Nano Congress 2016: Use and therapeutic application of nanocarriers (smart drugs) to prevention and remediation of cardiovascular diseases- J M Velez-Escuela Superior de Medicina del IPN, Mexico

Abstract

This work focuses on the potential of nanotechnology in nanomedicine, mainly cardiovascular pharmacology discipline, including the highlight rational approaches in design, manufacturing, development, and applications of nanodevices (smart drugs) containing nanoparticles that acts as nanocarriers to controlled and direct for site-specific targeted smart drug delivery into human body using artificial receptors, and unique nanoparticle systems for diagnostics, screening, medical imaging, prevention, and correction of cardiovascular pathologies therapy after administration routes. Our purpose is to offer the most efficient the development pathways for nanomedicine is to merge biomolecular and cellular techniques, tools and method with the nanotechnology knowledge base, as it specifically relates to the development of nanoparticles for enabling and improving targeted delivery of the therapeutic agents; developing novel and more effective diagnostic and screening techniques to extend the limits of molecular diagnostics providing point-of-care diagnosis and more personalized medicine.

Despite giant medical developments in the field, cardiovascular diseases (CVD), which encompass a variety of disorders of blood vasculature and heart, as properly as stroke, continue to be the leading motive of demise in the United States. Based on the NIH and American Heart Association statistics, close to 80 million human beings in the U.S. suffer from CVD and more than 35% of American deaths are attributed to CVD. The remaining disruptive science to impact CVD came about over a decade ago with the introduction of the coronary stent by way of Palmaz & Schatz—FDA authorized in 1994. Since then, scientific medication has relied upon new blockbuster therapeutics (statins, beta blockers, and diuretics) and refinements of surgical processes such as percutaneous transluminal coronary angioplasty (PTCA), coronary artery omit grafts (CABG) and stenting to deal with CVD; however, modern-day techniques for early detection and superior treatment options of CVD are limited and their efficiency in preventing the ailments is questionable.

By definition, nanotechnology includes the following interrelated constituents: nanoscale dimensions of the complete gadget or its quintessential components, man-made nature and the unique characteristics of new fabric that occur due to its nanoscopic size. In fact, nanotechnology represents a convergent discipline, in which the margins isolating a number of lookup areas such as chemistry, biology, physics, mathematics and engineering, end up blurred. Cardiovascular

nanomedicine is likely to face and address current challenges in CVD and to improve detection and remedy by means of advancing ex vivo and in vivo biomarkers detection and imaging, as properly as by directed/improved drug delivery and tissue regeneration.

In this review we will summarize and talk about recent traits in the subject of nanotechnology for the detection and remedy of CVD, focusing on nanoparticles, specifically designed therapeutic and tissue regeneration devices, and in vivo/ex vivo early detection techniques.

Nanomedicine is a rising area of medicinal drug which utilizes nanotechnology standards for advanced remedy and diagnostics. This convergent discipline, which merges lookup areas such as chemistry, biology, physics, arithmetic and engineering accordingly bridging the hole between molecular and cellular interactions, has a viable to revolutionize modern medical practice. This evaluation presents latest developments in nanomedicine research, which are poised to have a necessary influence on cardiovascular disease and treatment through improving therapy and prognosis of such cardiovascular issues as atherosclerosis, restenosis and myocardial infarction. Specifically, we discuss the use of nanoparticles for molecular imaging and advanced therapeutics, particularly designed drug eluting stents and in vivo/ex vivo early detection techniques.

A range of nanoparticle-based drug transport systems have been and are being developed for functions in cancer, CVD and different conditions. These have different elements and multiple-functionalities, exhibiting variations in (i) sizes, ranging from few tens of nanometers (as for dendrimers, gold and iron-oxide nanoparticles) to few lots of nanometers (as for polymeric and lipid-based particles) to micron-sized particles; (ii) shapes, from the classical spherical particles to discoidal, hemispherical, cylindrical and conical; (iii) surface functionalizations, with a vast range of electrostatic fees and bio-molecule conjugations.

Use of nanocarriers for these prerequisites allows for local or directed delivery, extended effect of the drug, facilitated delivery into the goal cells, discount of the shear effects of the blood flow. In the direction of development, atherosclerotic plaque and neointima display a variety of stage-specific molecules which can be used as focused on moieties in CVD (αvβ3-integrin, VCAM-1, YIGSR, etc.).

Along with the improvement and adoption of novel techniques for therapy and prevention of CVD, efforts are being spent to observe nanotechnologies for ex-vivo and in-vivo detection of CVD signals. The potential to screen for precursor indicators of CVD could doubtlessly limit the large variety of fatalities associated with the diseases. For example, monitoring thrombotic or hemorrhagic events ought to facilitate the prognosis and remedy of stroke and embolisms. Moreover, the dimension of versions in the blood pressure, flow, and biomolecule or ion awareness can furnish insight for the perception of cardiovascular events.

In the developed countries, CVD signify a good sized burden on the healthcare machine and economy, being the main cause of death and morbidity. Rapid evolution of

fields such as genetics, proteomics, molecular and mobile biology, material science and bioengineering, make nanotechnology, which bridges the hole between interactions on the molecular and microsopic levels, one of the most important potential players in the development of CVD treatment and detection. Though nonetheless in very early developmental ("embryonic") stages, cardiovascular nanomedicine is possibly to meet the excessive demand for the step forward innovation in the CVD therapy and diagnosis, taking an gain of the nanotechnological solutions developed for different clinical applications, broadly speaking oncology, the place therapeutic nanocarriers presently occupy a tremendous therapeutic niche. Different from the conventional molecular therapeutics, nanomedicine permits layout of multicomponent, multitasking, multimodular agents which can concurrently and precisely realize and deal with the disease. Another nanomedical answer for CVD could be projected for inclined plaque, where "click-chemistry" or surprisingly controlled crosslinking techniques that can target and "secure" the plaque prior to subsequent AMI barring risk of occluding the vessel can be utilized. In summary, here we gave a quick overview on the contemporary trends in cardiovascular nanomedicine with a extremely good manageable impact; however, we accept as true with that these light comparing to the future possibilities for application of nanotechnology for remedy and analysis of CVD.

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