SECTION 25.
MEDICAL SCIENCES AND PUBLIC HEALTH

Leshchenko Sofiia Olesivna
student
Kharkiv National Medical University, Ukraine

Horina Viktoriia Olehivna
student
Kharkiv National Medical University, Ukraine

Supervisor: Molodan V.I.
Docent
Kharkiv National Medical University, Ukraine

COMPARATIVE CHARACTERISTICS OF HEART VALVE REPLACEMENT PROSTHESIS

Heart valve replacement surgery is currently one of the most common treatments for heart disease. However, most heart valve prostheses do not take into account the somatic growth of the child and the needs of certain groups of people. As a result, surgery can be performed more than once, which is a big stress for the human body.

Realizing the need to create a heart valve that can be adjusted to the needs of each person separately, with the possibility of increasing its internal diameter in the patient's body, doctors and scientists are trying to invent the best technique and the best heart prosthesis.

In our work, we will focus on patients who need this operation and what are the best options for the valves and list the pros and cons of each.

Heart valve replacement surgery is necessary for patients suffering from heart valve damage, which is more than 100 million people worldwide. The lesion can be a congenital anomaly of development or acquired disease, such as calcium deposits, degenerative changes and adhesive sash, due to age-related changes, infectious or inflammatory changes, connective tissue weakness. These processes can lead to immobility of the valve leaflets, narrowing of the aortic mouth. Also, the valve does not close tightly, then part of the blood discarded from the left ventricle returns back. In such cases, we can assume aortic valve insufficiency. But both conditions lead to one consequence - a constant overload of the heart.

For some time it continues to work in this mode, but the reserve mechanisms of the heart muscle are exhausted and as a result heart failure develops. The patient feels this at first as constantly tired and relatively mild shortness of breath. These symptoms are quickly added to heart rhythm disturbances, chest pain, that can be described as squeezing pain - which is a manifestation of angina, and constant fatigue can lead to dizziness and sudden loss of consciousness. Patients usually come to the doctor with the above symptoms, which may seem too common. Due to auscultation and additional research methods, such as chest X-ray examination and laboratory tests, we are able to establish a preliminary diagnosis.

Then to confirm or exclude the diagnosis, the doctor can prescribe an echocardiographic examination (ultrasound of the heart), which performs its task in 99% of cases. It is very important to detect the pathology in time, because heart surgery must be done when there are still reserve mechanisms of the heart, before heart failure. Interventions are indicated for patients who show symptoms as appropriate. For some asymptomatic patients, the presence of predictors of rapid progression of the pathology is the basis for early intervention.
At first, doctors try to restore the valve using the valve-saving operation. Most often they are performed in childhood or adolescence in cases where the valve mobility can be restored. If the valve recovery is not possible, doctors are considering the complete replacement of the heart valve. Replacement of the valve is possible with the use of mechanical prosthesis, that are now made of carbon, which is a very wear-resistant material. By design, such prostheses are double-leaf and single-leaf.

Among the advantages of mechanical prostheses, the most important is the unlimited service life, it is also necessary to say about the relative ease of use. Unfortunately, this type of prosthesis has many disadvantages, including: increased risk of blood clots and increased risk of bleeding, increased risk of hemolysis, high risk of Infection, the possibility of prosthesis of a dependent narrowing of the left ventricular outflow tract. It is also important to note that the patient may feel a prosthesis throughout everyday life.

Alternatively, there is a biological prosthesis, which are made of animal tissues. Modern biological valves undergo a process of treatment against calcium deposition (decalcification), which increases the service life of the biological prosthesis.

Advantages and disadvantages of biological valves. If we consider biological prostheses on the frame, the advantages are the reduction time of taking anticoagulants, the patient takes them only for three months after operation was completed and a relative simple implantation technique. Among the disadvantages - this prosthesis requires a larger area for implantation. It is also necessary to mention the uncertainty of the service life of prostheses, which will depend on the state of the patient's immune system. Biological prostheses without a frame are a more complex technique, they are much more difficult to implant, which is a disadvantage along with their insufficient research. Among the positive aspects, the most important thing is that if the prosthesis is implanted correctly, it is not much different from the human valve. Anticoagulants are unnecessary, which improves the lives of patients immediately after surgery.

As the problem of valve prosthetics is common, researchers are trying to find a new innovative solution. For example, researchers from the University of Munich and the University of Western Australia are developing a technology that will make printing a valve on a 3D printer real. In addition, such prostheses will be made from the patient's own tissues and will be able to grow with them. Thanks to this technique, they want to overcome the shortcomings of conventional prostheses that were listed above. They currently use the 3D printing function to create porous skeletons that will allow the patient's cells penetrate this structure and grow. Checking the capabilities of this valve is currently underway. It has already been tested in the model of the circulatory system, where the invention was subjected to the same pressure and flow velocity, which must withstand a natural heart valve. But scientists still have to do in vivo testing to assess the process of skeletal growth and rate of degradation.

Thus, we analysed 4 options for replacing the valve - mechanical prosthesis, biological prosthesis on the frame, biological prosthesis without a frame, prosthesis printed on a 3D printer. In each of these species, we have noted all the advantages and disadvantages in comparison with each other and came to the conclusion - there is no unanimous answer to the question of which prosthesis is better to choose. Each patient should choose the type of prosthesis individually with their doctor, based on all the criteria (among them the patient's history and the financial component in particular).

References:
LOWER JAW ENDOPROSTHETICS WITH HYDROXYAPATITE AND COLLAGEN

**Abstract:** The use of materials corresponding to the composition and structure of human bone is seen today as the most promising direction in reconstructive surgery. The biocompatibility of the implanted material is correlated with this composition. Modification of the endoprosthesis surface by means of bioactive coating is considered to be one of the promising directions for the creation of complex materials, possessing not only the properties of the passive matrix for the newly formed bone, but also certain strength characteristics.

**The aim of the research** is to increase efficiency of surgical treatment of mandibular bone defects using combined osteoplastic material based on hydroxyapatite and collagen.

**Material and methods of research:** The study was based on the analysis of treatment results of 75 patients with mandibular defects who were treated in hospital. There were 42 (56%) male and 33 (44%) female patients among the operated patients. The age of the patients ranged from 25 to 58 years.

In the first group of patients (32 cases), a CONMET LLC titanium implant was placed during reconstruction. In patients of the second group (23 patients) hydroxyapatite powder was applied on the surface of the implant by laser sintering according to the method. In the third group of patients (20 patients), in addition to laser sintering of hydroxyapatite, collagen (Healos J&J) was applied on the implant surface by CONMET LLC.

**Results of the research and discussion:** All patients were evaluated for cellular and humoral immunity. The cellular component of immunity, which is responsible for transplantation immunity, is of great importance in implantation. Investigating the T-cell component of immunity, the number of T-lymphocytes, T-suppressors, T-helpers and immunoregulatory index of T(H)/T(S) ratio were calculated.

Preoperative analysis of the immunoregulatory subpopulations of T-lymphocytes revealed a slightly reduced content of T-helpers and T-suppressors compared to healthy controls, but the difference was not significant (P<0.05). Studies of B-lymphocyte functional activity by serum levels of immunoglobulins G, A and M before the operation showed no significant differences from the healthy subjects. Analysis of group data also showed no significant difference in preoperative IgG, IgA and IgM levels. Mean preoperative immunoglobulin levels as well as individual immunoglobulin levels did not differ significantly from the control group. X-ray examination 6 months after surgery showed homogeneous tissue in the area of the defect in the first and second groups of patients, while a trabecular structure was present in the third studied group.

All patients were X-rayed postoperatively and after 1, 3, 6 and 12 months. X-ray densitometry was used to determine bone mineral density by determining the surface bone mineral
density. According to the WHO recommendations (1994), a T-criterion of -1.0 - 1.4 g/cm² was considered normal. The maximum positive dynamics of the index was observed in the group III after 12 months at the bone-implant interface - 0.98±0.4* (p<0.01).

The implant with bio-coating is covered by dense bone tissue, micro-movements and tensions at the bone-implant interface are prevented. As proceeding from the above-mentioned we can conclude that application of hydroxyapatite to the titanium implant surface by the laser sintering method assists to optimize the restoration of the structural and functional characteristics of the bone.

**Conclusions:** Thus, it seems possible to conclude that the use of endoprostheses with a layer of hydroxyapatite, leads to faster formation and maturation of bone tissue, which allows to recommend its use in clinical practice.