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Review of techniques for monitoring patient vital signs used by intensive care nurses - part two

Grzegorz Ulenberg[1] Agata Ulenberg[2], Łukasz Czapiewski[1]
Marzena Humańska[2] Wojciech Kaczmarek[3]

[1]Cathedral treatment of Nursing, Department of Nursing in Intensive Care Medicine, Medical College Bydgoszcz, Nicolaus Copernicus University in Torun, Poland
[2]Laboratory of Clinical Skills and Fundamentals of Medical Simulation Medical College Bydgoszcz, Nicolaus Copernicus University in Torun, Poland
[3]Centre of Medical Simulation, Medical College Bydgoszcz, Nicolaus Copernicus University in Torun, Poland

Summary

The work consists of three parts, which discusses such matters relating to the functioning of the cardiovascular, respiratory and central nervous system. A nurse is a person who is directly involved in the conduct, measures and draws attention to possible complications, since it is she is the person who spends the most time at the bedside.

Development of medical science involves the construction of specialized medical equipment ever more perfect, more expensive, more complicated to build and operate, requiring more and more qualifications treatment team.

Keywords: monitoring of vital signs, nursing, intensive care

Admission

The purpose of conducting monitoring of vital functions is the early recognition of potential physiological imbalances and take urgent treatment. Supervision should be properly targeted and systematic, and the results must be reliable and accurate, because they are the basis for therapeutic intervention. The success of monitoring depends largely on the nursing staff. The nurse's role is enormous and requires a large resource of expertise and skills of its practical application, since it is the nursing staff spends the most time with the patient and the first notes any changes in the patient's condition.

Monitoring central venous pressure

The central venous pressure is defined as the pressure in the superior vena cava 2 cm above the right atrium. This is not affected by cardiac function, respiratory system, blood volume, skeletal muscle contraction (especially of the abdomen and lower limbs), sympathetic tensions, gravitational forces and changes in body position. Having a vein is much more susceptible to stretching than blood. There is a significant CVP dynamics for a given patient. Valid values in the range 1-10 mm Hg (4-12 cmH2O). CVP is the filling pressure of the right ventricle. Evidence of filling, size of venous return with normal cardiac contractility and provides indirect information about possible left ventricular failure (if you rule out heart failure). It does not reflect the absolute amount of circulating blood. Although the cause of low CVP is the most hypovolemia. The increase in central venous pressure can be carried out in addition to the absence of the above-mentioned left hypervolaemia chamber, pulmonary embolism, obstruction of the superior vena cava and tamponade heart [18]. Determination of the central venous pressure meter can be made with a water or electronic method using a central venous catheter. For an optimal catheter system, there are those in which the apex is located in the front of the mouth on the superior vena cava to the right atrium [11]. You can achieve this through an intravenous cannula and veins of a larger caliber: the head and basilic, internal and external cervical, subclavian, femoral and saphenous arteries. During the measurement, the patient must be placed flat on the back. The CVP kit is sterile and consists of the following elements: drain connection of the center line in the measuring scale drainage set, filler drain connection set to fill the measuring system, three-way isolating valve [1]. Gauge zero point set in the middle of the chest (right atrium). The manometer must be completely filled with infusion fluid and connected to the infusion system via a three-way valve, then open the three-way valve towards the patient and shut off the flow of the infusion fluid. the water column slowly begins to fall to the level of the venous pressure of the subject. It should be remembered that during the examination of venous pressure it is different: it decreases during inspiration, when the patient breathes alone and increases the use of a substitute breath. After measurement, set the three-way valve so that the connection with the measuring system is closed. Drain set drip connection fill the measuring system, three-way tap [1].

The measurement method ensures continuous electronic monitoring of this parameter, the pressure curve is displayed on the monitor. Preparing a measurement procedure that is designed to measure blood pressure using invasive responds. During calibration, the digital display indicates 30 mm Hg, and during the measurement, the display shows the average venous pressure. The pressure curve consists of three positive waves A, C, V, and two negative waves x and y. A wave is caused by contraction of the right atrium and there is no atrial fibrillation. High pulmonary hypertension and a huge nodal rhythm and arrhythmia of ventricular-cortical blocks appear.

The C wave is generated at the beginning of the right ventricular spasm (tricuspid valve protrusion) and the X wave in the subsequent relaxation of the atrial chambers and contraction. V phase filling the right atrium after tricuspid valve closure, and y is the reflection of the blood flow to the ventricle [9,12,16].

In patients with a diagnosed central venous catheter, it is extremely important to take care of the injection site. Often an infection, especially when the catheter is introduced through peripheral veins. Daily disinfection of the injection site, change of banding, infusion, administration of a connecting drug and measure central venous pressure should be done with aseptic.

Monitoring of wedge pressure in the pulmonary artery

The measurement of pulmonary artery pressure (PAP) is a hemodynamic monitoring parameters using the Swan-Ganz catheter. Standard catheter has a length of 110 cm and an outer diameter of approx. 2.3 mm. Swan-Ganz catheter is inserted through the subclavian vein or internal jugular vein. Immediately prior to introduction of the catheter into the vessel, its peripheral end connects to a pressure transducer and monitor. The introduction of a Swan-Ganz catheter in the pulmonary artery can measure systolic, diastolic and mean pulmonary artery wedge pressure and pulmonary artery correlate with the pressure of the left atrium. It also enables the measurement of cardiac output by thermodilution, calculation operation right and left ventricle of the heart and peripheral vascular resistance, and pulmonary vascular resistance. [2.6.]

For the indication of cardiac be the value of left ventricular ejection fraction less than 3540%, myocardial infarction, complex operations on the thoracic aorta and abdominal operation of the heart valves and cardiac surgery emergency treatment. Specially adapted Swan-Ganz catheter also enables the stimulation of the atria and / or ventricles and oznacz111enie mixed venous oxygen saturation. [2]

Placing a Swan-Ganz catheter in the pulmonary artery is encumbered with a large number of complications, which include:

- Heart arythmia
- burst pulmonary artery
- attack the lungs and bursting balloon flotation
- pneumotorax
- thrombosis vessels
- looping of the catheter within the vessel
- the occurrence of infectious complications.

For this reason, the main indication for the introduction of a Kaplan:

- left ventricular failure with low ejection fraction
- recent myocardial infarction with cardiogenic shock coexisting
- septic shock
- operations of the coronary arteries
- pulmonary hypertension.

With the help of a Swan-Ganz catheter can be measured:

- pulmonary artery pressure
- wedge pressure in the pulmonary artery
- cardiac output
- oxygen saturation of mixed venous blood
- peripheral vascular resistance.

Measuring pulmonary artery pressure (PAP) is carried out by combining the intravascular space to an external pressure transducer through fluid-filled pipe. PAP curve resembles the curve systemic arterial pressure, but its amplitude is lower. PAP value for the systolic pressure is 15-28 mmHg (approximately 24mmHg), and for 5-16 mmHg diastolic pressure (approximately 10 mmHg) [2,9]. The measurement of wedge pressure in the pulmonary artery (Paop) of 4-12 mmHg corresponds to the filling pressure of the left ventricle during diastole. Knowledge of this measurement, allows the lead of a controlled treatment with liquids, catecholamines and vasodilators. Measurements must be made very short in order not to block the flow of blood at a given area [2]. For measurement of cardiac output (CO) is necessary thermistor mounted on

the end of the catheter inserted into the pulmonary artery for measuring the blood flow by thermodilution. Thermodilution a method using indicator dilution. Indicator substance may be fluid or indocyanine green lower than the blood temperature. Cardiac output (CO) is measured at the end of expiration. It is recommended that each time a series of measurements which determines the average cardiac output. Marker solution is mixed with the blood as it passes through the right ventricle. The temperature of the mixture is measured as it passes the thermistor registrant changes in blood temperature. Information is sent to the electronic device, recording and displaying the curve of time and temperature. If there is no intracardiac shunt,
At an incorrect result may be affected by ventilation with positive expiratory pressure, tricuspid regurgitation, or leakage of blood from right to left. It can also measure the cardiac output using a catheter equipped with a thermal filament. Such a fiber generates heat pulses, which are transmitted to the surrounding blood. On the basis of changes in blood temperature thermodilution curves plotted are used to measure cardiac output [2].
Oxygen saturation of mixed venous blood (SvO2) can be monitored continuously by means of a specially constructed catheter in the pulmonary artery, which emits red light and infrared light, and captures reflected light from the hemoglobin. An alternative method is to measure the mixed venous oxygen saturation of the blood sample from the tip of a catheter in the pulmonary artery [2]. Index vascular vascular resistance (SVR) is the peripheral vascular resistance of the whole blood system and is proportional to the prevailing pressure gradient from the aorta into the right atrium (MAP-CVP), and is inversely proportional to blood flow (CI) [2].
SVR = (MAP RAP) x 80 / CI

Monitoring diuresis

In the intensive care unit, monitoring of diuresis is necessary in each case and each patient is catheterized [12,14,18,19]. The observation should concern the excretion of hourly urine, color, composition and relative density. Maintaining the balance between the amount of fluids delivered to the body and the amount of fluid excreted is an extremely important element of therapeutic treatment in patients with a serious clinical condition. The kidneys flow at rest to 1.08 l / min blood, which is 20% of the ejection volume of the heart. The proper functioning of the circulatory system gives the right blood flow through the kidneys, which determines the filtration. In turn, the abnormal functioning of the urinary tract becomes a cause of cardiovascular dysfunction. In the therapy of many patients of intensive care units, diuretic drugs are used, also in cardiac diseases, which lead to the removal of sodium and secondary water from the body. Monitoring of diuresis is a standard procedure, which allows to assess not only the functions of the kidneys, but also the circulatory system. Correct urinary excretion (> 1 ml / kg / hour) indicates that the patient is properly hydrating, normal circulating blood volume and sufficient cardiac output. Hourly urine collection is carried out using sterile, disposable sets. Numerous innovations are introduced into their construction, eg a non-return valve built into the drain connector that protects against retreating urine into the Foley catheter, a non-return valve in a protective bag against ascending infection, a double-tube drain preventing drainage of the urine in the drain or a needless port for retrieval urine samples.

Temperature monitoring

Under physiological conditions, the body temperature within a narrow range varies between 36.5 ° C and 37.5 ° C. The increase in temperature leads to vasodilatation, sweating and chills. The temperature is in the hypothalamus. Vasoconstriction occurs mainly when the temperature gradient between the central body and the forearm skin temperature is 4 ° C. Some drugs (anesthetic) can move this further higher range [9]. Lowering the temperature of peripheral parts of the body is associated with excess catecholamine and centralization of the circulatory system (shock flow through the skin is reduced) [16]. The temperature can be measured at different sites: the esophagus, which corresponds to the temperature of blood in the aorta (the central temperature), the rectum, the internal auditory canal (corresponds to the temperature of blood flowing through the brain). trachea, and on the skin in the ICU ECG monitors offer many ways depending on the temperature measurement of sensor used. The monitor usually can also calculate the difference of two temperature by subtracting the second from the first.

Monitoring the respiratory system

The respiratory system is the set of organs specialized in capturing oxygen from the air. Oxygen is essential for life processes in the cells of the body. Simultaneously, the respiratory system is used to remove carbon dioxide from the blood and other unnecessary gases that arise in the intracellular metabolic processes. This mechanism of absorption and removal of air from the lungs, known as respiration enables the cell-level process known as cellular respiration, which are used to generate energy and to use it in the system as needed. Put simply, the cells provide breathing oxygen, and the "digest" it, resulting in the use of energy and as a waste of various gases and water. In the human respiratory system is substantially formed by two types of structures:

Monitoring of oxygen saturation of capillary blood (PaO 2)

Tissue oxygenation depends on the function of the circulatory ventilation, perfusion, and the amount of hemoglobin in the blood. Important. already by the standard in determining the proper tissue oxygenation oximetry it is [4,5,7,8]. For the measurement of pulse oximeters are used, examining in a non-invasive oxygen saturation of hemoglobin in arterial blood, allowing early detection of hypoxia. Another measurement that can be achieved by the cameras, the pulse rate, and the obtained information is presented visually and audibly. The sensors can be placed on the fingers, legs and ear lobe. In the case when we measure pressure bloodless method, the pulse oximeter sensor should be attached to the limb opposite, that there is no interruption to the signal. Pulse oximetry is a non-invasive and can be used for a long period of time, requires no calibration data are immediately transmitted, and the sensor for several hours may be in one place, which is undoubtedly the advantage. Valid values measurement range from 95 to 100%. Deviations most pulse oximeters measure is less than 2%. When SaO2> 70% of the error is estimated at 2-3% [7]

Insufficient arterial blood flow due to vascular resistance (vasoconstriction), low cardiac output (low output syndrome, shock) leads to inadequate or lack of pulsations. Anemia can also cause errors in measurement because the test is based on the phenomenon of light absorption by hemoglobin [16]. Uses two LEDs, one emitting red light (660 nm) and the second infrared (940nm) in order to distinguish between oxyhemoglobin (Hb02) of deoxyhemoglobin (Hb). Oxyhemoglobin absorbs less red light, which is caused by red color, unlike with the infrared light. The LEDs light up alternately, pulse oximeter and the program makes the whole light reaching the photo detector at the time always comes with a photodiode and a camera "knows" of course, which [16].

Pulse oximetry is a simple method to use, reliable and sensitive, coupling constant and rapid assessment of the oxygenation of peripheral flow quality measurement. It belongs to the standards of monitoring data in the intensive care unit during the intraoperative and perioperative. It has some limitations, however, because writing is often disrupted, which may take place during:

- movements of the patient
- the use of shortwave diathermy
- cooling the distal part of the body
- now, also because of the use of the artificial nail
- hyperkeratosis of the skin of your finger nail

- measurement is also inadequate in the presence of pathology in the patient's blood hemoglobin and organic dyes [2].

Monitoring partial pressure of CO2 in the air, end-tidal (pEtCo2)

This test allows to determine the concentration of carbon dioxide in the exhaled air. It is non-invasive research method for controlling the artificial ventilation. Determination of the concentration of carbon dioxide occurs with the use of infrared radiation, to which is connected a measuring instrument is connected between the endotracheal tube connector and Y.

Purpose of use kapnometrii:

- Continuous control of ventilation
- meets the alarm function
- Evaluation of carbon dioxide
- prevention of pulmonary embolism during surgery particularly in the
- posterior fossa.

Research gasometry arterial blood

Test Gasometric arterial oxygen tension, and includes carbon dioxide, oxygen saturation, blood pH, buffer, and resource base deficit (BE).

Valid values blood gas parameters in arterial blood:

- Vapor pressure of oxygen (PO2) of> 80 mmHg
- Vapor pressure of carbon dioxide (PCO2) of 35-45 mmHg
- Oxygen saturation (SaO 2)> 95%
- blood pH 7.35-7.45
- a resource buffer (HCO3) 21-27 mEq / L
- base deficit (BE) - 2.1 to 2.1 [3].

The total amount of water in the human body ranges from 50% to 70% of body weight, but these values are slightly higher in men than in women. This range depends on the content of adipose tissue, which is essentially devoid of water. The body water is located in two main spaces: cellular and extracellular. Cellular space contains 2/3, and extracellular 1/3 of the total amount of water. Extracellular space can still be divided into intravascular space and interstitial space. The smallest volume of extracellular water (2.5%) is the so-called Trascellular water, that is, the liquid contents of the stomach and intestines, bronchial tree, secretory kidney lines and glands, cerebrospinal fluid and the fluid of the anterior chamber of the eye. Body fluids are a solution of many organic and inorganic substances in water. The most important of these are electrolytes, substances that dissociate into ions in water. The electrolyte composition of the intracranial fluid differs from the composition of extracellular fluid. The main ions of the latter are sodium and chlorine, which are associated with normal: urine output, and water binding. Potassium, conditioning proper cell functions of many organs and systems, and phosphates are the basic ions of intracellular space.

Normally, the aqueous liquid with each other in a steady state. This means that there is a steady movement of the water particles and the electrolyte spaces between all the water of the body, but does not change the ionic balance and moral. Deviations in one space immediately cause a change in the other, following the compensatory movements of water and electrolytes. This allows on the basis of the study, only the plasma to assess most of the disturbances occurring in body fluids.

The composition of body fluids depends on:

- external factors
- internal factors

Of particular importance in maintaining optimum environmental conditions aqueous electrolyte, osmotic and appropriate concentration are hydrogen ion kidney. They selectively regulate the excretion of different ions and water depending on the commutation and current needs of the system. This function is fulfilled by adjusting the volume and composition of morality urine, and their operation is closely related with the neuro-endocrine system.

The pathological conditions may lead to a variety of disturbances water - electrolyte, of which the most important are:

- volume changes, morality, and the concentration of body fluid various electrolytes
- changes in the acid - base [18].

In the third and last part will be presented and discussed techniques to monitor the central nervous system.

Bibliography

1. Dison N.: Technique nursing procedures. PZWL, Warsaw 1998.

2. Grabowska-Gaweł A.: Invasive diagnostic and therapeutic methods used in intensive care and the accompanying complications. Issues for nursing students. Ed. Scientific, Bydgoszcz, 2009.

3. Grabowska Gaweł A.: Selected aspects of the care and treatment of patients in intensive care for nursing students. Ed. scientific, Bydgoszcz

4. R. Hirt, Bubser H.: Handbook of Anesthesia for Nurses. PZWL, Warsaw 1994.

5. Huber, A., Karasek-Kreutzinger B., Jobin-Howald U.: Compendium of nursing. PZWL. Warsaw 1995.

6. Jastrzebski J. (ed.): Clinical Anesthesiology. Urban & Partner, 1997.

7. Kański A., R. Bialic, Mountain J.: oximetry. Anaesthesiology Intensive Therapy. 1992.

8. Kucha J., Pruszyński B. (ed.), Cardiovascular Research. PZWL, Warsaw 1987.

9. Larsen R.: Anesthesiology. Medical Publisher Urban & Partner, Wrocław 2002.

10. Lehmann, F. Horn, A. Ludolph NEUROLOGY - diagnosis and treatment Urban & Partner, Wrocław 2004

11. Mayzner-Zawadzka E. D.: Selected Kosson Guidelines for anesthesia. PZWL, Warsaw 2006.

12. Marino EN: Intensive therapy. Medical Publisher Urban & Partner, Wrocław 1998.

13. Naskalski JW Dembińska-Kieć A., Laboratory diagnosis of elements clinical biochemistry, Urban & Partner, Wrocław 2009

14. Orłowska W. (eds): The science of internal medicine. PZWL, Warsaw 1989.

15. Prusiński A. Practical Neurology, Medical Publishing PZWL
Warsaw 2005

16. Rybicki Z.: Intensive therapy adults. Novus Orbis, Gdańsk 1994.

17. Ślusarska B., D. Zaczyńska, Zahradniczek K (ed.) Fundamentals of Nursing, Ed. Headed Lublin2004.

18. Widomska-Czekajska T. (ed.): Internal medicine and intensive care nursing. PZWL, Warsaw 1991.

19. Wołowicka L. Dyk D. (eds): Anesthesiology and intensive care. PZWL, Warsaw 2007.