged: Check ETT position
  - Mainstem
  - Not in trachea
- O bstructed: Suction ETT
  - Kinked
  - Mucus plug
- P neumothorax: Listen to breath sounds
  - Decompress with needle
- E quipment:
  - Check from patient to wall:
    - Oxygen flow
    - Valves
    - CO₂ canister
    - Inspect for disconnections and obstructions

**SaO₂** ↓ **PaO₂** ↓
# Pediatric Patient Safety Checklist

## Hypoxia: Loss of ETCO2

<table>
<thead>
<tr>
<th>Respiratory</th>
<th>Cardiac Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Give 100% oxygen</strong></td>
<td><strong>Embolus: air, blood, fat</strong></td>
</tr>
<tr>
<td><strong>Check:</strong></td>
<td><strong>Actions:</strong> See Air Embolism card</td>
</tr>
<tr>
<td>- Airway patency</td>
<td>- Inform surgeon</td>
</tr>
<tr>
<td>- Breathing circuit connections</td>
<td>- Flood surgical field with saline</td>
</tr>
<tr>
<td>- Kinked endotracheal tube</td>
<td>- Lower surgical site below heart</td>
</tr>
<tr>
<td>- Breath sounds and chest excursion</td>
<td>- Low cardiac output or cardiac arrest</td>
</tr>
<tr>
<td>- Bilateral sounds and chest movement</td>
<td>- Actions:</td>
</tr>
<tr>
<td>- Quality of breath sounds</td>
<td>- Follow PALS algorithm if cardiac arrest</td>
</tr>
<tr>
<td>- Presence of wheezing or crackles</td>
<td>- Give 100% oxygen</td>
</tr>
<tr>
<td>- Gas analyzer connections; power on?</td>
<td>- Support ventilation</td>
</tr>
<tr>
<td>- Ventilation rate (excessive?)</td>
<td>- Support blood pressure with IV saline (10-20 mL/kg bolus)</td>
</tr>
<tr>
<td></td>
<td>- Turn off anesthetic agents</td>
</tr>
</tbody>
</table>

## Local Anesthetic Toxicity

- Call for help.
- Stop local anesthetic.
- Request Intralipid kit.
- Secure airway and ventilation
- Give 100% oxygen.
- Confirm or establish adequate IV access.
- Confirm and monitor continuous ECG, BP, and SaO2.

Seizure treatment: midazolam 0.05-0.1 mg/kg IV or propofol 1-2 mg/kg IV. Treat resultant hypoventilation.

- Treat hypotension with small doses of epinephrine 1 mcg/kg.
- Monitor and correct acidosis, hypercarbia and hyperkalemia.
- Avoid vasopressin, calcium channel blockers and beta blockers.
- If cardiac instability occurs:
  - Start CPR
  - Start Intralipid therapy (see inset box)
    - Continue chest compressions (lipid must circulate)
- Consider alerting nearest cardiopulmonary bypass center and ICU if no ROSC.

### Intralipid Dosing
- Bolus Intralipid 20% 1.5 mL/kg over 1 min
- Start infusion 0.25 mL/kg/min
- Repeat bolus every 3-5 min up to 3 mL/kg total dose until circulation is restored
- Increase the rate to 0.5 mL/kg/min if BP remains low or declines
- Continue infusion until hemodynamic stability is restored.
- Maximum total Intralipid 20% dose: 10 mL/kg over first 30 min
**PEDIATRIC PATIENT SAFETY CHECKLIST**

### Loss of Evoked Potentials

- Notify surgeon.
- Turn off inhalation agent/N₂O and switch to propofol/ketamine infusion.
- Turn off or reverse neuromuscular blockers
- Increase perfusion pressure (MAP > 70 mmHg) using ephedrine (0.2 – 0.3 mg/kg IV) and/or phenylephrine (1-10 mcg/kg IV).
- Check Hb; transfuse RBC (10-15 mL/kg IV) if anemic.
- Ensure normocarbia: ↑ I/E ratio, ↓ PEEP
- Ensure normothermia.
- Consider wake-up test.
- Consider high-dose steroid for spinal cord injury:
  - Methylprednisolone 30 mg/kg IV over 15 min, then 5.4 mg/kg/h IV infusion.

### Malignant Hyperthermia

- Call for help.
- Get Malignant Hyperthermia (MH) Kit.
- Stop procedure if possible
- Stop volatile anesthetic. Transition to non-triggering anesthetic
- Request chilled IV saline.
- Hyperventilate pt to reduce CO₂; 2-4 times patient’s minute ventilation
- Dantrolene 2.5 mg/kg IV every 5 min until symptoms resolve.
- Assign dedicated person to mix dantrolene (20 mg/vial) with 60 mL sterile water.
- Bicarbonate 1-2 meq/kg IV for suspected metabolic acidosis; maintain pH > 7.2.
- Cool patient if temperature > 38.5°C.
  - NG lavage with cold water.
  - Apply ice externally.
  - Infuse cold saline intravenously.
  - **Stop cooling if temperature < 38°C**.
- Hyperkalemia treatment: (See ‘Hyperkalemia’ card)
  - Ca gluconate 30 mg/kg IV or Ca chloride 10 mg/kg IV;
  - Sodium bicarbonate 1-2 mEq/kg IV;
  - Regular insulin 10 Units IV with 1-2 amps D50 (0.1 units insulin/kg and 1 mL/kg D50)
- Dysrhythmia treatment: Standard anti-arrhythmics; do NOT use calcium channel blocker
- Send labs: ABG or VBG, electrolytes, serum CK, serum/urine myoglobin, coagulation
- Place Foley catheter to monitor urine output.
- Call ICU to arrange disposition.

MH hotline 1-800-644-9737
**PEDIATRIC PATIENT SAFETY CHECKLIST**

### Myocardial Ischemia

**Recognition**
- ST depression >0.5 mm in any lead
- ST elevation >1 mm (2mm in precordial leads)
- Flattened or inverted T waves
- Arrhythmia: VF, VT, ventricular ectopy, heart block

**Treat potential causes**
- Severe hypoxemia
- Systemic arterial hypo- or hypertension
- Marked tachycardia
- Severe anemia
- Coronary air embolus
- Cardiogenic shock
- Local anesthetic toxicity

**Diagnostic studies**
- 12-lead ECG:
  - II, III, aVF for inferior (RCA)
  - V5 for lateral ischemia (LCx)
  - V2, V3 anterior ischemia (LAD)
- Compare to previous ECGs
- Ped Cardiology consult; echocardiography

**Tachycardia**

**Diagnosis:**
- ST: narrow complex, p waves present before every QRS
- SVT: narrow complex, no p waves or p waves not associated with QRS
- VT: wide complex, polymorphic or monomorphic

**Treatment:**
- If no pulse present, start CPR, go to "Cardiac Arrest, VF/VT" Card
- If pulse present:
  - Narrow Complex
    - Vagal maneuvers
    - Apply ice to face
    - Adenosine 0.1-0.3 mg/kg IV push
  - Wide Complex
    - Synchronized cardioversion at 0.5 -1.0 joules/kg (see table)
    - Amiodarone 5 mg/kg IV bolus over 20-60 minutes, or
    - Procainamide 15 mg/kg IV bolus over 30-60 minutes, or
    - Lidocaine 1 mg/kg IV bolus

**Read out H&Ts**

<table>
<thead>
<tr>
<th>Hypovolemia</th>
<th>Tension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxemia</td>
<td>Pneumothrax</td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td>Tamponade</td>
</tr>
<tr>
<td>Hyperglycemia</td>
<td>Thrombosis</td>
</tr>
<tr>
<td>Hypeermothermia</td>
<td>Toxin</td>
</tr>
</tbody>
</table>

**VT, Wide-complex irregular rhythm**
- Biphasic 2 J/kg, then 4 J/kg for additional shocks

**SVT, tachyarrhythmias with pulse**
- Synchronized cardioversion 0.5-1 J/kg, then 2 J/kg for additional shocks
PEDIATRIC PATIENT SAFETY CHECKLIST

Transfusion: Massive Hemorrhage

- Call for help.
- Notify Blood Bank immediately of massive transfusion need.
  - RBC : FFP : Platelets = 1:1:1
  - Use un-cross matched O negative blood until cross-matched blood available
  - Give cryoprecipitate to maintain fibrinogen > 100
- Obtain additional vascular access if needed.
- Send labs q 30 min
  - Type & Cross
  - CBC, platelets, PT/PTT/INR, fibrinogen
  - ABG, Na, K, Ca, lactate.
- Warm the room
- Blood product administration
  - Use 140 micron filter for all products
  - Use a blood warmer for RBC and FFP transfusion (not for platelets).
  - Rapid transfuser pumps may be used when increased flow is needed.
- Monitoring for hypothermia, hypocalcemia, electrolyte, blood gas, and acid-base disturbances.
- Consider rFactor VIIa for refractory hemorrhage if above measures are not corrected.
- Terminate the massive transfusion protocol once bleeding is under control.

Transfusion Reactions

For All Reactions
- Call for help.
- Stop transfusion.
- Disconnect donor product and IV tubing.
- Infuse normal saline through clean tubing.
- Examine blood product ID; determine correct pt.
- Send product to Blood Bank.
- Document per Institutional Policy

Hemolytic - Hgbemia, Hgburia, DIC, ↓BP, ↑HR, bronchospasm
- Furosemide 0.1 mg/kg
- Mannitol 0.5 grams/kg (2 mL/kg of 25% mannitol)
- Dopamine (2.4 mcg/kg/min)
- Maintain urine output at least 1-2 mL/kg/h.
- Prepare for cardiovascular instability.
- Send blood and urine sample to laboratory.

Non-Hemolytic - ↓BP, bronchospasm, pulmonary edema, fever, rash
- Stop Transfusion
- Send blood to blood bank
- Treat fever
- Observe for signs of hemolysis

Anaphylactic - Erythema, urticaria, angioedema, bronchospasm tachycardia, shock
- Stop transfusion
- Support airway and circulation as necessary.
- Epinephrine 10 mcg/kg IV
- Diphenhydramine 1 mg/kg IV
- Hydrocortisone 2-5 mg/kg
- Maintain intravascular volume.
PEDIATRIC PATIENT SAFETY CHECKLIST

Trauma

Prior to pt arrival to OR:
- Assemble team and assign roles.
- Estimate weight and prepare emergency drugs.
- Gather equipment:
  - airway supplies
  - invasive monitors
  - fluid warmer
  - rapid infusion device
  - code cart with programmed defibrillator
- Type and cross blood products.

On pt arrival to OR:
- Maintain c-spine precautions for transport.
- Secure/confirm airway (aspiration risk, unstable c-spine).
- Ensure adequate ventilation (maintain PIP <20 cmH₂O).
- Obtain/confirm large-bore IV access (central or interosseus if peripheral unsuccessful).
- Assess circulation
- Persistent tachycardia, delayed cap refill, decreased pulse pressure = hypovolemia.
  - Bolus 20 mL/kg LR or NS (repeat x2) and/or 10 mL/kg RBCs or 20 mL/kg whole blood
- Place invasive monitors.
- Maintain normothermia.
- Rapidly treat associated conditions (acidosis, electrolyte disturbances).
- Continuously assess for secondary injury (ongoing blood loss)

Head Trauma

- Secure airway if GCS < 9, respiratory distress, hemodynamic instability, or elevated ICP.
- Maintain pCO₂ 30-35 mmHg and pO₂ >60 mmHg.
- Maintain cerebral perfusion pressure.
  - (MAP – ICP) > 40 mmHg and systolic BP > 5th percentile for age (see ‘Hypotension’ card)
  - Use CVP in place of ICP if no ICP monitor available.
- Treat elevated ICP with:
  - Hyperventilation
  - Propofol or etomidate
  - Mannitol (1g/kg)
  - Hypertonic saline (3% via central venous catheter; 4mL/kg)
- Maintain normoglycemia.
  - Avoid glucose-containing solutions if hyperglycemic.
GRAND ROUNDS FOR THE MONTH OF DECEMBER

“Quality in the OR, at MUSC and Beyond”  
December 3, 2013  
Dr. Danielle Scheurer, MD  
Medical University of South Carolina  
Associate Professor of Medicine

“Aging; A Neuroscientist’s Perspective”  
December 10, 2013  
Anne-Charlotte Granholm, MD  
Medical University of South Carolina  
Professor of Neurosciences

“What Accelerates Cognitive Impairment? Lessons Learned from a Middle-Aged Rodent Model: A Research Update”  
December 17, 2013  
Dorothea Rosenberger, MD  
Medical University of South Carolina
Future Events/Lectures

**I Hung the Moon**

Don’t forget to nominate your co-workers for going ‘Beyond the Call of Duty’. I Hung The Moon slips are available at the 3rd floor front desk, and may be turned in to Kim Crisp. Thanks so much!!

- Chris Hackney, MD; Robert Harvey, MD; Sam Tripp, CRNA; Shelley Richardson, CRNA; Erin Straughan, CRNA; Ray White, CRNA; and Pat Tobin, CRNA - “For staying late to finish complex cases!”
- Jim Richardson, CRNA; Kathy Comley, CRNA; Kim Saletan, CRNA; Regan Saxton, CRNA; Leslie Ancrum, CRNA; Christine Coe, CRNA - “Thank you for being a team player on a very busy day.”
- Rita Meyers, CRNA - “Coming in on her day off to help with breaks and lunches.”
- Ally Cleveland, CRNA - “Her willingness to put patient needs above her own, for staying late to help finish cases and for doing it with a smile.”
- Alan Finley, MD - “Helping out to finish and start cases during a busy day.”

**Holiday Party:** December 7, 2013

Location: Carolina Yacht Club, at 7:00pm

Please RSVP to Glennda Ross by December 3.

**December 2013 Standard of the Month**

Maintain a positive, willing and flexible attitude.

We Would Love to Hear From You!

If you have ideas or would like to contribute to *Sleepy Times*, the deadline for the January edition will be December 19, 2013.

**Holiday Party:** December 7, 2013

Location: Carolina Yacht Club, at 7:00pm

Please RSVP to Glennda Ross by December 3.

**December 2013 Standard of the Month**

Maintain a positive, willing and flexible attitude.

We Would Love to Hear From You!

If you have ideas or would like to contribute to *Sleepy Times*, the deadline for the January edition will be December 19, 2013.