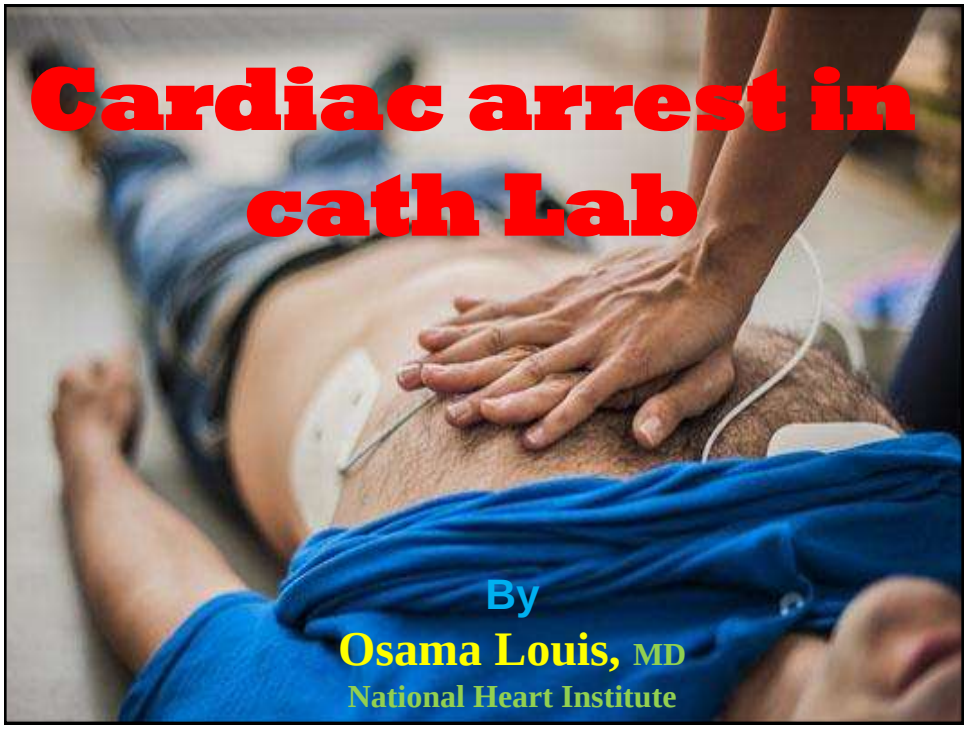


PCI in the real world

Although approximately 2,000,000 patients undergo PCI yearly worldwide, only a very small minority will suffer a protracted cardiac arrest episode during the procedure that results in death.

Cardiac arrest itself in the cath lab is not an uncommon event, but is usually rapidly resolved with proper management.

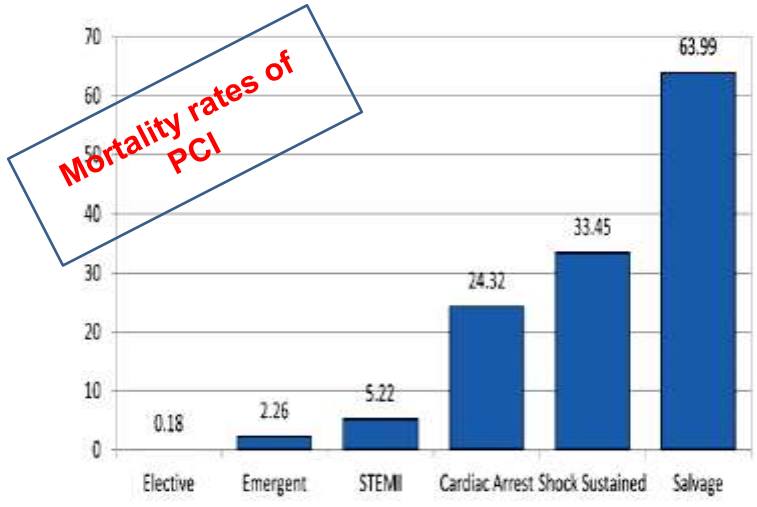
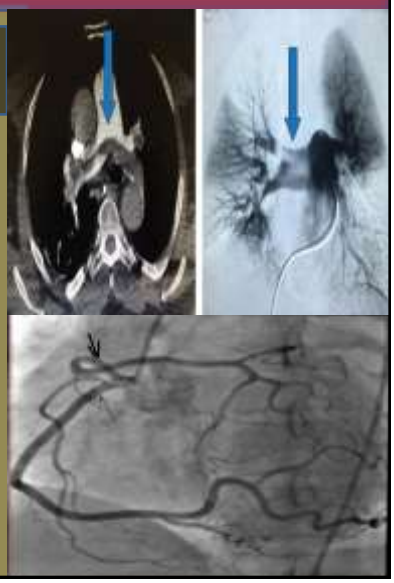


Figure 1. In-hospital mortality rates of percutaneous coronary intervention (PCI) reflect the severity of illness. The more seriously ill, the greater the observed mortality. Cardiac arrest=a pulseless clinical scenario requiring cardiopulmonary resuscitation (CPR) within 24 h of the PCI; Salvage=patient undergoing CPR en route to the operating room or prior to anesthesia induction or has ongoing ECMO to maintain life. ECMO, extracorporeal membrane oxygenation; STEMI, ST-elevation myocardial infarction.

Causes of Cath lab Catastrophes

Non-Coronary Arrest in the Cath Lab

- Massive and submassive PE
- HOCM
- Pneumothorax.
- Electrolyte disturbances
- Anaphylaxis
- Major Bleeding



Anaphylaxis Cardiac Arrest

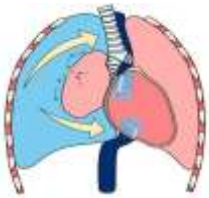
Five therapeutic agents are used for the treatment of anaphylactoid reactions:

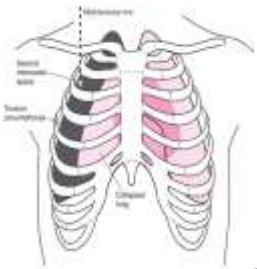
-Epinephrine
-steroids,
-H1 blockers
-H2 blockers
-volume administration

Pericardiocentesis for Cardiac Tamponade

Tension pneumothorax

During permanent pacemaker implantation





initial treatment?

1-needle decompression.

In 2nd intercostal space – mid clavicular line

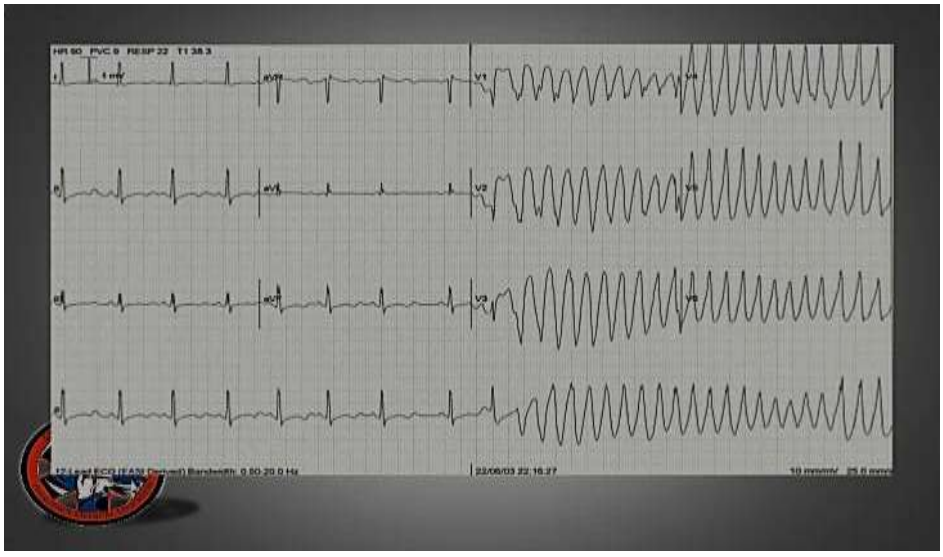
2-thoracostomy (if ventilated or expertise available)

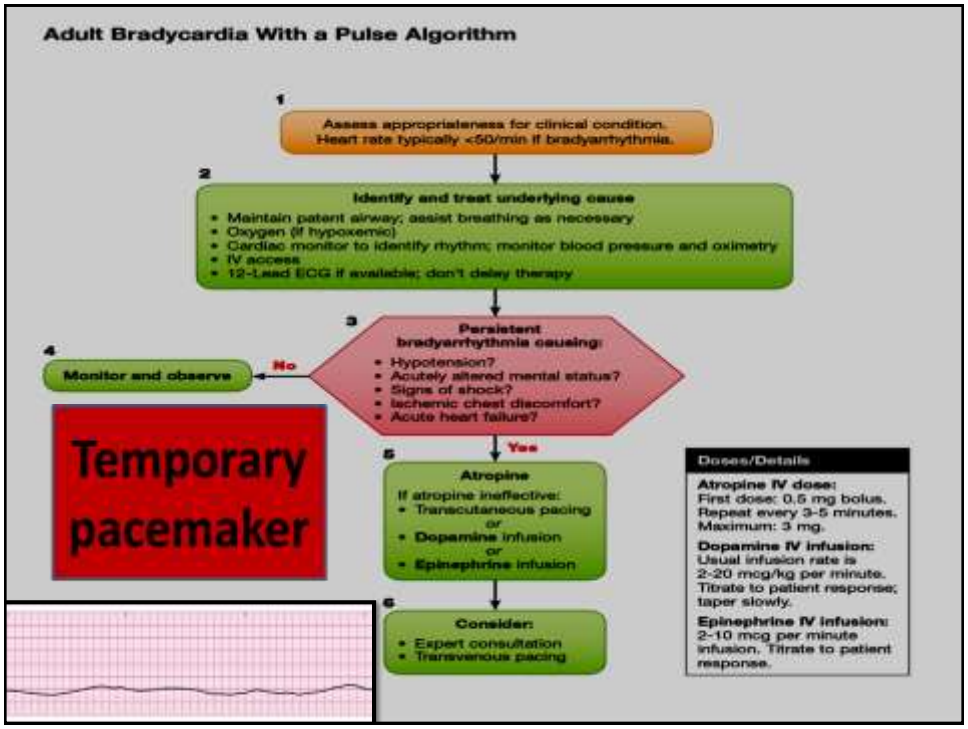
Cath lab Catastrophes

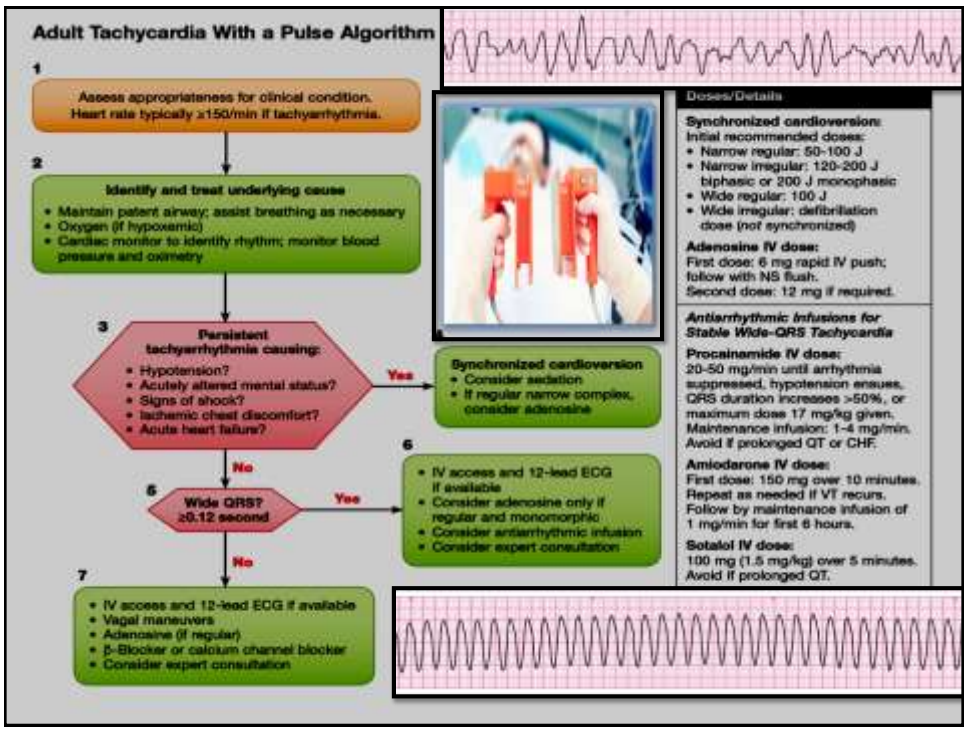
Coronary procedure related arrest

- Anomalous coronary arteries
- Anomalous LM arising from Right cusp
- Vessel closure:
  - Dissection
  - Thrombus formation
  - Spasm
  - No-reflow in a major vessel
- Introduction of Air or thrombus
- Perforations
- Electrical complications

Electrical instability




Adult Bradycardia With a Pulse Algorithm
1
Assess appropriateness for clinical condition.
Heart rate typically <50/min if bradyarrhythmia.
2
Identify and treat underlying cause
• Maintain patent airway; assist breathing as necessary
• Oxygen (if hypoxemic)
• Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
• IV access
• 12-Lead ECG if available; don't delay therapy
3
Persistent bradyarrhythmia causing:
• Hypotension?
• Acutely altered mental status?
• Signs of shock?
• Ischemic chest discomfort?
• Acute heart failure?
No
4
Monitor and observe
Yes
5
Atropine
If atropine ineffective:
• Transcutaneous pacing
or
• Dopamine infusion
or
• Epinephrine infusion
6
Consider:
• Expert consultation
• Transvenous pacing
Temporary pacemaker
Doses/Details
Atropine IV dose:
First dose: 0.5 mg bolus. Repeat every 3-5 minutes. Maximum: 3 mg.
Dopamine IV infusion:
Usual infusion rate is 2-20 mcg/kg per minute. Titrate to patient response; taper slowly.
Epinephrine IV infusion:
2-10 mcg per minute infusion. Titrate to patient response.


Adult Tachycardia With a Pulse Algorithm
1
Assess appropriateness for clinical condition.
Heart rate typically ≥150/min if tachyarrhythmia.
2
Identify and treat underlying cause
• Maintain patent airway; assist breathing as necessary
• Oxygen (if hypoxemic)
• Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
3
Persistent tachyarrhythmia causing:
• Hypotension?
• Acutely altered mental status?
• Signs of shock?
• Ischemic chest discomfort?
• Acute heart failure?
Yes
Synchronized cardioversion
• Consider sedation
• If regular narrow complex, consider adenosine
No
5
Wide QRS? ≥0.12 second
Yes
6
• IV access and 12-lead ECG if available
• Consider adenosine only if regular and monomorphic
• Consider antiarrhythmic infusion
• Consider expert consultation
No
7
• IV access and 12-lead ECG if available
• Vagal maneuvers
• Adenosine (if regular)
• β-Blocker or calcium channel blocker
• Consider expert consultation
Doses/Details
Synchronized cardioversion:
Initial recommended doses:
• Narrow regular: 50-100 J
• Narrow irregular: 120-200 J biphasic or 200 J monophasic
• Wide regular: 100 J
• Wide irregular: defibrillation dose (not synchronized)
Adenosine IV dose:
First dose: 6 mg rapid IV push; follow with NS flush.
Second dose: 12 mg if required.
Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia
Procainamide IV dose:
20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases >50%, or maximum dose 17 mg/kg given. Maintenance infusion: 1-4 mg/min. Avoid if prolonged QT or CHF.
Amiodarone IV dose:
First dose: 150 mg over 10 minutes. Repeat as needed if VT recurs. Follow by maintenance infusion of 1 mg/min for first 6 hours.
Sotalol IV dose:
100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.

Air Embolism

Often from manifold injections (contrast or flush) and/or during introduction of devices.

Usually Small amount are tolerated

Chest pain
Bradycardia
Hypotension
MI
Death

Prevention
-Back bleed before injection
-Avoid pressurized flush

Case:1

Case: 2

Catastrophes in cath lab

Case: 3

Catastrophes in cath lab

Case: 4

Coronary Perforation

- **Occurs in between 0.1% - 0.7%**
- **More with <u>oversized</u> stents**
- **Hydrophilic guide wire**
- **Cardiac tamponade and hemodynamic collapse can occur in seconds.**
- **Highest mortality among all PCI complications**

Coronary Perforation

- Early recognition is the key to a successful outcome
- Reversal of anticoagulation
- Prolonged inflation (up to 10 min) of an oversized balloon at low pressure.
- Pericardiocentesis
- Covered stents (require post-dilation, high pressure)
- Urgent surgical revascularization.

Javaid et al Am J Cardiol 2006; 98: 911-4

Rules of engagement for Code Blue

- **The cardiac catheterization lab** is a self-sufficient critical care area and is considered one of the best places to save cardiac arrest patients.
- All equipment and drugs are available for complete cardiovascular support and in some labs, even open heart surgery can be performed.
- Most cath lab nurses are highly skilled at both routine cath patient care as well as critical care patient and all the staff must have Advanced life support certification.

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How is CPR done in the cath lab?

manual chest compression in the cath lab is usually difficult and carry high risk to the medical team from exposure to radiation.

Disadvantages of Manual Chest Compressions in the Cardiac Catheterization Laboratory

- ☐ **Difficult to perform:**
  - Limited space around the cath table
  - Overreaching or stretching of rescuer performing compressions
  - Table itself less stable in the "working" position
  - May require lengthy periods of compressions
- ☐ **Extensive radiation exposure to the rescuer**
  - Hands in the beam
  - Head next to the radiation beam and intensifier

Circulation Journal
Official Journal of the Japanese Circulation Society
http://www.j-circ.or.jp

REVIEW

Mechanical Cardiopulmonary Resuscitation In and On the Way to the Cardiac Catheterization Laboratory

Preethi William, MD; Prashant Rao, MD; Uday B. Kanakadandi, MD; Alejandro Asencio, MD; Karl B. Kern, MD

Cardiac arrest, though not common during coronary angiography, is increasingly occurring in the catheterization laboratory because of the expanding complexity of percutaneous interventions (PCI) and the patient population being treated. Manual chest compression in the cath lab is not easily performed, often interrupted, and can result in the provider experiencing excessive radiation exposure. Mechanical cardiopulmonary resuscitation (CPR) provides unique advantages over manual performance of chest compression for treating cardiac arrest in the cardiac cath lab. Such advantages include the potential for uninterrupted chest compressions, less radiation exposure, better quality chest compressions, and less crowded conditions around the catheterization table, allowing more attention to ongoing PCI efforts during CPR. Out-of-hospital cardiac arrest patients not responding to standard ACLS therapy

- Gas-driven sternal compression device with suction cup (LUCAS)
- PCI feasible in 13 pts with arrest or severe hypotension / bradycardia; mean BP 81/34 mmHg

Larsen et al, Resuscitation 2007

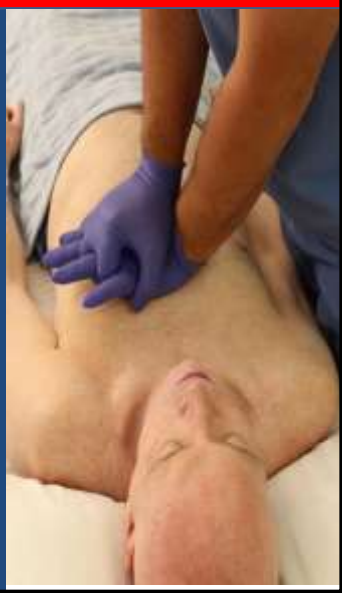
Columbia University Medical Center

Advantages of Mechanical Chest Compressions in the Cardiac Catheterization Laboratory

- ☐ Uninterrupted chest compressions
  - No fatigue or changing rescuers
- ☐ No hands in the X-ray beam or head near the image intensifier
  - Less radiation exposure
- ☐ Less crowded around the cath table
  - Allows more attention to ongoing percutaneous coronary intervention efforts
- ☐ Better quality chest compressions
  - Consistent rate, depth and release

Take Home Massage

- ✓ **Lengthy resuscitations in the cath lab carry extremely high rates of mortality because it is essentially impossible to perform effective chest compressions during PCI.**
- ✓ **Use of a mechanical chest compression device, LUCAS™, in the cath lab in patients who suffered circulatory arrest requiring prolonged resuscitation**



A Fundamental Philosophy

You must understand local circumstances in order to achieve success.


NENA
THE
9-1-1
ASSOCIATION
HeartRescue
PROJECT
HeartRescue Partners
Penn
Duke
EMS
AMR
Medtronic
FOUNDATION
Every Second Counts.
Every Action Matters.
A Community Response Planning Guide
for Sudden Cardiac Arrest
HeartRescue
PROJECT


EMS WORLD
VITAL INFORMATION FOR THE EMS COMMUNITY
The System
Behind the Save
Why the HeartRescue Project
will make a believer out of you
p. 30
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AMR
Thank YOU