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RESUSCITATION ACADEMY

HIGH PERFORMANCE CPR

1 High Functioning Checklist for Agencies

2 High Functioning Cardiac Arrest Team Evaluations

3 Team Approach Resuscitation Handouts

4 Seattle's High Performance CPR Guide

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High-Functioning Cardiac Arrest EMS Agency Requirement Checklist

Primary Sudden Cardiac Arrest Statewide ALS Protocol

System Requirements:

☐ EMS agency medical director must approve participation and oversee education and QI of primary cardiac arrest care.

EMS Agency Medical Director Signature _____

☐ At least 80% of the EMS agency's personnel must have initial pit crew model CPR continuing education. Training should include teamwork simulations integrating QRS, BLS, and ALS crew members who regularly work together. Attach roster of EMS Agency Providers identifying those who have completed BOTH of the following PA EMS CE courses:
High-functioning CPR Agency: Science of CPR (1.5 hrs.)
High-functioning CPR Agency: Pit Crew Resuscitation Simulations (1.5 hrs.)

☐ EMS agency must have a plan for regular ("shift change") pit crew CPR practice with simulation (low fidelity acceptable) available to crews at least monthly. Training should include teamwork simulations integrating QRS, BLS, and ALS crew members who regularly work together.

☐ The EMS agency, overseen by the agency medical director, must perform a QI review of care and outcome for every patient that receives CPR.

☐ QI must be coordinated with local receiving hospitals to identify and document percentage of patients that are discharged from hospital with good neurologic function. Participation in CARES (Cardiac Arrest Registry to Enhance Survival) may be used to document these outcomes.

☐ The QI must be coordinated with local PSAP/dispatch centers to review opportunities to assure optimal recognition of possible cardiac arrest cases and provision of dispatch-assisted CPR (including hands-only CPR when appropriate). The QI process must identify and document the percentage of cardiac arrest cases that are categorized as possible cardiac arrest at time of dispatch and the percentage of patients that receive bystander CPR. This information must be shared with the PSAP. Ideally, the QI process also documents the percentage of patients that receive dispatcher-assisted CPR, and works with the PSAP to improve the percentage of dispatch-assisted CPR in the community.

☐ High-functioning CPR EMS agency programs must be approved by the agency's local EMS regional council, and each agency must participate in the regional QI committee including submission of quarterly cardiac arrest QI summaries with information required by the Bureau of EMS.

EMS Agency Manager approval:_____Date:_____

EMS Agency Medical Director approval:_____Date:_____

Regional EMS Council approval:_____Date:_____

High-Functioning CPR Pit Crew Team
On-the-Fly ("Shift Change") Refresher Checklist

Run drills on a regular basis (e.g. once weekly per shift)

Strongly Encouraged (Low Fidelity Equipment):

☐ CPR Torso/Head Manikin

☐ Oropharyngeal/Nasopharyngeal airways

☐ Bag-valve-mask

☐ Portable oxygen tank

☐ AED Trainer (should match the agency's AED)

☐ Stop watch

☐ Evaluation forms

Additional Equipment to Consider (When agency owns or has access to higher-fidelity equipment):

☐ ALS Manikin (with advanced airway and cardiac rhythm generator) or High-Fidelity Simulation Manikin

☐ Wave-form capnograph

☐ King LT/Combitube

☐ Impedance threshold device

☐ ALS manual monitor/defibrillator

☐ Heart rhythm generator

☐ IO simulation leg

☐ IV needles and tubing/IO needles and insertion device

☐ Expired medications

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High-Functioning CPR Team Evaluation

DRAFT
2/12/13

Date: _____

Location: _____

Scenario/Patient Background: _____

_____

_____

1. *Patient Assessment and Teamwork*

Y	Partial	N	N/A		Category
				Pertinent history obtained by team, including enough information to identify any conditions that require variation in care (e.g. pediatric patient, drowning/hypoxic arrest, hypothermia, trauma arrest)	BLS/ALS Care
				Team leader clearly identified and takes charge	Teamwork - Leadership
				Team leader assesses situation and resources and modifies accordingly	Teamwork- Leadership
				Team leader communicates accurately and concisely while listening and encouraging feedback	Teamwork- Communication
				Pit crew approach to roles without confusion	Teamwork- Situational Awareness
				Team members maintain situational awareness related to their roles (e.g. team member at head monitors capnography and notifies team leader of reading and significant changes)	Teamwork- Situational Awareness
				Team members use closed loop communication to acknowledge direction from team leader	Teamwork - Communication
				Team members report on progress on tasks	Teamwork- Communication
				Team members use appreciative inquiry and openly communicate any patient care or safety concerns	Teamwork- Mutual Respect

Comments:

Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*

2a. First 4 Cycles - High Performance CPR: Actions

Y	Partial	N	N/A		Category
				Patient placed supine on firm surface	CPR Quality
				Initial 4 cycles of 200 uninterrupted compressions without interruption for ventilation (unless reason for ventilation pauses, e.g. pediatric patient, drowning, etc).	CPR Quality
				Continue compressions while AED /defibrillator is charging (but not when AED is analyzing rhythm)	BLS/ALS Care
				Switch to manual defibrillation ASAP, when ALS involved	ALS Care
				When indicated, defibrillate at 360 joules or maximum output allowed by device, in adult patient	BLS/ALS Care
				Compressions immediately after defibrillation with NO pulse check.	CPR Quality
				Place naso/oropharyngeal airway or Alternative Airway (King LT or Combitube) If alternative airway inserted, verify position with waveform capnography and auscultation at epigastrium and bilateral midaxillary line (Goal = verify waveform on fist ventilation)	Airway/Ventilation
				Apply oxygen	Airway/Ventilation
				Two-person BVM used (when 3-4 rescuers available) (2-thumbs-up technique)	Airway/Ventilation
				If ventilation via BVM or alternative airway, monitor perfusion with continuous capnography	ALS Care
				Either provide NO ventilation or deliver one ventilation every 15 compressions without interrupting compressions	Airway/Ventilation
				Establish IO or IV access and delivers EPINEPHrine (1mg 1:10,000, in adult) immediately after access obtained, then every 3-5 minutes	ALS Care
				Antidysrhythmic given if VF/VT persists after first shock (amiodarone 300 mg or lidocaine 1.5 mg/kg)	ALS Care
				Avoid endotracheal intubation during initial 10 minutes	Airway/Ventilation

Comments:

Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*

2b. First 4 Cycles - High Performance CPR: Quality/Patient Safety

Y	Partial	N	N/A	
				All real time CPR feedback devices used when available (e.g. metronome, audio/verbal feedback)
				Fresh compressors tag team with each other frequently (at least every 200 compressions, but consider switching every 100 compressions)
				Compressor vocalizes CPR count at key times to communicate timing with team (e.g. vocalizes compression number at "50, 75, 90, 95, 96, 97, 98, 99, switch")
				Team leader informs team of cardiac rhythm being treated (initially and with each rhythm check)
				Verbal acknowledgement at time of giving medication or treatment (drug name and dose)
				When available, second provider verifies each medication drawn up before it is given (drug name and dose)
				No time wasted on inappropriate testing like blood glucose
				No inappropriate medications given (no bicarbonate , atropine, calcium, naloxone, magnesium unless specific indication per protocol)
				Team leader ensures quality of CPR
				Team leader or designee runs CPR checklist as soon as time permits

Comments:

Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*

3. After 4 Cycles of CPR (800 compressions)

Y	Partial	N	N/A		Category
				If not previously ventilating, begin ventilations at 1 every 15 compressions or 8-10 breaths / minute	CPR Quality
				Establish advanced airway (King LT or Combitube acceptable)	Airway/Ventilation
				Advanced airway confirmed by waveform $ETCO_2$ immediately (Goal = with first breath)	Airway/Ventilation
				Contact medical command before moving patient if no ROSC	BLS/ALS Care
				Optional – Consider application of mechanical CPR device (not in initial 800 compressions for BLS crews)	BLS/ALS Care

4. Post-Resuscitation Care after ROSC

Y	Partial	N	N/A	
				After ROSC, promptly assess full vital signs, mental status, and breath sounds (Goal = within first minute)
				Provide NSS bolus if BP marginal (SBP <110)
				Prepare and start pressor drip (DOPAmine or EPINEPHrine) if SBP <110
				Obtain 12-lead ECG
				Team leader or designee runs Post-ROSC checklist
				Package (cover for dignity, but do not bundle warmly), and consider not moving patient until initial ROSC sustained (Goal = ROSC for 10 minutes before moving patient)
				Contact Medical Command to consider cooling and diversion to PCI/Hypothermia center

Comments:

Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*

Rescuer Names: _____

_____

_____

_____

_____

Evaluator Name: _____

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High-Functioning CPR Team
CPR Quality Time Evaluation

DRAFT
2/14/13

Date: _____

Providers: _____

Scenario/Patient Background: _____

_____

_____

1. *First 4 Cycles – High Performance CPR*

a. *Time – CPR Interruptions for Rhythm Checks/Defibrillation*

(Note: for AED use record time of interruption for "analysis" and for defibrillation)

First rhythm check/ defibrillation		*seconds*	Any other interruption (e.g. for defibrillation with AED)		*seconds*
Second rhythm check/ defibrillation		*seconds*	Other interruption		*seconds*
Third rhythm check/ defibrillation		*seconds*	Other interruption		*seconds*
Fourth rhythm check/ defibrillation		*seconds*	Other interruption		*seconds*
Time of longest interruption for rhythm check /defibrillation (**Goal ≤ 7 seconds**, although analysis with AED may take longer) Providers should immediately start compressions after shock and should NOT check pulse immediately after defibrillation. Providers should do compressions when either AED or defibrillator is charging. There should be NO pause in compression for airway insertion.					*seconds*
Comments:					
Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*					

b. *Time – Rate of chest compressions during each cycle (randomly measure the total time to provide 30 compressions at least once for each compressor)*

Cycle 1		*seconds*
Cycle 1		*seconds*
Cycle 2		*seconds*
Cycle 2		*seconds*
Cycle 3		*seconds*
Cycle 3		*seconds*
Cycle 4		*seconds*
Cycle 4		*seconds*
(Goal = 30 compressions in 14-18 seconds) If information related to depth/full recoil is available real time from monitor, record findings in comment section. Watch for slight palm lift from chest to ensure full recoil.		
Comments:		
Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*		

c. *Time – Ventilations <u>if ventilations are given</u> (randomly measure the time between each squeeze of BVM/ventilation)*

Compression cycle 1		*seconds*
Compression cycle 2		*seconds*
Compression cycle 3		*seconds*
Compression cycle 4		*seconds*
After first 4 cycles of 200 compressions		*seconds*
After first 4 cycles of 200 compressions		*seconds*
If ventilation given in first 4 CPR cycles, should be at 8-10 ventilations/minute **(Goal = 1 breath every 6 – 7.5 seconds)**		
Comments:		
Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*		

d. Time – Drug Interventions

Time of first EPINEPHrine administration		*minutes*
Time of antidysrhythmic administration		*minutes*
Time of second EPINEPHrine administration		*minutes*
Time of third EPINEPHrine administration		*minutes*
Time of other drug administration Drug Name:		*minutes*
Time of other drug administration Drug Name:		*minutes*
(Goal = EPINEPHrine given early and then every 3-5 minutes) Antidysrhythmic should be given after second rhythm check with shockable rhythm (i.e. refractory VF/VT)		
Comments:		
Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*		

2. After 4 Cycles

a. Time – Mechanical Device Application (option for agencies that choose to use device, not standard of care)

Compression interruption as a result of mechanical device application (Goal = 10 seconds)		*seconds*
Comments:		
Global rating: *a.) Exceeds expectations* *b.) Meets expectations* *c.) Needs improvement*		

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NREMT Team Leader Attributes

- Creates, implements and revises an action plan
- Communicates accurately and concisely while listening and encouraging feedback
- Receives, processes, verifies, and prioritizes information
- Reconciles incongruent information
- Demonstrates confidence, compassion, maturity, (respect for team members), and command presence
- Takes charge
- Maintains accountability for team's actions/outcomes
- Assesses situation and resources and modifies accordingly

NREMT Team Member Attributes

- Demonstrates followership – is receptive to leadership
- Maintains situational awareness
- Utilizes appreciative inquiry
- Avoids freelance activity
- Uses closed-loop communication
- Reports progress on tasks
- Performs tasks accurately and in a timely manner
- Advocates for safety and is safety conscious at all times
- Leaves ego/rank at the door

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2-Person Pit Crew Example
(BLS)

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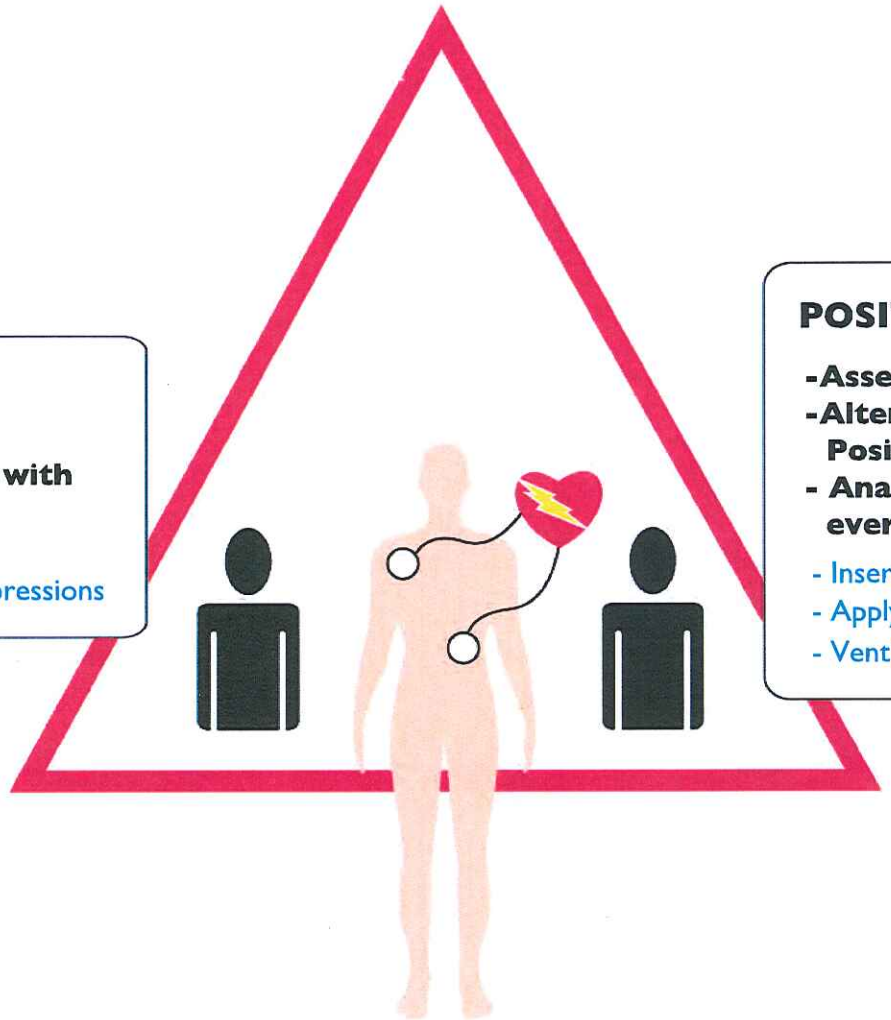
POSITION 2 (BLS)

-Attach AED
-Alternate 100 compressions with Position 1
**Compress while AED is charging*
-Ventilate in off cycle every 15 compressions



POSITION 1 (BLS - Team Leader)

-Assess patient and start CPR
-Alternate 100 compressions with Position 2
- Analyze/Shock immediately after every 200 compressions
- Insert Naso/oropharyngeal airway
- Apply oxygen via NRB mask or BVM
- Ventilate in off cycle every 15 compressions

KEY
Black = General Cardiac Arrest Protocol-Adult (331A).
Blue = Per agency policy, optional.

Note: Ventilation is not necessary during the first 800 compressions (4 compressions/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the inital 800 compressions. For agencies with mechanical CPR devices, these must not be applied until after the first 800 compressions. For pediatric patient ≤14 years old, provide CPR with 15:2 compressions to ventilations and follow protocol #331P.

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2-Person Pit Crew Example
(BLS and ALS)

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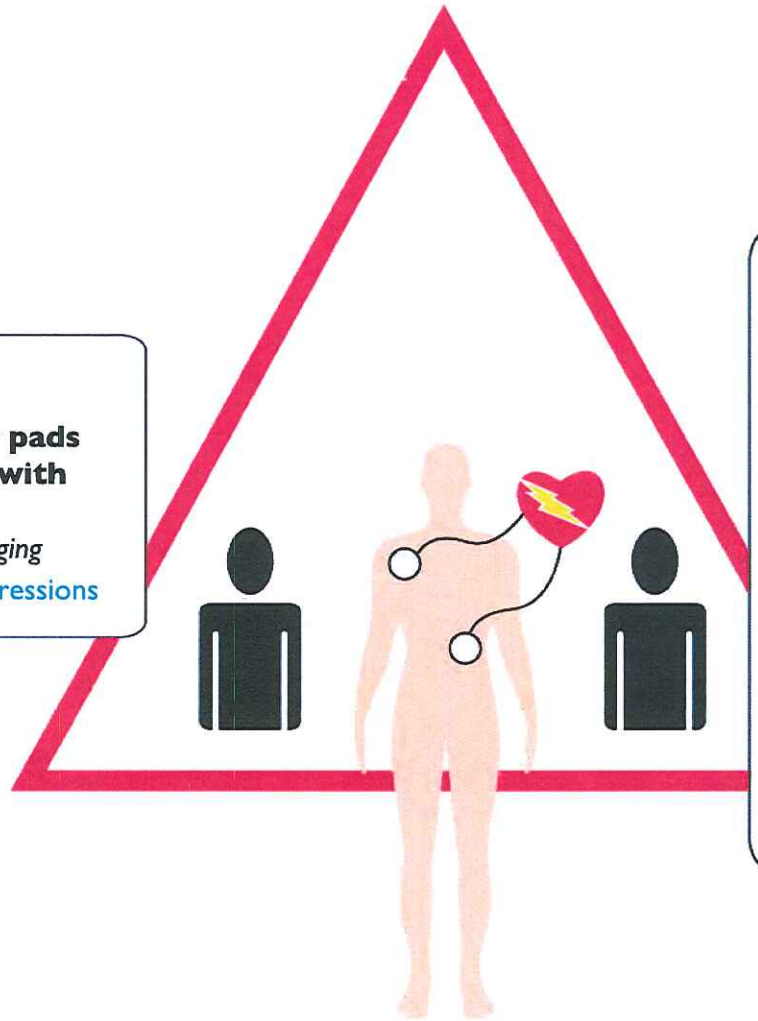
POSITION 2 (BLS)

- **Attach monitor/defibrillator pads**
- **Alternate 100 compressions with Position 1**
  **Compress while defibrillator is charging*
- Ventilate in off cycle every 15 compressions



POSITION 1 (ALS - Team Leader)

- **Assess patient and start CPR**
- **Alternate 100 compressions with Position 2**
- **Rhythm check/Shock immediately after every 200 compressions (charge during last 25 compressions of cycle)**
- Insert Naso/oropharyngeal airway
- Apply oxygen via NRB mask or BVM
- **IO/IV access**
- **EPINEPHrine ASAP and every 400 compressions**
- **Amiodarone if VF/VT after first shock**
- Ventilate in off cycle every 15 compressions

KEY

Black = General Cardiac Arrest Protocol-Adult (331A/3031A).

Blue = Per agency policy, optional.

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

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3-Person Pit Crew Example
(BLS)

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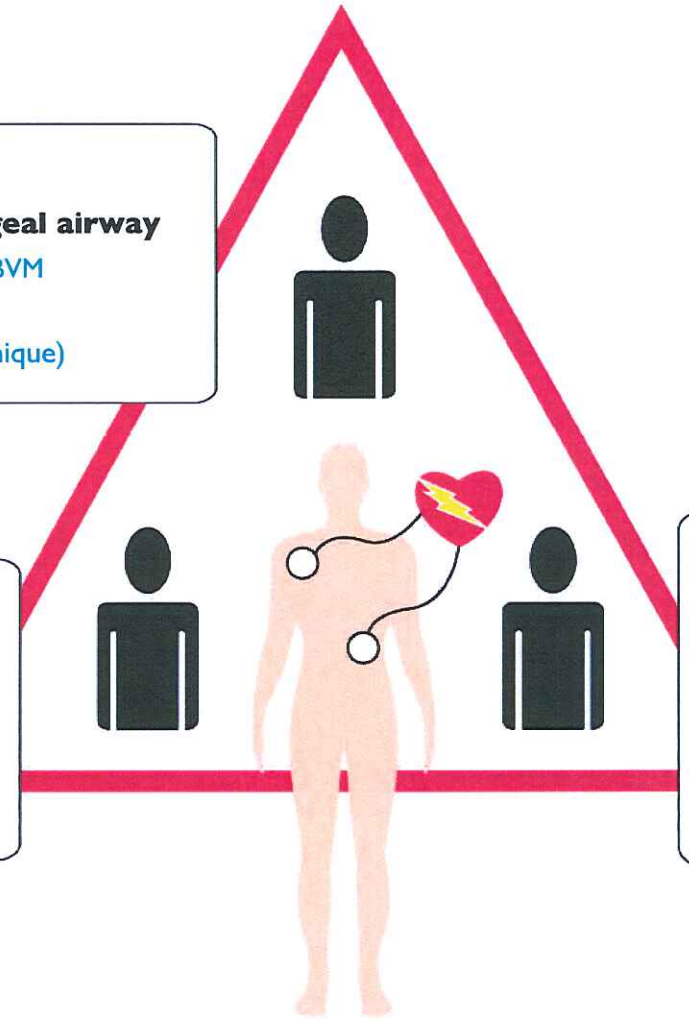

POSITION 3 (BLS)
-Insert Naso/oropharyngeal airway
-Apply oxygen via NRB mask or BVM
-Hold BVM mask to face
(2 thumbs up/ 2 person technique)

POSITION 2 (BLS)
-Attach AED
-Alternate 100 compressions with Position 1
**Compress while AED is charging*
-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)
-Assess patient and start CPR
-Alternate 100 compressions with Position 2
- Analyze/Shock immediately after every 200 compressions
-Ventilate in off cycle every 15 compressions

KEY
Black = General Cardiac Arrest Protocol-Adult (331A)
Blue = Per agency policy, optional

Note: Ventilation is not necessary during the first 800 compressions (4 compressions/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the inital 800 compressions. For agencies with mechanical CPR devices, these must not be applied until after the first 800 compressions. For pediatric patient ≤14 years old, provide CPR with 15:2 compressions to ventilations and follow protocol #331P.

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3-Person Pit Crew Example
(2 BLS and 1 ALS)

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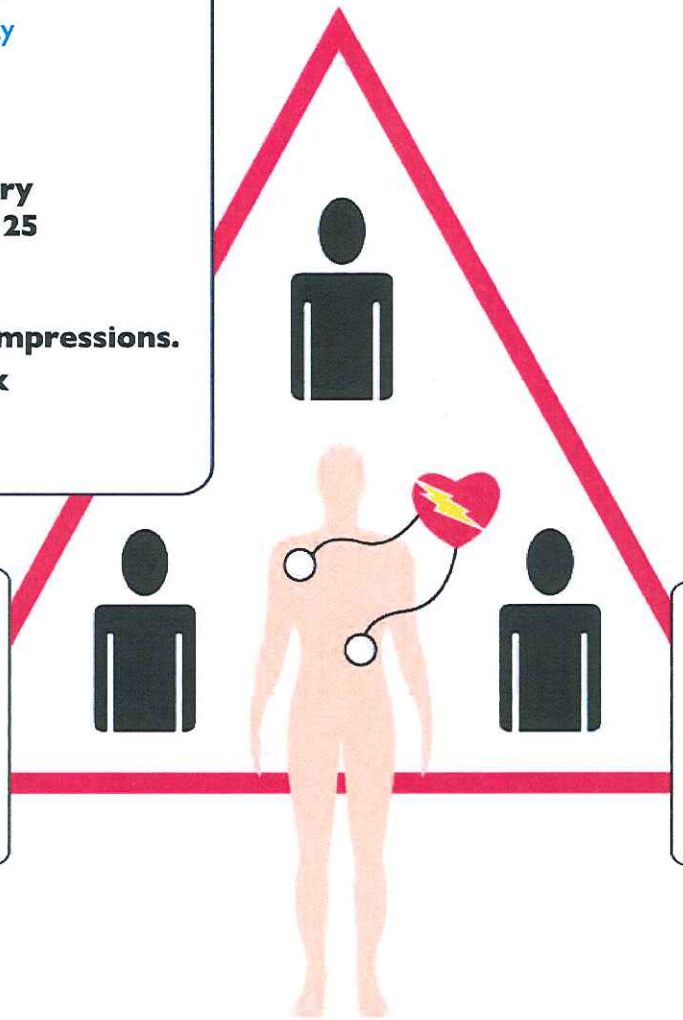
POSITION 3 (ALS Team Leader)

-Insert Naso/oropharyngeal or alternative airway
-Apply Oxygen
-Monitor capnography, if ventilating
-Attach ITD
-Analyze/Shock immediately after every 200 compressions (charge during last 25 compressions of cycle)
- IO/IV access
-EPINEPHrine ASAP and every 400 compressions.
-Amiodarone if VF/VT after first shock
-Consider treatable causes
-Run CPR checklist



POSITION 2 (BLS)

-Attach monitor/defibrillator pads
-Alternate 100 compressions with Position 1
**Compress while defibrillator is charging*
-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)

-Assess patient and start CPR
-Alternate 100 compressions with Position 2
-Ventilate in off cycle every 15 compressions

KEY
Black = General Cardiac Arrest Protocol-Adult (331A/3031A).
Blue = Per agency policy, optional.
Alt Airway= King LT or Combitube

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

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4-Person Pit Crew CPR Example
(2 BLS and 2 ALS)

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POSITION 3 (ALS)

-Insert Naso/oropharyngeal or alternative airway

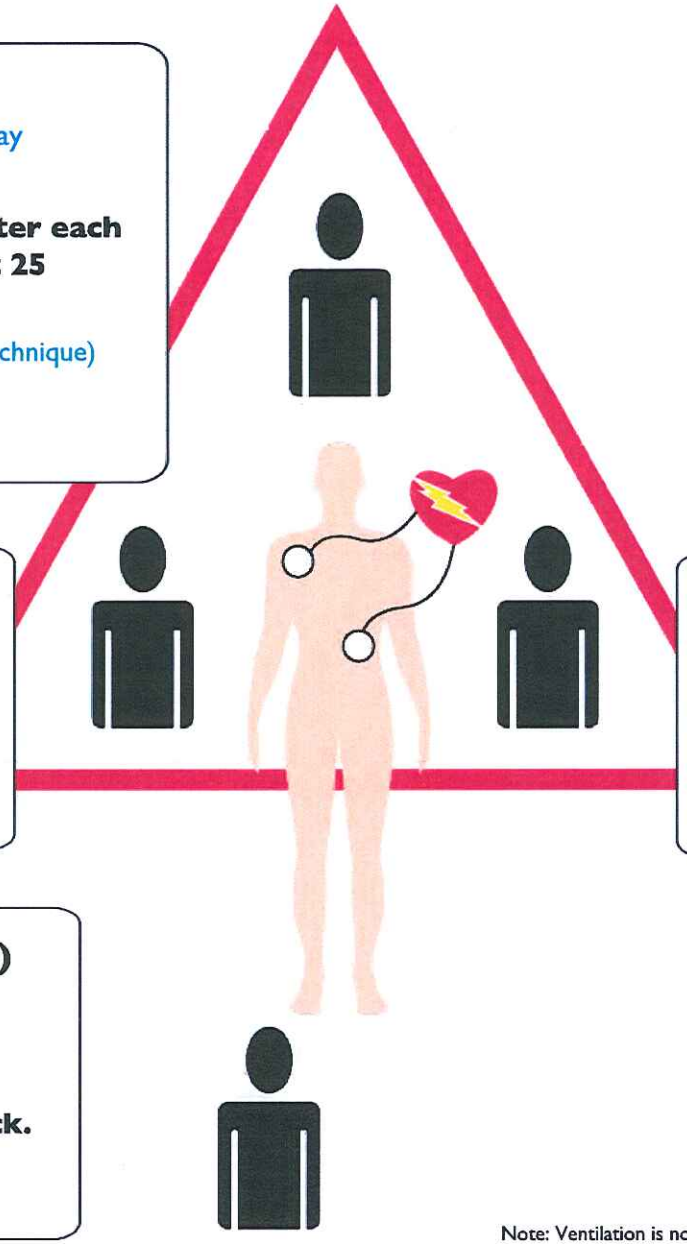
-Apply oxygen

-Rhythm check/Shock immediately after each 200 compressions (charge during last 25 compressions of cycle)

-Hold BVM mask to face (2 thumbs up/ 2 person technique)

-Monitor capnography, if ventilating

-Attach ITD



POSITION 2 (BLS)

-Attach monitor/defibrillator pads
-Alternate 100 compressions with Position 1

-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)

-Assess patient and start CPR
-Alternate 100 compressions with Position 2

-Ventilate in off cycle every 15 compressions

POSITION 4 (ALS Team Leader)

- **Start IO/IV**
- **EPINEPHrine ASAP then every 400 compressions**
- **Amiodarone if VF/VT after first shock.**
- **Consider treatable causes**
- **Run CPR checklist**

KEY

Black = General Cardiac Arrest Protocol-Adult (331A/3031A).

Blue = Per agency policy, optional.

Alt Airway= King LT or Combitube

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

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4-Person Pit Crew CPR Example

(3 BLS and 1 ALS)

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POSITION 3 (BLS)

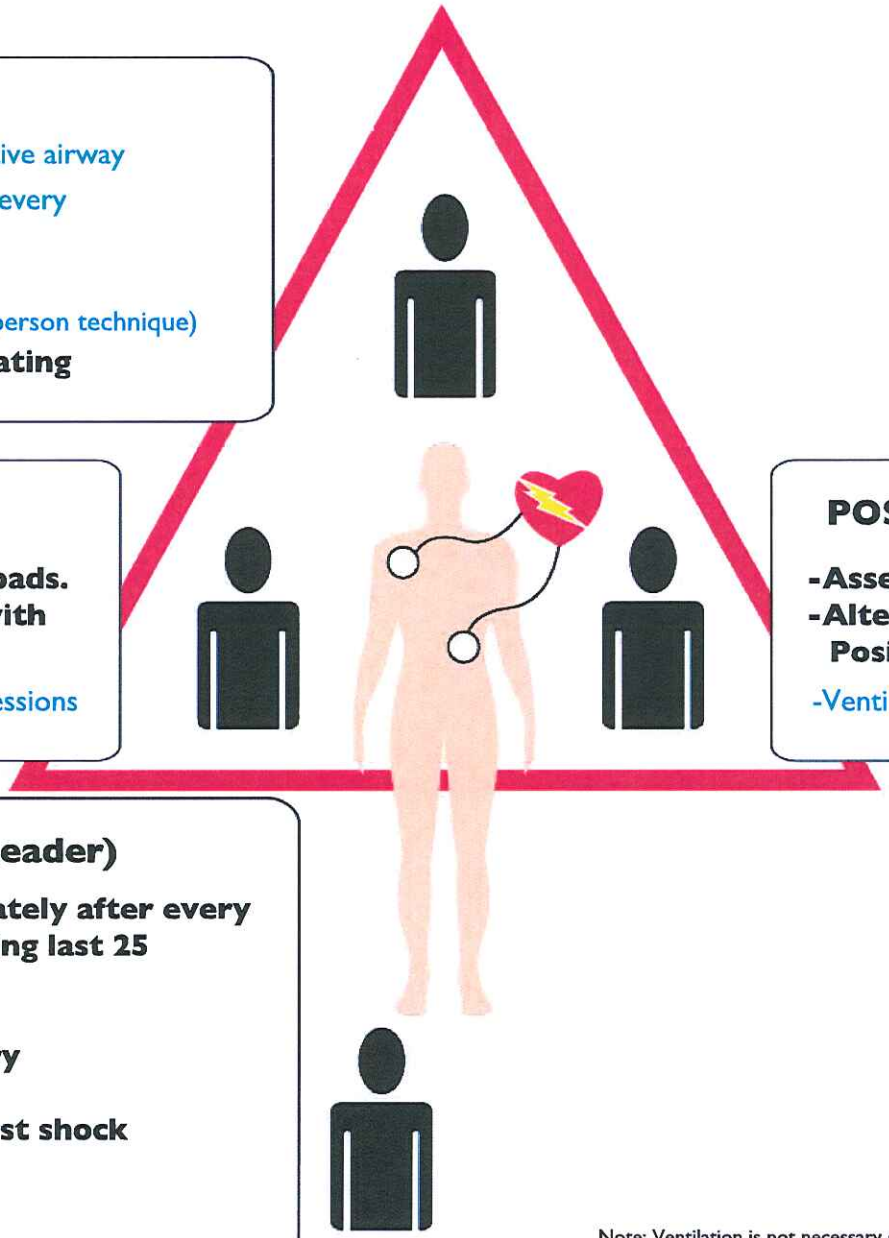
-Insert Naso/oropharyngeal or alternative airway

-If alternative airway in place, ventilate every 15 compressions

-Apply oxygen via NRB mask or BVM

-Hold BVM mask to face (2 thumbs up/ 2 person technique)

-Monitor capnography, if ventilating



POSITION 2 (BLS)

-Attach monitor/defibrillator pads.

-Alternate 100 compressions with Position 1

-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)

-Assess patient and start CPR

-Alternate 100 compressions with Position 2

-Ventilate in off cycle every 15 compressions

POSITION 4 (ALS Team Leader)

- **Rhythm check/Shock immediately after every 200 compressions (charge during last 25 compressions of cycle)**
- **Start IO/IV**
- **EPINEPHrine ASAP then every 400 compressions**
- **Amiodarone if VF/VT after first shock**
- **Consider treatable causes**
- **Run CPR checklist**

-Insert alternative airway

-Attach ITD

KEY

Black = General Cardiac Arrest Protocol-Adult (331A/3031A).

Blue = Per agency policy, optional.

Alt Airway= King LT or Combitube

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

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5 Person Pit Crew CPR Example
(2 BLS and 3 ALS)

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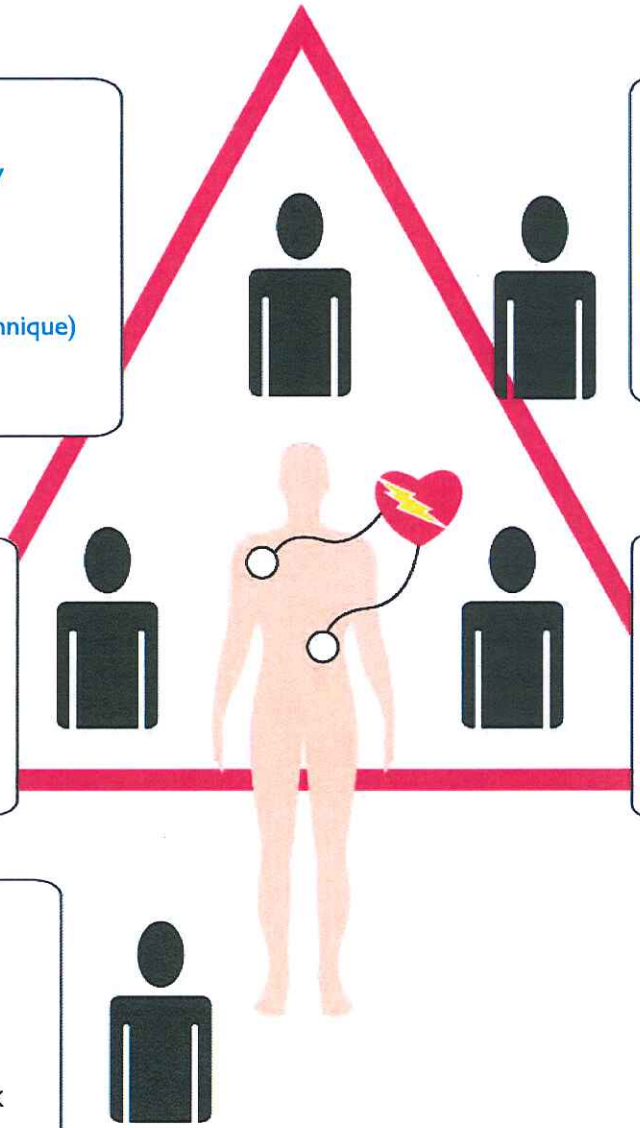
POSITION 3 (ALS)

-Insert Naso/oropharyngeal or alternative airway
-If alternative airway in place, ventilate every 15 compressions
-Apply oxygen via NRB mask or BVM
-Hold BVM mask to face (2 thumbs up/ 2 person technique)
-Monitor capnography, if ventilating
-Attach ITD

POSITION 5 (ALS Team Leader)

-Rhythm check/Shock immediately after every 200 compressions (charge during last 25 compressions of cycle)
- Consider treatable causes
- Run CPR checklist



POSITION 2 (BLS)

- Attach monitor/defibrillator pads
- Alternate 100 compressions with Position 1
-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)

- Assess patient and start CPR
- Alternate 100 compressions with Position 2
-Ventilate in off cycle every 15 compressions

POSITION 4 (ALS)

- Start IO/IV
- EPINEPHrine ASAP then every 400 compressions
- Amiodarone if VF/VT after first shock
- Administer medications as indicated

KEY

Black = General Cardiac Arrest Protocol-Adult (331A/3031A).
Blue = Per agency policy, optional.
Alt Airway= King LT or Combitube

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

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6-Person Pit Crew CPR Example
(2 BLS and 4 ALS)

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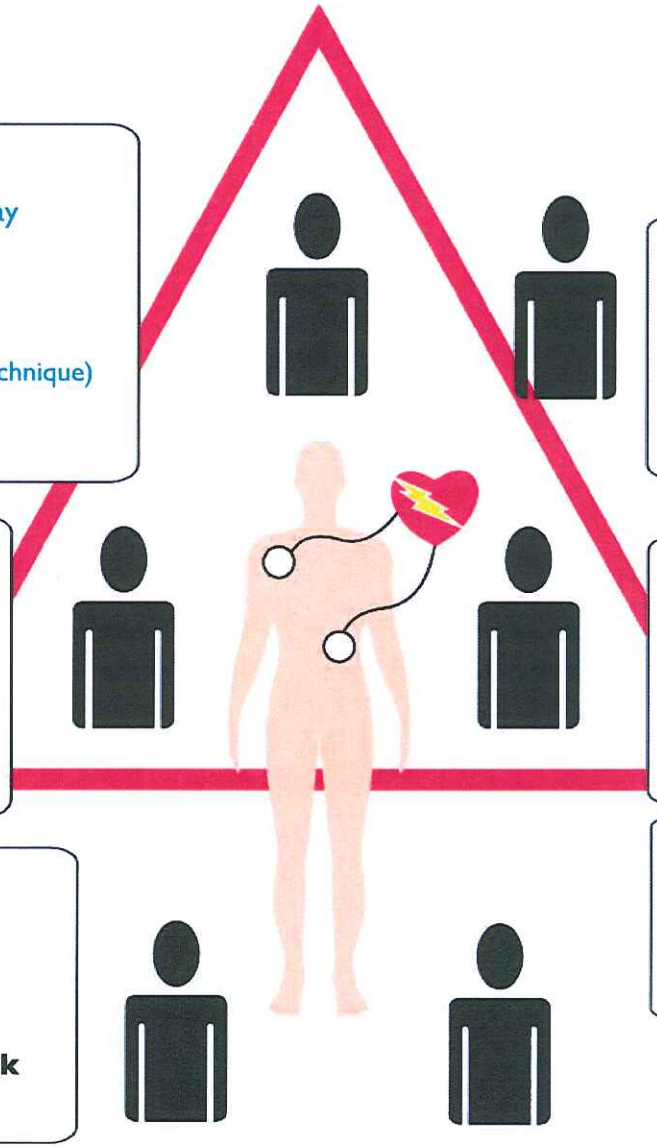

POSITION 3 (ALS)
-Insert Naso/oropharyngeal or alternative airway
-If alternative airway in place, ventilate every 15 compressions
-Apply oxygen via NRB mask or BVM
-Hold BVM mask to face (2 thumbs up/ 2 person technique)
-Monitor capnography, if ventilating
-Attach ITD

POSITION 5 (ALS)
-Rhythm check/Shock immediately after every 200 compressions (charge during last 25 compressions of cycle)

POSITION 2 (BLS)
- Attach monitor/defibrillator pads
-Alternate 100 compressions with Position 1
-Ventilate in off cycle every 15 compressions

POSITION 1 (BLS)
- Assess patient and start CPR
- Alternate 100 compressions with Position 2
-Ventilate in off cycle every 15 compressions

POSITION 4 (ALS)
- Start IO/IV
- EPINEPHrine ASAP then every 400 compressions
- Amiodarone if VF/VT after first shock
- Administer medications as indicated

POSITION 6 (ALS Team Leader)
- Consider treatable causes
- Run CPR checklist
- Communicate with family

KEY
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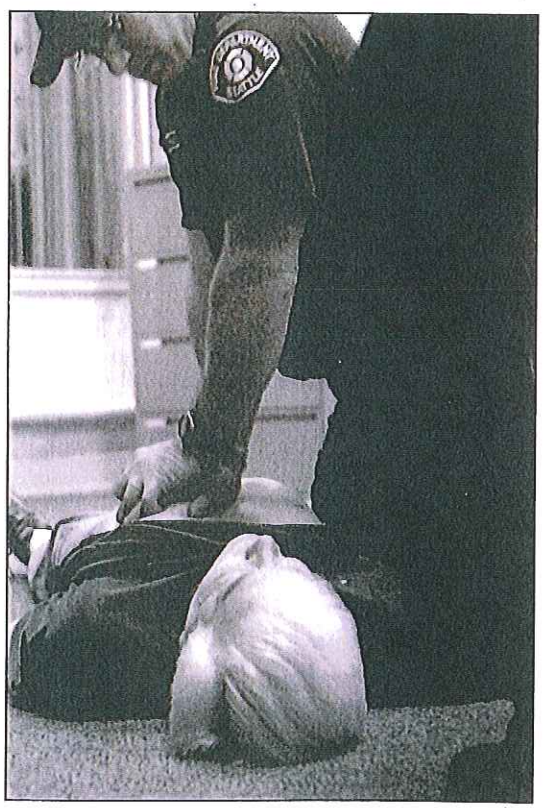
Blue = Per agency policy, optional.
Alt Airway= King LT or Combitube

Note: Ventilation is not necessary during the first 800 compressions (4 compression/shock cycles) except when there is a respiratory/hypoxic cause to the cardiac arrest (e.g. drowning) and after the initial 800 compressions. Intubation is not a necessity and should be avoided during the first 800 compressions For pediatric patient ≤14 years old, provide CPR with 15:2 compressions and follow protocol #3031P

High Performance CPR Overview

Cardiovascular disease is the single greatest cause of death in the United States. Each year upwards of a quarter of a million persons receive attempted resuscitation from cardiac arrest by Emergency Medical Services (EMS). The prognosis for the majority of these arrests remains poor.

Quality CPR improves survival from cardiac arrest. Scientific studies demonstrate when CPR is performed according to guidelines, the chances of successful resuscitation increase substantially. Minimal breaks in compressions, full chest recoil, adequate compression depth, and adequate compression rate are all components of CPR that can increase survival from cardiac arrest. Together, these components combine to create high performance CPR (HP CPR). This toolkit will provide you with teaching material to achieve HP CPR in your EMS system. The following written material is meant to complement the accompanying DVD.



Buy-in

Research indicates that HP CPR can save lives. In order to create an environment of sustained HP CPR, everyone must be on board. EMTs first on scene must take responsibility or "**OWN**" the CPR portion of the resuscitation. When paramedics arrive, they will perform the advanced life support measures of the resuscitation and work in coordination with ongoing CPR. For systems in which an EMT/paramedic team arrives first at the scene the EMT must assume responsibility for CPR while the paramedic assumes responsibilities for ALS. The goal is for additional resuscitation care such as defibrillation, medication therapies, or airway management to compliment CPR. CPR should be the default action at all times.

In order to have effective HP CPR ALL involved must work as a team, not as separate entities. In order to achieve this goal, HP CPR must start at the top and be endorsed by the EMS Chief and Medical Director. The value of HP CPR must be communicated to the men and women who actually perform the resuscitation.

The priority of the resuscitation team needs to be HP CPR. In many systems the EMT is directed to provide CPR. The EMT needs to provide CPR with the appreciation that it is their primary responsibility. Even though the EMT is providing CPR, paramedics need to recognize its critical importance and work to integrate ALS care in a way that enables the EMT to achieve consistent CPR. This partnership between EMTs and paramedics will provide the basis to achieve HP CPR and in turn improve the chances of successful resuscitation.

Teamwork is key: collaborate, communicate, and coordinate!

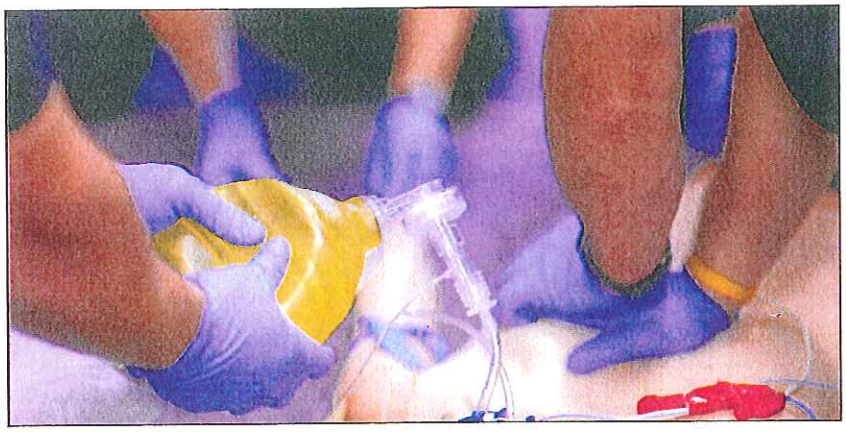
2010 AHA Guidelines recommendation:

Team Resuscitation

- Change:
  - Increased focus on using a team approach during resuscitations
- Why:
  - Many CPR interventions performed simultaneously
  - Collaborative work minimizes interruption in compressions
  - Clear communication minimizes errors

10 Principles

There are 10 main principals of HP CPR. The final page of this toolkit contains a list of relevant articles regarding the science behind these principals.

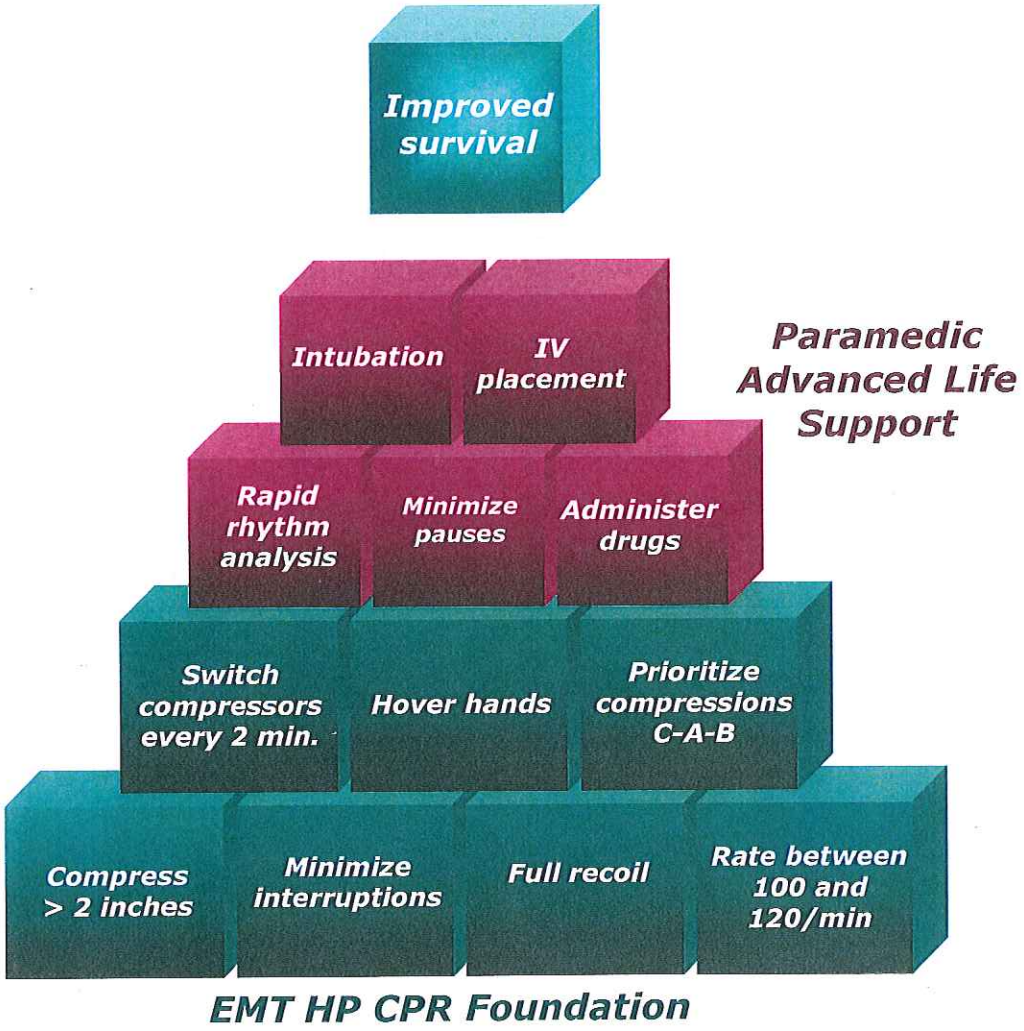


10 principles of HP CPR

1. EMTs own CPR
2. Minimize interruptions in CPR *at all times*
3. Ensure proper depth of compressions (>2 inches)
4. Ensure full chest recoil/decompression
5. Ensure proper chest compression rate (100-120/min)
6. Rotate compressors every 2 minutes
7. Hover hands over chest during shock administration and be ready to compress as soon as patient is cleared
8. Intubate or place advanced airway with ongoing CPR
9. Place IV or IO with ongoing CPR
10. Coordination and teamwork between EMTs and paramedics

Building blocks of resuscitation

Successful resuscitation begins with a foundation of HP CPR provided by EMTs. Advanced cardiac life support then builds upon the foundation of HP CPR. The approach requires teamwork by EMS crews.



Tools/Models

EMS systems are different. Therefore the specifics of HP CPR must be adapted to the protocols used within the system. Several models exist as examples of successful high performance CPR which can be adapted to fit different programs. The following chart shows two examples that are showcased in the accompanying DVD. Note that some EMS agencies require 1.5 to 3 minutes of CPR prior to the first rhythm assessment.

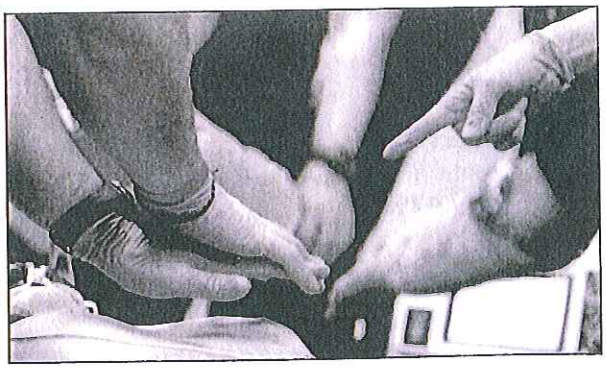
	BLS Continuous	BLS 30:2
Compression/ventilation ratio	10:1	30:2
Stop for ventilations	no	yes
Rhythm assessment	every 2 minutes	every 2 minutes*
Compressions prior to rhythm assessment	2 minutes or 200 compressions	variable*

*Some EMS agencies may require 30 compressions immediately prior to the first and every subsequent rhythm assessment.

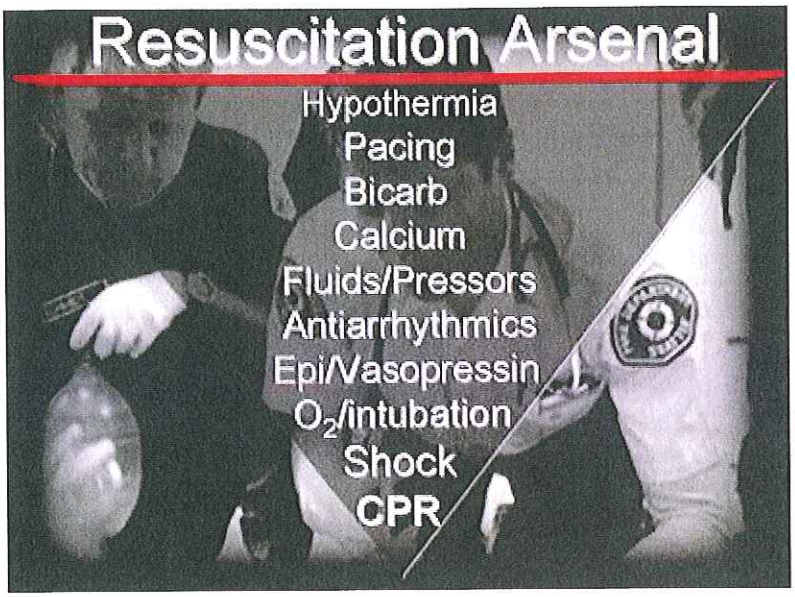
No matter which model is used or how many responders are present, the following are ***always*** true:

- C-A-B
- Minimize interruptions in compressions
- Compress at least 100/min
- Allow complete chest wall recoil/decompression between compressions
- Rhythm assessment every 2 minutes
- Rotate compressors every 2 minutes
- Hover over patient with hands ready during defibrillation so compressions can start immediately after the shock (or analysis) has occurred

Each resuscitation is different and faces unique challenges. Depending on the number of responders, each responder may have a single or multiple designated roles. Examples of the choreography and coordination of these roles is demonstrated on the accompanying DVD.



Science behind High Performance CPR



The importance of good CPR

- CPR is the foundation of the resuscitation arsenal.
- High performance CPR improves the likelihood of a successful defibrillatory shock.
- High performance CPR improves the likelihood of a successful resuscitation.

How well do we do?

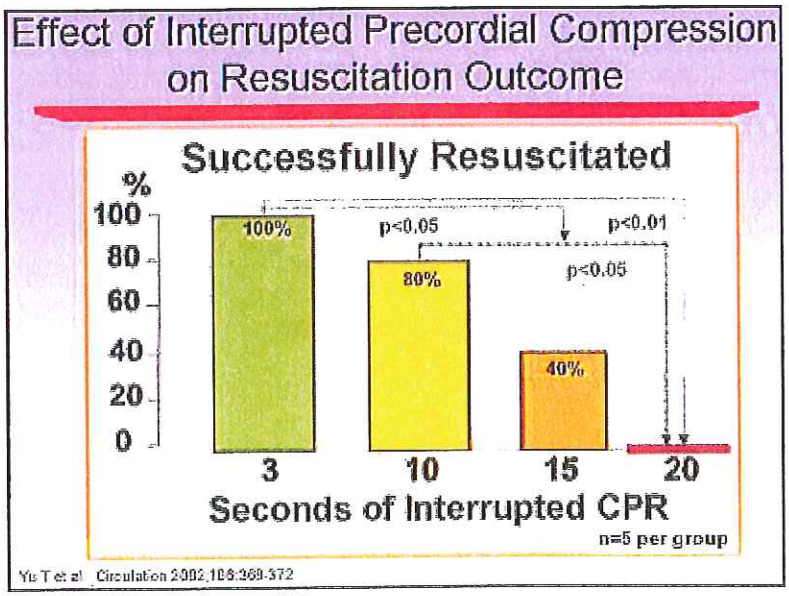
- Perceived performance does not always match observed performance.
- Aufderheide et al. showed that duty cycle, chest compression depth and complete recoil were performed significantly less well when directly observed than EMT perceptions of their performance.
- Wik et al. showed that chest compression rate and depth were both significantly below AHA guidelines by trained EMS providers, and no flow time (when there was neither a pulse nor CPR being given) was almost 50% in directly observed performance evaluations.
- The likelihood of ROSC increases significantly with higher mean chest compression rate (in a hospital study 75% of patients achieved ROSC with 90 or more chest compressions/minute compared to only 42% with 72 or fewer chest compressions/minute).

The components of CPR

- Better compressions lead to better organ perfusion which leads to better resuscitation.
- Greater depth of compressions=increased likelihood of a successful shock.
- **Compression**=Brain and organ perfusion.
- **Decompression**=Heart perfusion.

Does pausing make a difference?

- **YES!**
- *Longer pauses* in chest compressions=*lower chances* of positive outcome.
- The longer the pause preceding shock or following a shock, the lower the chances of survival.

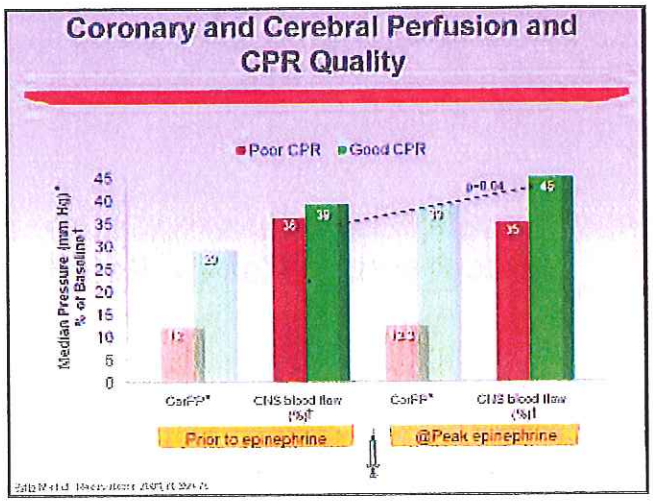


Recoil/Decompression

- If decompression is incomplete, compression is not as effective due to inadequate blood volume in the heart and lungs.
- Yannopoulos et al. showed that 75% decompression (rather than 100% decompression) does not provide sufficient coronary or cerebral perfusion pressures to achieve ROSC.
- Inadequate decompression compromises both coronary *and* cerebral blood flow
- Even limited periods of incomplete decompression can have a lingering effect on coronary and cerebral perfusion pressures, which may remain low even after this deficiency in CPR has been corrected.

Effect on medication

- Perfusion is the mechanism that circulates medications. The better the perfusion, the better the circulation of medications.
- Good CPR decreases two-fold the amount of time required for epinephrine to reach peak concentrations in circulating blood when compared to poor CPR.
- Better CPR=Decreased time to circulate and likely increased efficacy of medications.



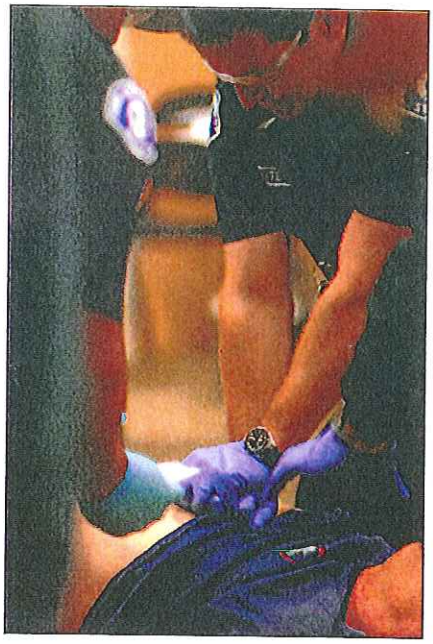
Ventilations

- Ventilation is believed to be a vital component of resuscitation, but too much of a good thing (hyperventilation) can decrease survival.
- Long ventilations (greater than the 1 second per breath recommended by AHA) potentially increases the pause (during 30:2) and the amount of time spent without chest compressions.
- Even when not interrupting CPR (such as in an intubated patient), excessive ventilation prevents the development of negative intrathoracic pressure during the decompression phase of CPR, which impedes blood return (filling) to the heart.

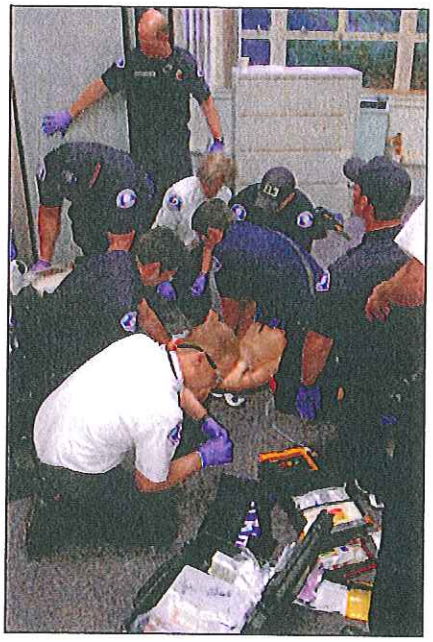
Training

Depending on the size of the agency, responders might participate in one resuscitation a week or one a year. It is important that they are well prepared no matter how many times they perform CPR throughout the year. Training responders on the key principals of HP CPR on a regular basis will keep skills sharp and lead to more successful resuscitation attempts.

There are many different forms of training and recertification for EMTs and paramedics. The most effective form is a hands-on approach. Understanding what 100 compressions/minute feels like and being in the middle of a well-choreographed resuscitation will give responders a better understanding of the different roles people play and how all of these different roles fit together. **The most effective training is simple, realistic, scenario driven, and completely hands on**. Other training options include combinations of paper, video, and hands-on models. It is incredibly difficult to learn psychomotor skills without hands-on practice; power points and lectures alone will not suffice. At 3 o'clock in the morning at the scene of a resuscitation, responders will remember what they last practiced, but won't necessarily remember a power point slide.



Education in the form of lectures, videos, and articles is valuable in gaining a better understanding of *why* high performance CPR is necessary, but it is the hands-on training that will give them the *how*.



HP CPR Training Module: Demonstrate, practice, practice, and more practice, and then evaluate.

Simplicity is essential for training EMTs and first responders. Get the tools out, explain the scenario, place the manikins on the floor, and **"practice like you play."** Remeber this type of training can become ineffective by trying to overcomplicate the core concepts.

In addition to technique, timing is also a very important aspect of HP CPR training. Yearly evaluations, bi-annual and monthly trainings, and timely training updates are effective in making sure staff is ready for the next call.

Maintaining successful HP CPR

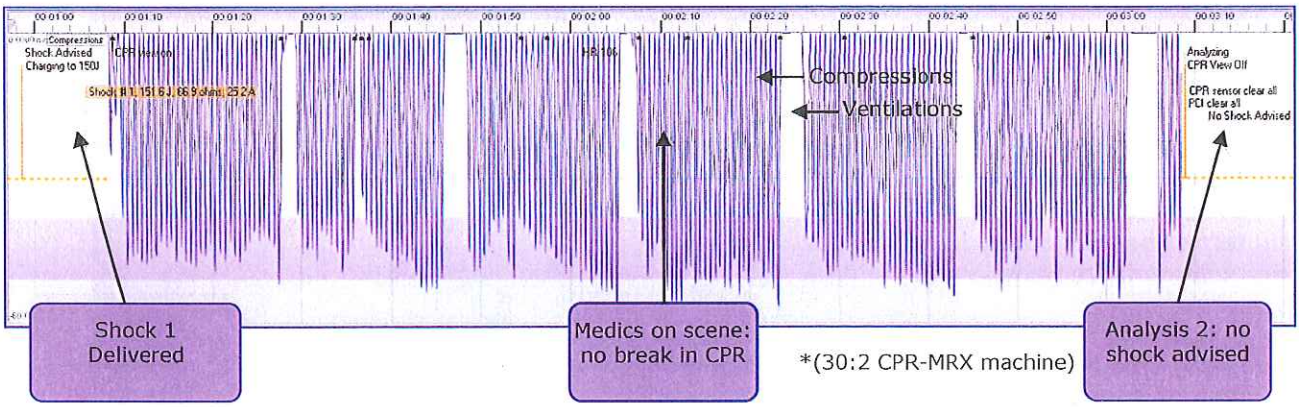
Maintenance

In order to ensure that patients are receiving the best resuscitation possible, each EMS system **must** have a way to measure the performance of their responders. Many tools are available for this specific purpose, from training tools to tools used in the field.

For example:

- Manikins which measure cadence, depth, recoil
- CPR performance tools
- Defibrillators which record ECG, compressions, and audio

These devices can measure the quality of chest compressions, the ability of ALS and BLS to coordinate, the amount of time chest compressions were not being performed and the reason for the lack of compressions. Some of these devices may require software updates or new hardware, but will prove invaluable in improving CPR.



Feedback

Responders want to know how they performed. By quantifying performance measures such as compression rate and time spent on rhythm analysis, they will have a solid marker to improve upon or try to maintain. Many agencies see it as a sort of competition, which can increase resuscitation performance as well as increase buy-in from responders.

Feedback is necessary to improve performance. How will a responder know what to improve upon during the next resuscitation if there is no feedback as to their performance on previous resuscitations?

There are many different options for providing feedback. Letters, short forms, and spreadsheets are just a few ways to provide the feedback. Additionally, options for timing and depth of feedback are also available. Individual feedback is key, but some agencies also choose to provide agency-wide feedback on a regular basis. The following pages show examples of different forms of individual and agency feedback for the purpose of quality improvement.

Articles

Aufderheide TP, Pirrallo RG, Yannopoulos D, Klein JP, von Briesen C, Sparks CW, Deja KA, Conrad CJ, Kitscha DJ, Provo TA, Lurie KG. Incomplete chest wall decompression: a clinical evaluation of CPR performance by EMS personnel and assessment of alternative manual chest compression-decompression techniques. *Resuscitation.* 2005 Mar;64(3):353-62.

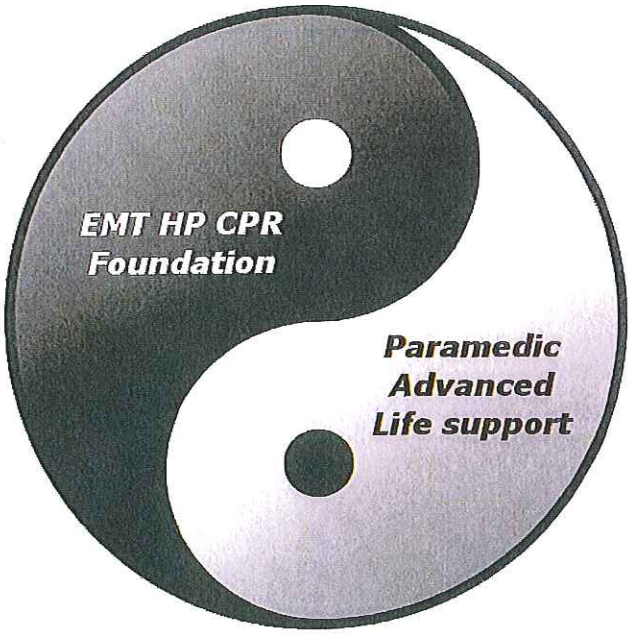
Edelson DP, Abella BS, Kramer-Johansen J, Wik L, Myklebust H, Barry AM, Merchant RM, Hoek TL, Steen PA, Becker LB. Effects of compression depth and pre-shock pauses predict defibrillation failure during cardiac arrest. *Resuscitation.* 2006 Nov;71(2):137-45.

Pytte M, Kramer-Johansen J, Eilevstjønn J, Eriksen M, Strømme TA, Godang K, Wik L, Steen PA, Sunde K. Haemodynamic effects of adrenaline (epinephrine) depend on chest compression quality during cardiopulmonary resuscitation in pigs. *Resuscitation.* 2006 Dec;71(3):369-78.

Wik L, Kramer-Johansen J, Myklebust H, Sørebø H, Svensson L, Fellows B, Steen PA. Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest. *JAMA.* 2005 Jan 19;293(3):299-304.

Yannopoulos D, McKnite S, Aufderheide TP, Sigurdsson G, Pirrallo RG, Benditt D, Lurie KG. Effects of incomplete chest wall decompression during cardiopulmonary resuscitation on coronary and cerebral perfusion pressures in a porcine model of cardiac arrest. *Resuscitation.* 2005 Mar;64(3):363-72.

Yu T, Weil MH, Tang W, Sun S, Klouche K, Povoas H, Bisera J. Adverse outcomes of interrupted precordial compression during automated defibrillation. *Circulation*. 2002 Jul 16;106(3):368-72.



Notes