International Journal of Advances in Scientific Research
ISSN: 2395-3616 (Online)
Journal DOI: https://doi.org/10.7439/ijasr **Review Article**

Peptide-based Therapeutic Service Delivery for Cancer

Wenzhe Huang*

State Key Laboratory of New-tech for Chinese Medicine Pharmaceutical Process, Jiangsu Kanion Pharmaceutical Co. Ltd., Lianyungang 222001, China

QR Code

***Correspondence Info:**
Wenzhe Huang
State Key Laboratory of New-tech for Chinese Medicine Pharmaceutical Process, Jiangsu Kanion Pharmaceutical Co. Ltd., Lianyungang 222001, China

***Article History:**
Received: 15/11/2018
Revised: 27/11/2018
Accepted: 30/11/2018
DOI: https://doi.org/10.7439/ijasr.v4i11.4961

Abstract

Peptides have numerous advantages as the chains help treat cancer, tumor and several complicated diseases. The review details on the different structures of peptides that can ensure positive and efficient delivery of therapy to tumor and cancer cases. The co-delivery system particularly aims to improve the therapeutic delivery process in terms of manufacturing, targeting, and impact.

Keywords: Peptide, cancer, tumor.

1. Introduction

With the introduction of new drugs to enhance the health status of patients, peptides are found to be better ingredients to enhance the overall drug delivery process [1-5]. Peptides are identified as amino acid monomer chains that can offer better effects on the patients. The first section of this review details about the assembly of peptides while the next section discusses more on the influence of peptide-based ligand on the health of the patient. Peptides quickly turn into proteins and have the ability to penetrate to the top layer of the patient's skin thereby having a long-term impact of the medicine [6-11]. The final part of this report discusses how peptides can serve as better drug delivery mechanism leaving a significant development in the health aspect of the person.

2. Assembly of Peptides

Self-assembly is a special feature of peptides. In this case, self-assembly enables the development of nanoscale structures comprising of nucleotides, amino acids or phospholipids [12-14]. This assembly has the ability to manage the non-covalent interaction between attractive and repulsive forces. In the field of material science, nanostructure made of hydrogel has an excessive capacity to retain the water content and build rigid structures. It is observed that peptide-based hydrogel is effective in maintaining the intermolecular interaction and enabling the biocompatibility between the bonds [15-18].

The other advantage with the peptide comprising of the hydrogel is the formation of nanofibers and crosslinks even in the aqueous media. This structure is already found to be effective in the field of *in vitro* cell imaging research [19-22]. Further, this form of peptide delivery is found to enable better blood circulation thereby curing tumor and arthritis. Drug delivery is a critical process where it can have numerous side effects if the amino acids react differently. When self-assembled peptide combined with the hydrogel is introduced, it can have antifungal, antibiotic, anticoagulation and anti-inflammatory properties. This is also photostable and this structure of peptide can have a great future in the biomedical field.

3. Peptide-based ligand

In the medical field, the targeted ligand includes peptides, proteins, and antibodies. For better therapeutic delivery, ligands comprising of liposomes have better consistency in terms of purity and binding affinity [23-29]. RGD peptide, which is a combination of arginine, glycine and aspartic acids, takes the responsibility to anchor the

cells. To treat the tumor cases, doxorubicin (DOX) is widely used. This RGD peptide is known to increase the delivery of doxorubicin with stabilized cells and activated performance of the drug.

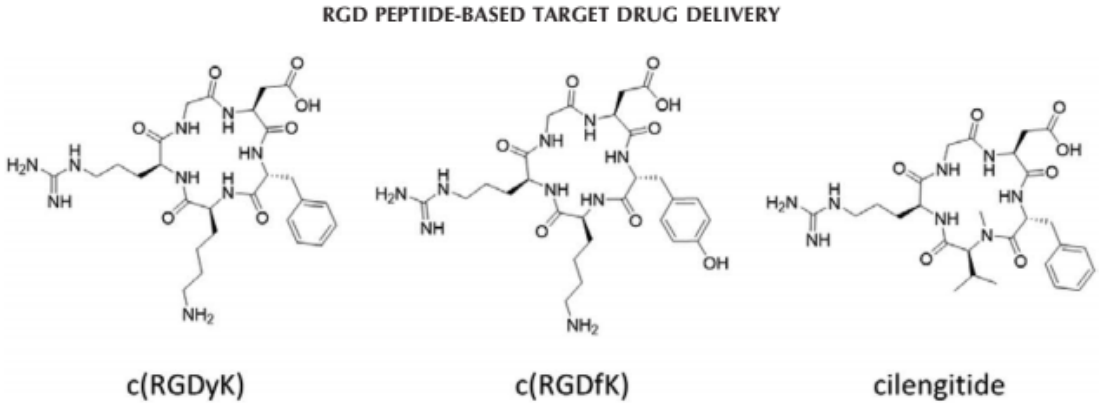

Figure 1: Chemical Structure of commonly used targeting RGD peptide

The advantage with RGD peptide is its flexibility in the structures. While the natural structure is advantageous, the mimetic version of RGD has the ability to improve stability and affinity. The other popular structure of RGD is cyclic which targets the ligands and binds its relationship with integrin [30-33]. In the field of biomedicine, many biologists face difficulties in the penetration of internal cells and this is feasible with the cell penetrating peptide in place. This has a high affinity and its impact is much visible in treating cancer cases.

Usually, the cancer cells are difficult to target and the dual ligand enables the target on cancer cells and the transfer time is quick. Liposomes have been regarded as an effective drug delivery system[34-36]. The problem with the present system is the inability to target the active ligands. With the use of DOX, there is certainly a need to activate the active ligands so peptides can work on binding the tissues and cancer cells and enrich the efficiency of the overall process. The peptide ligand assures to offer a long-term impact in usage for a shorter period.

4. Peptide-based drug delivery

The recent treatments available for cancer have had problems in the activation of cancer cells and targeting. Nanotechnology has proved to be a better method to treat the cancer patients and reduce the toxicity of the chemicals used [7,23]. Amphiphilic dendrimer including hydrophilic dendritic shell tends to promise a better drug delivery system due to the ease in preparation and high biocompatibility. With the introduction of this acid promoted drug, it is possible to improve the efficiency of 5-Fu/Dox-DNM in the patient's body.

The process of preparation of 5-Fu/Dox-loaded micelles follows ultrasonication dialysis method. This is highly suitable to treat cases requiring dialysis and also cancer. Both Dox and 5-Fu will have to be loaded into micelles and they improve hydrogen bond and electrostatic interactions. The co-delivery of 5-Fu and Dox is found to reduce the duration of tumor in the body and also minimize cancer-causing agents[37,38]. The enhanced process of drug release is found to target the affected cells and induce the toxics that can help achieve a reduced cancer effect.

Peptides have the ability to replace the traditional chemotherapeutic drugs with a powerful method to target and eliminate the presence of cancer. This also improves the resistance of the affected patient and turns dormant cells invisible. Peptide treatment with the co-delivery of 5-Fu and Dox can promise a better choice of cancer therapy[30,32].

5. Conclusion

Peptides are known to be a chain of amino acids that have antioxidant and antifungal properties and help coagulate between the cells. In recent time, the rate of patients affected with cancer is increasing for which co-delivery or peptide ligands can be of greater use. The advantage with this therapeutic system is the improved resistance and stability on the targeted bodies. It can help in targeting the specific cells and the cost of manufacturing is less. This is found to be the future of biomedicine to treat cancer cases.

References

[1]. Kang, C., Qin, J., Osei, W. & Hu, K. Age-dependent Mitochondrial Targeting Of Protein Kinase C Epsilon In Cardioprotection. *The FASEB Journal* 2017.

[2]. Han, R., Sun, Y., Kang, C., Sun, H. & Wei, W. Amphiphilic dendritic nanomicelle-mediated co-delivery of 5-fluorouracil and doxorubicin for enhanced therapeutic efficacy. *Journal of Drug Targeting* 2017; 25: 140-148.

[3]. Sun, Y., *et al.* Co-delivery of dual-drugs with nanoparticle to overcome multidrug resistance. *European Journal of BioMedical Research* 2016; 2: 12-18.

[4]. Liu, F., Sun, Y. & Kang, C. Controlling Amphiphilic Functional Block Copolymers' Self-Assembly: From Structure to Size 2016.

[5]. Song, L., *et al.* Crocetin inhibits lipopolysaccharide-induced inflammatory response in human umbilical vein endothelial cells. *Cellular Physiology and Biochemistry* 2016; 40: 443-452.

[6]. Sun, Y., Kang, C., Liu, F. & Song, L. Delivery of antipsychotics with nanoparticles. *Drug Development Research* 2016; **77**: 393-399.

[7]. Kang, C., *et al.* Delivery of nanoparticles for treatment of brain tumor. *Current Drug Metabolism* 2016; 17: 745-754.

[8]. Xue, X., *et al.* Discovery of novel inhibitors disrupting HIF-1α/von Hippel–Lindau interaction through shape-based screening and cascade docking. *PeerJ* 2016; 4: e2757.

[9]. Hersch, S.J., *et al.* Divergent protein motifs direct elongation factor P-mediated translational regulation in Salmonella enterica and Escherichia coli. *MBio* 2013; 4: e00180-00113.

[10]. Shuhong, X., *et al.* Dynamic expression of AQP4 in early stageof ischemia/reperfusion rats and cerebral edema. *Chinese Pharmacological Bulletin* 2016; 32:1433-1441.

[11]. Peng, J., *et al.* Enhanced Liver Regeneration After Partial Hepatectomy in Sterol Regulatory Element-Binding Protein (SREBP)-1c-Null Mice is Associated with Increased Hepatocellular Cholesterol Availability. *Cellular Physiology and Biochemistry* 2018; 47: 784-799.

[12]. Yang, Z., *et al.* Functional exosome-mimic for delivery of siRNA to cancer: in vitro and in vivo evaluation. *Journal of Controlled Release* 2016; 243: 160-171.

[13]. Kang, C., Hernandez, V.A. & Hu, K. Functional interaction of the two-pore domain potassium channel TASK-1 and caveolin-3. *Biochimica et Biophysica Acta (BBA)-Molecular Cell Research* 2017; 1864:1537-1544.

[14]. Waller, A.P., *et al.* GLUT12 functions as a basal and insulin-independent glucose transporter in the heart. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease* 2013; 1832: 121-127.

[15]. Li, Q., *et al.* Identification by shape-based virtual screening and evaluation of new tyrosinase inhibitors. *Peer J* 2018; 6: e4206.

[16]. Chen, Y., *et al.* Identification of 4-aminoquinoline core for the design of new cholinesterase inhibitors. *PeerJ* 2016; 4: e2140.

[17]. Kang, C. & Hu, K. Impact of hypoxia in the expression and regulation of the TASK-1 potassium channel in cardiac myocytes. *The FASEB Journal* 2016; 30: lb598-lb598.

[18]. Kang, C. *Ion channels, protein kinase C and caveolae in cardioprotection*, (The Ohio State University, 2015).

[19]. Yung, B.C., *et al.* Lipid nanoparticles composed of quaternary amine–tertiary amine cationic lipid combination (QTsome) for therapeutic delivery of AntimiR-21 for lung cancer. *Molecular* pharmaceutics 2016; 13: 653-662.

[20]. Cheng, X., *et al.* Lipid Nanoparticles Loaded with an Antisense Oligonucleotide Gapmer Against Bcl-2 for Treatment of Lung Cancer. *Pharmaceutical research* 2017; 34: 310-320.

[21]. Fan, S. & Chi, W. Methods for genome-wide DNA methylation analysis in human cancer. *Brief Funct Genomics* 2016; 15: 432-442.

[22]. Kang, C. & Hu, K. Modulation of the two-pore domain potassium channel TASK-1 by caveolin-3. *The FASEB Journal* 2015; 29: 814-845.

[23]. Davis, M.E., Chen, Z.G. & Shin, D.M. Nanoparticle therapeutics: an emerging treatment modality for cancer. *Nat Rev Drug Discov* 2008; **7**: 771-782.

[24]. Kang, C., Sun, Y., Wang, M. & Cheng, X. Nanosized camptothecin conjugates for single and combined drug delivery. *European Journal of BioMedical Research* 2016; **2**: 8-14.

[25]. Qiao, H., *et al.* Orally delivered polycurcumin responsive to bacterial reduction for targeted therapy of inflammatory bowel disease. *Drug Delivery* 2017; 24: 233-242.

[26]. Liu, F., Sun, Y., Kang, C. & Zhu, H. Pegylated Drug Delivery Systems: From Design to Biomedical Applications. *Nano LIFE* 2016; 6: 164-200.

[27]. Sun, Y., Kang, C., Yao, Z., Liu, F. & Zhou, Y. Peptide-Based Ligand for Active Delivery of Liposomal Doxorubicin. *Nano Life* 2016; 6: 164-200.

[28]. Yeh, C.Y., Hsiao, J.K., Wang, Y.P., Lan, C.H. & Wu, H.C. Peptide-conjugated nanoparticles for targeted imaging and therapy of prostate cancer. *Biomaterials* 2016; 99: 1-15.

[29]. Fan, S., Huang, K., Ai, R., Wang, M. & Wang, W. Predicting CpG methylation levels by integrating Infinium HumanMethylation450 BeadChip array data. *Genomics* 2016; 107: 132-137.

[30]. Qiao, H.*, et al.* Redox-triggered mitoxantrone prodrug micelles for overcoming multidrug-resistant breast cancer. *Journal of drug targeting* 2018; 26: 75-85.

[31]. Kang, C., Qin, J., Osei, W. & Hu, K. Regulation of protein kinase C-epsilon and its age-dependence. *Biochemical and Biophysical Research Communications* 2017; 482:, 1201-1206.

[32]. Sun, Y.*, et al.* RGD Peptide-Based Target Drug Delivery of Doxorubicin Nanomedicine. *Drug development research* 2017; 78: 283-291.

[33]. Kang, C. & Hu, K. Role of caveolin-3 in adenosine-induced increase in mitochondrial PKCε. *The FASEB Journal* 2013; 27: 1191.1197-1191.1197.

[34]. Cheng, X. & Lee, R.J. The role of helper lipids in lipid nanoparticles (LNPs) designed for oligonucleotide delivery. *Adv Drug Deliv Rev* 2016; 99: 129-137.

[35]. Sun, Y. & Kang, C. Self-Assembly of Peptides into Hydrogel. *Journal of Organic & Inorganic Chemistry* 2016; 2: 5.

[36]. Yao, Z., Sun, Y. & Kang, C. Structure and self-assembly of multicolored Naphthalene Diimides Semiconductor. *Nano LIFE* 2016; 6: 164-200.

[37]. Cheng, X.*, et al.* T7 Peptide-Conjugated Lipid Nanoparticles for Dual Modulation of Bcl-2 and Akt-1 in Lung and Cervical Carcinomas. *Molecular pharmaceutics* 2018; 15: 4722-4732.

[38]. Zhong, X., Sun, Y., Kang, C. & Wan, G. The theory of dielectrophoresis and its applications on medical and materials research. *European Journal of BioMedical Research* 2017; 2: 7-11.