

Arrhythmia /conduction disorder

This is a group of disorders that involve the system that generates and transmits the electrical impulses needed for the heart's activity. The electrical phenomena precede and start the sequence of mechanical phenomena that cause the heart's pumping activity (heart contractions).

The electrical impulses are conducted through specialised cells located in the atriums and ventricles. The specialised cells in the atrium are called sinus nodes or sinoatrial nodes. This is where the first electrical impulse that determines the heart to beat regularly is generated.

The electrical impulse is conducted along the atrial wall towards the atrioventricular node (another group of specialised cells located at the junction between the atriums and the ventricles), where a small delay takes place (which enables the ventricles to fill up with blood from the atriums); afterwards, the electrical impulse spreads through a specialised network in the ventricles, through the two main branches (right and left).

A normal heart activity consists of a regular succession of cardiac cycles (relaxation/contraction) whose varies between 60 and 100 heartbeats per minute in adults, while they rest or are awake. Cardiac frequency is influenced by numerous factors (activity, stress, emotions, medication, acute or chronic conditions). Any kind of irregularity in the frequency or regularity of the cycles that is caused by the occurrence of electrical stimuli from other areas than the usual ones and/or the deceleration, stop or desynchronisation of conduction at any level constitutes a rhythm irregularity or conduction disorder.

This condition is clinically translated into palpitations, stops, skipped heartbeats, dizziness, syncope (loss of consciousness), depending on the type and duration of the arrhythmia.

Methods of diagnosis

- ECG
- Effort test
- Holter ECG 24/48 hours
- Electrophysiologic study (EPS)
- Tilt test
- Event loop recorder

Treatment

- Medication: antiarrhythmic drugs
- Implantable antiarrhythmic devices that are aimed to prevent, diagnose and treat rhythm irregularities or conduction disorders :
 - [Cardiac pacemaker](#), including [resynchronisation therapy](#)
 - [Cardiac defibrillators](#)
- Interventional procedures: ablation treatment (interrupting the mechanism that maintains the arrhythmia)
- Surgical procedures

The most frequent arrhythmias are:

- **SUPRAVENTRICULAR ARRHYTHMIA, ORIGINATING IN THE ATRIUMS**

Sinus tachycardia is represented by the increased frequency of electrical impulse discharges in the sinus node over the normal maximum limit in adults (90-100 heartbeats/minute). The origin of this condition is found in the sinus node of the right atrium, whose role is to produce electrical impulses that are then conducted to the atriums and the ventricles, thus stimulating the contraction and pumping blood in the body.

There are multiple causes for sinus tachycardia.

This condition can occur as a normal reaction of the body to certain situations or intense stimuli (physical effort, stress, emotions, fear, panic attacks, rich meals, dehydration etc.), in which case it cannot be seen as a disease. Sinus tachycardia can also occur as a result of the consumption of coffee, coke, tobacco, cocaine or amphetamine, but also as a side effect of certain medicines.

On the other hand, sinus tachycardia can be associated with severe diseases, such as heart valve diseases, the inflammation of the heart muscle or of the pericardium (myocarditis and pericarditis), cardiac insufficiency, myocardial ischemia and myocardial infarction and, at the same time, it can be a sign of severe infection, pulmonary embolism or certain endocrine conditions (hypothyroidism and pheochromocytoma).

There are only a few cases in which the cause of sinus tachycardia cannot be determined, but in this case, the doctors suspect a primary condition of the sinus node.

Symptoms

Sinus tachycardia rarely exceeds 200 heartbeats per minute and it has a progressive start and ending. Some people, especially those who are in the first stages of the disease, do not show any symptoms. Others, however, can feel palpitations that produce discomfort, anxiety and fear. In the case of people who present with severe palpitations, the heartbeats are so fast that the ventricles do not have enough time to fill up with blood and therefore, they are unable to adequately irrigate the other organs. This is why certain symptoms can appear such as: weakness, fatigue, dizziness, chest pain, difficult breathing, headache or loss of consciousness.

The methods of diagnosis include carotid sinus compression, electrocardiogram and Holter monitoring.

The treatment for sinus tachycardia is established following the discovery of the primary condition that determined the tachycardia.

Sinus bradycardia is represented by a decreased frequency of electrical impulse discharges in the sinus node: less than 60 heartbeats per minute in adults and less 80 heartbeats per minute in children, values that are measured while the patient is resting. The sinoatrial node is a specialised cardiac tissue located in the right atrium and it is the heart's main pacemaker, whose role is to discharge stimuli, thus determining the sinus heart rhythm.

The causes of sinus bradycardia

Sinus bradycardia is normal in the case of healthy young people and athletes, since the normal values for them are less than 60 heartbeats per minute.

Sinus bradycardia can also be caused by sinus node dysfunctions, certain medication, exposure to toxins such as lithium or toluene, vagal hyperactivity, acute myocardial infarction, hypothermia, hypoglycaemia, sleep apnoea, diphtheria, myocarditis, acute joint rheumatism, icterus, hyperkalaemia, intracranial hypertension, meningitis, certain cerebral and mediastinal tumours, severe hypoxia, hypothyroidism, depression etc.

Symptoms

In some cases, bradycardia does not present any symptoms. However, when it does, the symptoms can be dizziness, decreased capacity of concentration, loss of consciousness, chest pain, difficult breathing, a constant state of fatigue and the occurrence of fatigue even during efforts of low intensity and palpitations.

Methods of diagnosis

The diagnosis can be determined through several methods, such as lab tests, electrocardiogram, Holter monitoring, electrophysiological studies or tilt test.

Treatment

For the asymptomatic cases no treatment is recommended. In general, treatment is recommended for the patients who display such symptoms as syncope or excessive fatigue and can be based on medication (administered only in the hospital and intravenously when it is necessary to increase the patient's heart rate, after a myocardial infarction) or surgery, by implanting a pacemaker.

Atrial extrasystoles

Patients perceive atrial extrasystoles as irregular heartbeats or as if the heart had skipped a beat. Normal heartbeats originate in the sinoatrial node, as opposed to atrial extrasystoles that are generated by the ectopic pacemakers located in the atrium, outside the sinoatrial node. They generate an electrical impulse that contracts the heart at an atrial level; this contraction occurs faster than the normal one (premature contraction).

Causes

The atrial extrasystoles can have physiological or pathological causes. The most frequent are the physiological causes, such as excessive consumption of coffee, alcohol, tobacco, stress, emotions, prolonged fatigue.

Pathological atrial extrasystoles can have various causes, such as the administration of certain medication, hyperthyroidism, ischaemic cardiomyopathy, myocardial infarction, electrolytic disorders.

Symptoms

The most frequent symptoms are palpitations, a pausing sensation between heartbeats, dizziness, headache, chest pain.

The methods of diagnosis include electrocardiogram, Holter monitoring and effort ECG.

In most of the cases, the treatment is only symptomatic and it consists of administering medication (beta-blockers or calcium channel blockers) or, when the pathological causes are excluded, the condition can be kept under control by lowering the consumption of caffeine, reducing stress and adopting a healthy diet.

Radiofrequency ablation is also a solution in the cases in which the condition hasn't been caused by severe cardiac diseases and it consists of introducing a catheter with radiofrequency into the atrial

area that generates extrasystoles. Radiofrequency will eliminate the ectopic areas that generate arrhythmias forever.

Clearly, if the atrial extrasystoles are generated by the above-mentioned cardiac conditions, the treatment will target them.

Sinus node disease (Sick Sinus Syndrome)

The heart is the organ that never stops operating, pumping blood constantly. This is due to the excitatory-conductive tissue that consists of the sinus node (located in the right atrium), the atrioventricular node, the bundle of His and Purkinje's network. The sinus node is the main pacemaker of the heart, with the highest speed of depolarization in comparison with the other cells of the heart that display an automatism.

The impulses discharged at the level of the sinoatrial node inhibit the discharge of impulses in the other heart cells. Cardiac frequency is determined by the impulse discharge frequency in the sinus node; a normal value would range between 60 and 100 heartbeats per minute.

The sinus node disease is characterised by irregularities of the impulses generated in the sinus node or by irregularities in the conduction of impulses. The disease manifests itself under the form of sinus bradycardia, sinoatrial obstruction, sinus obstruction or supraventricular rhythm irregularities.

Causes

The sinus node disease is more frequent in elderly people (aged over 50). In children, surgical interventions in the area of the atriums are a common cause for sick sinus syndrome. Sometimes, coronary artery diseases, arterial hypertension, mitral valve conditions or aorta conditions can be associated with this disease. The sinus node disease is rare, the most frequent form of the disease being sinus bradycardia.

Symptoms

In most of the cases the disease is asymptomatic. However, when the patient has symptoms, these can include chest pain, confusion, fainting, fatigue, dizziness, palpitations, difficult breathing.

Methods of diagnosis

The symptomatic sinus node disease can be diagnosed only during arrhythmic episodes. Even so, this disease is very hard to discover and prove.

The electrocardiogram can show an abnormal cardiac rhythm that is specific of this disease. Holter monitoring is another efficient instrument in diagnosing this disease, since it can capture slow heart rhythms with long pauses, accompanied by atrial tachycardia. Other long-term monitoring devices can also be useful. Moreover, in some cases, electrophysiological studies are recommended.

Treatment

If the patient shows no symptoms, treatment is probably unnecessary. Among the treatment methods it is worth mentioning the pacemaker implant (for bradycardia), radiofrequency ablation and medication.

Paroxysmal supraventricular tachycardia (PSVT)

Paroxysmal supraventricular tachycardia manifests itself with accelerated heart rhythm episodes that originate in an area located above the ventricles. "Paroxysmal" designates the frequency of these episodes and it means "from time to time".

Causes

In the case of people with healthy hearts, the atriums and the ventricles contract in a coordinated manner. The contractions are caused by the electrical signal that originates in the sinoatrial node, which is located in the right atrium. The movement of the electrical signal through the atriums determines their contraction. In the next stage, the signal moves to the inferior chambers of the heart, called ventricles, where it produces contractions. In the case of paroxysmal supraventricular tachycardia, the accelerated heart rhythm originates somewhere above the ventricles.

The high doses of digitalis drugs can cause this condition. Supraventricular tachycardia can also be determined by the Wolff-Parkinson-White syndrome, a congenital malformation that consists of an abnormal conductive tissue between the atriums and the ventricles, which determines the activation of the ventricles before the normal contraction (pre-excitation). This syndrome is usually encountered in children and young adults. The consumption of alcohol, caffeine, illegal substances or Tabaco does not represent a cause on its own, but it can increase the risk of paroxysmal supraventricular tachycardia.

The symptoms usually have a sudden beginning and end and they can manifest themselves for several minutes or even for several hours, under the form of anxiety, palpitations, fast pulse or difficult breathing and the sensation of “a claw in the chest”. Furthermore, dizziness and loss of consciousness are possible, in some cases.

The methods of diagnosis can be of several types and are determined depending on the situation. In some cases, the clinical exam together with the patient’s family history is enough to determine the diagnosis. The electrocardiogram is a very common and useful method of diagnosis that registers the heart’s electrical activity. It is preferred for this investigation to be performed during a tachycardic episode. However, it rarely happens. This is why, we usually use the Holter, which is a device used to register the heart’s electrical activity for 24-48 hours.

The electrophysiologic study is another method used to determine the type of tachycardia, as well as the therapeutic diagnosis that consists of administering medication during the tachycardic episode and monitoring its effects.

Treatment

If the tachycardia manifests itself rarely, treatment is not compulsory.

During the tachycardic episodes, vagal manoeuvres (carotid massage, breathing against a closed glottis, splashing cold water on the face, coughing while in sitting position, with the trunk of the body leaning forward, compressing the ocular globes) can also be applied, but only under the supervision of the specialist and by following clear instructions.

When medication is chosen as a method of treatment, it can be administered constantly, in order to prevent the occurrence of symptoms or only occasionally, during the crisis, in order to slow down the cardiac rhythm. Medication treatment usually consists of beta-blockers or calcium channel blockers. However, in the case of tachycardia caused by the Wolff-Parkinson-White syndrome, the above-mentioned medication is not recommended. In this case, the use of antiarrhythmic medication such as Propafenone is recommended. If after applying the vagal manoeuvres or the medication, the cardiac frequency is still high, it is recommended for the patient to go to the doctor, who will probably resort to electrical cardioversion, i.e. controlled application of electric shocks in order to re-establish a normal cardiac frequency.

For severe cases, we recommend radiofrequency ablation, a procedure that resolves definitely (without recidivism) approximately 95% of the cases of Wolff-Parkinson-White syndrome. Patients

who, for various reasons, cannot resort to radiofrequency ablation or whose reaction to the medication is not the expected one can opt for a surgical treatment.

Atrial fibrillation/atrial flutter

Atrial fibrillation or atrial flutter is a common form of arrhythmia that determines an increased and irregular heart rhythm. When the heart functions normally, the four chambers contract in an organised manner. The electrical signal that creates the contraction originates in the sinoatrial node. These signals help pump the adequate amount of blood to the organs. In atrial fibrillation, the electrical impulse is irregular and certain parts of the heart are unable to contract in an organised manner and based on a pattern. The consequence is that the heart is unable to pump the necessary amount of blood to the organs. In atrial flutter, the ventricles (the inferior chambers of the heart) have a fast and irregular rhythm of contraction.

Among the most common **causes** of this disease we can list: the consumption of alcohol, coronary disease, heart attacks or bypass surgeries, enlarged heart, valvular disease, arterial hypertension, administration of certain medication, hyperthyroidism, pericarditis and the sinus node disease.

Symptoms can be totally absent, thus it is possible for patients not to be aware that their heart rhythm is irregular. The symptoms can commence and stop suddenly and they can include: accelerated, irregular or low pulse, confusion, dizziness, fainting, fatigue, incapacity to perform physical exercises and difficult breathing.

Methods of diagnosis

The heart rhythm of a healthy heart is 60-100 heartbeats per minute. People suffering from atrial fibrillation have a more increased heart rhythm, i.e. 100-175 heartbeats per minute; however, their arterial pressure can have low or normal values.

The electrocardiogram registers the electrical activity of the heart and thus, it can be used to diagnose atrial fibrillation. The Holter device monitors the electrical activity of the heart for 24-48 hours and it is used as a method of diagnosis for the cases in which the atrial flutter does not manifest constantly. The echocardiogram and the electrophysiologic studies are also quite frequently used in diagnosing this condition.

The cardioversion **treatment** is applied when we want to immediately re-establish a normal heart rhythm. In this case, there are two methods of treatment: electric shocks and intravenous administration of substances. These methods of treatment can be applied in emergency situations or they can be planned. In some case, the treatment consists of a daily oral administration of medication. By using beta blockers, calcium channel blockers or digoxin, the heart rhythm can become normal. In most of the cases, this medication can prevent potential atrial fibrillation episodes, but they can have side effects.

When the heart is in fibrillation it causes blood to accumulate in the atriums, where it clots. Once these clots are pumped into the circulation, they can reach the brain and cause a stroke. The anticoagulants (Coumadin, Eliquis, Xarelto, Pradaxa, Sintrom) are medicines that fluidize blood and reduce the risk of stroke and they can be prescribed in certain cases. Doctors can also prescribe antiplatelet drugs, such as aspirin or clopidogrel – Plavix – for this condition.

In order to prevent the administration of medication that does not have the intended result in all the cases (fibrillation can manifest during treatment), the doctor can recommend radiofrequency ablation. The electrophysiologic studies performed before this intervention will identify the area of the heart that needs to be treated. During the ablation procedure a catheter is introduced into one of the arteries and it is manoeuvred through the artery and inside the heart. When the catheter

reaches the targeted area of the heart, the electrodes located on the head of the catheter will deliver high-frequency current. The current will heat and destroy the cardiac tissue that determines the irregular rhythm. Nevertheless, some patients might still need medication or a cardiac pacemaker implantation.

Preexcitation syndrome

The electrical impulse is conducted from the atriums to the ventricles through the atrioventricular node. The atrioventricular node represents the normal electrical link between the superior and inferior chambers of the heart and the only place through which the electrical impulse should be conducted.

In the case of patients suffering from a certain type of preexcitation syndrome, some accessory bundles occur and they conduct the electrical impulse from the atriums to the ventricles in an abnormal way, thus predisposing the patient to paroxysmal atrial tachycardia (a fast rhythm that is not tolerated by the body).

Depending on the accessory bundle, there are three types of preexcitation syndrome:

The Wolff-Parkinson-White Syndrome

The Lown-Ganong-Levine Syndrome

The Mahaim Fibre Syndrome