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Oleksandr Lukianenko¹, Yuliya Sobol²

¹PhD student, PhM Dpt., National University «Zaporizhzhia Polytechnic»

²PhD (Philology), associate prof. National University «Zaporizhzhia Polytechnic»

MAGNESIUM AS A PROSPECTIVE MATERIAL FOR THE PRODUCTION OF STENTS

Nowadays medicine has reached great heights in the field of implantology of human internal organs. Now it is impossible to imagine a successful fusion of hard

tissue after fractures without a variety of implants, such as wires, pins and plates. In addition, stenting can be considered a relatively new trend in implantology.

Stenting is a process of medical surgical intervention, with the aim of installing a special frame (stent) into the vessels or other hollow organs. This operation is performed with the aim of expanding the passing paths, narrowed due to pathological processes.

Although the technology of this surgical procedure is quite new, medical scientists have reached great heights in its improvement. However, the materials which are used for production of the stents are still being an important problem.

It is of crucial importance that such materials must not have a toxic effect on human organism. In addition, corrosion products of the material should not be accumulated in the tissues around the implant. These are the main requirements for the nature of the impact that are put forward for stent materials.

Also, do not forget about the mechanical properties of these materials. Since stenting is designed to expand the constrictions in the vessels and hollow organs, the materials must be strong enough to function properly. But even having satisfied all these requirements, the material must have sufficient plasticity so as not to disrupt the functionality of the vessels.

Based on all of the above demands, today the following materials are used for stents:

1. stainless steels - the main advantages of these materials are: low price, a varied combination of properties (which allows to choose a material for different tasks), relative ease of production. The disadvantages include the lowest degree of bioinertness among all the materials used. Because of this, it becomes necessary to use special coatings, which in turn increase the cost of these implants;

2. alloys based on tantalum - the main advantage of these materials is their radiopacity (that is, these materials are clearly visible when examined on an X-ray tomograph). Another advantage is that a protective oxide film is formed on their surface. However, the cost of these alloys and the complexity of their production limit their widespread use;

3. nitinol - an alloy consists of 55% nickel and 45% titanium. This alloy has good biocompatibility and sufficient corrosion resistance. Nitinol also belongs to shape memory alloys, which greatly simplifies the process of stent installation. Despite all the advantages of this alloy, it is not widely used for similar reasons as tantalum alloys. The production process of nitinol is much more complex than that of tantalum-based alloys.

All of the above-mentioned materials have found their application in the field of stenting, but they also have a significant drawback. It's known that vascular cells begin to grow rapidly after stent placement surgical procedure. These cells quickly grow through the holes in the stent and the vessel wall engulfs the stent within three weeks after surgery. Due to the rapid growth of cells, the vessel wall is strengthened

and the presence of a stent in the body is no longer required. Moreover, the stent remaining in the body can be harmful to the patient. New bio-soluble materials can provide a solution to this problem. Magnesium-based alloys are promising materials for these purposes.

Pure magnesium is a harmless material for the human body. Moreover, magnesium can have a positive effect on the patient's health. This means that the elimination of the products of its biodegradation will take place without complications, since most of it will be absorbed by the body. Low corrosion resistance of magnesium is often perceived as a disadvantage, however, for a biodegradable alloy it is rather an advantage. Also, the advantages of magnesium include its specific gravity (1.74 g / cm^3), which will provide a low mass of the stent.

Despite all these advantages, pure magnesium does not have sufficient mechanical properties for its practical use as a material for stents. However, this problem has a solution - the use of magnesium-based alloys doped with non-toxic, bio-inert components. Heat treatment, which can significantly improve the mechanical properties of magnesium alloys, should also be considered.