

**PUBLIC HEALTH MINISTRY OF UKRAINE
UZHGOROD NATIONAL UNIVERSITY
MEDICAL FACULTY
ONCOLOGY DEPARTMENT**

ANAESTHESIOLOGY AND INTENSIVE CARE

Topic 1: ACUTE DISORDERS OF BLOOD CIRCULATION

Topic 2: SHOCK STATES AND TRAUMATIC INJURIES

Methodical instructions for 5 year medical student practical training

Uzhgorod - 2022

УДК 612.887(072)+616-085(072)

ББК 53.76я73+53.775я73

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Methodological guidelines approved:

Meeting at State University Department of Oncology

"Uzhgorod National University" protocol № 9 dated 21.04.2022,

at a meeting of the Academic Council of the Medical Faculty State

University "Uzhhorod National University" protocol № 7 dated

20.06.2022.

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ACUTE DISORDERS OF BLOOD CIRCULATION

Topic actuality.

The diseases of the blood circulation system occupy the first place among causes of death rate among adults both in Ukraine and in European countries and USA. So, ischemic heart disease is the most frequent cause of death in Europe - about 2 million persons die annually from it. Decompensation of this pathology manifested by acute disorders of blood circulation. They include an acute heart and vascular failure, which developed as a result of the protracted anoxaemia (hypoxia) of myocardium in relation with shocks. A world lead cause of acute cardiovascular insufficiency among adults is the myocardial infarction, attended with the decreasing of the cardiac output. The acute cardiovascular insufficiency is typical for myocarditises, arrhythmias, cardiac surgery, for overloads by volume or by pressure, for acute alteration of hemodynamics in new-born with congenital heart diseases, for acute valvular failure and others. Usually the cardiac diseases with heart failure are accompanied by vascular insufficiency . An onset of fainting or collapse is lead to the acute falling of blood pressure and heart work disturbances.

Prevalence of acute circulatory insufficiency syndrome at different diseases, severity of clinical picture with high-rate of fatal outcomes, requires from a doctor thorough theoretical knowledge and ability to use of modern examination methods and treatment regimens.

Teaching aims.

General purpose: be able to diagnose an acute disorders of hemodynamics, render the first aid and determine the tactic of acute cardiovascular failure patients management.

Concrete aims	Initial level of knowledge-abilities
Be able:	
1. To collect complaints, anamnesis, perform an objective examination for patients with acute disorders of hemodynamics.	1. To interpret complaints, features of anamnesis, data of objective examination for patients with blood circulation pathology, and breathing (of internal medicine propedeutics).
2. To diagnose a kind and leading syndrome of acute hemodynamics disorders on the basis of urgent clinical and instrumental examination, to render the first aid for the adults and children.	2. To interpret system relations macro-and microcirculation at norm and in pathological conditions (department of pathophysiology), to render a primary urgent help for adults and children (departments of internal medicine, surgery, paediatrics and child's infectious diseases).
3. To work out a plan of examination, interpret its results for acute heart failure patients .	3. To interpret the results of laboratory and instrumental examination of the breathing, blood circulation, and hemostasis systems for adults and children (departments of internal medicine propedeutics, paediatrics and child's infectious diseases).
4. To preliminary diagnose and define the tactic of acute heart failure intensive care.	4. To interpret the mechanism of action and indications for application of pharmacological agents, used for patients with cardiovascular diseases (department of pharmacology).

Theoretical questions.

1. Physiology and pathophysiology of blood circulation. System transport of oxygen as index of the cardiovascular function adequacy.
2. Mechanisms of acute circulation insufficiency development.
Determination of critical hemodynamics disorders types - a heart and vascular failure, hypovolemia.
3. Critical microcirculatory disturbances.
4. Causes of origin, clinical picture, and treatment of acute heart failure.
5. Causes of origin, clinical picture, diagnostics, and intensive care of cardiac rhythm disorders.
6. Age-related features of the cardiovascular system and mechanisms of development of critical hemodynamics disorders and their treatment.
7. Pathophysiology, diagnostics, course features and intensive care for fainting and collapse patie

Tasks for verification of concrete teaching aims achievement.

Task 1.

In the 36 years old patient, suffering from aortic valve disease, 2 hours ago the shortness of breath was increased suddenly, a cough is appeared with the admixture of blood in a sputum. Objectively: sits, skin covers are cyanotic. Breath rate is 30 per minute. Auscultation: in the bottom departments of lungs on either side mixed rales. BP is 150/70 mmHg. What kind of hemodynamics disorders does take place for this patient?

- A. Acute right ventricular failure
- B. Acute left ventricular failure

- C. Acute mixed ventricular failure
- D. Chronic heart failure
- E. Acute insufficiency of blood circulation

Task 2.

A 60 years old patient, is suffering from rheumatism, after physical loading suddenly marked sense of shortage of air, retrosternal pain, dry cough. At examination: acrocyanosis, death-damp, breath rate is 32 per minute. Auscultation: there are harsh breathing, and in bottom departments moist small bubbling rales. Heart tones are dulls, unrhythmical, there is accent of 2 tone under pulmonary artery. BP is 140/90 mmHg. HR is 100 per minute. On the basis of what sign for a patient is it possible to suspect an interstitial pulmonary edema?

- A. Shortness of breath
- B. A picture of lungs auscultation
- C. Arrhythmia
- D. Dry cough
- E. Increase of BP

Task 3.

A 40 years old patient is delivered to the clinic in confused state. BP is 80/40 mmHg, HR is 120/min, skin is pale, marble, a test of white spot is 3 secs. Urges to urination are not present. The indexes of central hemodynamics are measured. A Systolic Index is $2L/(min \cdot m^2)$, Pulmonary capillary wedge pressure is 4 mmHg., total peripheral resistance is $2000 \text{ dyn/s} \cdot \text{cm}^2$. What first aid is indicated to the patient?

- A. Strophanthin intravenously

- B. Dexamethasone intravenously
- C. Norepinephrine intravenously
- D. Heparin intravenously
- E. Infusion therapy

Task 4

Ambulance doctor examined a 56 years old female patient and suspected for her the extensive transmural myocardial infarction. Bp is 60/20 mmHg. On ECG is paroxysmal ventricular extrasystole. What is the most effective combination of drugs for the first aid?

- A. Lidocaine and panangin
- B. Procainamide and dopamine
- C. Digoxin and prednisolone
- D. Izoptin and polarizing mixture
- E Izoptin and phenylephrine

Task 5.

To the clinic a 70 years old patient is delivered, with complaints about retrosternal pains. When they began finding out is impossible because of inadequate consciousness for a patient. Skin covers are moist, marble and cyanotic. Breath rate 28/min. BP is 80/40 mmHg. Auscultation: in the bottom departments of lungs mixed rales. At determination of haemodynamic profile the cardiac output is decreased, and pulmonary capillary wedge pressure and total peripheral resistance are rose. What additional research does this patient need for forming of treatment plan?

- A. Chest X-ray

- B. Determination of arterial blood gases
- C. Echocardiography
- D. Level of blood nitrogenous waste products
- E. Troponin test

Task 6.

In 68 years old female patient with viral A hepatitis bradyarrhythmia developed suddenly with HR of 45/min. She is complain about palpitation, air shortage sense, dizziness, numbness of extremities. After examination and determining of unfavorable signs a doctor administrate to the patient an atropine in a dose of 500 mcg. What from the signs listed below was the cause of this patient atropine injection?

- A. Systolic BP less than 90 mmHg
- B. HR is 45/min
- C. Presence of air shortage sense
- D. Presence of atrial extrasystoles
- E. Basic pathology

Task 7.

In 70 years old patient, which suffering from mitral valvular disease, heart failure is developed. On a monitor tachyarrhythmia is suddenly fixed with HR is 150/min. Objectively: consciousness at the level of confusion. BP is 80/50 mmHg. Auscultation: in middle and bottom departments of lungs there are the mass of moist rales . What first aid must be rendered to the patient?

- A. Synchronized cardioversion
- B. Infusion of verapamil

- C. Intravenous injection of magnesium sulfate
- D. Intravenous injection of adenosine
- E. Infusion of digoxin

Task 8.

In 63 years old patient with postinfarction cardiosclerosis the attack of palpitation was onset, and then there was a loss of consciousness. State is severe, a pulse is not determined, BP is 70/40 mmHg, on ECG: HR is 200/min, QRS complex is deformed, extended is a more than 0,14 sec. What is the patient management tactic?

- A. Lidocaine 120 mgs intravenously
- B. Cordarone 300 mgs intravenously
- C. Cardioversion
- D. Phenylephrine 2 ml intravenously
- E. Dopamine 400 mgs intravenously

Task 9.

For a 28 years old patient the mitral stenosis is diagnosed. Which is the most early signs of this disease?

- A. cardiac asthma attacks
- B. Attacks of paroxysmal tachycardia
- C. Hypertension stroke
- D. Transient disorders of cerebral blood circulation
- E. Extrasystole

Task 10.

A 45 years old patient is delivered to a clinic with complaints about squeezing retrosternal pains, shortness of breath, which were developing 1 hour ago. Objectively: skin is moist, in bottom departments of lungs there are moist rales. BP is 120/70 mmHg, pulse 92 per minute. On the electrocardiogram there are elevation of ST segment in I, II, aVL, V2 -4 - leads, depression of ST in III, and aVF. What first aid does need to the patient?

- A. Baralginum
- B. Streptokinase
- C. Atropine
- D. Digoxin
- E. Aminophylline

Standards of right answers.

Task 1. B. Task 2. B. Task 3. E. Task 4. A. Task 5. C.

Task 6. A. Task 7. A. Task 8. C. Task 9. A. Task 10. B.

Short methodical instructions for practical study work.

At the beginning of study students pass control of initial level of knowledge-abilities by means of test tasks. Students in the intensive care unit examine patients with critical disorders of hemodynamics, on the basis of clinical, laboratory and additional findings determine the clinical variant of acute disorders of hemodynamics, work off skill of central venous pressure measurement, estimate data of the patients monitoring,

and determine the urgent measures for hemodynamics correction. Make the plans of examination, preliminary diagnose and determine the patients medical treatment management. In default of thematic patients analyse the copies of hospital charts, situatioonal tasks decide. Students patient examination and answers of students controlled by a teacher.

In an educational room students together with a teacher discuss the results of examination, and students mistakes. Then the students pass test control. In the end worked out the students get the marks for study work.

Recommended literature

1. Bryan E. Bledsoe, Dwayne E. Clayden Prehospital Emergency Pharmacology (7th Edition). - Prentice Hall, 2011. - 560 p.
2. Mary Fran Hazinski , Ricardo, M.D. Samson , Steve, M.D. Schexnayder Handbook of Emergency Cardiovascular Care For Healthcare Providers 2010 (AHA Handbook of Emergency Cardiovascular Care). – AHA, 2010. – 212 p.
3. Gail Walraven Basic Arrhythmias (7th Edition). - Prentice Hall, 2010. - 640 p.

SHOCK STATES AND TRAUMATIC INJURIES

Topic actuality.

Acute blood circulation insufficiency is the severe complication of different pathological processes and one of the most frequent cause of the intensive care patients lethality. It is a process of hypoperfusion, inadequate oxygenation and tissue hypoxia as a result of the system and microvascular hemodynamics disorders. Thus the individual features of one or another shock type etiology practically are pushed to the sidelines. As all processes of organism vital functions are power-hungry, and a hypoxia rapid reduces an ATP synthesis , during shock the orientation of metabolic reactions changes and the cellular energy production sharply go down, that results in cell death.

The basic cause of hypovolemic shock are bleeding and losses of plasm. Traumatic shock is combination of acute hypovolemia, resulting in disorders of perfusion and tissue hypoxia, pathological impulses from the site of injury and intoxication due to joining of infection. The same picture is present the burn shock. However due to the considerably greater area of damage and it infecting, early respiratory damage because of combustion products breathing, this pathology prognosis gets worse considerably. Prevalence of sepsis and septic shock is conditioned by the low human organism resistibility by virtue of social, technological and ecological reasons, some lag of existent antibacterial therapy from speed of microorganisms transformation. The frequency growth of most rapid developing anaphylactic shocks, is related to strengthening of human allergization and increase of potential allergens amount among the

everyday application objects. Head traumas, polytraumas, crush syndrome can occur in industry, building, sport, especially extreme, transport as accidents and work accidents. An electric injuries current is possibly at any contact with electric equipment and accident prevention rules violation or their ignorance, especially for children. The doctor of any speciality must own skills of diagnostics and providing of the adequate first aid at these critical conditions, because exactly it provides the patient life rescue.

Teaching aims.

General purpose: able to diagnose the shock states, severe head trauma, polytrauma, crush syndrome, electrical trauma, render the first aid and determine the tactic of patients management with the different types of shock (hemorrhagic, traumatic, burn, anaphylactic, and septic), severe head trauma, polytrauma, crush syndrome, electrical trauma.

Concrete aims	Initial level of knowledge-abilities
To be able:	
1. To collect complaints, anamnesis, perform an objective patients examination and recognize the shock syndrome.	1. To interpret complaints, features of anamnesis, data of objective research for patients with blood circulation, breathing, and releasing pathology (department of internal medicine propedeutics).
2. To classify and differentiate the different types of shock on the basis of urgent clinical and instrumental examination, render the first aid.	2. To interpret system relations macro-and microcirculations in norm and in pathological states (department of pathophysiology), to interpret pathogenesis of shock (department of pathophysiology), render a primary

	emergency for the internal diseases, complicated by the urgent state (department of internal medicine, surgery).
3. To work out a plan of examination, interpret its results for patients with the different types of shock.	3. To interpret the results of laboratory and instrumental examination for breathing, blood circulation, hemostasis, releasing systems (department of internal medicine propedeutics), results of microbiological research (department of microbiology, virology and epidemiology).
4. To preliminarily diagnose and define the tactics of intensive care for different types of shock.	4. To interpret the mechanism of action and indication for application of pharmacological agents, used for patients with the cardiovascular system diseases (department of pharmacology).
5. To define the features of course and intensive care for severe head trauma, polytrauma, crush syndrome, and electrically injured patients.	5. To interpret the mechanisms of head trauma, electrical injuries, polytrauma, and crush syndrome development (department of pathophysiology).

Shock (circulatory)

Circulatory shock, commonly known as shock, is a life-threatening medical condition of low blood perfusion to tissues resulting in inadequate tissue function.

The typical signs of shock are low blood pressure, a rapid heartbeat and signs of poor end-organ perfusion or "decompensation/peripheral shut

down" (such as low urine output, confusion or loss of consciousness). There are times that a person's blood pressure may remain stable, but may still be in circulatory shock, so it is not always a reliable sign. The shock index (SI), defined as heart rate divided by systolic blood pressure, is a more accurate measure of shock than hypotension and tachycardia in isolation.

Circulatory shock is not related to the emotional state of shock. Circulatory shock is a life-threatening medical emergency and one of the most common causes of death for critically ill people. Shock can have a variety of effects, all with similar outcomes, but all relate to a problem with the body's circulatory system. For example, shock may lead to hypoxemia (a lack of oxygen in arterial blood) or cardiac and/or respiratory arrest.

One of the key dangers of shock is that it progresses by a positive feedback mechanism. Once shock begins, it tends to make itself worse, so immediate treatment of shock is critical to the survival of the sufferer.

Signs and symptoms

The presentation of shock is variable with some people having only minimal symptoms such as confusion and weakness. While the general signs for all types of shock are low blood pressure, decreased urine output, and confusion, these may not always be present. While a fast heart rate is common, those on β -blockers, those who are athletic and in 30% of cases those with shock due to intra abdominal bleeding may have a normal or slow heart rate. Specific subtypes of shock may have additional symptoms.

1. Hypovolemic

Hemorrhage classes			
Class	Blood loss	Response	Treatment
I	<15 % (0,75 l)	min. fast heart rate, normal blood pressure	minimal
II	15-30 % (0,75-1,5 l)	fast heart rate, min. low blood pressure	intravenous fluids
III	30-40 % (1,5-2 l)	very fast heart rate, low blood pressure, confusion	fluids and packed RBCs
IV	>40 % (>2 l)	critical blood pressure and heart rate	aggressive interventions

Hypovolemia is a direct loss of effective circulating blood volume leading to:

A rapid, weak, thready pulse due to decreased blood flow combined with tachycardia

Cool, clammy skin due to vasoconstriction and stimulation of vasoconstriction

Rapid and shallow breathing due to sympathetic nervous system stimulation and acidosis

Hypothermia due to decreased perfusion and evaporation of sweat

Thirst and dry mouth, due to fluid depletion

Cold and mottled skin (Livedo reticularis), especially extremities, due to insufficient perfusion of the skin

The severity of hemorrhagic shock can be graded on a 1-4 scale on the physical signs. This approximates to the effective loss of blood volume.

The shock index (heart rate divided by systolic blood pressure) is a stronger predictor of the impact of blood loss than heart rate and blood pressure alone. This relationship has not been well established in pregnancy-related bleeding.

2. Cardiogenic

Symptoms of cardiogenic shock include:

Distended jugular veins due to increased jugular venous pressure

Weak or absent pulse

Arrhythmia, often tachycardia

Pulsus paradoxus in case of tamponade

3. Distributive

Systemic inflammatory response syndrome	
Finding	Value
Temperature	<36 °C (96.8 °F) or >38 °C (100.4 °F)
Heart rate	>90/min
Respiratory rate	>20/min or PaCO ₂ <32 mmHg (4.3 kPa)
WBC	<4x10 ⁹ /L (<4000/mm ³), >12x10 ⁹ /L (>12,000/mm ³), or 10% bands

Distributive shock includes infectious, anaphylactic, endocrine and neurogenic causes. The SIRS features typically occur in early septic shock.

4. Septic shock

Systemic leukocyte adhesion to endothelial tissue

Reduced contractility of the heart

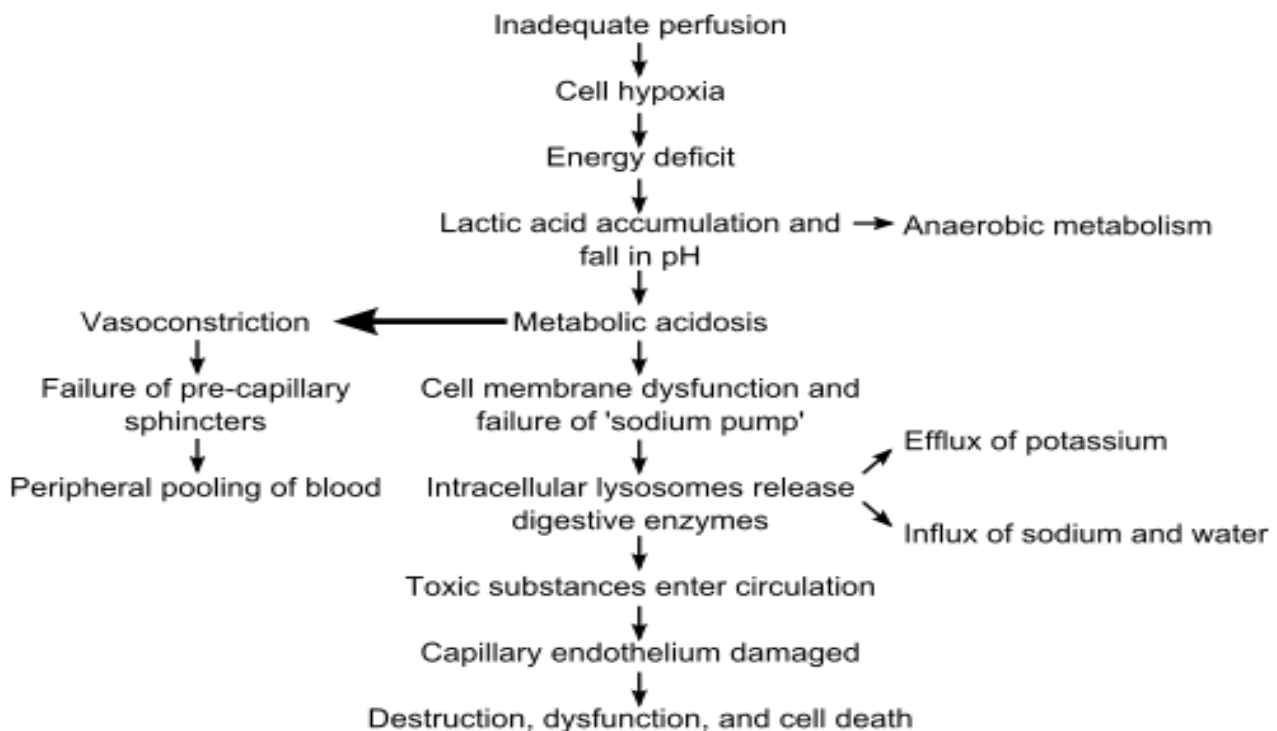
Activation of the coagulation pathways, resulting in disseminated intravascular coagulation

Increased levels of neutrophils

Main manifestations are produced due to massive release of histamine which causes intense vasodilation.

Pathophysiology

Effects of inadequate perfusion on cell function.



There are four stages of shock. As it is a complex and continuous condition there is no sudden transition from one stage to the next. At a cellular level shock is the process of oxygen demand becoming greater than oxygen supply.

Initial

During this stage, the state of hypoperfusion causes hypoxia. Due to the lack of oxygen, the cells perform lactic acid fermentation. Since oxygen, the terminal electron acceptor in the electron transport chain is not abundant, this slows down entry of pyruvate into the Krebs cycle, resulting in its accumulation. Accumulating pyruvate is converted to lactate by

lactate dehydrogenase and hence lactate accumulates (causing lactic acidosis).

Compensatory

This stage is characterised by the body employing physiological mechanisms, including neural, hormonal and bio-chemical mechanisms in an attempt to reverse the condition. As a result of the acidosis, the person will begin to hyperventilate in order to rid the body of carbon dioxide (CO₂). CO₂ indirectly acts to acidify the blood and by removing it the body is attempting to raise the pH of the blood. The baroreceptors in the arteries detect the resulting hypotension, and cause the release of epinephrine and norepinephrine. Norepinephrine causes predominately vasoconstriction with a mild increase in heart rate, whereas epinephrine predominately causes an increase in heart rate with a small effect on the vascular tone; the combined effect results in an increase in blood pressure. Renin-angiotensin axis is activated and arginine vasopressin (Anti-diuretic hormone; ADH) is released to conserve fluid via the kidneys. These hormones cause the vasoconstriction of the kidneys, gastrointestinal tract, and other organs to divert blood to the heart, lungs and brain. The lack of blood to the renal system causes the characteristic low urine production. However the effects of the Renin-angiotensin axis take time and are of little importance to the immediate homeostatic mediation of shock.

Progressive

Should the cause of the crisis not be successfully treated, the shock will proceed to the progressive stage and the compensatory mechanisms begin to fail. Due to the decreased perfusion of the cells, sodium ions build up within while potassium ions leak out. As anaerobic metabolism

continues, increasing the body's metabolic acidosis, the arteriolar smooth muscle and precapillary sphincters relax such that blood remains in the capillaries. Due to this, the hydrostatic pressure will increase and, combined with histamine release, this will lead to leakage of fluid and protein into the surrounding tissues. As this fluid is lost, the blood concentration and viscosity increase, causing sludging of the micro-circulation. The prolonged vasoconstriction will also cause the vital organs to be compromised due to reduced perfusion. If the bowel becomes sufficiently ischemic, bacteria may enter the blood stream, resulting in the increased complication of endotoxic shock.

Refractory

At this stage, the vital organs have failed and the shock can no longer be reversed. Brain damage and cell death are occurring, and death will occur imminently. One of the primary reasons that shock is irreversible at this point is that much cellular ATP has been degraded into adenosine in the absence of oxygen as an electron receptor in the mitochondrial matrix. Adenosine easily perfuses out of cellular membranes into extracellular fluid, furthering capillary vasodilation, and then is transformed into uric acid. Because cells can only produce adenosine at a rate of about 2% of the cell's total need per hour, even restoring oxygen is futile at this point because there is no adenosine to phosphorylate into ATP.

Diagnosis

The first changes seen in shock is an increased cardiac output followed by a decrease in mixed venous oxygen saturation (S_{mvO_2}) as measured in the pulmonary artery via a pulmonary artery catheter. Central venous oxygen saturation (S_{cvO_2}) as measured via a central line correlates

well with $SmvO_2$ and are easier to acquire. If shock progresses anaerobic metabolism will begin to occur with an increased blood lactic acid as the result. While many laboratory tests are typically performed there is no test that either makes or excludes the diagnosis. A chest X-ray or emergency department ultrasound may be useful to determine volume state.

Differential diagnosis

Shock is a common end point of many medical conditions. It has been divided into four main types based on the underlying cause: hypovolemic, distributive, cardiogenic and obstructive. A few additional classifications are occasionally used including: endocrinologic shock.

Hypovolemic

Hypovolemic shock is the most common type of shock and is caused by insufficient circulating volume. Its primary cause is hemorrhage (internal and/or external), or loss of fluid from the circulation. Vomiting and diarrhea are the most common cause in children. With other causes including burns, environmental exposure and excess urine loss due to diabetic ketoacidosis and diabetes insipidus.

Cardiogenic

Cardiogenic shock is caused by the failure of the heart to pump effectively. This can be due to damage to the heart muscle, most often from a large myocardial infarction. Other causes of cardiogenic shock include dysrhythmias, cardiomyopathy/myocarditis, congestive heart failure (CHF), contusio cordis, or cardiac valve problems.

Obstructive

Obstructive shock is due to obstruction of blood flow outside of the heart. Several conditions can result in this form of shock.

Cardiac tamponade in which fluid in the pericardium prevents inflow of blood into the heart (venous return). Constrictive pericarditis, in which the pericardium shrinks and hardens, is similar in presentation.

Tension pneumothorax Through increased intrathoracic pressure, bloodflow to the heart is prevented (venous return).

Pulmonary embolism is the result of a thromboembolic incident in the blood vessels of the lungs and hinders the return of blood to the heart.

Aortic stenosis hinders circulation by obstructing the ventricular outflow tract

Distributive

Distributive shock is due to impaired utilization of oxygen and thus production of energy by the cell. Examples of this form of shock are:

Septic shock is the most common cause of distributive shock. Caused by an overwhelming systemic infection resulting in vasodilation leading to hypotension. Septic shock can be caused by Gram negative bacteria such as (among others) *Escherichia coli*, *Proteus* species, *Klebsiella pneumoniae* which release an endotoxin which produces adverse biochemical, immunological and occasionally neurological effects which are harmful to the body, and other Gram-positive cocci, such as pneumococci and streptococci, and certain fungi as well as Gram-positive bacterial toxins. Septic shock also includes some elements of cardiogenic shock. In 1992, the ACCP/SCCM Consensus Conference Committee defined septic shock: ". . .sepsis-induced hypotension (systolic blood pressure < 90 mmHg or a reduction of 40 mmHg from baseline) despite

adequate fluid resuscitation along with the presence of perfusion abnormalities that may include, but are not limited to, lactic acidosis, oliguria, or an acute alteration in mental status. Patients who are receiving inotropic or vasopressor agents may have a normalized blood pressure at the time that perfusion abnormalities are identified.

Anaphylactic shock Caused by a severe anaphylactic reaction to an allergen, antigen, drug or foreign protein causing the release of histamine which causes widespread vasodilation, leading to hypotension and increased capillary permeability.

High spinal injuries may cause neurogenic shock. The classic symptoms include a slow heartrate due to loss of cardiac sympathetic tone and warm skin due to dilation of the peripheral blood vessels. (This term can be confused with spinal shock which is a recoverable loss of function of the spinal cord after injury and does not refer to the haemodynamic instability per se.)

Endocrine

Based on endocrine disturbances such as:

Hypothyroidism (Can be considered a form of Cardiogenic shock) in critically ill patients, reduces cardiac output and can lead to hypotension and respiratory insufficiency.

Thyrotoxicosis (Cardiogenic shock)
may induce a reversible cardiomyopathy.

Acute adrenal insufficiency (Distributive shock) is frequently the result of discontinuing corticosteroid treatment without tapering the dosage. However, surgery and intercurrent disease in patients on

corticosteroid therapy without adjusting the dosage to accommodate for increased requirements may also result in this condition.

Relative adrenal insufficiency (Distributive shock) in critically ill patients where present hormone levels are insufficient to meet the higher demands

Management

The best evidence exists for the treatment of septic shock in adults and as the pathophysiology appears similar in children and other types of shock treatment this has been extrapolated to these areas. Management may include securing the airway via intubation if necessary to decrease the work of breathing and for guarding against respiratory arrest. Oxygen supplementation, intravenous fluids, passive leg raising (not Trendelenburg position) should be started and blood transfusions added if blood loss is severe. It is important to keep the person warm as well as adequately manage pain and anxiety as these can increase oxygen consumption.

Fluids

Aggressive intravenous fluids are recommended in most types of shock (e.g. 1-2 liter normal saline bolus over 10 minutes or 20ml/kg in a child) which is usually instituted as the person is being further evaluated. Which intravenous fluid is superior, colloids or crystalloids, remains undetermined. Thus as crystalloids are less expensive they are recommended. If the person remains in shock after initial resuscitation packed red blood cells should be administered to keep the hemoglobin greater than 100 gms/l.

For those with hemorrhagic shock the current evidence supports limiting the use of fluids for penetrating thorax and abdominal injuries allowing mild hypotension to persist (known as permissive hypotension). Targets include a mean arterial pressure of 60 mmHg, a systolic blood pressure of 70-90 mmHg, or until their adequate mentation and peripheral pulses.

Medications

Vasopressors may be used if blood pressure does not improve with fluids. There is no evidence of superiority of one vasopressor over another. Vasopressors have not been found to improve outcomes when used for hemorrhagic shock from trauma but may be of use in neurogenic shock. Activated protein C (Xigris) while once aggressively promoted for the management of septic shock has been found not to improve survival and is associated with a number of complications.] The use of sodium bicarbonate is controversial as it has not been shown to improve outcomes. If used at all it should only be considered if the pH is less than 7.0.

Treatment goals

The goal of treatment is to achieve a urine output of greater than 0.5 ml/kg/h, a central venous pressure of 8-12 mmHg and a mean arterial pressure of 65-95 mmHg. In trauma the goal is to stop the bleeding which in many cases requires surgical interventions.

Epidemiology

Hemorrhagic shock occurs in about 1-2% of trauma cases] and affects about 1/3 patients in the intensive care unit (ICU).

Prognosis

The prognosis of shock depends on the underlying cause and the nature and extent of concurrent problems. Hypovolemic, anaphylactic and neurogenic shock are readily treatable and respond well to medical therapy. Septic shock however, is a grave condition with a mortality rate between 30% and 50%. The prognosis of cardiogenic shock is even worse.

Theoretical questions.

1. Definition of shock, its types.
2. Pathophysiology, diagnostics, features of course, and intensive care of hemorrhagic shock patients.
3. Pathophysiology, diagnostics, features of course, and intensive care for traumatic shock patients.
4. Pathophysiology, diagnostics, features of course, and intensive care at burn shock patients.
5. Pathophysiology, diagnostics, features of course, and intensive care for anaphylactic shock patients.
6. Pathophysiology, diagnostics, features of course, and intensive care for septic shock patients.
7. Features of transfusion therapy for different types of shock, description of preparations for infusion.
8. Pathophysiology, diagnostics, features of course, intensive care and complications preventing methods for severe head trauma, polytrauma, and crush syndrome patients.
9. Pathophysiology, diagnostics, features of course, intensive care and complications preventing methods for electrical trauma patients.

Tasks for verification of concrete teaching aims achievement.

Task 1.

The 42 years old patient with gastric ulcer disease had up to the 2 litres of coffee-grounds vomiting There is melena, near one litre. Objectively: skin is cold, and pale, temperature gradient is 4 oC, BP is 80/40 mm Hg, HR is 132 beats per minute, breath rate is 24 per minute. What from objective examination data does indicate to the presence of shock?

- A. Arterial low blood pressure
- B. Tachycardia
- C. Temperature gradient
- D. Shortness of breath
- E. Pallor of skin

Task 2.

A 26 years old patient within a week was treated oneself ambulatory on the subject of acute respiratory viral infection. About 2 hours ago the body temperature elevated up to 39,8oC there is chill occur, there was the single vomiting, whereupon she not afforded to move oneself. At examination: consciousness is confused. Skin covers are pale, surplus moist. Breath rate is 28 per minute, BP is 80/60 mmHg, pulse is 112 beats per minute. An abdomen is not swollen, soft, mildly sensible in an epigastrium. Before worsening urinated usually, but during examination urine output is 8-10 drops per minute. On the basis of what clinical picture sign is it possible to suspect for this patient shock syndrome?

- A.Pallor of skin

- B. Humidity of skin
- C. Disorders of consciousness
- D. Decline of diuresis
- E. Vomiting

Task 3.

The 32 years old patient admitted to the hospital with a diagnosis of traumatic amputation of right shin at the level of the middle third, and III degree traumatic shock. Objectively: a victim is confused, pale, BP is 60/20 mmHg HR is 145 per minute, breathing frequent, superficial. 20 min ago a tourniquet was applied on the thigh just over knee joint, bleeding is absent. A duty doctor is beginning infusion resuscitation. What is the primary purpose of infusion therapy in this case?

- A. Correction of blood volume circulation
- B. Qualitative structure of circulatory blood restore
- C. Restore of electrolyte balance
- D. Decreasing of coagulation function
- E. Increasing of coagulation function

Task 4.

A 45 years old patient is delivered in a clinic with complaints about dizziness, weakness, hives which appeared in 15 minutes after the honey intake. According to a wife, which working as trained nurse, there was a brief loss of consciousness. BP is not determined. After providing of the first aid the state became better, delivered in a clinic. What was the first aid to this patient?

- A. Intravenous injection of dopamine
- B. Intravenous injection of epinephrine
- C. Intravenous injection of vitamin C
- D. Desensitizing drug oral
- E. Calcium gluconate oral

Task 5.

A 60 years old patient is delivered in a clinic escorted by a wife in the put on the brakes state. According to a wife, 2 hours ago during standing up from a bed he became unconsciousness. The admission department doctor suspected about shock. What from the listed below will allow to estimate tissue oxygenation most adequately?

- A. Determination of arterial saturation
- B. Determination of the mixed venous saturation
- C. Echocardiography
- D. Concentration of haemoglobin
- E. Peripheral blood hematocrit

Task 6.

In a 16 years old patient after unsuccessful piercing a phlegmon of abdominal wall developed. The state became worse 3 hours ago, when a patient became languid, reject from ingestion, and monosyllabically answered to the questions. In the moment of examination there is a chill, skin covers are dry and pale, the body temperature is 37,9oC. Breath rate is 28 per minute, BP is 100/60 mmHg, pulse is 108 beats per minute. Urine

output is 10-12 drops per minute. What laboratory findings will confirm the considerable worsening of patient tissue perfusion?

- A. A serum creatinine concentration
- B. A serum urinary acid concentration
- C. A serum lactic acid concentration
- D. Acidity (pH) of urine
- E. Urine density

Task 7.

In a 6 months old child on a background profuse diarrhea there were the hoarseness, dryness of mucous membranes and tongue, mottled and cold extremities, decline of diuresis, sharp features, fever, and arterial hypotension. Delivered in a clinic. What preparation is it needed to begin infusion therapy?

- A. 10% solution of sodium chloride
- B. 10% solution of glucose
- C. 5% solution of glucose
- D. Rheopolyglucinum
- E. Ringer – Locke solution

Task 8.

For a patient with severe sepsis and septic shock after infusion resuscitation is rapidly attained to central venous pressure of 120 mmHg, but BP remains low up to 90/40 mmHg, HR is 100 beats per minute. A

patient does not have bleeding signs, adequate support of breathing is performed. For BP stabilization a doctor supposes to apply adrenomimetic drug with the combined vasopressor and inotropic action. What preparation is it necessary to choose in this case?

- A. Phenylephrine
- B. Norepinephrine
- C. Levosimendan
- D. Dopamine
- E. Dobutamine

Task 9.

A 48 years old patient is delivered to the hospital after electrical injury. In the moment of contact with wires there were the tonic convulsion and brief loss of consciousness. After 3 minutes of electrical current chain breaking the victim consciousness was restored. BP is 130/90 mmHg, HR is 100 per minute, heart rhythm is correct. Breath rate is 22 per minute. What is the degree of this patient electric injury? A. 1 B. 2 C. 3 D. 4 E. -

Task 10.

For a 28 years old patient, which state at the ICU on the subject of severe head trauma, and cerebral contusion, with coma level of 2 degree, the complex intensive care is performing. What measure from listed below is indicated to this patient with the purpose of intracranial hypertension correction?

- A. Moderate hypoventilation

- B. Use ketamine sedation
- C. Raising of head end of bed on 20-30°
- D. Complete parenteral nutrition
- E. Use of nootropics

Standards of right answers.

Task 1. C. Task 2. D. Task 3. A. Task 4. B. Task 5. B.
Task 6. C. Task 7. E. Task 8. Task 9. B. Task 10. C.

Short methodical instruction for practical study work.

At the beginning of the study the students pass control of initial level of knowledge-abilities by means of test tasks. Students in the intensive care department examine patients with different kinds of shock, on the basis of clinical and present laboratory and additional methods of examination, determine a kind and severity degree of acute blood circulation failure, estimate the patients monitoring data, determine the urgent measures of hemodynamics correction. Make and ground the plans of examination, preliminary diagnose, form the scheme of intensive care, and prophylaxis of complications. In default of thematic patients students analyse the copies of hospital charts, situational tasks decide, including. on diagnostics, clinical picture, intensive care, prophylaxis of complications for head trauma, polytrauma, crush syndrome, and electrical trauma patients. Examination of patients and students answers controlled by a teacher.

In an educational room students together with a teacher discuss the results of examination, and students mistakes. After it students pass test control. In the end worked out students get the mark of the study work.

Information sources.

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