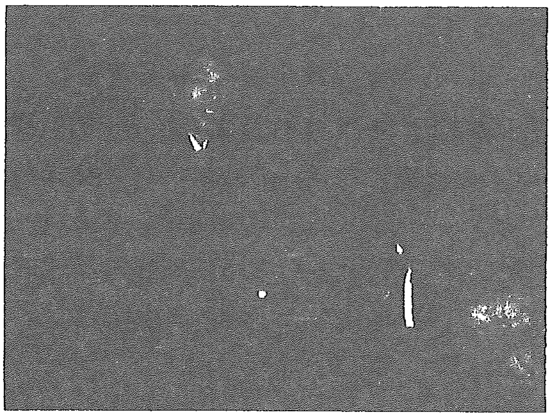
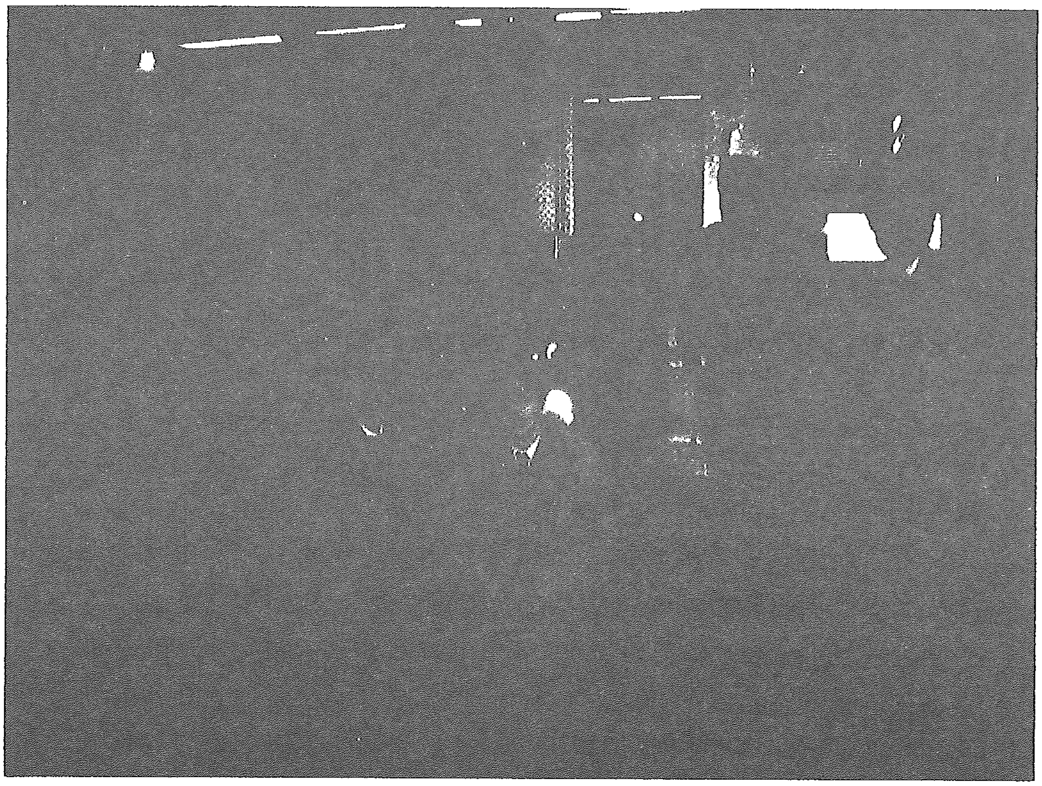


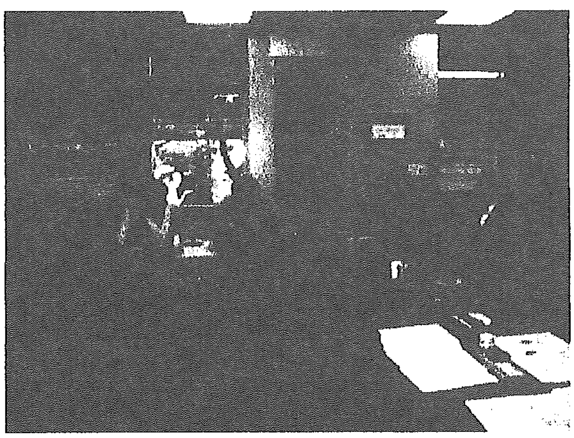
はしご車にも AED が搭載されていた。救急活動を検証する記録用紙も用意されていた。



消防署員とともに集合写真

4.3.5 Philips 社 AED 工場の視察ならびに AED に関する意見交換会

シアトルに本社をおく Philips 社の AED 工場を見学するとともに、AED 開発に携わった研究者、AED を用いた一般市民による除細動プログラムの効果を検証した大規模臨床試験である PAD トライアルに関わった研究者、シアトルの心肺蘇生教育をコーディネートしている方らとのディスカッションを行った。



意見交換の風景

資料 7：シアトル市の蘇生教育プログラムについて

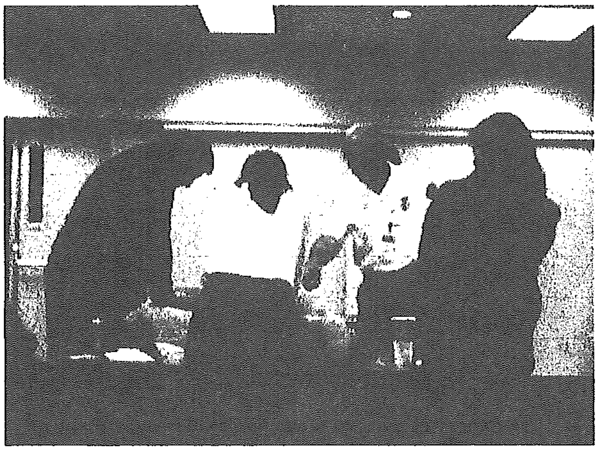
資料 8：フィリップス社での意見交換会で使用されたスライド資料

資料 9：Kings Counrty の市民による CPR-AED プログラム

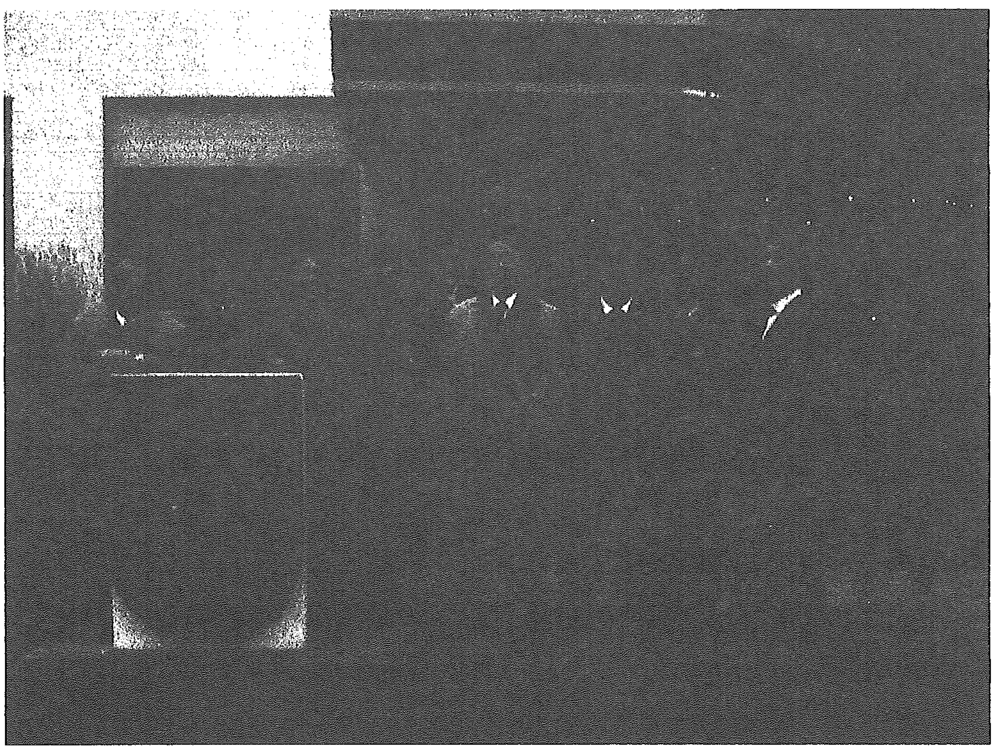
資料 10：PAD trial の概略

4.3.6 Philips 社で行われていた AED コース（AED を用いた心肺蘇生法講習会）の見学

Philips 社で社員に対して行われていた心肺蘇生法講習会を見学した。インストラクターはシアトル市消防の消防署員で、無料での開催とのことであった。



AED 講習会の様子



視察を終えて

5.　まとめ

心肺蘇生／病院外の救急医療システムに関する先進的な取り組みを行っている米国アリゾナ、シアトルを訪問し、情報収集・意見交換を行った。もっとも印象的だったのは、両地域とも常に心停止あるいはそれに近い状態となった患者を救命するためにはどうしたらよいのか、現状の問題点を常に検討し、その問題点を解決するための疑問を出し、臨床研究、基礎研究につなげるという総合的、戦略的な取り組みを続けていることである。そして、研究で得られた結果を着実に現場にフィードバックするという努力を絶え間なく続けている。また、現在の問題点を明確にするために客観的な記録をとり、検証することにも多くの労力を費やしている。

我々も、蘇生をはじめとした救急医療を必要とする患者を救命するためにどうしたらよいのかという原点を忘れずに、問題点を広い視野から見極め、ひとつずつ解決していくという姿勢を持って研究活動を継続していきたいと思う。

UMC

University Medical Center
Tucson, AZ

Announcements

Learn the New CPR, Jan 4

Be a lifesaver with continuous chest compression CPR. It's easy, effective and requires NO mouth-to-mouth.

Learn this groundbreaking method created by physicians and researchers at the University of Arizona Sarver Heart Center and profiled by NBC Nightly News, The New York Times and USA Today.

Free 1-hour class Wednesday, January 4, 2006

Start time 5:30 p.m.
University Medical Center DuVal Auditorium
1501 N Campbell Ave, Tucson

Presented by members of the University of Arizona Sarver Heart Center's CPR Research Group. For more information, please call 626-4083 or visit www.heart.arizona.edu/publiced/lifesaver.htm.

This method is **not** intended for children under 8 or for cases of suspected drowning or drug overdose.

Be a Lifesaver

with Continuous Chest Compression CPR

In witnessed sudden cardiac arrest in adults, mouth-to-mouth resuscitation is **not necessary**.* Follow these instructions to perform Continuous Chest Compression CPR:

1. Direct someone to call 911 or make the call yourself.

2. Position the victim on his or her back on the floor. Place one hand on top of the other and place the heel of the bottom hand on the center of the victim's chest. Lock your elbows and begin forceful chest compressions at a rate of 100 per minute.

3. If an automated external defibrillator (AED) is available, attach it to the victim and follow the machine's instructions. If no AED is available, perform continuous chest compressions until paramedics arrive. Take turns if you have a partner.

NOTE: **Gasping is not an indication of normal breathing or recovery.** Initiate and continue compressions even if victim gasps.

* Follow standard American Heart Association CPR procedures for cases of suspected drowning, drug overdose or collapse in children under the age of 8.

UMC University Medical Center

The University of Arizona Sarver Heart Center

Tucson Fire Dept.

To learn more about Continuous Chest Compression CPR, please call the UA Sarver Heart Center at 626-4083 or visit **www.heart.arizona.edu**.

There are different phases of cardiac arrest, and different approaches are needed for each. During the first phase – the electrical phase, which occurs during the four or five minutes after the collapse – an automated external defibrillator may be all that is needed to resuscitate the victim.

Studies have shown that AEDs on commercial airlines and in casinos (as demonstrated by Sarver Heart Center researchers Terence D. Valenzuela, MD, and Lani L. Clark) markedly improve survival.

The second phase is the hemodynamic phase and lasts for several additional minutes. Since paramedics rarely arrive within five minutes after an out-of-hospital collapse, most patients are in this phase when help arrives. Studies by the CPR group have shown that in this phase, prompt forceful chest compressions prior to defibrillation are essential for improved survival. Researchers from Sweden have confirmed these findings.

Karl B. Kern, MD, and Gordon A. Ewy, MD, recently presented the groundbreaking work of the SHC CPR group at the London CPR symposium. They reported that studies done by the CPR Research Group indicate that survival for out-of-hospital cardiac arrest would be much better with continuous chest compressions than with standard CPR. Further, standard CPR (with delays of 15 to 16 seconds between chest compressions for ventilation) results in a survival rate of 13 percent, compared with 70 percent to 80 percent for continuous chest compression CPR with no pauses for breaths.

It is of interest that Tucson's survival rate for out-of-hospital witnessed cardiac arrest due to ventricular fibrillation has been 13 percent to 14 percent over the past five years.

Many studies have shown that bystanders are more likely to perform CPR if they don't have to give mouth-to-mouth, and that survival chances are far worse when no CPR is administered. Eliminating the requirement for mouth-to-mouth breathing not only improves survival, but also increases how often bystanders give CPR.

In coming months, the Sarver Heart Center will be working with the medical and lay community to improve the city's cardiac arrest survival rates. We believe our efforts will bring forth significant changes in both CPR and dramatic increases in survival after cardiac arrest.

In addition to Drs. Ewy, Kern and Valenzuela and Clark, the Sarver Heart Center CPR Research Group includes: Robert A. Berg, MD; Ronald W. Hilwig, DVM, PhD; Charles Otto, MD; and Arthur B. Sanders, MD. ♥

We feel we can't wait to get the word out about continuous chest compression CPR so that people and organizations can start following it now.

CPR EDUCATION

KING COUNTY, WASHINGTON

The Emergency Medical Services Division administers a countywide Cardiopulmonary Resuscitation (CPR) Education Program which focuses on providing CPR training to targeted groups. The desired impact is to provide CPR training to citizens, thus increasing the incidence of bystander initiated CPR, improving the chance of survival from cardiac arrest for citizens in King County.

Student CPR Program

The student CPR training program provides CPR Training to approximately 18,000 students in grades six through twelve in King County, excluding the Seattle School District. Seventeen school districts participate in the Student CPR Training Program, with the majority contracting with the EMS Division to provide funds for the program in their district. Approximately $48,000 annually is divided amongst all school districts to be used for:

- Training school teachers to be CPR instructors;
- Purchase of equipment, audio visual aids and supplies;
- Providing CPR instructors from the community, if necessary.

The program goal is to provide the training to students three times prior to graduation from high school. In some districts it is a required part of the student learning \objectives in the curriculum. The standard AHA approved curriculum is used.

The program emphasizes training the school teachers to become CPR instructors so they can provide the training to students in the classroom. Funds provide to each district are used to hire substitute teachers in order to allow the teachers to attend the two day in-service CPR instructor workshops provided by the EMS Division. Approximately 200 school teachers are actively participating in the program now. A one day recertification workshop is required every two years.

Several school districts use the funds to bring in outside CPR instructors when teacher training is not feasible or to help support the teachers in the classroom.

Additional funds are used for program operations at the school level for the purchase of CPR training manikins, audiovisual aids and miscellaneous operating supplies.

If no funds are available in your area, a similar program could be established on a much smaller scale. We recommend recruiting school teachers to obtain the CPR instructor training on a volunteer basis and make arrangements to borrow training equipment and supplies from your local American Red Cross or local fire departments.

King County Employee Training

The EMS Division also sponsors an employee CPR training program for King County employees, targeting employees who work directly with the public. These employees start with Accounting Division and go through Youth Services Department. In addition, regular basic CPR and refresher classes are open to all employees, who are encouraged by the King County Executive to attend during their work day. Approximately 2,000 employees participate in this training annually.

High Risk Population

In 1983, the EMS Division cooperated with eight hospitals in King County to develop a program with a strong emphasis on providing CPR training to families of cardiac patients. Research indicates that it is the family members of this group of high risk patients who are most likely to need CPR skills, but are the least likely of all population groups to seek out and receive the training. Training continues to be provided in many hospitals for these families. IN addition, CPR classes held in the home are also offered by the EMS Division to family of patients who have experienced a heart related illness. Classes are available for theses families and friends in their home.

Dispatcher-Assisted Telephone CPR

Ten emergency communications centers in King County utilize emergency medical telephone instructions. This allows dispatchers to make an accurate identification of cardiac arrest calls, send appropriate aid to the incident and then provide CPR Instructions to the reporting party utilizing a specifically developed message.

The instructions are offered approximately 200 times each year throughout King County to people reporting a cardiac arrest. The greatest contribution of this program to our EMS system is the increase in bystander initiated CPR, which has risen from a preprogram 32% in 1981 to a current level of 56%.

Research

In 1991, the EMS Division, in cooperation with CEEMS, conducted research to determine the incidence of agonal respirations in cardiac arrest calls. (Incidence of Agonal Respirations in Sudden Cardiac Arrest (see enclosed publication in the Annals of Emergency Medicine, August, 1992).

The purpose of this research was to estimate the frequency and duration of agonal respirations, and to discover the witnessed status, cardiac rhythm and discharge rates associated with agonal respirations. Results showed that agonal respirations occurred in 40% of 445 out-of-hospital cardiac arrests. Callers described agonal breathing in a variety of ways, often using multiple descriptions. Fifty-five percent of witnesses arrests had agonal activity compares to 16% of unwitnessed arrests. Twenty-seven percent of patients with agonal respirations were discharged alive compared to 9% without agonals. Concluded there is a high incidence of agonal activity associated with out-of-hospital cardiac arrest and the presence of agonal respirations is associated with increased survival. Recognition of agonal is critical in identification of cardiac arrest and therefore initiation of CPR. These findings have implications for public CPR training programs and emergency dispatcher telephone CPR programs.

For additional information about any of the above King County programs please contact Barbara Welles at 206/205-5582

CPR training for citizens was first introduced in Seattle by the Seattle Fire Department Medic II Program. The Medic II Program continues to train large numbers of citizens in Seattle and King County. For further information on the Medic II Program, please contact the following individual:

Barbara Breit
Seattle Medic II
Seattle Fire Alarm Center
408 Thomas Street
Seattle WA 98109
206/684-7274

Improving Resuscitation by Optimizing Rescuer/Defibrillator Interactions

David Snyder
Senior Scientist
Philips Medical Systems
Seattle, Washington

PHILIPS

Background

- A defibrillator is more than just an electricity dispenser
- Functions as a protocol manger
- It may:
  - Aid in patient preparation and pad placement
  - Guide the overall resuscitation attempt
  - Determine CPR interruption intervals
  - Provide CPR coaching and/or guidance
- It guides ***and restricts*** execution of the resuscitation attempt

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Operational differences of defibrillators–what's important?

	Pads properly attached	Time to first shock	Cumulative biphasic shock efficacy	CPR initiated	Interruption between CPR and shock
Effect on mortality	100% if not adequately applied	7-10% per minute of delay	100% if VF not terminated	Not known, but approximately 50% if no CPR	> 3% per second of interruption[3-5]
Range of different AEDs[1]					
Improved via training?					
Potential mortality impact of AED differences					

[illegible]

PHILIPS

Operational differences of defibrillators–what's important?

	Pads properly attached	Time to first shock	Cumulative biphasic shock efficacy	CPR initiated	Interruption between CPR and shock
Effect on mortality	100% if not adequately applied	7-10% per minute of delay	100% if VF not terminated	Not known, but approximately 50% if no CPR	> 3% per second of interruption[3-5]
Range of different AEDs[1]	75% - 100%	78 - 128 seconds	Not known precisely, but > 90%	33% - 93%	0 – 28 seconds
Improved via training?					
Potential mortality impact of AED differences					

[illegible]

PHILIPS

Operational differences of defibrillators–what's important?

	Pads correctly attached	Time to first shock	Cumulative biphasic shock efficacy	CPR initiated	Interruption between CPR and shock
Effect on mortality	100% if not adequately applied	7-10% per minute of delay	100% if VF not terminated	Not known, but approximately 50% if no CPR	> 3% per second of interruption[5,6]
Range of different AEDs	73% - 100%	78 - 120 seconds	Not known precisely, but > 90%	33% - 93%	0 - 28 seconds
Improved via training?	Yes	Limited	No	Yes	No
Potential mortality impact of AED differences					

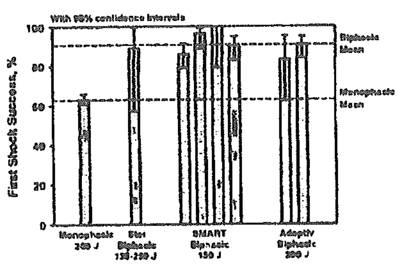
PHILIPS

Operational differences of defibrillators–what's important?

	Pads correctly attached	Time to first shock	Cumulative biphasic shock efficacy	CPR initiated	Interruption between CPR and shock
Effect on mortality	100% if not adequately applied	7-10% per minute of delay	100% if VF not terminated	Not known, but approximately 50% if no CPR	> 3% per second of interruption[5,6]
Range of different AEDs	73% - 100%	78 - 120 seconds	Not known precisely but > 90%	33% - 93%	0 - 28 seconds
Improved via training?	Yes	Limited	No	Yes	No
Potential mortality impact of AED differences	27%	< 8%	< 10%	> 30%	> 54%

PHILIPS

First shock efficacy



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CPR interruption

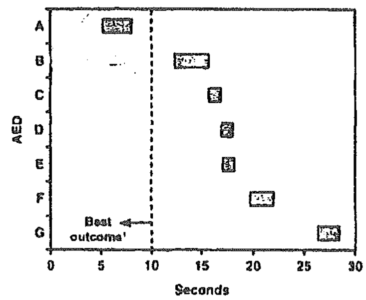
- Six popular AED models
  - Equipped with new batteries
  - Attached to a VF simulator
  - Advanced to CPR pause by delivering shocks
- Following CPR interval
  - "Best" and "Worst" case interruption interval between CPR and shock delivery measured with stopwatch, 5x for each AED
  - Time to deliver 3 shocks also characterized

Snyder, D and Morgan, C. Crit Care Med 2004 Sep 32(9 Suppl):S421-4

PHILIPS

Results

"Hands-Off" Interruption Interval — CPR to 1st shock



PHILIPS

Conclusions

- "Hands-off" CPR interruption intervals vary widely: 8.1 to 28.4 seconds
  - Responsible for more than two-fold survival variation in other studies
- Only one AED achieved interruption < 10 seconds, associated with best survival
- Survival impact of CPR interruption is likely much greater than any clinically documented efficacy variation between waveforms

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Putting it together–verification study

- 22 swine, 40-45 kg, 7 min VF, BLS resuscitation protocol (15 min), randomized to protocols provided by commercial products:
  - lower energy waveform (BTEL,150-150-150J) with shorter interruption (7 seconds)
  - higher energy waveform (BTEH, 200-300-360 J) with longer interruption (21 seconds)
- Endpoints
  - Survival
  - Post-resuscitation myocardial function
    - Left ventricular ejection fraction (EF)
    - stroke volume (SV)

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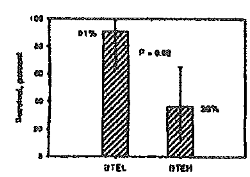
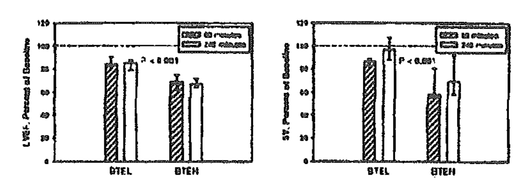
Results

3-shock efficacy 90% BTEL (150 J)

3-shock efficacy 82% BTEH (200-300-360 J)





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Conclusions

- Despite similar defibrillation efficacy, survival and myocardial function was :
  - Superior for short "hands-off" intervals combined with150 J biphasic shocks
  - Inferior for longer "hands-off" intervals combined with 200-300-360 J shocks
- The survival impact of the overall resuscitation protocol as determined by the defibrillator is likely far greater than any documented shock efficacy difference

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Resuscitation crystal ball

- ABC after defibrillation shock will be modified or eliminated
- One-shock as opposed to 3-shock defibrillation protocol for high efficacy defibrillation waveforms
- ▶ ECG analysis to recommend CPR versus defibrillation
- ▶ Active CPR performance feedback
- Mild hypothermia for long down-time patients

Background

- An inflexible resuscitation protocol of either shocks-first or CPR-first is unlikely to be optimal for all patients
  - Shocks-first are indicated for brief arrest times
  - CPR-first may offer benefit following long arrest times
- How can CPR-first be provided for long cardiac arrest times, without altering treatment for the most successful patient group?

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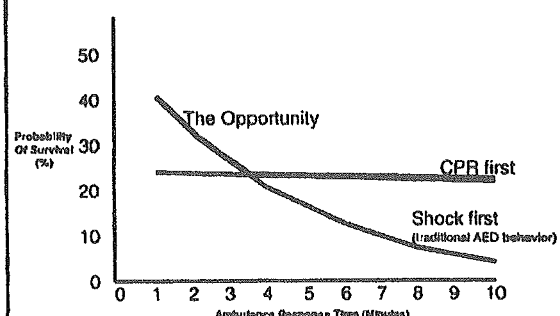
The Opportunity: Raise the Survival Curve



Methods

- We developed an ECG analysis to predict ROSC following 150 J BTE shocks (n = 575 shocks delivered to 151 VF/VT patients, Laerdal Medical) with high sensitivity and moderate specificity (Sn > 90% & Sp > 60%, or Sn > 80% & Sp = 70%)
- We hypothesized that the analysis could identify a group of patients unlikely to survive if treated with shocks-first protocol, and might therefore benefit from delay of defibrillation for CPR
- We tested the hypothesis against an independent database (n = 84 consecutive VF arrests treated with 150 J BTE through 2005, Rochester, MN)

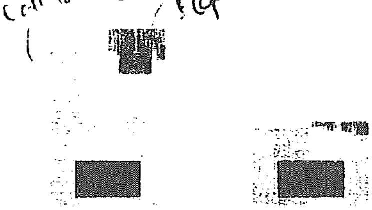
Automating the Resuscitation Protocol

- Option 1: use response time to determine initial treatment
  - Shocks-first for < 4 minutes (7 minute call-to-shock)
  - CPR-first for > 4 minutes (7 minute call-to-shock)
  - Survival cross-over point for the two interventions
- Option 2: use ECG analysis to determine initial treatment
  - Information is calculated automatically
  - Initial treatment is selected automatically
- How do option 1 & 2 compare in terms of maintaining or modifying initial treatment?

Protocol Automation: Call-to-Shock Time vs. ECG Analysis

Successful Treatment = Neurologically Intact Survival.

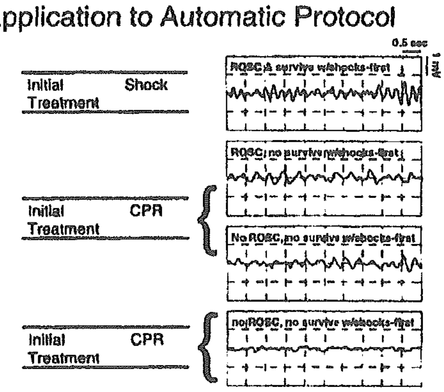
call to shock / ECG



shocks-first   6.6 ... CPR first

n= 32   n= 52.

Application to Automatic Protocol



Conclusions

- An ECG analysis has been developed that predicts ROSC following 150 J Biphasic defibrillation shock with high sensitivity and moderate specificity (Sn > 90% & Sp > 60%, or Sn > 80% & Sp = 70%)
- The analysis also identified good vs. poor outcome populations for patients treated with shocks-first protocol ($p < 0.001$)
  - Good: neurologically intact survival 53%, (95% CI [40%, 67%])
  - Poor: neurologically intact survival 4%, (95% CI [0.1%, 20%])

Conclusions (Continued)

- Call-to-shock time and ECG analysis are both useful for identification of a poor-outcome population that may benefit from delay of defibrillation in order to provide initial CPR
- When so employed, call-to-shock time and ECG analysis are statistically similar, though observed accuracies are higher for ECG analysis
- *Therefore, perhaps...*

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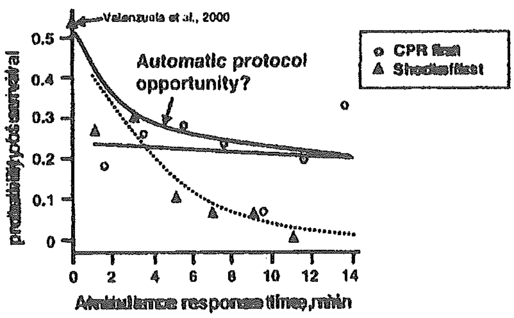
Automatic Protocol



Thank You

SMART CPR and Quick Shock

Only from Philips

FR2+ Therapy Innovations that Capitalize on the Benefits of CPR

PHILIPS

New HeartStart FR2+ Breakthroughs from Industry's Innovation Leader

- Capitalizing on the benefits of CPR for patients in Ventricular Fibrillation (VF)
  - SMART CPR
    - First AED to analyze presenting VF rhythm & advise initial therapy of either a defibrillation shock or CPR followed by a shock
  - Quick Shock
    - Only AEDs to deliver a shock after CPR in <10s, while heart is still "primed"; may improve return of circulation & survival

2

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Benefits of CPR Greater than Previously Realized

- CPR benefits
  - Oxygenates blood
  - Generates fuel the heart desperately needs
  - Distributes blood more optimally
  - *Makes the heart more receptive to a defibrillation shock*
- Interruptions to CPR should be minimized
  - Heart condition improves with each compression
  - Once compressions stop, the heart's condition degrades fast, reducing its ability to recover following a shock

Wik L, et al. JAMA, 2003; 289:1389-1395
Cobb LA, et al. JAMA, 1999; 281:1182-1188
Weisfeldt & Becker JAMA, 2002; 288:3035-3038
Yu T, et al. Circulation, 2002; 106:368-372
Eftestol T, et al. Circulation, 2002; 105:2270-2273

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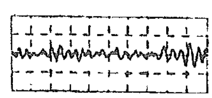
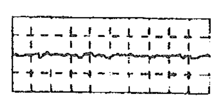
Defibrillating VF Doesn't Always Restore Circulation

- A patient with a coarse, spiky rhythm typical of short-duration VF may still have an energetic heart & may benefit from an immediate shock



- A patient with a weaker, flatter rhythm typical of long-duration VF has a depleted heart & is *unlikely* to return to circulation with a shock
  - Other contributors besides VF duration: Diseased heart, cause of arrest
  - CPR *first* may improve outcome

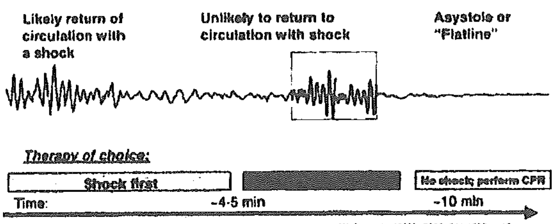


Wik L, et al. JAMA, 2003; 289:1389-1395
Cobb LA, et al. JAMA, 1999; 281:1182-1188
Weisfeldt & Becker JAMA, 2002; 288; 3035-3038
Trappe, H. J. et al. J Am Coll Cardiol, 1988 Jul; 12(1):166-174

4

PHILIPS

Promising Alternative Therapy Protocol



Wik L, et al. JAMA 2003; 289:1389-1395
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Weisfeldt & Becker JAMA 2002; 288; 3035-3038 5

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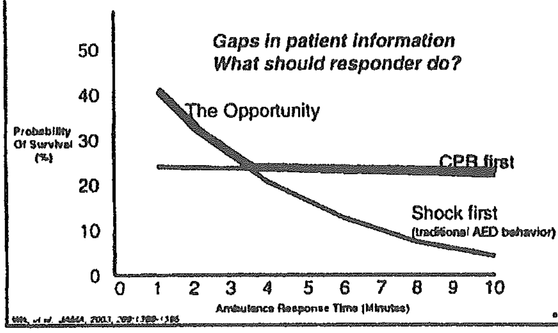
The Opportunity: Raise the Survival Curve



Wik, et al. JAMA, 2003, 289:1389-1395 6

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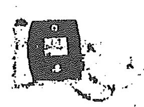
Introducing FR2+ with SMART CPR

- Offers opportunity for CPR first, before a shock
- Evaluates heart rhythm, **automatically** advises you on initial therapy
  - Immediate shock for hearts that are likely to benefit
  - CPR first for those that aren't
- An alternative to "one-size fits all" therapy
- Makes SMART Analysis SMARTer



7

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Applying the Latest Clinical Research to Help More Patients

- Designed to advise CPR first to patients with rhythms typical of long-duration arrest, without altering treatment for *the most successful patient group**
- Better informed, more refined treatment decisions
- Supports a protocol the literature suggests may have better outcome

**Snyder, DE, et al. AHA Scientific Sessions, November 2005*

8

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Configurable to Medical Director Preference

- FR2+ conforms to your CPR protocol; settings for:
  - Conventional shock-first advice and behavior (default)
  - Automated analysis & advice on initial therapy (shock first or CPR)
  - Responder control of initial therapy (shock first or responder-invoked CPR pause)

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Summary

Conventional AEDs generally treat all shockable VF the same: advising an immediate defibrillation shock. But not all VF is receptive to a shock. Hearts with VF rhythms typical of long downtime are unlikely to respond to a shock by returning to circulation. For those rhythms an initial period of CPR, followed by a shock is likely to improve outcome.

A protocol of initial shock to rhythms typical of short duration VF, and initial CPR *prior to shock otherwise may be better therapy.* It's an opportunity to raise the "survival curve" for SCA. The FR2+ with SMART CPR supports such a protocol.

It assesses the presenting heart rhythm. For shockable rhythms, the FR2+ is the first AED to further assess the likelihood that a shock will return circulation. If return of circulation is likely, FR2+ advises an immediate shock. Otherwise, it advises CPR first, followed by a shock.

SMART CPR lets responders make more informed, refined treatment decisions.

...And for those medical directors that want responders to use their discretion or follow CPR first standing orders, the FR2+ accommodates that too!

Quick Shock

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Quick Shock

- A unique feature offered only by Philips
- The HeartStart FR2+ can deliver a shock <10s after CPR
- CPR primes the pump (heart) & FR2+ quickly delivers a shock
- No other manufacturer is able to do this as quickly

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CPR is an Important Part of Resuscitation

- CPR Helps
  - CPR prior to defibrillation shock can help restore normal heartbeat in more patients, especially those with longer duration VF[1,2]
  - Beneficial effect of CPR disappears in seconds, so time to shock is very important[3,4]
- Quick Shock maximizes benefits of CPR
  - Minimizes interruption of CPR
  - Increases the chance that a shock will result in a successful return of circulation & may improve survival

[1] Cobb LA, et al. JAMA. 1999; 281(13):1182-1188
[2] Wik L, et al. JAMA. 2003 Mar 19; 289(11):1389-1395
[3] Yu T, et al. Circulation. 2002; 105:368-372
[4] Eftestøl T, et al. Circulation. 2002;105:2270-2273

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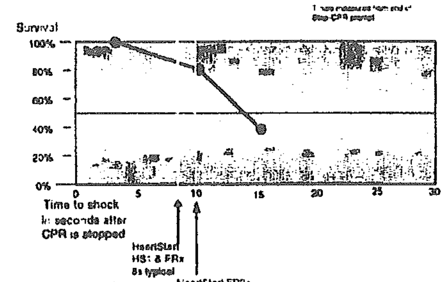
Survival Linked to Speed of Shock Delivery After CPR



Yu T, et al. Circulation. 2002; 105:368-372

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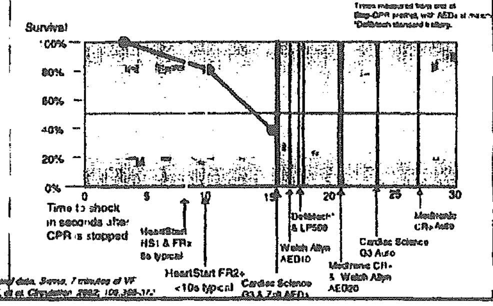
Survival Linked to Speed of Shock Delivery After CPR



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Peer-reviewed Research Supports QuickShock

- "Interruptions of precordial compression for rhythm analyses that exceed 15 seconds before each shock compromise the outcome of CPR and increase the severity of post resuscitation myocardial dysfunction."
  Yu T, et al. Circulation. 2002; 105:368-372
- "The interval between discontinuation of chest compressions and delivery of a shock should be kept as short as possible."
  Eftestøl T, et al. Circulation. 2002;105:2270-2273
- Simply put, getting a shock to the heart as soon as possible after CPR can save more lives