Development of the CPR and ECC Guidelines

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American Heart Association
GUIDELINES CPR ECC 2010

MARICOPA INTEGRATED HEALTH SYSTEM

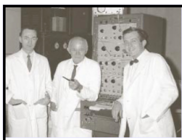
2020 Goals of the AHA

- **Double Survival from Cardiac Arrest**
- **Double Out of Hospital CPR Bystander Response**

What have we learned about CPR?

More profound overall understanding of CPR

- CPR makes a <u>difference!</u>
- CPR must be started as soon as a victim collapses
- We must rely on a trained/willing public to initiate CPR
- When CPR is performed, even by professionals, it is often not done well
- Compressions are interrupted too frequently
- Excessive ventilation is provided during CPR for victims with advanced airways
- Chest compressions are often too slow and shallow



1064 J.A.M.A., July 9, 1960

CLOSED-CHEST CARDIAC MASSAGE

W. B. Kouwenhoven, Dr. Ing., James R. Jude, M.D.
and
G. Guy Knickerbocker, M.S.E., Baltimore

Cardiac resuscitation after cardiac arrest or ventricular fibrillation has been limited by the need for open thoracotomy and direct cardiac massage. As a result of exhaustive animal experimentation a method of external transthoracic cardiac massage has been developed. Immediate resuscitative measures can now be initiated to give not only mouth-to-nose artificial respiration but also adequate cardiac massage without thoracotomy. The use of this technique on 20 patients has given an over-all permanent survival rate of 70%. Anyone, anywhere, can now initiate cardiac resuscitative procedures. All that is needed are two hands.

When cardiac arrest occurs, either as standstill or as ventricular fibrillation, the circulation must be restored promptly; otherwise anoxia will result in irreversible damage. There are two techniques that may be used to meet the emergency: one is to open the chest and massage the heart directly and the other is to accomplish the same end by a new method of closed-chest cardiac massage. The latter method is described in this communication. The closed-chest alternating current defibrillator[1] that was developed in our laboratories has proved to be an effective and reliable means of arresting ventricular fibrillation. Its counter-shock must be sent through the chest promptly, or else cardiac anoxia will have developed to such a degree that the heart will no longer be able to resume forceable contractions without assistance. Our experience has indicated that external defibrillation is not likely to be followed by the return of spontaneous heart action, unless the counter-shock is applied within less than three minutes after the onset of ventricular fibrillation.

A study was undertaken of means of extending this time limitation without opening the chest. A method was sought that would provide adequate circulation to maintain the tone of the heart and the nourishment of the central nervous system. This method was to be at once readily applicable, safe to use, and requiring a minimum of gadgets.

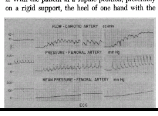
One of the first attempts at enhancing circulation in the arrested heart was a closed-chest method reported by Boehm[2] in 1878. Working with cats, he grasped the chest in his hands at the area of greatest expansion and applied rhythmic pressure. His results were quite striking in some series of

one-half minutes after the onset of induced ventricular fibrillation. They reported that this time limitation might be extended to as long as eight minutes by rhythmical application of pressure on the thorax in the region of the heart. In tests which lasted 10 to 15 minutes 19 animals survived and 17 died. These authors, however, gave no specific information as to the method of application of the pressure. Rainer and Bullough[7] treated cardiac arrest in children by lowering the head about 10 degrees, placing one arm underneath the patient's knees, and flexing the legs and buttocks against the chest. They reported eight successful resuscitations in patients ranging from 8 weeks to 13 years in age. Stout[8] in 1957 reported the successful use of this

Vol. 173, No. 10 CARDIAC MASSAGE–KOUWENHOVEN ET AL. 1065

was in ventricular fibrillation for eight minutes. Simultaneously recorded on a four-channel recorder were the blood flow in a carotid artery, the instantaneous and average pressures in a femoral artery, and the cardiogram. The tracings in the first column of figure 1 are the normal values of these respective phenomena immediately before fibrillation was induced by a 110-volt shock. The second column shows the build-up of blood flow and pressures that took place when closed-chest cardiac massage was started, one minute after the onset of fibrillation. The third column is a record of what took place about seven minutes later. Note that vigorous fibrillation has been maintained throughout the entire period. The fourth and last column shows the immediate return of normal sinus rhythm when the closed chest defibrillator shock was given. The electrocardiograph was temporarily disconnected when the counter shock was applied.

Method.–The method of closed-chest cardiac massage developed during these animal studies is simple to apply; it is one that needs no complex equipment. Only the human hand is required. The principle of the method as applied to man is readily seen by consideration of the anatomy of the bony thorax and its contained organs. The heart is limited anteriorly by the sternum and posteriorly by the vertebral bodies. Its lateral movement is restricted by the pericardium. Pressure on the sternum compresses the heart between it and the spine, forcing out blood. Relaxation of the pressure allows the heart to fill. The thoracic cage in unconscious and anesthetized adults is surprisingly mobile. The method of application is shown in figure 2. With the patient in a supine position, preferably on a rigid support, the heel of one hand with the



slightly to permit full expansion of the chest. The operator should be so positioned that he can use his body weight in applying the pressure. Sufficient pressure should be used to move the sternum 3 or 4 cm. toward the vertebral column.

Closed-chest cardiac massage provides some ventilation of the lungs, and if there is only one person present in a case of arrest, attention should be

Fig 2.–Position of hands during massage of adult.

concentrated on the massage. If there are two or more persons present, one should massage the heart while the other gives mouth-to-nose respiration.

1960 – Baltimore Fire Dept

CLOSED CHEST CARDIAC RESUSCITATION–

Another EMERGENCY METHOD OF RESUSCITATION

by Captain Martin C. McMahon,
Supervisor of Ambulance Service,
Baltimore, Maryland, Fire Department

Fire Fighter Hubert Cheek of Baltimore's Ambulance No. 2 shows technique he used successfully on a victim four days after he received the training. At his right is Dr. Kouwenhoven. Guy Knickerbocker is at Cheek's left.

NOTICE — This is a brand new technique and many medical personnel may not, as yet, have had the chance to study its application and benefits. Consequently, fire departments should consult with doctors before adopting the technique for training and standard practice.

MEMBERS of the ambulance crews of the Baltimore Fire Department recently have been applying a new technique on victims of cardiac arrest or standstill. Called "closed chest cardiac resuscitation," the technique is combined with mouth-to-mouth or mouth-to-airway artificial respiration as an emergency measure for cardiac arrest victims when no medical assistance is immediately available. The cessation of all circulation is recognized by absent respirations, cyanosis, absence of the pulses in the wrist and groin, and the absence of a heartbeat. The method is simple to understand and easy to perform and is shown in illustrations on these pages. If performed correctly, it may produce a palpable pulse and sufficient circulation to keep the brain alive and maintain the tone of the heart until medical assistance is obtained.

The victim when found should be placed on a hard surface such as a floor or sidewalk (a soft surface beneath him, such as a mattress, does not offer sufficient resistance for compression of the heart). The rescuer places the heel of one hand on the sternum, or breastbone, about two inches from the lower end. The palm of the other hand is placed on top of the first hand. Pressure is now exerted downward, compressing the heart between the breastbone and the spinal column. The largest part of the heart lies directly under the sternum, and the bones of the ribs, attached to the sternum by means of cartilage, are relaxed and flexible enough to allow compression of the chest. The heart is a valve-like chamber which allows blood to move in the correct direction when pumping, and the blood in the heart is squeezed out when external pressure is applied to the chest.

The correct pressure will vary according to the size of the rescuer and his victim and can be determined readily by the rescuer. The pupils of the eyes of a victim of cardiac arrest or standstill will dilate, but if an adequate amount of blood is being moved, the pupils will start to contract. The rescuer should apply his pressure at a rate of between 60 and 80 times per minute, approximately in the range of the natural beat of the heart. The technique should be continued where the victim is found and on the litter of an ambulance until it reaches the hospital.

If possible, the hospital should be alerted beforehand as to the nature of the case and informed of what techniques are being applied. In Baltimore, ambulance crew members call fire department headquarters by radio, and then headquarters alerts the hospital emergency room by telephone.

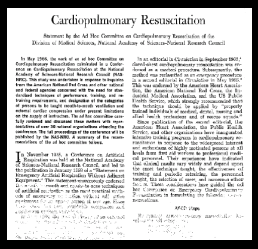
When such a victim is brought into the Johns Hopkins Hospital, doctors use an electrocardiograph and an external defibrillator in attempting resuscitation.

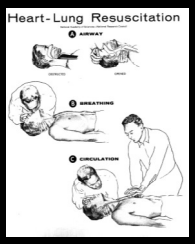
In April, 1960, Captain McMahon was invited to a demonstration of the closed chest cardiac massage technique at the Johns Hopkins Hospital. (*Ed note. Readers of* FIREMEN *magazine will recall that Captain McMahon worked with Dr. Peter Safar in developing the airway used in mouth-to-airway artificial respiration. See* FIREMEN *for December, 1958.*) When he saw the demonstration, the Captain asked for instructions for the ambulance crews in the Baltimore City Fire Department. Three classes were scheduled immediately and 105 persons attended. Four days after the first class had been trained, two members of Ambulance Crew No. 2 used the technique on a sixty-year-old man who was found unconscious, cyanotic, nonbreathing and pulseless. As they had been trained, fire fighters Hubert Cheek and Marvin Burkendine removed the victim from his bed to the floor. One man started the closed chest cardiac massage and the other started mouth-to-airway artificial respiration. Shortly afterwards, the victim's pulse was beating, and within five minutes he was gasping. He was then lifted to an ambulance litter and taken to the Johns Hopkins Hospital, with oxygen being administered on the run. Hospital personnel took over the task and the victim was successfully revived.

Dr. William B. Kouwenhoven, of Johns Hopkins University, Lecturer in Surgery at the hospital, is principally responsible for the closed chest cardiac massage technique. He is also chiefly responsible for the invention of the "external defibrillator" used by the

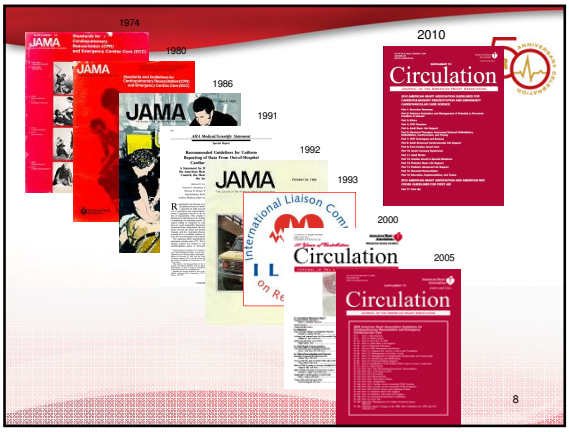
8 FIREMEN for October 1960

1966 - AHA collaborated to create the first CPR Standards


Cardiopulmonary Resuscitation



In 1966, the AHA collaborated with the National Academy of Science and the National Research Council to establish the first standards for CPR training and performance.



AHA CPR and ECC Guidelines

- Largest evidence evaluation process in the world

Achieving Consensus on Resuscitation Science

The American Heart Association and other member councils of International Liaison Committee on Resuscitation (ILCOR) complete review of resuscitation science every 5 years.

International Liaison Committee on Resuscitation ILCOR

American Heart Association. | American Stroke Association. Learn and Live.

New Zealand Resuscitation Council

European Resuscitation Council

Australian Resuscitation Council

Resuscitation Council of Southern Africa

InterAmerican Heart Foundation

Resuscitation Council of Asia

Heart and Stroke Foundation of Canada

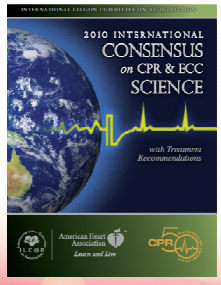
Expanding to International Consensus

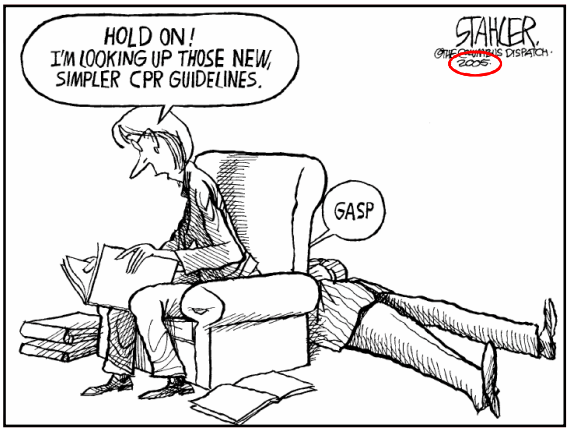
Process from Question to Guidelines

1. ILCOR Task Forces formulate questions
2. Worksheet authors perform structured evidence evaluation (with help from experts), present to Task Force
3. Task Forces debate, discuss, reach consensus, draft manuscripts
4. International Editorial Board, Councils review consensus, provide input to writing groups
5. Circulation obtains peer reviews
6. Consensus on Science published
7. Councils develop Guidelines

Evidence Evaluation Process

- 411 scientific evidence reviews on 277 topics
- 313 participants formed 6 working groups at 2010 Consensus Conference
- International process (46% from outside U.S.)
- Conflict of Interest (COI) questionnaires completed by all participants (802 collected and reviewed)
- Working group members voted on each recommendation





Guidelines never saved anyone……

Performing CPR SAVES LIVES

YOUR training is what actually saves lives!

AHA Evidence Classification

ESTIMATES OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	CLASS I *Benefit >>> Risk* Procedure/Treatment SHOULD be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	CLASS III *Risk ≥ Benefit* Procedure/Treatment should NOT be performed/ administered SINCE IT IS NOT HELPFUL AND/OR MAY BE HARMFUL
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations*	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	is not recommended is not indicated should not is not useful/effective/beneficial may be harmful

BLS-045A "In adult and pediatric patients with cardiac arrest (prehospital [OHCA], in-hospital [IHCA]) (P), does optimizing chest wall recoil (I) compared with standard care (C), improve outcome (eg. ROSC, survival) (O)? In patients with CA (P), does optimizing chest wall recoil (I), improve survival (O)?"

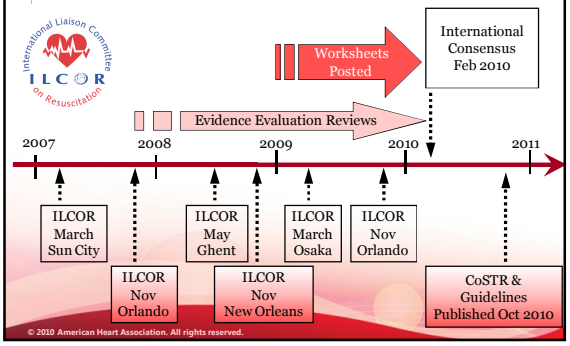
Worksheet identifier: BLS-045A
Author: Tom P. Aufderheide, M.D.
Affiliation: Medical College of Wisconsin
Taskforce: Basic Life Support

Knowledge Gaps

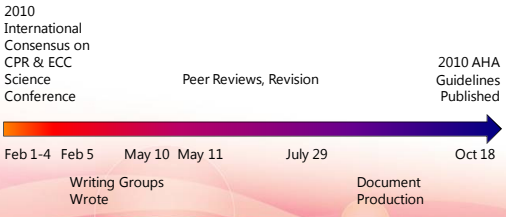
American Heart Association
Learn and Live

- Other specific worksheets that would be helpful
  - Another worksheet on teaching complete chest recoil has been suggested and completed
  - Specific method to train recoil is not yet clear, so studies on this are still needed.
- Specific research required
  - A large, multi-center, randomized clinical trial evaluating ROSC and survival to hospital discharge in patients receiving standard CPR versus techniques that produce a higher incidence of complete chest recoil (with monitoring quality of CPR delivered) is needed to definitively answer this question.

2010 Consensus Timeline



2010 Guidelines Timeline



2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science

Part 1: Executive Summary
Part 2: Evidence Evaluation and Management of Potential or Perceived Conflicts of Interest
Part 3: Ethics
Part 4: CPR Overview
Part 5: Adult Basic Life Support
Part 6: Electrical Therapies
Part 7: CPR Techniques and Devices
Part 8: Adult Advanced Life Support
Part 9: Post-Cardiac Arrest Care
Part 10: Acute Coronary Syndromes
Part 11: Adult Stroke
Part 12: Cardiac Arrest in Special Situations
Part 13: Pediatric Basic Life Support
Part 14: Pediatric Advanced Life Support
Part 15: Neonatal Resuscitation
Part 16: Education, Implementation, and Teams (EIT)
Part 17: First Aid

InterAmerican Heart Foundation

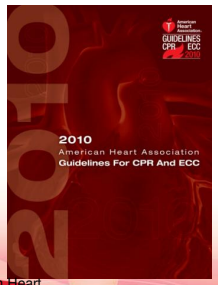
English version can be downloaded free of charge at: www.heart.org/cpr

Impact of 2010 AHA Guidelines for CPR and ECC

- **Since October 18th, AHA ECC Guidelines web content:**
  - **>7.6M page views**
  - **>1.6M unique visitors.**
- **In the first week,**
  - **800 million print, online and broadcast media impressions**
  - **More than any other AHA media launch including Go Red for Women**
- **Over 100,000 views of a YouTube video demonstrating updated CPR.**

2010 AHA Guidelines Reprint

- Printed Guidelines published November 3, 2010.
- Can be purchased through www.heart.org/cpr

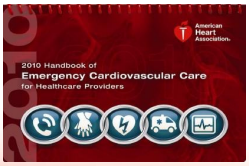


Guidelines Highlights

- Summarizes key changes in the 2010 AHA Guidelines for CPR and ECC
- Available electronically in English and 12 other languages at:
  heart.org/cpr

2010 Handbook of Emergency Cardiovascular Care for Healthcare Providers

- Valuable quick reference tool that incorporates the latest science and includes updated algorithms as well as information on therapeutic agents, stroke, and acute coronary syndromes.
- Available at AHA Sessions and heart.org/cpr



More Information

To view a copy of this presentation please go to www.heart.org/cprscience.

To learn more about upcoming products and information related to CPR and ECC visit www.heart.org/cpr.

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American Heart Association
GUIDELINES CPR ECC 2010