

Ministry of Healthcare of Ukraine
Poltava State Medical University

**GUIDELINES
FOR STUDENTS
INDEPENDENT WORK
IN THE PRACTICAL CLASSES PREPARING**

Academic discipline

Module

Content module

Study subject

Course

Faculty

Internal medicine

Emergency conditions in clinic of Internal Medicine

Emergency conditions in clinic of Internal Medicine

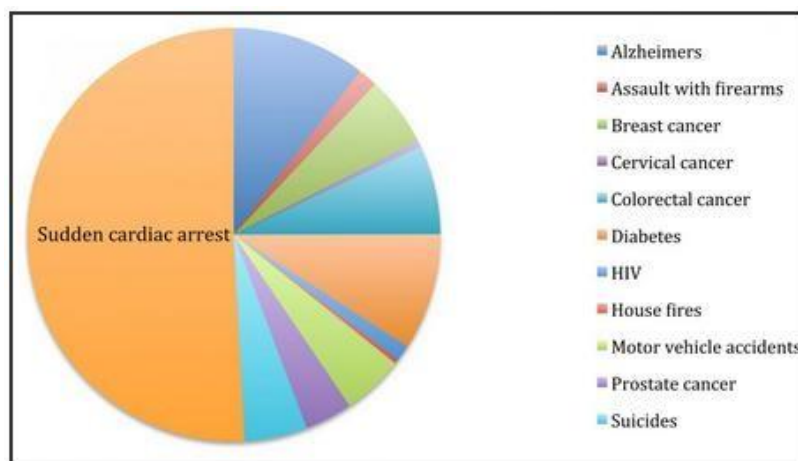
Curation of the patient with cardiac arrest and respiratory arrest. Curation of the patient with syncope.

VI

of foreign students training

1. Actuality of the theme:

Sudden cardiac arrest (SCA) is a leading cause of death among adults over the age of 40 in the United States and other countries. In fact, the number of people who die each year from SCA is roughly equivalent to the number who die from Alzheimers disease, assault with firearms, breast cancer, cervical cancer, colorectal cancer, diabetes, HIV, house fires, motor vehicle accidents, prostate cancer and suicides combined. SCA is a life-threatening condition--but it can be treated successfully through early intervention with cardiopulmonary resuscitation (CPR), defibrillation, advanced cardiac life support, and mild therapeutic hypothermia. When bystanders intervene by giving CPR and using automated external defibrillators (AEDs) before EMS arrives, four out of 10 victims survive.



2. Concrete aims:

- To make inquiry and physical examination of patients with chronic form of Sudden cardiac arrest
- To determine etiology and pathogenetic factors of Sudden cardiac arrest
- To determine etiology factors of Sudden cardiac arrest
- To determine pathogenetic factors of Sudden cardiac arrest
- To determine a typical clinical picture of Sudden cardiac arrest
- To determine the prognosis and work capacity at Sudden cardiac arrest
- To diagnose acute heart failure and to assist it
- To register an electrocardiogram in 12 assignments
- To show ethically-deontological foundations in the medical expert and principles of a medical subordination

3. Basic knowledge, skills necessary for studying of theme:

№	Previous subject	Obtained skill
1.	Anatomy	To know human anatomy, cardio-vascular system organs particularly.
2.	Physiology	To know physiology of cardio-vascular system.
3.	Histology	Histological structure of the cardio-vascular system.
4.	Pharmacology	To know characteristics of drug used for threatening and prevention in patient with ischemic heart disease and Sudden cardiac arrest
5.	Propedeutics of internal diseases	Symptoms of the cardiovascular diseases, data of general and local visual inspection, palpation, percussion, auscultation of the heart, main ECG-signs, Echo-CG signs of Sudden cardiac arrest

4. Plan and organizational structure of lesson.

<i>Nº</i>	<i>Kind of work</i>	<i>Time</i>
1	Check of attendance.	2 min.
2	Output test control of knowledge. 10 tests, mark Criteria: 75% -79% - 3, 80% -89% - 4, 90% and > - 5.	5 min.
3	Questioning and analysis of theme.	10 min.
4	Etiology and pathogenetic factors of Sudden cardiac arrest	10 min.
5	Clinical symptom in patient with Sudden cardiac arrest	10 min.
6	Result and the final assessment of knowledge, homework..	3 min.
TOTAL		40 min.

4. Task for self-depending preparation to practical training

4.1. List of the main terms that should know student preparing practical training

Sudden cardiac arrest	ischemia	Tamponade (Cardiac)
CPR.	Ischemic Heart Disease	Asystole
Hypoxia	Hypothermia	Chest compression
Hypovolemia	Tension pneumothorax	Thrombosis

4.2. Theoretical questions:

1. What does term “Sudden cardiac arrest” mean?
2. Tell about the main and additional risk-factors of Sudden cardiac arrest.
3. Tell about diagnostic criteria of Sudden cardiac arrest.
4. Tell about pathogenesis of Sudden cardiac arrest.
5. Tell about classification of Sudden cardiac arrest.
8. What can potential results of objective examination of patients with Sudden cardiac arrest be?
10. What laboratory and instrumental methods are used for diagnostics of Sudden cardiac arrest and their potential results?
12. What are purposes of examination of patients with arterial hypertension?
14. Tell about principles of Sudden cardiac arrest pharmacotherapy.
14. Tell about principles of CPR.

4.3. Practical task that should be performed during practical training

1. To carry out examination of patients with Sudden cardiac arrest.
2. To interpret obtained results.
3. To interpret results of laboratory and instrumental methods examination of patients with Sudden cardiac arrest.
4. To lead CPR

5. Topic content

A cardiac arrest, or circulatory arrest, is the abrupt cessation of normal circulation of the blood due to failure of the heart to contract effectively during systole.

The resulting lack of blood supply results in cell death from oxygen starvation. Cerebral hypoxia, or lack of oxygen supply to the brain, causes victims to lose consciousness and to stop breathing, which in turn causes the heart to stop. Brain damage is likely to occur after 3-4 minutes, except in cases of hypothermia. To improve survival and neurological recovery immediate response is paramount. Cardiac arrest is a medical emergency that, in certain groups of patients, is potentially reversible if treated early enough. When cardiac arrest leads to death this is called sudden cardiac death (SCD).

The primary first-aid treatment for cardiac arrest is cardiopulmonary resuscitation (commonly known as CPR).

Etiology

Ventricular fibrillation (VF) constitutes the most common electrical mechanism in cardiac arrest, and is responsible for 65 to 80% of occurrences. Another 20-30% is caused by severe bradyarrhythmias, pulseless electrical activity (PEA) and asystole. Other conditions are associated with impaired circulation due to a state of shock.

Among adults ischemic heart disease is the predominant cause. At autopsy 30% of victims show signs of recent myocardial infarction. Other conditions include structural abnormalities, arrhythmias and cardiomyopathies. Secondary cardiac arrest may be elicited by non-cardiac conditions such as hypoxia from a variety of causes, overwhelming infection (sepsis), massive pulmonary embolus, arrhythmias, cardiac tamponade, shock, pneumothorax, ventricular rupture, as well as other conditions such as electrocution and near-drowning. Non-cardiac conditions constitute the principal cause of cardiac arrest in in-hospital patients.

Coronary heart disease (CHD) -also known as coronary artery disease, or (CAD)-is the predominant disease process associated with sudden cardiac death in the United States and elsewhere in the developed world. The incidence of CHD in individuals who suffer sudden cardiac death is between 64 and 90%.

In children, cardiac arrest is typically caused by hypoxia from other causes such as near-drowning. With prompt treatment survival rates are high.

Treatable causes

There are 8 reversible causes of cardiac arrest, known as the "4Hs and 4Ts".

They are looked for and treated by ambulance technicians/paramedics or by medical staff at the hospital while undertaking advanced life support, protocols for which will be used alongside any specific treatments for each of the causes. Lay rescuers performing basic life support can generally neither identify nor treat them (with the exception of hypoxia due to choking), and so can offer only supportive treatment pending the arrival of emergency medical services.

4 Hs

- **Hypoxia** - A lack of oxygen to the heart, brain and other vital organs. This is treated by providing the patient with oxygen, either through a bag-valve-mask device, or through mechanical ventilation by inserting an endotracheal tube (intubation)
- **Hypovolemia** - A lack of circulating body fluids, principally blood. This is usually (though not exclusively) caused by some form of bleeding. Peri-arrest treatment includes giving IV fluids and blood transfusions, and controlling the source of any bleeding - by direct pressure for external bleeding, or emergency surgical techniques such as esophagogastroduodenoscopy (i.e. esophageal varices) and thoracotomy for internal bleeding.
- **Hypo/Hyper-metabolic disorders** - An abnormally high or low level of electrolytes such as potassium and calcium circulating the body. An arterial blood gas and blood electrolyte test are performed to find the problem, then IV crystalloids are given to correct it.
- **Hypothermia** - A low core body temperature, defined clinically as a temperature of less than 35 degrees Celsius. The patient is re-warmed either by using a cardiac bypass or by irrigation of the body cavities (such as thorax, peritoneum, bladder) with warm fluids; or warmed IV fluids.

CPR only is given until the core body temperature reached 30 degrees Celsius, as defibrillation is ineffective at lower temperatures. Patients have been known to be successfully resuscitated after periods of hours in hypothermia and cardiac arrest, and this has given rise to the often-quoted medical truism, "You're not dead until you're warm and dead."

4 Ts

- **Tension pneumothorax** - A rush of air into one of the pleural cavities which is not able to escape compresses the lungs and causes the trachea to deviate away from the mid-line, often putting pressure on the heart so it is not able to beat effectively. This is relieved in an emergency by inserting a needle into the 2nd intercostal space at the mid-clavicular line, releasing the air and the pressure on the thoracic organs.
- **Tamponade (Cardiac)** - Blood or other fluids building up in the pericardium can put pressure on the heart so that it is not able to beat. This is treated in an emergency by inserting a needle into the pericardium to drain the fluid (pericardiocentesis), or if the fluid is too thick then an emergency thoracotomy is performed to cut the pericardium and release the fluid.
- **Toxins** - Toxic substances which have been ingested, injected, absorbed or inhaled into the body can lead to cardiac arrest. This may be evidenced by items found on or around the patient, the patient's medical history (i.e. drug abuse, medication) taken from family and friends, checking the medical records to make sure no interacting drugs were prescribed, or sending blood and urine samples to the toxicology lab for report. Treatment is mainly supportive, unless there is an antidote which can be administered.
- **Thrombosis** - Blood clots in the heart (myocardial infarction) or lungs (pulmonary embolism) are both well known causes of cardiac arrest. Treatment includes thrombolysis, and possibly surgical interventions such as percutaneous transluminal coronary angioplasty (PTCA), coronary bypass or surgical embolectomy.

In addition to the specific treatments for the causes of cardiac arrest, full resuscitation (using advanced life support protocols) is offered to patients as soon as possible, and continues until the patient is either declared dead or regains a pulse and stable heart rhythm.

Cardiac Arrest is an abrupt cessation of pump function (evidenced by absence of a palpable pulse) of the heart that with prompt intervention could be reversed, but without it will lead to death.

In many cases, lack of carotid pulse is the gold standard for diagnosing cardiac arrest, but pulselessness (particularly in the peripheral pulses) may be a result of other conditions (i.e. shock, or other conditions leading to poor circulation). In a hospital or ambulance, cardiac arrest is identified by the lack of a pulse (or

lack of heartbeat if listened to through a stethoscope), and advanced life support is given.

Out of hospital, lay rescuers are now being taught to identify cardiac arrest in as simple a manner as possible. With the latest standard as set by the ILCOR, lay rescuers are taught that a lack of normal breathing is evidence of cardiac arrest, and they begin CPR without checking a pulse.

An ECG clarifies the exact diagnosis and guides treatment, but basic life support should begin without awaiting an ECG. The ECG may reveal:

- Asystole (known colloquially as a flatline) - a complete stoppage of the heart
- Pulseless electrical activity (formerly called electromechanical dissociation) - where the heart's electrical system is working normally but there is a problem with mechanical function (so the rhythm on the heart monitor appears normal, but there is no pulse)
- ventricular fibrillation - A quivering of the ventricles
- ventricular tachycardia - The ventricles contract so rapidly that they do not refill fully between beats, so they do not pump enough blood to maintain circulation.

Sudden cardiac arrest is the sudden, unexpected loss of heart function, breathing and consciousness. Sudden cardiac arrest usually results from an electrical disturbance in your heart that disrupts its pumping action, stopping blood flow to the rest of your body. SCA is a sudden

and unexpected pulseless condition attributed to cessation of cardiac mechanical activity. It is usually caused by ventricular fibrillation, an abnormality in the heart's electrical system. When SCA occurs, blood stops flowing to the brain, the heart, and the rest of the body, and the person collapses. In fact, the victim is clinically dead and will remain so unless someone helps immediately.

Sudden cardiac arrest is different from a heart attack, which occurs when blood flow to a portion of the heart is blocked. However, a heart attack can sometimes trigger an electrical disturbance that leads to sudden cardiac arrest.

Sudden cardiac arrest is a medical emergency. If not treated immediately, it causes sudden cardiac death. With fast, appropriate medical care, survival is possible. Administering cardiopulmonary resuscitation (CPR) — or even just compressions to the chest — can improve the chances of survival until emergency personnel arrive.

Sudden cardiac arrest symptoms are immediate and drastic.

- Sudden collapse
- No pulse
- No breathing
- Loss of consciousness

Sometimes other signs and symptoms precede sudden cardiac arrest. These may include fatigue, fainting, blackouts, dizziness, chest pain, shortness of breath, weakness, palpitations or vomiting. But sudden cardiac arrest often occurs with no warning.

When the heart stops, the lack of oxygenated blood can cause brain damage in only a few minutes. Death or permanent brain damage can occur within four to six minutes. Time is critical when you're helping an unconscious person who isn't breathing. Take immediate action.

- **Perform CPR.** Quickly check the unconscious person's breathing. If he or she isn't breathing normally, begin CPR. Push hard and fast on the person's chest — about 100 compressions a minute. If you've been trained in CPR, check the person's airway and deliver rescue breaths after every 30 compressions. If you haven't been trained, just continue chest compressions. Allow the chest to rise completely between compressions. Keep doing this until a portable defibrillator is available or emergency personnel arrive.
- **Use a portable defibrillator,** if one is available. If you're not trained to use a portable defibrillator, a 911 or emergency medical help operator may be able to guide you in its use. Deliver one shock if advised by the device and then immediately begin CPR starting with chest compressions, or give chest compressions only, for about two minutes. Using the defibrillator, check the person's heart rhythm. If necessary, the defibrillator will administer a shock. Repeat this cycle until the person recovers consciousness or emergency personnel take over.

Portable automated external defibrillators (AEDs) are available in an increasing number of places, including airports, casinos and shopping malls. You can also purchase them for your home. AEDs come with built-in instructions for their use. They're programmed to allow a shock only when appropriate.

The immediate cause of sudden cardiac arrest is usually an abnormality in your heart rhythm (arrhythmia), the result of a problem with your heart's electrical system.

Unlike other muscles in your body, which rely on nerve connections to receive the electrical stimulation they need to function, your heart has its own electrical stimulator — a specialized group of cells called the sinus node located in the upper right chamber (right atrium) of your heart. The sinus node generates electrical impulses that flow in an orderly manner through your heart to synchronize the heart rate and coordinate the pumping of blood from your heart to the rest of your body.

If something goes wrong with the sinus node or the flow of electric impulses through your heart, an arrhythmia can result, causing your heart to beat too fast, too slow or in an irregular fashion.

Often these interruptions in rhythm are momentary and harmless. But some types of arrhythmia can be serious and lead to a sudden stop in heart function (sudden cardiac arrest).

The most common cause of cardiac arrest is an arrhythmia called ventricular fibrillation — when rapid, erratic electrical impulses cause your ventricles to quiver uselessly instead of pumping blood.

Most of the time, cardiac-arrest-inducing arrhythmias don't occur on their own. In a person with a normal, healthy heart, a lasting irregular heart rhythm isn't likely to develop without an outside trigger, such as an electrical shock, the use of illegal drugs or trauma to the chest at just the wrong time of the heart's cycle (commotio cordis).

Heart conditions that can lead to sudden cardiac arrest

A life-threatening arrhythmia usually develops in a person with a pre-existing heart condition, such as:

- **Coronary artery disease.** Most cases of sudden cardiac arrest occur in people who have coronary artery disease. In coronary artery disease, your arteries become clogged with cholesterol and other deposits, reducing blood flow to your heart. This can make it harder for your heart to conduct electrical impulses smoothly. (and risk factors for CAD including smoking, high blood pressure, diabetes, elevated LDL cholesterol, family history of heart disease, sedentary lifestyle)
- **Heart attack.** If a heart attack occurs, often as a result of severe coronary artery disease, it can trigger ventricular fibrillation and sudden cardiac arrest. In addition, a heart attack can leave behind areas of scar tissue. Electrical short circuits around the scar tissue can lead to abnormalities in your heart rhythm.
- **Enlarged heart (cardiomyopathy).** This occurs primarily when your heart's muscular walls stretch and enlarge or thicken. In both cases, your heart's muscle is abnormal, a condition that often leads to heart tissue damage and potential arrhythmias.
- **Valvular heart disease.** Leaking or narrowing of your heart valves can lead to stretching or thickening of your heart muscle or both. When the chambers become enlarged or weakened because of stress caused by a tight or leaking valve, there's an increased risk of developing arrhythmia.
- **Congenital heart disease.** When sudden cardiac arrest occurs in children or adolescents, it may be due to a heart condition that was present at birth (congenital heart disease). Even adults who've had corrective surgery for a congenital heart defect still have a higher risk of sudden cardiac arrest.
- **Electrical problems in the heart.** In some people, the problem is in the heart's electrical system itself instead of a problem with the heart muscle or valves. These are called primary heart rhythm abnormalities and include conditions such as Brugada's syndrome and long QT syndrome.
- **Heart failure** from other causes
- **Episodes of fainting** of unknown cause
- **Blood vessel abnormalities**
- **A low ejection fraction (EF) (<35%)**

Because sudden cardiac arrest is so often linked with coronary artery disease, the same factors that put person at risk of coronary artery disease may also put you at risk of sudden cardiac arrest. These include:

- A family history of coronary artery disease
- Smoking
- High blood pressure
- High blood cholesterol
- Obesity
- Diabetes
- A sedentary lifestyle
- Drinking too much alcohol (more than one to two drinks a day)

Other factors that may increase risk of sudden cardiac arrest include:

- A previous episode of cardiac arrest or a family history of cardiac arrest
- A previous heart attack
- A personal or family history of other forms of heart disease, such as heart rhythm disorders, congenital heart defects, heart failure and cardiomyopathy
- Age — the incidence of sudden cardiac arrest increases with age, especially after age 45 for men and age 55 for women
- Being male — men are two to three times more likely to experience sudden cardiac arrest
- Using illegal drugs, such as cocaine or amphetamines
- Nutritional imbalance, such as low potassium or magnesium levels
- When sudden cardiac arrest occurs, your brain is the first part of your body to suffer because, unlike other organs, it doesn't have a reserve of oxygen-rich blood. It's completely dependent on an uninterrupted supply of blood. Reduced blood flow to your brain causes unconsciousness.
- If your heart rhythm doesn't rapidly return to its normal rhythm, brain damage occurs and death results. If sudden cardiac arrest lasts more than 10 minutes, survival is rare. Survivors of cardiac arrest may show signs of brain damage.

Examination

Electrocardiogram

A test commonly given after cardiac arrest is an electrocardiogram (ECG). During an ECG, sensors (electrodes) that can detect the electrical activity of your heart are attached to chest and sometimes to limbs. An ECG measures the timing and duration of each electrical phase in heartbeat and can reveal disturbances in heart rhythm. Because injured heart muscle doesn't conduct electrical impulses normally, the ECG may show that a heart attack has occurred. An ECG can detect abnormal electrical patterns, such as a prolonged QT interval, that increase your risk of sudden death.

Blood tests:

- **Cardiac enzyme test.** Certain heart enzymes leak into your blood if your heart has been damaged by a heart attack. Because a heart attack can trigger sudden cardiac arrest, it's important to know whether you've had a heart attack. Testing a blood sample for these enzymes may help indicate whether a heart attack has indeed occurred.
- **Electrolyte test.** A sample of blood may also be tested for levels of electrolytes, such as potassium, calcium and magnesium. Electrolytes are minerals in your blood and body fluids that help create electrical impulses. An imbalance in the levels of these substances can increase risk of arrhythmia and sudden cardiac arrest.
- **Drug test.** Doctor may check blood for evidence of drugs that have the potential to induce arrhythmia, including certain prescription and over-the-counter drugs and illegal drugs.
- **Hormone test.** Testing for hyperthyroidism may indicate this condition as the trigger for cardiac arrest.

Imaging tests:

- **Chest X-ray.** An X-ray image of chest allows your doctor to check the size and shape of your heart and its blood vessels. It may also indicate heart failure.
- **Echocardiogram.** This test uses sound waves to produce an image of heart. An echocardiogram can help identify whether an area of heart has been damaged by a heart attack and isn't pumping normally or at peak capacity (ejection fraction) or whether there are valvular abnormalities.
- **Ejection fraction testing.** One of the most important predictors of risk of sudden cardiac arrest is how well heart is able to pump blood. Doctor can determine heart's pumping capacity by measuring what's called the ejection fraction. This refers to the percentage of blood that's pumped out of a filled ventricle with each heartbeat. A normal ejection

fraction is 50 to 70 percent. An ejection fraction of less than 40 percent increases risk of sudden cardiac arrest.

Doctor can measure ejection fraction in several ways, such as with an echocardiogram, magnetic resonance imaging (MRI), a nuclear medicine scan (multiple gated acquisition, or MUGA), a computerized tomography (CT) scan or a cardiac catheterization

- **Nuclear scan.** This test, usually done along with a stress test, helps identify blood flow problems to heart. Tiny amounts of radioactive material, such as thallium, are injected into bloodstream. Special cameras can detect the radioactive material as it flows through your heart and lungs.

Other tests:

- **Electrical system (electrophysiological) testing and mapping.** This test, if needed, is usually done later, after recover of a patient and if an underlying explanation for cardiac arrest hasn't been found. With this type of test, doctor may try to cause an arrhythmia while closely monitoring heart. The test can help locate where in the heart the arrhythmia starts.

During the test, thin, flexible tubes (catheters) tipped with electrodes are threaded through blood vessels to a variety of spots within heart. Once in place, the electrodes can precisely map the spread of electrical impulses through heart. In addition, cardiologist can use the electrodes to stimulate heart to beat at rates that may trigger — or halt — an arrhythmia. This allows doctor to observe the location of the arrhythmia.

- **Coronary catheterization (angiogram).** This test can show if coronary arteries are narrowed or blocked. Along with ejection fraction, the number of obstructed blood vessels is another important predictor of sudden cardiac arrest.

During the procedure, a liquid dye is injected into the arteries of heart through a long, thin tube (catheter) that's advanced through an artery, usually in leg, to arteries in heart. As the dye fills arteries, the arteries become visible on X-ray and videotape, revealing areas of blockage.

Also, while the catheter is in position, doctor may treat a blockage by performing angioplasty and inserting a stent to hold the artery open.

Sudden cardiac arrest requires immediate action for survival.

CPR

Immediate cardiopulmonary resuscitation (CPR) is critical to treating sudden cardiac arrest. By maintaining a flow of oxygen-rich blood to the body's vital organs, CPR can provide a vital link until more advanced emergency care is available.

To perform CPR:

- Is the person conscious or unconscious?
- If the person appears unconscious, tap or shake his or her shoulder and ask loudly, "Are you OK?"
- If the person doesn't respond and two people are available, have one person call 911 or the local emergency number and one begin CPR.
- If you're alone and have immediate access to a telephone, call 911 or the local emergency number before beginning CPR — unless you think the person has become unresponsive because of suffocation (such as from drowning); in this special case, begin CPR for one minute and then call 911 or emergency medical help.
- If you're alone and rescuing a child, perform CPR for two minutes before calling 911 or emergency help or using an AED.
- If an AED is immediately available, deliver one shock if advised by the device, then begin CPR.

- Start chest compressions by putting the heel of one hand in the center of the person's chest and covering the first hand with the other hand. Keeping your elbows straight, use your upper body weight to push down hard and fast on the person's chest at a rate of about 100 compressions a minute. For a child, you may need to use only one hand.
- If you haven't been trained in CPR, continue chest compressions until emergency medical help arrives.
- If you have been trained in CPR, after every 30 compressions, gently tilt the head back and lift the chin up to open the airway. Quickly check for normal breathing, taking no more than 10 seconds. If the person isn't breathing, give two rescue breaths, making sure the chest rises after a breath. Pinch the nostrils shut and give the first rescue breath — lasting one second — and watch to see if the chest rises. If it does rise, give the second breath. If the chest doesn't rise, repeat the head-tilt, chin-lift maneuver and then give the second breath.
- If a child has not begun moving after five cycles (about two minutes) and an AED is available, apply it and follow the prompts. Administer one shock if so advised, then resume CPR — starting with chest compressions — for two more minutes before administering a second shock. If you're not trained to use an AED, a 911 or emergency medical help operator may be able to guide you in its use.
- Continue CPR or chest compressions until the person recovers consciousness and is breathing normally or until emergency medical personnel take over.

Defibrillation

Advanced care for ventricular fibrillation, a type of arrhythmia that can cause sudden cardiac arrest, typically includes delivery of an electrical shock through the chest wall to the heart. The procedure, called defibrillation, momentarily stops the heart and the chaotic rhythm. This often allows the normal heart rhythm to resume.

The shock may be administered by emergency personnel or by a citizen if a public-use defibrillator, the device used to administer the shock, is available.

Defibrillators are available in a small, portable form and come with built-in automated instructions to ensure proper use. They're programmed to recognize ventricular fibrillation and send a shock only when it's appropriate. These portable defibrillators are available in an increasing number of public places, including airports, shopping malls, casinos, health clubs, and community and senior citizen centers.

At the emergency room

Once you arrive in the emergency room, the medical staff will work to stabilize your condition and treat a possible heart attack, heart failure or electrolyte imbalances. You may be given medications to stabilize your heart rhythm.

The prognosis after sudden cardiac arrest varies. Some people may be in a coma for days, weeks or indefinitely. Others may recover only partial function. After you recover, your doctor will discuss with you or your family what additional tests you may need to determine the cause of the cardiac arrest. Your doctor will also discuss preventive treatment options with you to reduce your risk of another cardiac arrest.

Treatments may include:

- **Drugs.** Doctors use various anti-arrhythmic drugs for emergency or long-term treatment of arrhythmias or potential arrhythmia complications. A class of medications called beta blockers is commonly used in people at risk of sudden cardiac arrest. Other possible drugs include angiotensin-converting enzyme (ACE) inhibitors, calcium channel blockers or a drug called amiodarone (Cordarone).

As with any medication, anti-arrhythmic drugs may have potential side effects. For example, an anti-arrhythmic drug may cause your particular arrhythmia to occur more frequently — or even cause a new arrhythmia to appear that's as bad as or worse than your pre-existing condition.

- **Implantable cardioverter-defibrillator (ICD).** After your condition stabilizes, your doctor is likely to recommend implantation of an ICD. An ICD is a battery-powered unit that's implanted near your left collarbone. One or more electrode-tipped wires from the ICD run through veins to your heart.
The ICD constantly monitors your heart rhythm. If it detects a rhythm that's too slow, it paces your heart as a pacemaker would. If it detects a dangerous heart rhythm change, it sends out low- or high-energy shocks to reset your heart to a normal rhythm. An ICD may be more effective than preventive drug treatment at reducing your chance of having a fatal arrhythmia.
- **Coronary angioplasty.** This procedure opens blocked coronary arteries, letting blood flow more freely to your heart, which may reduce your risk of serious arrhythmia. Doctors insert a long, thin tube (catheter) that's passed through an artery, usually in your leg, to a blocked artery in your heart. This catheter is equipped with a special balloon tip that briefly inflates to open up a blocked coronary artery. At the same time, a metal mesh stent may be inserted into the artery to keep it open long term, restoring blood flow to your heart. Coronary angioplasty may be done at the same time as a coronary catheterization (angiogram), a procedure that doctors do first to locate narrowed arteries to the heart.
- **Coronary bypass surgery.** Another procedure to improve blood flow is coronary bypass surgery. Bypass surgery involves sewing veins or arteries in place at a site beyond a blocked or narrowed coronary artery (bypassing the narrowed section), restoring blood flow to your heart. This may improve the blood supply to your heart and reduce the frequency of racing heartbeats.
- **Radiofrequency catheter ablation.** This procedure may be used to block a single abnormal electrical pathway. In this procedure, one or more catheters are threaded through your blood vessels to your inner heart. They're positioned along electrical pathways identified by your doctor as causing your arrhythmia. Electrodes at the catheter tips are heated with radiofrequency energy. This destroys (ablates) a small spot of heart tissue and creates an electrical block along the pathway that's causing your arrhythmia. Usually this stops your arrhythmia.
- **Corrective heart surgery.** If you have a congenital heart deformity, a faulty valve or diseased heart muscle tissue due to cardiomyopathy, surgery to correct the abnormality may improve your heart rate and blood flow, reducing your risk of fatal arrhythmias.
- **Heart transplantation.** Some people with severe heart failure who've experienced cardiac arrest may be eligible for a heart transplant. But given the lack of donor hearts, availability is limited.

There's no sure way to know patient risk of sudden cardiac arrest, so reducing his risk is the best strategy. Steps to take include regular checkups, screening for heart disease and living a heart-healthy lifestyle with the following approaches:

- Don't smoke, and use alcohol in moderation (no more than one to two drinks a day).
- Eat a nutritious, balanced diet.
- Stay physically active.

If you know your patient have heart disease or conditions that make him more vulnerable to an unhealthy heart, you may recommend that he take appropriate steps to improve his health, such as taking medications for high cholesterol or carefully managing diabetes.

In some people with a known high risk of sudden cardiac arrest — such as those with a heart condition — you may recommend anti-arrhythmic drugs or an implantable cardioverter-defibrillator (ICD) as primary prevention.

If your patient have a high risk of sudden cardiac arrest, you may also wish to consider purchasing an automated external defibrillator (AED) for home use. Before purchasing one, discuss the decision with your doctor. AEDs can be expensive and aren't always covered by health insurance.

If you live with someone who is vulnerable to sudden cardiac arrest, it's important that you be trained in CPR. The American Red Cross and other organizations offer courses in CPR and defibrillator use to the public. Being trained will help not only your loved one but also those in your community. The more people who know how to respond to a cardiac emergency, the more the survival rate for sudden cardiac arrest can be improved.

Cardiopulmonary resuscitation (CPR) consists of the use of chest compressions and artificial ventilation to maintain circulatory flow and oxygenation during cardiac arrest. Although survival rates and neurologic outcomes are poor for patients with cardiac arrest, early appropriate resuscitation—involving early defibrillation—and appropriate implementation of post-cardiac arrest care lead to improved survival and neurologic outcomes.

Indications and contraindications

CPR should be performed immediately on any person who has become unconscious and is found to be pulseless. Assessment of cardiac electrical activity via rapid “rhythm strip” recording can provide a more detailed analysis of the type of cardiac arrest, as well as indicate additional treatment options.

Loss of effective cardiac activity is generally due to the spontaneous initiation of a nonperfusing arrhythmia, sometimes referred to as a malignant arrhythmia. The most common nonperfusing arrhythmias include the following:

- Ventricular fibrillation (VF)
- Pulseless ventricular tachycardia (VT)
- Pulseless electrical activity (PEA)
- Asystole
- Pulseless bradycardia

CPR should be started before the rhythm is identified and should be continued while the defibrillator is being applied and charged. Additionally, CPR should be resumed immediately after a defibrillatory shock until a pulsatile state is established.

Contraindications

The only absolute contraindication to CPR is a do-not-resuscitate (DNR) order or other advanced directive indicating a person's desire to not be resuscitated in the event of cardiac arrest. A relative contraindication to performing CPR is if a clinician justifiably feels that the intervention would be medically futile.

Equipment

CPR, in its most basic form, can be performed anywhere without the need for specialized equipment. Universal precautions (ie, gloves, mask, gown) should be taken. However, CPR is delivered without such protections in the vast majority of patients who are resuscitated in the out-of-hospital setting, and no cases of disease transmission via CPR delivery have been reported. Some hospitals and EMS systems employ devices to provide mechanical chest compressions. A cardiac defibrillator provides an electrical shock to the heart via 2 electrodes placed on the patient's torso and may restore the heart into a normal perfusing rhythm.

Technique

In its full, standard form, CPR comprises the following 3 steps, performed in order:

- Chest compressions
- Airway
- Breathing

For lay rescuers, compression-only CPR (COCPR) is recommended.

Positioning for CPR is as follows:

CPR is most easily and effectively performed by laying the patient supine on a relatively hard surface, which allows effective compression of the sternum

Delivery of CPR on a mattress or other soft material is generally less effective

The person giving compressions should be positioned high enough above the patient to achieve sufficient leverage, so that he or she can use body weight to adequately compress the chest

For an unconscious adult, CPR is initiated as follows:

- Give 30 chest compressions

- Perform the head-tilt chin-lift maneuver to open the airway and determine if the patient is breathing

- Before beginning ventilations, look in the patient's mouth for a foreign body blocking the airway

Chest compression

- The provider should do the following:

- Place the heel of one hand on the patient's sternum and the other hand on top of the first, fingers interlaced

- Extend the elbows and the provider leans directly over the patient (see the image below)

- Press down, compressing the chest at least 2 in

- Release the chest and allow it to recoil completely

- The compression depth for adults should be at least 2 inches (instead of up to 2 inches, as in the past)

- The compression rate should be at least 100/min

- The key phrase for chest compression is, "Push hard and fast"

- Untrained bystanders should perform chest compression-only CPR (COCPR)

- After 30 compressions, 2 breaths are given; however, an intubated patient should receive continuous compressions while ventilations are given 8-10 times per minute

- This entire process is repeated until a pulse returns or the patient is transferred to definitive care

- To prevent provider fatigue or injury, new providers should intervene every 2-3 minutes (ie, providers should swap out, giving the chest compressor a rest while another rescuer continues CPR)

Ventilation

- If the patient is not breathing, 2 ventilations are given via the provider's mouth or a bag-valve-mask (BVM). If available, a barrier device (pocket mask or face shield) should be used.

- To perform the BVM or invasive airway technique, the provider does the following:

- Ensure a tight seal between the mask and the patient's face

- Squeeze the bag with one hand for approximately 1 second, forcing at least 500 mL of air into the patient's lungs

- To perform the mouth-to-mouth technique, the provider does the following:

- Pinch the patient's nostrils closed to assist with an airtight seal

- Put the mouth completely over the patient's mouth

- After 30 chest compression, give 2 breaths (the 30:2 cycle of CPR)

- Give each breath for approximately 1 second with enough force to make the patient's chest rise

- Failure to observe chest rise indicates an inadequate mouth seal or airway occlusion

- After giving the 2 breaths, resume the CPR cycle

Complications

- Complications of CPR include the following:

- Fractures of ribs or the sternum from chest compression (widely considered uncommon)

- Gastric insufflation from artificial respiration using noninvasive ventilation methods (eg, mouth-to-mouth, BVM); this can lead to vomiting, with further airway compromise or aspiration; insertion of an invasive airway prevents this problem

ACLS

- In the in-hospital setting or when a paramedic or other advanced provider is present, ACLS guidelines call for a more robust approach to treatment of cardiac arrest, including the following:

- Drug interventions
- ECG monitoring
- Defibrillation
- Invasive airway procedures

Emergency cardiac treatments no longer recommended include the following:

- Routine atropine for pulseless electrical activity (PEA)/asystole
- Cricoid pressure (with CPR)
- Airway suctioning for all newborns (except those with obvious obstruction)

Background

For patients with cardiac arrest, survival rates and neurologic outcomes are poor, though early appropriate resuscitation, involving cardiopulmonary resuscitation (CPR), early defibrillation, and appropriate implementation of post-cardiac arrest care, leads to improved survival and neurologic outcomes. Targeted education and training regarding treatment of cardiac arrest directed at emergency medical services (EMS) professionals as well as the public has significantly increased cardiac arrest survival rates.

CPR consists of the use of chest compressions and artificial ventilation to maintain circulatory flow and oxygenation during cardiac arrest. A variation of CPR known as “hands-only” or “compression-only” CPR (COCPR) consists solely of chest compressions. This variant therapy is receiving growing attention as an option for lay providers (that is, nonmedical witnesses to cardiac arrest events).

American Heart Association CPR guidelines

In 2010, the Emergency Cardiovascular Care Committee (ECC) of the AHA released the Association’s newest set of guidelines for CPR. Changes for 2010 include the following:

- The initial sequence of steps is changed from ABC (airway, breathing, chest compressions) to CAB (chest compressions, airway, breathing), except for newborns

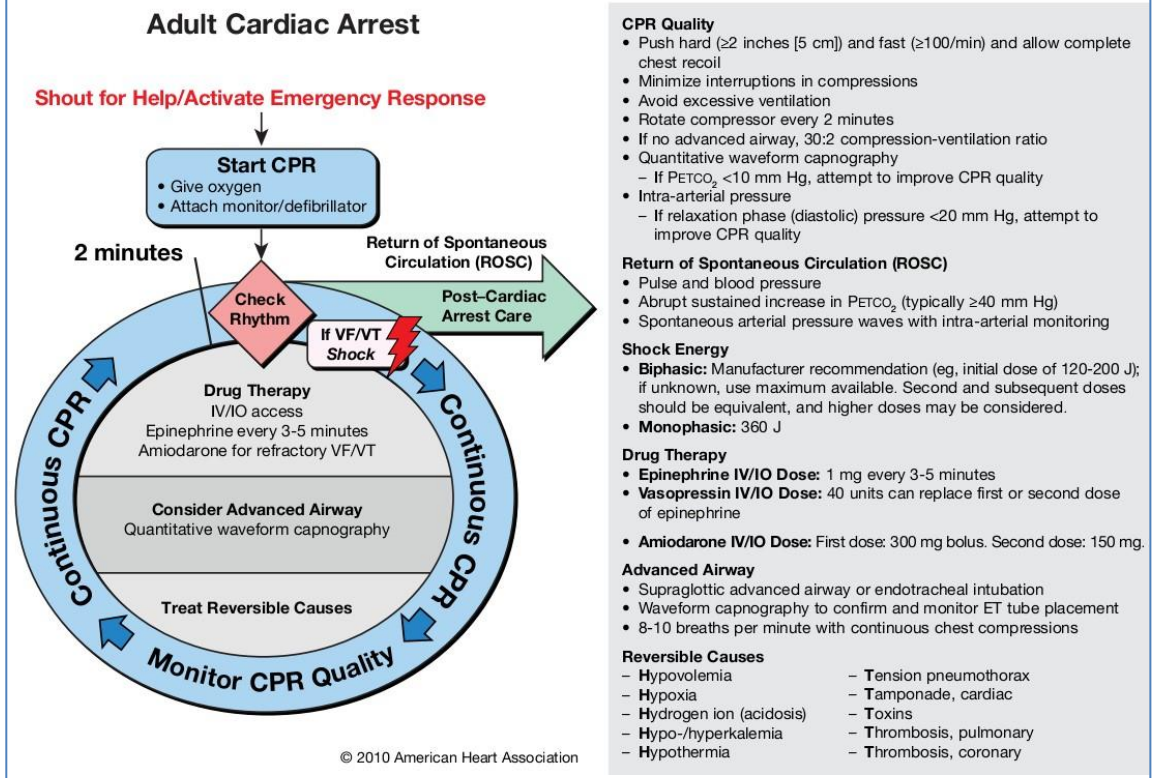
- “Look, listen, and feel” is no longer recommended

- The compression depth for adults should be at least 2 inches (instead of up to 2 inches)

- The compression rate should be at least 100/min

- Emergency cardiac treatments no longer recommended include routine atropine for pulseless electrical activity (PEA)/asystole, cricoid pressure (with CPR), and airway suctioning for all newborns (except those with obvious obstruction).

Figure 4
Circular ACLS Algorithm



Materials for self-control (added)

1. Treatable causes of cardiac arrest are not:

- A) Hypoxia
- B) Hypovolemia
- C) Hypermetabolic disorders
- D) Hypometabolic disorders
- E) **Headache**

2. Treatable causes of cardiac arrest are

- A) Tension pneumothorax
- B) Tamponade (Cardiac)
- C) Toxins
- D) Thrombosis
- E) **All from above**

3. Treatable causes of cardiac arrest are

- A) Hypoxia
- B) Hypothermia
- C) Hypovolemia
- D) Hypo/Hyper-metabolic disorders
- E) **All from above**

4. The basic mechanisms of IHD are not

- A) organic arteriostenosis coronal as a result of coronal atherosclerosis and other reasons
- B) **high blood pressure**
- C) spasm of coronary arteries
- D) coronary arterial thrombi
- E) violation of microcirculation

5. Classification of IHD is not include

- A) Sudden cardiac death
- B) Stable angina pectoris of tension
- C) Cardiosclerosis
- D) Unstable angina pectoris
- E) arterial hypertension

6. In patient with cardiac arrest the ECG may reveal:

- a) Asystole.
- b) Hypertension.
- c) Pulseless electrical activity (formerly called electromechanical dissociation) .
- d) ventricular fibrillation
- e) ventricular tachycardia .

7. Sudden cardiac arrest is the sudden, unexpected loss of:

- a) heart function.
- b) breathing.
- c) consciousness.
- d) All from above**

8. Heart conditions that can lead to sudden cardiac arrest:

- a) Coronary artery disease
- b) cardiomyopathy.
- c) Valvular heart disease
- d) Congenital heart disease
- e) extrasystole.

9. Because sudden cardiac arrest is so often linked with coronary artery disease, the same factors that put person at risk of coronary artery disease may also put you at risk of sudden cardiac arrest. These include::

- a) High blood pressure
- b) Obesity
- c) Smoking
- d) Diabetes
- e) All from above**

10. The most common nonperfusing arrhythmias include the following exept

- a) Ventricular fibrillation
- b) Asystole
- c) Pulseless electrical activity
- d) Pulseless bradycardia
- e) extrasystole

Recommended literature:

I. Main:

1. Internal Medicine: in 2 books. Book 1. Diseases of the Cardiovascular and Respiratory Systems: textbook / N.M. Seredyuk, I.P. Vakaliuk, R.I. Yatsyshyn et al. Київ, Медицина., 2019. - 664 + 48 кольор. вкл.).
2. Internal medicine: Part 1 (cardiology, rheumatology, haematology): textbook for English-speaking students of higher medical schools / edited by Professor M.A. Stanislavchuk and Professor V.A. Serkova. - Vinnytsia: Nova Knyha, 2019. - 392 p.
3. Медицина за Девідсоном: принципи і практика / Навчальний посібник: пер. 23-го англ. вид.: у 3 т. Т.3 С. Ралстона, Я. Пенмана, М. Стрекена, Р. Гобсона; К.: ВСВ «Медицина», 2021. – 642 с.
4. CURRENT Medical Diagnosis and Treatment 2012, Fifty-First Edition (LANGE CURRENT Series) by Stephen McPhee, Maxine Papadakis and Michael W. Rabow (Paperback - Sep 12, 2011)/
5. Побічна дія ліків – Side Effects of Medications: навчальний посібник у 2 т. / заг. ред. В.М. Бобирьова, М.М. Потяженка. – Вінниця:
6. Cardiovascular diseases. Classification, standards of diagnosis and treatment / Edited by Academician Kovalenko V.M., Prof. Lutaia M.I., Prof. Sirenko Yu.M., Prof. Sychova O.S. – Kyiv. – 2020.
7. Perederii V.H., Tkach S.M. Principles of internal medicine. – Vol.2 / Textbook for students of higher educational institutions. – Vinnytsia: Nova knyha. – 2018.
8. Internal diseases. The textbook based on the principles of evidentiary medicine, 2018.

II. Additional literature:

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2. Respiratory diseases / Ghanei M. - In Tech, 2012. - 242 p.
3. Clinical respiratory medicine / Spiro S., Silvestri G., Agusti A. - Saunders, 2012. - 1000 p.
4. Principles and practice of interventional pulmonology / Ernst A., Herth F. -Springer, 2012. - 757 p.
5. Clinical respiratory medicine / Spiro S., Silvestri G., Agusti A. - Saunders, 2012. - 1000 p.
6. Petrov Y. The chief symptoms and syndromes in patients with cardiovascular pathology : The practical handbook for medical students / Ye. Petrov, Yu. Goldenberg, N. Chekalina; UMSA. - Poltava : TexcepBic, 2010. - 143 .
7. Gastroenterology and Hepatology Board Review: Pearls of Wisdom, Third Edition (Pearls of Wisdom Medicine) by John K. DiBaise (May 11, 2012)
8. Clinical Pulmonology 2012 (The Clinical Medicine Series) by M.D., C. G. Weber (Oct 30, 2011) - Kindle eBook
9. Clinical Nephrology 2012 (The Clinical Medicine Series) by M.D., C. G. Weber (Sep 19, 2011) - Kindle eBook
10. Clinical Nephrology 2012 (The Clinical Medicine Series) by M.D., C. G. Weber (Sep 19, 2011) - Kindle eBook
11. Hematology: Clinical Principles and Applications, 4e by Bernadette F. Rodak MS MLS (Feb 18, 2017)
12. Rheumatology, 2-Volume Set: EXPERT CONSULT - ENHANCED ONLINE FEATURES AND PRINT, 5e by Marc C. Hochberg MD MPH, Alan J. Silman MD, Josef S. Smolen MD and Michael E. Weinblatt MD (Oct 19, 2019)
13. Endocrine Pathology: Differential Diagnosis and Molecular Advances by Ricardo V. Lloyd (Nov 5, 2018)
14. Clinical Endocrinology 2012 (The Clinical Medicine Series) by M.D., C. G. Weber (Sep 19, 2017) - Kindle eBook
15. Williams Textbook of Endocrinology: Expert Consult-Online and Print, 12e by Shlomo Melmed, Kenneth S. Polonsky MD, P. Reed MD Larsen and Henry M. Kronenberg MD (May 27, 2016)

16. Electrocardiography, 3e with Student CD (Booth, Electrocardiography for Health Care Personnel) by Kathryn A. Booth (Jan 27, 2017)
17. Echocardiography Review Guide: Companion to the Textbook of Clinical Echocardiography: Expert Consult: Online and Print, 2e (Expert Consult Title: Online + Print) by Catherine M. Otto (Mar 7, 2017).

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