

**"CONDUCTING SYSTEM OF THE HEART"**

*Alfraganus University Faculty of Medicine*

*Student of the medical specialty*

***Otaboyeva Marvarid Sodiqovna***

***Qo'ziboyeva Shahzoda Isomiddin kizi***

**ABSTRACT:** This article comprehensively covers the cardiac conduction system - its anatomical structure, physiological function, developmental embryology, cellular structures, electrical properties of impulses, pathological changes and clinical significance. This system is the central mechanism that controls the rhythm and synchronous contraction of the heart, and the interrelationship of its components ensures the balanced functioning of cardiac activity.

**Keywords:** Cardiac conduction system, sinoatrial node, atrioventricular node, Purkinje fibers, arrhythmia, electrocardiography, myocardium, automatism

**АННОТАЦИЯ:** В данной статье всесторонне освещается проводящая система сердца - её анатомическое строение, физиологическая функция, эмбриология развития, клеточные структуры, электрические свойства импульсов, патологические изменения и клиническое значение. Эта система является центральным механизмом, контролирующим ритм и синхронное сокращение сердца, а взаимосвязь её компонентов обеспечивает сбалансированное функционирование сердечной деятельности.

**Ключевые слова:** Проводящая система сердца, синусовый узел, атриовентрикулярный узел, волокна Пуркинье, аритмия, электрокардиография, миокард, автоматизм.

**ANNOTATSIYA:** Mazkur maqolada yurakning o'tkazuv tizimi — uning anatomik tuzilishi, fiziologik faoliyati, rivojlanish embriologiyasi, hujayraviy tuzilmalari, impulslarning elektr xususiyatlari, patologik o'zgarishlari hamda klinik ahamiyati to'liq yoritilgan. Ushbu tizim yurakning ritmini va sinkron qisqarishini boshqaruvchi markaziy mexanizm bo'lib, uning har bir komponentining o'zaro aloqasi yurak faoliyatining muvozanatli davom etishini ta'minlaydi.

**KALIT SO'ZLAR:** Yurak o'tkazuv tizimi, sinus tuguni, atrioventrikulyar tugun, Purkinye tolalari, aritmiya, elektrokardiografiya, miokard, avtomatizm

**INTRODUCTION:** The heart is a muscular organ that performs a central vital function, namely blood circulation, and its rhythmic contraction is controlled by the cardiac conduction system. Cardiac muscle tissue has the ability to spontaneously generate impulses and distribute them to other parts. These impulses lead to coordinated contractions of the heart parts.

Any disruption in the functioning of the cardiac conduction system can lead to heart rhythm disturbances, hemodynamic instability, and serious clinical conditions.

**MAIN PART****ANATOMICAL STRUCTURE**

The cardiac conduction system consists of specially modified muscle tissue and includes the following main parts:

Sinus node (Nodus sinuatrialis, sinoatrial node)

It is the "main clock mechanism" of the heart.

Located on the upper wall of the right atrium, near the superior vena cava.

Due to the gradual change in membrane potential, it independently generates impulses (automaticity).

The normal heart rate is 60–90 beats/min.

The atrioventricular node (Nodus atrioventricularis, AV node)

Is located in the lower part of the right atrium.

It receives the impulse from the sinus node with a short delay and transmits it to the ventricles.

This delay allows the atrium and ventricles to contract synchronously.

The bundle of His (Fasciculus atrioventricularis)

Starting from the AV node, it runs downward along the interventricular septum.

It transmits impulses to the left and right ventricles.

The left and right branches (crus dextrum et sinistrum)

Divide in the interventricular septum.

Each transmits impulses to the muscle tissue of the corresponding ventricle.

Purkinje fibers (Fibrae Purkinje)

Are located in the endocardial layer of the ventricles.

Very fast-conducting fibers.

Causes synchronous and powerful contraction of the ventricles.

**PHYSIOLOGY**

### Automaticity

The cardiac conduction system is capable of generating impulses on its own. The sinus node is the main automatic center, providing its rhythm to other parts. Lower structures can also generate impulses, but their frequency is lower.

Conductivity Each structure conducts electrical impulses at high speed in a specific direction. Delays (for example, in the AV node) allow the heart parts to contract in an orderly manner.

### Excitability and Refractory

Each segment is able to respond to an external stimulus. After the impulse, there is a short refractory period.

## EMBRYOLOGY

The cardiac conduction system is formed during the 5th–8th week of embryonic development. Impulses are generated randomly in the primary heart tube, and then the sinus node takes over. Anomalies (for example, congenital AV block) are associated with defects in prenatal development.

## CELLULAR AND MOLECULAR PROPERTIES

The cells of the conduction system differ morphologically and electrophysiologically from normal myocardial cells. They have many mitochondria, a good gap-junction system, and provide rapid ion exchange. The balanced functioning of ion channels ( $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ) determines the heart rhythm.

## PATHOLOGY AND CLINICAL SIGNIFICANCE

### Arrhythmias

Sinus bradycardia: Slow activity of the sinus node.

Sinus tachycardia: Excessive impulses.

AV blocks: Complete or partial cessation of impulse conduction.

Ectopic rhythms: Independent impulse generation in the AV node, bundle branch block, or Purkinje fibers.

Fibrillation: Irregular contractions (especially in the ventricles — a dangerous condition!).

### Diagnostic methods

Electrocardiography (ECG) — the main tool. Holter monitoring — day and night rhythm monitoring. Electrophysiological examination — invasive assessment. Echocardiography — structural assessment.

Treatment methods

Drug therapy: Beta-blockers, antiarrhythmics.

Pacemaker: In AV block and sinus node failure.

Radiofrequency ablation: Elimination of ectopic foci.

## SUMMARY

The conduction system of the heart is the electrical basis of the heart's activity and controls each contraction pattern. Functional or morphological disruption at any point in the structure can result in heart rhythm disturbances, hemodynamic failure, and even death. Therefore, a thorough study of this system is important in the process of cardiological diagnosis and treatment.

## REFERENCES

1. Tortora G.J., Derrickson B.H. Principles of Anatomy and Physiology. 14th ed. — Wiley, 2014. — pp. 678–692.
2. Hall J.E., Guyton A.C. Textbook of Medical Physiology. 13th ed. — Elsevier, 2016. — pp. 109–120.
3. Ganong W.F. Review of Medical Physiology. 25th ed. — McGraw-Hill, 2016. — pp. 547–556.
4. Moore K.L., Dalley A.F. Clinically Oriented Anatomy. — Lippincott Williams & Wilkins, 2014. — pp. 345–360.
5. Dolinkin V.N., Afanasev A.N. Physiology serdtsa. — M.: Medicine, 2013. — pp. 45–60.
6. Klabunde R.E. Concepts of Cardiovascular Physiology. 2nd ed. — Lippincott Williams & Wilkins, 2012. — pp. 210–225.
7. Guyton A.C., Hall J.E. Textbook of Medical Physiology. 12th ed. — Elsevier, 2011. — pp. 102–115.
8. Patocka J., Nepovimova E., Valis M. Cardiovascular Physiology: A Comprehensive Review. — Springer, 2020. — pp. 150–165.