C P R

“Changing Concepts”

A B C ........
to

........... C A B
Cardiopulmonary resuscitation (CPR) is an emergency procedure which is attempted in an effort to return life to a person in cardio-respiratory arrest at any place (in- or out-side of a hospital).

It is indicated in those who are unresponsive with no pulse and/or breathing or only gasps.
CPR alone is unlikely to restart the heart; its main purpose is to restore partial flow of oxygenated blood to the brain and heart. It may delay tissue death and extend the brief window of opportunity for a successful advanced resuscitation without permanent brain damage.

CPR is generally continued until the person has Return Of Spontaneous Circulation (ROSC) or is declared dead.
How CPR works?

2 mechanisms explain the restoration of circulation by external cardiac massage.

Cardiac pump

Thoracic pump
**Compression-Decompression**

**Compression**
- Compression of heart & lungs
- Increased intrathoracic pressure

**Decompression**
- Refilling of heart & lungs
- Decreased intrathoracic pressure
- Negative with full recoil
Cardiac pump during the cardiac massage

Blood pumping is assured by the compression of heart between sternum and spine.

Between compressions thoracic cage is expanding and heart is filled with blood.
Thoracic pump during the cardiac massage

- Blood circulation is restored due to the change in intra thoracic pressure and jugular and subclavian vein valves.

- During the chest compression blood is directed from the pulmonary circulation to the systemic circulation. Cardiac valves function as in normal cardiac cycle.
What does CPR do?

The critical effect of chest compressions is the generation of Coronary Perfusion Pressure (CPP). The higher & more sustained the CPP, the better the chances of ROSC & survival.

Satisfactory CPP > 15 mm Hg

\[ CPP = (AoD) - (RaD) \]

= Aortic Diastolic Pressure – Right Atrial Diastolic Pressure

Major determinant for survival in CPR is \( \Rightarrow \) CPP
CPR is often portrayed in movies and television as being highly effective in resuscitating a person who is not breathing and has no circulation.

Unlike in movies, most real-life rescuers are hesitant to do mouth-to-mouth to a stranger.

A 1996 study by the New England Journal of Medicine showed that CPR success rates in television shows was 75%.

The real survival rate of an un-witnessed, out-of-hospital sudden cardiac arrest is in a range of 6% to admission and even less to hospital discharge.

The current rise in the distribution and use of Automated External Defibrillators (AED's) has improved the survival rate dramatically.
Timeframe of a Cardiac Arrest

0 minute

CARDIAC ARREST

4 minute

RESPIRATORY ARREST

6 minutes

BRAIN DAMAGE BEGINS

10 + minutes

IRREVERSIBLE BRAIN DAMAGE
Golden Minutes

Survival % vs. Time to CPR (mins)

The graph illustrates the decrease in survival percentage with increasing time to CPR. The survival rate drops sharply as the time increases, emphasizing the critical importance of immediate CPR.
CPR : Changing Concepts
“The old order changeth,
yielding place to new;
And, God fulfils Himself in many ways,
Lest one good custom should corrupt the world.”

~ ‘Lord’ Alfred Tennyson
“Idylls of the King: The Passing of Arthur”
1833
In the Vedic India, it was believed that an unconscious state can be revived with special herbal medicine called “Sanjeevani Booti”.

The science of rejuvenation was known as “Rasāyana”.
A child of a Shunemite couple complained of a headache and died. The prophet Elisha prayed and then: "...placed himself over the child. He put his mouth on his mouth, his eyes on his eyes, and his hands on his hands, as he bent over him. And the body of the child became warm. He stepped down, walked once up and down the room, then mounted and bent over him. Thereupon the boy sneezed seven times, and the boy opened his eyes." (2 Kings, iv, 34.)
Mayan hieroglyphics and Peruvian Incas performed resuscitation by rectal fumigation!

One can only surmise that while not very successful this technique certainly kept anyone from faking to get off work for the day.
Other Heat Methods

Very early in our history, people realized that the body became cold when lifeless and connected heat with life. In order to prevent death from taking the person, the body was warmed. The use of warm ashes, burning excrement, or hot water placed directly on the body were all employed in an attempt to restore life.

Undoubtedly, these techniques had rather an elusive success over the years.
Phillipus von Hohenheim (1493-1541) wrote about using bellows from fireplaces to blow hot air and smoke into the victim's mouth.

This method was used for almost 300 years for resuscitation.

In 1829, Leroy d'Etiolles demonstrated that over distension of the lungs by bellows could kill an animal, so this practice was discontinued.
16th Century - Inversion Method

Originally practiced for victims of drowning in Egypt almost 3,500 years ago, it again became popular in Europe in the 16th century. It involved hanging the victim by his feet, with chest pressure to aid in expiration and pressure release to aid inspiration.
The Paris Academy of Sciences officially recommended mouth-to-mouth resuscitation for drowning victims.
In an effort to force air in and out of the victim's chest cavity, the rescuer would hoist the victim onto a large wine barrel and alternately roll him back and forth.

This action would result in a compression of the victim's chest cavity, forcing air out, and then a release of pressure which would allow the chest to expand resulting in air being drawn in.

This technique was in many ways a precursor to modern CPR techniques as it attempted to force air in and out of the lungs.
In mid-19th century, Dr. H. R. Silvester described a method of artificial resuscitation in which the patient was laid on their back, and their arms were raised above their head to aid inhalation and then pressed against their chest to aid exhalation. The procedure was repeated 16 times per minute.

This type of artificial respiration is occasionally seen in films made in the early part of the 20th century.
Late 19th Century: Emergence of Chest Massage for CPR

* Prof. Franz König of Göttingen, Germany in his 1883 “Textbook of Surgery” proposed compression @ 30/min of the “heart region” as a ventilatory procedure for revival from “chloroform syncope” in operating rooms.

* His assistant surgeon, Dr. Friedrich Maass, performed the 1st equivocally documented successful chest compression in humans in 1891, but @ 120/min.

Sadly, thereafter, for CPR the attention was more towards ‘open & direct’ cardiac massage and it took another 80 years to re-discover & convince the world for the close chest compressions!
1950s: Mouth to Mouth Advances

* 1954 - James Elam was the first to prove that expired air was sufficient to maintain adequate oxygenation (21% $O_2$ in air we breath in vs 17% $O_2$ in air we breath out)

* 1956 - Peter Safar and James Elam invented mouth-to-mouth resuscitation.

* 1957 - The US military adopted the mouth-to-mouth resuscitation method to revive unresponsive victims.
1960: Modern CPR Technique

* The next major step in CPR was the rediscovery of closed chest massage in the 1960's by workers at John Hopkins, Baltimore.

* On this basis many national and international guidelines to perform CPR came out.

* The American Heart Association became the forerunner of CPR training for the general public as well as physicians.
In July 9th 1960 issue of JAMA, 3 workers from John Hopkins published their observation on 20 CPRs while working on defibrillators. It went on to become one of the most remarkable discovery in the history of cardiology. They were . . .

W. B. Kouwenhoven
Dr James R. Jude, and
G. Guy Knickerbocker.

They meticulously documented, each patient’s case history, whom they were able to successfully revive. One of the highlights of their paper was, with each chest compression they were able to elevate the carotid pressure up to 90 mmHg and was recorded in a pressure tracings.
1962: ‘A-B-C of CPR’ coined

In 1962 Archer S. Gordon along with David Adams, made a 27-minute training film on CPR, in which they devised the easy to remember mnemonic A-B-C, standing for Airway, Breathing and Circulation, the 3 crucial steps needed in succession.

This mnemonic had been in use for almost half-a-century, till the latest AHA Guidelines came in last year.
Changing Concepts...

The ACLS guidelines were first published in 1974 by the American Heart Association and were updated in 1980, 1986, 1992, 2000, 2005, and now, 2010.
CPR

MAJOR STUDIES IN THE LAST DECADE
Weisfeldt et al

“3 phases of Cardiac Arrest”

- Electrical (< 5 mins)
- Circulatory / Hemodynamic (5-10 mins)
- Metabolic (> 10 mins)

(Myron L. Weisfeldt et al, Resuscitation After Cardiac Arrest: A 3-Phase Time-Sensitive Model. JAMA 2002; 288(23):3035-8.)
3 phases of Cardiac Arrest

• **The electrical phase**: the first 5 minutes of arrest due to ventricular fibrillation (VF). Immediate DC cardioversion is needed to optimize survival of these patients.

• **The hemodynamic phase**: the period from 5 to 10 minutes after sudden cardiac arrest during which the patient may remain in VF. Although early defibrillation has been advocated for all VF patients, evidence reveals that patients with low amplitude fibrillation, due to prolonged pulselessness, may benefit from well-performed CPR to generate adequate cerebral and coronary perfusion, prior to initial attempts at defibrillation.

• **The metabolic phase**: defined as greater than 10 minutes of pulselessness. If not quickly converted into a perfusing rhythm, patients in this phase generally do not survive.
3 phases of Cardiac Arrest

- **Electrical Phase**
- **Circulatory Phase**
- **Metabolic Phase**
Weisfeldt et al

“Survival in 3 phases of Cardiac Arrest”

(Myron L. Weisfeldt et al, Resuscitation After Cardiac Arrest: A 3-Phase Time-Sensitive Model. JAMA 2002; 288(23):3035-8.)
Delivering Defibrillation to Give Basic Cardiopulmonary Resuscitation to Patients With Out-of-Hospital Ventricular Fibrillation: A Randomized Trial

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Trond Boye Hansen
Frode Fylling
Thorbjørn Steen, MD
Per Vågenes, MD, PhD
Bjørn H. Austad, PhD
Petter Andreas Steen, MD, PhD

Early defibrillation is critical for survival from ventricular fibrillation. The survival rate decreases by 3% to 4% or 6% to 10% per minute depending on whether basic cardiopulmonary resuscitation (CPR) is performed. Another major factor known to influence survival in patients with ventricular fibrillation is whether CPR is performed prior to when a defibrillator is available. It has been assumed that the blood flow generated by CPR decreases the rate of deterioration of the heart and brain cells, but it is insufficient to improve the state of the tissues. If tissue perfusion could be improved, withholding defibrillation for a short period while administering CPR might improve the results for patients with depleted myocardial levels of high-energy phosphates, severe acidosis, and a ventricular fibrillation frequency spectrum indicating a low chance of defibrillation success. In an experimental study, defibrillation was more successful following basic CPR and high-dose epinephrine than immediate defibrillation in dogs with out-of-hospital ventricular fibrillation.

Context Defibrillation as soon as possible is standard treatment for patients with ventricular fibrillation. A randomized study indicates that after a few minutes of ventricular fibrillation, delaying defibrillation to give cardiopulmonary resuscitation (CPR) first might improve the outcome.

Objective To determine the effects of CPR before defibrillation on outcome in patients with ventricular fibrillation and with response times either up to or longer than 5 minutes.

Design, Setting, and Patients Randomized trial of 200 patients with out-of-hospital ventricular fibrillation in Oslo, Norway, between June 1998 and May 2001. Patients received either standard care with immediate defibrillation (n = 96) or CPR first with 3 minutes of basic CPR by ambulance personnel prior to defibrillation (n = 104).

Main Outcome Measures Primary end points were hospital admission and return of spontaneous circulation (ROSC), 1-year survival, and neurological outcome. A prespecified analysis examined subgroups with response times either up to or longer than 5 minutes.

Results In the standard group, 14 (15%) of 96 patients survived to hospital discharge vs 23 (22%) of 104 in the CPR first group (P = .17). There were no differences in ROSC rates between the standard group (56% [58/104]) and the CPR first group (46% [44/96]; P = .16), or in 1-year survival (20% [21/104] and 15% [14/96], respectively; P = .30). In subgroup analysis for patients with ambulance response times of either up to 5 minutes or shorter, there were no differences in any outcome variables between the CPR first group (n = 40) and the standard group (n = 41). For patients with response times of longer than 5 minutes, more patients achieved ROSC in the CPR first group (58% [37/64]) compared with the standard group (38% [21/55]; odds ratio [OR], 2.22; 95% confidence interval [CI], 1.06–4.63; P = .04); survival to hospital discharge (22% [14/64] vs 4% [2/55]; OR, 7.42; 95% CI, 1.61–34.3; P = .006), and 1-year survival (20% [13/64] vs 4% [2/55]; OR, 6.76; 95% CI, 1.42–31.4; P = .01). Thirty-three (89%) of 37 patients who survived to hospital discharge had no or minor reductions in neurological status with no difference between the groups.

Conclusions Compared with standard care for ventricular fibrillation, CPR first offered no advantage in improving outcomes for this entire study population or for patients with ambulance response times shorter than 5 minutes. However, the patients with ventricular fibrillation and ambulance response times longer than 5 minutes had better outcomes with CPR first before defibrillation was attempted. These results require confirmation in additional randomized trials.

**Objective:** To study the effects of CPR before defibrillation in VF patients with response times ≤ or > 5 minutes

**Design:** Blinded RCT of 200 out-of-hospital VF in Oslo between June 1998 – May 2001

**Groups:**
- **Standard** = immediate defibrillation
- **CPR first** = 3 minutes CPR prior to defibrillation (same if initial defibrillation unsuccessful)

**Outcome Measures:**
- Primary – survival to hospital discharge
- Secondary – ROSC on admission, 1-year survival, neurological outcome
## Results: Rates of Discharge From Hospital, ROSC, and 1-Year Survival*

<table>
<thead>
<tr>
<th>Group</th>
<th>CPR First (n = 104)</th>
<th>Standard (n = 96)</th>
<th>OR (95% CI)†</th>
<th>P Value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharged from hospital</td>
<td>23 (22)</td>
<td>14 (15)</td>
<td>1.66 (0.80-3.46)</td>
<td>.20</td>
</tr>
<tr>
<td>ROSC</td>
<td>58 (56)</td>
<td>44 (46)</td>
<td>1.49 (0.85-2.60)</td>
<td>.20</td>
</tr>
<tr>
<td>1-Year survival</td>
<td>21 (20)</td>
<td>14 (15)</td>
<td>1.48 (0.71-3.11)</td>
<td>.35</td>
</tr>
</tbody>
</table>

≤5 min

<table>
<thead>
<tr>
<th>Group</th>
<th>CPR First (n = 64)</th>
<th>Standard (n = 55)</th>
<th>OR (95% CI)†</th>
<th>P Value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharged from hospital</td>
<td>9 (23)</td>
<td>12 (29)</td>
<td>0.70 (0.26-1.91)</td>
<td>.61</td>
</tr>
<tr>
<td>ROSC</td>
<td>21 (52)</td>
<td>23 (56)</td>
<td>0.87 (0.36-2.08)</td>
<td>.82</td>
</tr>
<tr>
<td>1-Year survival</td>
<td>8 (20)</td>
<td>12 (29)</td>
<td>0.60 (0.22-1.69)</td>
<td>.44</td>
</tr>
</tbody>
</table>

>5 min

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<tr>
<th>Group</th>
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<th>OR (95% CI)†</th>
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<td>6.76 (1.42-31.4)</td>
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Abbreviations: CI, confidence interval; CPR, cardiopulmonary resuscitation; OR, odds ratio; ROSC, return of spontaneous circulation.

*Patients received ventricular fibrillation posthospitalization and 3 minutes of CPR before defibrillation vs standard treatment with immediate defibrillation.
†ORs and 95% CIs were calculated by logistic regression.
‡Calculated from the Fisher exact test.
Conclusions:

- Survival better with shorter response times
- Insignificant difference among 2 groups in end points for response time ≤ 5 minutes
- Survival improved with ‘CPR first’ if response times > 5 minutes
- Prolonged VF increases probability of unsuccessful defibrillation
- CPR may provide critical cardiac perfusion and metabolic state of myocytes → → more favorable response to defibrillation
Importance of CPR before Shock
‘Priming the Pump’

These VF tracings demonstrate the priming effect from an electrophysiological perspective. As pointed out with the 3-phase model schematic, the morphology of VF changes as time passed. The VF at 1 min is well within the electrical phase, with greater amplitude and median frequency. After 8 min, the morphology is very different; a shock at this point would likely be unsuccessful in producing ROSC. However, after only 90 sec of chest compressions, the morphology looks similar to the “fresh” & “shockable” VF on the left.
Effects of Interrupting Precordial Compressions on the Calculated Probability of Defibrillation Success During Out-of-Hospital Cardiac Arrest

Trygve Eftestøl, PhD; Kjetil Sunde, MD, PhD; Petter Andreas Steen, MD, PhD

Background—Cardiopulmonary resuscitation (CPR) creates artifacts on the ECG and, with automated defibrillators, a pause in CPR is mandatory during rhythm analysis. The rate of return of spontaneous circulation (ROSC) is reduced with increased duration of this hands-off interval in rats. We analyzed whether similar hands-off intervals in humans with ventricular fibrillation causes changes in the ECG predicting a lower probability of ROSC.

Methods and Results—The probability of ROSC after a shock was continually determined from ECG signal characteristics for up to 20 seconds of 634 such hands-off intervals in patients with ventricular fibrillation. In hands-off intervals with an initially high (40% to 100%) or median (25% to 40%) probability for ROSC, the probability was gradually reduced with time to a median of 8% to 11% after 20 seconds ($P<0.001$). In episodes with a low initial probability (0% to 25%; median, 5%), there was no further reduction with time.

Conclusions—The interval between discontinuation of chest compressions and delivery of a shock should be kept as short as possible. (Circulation. 2002;105:2270-2273.)

Withholding chest compressions for 20 sec can reduce the probability of resuscitation from 50% to 8%. *

* Eftestol, Circulation, 2002
Withholding chest compressions for 20 sec can reduce the probability of resuscitation from 50% to 8%. *

* Eftestol, Circulation, 2002
Adverse Outcomes of Interrupted Precordial Compression During Automated Defibrillation

Ting Yu, MD; Max Harry Weil, MD, PhD; Wanchun Tang, MD; Shijie Sun, MD; Kada Klouche, MD; Heitor Povoas, MD; Joe Bisera, MSEE

Background—Current versions of automated external defibrillators (AEDs) require frequent stopping of chest compression for rhythm analyses and capacity charging. The present study was undertaken to evaluate the effects of these interruptions during the operation of AEDs.

Methods and Results—Ventricular fibrillation was electrically induced in 20 male domestic swine weighing between 37.5 and 43 kg that were untreated for 7 minutes before CPR was started. Defibrillation was attempted with up to 3 sequential 150-J biphasic shocks, but each was preceded by 3-, 10-, 15-, or 20-second interruptions of chest compression. The interruptions corresponded to those that were mandated by commercially marketed AEDs for rhythm analyses and capacitor charge. The sequence of up to 3 electrical shocks and delays were repeated at 1-minute intervals until the animals were successfully resuscitated or for a total of 15 minutes. Spontaneous circulation was restored in each of 5 animals in which preeordial compression was delayed for 3 seconds before the delivery of the first and subsequent shocks but in none of the animals in which the delay was >15 seconds before the delivery of the first and subsequent shocks. Longer intervals of CPR interventions were required, and there was correspondingly greater failure of resuscitation in close relationship to increasing delays. The durations of interruptions were inversely related to the durations of subthreshold levels of coronary perfusion pressure. Postresuscitation arterial pressure and left ventricular ejection fraction were more severely impaired with increasing delays.

Conclusions—Interruptions of precordial compression for rhythm analyses that exceed 15 seconds before each shock compromise the outcome of CPR and increase the severity of postresuscitation myocardial dysfunction. (Circulation. 2002;106:368-372.)

Interruption of compression for rhythm analysis > 15 seconds before each shock compromises the outcome of CPR drastically. *

*Ting Yu, Circulation, 2002
Interuption of compression for rhythm analysis > 15 seconds before each shock compromises the outcome of CPR drastically.

*Ting Yu, Circulation, 2002*
1 shock is enough ..! (v/s 3 stacked shocks)

- BIPHASIC eliminates VF after first shock >90%
- AED requires 90 seconds for 3 shocks
  (So, NO CPR FOR 90 SECONDS..!)
- Such interruptions in chest compressions are harmful.
- Hence, 1 Shock strategy may be preferable
Defibrillation – General concept

- Immediate defibrillation if witnessed arrest and AED available
- Immediate Compressions before defibrillation if unwitnessed or arrival at the scene > 5 minutes.
- One shock followed by immediate CPR (beginning with chest compressions)
- Rhythm check after 5 cycles of CPR or 2 minutes
Consider giving a single precordial thump when cardiac arrest is confirmed, rapidly after a witnessed, sudden collapse and a defibrillator is not immediately to hand.

Using the ulnar edge of a tightly clenched fist, deliver a sharp impact to the lower half of the sternum from a height of about 20 cm.

A precordial thump is most likely to be successful in converting VT to sinus rhythm.

Successful thump for VF is much less likely: if it is not given within the first 10 s of onset.
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% O₂), 30 breaths per minute (100% O₂), or 30 breaths per minute (5% CO₂, 95% O₂). 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+ CO₂ 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.)

Key Words: cardiopulmonary resuscitation ■ death, sudden ■ heart arrest ■ ventilation ■ hypotension

Correlation of Ventilation Rate With Hemodynamics in CPR

High Ventilation rates resulted in significantly increased intrathoracic pressure and were demonstrated to be significantly and inversely correlated to Coronary Perfusion Pressures (CPP), Systolic Blood Pressure and Survival rate during CPR.

AVOID HYPERVENTILATION... IT KILLS...!

CPP improves with longer series of Chest Compressions. When CPR is paused, CPP falls quickly and when CPR is restarted, it takes 5-6 compressions to reestablish the previous level.

CPP at 5:1 C:V ratio

CPP at 15:2 C:V ratio
Abella et al measured the compression rates during 1626 CPRs in 3 large hospitals.
In this study, rates were between 90 and 110 in only 37% of the segments.

(Abella BS et al., Circulation 2005;111;428-434)
Abella et al found that overall, when ROSC was achieved, the mean compression rate was $90 \pm 15$ compressions per minute (cpm). With no ROSC, the mean rate was $80 \pm 15$ cpm.

The differences were significant, with a $p$-value of 0.0033

(Abella BS et al., Circulation 2005;111;428-434)
Abella et al also measured depth of compression during in-hospital cardiac arrest and demonstrated a wide variation. It was > 50 mm in only 23% of the cases.

(Abella BS et al., Circulation 2005;111;428-434)
Edelson et al correlated depth of compression with shock success and determined that shock success correlated significantly with compression depth.

(Edelson DP et al., *Resuscitation* 2006;71;137-145)
In 2007, researchers led by Dr. Ken Nagao of the Surugadai Nihon University Hospital in Tokyo analysed 4,068 adult patients who had cardiac arrest witnessed by bystanders. Of those, 439 received only chest compressions, and 712 received conventional CPR (15:2). Any CPR effort improved survival odds. But 22% of those who received just chest compressions survived with good neurological function compared with only 10% of those who received combination CPR.
In Oct 6, 2010 issue of the JAMA, Bobrow et al from the University of Arizona published a landmark study proving ‘hands-only’ CPR to be more effective than the conventional 30:2 CPR.

In the study, researchers looked at 4,415 instances of adult cardiac arrest that happened in non-hospital settings between 2005 and 2009. They found that 13% who received hands-only resuscitation by bystanders survived, while only 8% who were given conventional CPR managed to recover.

CPR: Current Concepts

- Chest compressions are sufficient to maintain circulation as well as ventilation.
- Uninterrupted, forceful (>2 inches) and rapid (>100/min) compressions are important for maintaining Coronary and Cerebral flow.
- Don’t waste time for checking pulse rate, rhythm, pupillary reaction and for intubation or ventilation.
- Ventilation is relatively unimportant in the first 10 minutes after collapse from VF.
- Early ventilation is necessary when resuscitating asphyxial cardiac arrest, but a 30:2 ratio may be adequate.
- So, for a lay rescuer, mouth-to-mouth is not required and he should just concentrate on compressions (Hands-Only CPR).
Simplifying the recommendations

2000: 15:2 adults, 5:1 children
2005: 30:2 for all
2010: Hands-Only CPR

Why? - By-stander CPR is on the order of < 30%
Simplify guidelines to increase bystander CPR.
## The ‘Real’ state of Success

<table>
<thead>
<tr>
<th>Type of Arrest</th>
<th>ROSC</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bystander CPR</td>
<td>40%</td>
<td>4%</td>
</tr>
<tr>
<td>No Bystander CPR (Ambulance CPR)</td>
<td>15%</td>
<td>2%</td>
</tr>
<tr>
<td>In-Hospital Cardiac Arrest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unwitnessed</td>
<td>21%</td>
<td>1%</td>
</tr>
<tr>
<td>Witnessed</td>
<td>48%</td>
<td>22%</td>
</tr>
<tr>
<td>Defibrillation within 3–5 minutes</td>
<td>74%</td>
<td>30%</td>
</tr>
</tbody>
</table>

(ROSC = Return Of Spontaneous Circulation)
“Despite widespread education about CPR, the outcomes from sudden cardiac arrest have not improved significantly since the 1960s.”

- AHA

“Eliminating the need for mouth-to-mouth ventilation and concentrating on ‘high quality’ chest compressions will dramatically increase the occurrence of bystander-initiated resuscitation efforts and will increase survival.”
The 2010 AHA Guidelines for CPR emphasize the need for high-quality CPR, emphasizing:

5 key points..

- A compression rate of at least 100/min (a change from “approximately” 100/min)
- A compression depth of at least 2 inches (a change from “range of 1½ to 2 inches”)
- Allowing for complete chest recoil
- Minimizing interruptions
- Avoiding excessive (hyper) ventilation
Chest compressions come first now

New CPR guidelines show the importance of starting chest compressions immediately, instead of opening the victims airway and breathing into their mouth first.

CPR revised guidelines: **Think C-A-B**
- **COMPRESSIONS**: Push at least 2 inches on adult breastbone, 100 times per minute, to move oxygenated blood to vital organs
- **AIRWAY**: Open the airway and check for breathing or blockage; watch for rise of chest and listen for air movement
- **BREATHING**: Tilt chin back for the unobstructed passing of air; give two breaths and resume chest compressions

NOTE: Those untrained in CPR can simply do chest compressions until help arrives.
CPR is as easy as 

C - Compressions
Push hard and fast on the center of the victim's chest

A - Airway
Tilt the victim's head back and lift the chin to open the airway

B - Breathing
Give mouth-to-mouth rescue breaths

American Heart Association
Learn and Live
Building blocks of CPR 2010
The links in this Chain are:

- Immediate recognition and activation,
- Early CPR,
- Rapid defibrillation/pacing,
- Effective advanced life support, and
- Integrated Post-Cardiac arrest Care (PCC)

Basic Life Support implies that no equipment is employed
2010 Adult Basic Life Support

Unresponsive
No breathing or no normal breathing (only gasping)

Activate emergency response

Get defibrillator

Start CPR

Check rhythm/shock if indicated
Repeat every 2 minutes

Push Hard = min 2” (5 cms)
Push Fast = min 100 / min
Allow the chest to recoil
Un-interrupted
2010 Adult Cardiac Life Support

Adult Cardiac Arrest

Shout for Help/Activate Emergency Response

Start CPR
- Give oxygen
- Attach monitor/defibrillator

2 minutes

Check Rhythm

Return of Spontaneous Circulation (ROSC)

Post-Cardiac Arrest Care

Drug Therapy
- IV/IO access
- Epinephrine every 3-5 minutes
- Amiodarone for refractory VF/VT

Consider Advanced Airway
- Quantitative waveform capnography

Treat Reversible Causes

CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If PETCO₂ <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in PETCO₂ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock Energy
- Biphasic: Manufacturer recommendation (e.g., initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/IO Dose: 1 mg every 3-5 minutes
- Vasopressin IV/IO Dose: 40 units can replace first or second dose of epinephrine
- Amiodarone IV/IO Dose: First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
What’s new in 2011?

Hands-Free Battery operated CPR System
Take home Message....
Take home Message....①

Focus on compression rather than ventilation
“Push hard and push fast with adequate recoil and minimal interruptions”
LEARN CPR
you can do it!

Begin
Compressions

Thanks
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