CALS

CARDIAC SURGERY
ADVANCED LIFE SUPPORT
Resident questions for Thursday morning:

1. In a post cardiac surgery patient, high quality CPR is the first and most important step in achieving a positive outcome? T/F

2. Define coronary perfusion pressure during CPR and explain its role in ROSC:

3. High quality CPR, when measured by a-line, is defined as a systolic BP of?

3. Re-sternotomy is indicated only in cases of tamponade? T/F

4. Define failure to rescue:
CASE PRESENTATION

63 M

S/P CABG x 3 and MVR

PMH: HTN, DM

Pre-OP EF: 20%
CASE PRESENTATION

POD 1

Drips DC’d
Swann Removed
Out of Bed
Case Presentation

Pod 2

Beta Blocker
CASE PRESENTATION

POD 2

Beta Blocker

Pleural Tube
CASE PRESENTATION

POD 3

Pacing **Wires** Removed

Med Tubes Removed
CASE PRESENTATION

POD 4

Cordis Removed
CASE PRESENTATION

POD 5
CASE PRESENTATION

POD 5

No palpable pulse
Arterial Line: Non-pulsatile
FIRST STEP ?
HARD & FAST
HANDS-ONLY CPR
It’s not as hard as it looks.
CALS VS. ACLS
THEY’RE JUST.....
DIFFERENT

Cardiac Surgery
Advanced
Life
Support

Advanced
Cardiovascular
Life
Support
CARDIAC ARREST

Assess rhythm
- ventricular fibrillation or tachycardia
  - DC shock (3 attempts)
- asystole or severe bradycardia
  - pace (if wires available)
- pulseless electrical activity

Start basic life support
- amiodarone 300mg via central venous line
- atropine 3mg consider external pacing
- if paced, turn off pacing to exclude underlying VF

Prepare for emergency resternotomy
- continue CPR with single DC shock every 2 minutes until resternotomy
- continue CPR until resternotomy
- continue CPR until resternotomy
In-Hospital Arrest 17% survive to discharge (all comers)  
Girotra, NEJM 2012

Post cardiac surgery 48-79% survive to discharge  
European Resuscitation Council 2010
DIFFERENCES

Monitoring

Personnel / Location

Causes
D I F F E R E N C E S

- Tamponade
- Tension
- Hypovolemia
- Ischemia
- Arrhythmia
  - 25-50% initial
  - Rhythm is vFib
CARDIAC ARREST

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Remember: Shocking asystole never hurt anyone
VF - Initial Rhythm in 25-50% of arrests
3 Shocks - start 150 J increase to 200 J

- Chance of success: 75% —> 35% —> 14%

124 V-Fib arrests, 48% discharged alive if defibrillated in under 2 minutes…. so you get 1 minute
124 V-Fib arrests, 48% discharged alive if defibrillated in under 2 minutes.... so you get 1 minute
CARDIAC ARREST

assess rhythm

- ventricular fibrillation or tachycardia
  - DC shock (3 attempts)
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start basic life support
90 BPM DDD pacing
CALS

CARDIAC ARREST

assess rhythm

ventricular fibrillation or tachycardia

asystole or severe bradycardia

pulseless electrical activity

DC shock (3 attempts)

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start basic life support
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Controversial

Rebound hypertension —> suture line bleeding
  • Restart the heart to kill the patient

Lower dose: 100-200 mcg (1-2 cc)
  • Stop the drips
  • PEA
  • Peri-arrest
  • After 2 shocks
CPR

Perfuse the brain
  • Goal of 80 systolic

ROSC
  • Generate coronary perfusion pressure (CPP)
  • 15 mmHg

Buy time
Figure 2. IAC-CPR. Abdominal compressions are performed during the release phase of chest compressions. Two rescuers are required to perform the compression components of IAC-CPR. Source: AHA 2000.
Abdominal Compressions alone Interposed with Chest compressions
• 60% higher CPP
• 25% greater increase in ROSC
• Level 1 data
• LVAD

Figure 2. IAC-CPR. Abdominal compressions are performed during the release phase of chest compressions. Two rescuers are required to perform the compression components of IAC-CPR. Source: AHA 2000.
RE-STERNOTOMY

WHY?

Release Tamponade
WHY?

Release Tamponade

Internal Defibrillation
  • 20J
  • Across ventricles
WHY?

Cardiac Massage

- Mean CPP Closed Chest —> 7.3 mmHg
- Mean CPP Open Chest —> 32 mmHg
- Goal = 15 mmHg
Why not do better than 46%?
RE-STERNOTOMY

WHO?

In CTICU

< 10 days post

Minimally invasive

or

Traditional Sternotomy

Within 10 minutes
NO ONE DIES WITH A CLOSED CHEST
RE-STERNOTOMY

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Kathleen Allen, PhD
University of Southern California

Peter Economy
Coauthor, Managing For Dummies
SEQUENCE

• Call for help

• Prep +/-

• Gown Glove & Drape

• Scalpel

• Heavy needle holder and wire cutter
SEQUENCE

• Suction
• Retractor
• Look around
• Defibrillate
• Manual Compression
OPEN COMPRESSIONS

RIGHT HAND BEHIND AROUND APEX

LEFT HAND FLAT ON ANTERIOR SURFACE
Volume & Mortality

Hospital volume and surgical mortality in the United States

Birkmeyer et al., NEJM, 2002

• Nationwide inpatient sample and Medicaid database
• 2-12% difference in absolute mortality by procedure
• How does volume make it safer?
Failure to Rescue

Hospital and patient characteristics associated with death after surgery. A study of adverse occurrence and failure to rescue.

Silber, Med Care, 1992
Failure to Rescue

Complications, Failure to Rescue and Mortality with Major Inpatient Surgery in Medicare Patients

Ghaferi et al., Annals of Surgery, 2009
Failure to Rescue

LaPar et al., Annals of Thoracic, 2014

Retrospective review of the Virginia Cardiac Database
- 79,000 patients; 4,138 cardiac arrests (5.2%); 2,483 deaths/FTR (60%)

Patient predictors:
- Peripheral arterial disease
- Renal failure requiring hemodialysis
- NYHA 4
- Controlled for patient risk factors
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Likelihood Ratio (Wald)</th>
<th>AOR</th>
<th>p Value</th>
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<tr>
<td>Hospital</td>
<td>45.51</td>
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<td>Surgeon</td>
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<tr>
<td>Volume</td>
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<td>0.02</td>
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<td>0.39</td>
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<tr>
<td>CABG only</td>
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<td>NYHA class</td>
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<td>Renal failure</td>
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<td>Hypertension</td>
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<td>Year</td>
<td>0.53</td>
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Failure to Rescue

Understanding the Volume-Outcome Effect in Cardiovascular Surgery
Gonzalez et al., JAMA Surgery, 2014

Medicaid Database review 1 year
119,434 patients; CABG or AVR or AAA
Patient predictors controlled
Comparison of highest and lowest quintiles

<table>
<thead>
<tr>
<th></th>
<th>LowVol</th>
<th>HiVol</th>
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<tr>
<td>CABG</td>
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<td>591</td>
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<tr>
<td>AVR</td>
<td>27</td>
<td>274</td>
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Mortality

Complications

No difference

Fail To Rescue

A

B

C

Lowest-volume quintile

Highest-volume quintile

OR = 1.23

(95% CI, 1.15-1.33)

OR = 1.80

(95% CI, 1.56-2.07)

OR = 1.63

(95% CI, 1.47-1.81)

OR = 1.02

(95% CI, 0.89-1.16)

OR = 1.18

(95% CI, 1.09-1.27)

OR = 1.12

(95% CI, 1.06-1.18)

OR = 1.16

(95% CI, 1.02-1.33)

OR = 1.38

(95% CI, 1.16-1.64)

OR = 1.57

(95% CI, 1.38-1.79)
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THANK YOU