LUCAS COUNTY
DEPARTMENT OF EMERGENCY SERVICES

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TO: ALL LUCAS COUNTY PARAMEDICS

DATE: October 7, 2008

FROM: Brent Parquette, NREMT-P
Continuing Education Program Administrator

RE: **Continuing Education December 2008**

In the month of December you will be introduced to ***WebPCR***, the next phase in patient care reporting. The web component will allow for "open" calls within the inbox of the tablet to be transferred to a desktop computer for completion. Each paramedic will be given secured web access which will allow for more versatility in completing patient care documentation. ***WebPCR*** access will also help facilitate a QA/QI process to aide in identifying areas for documentation improvement.

Additionally, a new advanced airway device (KING LTS-D) will be in-serviced with time set aside for mannequin practice. The KING LTS-D is a disposable supralaryngeal airway created as an alternative to tracheal intubation or mask ventilation. You will find that the KING airway is very easily placed and maintained and will serve as a better back-up airway than the current LMA. It is the intent, based upon EMS funding, to start utilizing the KING airway by early 2009.

With most recent emphasis on EMS response and treatment of cardiac arrest, I will offer some "tips and techniques" for optimizing outcomes after cardiac arrest that you will "put into action" while in skill stations. The remainder of class time will be spent in review of some recent patient care reports (ePCR). Continual review is important to help improve our documentation skills as an EMS system.

Please take time to review the attached educational material to help better prepare you for your scheduled class in the month of December. As always, if you have any questions or comments, please feel free to call me at 419-213-6508.

Lucas County EMS Continuing Education
December 2008

December Class Schedule

Date	Time	Shift
December 2, 2008 (Tues)	1800-2200	A
December 3, 2008 (Wed)	1300-1700	B
December 9, 2008 (Tues)	1800-2200	B
December 10, 2008 (Wed)	0900-1300	C
December 11, 2008 (Thurs)	1300-1700	A
December 15, 2008 (Mon)	0900-1300	B
December 16, 2008 (Tues)	1800-2200	C
December 17, 2008 (Wed)	1300-1700	A

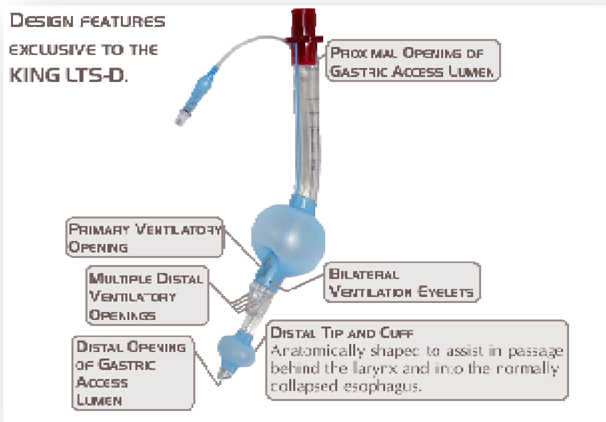
Lucas County EMS Continuing Education
December 2008

Agenda

10 minutes	Welcome • Announcements
50 minutes	Introduction to *WebPCR*
15 minutes	BREAK
30 minutes	Introduction to KING LTS-D Airway • Video
15 minutes	Resuscitation "Tips and Techniques"
60 minutes	Skill Stations: • KING LTS-D Airway • "ICE" Protocol • Resuscitation Techniques
15 minutes	BREAK
45 minutes	ePCR Chart Review

KING LTS-D AIRWAY

Description:
The KING LTS-D is a single use device intended for airway management. It consists of a curved tube with ventilation apertures located between two inflatable cuffs. Both cuffs are inflated using a single valve/pilot balloon. The distal cuff is designed to seal off the esophagus, while the proximal cuff is intended to seal the oropharynx. Attached to the proximal end of the tube is a 15 mm connector for attachment to a standard breathing circuit or resuscitation bag.



Indications for Use:
The KING LTS-D is intended for airway management involving controlled (30 cm H_2O or higher) or spontaneous ventilation. Also indicated for difficult and emergent airway cases and is well suited for ambulatory and office-based anesthesia.

Contraindications:
The following contraindications are applicable for routine use of the KING LTS-D:

- Responsive patients with an intact gag reflex.
- Patients with known esophageal disease.
- Patients who have ingested caustic substances.

KING LTS-D AIRWAY

Warnings:

- Does not protect the airway from the effects of regurgitation and aspiration.
- High airway pressures may divert gas either to the stomach or to the atmosphere.
- Intubation of the trachea cannot be ruled out as a potential complication of the insertion of the KING LTS-D.
- After placement, perform standard checks for breath sounds and utilize an appropriate carbon dioxide monitor as required by protocol.
- Lubricate only the posterior surface of the KING LTS-D to avoid blockage of the aperture or aspiration of the lubricant.
- The KING LTS-D in not intended for re-use.
- During transition to spontaneous ventilation, airway manipulations or other methods may be needed to maintain airway patency.

Latex-Free:
The KING LTS-D is 100% latex-free and should be considered safe to use on patients who are latex sensitive.

KING LTS-D	3	4	5
Connector Color	Yellow	Red	Purple
Recommended Patient Height	4-5 feet (122-155 cm)	5-6 feet (155-180 cm)	greater than 6 feet (180 cm)
Item #	KLTSD403	KLTSD404	KLTSD405
O.D./I.D.*	18 mm/10 mm	18 mm/10 mm	18 mm/10 mm
Cuff Pressure	60 cm H_2O	60 cm H_2O	60 cm H_2O
Gastric Tube	up to 18 Fr	up to 18 Fr	up to 18 Fr
Cuff Volume	45-60 ml	60-80 ml	70-90 ml

*Ventilation Lumen is not round, but is equivalent to a 10 mm I.D. tube, Max Tube Exchange Catheter: 19 Fr, Max Fiberoptic Bronchoscope: 6 mm OD, Minimum Mouth Opening: 20 mm

KING LTS-D AIRWAY

KING LTS-D Insertion Instructions:

1. Using the information provided, choose the correct KING LTS-D size, based on patient height.

2. Test cuff inflation system by injecting the maximum recommended volume of air into the cuffs (refer to sizing information chart). Remove all air from cuffs prior to insertion.

3. Apply a water-based lubricant to the beveled distal tip and posterior aspect of the tube, taking care to avoid introduction of lubricant in or near the ventilatory openings.

4. Have a spare KING LTS-D ready and prepared for immediate use.

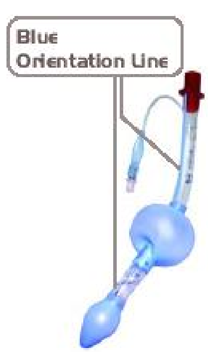
5. Pre-oxygenate.

6. For EMS/Non-Operating room Applications: Ensure gag reflex is not intact.

7. Position the head. The ideal head position for insertion of the KING LTS-D is the “sniffing position”. However, the angle and shortness of the tube also allows it to be inserted with the head in a neutral position.

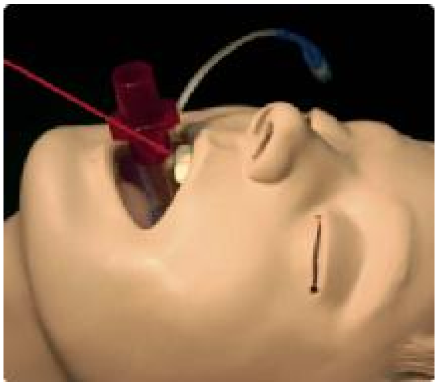
8. Hold the KING LTS-D at the connector with dominant hand. With non-dominant hand, hold mouth open and apply chin lift.

9. With the KING LTS-D rotated laterally 45-90° such that the blue orientation line is touching the corner of the mouth, introduce the tip into mouth and advance behind base of tongue. Never force the tube into position.



10. As tube tip passes under tongue, rotate tube back to midline (blue orientation line faces chin).

11. Without exerting excessive force, advance KING LTS-D until base of connector is aligned with teeth or gums.



12. For EMS/Non-Operating Room Applications: Fully inflate cuffs using the maximum volume of the syringe included in the EMS kit.

13. Attach the breathing circuit or resuscitator bag to the 15 mm connector of the KING LTS-D. While gently bagging the patient to assess ventilation, simultaneously withdraw the airway until ventilation is easy and free flowing (large tidal volume with minimal airway pressure).

14. Depth markings are provided at the proximal end of the KING LTS-D which refer to the distance from the distal ventilatory openings. When properly placed with the distal tip and cuff in the upper esophagus and the ventilatory openings aligned with the opening to the larynx, the depth markings give an indication of the distance, in cm, from the vocal cords to the upper teeth.

15. Confirm proper position by auscultation, chest movement and verification of $C0_2$ by capnography.

16. Readjust cuff inflation to 60 cm of H_20 (or to just seal volume). Typical inflation volumes are as follows:
    - Size 3 45-60mL
    - Size 4 60-80mL
    - Size 5 70-90mL

17. Secure KING LTS-D to patient using tape or other accepted means. A bite block can also be used, if desired.

KING LTS-D AIRWAY

Removal of the KING LTS-D:

1. Once it is in the correct position, the KING LTS-D is well tolerated until the return of protective reflexes.

2. KING LTS-D removal should always be carried out in an area where suction equipment and the ability for rapid intubations are present.

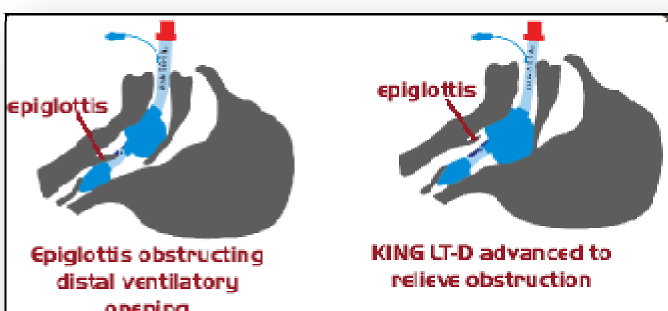
3. For KING LTS-D removal, it is important that both cuffs are completely deflated.

User Tips:

1. The key to insertion is to get the distal tip of the KING LTS-D around the corner in the posterior pharynx, under the base of the tongue. Experience has indicated that a lateral approach, in conjunction with a chin lift, facilitates placement of the KING LTS-D. Alternatively, a laryngoscope or tongue depressor can be used to lift the tongue anteriorly to allow easy advancement of the KING LTS-D into position.

2. Insertion can be also accomplished via a midline approach by applying a chin lift and sliding the distal tip along the palate and into position in the hypopharynx. In this instance, head extension may also be helpful.

3. As the KING LTS-D is advanced around the corner in the posterior pharynx, it is important that the tip of the device is maintained at the midline. If the tip is placed or deflected laterally, it may enter the piriform fossa and the tube will appear to bounce back upon full insertion and release. Keeping the tip at the midline assures that the distal tip is placed properly in the hypopharynx/upper esophagus.



4. Depth of insertion is key to providing a patent airway. Ventilatory openings of the KING LTS-D must align with the laryngeal inlet for adequate oxygenation/ventilation to occur. Accordingly, the insertion depth should be adjusted to maximize ventilation. Experience has indicated that initially placing the KING LTS-D deeper (base of connector is aligned with teeth or gums), inflating the cuffs and withdrawing until ventilation is optimized results in the best depth of insertion for the following reasons:

Lucas County EMS Continuing Education
December 2008

Optimizing Outcomes after Cardiac Arrest

"Tips and Techniques for Improved Survival"

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December 2008

Optimizing Outcomes after Cardiac Arrest
"Tips and Techniques for Improved Survival"

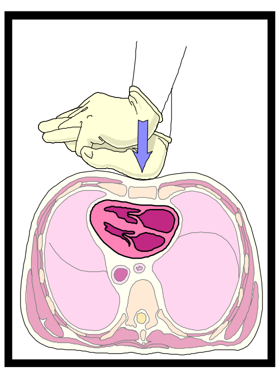
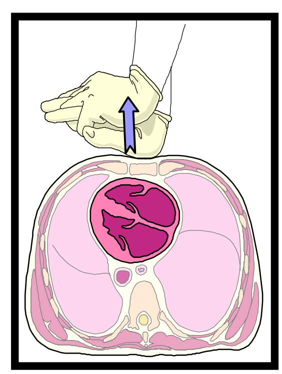
Introduction

Despite receiving conventional, standard cardiopulmonary resuscitation (S-CPR), most patients who experience out-of-hospital cardiac arrest die prior to arriving at a hospital. At present time, the hospital discharge rate following out-of-hospital, non-traumatic cardiac arrest in adults in the United States is estimated to be <5%. Many factors contribute to the currently poor survival statistics, including the inefficiency of the technique itself. CPR provides only 10% to 20% of normal myocardial perfusion, and only 20% to 30% of physiologically normal cerebral perfusion.

Background and Significance of Standard CPR (S-CPR)

The purpose of S-CPR is to pump blood from the chest to vital organs during the compression phase and to enhance the return of blood back into the heart during chest wall recoil (or decompression) phase. These phases are illustrated in Figure 1 below.

Figure 1: Standard CPR (S-CPR)

	*Chest Compression:* 1. *Increases intrathoracic pressure* 2. *Mechanically compresses the heart*		*Chest wall recoil causes small, transient decrease in intrathoracic pressure that returns venous blood to the right heart. Incomplete recoil reduces the vacuum created during chest wall decompression.*
Compression Phase		Decompression Phrase	

During S-CPR, chest compression results in an elevation of intrathoracic pressure and direct cardiac compression. Both of these mechanisms result in forward blood flow out of the chest to perfuse the brain and other vital organs. The effectiveness of S-CPR is largely determined by the amount of blood returned to the heart (preload) after each compression phase. Blood flow back to the heart is highly dependent on the degree of chest wall recoil. When the chest recoils back to its neutral position, intrathoracic pressures fall relative to extrathoracic pressures and venous blood returns to the right heart.

S-CPR by itself is inherently inefficient, in large part due to the lack of adequate blood return to the thorax during the chest wall recoil phase. Blood flow to the vital organs is severely reduced during S-CPR, even under the best circumstances. Moreover, the coronary perfusion pressures are only marginally adequate as the pressure gradient between the aorta, the right atrium and left ventricle is far from optimal. During the decompression (or passive relaxation) phase of CPR, a small decrease in intrathoracic pressure (relative to atmospheric pressure) develops, which promotes blood flow back to the heart. Myocardial perfusion occurs predominately during this decompression phase. The coronary perfusion pressure, which can be estimated as the mathematical difference between the diastolic aortic and the right atrial pressures, is considered a critical determinant of CPR efficacy.

The American Heart Association (AHA) recognized the inefficiencies of S-CPR in their 2005 (current) guidelines for performing CPR. This guideline reinforces the importance of the chest decompression phase and emphasizes allowing complete chest wall decompression while performing CPR:

"Release the pressure on the chest to allow blood to flow into the chest and heart. You must release the pressure completely and allow the chest to return to its normal position after each compression."

Despite these recommendations, recent studies have documented that when CPR is performed on patients by professional rescuers, there is often incomplete chest wall recoil. Even with training, it is difficult to perform S-CPR correctly and allow for the chest to fully recoil after each compression. Incomplete chest wall recoil is a common error, especially for the overzealous or fatigued rescuer. This results in significantly less blood flow back to the heart. Other studies have revealed that the observed incomplete chest wall recoil results in a decrease in coronary perfusion pressure.

Impedance Threshold Device (ITD) – ResQPOD

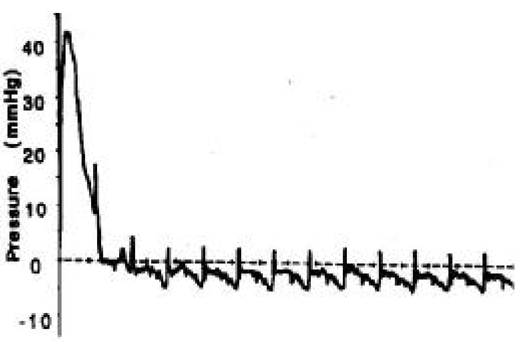
The impedance threshold device (ITD) was developed to enhance the efficacy of S-CPR by increasing the negative intrathoracic pressure during the decompression phase of CPR, without impeding manual ventilation or exhalation. The device is based on the principle that impedance of inspiratory gas exchange during the decompression or relaxation phase of CPR leads to a greater negative intrathoracic pressure. This creates a small vacuum within the thorax, relative to the rest of the body, which results in an increase in venous blood return to the heart and an increase in overall vital organ blood flow, critical to affecting survival outcomes. The ITD contains an atmospheric pressure sensitive valve that impedes the influx of inspiratory gas during chest wall decompression, thereby augmenting the amplitude and duration of the vacuum within the thorax (Figure 3).

Figure 3: ITD (ResQPOD)

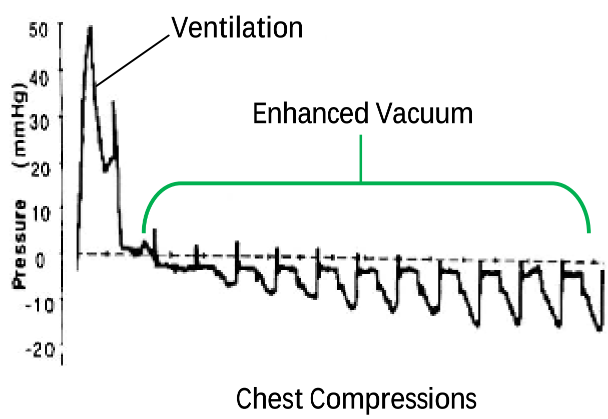
 	*ITD Concept: Lowers intrathoracic pressure in the chest during the decompression phase of CPR and enhances venous return to the thorax:* *ITD Design: Each time the chest wall recoils following a compression, the ITD transiently blocks air from entering the lungs, creating a small vacuum in the chest, resulting in improved blood preload. There is no resistance through the ITD on exhalation or with positive pressure ventilation.*

This vacuum draws more venous blood back into the heart (preload), resulting in improved cardiac output and vital organ perfusion. As such, the ITD augments the action of the chest with each compression-decompression cycle. This is shown graphically in the representative airway pressure tracings from patients undergoing S-CPR with an active ITD on both a facemask and endotracheal tube.

Conventional CPR



CPR with ITD



Ventilations during CPR

The *ECC Guidelines* recommend a variety of tidal volumes, respiratory rates, and breath delivery intervals. These guidelines provide simple recommendations for delivery of rescue breaths during cardiac arrest as follows:

- Deliver each rescue breath over 1 second (Class IIa).
- Give sufficient tidal volume to produce *visible chest rise* (Class IIa).
- Avoid rapid or forceful breaths.
- When an advanced airway (i.e., endotracheal tube, Combitube, KING Airway, or LMA) is in place during 2-person CPR, ventilate at a rate of 8-10 per minute without attempting to synchronize breaths between compressions. There should be no pause in chest compressions for delivery of ventilations (Class IIa).

During adult CPR tidal volumes of approximately 500-600mL (6-7mL/Kg) should suffice. Although a rescuer cannot estimate tidal volume, this guide may be useful for setting automatic transport ventilators.

Gastric inflation often develops when ventilation is provided without an advanced airway. It can cause regurgitation and aspiration, and by elevating the diaphragm, it can restrict lung movement and decrease respiratory compliance. Air delivered with each rescue breath can enter the stomach when pressure in the esophagus exceeds the lower esophageal sphincter opening pressure. Risk of gastric inflation is increased by high proximal airway pressure and the reduced opening pressure of the lower esophageal sphincter. High pressure can be created by a short inspiratory time, large tidal volume, high peak inspiratory pressure, incomplete airway opening, and decreased lung compliance. To minimize the potential for gastric inflation and its complications, deliver each breath to patients with or without an advanced airway over 1 second and deliver tidal volume that is sufficient to produce visible chest rise (Class IIa). But do not deliver more volume or use more force than is needed to produce visible chest rise.

Bag-Mask Ventilation

Bag-mask ventilation is a challenging skill that requires considerable practice for competency. The lone rescuer using a bag-mask device should be able to simultaneously open the airway with a jaw lift, hold the mask tightly against the patient's face, and squeeze the bag. The rescuer must also watch to be sure the chest rises with each breath.

Bag-mask ventilation is most effective when provided by 2 trained and experienced rescuers. One rescuer opens the airway and seals the mask to the face while the other squeezes the bag. Both rescuers watch for visible chest rise.

Figure 4: 2-Hand Face Mask Technique

Ventilation with an Advanced Airway

When the victim has an advanced airway in place during CPR, 2 rescuers no longer deliver cycles of CPR (i.e., compressions interrupted by pauses for ventilation). Instead, the compressing rescuer should give continuous chest compressions at a rate of 100 per minute without pauses for ventilation. The rescuer delivering ventilation provides 8-10 breaths per minute. The 2 rescuers should change compressor and ventilator roles approximately every 2 minutes to prevent compressor fatigue and deterioration in quality and rate of chest compressions. When multiple rescuers are present, they should rotate the compressor role about every 2 minutes.

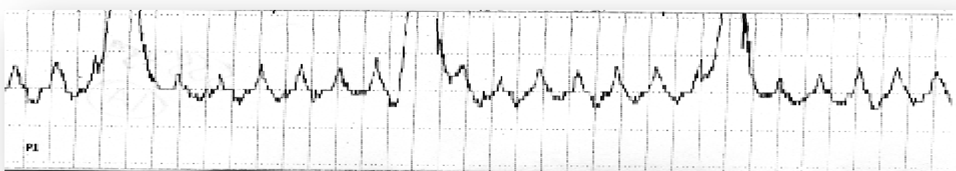
Rescuers should avoid excessive ventilation by giving the recommended breaths per minute and limiting tidal volume to achieve chest rise (Class IIa). A translational research study showed that delivery of >12 breaths per minute during CPR leads to increased intrathoracic pressure, impeding venous return to the heart during chest compressions. Reduced venous return leads to diminished cardiac output during chest compressions and decreased coronary and cerebral perfusion. It is critically important that rescuers maintain a ventilation rate or 8-10 breaths per minute during CPR and avoid excessive ventilation.

Lessons Learned Along the Way: "Ventilation and Compression Strategies"

3 common errors during CPR that must be avoided:

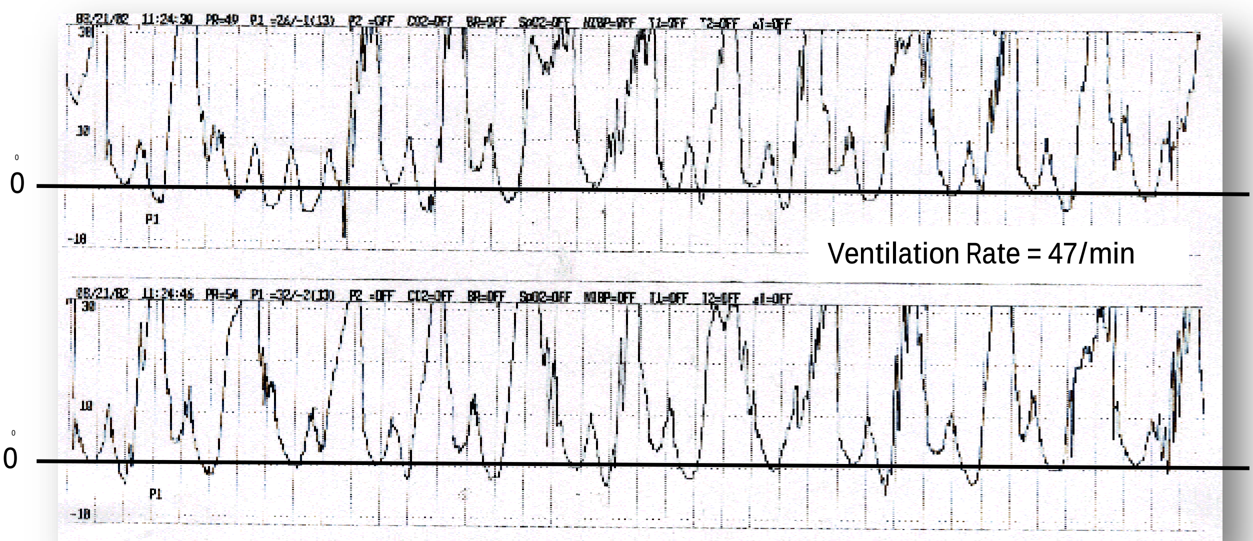
1. Avoid hyperventilation
2. Allow the chest to recoil completely after each compression
3. Always maintain a continuous airtight seal when using the ResQPOD with a facemask

Airway Pressure Waveforms

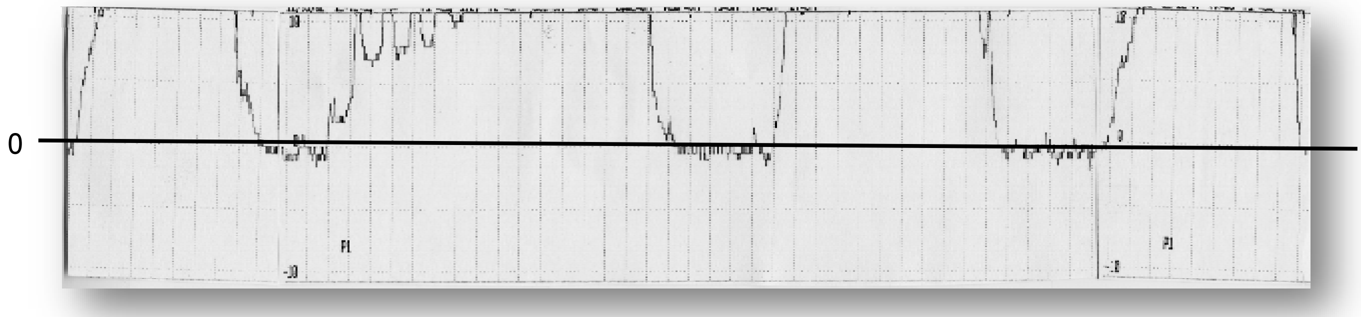


Large amplitude waves = ventilation
Small amplitude waves = compression

"Death by Hyperventilation"



Effects of Prolonged Ventilation



Ventilation Duration = 4.36 seconds / breath
Ventilation Rate = 11 breaths / minute
% Positive Pressure = 80%

Porcine Survival Study

Breaths / Minute	02 / C02	Survival Rate
12	100% 02	6/7 (86%) 
30	100% 02	1/7 (14%) 
30	95% 02 / 5% C02	1/7 (14%) 

Hyperventilation-Induced Hypotension During Cardiopulmonary Resuscitation

Tom P. Aufderheide, MD; Gardar Sigurdsson, MD; Ronald G. Pirrallo, MD, MHSA; Demetris Yannopoulos, MD; Scott McKnite, BA; Chris von Briesen, BA, EMT; Christopher W. Sparks, EMT; Craig J. Conrad, RN; Terry A. Provo, BA, EMT-P; Keith G. Lurie, MD

Background—A clinical observational study revealed that rescuers consistently hyperventilated patients during out-of-hospital cardiopulmonary resuscitation (CPR). The objective of this study was to quantify the degree of excessive ventilation in humans and determine if comparable excessive ventilation rates during CPR in animals significantly decrease coronary perfusion pressure and survival.

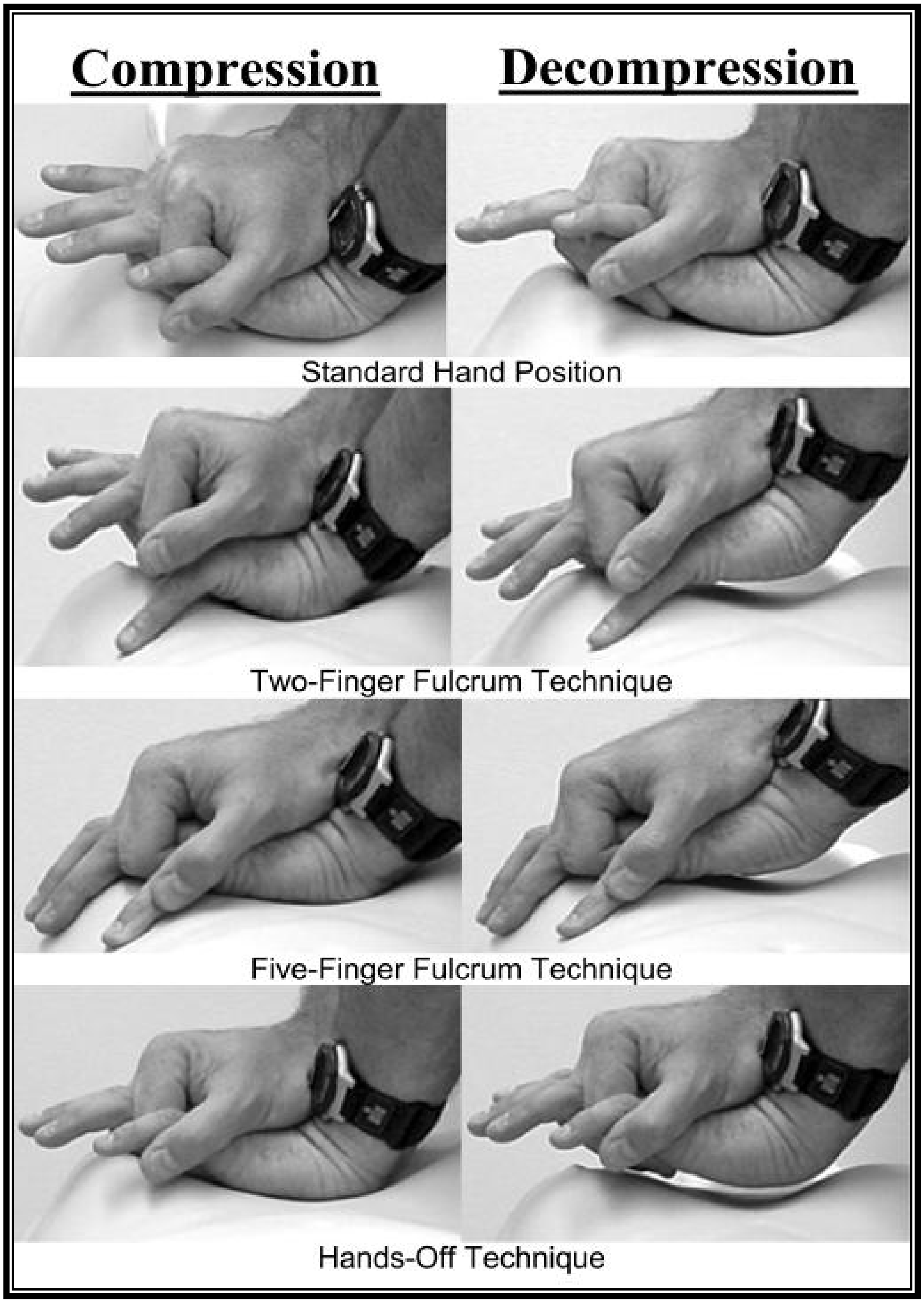
Methods and Results—In humans, ventilation rate and duration during CPR was electronically recorded by professional rescuers. In 13 consecutive adults (average age, 63±5.8 years) receiving CPR (7 men), average ventilation rate was 30±3.2 per minute (range, 15 to 49). Average duration per breath was 1.0±0.07 per second. No patient survived. Hemodynamics were studied in 9 pigs in cardiac arrest ventilated in random order with 12, 20, or 30 breaths per minute. Survival rates were then studied in 3 groups of 7 pigs in cardiac arrest that were ventilated at 12 breaths per minute (100% O_2), 30 breaths per minute (100% O_2), or 30 breaths per minute (5% CO_2/95% O_2). In animals treated with 12, 20, and 30 breaths per minute, the mean intrathoracic pressure (mm Hg/min) and coronary perfusion pressure (mm Hg) were 7.1±0.7, 11.6±0.7, 17.5±1.0 ($P<0.0001$), and 23.4±1.0, 19.5±1.8, and 16.9±1.8 ($P=0.03$), respectively. Survival rates were 6/7, 1/7, and 1/7 with 12, 30, and 30+ CO_2 breaths per minute, respectively ($P=0.006$).

Conclusions—Professional rescuers were observed to excessively ventilate patients during out-of-hospital CPR. Subsequent animal studies demonstrated that similar excessive ventilation rates resulted in significantly increased intrathoracic pressure and markedly decreased coronary perfusion pressures and survival rates. **(*Circulation*. 2004;109:1960-1965.)**

A balance between ventilation and circulation is fundamental to optimizing outcomes during CPR.

8-12 breaths/min provides adequate respiration with minimal negative impact on circulation.

Compression Strategies



What Can We Do Today to Optimize Blood Flow to the Heart and Brain during CPR?????

Ventilate Correctly:

- Deliver ~500cc/breath (AHA Level IIa)
- BLS:
  - 30:2 (AHA Level IIa)
  - Maintain seal with 2-person facemask
- ALS:
  - 10 breaths/min asynchronously (AHA Level IIa)

Compress Correctly:

- Continuous chest compressions for ALS (AHA Level IIa)
  - Allow the chest to fully recoil after each compression
  - Rotate rescuer personnel to avoid fatigue
- For BLS and ALS
  - Generate a vacuum with an ITD (AHA Level IIa)
  - Allow the chest to fully recoil after each compression (AHA Level IIb)
- For VF
  - 90-180 seconds of CPR before and after shock if VF >4 minutes (AHA Level IIb)

I.C.E – Hypothermia Protocol
(Induced Cooling by EMS)

Current research has shown, almost universally, that therapeutic hypothermia reduces brain damage following cardiac arrest. It is well known that the brain responds poorly to hypoxic events. In most situations, the 4-6 minute "point of no return" still applies. Part of the problem (perhaps not realized by many responders) is that brain damage will continue for several hours following resuscitation; it doesn't simply stop because the patient's heart starts beating again. Therapeutic hypothermia can help increase the odds of these patients recovering completely.

Paramedics play an important role in beginning the therapeutic hypothermia process, which usually must continue for a minimum of 12 hours following cardiac arrest. Since therapeutic hypothermia benefits decrease drastically after a delay of even a few minutes following successful cardiac arrest resuscitation, EMS may be in the best position to begin immediate treatment.

Criteria for Induced Hypothermia:

1. ROSC after cardiac arrest not related to trauma or hemorrhage
2. Age $\geq$ 18
3. Initial temperature > 34°C
4. Patient has advanced airway in place (e.g., ETT, LMA) and remains comatose (no purposeful response to pain)
    a. If unable to secure an advanced airway in place, **DO NOT** initiate induced hypothermia
5. Not obviously pregnant

Special Considerations:

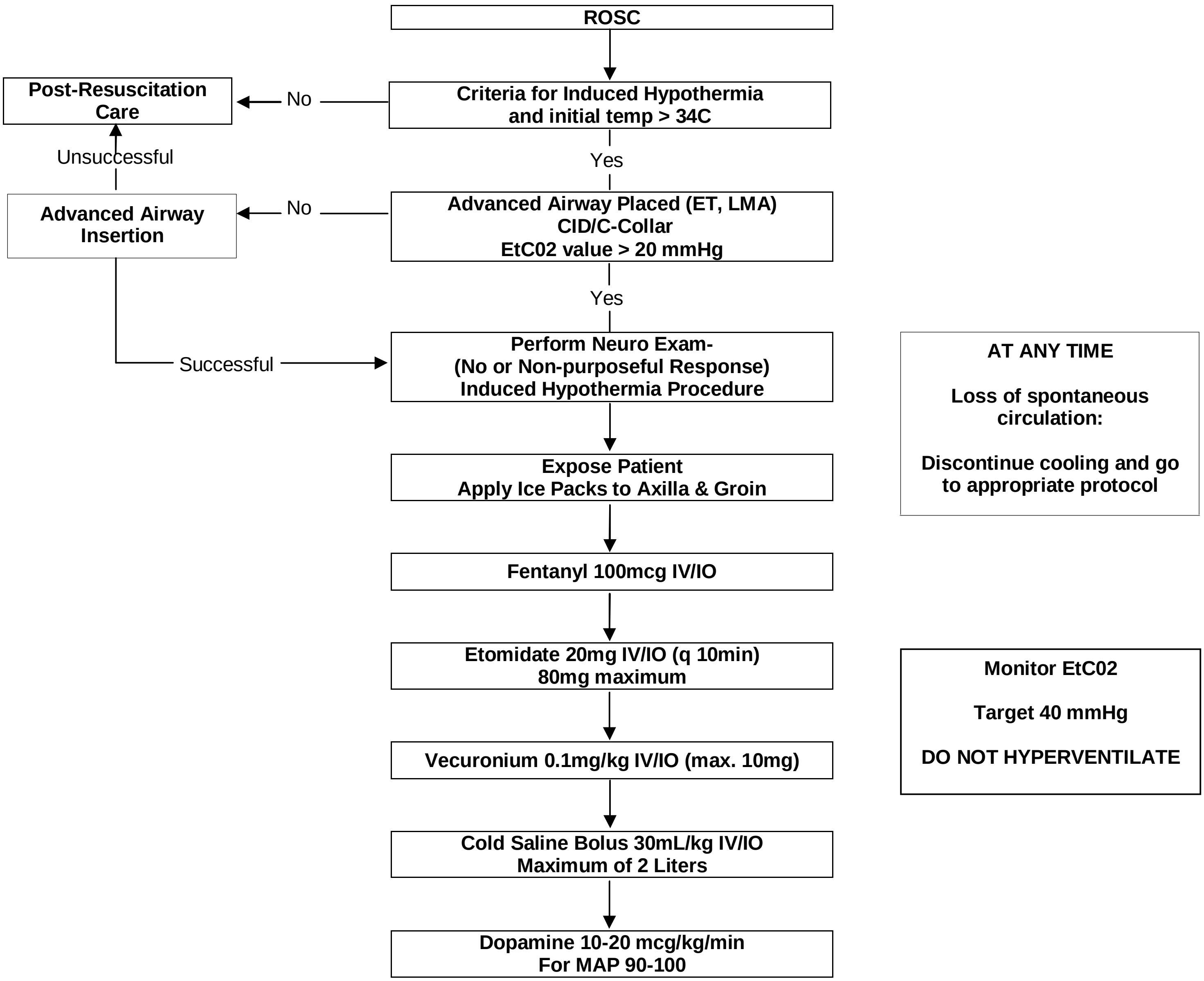
1. In patients with return of spontaneous circulation (ROSC), the first visualized sign may be a significant increase in capnographic waveform and capnogram value. C02 washout through the lungs upon return of mechanical circulation proves a valuable sign of ROSC and should prompt the paramedic in the field to assess patient circulation (pulses).
2. When exposing patient for purpose of cooling with cold packs, undergarments may remain in place. Be mindful of your environment and take steps to preserve the patient's modesty.
3. The hypothermia process may be initiated on the scene. Upon administration of sedation and chilled saline infusion, patients should be prepared for transport to the closest assigned hypothermia center.
4. Two (2) IV/IO access points are desired for purposes of administering chilled saline in the field. Consider 14ga or 16ga catheter placement in the AC (antecubital) area or EJ (external jugular). In the setting of vascular collapse and IV attempts fail or are futile, insert IO for fluid and/or medication administration.

Special Considerations, cont.

5. Fentanyl 100mcg and Etomidate 20mg are administered IV/IO for patient sedation during the therapeutic hypothermia process. Etomidate should be administered every 10 minutes during the course of ICE therapy to a maximum of 80mg. Vecuronium Bromide (Norcuron) 0.1mg/kg is administered IV/IO as a paralyzing agent. Follow all outlined dosing regimens during the hypothermia process.
6. During the induced hypothermic process, patient assessment is critical for ongoing care: With any new signs of patient movement (i.e., gasping, eye fluttering, shivering, seizure activity, movement) during ICE therapy, re-dosing of Etomidate 20mg and 1/10 the original dose of Norcuron (0.01mg/kg) are required.
7. Maintaining cerebral perfusion is essential during the therapeutic hypothermia process. Maintain MAP (Mean Arterial Pressure) at 90-100. Cold saline is a strong vasoconstrictor. MAP values below 90 after cold saline infusion may require pressor administration (Dopamine) for adequate perfusion pressures.
8. Reassess the patient's airway frequently and with every patient movement.
9. Patients develop metabolic alkalosis with cooling. **DO NOT** hyperventilate.
10. Monitor EtC02 frequently and target value at 40mm Hg. If EtC02 values fall below 20mm Hg, consider possible loss of pulses.
11. If there is a loss of ROSC at any time, discontinue cooling and go to appropriate protocol for treatment. Chilled saline infusion should be slowed to KVO rate during the resuscitative process. Upon ROSC (if attained), return chilled saline to wide open infusion.
12. Chilled saline is infused at 30mL/kg to a maximum of 2000mL. With extended transport times, and maximum saline infusion met based upon patient's body weight, continue hypothermia process by hanging additional chilled saline bags at KVO rate.
13. Continue to address specific differentials associated with original dysrhythmia or cause of arrest (H's and T's).
14. With post-arrest 12-Lead acquisition that reveals STEMI criteria, consider Morphine and Lopressor administration as long as adequate pulse and blood pressure parameters are met (per LCEMS protocol: Tab 800 – O: "ACS")
15. Patients with ROSC and/or induced hypothermia should be triaged to the closest "STEMI"/ "Hypothermia" Center. A ROSC or "ICE" Alert should be declared through LCEMS Dispatch for determination of closest open facility and med channel assignment.
16. "STEMI"/ "Hypothermia" Centers include St. Lukes, St. Vincent Mercy Medical Center (SVMMC), The Toledo Hospital (TTH), and The University of Toledo Medical Center (UTMC).

I.C.E – Hypothermia Protocol (Induced Cooling by EMS)

History:	Signs/Symptoms:	Differential:
• Non-Traumatic Cardiac Arrest	• Return of Pulse (ROSC)	• Continue to address specific differentials associated with the original dysrhythmia



Screening for Utilization

- Return of Pulse (ROSC)
- Age ≥ 18
- Temperature > 34°C (Tympanic measurement)
- No purposeful pain response
- Intubated (or LMA) with EtC02 > 20 mm Hg
- Not obviously pregnant

Preparation for Induction - Hypothermia

- Conduct NEURO assessment:
    a. Pupils (size, reactivity, equality)
    b. Motor Response to Pain
- Remove clothing, protect modesty
- Apply cold packs to axilla and groin
- Goal EtC02 = 40; NO Hyperventilation
- Attempt second IV/IO (if not in place)

1

Induction of Paralysis

1. Administer Fentanyl 100mcg IV

2. Administer Etomidate 20mg IV (repeat q10 minutes to max. of 80mg)

3. Administer Vecuronium 0.1mg/kg IV (max. 10 mg)

Weight (lbs)	Weight (kg)	Dose (mg)	Volume (cc)
88	40	4	4
110	50	5	5
132	60	6	6
154	70	7	7
176	80	8	8
198	90	9	9
220	100	10	10

Vecuronium 1mg/mL

Only

2

Saline Infusion and Maintenance of Mean Arterial Pressure

1. Initiate cold saline bolus through up to two (2) IV or IO access points
2. Infuse cold saline at 30mL/kg to maximum of 2 Liters

Weight (lbs)	Weight (kg)	Volume Target (mL)
88	40	1200
110	50	1500
132	60	1800
> or =143	> or =65	2000

3. **Target Mean Arterial Pressure (MAP): 90-100**
4. Check MAP on the LP12, but manually monitor

Systolic	Diastolic	MAP
110	80	90
120	75-90	90-100
130	70-85	90-100
140	65-80	90-100

MAP = Diastolic Value + 1/3 Pulse Pressure

- **Target Diastolic: 80-90**

5. If chilled saline does not maintain MAP go to 4

3

Maintenance of MAP with Pressors

1. Support BP with Dopamine as required to **maintain MAP of 90-100**

The values in this chart are drips per minute on a 60 drop/minute drip set:

Dopamine 400mg/250mL D5W

Weight (lbs)	Weight (kg)	5mcg/kg/min	10mcg/kg/min	20mcg/kg/min
88	40	8	15	30
110	50	9	19	38
132	60	11	23	45
154	70	13	26	53
176	80	15	30	60
198	90	17	34	68
220	100	19	38	75
242	110	21	41	83

NOTE: Discontinue or slow Dopamine drip when diastolic pressure is $\geq$ 90 or MAP $\geq$ 100.

2. Cold saline is a strong vasoconstrictor. Watch MAP closely!

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