CHAPTER 17

Cardiac Emergencies
Review of Circulatory System
Cross Section of the Heart.

From body
Superior vena cava

To lung
Right pulmonary artery (branches)

From lung
Right pulmonary vein (branches)

Right atrium

Coronary sinus

Tricuspid valve

Epicardium (outer layer)

Right ventricle

Inferior vena cava

From body

To lung
Left pulmonary artery (branches)

From lung
Left pulmonary vein (branches)

Left atrium

Bicuspid valve

Left ventricle

Interventricular septum

Myocardium (heart muscle)

Apex

Descending aorta

To body

Limmer et al., Emergency Care Update, 10th Edition
The 4 Chambers of the Heart

- **Right Atrium**
  - Receives blood from veins; pumps to right ventricle.

- **Left Atrium**
  - Receives blood from lungs; pumps to left ventricle.

- **Right Ventricle**
  - Pumps blood to the lungs.

- **Left Ventricle**
  - Pumps blood through the aorta to the body.

The Coronary Arteries

- Right Coronary Artery
- Left Coronary Artery
- Anterior Descending Branch
Cardiac Compromise
Key Term

Acute Coronary Syndrome

A blanket term used to represent any symptoms related to lack of oxygen (ischemia) in the heart muscle.
Key Term

Cardiac Compromise

Any kind of problem with the heart
Causes of Cardiovascular Compromise –

Atherosclerosis
Causes of Cardiac Compromise –
Angina Pectoris

Coronary arteries
Partial blockage producing chest pain
Area of decreased blood supply
Causes of Cardiac Compromise – Acute Myocardial Infarction

Area of Infarct
Causes of Cardiovascular Compromise – Aneurysms
Causes of Cardiac Compromise

Signs of Congestive Heart Failure

- Mild to severe confusion
- Anxiety
- Increased respiration rate
- Dyspnea (shortness of breath)
- Difficulty breathing while lying flat

- Distended neck veins
- Pink sputum
- Rapid heart rate
- Normal to high blood pressure
- Abdominal distention
- Edema of the lower extremities
Symptoms of Cardiac Compromise

Chest Pain

- Discomfort in chest or upper abdomen
  - Pain, pressure, crushing, squeezing, heaviness

- Palpitation/fluttering

- May radiate down one or both arms
Symptoms of Cardiac Compromise

- Difficulty breathing (dyspnea)
- Nausea
- Anxiety/feeling of impending doom
Signs of Cardiac Compromise

- Vomiting
- Sweating
- Abnormal heart rates
  - Tachycardia – faster than 100 bpm
  - Bradycardia – slower than 60 bpm
- Abnormal blood pressures
Perform initial assessment.
Place patient in position of comfort; give high-concentration oxygen by non-rebreather mask.
Perform focused history and physical exam; take baseline vital signs.
Assessing Cardiac Compromise

Transport immediately if:

- No history of cardiac problems, OR
- History of cardiac problems but no nitroglycerin, OR
- Systolic blood pressure is below 90 - 100
Assessing Cardiac Compromise

Transport decision:

- If available, transport patient to hospitals that have:
  - “Clot-buster” capabilities
  - Ability to perform angioplasty
- Local protocols will provide guidance.
If patient meets nitroglycerin criteria, consult medical direction.
Nitroglycerin
To Administer Nitroglycerin

- Patient must have:
  - Chest pain
  - History of cardiac problems
  - Prescribed nitroglycerin with them
  - Pulse greater than 50 and below 100 beats per minute (follow local protocols)
To Administer Nitroglycerin

* Patient must have:
  * BP meeting your protocol criteria, usually greater than 90-100 systolic
  * Not taken Viagra or similar drug for erectile dysfunction within 48-72 hours

* Medical control authorizes administration.
Check the four rights.
Check the expiration date.
The Four Rights

- Right patient?
- Right drug?
- Right dose?
- Right route?
Remove oxygen mask and ask patient to open mouth and lift tongue.
Place tablet or spray medication under tongue.
Have patient close mouth. Replace oxygen mask. Reassess patient, and document findings.
Repeat Nitroglycerin after 5 Minutes IF:

- Patient gets no or only partial relief, AND
- Systolic blood pressure remains > 90-100, AND
- Medical direction authorizes another dose.

Maximum three doses.
To Administer Aspirin (if local protocols allow)

- Patient must have:
  - Chest pain
  - No allergies to aspirin
  - No history of asthma
  - Not taking any other clotting medications
  - Ability to swallow

*Medical control authorizes administration.*
Cardiac Compromise and BLS
Some patients with cardiac compromise go into cardiac arrest. You must be prepared for that, but fortunately, most patients with heart problems do not.
American Heart Association's Chain of Survival

Chain of Survival

EARLY ACCESS
EARLY CPR
EARLY DEFIBRILLATION
EARLY ADVANCED CARE
Early Access

- Public recognizes an emergency exists.
- Public knows emergency access phone number (9-1-1 or other #).
Early CPR

- Train the public to perform CPR.
- Get CPR-trained professionals to the patient faster.
- Train dispatchers to instruct callers on CPR.
Early Defibrillation

- Single most important factor in survivability (time is critical!)
- Automated External Defibrillation (AED).
- Use of nontraditional responders (police, fire, security, etc.)
Early Advanced Care

- Advanced Cardiac Life Support (ACLS)
- Typically provided by EMT—Paramedics (other EMT levels may have some options)
- Also provided by emergency room physicians
Cardiac Arrest: Critical Skill for EMT–B

You must be able to:

- Use an automated external defibrillator
- Request ALS backup when appropriate
- Use BVM and FROPVD
- Lift and move patients
Cardiac Arrest: Critical Skill for EMT-B

You must also be able to:

* Suction the airway
* Use airway adjuncts
* Take BSI precautions
* Interview family/bystanders

Limmer et al., Emergency Care Update, 10th Edition
Automated External Defibrillation
Automated External Defibrillation

- Many EMS systems have resuscitated patients with AEDs (automated external defibrillators).
- The highest survival rates occur in systems with strong links in the chain of survival.
Types of AEDs

- Semi-automatic/shock advisory
  - Computer in AED analyzes rhythm, advises EMT to deliver shock.

- Fully automatic
  - EMT turns on power and attaches to patient; shocks delivered automatically if needed.

Limmer et al., *Emergency Care Update, 10th Edition*
Types of AEDs

Monophasic

- Sends single shock (energy current) from one pad to the other

Biphasic

- Sends shock in both directions, measures resistance, and adjusts energy
- Causes less damage to heart muscle
AEDs are extremely accurate in distinguishing between shockable and nonshockable rhythms.
Inappropriate Shocks

- Very rarely does the AED computer make a mistake.
- AED-related errors are almost always human error due to:
  - Touching the patient during analysis
  - Not stopping the ambulance to analyze rhythm
Shockable Rhythms

AEDs will shock two rhythms:
- Ventricular fibrillation
  - 50% of cardiac arrest patients
- Ventricular tachycardia over certain rates
  - 10% of cardiac arrest patients
Not Shockable Rhythms

- An AED will not shock:
  - Asystole (20-50% of victims) OR
  - Pulseless electrical activity (PEA) (15-20% of victims)

- Typically only 6-7 out of 10 patients are in a shockable rhythm.
Safety Considerations

An AED must be applied ONLY to a patient who is unresponsive, apneic, and pulseless.
No one should do CPR or touch the patient when the AED is analyzing the rhythm or delivering a shock.
Interrupting CPR

- You may stop CPR to allow AED analysis and a shock (if detected).
- Resume CPR immediately after delivering a shock or after AED analysis of no shock detected.
- Other than AED analysis, do not interrupt for more than 10 seconds.
Take BSI. Briefly question bystanders about pre-arrest events.
Perform initial assessment. Verify patient is pulseless and not breathing. Check for no longer than 10 seconds.
Note

In a witnessed arrest, defibrillation should occur before CPR.

In an unwitnessed arrest, or prolonged downtime, 2 minutes of CPR should precede defibrillation attempts.
AED Indications:

- Adult patients (puberty or older) after 2 minutes of CPR.
- Children (1 year old to puberty) after 2 minutes of CPR and the availability of an AED designed for children.
- Do not use an AED on an infant (under 1 year of age)
Set up AED as partner starts (or resumes) CPR. Unless the arrest was witnessed, administer 2 minutes (5 cycles) of CPR.
Turn on power and, if appropriate, begin verbal report.
Firmly attach one pad to right upper bare chest. Firmly place one pad over lower left bare ribs.
Say "Clear!" Ensure no one is touching patient. Press analyze button.
If AED advises shock, say "Clear," ensure no one touching patient, and press shock button.
After delivery of shock, immediately perform CPR for 2 minutes (5 cycles), unless the patient wakes up.
Check effectiveness of CPR by evaluating pulse.
Gather additional information on arrest events.
Insert an airway adjunct and ventilate with high-concentration oxygen.
After two minutes of CPR, have all individuals stand clear and reanalyze with the AED.
If no shock is advised, check carotid pulse, for a maximum of 10 seconds. If present, assess adequacy of breathing.
If breathing is adequate, give high-concentration oxygen by nonrebreather.

If inadequate, ventilate with high-concentration oxygen.
If the AED gives 3 consecutive no-shock messages with no carotid pulse . . .

. . . or a total of 3 shocks are delivered

. . . then transport with CPR and oxygen.
If advanced life support is not available, transport when:

- Patient regains pulse, OR
- You have delivered 3 shocks, OR
- AED has given 3 consecutive no-shock messages (separated by 2 minutes of CPR), OR
- Your local protocols indicate an earlier transport.
General AED Procedures

- While one EMT–B operates the AED, the partner performs CPR.
- CPR must include high-quality compressions.
- Defibrillation is the first priority in witnessed arrest or short downtimes.
General AED Procedures

- Do not touch patient when analyzing rhythm and delivering shocks.
- Do not analyze rhythm or defibrillate in a moving ambulance. Stop first.
General AED Procedures

* Be familiar with your model of AED.
* Check batteries at beginning of shift.
* Follow manufacturer's charging recommendations.
* Carry an extra battery.
Coordination of EMT–B and ALS

- Call for ALS as soon as possible.
- Local protocols determine if you should wait for ALS or begin transport to rendezvous with ALS.
If AED is in use by a first responder when you arrive, ensure they are performing properly, and continue with shock analysis and 2 minutes of CPR sequence.
Post-resuscitation Care

- Maintain airway.
- Transfer to ambulance.
- Coordinate rendezvous with ALS if appropriate.
Post-Resuscitation Care

- Leave AED attached to patient.
  - Patient has a high risk of returning to cardiac arrest.
- Perform focused assessment and ongoing assessment en route.
Post-Resuscitation Care

- If patient is unconscious, check pulse at least every 30 seconds.
- If no pulse:
  - Stop ambulance.
  - Analyze rhythm/deliver shocks per local protocol.
  - If AED not available, perform CPR.
Single Rescuer with AED

- Initial assessment reveals:
  - Unresponsive
  - Apnea
  - No pulse

- Immediately attach AED and initiate analysis if the arrest was witnessed.
Single Rescuer with AED

Activate EMS system and start CPR:

- Immediately, if prolonged downtime, OR
- AED gives no-shock message if arrest was witnessed
Pediatrics & AED

* Do not use on patients less than 1 year old.

* Aggressive airway management and CPR are best methods.

* AED may be beneficial if pediatric AED is available.
Additional Safety Considerations

* Water
  * Dry patient’s chest; remove from wet environment.

* Metal
  * Ensure no one in contact with the patient is touching any metal.
Additional Safety Considerations

Medication Patch

* If patch visible on chest, remove it with gloved hands before delivering shock.
Advantages of AEDs

- Initial training and continuing education are simple.
- AEDs are very fast.

Advantages of AEDs

- Use of adhesive pads instead of paddles is safer, provides better electrode placement, and lowers EMT–B’s anxiety.
AED Maintenance

- AED failure typically results from inadequate maintenance.
  - For example, failing to charge batteries on a regular basis
- Use daily checklist to maintain machine and supplies.
AED Quality Improvement

- Medical direction
  - Review calls
  - Assist in training and skills
- Continuing education
- Skill review every 3 months
- Data collection
Mechanical CPR Devices

- Mechanical CPR compressor devices can assist with high quality compressions during CPR.
- Begin use early in the arrest.
- Do not interrupt CPR for more than 10 seconds to apply.
Review Questions

1. What signs and symptoms should prompt you to treat a patient for cardiac compromise?

2. What are the indications, contraindications, and dose for nitroglycerin?
Review Questions

3. How many shocks should you give to a patient with a shockable rhythm?

4. What should you do when you get a no-shock message?
Review Questions

5. Which patients in cardiac arrest should not have an AED applied?

6. When using an AED, what safety practices should you follow?

7. How can you be sure that your AED will work when you need it?
Street Scenes

* What type of emergency equipment needs to be taken to the side of every potential cardiac patient?

* What are the treatment priorities for this patient?
What assessment information do you need to obtain next?

What should you do next?
## Sample Documentation

**Patient Name:** Mary Anderson

**Chief Complaint:** Chest pain, witnessed cardiac arrest

### Vital Signs

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<th>TIME</th>
<th>RESP</th>
<th>Pulse</th>
<th>BP</th>
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<td>120</td>
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<tr>
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<td>Rate: 28</td>
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### Past Medical History

- None
- Hypertension
- Stroke
- COPD
- Cardiac
- Other (List): Asthma

Current Medications (List): Unknown antihypertensive

### NARRATIVE

On arrival, we met a conscious, alert, 70-year-old female who states a sudden onset of indigestion-like chest discomfort, which worsened with rest and began to radiate down her left arm.

She appears somewhat anxious. She states the onset occurred after shopping and while eating her lunch. The chest discomfort quickly resulted in shortness of breath and 8 on 10 chest pain. She has been suffering from worsening pain for about 2 hours. We placed the patient on 100% O₂ via nonrebreather mask. During the assessment, she suddenly became unresponsive and was noted to be pulseless and apneic. AED was applied, and one shock was administered. Pulse returned but respirations were initially absent. Patient ventilated via two-rescuer BVM. Paramedics arrived on scene and provided ALS care. Patient began breathing adequately en route to hospital. O₂ was continued at 10 LPM via NRB. She was verbally responsive by arrival at hospital.