Research Status of Tissue Engineering of Endovascular Stent and Spring Ring

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Keywords: tissue engineering; endovascular stent; spring ring

Abstract. Tissue engineering in cerebral vessels refers to fusion of bioengineering, cytobiology, molecular biology and traditional endovascular treatment technology. This technology takes spring ring and stent as mechanical carrier and takes biodegradable material or virus as biological carrier, and carries in-vitro prepared protein, cells, genes and attachment proteins or cell factors to treat corresponding cerebrovascular disease (vessel occurance, ischemia and ischemia etc.) with the help of conventional catheter technology. This technology has such advantages as high biocompatibility, growth, plasticity and no damage to body. The lesion part treated by endovascular tissue engineering will be closer to normal tissue form and recovery of physiological functions.

Introduction

The endovascular treatment of cerebrovascular disease usually used coils and stents. The development of Coil inner vessel cerebrovascular disease experienced the liberated changes and the updated production matetrials. After the traditional platinum coils inserting into the aneurysm, it makes the endovascular hemodynamic changes and then develops the thrombosis tamponade aneurysm. Platinum is a biologically insert metal, the presence of thrombogenic effect is weak, it can weak the thrombogenic effect, make the tumor cavity filling not dense enough and make the neck tumor endothelial cell adhesion not easy to cover, moreover it can not recanalize the aneurysm cavity after filling the aneurysm cavity. Therefore, it diffcult to effectively prevent aneurysm after filling relapse or re-bleeding. Now with the development of biotechnology, we are developing biodegradable material or a biological virus carrier coils and stents tissue engineering technology. The tissue engineering of coil and stent has become a new luminescent spot material progress in the field of neural involvemen.

Intravascular Stent

Cell Seeded Scaffolds Endothelial progenitor cells exist in peripheral blood and bone marrow, which has the potential of rapid proliferation and anti thrombosis. The endothelial progenitor cells in peripheral blood may move to the site and express the functional properties of the endothelial cells in the vascular intima injury. It can be inferred that the number and function of endothelial progenitor cells in the peripheral blood may be a part of the cause of the excessive proliferation of the intima after stent implantation[1]. He had 16 cases of stent implantation in patients with

restenosis after stent implantation in 11 patients with vascular endothelial progenitor cell number and adhesion function were compared, the results showed that the number of peripheral blood endothelial progenitor cells and the presence of adhesion dysfunction, suggesting that the endothelial progenitor cells can prevent the injury of intimal hyperplasia. Yong [2] et al confirmed that in vitro cultured endothelial progenitor cells can produce anti platelet substances, such as endothelial nitric oxide synthase, 6 - -F (L) - A and tissue type plasminogen activator, et al. The endothelial progenitor cells were located at the site of the lesion and differentiated into vascular endothelial cells, and the blood flow shear stress was covered in the vascular lumen, and it had a strong ability of proliferation and anti thrombosis. Hieb B [3] and other human endothelial progenitor cells were cultured on the scaffolds of poly (1 - lactic acid). Endothelial progenitor cells, smooth muscle cells and microporous poly glycolic acid - poly - L - lactic acid) scaffolds in vitro bath, bracket produced capillary like structures. Hung HS [4] and so on, which will be seeded with endothelial progenitor cells, the thin film coated with gelatin coated with a thin layer of polyurethane patch, which is placed in the dog's bilateral internal carotid artery, 1 months and 3 months after implantation, the observation and study of the internal carotid artery intima covered circular stone like monolayer cells, 300 months of new arterial wall thickness of 3 microns, a small amount of smooth muscle cell proliferation, local no thrombosis.
In addition to endothelial progenitor cells, vascular endothelial cells, smooth muscle cells, stromal cells can be used as seed cells seeded on the scaffold, which carries the lesion to the lesion site, and can achieve local localization, migration, differentiation and functional expression of cells.

Transgenic Scaffolds Transgenic expression products mainly include anticoagulant substances and vascular protective substances, so as to prevent thrombosis and intimal hyperplasia in the stent implantation site. Griese [5] will be of endothelial progenitor cells and can code of tissue type plasminogen activator or leech of retroviral gene recombinant plasminogen activator, carotid arterial injury caused by balloon dilatation, local infusion, after 7 days, 73 + 10)% of lesions in the lumen is covered with genetically modified endothelial progenitor cells and detected anticoagulant substances secreted continuously. Endothelial progenitor cells can inhibit the expansion of the damaged arteries, and prevent the thin film from the arteries, but can not prevent the proliferation of new intima. DA Dichet [6] by using retrovirus mediated gene delivery method, the human tissue plasminogen activator gene was inserted into sheep endothelial cells, endothelial cells were cultured in vitro, and the number of cells attached to the scaffold and secreted high levels of tissue type plasminogen activator. He thinks stent implantation coating of genetically modified endothelial cells, the endothelial cells directly into the artery wall, and the expression of anticoagulant, antithrombotic, anti proliferative molecules to prevent complications after stent implantation.Werling NJ [7] after the recombinant retrovirus recombinant of endothelial progenitor cells and the gene of the protection of the gene of the vascular protection of rabbit endothelial progenitor cells and encoding, the common carotid artery after balloon angioplasty. After 2 weeks, the expression product of the gene was detected by the animal blood vessel, the endothelial cell nitric oxide synthase, heme and green fluorescent protein, and the local free of thrombosis, the new intima was small and the proliferation was lower than that in the control group.

Drug anti Coagulation Stent The release of anticoagulant drugs used in the treatment of cardiovascular diseases, the prevention and treatment of thrombosis caused by stent thrombosis, which brings new inspiration. Vaajanen A [8] in the stainless steel bracket, a screw poly lactic acid stent and braided poly lactic acid stent of platelet deposition comparative study pointed out: braided

poly caproic acid lactone, poly lactic acid of heparin coated stents platelet adhesion deposition amount less, has the best blood compatibility. The material, configuration, biodegradable coating technology will affect the treatment effect.

Controllable Micro Coil

Biological Coating Spring Coil Matrix is a copolymer coating of platinum coil, for the original GDC platinum gold wire on the addition of a copolymer coating (90%), 10% of the total volume of 70% of the total volume of the spring coil, which is conducive to the formation of the spring coil, the formation of the artery and the carotid artery intima growth. 90 days the copolymer will be completely absorbed in the body. Matrix has the ability to induce thrombosis, increase the number of connective tissue in the artery, increase the thickness of the cervical tissue, reduce the size of the aneurysms and no effect on the diameter of the tumor. The results of Muratoglu SC [9] by comparing the results of animal experiments showed that: the Matrix of the early stage of the inflammatory response in the aneurysm cavity, without affecting the flow of the carrier, to accelerate the formation of the arteries and the intima of the aneurysms, effectively prevent the recurrence of the aneurysm. His previous results also confirmed that Matrix was beneficial to the formation of fibrous connective scar in the aneurysm, and to reduce the volume of the aneurysm and the effect of giant aneurysms.

Expandable Hydrogel Spring Coil Platinum coils are platinum coils by biological hydrogel. Hydrogel can be expanded in the biological physiological environment in order to completely fill the aneurysm, and without secondary thrombosis of the arterial aneurysmWhite PM [10] and other use of hydrogel - platinum coil embolization 44 aneurysms, the immediate complete embolization rate was 65%, 89% minutes after the occlusion rate was 20. Gaba RC [11] and other water gel - platinum coils were packed in 11 cases of aneurysms, compared with the same size of the same size of the common GDC embolization, the former was 73%, the latter was 32%. The above data show that the density of the hydrogel and the platinum coil is much higher than that of the common GDC.

Growth Factor Spring Coil Abrahams JM [12], and the internal carotid artery, which was implanted into the adult rats with a human recombinant vascular endothelial growth factor or collagen, was observed in the 14 days. His findings show that the spring coil with human recombinant vascular endothelial growth factor is beneficial to the integration of the internal thrombus in the aneurysm cavity and the fusion between the tissue and the spring ring, which is beneficial to the arterial intima. Pan RL[13] et al. In vitro and in vivo experiments revealed that the platinum coil of the fibroblast growth factor with basic fibroblast growth factor, which can increase the proliferation of fibrous connective tissue in the aneurysm. Pandiar D and Shameena P [14] containing alkaline fibroblast growth factor biodegradable material coated in special coil surface, or into the coil, in order to embolize aneurysms, basic fibroblast growth factor in tumor slow release, promote the intra aneurysmal fibrosis.

Conclusion

Coils and stents are the main materials in the endovascular treatment of cerebrovascular disease. The tissue engineering technology of coil ans stent is taking the coin and stent as the mechanical carrier and the biodegradable materials or viruses as the biological carrier, carring protein vitro preparation of cells, genes, or adhesion proteins cytokines by conventional catheter technology into

intravascular to treat cerebrovascular disease accordingly. About this new technology, some of which are still in preliminary animal experiments or clinical trials, some have been applied to clinical and achieved good effects. The technology has a high degree of biocompatibility, growth resistance, plasticity and no damage the body, etc, which is expected to good prospects for clinical application. It will be possible to gradually replace coils and bare naked stents.

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