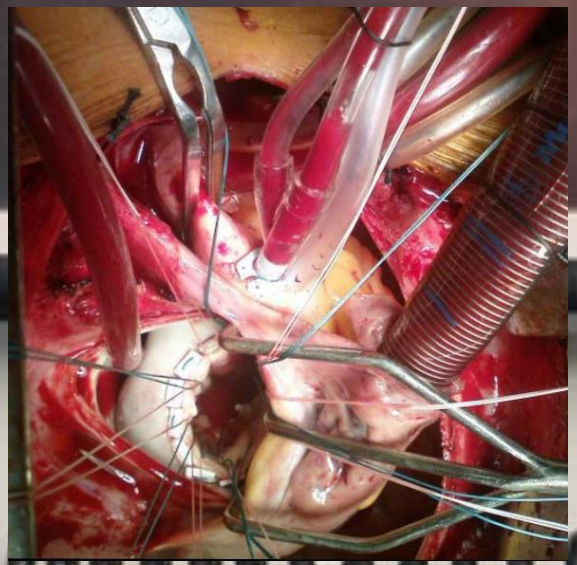
CPR after Cardiac Surgery



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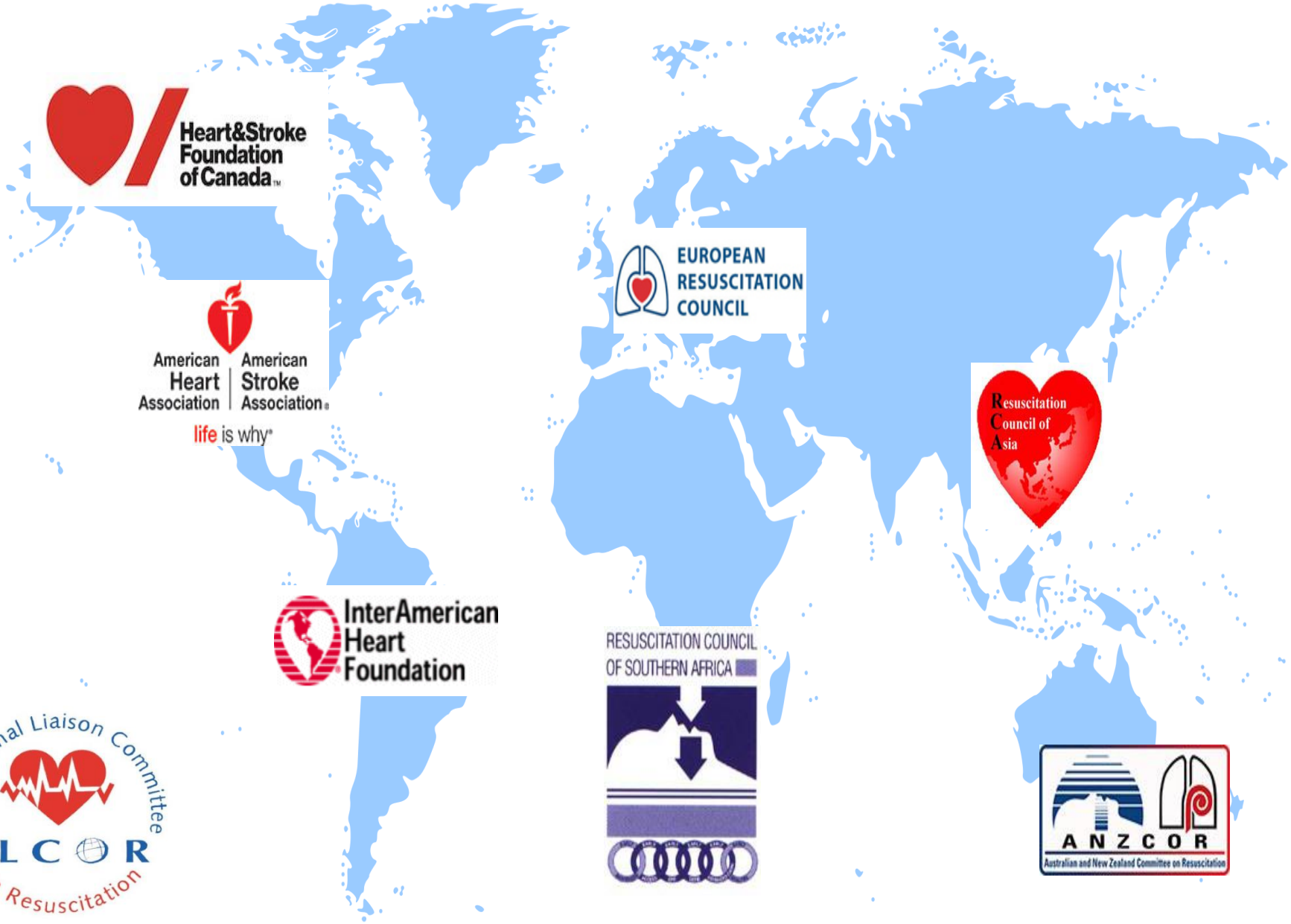
Heart&Stroke Foundation of Canada
American Heart Association
American Stroke Association
life is why
EUROPEAN RESUSCITATION COUNCIL
Resuscitation Council of Asia
InterAmerican Heart Foundation
RESUSCITATION COUNCIL OF SOUTHERN AFRICA
International Liaison Committee on Resuscitation
ILCOR
ANZCOR
Australian and New Zealand Committee on Resuscitation

Circulation
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Resuscitation 95 (2015) 264–277

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Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Part 10: Special Circumstances of Resuscitation: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Eric J. Lavonas, Ian R. Drennan, Andrea Gabrielli, Alan C. Heffner, Christopher O. Hoyte, Aaron M. Orkin, Kelly N. Sawyer and Michael W. Donnino

Circulation. 2015;132:S501-S518
doi: 10.1161/CIR.0000000000000264
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

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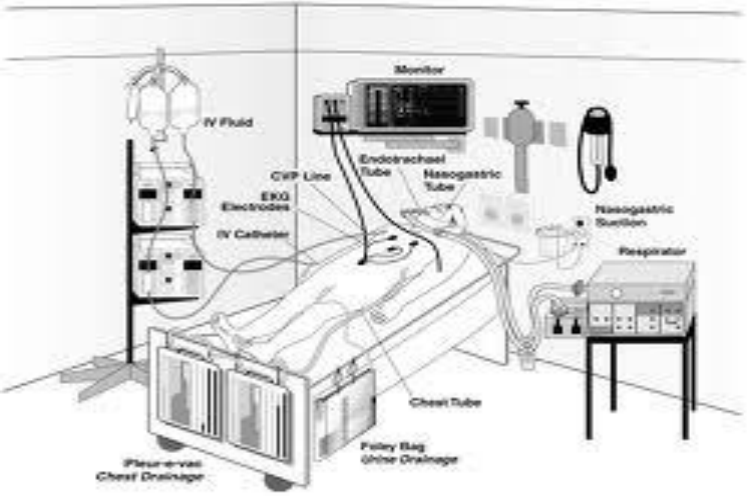
Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

European Resuscitation Council Guidelines for Resuscitation 2015 Section 4. Cardiac arrest in special circumstances

Anatolij Truhlář[a,b,*], Charles D. Deakin[c], Jasmeet Soar[d], Gamal Eldin Abbas Khalifa[e], Annette Alfonzo[f], Joost J.L.M. Bierens[g], Guttorm Brattebø[h], Hermann Brugger[i], Joel Dunning[j], Silvija Hunyadi-Antičević[k], Rudolph W. Koster[l], David J. Lockey[m,w], Carsten Lott[n], Peter Paal[o,p], Gavin D. Perkins[q,r], Claudio Sandroni[s], Karl-Christian Thies[t], David A. Zideman[u], Jerry P. Nolan[v,w], on behalf of the Cardiac arrest in special circumstances section Collaborators[1]

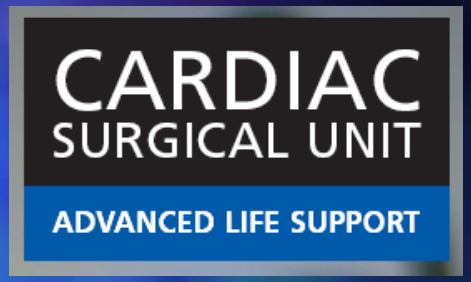


Cardiac Arrest in Special Situations

AHA 2015 Guidelines

Special Resuscitation Situations

- Asthma
- Anaphylaxis
- Pregnancy
- Morbid obesity
- PE
- Electrolyte imbalance
- Toxins
- Hypothermia
- Avalanche
- Drowning
- Trauma
- Electric shock/lightening
- PCI
- Cardiac tamponade
- Cardiac surgery



European Association for Cardiothoracic Surgery

2009 Guidelines for the resuscitation of patients who suffer cardiac arrest following cardiac surgery

Cardiothoracic Advanced Life Support (CALS)
Audit and Guidelines Committee EACTS

Guideline for resuscitation in cardiac arrest after cardiac surgery

EUROPEAN JOURNAL OF
CARDIO-THORACIC
SURGERY

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European Journal of Cardio-thoracic Surgery 36 (2009) 3—28

EUROPEAN JOURNAL OF
CARDIO-THORACIC
SURGERY

www.elsevier.com/locate/ejcts

Guideline

Guideline for resuscitation in cardiac arrest after cardiac surgery

Joel Dunning [a], Alessandro Fabbri [b], Philippe H. Kolh [c], Adrian Levine [d], Ulf Lockowandt [e], Jonathan Mackay [f], Alain J. Pavie [g], Tim Strang [h], Michael I.M. Versteegh [i], Samer A.M. Nashef [j,*], on behalf of the EACTS Clinical Guidelines Committee

STS EXPERT CONSENSUS STATEMENT

The Society of Thoracic Surgeons Expert Consensus for the Resuscitation of Patients Who Arrest After Cardiac Surgery

The Society of Thoracic Surgeons Task Force on Resuscitation After Cardiac Surgery*

(Ann Thorac Surg 2017;103:1005–20)

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RCoA Revalidation matrix
RCoA Matrix Codes:
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Management of cardiac arrest following cardiac surgery

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Standards for Resuscitation After Cardiac Surgery

S. JILL LEY, RN, MS, CNS

 doi: http://dx.doi.org/10.4037/ccn2015652

CriticalCareNurse
The journal for high acuity, progressive, and critical care nursing

Introduction

- Every year, over 250,000 patients have cardiac surgery in some 450 centers in Europe.
- Every year, more than 400,000 patients undergo cardiac surgery in the United States at one of approximately 1,200 medical centers.
- The incidence of cardiac arrest after cardiac surgery is around 0.7% to 2.9 in Europe and 8% in US and has reduced in recent years.
- The most remarkable statistic regarding these patients is the relatively good outcome with 17%-79% of patients suffering a cardiac arrest surviving to hospital discharge.

Introduction

- Superior survival is the high incidence of reversible causes for the arrest.
- Ventricular fibrillation (VF) accounts for the rhythm in 25-50% of cases and, in the intensive care unit (ICU) setting, this is immediately identified and treated.
- In addition, tamponade and major bleeding account for many arrests and both conditions may be quickly relieved by prompt resuscitation and emergency resternotomy where appropriate.

Introduction

- Because many patients may potentially be saved by prompt treatment, ICU staff must be well versed in managing cardiac arrests.

- Practicing protocol-based arrest management has been shown to halve the time to chest reopening and reduce complications in the conduct of the resternotomy after cardiac surgery.

- The EACTS Clinical Guideline Committee of the European Association for Cardio-Thoracic Surgery have published a set of clear clinical guidelines to apply specifically to resuscitation after cardiac surgery.

CARDIAC ARREST

assess rhythm

- ventricular fibrillation or tachycardia — DC shock (3 attempts)
- asystole or severe bradycardia — pace (if wires available)
- pulseless electrical activity

start basic life support

- amiodarone 300mg via central venous line
- consider external pacing
- if paced, turn off pacing to exclude underlying VF

prepare for emergency resternotomy

- continue CPR with single DC shock every 2 minutes until resternotomy
- continue CPR until resternotomy
- continue CPR until resternotomy

airway and ventilation

- If ventilated turn FiO_2 to 100% and switch off PEEP.
- Change to bag/valve with 100% O_2, verify ET tube position and cuff inflation and listen for breath sounds bilaterally to exclude a pneumothorax or hemothorax.
- If tension pneumothorax suspected, immediately place large bore cannula in the 2nd rib space anterior mid-clavicular line.

DO NOT GIVE EPINEPHRINE unless a senior doctor advises this.

If an IABP is in place change to pressure trigger.

Do not delay basic life support for defibrillation or pacing for more than one minute.

Airway and Breathing

Recommendations:
Airway and breathing.
Immediately turn the oxygen up to 100%.
For ventilated patients, PEEP should be removed, and if you are happy to do so, the ventilator should be disconnected and a bag/valve used. Listen for breath sounds both sides and equal chest movement to identify a pneumothorax or a haemothorax if present.
If you suspect a tension pneumothorax, place a large bore needle into the 2nd intercostal space, anterior mid-clavicular line, followed either by a chest drain or opening of the pleura at resternotomy.
If you are happy with the airway and breathing, the patient may be reconnected to the ventilator.

Medication and shock

Recommendations:
In an established cardiac arrest all infusions and syringe drivers should be stopped.
If there is concern about awareness then it is acceptable to continue the sedative infusions.
Other infusions can be restarted as required by the clinical situation.

Recommendation:
Neither adrenaline nor vasopressin should be given during the cardiac arrest unless directed by a senior clinician experienced in their use.

Recommendations:
In ventricular fibrillation or pulseless ventricular tachycardia 3 sequential shocks should be given without intervening CPR.
In VF or pulseless VT, emergency resternotomy should be performed after 3 failed attempts at defibrillation.

IABP

Recommendation:
In cardiac arrest with an IABP in place, it should be set to pressure trigger.
If there is a significant period without massage, triggering should be changed to internal at a rate of 100 bpm until massage is recommenced.

Intra Aortic Balloon Pump (IABP)

Indications: : Intra-aortic balloon pump therapy is used to improve coronary artery perfusion and to decrease left ventricular afterload. A specialised arterial catheter, which has a helium filled balloon is inserted percutaneously into the descending aorta. This catheter is attached to the IABP which pumps helium into the balloon during ventricular diastole (thereby increasing myocardial perfusion) draws back the helium prior to ventricular systole (thereby decreasing ventricular afterload). IABP increases myocardial and systemic blood flow in the following incidences: LV failure, unstable refactory angina, septic shock, mechanical complications secondary to AMI, bridge to cardiac transplantation, valvular disease, prophylaxis prior to cardiac surgery, post cardiac surgery cardiogenic shock and provides support for failed angioplasty and valvuloplasty.

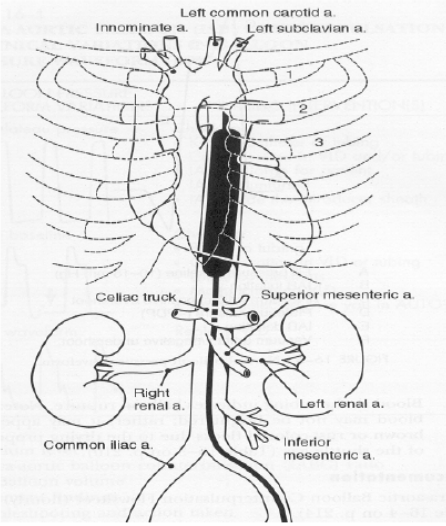


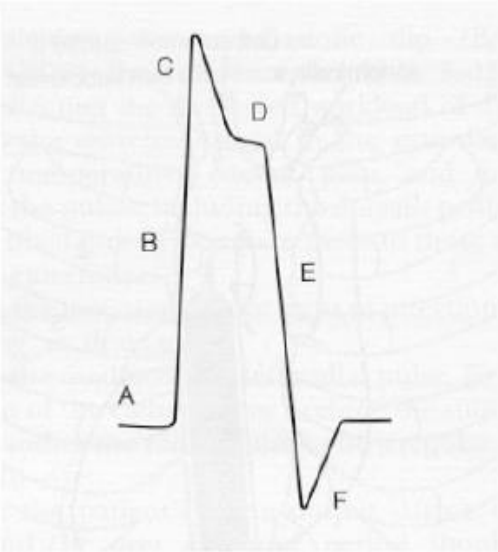
Fig 1 Intra Aortic Balloon Pump (IABP)

IABP

C pressure artifact/positive overload

B IAB inflation

A fill pressure baseline (10-15 MM Hg)



D plateau pressure

E IAB deflation

F vacuum artifact/negative undershoot

Fig 2. Normal balloon pressure waveform

Cardiac Arrest:

- Switch to pressure triggering once pump alarms due to loss of ECG rhythm (remember to select "assist" after changing trigger modes). Reduce the pressure threshold if balloon fails to pump from pressure trigger (decrease arrows in auxiliary box under trigger options).
- The balloon pump does not need to be disconnected during defibrillation.
- If CPR cannot generate a consistent and reliable trigger, then switch to "INTERNAL" mode which will maintain movement of the IAB and therefore reduce the risk of thrombus formation.

Rhythm Management

Recommendations:
A precordial thump may be performed if within 10 s of the onset of VF or pulseless VT.
This should not delay cardioversion by defibrillation.

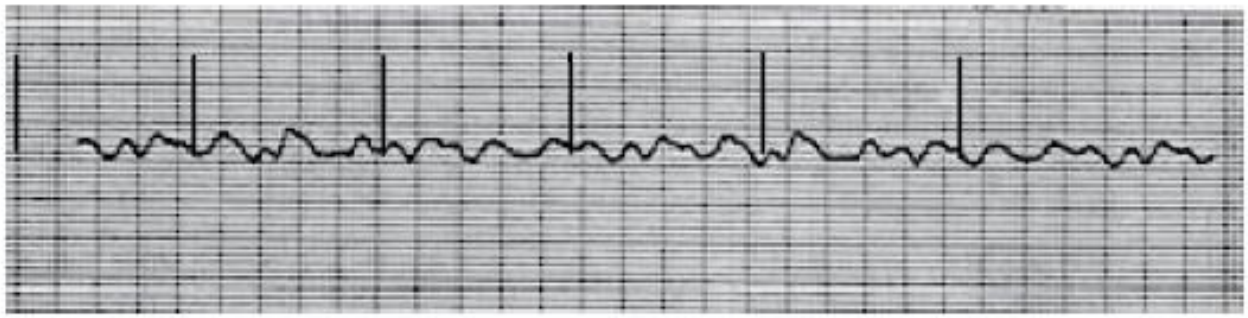
Recommendation:
In an arrest after cardiac surgery, external cardiac massage can be deferred until initial defibrillation or pacing (as appropriate) have been attempted, provided this can be done in less than 1 min.

Pacemaker Setup

Recommendations:

For asystole or severe bradycardia, connect the epicardial pacing wires and set to DDD at 90 bpm at the maximum atrial and ventricular output voltages.

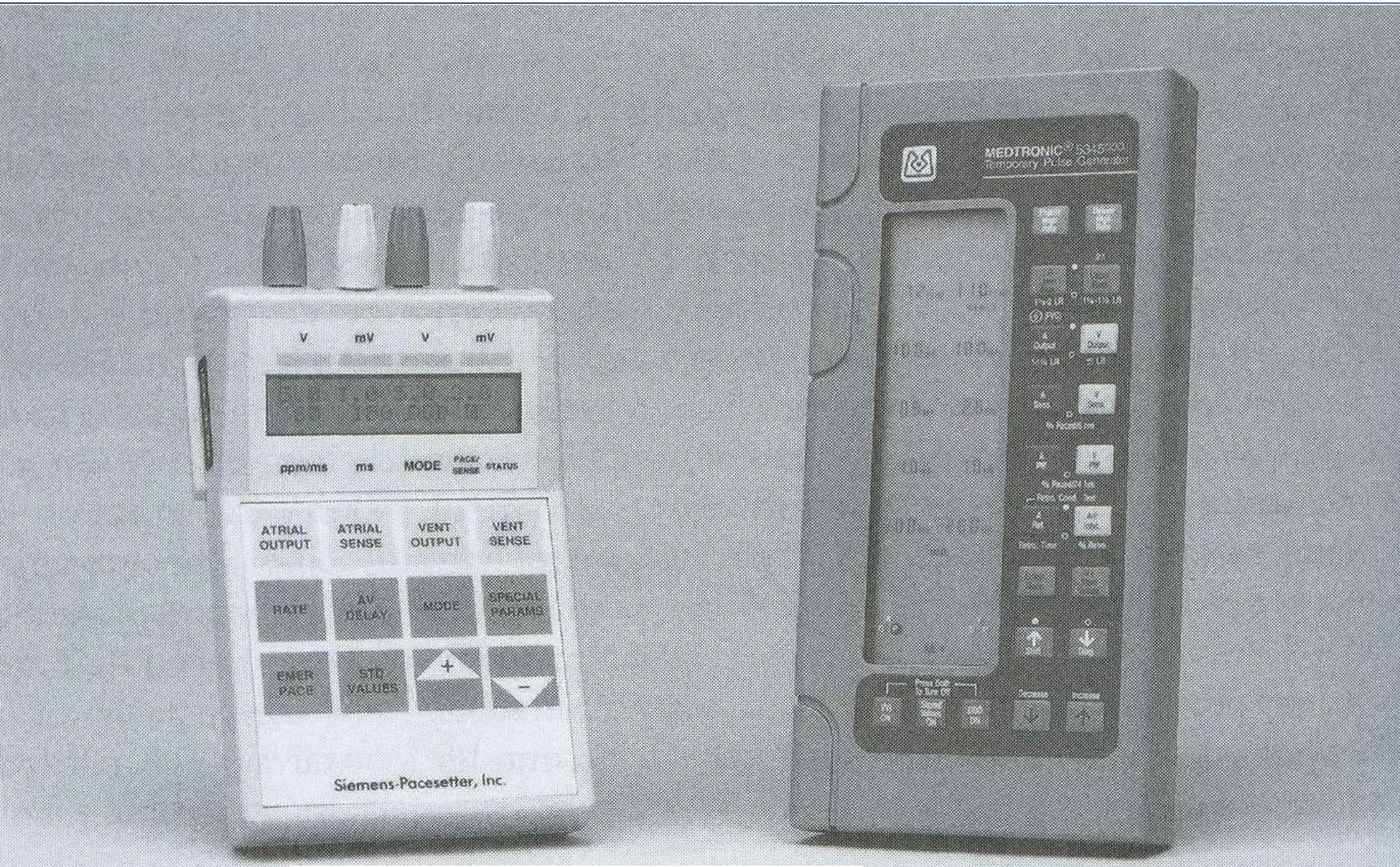
If the rhythm is pulseless electrical activity and a pacemaker is connected and functioning, then briefly turn the pacemaker off to exclude underlying ventricular fibrillation.



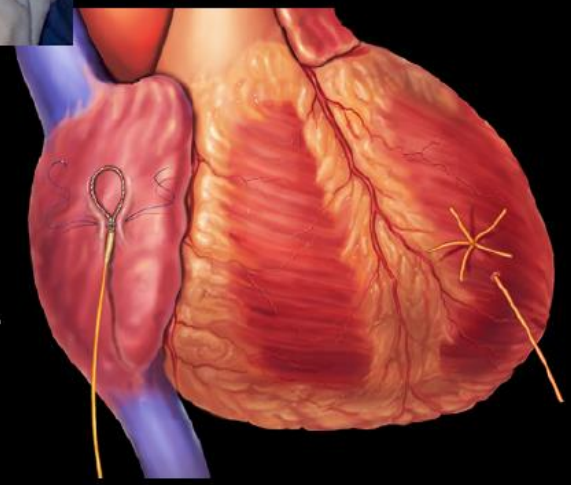
A. Arrhythmia with pacemaker artifact present

B. Pacemaker paused revealing underlying ventricular fibrillation

Figure 3. Electrocardiogram of arrhythmia with and without pacemaker artifact.



DUAL-CHAMBER GENERATORS



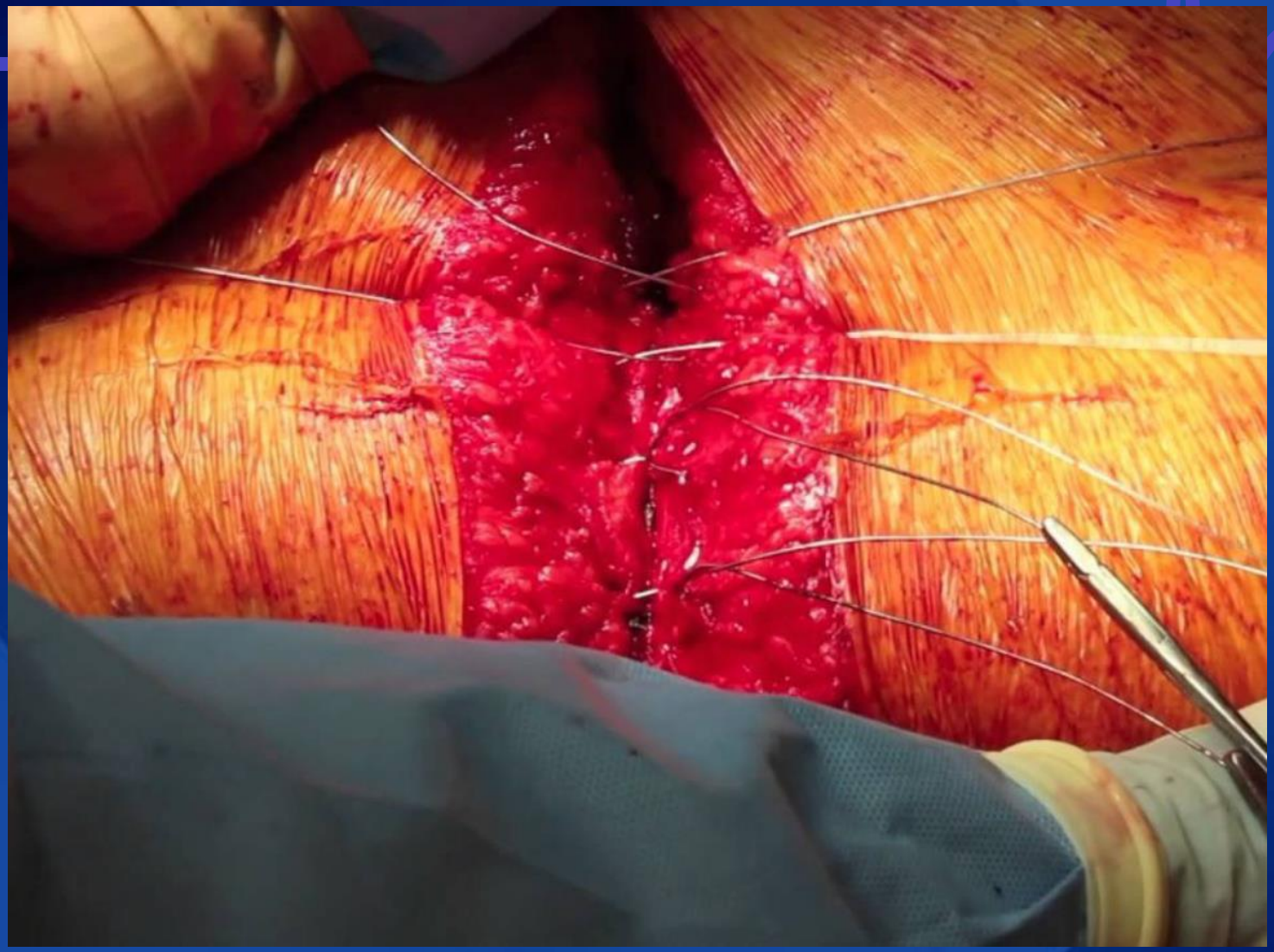
90 BPM DDD pacing

S E Q U E N C E

- Call for help
- Prep +/-
- Gown Glove & Drape
- Scalpel
- Heavy needle holder and wire cutter

Recommendations:
Two to three staff members should put on a gown and gloves as soon as a cardiac arrest is called, and prepare the emergency resternotomy set.
Hand washing is not necessary prior to closed-sleeve donning of gloves.

Fig. 3. Small resternotomy set packed with scalpel on top (above) and opened (below).



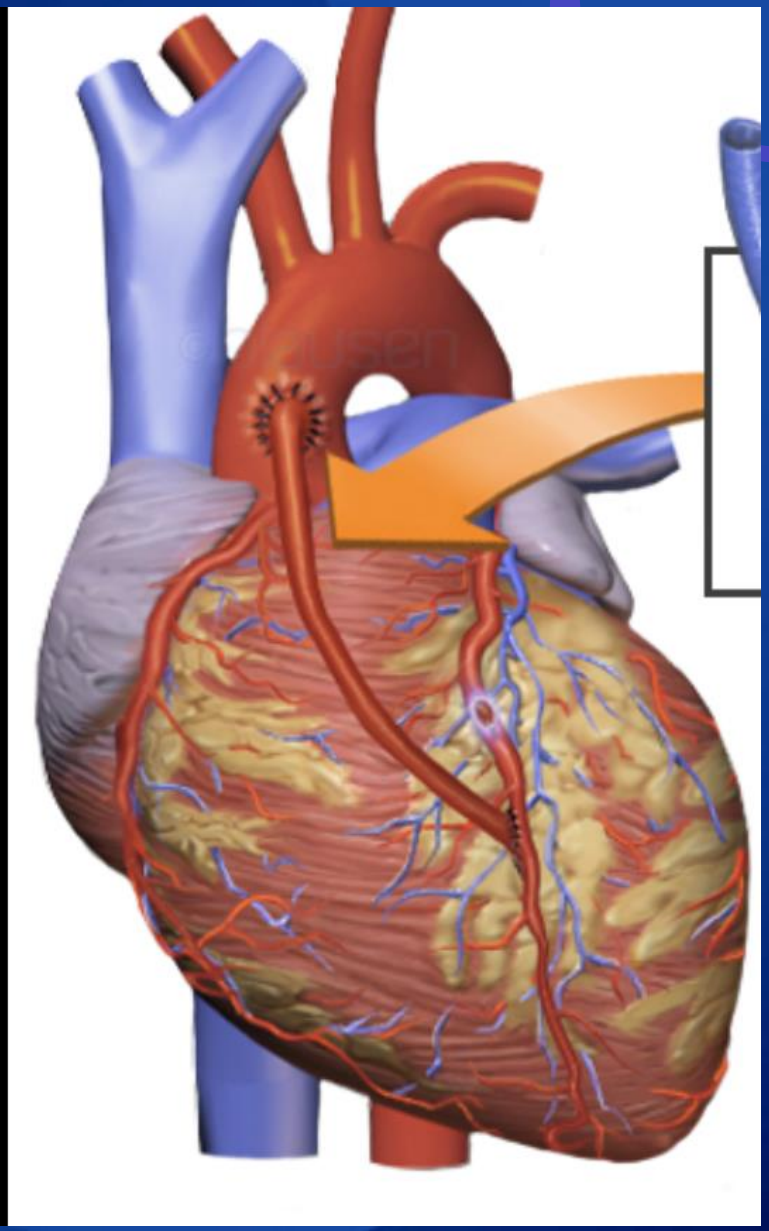
S E Q U E N C E

- Suction
- Retractor
- Look around
- Defibrillate
- Manual Compression

OPEN COMPRESSIONS

RIGHT HAND BEHIND AROUND APEX

LEFT HAND FLAT ON ANTERIOR SURFACE



TWO-HANDED INTERNAL CARDIAC MASSAGE AVOIDS PERFORATION OF RIGHT VENTRICLE BY SURGEON'S THUMB

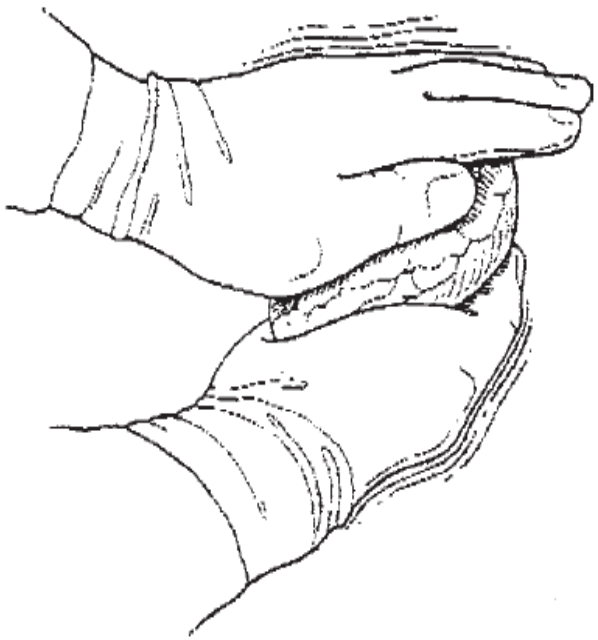
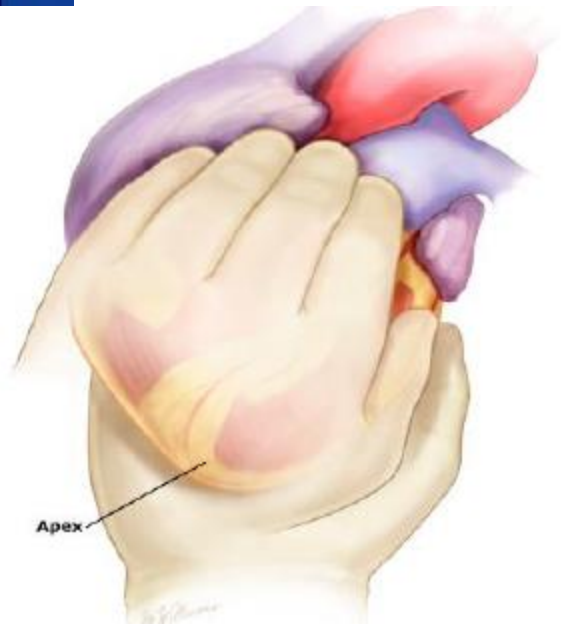
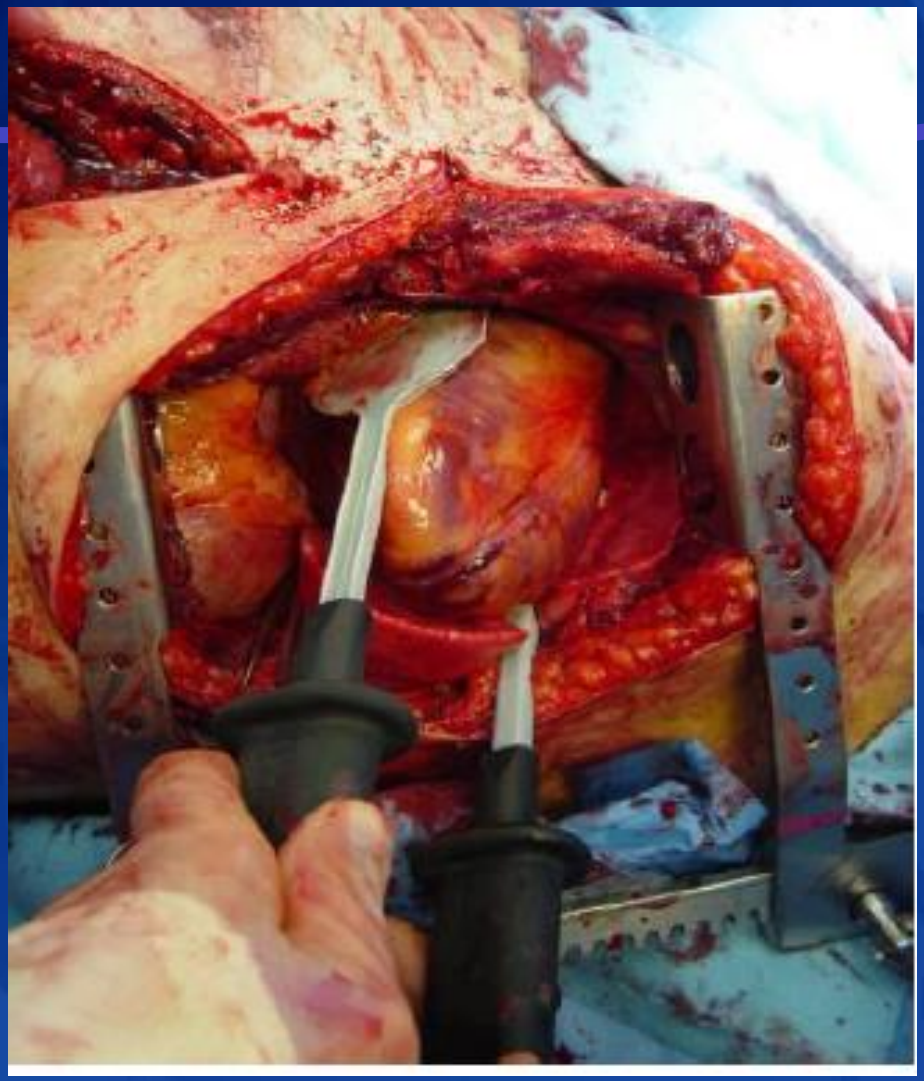


Figure 6





One internal paddle is placed on anterior surface and one on posterior surface of heart

A New Internal Cardiac Massage Technique

Erkan Kuralay

Suleyman Demirel University, Cardiac Surgery Department, Isparta, Turkey

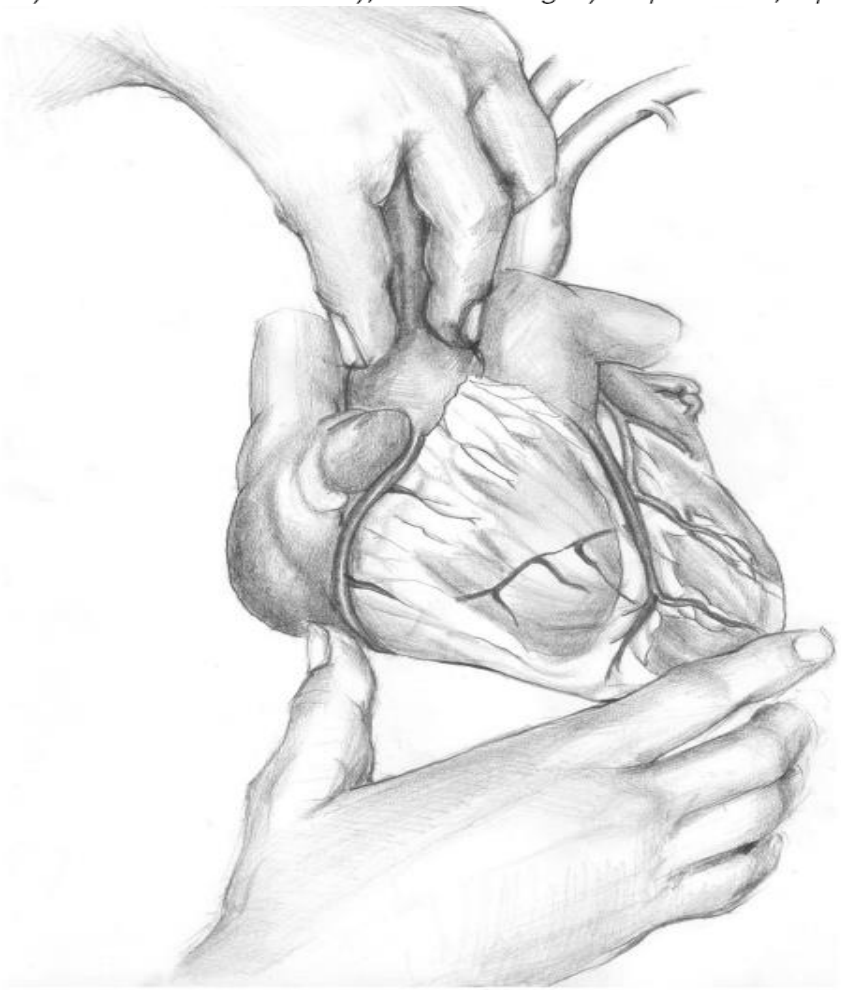
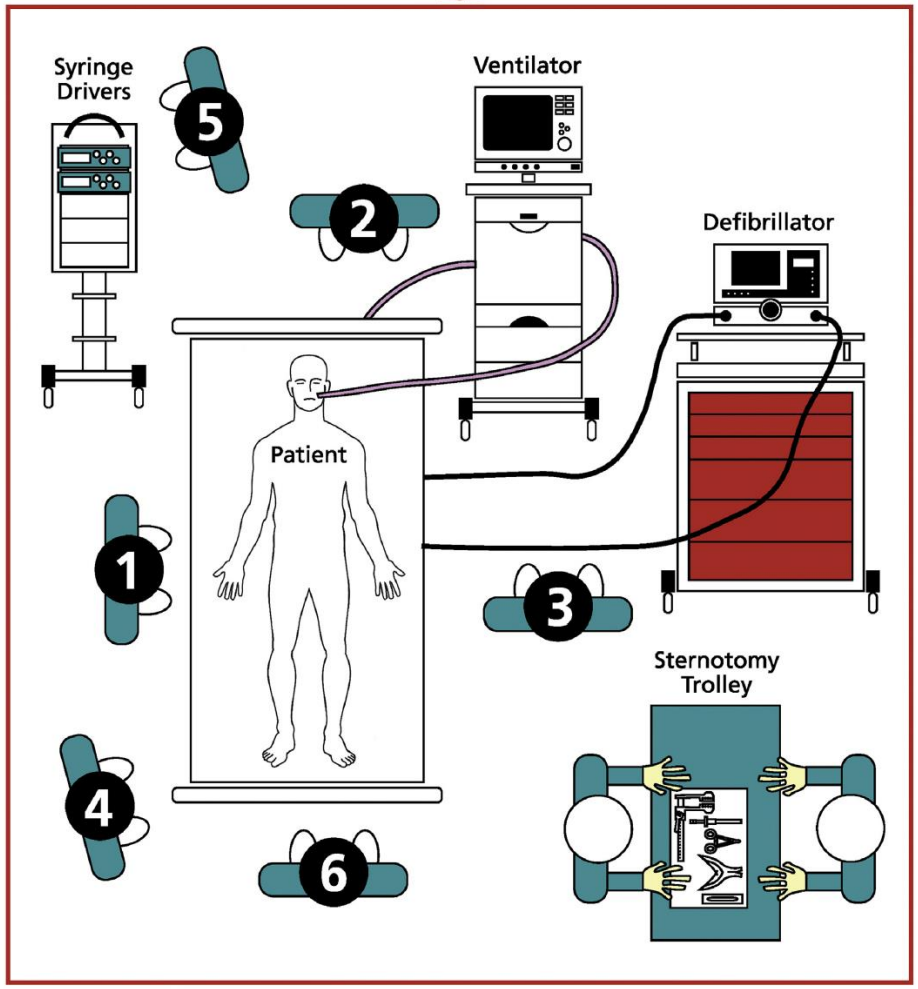


Figure 1. *To be able to increase the diastolic blood pressure sufficiently, in our practice the surgeon grabs the distal part of ascending aorta between the thumb and index finger of the left hand and squeezes it during the diastolic time period to effectively increase the diastolic blood pressure. The patient's head is elevated up to 30° to ensure optimal filling of the ascending aorta by the aid of gravity.*

Figure 2. *The ascending aorta is released during ventricular squeezing, and subsequently it is squeezed during the ventricular relaxation (Kuralay technique).*

Ann Thorac Surg
2017;103:1005–20

Six key roles in the cardiac arrest



Six key roles in the cardiac arrest:

1. External cardiac massage
2. Airway and breathing
3. Defibrillation
4. Team leader
5. Drugs and syringe drivers
6. ICU co-ordinator

Recommendation

Recommendations:

Emergency resternotomy should form an integral part of the cardiac arrest protocol up to the 10th postoperative day.

Beyond the 10th postoperative day, a senior clinician should decide whether emergency resternotomy should still be performed.

Emergency resternotomy for internal cardiac massage should still be considered in preference to prolonged external cardiac massage even if a surgically reversible cause for the arrest is not suspected.

Recommendation

Transplant Patients

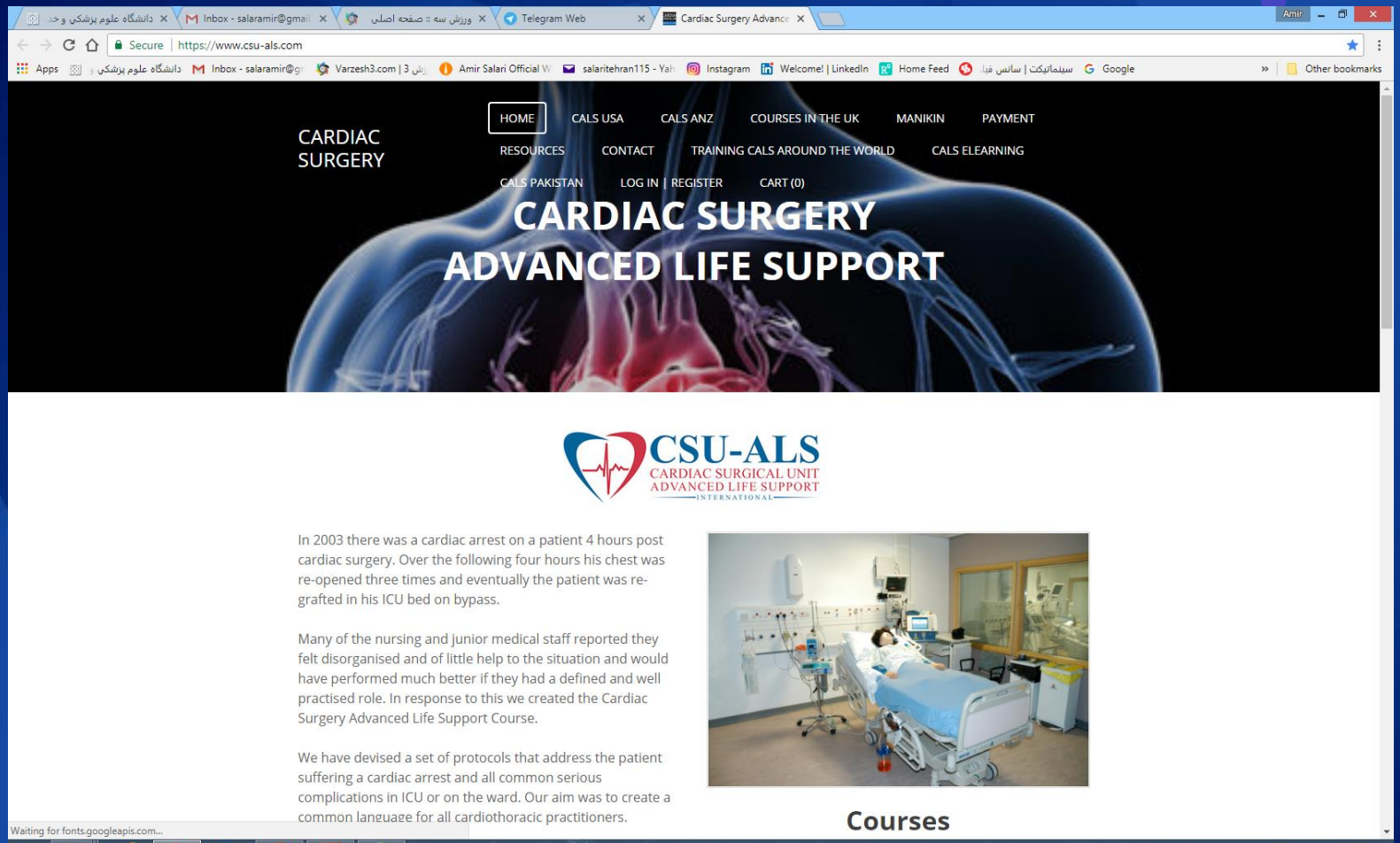
Patients undergoing heart, heart-lung, or double lung transplant through a sternotomy may be resuscitated using these guidelines. Patients having a transplant procedure through a clam-shell incision or bilateral thoracotomy incisions may have an emergency reopening of the clam-shell incision using the same indications in this guideline. Patients with bilateral thoracotomy may need a sternotomy in case of an arrest. Only a surgeon experienced in this particular approach should perform this procedure, and local guidelines should be drawn up to address these issues.

Table Recommendations for management of cardiac arrest: ACLS versus CSU-ALS

ACLS recommendations for arrest	CSU-ALS recommendations for postoperative cardiac surgical arrest
Ventricular fibrillation or pulseless ventricular tachycardia	
Immediate external cardiac massage	Defibrillate first if available within 1 minute
External cardiac massage → single shock → external cardiac massage × 2 minutes before repeating shock	Three stacked shocks before external cardiac massage
Asystole or profound bradycardia	
External cardiac massage → vasopressor	DDD pacing at maximum outputs if available within 1 minute → external cardiac massage
All pulseless cardiac arrests	
Epinephrine 1000 μg every 3-5 minutes; vasopressin 40 units may be used for first or second dose	No epinephrine or vasopressin during arrest Reduce epinephrine dose to 100 μg *prearrest*
Use specific roles under direction of team leader	Use 6 key roles during arrest management (see Figure 1)
	Rapid resternotomy (<5 minutes) if no response to initial therapies

Abbreviations: ACLS, Advanced Cardiac Life Support; CSU-ALS, Cardiac Surgical Unit–Advanced Life Support.

https://www.csu-als.com



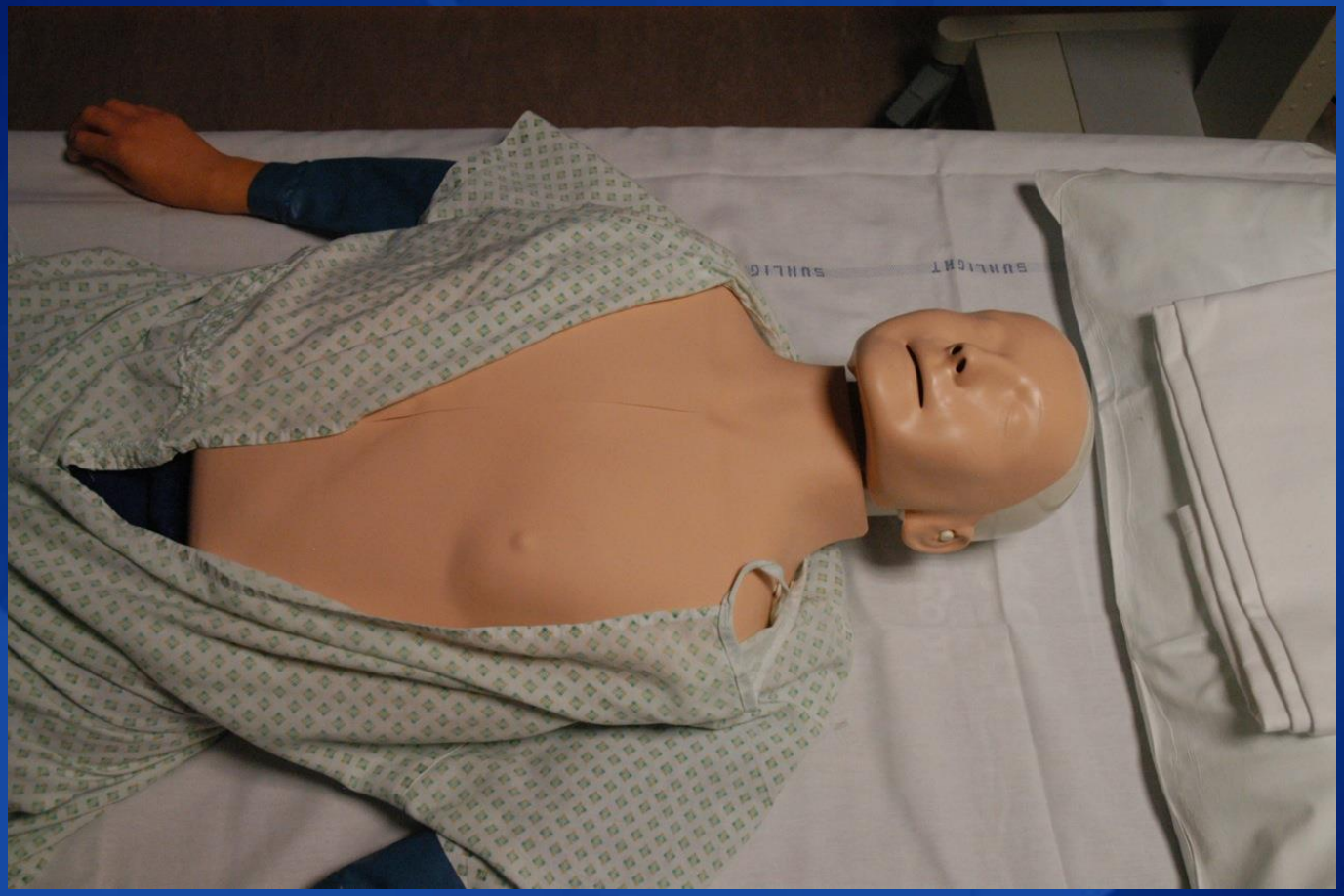
Everyone can do it !

The New Sternotomy Manikin

Designed for use with Cardiac Surgery Advanced Life Support Course training

The sternotomy manikins is constructed from a new Laerdal Little Anne.

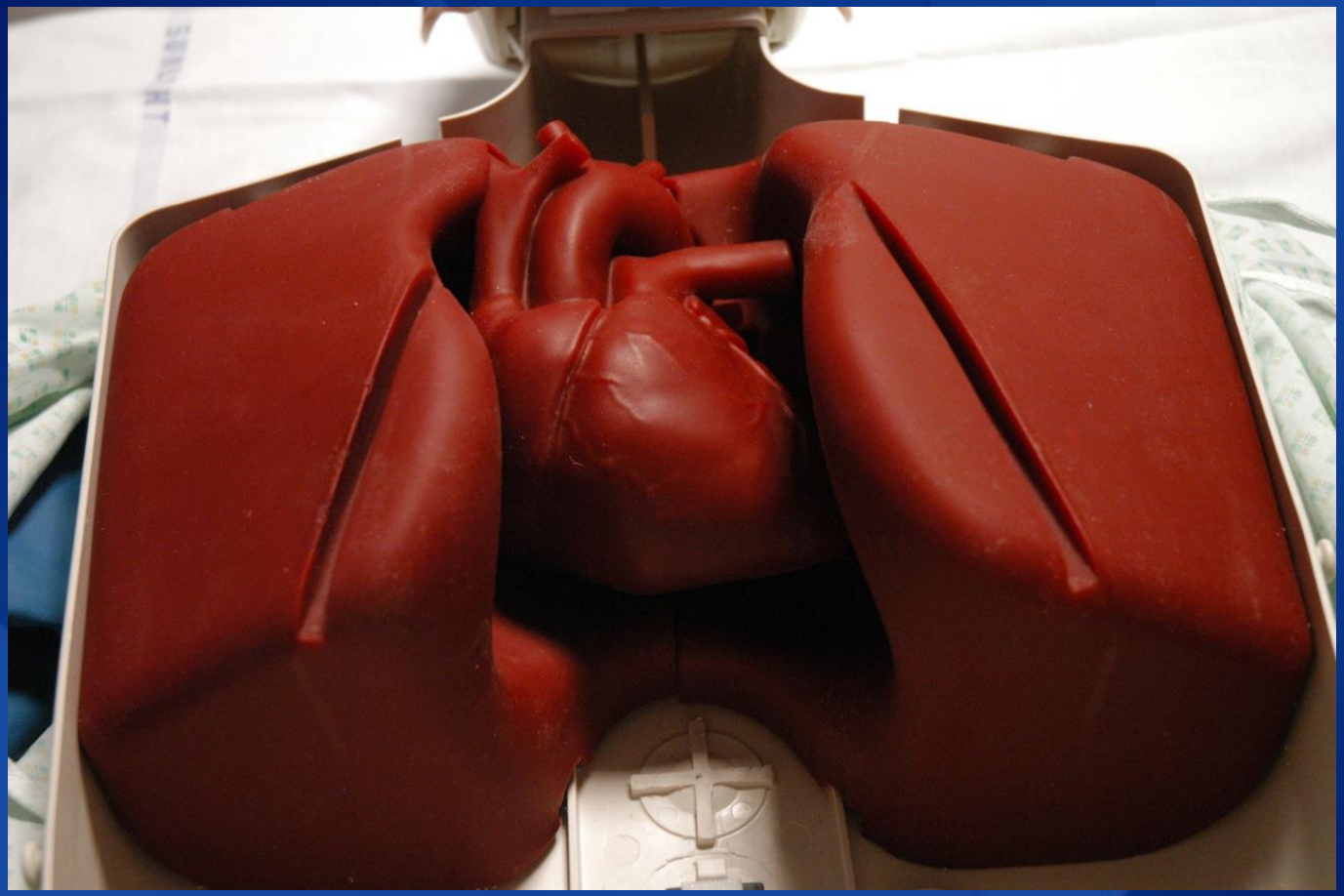
Midline incision has been made



Under the midline incision the sternal plate has been extensively modified, with a machined full length sternotomy, 6 wire holes on each side, riveted elastication above and below the sternotomy to take a retrator and then the plate has been riveted to the Little Anne base for stability

Under the sternal plate is a heart and lung block recreated by 3D computer modelling from an MRI scan of a mediastinum and the little Anne, and moulded in red Silastine so that it is sturdy but has some elasticity for internal massage

Under the sternal plate is a heart and lung block recreated by 3D computer modelling from an MRI scan of a mediastinum and the little Anne, and moulded in red Silastine so that it is sturdy but has some elasticity for internal massage



The heart is removable for close up demonstration of internal massage

Resuscitation After Cardiac Surgery (2010 ERC - EACTS - AHA Guidlines)

Cardiac Arrest

بررسی ریتم

- Ventricular Fibrillation or Tachycardia (VF/VT) → سه بار شوک
- Asystole or Severe Bradycardia → استفاده از ضربان ساز در صورت وجود سیم Pace
- Pulseless Electrical Activity (PEA)

شروع حمایت حیاتی پایه (BLS)

- در صورت وجود ضربان ساز خاموش کردن آن جهت رد کردن VF زمینه ای
- آتروپین 3 mg (با صلاحدید متخصص) در نظر داشتن ضربان سازخارجی
- آمیودارون 300mg از طریق مسیر وریدی مرکزی (CV line)

آماده شدن برای باز کردن مجدد قفسه سینه اورژانسی

- CPR ادامه تا Resternotomy
- CPR ادامه تا Resternotomy
- CPR ادامه با یک شوک هر ۲ دقیقه تا Resternotomy

Edited by : MAJID SEHAT - AMIR SALARI
(Emergency and Intensive care Educators)

References :
ERC : European Resuscitation Council - AHA : American Heart Association
EACTS : European Association for Cardio-Thoracic Surgery

Approved by Iranian Society of Critical Care

Tel and Email : 09122791577 (majid.sehat@yahoo.com)
09124065510 (Info@Amirsalari.ir)

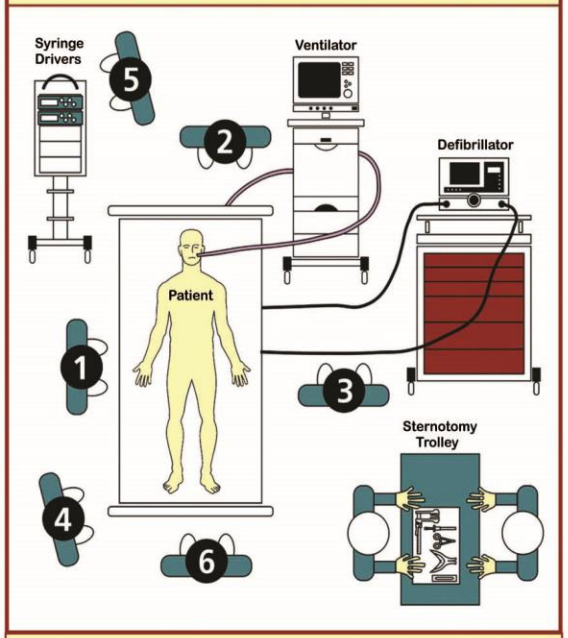
راه هوائی و تهویه مصنوعی :

- در صورت اتصال به ونتیلاتور رساندن FIO_2 به ۱۰۰٪ و خاموش کردن PEEP
- تغییر نحوه تهویه بیمار از ونتیلاتور به آمبوبگ (BVM) با O_2 ۱۰۰٪ ، تأیید محل صحیح لوله تراشه و میزان باد کاف آن
- گوش کردن صداهای تنفسی دو طرفه جهت رد کردن پنومو توراکس یا هموتوراکس
- در صورت شک به پنوموتوراکس فشاری بلافاصله زدن یک آنژیوکت شماره ۱۴ یا ۱۶ (نارنجی یا خاکستری) به فضای دوم بین دنده ای خط میان ترقوه ای و در ادامه تعبیه درن قفسه سینه یا باز کردن پلور بعد از Resternotomy

نکات مهم و مورد توجه :

- عدم استفاده از آدرنالین و وازوپرسین (در صورت صلاحدید پزشک ارشد و متخصص آدرنالین با احتیاط و با دوز 100 mcg یا کمتر جهت بزرگسالان و 1 mcg/kg جهت کودکان داده می شود .)
- عدم تأخیر BLS برای دفیبریلاسیون یا ضربان ساز ، اما در صورتیکه انجام دفیبریلاسیون یا استفاده از ضربان ساز درکمتر از یک دقیقه مهیا می شود می توان فشردن قفسه سینه را به تأخیر انداخت .
- قطع داروهائی که با سرنگ پمپ برای بیمار انفوزیون می شود، اما درصورت نگرانی از بیدار شدن بیمار می توان انفوزیون آرامبخشها را ادامه داد. سایر انفوزیون ها در صورت وجود برخی شرایط بالینی می تواند دوباره شروع گردد.
- در ایست قلبی بیماران دارای بالون پمپ داخل آئورت (IABP) حساسیت آن روی حالت Pressure Trigger تنظیم و درصورت یک دوره بدون ماساژ حساسیت آن روی حالت داخلی با ضربان ۱۰۰ باردر دقیقه تا انجام دوباره ماساژ تنظیم گردد.
- انجام Precordial thump می تواند در ۱۰ ثانیه اول از شروع VF یا VT بدون نبض انجام شود ، ولی انجام شوک نباید به تأخیر بیفتد.
- در VF یا VT بدون نبض سه شوک پی در پی بدون انجام ماساژ خارجی قفسه سینه داده و بعد از آن استرنوتومی مجدد باید انجام گردد.
- جهت انجام شوک با دستگاه مونوفازیک ۳۶۰ ژول و با دستگاه های فازیک بسته به نوع دستگاه از ۱۲۰ تا ۳۶۰ ژول شوک داده می شود.
- بعد از سه بار شوک ناموفق 300 mg آمیودارون بصورت بلوس باید از طریق ورید مرکزی داده شود.
- برای آسیستول یا برادیکاردی شدید اتصال سیمهای ضربان ساز Epicardial به‌ضربان ساز و تنظیم آن روی حالت DDD با ضربان ۱۰۰ – ۹۰ بار در دقیقه و حداکثر ولتاژ خروجی دهلیز و بطن می بایست انجام گیرد.
- تشخیص فعالیت الکتریکی بدون نبض (PEA) با بررسی نبض مرکزی به مدت ۱۰ ثانیه و مانیتور فشار شریانی(آرتریال لاین) انجام می گیرد.
- در صورت ریتم PEA و وصل بودن ضربان ساز و فعال بودن آن جهت رد کردن VF زمینه ای باید آن را خاموش کرد.
- جهت آسیستول یا برادیکاردی خیلی شدیددر صورت صلاحدید متخصص 3 mg آتروپین یکجا می تواند از طریق ورید مرکزی داده شود.
- در ایست قلبی با ریتمهای غیر قابل شوک در صورت عدم پاسخگوئی به تزریق آتروپین و استفاده از ضربان ساز می بایست استرنوتومی مجدد به طور اورژانس انجام گیرد.
- ماساژ داخلی قلب از ماساژ خارجی ارجحتر و مؤثرتر است. (تکنیک ماساژ دو دستی برای جلوگیری از پارگی بطن راست ارجحیت دارد.)
- پس از انجام استرنوتومی مجدد جهت دفیبریلاسیون داخلی باید از ۲۰ ژول انرژی استفاده گردد و این شوکها باید بعد از انجام ۲ دقیقه ماساژ داخلی قلب باشد.(در بیمارانی که تحت بای پس قلبی ریوی هستند می توان با ۵ ژول شروع نمود.)
- ست کوچک استرنوتومی مجدد می بایست در هر ICU موجود باشد و بطور دوره ای و منظم توسط پرسنل پرستاری کنترل گردد.
- این ست‌شامل یک چاقوی جراحی یکبار مصرف که به بیرون ست متصل شده است و در داخل این ست استریل یک سوزنگیر قوی ، یک قطعه ریتراکتور جناغی ، یک وایر کاتر و یک سرساکشن مخصوص موجود می باشد(طبق شکل)
- دو تا سه نفر از پرسنل باید برای انجام استرنوتومی مجدد دستکش و گان استریل بپوشند . شستن دستها قبل از پوشیدن دستکش و گان الزامی نیست.
- این دستورالعمل می تواند با نظر جراح برای بیمارانی که جراحی قلب بدون استرنوتومی شده اند نیز بکار گرفته شود.
- استرنوتومی مجدد یکی از مهمترین قسمتهای این دستورالعمل تا دهمین روز بعد از عمل می باشد.در صورت انجام طولانی ماساژ خارجی قفسه سینه انجام استرنوتومی مجدد برای ماساژ داخلی قلب حتی اگر علل قابل برگشتی محتمل نباشد ، توصیه می شود.
- در ایست قلبی بیمارانی که بطور میانگین ۷ ساعت از عمل جراحی قلب باز آنها گذشته است می توان از بای پس قلبی ،ریوی اورژانسی استفاده نمود.
- در کودکان دستورالعمل مشابه بزرگسالان بوده ولی دوز داروها و دفیبریلاسیون باید طبق دستورالعمل احیاء کودکان تعدیل گردد.
- در مورد سایر بیمارانی که در ICU بستری نیستند می بایست دستورالعمل سال ۲۰۱۰ انجمن قلب امریکا و اروپا بکار گرفته شود.
- شستشو با محلول آنتی سپتیک بعد از استرنوتومی و دادن آنتی بیوتیک داخل وریدی خصوصاً در مواردی که تکنیکهای آسپتیک به طور کامل اجرا نشده است عمومیت دارد.

شش نقش کلیدی در ایست قلبی بعد از جراحی قلب باز



۱ مسئول انجام ماساژ خارجی قلب ۲ مسئول برقراری راه هوائی و انجام تهویه مصنوعی
۳ مسئول انجام دفیبریلاسیون ٤ مسئول هدایت گروه ٥ مسئول دارو ها و تزریقات ۶ هماهنگ‌کننده ICU

ست کوچک استرنوتومی مجدد

تکنیکهای ماساژ داخلی قلب

روش یک دستی (One-handed Technique)

روش دو دستی (Two-handed Technique)