LECTURE 3

GENERAL ANESTHESIOLOGY, INTENSIVE CARE AND RESUSCITATION

I.Actuality of theme.

Anesthesiology is concerned not only with the administration of anesthesia for surgery but also with many other areas of patients care, including critical care medicine, management of chronic pain, and respiratory therapy. In this lecture , the discussion will be linited to anesthesia during surgery and the overall perioperative period.

Heart disease is the number 1 killer in the world. For example, each year, almost half a million Americans die from a heart attack. Half of these, or one quarter of a million people, will die suddenly, outside of the hospital, because their heart stops beating.

The most common cause of death from a heart attack in adults is a disturbance in the electrical rhythm of the heart called ventricular fibrillation. Ventricular fibrillation can be treated, but it requires applying an electrical shock to the chest called defibrillation. If a defibrillator is not readily available, brain death will occur in less than 10 minutes. One way of buying time until a defibrillator becomes available is to provide artificial breathing and circulation by performing cardiopulmonary resuscitation, or CPR.The earlier you give CPR to a person in cardiopulmonary arrest (no breathing, no heartbeat), the greater the chance of a successful resuscitation. By performing CPR, you keep oxygenated blood flowing to the heart and brain until a defibrillator becomes available. Because up to 80% of all cardiac arrests occur in the home, you are most likely to perform CPR on a family member or loved one. CPR is one link in what the American Heart Association calls the "chain of survival." The chain of survival is a series of actions that, when performed in sequence, will give a person having a heart attack the greatest chance of survival.

II. Aims of lecture :

Educational:

- To describe the history of general, local and regional anesthesia (β= I);
- To expound general considerations for general, local and regional anesthesia (β= II);
- To expound the common techniques for general and local anesthesia(β= II);
- To characterize the indication, contra-indications, complications for different type of anesthesia (β= II);
- To perform critical analisys of advanced interventional techniques in anesthesiology (β= III);

- To describe the history of resustitation (β= I);
- To give definition of death, clinical death(β= I);
- To study the students of technique of cardiopulmonary resuscitation(β= II);
- To substantiate the drug therapy in cardiopulmonary resuscitation(β= II);
- To describe the main items of post-resuscitation care (β= II);
- .To study the students the main principles of evidence-based medicine according the subject of lecture (β= IV).

Educative:
1.To study the students to establish the psychological contact with relatives of seriously ill patients.
2. To study the students the main priciples of bioethics in intensive care.

III**.** Plan and organization of structure of lecture

№	**Basic stages of lecture and their maintenance**	**Aims are in the levels of abstraction**	**Type of lecture, methods and facilities of activation of students, equipment**	**Division of time**
1	Preliminary stage. Determination of educational aims and motivation.		Items I, II	5%

2	**Basic stage. Teaching of lecture's material** The history of general, local and regional anesthesia General considerations for general, local and regional anesthesia Common techniques for general and local anesthesia Indication, contra-indications, complications for different type of anesthesia Advanced Interventional techniques in anesthesia Future Trends in Regional Anesthesia The history of resuscitation The pathophysiology of cardiorespiratory arrest Life support techniques Drug therapy in cardiopulmonary resuscitation Post-resuscitation care Training and evaluation in basic and advanced resuscitation Definition of death Ethical aspects of resuscitation.	 I II II II III III I III II II II II I II	Type of lecture – thematic (with controversial elements – critical analysis of results of meta-analyses, randomized controlled, trials, guidlines which are devoted for the problem of resustitation, intensive care and anesthesiology). Facilities of activation of students are a questions, controversial situations, illustrative material	85%

3	Final stage (resume of lecture, general conclusions, answers to the possible questions, task for students for preparation for practical classes)		List of literature, question, task for students	10%

IV. Subject of a lecture

Anesthesia was used as early back as the classical age. Dioscorides, for example, reports potions being prepared from opium and mandragora as surgical anesthetics. In the East, in the 10th century work Shahnama, the author describes a caesarean section performed on Rudaba when giving birth, in which a special wine agent was prepared by a Zoroastrian priest, and used to produce unconsciousness for the operation. Although largely mythical in content, the passage does at least illustrate knowledge of anesthesia in ancient Persia. Hypnotism and acupuncture have a long history of use as anaesthetic techniques. In China, Taoist medical practitioners developed anaesthesia by means of acupuncture. Chilling tissue can temporarily cause nerve fibres to stop conducting sensation, while hyperventilation can cause brief alteration in conscious perception of stimuli including pain.

In modern anaesthetic practice, these techniques are seldom employed. The first herbal anaesthesia was administered in prehistory. Opium and Cannabis were two of the most important herbs used. They were ingested or burned and the smoke inhaled. Alcohol was also used, its vasodilatory properties being unknown. In early America preparations from datura – effectively scopolamine – were used as was coca. In Medieval Europe various preparations of mandrake were tried as was henbane (hyoscyamine). In 1804, the Japanese surgeon Hanaoka Seishu performed general anaesthesia for the operation of a breast cancer (mastectomy), by combining Chinese herbal medicine know-how and Western surgery techniques learned through "Rangaku", or "Dutch studies" His patient was a 60-year-old woman called Kan Aiya. He used a compound he called Tsusensan, based on the plants Datura metel and Aconitum and others. In the West, the development of effective anaesthetics in the 19th century was, with Listerian techniques, one of the keys to successful surgery. Henry Hill Hickman experimented with carbon dioxide in the 1820s. The anaesthetic qualities of nitrous oxide (isolated by Joseph Priestley) were discovered by the British chemist Humphry Davy about 1795 when he was an assistant to Thomas Beddoes, and reported in a paper in 1800. But initially the medical uses of this so-called "laughing gas" were limited - its main role was in entertainment. It was used in December 1844 for painless tooth extraction by American dentist Horace Wells. Demonstrating it the following year, at Massachusetts General Hospital, he made a mistake and the patient suffered considerable pain. This lost Wells any support. Another dentist, William E. Clarke, performed an extraction in January 1842 using a different chemical, diethyl ether (discovered in 1540). In March 1842 in Danielsville, Georgia, Dr. Crawford

Williamson Long was the first to use anaesthesia during an operation, giving it to a boy before excising a cyst from his neck; however, he did not publicize this information until later. On October 16, 1846, another dentist, William Thomas Green Morton, invited to the Massachusetts General Hospital, performed the first public demonstration of diethyl ether (then called sulfuric ether) as an anesthetic agent, for a patient undergoing an excision of a tumour from his neck. In a letter to Morton shortly thereafter, Oliver Wendell Holmes, Sr. proposed naming the procedure anæsthesia. Anesthesia pioneer Crawford W. LongDespite Morton's efforts to keep "his" compound a secret, which he named "Letheon" and for which he received a US patent, the news of the discovery and the nature of the compound spread very quickly to Europe in late 1846. Here, respected surgeons, including Liston, Dieffenbach, Pirogoff, and Syme undertook numerous operations with ether. Ether has a number of drawbacks, like its tendency to induce vomiting and its flammability. In England it was quickly replaced with chloroform. Discovered in 1831, its use in anaesthesia is usually linked to James Young Simpson, who, in a wide-ranging study of organic compounds, found chloroform's efficacy in 1847. Its use spread quickly and gained royal approval in 1853 when John Snow gave it to Queen Victoria during the birth of Prince Leopold. Unfortunately chloroform is not as safe an agent as ether, especially when administered by an untrained practitioner (medical students, nurses and occasionally members of the public were often pressed into giving anaesthetics at this time). This led to many deaths from the use of chloroform which (with hindsight) might have been preventable.

Anesthesia is the loss of feeling or sensation. It may be accomplished without the loss of consciousness, or with partial or total loss of consciousness.
Anesthesiology is a branch of medical science that relates to anesthesia and anesthetics. The anesthetist is a specialized physician in charge of supervising and administering anesthesia in the course of a surgical operation. Depending on the type of operation and procedures used, there are two types of anesthesia: general anesthesia, which causes a loss of consciousness, and local anesthesia, where the anesthetic "freezes" the nerves in the area covered by the operation. In local anesthesia, the patient may be conscious during the course of the operation or given a sedative, a drug that induces sleep.
There are several forms of anesthesia:
General: anesthesia resulting in amnesia, with a loss of protective airway reflexes. While usually administered with inhalational agents, general anesthesia can be achieved with intravenous agents, such as propofol. Amnesia is the main characteristic, while analgesia and muscle relaxation may be present, to varying degrees.

Regional: Loss of pain sensation, with varying degrees of muscle relaxation, in certain regions of the body. Administered with local anesthesia to peripheral nerve

bundles, such as the brachial plexus in the neck. Examples include the interscalene block for shoulder surgery, axillary block for wrist surgery, and femoral nerve block for leg surgery. While traditionally administered as a single injection, newer techniques involve placement of indwelling catheters for continuous or intermittent administration of local anesthetics.

Spinal: also known as subarachnoid block. Refers to a regional block resulting from a small volume of local anesthetics being injected into the spinal canal. The spinal canal is covered by the dura mater, through which the spinal needle enters. The spinal canal contains cerebrospinal fluid and the spinal cord. The sub arachnoid block is usually injected between the 4th and 5th lumbar vertebrae, because the spinal cord usually stops at the 1st lumbar vertebra, while the canal continues to the sacral vertebrae. It results in a loss of pain sensation and muscle strength, usually up to the level of the chest (nipple line or 4th thoracic dermatome).

Epidural: Regional block resulting from an injection of a large volume of local anesthetic into the epidural space. The epidural space is a potential space that lies underneath the ligamenta flava, and outside the dura mater (outside layer of the spinal canal). This is basically an injection around the spinal canal.
Local anesthesia is similar to regional anesthesia, but exerts its effect on a smaller area of the body.
Not all surgical procedures require anesthetic. Sometimes no anesthetic is required, and conscious sedation is used, which does not result in loss of consciousness or significant analgesia, but frequently produces a degree of amnesia, and relaxes the patient.

General anesthesia

There are three phases to general anesthesia. The anesthetist must first induce the state of unconsciousness (induction), keep the patient unconscious while the procedure is performed (maintenance), then allow the patient to emerge back into consciousness (emergence).
A drug commonly used to induce unconsciousness is thiopentone sodium. It is a barbiturate that produces unconsciousness within 30 seconds after being injected intravenously. Thiopentone does not reduce pain; it actually lowers the threshold of pain. It is used in the induction stage to bring about a quick state of unconsciousness before using other drugs to maintain the anesthetic condition during surgery.
Other agents used for the induction and maintenance of anesthesia are gases or volatile liquids such as nitrous oxide, halothane, enflurane, methoxyflurane and cyclopropane.
Nitrous oxide is still commonly used in dentistry, minor surgery, and major surgery when it is accompanied by other anesthetics. Though the gas has been used

for many years, it is still uncertain how nitrous oxide accomplishes its anesthetic effect. Mixtures of oxygen and nitrous oxide appear to enhance its effect. Unlike other agents used today, it appears to have no toxic side effects on the body.
Halothane is a colorless liquid with a very low boiling point. Its use, though, may be connected to liver toxicity. Enflurane and methoxyflurane are also liquids that are useful as analgesics (pain relievers) and muscle relaxants, but they also may have undesirable side effects. Cyclopropane, which is an expensive and explosive gas used for rapid induction and quick recovery, has over the years been replaced with the use of halothane.
The anesthesiologist interviews the patient before the operation and examines his or her medical records to determine which of the many anesthetic agents available will be used. Cyclopropane or atropine may be given before the operation to relieve pain and anxiety. When a muscle relaxant is given for the surgical procedure, the anesthesiologist monitors the respiratory equipment to ensure the patient is breathing properly.
Administration of the anesthetic is usually accomplished by the insertion of a cannula (small tube) into a vein. Sometimes a gas anesthetic may be introduced through a mask. If a muscle relaxant is used, the patient may not be able to breathe on his own, and a breathing tube is passed into the windpipe (trachea). The tube then serves either to deliver the anesthetic gases or to ventilate (oxygenate) the lungs.
During the course of the surgery, the anesthesiologist maintains the level of anesthetic needed to keep up the patient's level of anesthesia to the necessary state of unawareness while monitoring vital functions, such as heart beat, breathing, and blood/gas exchange.

Complications of general anesthesia. There are a number of possible complications that can occur under general anesthesia. They include loss of blood pressure, irregular heart beat, heart attack, vomiting and then inhaling the vomit into the lungs, coma, and death. Although mishaps do occur, the chance of a serious complication is extremely low. Avoidance of complications depends on a recognition of the condition of the patient before the operation, the choice of the appropriate anesthetic procedure, and the nature of the surgery itself.

Local anesthesia

Local anesthetics block pain in regions of the body without affecting other functions of the body or overall consciousness. They are used for medical examinations, diagnoses, minor surgical and dental procedures, and for relieving symptoms of minor distress, such as itching, toothaches, and hemorrhoids. They can be taken as creams, ointments, sprays, gels, or liquid; or they can be given by injection and in eye drops.
Some local anesthetics are benzocaine, bupivacaine, cocaine, lidocaine, procaine, and tetracaine. Some act rapidly and have a short duration of effect, while others

may have a slow action and a short duration. They act by blocking nerve impulses from the immediate area to the higher pain centers. Regional anesthetics allow for pain control along a wider area of the body by blocking the action of a large nerve (nerve block). Sprays can be used on the throat and related areas for a bronchoscopy, and gels can be used for the urethra to numb the area for a catherization or cystoscopy.
Spinal anesthesia is used for surgery of the abdomen, lower back and legs. Spinal or epidural anesthesia is also used for surgery on the prostate gland and hip. A fine needle is inserted between two vertebrae in the lumbar (lower part) of the spine and the anesthetic flows into the fluid surrounding the spinal cord. The nerves absorb the anesthetic as they emerge from the spinal fluid. The area anesthetized is controlled by the location of the injection and the amount of absorption of the anesthetic by the spinal fluid.
Complications of local anesthesia. It is possible to have adverse reactions to local anesthetics, such as dizziness, hypotension (low blood pressure), convulsions, and even death. These effects are rare but can occur if the dose is too high or if the drug has been absorbed too rapidly. A small percentage of patients (1-5%) may develop headaches with spinal anesthesia.

The development of modern cardiopulmonary resuscitation (CPR) is an exciting and surprising history to modern health professionals who rarely are aware of how new CPR really is. Artificial respiration began in the 16th century with Vesalius's work on living animals; progressed with the rise and fall of mouth-to-mouth, manual, and positive pressure ventilation methods of the 18th and 19th centuries; and culminated in 1958 with demonstration of the superiority of the mouth-to-mouth technique. Cardiac massage began in 1874, with the open chest method gaining ascendancy until the 1960 demonstration of the equality and greater ease of closed chest cardiac massage. Electrical defibrillation may have begun in 1775, but was not proven successful in animals internally until 1899. The technique was applied to man internally in 1947 and externally in 1956. The simultaneous use of all these modern CPR methods dates back only 20 years.In the late 1950s, Dr. Peter Safar, the father of modern day CPR, pioneered the development of the ABCs (airway, breathing, circulation) of resuscitation, including "mouth-to-mouth" resuscitation. Peter Safer invented cardiopulmonary resuscitation or CPR.

Cardiopulmonary resuscitation (CPR) is a procedure to support and maintain breathing and circulation for an infant, child, or adolescent who has stopped breathing (respiratory arrest) and/or whose heart has stopped (cardiac arrest). CPR is performed to restore and maintain breathing and circulation and to provide oxygen and blood flow to the heart, brain, and other vital organs. CPR can be performed by trained laypeople or healthcare professionals on infants, children,

adolescents, and adults. CPR should be performed if an infant, child, or adolescent is unconscious and not breathing. Respiratory and cardiac arrest can be caused by allergic reactions, an ineffective heartbeat, asphyxiation, breathing passages that are blocked, choking, drowning, drug reactions or overdoses, electric shock, exposure to cold, severe shock, or trauma. In newborns, the most common cause of cardiopulmonary arrest is respiratory failure caused by sudden infant death syndrome (SIDS), airway obstruction (usually from inhalation of a foreign body), sepsis, neurologic disease, or drowning. Cardiac arrest in children over one year of age is most commonly caused by shock and/or respiratory failure resulting from an accident or injury.

CPR involves a combination of mouth-to-mouth rescue breathing and chest compression that keeps oxygenated blood flowing to the brain and other vital organs until more definitive medical treatment can restore a normal heart rhythm. When the heart stops, the absence of oxygenated blood can cause irreparable brain damage in only a few minutes. Death will occur within eight to 10 minutes. Time is critical when you're helping an unconscious person who isn't breathing.

CPR is divided into three support stages:

- Basic life support
- Advanced life support
- Prolonged life support.

The classical description of arrest includes the following:

1) absence of ventilation and cyanosis ("respiratory arrest");

2) absence of a palpable pulse (pulse will disappear when systolic pressure < 60 mm Hg);

3) absence of heart sounds (heart sounds will disappear when systolic pressure < 50 mm Hg);

4) dilatation of the pupils.

PHASES OF CARDIOPULMONARY RESUSCITATION AND GOALS

Basic Life Support:

A -- Establishment of an **A**irway.

B -- **B**reathing support.

C -- **C**irculation support.

Advanced Life Support:

D -- **D**iagnosis and **D**rugs.

E -- **E**lectrocardiography.

F -- **F**ibrillation control.

Prolonged Life Support:

G -- **G**auging a patient's response.

H -- **H**opeful measures for the brain

I -- **I**ntensive care.

Remember the ABCs

Airway, Breathing and Circulation — to remember the steps explained below.

AIRWAY: Clear the airway

1. Put the person on his or her back on a firm surface.
2. Kneel next to the person's neck and shoulders.
3. Open the person's airway using the head tilt-chin lift. Put your palm on the person's forehead and gently push down. Then with the other hand, gently lift the chin forward to open the airway.
4. Check for normal breathing, taking no more than 10 seconds: Look for chest motion, listen for breath sounds, and feel for the person's breath on your cheek and ear. Do not consider gasping to be normal breathing. If the person isn't breathing normally or you aren't sure, begin mouth-to-mouth breathing.

BREATHING: Breathe for the person

Rescue breathing can be mouth-to-mouth breathing or mouth-to-nose breathing if the mouth is seriously injured or can't be opened.

1. With the airway open (using the head tilt-chin lift), pinch the nostrils shut for mouth-to-mouth breathing and cover the person's mouth with yours, making a seal.
2. Prepare to give two rescue breaths. 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 and then give the second breath.
3. Begin chest compressions — go to "CIRCULATION" below.

CIRCULATION: Restore blood circulation

1. Place the heel of one hand over the center of the person's chest, between the nipples. Place your other hand on top of the first hand. Keep your elbows straight and position your shoulders directly above your hands.
2. Use your upper body weight (not just your arms) as you push straight down on (compress) the chest 1 1/2 to 2 inches. Push hard and push fast — give two compressions per second, or about 100 compressions per minute.

3. After 30 compressions, tilt the head back and lift the chin up to open the airway. Prepare to give two rescue breaths. Pinch the nose shut and breathe into the mouth for one second. If the chest rises, give a second rescue breath. If the chest doesn't rise, repeat the head tilt-chin lift and then give the second rescue breath. That's one cycle. If someone else is available, ask that person to give two breaths after you do 30 compressions.

In 2005, new CPR guidelines were published by the International Resuscitation Councils, agreed at the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science. The primary goal of these changes was to simplify CPR for lay rescuers and healthcare providers alike, to maximise the potential for early resuscitation. The important changes for 2005 were:

- A universal compression-ventilation ratio (30:2) recommended for all single rescuers of infant (less than one year old), child (1 year old to puberty), and adult (puberty and above) victims (excluding newborns). The primary difference between the age groups is that with adults the rescuer uses two hands for the chest compressions, while with children it is only one, and with infants only two fingers (pointer and middle fingers). Whilst this simplification has been introduced, it has not been universally accepted, and especially amongst healthcare professionals, protocols may still vary.
- The removal of the emphasis on lay rescuers assessing for pulse or signs of circulation for an unresponsive adult victim, instead taking the absence of *normal* breathing as the key indicator for commencing CPR.
- The removal of the protocol in which lay rescuers provide rescue breathing without chest compressions for an adult victim, with all cases such as these being subject to CPR.

Death was once defined as the cessation of heartbeat (cardiac arrest) and of breathing, but the development of CPR and prompt defibrillation have rendered the previous definition inadequate because breathing and heartbeat can sometimes be restarted. This is now called "clinical death". Events which were causally linked to death in the past no longer kill in all circumstances; without a functioning heart or lungs, life can sometimes be sustained with a combination of life support devices, organ transplants and artificial pacemakers.

Today, where a definition of the moment of death is required, doctors and coroners usually turn to "brain death" or "biological death": People are considered dead when the electrical activity in their brain ceases (cf. persistent vegetative state). It is presumed that a stoppage of electrical activity indicates the end of consciousness. However, suspension of consciousness must be permanent, and not transient, as occurs during sleep, and especially a coma. In the case of sleep, EEGs can easily tell the difference. Identifying the moment of death is important in cases

of transplantation, as organs for transplant must be harvested as quickly as possible after the death of the body.
Those maintaining that only the neo-cortex of the brain is necessary for consciousness sometimes argue that only electrical activity there should be considered when defining death. Eventually it is possible that the criterion for death will be the permanent and irreversible loss of cognitive function, as evidenced by the death of the cerebral cortex. All hope of recovering human thought and personality is then gone. However, at present, in most places the more conservative definition of death — irreversible cessation of electrical activity in the whole brain, as opposed to just in the neo-cortex — has been adopted (for example the Uniform Determination Of Death Act in the United States). Even by whole-brain criteria, the determination of brain death can be complicated. EEGs can detect spurious electrical impulses, while certain drugs, hypoglycemia, hypoxia, or hypothermia can suppress or even stop brain activity on a temporary basis. Because of this, hospitals have protocols for determining brain death involving EEGs at widely separated intervals under defined conditions

V. Materials of activation of students
(questions, tasks, controversial situations, illustrative materials and other).

VI. Materials of selftraining of students on the topic of lecture: literature, questions, tasks.

Literature

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