

Advances and applications of Nanotechnology to solve Coronary Heart Disease

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Abstract. Coronary heart disease is a common disease faced by human beings, regardless of age, there may be a risk of disease. But the sequelae of this disease are so high that bypass technology is not yet fully developed. Now for the solution of coronary heart disease is mainly in the study of nanoparticle implantation method, unlike modern bypass surgery years of medicine, can also recover well. This will greatly reduce the side effects of medicine on the body, and also save money. Nanotechnology will take a long time to make a clinical diagnosis and obtain a lot of evidence. The exact timing has not yet been determined, but it is clear that nanoparticles have potential.

Keywords: Heart disease, Nanoparticle, Gene.

1. Introduction

Coronary Heart Disease (CHD) blocks the blood to achieve the heart, which is a disease that has a high incidence rate nowadays. The incidence of coronary heart disease is about 10%, the incidence is higher. Coronary heart disease includes not only angina pectoris and myocardial infarction, but also other types, such as occulted coronary heart disease. Such patients are usually ignored, only in the process of physical examination, electrocardiogram found ST-T changes. The mortality rate is 2 to 3 percent. Being over 40 years of age, regular smoking and alcohol abuse, obesity, a diet high in fat and cholesterol, and lack of physical activity increase the risk of coronary heart disease by up to 8% and mortality by 3%. In the past, people have to eat drugs for controlling their symptoms [1].

While targeted drugs have side effects like antibiotic resistance. Around the 19s, people used to solve this problem through bypass operations. It is resistant to high temperatures and does not corrode easily. In particular, the gold nanoparticles will be a different color. Traditional ways have sequela, while nanomaterials could transplant into human's body and washed out the body, except kidney. It is worth researching because nanoparticles characteristic could make a contribution to CAD in the future. Like Nano Contrast Agent, and heating in alternating magnetic nanomaterials. Many scientists explored the magnetic nanomaterials, using some contrast experiments to show nanoparticles have the potential to be implanted into the bodies of human, and even nowadays people have patents to design some drugs that have already been used in nanoparticles. The thing needs to explore whether there is another characteristic that could help to solve coronary heart disease.

Researchers predict maybe many years later, nanotechnology will be widely used in hospitals. Bypass operation has the mini one and chest one, especially for the chest bypass, it is risky because it is directly the blood in the body, and in recent decades, there's a new process of a minimally invasive bypass operation, this leads to not with the blood inside the body, leaving only a scar on the hand. Although the risks are much smaller now, after the long-term medication. Technology is worth developing due to it could reduce hyperplasia compared to taking drugs. Although nanoparticles have a lot of advantages and it would be the trend, they still have some disadvantages and some shortages, also make a comparison between people who take the drugs and people who implant nanoparticles.

The following literature review introduces how to use nanoparticles to solve CAD, some of using nanoparticles methods, their advantages and disadvantages, side effects, and clinical results. Discuss past findings from past people. A lot of research done by former people claimed that nanotechnology in the field of biomedical engineering seems to be possible to solve coronary heart disease in the future.

2. Therapies for CHD and its symptoms

Patients with coronary heart disease have great individual differences and different medication regimens, it is impossible to directly give medication regimens without understanding the specific physical conditions and conditions of the elderly. , the treatment of coronary heart disease (CHD) is the best method is interventional therapy, or bypass treatment, the effect is very good, if a single rely on drug treatment, can only alleviate coronary vascular narrowing slowly process, narrow can't disappear by drug treatment, treated by interventional therapy or bypass, can be restored, the circulation of the blood supply of ischemic myocardium, In order to relieve the symptoms of angina pectoris, improve cardiac ischemia function, reduce the pain of patients' life, bypass or interventional therapy, but also need to take long-term anticoagulant drugs. To prevent recurrence of the disease. It is recommended to eat a light diet and avoid greasy foods. Do not eat high cholesterol content of food, animal viscera, etc., eat fresh vegetables and fruits, keep the stool unobstructed. The first id lifestyle changes: smoking cessation and alcohol restriction, low-fat and low-salt diet, proper physical exercise, weight control, etc. Then Drug therapy: antithrombotic, reduce myocardial oxygen consumption, relieve angina pectoris, regulate lipid and stabilize plaque; Third, Revascularization therapy: including interventional therapy and surgical coronary artery bypass grafting. Medication is the basis of all treatments. Long-term standard medical therapy should also be maintained after interventional and surgical treatment [2].

3. Nano ways to solve CHD and modern ways

Current ways to solve CHD (blood could not flow in one of the three arteries, which means arteries are blocked and cannot function as the original) is to use chemical methods such as drugs, and the bypass operation (one of the blood vessels blocks and in order to replace a new one). Bypass operation mainly has two kinds: one of the chest bypass surgeries and another one is minimally invasive bypass surgery. Chest bypass surgery is cut the sternum open, and this method is most developed in 19s century. Nowadays, higher conditional families prefer to have minimally invasive surgery, this is a method do not use the blood from the inner body while from outer circulation due to is not risky as chest bypass surgery. And the specific process is the median sternal incision is still routinely used in CABG with conventional cardiopulmonary bypass. Although the second inferior intercostal incision of the lower sternum can be used in some patients, it greatly increases the difficulty of operation. The incision was made from about 1cm below the suprasternal fossa to about 2-4cm below the xiphoid process. The skin was cut, and the skin tissue and chest wall fascia were cut with an electric coagulation knife. With the junction depression of xiphoid process and sternum as the lower landmark point, the superior sternal depression as the upper landmark point, and the connection line of the two as the landmark line for sawed sternum, the sternal incision rarely deviated to both sides. After sternotomy, the blood was carefully stopped, and the bone marrow was stopped with bone wax or hemostatic gauze.

Although minimally invasive bypass surgery has advancements and they are used widely in coronary heart disease departments, scientists still find nanoparticles have the great potential to solve CHD in the future. Nanoparticles are function as carriers. Researchers see them as a car that carries nanoparticles. They could circulate in the body for a long time and find the problem. Nanoparticles in CHD are mainly for adjusting the inflammatory reaction to avoid broken of arteries plaque. In order to solve CHD, scholars should acknowledge where the problem is [3].

In addition to drugs, acupuncture and other treatments, massage therapy is also an effective treatment. If the doctor or the patient's family can correctly implement the pressing, pressing, kneading, pressing, pressing and other methods, better treatment results can also be achieved. The effective acupoints and massage methods of coronary heart disease are summarized as follows:

The pericardial meridians of hand jueyin start from the chest, and the collateral Sanjiao. Its meridian circulation route starts from the breast, from the inner upper arm to the outside, from the bottom to the middle finger. In traditional Chinese medicine, the heart meridian is considered as the

essential meridian, and the pericardial meridian is connected with the heart meridian. The heart is evil, and the pericardial meridians pass directly. If the heart is sick, it can be reflected in the pericardial meridians. When angina pectoris and arrhythmia attack, continuous pressing Neiguan point, 3 minutes each time, 1 minute intermittent, can quickly relieve pain or regulate heart rhythm.

An alternative approach to treating damaged heart tissue after a CHD attack is the use of cardiac tissue engineering patches. Carbon nanofibers embedded in PLGA can lead to more robust growth of CMs compared to traditional polymer matrices. In addition, CMs can be enhanced by simulating the tensile strength and electrical conductivity of heart tissue and the adhesion of enhancement related protein. In addition, Malki et al. developed a CMS-inoculated cardiac engineered patch consisting of albumin electrospun fibers and gold nanorods. The patch is localized in the myocardium and irradiated by a near-infrared laser (808nm), which can absorb light and convert it into thermal energy. The molecular structure of the fiber scaffolds is partially modified, so that it can be firmly and safely attached to the heart wall. Application of nanomaterials in CHD: Macrophages can transfer when the person dies, leading to heart failure. So heart transplantation, as mentioned earlier, is also an effective method. But because the cost is very expensive, and people are not very willing to accept, including it is difficult to match their own genetic bone marrow. But nanomaterials are actually based on these cells for therapy [4].

Knead the Lingdao point, Lingdao is the acupoint of the heart meridian of the hand shaoyin, located in the inner wrist joint of the little finger 1 cun (refers to the same body cun method of traditional Chinese medicine). It has been found that about 91%; The patient with coronary heart disease had a marked tenderness at the left Lingdao point. However, there's still some situation that drug treatment does not work, so other methods are: perfusion treatment of coronary heart disease is to take measures to occlude the coronary artery, restore myocardial perfusion, save the ischemic myocardium, reduce the infarct size, improve the hemodynamics of patients with coronary heart disease, restore the blood supply to the heart. Or the coronary heart disease developed to advanced stage after heart transplantation, and drug treatment was ineffective; Surgery or interventional therapy cannot correct, repair and guide; Intractable heart failure, recurrent arrhythmias, and life-threatening. It is estimated that the risk of death within one year is extremely high and heart transplantation should be performed as soon as possible.

4. Future therapies-for detecting and solving diseases

Hence the following methods are how the problems detect the diseases. Firstly, using Cross-linked ferric oxide fluorescent nanoparticles target macrophages to detect inflammatory responses in atherosclerotic plaques. The observed signal of perfluorocarbon nanoparticles was close to the spatial resolution, and the presence of different F signals in the target tissue was used to explore the progression of inflammation. This approach is mainly targeted to display macrophages to detect plaques, because coronary heart disease is caused by atherosclerosis. There are other ways to localize macrophages, such as the technique with photoelectronic contrast agents [5]. In more detail, gold nanoparticles are used to localize macrophages by combining them with light and sound images in blood vessels. These targets are followed by a fission effect. It uses radioisotope-related and nanocomprehension to detect oxidized lipoproteins. When these vessels rupture, new vessels are regenerated.

Gold nanoparticles are mainly used in photothermal therapy. Its state is essentially a metal that does not corrode easily, and it is unique in that it exhibits different colors depending on its shape. The experimenter varied the size of the shape to get the frequency of the interaction. And photo heat will make the gold nanoparticles high temperature. In the spectrum, light makes our bodies somewhat transparent, so changing their shapes makes them easier to see in contrast agents. What has just been mentioned is how to target and how to solve this coronary heart disease after targeting needs to be sorted out. There are many approaches to magnetic nanoparticles to solve coronary heart disease. Magnetic nanoparticles (MNPS), due to their unique properties based on magnetic and nanoscale

structures, improve biocompatibility, stability, MNP targeting ability, and prolong the circulation time of their biomedical applications, MNPS deliver and release drugs to the desired sites, and are applied in magnetic thermotherapy. This is similar to photothermal, but it uses magnetic nanoparticles instead of gold nanoparticles [6]. The magnetic nanoparticles of angiography are composed of stable magnetite. The surface of the iron oxide was coated with non-covalently bonded low molecular weight dextran for intravenous use. Iodinated polymer nanoparticles for CT imaging of macrophages in coronary atherosclerotic plaques Macrophages digest the extracellular matrix by secreting proteases and weaken the protective fibrous cap of the atherosclerotic core. The development of nanoparticles will make CT more accurate because the resolution of CT has improved.

As mentioned before, gold nanoparticles could increase the resolution of CT. Here is the diagram, this is a contrast graph where the two substances are gold nanoparticles and the other is iodine contrast agent. The abscissa represents the concentration and the ordinate is the value of CT. The value of CT varies with the concentration, and when the concentration is high, the value of CT difference is large. On the right is the obvious contrast plot, the white protrusion is obviously more obvious for the gold nanorods. The enhancement of the CT contrast agent results in a difference in the coefficient of the tissue and surrounding the lesion. If the difference between the coefficients is large, it means that the image is clear. The reason why gold nanorods can enhance the difference in coefficient is because the iodine contrast agent of gold nanorods can attenuate the effect.

The nanoparticles are small in size about 100,000 hairs and they can flow through the blood, they can be delivered to other tissues to deliver targeted drugs, and tissues and organs are cleared long enough to enhance imaging or execution. The way now and the way in the future will certainly be different, ordinary drugs now can not meet the needs of people, which is now the need to address the improvement of coronary heart disease. Chemical drugs are not effective to treat coronary heart disease because of drug resistance. That is to say, a patient takes medicine for a long time, but suddenly a certain stage does not take medicine, so that some virus mutation, so that the coronary heart disease will be more serious. Including the first three to six months after bypass surgery there are significant sequelae because of general paralysis and the need for lifelong medication to relieve pain. Many scholars have only considered how to solve it, but the cost of long-term use is large. Most medications are prescribed and require a visit to a specialist. This is not enough for poor families to sustain lifetime consumption. Statins, they can reduce the incidence of coronary heart disease because they are not limited by targeting. However, Broz et al. described that through the function of the oligonucleotide to reduce load, pravastatin nanosized vesicles targeted to macrophages could be used for high-dose therapy, thereby reducing toxicity. Nicotinomycin is an example that has the potential to target paramagnetic nanoparticles via integrins. Additionally, hirudin-derived autothrombin inhibitor hirudin has been associated with nanoparticles to inhibit coronary artery occlusion due to plaque degeneration and rupture. Nanoparticles increase the time that blood circulates to ensure that disease is found [7].

Off-target toxicity of the drug is reduced, as chemical agents increase hyperplasia. Nanotechnology targeting would be accurate, and it would not be prone to side effects, meaning sequelae would be relatively small, and it would not require any surgical support. However, nanoparticles have many limitations [8]. For example, he needs a long clinical report, and he does not yet have an accurate time to prove that the patient is able to help the patient resolve completely.

The second is that the life of nanomaterials is uncertain after nanoparticle implantation, and patients can be guaranteed at the initial stage of implantation, and then need to be implanted again. Restenosis after coronary angioplasty is affected by mechanical damage, inflammatory response, inhibition of in-stent blood, formation and restenosis are deterministic stents Tsukie et al. demonstrated that nanoparticle eluting stents can avoid becoming more stenotic [9].

Nanomaterials also have prominent applications in other cardiovascular fields. As a mitogen-activated protein kinase (MAPK), APK can significantly increase the long-term patency rate of vascular grafts by inhibiting intimal inflammation and cell proliferation. The nanostructured films

have the ability to continuously release drugs and most importantly significantly reduce the inflammatory response, fibrous tissue adhesion, and the occurrence of atrial fibrillation [10].

5. Conclusion

It is necessary to further deepen the understanding and increase the application of nanotechnology. Nanomedicine has great potential in the treatment of CHD. Effective nanodrug delivery systems for different drugs are being developed. However, their implementation faces many problems. For example, the age of nanomaterials in biological cells is uncertain, and nanomaterials may also produce allergic reactions and inflammatory reactions in the body. In addition, nanotechnology has achieved satisfactory results in the treatment of cardiovascular diseases. Therefore, more and more scientists are trying to take the advantages of nanotechnology to provide a bright future for the diagnosis and treatment of cardiovascular diseases. Overall, nanotechnology research and clinical translation still have a long way to go. Tremendous advances in nanomedicine have greatly improved the current treatment of coronary heart disease. As treatments narrow and scientific curiosity expands, the future of treatment for this range of diseases is very exciting indeed.

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