Regional Approach to Cardiovascular Emergencies
Cardiac Arrest Resuscitation System

Team Resuscitation and High Quality CPR

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Objectives:

• Discuss team basics
• Discuss where we resuscitate
• Update on science behind CPR
• Building a team in your system
• Strategies for Improved Survival
Si’s First Rule of Resuscitation

Live Where You Have a Better Chance of Survival

Jack!

Si’s Rules of Resuscitation
EMS Makes a Difference

- Respiratory Distress
- STEMI
- Trauma
- CVA
- Cardiac Arrest

Own it!
Careful with Words / Phrases

- Team Focused
- Pit Crew
- High Quality
- Uninterrupted
- Controlled ventilations

≠ SUCCESS

First it's pretty tires, then it's pretty guns. Next thing you know, you're shavin' your beard and wearin' Capri pants!
“Hey! There are two types of people, educated and unducated...”
Make Up / Building a Team

- Leader
- Awareness of how you work
- Clearly define roles and responsibilities
- Feedback
Where Do You Start

• First you must know where you are
  – Many believe their success is far greater than actual

• CARES is one place to start

• Establish a goal

• Who makes up your team?
Bystander Intervention (924)
AED %: 1.3% (12)
CPR %: 23.5% (217)

Cardiac Etiology Survival Rates
Overall: 11.8% (1096)
Bystander Wit'd: 18.7% (396)
Utstein: 31.7% (164)
Utstein Bystander: 28.7% (80)
EMS Witnessed: 19.8% (172)
Un witnessed: 4.0% (528)
Shockable/Bystand: 41.4% (396)
Would you do this?
Would you do this?

EVERYBODY IS IN TOO BIG OF A RUSH

LAY BACK, DRINK A SIP OF TEA, MOW SOME GRASS, AND IF YA GET TIRED, TAKE YA A NAP
ACTIONS: De-emphasis of Devices, Drugs and other Distracters

- Focus on high-quality CPR and defibrillation
- Atropine no longer recommended for routine use in
Keep It Simple

- “These boys packed so much stuff, Hey, they could survive a zombie, a-poca-liss”
PREHOSPITAL HIGH QUALITY COMPRESSIONS

• Goal: High quality means continuous chest compressions with *limited interruptions*
  – Rate: 100 – 120/min
  – Depth: 2 inches
  – Allow for complete chest recoil
  – Change every 2 minutes with pulse check
    • not to exceed 5 seconds
  – Address airway 2 cycles unless indicated earlier
TEAM APPROACH TO RESUSCITATION
Define Your Team
“The First, First Responder”

- Time from collapse to CPR critical
- PAI CPR decreases this time interval
- Goal for CPR initiation is?
  - 1 minute
- US average response time 4 – 6 minutes
- Average response time for ALS in US?
  - 8 – 12 minutes
Define Your Team

- First Responders with ALS
  - Define roles as responders arrive on scene
  - Define team leader and when this is established
First Responders with ALS

- First responder: Compressions
- Second responder: AED, Airway, cycle with compressor
- Third responder: Team leader, cycle with compressor
- Fourth responder: Team leader
Career agency with ALS

- Fire department / squad
  - Firefighter 1: Compressions
  - Firefighter 2: AED
  - Engineer 3: Airway
  - Captain: Team Leader
Pit Crew Approach

- Each person has assigned role
  - Providers focus on their assigned job expertly and efficiently
  - Practice in each role
  - Helps minimize interruptions

Pre-assigned Roles
1. Pit Crew Leader
2. Airway Leader
3. IV/IO & Medications
4. CPR Chief
5. CPR Duty Chief
6. Variable Player

Variations to this model exist for:
- 3 Rescuers
- 4 Rescuers
- 5 Rescuers
- 6 Rescuers
Team Focused CPR NCCEP / NCOEMS Protocol 2012

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES

Do not begin resuscitation
Follow Deceased Subjects Policy

NO

Begin Continuous CPR Compressions
Push Hard (≥ 2 inches) Push Fast (≥ 100 / min)
Change Compressors every 2 minutes
(change in less than 10 seconds)

First Arriving BLS / ALS Responder
Initiate Compressions Only CPR
Initiate Defibrillation Automated if available
Call for additional resources

Second Arriving BLS / ALS Responder
Assume Compressions or
Initiate Defibrillation Automated / Manual
If available
Place BIAD
DO NOT Interrupt Compressions
Ventilate at 6 to 8 breaths per minute

Utilize this Protocol with Cardiac Arrest Protocol

AT ANY TIME
Return of Spontaneous Circulation
Go to Post Resuscitation Protocol

BLS

Third Arriving Responder
BLS or ALS

ALS

Establish Team Leader
(Hierarchy)
Fire Department or Squad Officer
EMT-B
First Arriving Responder

Rotate with Compressor
To prevent Fatigue and effect high quality compressions
Take direction from Team Leader
Every responder on scene is responsible for performing and ensuring high quality CPR compressions

Fourth / Subsequent Arriving Responders
Take direction from Team Leader

Establish Team Leader
EMS ALS Personnel
Fire Department or Squad Officer
EMT-B
First Arriving Responder

Rotate with Compressor
To prevent Fatigue and effect high quality compressions
Take direction from Team Leader
Every responder on scene is responsible for performing and ensuring high quality CPR compressions

Initiate Defibrillation Automated
Establish IV
Administer Appropriate Medications
Establish Airway with BIAD if not in place

Initiate Defibrillation Manual
Continuous Cardiac Monitoring
Establish IV / IO
Establish IO After 1 failed IV attempt
Administer Appropriate Medications
Establish Airway with BIAD if not in place

Continue Cardiac Arrest Protocol
Pit Crew Approach to Resuscitation

• Focus on:
  – Leadership, team approach, skills & competencies, communication & teamwork, best practices, and rehearsal

• Emphasis on:
  – Minimally interrupted CPR
  – Controlled ventilations
  – Defibrillation
  – Appropriate timing of interventions
Henderson EMS, Nevada

- Created Team Based Method
- Developed 4 roles with specific responsibilities
  1. Compression Tech
  2. Monitor Tech
  3. Ventilation Tech
  4. Medication Tech

*Identified which roles would be filled in what order as providers arrived to scene*
• Developed the **375E5 Program**

  *375 Compressions & Epinephrine in 5 minutes*

• Re-tasked the first 5 minutes of cardiac arrest management to:
  – Maximize hands on compression time

**Goal: Maximize coronary & cerebral perfusion pressures**
<table>
<thead>
<tr>
<th>Problem</th>
<th>Mitigation</th>
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<tbody>
<tr>
<td>Delay in initiating CCC</td>
<td>Rapid ABC assessment and initiation of CCC; one rescuer CCC while monitor placed</td>
</tr>
<tr>
<td>Pauses of CCC for rhythm analysis and defibrillation</td>
<td>Brief pause for rhythm analysis; continue CPR until ready for shock, clear and then resume CCC immediately</td>
</tr>
<tr>
<td>Pauses of CCC for advanced airway placement</td>
<td>Defer until later in the arrest unless clinically indicated to do earlier or placement with interruption of CCC</td>
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CAN THIS MAKE A DIFFERENCE IN MY COUNTY?

Wait a minute: I am not Wake, Mecklenburg or Durham County. My response times are longer, transport times are longer, I have limited resources and I don’t have a major medical center.
Stokes EMS System Overview
Stokes EMS System Overview

- 5 ALS credentialed Ambulances supported by 1–3ALS Quick Response Vehicles.
- 57 FT/PT employees.

- Approximately 8000 call responses per year.
  - 67% ALS responses (Based on 2011 figures)
  - 31% BLS responses (Based on 2011 figures)
Stokes EMS Interpretation of the 2010 AHA Changes

- High Quality, Uninterrupted, Continuous Chest Compressions
  - CPR where patient is found

- BIAD vs. Intubation
  - BIAD

- Avoiding excessive Hyperventilation
  - ITD

- Team Focused Approach

- Post-Resuscitation Care
- Therapeutic Hypothermia

TERMINATION ON SCENE
Assignment of On-Scene Responsibilities

- Fire Department / Squad Assignments (Career/Volunteer).
- Build upon the team as more personnel arrive.
- On scene command
  - Fire Department (manager of the scene)
  - EMS (manager of patient Care)
Training of EMS / First Responders

• On shift Scenarios
• Everyone on scene is responsible for the quality of CPR (Not just the Team Leader)

• Role playing
  - Team Leader
  - Airway management
  - Chest Compressions/AED Placement
  - EMS interventions
  - Family Interactions (included in this explanation of discontinuation of efforts)
    • Beginning care of a new patient
Summary

- Define your team your way
- Practice with all responders
  - Ensure knowledge of roles
  - Ensure all knowledgeable of the science
- Immediate feedback during event
- Debrief following event
- Gather data if possible
  - Partner with another agency for data
Excellence in EMS

- “I can fly, I don’t even need a cape..”
Termination of CPR

• Why transport CPR?
  – Cardiac Arrest Survival is Rare Without Prehospital Return of Spontaneous Circulation
    • Wampler, DA et al. Prehospital Emerg Care 2012, Jul 26; (E-pub)
    – 2483 patients in the ROC 2008-10
    – Survival 6.6%
    – Field ROSC 36% (17.2% survival)
      • No ROSC 0.7% survival
      • If TOR rules followed transport decreased 50 %
Termination of CPR

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES

Decomposition
Rigor mortis
Dependent lividity
Blunt force trauma
Injury incompatible with life
Extended downtime with asystole
Do not begin resuscitation
Follow Deceased Subjects Policy

NO

Age ≤ 17

YES

Exit to Appropriate Protocol

NO

Downtime ≥ 20 minutes

YES

Exit to Cardiac Arrest Protocol

NO

AED / ECG Monitor
Initial Rhythm
Asystole / PEA
No shock indicated

YES

Do not begin resuscitation
Follow Deceased Subjects Policy

NO

Assess / Address Reversible Causes

FR / EMS
BLS / ACLS
≥ 30 minutes

YES

Cardiac Arrest Protocol

NO

ROSC

YES

Terminate CPR Effort
Follow Deceased Subjects Policy

NO

Exit to Post Resuscitation Protocol

AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol

Reversible Causes
Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypocalcemia / Hyperkalemia
Hypoglycemia
Tension pneumothorax
Tamponade: cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis: coronary (MI)

Team Leader
ALS Personnel
Responsible for patient care
Responsible for briefing / counseling family

Incident Commander
Fire Department / First Responder Officer
Team Leader until ALS arrival
Manages Scene / Bystanders
Ensures high-quality compressions
Ensures frequent compressor change
Responsible for briefing family prior to ALS arrival
Why 100 – 120 Rate?

- Study measured rates from 2005 – 2007
- 3098 patients enrolled
- Mean compression rate 112
- ROSC peaked at 120
- ROSC declined markedly < 75
  - In this study ROSC not associated with hospital discharge

Why 100 – 120 Rate?
Increased chest compression fraction is independently predictive of better survival.

Graph shows survival as it relates to chest compression fraction:

- Move from lower levels of CCF to intermediate has significant benefit.
- Supports evidence that increasing pre-shock coronary and cerebral blood flow can improve outcomes.
Chest Compression only CPR:

- Bystanders more willing to initiate
- Arterial blood is adequately oxygenated at onset of primary cardiac arrest
- Less likely to cause regurgitation of stomach contents
- Rescue breathing interrupts critical chest compressions
- Easier to teach
- Observational evidence of improved survival
Depth and Speed Matter

- ROC Study
- 1029 Adult patients including 58 EMS agencies
- Median compression rate is 106
- Median compression depth is 37.5 mm
- 53 % with compression depth < 38 mm
- 92 % with compression depth < 50 mm
  - Faster compression rate = less depth
- Survival improved with depth > 38 mm

Why 2 Minutes?

- 45 Providers, single rescuer CPR – 10 minutes
- Child and Adult manikins with AV feedback
- Mean compression rate remained > 100
- Adequate compressions
  - Fell from 85 % to < 40 % over 10 minutes
  - < 70 % after 90 seconds in child
  - < 70 % after 120 seconds in adult
- Self reported fatigue low by 2 minutes

Si's First Rule of Resuscitation

Pump Hard and Pump Fast
Jack!
WHY CAN’T WE LET GO OF THE AIRWAY
Why De-emphasis of Airway?

- Nationwide Japanese Registry 649,654
- ETT or BIAD Good Neurological Outcome 1%
- BVM Good Neurological Outcome 3%

Kohei Hasegawa, MD, MPH; Atsushi Hiraide, MD, PhD; Yuchiao Chang, PhD; David F. M. Brown, MD JAMA. 2013;309(3):257-266. doi:10.1001/jama.2012.187612.
• 100 cases reviewed
• Median 2 intubation attempts

• Median duration of interruption for 1\textsuperscript{st} attempt = 46.5 sec.

• Median total interruptions for all attempts = 109.5 sec

Interruptions in Cardiopulmonary Resuscitation From Paramedic Endotracheal Intubation (WANG 2009)
Goal: High quality means NO hyperventilation / hyperoxygenation

- Don’t interrupt chest compression for insertion
  - Adult takes 10–15 minutes to de-saturate
  - Ventilate 8–10 / minute
  - Maintain SpO2 ≥ 94 %
  - Do NOT Hyperventilate
Si’s First Rule of Resuscitation

Forget about the airway initially…
Jack!
Perishock Pause
Independent Predictor of Survival

Study showed that odds of survival were significantly lower for patients with:
1. Pre-shock pause > 20 seconds
2. Peri-shock pause > 40 seconds

**Optimal Pre-Shock Pause:**
< 5 seconds, max of 10 seconds

**Perishock Pause**
interruption in chest compressions before and after defibrillatory shock

**Resuscitation Science**

Perishock Pause
An Independent Predictor of Survival From Out-of-Hospital Shockable Cardiac Arrest

Sheldon Cheskes, MD; Robert H. Schmicker, MS; Jim Christenson, MD; David D. Salcido, MPH; Tom Rea, MD; Judy Powell, RN; Dana P. Edelson, MD; Rebecca Sell, MD; Susanne May, PhD; James J. Menegazzi, PhD; Lois Van Ottingham, RN, BSN; Michele Olsufka, BSN; Sarah Pennington, RN; Jacob Simonini, ACP; Robert A. Berg, MD; Ian Stiell, MD, MSc; Ahamed Idris, MD; Blair Bigham, MSc; Laurie Morrison, MD, MSc; on behalf of the Resuscitation Outcomes Consortium (ROC) Investigators
No Pause CPR
TIME IS CRITICAL

Survival decreases by **10%** for every **minute** treatment is delayed.
How many links with EMD?

1. Immediate recognition of cardiac arrest and activation of the emergency response system
2. Early CPR with an emphasis on chest compressions
3. Rapid defibrillation
Amsterdam dispatch

506 cardiac arrest emergency calls (3%)

Unrecognized, dispatch 0.9 min later, on scene 1.4 min later

Main reason in not recognizing cardiac arrest - not asking if the patient was breathing (42 of 82) / describe the type of breathing


Resuscitation Science

Importance of the First Link
Description and Recognition of an Out-of-Hospital Cardiac Arrest in an Emergency Call

Jocelyn Berdowski, MS, MSE; Frerik Beekhuis, RN; Aeilko H. Zwinderman, PhD;
Jan G.P. Tijssen, PhD; Rudolph W. Koster, MD, PhD
Odds ratio of survival by CPR status and BLS response time
Witnessed cardiac arrest, King County 1983 – 2000, n = 7265

Common Delays in Delivering CPR

- Research showed these common causes of delay to CPR:
  - Unnecessary questions asked
  - Bystander not near patient
  - Omission of “breathing normally”
  - Deviation from protocols
Unnecessary questions cause delays

- How old is the patient?
- Does the patient have a heart history?
- Duplication of questions.
- What is the patient experiencing?
If patient is not conscious and not breathing - normally do we really need to know medical history?

All we need to know...

...the patient is dead.

We need to offer CPR without delay and inform the caller that we will help them.
“The Agony of Agonal Respirations”
Agonal Breathing Facts

- Agonal breathing present 40% of arrests
- Commonly mistaken for signs of life
- Very difficult to recognize over phone
- Prevents bystanders from CPR
- Caller may report as breathing to EMD
Agonal Breathing Facts

• Agonal breaths is the last respiratory pattern seen before apnea
• Duration may be 1 or 2 breaths
• Duration may be minutes to hours in some cases
Agonal Respirations

- Described by callers in a variety of ways:
  - barely breathing
  - heavy, labored breathing
  - gasping
  - snoring, snorting
  - gurgling
  - groaning, moaning
  - breathing every once in awhile
2-Question Approach

1. Is the patient responsive/conscious?
   - Yes → Consider alternate conditions
   - No → Is the patient breathing normally?

2. Is the patient breathing normally?
   - Yes → Consider alternate conditions
   - No → Possible Cardiac Arrest
     START CPR