Presentation of the Cardiac Surgery Simulation Syllabus to the Thoracic Surgery Directors Association

A Comprehensive 6 Module Curriculum for Simulation Based Training in Cardiac Surgery from the AHRQ Cardiac Surgery Simulation Training Grant

AHRQ Grant # 1R18HS020451-01

“Improved Patient Safety by Simulator Based Training in Cardiac Surgery”
AHRQ Cardiac Surgery Training Grant
AHRQ Grant # 1RH18RSO20451-01

• Collaboration of 8 institutions
  Cardiac Surgery Simulation Consortium

• $1,049,298 over three years

• 2 groups of 16 first year cardiothoracic residents - Total 32 residents
Improved Patient Safety by Simulator Based Training in Cardiac Surgery

AHRQ Grant # 1R18HS020451-01

INVESTIGATORS

Richard H. Feins, M.D.
Harold M. Burkhart, M.D.
John V. Conte, M.D.
Daniel Coore, PhD.
James I. Fann, M.D.
George L. Hicks, Jr. M.D.
Nahush A. Mokadam, M.D.
Jonathan C. Nesbitt, M.D.
Paul Ramphal, M.D.
Robert Shen, M.D.
Jennifer Dale Walker, M.D.

University of North Carolina
Mayo Clinic
Johns Hopkins University
University of the West Indies-Mona
Stanford University
University of Rochester
University of Washington
Vanderbilt University
University of the West Indies-Mona
Mayo Clinic
Massachusetts General Hospital
AHRQ Cardiac Surgery Simulation Grant

• Each center trained 1-2 first year cardiothoracic residents or advanced 1-6 residents in 3-4 hour sessions for 40 sessions each year covering 6 modules
• Each module ran 5-7 sessions
• Study included total 2 years of simulation experience
• All critical parts were videotaped
• All sessions conformed to the Cardiac Surgery Simulation Syllabus developed for the study by the investigators
1. Cardiopulmonary Bypass (CPB)

2. Coronary Artery Bypass Grafting (CABG)

3. Aortic Valve Replacement (AVR)
AHRQ Grant Simulation Modules
Significant Adverse Events

4. Massive Air Embolism (MAE)

5. Acute Intra-operative Aortic Dissection (AIAD)

6. Sudden Deterioration of Cardiac Function (SDCF)
Component Task Based Simulation Training in Cardiac Surgery

Procedure or Adverse Event

Component Task

Component Task

Component Task

Procedure or Adverse Event
Deliberate Practice

“a highly structured activity, the explicit goal of which is to improve performance”
Improved Patient Safety by Simulator Based Training in Cardiac Surgery
AHRQ Grant # 1R18HS020451-01

- 27 Residents participated
- Over 15,000 data points recorded
- Over 120 individual simulation hours per resident
- Over 3000 total simulation hours
- Component task simulators developed for all component tasks
- Extensive video library recorded
- Comprehensive curriculum syllabus written
Improved Patient Safety by Simulator Based Training in Cardiac Surgery

AHRQ Grant # 1R18HS020451-01

Simulation Syllabus for Each Training Session

- Overview
- Goals and Objectives
- Teaching Plan
- Simulator(s) Set-up
- Conduct of Simulation
- Assessment Tools
Syllabus

Improved Patient Safety by Simulator Based Training in Cardiac Surgery

A curriculum of surgery simulation to teach cardiac surgery skills and decision-making

Funded by U.S. Department of Health and Human Services (HHS)
Agency for Healthcare Research and Quality
Grant # R18HS020451

Investigators:
Richard Feins, M.D., University of North Carolina at Chapel Hill (PI)
Harold Burkhart, M.D., Mayo Clinic, Rochester, MN
Daniel Coore, Ph.D., University of the West Indies-Mona, Kingston, Jamaica
John Conte, M.D., Johns Hopkins University, Baltimore, MD
James Fann, M.D., Stanford University, Palo Alto, CA
George Hicks, M.D., University of Rochester, Rochester, NY
Jonathan Nesbitt, M.D., Vanderbilt University, Nashville, TN
Nabush Mokadam, M.D., University of Washington, Seattle, WA
Paul Raphael, M.D., University of the West Indies-Mona, Kingston, Jamaica
Robert Shen, M.D., Mayo Clinic, Rochester, MN
Jennifer Walker, M.D., Massachusetts General Hospital, Boston, MA
Module 1. Cardiopulmonary Bypass (CPB)

Harold M. Burkhart, M.D.
George L. Hicks, Jr., M.D.
The CPB Module is a four-week simulation-based training program leading to familiarity and competence with the surgical techniques of cardiopulmonary bypass. It has the following objectives:

1. The resident will be able to master and recite the steps of CPB from memory without hesitation.
2. The resident will be able to perform aortic cannulation, venous cannulation, cross-clamping, administration of cardioplegia, weaning from CPB, and decannulation on the Ramaphal Cardiac Surgery Simulator with a Likert score of 5 for each step.
3. Residents are to repeat all steps until the session objectives are met.

Assessment using video is very helpful but at the discretion of the instructor.

It is recommended that residents gown, glove and wear masks to better simulate the OR setting.

The four-week CPB training program will consist of one half-day per week (approximately 4 hours) for each resident. The component task and full procedure schedule is:

**Week 1:** Fundamentals of CPB
   - Aortic Cannulation

**Week 2:** Venous Cannulation
   - Administration of cardioplegia

**Week 3:** Full CPB run
   - Ramaphal simulator

**Weeks 4:** Full CPB run
   - Ramaphal simulator

Residents should have ample opportunity to practice between weekly sessions.

Each weekly session will begin with an evaluation of the component tasks covered in previous weeks.
CPB Session 1: Fundamentals of CPB and Aortic Cannulation

Overview

Week 1 of the Cardiopulmonary Bypass Module consists of 2 parts; an introduction to cardiopulmonary bypass and training in the component task of aortic cannulation. Through an introductory didactic session and subsequent practice, the resident will train in the components of conducting cardiopulmonary bypass. The resident will then use the aortic cannulation component task simulator to perform multiple aortic cannulations and de-cannulations. The skills learned will be:

1. Pre-bypass team briefing
2. CPB communication of steps and commands
3. Debriefing
4. Aortic cannulation and de-cannulation. Deairing and testing of line

Prerequisites


Fundamentals of Cardiopulmonary Bypass Training

Objectives for Fundamentals of Cardiopulmonary Bypass Training

The objectives for CPB Week 1: Fundamentals of CPB are that by the end of the session:

1. The resident will be able to write down and recite the seven steps for CPB
2. The resident will be able to identify the component parts of the cardiopulmonary bypass circuit
   a. Review the lecture on CPB and pass the 10 question exam (90%)
3. The resident will be able to conduct a complete pre-bypass briefing
4. The resident will be able to conduct a simulated cardiopulmonary bypass run using all commands and check points of the Seven Steps of CPB.
Equipment and Materials Required:

Seven steps of cardiopulmonary bypass (Listed in Teaching Plan, #5)
10 Question CPB Test (See Appendix CPB 1-1)

Teaching Plan for Fundamentals of Cardiopulmonary Bypass

All parts of the teaching plan should be repeated as many times as necessary for the resident to be able to perform them perfectly (deliberate practice)

1. Administer the 10-question CPB test
2. Review Intro to CPB, which resident should have reviewed prior to session
3. Have a CPB circuit set up and review component parts with resident. Resident should be able to identify and state the function of all of the parts:
   a. Pumps
   b. Oxygenator
   c. Venous reservoir
   d. Tubing
   e. Cardioplegia
   f. Heat exchanger
   g. Safety devices

4. The resident will conduct a cardiac surgery preoperative briefing covering:
   a. Diagnosis
   b. Procedure
   c. Incision
   d. Significant surgical history (redo, patent grafts...)
   e. Cannulation
   f. Cardioplegia
   g. Temperature
   h. Questions

5. The resident will go through a mock CPB run covering all of the following 7 steps of CPB including appropriate communication to the team.
   1. Heparin
   2. Expose the heart
   Check BP/aorta
Aortic Cannulation Component Task Simulation

Objectives:
1. The resident will be able to place and secure the aortic cannula into the aorta.
2. The resident will be able to connect the arterial line and de-air it.
3. The resident will be able to de-cannulate the aorta and secure the purse strings.
4. The resident will perform complete aortic cannulation and de-cannulation a minimum of 10 times.

Resident should be given the opportunity to practice during the week after the session using the HeartCase of some equivalent simulation model or by having access to the simulation center.

The residents should be gowned, gloved and wear a mask to improve the real world environment for the session

Equipment required for each resident (may vary depending on cannulation technique being taught):
- **Aortic Cannulation Component Task Simulator** *(Appendix CPB 1-6)*
  - Aortic cannulation simulation model (supplied from UNC)
  - Length of aorta (supplied from UNC)
  - 2 bags of artificial blood
  - 1 IV pole
  - Purse-string suture (2) (2-0 double-armed non-pledged suture)
  - Silk ties
  - 2 tourniquet sliders
  - Needle driver
  - 2 pairs of DeBakey forceps
  - 2 small clamps
  - #11 blade on knife handle
  - Suture scissors
  - Metzenbaum scissors
  - 2 tubing clamps
  - 2 lap sponges
Set-up of Aortic Cannulation Component Task Simulation model
(See Appendix CPB 1-6)

Aortic length is placed in the silicone well.
Bag of artificial blood is hung.
One arm of Y is connected to the quick connect of the aortic length, the other arm is clamped with a tubing clamp.
Blood is infused into the aorta.
The arterial line is advanced by removing the tubing clamp from the Y.

Conduct of the simulation

1. During the simulation, the resident will be expected to perform the parts of the 7 steps of CPB appropriate to aortic cannulation.

2. Starting at proximal end of the aorta and using the agreed upon method of the institution, the resident will
   a. Give heparin, check aortic pressure, palpate aorta
   b. Place the purse string(s), the slider(s), and clamp the slider(s)
   c. ACT check
   d. Clean off aorta at cannulation site. Be sure cannula is ready and clamped with tubing clamp if necessary
   e. Re-check aortic root pressure
   f. Open aorta with #11 blade
   g. Place aortic cannula
   h. Tighten and secure purse string(s)
   i. Fill aortic cannula into sponge by leasing clamp on cannula
   j. Advance arterial line by giving command. Arterial line is unclamped to allow it to fill
   k. Connect aortic cannula, while line is being forwarded to remove air
   l. Check line for air
   m. Ask perfusionist to confirm proper pressure and flow
   n. Insure patient ready to come off bypass
   o. Come off bypass and decannulate aorta with purse strings being tied (Aortic line may be clamped or not depending on centers procedure)

Repeat procedure until no errors using more distal parts of aorta. Aorta can also be turned to expose clean aorta. A minimum of 10 repetitions is recommended.
APPENDIX CPB 1-5
CPB Week 1 Assessment - Aortic Cannulation Assessment Tool (ACAT) –

REPETITION ASSESSMENT (first or last)

<table>
<thead>
<tr>
<th>RESIDENT NAME</th>
<th>YR OF TRAINING</th>
<th>DATE</th>
<th>EVALUATOR</th>
</tr>
</thead>
</table>

1. Aortic site

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not palpate aorta</td>
<td>Minimal aortic evaluation</td>
<td>Palpates and evaluates aorta</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interferes with graft or aortotomy</td>
<td>Close to grafts or aortotomy</td>
<td>Adequate spacing for grafts or aortotomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP not mentioned</td>
<td>BP noted</td>
<td>BP noted, appropriate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

2. Needle angles

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not aware of angles</td>
<td>Understand angles, not consistent</td>
<td>Consistent correct angles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does not consider subsequent angles</td>
<td>Partial consideration of subsequent angles</td>
<td>Consistent adjustment for subsequent angles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

3. Bite

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular entry/exit</td>
<td>Mostly regular entry/exit</td>
<td>Consistent regular entry/exit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hesitant, multiple punctures</td>
<td>Mostx single puncture</td>
<td>Consistent single puncture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

4. Spacing

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneven/irregular spacing</td>
<td>Mostly even spacing</td>
<td>Consistent even spacing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irregular distance from previous bite</td>
<td>Mostly consistent distance from previous bite</td>
<td>Consistent distance from previous bite</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

5. Needle holder use

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awkward finger placement</td>
<td>Functional finger placement</td>
<td>Comfortable, smooth finger placement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unable to rotate instrument</td>
<td>Hesitant when rotating</td>
<td>Smooth rotation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awkward and not facile</td>
<td>Moderate facility</td>
<td>High facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent needle placement</td>
<td>Generally good placement</td>
<td>Consistent proper placement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

6. Use of forceps

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awkward or no traction</td>
<td>Moderate proper traction</td>
<td>Consistent proper traction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unable to expose</td>
<td>Able to assist in exposure</td>
<td>Consistent proper exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not use to stabilize needle</td>
<td>Able to stabilize but rough</td>
<td>Knows when to stabilize, gentle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:
Improved Patient Safety by Simulator Based Training in Cardiac Surgery

AHRQ Grant # 1R18HS020451-01

Simulation Syllabus

v. 1.0
July 25, 2012

Investigators:

Richard Feins, M.D., University of North Carolina at Chapel Hill (PI)
John Conte, M.D., Johns Hopkins University, Baltimore, MD
Jennifer Walker, M.D., Massachusetts General Hospital, Boston, MA
Harold Burkhart, M.D., Mayo Clinic, Rochester, MN
George Hicks, M.D., University of Rochester, Rochester, NY
James Fann, M.D., Stanford University, Palo Alto, CA
Jonathan Nesbitt, M.D., Vanderbilt University, Nashville, TN
Nahush Mokadam, M.D., University of Washington, Seattle, WA
1. Cardiopulmonary Bypass (CPB) Module

Harold M. Burkhart, MD
George L. Hicks, Jr., MD

August 1, 2011
The seven week CPB training program will consist of one half-day per week (approx. 4 hours) for each resident. The component parts schedule is:

**Week 1:** Fundamentals of CPB

**Week 2:** Fundamentals of CPB
- Aortic Cannulation

**Week 3:** Fundamentals of CPB
- Aortic Cannulation
- Venous Cannulation

**Week 4:** Fundamentals of CPB
- Aortic Cannulation
- Venous Cannulation
- Cardioplegia

**Weeks 5, 6, 7:** Full CPB on Ramphal Simulator
Objectives

The objectives for this week are:

1. The resident will be able to write down the 7 Steps of CPB from memory
2. The resident will be able to place and secure the aortic cannula into the aorta within 8 minutes
3. The resident will be able to connect the arterial line and de-air it.
4. The resident will be able to de-cannulate the aorta and secure the purse strings
5. The resident will perform complete aortic cannulation and de-cannulation a minimum of 10 times.

The cannulation and de-cannulation technique practiced will be specific to the training center. Only one technique will be taught at each center. The simulation will provide better training if the resident is gowned, gloved, and masked during the session.

Teaching Plan

Equipment required for each resident (may vary depending on cannulation technique being taught):
- Aortic cannulation simulation model (supplied from UNC)
- Length of aorta (supplied from UNC)
- 2 bags of artificial blood
- 1 IV pole
- Purse string suture (2)
- Silk ties
- 2 tourniquet sliders
- Needle driver
- 2 pairs of deBakey forceps
- 2 small clamps
Set-up of Aortic Cannulation Simulation model

Aortic length is placed in the silicone well
Bag of artificial blood is hung
One arm of Y is connected to the quick connect of the aortic length, the other arm is clamped with a tubing clamp.
Blood is infused into the aorta
The arterial line is advanced by removing the tubing clamp from the Y

Conduct of the simulation

1. Resident must write from memory the 7 steps of CPB. During the simulation, the resident will be expected to perform the parts of the 7 Steps appropriate to aortic cannulation

2. Starting at proximal end of the aorta and using the agreed upon method of the institution, the resident will
   a. Give heparin, check aortic pressure, palpate aorta
   b. place the purse string(s), the slider(s), and clamp the slider(s)
   c. ACT check
   d. Clean off aorta at cannulation site. Be sure cannula is ready and clamped with tubing clamp if necessary
   e. Re-check aortic root pressure
   f. Open aorta with #11 blade
   g. Place aortic cannula
   h. Tighten and secure purse string(s)
   i. Fill aortic cannula into sponge by leasing clamp on cannula
   j. Advance arterial line by giving command. Arterial line is unclamped to allow it to fill
   k. Connect aortic cannula while line is being forwarded to remove air
CPB Week 3 Assessment - Venous Cannulation Assessment Form (VCAF)

Atrial _______ Bi-caval _______

RESIDENT NAME__________ YR OF TRAINING__________ DATE__________
EVALUATOR______________ TIME TO COMPLETION__________

<table>
<thead>
<tr>
<th>1. Atrial/Bi-caval site</th>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Does not identify atrial appendage or venous sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Identifies atrial appendage or venous sites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Injury to RCA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Appropriately away from RCA</td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments: __________________________________________________________

<table>
<thead>
<tr>
<th>2. Needle angles</th>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not aware of angles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent correct angles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does not consider subsequent angles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent adjustment for subsequent angles</td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments: __________________________________________________________

<table>
<thead>
<tr>
<th>3. Bite</th>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Irregular entry/exit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent regular entry/exit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hesitant, multiple punctures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent single puncture</td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments: __________________________________________________________

<table>
<thead>
<tr>
<th>4. Spacing</th>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uneven/irregular spacing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent even spacing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Irregular distance from previous bite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consistent distance from previous bite</td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments: __________________________________________________________
Improved Patient Safety by Simulator Based Training in Cardiac Surgery

AHRQ Grant # 1R18HS020451-01

- Resident time is a major problem
- Deliberate practice is an effective way to improve skills
- Faculty commitment very important
- Adverse events can be orchestrated for training
- A comprehensive syllabus is essential
AHRQ Cardiac Surgery Training Grant Investigators

**UNC**

Richard H. Feins, M.D.
3031 Burnett Womack Building
C0 7035
Chapel Hill, NC 27599-7685
United States
1 919 966-3381
1 919 966-3475 (Fax)
Richard_Feins@med.unc.edu

John V. Conte, M.D.
600 N. Wolf Street
Bld 610
Baltimore, MD 21287-6418
United States
1 410 955-1753
1 410 955-2829 (Fax)
jconte@csurg.jhmi.jhu.edu

**JOHNS HOPKINS**

**MGH**

Jennifer Dale Walker, M.D.
55 Fruit Street
Cox 644
Boston, MA 02114
United States
1 617 726-8811
1 617 726-5064 (Fax)
jdwalker@partners.org

**MAYO**

Harold M Burkhart, M.D.
University of Oklahoma Health Sciences Center
920 S. L. Young Blvd.
WP2230
Oklahoma City, OK 73104
United States
1 405 271-5789
harold.burkhart@ouhsc.edu

Robert Shen, M.D.
Mayo Clinic, Division of General Thoracic Surgery
200 First Street SW, 1241W
Rochester, MN 55905
United States
1 507 284-2511
1 507 284-0058 (fax)
shen.krobert@mayo.edu

**Stanford**

James I. Fann, M.D.
300 Pasteur Drive
Falk CV Research Center
Stanford, CA 94305-5247
United States
1 650 723-7110
1 650 852-3430 (Fax)
jfann@stanford.edu

**Rochester**

George L. Hicks, Jr., M.D., Program Director
601 Elmwood Avenue
Rochester, NY 14642
United States
1 585 275-5384
1 585 244-7171 (Fax)
george_hicks@urmc.rochester.edu

**Washington**

Nahush A. Mokadam, M.D.
1959 NE Pacific
Box 358310
Seattle, WA 98195-6310
United States
1 206 543-3093
1 206 229-0325 (Fax)
mokadamn@uw.edu

**Vanderbilt**

Jonathan C. Nesbitt, M.D.
609 Oxford House
1313 21st Avenue South
Nashville, TN 37232-4682
United States
1 615 322-0064
1 615 343-0104 (Fax)
jon.nesbitt@vanderbilt.edu
Introduction

The Syllabus for Simulation Based Training in Cardiac Surgery (The Syllabus) is composed of training in 6 basic cardiac surgery modules: 3 basic cardiac surgery procedures and 3 important intraoperative adverse events:

- Cardiopulmonary bypass (CPB)
- Coronary artery bypass graft surgery (CABG)
- Aortic valve replacement (AVR)

- Massive intraoperative air embolism (MAE)
- Acute intraoperative aortic dissection (AIAD)
- Sudden perioperative deterioration of cardiac function (SDCF)

Each of the modules is broken down into its important component tasks; detailed simulation exercises on component task simulators are outlined in the syllabus. In the last few sessions of each module, the learned component tasks are combined into full cardiac surgery procedures using the Ramanha Cardiac Surgery Simulator. The principles of task and procedure mastery by repetitions, coaching, and debriefing are emphasized throughout the 29 sessions of the curriculum.

For each simulation session, the module provides the following:

- Session overview
- Prerequisites
- Objectives
- Equipment and materials required
- Simulation set-up
- Conduct of the simulation
- Assessment tools

We have found it helpful to video-record the simulation sessions for more detailed review and analysis.

Each session is designed to take between 2 and 4 hours and each module takes between 4 and 7 sessions to complete. The actual time needed will depend on the individual residents ability to meet the goals and objectives for each session. Defined benchmarks and prerequisites should be attained by the trainee prior to advances through the curriculum.

An important concept to remember is that mastery of a skill comes from multiple supervised repetitions of a task along with self-practice. The ultimate goal of the CABG module, for example, is not to complete a coronary bypass procedure but rather to repeat the components involved as many times as possible with the goal of mastery. In addition, the mentor must balance in-depth supervision and coaching with allowing the trainee to make his or her own mistakes.

The Syllabus does not prescribe a particular method for a given task but rather leaves it up to the individual institution to train its residents in its own way of doing a given task or procedure. This also applies to the Emergency Action Plans used in the adverse events modules.